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Abbreviations and Definitions

Adj/ "Adjective"	A lexical category generally defined in terms of its denotation of stable properties of entities, its ability to function as a modifier of N, and a typical inability to function as a predicate without support from a copula or lexical verb; also used here to distinguish intransitive stative verbs from dynamic verbs in the ILs. In TL Mandarin, these lexemes all belong to the class V.
Adv	The lexical category Adverb
ADV	A categorial feature assumed to be expressed by Adverbs (especially in PT accounts of Adv-fronting)
AgrP; AGR	Agreement Phrase
ANT	Anterior aspect
ASAP	As soon as possible, an economy condition in the MP
Asp	Aspect
Aux	Auxiliary verb
C_{HL}	Chomsky's (1999) abbreviation for the 'computational mechanism of human language'
Class /CL	classifier
Cop	Copula
COS	Canonical Order Strategy; an early strategy for organising words in the Multi-Dimensional Model (Clahsen, Meisel and Pienemann, 1981)
CP	Complementiser Phrase

CRS	Change in relevant state; Li and Thompson's gloss for the SFP /e
c-structure	constituent structure
CWO	Canonical Word Order
D	The head node of the DP, typically occupied by a determiner
de (ADJ)	Adjectival <i>de</i> ; label for the particle <i>de</i> when preceded by an 'Adjective' (Zhang 2001) cf. de (ATT), de(GEN), de (RC)
de (ATT)	Attributive <i>de</i> ; label for the particle <i>de</i> when preceded by a non-possessor NP (Zhang 2001) cf. de (GEN), de(ADJ), de (RC)
DEF	Definite feature or value
de (GEN)	Genitive <i>de</i> , label for the particle <i>de</i> when preceded by a 'possessor' NP (Zhang 2001) cf. de (ATT), de(ADJ), de (RC)
Dem	Demonstrative
de (RC)	Label for the particle <i>de</i> when preceded by a relative clause (Zhang 2001) cf. de (ATT), de(GEN), de (ADJ)
Det	The lexical category, Determiner
DF	Discourse function, e.g. Topic of Focus; in LFG, a feature type associated with non-argument positions in c-structure, but linked to argument GFs in f-structure
DBP	Chomsky, 1999: "Derivation by Phase"
DO	In PT, a feature expressed by the English Auxiliary verb 'do' in any form ; otherwise a direct Object
EMP	Endocentric Mapping Principles (Bresnan, 2001; Grimshaw, 1994)
ESL	(Acquisition of) English as a second language
ET	Emergence time in weeks since instruction began
EPP	Extended Projection Principle; the idea that each sentence must include a Subject node in c-structure
F	feature(s); a unit of information comprising a label and a value
FP	In Vainikka and Young-Scholten (1996) an underspecified Finite Phrase that has no tense features but provides a landing-site for V movement; In Bernstein's (2001) discussion of nominal structure, a Functional Phrase occurring between DP and NumP, which takes demonstratives as its specifier.
f-structure	Functional structure (in LFG); the level of representation associated with functional relations
F-structure	Lexical feature structure
FLA	Foreign language acquisition: acquisition of a second or subsequent language in an environment in which the TL is not routinely encountered as a community language
FP	A Functional Phrase of unspecified type
FUO	Finite Utterance Organisation; the third stage of IL development in Perdue's model (Perdue 1993) where verbal inflections, subordinating structures, and language-specific differences emerge
GF	Grammatical Function, e.g. Subject of Object; a feature type to which thematic roles are linked in LFG
GSL	(Acquisition of) German as a second language
H1-H9	Labels for the samples 1-9 taken from Hannah's IL
IFS	Initialisation-Finalisation Strategy; an early strategy for adding words outside the basic NVN string in the Multi-Dimensional Model (Clahsen, Meisel and Pienemann, 1981)
IL	Interlanguage; the linguistic system of a learner related to a specific TL but before they reach native-like competence
IP	Inflectional Phrase; the 'X' term for the sentence; a conflation of Tense , Modal , Agreement and other functional categories above lexical V
IPG	Incremental Procedural Grammar
IUO	Infinite Utterance Organisation; the second stage of IL development in Perdue's model (Perdue 1993) where Prepositions and some functional elements occur

K1-K9	Labels for the samples 1-9 taken from Kazuko's IL
LCA	Linear Correspondence Axiom (Kayne, 1994). The idea that there are strict constraints on the mapping between surface order and underlying syntactic structure
LDD	Long Distance Dependency; used as a lexical feature of verbs in Dalrymple's LFG analysis of functional uncertainty in relative clauses (Dalrymple, 2001)
Lex	Chomsky's abbreviation for the lexicon
LFG	Lexical Functional Grammar
LI	Lexical item (in the MP)
L1; L1A	First language; first language acquisition
L2	Second or subsequent language
Loc	Locative
Mod deP	Mandarin structures of the form AdjP/V _i P de N
MP	The Minimalist Programme
MPD, M&P&D	Numbers of phases, mergers and delay, respectively, in the minimalist analysis of processing demands
N	Noun; a lexical category defined in terms of its function in denoting generic types of entities, its involvement in referring expressions and its association with features like Number, Gender and Person
NOM	Nominaliser; label for the particle <i>de</i> especially when the following noun is optionally omitted (Li & Thompson, 1981; Zhang, 2001)
NP	Strictly, the lexical projection of N; loosely, any nominal constituent
NP1; NP2	Respectively, the nominal constituent preceding and following the particle <i>de</i> in Mandarin <i>de</i> -constructions, or the verbal element in Perdue's description of universal syntactic structures.
NUM	The feature NUMBER
number	Numeric lexical heads: <i>yī</i> 'one' etc
Number	Functional heads with a value such as singular, dual, plural, etc
NumP	Mostly, the phrase headed by <i>lexical</i> /numbers; also the phrase headed by grammatical Number when so-used by other authors. The distinction will be made clear in context
NUO	Nominal Utterance Organisation; the first stage of IL development in Perdue's model (Perdue 1993) where no verbs and few functional morphs occur;
NVN	A string consisting of a noun, a verb and another noun; especially in reference to Bever's (1970) observation that children and adults under cognitive stress tend to interpret such strings as agent-action-undergoer
O	Syntactic Object (the closest nominal complement of a verb)
OBJ	The GF Object in LFG analyses
P	The 'pragmatic universal' (focus comes last) in Perdue's theory of SLA
PERS	The feature PERSON as in 1 st PERSON
Person	a covert functional head
PIC	Phase Impenetrability Condition; a minimalist constraint on the syntactic distance across which a lexical feature is visible within the computational mechanism
PL	Plural
PLP	The phrase headed by <i>grammatical</i> /Number SG/PL
Poss deP	Mandarin structures of the form NP de N
PRED value	The feature representing semantic content in LFG
pro	The covert pronoun, 'little pro'; a phonetically empty constituent with the distribution of an overt pronoun
Pron	Overt pronoun
Pseudo RC	An IL structure where a sentence is used as a postmodifier of a topic noun
PT	Processability Theory

Q	Quantifier;
Q-predicate	A Mandarin predicate that takes a quantity-denoting Subject
Q-PRT	Question particle, <i>ma</i>
RC	A relative clause; a clause embedded within nominal structure with the function of modifying a noun; cf <i>pseudo</i> -RC: an IL structure where a clause modifies a noun but is not necessarily embedded within the phrasal structure associated with that noun
RC structure	A nominal containing an RC
RMET	Ranked Mean ET; a measure of emergence order derived by ranking structures according to their mean ET
RMR	Ranked mean rank; a measure of emergence order derived by ranking structures according to the mean of different rank orders in individual ILs
S	Syntactic subject, in SVO etc, OR Sentence depending on context
S'	An embedded clause, including the complementiser.
S1-S9	Labels for the samples 1-9 taken from Sam's IL
S1; S2	Respectively, the first and second semantic universals in Perdue's theory of SLA
SC	Subordinate Clause; a clausal structure syntactically contained within a matrix structure
SCS	Subordinate Clause Strategy; a late strategy for simplifying subordinate clauses in the Multi-Dimensional Model (Clahsen, Meisel and Pienemann, 1981), by forcing them to have the same word order as main clauses
SEP	A strategy that allows separation of the lexical and auxiliary verbs, a step towards production of verb-final order in the MDM model of GSL, and towards Subj-Aux inversion in ESL
SFP	sentence final particle
SG	singular
SLA	Second or Subsequent Language Acquisition; acquisition of a language that commences after one or more primary languages have been acquired during infancy and early childhood; more specifically, acquisition of such a language in an environment where it is routinely encountered as a community language
SO	Syntactic object; the term used in the MP to include any lexical item and any product of merger
SOP	Serial Order Principle; an early strategy for organising words in the Processability Theory (Pienemann, 1998a). Similar to the COS of MDM and Bever's NVN order, but order is not necessarily confined to SVO
SPEC	A feature label / GF of N which has a value DEF (used by Pienemann and Hakansson 1999)
Spec	The Specifier position in a phrasal structure in X' theory
SVO	Subject-Verb-Object constituent order
SUBJ	The GF Subject in LFG analyses
θ-role	Theta-role or thematic role. A formal representation of the thematic link between a predicate and its semantic arguments
T; TP	Tense and the Tense Phrase
T1-T9	Labels for the samples of ILs taken at different times
TAM	Tense, Aspect, Mood; used to represent any features that attract lexical predicates (V) to the functional heads that select them (T, A, C etc)
TL	Target language; the language a learner is aiming to acquire
V	verb, a lexical category defined in terms of its function as a predicate and its association with the expression of Tense or Aspect
V _i	intransitive verb
VP	Verb phrase; i.e. a c-structural constituent containing at least a lexical verb and any complement(s) that it selects
vP	light or functional verb phrase
V _t	transitive verb
V2 effect	where the verb always appears as the second element in a sentence; as in German

WH	An interrogative feature, especially the English feature associated with fronting
XP	A phrase of unspecified type

Representing lexical feature-structures

The following conventions have been adopted for the representation of lexical feature structures in a minimalist framework (see Chapter 7). The term feature-*status* refers to whether a specific feature is interpretable (has a value) or uninterpretable (has no value) at a given point. Features are represented as a label written in upper case, followed by a value, both in square brackets. For example, [REF DEF] represents a referential feature with a definite value. For uninterpretable features, the missing value is as an underline thus: [REF _].

When two items express an identical value for the same feature, but the actual value is irrelevant to the discussion a repeated symbol such as α or β will be used.

A binary choice of values for a feature will be represented as \pm . For purely orthographic convenience, such a feature value may be represented as + COUNT instead of [COUNT +]. A small set of alternative values will be listed within braces: [PERSON {1st /2nd /3rd}] and a set of values too large to list will be represented as thus: [GENDER Δ].

In diagrams representing derivational steps, a value will replace the underline of an unvalued feature, as it becomes accessible through agreement relations. The link between the valued source ('goal' in Chomsky's terms) and the unvalued recipient (or 'probe'), will be indicated by an arrow. A set of features for a single lexical item or syntactic object will be represented within one pair of brackets: [PERSON 3; GENDER MASC].

Chapter One: Introduction

“For any given target language the rules that follow an implicational pattern and those that do not are always constant, and [...] this implicational order is retraced by all learners who have been observed longitudinally.” (Pienemann, Johnston & Meisel, 1993, p. 496).

1.0 The research context

Past research has shown that there is a natural order in which different syntactic structures emerge in acquisition of a given second language (Dulay & Burt, 1974; Clahsen, 1980, 1984; Larsen-Freeman, 1975, p. 96; Fathman, 1978; Makino, 1979; Pica, 1983; Pienemann, 1980, 1984, 1985; Pienemann & Johnston, 1987; Pienemann & Hakansson, 1999). Moreover, it is possible to generalise that acquisition in all languages begins with single lexemes, and proceeds through short nominal phrases, to simple sentences and then to complex sentences (Pienemann, 1989; Purdue, 1993). However, beyond this simple generalisation, it is difficult to predict the emergence order for specific structures in a new language either on the basis of known emergence orders of other languages, or on the basis of the characteristics of the target language (TL). This is because firstly, structures in different languages are rarely exact equivalents in either formal *or* functional terms, secondly, it is unclear which aspects of syntactic structure impact significantly upon emergence order in SLA, and thirdly, it is not clear how learner grammars relate to the grammar of the TL being acquired.

The aim of this thesis is to assess the extent to which the natural acquisition order for Mandarin nominal structures can be explained by processing demands calculated on the basis of two alternative theories of syntactic processing: Pienemann’s Processability theory (PT), (Pienemann, 1984, 1989, 1998c; Pienemann, Johnston & Brindley 1988; Pienemann et al., 1993) which implements the derivational mechanisms of Lexical Functional Grammar (LFG) (Bresnan, 1982, 2001), and the Minimalist Programme as developed in recent work by Chomsky, (Chomsky, 1992, 1993, 1995a, 1995b, 1999, 2000, 2001).

By comparing the processing demands entailed by each theory to the emergence order for a single set of structures, it is possible to gain interesting insights into the relative effects of different aspects of processing on the emergence order of syntactic structures. The research described below supports the view that processing demands arise primarily through interactions between the feature structures of lexical items as they become embedded in increasingly hierarchical constituent structures. While the MP provides an explicit account of syntactic construction, it tends to mask the relevance of agreement relations to processing demands; while Processability theory takes too simplistic a view of

constituent structure to allow an adequate account of processing differences within the nominal domain, a revised version of the theory, incorporating recent developments in LFG suggests that increases in the c-structural distance between agreeing items depend upon increasingly complex methods for linking c-structural positions to functional constituents in functional structure. Thus each theory contributes to our understanding of different aspects of syntactic processing and their impact on acquisition order.

1.1 The research approach

The focus of this research is Mandarin nominal structures. A description of Mandarin nominal syntax is given in Appendix A.

To assess the extent to which the emergence order of nominal structures can be explained by processing demands, three things must be ascertained:

1. The natural emergence order for a set of nominal constituents;
2. The processing demands entailed by the construction of each constituent;
3. The correlation between increased processing demands and later emergence.

Each of these aspects constitutes a separate phase of the research project described here. The first phase is discussed in Chapters Two to Five, the second, in Chapters Six and Seven, and the last in Chapters Seven and Eight. Chapter Nine draws conclusions about the insights each theory provides into developmental processes, and their effectiveness as theories of acquisition order.

1.2 Establishing a natural emergence order

The establishment of a natural emergence order for Mandarin nominal structures is essentially an empirical problem which falls within the tradition of interlanguage (IL) studies, particularly the analysis of IL grammars. ILs are a series of linguistic systems employed by learners as they pass from their initial state towards a state approximating that of the target language (TL) (Selinker, 1972). IL grammars are the syntactic component of those IL systems.

CHAPTER TWO discusses the history of IL grammar analysis in SLA. *Section 2.1* traces the development of IL studies back to the morpheme studies of the 1970s on which claims of natural emergence orders were first based. It then describes subsequent research that demonstrates consistent patterns of emergence for extended syntactic structures, rather than isolated morphs. *Section 2.2* discusses the development of theories to account for these developmental patterns in terms of syntactic processing demands. A distinction is drawn between transitional models of grammatical development, which see language-specific syntactic systems gradually replacing universal combinatorial processes based on semantics and pragmatics on the one hand, and purely syntactic models which see grammatical development as a gradual extension of universal *syntactic* processes, to construct complex language-specific syntactic systems on the other. The research reported here compares a transitional

model, exemplified by Pienemann's Processability theory (PT), and a syntactic model, exemplified by the minimalist programme (MP).

Section 2.3 compares three theories within the transitional approach: the multi-dimensional model (MDM) (Clahsen, Meisel & Pienemann, 1983), a functional model (Perdue, 1993) and Processability Theory (PT) (Pienemann, 1984, 1985, 1989, 1998a, b, c). The significant contribution of PT is that it draws explicit links between the emergence order of syntactic structures and cognitive demands entailed by their construction. Moreover, it ascertains the processes by which a structure is constructed by reference to an explicit and well developed theory of generative grammar, LFG. The basic assumptions of LFG and its implementation in PT are discussed in this section with particular attention given to the role of lexical features and constituent-structure (c-structure) rules in the construction of constituents, and to the way PT places the mechanisms of LFG into a transitional framework where syntactic mapping procedures are supplemented by pragmatic ordering principles, and processing demands arise because of information transfers from procedure to procedure.

Section 2.4 introduces the basic theoretical framework of the MP, in particular the notions of interpretable and uninterpretable features (F), and their role in motivating the constructive operations: attract, merge and copy, to build syntactic objects (SOs). It also explains the limitations placed on syntactic structures by minimalist economy constraints. These limit the extent to which constituents can move away from the c-structure position to which they are first attracted.

In the MP, processing demands are related to derivational economy. Syntactic operations are all motivated by the need to bring words into configurations where they can enter agreement so that unvalued features can be valued; the fewer operations required to value all features, the more economical a structure is to produce. However, unlike PT, the MP assumes no c-structure rules; instead phrase-structures arise as a direct consequence of attractions between lexical features of the same type.

This means that in PT, processing demands can only be assessed after the structure-building procedures used in ILs have been ascertained, and in the MP they can only be assessed once IL lexical feature structures have been determined.

CHAPTER THREE discusses past research on Mandarin SLA. *Section 3.1* describes early morpheme studies of Mandarin, and *section 3.2* discusses a study in the PT framework (Zhang, 2001). This was a longitudinal study of three adults learning Mandarin at the Australian National University, Canberra; a foreign language environment. Zhang focussed on the emergence of specific *morphs*, five of which fall in the domain of nominal syntax: the classifier, which precedes count nouns in numeric expressions and the form *de*, which follows possessors, attributive nouns, adjectives and relative clauses.

Zhang views the form *de* as a realisation of four distinct morphs, one associated with each of the four modifier types. She assigns these four morphs and the classifier to three different categories in

terms of processing demands and establishes an implicational hierarchy for their emergence, which, she claims supports the view that emergence order reflects processing demands.

Section 3.3 argues that what Zhang is really assessing in her analysis of *de* is the processing demands associated with the preceding modifiers, not with *de* itself. Moreover, her claims about the processing demands associated with those constituents are inconsistent, and unsupported by explicit analysis of lexical or syntactic structures and her implicational hierarchy is flawed, because it treats the first point of emergence in any IL as emergence in all three. As a result, Zhang's study actually provides only weak support for a PT account of emergence order.

CHAPTER FOUR is a short chapter describing the methodology employed in my own longitudinal study of three adults acquiring Mandarin through instruction at Auckland University. The research was contemporaneous with Zhang's and, in terms of data elicitation, the research design was almost identical. The main difference is that Zhang's learners were exposed to intensive instruction on locatives in week 12, and intensive modelling and elicitation of RC structures in weeks 13 and 16. The other differences relate to the analysis and classification of structures.

CHAPTER FIVE describes the IL corpus that resulted from data collection in the Auckland study, and the emergence orders evident therein. *Section 5.1* describes the preparation of the corpus from transcripts of elicitation sessions. Details of the elicitation timetable and instruments are given in Appendix B. Selected samples of Transcripts are provided in Appendix C.

Section 5.2 describes the lexical classes evident in the ILs and the order in which they emerged, and *Section 5.3* describes the nominal structures that were productive in all three ILs, and their order of emergence in each IL. A list of lexical categories, examples of each nominal structure, and data on their frequency and emergence order in each IL are given in Appendix D. The distributional analyses that support the IL lexical classification is presented in Appendix E.

Section 5.4 explains the methods used to establish the degree of correlation between the three individual emergence orders, and to derive different representations of a *single* natural acquisition order for Mandarin nominals. *Section 5.5* compares the findings of this study to those of Zhang's (2001) study with respect to ten structures that were investigated in both, i.e. those with and without the particle *de* or the classifier.

1.3 Ascertaining processing demands

CHAPTER SIX introduces the next phase of the research project, the calculation of processing demands for each of the naturally ordered nominal structures. It takes a critical view of Pienemann's suggestion that the only constituent boundary significant in assessments of processing demands is that between a Subject and a Verb. If this were true, then PT would have little to say about the emergence order for nominal structures, which, apart from relative clause (RC) structures, do not involve such boundaries.

Section 6.1 considers the basic process of feature unification in which information is exchanged according to LFG, and the nature and role of information exchange in three distinct types of syntactic relationship: licensing, agreement and assignment of grammatical functions (GFs) such as Subject and Object. *Section 6.2* considers the implementation of unification in Pienemann's PT and how it relates to the six developmental levels that theory proposes. It argues that the processing demands associated with licensing and GF assignment are not consistently acknowledged or integrated into the definition of these developmental levels.

Section 6.3 considers the distinction drawn by Pienemann between information which resides in the conceptual module and activates lexical items on the one hand, and abstract or syntactic information that is stored in the syntactic module and shared between procedures on the other. In the standard PT model, categorial procedures are said to involve no information exchange, phrasal procedures are said to involve the exchange of conceptual information only; and the sentential procedure is said to involve the exchange of abstract information. It is on this basis that the three procedure types are associated with three distinct developmental levels. However, this section argues that certain basic assumptions of PT entail that all procedures, including the most basic, involve syntactic information. This leads to the overall conclusion that processing demands have more to do with quantitative differences in c-structural complexity than with qualitative differences between types of information or types of procedures. C-structural complexity is thus a crucial but largely unacknowledged contributor to processing demands in the PT framework.

Section 6.4 outlines a refined version of PT that takes account of processing demands and developmental dependencies associated with structural licensing, lexical licensing, GF assignment and functional uncertainty, where one GF is mapped to another, and acknowledges the significance of c-structural complexity. *Section 6.5* concludes that the significance of c-structural complexity forces us to confront the problem of structural indeterminacy. LFG, assumes that lexical and constituent structures can vary cross-linguistically, and provides no theoretical basis on which IL lexemes can be parsed into unique lexical feature-structures (F-structures), or IL utterances can be parsed into unique c-structures. This raises the question of how IL structures can be determined so that processing demands can be assessed. The problem of structural indeterminacy is discussed in more detail in Appendix F which outlines controversies regarding nominal constituent structure, both cross-linguistically, and in the TL, Mandarin.

CHAPTER SEVEN outlines the minimalist solution to the problem of structural indeterminacy. Chomsky (1999) observes that lexical feature structure is a matter of empirical observation, and constituent structure in the MP is entirely determined by lexical F-structure. *Section 7.1* reviews the link between lexical F-structure and c-structures in the MP, and shows that that link rests on a number of stipulations, but can be made to follow from economic constraints on projection and on the lexicon. This allows c-structures to be determined entirely by reference to lexical F-structures

and economy conditions. (Related theoretical discussion can be found in Appendices G to I.) Section 7.1 closes with a description of the methodology employed to determine the lexical f-structures of the IL lexical types described in Chapter Five, and presents the results of that lexical analysis, in Table 24. (The analyses of IL f-structures are discussed more fully in Appendix J.)

Section 7.2 addresses the question of IL *constituent*-structures. It outlines the methodology by which IL *c*-structures were determined on the basis of lexical F-structures, briefly reviews the order in which IL structures emerged, and then relates that emergence order, in general terms to underlying IL *c*-structures. Diagrams of all relevant IL *c*-structures are presented there and in Appendix K, where *c*-structural analyses are discussed in detail.

Section 7.3 addresses the issue of the processing demands associated with the 19 most stably ordered IL constituents identified in Chapter Five. First it explains how minimalist processing demands were quantified and presents a summary of minimalist processing demands associated with each structure (Table 25). Next it presents the results of the corresponding analysis according to the standard and the refined versions of PT (Tables 26 and 27 respectively). The determination of processing demands from each perspective is discussed in detail in Appendix L.

Section 7.4 presents the correlations between these processing demands and emergence orders.

1.4 Correlating processing demands and emergence orders

CHAPTER EIGHT discusses the implications of the three sets of results, and investigates some individual variation in responses to specific processing demands.

Finally, **CHAPTER NINE** reviews the major conclusions of the research and considers the overall explanatory power of the two theories.

Chapter Two: Analysing IL Grammars

“The fundamental problem for a theory of syntax is to characterize the mapping between semantic predicate-argument relationships and surface word order and phrase configurations by which they are expressed.” (Kaplan & Bresnan, 1982, p. 174)

2.0 INTRODUCTION

Kaplan and Bresnan (1982) suggest that the fundamental problem for syntactic theory is the characterisation of mappings between semantic and syntactic structures. If so, then a fundamental problem for a theory of the acquisition of syntax must be a characterisation of how such a mapping process develops. This chapter discusses past research into the relationship between emergence orders and syntactic processing.

Section 2.1 discusses how the morpheme studies of the 1970s gave rise to the idea of a natural acquisition order, and so to the developmental problem, the need to explain the acquisition orders observed. It then outlines problems inherent in the use of an eclectic selection of morphs to represent an IL grammar and the move to viewing learner language as Interlanguage: a series of transitional but comprehensive grammatical systems in their own right. It also discusses the ‘comparative fallacy’ (Bley-Vroman, 1983), the mistaken idea that similar phonetic sequences in learner and target languages necessarily serve similar functions and represent similar underlying structures and processes.

Section 2.2 discusses subsequent moves to relate language-specific emergence orders to universal processes. If learner languages are treated as the product of universal processes of language production, then analysis of IL syntax can proceed on the basis of IL data, without reference to the TL. This significantly reduces the risk of being influenced by any comparative fallacy.

Theoretical perspectives on universal linguistic processes fall into three main schools: one views language acquisition as an instance of general learning processes, another as a process specific to language, the third sees it as a process of transition from universal non-linguistic to language-specific processing systems. The focus of this thesis is on the latter two types. This section introduces theories which exemplify the transitional viewpoint, with particular emphasis on Processability Theory (Pienemann, 1980, 1984, 1998). Section 2.2.1 describes the six developmental stages that Pienemann suggests arise in second language acquisition (SLA), as a consequence of gradual automatization of syntactic processing. This allows increasing independence from general cognitive processes related to

thematic structure and perceptual saliency. Section 2.2.2 discusses the advantages of this theory over its predecessor, a strategy-based approach proposed by Clahsen, Meisel and Pienemann (1983), where constraints are gradually shed to reveal an underlying grammar, and over an alternative three - stage development proposed by Perdue (1993), where internal conflicts within a basic universal syntactic system provide the pressure to develop more grammatical structures.

Section 2.3 introduces theories that exemplify the nativist or purely linguistic viewpoint, including the minimalist programme (Chomsky, 1995, 1999, 2000). First it argues that parameter-setting addresses the logical problem of why acquisition occurs, but not the developmental problem of why it follows the course it does. Then it discusses two views of acquisition as a gradual extension of phrase structure from lexical through various functional levels, and introduces the minimalist programme (Chomsky, 1995, 1999, 2000). The discussion of minimalist theory reviews the generative structure-building operations of minimalism, from the construction of lexical items to the determination of word order, then reviews economy conditions held to determine choices between alternative derivations for the same surface string. Herschensohn's constructionism is discussed briefly (Herschensohn, 2000), but shown to be inconsistent with the version of feature theory proposed in Chomsky's "Derivation by Phase" (Chomsky, 1999).

Because it makes explicit links between derivational efficiency and grammaticality, minimalist theory provides the basis for an account of acquisition order in terms of relative economies. This is outlined on page 42*f*

Section 2.4 outlines a *new* minimalist theory of acquisition which views minimalist operations as contributors to processing demands.

2.1 MORPHEME STUDIES AND NATURAL ACQUISITION ORDERS

As early as 1972, Selinker had proposed that learner languages could and should be treated as independent objects of linguistic analysis. His proposal that learners pass through a series of interlanguages as they move from an initial state towards a target system, opened the door to attempts to explain IL development in terms of general, and possibly universal processes of language production. Since 1972, the analysis of learner language has progressed from descriptions of ILs viewed as transient *ideolects* to descriptions of IL *systems* viewed as instantiations of universal grammar.

The earliest characterisations of acquisition orders were couched in terms of grammatical functors or morphemes. In 1973, Brown observed a marked similarity in the order in which three children acquired certain grammatical morphemes as part of their L1, English (Brown, 1973). Soon after, Dulay and Burt demonstrated common but different patterns in the acquisition of English as a *second* language (ESL) (Dulay & Burt, 1974) and it was subsequently shown that this order is relatively unaffected by the linguistic environment (Fathman, 1978; Makino 1979); the learners' L1s (de Villiers &

de Villiers, 1973; Dulay & Burt, 1974; Larsen-Freeman, 1975); or the measure of proficiency employed (Pica, 1983).

Though not all these morpheme studies found *precisely* the same order, Krashen (1975, 1976, 1977) argued that the morphs could be allocated to stages whose order does remain constant, and on this basis he proposed the existence of a *natural* order of acquisition for English. He also presented evidence that this natural order applies equally to instructed and naturalistic learners. In fact, he claimed that teaching and conscious study are quite *unable to affect the natural acquisition order*. A controlled experiment conducted by Pienemann later confirmed that even intensive instruction could not affect the order in which morphs emerge in *spontaneous speech*, though it can improve declarative knowledge that can be employed in more slowly paced tasks, like writing, or grammatical judgements (Pienemann, 1987).

Similar studies have found consistent emergence orders for other languages, including Spanish (van Naerssen, 1980) German, (Clahsen, 1980) and Japanese (Huter, 1996, 1998). Other studies have also revealed a stable order in the emergence of syntactic structures within a given pragmatic domain. Spanish, Chinese, and Norwegian speaking children acquiring English all follow a similar sequence in the development of interrogative forms (Adams, 1978; Cazden et al., 1975, cited in Larsen-Freeman & Long, 1991; Huang, 1970; Ravem, 1974; Wagner-Gough, 1975), and pre-verbal negation occurs consistently in ESL, regardless of the form of negation in the learners' L1s (Hyltenstam, 1977; Schumann, 1979; Stauble, 1984).

The observation of these similarities gave rise to a growing conviction that there is a profound cross-linguistic homogeneity of language production and acquisition processes. However the language-specific and apparently arbitrary nature of the morphemes studied and the stages they fell into made it difficult to grasp just what those universal underlying processes might be, and how they might relate to the form or function of the selected morphs.

During the '80s and '90s, a theoretical framework was sought that might unify and explain this disparate data. Attention turned to complete syntactic structures, and whole interlanguage systems rather than to isolated morphs, and a continuum of views emerged, ranging from, at one extreme, those who saw language production as arising out of *general* cognitive processes (Bever, 1970; MacWhinney & Anderson, 1986; Rumelhart & McClelland 1986; N. Ellis, 1994), and at the other extreme, those who view human languages as products of innate language-specific cognitive processes (Chomsky 1986, 1995, 1999, 2000; Bresnan, 1982; Haegemann, 1995, 1996; Radford, 1990; Vainikka, 1993; Vainikka & Young-Scholten, 1994, 1995, 1996a,b, 1998; White 1990, 1992, 1996).

The notion of language-*specific* processes has two different, but equally important senses. First productive processes may be language-specific in the sense of applying only to *language*, and not, for example, to vision, or mathematical deduction etc; secondly, processes may be language-specific in the sense of applying only to language A, and not to language B. The idea of processes that are language-

specific in the first sense makes it possible to explain phenomena that are language-specific in the second sense in terms of constraints on and freedom within the language-processing system generally.

Between these two extremes is a view I will label 'transitional'. This holds that *mature* languages are the product of specifically linguistic processes, but in *immature* languages, or in times of cognitive stress, words can be manipulated by more general cognitive processes (Clahsen, 1980, 1984; Clahsen & Muysken 1986; Pienemann, 1984, 1989, 1998c; Perdue, 1993). The cognitive processes seen as particularly relevant relate to semantic and pragmatic knowledge: in particular, the application of knowledge about the world, or the immediate context, to the interpretation of words, alone or in sequence. Semantic knowledge includes understanding thematic relations - the relationships between entities in an event; pragmatic knowledge includes an understanding of pre-supposition - inferences about another's state of knowledge at the time of speech.

I will be concerned only with the transitional and language-specific views of language acquisition. In the next section I consider three different proposals about the nature of the transition of language systems from a pre-syntactic to a syntactic state. The first two prove to be problematic because they do not adequately address the nature of the developing syntax; nor are they readily applicable to the analysis of nominal structures. The third, Processability theory, incorporates a complete theory of generative grammar. This makes it applicable in principle to the nominal structures of Mandarin, the focus of this study. However, as will be shown, that applicability is significantly limited by the theory's treatment of phrasal structures.

2.2 TRANSITIONAL MODELS

It is well-established that semantic and pragmatic knowledge have an important relationship with word order. Native-speaker choices of word order reflect the relative agentivity, topicality, salience, and familiarity of the referents within an utterance (Dubois, 1987; Lambrecht, 1987; La Polla, 1995). Pragmatic knowledge also forms part of the information content expressed in many languages by nominal morpho-syntax such as the choice of articles, determiners, or inflections to indicate definiteness, specificity, number etc. Because of this relationship between word order, semantics and pragmatics, alternative syntactic structures can be understood as a means by which to arrive at a word order that is desirable for semantic or pragmatic reasons. However, since word order serves *multiple* functions, indicating thematic relations - who does what to whom- as well as pragmatic information- what is known to whom - and discourse structure - what is being talked about, each variation in word order motivated by factors in one domain, threatens the preservation of meaning in the other domains. In this context, morpho-syntactic markers can be seen as a means of avoiding loss of information: they express information that, for whatever reason, cannot be expressed by word order alone.

A central idea within the transitional models of language acquisition is that pragmatic or thematic information can be mapped to *word order*, *before* it can be expressed by morphological means. Thus,

language acquisition is a process of transition from a primitive reliance on semantic and pragmatic *linear* ordering strategies, through a stage where abstract *hierarchical* linguistic units are discovered or constructed, to a mature stage where those units are manipulated, *primarily* by processes that are language-specific, in both senses.

2.2.1 The multi-dimensional model: shedding strategies to reveal syntax

One of the earliest transitional accounts of SLA was the multi-dimensional model (MDM) (Clahsen, 1980, 1984, 1986; Clahsen, Meisel & Pienemann, 1983; Clahsen & Muysken, 1986; Meisel, Clahsen & Pienemann, 1981; Pienemann, 1985). This integrated psychological research on memory and on processing under stress into a model proposed to account for patterns in German SLA. According to this model, learners gradually bring into play, and then abandon, three processing strategies, the 'Canonical Order Strategy' (COS), the 'Initialisation- Finalisation Strategy' (IFS) and the 'Subordinate Clause Strategy' (SCS). COS is based on work by Bever (1970) who demonstrated that adults processing under stress tend to interpret NVN strings as agent-action-patient, and ascribed this to universal cognitive processes. COS constrains the order of the main predicate and its arguments to a stable canonical order, initially thought to be SVO. IFS is based on primacy and recency effects (Murdock, 1962); items at the end-points of a linear sequence are more memorable than intermediate items, and the IFS excludes movement, or the addition of items to central positions in an SVO string. The last strategy, SCS, is an extension of this and also based on direct observations of SLA, especially of German, where word order of Subordinate clauses (SCs) is different from that in main clauses. The SCS prohibits permutations in subordinate clauses, reflecting the fact that SC word order is mastered late in German SLA (GSL).

One important contribution of this model was the move towards a formal definition of a "stage". Stages in development were defined in terms of the combination of strategies in use at a given time. To count as a 'theoretically interesting' stage, Meisel, Clahsen and Pienemann (1981) required a set of structures to be a) obligatory, and b) ordered with respect to other sets. So the earliest stage is one where word order is fixed by COS, and the next stage is one where IFS allows the use of initial or final adverbs in addition to the COS string. Larsen-Freeman and Long (1991) point out that prior to this a stage was traditionally identified in terms of the most *frequent* structures used, not in terms of a definable *class* of structure.

Also significant was the idea that strategies function to extend or limit the psychological difficulty of the structures that learners produce. In Pienemann's words, "the psychological complexity of a structure is dependent on the degree of re-ordering and rearrangement of linguistic material involved in the process of mapping underlying semantics onto surface forms" (Pienemann, 1998c, p. 46). When COS is abandoned, in the third stage, core items, S, V, and O can be moved to a terminal position, which accounts for the emergence of Subject-auxiliary inversion in ESL questions (as reported in Larsen-Freeman and Long, 1991), and verb-final order (SEP) in GSL. However SCS still prevents re-

ordering in subordinate clauses. Abandonment of IFS then allows string-*internal* movement, contributing to the V2 effect in GSL, and Do-support in English Wh-questions. Finally, abandonment of SCS, allows the verb to take clause-final position in German subordinate clauses.

PROBLEMS WITH THE STRATEGIES APPROACH

Weaknesses in this account are immediately apparent. Larson-Freeman and Long (1991) raise three questions of falsifiability. Firstly, formulaic or “chunked” data can easily mislead in the assessment of productive capacity; secondly, there are no clear grounds on which to identify structures which are variational, and hence properly excluded from the model¹, and thirdly, it is not clear to what extent structures from different developmental levels can be permitted to co-occur without invalidating the model.

Pienemann (1998c) raises concerns about the structure of the language processing system represented by the MDM, pointing out that the strategies do not generate linguistic structures; they only constrain them. Given this, “the specification –COS, +IFS, +SCS needs to be complemented by an explicit grammatical rule or system of rules” (Pienemann, 1998c, p. 49). In other words, the acquisition of the grammar that supersedes or underlies production still remains to be explained.

Pienemann also maintains that early lexical items “cannot be shown to be indexed to particular syntactic categories” (1998c, p. 50). If so, then learners cannot initially implement strategies like COS, that refer to N or V. Likewise, learners cannot identify linguistic units like a clause, until they have acquired knowledge of language-specific collocational possibilities, so strategies that refer to clauses, like SCS, cannot initially constrain production. Crucially, Pienemann (1998c) also rejects the centrality of syntactic movement, claiming that psychological experiments have shown passive sentences, theoretically involving movement, to be no slower to process than active sentences, theoretically more basic (Altmann, 1990; Horrocks, 1987; Levelt 1989) ².

Finally, Pienemann echoes White’s (1990) criticism that the strategies applied to production are derived from studies of comprehension. As comprehension routinely anticipates production, constraints on the latter must relate to processes other than those employed for interpretation.

More could be said about the relationship between the proposed psychological constraints and productive capacity. For example, the IFS refers to spans of only three items: “in underlying sequences [X Y Z] permutations are blocked which move X between Y and Z)” (Pienemann, 1998c, p. 46). Yet, the psychological salience of terminal positions is based on recency and primacy effects for lists of 7 ± 2 random items (Murdock, 1962). The items may themselves be ‘chunks’, complex items that for

¹ Structures whose emergence order varies considerably are properly excluded because Processability theory aims to understand the factors that constrain emergence order, *where it is constrained*. Pienemann suggests that some variation is inevitable, because any structure can emerge at a given stage as long as it does not exceed the processing capacities that define that stage. The nature of this variation cannot be explained in terms of processing demands. It requires an alternative account.

² Though in later transformational analyses, active sentences also involve movement of the Subject out of VP

whatever reason are readily memorable in isolation (like important dates in history, familiar birthdays etc). Thus, an ordered set of just three words or phrases should fall well below the threshold at which recency and primacy effects arise. Thus the IFS cannot be said to follow directly from the effects discovered in psychological research.

Moreover, it is unclear *how* a violation of the IFS could even arise in a string of just three items. Given an underlying string [XYZ], all six permutations of X, Y, and Z should be legitimate in the COS, +IFS stage since all can be derived by moving items only to terminal positions, as indicated by the following, where t_x represents the initial position of X etc.: [t_x Y Z X] [X t_Y Z Y] [Y X t_Y Z] [Z X Y t_z] [Z t_x Y t_z X]. As the same orders can also be derived by prohibited movements, it is impossible in principle to distinguish licit strings of three items from illicit ones, and impossible for the learner to establish, on the basis of input, which order is basic, and which derived.

Though it is plausible to think that general psychological constraints might limit the number of linguistic units that can be combined in early processing, this entails the existence of linguistic units to begin with.

2.2.2 Perdue's 3 stage functional model: syntax as a resolution of pragmatic conflicts

Perdue (1993) addresses the issue of an underlying grammar by proposing a transitional system where universal semantic and pragmatic principles are *supplemented* by universal syntactic rules which are expanded over time. He proposes two semantic universals (S1, S2) and one pragmatic universal (P) which together determine the linear position of NPs as follows:

S1: NP with highest control comes first;

S2: Controller of source state outweighs controller of target state;

P: Focus comes last.

"Control" refers to properties such as animacy, volition, causation, etc. The level of control, and hence the linear order of NPs, depends on the "scale of a particular role property rather than categorial distinctions such as 'agent' 'patient' etc." (Perdue, 1993, p. 20). "Focus" is defined in terms of a '*quaestio*' or implied question: a focus is "that particular candidate which is selected and specified as the *actual* participant in the activity implied by the *quaestio*" (Perdue, 1993, p. 21).

There are also four universal syntactic structures: V NP2 , {PP/Adv} Cop NP2, NP1 V (NP2), and NP1 COP {PP/Adj/NP2} (Perdue, 1993, p. 26).

Acquisition is said to fall into three stages. The first is 'Nominal Utterance Organisation' (NUO): no verbs and few functional morphs occur; the second is 'Infinite Utterance Organisation' (IUO): *uninflected* verbs, prepositions and some functional elements occur. Together these two stages constitute a "basic variety" independent of TL or L1. The third stage is 'Finite Utterance Organisation' (FUO), where verbal inflections, subordinating structures, and language-specific differences emerge.

The motivation to move beyond the basic variety is said to stem from an inherent tension between the three universal principles. For example, Perdue suggests that a conflict between S1 and P arises for statements that answer the question “what did Charlie steal?” because the NP ‘Charlie’ is both focal (i.e. names an actual participant) and the NP with most control (i.e. a volitional animate agent). This conflict is said to motivate learners to develop new phrase structures, specifically, focus marking and cleft constructions.

Perdue (1993) discusses how this model accounts for developmental patterns among learners from various L1 backgrounds acquiring various L2s, but comments that it was difficult to interpret form-function relations for *nominals* in the data. This makes the model largely irrelevant to the topic of this thesis: the investigation of nominal structures. There is also a more general difficulty in applying this model to Mandarin. Diagnosis of development from IUO to FUO relies crucially on tense inflections, and though Mandarin has a distinction between finite and non-finite clauses, this is manifest only in the use of modals and aspect markers (Huang, 1987). These are proscribed in non-finite clauses, but are *optional* in finite ones; this means Mandarin provides no simple surface contrasts between the IUO and FUO states.

The model also suffers from more general limitations. Firstly, Perdue’s research suggests the FUO stage could persist for a year or more and the model says nothing about the nature of structural development *within* that year. Secondly, grammatical developments are said to be motivated by the need to resolve conflicts between universal principles, but in fact the development of cleft-constructions and focus-marking mentioned above does not *resolve* the conflict between S1 and P, it simply adds markers to items that *violate* one of the principles. This throws doubt on the validity of these principles as universals in the first place, and simply takes for granted the fact that ILs move from using word order as their sole strategy to using morphology as well. Finally, the theory does not address the issue of why specific conflicts should arise *when* they do, and why *specific* solutions should emerge as they do. While the theory does attempt an explicit description of an initial state grammar and subsequent grammatical developments, those developments are not clearly motivated by any underlying theory of universals.

2.2.3 Processability Theory: the automatisisation of syntactic processes

OVERVIEW

Pienemann, who first made the criticism that the MDM lacks an underlying grammar, proposes a transitional model, Processability Theory, which builds on certain aspects of the MDM, but also integrates an explicit syntactic theory, LFG (Bresnan, 1982) and brings a new perspective on the source of stress in learner systems (Pienemann, 1984, 1987, 1988, 1998c, 1993). He reasons that mature linguistic processing is automatic processing. Automatic processing is thought to depend on ‘procedural memory’ or task-specific ultra-short-term stores. For example, Gough (1972) presents evidence for a visual buffer which can store images of letters for about 15 milliseconds. This contrasts with conscious

or ‘controlled’ processing, which makes use of short-term memory, where retention is longer but capacity is limited to a “digit-span” of 7 ± 2 units, as mentioned above.

According to Cohen “procedural memory is linked to the cortical processors *through which it was acquired*” (Cohen, 1991) cited in Pienemann, 1998c, p. 61-2, my emphasis). This means, initially, learner processing cannot be automatic. New learners must depend on conscious, non-automatic processes. Pienemann suggests that this may excessively delay the exchange of information crucial to certain syntactic processes. Information transfer may take longer than the life-span of any ultra-short term or short-term memory store learners have so far developed. Though learners may make use of conscious processing to perform one syntactic process, they do so only at the expense of other processes. So learners are *necessarily* under stress. As a consequence there are certain syntactic processes that new learners simply *cannot* perform, and therefore certain structures they cannot generate. Only when the relevant processes become automatic will the structures that depend on them be able to emerge.

From this insight Pienemann theorises that the natural order of acquisition arises as a consequence of three factors:

- i) inherent constraints on working memory;
- ii) the slow pace of procedural performance by novice processors;
- iii) the hierarchical nature of syntactic processes.

Because the focus is on *automatic* L2 processing, research in this framework assesses acquisition solely in terms of *spontaneous* IL production, where rehearsal and conscious processing are excluded by the demands of conversational performance. Structures produced *spontaneously* rely on high speed processing, and so are limited to those whose production has already become automatic, or those that involve minimal transfer of information. As simpler procedures become automatic, they contribute to the faster running of more complex procedures. Thus emergence order for a set of structures should relate to the complexity of their processing, which relates in turn to the information transfers required in the derivation of each structure.

To provide an explicit account of the information exchanges involved in different syntactic derivations, PT relies on Lexical Functional Grammar (LFG) (Bresnan, 1982, 2001).

LEXICAL FUNCTIONAL GRAMMAR

The aspect of LFG most relevant to the calculation of processing demands in PT is the unification of features.

Lexical feature-structures

Categorial, semantic and phonetic features

A defining characteristic of LFG is that it views lexical items as structures composed of combinations of phonetic, semantic and syntactic features, where features represent units of knowledge or information about linguistic constituents. A single feature consists of a label and one of a number of possible values associated with that label. For example, and in their account of Swedish SLA,

Pienemann and Hakansson (1999, p. 400) represent the Swedish nouns *hunden* and *hundar* as sets of features: *hunden* [N; PRED = HUND 'dog'; SPEC = DEF; GENDER = UTER], and *hundar* [N; PRED = HUND 'dog'; NUM= PL]. The feature N represents the lexical category, noun. Essentially, categorial features are an abstract representation of information about the distribution of a word. PRED is an LFG convention representing the semantic denotation of a word; its value is conventionally represented by the phonemic base form of the item either in the language under analysis, or in the language of analysis, in this case, English; SPEC is a formal feature relating to referentiality, and DEF indicates a definite value for that feature. GENDER represents the fact that Swedish nouns fall into arbitrary classes, *uter* (animate) and *neuter* (inanimate).

In this example the abstract features do not have a 1-1 correspondence with phonetic forms: number, definiteness and gender information combine in portmanteau forms, and categorial status is evident from the selection of other features that are expressed. Thus there is a measure of independence between lexical *feature*-structure and morpho-phonemic structure. Each abstract feature is treated as a separate atom in a lexeme's f-structure, regardless of its phonetic realisation.

Grammatical Functions

Predicates also express a special type of feature related to their thematic structure. For each predicate, certain of the thematic arguments entailed by its semantic denotation are mapped obligatorily to syntactic constituents. Each of these arguments is represented in its lexical f-structures by a feature called a Grammatical Function (GF). GFs are unusual in taking as their value, a complete feature matrix, that is one or more other feature labels and associated values. For example the semantic content of a transitive verb like *hit* entails the involvement of two participants, an agent and a patient, so the verb *hit* would have a complex feature: *hit*: [PRED: 'hit <SUBJ, OBJ>'], where 'SUBJ' and 'OBJ' are GFs. They are contained within the delimiters of the PRED value, the inverted commas to indicate that they are semantically licensed. A raising predicate, which licenses a dummy Subject with no semantic content would express a GF outside its PRED value: *seem*: [V; PRED 'seem <OBJ>' <SUBJ>].

Selectional features

Words can also specify precise syntactic, semantic or phonetic features for their collocates, by placing restrictions on the values acceptable in the feature matrix associated with its GFs. For example the English verb *talk* will include the specification: [PRED: 'talk <SUBJ, OBJ>'], [\uparrow OBJ]=c PP], restrict the choice of its complement to a PP, and the form 'talks' will specify [\uparrow SUBJ PERSON]=c 3rd], [\uparrow SUBJ NUM]=c SG] restricting the person and number values for its Subject.

In short, features are stored as part of the representation of a speaker's knowledge about lexical structure, that is knowledge about the denotation, the distribution (i.e. category), and selectional restrictions associated with words. These features are the basic units of information exchanged in syntactic processing, and on which processability theory bases its calculation of processing demands.

Unification of features in c-structure rules

During the construction of syntactic constituents, lexical items are selected from the lexicon and combined in accordance with language-specific c-structure rules. These rules are also composed of feature specifications. In general terms each c-structure rule defines a set of *categorial* features that can be combined to form a valid syntactic constituent of a given type. In addition c-structure rules may place added restrictions on the *sub-type* of a given category that can be placed in a given c-structural position. For example, a basic rule for sentence construction may require an NP to be followed by a VP: S → NP VP. To implement such a rule, certain lexemes must express the category N and others the Category V. Moreover, the categorial feature expressed in a lexical item must be compared to the categorial feature specified in the c-structure rule to ensure that they match. This is the process of unification.

More particularly, the rule for English Yes-No question formation will specify that the first element in S-structure must be an *auxiliary* verb, lexical verbs will be excluded. Restrictions such as this are represented as constraint equations associated with a specific position in c-structure. These take the form $[\downarrow F] =_c X$, where the symbol \downarrow refers to the item inserted at the node to which the equation refers, F stands for a specific feature, and X is the required value or values. Simplified somewhat, the basic rule for an English Yes-No question would be:

$$1) \quad S \rightarrow \begin{matrix} [\downarrow \text{Aux}] =_c + & & [\downarrow \text{Aux}] =_c - \\ \text{V} & \text{NP} & \text{VP} \end{matrix}$$

To implement this rule, all verbs would need to contain the feature $[\pm \text{AUX}]$. The feature value specified in the c-structure rule must match that contained within the lexical F-structure of an item *before* that item can be inserted at this c-structure node.

It is this process of storing and comparing feature values which forms the basis for the assessment of processing demands in PT.

Unification and conditions on well-formedness

This requirement that features match is an instantiation of a more general constraint on syntactic well-formedness called the Uniqueness Condition. This states that no single token of a feature can be attributed with two different values. As words are added to c-structure nodes to form c-structural constituents, so their lexical features, and those specified at c-structure nodes are combined in an abstract representation of syntactic relationships called functional structure (f-structure). As a consequence different items or nodes may independently contribute values for the *same feature in f-structure*, such as the Aux feature associated with the initial position in the Yes-No question just discussed.

Other conditions on well-formedness relate to GF assignment.

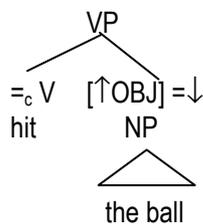
Completeness and coherence in GF Assignment

The Completeness Condition requires that each GF in the lexical structure of a predicate must be linked to a constituent with a PRED value. Conversely, the Coherence Condition requires that a GF can only be assigned to a constituent if it is introduced into f-structure in the lexical structure of a predicate. To satisfy these requirements, for each GF specified in lexical structure, there must be a C-structure rule that assigns that GF to a specific node in c-structure. That node will bear an annotation which contributes the GF to whatever constituent is inserted there. This annotation takes the form: $\uparrow\text{GF} = \downarrow$, meaning, “the daughter of this node is the f-structure associated with the GF specified in the f-structure associated with the mother of this node”. The mother node in question acquires a specific GF only by including a lexical predicate.

So for example, a verb like ‘hit’ which specifies a Subject and an Object GF can only form a valid structure if it is inserted into constituents containing such nodes. Conversely, a nominal constituent can only be inserted at the node to which an Object GF is assigned, if the VP containing that position also contains a verb like ‘hit’ that licenses an Object GF, rather than one like ‘sleep’ which includes only a Subject GF. Since an Object typically follows immediately after the verb in English, the English VP must involve a position which excludes all but verbs, and to its immediate left, a position in which the OBJ GF is assigned. This is shown in Fig. 1.

lexical entry for V: PRED ‘hit <SUBJ, OBJ>’

Constituent structure:



Functional structure:

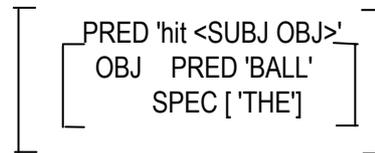


Fig. 1. Structure of VP

A unification process must compare the GF feature value specified by V, and in VP, and check the inserted NP to ensure it contains a PRED value.

Note that, in Fig. 1, the verb hit includes a Subject GF but this is *not* assigned in VP; it is assigned only in S, a larger structure that contains VP. This means the functional structure shown in Fig 1. is incomplete; it violates the completeness condition and the functional structure and the c-structure to which it is mapped, must both be enlarged to include a Subject phrase or it will be ungrammatical. Thus, GFs support the creation of a long-distance relationship between a head and the constituents whose insertion it licenses.

The feature specifications within VP also mean that any functional structure mapped to the position following a transitive verb is necessarily interpreted as its Object. The nonsense sentence ‘they smoked water’ is nonsense precisely *because* the NP ‘water’ acquires an Object GF by virtue of its adjacency to the verb ‘smoked’. As a consequence, it also receives the thematic role associated with that

GF in the verb's lexical structure, despite its inappropriate semantic denotation. This means that an adjunct must occupy a different c-structural position from an argument or GF position.

Adjuncts, DFs and extended coherence

The Adjunct GF is an exception to the coherence condition; adjuncts are generally available in any phrase, without lexical licensing. The Adjunct GF is assumed to be assigned in positions freely adjoined to any c-structure.

In addition to GFs, LFG also recognizes syntactically relevant discourse functions (DFs), such as Topic and Focus. Like GFs, DFs are also associated with specific c-structure nodes, as defined by language-specific c-structure rules. However, unlike GFs they are not lexically licensed. Instead they are licensed by an "Extended Coherence condition". This requires each DF to be linked to a GF in f-structure. The uniqueness condition prevents a DF being linked to a GF that is already associated with a PRED value, because two PRED values cannot be unified. Thus appearance of a DF is typically associated with the absence of a core GF. For example, an initial Topic might be coreferent with an absent Object, as in 'Coffee, I like', giving the *appearance* of movement.

No constraints on c-structures

Also relevant to the analysis of SLA is the fact that for the most part, the universal constraints of LFG apply to *functional* structures *not* to constituent structures. Grimshaw (1998) argues that phrases *tend* cross-linguistically to be endocentric structures where a *lexical* head may form a phrase by selecting a complement that fills an argument function. The resulting phrase may then be selected by a *functional* head, either as its complement, or as its specifier. This phrase may be selected in turn as the complement or specifier of another functional head, and so on. Grimshaw also claims, in line with the assumptions of X'-Theory, that specifiers and complements are not sisters; they occupy distinct levels in c-structure.

On this basis, Bresnan (2001) proposes a set of 'universal' endocentric mapping principles (EMPs) that consistently relate certain functional attributes with certain c-structural attributes. According to these principles the annotation $\uparrow GF = \downarrow$, is added to the c-structural sister of any lexical head. This links it to an *argument* function. The annotation $\uparrow = \downarrow$ is added to any node that dominates a *functional* head, and to its c-structural sister. As a consequence, they share *all* their features, which makes them *f-structural* co-heads. The *specifier* of a functional head is annotated $\uparrow DF = \downarrow$. This links a constituent occupying any specifier position to a discourse function (DF). This is shown schematically in Fig. 1a below. Bresnan also agrees that phrases are more *likely* to be endocentric than not; she states: "any c-structural pattern can be considered *unmarked* if it is an instantiation of these universal endocentric constraints" (Bresnan, 2001, p. 101, emphasis added). However, she also argues that phrases *may* be lexocentric, having multiple sisters, with the head and other functions specified by language-specific c-structure rules. This is shown schematically in Fig. 2b, overleaf.

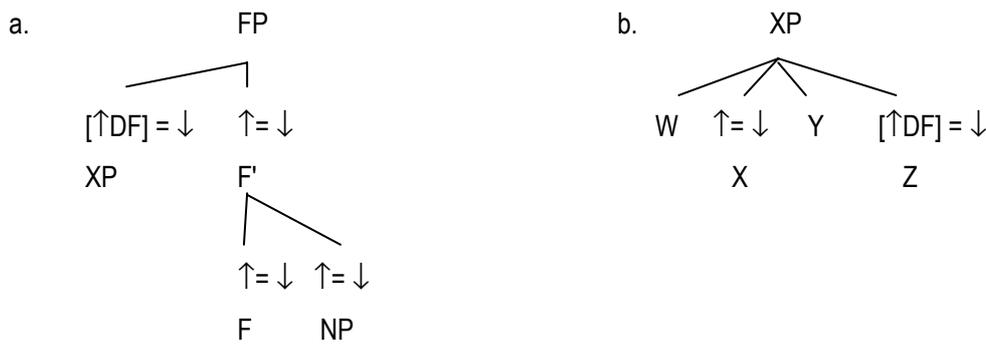


Fig. 2 Endocentric and lexocentric Structures

Thus endocentricity is seen only as a tendency, not as a constraint. So, for example, in languages where V and O do not form a recognisable c-structural constituent, there is no basis on which to assume a c-structural VP, but an Object GF must still be assigned, most probably in S, and V and O will still have a special relationship in *f*-structure. Similarly, though English is seen as having endocentric *sentence* structures, some maintain that its *nominal* structures are lexocentric; they are not DPs, where a functional head D (the determiner) selects a lexical NP as its complement, rather they are NPs where a certain function, SPEC is assigned to the determiner by the NP c-structure rule (for example see Dalrymple, 2001).

Nor are there any universal constraints on lexical feature structures. Where the Swedish noun *hunden*, illustrated above, includes SPEC = DEF as a feature of its own, realised as part of a portmanteau suffix, in Fig. 1 a SPEC function is licensed by the NP c-structure rule, which is then assigned to an independent lexical item, with a distinct position in c-structure (cf. Dalrymple, 2001, p. 401)³. In principle, the SPEC GF could be assigned within NP, like an Object GF, or in a larger structure that includes NP, like a Subject GF. Nothing in LFG or PT forces us to choose one analysis over the other since both are equally possible. C-structures must be determined language by language, through a consideration of scope relations, word order variation, constituency, and so on.

Implications for SLA

This means, of course, that learners' c-structures and lexical feature structures do not necessarily conform to those of the TL they are aiming to acquire. Nonetheless, the basic processes in which the information supplied by feature-values is transferred are processes implementing collocation constraints, agreement and GF assignment. Unification for uniqueness, licensing, completeness, and coherence are all clearly important in the analysis of Mandarin nominal structures. They exhibit licensing, in the form of consistent constituent order; agreement between classifiers and nouns, and

³ There are some problems here though. If SPEC is a GF it must be lexically licensed; if it is a DF, it is subject to the Extended Coherence Condition, and must be linked to a GF. Since SPEC is not optional it cannot be linked to an Adjunct GF, but English Ns do not generally take semantic arguments, so a GF within their PRED value is not justified. In this analysis then, English nouns must have a formal GF, outside their PRED value, cf. raising predicates like 'seem'.

between numbers and classifiers; thematic relations in affine and locative structures, and optional adjuncts.

Pienemann's Processability Theory makes proposals on the way this information transfer adds up to different processing demands in different syntactic contexts, and so impacts upon emergence order in SLA.

PIENEMANN'S PROCEDURAL GRAMMAR

Pienemann implements LFG within an Incremental Procedural Grammar (IPG), based on Kempen and Hoenkamp (1987) and Levelt (1989). In Levelt's model of language production, conceptual information becomes available to a syntactic processor in discrete units, called iterations. In Kempen and Hoenkamp's IPG, information delivered to the syntactic processor is processed in numerous syntactic procedures. These run in parallel, each taking specific input and sending outputs to other specific procedures to compile syntactic structures.

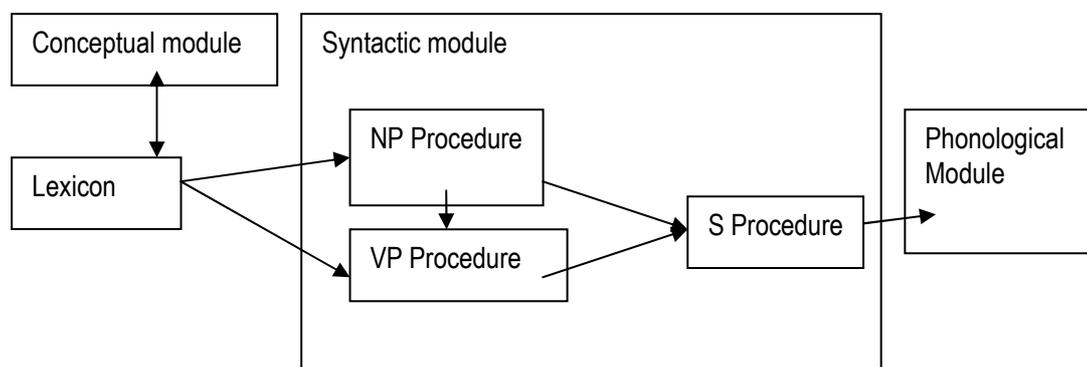


Fig 2. Pienemann's procedural grammar (after Levelt, 1989)

Procedural and developmental dependencies

This gives rise to procedural dependencies within the syntactic component. Higher order procedures cannot run to completion until they have received all the necessary input from lower order procedures. Pienemann argues that these procedural dependencies give rise to developmental dependencies: higher order procedures cannot *develop* in a learner's system, until the lower-order procedures that feed them have become automatic, (Pienemann, 1998c). The development and automatization of each procedural level is represented as a stage in the learner's overall development. This link between procedural and developmental dependencies provides the conceptual link between a theory of structure *generation* and a theory of *acquisition order*.

Moreover, each procedure serves specific syntactic functions which have an impact on surface form, so a learner's development can be mapped by reference to surface forms in their spontaneous output. In order to understand how morphology reflects syntactic development, it is essential to understand the relationships between procedures, and the nature of each procedure in some detail.

Four kinds of procedure

PT assumes four kinds of procedure: categorial, phrasal, sentential (S), and subordinate clause (SC) procedures (Pienemann, 1998c, p. 79-80). These will be discussed in turn.

Categorial procedures

The lowest order procedure is a categorial procedure. Information from a conceptual iteration is either delivered directly to categorial procedures, or activates lexical items, which are then delivered to categorial procedures. Pienemann is a little unclear on this issue. On the one hand he represents the lexicon as a set of fully inflected word-forms. For example, he says: “Lexical morphemes rely on diacritic features *which are contained in the lexical entry.*” (1998, p. 115, my emphasis), and he explains the activation of a verb inflected for past tense like this:

“The concepts related to time reference and ‘EVENT’ are activated in the same iteration, and together they activate the lemma search. This means the diacritic feature in question is available in the same location where the morpheme for the marking of past has to occur *and no information has to be deposited into any syntactic procedure* to achieve this process.” (Pienemann, 1998c: 76, my emphasis).

This view is evident also in Pienemann and Hakansson’s (1999) discussion of Swedish gender-marking on nouns, mentioned above. Since gender is arbitrary and fixed, it must be encoded in the lexical entry of each noun, but the value of other features varies with context of use. Nonetheless, Pienemann and Hakansson do not represent Swedish nouns as a single gendered root that combines with alternative affixes, depending on context, they represent each *form* of a single Swedish noun as a distinct lexical entry: hundar N PRED = HUND ‘dog’, NUM= PL; and hunden N PRED = HUND ‘dog’ SPEC = DEF GENDER = UTER (Pienemann and Hakansson, 1999, p. 400).

On the other hand, Pienemann argues elsewhere that at first, learners’ L2 lexemes are *uninflected*, because they are uncategorised and so *cannot initiate categorial procedures*. In this view, diacritic features are stored *not* as part of a lexical entry but in the *categorial procedure*, and are added to a root lemma, *after* it enters that procedure. Pienemann describes this explicitly: “*the categorial procedure* inspects the conceptual material of the current iteration...and *provides values for diacritic features*” (Pienemann, 1998c, p. 67, my emphasis).

Since this latter view is crucial to Pienemann’s account of development, we must conclude that each lemma consists of a set of features encoding idiosyncratic semantic and phonetic content, and it is activated when its semantic content matches semantic content in the current iteration, but *grammatical* features common to all lemmata of a category, are stored in the categorial procedure, and lemmata are linked to this procedure by addition of a categorial feature to their lexical structure. The categorial procedure is then initiated whenever a lemma of the appropriate category is activated by conceptual structure.

Categorial procedures can also access information that is not conceptual. Pienemann says that the feature ‘-accessible’ of the English NP ‘a child’ “was not captured by the simplified account of the

conceptual structure that represents the pre-verbal message” (Pienemann, 1998c, p. 67), yet, the morph *-en*, which expresses the corresponding value +accessible in Swedish, is classified as *lexical* in Pienemann and Hakansson (1999). This is presumably why SPEC is represented as a lexical feature of the Swedish noun, rather than as a GF specified within its PRED value. This means pragmatic information about accessibility of a referent *can* enter the categorial procedure of the noun, even though it is not part of conceptual structure.

Since conceptual and pragmatic information is held to be available in *non*-linguistic form, there is no reason to suppose that it is unavailable to learners when they employ their L2. If it is not *expressed* in the L2 it must be because the learner’s lexicon includes no L2 form linked to those meanings, or there is a form but no categorial procedure in which to deposit it. Pienemann’s view is that both conditions occur: a form must be recognised as recurrent before it will be stored as part of a categorial holder, rather than as part of a lexical item, then each lemma must be individually linked to the appropriate categorial holder before it will exhibit alternations in form.

The acquisition of lexical structure is thus partly the acquisition of language-specific forms, base and affix; partly the development of categorial holders storing feature labels; partly the development of automatic processes that deposit certain information types as values, in certain categorial holders; and partly the formation of links between many lemmata and features stored in *one* such holder.

Phrasal procedures

Once words are formed, a categorial procedure initiates a phrasal procedure, and delivers its product, the inflected lemma to a storage space or ‘holder’ associated with that procedure. The lemma that calls a phrasal procedure becomes the head of the phrase, and the phrasal procedure implements language-specific appointment rules, the counterpart of LFG c-structure rules to determine which other items can be combined with it, in which order. Input items gain access to certain positions in a phrasal holder by delivering the relevant feature to that position; a counterpart of the LFG constraint equations at given nodes in c-structure. The compatibility of the two features, the one stored in the holder, and the one introduced in an input item must be ensured by a process of unification. For example, Pienemann explains ‘do-fronting’ in early English interrogatives in terms of the provision of a do-feature to gain access to a restricted position in a ‘simplified S-procedure’. This emerges prior to the true sentential procedure (see below), which implements Subject verb agreement. In effect then, phrasal holders *are the instantiation* of c-structure rules.

The other function of phrasal procedures is to implement phrasal agreement: the unification of grammatical features expressed on independent lemmata: the head of a phrase and its modifiers, such as Det-N or Adj-N agreement. Despite the implied involvement of the unification process in assigning lexical items to a consistent position within a phrase, Pienemann represents phrasal agreement as the first significant increase in processing demands, after the acquisition of categorial features: “Phrasal morphemes require the unification of diacritic features in the head of a phrase and the modifier”

(Pienemann, 1998, p. 115). He discusses ordering constraints primarily in the context of sentential structures, where contrasts of order are apparent, as in question vs. statement formation.

Sentence procedure

The highest order procedure is the sentence procedure. This is a distinct *type* of procedure from the phrasal procedure. Firstly it is initiated not by a categorial feature, but by a Subject NP. Secondly, it incorporates information from two iterations of conceptual structure (Levelt, 1989), one contributing to construction of the Subject NP, the other to construction of VP. Agreement between items from separate iterations is called ‘inter-phrasal agreement’, and is seen as more taxing than that between items from one iteration, because it involves “the matching of features in two distinct constituents” (Pienemann, 1998, p. 113).

Pienemann suggests that during the processing of phrasal agreement, information can be retained in conceptual form, but in inter-phrasal agreement, “while the one phrase is being produced the head of the agreeing phrase has not been conceptualised. This means that the relevant diacritic information cannot be stored in the phrasal procedure.” (1998: 77). For example, in the sentence “*A child is coming*”, the auxiliary *is* agrees with the NP *a child* for person and number, but the values 3rd person and singular cannot be deposited in the VP procedure, because this is initiated by the categorial feature V, and the verb has not yet been conceptualized. The information must be deposited in the S-procedure, where it is stored till the VP is delivered. The exchange of information between separate iterations makes it necessary to store information in abstract syntactic form within the processor.

If there is no S-procedure, or the abstract representation of the features cannot be sustained for long enough, Subject-verb agreement cannot occur.

According to Pienemann, the head of a phrase and its modifiers are not ‘distinct constituents’ in a sense relevant to the calculation of processing demands because “the phrase ‘a child’ [is] produced in one and the same iteration” (1998c: 77). It is therefore the division of conceptual structure into separate iterations that Pienemann sees as the most significant influence on processing demands, after the establishment of phrasal agreement. It sets sentential processes apart from all phrasal ones, no matter how complex the phrasal relations may be. I refer to this as an iteration effect.

SC-procedure

S and SC procedures are distinct from each other because SC-procedures produce dependent clauses (S') that feed S-procedures, while S-procedures are output to the phonological component. The two may also implement different constituent orders (as in German). LFG analyses of relative clauses (RCs) represent them as a kind of S' (Sells, 1985), or CP (complementiser phrase) (Dalrymple, 2001). Pienemann does not discuss RCs at all, but if they contain a Subject NP they will involve iteration effects, so they are clearly an exception to the claim that all information required for production of any nominal is derived from one iteration. In a learner system RCs could be the product of SC procedures,

or the product of a distinct RC-procedure, which is input only to NP. Either way, they should belong to the same stage of development as complex sentences.

Syntactic vs. inter-modular dependencies

S and SC procedures (including RC procedures) are all procedurally dependent upon phrasal procedures for input; phrasal procedures are dependent on categorial ones, and categorial procedures are dependent on the activation of lemmata of a certain category. None can be initiated or run to completion without input from the other.

These procedural dependencies all arise as a consequence of relationships within the syntactic module. They relate, in fact, to the input rules defined by c-structure rules. These determine which procedures contribute their product to which other procedures. It is useful to distinguish these from the inter-modular dependency which lies at the heart of iteration effects. The terms syntactic and inter-modular dependency are preferable in some ways to Pienemann's terms, phrasal and inter-phrasal agreement, because the former highlight the fact that dependencies may exist *without* morphological agreement, and there may be significant syntactic relationships between phrases that are not 'inter-phrasal' in Pienemann's terms because they involve no inter-*modular* dependencies.

An important facet of Pienemann's model is that inter-phrasal agreement, which involves one inter-modular dependency is significantly more taxing than phrasal agreement, which may involve quite a number of syntactic dependencies. In Chapter Six arguments will be presented against this idea. In the mean-time, it is useful to bear in mind that relations between adjectival phrases, numeric expressions and noun phrases are classified as 'phrasal', rather than 'inter-phrasal', solely because they do not involve iteration effects.

Pre- syntactic processing

Pienemann argues that developmental stages arise as a consequence of procedural dependencies, with inter-modular dependencies marking a crucial division between phrasal and sentential processing. He augments this idea with additional claims that, in a pre-syntactic stage, learners are initially supported by universal, generalised cognitive processing, like Bever's (1970) NVN strategy, revised and re-labelled the 'Serial Order Principle' (SOP), and primacy and recency effects, relabelled the Saliency Principle. Where Bever's NVN strategy proposed a basic agent-action-undergoer sequence mapping later onto SVO order, Pienemann suggests a Canonical Word Order stage, where order is fixed for a given language, and processed by mapping thematic roles directly to linear order, but the order can vary from language to language. These principles enable the production of pseudo- or semi-syntactic structures that may share surface similarities with some TL structures, but cannot perform abstract and purely syntactic processes like agreement. Structures that cannot be accounted for within the framework of developing procedural complexity can be accounted for by reference to these general strategies interacting with the current procedural repertoire.

THE SIX STAGES IN SLA DEVELOPMENT

The interaction of syntactic and general cognitive processes gives rise to six stages in SLA, illustrated on Table 1. below. In the lemma stage, words are invariant and unrelated to each other, except by the SOP; in the categorial stage, lexical morphs appear; in the phrasal stage, phrasal agreement appears; in the simplified sentential stage, *peripheral* items enter inter-phrasal agreement, supported by perceptual saliency; in the sentential stage, inter-phrasal agreement involves string-medial words, reflecting independence from saliency; and in the SC-stage, complex sentences emerge, reflecting an increased capacity to deal with both syntactic and inter-modular dependencies.

To illustrate, Pienemann sees the basic SVO order in early ESL as the product of the SOP. Later, when certain words begin to appear in initial position, - an invariant form of 'do' in 'do he goes', wh-words or Adverbs, as in 'now he is here', 'when he is here?', - he argues that constraint equations ($=c$ XP, XP = ADV; WH =+ , or $=c$ DO) must be stored in an initial topic position, and the relevant licensing feature (+ DO; +wh etc) must be delivered to a unification procedure to be matched against the specified value. This advance precedes Subject-verb agreement, because it is supported by the Saliency principle: the constraints occur in a salient string-initial location. In addition, the initial position "becomes available separately to wh-words, adverbs, etc. because each of these categories requires separate control equations, which may be acquired individually" (1998, p. 99). In other words, the simplified S procedure is modified over time, by addition of an increasing number of alternative constraint equations associated with the *same initial* position. Thus syntactic and general cognitive processes combine to support the learner's productive efforts.

Table 1 Summary table for Processability and Developmental stages for German/ English (based on Pienemann, 1998c)

	Pienemann's label	S-structure	mechanisms	Capabilities	structures
Level 1	lemma	None	PF specification	link concepts to phonetic features (PF)	none
Level 2	Categorial	CWO chunks	Categorial F specification serial order principle	link Categorial F to PF/ concept; order lexemes by category	NVN
Level 2	Categorial	CWO chunks	diacritic F specification	'lexical morphology'	N(+aff) V (+aff) N(+aff)
Level 3	phrasal	NP V NP	appointment rules serial order principle;	two-word phrases, no possible variation in order	(Det N) V (Det N)
Level 3	phrasal	(Initial) NP V NP (Final)	saliency principle: licensing for salient positions	Locally licensed salient positions: information from one lexeme (DO) or phrase (XP) checked against that specified at salient position in holder	Do-fronting ADV/ WH initial
Level 3	phrasal	NP V NP	phrasal Agreement: lexical feature checked against a phrase in its own procedure	place a phrase within a phrasal procedure and unify features of matrix and embedded heads	Det-N agreement
Level 4	(simplified) S-procedure / WO rules + saliency: inter-phr info	(Initial) (Aux) NP VP/VCOMP (Final)	Appointment rules for S and VP constraint satisfaction for i) salient position ii) other position?	Thematic mapping mediated through GFs; Aux -V separation, variable order: Aux - V unification through i) saliency principle (Y/N INV) or ii) phrasal (VP) procedure. Initial positions (Aux and XP) still locally licensed under saliency, no connections with each other =>	Aux S V NP (Y/N INV) S [VP[VCOMP]] (DECL) Sporadic, (Aux 2) position, but missing Subj means derivation is unclear
Level 5	S-procedure / WO rules - saliency: interphr info; SV agreement	(Topi) (Aux) NP VP / VCOMP	Appointment rule(s) for S constraints: all grammatical	non-locally licensed internal position: information from two adjacent lexemes checked against one position in holder; information from two phrasal subconstituents checked against each other, regardless of their positions in the holder	Aux 2 (German) S-V agreement
Level 6	SC-procedure				embedded clauses; RC

SYNTAX WITHOUT MORPHOLOGY

Processability theory then takes the highly significant step of establishing a classification system for morphs based on the kind of processing demands they each entail. Pienemann recognises three types of morphs: lexical, phrasal and inter-phrasal. Lexical morphs express features stored in categorial procedures like English plural; phrasal morphs express features unified in phrasal procedures, like number inflections that appear on N *and* Adj in French; inter-phrasal morphs express features that can only be unified in the S-procedure, because they are present in items from *distinct iterations*, like the features of a Subject NP realised on a verb. This provides a useful diagnostic tool in the study and description of Interlanguage.

However, note that ‘Do-support’ and Adverb-fronting are dependent on phrasal procedures which implement appointment rules and on unification processes which check licensing features, even though they may involve *no overt morphological agreement*. (In English SLA, S-initial ‘do’ appears first as an invariant ‘do-form’.) In assuming the significance of licensing features, like +Aux, +WH, Pienemann tacitly accepts that some syntactically powerful diacritic features may be phonetically empty, or simply associated with unanalysable forms.

Conceptual features may also be null: [+ sg] is not overt on English N; we deduce its existence only from a contrast in form with plural N.

The importance of covert features means that a methodical overview of syntactic processing in a linguistic system, and of the processing demands of IL syntactic structures, cannot be achieved through an analysis of overt morphs alone. Rather, the identification of syntactically powerful features must be approached through an analysis of distributional and collocation constraints. This is especially important for an isolating language like Mandarin, which has little inflectional morphology, and for the analysis of any interlanguage, where syntactic processes may be active, but the attendant morphological markers may not have been acquired.

2.2.4 Critique of Processability Theory

Probably the severest critic of the Multi-dimensional model, in which Processability theory has its roots, is Hudson (1993). He claims that “the original social-psychological research (Clahsen et al., 1983) is fundamentally flawed, and the theoretical framework that emerged from that research has no empirical support” (Hudson, 1993, p. 462). However as Pienemann et al., (1993) point out, the psychosocial aspects of the theory relate only to *variation* between ILs, not to consistent developmental sequences, which is the aspect of the model that Processability theory builds on, and the aspect relevant to this research.

On that aspect of the model, Hudson is critical that PT equates production with competence, when production may require abilities beyond those that instantiate a grammatical system. He also questions the methodology, specifically the “problems of using unstructured interviews in combination with a reliance on suppliance or nonsuppliance” as a measure of productive capacity. His other main

criticisms are that there are no “external criteria against which to reference the developmental stages [and] ... relatively few language features that can be addressed through the developmental dimension” (Hudson, 1993, p. 479).

PRODUCTION IS NOT COMPETENCE

To take the methodological issues first, though PT treats only unrehearsed output as a valid reflection of processing ability, it also employs certain elicitation techniques to encourage the use of specific structures, while excluding other techniques. These are described in more detail in Chapter Four. Thus elicitation techniques are not as unstructured as Hudson’s comments suggest, and because of this, non-suppliance is more likely to reflect actual inability than would be the case with randomly collected spontaneous data.

On the other hand, the point that production is not competence is a valid one, and it is true that a functioning grammatical system could be explored through analysis of learners’ interpretative accuracy, or grammaticality judgements, as well as through their production. However, this does not invalidate the use of production as one means to investigate competence, especially since declarative knowledge is known to bear *no* relationship to competence either in native speakers, who are fully competent by definition, but may have *no* declarative knowledge, or in learners, who may cite pedagogical rules but not apply them, or apply them with ungrammatical results because the rules themselves are flawed. Thus, spontaneous production is at least as good a measure of competence as interpretation or grammaticality judgements.

SYNTACTIC DEVELOPMENT IS NOT A MEASURE OF PROFICIENCY

To the criticism that syntactic development assessed by Processability theory does not accord with standard measures of *overall* proficiency, Pienemann et al. respond: “It was repeatedly found that (a) in any large sample one finds a set of grammatical rules that *is ordered implicationaly*, (b) for any given target language *the rules that follow an implicational pattern* and those that do not *are always constant*, and (c) this implicational order is *retraced by all learners* who have been observed longitudinally (Clahsen et al., 1993; Jansen 1991; Meisel, 1980, 1983, 1991; Pienemann 1981, 1984, 1988; Pienemann & Mackey 1993)” (Pienemann et al., 1993, p. 496, my emphasis). In other words, one of the strengths of PT is that its developmental stages are *descriptive* of empirical observations in longitudinal studies. As such, they can hardly be disputed. If they are not consistent with conventional proficiency measures this can only mean that those measures assess something other than spontaneous syntactic productivity. Since there is clear evidence that teaching brings quicker and more long-lived changes when it follows the natural order (Pienemann, 1984), it would seem that a student’s position along a developmental continuum is at least as important to assessment and curriculum design as other measures of proficiency.

A LIMITED FRAMEWORK?

Pienemann et al., (1993b) answer Hudson's claim that PT addresses relatively few language features with the argument that automatic morpho-syntactic processing, which it does address, is *crucial* to grammatical development, implying that grammatical development is also a key component of more general linguistic competence. Hudson's view is that communicative ability is more important to the satisfaction of social needs than normalcy, but only a reasonable mastery of linguistic norms, both phonological and syntactic, will meet the more complex social needs of non-native speakers: autonomy, empowerment, and if they should choose it, cultural integration.

As for describing morpho-syntax itself, Pienemann et al argue that "it would be an oversimplification to reduce this system to a simple 5- or 6-point scale" (1993, p. 501) because in one developmental grammar, "the rules, in all their variations, may number between 50 and 100" (Pienemann, 1993, p. 501). This is an interesting comment given that Pienemann himself presents PT as a six stage developmental hierarchy. Though grammars may comprise hundreds of rules, PT really provides no insights into the ordering of rules within the six stages, because for Pienemann c-structural variation and complexity is not generally significant in the determination of processing demands. Though his adaptation of LFG focuses mainly on the representation of c-structural relationships, rather than f-structural relationships, at the same time, it downplays the significance of constituent structure on processing demands. This is in keeping with the spirit of LFG since processing is related to f-structural relationships rather than c-structural relationships. The main c-structural distinctions relevant to PT are those between a word and a phrase at one extreme, and a phrase and a sentence at the other.

More significant, in Pienemann's view, is the way *conceptual* structure interfaces with the syntactic processor: the iteration effect. This does create some apparent limitations in the scope of the theory. It seems that PT may have little to say about developments in nominal syntax, the focus of this thesis, because nominal syntax is largely phrasal syntax. Nonetheless, it has been applied to the acquisition of some Mandarin nominal morphs (Zhang, 2001), as will be seen in Chapter Three. Moreover, I will argue in Chapter Six that the very assumption of a unification process in phrasal agreement entails that information from conceptual structure is *not* equally available to all phrasal or indeed all categorial procedures activated within a single iteration. This means information must be stored and exchanged in abstract form in phrasal, and categorial procedures as well. This indicates that the difference between sentential and phrasal processing has a basis other than the purely conceptual one that Pienemann suggests. Iteration effects notwithstanding, it is primarily c-structure rules, instantiated as *phrasal* holders, that determine when specific features *must* be made available, either to license lexical insertion or to satisfy GF assignment, and it is *lexical* feature structures that determine when specific lexical features *can* be made available, and which GF positions must be filled. In other words, it is the distribution of features across lexical and phrasal structures that determines how far information must

be transferred, and so how long it must be stored in abstract form. The (matrix) s-procedure is simply the last possible point at which unresolved feature specifications can be resolved.

Thus, PT is more relevant to the development of nominal structure than first appears to be the case. Despite Hudson's reservations, Processability theory continues to offer a robust framework within which the orderly acquisition of syntax can be profitably explored. Being grounded in concepts of constituency and the need for information transfer, it has the significant advantage over earlier descriptions of morphemes, that it can be applied to languages of any type. Moreover, it proposes constraints on acquisition orders based on universally applicable and theoretically assessable factors, and thereby creates the opportunity to develop an account of acquisition orders relevant not just to a single language, but to language generally. To date, PT has already been applied not only to inflectional languages like German (Pienemann, 1998c) and Swedish (Pienemann & Hakansson, 1999), and to a lesser extent, English (Pienemann & Johnston, 1997), and Japanese (Huter, 1998) but also to the isolating language, Mandarin (Zhang, 2001). I discuss Zhang's research in Chapter Three.

Now I turn to theories that view language acquisition as the work of a Language-Acquisition-Device (LAD), distinct from generalized cognitive processing.

2.3 NATIVIST /STRUCTURAL MODELS

Cognitive capacities dedicated specifically to the acquisition of language are often referred to as a Language-Acquisition-Device (LAD). The most convincing evidence for cognitive processes specific to language is the fact that language *acquisition* is generally successful in people with various general cognitive impairments, and, on the other hand, language recovery after trauma may sometimes be difficult, even when other faculties are recovered. The view that language processing *must* be independent of general cognitive processes, even during acquisition, is based more on the notion that abstract uniformities underlie all languages, that cannot be readily explained in terms of direct experience: the poverty of stimulus argument (Chomsky, 1965). These uniformities seem to bear no relation to constraints on other cognitive or bodily processes.

Over the last 50 years Chomsky (1965, 1986, 1995, 1999, 2000) has been a significant figure in the move to discover these uniformities and describe them in terms of some kind of universal principles or constraints. Though he has proposed a number of different paradigms of universal grammar, the latest being the minimalist programme, his basic view on language acquisition has remained fundamentally unchanged. Chomsky (1999) describes language acquisition as a process partly of syntactic 'refinement', but also partly of lexical construction. Using the terminology of minimalism, he says:

UG makes available a set *F* of features (linguistic properties) and operations *C_{HL}* (the computational mechanism for human language) that access *F* to generate expressions. ... [A]cquiring a language involves at least selection of the features [*F*], construction of lexical items *Lex*, and refinement of *C_{HL}* in one of the possible ways – parameter setting. (2000, p. 100).

2.3.1 Parameter-setting

Parameter-setting is the aspect of the Chomskyan paradigm that has been applied most extensively and most consistently to the analysis of language acquisition. Parameters represent bounds within which grammars may vary, and language-specific settings for parameters clearly need to be acquired (Haegemann, 1995; Radford, 1990).

Studies of SLA within the earlier paradigm of Government and Binding theory focussed mainly on refining parameters (Pollock, 1989; Haegemann, 1995) identifying input relevant to parameter-setting (Haegemann, 1995; Radford 1990; White 1996) and determining the extent of L1 influence over the process of parameter re-setting (Roeper & Weissenborn 1990; Valian, 1991; Crisma, 1992; Levow, 1995; Haegeman, 1996; Clahsen Kursawe & Penke, 1996). Little of this research is relevant to the question of acquisition *order*; but one idea that is relevant is Berwick's 'subset principle' (Berwick, 1985). This proposes that each parameter should begin with the setting that produces the smallest range of structures, so that it can be readily contradicted by direct counter-evidence from the TL.

The pro-drop parameter is one of the most extensively studied. This parameter allows retrievable Subjects to be omitted in main clauses (in apparent violation of the Empty Category Principle) and is also associated with the acceptability of post-verbal Subjects, (though these may occur even in non-drop languages like English). According to the subset-principle, the initial setting of the pro-drop parameter should exclude dropping, so exposure to just one dropped Subject will indicate the need to reset the parameter. In fact, research on L1 acquisition has found Subject-dropping and the use of post-verbal Subjects to be common-place among *all* children regardless of TL, which seems to undermine the subset-principle. For example, children acquiring French, a non-drop language, produce post-verbal Subjects at around the age of two (Friedemann, 2000), and two-year olds acquiring French, Danish and English, all non-drop languages, frequently omit Subjects (Rizzi, 2000). However, the *context* of dropping varies with the TL type: in pro-drop languages, Subjects may be dropped in any clause; in non-drop languages like French, Dutch and German, early Subject drop is limited to main clauses and does not occur in post-*wh* positions. Recent studies indicate that this distinction can be seen as a difference in the relative *frequency* of dropping in these two contexts by two-year-olds (Roeper & Weissenborn, 1990; Valian, 1991; Crisma, 1992; Levow, 1995; Haegeman 1996; Clahsen, Kursawe and Penke, 1996). Rizzi (1994, 2000) interprets this as evidence that the pro-drop parameter is set *before* production begins, and also, that L1 development is shaped by other equally important factors not related to parameter setting.

His proposal is that children initially fail to project the functional levels of structure that contain Subjects (Rizzi, 1994), while adult speakers generally do project them, except in special registers. Children begin to project upper levels, in order to accommodate *wh*-words and complementisers, which fall outside the canonical string of S, V and O. As learners of non-drop languages begin to use

Subjects in embedded clauses, while learners of pro-drop languages do not, the setting of the pro-drop parameter becomes evident, however it is not clear when it is actually set.

Despite years of research, parameters and the input that ‘triggers’ their setting have proved to be difficult to identify, and the issue of unsetting and resetting parameters in SLA poses additional problems. The WH-parameter, responsible for a range of phenomena including the fronting of question words, adverb preposing, quantifier movement and certain types of syntactic ambiguity has also been re-considered subsequent to the realisation that these phenomena do not emerge together in L1 or L2 acquisition. This throws doubt on the validity of the parametric construct on the one hand, that is on the range of phenomena held to be reflexes of a single parameter, and on the notion that parameters are a syntactic construct that must be set once for all phrase types or levels of structure in a language.

Increasingly, accounts of SLA have looked to the idea that syntactic acquisition involves a gradual extension of syntactic projections, triggered by the acquisition of specific lexical items or lexical features. These proposals are examples of weak continuity between the processes of L1A and SLA (Clahsen, Eisenbeiss and Vainikka, 1994).

2.3.2 Building functional structure

MINIMAL TREES

Vainikka and Young-Scholten (1994, 1996, 1998) propose explicitly that “L2 learners build up phrase structure in much the same way as children do” (1996, p. 13), and in particular, lack functional projections but transfer lexical projections from their L1. Functional projections are then acquired in a fixed order from the bottom up: VP, FP, AgrP, IP, CP. Each addition reflects a new (mental) grammar, making new output and processes possible, and so constituting developmental stages.

Vainikka and Young-Scholten argue that in English L1 acquisition (Vainikka, 1993), and the SLA of English, German, and French, acquisition of functional levels proceeds from the bottom, up. In the initial VP stage of SLA, learners employ the word order of their L1: in their early German sentences, Romance speakers produce predominantly VO order, while Turkish and Korean speakers produce predominantly OV order. Structures have the appearance of sentential structures (SVO or SOV), because learners can accommodate the Subject within VP, but they use no Tense, Nominative case, or movement, since these require a functional structure larger than VP. Matrix verbs may be subcategorised as taking complements that are “extensions of VP” (Vainikka & Young-Scholten, 1996), but the grammar can produce no such extensions, so embedded clauses do not appear at this stage.

In the next stage, learners develop an “underspecified” Finite Phrase (FP) which contains no grammatical features or tense, but provides a landing-site for movement: V-raising past negation and adverbs (both adjoined). FP is said to be aligned according to a universal default FP-VP, so if learners assumed an OV order, based on L1, but the TL is VO, they can now move V past O to simulate the TL order. Next, FP either develops into, or is “overlaid” by a *TL* AgrP, containing the features of the

Subject. This makes Subj-V agreement possible, as appropriate. Following this, IP develops, allowing Modals and Auxiliaries to appear, and finally CP emerges, bringing with it embedded clauses, complementisers, Wh-movement, and V2 phenomena.

Aware of proposals that the word order parameter may actually be associated with functional rather than lexical projections (Chomsky, 1991), Vainikka and Young-Scholten qualified their claim as to just how much is transferred, and how much acquired, by proposing that acquisition may involve only some functional projections “(say located at the top vs bottom of the tree) rather than functional vs lexical projections” (Vainikka & Young-Scholten, 1996, p. 14). Clearly they view acquisition as proceeding in an ‘upwards’ direction. They also assume a universal order of functional levels.

On the topic of nominal structure however, Vainikka and Young-Scholten say little, though they do stress a point observed by Zobl and Liceras (1994) that in English SLA, DP (the use of articles), emerges *before* IP (the use of Auxiliaries). Assuming an appropriate nominal structure, with functional levels between D and N, their ideas are easily extended to the nominal domain, and could account for the absence of definite articles in early child language also.

VALUELESS FEATURES (“INERT” FUNCTIONAL PHRASES)

However, the idea that phrase structure is extended from bottom to top is disputed by Eubank (1996). He points out that Germans learning English appear to transfer verb-raising from their L1 (Wode, 1981), because they place uninflected verbs before negation, as in (2) below, but French learners do not do so, even though this order exists in their L1 also (White 1992; Tiphine, 1983), i.e. in the colloquial: *vas pas* ‘go NEG’.

2) John go not to the school (from Wode, 1981, as cited in Eubank 1996, p. 85)

Since there is no uniform transfer effect, Eubank argues, the difference must relate instead to variation in the order of functional projections across languages. While Pollock (1989) argues that T(ense) is above AGR in English, French and German, and differences arise between them because T moves downwards to V in English, but thematic verbs move upwards to T in French and to C in German, Eubank argues that T is *below* AGR in French and English, but above AGR in German, i.e. ‘in CP’. The V2 effect is then said to arise in German, where V consistently precedes negation, because all verbs move to C (Evers 1982, cited in Eubank, 1996; Santorini 1994), while in French, finite verbs precede negation, but non-finite verbs must not, since they do not move to T.

Next, Eubank argues, following Speas (1994), that functional projections become available only when phonetic or semantic content forces them to project. However, he then argues, *contra* Speas (1994) that “the presence of Agreement implies the presence of Tense... even though without morphological manifestation” (p. 97, note 13). This means once a learner of English projects AGR, on the basis of 3rd person *-s*, they must also project TP. So, Eubank suggests, French learners of English will project their L1 version of structure, with TP below Agr, while German learners of English project *their* L1 version, with T in CP above Agr. The French TP attracts only tensed V, and while T is still

'inert' in the French learners' English, V will not move above negation in their IL, but the German CP attracts *all* V, tensed or not, so German learners will produce structures as at (2) above.

In a sense, Eubank's proposals contradict the more typical assumption that acquisition is a *lexically* motivated extension of phrase structure from the bottom up, but in another sense they rely upon that assumption, since projection of a higher level is held to *entail* the projection of all lower levels. This points up the fact that neither Eubank's nor Vainikka and Young-Scholten's accounts are really *explanations* of acquisition order; they simply transpose the question into a new domain: if functional levels emerge in the order they do because development proceeds from the bottom, up, why are functional heads arranged in the order that they are in the first place?

In Eubank's account it is not at all clear why C and T are forced to project whenever Agr does, or why the structural level in which the IL V appears is labelled CP when neither T nor C is active. Moreover, since the location of T and the strength of Agr are both parameters, there is no clear basis on which to argue that one is transferred, but the other is not.

A more fundamental problem for these proposals is the question as to whether the truncation hypothesis, i.e. the absence of FPs, can be legitimately extended to SLA at all. Zobl and Liceras argue that morpheme orders in English L1A are quite different from those in SLA precisely because in SLA, functional structure is *already set*. Rizzi (2000) argues on the basis of research on verb-Neg order in early child French (Friedemann, 1993) and Dutch (de Haan, 1987, and others), that even in L1A, "it seems fairly safe to conclude that *children project functional layers very early on*; their initial syntactic representations cannot be purely lexical, nor can they systematically constitute manifestations of small clauses excluding functional material" (Rizzi, 2000, p. 8). So the absence of the IP level in child L1 acquisition provides a plausible account of absent Subjects in child-speech, but it is by no means clear that such simplifications would arise in SLA, or would affect lower levels of structure. It is also unclear whether we can safely assume a stable cross-linguistic order of functional heads.

THE ORDER OF FUNCTIONAL HEADS AND ACQUISITION ORDER

Though the possibility of cross-linguistic variation in the order of functional heads is still very much a moot point, the most exhaustive typological studies in this area do suggest a high degree of uniformity in the underlying order of elements, if not in their realisation. Cinque (1999) compares restrictions on the ordering of different adverbs, modals, tense, aspect, and polarity items in many languages and argues that the possible orders arise because each semantic type of adverb is the specifier of a different functional head; the functional heads are uniformly ordered in all the languages surveyed; and the possible variations in order are limited to those that can be derived by moving ordered subsections of the hierarchical structure upwards to higher specifier positions. He concludes by proposing upward of 30 universal functional heads occurring in fixed order in clausal structure.

Longobardi (1994, 2001) performed a similar analysis of adjective order in Germanic and Romance nominals, and argues for at least three distinct head positions between DP and NP, into

which the N might move, as well as numerous specifier positions on either side of these, where Adjective phrases can be accommodated.

However, this data is based largely on Indo-European languages, and the order proposed cannot account so readily for orders found in some genetically distant languages, such as Niuean (D. Massam personal communication, July 2004). Cinque (2000) proposes a similar base order for nominals, with reference to Semitic and Celtic languages as well as Romance, but these all conform to Greenberg's Universal 20, which states that, wherever Dem Num and 'descriptive Adjective' all precede N, they do so only in that order. In Mandarin however we see optional modifiers that *precede* demonstratives and numerals:

- 3) a. zūi dà de nà yī běn shū
 most big de that one classifier book
 That biggest book
- b. guó lì de nà yī suǒ xuéxiào
 state-established de that one classifier school
 That state-founded school

While the structure at (3a) might be excluded from Greenberg's universal 20 on the basis that the modifier *dà* is a verb, not an adjective, the modifier *guólì* (state-founded) is among the lexemes that Li and Thompson (1981) identify as adjectives in Mandarin on the basis that they cannot function as predicates. Thus Greenberg's proposed Universal 20 is *not* in fact universal. Moreover, since Cinque argues that the order Adj Dem Num is excluded in Romance, Celtic and Semitic languages because it cannot be derived by legitimate movements from the underlying order Dem Num Adj, we are forced to assume that Mandarin either has a different underlying order, and other languages might have different orders too, or that movements or combinations of movements other than those proposed by Cinque are permitted. Either way, the relationship between a universal base order, restrictions on movements and possible surface variations is undermined.

Minimalism also presents a challenge to the view the functional heads are universally ordered by suggesting that the order of phrasal levels is constrained only by the way in which lexical features interact (Chomsky, 1999; and see Silvar-Villar & Gutierrez-Rexach, 1997, on cross-linguistic variation in the feature structure of 'CP').

While research in the Principles and Parameters framework has been instrumental in revealing similarities and differences in acquisition orders, it has led ultimately to a search for alternative models through which to account for syntactic constraints and patterns of acquisition, and relate these to generative processes. The most significant recent development in this regard is the minimalist programme (MP).

2.3.3 Minimalist SLA

The Minimalist Program (MP), first articulated by Chomsky in 1993, takes a fresh look at the notion of parametric variation, and the projection of constituent structures, with significant

consequences for the development of acquisition theory. The MP is a programme for the development of theory, and as such its theorems are frequently revised (Chomsky 1993, 1995, 1999, 2000), but its central tenet remains constant: syntactic processing must be as economical as possible, because the resources of the computational mechanism are limited. The MP aims to account for the characteristics of language in terms of these limitations interacting with lexical structure. This constitutes a major paradigm shift from the assumptions that underlay the older Principles and Parameters approach. It also makes the MP an obvious framework within which to consider possible relationships between processing demands, in this case relative economies, and acquisition order in SLA.

The MP still incorporates the notion of principles, i.e. universal constraints, and parameters, i.e. limited cross-linguistic variability, but the nature of the principles and parameters has changed significantly. To understand how the MP might account for acquisition orders, it is necessary to understand something of the way syntactic derivations are conceptualised in this paradigm. I follow Chomsky, 1999, unless otherwise stated.

The aspects of the MP that are most relevant to the analysis of Mandarin ILs that will come later are firstly, those that impact on efficiency, since these will be important in calculating processing demands, and secondly, those that constrain the distribution of features across lexical items and constituent structures, since these will be important in parsing the feature structure and constituent structure of IL lexemes, and syntactic constructions, respectively. These two aspects of linguistic structure are theoretically unconstrained in LFG.

Factors impacting on efficiency include the number of constructive operations required in a given derivation, and the duration of a derivation's occupation of the syntactic processor. Both of these depend upon the number and distribution of features across lexical items.

It is assumed that the main factors that constrain lexical feature structure are interactions between two different types of feature, interpretable and uninterpretable; the way these activate lexical items as a whole, making them eligible to partake in syntactic processes; and the limited capacity of the processor, which forces sections of a developing structure to 'spell-out' to the phonological and interpretative interfaces at certain intervals, terminating any possibility for features to form further syntactic relationships.

LEXICALLY -DRIVEN DERIVATIONS

The minimalist conception of syntactic structure building is not unlike that of LFG. Words are seen as collections of features (F) which consist of a label, indicating their type, and a value corresponding to content: phonetic, semantic or in some instances abstract values, like case. They combine to derive syntactic objects (SOs). However, unlike LFG, the MP employs no phrase structure rules; instead, syntactic relations arise *directly* from relationships between lexical features. A derivation is initiated by copying selected lexical items from long-term memory to a working space or 'numeration' organized into sub-arrays. A sub-array can be identified by "considerations of semantic-phonetic

integrity” (Chomsky, 1999, p. 11). “On the “meaning side”, perhaps the simplest and most principled choice is to take SO to be the closest syntactic counterpart to a proposition: either a verb phrase in which all θ -roles are assigned or a full clause including tense and Force.” (Chomsky, 2000, p. 106). In other words, a sub-array corresponds to a conventional constituent, much like the procedures of Processability Theory. However in the MP there are no significant conceptual divisions: all portions of a proposition are made available to the computational mechanism at the same time, in the form of a ‘numeration’ or ‘lexical array’, containing all lexemes relevant to a given construction.

SOs are built by two productive operations Merge and Copy. Merge “takes a pair of syntactic objects (SO_i, SO_j) and replaces them by a new combined syntactic object SO_{ij} ” (Chomsky, 1995, p. 226). Merger involves one of the selected items ‘projecting’ a new structural position, to which the other attaches. The item that projects becomes the head of the new SO, and the other item becomes a sub-constituent which can no longer project. The operation Copy replicates an SO that is already merged, so the copy can be merged at a later point in the derivation of a larger SO. At PF the phonetic features of either copy can be interpreted, but only one is generally implemented as an articulatory schema. When this is the copy merged later, it creates the impression of movement.

The smallest possible SO must be a single lexical item. To be eligible for merger, two LIs must share at least one feature *type* (Chomsky, 1995). Feature values are irrelevant because they cannot be interpreted within the syntactic processor. To be visible to each other, and to the operations, Merge and Copy, each lexical item and larger SO must have at least one *uninterpretable* feature. These are feature labels with no value.

A principle of Full Interpretation requires that all features in the numeration must be delivered to Conceptual-Interpretative and Phonological Interfaces where they are converted to conceptual representations and articulatory schemata, (LF and PF respectively). The delivery of an SO to the interfaces is called spell-out. Since uninterpretable features have no value, they cannot be assigned a phonetic reflex or semantic interpretation (Chomsky, 1995, 2000). If they are spelt out, the derivation will ‘crash’, cancelling the current numeration, and forcing construction to start again. To avoid a crash, uninterpretable features must inherit a value by entering an agreement relation with a valued feature of the same type before they spell out.

Agreement is initiated by attraction between the like feature-types, resulting in the merger of the LIs that contain them. The uninterpretable features ‘activate’ an item making all its features visible. The more feature-types two items in a numeration share, the more strongly they will be attracted (Maximal match), and so the more likely that they will merge to form an SO.

In this way, the principle of Full Interpretation is the main driving force behind the process of syntactic derivation, and the distribution of valued and unvalued features across lexical items is one of the main factors in determining constituent order.

The other main factor is the capacity of the working-space.

STRENGTH, MOVEMENT AND SPELL-OUT: THE MINIMAL PARAMETERS

Because the capacity of the workspace is inherently limited, unvalued features cannot be stored indefinitely. Therefore the derivation is punctuated at intervals by the delivery of a certain quantity of structure to the interface, in spell-out. This is one of the aspects of the model that has undergone significant revision. In the MP, Chomsky (1993) suggested that the complement of every phrase was spelt-out at completion of the phrase, and the periphery, head and specifiers, remained to be integrated with the next item merged. Just before spell-out, a special feature called an EPP feature could be deployed to move one portion of structure containing any unvalued features from the complement to the head or a specifier position, to avoid spell-out. The label EPP derives from the older notion of an Extended Projection Principle, which forces a Subject to move from VP into IP, the extended functional projection of a verb.

An EPP feature was said to force an SO of a specific *category* to be merged or moved into the phrase where the EPP feature is expressed, and that feature was said to be checked or deleted when this merger or movement had occurred. Related to this was the proposal that features could only be valued in Head-Head or Spec-Head relationships. This meant that unvalued features could not be tolerated within a complement. Recall that 'movement' is actually a combination of copy, merge and selective parsing of the copy into phonetic form (PF). When the features of the later merged copy were converted to PF, the movement would appear overt, and the EPP feature was called 'strong'. When the features of the original were converted to PF, the movement was called covert, and the EPP feature was 'weak'. An EPP feature overtly deleted by a DP was referred to as a 'strong D' feature, and so on. The sentence or Tense Phrase (TP) is assumed to universally express a strong D feature, giving rise to Subject extraction out of VP and expletive Subject insertion. Pro-drop languages are theorised to have strong DP features, but to have covert pronouns which overtly check the strong D feature of TP. Apart from this, the availability and strength of EPP features is seen as generally parametric. Assuming a base order of SVO, a strong D feature in V gives rise to scrambling of an Object to a pre-verbal position, giving SOV order; one in C, gives rise to V2 order; and a strong N feature in D, gives rise to N-D movement, allowing Nouns to precede their modifiers and so on. Since a strong EPP feature must be checked, an expletive would be merged if no constituent was visible to Copy, that is, if the complement was already fully valued. In this way, strong EPP features account for successive cyclic movement, both head movement, and A-movement, as well as parametric variations in head order. In fact, the inclusion, quantity and strength of EPP features are really the only parameters available in the MP.

HERSCHENSOHN'S CONSTRUCTIONISM: A THREE STAGE MODEL

On the basis of this conceptualisation Herschensohn (1998, 2000) proposes an account of acquisition order in SLA, which she calls Constructionism. She argues that, since adults process their L1s by way of the two operations, Merge and Copy, they necessarily have access to UG, in this

restricted sense. Also since Parametric values are seen as values of lexical features, all that needs to be acquired is a new ‘morpho-lexicon’ with L2 appropriate features. She likens this to Clahsen’s Lexical Learning Hypothesis in L1A (Clahsen et al., 1994, 1996; Müller, 1994, 1996). It is also a restatement of Chomsky’s position quoted earlier: that acquisition consists of lexical construction and refinement of the mechanism through parameter setting.

Herschensohn proposes that “L2 learning is substantially a matter of vocabulary and morphology acquisition with a progressive fleshing out of [\pm interpretable] features to gain the correct value for a given parameter” (Herschensohn, 2000, p. 109).

More specifically, Constructionism recognises three stages of L2 development: an initial stage, characterised by full L1 transfer (Schwartz and Sprouse, 1996); an intermediate stage, where parameters are reset to L2 settings; and an expert stage where parameters largely match those of the L2. In the intermediate stage, Herschensohn suggests, uninterpretable features are acquired before interpretable ones, and word order is acquired, through a determination of the strength of EPP features, attracting categorial features, before semantic agreement features like person, gender number appear. Uninterpretable features become specified gradually, from lexical item, to morphosyntactic class (lexical class) to other classes, ‘construction by construction’. Thus, Herschensohn claims that “the L2ers are able to unset the L1 value long before setting to the L2 value” (Herschensohn, 2000, p. 112).

To understand these claims, it is important to realise that Herschensohn is speaking of parameters in two distinct senses. In the principles and parameters framework, a parameter was expected to be associated with a cluster of related constructional effects: a V2 parameter would cause the verb to be second in every construction, regardless of whether it was preceded by an adverb or a wh-word. In minimalism, parameters are realised as the strength of features in each distinct functional level. In this light, Herschensohn’s claim that a parameter is ‘progressively fleshed out’ can be understood to mean that a *combination* of parameters that produce macro-effects like V2 may be set level by level. By the same token, the claim that a parameter can be unset long before it is re-set must mean that a series of parameters can be returned to a default value, and then revalued individually, until the expected cluster of similar patterns asserts itself. Assuming adverbs and wh-words occupy *distinct* functional levels, each level’s strength can be determined separately. Herschensohn suggests that because the MP sees acquisition as grounded entirely in the lexicon, which may be more or less accurately acquired, it copes better with the variability and incompleteness of SLA than a principles and parameters approach.

PROBLEMS WITH HERSCHENSOHN’S MINIMALIST MODEL.

This view of acquisition actually does little to account for regular patterns in the emergence of syntactic structures. In effect it suffers from the same limitations as the minimal trees approach: it simply transfers the phenomena to be explained into a different domain. Instead of accounting for the

emergence of syntactic structure, we must account for the emergence of specific lexical feature values. There are problems with the basic implementation of minimalist principles also.

Lexical transfer and lexical construction

First Herschensohn suggests that the initial stage of SLA is full transfer, but in the MP framework, a language specific-grammar is instantiated only within the lexicon. Full L1 transfer of an L1 lexicon is not acquisition at all. Moreover, within the MP framework, it is not clear that L1 lexical items can be decomposed, say by removing L1 phonetic features, and overlaying new L2 features, because Chomsky states:

“Operative complexity is reduced if L makes a one-time selection of a subset [F] of F, *dispensing with further access to F*. It is reduced further if L includes a *one-time* operation that assembles elements of [F] into a lexicon **Lex**, *with no new assembly as computation proceeds*. (Chomsky, 2000, p. 100, my emphasis).

It is a premise of the theory that ‘operative complexity’ must be reduced, so this suggests that features must remain bound within the lexical items they initially construct, as they are stored in long-term memory (see Appendix I).

Necessarily then, SLA involves, the construction of a new lexicon by a new ‘one-time’ selection of F from the universal pool of F. It is possible that familiar features or even feature clusters might be transferred, but this is different from the full transfer of L1 lexical items that Herschensohn’s description suggests. Her claim that “L2 learning is substantially a matter of vocabulary and morphology acquisition” is more in keeping with minimalist notions.

Unspecified features and uninterpretable features

However, Herschensohn suggests that L2 features are initially unvalued, and then progressively ‘fleshed out’. In principle every working lexicon must include both valued and unvalued features, in complementary sets. This is because unvalued features are essential to render lexical items visible to the operations Merge and Copy, and valued counterparts are essential to satisfy Full Interpretation. The computational mechanism cannot tolerate unvalued features that have no valued counterpart, or cannot enter into agreement with that counterpart. They would cause the derivation to be cancelled in its entirety.

It is also not possible for a single parameter to be ‘unset’ in the sense of having no value. Since EPP features are lexical features, they are either part of a functional head’s structure or not. It would be possible to assume a preference for no EPP features, since they necessitate movement, which is costly. In this case, we’d expect initial L2 utterances to revert to a default order. However, in the MP that order is dictated entirely by maximal match. This means early L2 constituent order will depend entirely on the particular combination of interpretable and uninterpretable F each learner selects to construct their first L2 lexemes.

If they do select some EPP features, those features must be deleted by a specific category: this is essentially what EPP features are. So, the relevant categorial features must be selected and distributed across lexical items before a corresponding EPP feature can be successfully included in the structure of any functional head. Finally, once EPP features are integrated into functional heads, they must be either strong or weak, but either way, they will generate movement. The only difference is whether the earlier or later copy of the item is converted to PF. Since it is syntactic movement rather than conversion to PF that is deemed costly, there is no clear reason why learners should prefer a weak over a strong setting. So in this framework, there is basically no clear reason why regular patterns of word order or regular changes to patterns of word order should arise cross-linguistically, on the basis of parameter-setting.

While the minimalist model can better accommodate the gradual emergence of a cluster of similar effects, it offers no obvious advantages over the earlier models in terms of motivating the specific order that is observed.

The model becomes even more problematic in the later version of feature theory proposed in *Derivation by Phase*, (Chomsky, 1999).

Derivation by Phase

In *Derivation by Phase* Chomsky (1999) revises several of the basic assumptions about relationships between EPP features, movement, spell-out and the constraints on agreement relations between features. Where previously agreement was restricted to head-head and head-specifier relationships, the revised version allows features to be valued in certain complement positions. Secondly, not every phrase is spelt-out. These revisions and others were deemed necessary to account for agreement between a verb and a 'post-verbal' Subject, as in the Icelandic structures at (4). The case of the direct object (DO) varies depending on whether the verb is unaccusative, as in a) where the DO *a man* is nominative, or a passive participle, as in b) where the DO *several fish* is accusative.

- 4) a. there is likely to [_{unaccus. VP} arrive a man_{Nom}]
 +Nom theta-marker
- b. we expect there to be [_{PRT} caught_{ACC} several fish_{Acc}]
 +Acc theta-marker

Chomsky argues that this is because the verb-forms 'is' and 'caught' that theta-mark the DOs in (4) lack a crucial type of feature, and this prevents them from deleting case. In the MP case is deleted as a reflex of a DP's contributing the values of specific features called ϕ -features to a functional head. The ϕ -features are generally assumed to include gender, person and number. In this case, the verbs are said to be unable to *inherit* a value for the feature person, because they simply lack that feature type. Therefore, the DO must delete case by entering agreement with a more distant head which expresses that feature. This is T in (4a), and the functional head v dominating 'expect' in (4b) (see Fig.3.)

The assumptions here are that the DO is the *complement* of the verbal participle (PRT), since it is the first item that merges with it. At the close of TP, the Case feature of DP was still unvalued, but the DO must not have moved to delete the EPP feature in TP, because it was deleted by an expletive ‘there’. Despite remaining *in-situ*, the unvalued DO did not cause the derivation to crash, and the DO had not spelt-out till after the verb [expect] was merged. Clearly then, even if TP triggered spell-out, the VP [caught some fish] was not selected to spell out, nor did it trigger spell-out of its complement, the unvalued DO.

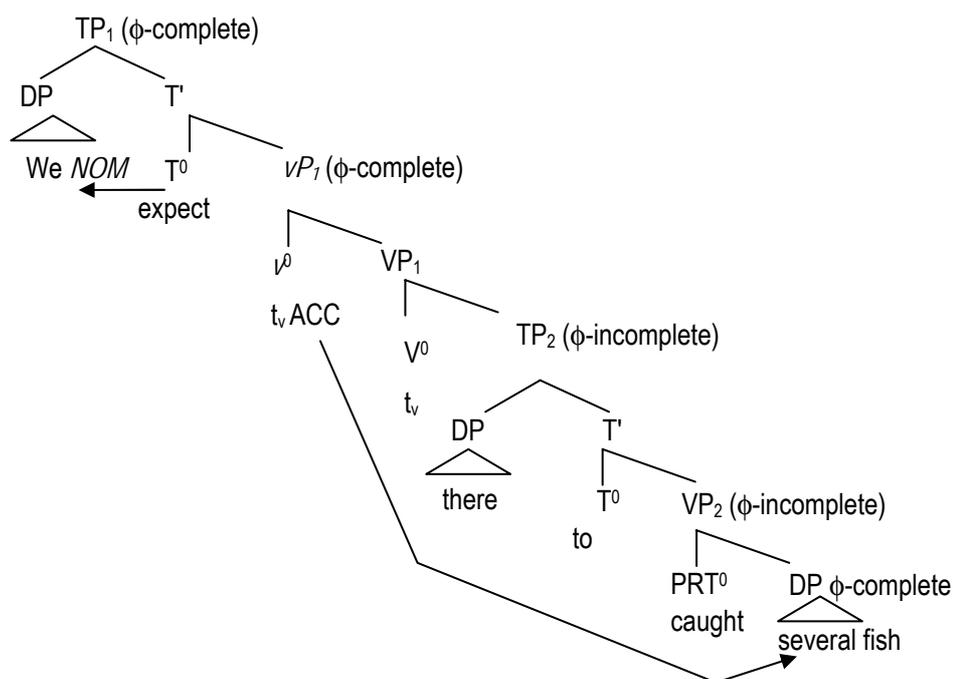


Fig. 3. ϕ -completeness and Case assignment

To account for these facts, Chomsky proposed a new notion: the *phase*. Basically, a phase is equivalent to a phrase: all the mergers licensed by a single head, but only some phases trigger spell-out. These are called strong phases. At the completion of one strong phase, the complement of the *previous strong phase* is delivered to the interfaces, while the periphery remains in the work-space, as (part of) the complement of the *current strong head*. Strong phases are always functional, rather than lexical or ‘substantive’, but the converse is not true. Phases that do not instigate spell-out are called weak.

In this version strength and the deployment of EPP features are related but not identical. EPP features occur only in strong phases, but the location of strong and weak phases varies parametrically, as does the inclusion of an EPP feature in a given type of strong phase.

Finally, Chomsky (1999) explicitly excludes categorial features N, D, V, C, etc from the pool of universal features from which lexical items are formed, because they serve no function at either interface. Though minimalist analyses may describe phrase structure as a series of levels, referred to as NP, DP, VP CP etc., and may even claim universal selection patterns between such categories, the labels ‘C’, ‘T’, ‘V’ etc must be understood as “cover terms” for specific *combinations* of more substantive

lexical features⁴, like the ϕ -features. EPP features are now checked by the movement or merger of *any* item at all into their phase.

So in the lower part of the structure shown above, the passive VP₂ is weak, and so, though TP₂ is strong there was no previous strong phase⁵ so nothing spelt out at the close of TP₂. The lexical V is merged next to create the VP₁ [expect [there to be caught some fish]], but it is also weak, because it is lexical. The functional νP_1 which assigns ACC Case is strong. Since all of the lower TP₂ remains in the working space when [expect] is merged, the light verb ν can enter agreement with the DO [some fish], to value its ϕ -features. The DP's case feature is valued as a consequence, and when νP_1 closes, the complement of TP [caught some fish] will spell out, fully valued.

If the lowest VP₂ had been strong instead of weak, it might have deployed an EPP feature, allowing a constituent to be 'moved' out of the complement due to be spelt out, and into its periphery, thus preventing the possibility of a crash. However, if the complement contained no unvalued F it would be invisible to the operation Copy, and so could not be selected to delete the EPP feature. An expletive element would need to be merged instead. This is optimal because movement, consisting of two operations, is more costly than merger, and so to be avoided wherever possible.

Since unvalued features can remain in the complement of a weak phase, with no ill effects, EPP features cannot appear in weak phases.

A final point on the implications of this view of derivational development is that any items spelt out together, correspond to a single SO, both in the sense of being the complement of a strong head, and in the sense of being a single intonation unit. Thus, where Processability Theory sees intonation boundaries as a consequence of conditions on the *input* of conceptual material to syntactic procedures, Minimalism sees them as a consequence of conditions on the *output* of syntactic processes, i.e. phases.

These alterations to the basic constraints on the computational mechanism undermine Herschensohn's proposals substantially: strong phases must be present from the outset because they are essential to spell-out; EPP features may or may not be present, but cannot be checked by categorial features, so they do not account for parametric differences in word order. In fact, word order variations are not necessarily related to strength at all: they could reflect variations in lexical structure, or in the order of mergers, if there is no universal order.

2.4 A NEW MINIMALIST ACCOUNT OF ACQUISITION ORDER

So what does this mean for a minimalist theory of acquisition? Basically it means that emergence order, like linguistic structure, can only be explained in terms of two factors: processes of lexical

⁴ For example, Chomsky points out that he uses " T and C as cover terms for a richer array of functional categories" (1999 p. 34, note 6), but even then, the functional categories themselves must be decomposed into clusters of specific features.

construction, which must be constrained by the nature of the computational mechanism; and relative economy, which, as proposed by Pienemann (1998c), may influence the kinds of structures a novice L2 mechanism can process.

In the MP, lexical structure and relative economy are intimately related because it is essentially the need to value lexical features that motivates the repetition of the operations Merge and Copy, driving a syntactic derivation to project, while derivational economy is determined essentially by the number of operations required to reach full interpretation. Consider the nature of economy constraints under which the computational mechanism is said to operate.

2.4.1 Economy conditions

ASAP

The central hypothesis of minimalism is that the attraction and valuation of lexical features must proceed in as economical a manner as possible. Most simply, this means as soon as possible after selection for a numeration. This requirement is known as ASAP. Maximal match, mentioned above, is a manifestation of 'ASAP', in that it maximizes the chance of F-deletion at each merger. In a sense strong phases are another manifestation of ASAP: they regularly force the spell-out of as much structure as possible, reducing operative complexity within the syntactic component, and effectively allowing phonological, or orthographic processing, and hence production to proceed.

PROCRASTINATE

Movement is composed of two operations, copy and merge, and it is because of this that Chomsky says it is more costly than merger alone. This is why it is always preferable to *merge* a new item to delete an EPP feature, than to move one. The disinclination to move material before spell-out is known as 'Procrastinate'.

In fact, movement triggered by an EPP feature contravenes ASAP, because moving items keeps them in the derivation's work-space. However, it is motivated by the fact that failure to move could provoke a crash, and crashing is more costly than movement. Because of this, movement is known as a Last Resort.

LAST RESORT MOVEMENT AND THE PIC

The possibility of crashing cannot be calculated in advance, so local economies must work to reduce the *risk* of crashing. In other words, the deployment of EPP features should not require 'look-ahead', it should be a response to local conditions. In general terms, an unvalued F *must* be moved at completion of a phase, if it will otherwise be invisible to items merged later. Chomsky formulates limits on visibility in terms of closeness and phases and expressed as a Phase Impenetrability Condition (PIC). He entertains various hypotheses about the nature of the PIC (Chomsky, 1999), but in its strongest

⁵ DP might be strong, but if so, N must be in its periphery, since it still has no Case feature. Chomsky does not discuss structure within DP.

form, the complement of each phase is inaccessible to any later phase. As discussed above, this was subsequently revised to allow heads of *weak* phases to access the complement of prior phases, up to and including the most recent strong phase. But, even though a strong phase may remain within the work-space during construction of a second strong phase, items in its complement are *not* eligible for movement, if there is a closer equally eligible but fully valued match. “Locality conditions yield an intervention effect if probe α matches inactive β which is closer to α than matching Γ , barring Agree (α, Γ).” (Chomsky, 1999, p. 3). In other words, if an inactive item β *matches* and intervenes between two other items, (α, Γ) this more distant pair cannot enter agreement.

In practice, though intervention effects may be obviated by further considerations. For example, the principle: “maximize matching effects” (Chomsky, 1999, p. 12) allows agreement past *inactive* elements if the more distant goal has *more* features matching the probe than a closer *inactive* goal. Intervention effects force Case deletion to be local most of the time.

In a still later formulation of the PIC it is “the *phonological edge*” of the current derivation that is visible to the operation copy (Chomsky, 1999, p. 22). This means an intervening matching head or specifier blocks access to a complement, *only* if they have phonetic F; if both specifier and head are covert, the complement of a *strong* phase becomes accessible even to items in a later strong phase; the extent of the ‘periphery’ is determined by the PF interface, which is sensitive primarily to phonetic F.

In whatever version of PIC is assumed, it is the delay between merger of an SO as a complement, and its delivery to spell-out in a *subsequent* strong phase, that allows the deployment of EPP features to ‘move’ *one* item out of that portion which is about to spell out, into that portion which is to remain in the work-space. The function of the PIC is to limit the distance across which items can move, and the positions in which items are visible to items merged later.

For present purposes it is sufficient to note that an item which is still active at the end of a strong phase can remain until the *next* strong phase is completed, without causing a crash, as long as it is a) at the periphery of a strong phase or b) agrees with a weak (substantive) head of the next phase. The weak head can ‘see’ the complement and inherit features from above, then transfer them to the complement of the lower strong phase, before it spells out.

SHORTEST MOVE AND PIED-PIPING OF F

Where movement is inevitable, it should be across the shortest distance possible. Movements from within the same phase are considered equidistant. Economy should also dictate that the smallest structure possible be selected to move. This is simply a manifestation of procrastinate: do not move unless absolutely necessary. However, it is generally considered that a single F cannot be moved away from the other F with which it forms a lexical item. Essentially it is this inseparability that makes a set of features into a *lexical* item, rather than simply an accumulation of features.

Movement can be repeated as long as an EPP feature is available to motivate it; a matching item is visible within the complement; no other item remains in the lexical array to delete the EPP feature by merger; and no item closer to the landing site is better matched.

In addition to these named economy constraints there are factors that contribute generally to operative complexity. For example, smaller rather than larger lexical arrays will lead to shorter derivations. Fewer phases within a lexical array will lead to quicker spell-out. Maximally complementary F-structures and fewer F per selected item will also lead to simpler derivations and quicker spell-outs with minimal movements.

2.4.2 Operations as processing demands

The basic assumption underlying all these economy conditions is that the working-space for derivations is limited, and each additional operation delays spell-out, and so detracts from economy. Obviously, different numerations may give rise to different minimal derivations, but we can hypothesize, the way Pienemann does, that acquisition will proceed from structures with the shortest derivations to those of increasing operative complexity, as the calculations of maximal match, selection of a projector, mergers, movements and spell-out become automatic for combinations of newly constructed L2 lexemes.

It is also possible to hypothesize on the basic minimal initial state a learner's system must achieve before syntactic production can begin.

2.4.3 Initial State: Minimal Productive requirements

The computational mechanism has certain *minimal* requirements which must be met for it to function. These impose a *lower* bound on the kinds of lexical items a learner can construct and employ, and hence on the output they can produce. Since each substantive must be selected by a functional head, and spell-out is delayed till the end of a *second* strong phase, in principle the minimal lexicon must consist of one substantive and *two* strong functional heads⁶. Interestingly, a similar conclusion follows from the nature of lexical activation. The *procedurally* simplest convergent structure would involve a perfectly complementary functional-substantive pair, where each has one interpretable F, matching an *un*interpretable F of the other. However, such a pair would form what I call a terminating SO: all uninterpretable F would be matched and valued in a single merger, and the SO would thenceforth be invisible, unable to be attracted to merge again. Arguably, a matrix 'CP' or illocutionary force projection (Cinque, 1999), is such a terminating SO.

However, the basic building block of syntax must be an SO whose head is *not* entirely valued by the items it selects, and remains visible after it can no longer project. I call this a constructive head. The minimal lexicon must therefore consist of a substantive, a constructive functional and a terminating

functional head, with both the latter strong. Each of these three heads must have at least one *uninterpretable* feature, in order to be visible to the operation merge, and each uninterpretable F must have an *interpretable* counterpart on at least one of the other two heads, so the three heads can converge. Though just two features would suffice to attract all three items into one SO, this would make movement inevitable.

To see why, it is necessary to consider how merger gives rise to specific phrase structural patterns. When merger combines two items into an SO, one of the items projects a structural position, to which the other, attaches. By virtue of projection, the projecting item becomes the head of the new SO; the other item can no longer project, and if it was the first item merged with the projector it becomes a complement by virtue of this. Any item subsequently merged to the same head is, by definition, a specifier. Since projection is a function of attraction, phrase structure is necessarily “bare”: there are no empty projections, and binary: only two items are maximally matched at any time. Any lexical item that is selected and does not project is simultaneously a lexical head (X^0) and a maximal projection (XP) (Chomsky, 1995, p. 249).

There may be absolute limits to the number of times a single head can project. One proposal is that projection is strictly limited by thematic *argument* structure: a head may project once for each argument it requires. Whichever item matches the head best, will merge with it first and become, by definition, its complement. Thus, successive mergers give rise to *binary branching* phrase structures. The alternative proposal is that *adjuncts* are freely merged as optional specifiers. Phrase structure may also be further complicated by the involvement of Extended Projection or EPP ‘features’.

The substantive head which I will call S must be merged to one or other functional head, let’s say A, and since this will be the first merger to A, S must be the complement of A. In order for A to reliably select S whenever they appear in a numeration, S must share more features with A (maximal match) than with the any other functional head, specifically B. However, A and B must share at least one feature in order to attract each other; call that feature F.

S and A can attract each other without attracting B, if they both express a different feature which B lacks, say G. Thus our lexical items are $\{S^{F,G} A^{F,G} B^{F,H}\}$. A selects S as a complement, forming AP, and since the feature G cannot be valued later through merger with B, it must be valued through the merger of A and S. Since two valued features would make AP invisible, their other feature F must remain unvalued after they merge. This violates ASAP, but the violation is necessary to maintain the visibility of AP. It must be B that provides a value for feature F, and to make B visible it must have another unvalued feature, H. Assuming A is strong to speed spell out (ASAP), its complement S will be invisible to B, despite being active, so S will *have* to move to the periphery of A, forming a specifier in

⁶ Obviously the question arises as to how the second strong phase spells out. The logic of the model seems to force the conclusion that every structure that is produced is actually the complement of a strong phase which never spells out, but triggers spell-out; a purely procedural strong phase with no semantic or phonetic content.

AP, in order to enter agreement with B, and delete F. To license the movement of S, the phase AP would have to have an EPP feature as well as the lexical features F and G. Once S had moved, B would project and select AP, forming BP, and valuing F, so AP, including SP can spell out as a unit, at the end of the *next* strong phase, *after* BP. (“The effects of Spell-Out are determined at the *next higher* strong phase” Chomsky, 1999, p. 10) This is illustrated in Fig. 4, below.

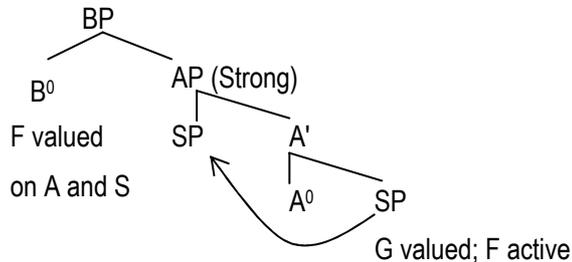


Fig. 4 A minimal strong phrase with two features

One more strong phase would be required to spell out B, a total of 5 mergers, and one copy, in *five* phases.

If, A were *overt*, the derivation would be simpler under one version of PIC: S would not move, since it is at the phonological (left) edge of AP. B could simply select AP, and value F on S *in situ*. Two subsequent phases would be required to spell out AP and B, a total of 4 phases and no movement.

However, just as simple derivationally, is a system with *three* lexical features, and S fully valued by A. Suppose we have lexical items: $\{S^{G+ H-} A^{G- H+ F-} B^{G- F+}\}$ where + means interpretable, and - means uninterpretable. Each item has one interpretable F, and S and B have one unvalued F, but share only G, while A has two unvalued F and shares two F with each of S and B. Merger of A and B will not produce a fully valued lexical item, since neither is valued for G; thus merger of S and A is automatically preferred, under Maximal Match, and ASAP. S is fully valued as a result, and A retains one unvalued feature, F. B projects and selects AP as its complement and SP spells out, *after just two mergers and no moves*. As before, two further strong phases are required to spell out A and B, but it makes no difference whether A is overt or covert.

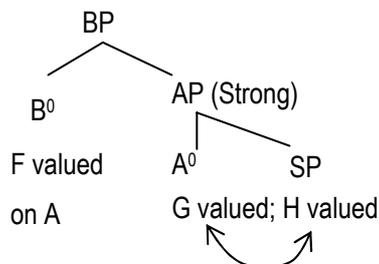


Fig. 5 A minimal strong phrase with three features

Thus, a maximally economical lexicon consisting of three lexical items must include at least three lexical features, distributed unevenly across three lexical items, two of which are functional and strong.

Note also that in this scenario, the upper level B has an unvalued feature *G* *identical* to the single valued feature, *G* on the substantive. This feature effectively ties the three items together into a single unit, much as ϕ -features are said to tie arguments to predicates in case relations.

It is immediately obvious that repetition of features like gender or number on many nominal heads can serve to align nominal heads in certain recurrent arrangements. Spell-out of a substantive requires nothing more than this minimal system (and two subsequent phases, which I will assume might run 'empty').

In a system such as this, where syntactic derivations are lexically driven, and the number and nature of features in lexical feature structures determines the number of syntactic operations necessary to complete a syntactic derivation, it is clear that processing demands can only be calculated after a thorough analysis of lexical feature structures. Moreover, if IL development, is to be explained in terms of processing demands, it is essential to begin with an explicit analysis of the lexical F-structures evident in the IL systems.

The significant difference between the MP and PT in this regard is that in PT, c-structures and lexical F-structures can vary independently of each other, while in the MP, c-structures are determined entirely by lexical F-structures and economy conditions. Moreover, Chomsky asserts that given the constraints on agreement relations and constituent structure in the MP, the identification of lexical feature structures is "an empirical issue" (Chomsky, 1999). I return to the question of how lexical feature structures can be identified in Chapters Six and Seven, after discussion of past studies into Mandarin SLA, and the presentation of some IL data.

2.5 CONCLUSIONS

2.5.1 Natural orders

Modern theorists generally agree that learner languages must be analysed as systems in their own right, and eclectic selections of morphs do not represent IL grammars as a whole. Many also agree that developments in syntactic competence are best reflected by changes in unrehearsed, unmonitored, or uncontrolled output. Analysis of unrehearsed outputs in the SLA of various languages has revealed that in any language there will be some complex grammatical structures that emerge in a consistent order for different learners. However, generalisations about emergence orders across languages tend to be fairly gross.

2.5.2 Developmental stages

One of the finer developmental hierarchies is that of six stages proposed by Pienemann (1980, 1984, 1998). This consists of two lexical stages, with and without lexical inflections; a phrasal stage; two sentential stages with inter-phrasal inflections first restricted to salient positions, then spreading to non-salient positions; and a final stage involving complex sentences. Grammatical morphs fall into three categories relating to the syntactic distance across which the information they express has been

transferred: lexical, phrasal and inter-phrasal, i.e. sentential. The emergence of each type reflects the automatization of procedures at the corresponding level of structure. Thus PT allows us to classify inflectional morphs from different languages according to the same system, and so use morphological development to chart syntactic development cross-linguistically. Moreover, even in the absence of overt morphology, each stage can be identified on the basis of word order variations, collocational constraints and c-structural complexity. The imposition of collocational constraints and the inclusion of optional modifying elements within a phrase indicate the presence of sometimes covert syntactic features processed in phrasal procedures.

However, PT gives most weight to constituent boundaries associated with conceptual divisions: lexical boundaries, and the VP boundary that separates a verb from its Subject. Phrase-internal complexity is largely ignored. Because of this, PT's applicability to nominal syntax appears rather limited: nominal structures will belong to the categorial or the phrasal stage of development, unless they involve a relative clause. Nonetheless, Pienemann's observation that an IL grammar may involve hundreds of rules hints at the possibility of a much finer differentiation between phrasal structures.

In the MP view, conceptual divisions are irrelevant. There are only two basic operations merge and copy, which are already available in SLA, and their application is dictated purely by lexical structure. This means a minimalist analysis can make finer distinctions between structures in terms of the total number of operations required in their derivation, and it should therefore be applicable to nominal syntax. However, it also means that acquisition will not necessarily fall into discrete stages. To the extent that development does reflect operational complexity, it should fall into a continuum of gradually increasing complexity.

2.5.3 Factors that impact on emergence times

There are varying accounts of why regular developmental patterns should arise. Pienemann argues that the two main factors are procedural dependencies and processing demands. Pienemann's six discrete stages arise because he assumes just four basic kinds of syntactic procedure which feed into each other, and because of these procedural dependencies, developmental dependencies also arise: simpler structures must be mastered before they can contribute to the construction of more complex matrix structures.

Processing demands arise from the need to transfer and hence to store information. The more complex the structure, and the longer it requires information to be stored, the later it will emerge. In Pienemann's view, two factors impact on the speed of information exchange: conceptual factors - whether the information travels between material derived from two iterations or just one, and automaticity - whether the learner's system includes ultra-short term memory stores dedicated to the specific information exchange or not.

In the Chomskyan paradigm also, development is related to the acquisition of language-specific features, and the expansion of constituent structure. This is held to be a direct consequence of

attractions between lexical features, merging in maximally economical ways. Conceptual factors have no direct impact on economy, and there is no cross-linguistic variation in what is economical. The main drain on cognitive resources is the retention of lexical features within the computational mechanism. Delays in feature valuation, and the expansion of constituent-structure between strong phases should both impact on emergence time. Each additional syntactic operation adds to processing demands.

2.5.4 The role of lexical and constituent structures

In PT, the need to exchange information is determined partly by the features of lexical items, and partly by the location of items in constituent structures, or, in procedural terms, by the procedures they can gain access to, and the route they must take to do so. In the MP, it is lexical feature structures that determine the number of operations required to satisfy the principle of Full interpretation. In addition, if there is cross-linguistic variation or uniformity in constituent order, it must relate to variations or uniformity in lexical feature-structure. The MP provides no other mechanism by which a universal order of functional heads can be instantiated.

In both theories then, processing demands can be calculated only if lexical feature-structure and constituent structure are known. Minimalism claims that constituent structure is *uniquely* determined by economy and lexical feature structure, and that lexical structure itself can be determined empirically. These claims are discussed further in Chapter Six, after the empirical data about the IL systems has been introduced.

Chapter Three: Mandarin SLA

3.0 Introduction

This chapter discusses past research into Mandarin SLA, with particular attention to Zhang's (2001) study in the Processability framework. Section 1 reviews morpheme studies of Mandarin SLA, which have focussed mainly on aspects of sentential syntax: aspect marking and negation. It summarizes some problems with the most comprehensive of these, a study of 22 different sentence types (Shi, 1998) pointed out by Zhang (2001). Section 2 describes Zhang's own study, which includes data relating to Mandarin nominal morphemes: classifiers, and the particle *de*. Zhang claims the latter is a reflex of four distinct morphemes, associated with different processing demands. She proposes an implicational hierarchy for the acquisition of these four morphemes and the classifier which supports Pienemann's hypothesis that acquisition order follows processing complexity. She also accounts for individual variation from the predicted order in terms of the misclassification of certain lexemes by some learners. Section 3 critiques Zhang's analysis, and establishes the need for further research into this topic.

3.1 Morpheme studies in Mandarin

Research into the SLA of Mandarin has followed the path of theoretical development outlined in Chapter Two. According to Liu (Liu 1999, cited in Zhang, 2001), work on Mandarin acquisition orders began only in the 1990s, and most investigations of acquisition order in Mandarin SLA have either focussed on a few selected morphs, such as the aspect markers *le*, *zhe* and *guò* (Sun, 1993, 1999; Zhao, 1997) or negation markers (Wang, 1997), or they have looked at selected verbal structures (Qian, 1997). One exception is a study by Shi (1998), which analysed 22 different sentence types (7,611 tokens all told) from a database of written examples divided into 6 proficiency levels. Shi hypothesised a natural order of acquisition for these 22 structures, and tested her hypothesis by comparing her predicted order to the proficiency level at which each structure in the database reached an accuracy level of 80%. This resulted in an implicational hierarchy with five steps, which according to Shi fell into three obligatory stages, such that items from a higher stage did not emerge prior to items from a lower stage.

From this implicational hierarchy Shi derived an 'objective acquisition order' for the 22 structures. However, none of the 22 structures studied were nominal structures and Shi made no generalisations about syntactic features that might characterise the structures of a single stage and

possibly account for the accuracy order. Thus Shi's study has little relevance to the investigation of nominal syntax under discussion here.

Moreover, Zhang (2001) points out that Shi's research has a number of methodological flaws that call into question the validity of its conclusions on sentential syntax as well. Firstly, steps in the implicational hierarchy are not consistently associated with any single measure of accuracy; secondly, no criteria are given for the determination of stage boundaries; and thirdly, sentence types belonging to the same level in the implicational hierarchy are shown as belonging to different stages in the proposed 'objective acquisition order'. The study is also weakened by the use of mixed data. The databank consisted of isolated written sentences of unknown provenance. This was supplemented with grammaticality tests completed by both *adult* learners, and *native-speaking children* as well as observations of a single learner over 30 weeks. Proficiency levels appear to have been determined by subjective ratings of the difficulty of structures by learners.

Since Krashen (1976), written data and grammaticality judgements have not been considered valid bases on which to propose a '*natural*' order of acquisition, because both allow time for reflection, and retrieval of declarative knowledge, engaging the very processing resources whose *exclusion* is theorised to shape development in spontaneous speech (Krashen 1976, 1977; Levelt, 1989; Pienemann 1984, 1998c). Moreover research in English has shown that acquisition orders are different in child L1 acquisition and adult L2 acquisition, so the use of data from L1 children and adult L2 learners confounds several potential variables.

3.2 A Processability account

3.2.1 Research design

Zhang's own study (Zhang, 2001) is more relevant to the SLA of Mandarin Nominal structure, and employs more appropriate methodology in data collection. Following the now standard methodology in Processability studies, Zhang taped hour-long interviews with each of three university students, (from a pool of 50) at roughly three-weekly intervals throughout their first 30 weeks of acquisition, beginning at week 5. The students were two women and one man, all native speakers of English, aged between 18 and 25, and all enrolled in the beginners' level Mandarin classes at the Australian National University (ANU). The regular interviews combined free discussion and structured elicitation tasks, and the focus of the investigation was the emergence of eight Mandarin morphemes, five of them within the nominal domain. One was the classifier, which occurs in different forms between a number and a noun, the other four were all represented by a single form *de*. Though *de* appears between various modifiers of a noun and the noun itself, Zhang analysed the form as homophonous reflexes of four different morphemes, depending on the nature of the modifier (see below).

3.2.2 Elicitation of relative clauses

Since relative clauses occur at relatively low frequency in spontaneous speech, Zhang attempted to elicit RC structures from her learners, in weeks 13 and 16 of her study by using RCs in questions, and by instructing learners to combine two sentences into one, with *no time limits*. However, Zhang herself states that:

it is doubtful if the speech data obtained from the “sentence link” task constitutes valid data... [because]... a delay of 4-9 seconds usually ensured before the informants produced the response. During the “waiting period” it was sometimes obvious that the informants were performing syntactic operations mentally: their fingers tapping or moving on the desk or the knee as if they were moving constituents around. At the same time, the informants were uttering the sentences sub-vocally. (Zhang, 2001, p. 142).

Because of this, Zhang subsequently excluded this data from her analysis.

3.2.3 Corpus preparation

In preparation for analysis, the tapes of all interviews were transcribed, and each utterance that either contained or provided a context for the use of one of the morphs under study was selected. Zhang then compared the use over time of semantically equivalent utterances with and without each morph, to establish an implicational hierarchy reflecting their emergence order. The criteria for emergence, based on the precedent set by Meisel et al., (1981) and Pienemann (1989) was ‘the occurrence of at least two tokens in a minimum of four obligatory contexts’ (Zhang, 2001, p. 110). The two tokens of a structural type, were also required to be *distinct*.

3.2.4 The morphemes

In principle, Zhang recognised two main types of *de*: ‘nominal *de*’, where *de* was preceded by an NP (henceforth NP1), and ‘non-nominal *de*’, where the modifier preceding *de* was *not* a noun. Each main type was divided into two sub-types. Nominal *de* included genitive or *de*(GEN) and attributive or *de*(ATT) sub-types. The *de*(ATT) subtype was further divided into five categories identified by example (Zhang, 2001: 123); the examples cited below are Zhang’s but the descriptions that follow are my own:

- i) hòubiān de fángjiān (behind DE room) ‘the back room’; NP1 is a locative attribute;
- ii) ‘language de study’ (see Table 6.2-3. pg 125); NP1 is inanimate but not locative;
- iii) xiàge xīngqí de xīngqí sān (next week de Wednesday) ‘next Wednesday’; NP1 is a complex expression of time;
- iv) xǐzǎojiān de zuǒbiān ‘on the left of the bathroom’ (Dave, T3.4, #15, pg 127). The noun following *de* (henceforth NP2) is a locative *predicate*;
- v) other N de N structures.

However, in practice most nominal *de* structures were classified as *ambiguous* between genitive and attributive sub-types. For example, structures like (5) below, in which NP1 denoted a

'country/city/institution', were classified as ambiguous between de (ATT) and de (GEN) and described as a semantic extension of de (GEN) (Zhang, 2001, p 112, 123).

- 5) rìběn de shòuyīnjī
Japan ATT radio
Japanese radio (Zhang, 2001, p. 129, Kate T6)

In fact, the only IL structures classified as attributive but *not* genitive were those containing a locative noun or time expression, either as NP1 as in types (i) and (iii) above, or as NP2, as in type (iv) above. On the other hand, the only structures classified as genitive but *not* attributive were those where the modifier was a pronoun, or referred to a human, like that at (6) below.

- 6) tā de fángjian shì dà.de
he/she POSS room be big.NOM.
The big room is his/hers (Zhang, 2001, p. 138 e.g. 7b)

This degree of overlap casts doubt on whether de(GEN) and de(ATT) structures really are distinct and thus whether there really are two distinct nominal morphemes that share the form de, or whether there is just one morpheme de that collocates freely with modifiers of various semantic types. In fact, Zhang herself suggested a 'flow-on' effect where instruction in locatives led to expansion of the de(ATT) category into more semantic realms. This also suggests that the structures actually belonged to a single type. This issue is discussed further in Section 3.3 below, and again in Chapter Five.

Zhang's *non*-nominal types included de(ADJ), where the modifier preceding de was an 'adjective', as in (7a), and de(RC), where the modifier was a relative clause as in (7b).

- 7) a. hǎo de dōngxi
good ADJ thing
Good things
b. tā chàng.de gē hěn hǎofīng
He/She sing-RC song very good-hear
The songs he/she sings/sang are nice (Zhang, 2001, p. 82)

Li and Thompson (1981) argue that, in fact, there is no such distinction; the modifier in (7a) is actually a relative clause, because though Mandarin words like hǎo 'good' translate into *English* as adjectives, their distribution in *Mandarin* is identical to that of Mandarin verbs. In short the so-called 'adjectives' are simply a subclass of verb. However, Zhang suggests that adjectives can be distinguished from stative verbs by the fact that the 'nominalizing particle de' can follow an adjective, but not a stative verb. To illustrate, she contrasts the 'adjective' in (8a) and (8b) with a 'stative verb' in (8c) (Zhang, 2001, p. 138) e.g.s 7a, b, c; the glosses are Zhang's).

- 8) a. zhè shì yī zuò dà de fángzi
this be one CL big ADJ house
This is a big house.
b. tā de fángjian shì dà-de
he/she POSS room be big-NOM.
His/her room is the big one.

- c. zhè zuò fángzi hěn dà (*de)
 this CL house (very) big (-Nom)
 This house is big.

Though this nominalising particle is apparently a *fifth* morpheme that shares the form *de*, it is not included in Zhang's study. It is not clear therefore whether this supposed distributional distinction between Adj and RC is actually evident within the IL data or not. This issue is also discussed further in section 3.3 below.

The fifth nominal morpheme in Zhang's study is the classifier. This occurs between a number and most nouns:

- 9) yī.ge gēge
 two CL older brother
 Two brothers (K1)

3.2.5 Processing demands and predicted emergence orders

Having argued for the existence of these five distinct morphs, Zhang classified each of them as lexical, phrasal or inter-phrasal according to the criteria of Processability theory. The two nominal *de*, and *de*(ADJ) were all classified as lexical morphemes because "their insertion does not involve any feature unifications with other constituents of a phrase or sentence" (Zhang, 2001, p. 72). This claim appears to be based on the fact that there are no *overt* reflexes of agreement in these structures. However, there is no overt agreement in relative clause structures either, yet of those structures Zhang says: "syntactic and semantic information of the relative clause and the head noun is exchanged via the particle *de*(RC), making it an *inter-phrasal* morpheme as the *information transfer occurs* across phrasal boundaries, between a clause and a noun" (Zhang, 2001, p. 83; my emphasis).

Zhang makes two crucial assumptions here: first that information is exchanged between N and its *clausal* modifier, but not between N and its *non-clausal* modifiers, and second that any exchange of information that does occur in the presence of *de*, necessarily involves the morpheme *de*.

The classifier was classed as a phrasal morph, firstly, because the choice of classifier depends on the choice of the noun, which Zhang accounts for in terms of the transfer of two features, SHAPE and \pm HUMAN from the noun to the classifier; and secondly because 'the classifier is called for by the numeral' (Zhang, 2001, p. 82).

Based on these classifications, Processability theory predicts that *de*(GEN), *de*(ATT) and *de*(ADJ) should all emerge before the classifier does, while *de*(RC) should emerge later than the classifier.

3.2.6 Zhang's findings and Interpretation

Zhang found these predictions largely confirmed. *De*(GEN) and *de*(ATT) emerged between week 5 and weeks 10 and 13 respectively, the classifier did not appear in week 5 but emerged between week 10 and week 13, and *de*(RC) emerged at week 13 for Dave, but not until week 29 for Sharon, and never in Kate's IL (See Table 2 below, based on Zhang 2001, p. 173, Tables 6.8-1- 6.8-3; D = Dave; K=

Kate; S = Sharon). In short, in each IL the phrasal classifier emerged later than some instance of lexical *de*, but earlier or alongside interphrasal *de*(RC).

Table 2. Emergence order of Zhang's 5 morphs

week	Structure
5-13	<i>de</i> (GEN) / <i>de</i> (ATT);
10-13	Num-Class
13	<i>de</i> (ADJ) (D); <i>de</i> (RC) (D); <i>de</i> (ATT-Locative) (D, K)
16	Dem-Class
29	<i>de</i> (RC) (S)

However, there were some observations that could not be readily explained by PT. First, *de*(ADJ), which Zhang classified as lexical, emerged *after* classifiers and at the same time as the inter-phrasal *de*(RC): at week 13, for Dave, week 29 for Sharon, and never in Kate's IL (Zhang, 2001, p. 136). Second, the combination of a classifier and a *demonstrative* did not appear till week 16, after the emergence of *de*(RC) in Dave's IL (Zhang, 2001, p. 154). This contrasts with the appearance of the classifier with *numbers* at week 13. Since the licensing relationship between Dem and Class is identical to that between Num and Class, this delay is unexpected.

Finally, though *de*(ATT) first emerged as early as week 5, according to Zhang the structure exhibited an expansion into new semantic domains between weeks 23 and week 29. Prior to week 12 most N *de* N structures were ambiguous between *de*(ATT) and *de*(GEN) (Zhang, 2001, p. 124-6); NP1 denoted a language, a time, or a specific location, such as 'dormitory', while NP2 denoted a concrete entity: teacher, book, class or food. In week 13, immediately after locatives were taught in class, the first structures emerged where NP2 was locative e.g. *xǐzǎojiān de zuǒbian* (bathroom *de* left-side) 'to the left of the bathroom' (Zhang, 2001, p. 127, Dave T3.4 #15). Then the structure underwent a sudden extension into more semantic domains, just after inter-phrasal *de* emerged in Dave's IL. The extension of a structure some time after it has been acquired is not explained by PT.

These factors do not *contradict* PT, because PT does not claim that *all* morphs of the same type must emerge at the same time; it only says that morphs of each type must be preceded by *at least one* morph of a simpler type. Thus, late emergence of *de*(ADJ) and the Dem-Class sequence do not invalidate the predictions of PT. However, they do contribute to a large amount of overlap between the emergence of supposedly lexical, phrasal and inter-phrasal structures. This is the problem of falsifiability raised by Larsen-Freeman and Long (1991), and mentioned in Chapter Two.

In fact, Zhang derived an implicational hierarchy based on 'amalgamated data' from the three ILs that seems to strongly confirm the predictions of PT. To arrive at this implicational hierarchy Zhang added the instances of each morph *in all three ILs* at each observation point; when *the sum* reached criterial levels, she counted the morph as acquired. The implicational hierarchy for the 'five' nominal morphs discussed above, is shown in Table 3, below (based on Zhang, 2001, p. 178, Table 7-1-1).

Table 3 . Zhang's implicational hierarchy for 5 nominal morphs

Processing procedures	L2 Process	Morpheme	T1	T2	T3	T4
word/lemma	"words" , invariant forms	none	+			
Category Procedure	lexical	de(GEN)		+		
		de(ATT)		+		
		de(ADJ)		+		
Phrasal Procedure	phrasal	CL			+	
S-procedure	inter-phrasal	de(RC)				+

Note that, according to Table 2 above, Kate and Sharon never produced de(ADJ) at criterial levels and Dave did not do so till week 13 (T3) but according to Table 3, *all* types of *de* construction had emerged by week 10 (T2) except de(RC). This is shown as emerging only at T4, though actually Dave already produced spontaneous RCs at T3. The reason for this discrepancy is not made clear.

The amalgamated data actually masks individual variation in the emergence of structures. Because Dave had the fastest acquisition *rate* of all learners, the implicational hierarchy primarily reflects the emergence order exemplified by his IL alone.

In reality, structures classified as having the *same* level of processing demands emerged at quite different times in each individual IL, while some with quite different processing levels emerged together. This clearly suggests that processing demands are not the only factor that determines emergence times, at least, not as those demands are assessed by Zhang. In particular, the semantic expansion within the de(ATT) type suggests that semantic factors play as significant a role in emergence order as syntactic factors.

Zhang suggested that these patterns arose as a consequence of changes to the lexical structure of *de*. Moreover, she suggested that it was intensive teaching of locative *de* structures in week 12 that led to the addition of new semantic features to *de* which licensed new collocations so that *de* began to select more kinds of NP1 after week 12 (Zhang, 2001, p. 131).

In a similar vein, Zhang suggested that the apparently late emergence of de(ADJ) in Kate's and Sharon's ILs was due to a delay in their acquisition of the lexical *category* Adj. To support this view Zhang pointed out that all three learners used 21-24 different stative verbs but Kate and Sharon used only 7 or 8 different adjectives; only Dave for whom de(ADJ) emerged significantly earlier, used a similar number of adjectives and stative verbs. She concluded: 'if the majority of the forms are categorized initially as stative verbs... there would be a shortage of adjectives in the interlanguage lexicon and data. A natural consequence would be the under-development of – de(ADJ). On the other hand, if many of the forms are analysed as adjectives, then de(ADJ) may have a chance to emerge in due time' (Zhang, 2001, p. 141).

This suggests that emergence order is partly determined by the acquisition of lexical features, in particular the acquisition of categorial features, which then raises the question of what determines *their* acquisition order. The implication here is that the acquisition of categorial F depends upon the number

of distinct lexemes that exhibit similar distributional properties in a learner's IL. Seven or eight tokens of one lexical type are not enough to stimulate the acquisition of a morph that introduces that lexical type as a modifier of N.

3.3 Some unresolved issues

Zhang's research provides an excellent description of the emergence order for Mandarin nominal structures involving a classifier or the form *de*. However, her interpretation and her analysis is advanced on some unfounded *premises*, and suffers from some methodological flaws which leaves several questions still unanswered. Firstly as I will show below, what Zhang takes as evidence for four distinct morphemes all realised by the one form, *de* is actually evidence that one morpheme appears in various *contexts of use*.

Secondly, Zhang's argument that adjectives are distinct from stative verbs in the TL is based on a false analogy, and besides the claim needs to be based on IL data, not on TL data if it is to explain emergence order in the ILs. In the absence of direct evidence that *learners* differentiate between Adj and stative verbs in some context independent of the use of *de*, there is no basis on which to differentiate between *de*(ADJ) structures and *de*(RC).

These points make the emergence times for *de*(ADJ) structures appear unexceptional, compared to those for other RC structures. However, it casts doubt on Zhang's classification of what is really one morpheme, as sometimes lexical but sometimes inter-phrasal. Thirdly, there is no evidence that the different nominal modifiers that appear with *de* over time, are in fact related to lexical properties of *de* and therefore there is no evidence for changes in the feature-structure of *de* over time. In fact, what Zhang classifies is the processing demands associated with the modifier that precedes *de*, not with *de* itself.

Fourthly, the IL data contains evidence that refutes the idea that acquisition of a syntactic structure depends on the prior acquisition of more than seven or eight tokens of a type that participates in it. This leaves the variation in emergence times for structures classified as belonging to the same developmental stage still unaccounted for.

Finally, Zhang's method of constructing an implicational hierarchy is clearly problematic because instances of use below criterial level in three ILs clearly do not demonstrate acquisition in all three, yet this is what the use of accumulated data suggests.

3.3.1 The morphemic status and lexical properties of *de*

First consider Zhang's analysis of *de* as four distinct morphemes. This is open to three main criticisms. First, the division is based on the lexical class and semantic subtypes of *de*'s collocates, not on differences in the interpretation or syntactic effects of *de* itself. Appearance in multiple contexts is actually a defining characteristic of a *single morph*, not evidence *against* such a treatment. Second, variations in collocations do not necessarily entail correlating variations in the *lexical properties* of *de*;

lexical properties *may* restrict collocates, but they may place *no* restrictions, in which case collocates will vary anyway. Third, the categorial and semantic criteria by which Zhang establishes classes of modifier that in turn establish sub-types of *de* are inconsistently applied, producing results contrary to established analyses. I take these points in turn.

A *morpheme* is defined as the smallest unit of meaning (or function); a *morph* is a form that realises some morpheme and *recurs in different contexts*. Thus collocational variation is *not* a basis on which to claim the existence of distinct homophonous morphs, rather it is *required* of a form before it can qualify as a reflex of one abstract morpheme. If variation in the lexical class of collocates *were* evidence of homophony, then the English possessive marker *-s* would also be a reflex of several distinct morphemes, because, like *de* it too can follow virtually any part of speech e.g: the man's dog; the man who runs' dog; the man I saw yesterday's dog etc.

The *semantic* contexts in which English 'possessive' *-s* occurs are also quite varied: a dog's mother, a dog's owner, a dog's trainer, a dog's victim, and a dog's collar each stand in quite a different semantic relationship to a dog. Nonetheless, English '*s*' is treated as a reflex of just *one* morpheme, because it reflects a constant *syntactic function*; the semantic detail is contributed by the combination of nouns and pragmatic knowledge, not by '*s*'.

In fact, the variability in the lexical category of their collocates reflects the morphological status of the English possessive marker '*s*' and the Mandarin particle *de* as clitics, that is, bound forms that adjoin to a *phrasal* constituent, rather than a word (Zwicky, 1985). The variability in the semantic contexts of their use reflects their *lack* of specific semantic content. In short there is no basis on which to treat *de* as a homophonous reflex of four distinct morphemes simply because it follows modifiers of different lexical categories, standing in different semantic relationships to the noun that follows *de*. Rather, its recurrence with a constant function in different collocations demonstrates that *de* is a single functional morpheme.

3.3.2 Zhang's sub-classes of N *de* N structures: some problems

Given the conclusion that *de* represents a single morpheme, there is no basis on which to suppose that the developmental sequence for structures containing *de* is related to properties of *de* itself. The more natural conclusion is that this sequence arises from differences between *the modifiers* that precede *de*. We might view Zhang's classification of *de* then as an indirect classification of modifier types in various structures where *de* links a modifier to a noun. However, this classification also has problems.

Zhang's classification of N *de* N structures is a *semantic* one that appears to be based on that proposed by Wen (1999). Wen (1999) argues for two major semantic sub-types of N *de* N structure, possessive (língyǒu) and attributive (shǔxíng). These can be identified by semantic extension and paraphrase. Extension involves *adding* implicit predicates to the structure, to highlight alternative meanings; paraphrase *replaces* *de* with a predicate to the same end. Any structure in which *de* can be

replaced by the predicate *yǒu* 'have', or a related compound such as *jùyǒu* ('to have something abstract'), *yōngyǒu* ('to have by virtue of containment') etc., belongs to the possessive (*lǐngyǒu*) class. If no such substitution is possible, the structure belongs to the attributive (*shǔxíng*) class. These two major classes are then divided into minor sub-classes by the same methods: if a *single* structure can be extended or paraphrased with *different* predicates, it is ambiguous, with each different meaning belonging to a different semantic sub-class; if two different structures can be paraphrased or extended by use of the *same* predicate, they belong to the same semantic sub-class. On this basis, Wen divides the major possessive (*lǐngyǒu*) class into, among others, a minor possessive (*lǐngshǔ*) subtype, and a locative (*chǔshǔ*) subtype.

Judging from her labels and discussion, Zhang's division of N de N structures into de (GEN) and de(ATT) is styled on this system of Wen's. However her classification of structures does not conform to Wen's diagnostics. Consider the structures at (10), (11) and (12), all of which would belong to Zhang's de (ATT) category.

- 10) *túshūguǎn de shū*
 library -ATT book
 a. The book *at* the library
 b. The book *belonging to* the library
- 11) *yòubiān de xìn*
 right -ATT letter
 a. The letter *on* the right (Zhang, 2001, p. 127 Kate, T4.2, #8)
not b. * The book belonging to the right
- 12) *yīhéyuán de nánbian*
 Yihe Garden de south.side
 a. To the south of the gardens
 b. The southern *part* of (belonging to) the gardens'

(10) and (11) can be paraphrased in Mandarin, either with a possessive predicate as in (13a, b), or with a locative predicate as in (14a, b). (Note the change of word order in the locative paraphrases at (14): the locative Noun in (11) precedes *de*, but in (14) it *follows* the locative co-verb *zài*.)

- 13) a. *túshūguǎn yǒu shū*
 library have book
 The library *has* a book
 b. *yòubiān yǒu xìn*
 right have letter
 There is a letter on the right
- 14) a. *shū zài túshūguǎn*
 book at library
 The book is in the library
 b. *xìn zài yòubiān*
 letter at right
 The letter is on the right

These paraphrases show that the *de* structures at (10) and (11) are both ambiguous, and belong to both the minor possessive sub-type (*lǐngshǔ*) and the minor locative (*chǔshǔ*) subtype of Wen's major possessive (*lǐngyǒu*) class (Wen, 1999, p. 24).

A possessive predicate can also be substituted for *de* in (12), giving (15a) below, but the locative predicate *zài* *cannot*, as shown in (15b).

- 15) a. yīhéyuán yǒu nánbian ...
 Yiheyuan have southside
 Yiheyuan has a south side....
- b. *nánbian zài yīhéyuán
 southside at Yiheyuan

There is no counterpart of (12b) that uses *zài* because a locative noun that follows *de* does not denote an independent entity that can be contained within another entity. Thus, the partitive meaning indicated at (12a) belongs to the possessive sub-class of Wen's major possessive class, but the *locative* meaning indicated at (12b) belongs to the major *attributive* class⁷, not to the major possessive class at all.

There is therefore no clear semantic basis on which to combine the meanings of (11) and (12) into a single class, *de*(ATT), while classifying (10b) as a member of a distinct class, *de*(GEN), the way Zhang does.

ADDITIONAL ARGUMENTS FOR A DISTINCT LOCATIVE DE STRUCTURE

There are other good pragmatic, thematic *and* structural reasons for treating structures where NP2 is locative, as a distinct category from other N *de* N structures. Firstly, both in possessive constructions, like *wǒde shū* 'my *de* book', and in structures where NP1 is a locative noun, like (11) *yòubiān de xīn* (right –ATT letter) above, NP1 is an optional modifier of NP2, and can be omitted, along with *de*. In contrast, in a locative *de* structure like (12) above, or (16) below (taken from Zhang, 2001, p. 127), NP2 *must* be accompanied by an overt NP1, or else its referent must be retrievable from context; *zuǒbian* cannot function on its own without a retrievable reference point or *locus*.

- 16) a. xīzaǒjiān de zuǒbiān
 bathroom ATT left
 (On) the left of the bathroom (Dave, T3.4, #15)

In fact, even when a locative is used as NP1 as in (11) above, the locus to which it refers must still be retrievable: the letter is to the left of *something*. In other words, this need for an explicit or retrievable reference point is a *lexical* feature of locative nouns; NP1 is an obligatory *complement* of NP2, not an optional modifier.

⁷ Though Wen claims the opposite in general terms (Wen, 1999, p. 24), the results of the tests are clear, and structures like (12) are not actually included in Wen's hierarchy (Wen, 1999, p. 27).

Secondly, whereas the order of participants in (10b) and (11) is location-theme⁸ i.e. library- books / left-letter, in (12) it is location-*direction* (i.e. gardens - South) with *no explicit theme* at all. Thus the pragmatic function, the semantic content *and* the arrangement of thematic content is parallel in (10) and (11), and distinct from that of (12b).

Third, the structures at (10) and (11) can function as arguments of many verbs, but the structures at (12) and (16) can only function as the complement of a locative predicate such as *zài* 'at', or as the subject of a presentative verb, *yǒu*. Example (17) shows that, as the object of *kàn* 'see', the string *xīzǎojiān- de zuǒbiān* 'bathroom de left-side' can have only the partitive meaning (i.e. 'the left-hand part of the bathroom') not the directional meaning (i.e. 'to the left of the bathroom'). This is because the verb *kàn* 'see' requires an entity-denoting complement and a locative noun is not entity-denoting. Example (18) shows that when the same string is the object of the preposition *zài*, the directional meaning *is* available; *zài* requires a location denoting complement, and an entity-denoting theme. The latter is provided in the form of the sentential Subject *ménkǒu* 'doorway'.

- 17) wǒ néng kàn xīzǎojiān de zuǒ biān
 1sg can see bathroom de left side
 I can see the left-hand side of the bathroom

* To the left of the bathroom, I can see

- 18) ménkǒu zài xīzǎojiān de zuǒ biān
 door at bathroom de left side
 ?The door is within the left-hand side of the bathroom

The door is to the left-hand side of the bathroom

In other words, the Subject and NP1 are *both* logical arguments of the locative Noun, NP2. These structures are *transitive* predications, thematically comparable to RC structures with transitive verbs, except the predicates in this case are nouns.

Given the semantic, pragmatic, thematic, and structural differences between possessives and structures where NP1 is locative, on the one hand, and structures where NP2 is locative, on the other, there clearly is a basis for two categories, Associative and Locative, and not one category that combines structures like (11), and (12) and treats both as distinct from structures like (10), as Zhang proposes.

3.3.3 Adj vs. V; de Adj vs de RC: a faulty comparison

Zhang's arguments that Adj and V are distinct and that *de*(ADJ) and *de*(RC) therefore entail different processing demands, is based on *structural* rather than semantic evidence. However Zhang's conclusion is different from that drawn by Li and Thompson (1981) from the same evidence. Zhang suggests that a Mandarin adjective can be distinguished from a stative verb because the former *must* be followed by *de* in 'predicative function' while the latter cannot be followed by *-de* *at all* (Zhang, 2001,

⁸ 'Theme' is used here in the sense of a thematic role: an entity whose existence or location is being predicated.

p. 76 and footnote 9). If true, this would constitute valid evidence of a categorial distinction *in the TL*, though not necessarily in the ILs, but in any event, the claim is based on a false analogy. Zhang contrasts a ‘stative verb’ serving as a main predicate, as in (19a) with the same lexeme serving as an *attributive* modifier in a copula structure, as in (19b) (the starred *de* is my addition, based on the claim in Zhang’s text). The same lexeme is labelled an “adjective” when used in the copula construction (Zhang, 2001, p. 76 e.g. (10) and (11)).

- 19) a. ta hěn rènzhēn *de
3sg very serious *-NOM
(S)he is very serious
- b. ta shì yīge hěn rènzhēn-de rén
he/she COP a.CL very serious -de person
(S)he is a serious person

In fact it is the copula construction that makes the use of *de* obligatory, as the following examples show. (20) shows the use of stative predicates *dà* ‘big’, and *rènzhēn* ‘serious’ *and* the dynamic verb *dǎ* ‘hit / play’ as main predicates, and (21) shows the same lexemes as complements of the copula *shì*. There is no formal distinction between stative predicates and dynamic predicate in either collocation.

- 20) a. zhège fángjian dà
this.CL room big
This room is big
- b. tā de lǎoshi rènzhēn
3sg PossDE teacher serious
His / her teacher is very serious
- c. tāde lǎoshi dǎ lánqiú
3sgPoss teacher hit basket ball
His/her teacher plays basket ball
- 21) a. tāde fángjian shì dà *(de) (fángjian)
3sg.POSS room be big-NOM (room)
His/her room is the big room.
- b. tā.de lǎoshi shì rènzhēn*(de) (lǎoshī)
3sg.POSS teacher be serious- NOM (teacher)
His/her teacher is the serious one
- c. tā.de lǎoshi shì dǎ lánqiú *(de) (lǎoshī)
3sg.POSS teacher be hit basketball- NOM (teacher)
His/her teacher is the basket-ball-playing one / the one who plays basket ball

(20) shows that *de* is not required after any predicate, and (21) shows that *de* is required in the copula construction regardless of the predicate type. This is because the copula *shì* demands a *nominal* complement and the presence of the final *de* indicates that the structure is nominal. An overt N can be placed in final position (as shown in brackets) confirming that the *de*-marked complement is indeed a nominal one.

Aspectual affixes and adverbs can also be used to demonstrate that *de* does not convert verbs into adjectives. The a) examples in (17) (18) and (19) show a predicate in predicative function, with an

aspect marker; either the ‘change of state’ suffix *le*, which is appropriate to words denoting stable states, or the ‘experiential’ suffix *guò*, which is appropriate for terminating but repeatable events. The b) examples show the same predicates in attributive function with the same aspect markers present. (An optional degree adverb is included with the intransitive verbs to show that the aspect marker is contained within a modifying VP; it is not a sentence-final particle associated with the matrix structure).

- 22) a. zhè kè shù [dà-le xǔduō]
This CL tree big-ASP much
This tree has become much bigger
- b. zhè shì yīkè [dà-le xǔduō] de shù
This be oneCL big-ASP much de tree
This is a much enlarged tree / a tree that has become much bigger
- 23) a. zhè wèi lǎoshī [rènzhēn le xǔduō]
this CL teacher serious ASP much
This teacher has become much more serious
- b. zhè shì yīwèi [rènzhēn le xǔduō] de lǎoshī
this is oneCL serious ASP much de teacher
This is now a much more serious teacher / a teacher who is now much more serious
- 24) a. zhè wèi lǎoshī [dǎ.guò lánqiú]
this CL teacher hit.ASP basket ball
This teacher has played basket ball before
- b. zhè shì yī.wèi [dǎ.guò lánqiú] de lǎoshī
this is one.CL hit.ASP basketball de teacher
This is a teacher who has played basket ball before

Whether the phrase functions as an attributive or a predicate, its form is identical. There is therefore no evidence that the head of the phrase has undergone a change in lexical status. The distinction that Zhang claims between adjectives and stative verbs is really a distinction between copula predications and verbal predications; there is no distinct class, adjective, in the TL.

Given this, Sharon and Kate, the learners for whom *de*(ADJ) appeared ‘late’, cannot be said to have *misclassified* adjectives as stative verbs. Firstly, whether they classified these lexemes as verbs or not can only be determined by reference to their own ILs, not by reference to TL data, and secondly, if they did classify them as verbs that would actually be correct from the TL perspective. It would also make the so-called *de*(ADJ) structure simply an intransitive relative clause, or *de*(RC) structure. The examples at (25) show the parallels between intransitive attributives and relative clauses.

- 25) a. zhè shì yījiān dà.de fángjian
This COP oneCL big.de room
This is a big room / a room that is big
- b. tā shì yī.wèi rènzhēn.de lǎoshī
3sg COP one.CL serious.de teacher
He /she is a serious teacher / a teacher who is serious
- c. tā shì yī.wèi dǎ lánqiú de lǎoshī
3SG COP one.CL hit ball de teacher
He /she is a basket-ball-playing teacher / a teacher who plays basket-ball.

All these examples exhibit the ‘gap’ typical of a relative clause: no subject appears between the copula and *de*. Arguably then, when the so-called ‘*de*(ADJ)’ emerged later than so-called ‘*de*(ATT)’ and at precisely the same time as *de*(RC), it was not actually emerging late, because the ‘*de*(ADJ)’ structures are just a semantic and thematic subset of *de*(RC) structures.

However, this clearly raises questions as to whether Zhang was justified in classifying *de*(ADJ) as lexical but *de*(RC) as inter-phrasal. If there is really only one non-nominal *de*, and Adj is also just a sub-type of RC, then there is no clear basis on which the two structures should be classified as having different processing demands.

Finally, even if the distinction between Adj and RC were warranted in the ILs, and even if *de*(ADJ) were really late in Kate’s and Sharon’s ILs, the fact that they used only eight ‘adjectives’ would still not account for the developmental delay. After all, there are at most six pronouns in any IL, and yet the affine structure which combines a pronoun and a noun emerged very early indeed. This shows that the number of distinct tokens of a lexical type has no bearing on the emergence of syntactic structures that contain that type.

In sum, no aspect of Zhang’s classification of *de*-marked structures is clearly warranted, either by semantic or structural evidence, from the TL or the IL. In precise counter-point to accepted analyses, she collapses nominal structures that have clear structural and semantic differences into *one* category on the one hand, and on the other, claims a dubious distinction between Adj and V, and so between *de*(ADJ) and *de*(RC).

3.3.4 Assessments of procedural demands.

These problems with lexical classification are further compounded by unsubstantiated assumptions about lexical feature structures and the exchange of information. Zhang assumes the classification of syntactic contexts in which *de* occurs reflect lexical properties of *de*, but if this were so, it would mean that *de* selects its collocates, and this would make it a phrasal morph at the least. Yet, there is no clear evidence for such selectional restrictions; to the contrary, *de* seems less restrictive in its collocational possibilities than IL nouns are.

LICENSING AND INFORMATION TRANSFER: *DE*(GEN), *DE*(ATT) AND *DE*(ADJ).

As explained in Chapter Two, collocations may be limited or licensed by features of lexical heads, and in PT, such licensing relationships entail processing demands, since they depend on the transfer of information between the licensing and licensed elements. Moreover, to implement a licensing relationship between independent lexemes, constraint equations must be employed to restrict access to a *phrasal* holder. For instance Pienemann (1989) proposes to account for the emergence of V2 in German SLA, by the implementation of constraint equations that allow only Adverbs and *wh*-words into initial position, and another which excludes all but V from the following position. By claiming that *de* must *license* each new collocate that precedes it, Zhang is effectively assuming the use of constraint

equations to initially *restrict* the selection of modifiers that precede *de* and is further assuming the gradual addition of more constraint equations as more types of collocates appear. This entails firstly that information is exchanged during licensing, which should make *de*(Gen) and *de*(ATT) both *phrasal* morphs, and secondly that all modifiers emerging together must contribute *the same specific licensing feature* which is absent from all modifiers that emerge only at a later time.

As we have seen, the nature of modifiers preceding *de* at any time is so diverse that it is not easy to identify a single licensing feature that might account for all of them (and see Chapter Five for a more detailed analysis). Moreover, Zhang argues that *no information is exchanged* in 'nominal' *de* structures because the relationship between the NPs on either side of *de* is clear from the 'conceptual material'. It is on this basis that she classifies them as lexical rather than phrasal structures.

In short, Zhang's two claims about *de* are contradictory: if new combinations of NP1 and NP2 are licensed by the addition of semantic F to *de* then information *must* be transferred from NP1 to *de* to NP2, and *de* must be *phrasal*; on the other hand, if the relationship between the two NPs is clear from conceptual structure, then *no* licensing is involved and variation in the modifiers is totally unrelated to any lexical features of *de*, though it would still be classified as phrasal nonetheless, because it heads its own phrase.

Two types of evidence suggest that relationships involving *de* are actually *not* restricted ones, but are generally productive syntactic processes. Firstly, except for RC, each *type* of modifier that can precede *de* can also precede N without the use of *de*, but when *de* is absent only specific *tokens* of each type can precede N. In this light, what *de* does is *remove* restrictions imposed by the noun on the choice of modifier. In other words, N places restrictions on items adjacent to it, but *de* provides an *unrestricted* position into which *any* modifier can be placed.

Secondly, the initial expansion of modification of N is actually *unrelated* to the use of *de*. Zhang suggests that exposure to locative structures encourages the learners to add more selectional features to *de*, leading to an expansion in its semantic contexts of use. If this were true, then *de* structures subsequent to this exposure would include at least one semantic type that was absent from *de* structures prior to exposure. In fact it can be seen from Zhang's tables (pp. 112-115; pp. 123-5) that prior to instruction on locatives, all N *de* N structures were ambiguous between *de*(GEN) and *de*(ATT), indicating that they already exhibited the full range of semantic types she recognised, and after exposure in week 12, the locative structures that emerged *first* were those that *excluded* *de*. When locative structures *containing* *de* did finally emerge in week 23 (Zhang, 2001, p. 114 and 125; Tables 6.1.-3; and 6.2-3) there was still no clear semantic feature that could be attributed to these new combinations, that was not already in evidence before week 12 (see Chapter Five for a more detailed discussion).

In short, there was actually no clear link between the expansion of types of NP2 in *de* structures and exposure to locatives, but there *was* a link between the use of *de* and relatively *unrestricted* choice of modifiers for N.

The simplest way to account for this in a PT model is to assume that *de* heads its own procedure, accepting any modifier, and the modified N as input. This still makes *de* a phrasal morph, in the sense that any lexical head is a phrasal morph, once it initiates a phrasal procedure, but the reasons for the classification are related to construction, not to information exchange. It also suggests that the delay in the emergence of different modifier types in construction with *de* could relate to delays in the emergence of the modifier types *per se*, not to delays in their access to the *de* procedure.

DE (ADJ) AND RELATIVE CLAUSES

Though Zhang claimed that no information exchange was involved in nominal *de* structures, she claimed there was such an exchange involving *de* in RC structures. Her argument here was that *de*(RC) “must recognize a) the VP or S’ as the modifier; b) the presence of a syntactic gap in the VP or S’; c) the logical connection between the gap and the FOCUS” (Zhang, 2001, p. 83). FOCUS is a discourse function (DF) which, according to Sells (1985), is assigned to the head noun in a relative clause structure and linked to a GF in the RC itself. This linking does clearly distinguish a relative clause from *most N de N* structures. The exception, as argued above, is locative structures, where locative nouns are also predicates and therefore also assign GFs.

The involvement of a GF is also crucial to the classification of this structure as *inter*-phrasal. In PT any procedure assigning a Subject GF is a kind of sentential procedure, and any non-basic S-structure, like an RC, belongs to a stage *beyond* the inter-phrasal level. Thus whenever a Subject GF is assigned in an RC, or whenever any GF is mapped to another position outside the RC, advanced processing demands are entailed.

However, since ADJ is arguably a kind of V, and locative structures arguably involve GF assignment as well, the same analysis should apply in principle, to *de*(ADJ) and locative *de*(ATT).

This clearly undermines Zhang’s claim that *de*(ADJ) structures are lexical, but it does potentially explain why *de*(ADJ) structures emerged alongside RC structures instead of alongside the ‘nominal’ *de* structures.

However, there is still no evidence that *de* itself contributes to this processing complexity. It is GF assignment within the RC, and the link with some entity-denoting nominal outside the RC that entails the inter-phrasal processes, not the morph *de*. The processing demands are associated with the modifier and with the structure as a whole, not with the morph *de* itself.

THE CLASSIFIER

Zhang’s classification of the classifier as phrasal is clearly warranted, on the basis of its licensing of numbers. However it is not clear exactly what features are exchanged in agreement. While Zhang proposes SHAPE and HUMAN as relevant features of classifiers, these relate to collocations with N, not with numbers. She also says that “‘ge’ the default classifier was used most frequently, often substituting for others” (Zhang, 2001, p. 154). Since ‘ge’ was used with all manner of nouns, it is not

actually clear that the features HUMAN or SHAPE or any others were in fact relevant to its collocation with nouns in the ILs. This means it is unclear how best to calculate the processing demands associated with *ge*, or how to rank the processing demands of classifiers as a whole relative to *de*.

3.3.5 Limitations of the Study

None of these points invalidate Zhang's *descriptions* of the acquisitional sequence evident in each IL. However, her analysis seriously confounds the relationship between those individual sequences, specific lexical forms, and procedural requirements of syntactic structures as a whole. Moreover the calculation of an implicational hierarchy based on amalgamated frequencies from three learners creates a misleading impression of the way structures actually emerged. This undermines Zhang's explanatory account, making it unable to either clearly support or significantly challenge Processability Theory. Potentially significant stages of development are masked by Zhang's structural categories, rather than revealed by them, and there was extensive overlap between the extension of putatively early structures and the onset of putatively late structures, that Zhang's derived hierarchy did not capture. Finally, even if the developmental hierarchy does prove to be valid, Zhang's discussion leaves us with little sense of how these particular structures fit into the development of Mandarin nominal structures as a whole.

Despite being an application of Pienemann's Processability theory, Zhang's decision to focus on specific morphs means her study suffers from many of the same limitations as early morpheme studies: it describes IL development in terms that are both language- and structure-specific.

3.4 Conclusions

Zhang's study has provided evidence of a stable acquisition order for three clearly distinct nominal structures: NP *de* N > Num-Class-N > Adj/RC *de* N. However, Num-Class-N emerged just one sample later than the NP *de* N, and the emergence of various semantic sub-types of the NP *de* N structure actually extended through most of the observation period. The third structural type emerged at quite different times for two learners, and not at all for the third, but because there were effectively just three structural types and two emerged quite early on, this variation in emergence *rates* made no difference to the emergence *order* overall.

However, whether this emergence pattern actually supports or contradicts the predictions of Processability theory is still unclear, because the morphs which Zhang considered are not the sole contributors to the processing demands of each structural type. Where Zhang classified *de* as a reflex of four different morphs, three lexical and one inter-phrasal, I have argued that *de* is in fact a single *phrasal* morph and that the emergence order of the structures relates to the nature of the constituents that collocate with *de*, or in the classifier, not to the lexical structure of *de* or the classifier alone. Moreover, there is no evidence in the TL data for the distinction that Zhang assumes between stative verbs and adjectives, and Zhang herself presents no evidence for such a distinction in the IL data. Together these points help to account for the fact that 'genitive' and 'attributive' N *de* N structures emerged together,

since they are really just different tokens of the same structural type (see Li & Thompson, 1981; Simpson 2001; Charters, 2004, forthcoming, for arguments supporting this view) and might account also for the fact that 'de(ADJ)' structures emerged alongside RC de N structures, since the former can clearly be understood as a sub-type of the latter. However, in the absence of direct evidence *from the ILs* that the structures occurring there actually involve GF assignment or inter-phrasal processing, the IL 'de(ADJ)' construction in particular could still be nothing more than a lexical head placed adjacent to de, and the IL RC structure could be the product of a phrasal de procedure that accepts input from VP, without the involvement of a sentential procedure or GF assignment.

The lag between emergence of Num-Class-N and Dem-Class N, and the general use of the default classifier ge also suggest that factors other than the gender features specified by Class help to determine the emergence time for numeric vs. demonstrative structures.

Given the problems with Zhang's analysis, and the construction of an implicational hierarchy that conflates results from three learners, it is really difficult to assess the extent to which stages in Mandarin SLA actually do overlap, or the extent to which a more careful analysis might reveal developments within each stage.

It is both a strength and a weakness of Processability theory that its predictions can appear to be confirmed by an implicational hierarchy of emergence, even when the classification of morphs on which that hierarchy is based, is clearly flawed. Because PT assumes that processing capacities *must* develop independently for each *lexical* type, development relating to one lexical or phrasal category is not necessarily accompanied by equal development in all categories. PT's predictions are confirmed if just *one* lexical morph emerges before *any* phrasal morph, and *one* phrasal morph emerges before *any* inter-phrasal morph. Any 'out-of-order' patterns can be explained as late acquisition of specific *features* or specific *lexical items*; as misclassification of a lexical category; or as variation from phrasal category to phrasal category.

This demonstrates both the potential and the dangers of a theory like Processability theory that links processing demands to overt morphs. While in principle it can be applied to languages with strikingly different structural configurations and morphological markers, in practice those markers easily become the focus of study, to such an extent that they are mistakenly equated with the *structures* in which they are found. Though Pienemann et al (1993) argue that acquisition may involve a progression through hundreds of alternative syntactic procedures, the focus on isolated morphs, rather than syntactic derivations and processes, virtually forces the analyst to allocate all structures into one of just six basic stages relating to the kind of morphs involved in each structure, and the dependence or otherwise on general cognitive ordering processes. The theory's relative neglect of developmental patterns *within* these stages leads inevitably to a loss of detail in the consideration of average acquisition orders. This is particularly pertinent to the acquisition of nominal syntax, since so much development in this domain falls within a single stage: the phrasal stage.

Thus, the kind of implicational hierarchy that Zhang derived from her IL data may appear to confirm the predictions of Processability theory, yet it contributes little to our understanding of acquisition orders or processes more generally. A good deal more clarity might be achieved if the whole domain of nominal syntax is considered, and submitted to thorough syntactic analysis rather than observing the emergence of a few selected forms. This requires attention to the detail of how phrases are generated within the proposed incremental procedural grammar, and to hypotheses about constraints on linguistic structure expressed within a complete formal theory of syntax.

Chapters Four and Five present the methodology and results of my own longitudinal study into the acquisition order of nominal structures in Mandarin, and an analysis that seeks to address the issues of underlying derivations in IL grammars.

Chapter Four: Methodology

4.0 Introduction

In the last chapter I identified some pitfalls of a too simplistic approach to the study of IL grammars, focussing only on grammatical morphs. I also highlighted some weaknesses in the use of implicational hierarchies as a representation of emergence orders observed longitudinally. Despite these misgivings about Zhang's analysis and interpretations, the data themselves were collected according to standard methodology employed within the processability framework, and remain a valid source of IL data. This chapter describes how much the same methodology was employed in the data collection phase of my own longitudinal study of Mandarin SLA. Unlike Zhang's research this study analysed *all* nominal structures produced by three learners in their first year of study. Section 4.1 describes the research design; section 4.2 describes the participants; Section 4.3 describes the data collection. The initial results of the study are then discussed in Chapter 5.

4.1 Research Design

4.1.1 Hypothesis

The hypothesis for this phase of the research was the null hypothesis that three different learners from different L1 backgrounds would acquire syntactic structures of Mandarin in the same order. To test this hypothesis samples of spontaneous speech were collected from three adult learners of Mandarin and submitted to structural and statistical analysis.

4.1.2 Context

The study was a longitudinal study of instructed learners in a foreign language environment, the University of Auckland, New Zealand. At the time of data collection, (1997-8) Mandarin was a minority language in the local community, but it was not commonly heard in public, there were no Chinese language radio or TV channels in operation. The observation period was two years, but only the first year's data is discussed here. Instruction time during this year consisted of two 12-week semesters with six hours of classes per week each semester. There was a two-week break in each semester, and six weeks between semesters. Thus, the nominal "year" of observation actually spanned a total of 34 weeks, containing 144 possible formal contact hours. The textbook used was Chang, Mackerras and Yu (1993).

4.1.3 Population and sample selection⁹

Participants were drawn from the pool of students enrolled in the entry level course in Mandarin. This course had no prerequisites beyond the general restrictions on entry to the BA programme: students must have passed or been accredited with a qualifying examination, or be over 20 years of age. As NZ Residents, the participants eventually recruited for this study did not need to demonstrate any particular proficiency in English.

Participants were recruited through advertisements on University notice-boards, and announcements in first year classes. In order to participate, students were required to have no prior knowledge of any Chinese language, and no significant time spent living in a country where Chinese is an official or community language. This excluded those with a Chinese language as their L1. Apart from that, no effort was made to limit the L1 of participants because past research has already indicated that L1 makes no significant difference to emergence *orders*¹⁰ in SLA (Dulay & Burt, 1974; Selinker, Swain & Dumas, 1975; Adiv, 1984; Pica, 1988; White, 1996; Clahsen & Muysken, 1986; Pienemann, 1989).

16 students responded to the advertisements; three agreed to participate regularly, *and* completed the first year of study. This sample size is small, but not exceptionally small for a longitudinal study (cf. Brown, 1975; Pienemann, 1984; Zhang, 2001).

4.1.4 Data Collection and Sampling

The learners' ILs were sampled in a series of taped conversations with the researcher. These started six weeks after instruction commenced, and continued at 2-4 week intervals for the first year. The delay of six weeks was a consequence of the time required to implement ethical and selection procedures, which could only begin after classes started.

There were nine observation times in total, and each of the three learners was observed for at least eight of these. The times for the first year are shown on Table 3, below. The first column indicates the sequence of nine observation cycles in the first year, from Time 1 – Time 9; the next column shows weeks elapsed since the start of instruction. The third column shows the elicitation activity in each period (see below), and the fourth column shows sequential sample codes, where the letter (H/S/K) indicates the learner and a number from 1-9 indicates where this sample falls in the sequence of all observations *on that speaker*. Samples with the same time-code used the same elicitation material, and on all but three occasions (indicated by dates) were collected within two days of each other.

Because learners sometimes missed an interview, Time-codes and sample codes do not necessarily correspond. For example, Sam missed the first observation time, so his first sample, S1, was collected at T2, in response to the T2 elicitation task. Examples of learner utterances will be annotated

⁹ The project was approved by the Ethics Committee of the University of Auckland.

¹⁰ Different L1s may be associated with different emergence *rates* and with structures absent from other ILs, but for a given TL, certain structures will appear in the same sequence in all ILs regardless of L1.

with the sample code; times of emergence will be indicated by reference to time-codes, or elapsed weeks.

Table 3. Timetable of samples

T1	week 6:	Descriptions: Kids	H1, K1
T2	week 8 :	Sequences: Bikes	H2, K2, S1
T3	weeks 10-11:	Differences: Playground	S2 (14/5) , H3, K3 (21/5)
T4	weeks 14-15:	Sequence: Men at Work	S3 (11/6), K4 (18/6)
T5	weeks 21-22:	Sequence: Taishan	S4, H4 (1/8), K5 (6/8)
T6	week 24:	Sequence : Picnic	H5, S5 (K missed)
T7	week 26:	Differences: Shapes	H6, S6 K6
T8	week 28:	Sequence: snowy day	H7, K7, S7
T9	week 30:	Sequences: the beach	H8, K8, S8

In addition to these codes, each interview and corresponding tape and transcript was given a reference code (not shown) which served to link learner samples extracted from the transcript to an interview. This was to preserve the context of use.

4.2 Participants

The participants were Sam¹¹, an 18 year old New Zealand born Pakeha man; Kazuko, a 19 year-old Japanese woman, and Hannah, a 23-year old Korean woman. They were unknown to each other and to the researcher, at the beginning of the study.

Sam was born and grew up in small-town New Zealand, speaking only English. Some of his family had lived in NZ for two generations or more, also speaking only English. Sam studied Japanese at high school and was just commencing university study of both Mandarin and Korean at the start of the observation period. At the time of the study he lived with his family of origin, in suburban Auckland.

Hannah was born and grew up in Korea, speaking Korean, but had lived with her family of origin in several different countries before moving to New Zealand with them in 1991 (six years before the study commenced). Her father was a diplomat. Hannah spoke only English and Korean. Her English was excellent.

Kazuko was a native speaker of Japanese, who grew up in Japan and came to NZ, via Australia, with her family of origin, in the same year as Hannah. She spoke good English; we had no difficulty communicating in that language.

Despite the somewhat exclusive nature of University study, the sample is far from homogeneous: though close in age, Sam, Kazuko and Hannah come from different cultures with very different historical relationships to China. They speak different L1s, have somewhat different prior linguistic experience, and they are not equally embedded in New Zealand society. Two are immigrants, one of whom has had a transient life with her family, and the other maintaining strong links with extended family in her homeland. Because their societal affiliations are different, and they are students, their

¹¹ These are pseudonyms.

socio-economic status is difficult to assess, and not necessarily comparable. However prior research on language acquisition has already established (in larger groups) that the natural order of acquisition is unlikely to be affected by such factors (see Dulay & Burt, 1974; Selinker et al., 1975; Adiv, 1984; Pica, 1988; White, 1996; Clahsen et al., 1986; Pienemann, 1989).

4.3 Data Collection

4.3.1 Recording Procedures

The nine recording sessions took place either in the recording studio at Auckland University or in the researcher's office. Each recording session lasted an hour and started with a period of relatively unstructured conversation, up to a maximum of half an hour. This was followed by a brief explanation, in Mandarin, of a task to be performed during the rest of the session, and distribution of related materials (see next section). In early sessions, to ensure comprehension of the tasks to be performed, they were explained in English before recording commenced. The participants were then reminded to avoid the use of English or their other languages during recording.

Recording sessions generally involved two learners and the researcher as facilitator, but occasionally there were three learners in one session, and quite frequently, there was just one. Early sessions with three participants contained a lot of overlapping speech, posing problems of speaker identification on playback, so later sessions were restricted to a maximum of just two learners where possible. The presence of two learners meant they could each encourage input from the other, maximising learner talk, and extending their social roles and communicative functions in the session. However, in Kazuko's case, one-to-one sessions were preferable because she was soft-spoken, and reticent. Being the sole respondent put more pressure on her to speak, and allowed the recording volume to be adjusted for her alone, making her utterances easier to hear on playback.

Recordings were made on cassette tapes, and have been retained. Transcriptions were made using MS Word to create electronic text-files. Subsequently, the text files were imported into Shoebox®, to form a corpus available for further research.

4.3.2 Elicitation procedures

Before the recording phase commenced, the three participants were told that the researcher was not evaluating 'correctness', but was interested in both the kinds of sentences they could produce and the kinds of mistakes they might make; and that quantity of speech was more important than correctness. The intention was to encourage them to use their full repertoire of Mandarin. The learners all contracted to speak as much as possible, and as much in Mandarin as possible, when being recorded. They also agreed that the transcripts of their sessions could be used for future research.

In group sessions, learners were largely left to manage turn-taking themselves. The researcher intervened mainly to invite participation from specific participants as necessary, or introduce a secondary task if the learners ran out of things to say. The learners were permitted to elicit lexical items

from the facilitator, both before and during sessions, and were sometimes provided with a vocabulary-sheet to which they could all refer. This was justified on the basis that knowledge of lexical forms was not the focus of inquiry, and ready access to the vocabulary items would encourage continuity and fluency of expression, and so maximise the production of structured utterances, which *were* the focus of study. If learners asked how to express an idea or proposition, they were told some appropriate lexical items, but not told how to construct a sentence. If they asked in an interview, “Can you say this? Is this right?” they were just given a nod of encouragement, or told “wǒ fīngdǒngle” (I understand) without comment on grammaticality¹².

4.3.3 Elicitation Techniques

Elicitation took the form of free conversation followed by invitations to perform specific, information-gathering and reporting tasks. During free conversation, the learners had to introduce, and maintain or change topics, and refer to previously introduced referents, encouraging the use of pronominal and deictic forms. In each specified task, each participant had pictures that the others could not see, and had to describe their contents so the group as a whole could accomplish the task. The specific tasks included:

- a) description of pictures;
- b) paraphrase of others' descriptions;
- b) identification of differences between pictures;
- c) allocation of depicted events to a temporal sequence.

4.3.4 Elicitation Instruments

The pictures used and the instructions given to the participants are presented in Appendix B. (Line drawings are based on materials developed by the Australian LARC project).

Each task required the participants to use quantification, the attribution of properties, and the specification of spatial and temporal relations to identify specific referents. These are all especially relevant to the production of nominal structures. In addition, each of these general tasks entails the task before it: in order to assign a sequence to events it is necessary to know key differences and similarities between images, and in order to discover these it is necessary to know the content of each picture in some detail. Description was used mainly in the first sample; in later samples, the most inclusive task, sequencing, predominates. Repetition and sequencing also served as comprehension checks.

¹² Some feedback on grammaticality was given, if requested, when transcripts were distributed, but this was never on the day of a recording session. As the research progressed, the learners became less interested in reading the transcripts and sometimes signed the release forms without reading them at all. Awareness of and reflection on their language use as shown in the transcripts was therefore minimal and unlikely to significantly affect later production or the results of the study.

Avoiding avoidance

Where certain morphs are obligatory in the TL, it is possible to devise elicitation tasks that force that context to arise, and therefore oblige the learner to produce the target item if they can. If they do not, this can be reasonably taken as evidence of inability to produce, not sampling error. The contrast between use and non-use in the same obligatory context can then be taken as evidence of generative production: whenever an obligatory morph appears in a context where it was previously absent, this indicates a change in the learner's productive system whereby the form is now a morph that can be creatively combined with other morphs. The alternative would be that the learner has gained control of *two* unanalyzed sequences with almost the same meaning and conditions of use, but one contains an additional segment that the learner does not associate with any meaning. This is possible in principle, but it seems counter-intuitive. Psychological research has shown that our capacity to memorize long sequences of meaningless sounds, or of unrelated words in our own tongue, is very limited indeed. We find it easier to remember meanings and combine familiar forms to reconstruct meanings, than to memorize and reproduce long unanalysed strings of sound. Since instructed learners are taught and memorize many morphs (in the form of simple words) from the TL every week, we can be reasonably confident that they will recognize these morphs when they occur, and attempt to combine them to produce novel meaningful utterances.

Though the same logic cannot be applied to the production of *optional* morphs, such as attributive modifiers, or of complete syntactic structures, which, as a whole, are not obligatory, the issue of avoidance can still be handled via the use of effective elicitation techniques. Given that different syntactic structures serve different communicative, pragmatic and discourse functions, it is reasonable to assume that a manipulation of communicative tasks and pragmatic contexts will encourage learners to employ whatever appropriate variations in syntactic structure they can, to complete the tasks assigned.

So for example, when learners need to determine the differences between two photographs, they will be obliged to identify and describe the people or things depicted therein, and therefore to either predicate some attributes of entities, or use attributive modifiers to limit the reference of entity-denoting words. Though we cannot exclude the possibility that they might prefer one syntactic structure over another, we can reasonably assume that they will avoid the structures that they find more difficult, or are unsure of, not those they find easy. Thus the emergence order of the structures that are captured should reflect the relative ease with which the learner can produce them, even if it does not necessarily reflect the earliest *possible* emergence time for each structure. This means the emergence times may be generally conservative, but they are unlikely to be totally unrelated to the ease of production.

It was in order to ensure that that the same *pragmatic* contexts for use were present in each interview, that a repetitive cycle of elicitation was used, with tasks assigned in later sessions entailing tasks assigned in earlier ones. For example, sequencing is a canonical context for the use of ordinal

numbers. A sequencing task was explicitly assigned at T2, but ordinal forms do not emerge till T3 or T4. Because the context of use was supplied at T2, we can state with greater certainty that ordinal forms, are indeed absent from the learner's repertoire at T2.

In short, the elicitation tasks put significant productive demands on the learners, maximising the probability that their output in any given interview was representative of their repertoire at that time. After transcripts had been prepared, the learners were given copies of all recording sessions in which they were involved and given the opportunity to delete any parts that they wanted to exclude from analysis. This option was never exercised.

Chapter Five: A natural emergence order

5.0 Introduction

This Chapter presents the initial results of data collection, and of the first stages of analysis whereby a natural emergence order for Mandarin nominals was extrapolated from three individual emergence orders. It then compares the results of this study with those of Zhang's study discussed in Chapter Three. Section 5.1 describes the construction of a coded corpus from tapes of interviews. It ends with examples of the nominal structures that occurred in all ILs. Section 5.2 describes the methods by which IL word forms were allocated to lexical classes and then describes the order in which those lexical classes emerged. Section 5.3 describes the criteria by which a string of words was accepted as a product of generative processes, and the basis on which certain structures were excluded from subsequent consideration. It then describes twenty-two structures that were productive in all three ILs, and their order of emergence in each IL. Section 5.4 explains the methods used to establish the degree of correlation between the individual emergence orders, and to derive three slightly different representations of a single natural acquisition order for these Mandarin nominals. Finally, Section 5.5 compares the findings of this study to those of Zhang's (2001) study with respect to ten structures that were investigated in both.

5.1 The Corpus

5.1.1 Construction of IL text samples

The elicitation sessions described in the previous chapter resulted in a total of approximately 15 hours of tape. These were transcribed in MS Word, using the official standard Phonetic Romanisation of mainland China (luómǎ pīnyīn), supplemented by English orthography (for English words, back-channels, fillers etc), and close IPA transcription (using SILIPA fonts) as appropriate¹³. Pausing and precise phonetic content, including tone, was transcribed only where it seemed to influence the interpretation of meaning, lexical choice or constituency.

After transcription, a set of sample files was created for each learner, containing one file for each interview in which they had participated. Each file contained selected utterances by a single learner

¹³ Standard tones are included in transcriptions cited here to aid recognition of lexical items. This does not reflect the actual tonal system used by the learners.

from a single elicitation session, in the order in which they occurred¹⁴. Each separate string within the sample file was given a number corresponding to its position in the original conversation.

The selected utterances included all strings of words that were comprehensible, semantically coherent and pragmatically appropriate at the time of utterance. These were deemed most likely to represent syntactic structures. The criteria of comprehensibility and pragmatic appropriateness were intended to capture strings that *might* contain IL structures different from TL structures. In practice very little phonetic output was excluded as incomprehensible. Obviously, a selection that contains the essential elements of a predication is not necessarily a single syntactic construction. However, the aim at this point was simply to preserve whatever structures *might* be present in the data. Subsequent analysis determined whether the strings were indeed constituents within the learner's linguistic system at the time or not.

The minimal string selected had to contain at least two morphs, at least one of which was Mandarin. This included mispronunciations but excluded back-channels ('um', 'er', 'uhuh' etc).

In order to preserve hierarchical structure, each selection was as long, and as close to a complete predication as possible. However, any single utterance was broken into separate strings at overt signals of structural disjunction. These included sentence-final particles; an unchallenged change of speaker; introduction of a new topic; prosodic junctures such as low-falling or high-rising intonation on declaratives and interrogatives respectively; or a false start signal, such as *bù* 'No' followed by commencement of a new predication, or repetition of the previous string with a change or addition. Two predications were never selected as a single string unless one was surrounded by parts that formed another, or there was some overt marker of subordination, such as the particle *de*, or co-referent deletion. So, the first selection in a given IL stretched from the first interpretable item to the first subsequent signal that a predication was either complete or abandoned.

Sometimes a single predication spanned simultaneous or interjected talk by other speakers. If two speakers spoke simultaneously for more than a few words, the first speaker would generally stop. If that speaker then repeated some of their previous turn when they resumed, this was taken as an indication that the repeated sequence and the following material formed a syntactic unit in their view. In this case, the largest coherent string immediately preceding the interruption was selected then the repetition and the semantically related information that followed were counted as a separate string. Where a consecutive series of utterances by the same learner formed or contained no complete predication, the largest coherent unit was selected from each utterance, and each was counted as a separate string for purposes of analysis. In practice, the focus on nominal structures meant interruptions were largely irrelevant. Nominal constituents were rarely interrupted by other speakers' attempts to talk. All talk produced by other speakers was deleted from a chosen speaker's sample file, but separate utterances

¹⁴ This procedure was derived in part from that used by Coala®.

were marked as such and cross-referencing made it possible to locate the utterance within the transcript whenever necessary for clarification. This process produced a total of 24 sample files, eight for each learner.

5.1.2 Initial Coding of IL words

Once the 24 sample files were created, each word-form was glossed on the basis of its meaning, its collocates, and the category of the same form in the TL grammar, unless the IL context indicated that this was inappropriate. The only exception was the use of the label Adjective for words that denoted stable properties. As discussed in Chapter three, in TL Mandarin property-denoting words are classed as stative verbs. The term Adj was used to allow comparison of property-denoting words and dynamic verbs to see if they constituted a single class in the ILs. Where the IL contained an English, L1, or nonce word, or used a word in a non-TL collocation, the word was assigned a label on the basis of its distribution in the IL, not on the basis of its form and class in the TL. In any event, at this stage lexical glosses were mainly mnemonic devices. The status of any phonetic sequence as a token of a valid IL lexical category was confirmed later by standard tests: evidence of recurrence with a constant meaning, and constant distribution relative to other recurrent forms within samples of a single speaker's IL.

Subsequent analysis focussed primarily on constituents containing a noun or pronoun, or having the distribution expected of a noun or pronoun in the TL. After some initial analysis, data on the use of predicative adjectives was also collated, in order to compare the tokens and their emergence order to that of attributive adjectives and to test some claims about the relationship between the number of different Adj and the emergence of Adj de N structures suggested by Zhang (2001).

After initial glossing, each sample file was converted into a table using MS word, and sorted alphabetically by gloss, so that identical sequences of lexical categories were grouped together. The groups were then arranged by length, so for example, N, Pron, and Names formed one section, Pron-N, Quantifier-N, Number-N, and Adj-N formed another, Num-Class-N another, and so on. Each group was then checked to ensure consistency of coding from token to token within a group, and adjustments were made where necessary. The final groups were assigned a descriptive label. For example, strings where a kin-term was preceded by a pronoun were labelled 'affine structure'; those where an Adjective preceded de were labelled Mod deP (for modifying deP); those where transitive VP preceded de were labelled RC (relative clause) and, following Li and Thompson (1981), strings where the particle de occurred between two nouns were labelled Associative deP, unless N2 was a locative or temporal noun, in which case they were labelled Locative deP. These labels, like the lexical class labels were intended as mnemonics only. Lexical and structural analysis were later undertaken to determine which sequences were actually examples of the same syntactic type, and what the constituent structure of each type might be (see Sections 5.2 and 5.3, below and Appendices D-I).

35) Affine structure

wǒ nǎinǎi yéyé zhù hánguó
 1sg grandma grandpa live Korea
 My g.mother and g.father live [in] Korea (H1)

36) Num-CL-N

yī.ge gègè liǎng something zìxíngchē
 two CL older. brothers two something bicycles
Two brothers (K1) Two bicycles (S1)

*Num-CL-N:

*liù.ge nián
 six CL year
Six years (H1)

37) Dem-CL-N

zhège huà
 this.CL picture
This picture (H4)

38) deP Poss

wǒde jùjù de jiā
 1sg.Poss uncle Poss home
My uncle's home (S4)

39) Conj

tā chuán huáng hé hóng hé lán yīfu
 3sg wear yellow and red and blue clothe(s)
 She wears yellow and red and blue clothe[s] (K2)

40) (adv) Adj-N

hěn dà zìxíngchē
 very big bicycle
 Very big bicycle (H2)

41) (hen) duo-N

hěn duō rén
 very many people
 Very many people (K3)

42) Num-CL Adj N

liǎng bǎ cháng yǐzi
 two CL long seat
 Two long seat[s] (S2)

43) *Pseudo Rel Cl

wǒde huà zhège yī jiā qù chāojǐshìcháng shì dìyī
 my picture this.CL one family go supermarket is the first
 My picture [where] this family goes [to the] supermarket, is the first (H5)

44) Mod deP

dǎ.qiú de rén
 play.ball DE people
Ball-playing people (K3)

45) Locative deP

hěn duō shù de zhōngjian
 very many trees DE middle
 In the middle of many trees (H5)

46) Num-CL deP N

yī.tiáo qiánlánsè de niúzǎikù
 1.CL lightblue DE jeans
 One pair of light blue jeans (H4)

47) Predicative AdjP

tāmen zhēn ǎide
 they very short
 They are really short (K1)

5.2 Lexical categories in the ILs

Once recurrent patterns of potential word-types were identified, lexical classes were established on the basis of the distribution of recurrent forms in each IL. The first requirement was that the glossed items were in fact identifiable as morphs. A morph is defined conventionally as a form that recurs in different collocations, with the same meaning or function, and which cannot be divided into smaller meaningful recurrent forms. The identification of individual morphs was a necessary precursor to the identification of productive structures, since these are defined in terms of being composed of separable components. Because the notion of morphemic status and generative production are bound

together in this way, it is convenient to discuss the criteria by which recurrent forms were identified as words, and structures were identified as productive, at the same time.

5.2.1 Emergence Criteria

It is established practice within Processability studies to use a criterion of emergence, rather than of accuracy to identify the point at which a learner first demonstrates the ability to produce a specific syntactic structure. This is because Processability theory is interested not in the norms of the TL, but in the way the productive capacity of a learner changes over time. Pienemann argues: “If a structure has been acquired it will be a constant part of the interlanguage system at later levels of development. In this way one discounts the single and isolated occurrence of seeming rule application as an aberration in the data.” (1998c, p. 147). In other words, if a learner is capable of *generating* a structure, they will do so more than once, and even a few repeated occurrences of a structure indicate that it has been acquired.

This assumption is valid unless structures are avoided, or appear to be present but are actually unanalysed or ‘formulaic’ utterances, and not the product of a generative process (Larsen-Freeman & Long, 1991; Pienemann, 1998c). Pienemann addresses the first issue through elicitation techniques that control the linguistic context, as described in Chapter Four. Assuming the application of such techniques, Pienemann’s standard criterion of emergence for an obligatory morph is then two occurrences in contexts where it has not previously appeared in the speaker’s IL.

This contrast between use and non-use is intended to address the second issue of formulaic production: it furnishes evidence that an observed form is indeed a separable morph in the learner’s IL system. However, it is actually somewhat problematic because, by this criterion, a *native speaker* would be judged unable to produce obligatory morphs; their use would not normally contrast with *non-use*. Therefore the use of this criterion depends both upon the assumption that learners will attempt to produce structures *before* they have acquired the necessary morphs to do so correctly, and upon observing acquisition *from the start*.

5.2.2 Establishing Morphemic status, and Dealing with Formulaic utterances

To further address the problem of rote-learned unanalyzed sequences, strings in the current study were submitted to the standard linguistic tests of morphemic status and constituency: movement, substitution, and semantic coherence. To count as a single morph, a form had to recur with different collocates, but the same apparent meaning or function. So, for example, the appearance of the forms *wǒ* and *nǐ* in front of *de* in statements of possession, in front of kin-terms in descriptions of family, or on their own to refer to established referents, confirmed the identity of all these forms as distinct morphs. The deictic use of *wǒ* and *nǐ* also identified them as pronouns. While the meaning or role of *de* could not be so easily determined, it did have a consistent distribution, between a noun and a modifying element, and a consistent effect: in most cases the modifier that preceded *de* did *not*

otherwise precede a noun. This indicated a licensing effect on the part of *de*. No other items shared this distribution or effect with *de* so, on this basis, *de* was allocated to a lexical class of its own.

As Pienemann points out, a single occurrence in two different contexts is sufficient to indicate that the form can occur alone with a constant meaning, so the criterion for emergence of a morph was precisely that: recurrence in two distinct contexts, with the same meaning or function *within a single IL sample*. The latter condition was added in respect of the fact that ILs are transitional systems undergoing change.

It might still be suggested that learners are somehow assisted by ‘formulae’, to produce structures that look more complex than they really are. For example, many of the bare possessives in the learners’ early productions occurred in a learned pattern or ‘formula’, which could be described as a “Family Structure Formula”:

48) wǒ jiā yǒu X Y (Num -ge Z)* hé wǒ
1sg family have X Y (Num-Class Z)* and 1sg

X, Y was usually *bàba māmā* ‘father, mother’ and Z was one of the four terms for siblings (older / younger brother / sister), and the string ‘Num-ge Z’ could recur.

Though clearly formulaic in nature, the family structure formula can still be classified as a legitimate phrasal construction in PT terms. Firstly, since formulaic structures are used in a meaningful way, they must represent a mapping of conceptual structure onto phonetic form; thus they are either a product of the pre-linguistic pragmatic sequencing strategy, the SOP, or a product of the learner’s *linguistic* system. Secondly, all utterances, formulaic or otherwise must be within the processing capacity of the learner at the time they are uttered. This means that formulae produced at the lemma stage must behave like uninflected words, having no alternating parts, those produced at the categorial stage must behave like members of an established word class, exhibiting standard lexical inflections associated with a noun, or verb etc, those produced by reference to the SOP must exhibit the sequence NVN mapped to thematic roles. Only formulae produced at the phrasal stage or later can combine *any elements*, with *internal* alternations in form. Formulae produced at the sentential stage would combine items from different iterations of conceptual structure, would involve a Subject GF, and might exhibit Subject-Verb agreement (where the TL manifests such agreement).

The ‘family structure formula’ at (48) combines at least four elements: [wǒ jiā yǒu | [X,Y] [Num-ge Z]* and [hé wǒ] in fixed order, but with internal variations. The learner’s frequent use of wǒ ‘1 sg’ as an independent lexeme, of other affine structures such as wǒ nǎinai ‘my Grandmother’ and wǒ yèye ‘my Grandfather’, and of the Num-Class-N string *outside* the formula in the same interviews, all indicate clearly that wǒ, jiā, yǒu, bàba māmā and the Num-Class sequence at least, are stored as separate lexical items in their lexicons. Therefore to treat an utterance modelled on (48) as a *single* lexical item would imply that the learners view Mandarin as an agglutinating language with *infixes* of the forms just described,

occurring in three distinct positions within a single root. The learners' exposure to monosyllabic citation forms in learned vocabulary would surely prevent their making such inappropriate assumptions. Moreover, the component parts indicated in (48) cannot be understood as a single NVN sequence, so it could not be the product of the SOP. There is also no evidence of syntactic Subjecthood, or inter-phrasal agreement. Since the formula provides evidence of recursion, embedding, and paradigmatic alternation, in *non-salient positions*, but no inter-phrasal processes, it can only be the product of *phrasal* processing.

Though the structure may be formulaic to some degree, the formula itself must be treated as 'phrasal' within the terms of the theory. As long as the standard diagnostics for word-hood and constituency are applied rigorously to IL utterances, there is no significant risk that formulae will be interpreted as evidence of productive capacities beyond those they actually indicate, even if they are produced by non-TL like means.

5.2.3 Determining Lexical category membership

Nominal morphs in the IL utterances were initially assigned to one of 12 lexical groups: Noun, Pronoun, Name, Number, Classifier, Demonstrative, DE, Ordinal, Postposition (for locative nouns following another noun), Adjective, WH (for interrogatives), and Q (for non-numeric quantifiers). Also coded were Prepositions; predicative adjectives; verbs, where they were used to modify a noun; adverbs (hěn 'very') that occurred with adjectives and non-numeric quantifiers; the copula (shì); and nominal conjunctions (hé 'and' and háishi 'or').

Table 5. Nominal Categories in the ILs

Free morphs	Bound morphs
Pronoun: Personal Names, Demonstrative null	Possessive DE
Noun "Number" numeric demonstrative	Incorporated Locatives Classifier Ordinal Marker Classifier
Adjective property words quantity words WH-Adj	Attributive DE
Determiner Demonstrative Wh-Dem	
Preposition	
Conjunctions: Nominal Interrogative	

Having established the morphemic status of the coded 'words' their membership in distinct distributional classes was investigated. Where words of different semantic types (having different

glosses) appeared in identical collocations, a contingency table was constructed showing the frequency of each type in all their combined collocations, up to and including the interview in which the shared collocation first appeared. For instance by T4, words immediately preceding N, included words glossed as Adj, Q and Class. Therefore the overall distribution of words glossed Adj, Q and Class was compared to determine whether they should count as members of one or more distributional classes. Where frequency allowed, χ^2 was used to determine if the differences in distribution for each type were statistically significant ($p < .01$). Where frequencies were too low for χ^2 , Fisher's exact test was used. Only if the frequencies were too low for Fisher's exact test, were data from all three ILs combined. Though not ideal, there was in fact no reason to suppose that ILs differed with respect to the distributional categories they contained, because most combinations of items appeared at well above criterial frequencies in each IL.

Where the overall distribution of two lexical types was found to be significantly distinct ($p < .05$), the types were deemed to be distinct lexical categories. Where distribution was not statistically distinct, or where frequencies were too low to apply statistical tests, types were treated as sub-types of a single lexical category. For example, words glossed as adjectives and those glossed as Q were ultimately classified as sub-types of 'Adj' in the first samples, because they were distributionally indistinguishable. Later a new collocational possibility emerged for words glossed Adj that was not shared by words glossed Q, and the difference in their distributions then became statistically significant. The distinct lexical category Q was deemed to have emerged only at that point.

On this basis 11 distributional classes were eventually identified in all three ILs, with some divided into distributional or semantic sub-classes, as shown in Table 5, above. Though Prepositions are not a nominal category their occurrence is relevant to the classification of relational locatives in the ILs, so they are included in Table 5 also. The evidence for these lexical categories is presented in Appendix E.

5.2.4 Emergence order for lexical categories

As indicated above, in the process of determining the valid lexical classes for the three ILs, some facts about the emergence of lexical categories became clear. This section brings those observations together in a description of the emergence order for the IL lexical classes. The discussion is arranged according to sample times.

T1- T2

Pronouns, nouns, numbers, classifiers and the bound morph 'de' were all clearly distinct by the time the second samples were taken. However, de was confined to possessive constructions with pronominal possessors, and so, at that stage, it could be analysed as a pronominal suffix, not a distinct free lexical item.

References to locations in the first four interviews were generally deictic: *zhèr yǒu sān ge rén* 'here are three people'. Non-deictic locatives used the preposition *zài* followed by an NP, but no explicit locative: *zài chuán* 'at boat' *zài tǔdì* 'at ground' *zài jiétí* 'at stairs'. Only one utterance at T1 contained an explicit locative: *zài wàimian* 'outside' (K1); *wàimian* was treated as a fixed collocation.

Words glossed as 'adjectives' (Adj) appeared in predicative function at T1 in all ILs e.g. *tā bù féi* 'he [is] not fat' (H1), *hànzì nán* 'Chinese characters [are] difficult' (S1) and *tāmen zhēn ǎide* 'they [are] really short' (K1). They were not distinct from verbs. There was no clear evidence of attributive Adj till two samples later. Though T1 interviews contained structures such as *Hánguórén* (H1) and *Zhōngguórén* (K1) (literally 'Korea person' and 'China person' respectively); the modifying items here are nouns in the TL, not adjectival expressions as their translation into English might suggest. Moreover, these are conventional compounds rather than clearly ad hoc syntactic collocations. They were therefore counted as compound nouns. In fact, attributive Adj could only be distinguished distributionally from an incorporated N in a compound once the adverb *hěn* had emerged. This first occurred at T3, thus it was only at T3 that attributive Adj could be accepted as a valid IL lexical category, distinct from both a modifying N, and from dynamic V which served only as a predicate at that stage.

T3-T4: Adj and Locative N

The extract below illustrates the development of attributive Adj. In the course of her third interview, Hannah moved from mimicry of a TL fixed phrase *chīde dōngxī* 'food' (lit: eat de things or edible things) provided during the interview by the researcher (line 12), to collocations still potentially analysed as N-N compounds, *zhōngguó chīde dōngxī* 'Chinese food' (line 14), *idali chīde dōngxī* 'Italian food' (line 22), to what can only be *ad hoc* Adj-N collocations: *tián dōngxī* 'sweet things' (line 43), and *ruǎn dōngxī* 'soft things' (line 48), because she had only learned the words *dōngxī* 'thing' and *ruǎn* 'soft' in the course of the interview. In the first examples the modifier denotes an entity, in the later ones, a property. Hannah's interlocutor, Kazuko, also extended the use of a modifier familiar from the compound Noun, *rìběn rén* 'Japan-person' to modify a newly elicited N *cài* 'food' but her modifiers were still arguably Ns, not adjectives.

Extract from H3/K3 (I= Interviewer; K = Kazuko; H = Hannah)

Line No.

1. K: qǐngwèn um food zěnmē shuō.....
How do you say 'food'?....
- 6 I: chīde dōngxī () dōngxī dǒng ma dōngxī *thing*
'chīde dōngxī'. do you understand 'dōngxī'? 'dōngxī' 'thing'..... **model compound N1**
explanation
- 8 I: chī 'eat' chīde dōngxī a
'chī' is 'eat' 'chīde dōngxī'
- 11 K: nǐ nǐ xǐhuān chīde dōngxī () ma
Do you like food repetition
- H: shénme shénme chīde dōngxī
what, what food **wh-N1 collocation**
- K: shénme chīde dōngxī
what food repetition
- H: a: m: wǒ xǐhuān a zhōngguó chīde dōngxī
a: m: I like a Chinese food **N2-N1 collocation**
- 15 I: a zhèyàng nǐ kěyǐ shuō zhōngguó cài
a in this case you can say Chinese 'cài' **model compound N2**
- H: cài a cài dǒng a chīde dōngxī
'cài' a I understand 'cài' 'food'
- I: bù zhōng zhōngguó cài
no Chi- Chinese 'cài' **repeat compound N2**
- H: o zhōngguó cài um ye () o () a and ?
o Chinese 'cài' repetition
- 20 H: o he um () um () Italian
um Italian ? English Adj
- I: yìdàlì
Italy ! Mandarin N3
- H: a yìdàlì () um chīde dōngxī
a italian () um food **N3- compound N1**
- I: cài
model N2
- H: cài ... o nǐne
"cài" ... o and you? acknowledge
- K: a wǒ xǐhuān rìběn càihe zhōngguó cài
a I like Japanese food ...and Chinese food. **variation on compound -**
N2

.....(no repetition of this structure till line 38)

Extract Cont'd

- 37 H: a wǒ xǐhuān pavalova
I like Pavlova
- 38 I: pavlova o shì ma hahah nǐ xǐhuān chī tián de dōngxi ma model Adj5 de N3
Pavlova, do you? Do you like to eat sweet things?
- H: chī tián repetition Adj5
eat sweet
- 40 I: pavlova hěn tián
Pavlova is very sweet
- H: sweet ? confirm sense
- I: m tián ! confirm sense
m sweet
- H: m () a: wǒ bù xǐhuān tián dōngxi but () um Adj5 N3
m: a: I do not like sweet things , but () um
- 45 H: dànsù um (writing pause) () m dànsù shénme
but um (writing 'danshi') but what
- H: dànsù a: um: hh () um soft hànyǔ zěnmē shuō elicit Adj6
but a: um: hh () um how do you say "soft" in Chinese?
- I: ruǎn model Adj6
- H&K: (general repetition of ruan)
- H: wǒ xǐhuān ruǎn dōngxi Adj6 N3
I like soft things

From this point on, Adj was distributionally distinct from the class of verbs, because the latter did not appear in pre-N position in these ILs. As discussed above, the Adjectives emerging at this time included the non-numeric quantifiers, and also wh-words. The latter emerged at different times in each IL, K2, S2, and H4, but since they belonged to the Adj class throughout this time, this is not relevant to the emergence of a lexical class as a whole; it represents variation in the emergence of a semantic or functional subclass.

A similar difference in emergence time for specific members of a general class was the first emergence of locative nouns. The locative *biàn* 'side' did not emerge in Sam's or Kazuko's ILs until T4 and not in Hannah's till T6. At T4, *shàng* 'on' was also emerging in Sam's and Kazuko's ILs as a Preposition, a non-TL usage.

The declarative conjunction emerged at different times in each IL. Kazuko used the TL conjunction *hé* 'and' from T1, Sam started to use his nominal conjunction *yě*, at T3, and Hannah started

to use *hé* at T4. Thus it cannot be clearly associated with any particular stage of development. Other than this, the emergence for lexical categories followed much the same timetable in each IL.

T4-T6: Changes to *de* and emergence of Dem and *dī*

At T4 –T5 phrasal modifiers began to precede *de* in Sam's and Kazuko's ILs and began to include AdjP as well as NP, *hěn dà de wèng*, very big DE jar (K5). Whether there were now two homophonous *de* morphs or the original *de* had been superseded by a new, less selective morph is a moot point, but in any event the ILs now clearly contained a *clitic de*, not (just) a *suffix* that attached only to nouns and pronouns.

The Dem-CL-N string also appeared at T4 in Kazuko's and Sam's ILs but not till T8 in Hannah's. Prior to this, the Dem forms had functioned only as pronouns (see (6) above). By T5 Dem was also distinct from Num in Sam's IL, but not in Kazuko's, partly because of differences in the emergence of the ordinal in their respective ILs. The ordinal *dīyī* 'first' was elicited by Sam during the course of the interview at T5, and subsequently both Sam and Hannah use the marker *dī* with other numbers in the same interview (n=7, n=2 respectively). This provided a context for numbers that demonstratives did not share. However, ordinals didn't appear in Kazuko's IL until T8, so Dem and Num remained indistinguishable in her IL until they appeared together in a single nominal structure.

At T6, the learners also began to use a variety of conventional locative compounds, *wàimiàn* 'outside', *shàngmiàn* 'top-side = above', *zhōngjiān* 'middle-between = in the middle', *following de* e.g. *zài shù de zhōngjiān* at tree *de* middle 'in the middle of the trees', and at the same time, prepositional *shàng* 'on' disappeared from Sam's IL, and the range of nouns to which he attached locatives became more restricted. In other words, he was *lexically* less productive, but *syntactically* more productive.

T6-9: Determiners and Interrogatives

The learners clearly grappled with the correct relative order for Dem, Num and CL; collocations were varied, each string was infrequent and idiosyncratic, and the structure was often accompanied by pausing, false starts and repetitions, indicating difficulty in its production or uncertainty about the TL norms. It was only at T6 that Dem become statistically distinct from Num in Sam's IL, and at T9 in Kazuko's. They never did become clearly distinct in Hannah's IL. This made the category of determiner, which included demonstratives and interrogatives, the last lexical category to emerge.

The interrogative sub-class of conjunction also emerged relatively late, in S6, and K8, but not at all in Hannah's IL.

5.2.5 Summary of emergence patterns:

This pattern of emergence is summarised in Table 6. It shows that pronouns, nouns and numbers were all distributionally distinct from the outset; and one or two classifiers and possessive *de* also

appeared regularly and in target-like use from the second sample on, as did the Preposition *zài* 'at'. However, Adj was present only as a predicate in the first two samples, and appeared before N only at T4. At this time Adj included Q.

Table 6. Emergence order of lexical categories

Emergence Time	Free Morphs	Bound Morphs
T1-2	Pron N Numbers Preposition (<i>zài</i>) Nominal Conj (Kazuko)	Possessive DE Classifier
T3-4	Num _{Dem} Attributive Adjective ±wh / Q Locative N (<i>biān</i>) Locative P (<i>shàng</i>) Nominal Conj (Sam & Hannah)	
T5-6	Det Dem (Sam) Locative N (<i>shang</i> etc)	Attributive <i>de</i> Ordinal Prefix (Sam & Hannah)
T6 -T9	Det Dem (Kazuko) Wh-Det Conj _{int}	Ordinal Prefix (Kazuko)

Conjunctions and some interrogatives also appeared by T4, the latter accommodated as members of existing classes, Num and Adj. By T6 the clitic *de* was used in a variety of modified N structures, and the ordinal prefix *dì* appeared on numbers. The category Dem was not clearly distinct from Num at the outset, except for its semantic difference, but in the final samples Num and Adj/Q became distinct in at least one IL. Except for *shàng* which was first used as a Preposition 'on', locatives first appeared as nouns in fixed compound structures. Subsequently locatives were all treated as nouns appearing in final position within the nominal structure. Interrogative conjunctions and determiners were among the last items to emerge.

5.3 The emergence of constituents in three ILs

Having established the validity of these lexical categories for the three ILs, the recurrent patterns of lexical sequences could then be treated as valid combinations of separate morphs. It was then possible to address the question of the emergence order for syntactic structures. For each learner, a table was prepared showing every structural pattern that they used, and the frequency with which that pattern occurred in each of their sample files (see Appendix B). Then criteria of emergence were applied, to see which structures could be counted as productive.

5.3.1 Criterion of emergence for syntactic structures

Pienemann's standard criterion for emergence of a syntactic structure, as opposed to an isolated morph, is simply the occurrence of two different tokens of a type. I employed a slightly different criterion requiring the occurrence of two distinct tokens of a string, *within two consecutive interviews*. The distinct tokens also had to meet a criterion of paradigmatic variation: alternative tokens were required for each position within a recurrent sequence. For example, the associative *de* structure (NP *de* N) could be counted as productive only when two *different* pronouns had appeared in the first position, *and* two different nouns had appeared in the last position. The form *de* could not alternate since it is a basic component essential to the structural type.

This basic criterion of paradigmatic variation was supplemented by three others when collocations were fixed by the grammar, when closed classes allowed few paradigmatic alternatives, or where structural types were of low frequency overall. These additional criteria were:

Optional parts – *all* parts of a repeated string occurred separately, within the same or immediately preceding interview.

Novel form – a string contained a portion that could not have been rote-learned from previous exposure, for example *ad hoc* coinage, or an item elicited during the interview itself.

Novel context – a string contained one or more items that had been previously established as productive in other contexts (though not necessarily in the *immediately* preceding interview).

The optional parts criterion was necessary when a given collocation was potentially restricted by the grammar itself. For example, in the TL Num-Class-N collocation, the classifier is a member of a closed class, whose form is determined by the choice of N, and whose presence is required to license the use of a number. A stable collocation of a specific classifier and a specific N is therefore a requirement of the grammar; as is the recurrent collocation of a number with a classifier. Thus neither is necessarily evidence that the sequence of sounds corresponding to the classifier is understood as part of the number, or of the noun. At the same time, the classifier cannot function alone as an argument, a modifier or a predicate, so we cannot expect the classifier to appear without some preceding number or following noun. To differentiate productive generation of a stable Num-Class or Class-N collocation from a fixed chunk, it was deemed sufficient to demonstrate that a) different nouns could follow the same classifier, *and* b) different numbers could precede it, *or* that c) the noun and number on either side of a classifier also appeared elsewhere in the same speaker's IL, without the classifier being used. Point c) exemplifies the "optional parts" criterion.

The "novel form" criterion refers to the use of items clearly coined or elicited by the speaker at that time of recording. These cannot logically be part of a learned formula, but must be combined with other lexemes by productive means. The application of this criterion has been illustrated in the

discussion of lexical categories above. When Kazuko said “wǒ gòngzuò rìběn restaurant” ‘1 sg work Japan restaurant’, the string ‘rìběn restaurant’ could not be a rote-learned chunk taken from the text-book or studied in class because it mixes codes. It was also clear from context that Kazuko did not intend to mean the restaurant was *in* Japan, rather it was a restaurant that served Japanese food. This was therefore taken as an instance of a productive collocation of an Adjective (property denoting word) and a Noun, even though the noun was an English one. Though this is a reliable indicator of generative capacity, it is of less value than the other criteria because opportunities for application arose infrequently.

The criterion of *novel context* relied on evidence from more remote interviews. Generally if more than one interview intervened between two tokens of a type, the probability that the first was non-productive is higher. In such cases, the earlier instance was normally discounted. Relaxation of this requirement is potentially problematic because homophonous items from separate samples do not necessarily represent the same lexical category in the two samples, as we have seen with the development of *de* and *Dem*. Therefore, this criterion was applied only as a last resort, when the state of the current IL-system made it highly unlikely that other criteria *could* be satisfied, but the overall pattern of emergence made it likely that the structure *was* productive. For example, Sam produced a combination of a demonstrative and Noun, *zhèi huà* ‘this picture’, twice in his third interview (S3); this would be excluded as evidence of productive capacity under the paradigmatic alternation criterion because the two tokens were identical. It would also be excluded under the optional parts criterion, because neither the demonstrative nor that particular noun had been used independently in the same or the earlier interview.

However, there were a number of factors reducing the probability that the stricter criteria could be met for this particular structure. Firstly, the demonstrative class has only two members in the TL: *zhè(i)* ‘this’ and *nà* ‘that’, and it was not clear that Sam had separate functions for these two forms; at that time both *nà* and *zhè* seemed to function as markers of definiteness, not distance, and since Sam was describing pictures whose contents were all equidistant from him, there was no need to specify distance anyway. There was therefore little possibility and no pragmatic need to alternate between two demonstratives. Secondly, there were other factors militating against alternation of the noun. The primary activity in this interview was describing pictures and once the *Dem-N* combination had been used to establish a given picture as a topic, there was no need to refer to that picture by such an expression again. In fact, Sam had been omitting topical referents altogether (in a TL-like manner) from his first interview, so subsequent mentions of the same topical picture were generally rare. Apart from the pictures, there were no other groups of salient referents that could be usefully identified by the use of a definite determiner, so no other nouns occurred within the *Dem-N* structure either. Overall then

the lack of distinctive functions and forms for Demonstratives, and the pragmatic context both made it unlikely that paradigmatic variation of any part of the structure would occur.

On the other hand, other factors indicated that the two elements Dem and N were indeed independent members of Sam's lexicon in S3, even though they did not occur separately at that time. Both the Noun *huà* 'picture', and Demonstrative elements, had occurred separately in Sam's earliest sample (S1). The Demonstrative forms were used as deictic pronouns. They also appeared in this function in samples subsequent to S3. Given this it seemed more plausible to suppose that the deictic pronouns still existed in Sam's repertoire at S3, rather than suppose that they were temporarily lost, then re-acquired subsequent to S3. We can conclude then that Sam was able to produce a demonstrative pronoun, without a following noun, at the time he produced the string including both a demonstrative and a following noun, *huà*. In other words, the Noun and Demonstrative were not elements that only occurred in this combination; they were low frequency but clearly distinct members of Sam's vocabulary at the time in question. This criterion was applied only rarely, and only with members of a small closed class like demonstratives.

5.3.2 IL syntactic structures: common structures and idiosyncratic ones

When these criteria were applied to the structures produced in each interview by each learner it was found that there were 11 that failed to meet the emergence criteria, but there were a further 22 that were productive for only one or two of the three learners. Since the focus of this study is on nominal structures that are likely to emerge in *all* ILs in a stable order, further analysis was confined to the 21 distinct productive nominal structures used by all three of the learners. These 21 structures included four one-word nominals, and 17 more complex nominal structures. Predicative Adj was also included, in order to see whether its emergence was a prior condition on the emergence of attributive Adj, which Zhang had found to be quite variable in its emergence time. These 22 structures are those exemplified in 26) - 47) above. (They are also shown together in Appendix D then briefly described, and illustrated with examples from the ILs. Their c-structural analyses are presented in Appendix K.)

The idiosyncratic structures included 10 productive structures that occurred in two of the three ILs, and 12 that occurred in only one. Interestingly, 18 of these 22 structures emerged at T7 or later, whereas the 22 common structures had all emerged by T6. This indicates that ILs become more varied as learners become more proficient. Of the 10 productive but late-emerging idiosyncratic structures, four involved demonstratives in various arrangements with numbers, classifiers and other modifiers; three combined possessors and numeric expressions; three involved non-TL combinations *Num-N, *Dem-N, *Q-N; and two were nominal expressions that omitted N (Dem-Cl, Mod deP); the remainder bore no particular relationship to these or to each other. They included the combination *shénme* N 'what N; the interrogative conjunction *háishi* 'or' (S6, K9); the use of the fraction *bàn* 'half' or

the quantifier *dōu* 'all'; the combination AdjP Num-CI N; a single instance of a relative clause, and the reverse locative structure.

The reverse locative structure was the most frequent of the idiosyncratic structures. In this structure the order of the locative and locus- denoting nouns is the reverse of that in the TL; the TL structures are illustrated at (49a) and (b); reverse locatives are at (49 c) and (d); the locative N is underlined, and the locus is underlined with dots.

- 49) a. zhè.ge sānjiǎoxíng de yòubiān yǒu yuánxíng
 this.CL triangle de left have circle
 To the left of this triangle is a circle
- b. wǒde wòshì dùimian yǒu xǐzǎojiān
 1sg de bedroom opposite have bathroom
 Opposite my bedroom is a bathroom
- c. yòu.biān de zhè.ge sānjiǎoxíng yǒu yuánxíng
 left.side de this.CL triangle have circle
 To mean: 'Left of this triangle is a circle' (K7)
- d. wài bùfen de bànlúánxíng zài něi mian de báisede yuánxíng
 outside part de oval at which side de white circle
 To mean: 'On which side of the white circle is the outer part of the oval?' (S7)

The locatives in c) and d) appear to be modifiers in a Mod de construction, but the intended meaning is not to locate the referent of the N following de, as in that construction, but to locate a theme relative to that referent, which denotes a locus. The locative precedes the locus, rather than the other way around. What makes this structure particularly interesting is that it appeared in two ILs even though it is not a TL structure, and a similar structure, without de occurred also in Zhang's (2001) study. The example at (25) is from Sharon's IL, one of the learners studied by Zhang. Here again the locative 'dùimian' precedes the locus 'wǒde wòshì'.

- 50) *dùimian wǒde wòshì yǒu xǐzǎojiān
 opposite 1sg de bedroom have bathroom
 To mean : Opposite my bedroom is a bathroom (Zhang, 2001, p. 128).

This makes the locative effectively a preposition, like its English counterpart, and like *shàng* in Sam and Kazuko's ILs. It is possible then that the reverse locative is developmentally associated with the use of prepositional locatives. Neither appear in Hannah's IL, and she did not produce reverse locatives either.

Generally speaking, the locative structure seems to pose difficulties for the learners. Otherwise, the structural variation in the samples after T6 relates largely to the incipient emergence of a Demonstrative determiner, and the combination of the by now extensive repertoire of nominal subconstituents. In contrast, only one of the seven idiosyncratic structures that emerged *before* T7, combined different nominal sub-components in one nominal: a possessor and modifier structure. Another involved recursive possession (K5, H4); four were pronominals formed by omission of N from simple structures that the same learner used in full at the same time: *Pronominal Adj (K3);

Pronominal Num-CL (K3); pronominal Q (S4); and a pronominal Possessor (K2); and one was the use of a number alone: Num (H1, K1).

It appears that the numerous logical possibilities for ordering that increase as the learners' syntactic repertoires expand destabilised their grammars, leading to the structural variability observed in the later samples. This warrants further research, but for now the focus is on what is uniform about the three ILs.

5.3.3 Individual emergence orders for Nominal structures

Once the 22 common productive structures were identified, it was possible to establish their order of emergence in each IL, and then to see how closely those orders tallied across all three ILs. First a table was drawn up for each learner, showing the frequency with which each structure occurred in each sample from his or her IL. The point at which each structure reached criterial levels was then identified. A second table was then prepared with structures arranged in order of emergence and the point of emergence for each structure indicated by an 'x'.

By way of illustration, the frequencies of the 22 common structures in Kazuko's IL are shown in Table 7 with the point at which each structure first reached criterial levels shown in bold. Kazuko's emergence order is shown in Table 8. The frequency and sequence tables for Hannah and Sam are shown in Appendix D.

Table 7. Frequencies for Kazuko.

Elapsed Weeks ->		6	8	11	14	21	26	28	30
Sample code		K1	K2	K3	K4	K5	K6	K7	K8
Time code	ID	T1	T2	T3	T4	T5	T7	T8	T9
N / Compound N	1/5	14	17	19	39	36	29	47	83
pron /Name	2/3	21	11	25	45	75	1	49	68
pro	4	6	2	2	4	10	9	8	6
Num		2			3	2			
Num-N	6	3		1	2	2	2	5	
*Num N	6			1			2		
affine structure	7	6	2	3				1	1
Num-CL-N	8	2	8	11	26	20	7	10	28
deP Poss	9	1	4	14	9	16	1	13	10
(adv) Adj (predicative)	10	1	2		17				
(adv) Adj-N	11		5	3	2	1			2
Conjoint NPs: he/ye	12	1	3	3	4	4	4	1	
Pronominal Dem	13		2		16	3	8	1	15
[Num-CI] -Adj N	14			2					
Pseudo Rel CI	15			2					
Dem-CL-N	16		1		12	19	4	4	11
(hen) duo N	17			1	1				
Incorporated Loc N	18	1	1		5	1		3	7
Mod deP	19				4	2	10	1	9
Num-CI deP N	20					2	5		
Locative deP	21						4		3
Ordinal	22					1	1	3	

Table 8. Emergence Sequence for Kazuko.

Elapsed Weeks ->		6	8	11	14	21	-	26	28	30
Sample code		K1	K2	K3	K4	K5		K6	K7	K8
Time code	ID	T1	T2	T3	T4	T5	T6	T7	T8	T9
N	1	X								
pron	2	X								
Name	3	X								
pro	4	X								
Compound N	5	X								
Num N	6	X								
affine structure	7	X								
Num-CL-N	8	X								
deP Poss	9		X							
(adv) Adj (predicative)	10		X							
(adv) Adj-N	11		X							
Conjoint NPs: he/ye	12		X							
Pronominal Dem	13		X							
[Num-Cl] -Adj N	14			X						
Pseudo Rel Cl	15			X						
Dem-CL-N	16				X					
(hen) duo N	17				X					
Incorporated Loc N	18				X					
Mod deP	19				X					
Num-Cl deP N	20					X				
Locative deP	21							X		
Ordinal	22								X	

5.4 An Average acquisition order

5.4.1 Statistical comparison of three emergence orders

To allow statistical comparison of the three individual emergence orders, each emergence order was treated as a ranking of structures: so each structure was assigned three rank scores, each one indicating when it emerged in a different IL. Kazuko's IL fell into seven ranks because she missed one of the nine observation periods and no new structures emerged in the last sample. Hannah's IL also fell into seven ranks, but Sam's fell into only five; he had several samples in which no new structures emerged. For example, structure 13 emerged in Sam's first sample (S1), Kazuko's second, (K2), and Hannah's seventh (K7), so it was given ranks of 1, 2, and 7 respectively.

Because time and economic constraints made it impossible to observe the learners in the classroom, the text-book they used in class was taken as a rough guide to the order in which structures were presented to the learners. To assess the impact of presentation order, the text-book was divided into sections corresponding to each recording session, and each structure was assigned a fourth rank score indicating the section of the book in which it first appeared. A structure which first appeared in the unit covered after T1 and before T2 was given the rank score of 2 and so on. (The limits of each section are indicated in Table 45, Appendix D). This rank order was then compared to the emergence order evident in the three ILs.

Naturally the non-TL structures produced by the learners did not appear in the text-book at all, and nor did four other TL structures. Moreover, it transpired that of the remaining 18 TL structures produced by all three learners, 14 were presented within the first *eight pages* of the book, Unit 1.1. Since the learners covered this unit in their first few weeks of study, this meant the structures presented there were effectively unordered in *time* relative to each other. Because of this, the order of structures in the text book actually had no bearing on the order in which they emerged in spontaneous speech (see Tables 11 and 12 below).

Table 9 below illustrates the variation in emergence orders for 22 structures produced by all three learners, represented as ranks. Structures are grouped together according to their rank, with the resulting groups ordered according to the *variation* in the ranks they received. The least variable group is at the top. It can be seen at a glance that 15 of the 22 structures varied by only one rank, or not at all.

Table 9. Variability of rankings for 22 common structures

		Kazuko	Sam	Hannah	Book
Identical rank		Ranks			
1	N	1	1	1	1
5	compound N	1	1	1	1
2	pron	1	1	1	1
3	Name	1	1	1	1
8	Num-CL-N	1	1	1	1
9	deP Poss	2	2	2	1
19	Mod deP	4	4	4	5
variation by 1 rank					
4	pro	1	1	2	1
7	bare poss	1	2	1	1
10	(adv) Adj (predicative)	2	1	2	2
11	(adv) Adj-N	2	2	3	2
17	(hen) duo-N	4	4	3	-
16	Dem-CL-N	4	4	5	1
20	Num-CI DeP N	5	4	4	-
21	Locative deP	6	5	5	-
variation by 2 ranks					
12	Conj	2	2	4	1
15	*Pseudo Rel CI	3	4	5	*
18	Incorporated Locative	4	3	5	3
22	Ordinal	7	4	4	1
variation by ± 5 or more ranks					
6	Num N	1	4	6	1
13	Pronominal Dem	2	1	7	3
14	Num-CI -Adj N	3	2	6	1

5.4.2 Statistical analysis

To confirm that the emergence orders were *significantly* similar, statistical correlations between the three sets of rank orders were calculated using three different rank order statistics. Kendall's coefficient of correlation (Kendall's tau) and Spearman's rho were used in a series of two-way comparisons. Kendall's coefficient of concordance (Kendall's W) was used for three-way comparisons of learners, and four-way comparisons including the text-book order.

Though Spearman’s rho is used more often in SLA research, it tends to over-estimate correlations, whereas Kendall’s tau tends to under-estimate them, with true correlations lying somewhere between (Hatch & Lazaraton, 1991). However, Kendall’s tau is actually preferable for data such as this which contains many tied ranks, (Daniel, 1978; Snedecor & Cochran, 1980). To calculate these statistics, the structures were treated as ‘cases’, and the learners as ‘judges’: effectively each learner had ‘scored’ each structure as to its natural emergence time, by producing it at the time that they did.

A three-way correlation between the different ILs was both high and significant (Kendall’s W = .775 (p=.001; $\chi^2=48.84$), but pair-wise correlations were generally higher still, indicating that pairs of learners varied together in certain regards. Moreover, the correlations between each pair of individual ILs was higher than any correlation between one IL and the order of presentation in the book (see Tables 10 and 12). Even by the more conservative statistic, Kendall’s tau, the pair-wise correlations between ILs were all over 49%, while even by the *less* conservative statistic, the emergence order in two of the ILs was *not significantly correlated with that in the book at all* (p>.05).

Table 10. Correlations between 3 orders of emergence (K, H, S) for 22 items (Kendall’s τ)

	K	H
H	.4938 p=.0046	
S	.7100 p<0001	.5135 p=.0040

Table 11. Correlations between 3 orders of emergence (K, H, S) for 22 items (Spearman’s ρ)

	K	H
H	.6100 p=.0026	
S	.7751 p<0001	.6064 p=.0028

Table 12. Correlations between 3 ILs and the text-book (B) for 18 items (Kendall’s τ)

	K	H	S
H	.5635 p=.0048		
S	.6335 p=.0025	.5208 p=.0098	
B	.6151 p=.0040	.3874 p=.0595 (n.s.)	.4008 p=.0633 (n.s.)

Table 13. Correlations between 3 ILs and the text-book (B) for 18 items (Spearman’s ρ)

	K	H	S
H	.6710 p=.0023		
S	.6661 p=.0025	.6025 p=.0081	
B	.6573 p=.003	.4571 p=.0565 (n.s.)	.4265 p=.0776 (n.s.)

In other words, there were significant levels of similarity in the three emergence orders that cannot be explained by the order of presentation in the text-book. This is not surprising given that so many of the structures were presented within a single section of the book.

To determine how they impacted on overall correlations, the 3 most variable structures (6, 13, 14) were excluded. Correlations between ILs for the remaining 19 structures ranged from 74-80% (see Table 14). Correlations between the ILs and the 15 of these structures found in the

text-book did then reach statistical significance, but the correlations remained below 69%, still lower than any inter-learner correlations (see Table 15).

Table 14. 19 least variable Items for each learner (Kendall's τ)

	K	H
H	.748 p<.0001	
S	.8319 p<.0001	.7367 p<.0002

Table 15. 15 least variable Items in the textbook (Kendall's τ)

	K	H	S
H	.8365 p=.0002		
S	.8267 p=.0004	.7224 p=.0015	
B	.6859 p=.0039	.5278 p=.0230	.6532 p=.0060

5.4.3 From individual emergence orders to one 'natural' order

On this basis we can state with confidence that 19 structures did emerge in a stable order. This finding is consistent with established findings from other languages. However, the fact that the three emergence orders correlated highly and significantly does not negate the fact that they also varied to some extent. This variation is illustrated graphically in Table 16 below.

Table 16. Variable emergence orders for 19 structures

ER ¹⁵	Structure			
1	N pron Name compound N			
1-2	pro-drop (adv) Adj (predicative) Num-CL-N affine structure			
2	deP Poss	↑↑		
2-3	(adv) Adj-N		↑↑	
3-4	(hen) duo-N		*Pseudo Rel Cl	
4	Mod deP N	Conj	Incorp Locative	
4-5	Dem-CL-N			↑↑
	Num-Cl deP N	↓↓	↓↓	Ordinal
5	Locative deP			↓↓

The first column shows the range of ranks reflecting variation in emergence times for structures in the columns to its right; the second column contains the 15 structures whose emergence varied by at most one rank, and the four more variable structures are shown in the columns to the right, staggered according to their lowest emergence rank. The solid horizontal lines indicate boundaries between one-word, two-word, three-word and more complex structures. Locative deP is included in the last category because of its emergence time, but note that it also entails the presence of a theme-denoting nominal, as well as the locus-denoting nominal, and the locative noun. This makes it thematically and structurally more complex than modifying and associative de structures.

5.4.4 Implicational hierarchies

The conventional method for deriving a single acquisition order from a set of individual orders is an implicational hierarchy. However, as discussed in Chapter Three, the use of amalgamated data from separate ILs can result in distortions whereby a structure that has actually emerged in no IL appears to have emerged in all. This indicates that summing frequencies is not an accurate means to produce an implicational scale representative of a small group. However, taking the earliest or latest overall emergence point from any IL is not necessarily more accurate. This is evident from a comparison of Tables 17 and 18 which show implicational hierarchies derived in this way. Quite different orders *and groupings* of structures result because some structures have more varied emergence times than others.

Table 17. Implicational scale based on earliest emergence time

Elapsed Weeks	6	8	11	14	21	24
Structure						
N	x					
Name	x					
Num N	x					
[Num-CL]-N	x					
Compound N	x					
pron	x					
affine structure	x					
pro	x					
Adj (predicative)		x				
Pronominal Dem		x				
deP Poss		x				
Conjoint NPs: hé/yě		x				
(adv) Adj-N		x				
[Num-CI] –Adj N			x			
Pseudo Rel CI			x			
(hen) duo-N			x			
Incorporated Locative				x		
Mod deP				x		
Dem-CL-N				x		
Num-CI deP N					x	
Ordinal					x	
Locative deP						x

Table 18. Implicational scale based on latest emergence time

Elapsed Weeks	8	11	21	24	26	28
Structure						
N	x					
Name	x					
[Num-CL]-N	x					
Compound N	x					
pron	x					
pro	x					
Adj (predicative)	x					
affine structure		x				
deP Poss		x				
(adv) Adj-N			x			
(hen) duo-N			x			
Mod deP			x			
Conjoint NPs: hé/yě			x			
Num-Cl deP N			x			
Incorporated Locative				x		
Pseudo Rel Cl				x		
Dem-CL-N				x		
[Num-Cl] –Adj N					x	
Locative deP					x	
Ordinal						x
Pronominal Dem						x
Num N						x

Table 19, overleaf, reveals why this problem arises. It shows emergence in terms of time *spans* for the 19 least variable structures. While some structures form a plausible group, such that the span between the earliest and latest emergence times for the group as a whole is relatively short, other structures only form a group because the relatively brief spans over which individual structures emerge happen to overlap with each other, forming a succession, and that succession as a whole falls within the longer time span observed for a few other structures. The overlaps make it impossible to define neat stages in terms of groups of structures emerging at precisely the same time. In fact, the structures in Table 19 fall into just three rough sets, as indicated by the solid lines in column 1. Each set spans several separate observation times, but there are still many structures that are either early or late in one IL compared to the others. These are indicated by the shaded cells.

Table 19. Implicational hierarchy showing emergence points for 19 structures in three different ILs

LEARNER		H1	K1	S1	H2	K2	S2	K3	H3	S3	K4	H4	S4	K5	H5	S5	H6	K6	K7
STRUCTURE	ET	6	6	8	8	8	11	11	11	14	14	21	21	21	24	24	26	26	28
N		X	X	X															
Name		X	X	X															
[Num-CL]-N		X	X	X															
Compound N		X	X	X															
Affine Structure		X	X				X												
pron		X	X	X															
pro			X	X	X														
Adj (predicative)				X	X	X													
deP Poss					X	X	X												
Conjoint NPs: he/ye						X	X				X								
(adv) Adj-N						X			X				X						
(hen) duo-N						X			X				X						
Incorporated Locative									X		X				X				
Mod deP										X	X	X							
Num-Cl deP N											X	X	X	X					
Ordinal												X	X						X
Pseudo Rel Cl								X					X		X				
Dem-CL-N											X		X		X				
Locative deP													X		X			X	

5.4.5 Comparison of rank orders

Clearly implicational hierarchies mask complex patterns of development. Because of this, two alternative methods were used to convert the IL data into a single sequence, both designed to decrease the effect of variability in the length of time it takes for each structure to emerge.

The first method was to reduce the three *rank* scores assigned to each structure to a single score by calculating the mean of the *ranks* (MR). Then structures were re-ranked according to this mean rank, producing a set of ranked mean ranks (RMRs) as shown in Table 20 below. The second method was to calculate a mean *emergence time* (ET) for each structure, then assign them new ranks on the basis of that score. This resulted in the rank order for mean emergence *times* (RMET) shown on Table 20.

Table 20. Mean ranks and Mean ETs for 18¹⁶ nominal structures

Structure	ETS			mean rank	RMR	mean ET	RMET
	Kaz	Sam	Han				
Compound N	6	8	6	1	1	6.66	1
Name	6	8	6	1	1	6.66	1
Noun	6	8	6	1	1	6.66	1
Num-Class N	6	8	6	1	1	6.66	1
Pron	6	8	6	1	1	6.66	1
little pro	6	8	8	1.33	2	7.33	2
Affine structure	6	11	6	1.33	2	7.66	3
dePPoss	8	11	8	2	3	9	4
(Adv) Adj N	8	11	11	2.33	4	10	5
Conjunct (min)	8	11	21	2.66	5	13.33	6
hen duo N	14	21	11	3.66	6	15.33	7
dePMod (indef)	14	21	21	4	7	17.33	8
Incorporated Locatives	14	14	24	4	7	18.66	9
Pseudo-RC	11	21	24	4	7	18.66	9
Dem Class N	14	21	24	4.33	8	19.66	10
Num-Class deP	21	21	21	4.33	8	21	11
Ordinals	28	21	21	5	9	23.33	12
Locative DE	26	24	24	5.33	10	24.66	13

Because the same rank sometimes corresponded to different ETs depending which of the observation periods the learners missed, and which of their samples contained no new structures, differences naturally arose between the RMRs for a given RMET. For example, incorporated locatives have a RMR of 7, but they emerged earlier in Sam's IL than Mod deP, which has the same RMR and (hěn) duo N, which has a lower RMR of 6. In other words, the RMET is more sensitive to differences in acquisition *rates* between learners, so it differentiates more finely between structures with the same mean rank. Nonetheless, the correlation between these two mean measures was 99% (Kendall's Tau, $p < .0001$), and each ranking also correlated highly with each individual emergence order: for Kazuko the correlations were .89 and .88 for mean rank and mean ET respectively, for Sam, they were .88 and .87; and for Hannah .83 and .82 ($p < .0001$ in all cases). On the basis of the structures' mean ETs it was

¹⁶ Excludes predicative AdjP

possible to construct the (still imperfect) implicational scale shown in Table 21 below. Structures are listed in order of their mean ET. The numbers in columns 2-4 are the raw ETs (in elapsed weeks) at which a structure actually emerged in each IL; bold figures indicate items that emerged out of order in some IL relative to the order predicted by their mean ET; that is, they emerged earlier in one IL than other structures with a similar or lower mean ET. Shaded cells represent structures whose emergence was incorrectly implied by the early emergence of the items indicated in bold.

Table 21. Implicational hierarchy for 18 nominal structures

Structure	Kaz	Sam	Han	Mean Rank	RMR	mean ET	RMET	Implicational Stage
Compound N	6	8	6	1	1	6.66	1	1
Name	6	8	6	1	1	6.66	1	
Noun	6	8	6	1	1	6.66	1	
Num-Class N	6	8	6	1	1	6.66	1	
Pron	6	8	6	1	1	6.66	1	
little pro	6	8	8	1.33	2	7.33	2	
Affine structure	6	11	6	1.33	2	7.66	3	2
dePPoss	8	11	8	2	3	9	4	
(Adv) Adj N	8	11	11	2.33	4	10	5	
Conjunct (min)	8	11	21	2.66	5	13.33	6	3
(hen) duo N	14	21	11	3.66	6	15.33	7	
dePMod (indef)	14	21	21	4	7	17.33	8	
Incorporated Locatives	14	14	24	4	7	18.66	9	
Pseudo-RC	11	21	24	4	7	18.66	9	
Dem Class N	14	21	24	4.33	8	19.66	10	
Num-Class deP	21	21	21	4.33	8	21	11	
Ordinals	28	21	21	5	9	23.33	12	
Locative DE	26	24	24	5.33	10	24.66	13	

The single horizontal lines indicate points where changes in mean rank coincide with changes in actual ETs for each learner, that is points at which it is possible to say that anything below that line in that column is ranked higher *and* emerged later than anything above that line. A perfect scale equally applicable to all ILs would appear as a single line across the whole table. However, the boundary lines between the individual scales do not generally coincide showing that no individual scale correlates perfectly with this average scale based on mean ET.

The only perfect implicational scale is that shown by the double lines in the last column. Even with the alternative method of deriving a single emergence scale, this hierarchy, just like the one shown in Table 19 above, has only three stages: two large groups of structures are effectively unordered with respect to each other.

5.4.6 Compensating for variable emergence times

The picture represented by these implicational scales is clearly at odds with the results of the statistical analysis, which indicates a high and significant correlation between ILs which *individually* fall into sequences with 5-7 ranks, almost as many as there were observation periods. In other words, it is not actually the case that all the structures in the final group emerged in *random* order after the

emergence of AdjP-N at T2-3 (i.e. week 8-10). Statistically speaking, these later structures also emerged in much the same order in each IL. This indicates that no matter how they are constructed, implicational hierarchies lead to the loss of a significant amount of detail about ordering that direct observations from longitudinal studies can provide, because consistent patterns are masked by the inclusion of structures whose emergence times are variable.

To lessen the impact of the four most variable structures from among this set, their mean ranks were adjusted. Consider the variable structures on Table 16 above: the conjunct structure, incorporated locatives, pseudo-RC and ordinals. It is clear that in Hannah's IL, incorporated locatives and conjuncts were exceptionally late compared to the other two ILs, while in Kazuko's IL, ordinals were exceptionally late but pseudo-RC was exceptionally early. When these exceptional scores were excluded and the average of the remaining two was taken the structures shifted their position in the rank orders, as shown by the adjusted mean ranks (in bold) on Table 22, below.

Table 22. Adjusted Implicational hierarchy

Structure	Kaz	Sam	Han	adjusted mean rank	ranked adjusted mean rank	adjusted mean ET	ranked adjusted mean ET	Implicational Stage
Compound N	6	8	6	1	1	6.66	1	1
Name	6	8	6	1	1	6.66	1	
Noun	6	8	6	1	1	6.66	1	
Num-Class N	6	8	6	1	1	6.66	1	
Pron	6	8	6	1	1	6.66	1	
little pro	6	8	8	1.33	2	7.33	2	
Affine structure	6	11	6	1.33	2	7.66	3	
dePPoss	8	11	8	2	3	9	4	2
(Adv) Adj N	8	11	11	2.33	4	10	6	
Conjunct (min)	8	11	21	2	3	9.5	5	
hen duo N	14	21	11	3.66	6	15.33	8	3
dePMod (indef)	14	21	21	4	7	17.33	9	
Incorporated Locatives	14	14	24	3.5	5	14	7	
Pseudo-RC	11	21	24	4.5	9	22.5	12	4
Dem Class N	14	21	24	4.33	8	19.66	10	
Num-Class deP	21	21	21	4.33	8	21	11	
Ordinals	28	21	21	4	7	21	11	
Locative DE	26	24	24	5.33	10	24.66	13	5

Naturally these adjustments meant that the new mean measures became more closely correlated with Sam's ILs, and less closely correlated with Hannah's and Kazuko's. However, the overall correlations between the *adjusted* mean ranks and individual sequences were still high and significant: .90 for Sam; .82 for Hannah, and .77 for Kazuko ($p < .0001$). This is still within 1% of the correlations with unadjusted measures for Sam and Hannah, but 12% lower for Kazuko, because her IL contained both relatively early and relatively late structures.

On the basis of these adjusted scores, it was possible to construct a more meaningful 5-stage implicational hierarchy, where the only exceptions arose as a consequence of these variable structures. This is indicated by the solid lines on Table 22. The exceptional ETs are shaded dark.

For Sam's IL, the divisions indicated on Table 22 now form a *perfect* five-stage implicational hierarchy, and the exceptions in the other ILs all relate to the four structures we know to be highly variable: in Kazuko's IL, the emergence of three structures at stage 3 (lightly shaded) is falsely predicted only in relation to pseudo-RC, which is exceptionally early in her IL, and the emergence of locative *de* falsely predicts the prior emergence of ordinals only, which are exceptionally late. In Hannah's IL, only the emergence of the two exceptionally late structures (darkly shaded) is falsely predicted.

Moreover, we can now characterise the 5 stages represented here in terms of mean ETs: structures of stage one have a mean ET of less than 8 weeks; those of stage 2 have a mean ET of 9 or 10 weeks; those of stage 3 have a mean ET of 14-18 weeks; those of stage 4, 19-23 weeks; and stage 5, over 24 weeks. Given similar levels of instruction to those the learners in this study received we can reasonably expect other learners to demonstrate similar emergence times for these structures.

Since we are concerned primarily with accounting for stable emergence orders *where they occur*, and the adjusted ranking minimises the impact of a small number of variable structures, it is arguably the most accurate representation of emergence order for the majority of the structures considered here.

5.5 Comparison to Zhang's results

We've now seen that, statistically speaking, 19 different productive nominal structures emerged in all three ILs in much the same order. Of these 19 structures, ten were also investigated in Zhang's (2001) study because they combined numbers or demonstratives and nouns, with or without a classifier, or combined a modifier and N, with or without *de*. However, before the results of the two studies can be compared, it is necessary to re-classify some of Zhang's data according to the structural categories used in the Auckland study.

The main discrepancies in the classification arose with respect to structures of the form N *de* N. As explained in Chapter Three, Zhang divided these into *de*(GEN) and *de*(ATT) categories on the basis of the semantics of the N preceding *de*; in the Auckland study they were divided into locative and associative categories on the basis of kind of N that *followed de*. The 'locative *de*' category of the Auckland study corresponds to sub-type (iv) of Zhang's *de* (ATT) category (see Chapter Three, pages 55-56.) These correspondences and others are shown on Table 23, below.

Zhang grouped structures where N1 was locative as in (51a) together with those where N2 was locative, as in 51b) on the basis that in either case "-*de*(ATT) marks the attributive relationship". She gives the following examples (the glosses are Zhang's, see Zhang, 2001, p. 127):

- 51) a. yòubian de xīn
right -ATT letter
The letter on the right (Kate, T4.2, #8)
- b. xǐzǎojiān de zuǒbian
bathroom- ATT left
On the left of the bathroom (Dave, T3.4, #15)

In fact, (51a) is attributive, but (51b) is *not*. being ‘on the right’ is an attribute of the entity, ‘a letter’, but ‘the bathroom’ is *not* an attribute of an entity ‘left’; rather the word ‘left’ in (51b) defines a location *relative* to the bathroom; ‘the bathroom’ is therefore an essential logical argument of the relational term ‘left’. On this basis, locative structures in my analysis were identified as predications and differentiated from modifying structures. In practice, when learners in the Auckland study produced structures with an initial locative N, like (51b), their intended meaning was actually that of (51a) i.e. ‘to the left of the letter’. This structure was classified as a ‘reverse locative’ as described above.

Table 23 Correspondences in the classification of NP DE N structures

Structure	Zhang's label	My label
N-N _{-Loc}	N-0	compound N
N-N _{+Loc}	N-0 Loc.N	Incorporated Loc
pron-N	de(GEN): pron-0 (+kin)	affine structure
N _{+Human} de N _{-Loc}	de(GEN): N-de	Poss <i>de</i>
N _{-Human} de N _{-Loc}	de(ATT)	Poss <i>de</i>
N de N _{+Loc}	de(ATT)	Locative de
V _i N	(adv) mono.adj-N	Adj P
V _i de N	de(ADJ)	Mod <i>de</i>
RC de N	de(RC)	RC
Num-Class-N	num-CL	Num-Class-N
Dem-Class-N	demo-CL	Dem-Class-N

5.5.2 Standardising classification

In order to standardise the classification of N de N structures, all such structures from both studies were allocated to new categories on the basis of the semantic relations between the two nouns. Since kinship was the first relationship expressed by the *de* structure in my data, as in *wǒ de māma* ‘my mother’, because all kin-terms derive from an event of creation, i.e. a birth, and because kin have special rights over, and responsibilities towards one another comparable to the rights of creators and ‘owners’, the kin relation was taken as a plausible prototype for a ‘possessive’ or ‘genitive’ category.

Other constructions, where NP1 was human, but NP2 was not, were clearly metaphorical rather than literal expressions of possession. For example, when learners describing pictures referred to them as *wǒde huà* ‘my picture’, they were not talking about a picture that belonged to them, but one constructed, owned, brought to the session, and taken back at the end of the session, *by the interviewer*. Because of this, the speaker lacked certain crucial rights (e.g. the right of disposal) with regard to the picture. Nonetheless, they also had a temporary association with that specific picture during the interview, and because of that association, they had certain rights (secrecy) and responsibilities (disclosure) with regard to it.

On this basis, such structures were classified as metaphorical extensions of possession¹⁷, rather than as core possessive structures. Three-sub-types of metaphoric extensions emerged, relating

¹⁷ The terms ‘alienable’ and ‘inalienable’ have been avoided as these are typically applied to different structures with an ad hoc allocation of actual semantic relationships to each category.

essentially to whether the association between two entities was relatively stable for temporal reasons (derivative); for physical reasons (partitive); or was actually *ad hoc* or easily altered (contextual).

As discussed above, structures with a *locative* N2 such as *shù de hòubian* (tree de behind) ‘behind the tree’ do *not* express a possessive, derivative, partitive *or* contextual relationship between a tree and an entity called ‘behind’, rather the locative names a relationship ‘behind’ that exists between the tree and some *other* entity elsewhere in the sentence. Thus, as argued above and in Chapter Three, the locative *de* construction is clearly of a distinct semantic type from the associative *de* structures, both core possessive types and metaphoric extensions. They were therefore allocated to a distinct locative category. Examples of the various sub-types are given below.

‘Core’ Possessives:

a) Affine relations: *wǒ (de) māma* ‘my (de) mother’;

b) Possessive relations: a human who creates, owns or has special rights to use a thing e.g.

wǒde hànyǔ kèběn (1sg de Chinese textbook).

Metaphorical extensions:

a) Derivative: NP1 denotes a place, and NP 2 originates there, e.g. *rìběn de shouyīnjī* (Japan de radio) ‘radio from Japan’.

b) Contextual: NP1 denotes an entity, a place, or a time, and NP 2 is habitually or temporarily associated with that entity, place or time e.g. *wǒde huà* ‘my picture’¹⁸; *gōngyuán de lù* (park de road) ‘a road in the park’; *shídiǎn de kè* (10 o’clock de class) ‘a 10 o’clock class’; *zuǒbiān de fángjiān* ‘the left-hand room’; *?hànyǔ de laǒshī* (Chinese de teacher) ‘teacher of Chinese’.

c) Partitive: i) NP2 denotes a physical part of NP1 e.g. *Saudi de Jeddah* (Saudi DE Jeddah) ‘Jeddah in Saudi’;

ii) NP2 denotes a representation of part of NP1 e.g. *hànyǔ de kèběn* (Chinese de textbook) ‘Chinese textbook’.

5.5.3 Emergence orders for NP de N structures

Having established these relatively clear and distinct semantic categories, the development of each was traced in both sets of data (using tables from Zhang 2001, p. 112-114; 123-125¹⁹). The results are shown on Table 24, below. For each semantic type, there is a row indicating which learners produced it at which times. The learners are represented by labels: Kate, D(ave) and Sha(ron) in the Canberra study; Sam, Kaz(uko) and H(annah) in the Auckland study. Semantic types are arranged

¹⁸ As used in interviews (see discussion below); had the same phrase referred to a depiction of the speaker, it would then have been classified as partitive type (ii).

vertically in order of first emergence (in any IL); an asterisk marks the point at which a given semantic type has emerged in all six ILs; shaded labels mark the point where a learner first used a *metaphorical* rather than a *core* possessive structure; numbers in brackets show the frequency of tokens, where it is relevant to further discussion below.

Table 24. Emergence orders for semantic sub-types of N de N structures

Categories	week							
	5-6	8-10	11-13	14-16	21	23-24	26	28+
core (pron-de kin)	D	D	D	D		D	D	D
	Kate	Kate	Kate					Kate
	Kaz	Kaz		Kaz	Kaz			Kaz
	Sha	Sha	Sha	Sha		Sha		Sha
		H		H		H		
			*Sam		Sam			
contextual (shí diǎn de hànyǔ kè) a ten o'clock class	H	H	H	H		H	H	H
	D	D	D			D	D	D
		Kaz	Kaz	Kaz	Kaz	Kaz	Kaz	Kaz
			Sam	Sam	Sam	Sam	Sam	Sam
				*Kate			Kate	
			*Sha				Sha	
partitive i) (Saudi de Jedda) ii) lang-de bk	H						H	H
			D	D				D
			Sha					Sam
				Kaz				Sha
					Sam			
derivational <i>T. de chǎnpǐn</i> products of T.			Sha		Sam			Sam
					Sam			
						D	D	
							Kate	
Locative DE / N de Loc N (zài N de zuǒbiān)			D (14)				D (1)	D (2)
			Kate (19)	Kate (9)			Kate (1)	Kate (1)
						H (6)	H (21)	H (5)
						Sam (4)	Sam(15)	Sam (7)
						Kaz (4)		Kaz (3)
reverse Locative							Kaz (12)	Kaz (10)
							Sam (12)	

From Table 24 it can be seen that core possessives were acquired by *all* learners by week 13, and metaphorical extensions were also present in *five* of the ILs by that time, and in all six by week 16. However there is no consistency in the *type* of metaphorical extension used by different learners. Moreover, the use of metaphoric extensions bore *no* relationship to instruction on locatives, or to the emergence of locative structures: four learners (Hannah, Dave, Kazuko, and Sam) produced the former before they produced the latter, *and* before or without exposure to intensive instruction. This indicates that, contrary to Zhang's suggestion, this *de* construction began to be extended metaphorically soon after it was first acquired. The expansion was *not* a consequence of the addition of some specific semantic feature to the lexical structure of *de* arising as a response to instruction on locatives and

¹⁹ Where there was insufficient detail on Zhang's tables to be certain of classification, I counted the structure as core.

licensing the selection of new collocates. Moreover, there is no clear developmental basis on which to treat the various semantic sub-types as distinct structures for the purposes of assessing development.

In contrast Table 24 reveals two different patterns of emergence for *locative de* structures. In the Auckland study the locative de structures did not become productive till week 24, but continued with *increased* frequency thereafter; in Zhang's study where intensive instruction on locatives took place in week 12, Sharon produced *none of the locative de structure at all* (Zhang, 2001, p. 124) but the other learners produced them at *very* high frequencies in week 13, Kate produced fewer in week 16, then neither produced any more until weeks 26 and 29, when a few isolated tokens recurred in each case.

This short-lived production immediately after instruction, followed by a lapse and subsequent re-emergence, is precisely the pattern that Pienemann found when students were taught a structure at a developmental level beyond that evident in their ILs at the time of instruction (Pienemann, 1984). The obvious conclusion is that the natural point of emergence for locative de structures in the Australians' ILs was actually closer to weeks 26-29, where the structure recurred than week 13 where they first followed intensive instruction.

5.5.4 Standardising emergence criteria

A slight difference in the emergence criteria used in the two studies also needed to be taken into account before the findings could be compared. Recall that, in Zhang's study, which focussed on the emergence of specific *morphs*, a morph was counted as emerged only after two distinct tokens occurred within *four* contexts of use; in the Auckland study, which focussed on structures as a whole, a structure counted as emerged when two distinct tokens occurred within two interviews *and* each element of the structures could be shown to have morphemic status in the IL by that time. In most cases this difference in criteria made no difference to the calculation of emergence times, because structures occurred at frequencies of 4 or more in either case.

However, in the case of the Mod de structure (or de(ADJ) in Zhang's terms) the difference proved significant. According to Zhang, this structure emerged particularly late in Sharon's IL, at week 29, and did not emerge at all in Kate's. Zhang put this down to their failure to acquire the lexical category Adj. However, Sharon did produce two distinct tokens of the structure at week 23 (Zhang 2001, p. 135). Zhang did not count these because she found no additional contexts of use within that interview, but by the criteria used in the Auckland study, this would have counted as emergence.

Recall also that the 'contexts of use' criterion is intended to indicate that a string is not an unanalysed chunk, that each of its components can occur in the IL independent of the others. According to Zhang's tables, Sharon had already produced other types of structure using the form de before a noun, and had also produced the same Adj forms in earlier interviews without de (Zhang, 2001, p. 135). It is therefore evident that her lexicon did contain the component parts of the two

distinct Mod de structures that she produced in week 23. On this basis, for the purposes of comparing the results from both studies, the Mod de structure was counted as present in Sharon's IL at week 23.

Once this single alteration had been made to the emergence order described by Zhang, and the N de N structures had been reclassified, the results for ten structures in the two studies could be compared. This comparison is shown in Table 25. Where structures were acquired at different times by different learners their codes are shown in brackets after the structure name.

Table 25. Comparison of Emergence orders for 10 structures in 6 ILs

Structure	Emergence Time (weeks)	
	Canberra	Auckland
compound N affine structure Poss de Num-Class-N AdjP	5-10	6-11
<i>de</i> (RC) (D) Locative <i>de</i> (D, Kate)	13	
Incorporated Loc Mod de (= de (ADJ) (D, Kaz, Sam, H)		14/15
Dem-Class-N	16	21
Mod de (= de (ADJ) (Sha)	23	
Locative <i>de</i> (H, Sam, Kaz; recurs for D, Kate)	23	24
<i>de</i> (RC) (Sha)	29	

Table 25 shows that most of the structures emerged not only in the same *order* in the two studies, but also at approximately the same *elapsed time*. The differences that stand out are the still rather late emergence of Mod de in Sharon's IL (and in Kate's where it did not appear), and the relatively *early* emergence in Dave's IL, of locative de, and also of RC. In fact Dave was one of only two learners to produce spontaneous RCs at criterial levels within the observation period.

In general then, when the two sets of data were analysed according to the same categories and criteria, they both exhibited the emergence order shown in Table 22 above.

5.6 Conclusions

To conclude, roughly half (19) of the *productive* nominal structures observed in the Auckland study did emerge in a statistically consistent order in three ILs, and eight of these also emerged in the same order in the three additional ILs described by Zhang (2001). The main differences between these two studies were the rapid acquisition of locative structures and relative clauses for one of Zhang's learners, Dave, associated with intensive instruction and modelling of those same structures, and the generally *later* emergence of adjectival de structures in Sharon's and Kate's ILs, accompanied by early, out of sequence use of locative de by Kate, possibly a response to the same intensive instruction.

5.6.1 Patterns of Nominal development in Mandarin

Some preliminary generalisations about the pattern of Mandarin IL development are now possible. Overall there was a clear pattern of increasing structural complexity as acquisition proceeded. This is immediately evident from two surface phenomena, the number of words involved in structures of the same general type, and particularly, the presence or absence of *de*.

N-N Compounds and plural suffixation on pronouns made up the majority of nominals at T1 and T2, (n = 188). The classifier also behaved like a suffix on numbers, in the sense that it appeared only in this one context, and possessive *de* behaved like a suffix on pronouns up till and including T4. The affine structure and the basic numeric expression Num-CL-N both productive at T1, can thus be understood as two-word structures. They exhibited TL-like restrictions indicating licensing and agreement processes at work. Predicative adjectives were also present in all three ILs at T1, but attributive Adjectives were not.

At T3, the CL was sometimes omitted where omission is not lexically licensed in the TL. This indicates that CL was recognised as a lexically selected item in its own right. Also at T3, Adjectives began to function as pre-nominal modifiers. Adjectival Quantifiers appeared slightly later than property-denoting adjectives, and AdjP appeared in collocation with a numeric expression. This was the first use of *two* independent pre-N elements constructing a “three-place” Nominal.

At the same time the first incorporated locatives emerged, initially these were in fixed expressions such as *zài hǎibiàn* ‘at the seaside’ and *zài wàimian* ‘outside’; other locative expressions used the preposition *zài* with no explicit locative: *zài chuán* - ‘at boat’. The locative noun *biàn* ‘side’ was productive in Sam’s IL, as was *shàng* ‘top’ which Sam and Kazuko both used as a Preposition. The Dem-CL-N string also began to appear frequently in Kazuko’s IL, and at T5 in Sam’s, but it did not emerge in Hannah’s till T8. As discussed above Dem could not be distinguished distributionally from Num, at this point, but its later emergence, and its clearly different semantics, suggest it was a distinct category which occupied a different structural position from Num.

The Mod *de* structure first appeared at T5, some time after the associative *de* structure was already in use. This was followed by an increasing number of complex and idiosyncratic collocations of different types of nominal subconstituents. The final interviews were characterised by attempts to integrate demonstratives into more complex nominals and to handle new locative constructions, involving bound locative nouns, free locative nouns with *de*, and the preposition *zài*. Of the 12 structures produced by just *two* learners (see Appendix D), seven emerged in a clear sequence *before* T6, as shown below; the rest emerged between T7 and T9:

T1	Num (H1, K1);
T2	Pronominal Possessor (K2)
T3	*Pronominal Adj (K3); Pronominal Num-CL (K3);

T5 Pronominal Q (S4); recursive possessive (K5, H4) ; Possessor de Adj N (S4).

Basically, this pattern is consistent with the overall pattern of emergence observed for structures common to all six ILs: the four pronominals each co-occurred with fully specified counterparts; the use of the recursive possessive at T5 is a natural extension of the simple possessive structure present since T2, and anticipates the increased complexity that characterised the ILs from T6-T9. At the other structural extreme, the ordinal prefix also emerged at T5, though it appears to be a simple derivational prefix attached to a number. This is counter to the general trend.

5.6.2 Five generalisations

These facts can be restated in terms of five generalisations.

1. Numeric expressions emerged before clear evidence of attributive modification of N;
2. The acquisition order for modifiers of N is related to the structural complexity of the modifier.
Simple one-word modifiers - N and Adj - emerged before phrasal ones - AdjP, NP- and phrasal modifiers emerged before sentential ones.
3. Different *lexical* categories of modifier emerged at different times: nominal modifiers - pronouns and nouns- before verbal or sentential ones - adjectives and RCs.
4. Each modifier type collocated directly with N before it collocated with de and N together.
5. Locative structures were exceptional, in being entirely nominal yet relative late to emerge.

In fact, locative structures clearly followed a developmental timetable of their own. One of the first productive uses of locatives was Sam's use of *biān*, at T4, as in (52).

52) tāmen shì zài hú.bian
they are at lake.side
They are at [the] lake.side (S3)

This has three possible analyses: suffixation, compounding, or syntactic selection of an argument by *biān*. All three processes were evident in Sam's IL at T2 yet the locative did not appear in his IL until T4. In the same interview Sam used the locative *shàng* as a preposition 'on' ; thus, he did not generalise his treatment of *biān* 'side' to other locatives; they were assigned to different lexical classes. However, at T5, Sam demonstrated uncertainty about the use of *shàng* and its relationship to the preposition *zài* 'at'. Wanting to describe a picture of a gateway on a mountain top, he asked:

53) S: do you say 'zài shàng shān'?
Do you say 'at top mountain'? (S4)

He was told '*zài shān dǐng*' 'on mountain-summit', and his response was not to use *shàng* again in that interview! By the next interview he was using the locative *de* construction, with the compound *shàngmian* 'top-side': *zài gùizi de shàngmian* (at cupboard de top) 'on top of the cupboard' (S5). This was some time after other *de* structures were in regular use in his IL and all the others.

5.6.3 Three independent continua

If we treat modifying structures involving *de*, specification involving quantities and demonstratives, and thematic relations involving locatives as three discrete systems, then these facts can be described in terms of three interwoven hierarchies as follows (from early to late):

Num-Class-N >				Dem Class-N		Specification
N-N / pron N >	pron/N <i>de</i> N >	adj-N >	adj <i>de</i> N>		RC	modification
		P-N	N-N _{LOC} >		N <i>de</i> N _{LOC}	complementation

Fig. 7 Development in three functional domains

These structural categories form the basis of most of the 54 nominal structures produced in the first year, including the idiosyncratic structures. Apparently, lexical category is also relevant to emergence time: Nominal sub-components *generally* became integrated with a head noun before verbal and sentential components, and production of RC lagged behind production of the intransitive Mod *de* structure. At first glance, this seems paradoxical given the arguments presented in Chapter Three that Adj is really a subset of V and Mod *de* structures and RC structures are really one and the same. However there is one clear difference between them: the latter involve *transitive* verbs, and the modifier includes at least one argument of that verb; the former involve intransitive verbs and include no overt argument. The fact that structures with locative predicates also lagged behind other *nominal* structures suggests valency is relevant to processing demands. This is not a factor normally addressed within Processability Theory; its significance is considered further in the next chapter.

Chapter Six: Processing phrases

6.0 Introduction

We have now established a natural emergence order for certain Mandarin nominal structures. The next goal is to see if this emergence order can be explained in terms of processing demands. Chapter Two introduced two theories that relate processing demands to syntactic structure: Processability theory, and Minimalism, and foreshadowed a problem with the application of PT to nominal structures. PT sees development falling into just six stages, and, with the possible exception of RC structures, all nominal structures containing more than one word belong to the same stage of development, the phrasal stage. Yet there is clearly an order of emergence among them. Pienemann himself acknowledges that a six-stage model is not sufficiently sensitive to reflect all aspects of IL development. If the basic premise of PT is correct, the nominal structures identified in Chapter Five must involve different processing demands, but those demands must relate to factors *other* than iteration effects and the shift from sharing conceptual information to sharing abstract information. They must relate to more subtle variations in developing IL grammars over time.

This chapter takes a critical look at the main factors said to differentiate the categorial, phrasal and sentential stages in PT: information exchange and delays associated with the division of conceptual structure into iterations, and considers other factors that might account for developments *within* the phrasal stage.

Section 6.1 considers the basic process of feature unification both as it is conceptualised in LFG and as it is implemented in PT. Specifically, it considers the nature and role of information exchange in four distinct types of syntactic relationship: licensing, agreement, GF assignment and argument-sharing or functional uncertainty. This reveals that greater c-structural distances between items in such relationships entails more feature storage and greater delays in feature unification, but the standard PT approach ignores c-structural complexity as a significant contributor to processing demands.

Section 6.2 takes a fresh look at the nature of the information stored in and exchanged between different types of procedures. It argues that since categorial and phrasal procedures entail the storage of abstract features, just as sentential procedures do, activation within a single iteration actually bestows no particular procedural advantage. It also argues that the earliest developmental stage, the SOP, is a sentential procedure that already handles iteration effects.

Together these two discussions undermine the claim that IL development proceeds in a 'bottom-up' manner, from lexical through phrasal to sentential procedures, and show that much of early SLA

involves the elaboration of *internal* levels of structure. C-structural differences between nominal structures should have a significant impact on processing demands that is quite unrelated to any iteration effects.

Section 6.3 suggests revisions to PT that take more careful account of the interaction between licensing, agreement, GF assignment and c-structural complexity. It points out that a number of different syntactic relations form an implicational hierarchy where each entails the process before. This creates both developmental and procedural dependencies that impact on emergence times for certain syntactic structures. Moreover these processes interact with c-structural complexity in predictable ways.

Finally, section 6.4 summarizes the earlier discussion and concludes with the observation that the significance of c-structural complexity for processing demands poses a new practical problem for the determination of the processing demands of IL structures: the problem of structural indeterminacy. PT, like LFG, assumes that IL c-structures are not necessarily the same as TL c-structures because c-structure is constrained only by language-specific rules. This means the nature of IL c-structures must be determined by reference to IL productions within a theoretical framework that links c-structure to linear order. Neither PT nor LFG provide such a framework, but the minimalist programme does. That issue is developed further in Chapter Seven.

6.1 Feature Unification

In the standard PT approach to assessing processability, structures are assigned to one of six developmental levels depending whether they involve 1) uninflected isolated words and unanalysed chunks, 2) lexical inflections and fixed canonical sequences of three words, 3) phrasal sub-constituents and morphological agreement, 4) sentential structures with advanced processes restricted to peripheral items, 5) agreement between constituents derived from different iterations of conceptual structure, or 6) embedded clauses.

In fact, Pienemann equates constituency with the notion of an iteration of conceptual structure, and sees the involvement of information transferred from the conceptual module to the linguistic module as the major factor differentiating developmental levels 2, 3 and 5. He says that for the categorial process of adding lexical inflections, “no information has to be deposited into any syntactic procedure” (Pienemann, 1998c, p. 76); that all items in a phrase are “produced in *one and the same iteration*” (1998c, p. 113, my emphasis), and information is deposited directly from conceptual structure to the categorial or phrasal procedures of those items; whereas inter-phrasal agreement involves “the matching of features in two *distinct constituents*” (1998c, p. 113, my emphasis), so that “while the one phrase is being produced, the head of the agreeing phrase *has not been conceptualised*” (1998c, p. 77, my emphasis). This makes it necessary for information about the Subject to be stored in ‘abstract’ form, while conceptual information that identifies the verb is retrieved.

Since a ‘phrase’ is generally understood as a c-structural unit, the definition of ‘inter-phrasal’ agreement in terms of *conceptual* units can be misleading. For example, in some analyses of nominal structure, adjective *phrases* and noun *phrases* are distinct *constituents* within a functional *phrase* DP. Given this, agreement between AdjP and NP, might be described as *inter-phrasal* agreement, but in Pienemann’s model NP and AdjP are not *distinct constituents* in the relevant sense, because they are assumed to be derived from just one conceptual iteration. On this basis all complex nominal structures, and all syntactic relations within them, are ‘phrasal’, unless an embedded *clause* is involved.

Essentially, this characterisation leaves us with no obvious account of the stable emergence order evident among 13 of the 17 complex nominals²⁰ described in Chapter Five.

In Chapter Two it was suggested that the distinction between ‘phrasal’ and ‘inter-phrasal’ relations might be better described as a distinction between syntactic and inter-modular dependencies, respectively. These terms focus attention on whether delays in feature unification arise because of communication between the syntactic and conceptual modules of the syntactic processor, or because of communication *within* the syntactic processor, relating to one iteration that is already delivered. It was also explained that, in principle, PT relates processing demands to the process of unification, which compares feature values in LFG. This section takes a closer look at how unification requires information to be exchanged *within* the syntactic processor, and how this exchange is implemented by way of c-structural nodes. This reveals a clear link between information transfer and c-structural complexity.

6.1.1 Feature storage and unification in LFG

In LFG there is really only one process in which information is transferred: unification. In unification, *independent* values for the same feature are *compared* and a structure is either rejected or accepted on the basis of their compatibility. As explained in Chapter Two, unification is deemed *necessary* to ensure the satisfaction of universal constraints on syntactic well-formedness: the Uniqueness, Completeness, Coherence and Extended Coherence Conditions. A mismatch in features makes the functional-structure invalid (Bresnan 1982, 2001).

Unification is *implemented* in LFG via the merger of features contributed by lexical items and c-structure nodes into feature-sets in functional structure (f-structure). The feature-sets in f-structure are organised hierarchically, with each level in f-structure mapped to some level in c-structure. For example, since grammatical number relates conceptually to the entities denoted by nouns, it is generally assumed that a noun’s lexical entry can specify a number value. This would take the form [\uparrow Num] = SG. This means “the feature [Num SG] must be added to the f-structure associated with the c-structural node that dominates me” (i.e. the node that dominates the noun containing this equation in its lexical structure). As a consequence of this lexical specification, when a noun is inserted at any c-

²⁰ That is all the common nominal structures other than Pron, N, Name and little pro, which are *simple* nominals.

structural node, the relevant feature [NUM SG] is copied first from the word to the c-structural node, and then to a feature-set in f-structure that is co-indexed with that c-structure node. As more lexical items are inserted at specific nodes in c-structure, more features are added to corresponding levels in functional structure.

Though f-structures are arranged hierarchically, c-structures are not necessarily so. Annotations on c-structure nodes (e.g. $\uparrow = \downarrow$) can equate one node with its mother or daughter so both are mapped to the same f-structural constituent. This means that features attributed to the same f-set in f-structure may originate in different lexical items or c-structure nodes. For example, since the referents of adjectives are not countable entities, Adj is not considered to express a value for the feature NUM in the way N does, but its lexical structure may contain an equation of the type: $(\uparrow \text{ NUM}) = \text{c SG}$, which *constrains* the contexts in which this Adj form can be used: It specifies that singular (SG) is the *only acceptable value* for the feature NUM expressed at the c-structural node that dominates this Adj form. The effect of this is firstly that Adj alone cannot *contribute* a NUM feature to an f-structure, and secondly, this Adj may not be inserted at a c-structure node that is mapped to an f-structure with a value for Num other than that specified in the f-structure of the Adj form.

To ensure uniqueness, values associated with a single referent, but contributed independently from different sources must be checked for compatibility. To ascertain whether the value that Adj *permits* is consistent with a value actually *expressed* in f-structure, the node that dominates Adj must be linked in some way to the node that dominates N and thus to the level in f-structure where N's Num value is stored. In this way the constraint expressed by Adj is merged with the value expressed by N in one feature-set in f-structure.

LINKING C-STRUCTURE NODES ESSENTIAL TO UNIFICATION

The link that forces features to be unified may be implemented in various ways, as we shall see below, but no matter how the link is formed, each c-structural node which separates values to be unified must bear some kind of annotation transferring the relevant information to a dominating or dominated c-structural node, until the sum of all annotations forces the two (or more) values to be merged in one single feature set in f-structure. The necessary annotations are a stable part of a given (language-specific) c-structure rule, one of the things to be acquired in SLA.

In short, the unification process must access feature values from distinct lexical *and c-structural sources*, assign them to a *functional*-structure according to language specific mapping principles expressed in c-structure rules, compare *all* values for the same feature in a single f-structure and accept or reject the outcome. Crucially, as the number of c-structural nodes that separates two items increases, so does the number of annotations involved in the path between them. Since each annotation is a piece of syntactic information, and processing demands reflect the need to store information, processing demands must increase with c-structural complexity, whether inter-modular dependencies are involved or not.

6.1.2 Where unification is required

This makes it important to review in some detail, the various syntactic contexts in which unification becomes necessary, and the various mechanisms by which it is enforced.

UNIFICATION FOR LICENSING

First, unification is involved in local licensing. This is where access to specific c-structural positions is restricted to certain words or categories of word. Pienemann acknowledges licensing constraints explicitly in his discussion of question-formation and ‘topicalisation’ in the SLA of English (ESL). Before learners master full Subject-Auxiliary inversion in English yes-no questions, they first produce a structure where an invariant form of ‘do’, a wh-word, or an adverb appears in utterance-initial position, as in: ‘do he goes?’, ‘when he is here?’, ‘now he is here’. Pienemann refers to these as Pseudo-inversion or do-fronting, TOPI and ADV respectively.

Starting from an analysis of ESL inversions by Pinker (1984, p. 278) Pienemann proposes the rule shown at (R1) for Do-fronting:

(R1) $S \rightarrow (V_{aux=c} 'do') NP_{subj} V (NP_{obj}) (ADJ) (S)$ (Pienemann, 1998c, p. 173-4, (R9)).

According to (R1) there is no lexical VP containing V and the Object; the central canonical NP V NP string is ordered by the SOP. However, there is an initial position, which Pienemann refers to as a ‘topic position’ *outside* the canonical string, and this position is subject to a licensing constraint which permits insertion of ‘do’, in that position, and nothing else. A unification procedure must check that lexical items express the licensing feature (+DO); if not they cannot be inserted at that node. Thus the rule can only be implemented when appropriate features are instantiated in lexical items.

Pienemann suggests that “the topic position becomes available separately to wh-words, adverbs, etc. because each of these categories requires separate control equations, which may be acquired individually” (1998c, p. 99). The relevant equations ($=c$ ADV, and $WH =c +$) are added to the *same* initial c-structure node. These structures are allocated to developmental level *four*; a transitional level *between* phrasal and sentential processing to which Pienemann refers as the “simplified S-procedure / WO rules” (1998c, p. 171; 182).

UNIFICATION FOR PHRASAL AGREEMENT

Overt agreement

Obviously, unification is also required in agreement, but not so obviously, agreement may occur without overt morphological marking. For example, French nouns, adjectives and articles each have distinct forms associated with a plural interpretation and the plural forms of each lexical category share certain *orthographic* features. For example in les bonnes filles ‘the (PL) good (PL) girls (PL)’ each word ends in ‘s’. However, these orthographic features surface as *phonetic* features only in certain phonotactic contexts and the same orthographic features may surface as *different* phonetic features. Unless followed by a

vowel, the article expresses plurality phonetically, only by way of its vowel: [e]; the Adj and N do not differ phonetically from singular forms. When followed by a vowel, the /s/ of *les* surfaces as [z]: *les* [lez] *autres* 'the others'.

In other cases feature-values may be indicated by only one item of a set. French articles and adjectives also have masculine and feminine forms (*bon* / *bonne*) but gender is not marked on *all* French nouns by the same orthographic or phonetic features. For example one French language web-site (<http://french.about.com/library/weekly/bl-gender-f.htm>) lists about 50 different noun endings from French, half 'typically' feminine and half 'typically' masculine. Moreover, for almost every ending there are numerous exceptions to the 'expected' gender. The fact that children acquiring French as their L1 assign a gender to nonsense words on the basis of the words' phonetic form (Corbett, 1991) does not negate the fact that French nouns cannot be said to be regularly *inflected* for gender, since most cannot occur *without* the phonetic features that typically map to a gender, and some clearly have *no* orthographic or phonetic specification of gender at all; their gender is evident only in the form of the adjectives and articles with which they collocate. Nonetheless it is *nouns* that are said to 'have' gender rather than adjectives and articles, because the inflections of adjectives and articles change depending on the noun they collocate with, rather than the other way around.

This means that the feature structure of all French nouns contains a specification of a *gender* value, just like the specification of Number described above, but it happens not to be mapped consistently to any phonetic *or* orthographic features.

Covert agreement or collocation constraints

Two words can also agree without *either* expressing the relevant feature morphologically. For example, Mandarin, like many other isolating languages, has a large number of classifiers that precede a noun when it is quantified by a number. Each classifier form and many nouns are prosodically complete mono-morphemic words, with no inflectional or morphological sub-parts, but it is still clear that classifiers and nouns agree, because each classifier form can only collocate with certain nouns and vice versa. It is also clear that the feature for which they agree is an abstract feature that has little meaning or function except defining classes of nouns in terms of the classifier that they share: an abstract Gender feature. While classes might be based around common aspects of the semantic denotation of nouns, the possible classes to which they can be allocated is defined by the linguistic system and varies from language to language. Moreover membership within a linguistically defined class is often arbitrary. For example Mandarin has several distinct classifiers for paired items, depending on the nature of the pairing: physically joined, paired for breeding, complementary vs. identical pairs etc, however, some items constructed intrinsically from two parts, such as trousers, are not classified by reference to any of these, they are classified by reference to another characteristic entirely (i.e. length). It is not possible therefore to predict *which* natural feature of the referent of a noun will provide the basis for classification of that noun; class membership is idiosyncratic.

What is not so clear is whether it is the noun, the classifier or both that specify a *value* for the Gender feature, and which if any is simply constrained to agree with a value expressed by the other. Many classifiers are derived historically from nouns, and serve pronominal functions in the absence of a noun, so they might be held to express their own value for gender, but it is not at all clear that *all* classifiers express some specific concrete or physical trait that unites the class of nouns that they select, especially when classes include nouns whose referents share few obvious characteristics, like the class that includes trousers, bridges, and *dogs*²¹. The distinction makes little difference to the processes of unification however. In any event, whatever is specified by the noun and classifier with respect to the Gender feature, that information must be merged in a single f-set and be unified.

UNIFICATION FOR GF ASSIGNMENT

As well as being involved in local licensing and agreement, unification is also required in GF assignment. As explained in Chapter Two, GF assignment is actually a three-step process that consists of i) checking that a constituent has a PRED value and so is appropriate to receive a GF; ii) checking that a lexical predicate specifies the same GF as that specified in a particular c-structure and thereby licensing the assignment of that GF to a constituent; and iii) actually assigning the GF, by inserting the constituent with the PRED value at the appropriate GF position in c-structure, and adding the feature-set corresponding to the inserted constituent to the GF label present in *f-structure*. For each GF specified in the lexical structure of any predicate, there is typically just one c-structural position in which that GF is assigned. That position bears the annotation $(\uparrow \text{GF}) = \downarrow$, which means “the f-structure of the constituent inserted here is added to the f-structure corresponding to my *mother* node with the GF label specified”. For example, the noun in the English constituent ‘a ball’ expresses the PRED value ‘ball’ as part of its lexical structure, while the predicate ‘hit’ includes Subject and Object GFs in its PRED value, ‘hit<SUBJ OBJ>’, and an English VP rule assigns the OBJ GF to the sister of V, which is on V’s right. Thus when the constituent ‘a ball’ is inserted in the OBJ position in c-structure, as shown in Fig 8a below, its f-structure is added to that of the VP, as shown in Fig. 8b.

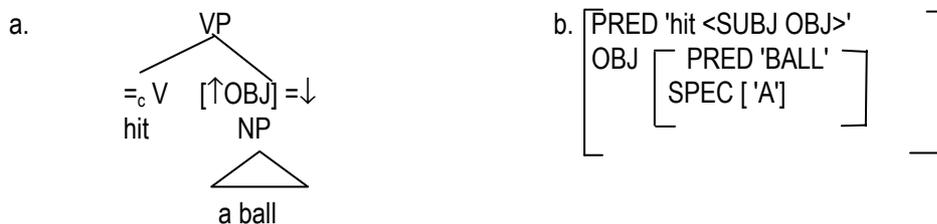


Fig. 8 GF Assignment in LFG

If the constituent ‘a ball’ were inserted instead into a VP whose head was the predicate ‘sleep’ with the PRED value ‘sleep<SUB>’, then the resulting f-structure, shown in Fig. 9b, would be incoherent.

²¹ Though it is sometimes claimed that *tiáo* is the classifier for long things, other animals (like monkeys and cats) are arguably just as long as dogs, yet the nouns denoting those animals do not select this classifier; conversely, *duǎnkù* literally ‘short trousers’ selects the classifier *tiáo*, though the thing it denotes is relatively short.

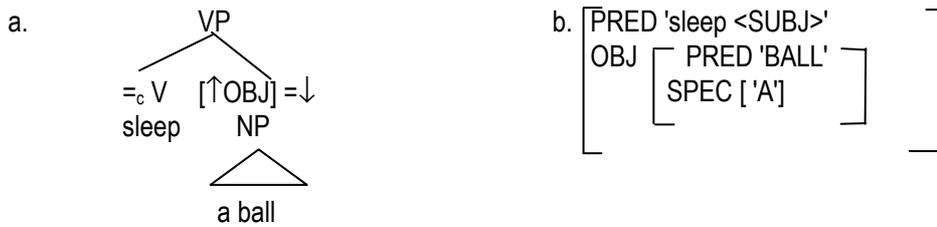


Fig. 9 Incoherent VP with unlicensed constituent

The constituent 'a ball' in Fig. 9b has a GF in the F-structure of the VP that is not licensed by the predicate 'sleep'. This violates the coherence condition.

As with agreement, the node at which a GF label is assigned may or may not dominate the predicate that licenses the GF; if it does not, a link must be forged between the node that dominates the GF-receiving constituent, and the node that dominates the GF licensing predicate so the GF features can be unified. In general terms then the '↑' indicates that a licensing GF feature must be sought *outside* the node at which the GF is assigned. For example, in the (simplified) representation of a sentence c-structure in Fig. 10a below, the Subject GF of the verb 'sleep' is mapped out of VP to be assigned in S. The resulting F-structure for S is shown in Fig. 10b.

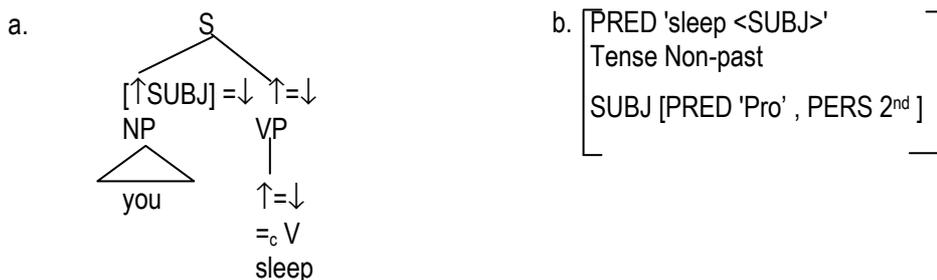


Fig. 10 Subject GF assignment in S

This applies to all GFs *except* Adjunct GFs, which can be assigned in any phrase.

6.1.3 How unification is enforced

SOME RESTRICTIONS ON ADJACENCY

As mentioned above, there are various ways in which unification can be enforced. Most simply, the node dominating each of the items that contributes a value for the same feature will be one and the same node. In Adj-N agreement, Adj and N could be c-structural sisters. In this way their feature specifications would be automatically mapped to the same f-set in f-structure. However, as discussed in Chapter Two, the endocentric mapping principles dictate that c-structural sisters are either in a predicate-argument relation, or in a co-head relation. The predicate-argument relation is excluded in the case where Adj optionally *modifies* N, and the co-head relation is excluded for *any* two items with distinct PRED values or different categorial F, because co-heads necessarily share *all* their features and distinct PRED values and categorial Fs cannot be unified. Thus Adj and N cannot be c-structural

sisters in an endocentric phrase structure; an optional modifying Adj or AdjP could only be an adjunct or specifier. In a lexocentric structure however, no such restriction exists.

Thus, the precise c-structural relationship between a noun and an adjective depends in *general terms* on whether the nominal structure is lexocentric or endocentric, and in *particular* on the norms of each given language. However, unification in a lexocentric structure can clearly take place more rapidly than unification in an endocentric structure where many nodes may intervene between the partners in unification.

UNIFICATION BY STRUCTURE- SPECIFIC ANNOTATION

The main device by which unification traverses c-structural distance in LFG is via annotations on c-structure nodes. These form part of the procedural knowledge required to produce a given structure. One possibility is to simply repeat the lexical constraints or values specified on two lexical items at the c-structure nodes that dominate each until a node is reached that dominates both. For example an equation ($\uparrow\text{NUM} = \text{c SG}$) expressed by lexical Adj could be repeated on Adj⁰, Adj', AdjP and the equation ($\uparrow\text{NUM} = \text{SG}$) or ($\uparrow\text{NUM} = \text{PL}$) expressed by N would be repeated on N⁰, N' and NP, or whatever other nodes intervene between N and Adj. When the annotations reach a common node, they would be mapped to a common f-structure and forced to unify

UNIFICATION BY CO-HEAD RELATIONS

Another kind of annotation is the co-head annotation $\uparrow = \downarrow$ used in Subject GF assignment as illustrated above. This equates *all* features of a mother and daughter node. When it occurs on c-structural sisters, *all* their features are associated with the same level of f-structure, making them functional co-heads. As mentioned above, this is appropriate only when two items share the same categorial feature and only one includes a PRED value (semantic content). Thus the co-head relation is normally restricted to a pair of nodes where one dominates a functional head and the other dominates a lexical item of the same type: I (=S) and V, or D and N.

The combined effect of a constraint equation such as that expressed by Adj and a co-head annotation at a node that dominates Adj would be to add the constraint encoded at the Adj node, along with all the other F of Adj, to a higher c-structural node Adj' and to equate the *f-structure* associated with Adj to the *f-structure* associated with that mother node. That f-structure would also include any features donated by other daughters of Adj', and sisters of Adj⁰.

UNIFICATION BY WAY OF A GF

A third possibility, and one that is often assumed in LFG accounts of agreement like that between N and Adj, is agreement mediated by GF assignment (see Kaplan & Bresnan, 1982; and see Sells, 1985; Dalrymple, 2001 for comparable treatment of relative clauses). Recall that a GF is usually associated with a predicate, and the predicate can specify or constrain the feature values of the constituent to which its GF is ultimately assigned. For example, the present tense forms of an English

Verb express the constraint equations $[\uparrow\text{SUBJ NUM}] =_c X$; $[\uparrow\text{SUBJ PERS}] =_c Y$, where X and Y are the values for Number and Person appropriate to the verb's lexical form. This restricts the selection of constituents to which the SUBJ GF can be assigned to those with appropriate Number and Person values. Fig. 11 shows an example of an F-structure that is ill-formed because the actual Person value of the Subject conflicts with a constraint placed on the Person value of the SUBJ GF by the verb.

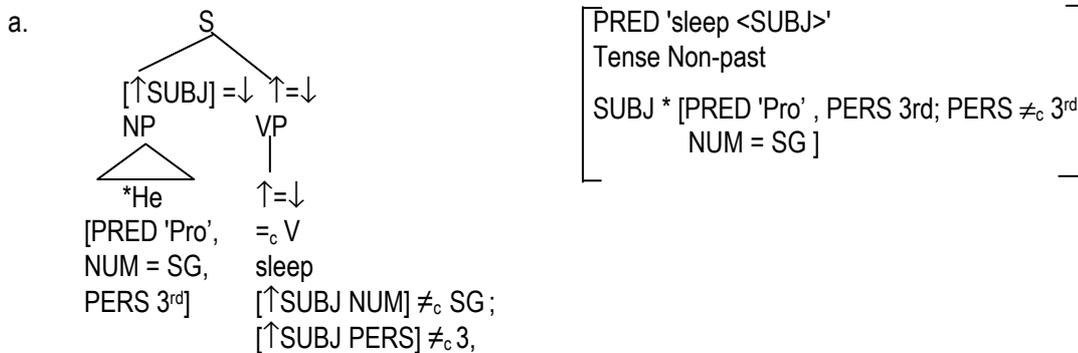


Fig. 11 Agreement mediated by the SUBJECT GF

The Adjunct GF is not lexically licensed, so restrictions on the possible values for Adjunct forms cannot be specified in the same way. The adjunct must specify the values of a head with which it is compatible. It can then be added to any phrase where appropriate feature-values are specified.

In agreement mediated by GFs, no specific annotations need to be added to c-structure nodes to link the agreement features to a specific functional level; these are superseded by annotations that ensure that the GF is properly assigned, as discussed below.

GF TRANSFER BY A CO-HEAD RELATION

In other cases, unification is mediated by way of the co-head relation. An OBJ GF feature expressed by V must be unified with the OBJ GF feature added to a constituent. In English, and in endocentric structures generally, the Object is a c-structural sister of V, and V is a head of VP, so V expresses the annotation $\uparrow = \downarrow$, which causes it to share all its features with the node that dominates it, and as it happens, also dominates the Object position. Since the Object position bears the annotation $[\uparrow\text{OBJ}] = \downarrow$, which equates the f-structure of its daughter with the OBJ GF of its mother, there is minimal transfer of features from node to node before unification of the OBJ GF feature can take place.

However, a Subject GF is assigned in S (or IP) not in VP. In this case, V', and VP must also express the annotation $\uparrow = \downarrow$ so the SUBJ GF will be attributed to S (see Fig. 10 above). The lexical licensing of SUBJ is therefore delayed, not because of any inter-modular dependency, but simply because the S node is further from V than the V' node.

FUNCTIONAL UNCERTAINTY: GF ASSIGNMENT IN RELATIVE CLAUSES

Finally, a constituent is sometimes not available at the c-structural node to which a lexically licensed GF is usually assigned. In this case, to satisfy the Completeness Condition, the GF must be

linked to another GF or to a DF assigned elsewhere. This is how a GF specified by a verb within an RC comes to be assigned to a nominal outside its immediate clause. Sells (1985) suggests that the GF associated with a gap in an RC is linked to a discourse function called Focus, which is assigned to a peripheral position in S. Moreover, the path linking a GF to this DF can “range over arbitrary sequences of function names (such as COMP COMP SUBJ, etc.)” so that it “effectively ... builds in the Extended Coherence Condition” (Sells, 1985, p. 182, note 22). Recall that Extended Coherence requires a DF to be linked to some GF; Sells’ point is that there is uncertainty as to which GF that will be, on any given occasion, but a search can simply be implemented through successive complements in f-structure till a suitable candidate is located, that is a GF that is not already associated with a PRED value.

Dalrymple (2001) points out that in an English RC, the Focus is actually the relative pronoun, while the GF associated with a gap is often linked to a larger constituent in which that pronoun is contained, and this larger constituent is a *Topic*. Thus she suggests that RCs have the structure shown in Fig 12.

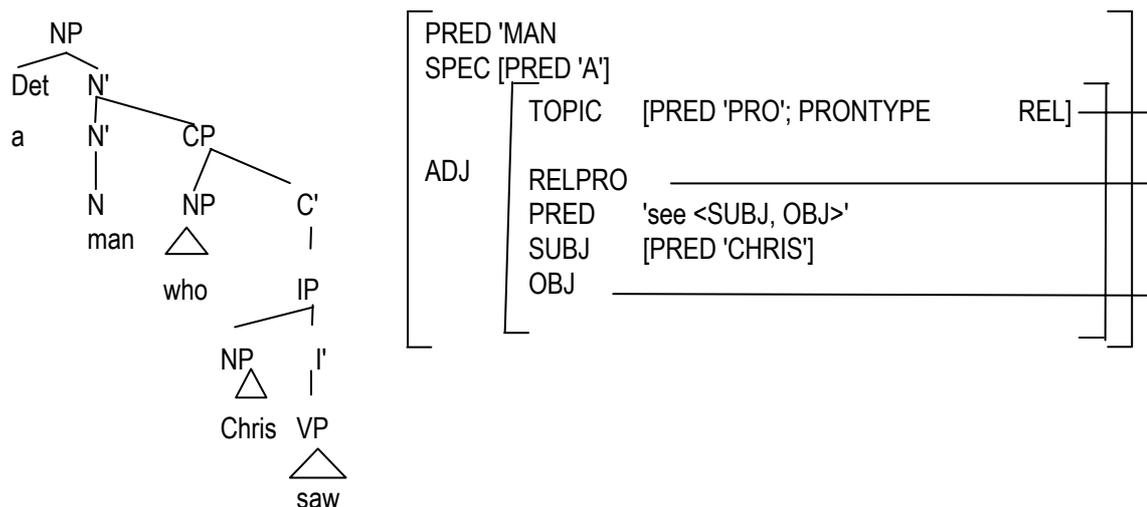


Fig. 12 Relative Clause Structure (based on Dalrymple 2001, p. 401)

According to Dalrymple, the sequence of function names in the path that links the Topic DF and GF is not entirely arbitrary: certain links are unacceptable. For example, Dalrymple (2001, p. 404) shows that English RCs and clauses with initial topics exhibit the same restrictions on extractions, as illustrated in (54) and (55) below.

- 54) a. Chris, we think that David saw.
 b. A man who we think that David saw
- 55) a. *Chris, that David saw surprised me.
 b. *a man who that David saw surprised me

54a) shows a topic controlling an Object gap in a complement clause and 54b) shows the corresponding RC structure; 55a shows that a topic cannot control an object gap in a sentential Subject and 55b) shows that the same restriction applies to relativisation (and see Dalrymple, 2001 for

numerous additional examples). On this basis Dalrymple proposes that paths through f-structure must be specified in the grammar for different DFs, and functional uncertainty equations at different locations in c-structure can refer to the same or different paths, as appropriate. Simplified somewhat, the functional uncertainty equation proposed for the Topic position in English RCs takes the form:

$$(56) \quad (\uparrow \text{TOPIC}) = (\uparrow \text{COMP}^* \text{GF}).$$

The left side of the equation identifies a DF; the right represents the path to travel to find a GF to which the DF can be linked. The component COMP* indicates that the DF can be linked to a GF embedded at any depth within a series of complements, as Sells proposed.

Dalrymple's full definition of the path includes 'off-path constraints' which restrict the set of complements through which the search can pass. She suggests that heads that block the path have a lexical feature [-LDD], meaning they do not permit long-distance dependencies. The final GF represents the target of the search. Both the path and the possible choices for the target GF can be restricted as necessary, to account for language-specific limits on relativisation.

Like co-head relations, functional uncertainty equations allow the unification process to be extended across many c-structural nodes. Each node must bear some form of annotation transferring feature specifications and constraints so that, as c-structural distance between a predicate and its argument increases, so does the number of features stored and exchanged, and so does the delay until unification can take place. Also, as with co-head relations, this delay arises entirely independently of any delay associated with inter-modular dependencies, or a hiatus in conceptualisation.

6.1.4 The Implementation of unification in PT

From this consideration of the contexts and processes in which unification takes place in LFG, we can readily deduce the procedural correlates of unification in Pienemann's processing model.

THE BASIC CORRELATES OF C-STRUCTURE AND F-STRUCTURE MAPPING

In the procedural grammar of PT, each c-structure rule is seen as implementing its own procedure. A node in c-structure is therefore a position in a procedural holder, and an annotation on a c-structural node, which adds a feature or specifies equality between mother and daughter nodes, corresponds to feature specifications stored at specific positions within a phrasal procedure. These positions must function as stores for features or constraints to be delivered to a subsequent procedure to which the current procedure is linked.

The correlate of *functional* structures in PT, where information is collated and compared, must be distinct memory stores associated with sets of procedures. In other words, there are (at least) two related sets of memory stores or 'knowledge' involved in constructing a syntactic structure: one set constitutes procedures corresponding to c-structural arrangements, another set services calculations or information transfer within and across those procedures. Each needs to be acquired in the process of SLA.

Unification processes in PT must access features from within each individual procedure and ensure their compatibility with other features contributed to the *same* memory store by sub-procedures and matrix procedures. The transfer of information in unification must pass from procedure to procedure in Pienemann's model, as it passes from node to node in the c-structural representations of LFG.

GF ASSIGNMENT IN PT

Despite these clear correspondences, Pienemann's implementation of GF assignment departs somewhat from the standard LFG account. In the standard account, as described above, a GF feature is associated with a given position in c-structure, and is added to any item inserted there. So, for example, a constituent becomes a Subject by virtue of its insertion in a particular position in S, and in endocentric structures, it becomes an Object by virtue of insertion in a position adjacent to V. In contrast to this, Pienemann suggests that "it is the categorial procedure itself that chooses its functional destination" (Pienemann, 1998c, p. 69), "only if the function *of the phrase has been determined* can it be attached to the S-node" (1998c, p. 80, my emphasis). In other words, in his model, GFs are assigned in the NP procedure that constructs the constituent, not in the procedure that receives that constituent. Pienemann even suggests that the S-procedure cannot be initiated except by a *Subject* NP.

There are two fundamental problems with Pienemann's proposals. Firstly, GFs are lexical features of *verbs*, not nouns, so an NP procedure cannot 'know' what GF to assign unless it communicates with a verb. This can only happen once NP enters a VP or S procedure, so GF assignment *cannot* be completed before that point. GF assignment *must* be a *consequence* of insertion in a matrix procedure, not a precursor to such insertion.

Secondly, Pienemann's suggestion cannot work for relative clauses and other structures where functional identity creates a gap. In these cases, two GFs are linked to a *single* constituent which, in a procedural grammar, can only be the product of a *single* procedure. The c-structural position normally associated with one GF contains no lexical content. Since phrasal procedures are initiated by heads, this means that no phrasal procedure has been initiated to produce output for the gap, and a GF cannot be assigned within a procedure that has not been initiated. Yet the associated GF is still assigned. Since Pienemann's proposal is clearly problematic, I adopt the LFG analysis henceforth.

6.1.5. The impact of unification on processing demands

Since the basic premise of PT is that processing demands arise from feature storage and delays in unification, and the number of features stored and the time for which they are stored clearly increases as unification spans greater and greater c-structural distances, the obvious conclusion is that processing demands increase with c-structural complexity. Though Pienemann assumes that storage due to purely *syntactic* dependencies is less taxing than storage due to inter-modular dependencies, he also assumes that it is the lack of automatic processing that taxes the novice processor the most. It is this which is said to force the novice speaker to use *conscious* processes, which may be so slow that information

necessary for unification is *not* made available within the active lifespan of a syntactic procedure, and it is this which gives rise to the link between processing complexity and emergence order.

Links between procedures within the syntactic processor need to be first acquired, then automatised, as much as any link between conceptual structure and the syntactic processor as a whole, the *processing demands* associated with unification *must* increase with the number of distinct unification operations *and* the number of c-structure nodes traversed, *whether inter-modular dependencies are involved or not*.

6.2 Abstract vs conceptual information

6.2.1 An inherent contradiction in phrasal agreement

It might still be argued that syntactic dependencies are still less taxing than inter-modular dependencies because the activation of lexemes during one iteration, and the availability of conceptual information to each facilitates the exchange of information in the syntactic processor. Effectively this is Pienemann's argument for distinguishing between so-called 'phrasal' and 'inter-phrasal' agreement. However, at this point an inherent contradiction becomes apparent between the assumption that phrasal agreement entails unification, and the assumption that features unified in phrasal agreement are delivered directly from conceptual structure to *each* phrasal procedure.

Obviously, if several procedures retrieve values for the same feature from the *same* iteration of conceptual structure, the values cannot possibly differ, so unification would be unnecessary. Since unification *is* deemed necessary in phrasal agreement, it must be the case that some procedures do *not* successfully retrieve the information they require from conceptual structure, whether the information is represented there as they are activated or not. In fact, this is why Num features of Adj and N are represented differently in LFG, as described above.

In PT terms, a noun's categorial procedure may seek out information about number from conceptual structure, but an agreeing adjective's categorial procedure contains only the *abstract* specification of a value for number with which it is compatible. Whether this value is compatible with the current *conceptual structure* or not, can only be determined once Adj is inserted at a specific c-structural node, corresponding to a specific position in the holder of an AdjP procedure, which determines which features of Adj should be communicated outside AdjP, *and* after the product of that AdjP procedure has been delivered to another procedure in which features contributed by N are made available. In other words, the feature values of the selected noun become available only after the noun and the adjective have formed a *syntactic* relationship.

Moreover, the *categorial* Adj procedure which adds diacritic feature values to lexical Adj cannot be concluded until it receives information returned to it from the *NP* procedure. This is precisely analogous to the kind of delay that Pienemann describes in Subj-V agreement, where the diacritic features of a Subject NP cannot be delivered to the categorial V procedure. Though the source of delay

in inter-modular and syntactic dependencies may be different, the procedural consequences are essentially identical; the activation of two lexical items during the same iteration does not bestow the kind of procedural advantage that Pienemann suggests. In fact, even once the relevant links have been acquired, and have become automatic, procedural delays must still arise because the Adj procedure *cannot* retrieve all information relevant to its selection directly from conceptual structure.

This calls into question the validity of the distinction between phrasal and inter-phrasal processing, and hence the validity of the proposed boundary between developmental levels three and five in PT, as well as the transitional level four.

6.2.2 Abstract information in phrasal procedures

Not only is the delay in unification of Adj-N agreement comparable to that in Subj-V agreement, so is the kind of information transferred. The discussion above has made it clear that phrasal agreement between Adj and N (or other items within nominal structure) involves specifications of information precisely comparable to those involved in Subject-Verb agreement. Lexemes like adjectives do not (necessarily) express values for features like number and gender; they express a constraint equation referring to *permissible* values for a specific c-structural node. These are syntactic abstractions reflecting *lexical* choices and distribution constraints in *linguistic* output; they are not semantic information of the type that we'd expect to find in a conceptual proposition about an event or state of affairs in the real world.

THE LINGUISTIC DEFINITION OF FEATURE TYPES AND VALUES

In addition, even when features like gender and number are expressed by nouns, they are only loosely related to events, or entities in the real world, or propositions in conceptual structure. As discussed above, the classes to which nouns can be allocated are defined by the linguistic system and vary from language to language, and the membership of a given noun in a given class is often arbitrary. This means gender features do not encode actual features of actual entities as they are instantiated in pre-linguistic conceptual structure; they encode the membership of lexical items in abstract and arbitrary linguistic classes. In Pienemann's Leveltian model of linguistic processing, the lexicon belongs clearly in the linguistic domain, not in the conceptual domain; lexical items *respond* to conceptual structure, they do not embody it.

Thus even the *semantic* information exchanged in phrasal agreement is not necessarily derived from conceptual representations; both feature label and value are abstract and arbitrary, with only a loose relationship to any specific semantic conceptualisation.

THE SIMILARITY OF ADJ-N AND SUBJ-V AGREEMENT

Not only are Adj-N and Subj-V agreement similar in terms of the delays in unification incurred and the kind of information transferred, they also involve the same mechanisms of feature transfer. In recent LFG analyses, both Subj-V and Adj-N agreement are seen as arising from GF assignment,

because each partner in these agreements has a different categorial feature, and expresses its own PRED value. On the other hand, *both* Aux-V agreement *and* Det-N agreement can be handled via a co-head relation, because Aux and Det are assumed to have no PRED value and I and D are viewed as functional variants of the categories V and N respectively.

This grouping of Subj-V with Adj-N agreement and Aux-V with Det-N agreement contrasts markedly with Pienemann's assumption that Adj-N and Det-N agreement are both 'phrasal', while Subj-V and Aux-V agreement are both 'inter-phrasal'. This is a clear indication that the developmental levels of PT are not as closely related to the generative theory of LFG as they could be.

6.2.3 Abstract information in categorial procedures

A similar problem arises with respect to the distinction between phrasal and categorial processing. In Chapter Two it was argued that the initial absence of lexical inflections in SLA can only be explained as a consequence of the lack of categorial procedures as Pienemann suggests, if the information encoded by lexical inflections *is added during* categorial procedures. This means it must be deposited into categorial procedures from conceptual structure or elsewhere. Recall that Pienemann and Hakansson's classification of the Swedish definite enclitic *-en* as a lexical morph entails that pragmatic information about the level to which a referent is activated in the mind of an interlocutor is also deemed to be delivered to categorial procedures, though according to Pienemann, it is *not* part of the conceptualisation of an event.

The discussion above now makes it evident that categorial procedures must also perform unification: only lexemes of a specific category can access a given categorial procedure, so categorial procedures must access and verify the categorial features of lexical items. Categorial features are as abstract as any involved in phrasal or inter-phrasal agreement, or in GF assignment. They do not encode conceptual or semantic information; they simply reflect the set of procedures to which a given lexeme has access in the syntactic processor. These points plainly negate the claim that no syntactic information is deposited in categorial procedures and therefore negate the suggested distinction between categorial and phrasal levels of development.

6.2.4 Licensing and iteration effects in the SOP

The distinctions between developmental levels three, four and five are also worthy of closer attention. Recall that level four is a transitional level between phrasal and true sentential processing where supposedly advanced processes can be performed only in peripheral positions, because these are salient. Pienemann exemplifies this stage with a discussion of Do-fronting, TOPI and ADV in ESL as outlined above, and suggests that the initial position in the structure described by (R1), repeated below, is made available to more types of constituents as more constraint equations are added.

(R1) S → (V_{aux=c'do'}) NP_{subj} V (NP_{obj}) (ADJ) (S) (Pinker, 1984, p. 278, as cited in Pienemann, 1998c, p. 173-4).

Recall also that the two NPs and V are held to be positioned by the SOP. Since agreement between constituents derived from different iterations is a level five process, not only is there no Subj-V agreement in this structure, the SUBJ GF has not been assigned either, and since the completeness condition forbids the non-assignment of a lexically specified GF, English verbs at this developmental stage must not include a Subj GF.

This seems to suggest that the significant development represented by do-fronting is the implementation of the licensing constraint on the initial position. However, licensing constraints must actually be assumed *whenever* word order can be described in terms of a fixed sequence of categorial types. This includes not only the phrasal c-structure rules allocated to level three, but also the categorial and SOP procedures of level *two*. The categorial procedure grants access to just one lexical category, and the SOP orders three items on the basis of their *lexical categories*. The latter clearly requires the ability to implement a constraint equation even in a *medial* position.

Not only does the SOP implement local licensing in non-salient positions, it also handles iteration effects. Since all propositions are assumed to be divided into two conceptual iterations, *any* procedure that constructs a complete proposition must deal with delays caused by inter-modular dependencies. This includes the *earliest* procedure, the SOP. The categorial and semantic features of nouns that determine their position relative to V in the SOP must be stored while the verb is being retrieved, or vice versa. In short, the SOP *already* performs the basic functions of sentential processing. The ability to license distinct positions in a procedure fed by two iterations and feeding the articulatory system is among the *earliest* syntactic abilities to emerge, not the latest.

Since neither GF assignment, nor inter-phrasal agreement are involved in Pseudo-inversion, and since the implementation of licensing constraints even in string medial positions, and the handling of delays due to inter-modular dependencies are not new, it must be some other fact that accounts for the emergence of Pseudo-Inversion later than the emergence of phrasal NPs in ESL.

What does set these structures apart from the level three SOP is simply the addition of an initial AUX node, a *purely lexical and c-structural development*. More specifically, what this entails is that the lexeme 'do' now has a categorial feature [\pm Aux] which initiates a procedure different from the SOP (and from VP for which there is, as yet, no evidence). That procedure is very *like* the earlier SOP procedure in that it accepts input from a categorial V procedure *and* from the phrasal NP procedure, but it does not rely on thematic and categorial information alone to determine word order. What is really involved then is the elaboration of a *lexocentric* procedure that orders three items in a flat structure, into two or three *endocentric* procedures with procedural dependencies between them. One is the NP procedure, and this feeds what is technically now a VP procedure that accepts *lexical* input only from a *categorial* procedure, i.e. that initiated by lexical V. The third is a new and distinct procedure that accepts input of + Aux items from the categorial V procedure *and* input from a lexical VP/SOP procedure.

In short it appears to be a difference in internal c-structural complexity and a *quantitative* difference in the *number* of unification processes performed, that makes Pseudo-inversion emerge a little later than phrasal nominals. It is not a *qualitative* difference in the type of operations performed or the type of procedure that is involved, and the development has no relationship at all to *intermodular* dependencies.

6.2.5 C-structural complexity is more significant than iteration effects

To sum up, licensing, overt and covert agreement, and GF assignment all involve unification and hence require information to be transferred. LFG includes a number of related mechanisms by which features can be transferred across varying c-structural distances, and in general, the amount of information transferred increases as a function of that distance. Though PT is based on the assumption of a link between feature transfer and emergence times, Pienemann acknowledges the relevance of licensing and GF assignment only sporadically, and the relevance of c-structural complexity is scarcely acknowledged at all. None of these factors inform the definition of developmental levels in a consistent manner. There are clearly cases, like the emergence of pseudo-inversion in ESL, where emergence time appears to be associated with increases in c-structural complexity or syntactic dependencies and in the number of unification processes performed, not with new types of processes or with inter-modular dependencies.

Finally it has been argued that the need for unification of features activated during one iteration, means that conceptual information is not delivered directly to all categorial procedures, so simultaneous activation actually bestows no clear procedural advantage in terms of accessing the feature values necessary for unification. This means there is in fact no theoretical basis for the boundaries between the notional developmental levels 3, 4, and 5, or phrasal, simplified sentential and true sentential processing respectively. To the extent that incremental advances do seem to exist, they appear to reflect c-structural elaboration and total processing demands, not qualitative differences between types of procedures.

6.3 A revised framework: from local to long-distance relations

It is now apparent that the developmental levels of PT are not as directly associated with advances in processing demands as they initially appear to be. On the one hand, even the *earliest* productive procedure, the SOP, copes effectively with inter-modular dependencies, and implements licensing constraints, and on the other hand, information from a single iteration is not made available to all active categorial procedures, it can be accessed only via syntactic connections. This means feature specifications at the so-called Categorial stage are already as abstract as any transferred in Subject-Verb agreement, and that abstract information must be stored within the syntactic processor *whenever* feature unification *of any kind* occurs. Since the information required for licensing and phrasal agreement is *not* taken directly from conceptual representations, categorial and phrasal procedures must be *syntactically*

dependent on each other, just as the VP procedure is dependent on the Subject's NP procedure in inter-phrasal agreement.

This means the significant difference between phrasal and inter-phrasal processes is *not* related to a distinction between abstract or syntactic and conceptual structure or to the involvement or otherwise of iteration effects. It must be related to syntactic and/or morphological factors: syntactic dependencies relating to the elaboration of c-structure, and the acquisition of appropriate lexical features.

Clearly, the factors that contribute to increases in processing demands need to be defined in a more consistent and theoretically motivated way. This section outlines some general principles based on the discussion of unification above, by which the different processes involving unification might be related to emergence orders.

6.3.1 Developmental dependencies

LICENSING BEFORE AGREEMENT

Firstly, as outlined above, licensing, agreement, co-head relations and GF assignment, and functional uncertainty equations each involve somewhat *different steps* up to the point where unification can occur. In addition, each process actually entails one or more of the processes before it. Local licensing, such as that required to impose the stable constituent order evident in the earliest stages of SLA, involves unification of one or more lexical features with *invariant* values stored in a procedure; agreement or lexically specified collocation constraints, such as those between French Adj and N or Mandarin Classifier and N, involves unification of two or more values for the same feature, each contributed by *independent* lexical heads, *as well as* the transfer of the relevant feature specifications from node to node in c-structure, according to annotations stored at each c-structural node. As annotations stored at c-structure positions are a constant part of a c-structure rule, they apply whenever that rule is employed. Annotations at a given node will copy features specifications from, restrict the features of or assign features to whatever item is inserted there. However, the instructions at a given node will lead to *successful* unification only when *appropriate* lexical items or categories, with appropriate feature specifications are inserted there. This means, ideally, annotations relevant only to a specific feature or specific lexical item, should be expressed in positions to which only the appropriate item can gain access. Likewise annotations relevant to a *category* should be expressed at positions restricted to that category. It follows that c-structural annotations implementing agreement relations are unlikely to develop until constraint equations which limit access to specific nodes are already functioning.

AGREEMENT BEFORE GF ASSIGNMENT AND CO-HEAD RELATIONS

Assignment of an Adjunct GF is comparable to an agreement process. First it involves a search for a feature-set containing a particular feature type: a Pred value; then it involves the addition of a feature to a specific feature-set: the GF feature.

However, assignment of a lexically licensed GF, like SUBJ or OBJ requires the additional step of unifying the GF assigned in c-structure with one specified in the lexical structure of a predicate. This of course depends upon the prior development of a (minimally) phrasal procedure in which the relevant GF is stored, ready to be assigned. In fact, because the coherence and completeness conditions entail that no GFs can be lexically specified until the phrasal procedures that assign each GF have developed, and the unification process that matches lexical and structural GF in f-structure can be performed, all GF assignment must develop relatively late, and the lexical and procedural annotations of GF features must develop together.

Co-head relations also depend upon the ability to transfer more than one feature between separate nodes, and to check for PRED values and generally unify several features at once.

FUNCTIONAL UNCERTAINTY

Finally, argument sharing licensed by functional uncertainty equations maps GFs to other GFs or to DFs. Therefore it cannot emerge until GF features are already active. The resolution of functional uncertainty also depends on the development of an appropriate path equation. Initially this may be a local equation appropriate to just one structure and fully specified within a single procedure.

AN IMPLICATIONAL HIERARCHY OF PROCESSING CAPACITIES.

The developmental dependencies between these different ways of forcing unification create a natural implicational hierarchy of processing capacities. No process in the following sequence can be performed until the preceding process has been mastered:

local licensing > agreement > GF assignment / co-head relations > resolution of functional uncertainty.

Interacting with this implicational hierarchy is variation in c-structural complexity and the richness of lexical F-structure.

6.3.2 Interactions with c-structural complexity

Processing demands for a given structure will depend in part on which of the preceding relations it entails, but also in part on the syntactic distance across which the relationship is sustained. To some extent these appear to be correlated, but aspects of lexical structure and classification, and the nature of language-specific c-structure rules also shape the choice of mechanism by which unification is imposed. A co-head relationship requires all features of two items to be shared, but this entails unification only if they happen to express some of the same features independently. On the other hand, GF assignment involves sharing just a selected sub-set of features, but it entails unification of two GF features in every case. In endocentric structures, the expression of different categorial and PRED values makes it impossible for two items to enter a co-head relationship, since these values could not be unified if they were attributed to the same functional constituent. However lexocentric structures do not impose fixed functional relationships on items on the basis of their c-structural relationships.

As long as lexical and constituent structure are both simple, the co-head relation will be easier to process than GF assignment, but as lexical feature structure becomes richer, intermediate levels of structure develop, and syntactic dependencies increase, so the implementation of co-head relations should become rapidly more taxing, and the selection of *specific* features for unification should become relatively more economical of storage resources.

At the same time, as structures become more endocentric, a consequence of the development of distinct procedures activated by distinct categorial features, so co-head relations must develop to transfer features as required from lexical head to procedural holder to matrix procedures. Since this involves multiple unifications for one lexical item, functional co-heads won't generally emerge until after some more minimal and local agreement relations have appeared.

However it is implemented, the demands associated with unification will increase as the number of lexical items in a structure increases, and c-structures become increasingly hierarchical. The first increases the number of features needing to be unified, the second increases the number of syntactic dependencies, or nodes across which feature specifications must be transferred.

6.4 Conclusions: Outside-In development

6.4.1 Conceptual divisions less significant than c-structural complexity

In conclusion, Processability Theory relates processing demands in principle to the need to store and exchange syntactic information, but the standard six-stage model of development that is typically presented as an overview of PT emphasizes demands associated with divisions of *conceptual* organisation, and the development of Subject-verb agreement, at the expense of demands associated with c-structural complexity and covert syntactic relationships like licensing and GF assignment.

We have now seen that, in fact, the ability to cope with iteration effects and implement licensing constraints are already entailed by the very first organisational process posited for learners, the SOP, and what really makes the phrasal and sentential stages increasingly more taxing is the elaboration of *intermediate* levels of organisation, which increases syntactic dependencies.

6.4.2 Developmental and procedural dependencies in unification

We have also seen that unification processes can be divided into several categories in terms of their overall function: licensing, agreement, the creation of co-head relations, GF assignment, and resolving functional uncertainty, and that a relationship of developmental dependency exists between these functions: each entails the previous process, and cannot emerge until that process has been mastered.

In addition there are procedural dependencies involved in any instance of unification, and these increase with c-structural complexity. In particular the relative costs of co-head relations and GF assignment will depend to a large extent on how many features are exchanged between co-heads and

how many c-structural nodes, *and types* of c-structural annotations are involved in the chain that forces unification to occur.

Overall, agreement involving Adjuncts is marginally less demanding than agreement involving obligatory GFs (and thematic arguments), or co-head relations because the Adjunct GF need not be lexically licensed, it can be assigned immediately to any constituent with a PRED value, assuming any constraints in terms of other agreement features are also met.

Lexically licensed GF assignment may be less demanding than agreement mediated by co-head relations, because the former can limit the number of features being unified. On the other hand, it may be more demanding in terms of the number of procedures it traverses. Where lexical f-structures themselves are not complex, co-head relations may be relatively undemanding.

Finally, we have seen that unification is required even when there is *no* morphological *agreement* simply to satisfy the completeness and coherence conditions. In fact, assignment of a Subject GF is the functional equivalent of Subj-V agreement and, by analogy, so is the assignment of any GF in a constituent outside that in which the licensing predicate is found. Argument sharing, as in RC structures is more demanding still.

6.4.3 Syntactic development: outside-in, not bottom-up

Overall then, it is not the case that acquisition proceeds from categorial through phrasal to sentential procedures in a process of bottom-up development. Rather, it proceeds through the development of *intermediate* levels of organisation, in a process of outside-in analytic elaboration and increasing functional versatility. This means categorial procedures are less taxing than phrasal ones, not because the former involve *no* syntactic information exchange, but because they involve *less*; they implement only a single local licensing constraint, while the latter may implement several constraints and must also manage unification processes across multiple procedures. It is a difference of degree, not a difference of kind.

In general terms, it is clear that the progression in Mandarin SLA described in the preceding chapters, from early quantity expressions and associative structures to later locative structures, to combinations of modifiers and quantifiers can be understood in part as a progression from structures where no GFs or Adjunct GFs are assigned, to ones where obligatory thematic GFs are assigned and agreement is implemented over increasingly longer linear distances. If we assume that learner phrases are endocentric, longer linear distances equate to some extent to longer c-structural distances.

However, certain aspects of the emergence order reported in Chapter Five remain to be explained. For example, why do incorporating locatives, locative de structures and RC structures, all of which should involve GF assignment have such different emergence times? And why does 'AdjP' which in TL terms is also a kind of RC structure, emerge so early?

To confirm the validity of the general proposals made above, and to account for these apparent divergences from what is predicted, a more careful analysis of each IL structure is required, to

determine the kind of unification processes involved and the syntactic distances across which unification takes place in each. Only then can processing demands be assessed with a sufficient degree of precision to differentiate between these 'phrasal' structures.

This brings us to a new problem standing between the data and an assessment of processing demands: the problem of structural indeterminacy.

6.4.4 A new problem: Structural indeterminacy

Neither the lexical structures nor the constituent structures of an IL grammar are necessarily identical to those of the TL. They must be ascertained through a process of analysis, starting from IL utterances. In analysing learner languages, the usual diagnostics for constituency - movement, coherence, and substitution- are available to some extent, as shown in the analysis of IL output discussed in Chapter Five, but they are also limited by the fact that grammaticality judgements are not available, learners are passing through stages where word order is relatively fixed, semantic coherence is unavoidably influenced by assumptions about a learner's *intended* meaning, and in any event, its relationship to c-structure is not entirely clear. Observations of repair and context can give some indications of what learners view as coherent units, but such units are still open to interpretation as either a series of positions in one lexocentric structure, or a series of sub-constituents combined by way of several procedures.

Moreover, neither PT nor LFG places any constraints on possible lexical or constituent structures. Though Bresnan (2001) suggests that endocentric phrases are the unmarked choice in *mature* languages, she also allows that lexocentric structures are possible, and a single linguistic system may combine the two. The SOP procedure of PT, like the CWO stage of the multi-dimensional model before it and Bever's NVN strategy before that, all reflect observations made repeatedly in many previous studies of language development, that early structures are flat, like lexocentric structures, with little or no internal organisation, so if endocentric structures are the unmarked norm for mature languages, SLA must involve the development of endocentric structures out of lexocentric ones.

However, LFG also deems all c-structural nodes to be optional, with economy favouring the 'pruning' of any nodes that are not required in a given structure. This means underlying 'rules' may be only loosely related to what is realised on any given occasion. The only requirements are that uniqueness completeness and coherence are satisfied, but, as we have seen, this can be achieved in numerous ways.

In the standard six-stage model of PT, it matters little whether an article or modifier is contained directly by NP, within a phrase within NP, or heads a phrase that contains NP, because in any case the product will be classified as phrasal if the two items can be shown to occur separately. But if, c-structural complexity contributes to processing demands, as now seems likely, the assumption of lexocentric vs. endocentric structures could have significant consequences for processing demands. This means ultimately, processing demands cannot be assessed unless relationships between the lexical

feature structure of lexemes, the phrase-structure of constituents and the linear order of words in utterances are subject to some theoretical constraints. Though LFG assumes no such constraints, the MP assumes nothing else.

The basic claim of minimalism is that economy restricts the choice of possible derivations for any given sequence of words to just one, and this means that, in principle methodical choices can be made in a minimalist framework, between alternative analyses for the same IL string. The next chapter makes a critical evaluation of this claim and considers how it might allow us to determine the lexical and constituent structures of the learners' systems, and hence to calculate the processing demands associated with the structures they produce.

Chapter Seven: Structures and Processing Demands

“Acquiring a language involves at least selection of the features [F], [and] a one-time operation that assembles elements of [F] into a lexicon *Lex*.” (Chomsky, 2000, p. 100)

“State changes, of course, may modify the lexicon.” (Chomsky, 2000, p. 142, Note 27.)

7.0 Introduction

In the last Chapter I argued that an assessment of processing demands within a PT framework depends upon the prior determination of the c-structures and lexical f-structures that a learner's IL instantiates. However, LFG does not constrain lexical structures at all, and allows both lexocentric and endocentric c-structures, as long as universal constraints on feature unification are ultimately satisfied. This raises the question of how IL lexical and constituent structures can be determined so that processing demands can be assessed. This requires a theory that constrains the possible underlying lexical and constituent structures for a given surface structure or utterance, and relates them in explicit ways to observable characteristics of utterances. The MP represents attempts to construct such a theory. As outlined in Chapter Two, the MP is based on the premise that c-structures are rigidly constrained both in terms of what is possible, i.e. structures must be binary branching, and in terms of their relationship to lexical feature-structure, and derivational economy. It also holds that lexical F-structure can be determined by empirical observation. This chapter explains how minimalist assumptions allow us to determine IL F-structures and c-structures on the basis of IL data, and then presents conclusions about the relative processing demands of IL nominal constituents, based on that analysis. Detailed analyses of IL F-structures and c-structures are presented in Appendices J and K.

Section 7.1 addresses the issue of lexical F-structures. First it reviews the link between these and constituent structures in a minimalist framework. It points out that c-structure depends in large part on which of two lexical items (LIs) projects during merger to become the head of the resulting syntactic object (SO), and argues that it is theoretically more economical for the item with more unvalued features to project. On this basis, the c-structure of a constituent can be determined entirely by reference to the lexical f-structures of the items it contains. This section then reviews minimalist constraints on *possible* lexical feature-structures and describes the methodology used to determine the feature structures of the IL lexical types described in Chapter Five. Finally it presents the results of that lexical analysis, which are summarized in Table 26 (page 150). Theoretical issues relating to the link

between lexical and constituent structure in the MP are discussed in more detail in Appendices G - I. The analyses of IL F-structures are discussed in Appendix K.

Section 7.2 addresses the question of IL constituent-structures. Firstly it outlines the methodology by which IL c-structures were determined, then it describes the emergence order of IL nominal structures in terms of underlying c-structural developments. Diagrams of all relevant IL c-structures are presented in this section, as well as in Appendix K.

Section 7.3 discusses the processing demands associated with the productive IL constituents discussed in Chapter Five. First it presents an overview of the different factors contributing to processing demands according to the MP; then it explains how processing demands were quantified for each IL structure, and summarizes in tabular form the specific processing demands associated with each structure. It then presents the results of the corresponding analysis according to Processability theory. This includes a classification of structures by developmental level according to the standard PT view, and a classification based on a refined PT which takes account of developmental dependencies between different types of unification processes and c-structural complexity. The determination of processing demands from each perspective is discussed in detail in Appendix L.

Section 7.4 presents the results of statistical correlations between emergence orders and rankings of processing demands according to each of the theoretical models discussed previously. The implications of these results are discussed in the next chapter.

7.1 Determining Lexical F-structure

7.1.1 How lexical features constrain c-structure

Where LFG allows that syntactic structures may be either lexocentric or endocentric, with the latter being the unmarked choice, the MP assumes that all syntactic structures are endocentric *and* binary branching, i.e. formed by the merger of just two items at a time. Moreover, in the MP there are just two factors that determine which items are merged as heads, which as complements, and which as specifiers: firstly the order in which LIs are selected to merge, and secondly the choice of projector in each instance of merger. The order of mergers is determined in turn by an economy condition, maximal match: two items in a numeration will merge only if they share more lexical features with each other than either shares with any third item. Whichever item of a pair projects becomes the head, and the other becomes either its complement, or, if the head has projected before, its specifier. A lexical head can project only twice; a functional head can project at most three times, with the third projection being licensed by an EPP feature, and associated with athematic elements or with movement.

The choice of projector however, has not been previously related to economy conditions; it is simply stipulated. Chomsky stipulates firstly, that “ θ -structure and similar semantic roles are based on pure Merge of XP to substantive LIs or their projections” (Chomsky, 2000, p. 127) and secondly that “phases are configurations of the form F-XP, where XP is a substantive root projection, its category

determined by the functional element F that selects it” (Chomsky 1999, p. 11). ‘Pure merge’ means merger without movement; an argument must merge with the head that assigns it a θ -role before it merges with any other head. Together these two stipulations allow substantive heads to project and assign a θ -role to constituents that merge with it, and allow functional heads to project when they attract a substantive, and also to assign theta-roles inherited from that substantive, along lines proposed by Hale and Keyser (1993; 2002). (See Appendices G and H for discussion of thematic role assignment in the MP.) Given the lack of categorial features in the MP, Chomsky’s reference to the determination of a substantive’s ‘category’ must be understood as a reference to the way functional heads attract substantives with a specific *mix* of lexical features most similar to their own. In other words, ‘categories’ are an epiphenomenon of more complex feature-structures. (See Appendix G for a discussion of selection as a response to combinations of lexical features.)

Chomsky also stipulates that upon merger of an adjunct, the “adjoined element α leaves the category type unchanged: the target β projects” (2000, p. 133). Actually, assuming modifiers are substantives, this follows from the first two proposals. The substantive modifier cannot merge with a lexical head, as it is not a thematic argument; therefore it must be selected by a functional head, the ‘target β ’. Since functional heads do not generally have denotations that can be semantically modified, that functional head must have previously selected the substantive to be modified as its complement. Thus modifiers are actually specifiers of functional heads (and see Kayne (1994) and Cinque (1999) for similar conclusions based on logical and empirical evidence respectively).

All three stipulations add up to the same structural arrangements proposed by Grimshaw (1998) and implemented in LFG by Bresnan’s Endocentric Mapping Principles (Bresnan, 2001). As noted above, the main difference is that the MP takes such endocentric structures to be universal, whereas Bresnan takes them to be only an unmarked choice and allows that lexocentric structures also may occur. Another difference touched on below is that LFG allows phrases with specifiers but no complements; the MP does not.

Though these stipulations account for projection in thematic relations, in the selection of lexical heads by functional heads, and in modification, they still do not account for all cases of merger. Within nominal constituents there are elements which are not easily classified as either functional or substantive, and pairs of collocates whose relationship is neither that of a predicate and argument, nor that of a modifier and modified item. For example a number and a classifier have semantic denotations comparable to those of substantives, but syntactic licensing functions comparable to those of functional heads. They are not clearly related to each other as either predicate and argument, or modifier and modified, and yet their collocation is in many cases obligatory, and in others proscribed (see Appendix A). Thus it is not clear from the stipulations, which of the two, if any, should project to merge with the other. The lack of clarity on this point is very evident from the controversy over the

proper analysis of Mandarin nominal structure generally, and of the structural relationships between numbers, classifiers and a putative head 'D' in particular (see Appendices A and F).

Moreover, the stipulations proposed above do not relate projection to issues of economy or lexical feature structure as a true minimalist account should do. Unless we can explain the choice of projector on the basis of economy conditions and/or lexical F-structure, those factors alone will be insufficient to determine constituent-structure, and the accurate calculation of processing demands will still be impossible.

THE COST OF PROJECTION

Fortunately, a little thought makes it evident that the ability to project can be readily related to economy. Because a complement spells out to PF only at the end of the second strong phase after it is merged (Chomsky, 1999), each additional projection by the head that first selects it, delays the point at which it can spell out, and any such delay is a violation of the basic economy principle ASAP. ASAP requires features to be spelt out as soon as possible.

Ideally then, though some projection is obviously inevitable if SOs are to be formed, it should be kept to a minimum. In addition, an item clearly must *not* project if the merger that ensues will value its *last* unvalued F. This is because SOs are only visible to each other and to the computational mechanism, as long as they have an unvalued F. An SO whose periphery is fully valued will be unable to attract another SO, and so unable to merge further, wasting all the derivational effort that went into constructing it.

Finally, since the mechanism cannot look ahead, the choice of projector must be made on the basis of local probabilities: the item of a pair that projects should be the item that has more unvalued F. This leaves it free to merge *and* project again if necessary, while maximizing the chance that the *non*-projecting item will be fully valued and spelt out ASAP.

Since we can account for projection purely on the basis of lexical F-structure and economy, and since these factors also limit the extent to which LIs can move after they are merged, the MP does allow us to ascertain IL c-structures on the basis of IL lexical F-structures.

THE NATURE OF THE MINIMALIST LEXICON

According to Chomsky (1999), the distribution of features across LIs is open to empirical investigation. Before considering exactly *which* empirical observations allow us to ascertain lexical F-structure, we must consider the nature of lexical items in the MP generally. In the MP, the lexical items that enter a numeration are not the same as the prosodic words that occur in output. Firstly, every LI in the lexicon must include at least one unvalued F, but no LI in output can still retain an unvalued F. Missing values are added in the course of a derivation, and this prompts Chomsky to propose a 'Bloomfieldian' lexicon (Chomsky 2000) which contains only word-roots and idiosyncratic features, alongside a distributed morphology (Halle and Marantz, 1993) whereby phonemic values are mapped to abstract syntactic feature values, after syntactic computations are complete (Chomsky 2000, p. 119).

Thus LIs in the minimalist lexicon include a specification of feature *types* some of which are without feature *values*. In particular, items in the lexicon may have incomplete or entirely absent *phonemic* specifications.

Secondly, Chomsky says that “acquiring a language involves at least selection of the features [F], [and] construction of lexical items *Lex*” (Chomsky, 2000, p. 100). Selective construction clearly allows the possibility that lexicons will vary from language to language. In fact, assuming that languages *do* select features from a universal pool, it would be very surprising indeed if they all selected the *same* lexical features and constructed the same type of LIs.

Empirical evidence suggests that LIs do indeed vary in their F-structure from language to language. For example, some languages have classifiers, a lexical category largely missing from the Indo-European inventory; Germanic and Romance languages have articles, which Sinitic languages generally lack; and Silvar-Villar and Gutierrez-Rexach (1997) argue that the different positions of nominals relative to complementisers in Spanish, French and German can be explained by the fact that the complementisers in each language actually have different lexical feature-structures. They are all examples of ‘C’ in the sense that they all share some feature which makes them attractive to Tense, but they are not identical clusters of features in each language.

However, Hale and Keyser (2001) argue that if lexical items are classified in terms of their ability to project syntactic phrases on the one hand, and on their thematic structure on the other, there are basically just four logically possible types of LI: those which have semantic arguments and can project; those which have *no* semantic arguments and cannot project; those which project but have no semantic arguments; and those which have semantic arguments but cannot project. Prototypically ²²these correspond to English Verbs, Nouns, Prepositions, and Adjectives respectively. Different *concepts* may be mapped to each lexical type in different languages, but there are only these four basic choices for lexical structure. In this view, cross-linguistic similarities in distributional classes are simply a consequence of the small number of *possible* lexical types; languages tend naturally to exploit them *all*, though in different ways and proportions.

However lexical items are constructed, Chomsky suggests that the process of constructing them is a ‘one-off’ process (Chomsky, 1995), though he qualifies this by noting that: “L[anguage] is a state of FL [the faculty of language]; state changes, of course, may modify the lexicon” (Chomsky, 1999, p. 42, Note 27). Since actually, lexical acquisition continues all our lives, it is *each individual LI* that is constructed only once, and it is derivational processes- syntactic and phonological processes - that cannot alter the form stored in the lexicon. Lexical change actually involves *replacing* or *supplementing* an old item with a newly constructed item.

²² There are exceptions, for instance predicate nouns have semantic arguments; nonetheless in this framework they must belong to one of only two types: projecting or non-projecting. Later this will be relevant to the discussion of special characteristics of Mandarin locative nouns.

This has implications for the way we must understand apparent variation in the distribution and interpretation of a single word-form in a given sample of an IL. Any one phonetic form that *seems* to be mapped to different f-structures in different contexts must actually arise because the lexicon contains *two* LIs that are phonetically identical, or because the syntax sometimes adds a *covert* LI with its own particular features to an overt LI, creating a single *prosodic word*, whose distribution differs from that of the overt LI on its own. Though syntactic derivations cannot construct new *LIs* stored in long-term memory, they can combine *separate* LIs into one *ad hoc* prosodic word.

This process is evident from the combination of *overt* LIs. For example, from the MP perspective, a transitive verb-form inflected for tense contains at least three distinct LIs, functional T and *v*, and lexical V. T and *v* must be separate LIs because each deletes Case on a different nominal. As explained in Chapter Two, Case deletion is associated with the valuation of features of a functional head by a nominal argument. If two cases are deleted (Nominative by T and Accusative by *v*) T and *v* must each express their own *independent* set of ϕ -features (see Appendices G and H for more discussion of case and ϕ -features in the MP). A single LI can express only one value for each feature type that it contains, so T and *v* must be separate LIs. Lexical V is separate because it can occur without incorporating T or *v* e.g. in passive form, and it includes thematic structure which T and *v* both lack.

Given all this, the analysis of constituent structures cannot proceed on the assumption that each *prosodic* word in an IL utterance is a single LI in the underlying IL lexicon. Rather, each prosodic word must be submitted to analysis to ascertain how many lexical features and distinct abstract LIs it contains. Only then can constituent structures be determined by reference to the operation of economy constraints on combinations of the F-structures of individual lexical items.

7.1.2 Economy and Lexical Structure

Fortunately, the proposal that projection is determined on the basis of lexical feature structure also has some useful implications for the nature of the lexicon. Since the only objects visible to the computational mechanism are those with at least one unvalued F, since pairs of items are selected for merger on the basis of maximal match, and since a projector is selected on the basis of the number of unvalued F each selected item has, it follows that pairs of LIs which complement each other perfectly, which do not match at all, or which have the same number of unvalued F, will all be useless to the computational mechanism. The first will make each other invisible to further operations, the second will be unable to merge, and for the third there will be no unique choice of projector. From this it follows that the ideal *workable* lexicon is one that consists of a continuum of lexical types where each type is maximally matched to, but *minimally distinct from* just one other type. LIs forming such a lexicon will naturally also form stable endocentric c-structures, based on maximal matches and unequal numbers of unvalued F. (For a more detailed discussion of the optimal lexical f-structure see sections 5-7, Appendix I.)

With this in mind, we are ready now to consider how lexical feature structure can be ascertained from empirical evidence.

7.1.3 Determining feature-types and feature-status

Given the basic minimalist premise, that nothing is assumed that is not absolutely necessary, features must be *absent* from a given language unless there is good evidence for their presence. Such evidence consists of a) an overt reflex, b) regular variation in *interpretations* of the same form or c) regular variations in the *distribution of the same form*. The last two arise because of optionally valued covert features on the one hand, and optionally introduced covert lexical items on the other. As discussed above, since each LI is constructed only once, it cannot vary in its F-structure; if a single overt form *appears* to intermittently include some feature-*type*, resulting in alternative interpretations, this actually reflects the intermittent use of an optional covert LI expressing a feature-type related to the changing interpretation. Similarly, variations in the *distribution* of one overt form, relative to the same set of other forms, indicates the intermittent involvement of an optional covert LI motivating *agreement* relations that would not otherwise arise, and hence a distribution that does not occur when the covert item is absent. Variations in distribution associated with *no* change in meaning, indicate the involvement of a feature that has no semantic content, such as Case.

In short, the type and status of features, and the presence or otherwise of *covert* lexical items can be discovered by considering the interpretations of a given prosodic word in each of its contexts. Feature *types* are revealed by the *kind* of meanings expressed by a word-form in isolation, or recurring each time a word-form recurs. Feature *status* (that is whether a feature is valued or unvalued) is revealed by relationships between variations in distribution and variations in meaning.

Some aspects of meaning will be *invariant* regardless of a word-form's position relative to other word-forms; some will *vary* regardless of collocates or context of use; and some will *co-vary* with the choice of collocates. Respectively these variations reflect intrinsic interpretable features; optionally valued interpretable features; and uninterpretable features, valued through agreement.

7.1.4 Lexical F- structures in the ILs

By applying these principles of analysis to overt IL word-forms, the feature-structure of IL nominal lexemes can be determined. Such an analysis was performed on the seven types of LI described in Chapter Five, and the results of that analysis are summarized in Table 26 below. (More details of the methodology employed, and the analysis itself are discussed in Appendix J, including a justification of all the feature-structures shown in Table 26.) As a result of the lexical analysis of IL utterances, 12 distinct nominal types were identified, including bound and covert items: demonstratives, classifiers, pronouns, numbers, nouns, definite D, ordinal di, plural -men, the particle de, a genitive case assigner 'Poss', an indefinite head 'Mass', and a specific entity denoting head 'Person'.

Table 26 The Feature-structure of Nominal Lexemes in Mandarin ILs

Lexeme		Interpretable F	Uninterpretable F	Comments
Predicates	Verbs	[θ -FEATURE(s); TOPIC -]	[PERSON _; TAM _]	TAM = features that keep predicates active after ϕ -features are valued.
	<i>v</i>	[CASE ACC; TOPIC -]	[PERSON _; TAM _; θ _]	
Predicate <i>Nouns</i>	Kin-terms	[θ Kin; TOPIC -; GENDER Δ]	[PERSON _; TAM _]	
	Locative N	[θ domain, theme; GENDER Δ]	[PERSON _; REF _; TOPIC _]	Some locative nouns like <i>lǐ</i> 'inside' have interpretable REF
REFERENTIAL N	Generic N	[GENDER Δ]	[REF _]	
	Exceptional N	[GENDER Δ ; COUNT +]	[REF _]	Require no classifier in Numeric quantification
	Pronouns	[PERSON{1/2/3}; REF DEF; NUM {SG/PL}]	[TOPIC _]	
Demonstrative Pron		[REF DEF; DEIXIS +; LOC+; PERSON 3; GENDER β]	[CASE _]	The demonstrative pronoun is typically a Subject, hence activated by Case and extracted from VP.
Numbers	<i>yī</i> 'one'	[NUMBER SG; (REF INDEF)]	[COUNT _] and [PERSON _], or [TOPIC _] or [CASE]	the alternatives relate to different stages of acquisition:
	'plural' num; <i>jǐ</i> 'some'	[NUMBER PL; (REF INDEF)]	[COUNT _] and [PERSON _] or [TOPIC _] or [CASE]	Numbers express indefiniteness at least till the emergence of the ordinal marker.
<i>Classifier</i>		[COUNT +; REF 0]	[GENDER _] and [TOPIC _]	
<i>Demonstrative Det</i>		[REF DEF; DEIXIS +; LOC+; PERSON 3]	[COUNT _; TOPIC _]	Dem is weak and activated only by TOPIC; its incorporation with Num is phonological.
Bound morphs	<i>de</i>	[REF INDEF]	[TOPIC _; PERSON _; GENDER _]	a functional predicate
	<i>dì</i>	[REF DEF; COUNT +; PERS 1/2/3]	[NUM _; CASE _]	ordinal prefix
	<i>-men</i>	[NUM PL]	A lexical suffix, it is not syntactically active in the ILs	
Covert heads	Person	[PERS 1/ 2 / 3]	[GENDER _; REF _] and [TOPIC _] or CASE	Person is strong.
	Poss	[CASE GEN; TOPIC -]	[PERSON _; GENDER _]	The function of Poss is to deactivate all PERSON features of embedded arguments so that only the 'possessed' N enters agreement with the predicate that theta-marks the entire nominal.
	Mass	[MASS \pm ; REF INDEF]	[PERSON _; (TOPIC _)]	covert Mass is involved in modification of N, and in indefinite 'bare' NP
	D	[REF DEF]	[PERSON _; CASE _]	D is weak. The lack of a Topic feature means predicates that don't value Topic, like <i>zài</i> 'be at', can still select a DP argument

Numerals occurred in two sub-types, singular and plural, and nouns in four: locative and kin nouns (both semantic predicates), exceptional count-nouns (that require no classifier) and common generic nouns. There were also verbs, which functioned sometimes as modifiers within nominal structure, and sometimes as main predicates.

A total of ten lexical features were required to construct these 12 distinct nominal types: GENDER, NUMBER, PERSON, REF, COUNT, MASS, DEIXIS, LOC(ative) TOPIC, and Case, (along with thematic features related to argument structure that differentiate predicates from each other).

The five features GENDER, NUMBER, PERSON, REF and COUNT account for most of the distributional distinctions observed within the IL nominal constituents. However the features TOPIC and CASE proved significant in understanding the distribution of nominals within sentence structure, and the distribution of the arguments of nominal predicates, like locative nouns. In the IL system that emerged from this analysis, TOPIC and CASE function rather differently from the way they are usually thought to function in Indo-European languages. (See Appendix H for more detail).

The standard assumption is that extraction from VP is motivated by a nominal's need to delete Case, and that Case is deleted as a reflex of the nominal's contribution of ϕ -features to a functional head. Chomsky (1995, 1999) suggests that there are three ϕ -features, PERSON, NUMBER and GENDER, that these must be valued *simultaneously* in order to delete Case, and that each head can therefore delete Case only once. However, he also suggests, in his discussion of English expletive 'there' (Chomsky, 1995), that the only one ϕ -feature that is absolutely *crucial* to Case deletion is PERSON. (See discussion in Section Three, Appendix H.)

In analysis of the Mandarin IL data discussed here, it was determined that definite and indefinite nominals have different distributions relative to V just as they do in the TL (see Appendix A). The latter must follow V, while the former generally precede V, whether a second argument follows V or not (see discussion of definite and indefinite 'NP's in Section 2 of Appendix J). Since first merger is always as a complement, and complements always follow lexical heads in the Mandarin VP, it seems that definite nominals are generally extracted *out* of the complement of VP, to the periphery of VP, or beyond. Indefinite nominals on the other hand, remain in the complement of VP where they are merged. On this basis it was concluded that a) definite nominals express some unvalued feature type that indefinites *and verbs*, both lack. This makes indefinites a better match for V, so they merge as complements of V, leaving the specifier free for a definite argument. It was also concluded that Mandarin verbs are generally *strong*. This *forces* definite nominals merged in the complement of V to *move* to the *periphery* of VP so they can enter agreement with another head. (Pronouns and DemP are exceptions, to be discussed below.)

Since the standard assumption is that extraction from VP is motivated by Case, it was concluded that Mandarin V *cannot delete Case at all*; that any definite nominal that invariably precedes V in

Mandarin needs to delete Case; and that indefinite nominals remain in the complement of V because they do *not* need to delete Case. The only definite nominal invariably *forced* to pre-verbal position is the so-called definite 'bare NP'. It was concluded that this constituent includes the covert functional head D, which expresses unvalued Case; indefinite nominals exclude D, but include the functional head *Mass*, which does not express Case. (See discussion of extraction from VP in Section 4 of Appendix H.)

Pronominals and DemP are sometimes extracted out of VP, but they can also remain within the complement of VP. Hence they are not necessarily activated by Case themselves; they attract D, if it is in the numeration, because they share the [REF DEF] feature with D.

The involvement of a feature called TOPIC is related firstly to the need to keep indefinite arguments, pronouns and DemP visible until they merge with a predicate, without assigning this function to Case. Since different nominal arguments can potentially *contribute* GENDER, and NUMBER features to V, nominals cannot generally be *activated* by unvalued tokens of these types. In the TL, PERSON is also clearly excluded by the existence of arguments that lack this feature altogether. This is evident from limited cases where *indefinites* are extracted out of certain VPs (Li, 1999a). Extracted indefinites are always non-specific quantity-denoting expressions, rather than specific entity-denoting expressions, and occur only with Q-predicates, i.e. predicates that require a quantity-denoting (or in some cases a generic) argument. (See Li, 1999a, and discussion thereof in Appendix A). In other words, the obligatorily extracted arguments of Q-predicates lack the feature PERSON, associated with specificity and entity-denotation in the feature-system employed here, but must include a feature that is generally *valued* by other Verbs, so that they are typically deactivated while they are still within VP. The feature TOPIC was chosen because the topicality of any argument is largely predictable from its location relative to V²³. Pre-verbal Nominals are typically topical; indefinite Q-denoting arguments are the exception.

A TOPIC feature valued on V and unvalued on all indefinite arguments, maintains the visibility of an argument's PERSON feature, if it expresses one, until it merges with V, but no longer, leaving indefinite nominals fully valued *in situ*, unless the V is one that fails to express TOPIC. Quantity-denoting predicates are assumed to do just that. Their Q-denoting arguments lack the PERSON feature anyway, but must be extracted out of the complement of VP to value Topic. This entails of course that V is strong. Given this, definite nominals with unvalued *Case* will also need to move out of VP. (These modifications are defended more fully in Appendices H-J).

This analysis accounts for the distribution of Q-denoting vs entity-denoting indefinites in the TL. However, the IL samples did not actually include any Q-predicates and did not provide evidence for the extraction of indefinites, or for that matter, for functional projections outside VP that might value extracted constituents. Because of this, the identity of the feature that motivates extraction from VP in

²³ Except for cases of right dislocation, in which case an argument can be judged topical from its position following an illocutionary force particle, these being typically clause final, and candidates for the category 'C'.

the *IL* system is still open to question. I have assumed it is TOPIC for the sake of consistency with the TL, and because a TOPIC feature is in evidence in the ILs in the context of the pseudo-RC structure (See discussion in Appendices I-K).

The existence of the functional heads Person, Mass and Poss ‘fell out’ of the analysis of variations in the referential value of bare NP, and limitations on the effects that values associated with a possessor can have on the interpretation of a possessed N or the nominal structure as a whole. Possessors do not generally enter agreement with possessed Ns, or with the predicates that select possessive structures. In the ILs this is evident from the fact that possessor and possessum nouns do not necessarily share the same values for GENDER. This means some functional head must fully value the possessor, rendering it invisible to the syntactic mechanism, before it combines with the possessed N. This function was assigned to the covert head Poss. (For a discussion of why D cannot delete Genitive Case, see the analysis of the affine structure in Section Two, Appendix K.)

The feature MASS proved necessary to differentiate the covert indefinite head, Mass from the covert definite head, D, and to account for its attraction to Numbers. DEIXIS, and LOC proved necessary to differentiate the overt definite Demonstrative, from D, and from locative nouns, which have different distributions from Dem (e.g. D cannot select ClassP to make a definite Class-N sequence, but Dem can do so).

7.2 Deriving IL Constituent structures

7.2.1 Methodology

The analysis of IL constituent structures developed hand-in-hand with the analysis of lexical f-structures. It began with a consideration of the f-structure of *overt* lexical items. Additional *covert* items were then assumed as required to ensure the valuation of all lexical features of these overt items. Once *all* lexical participants in each structure had been identified and analysed, as shown in Table 1 above, it was possible to determine the steps required to derive the 19 IL nominal constituents shown in Table 15 of Chapter Five, on the basis of maximal match, and the choice of projector, as outlined in Section 7.1, above.

Thematic and prosodic factors were also taken into account. The former indicate which items are merged to enable theta-role assignment, and the latter indicate which items spell out together as the complement of a strong head, and which form the periphery of a strong phase. On the basis that prosody and distribution can be directly observed while lexical F-structures cannot, if prosody or distribution indicated a derivation other than that suggested by already identified lexical features, additional features were added till the F-structures did predict the observed outcomes. The identity, distribution and status of the additional features were determined by analysis of the semantic and pragmatic information each item of a constituent appeared to contribute in different contexts. In any

case where alternative derivations were possible for the same constituent, the most economical derivation was always assumed.

7.2.2 Results: IL constituent structures

The results of the c-structural analyses are presented in Figs 13- 25 below. These 13 diagrams illustrate the constituent structures underlying all but one of the 14 *complex* productive constituents listed on Table 19 of Chapter 5. Note that Table 19 lists 18 structures but three of these, Pronouns, little *pro* and Names, are excluded from the c-structure diagrams below because they are simple lexical items not complex items with syntactic derivations. The pseudo-RC structure is also excluded because analysis revealed this to be a Topic – comment structure, and thus a product of sentential rather than nominal syntax (see discussion in Appendix K). The remaining 14 structure labels listed on Table 18 correspond to only 13 different constituent structures because [(adv) Adj]-N and [(adv) Q]-N are listed separately there but were not statistically distinct; the diagram at Fig 18 below applies to both. Simple and compound nouns are also listed separately on Table 18, and they do not have different syntactic derivations either, but this is offset by the fact that definite and indefinite ‘bare’ NPs *do* have different syntactic derivations (see Figs 13 and 14 below), and they are *not* listed separately in Table 18.

Overall then there were 13 different syntactic derivations underlying the *complex* nominal structures that emerged in stable order in all three ILs. The steps in the derivations of these 13 complex nominals and the agreement relations that motivate them are discussed more fully in Appendix K. A breakdown of various steps in the minimalist derivation of each structure is also presented in Table 27 on page 163 below.

‘BARE’ NPs

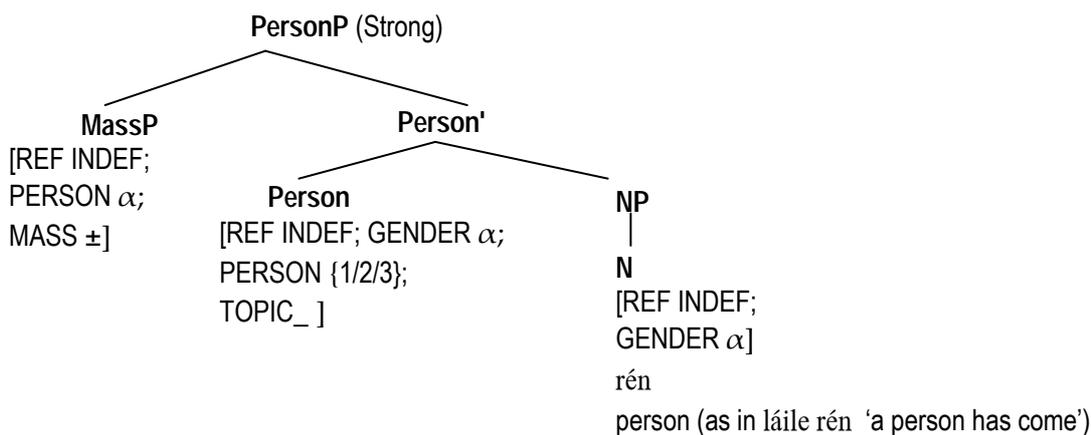


Fig. 13 Indefinite ‘bare NP’

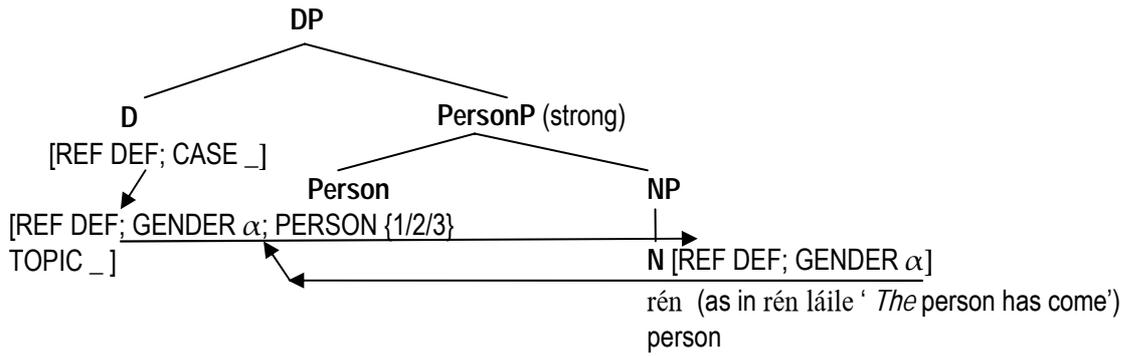


Fig. 14 Definite 'bare NP'

COMPLEX NOMINALS

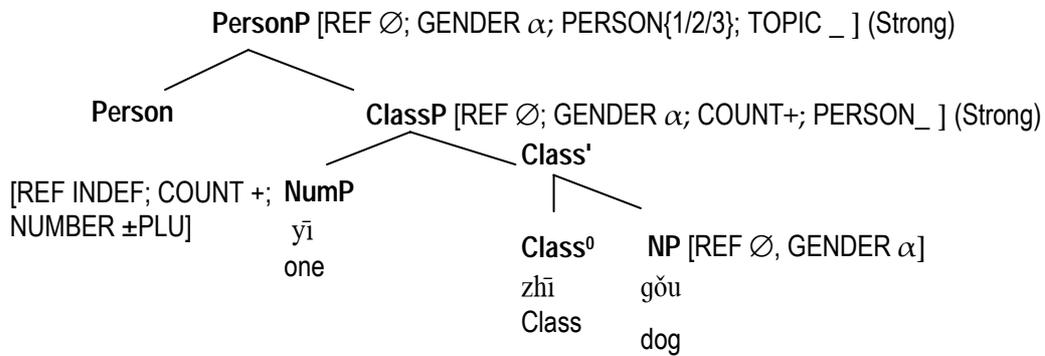


Fig. 15 Num-Class-N

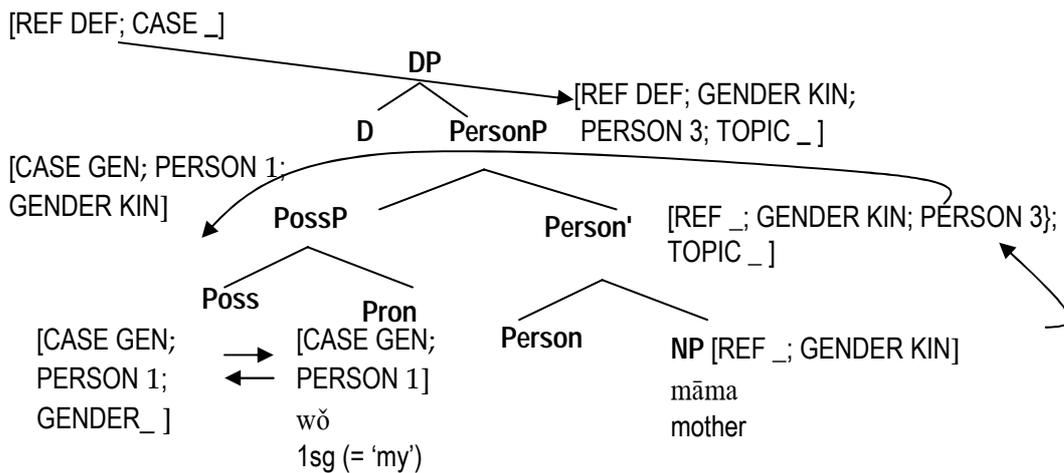


Fig. 16 Affine Structure

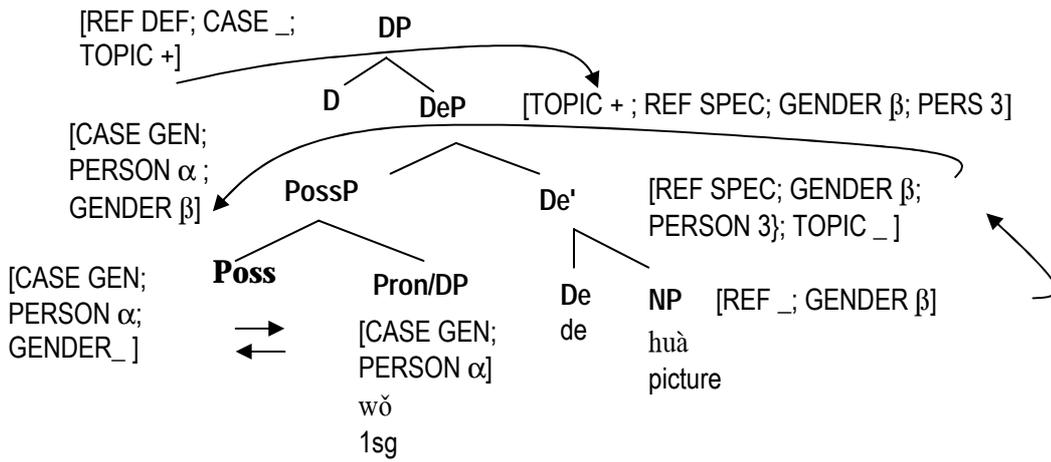


Fig. 17 Associative de Structure

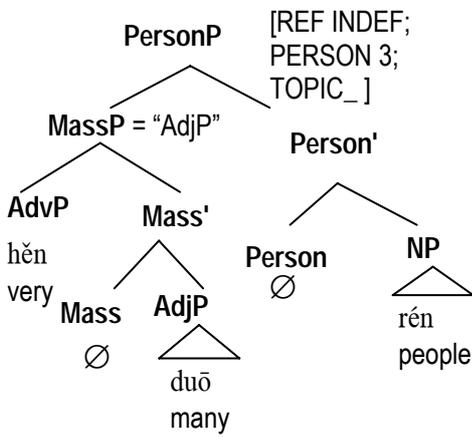


Fig. 18 AdjP N

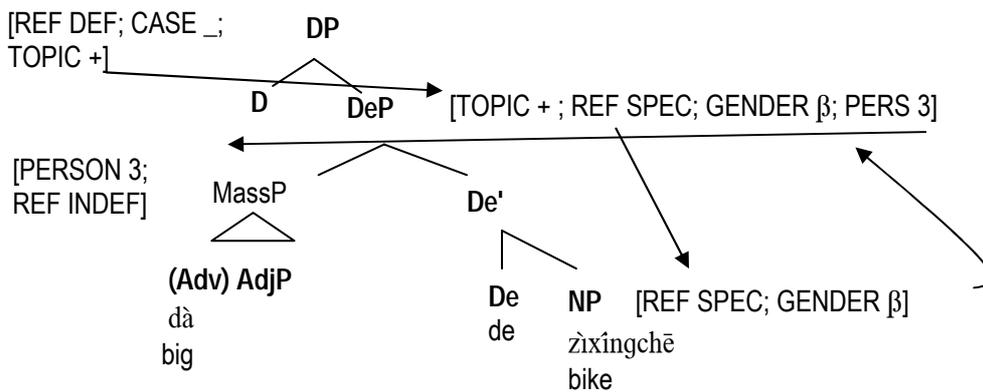


Fig. 19 Mod de structure

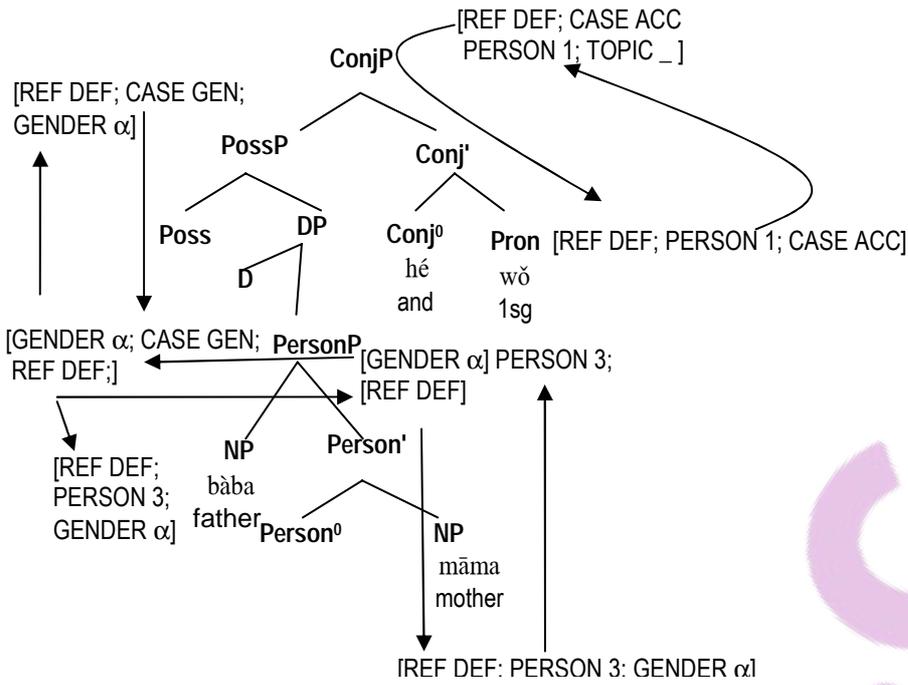


Fig. 20 Conjunction

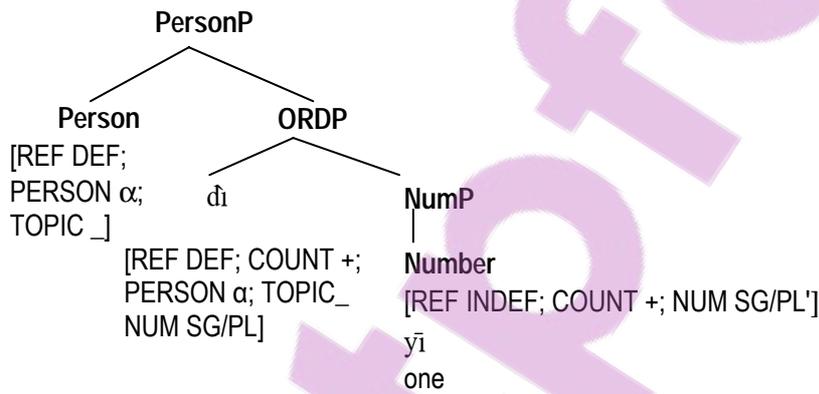


Fig. 21 Ordinal

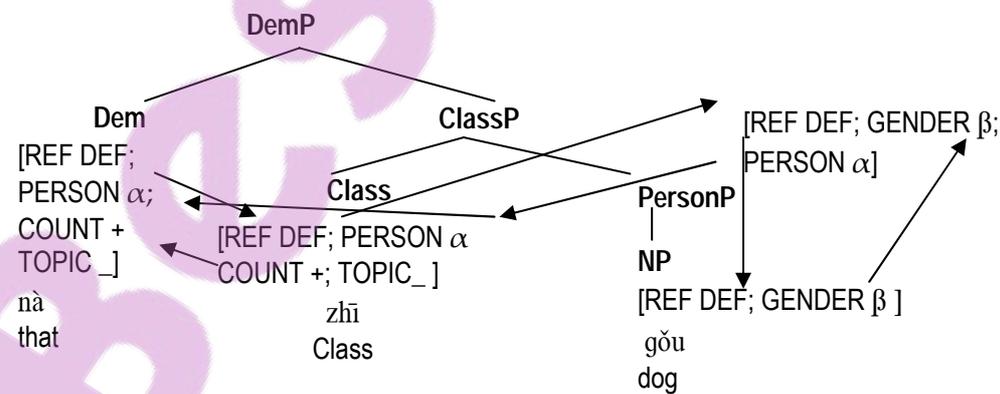


Fig. 22 Dem-Class-N

LOCATIVES

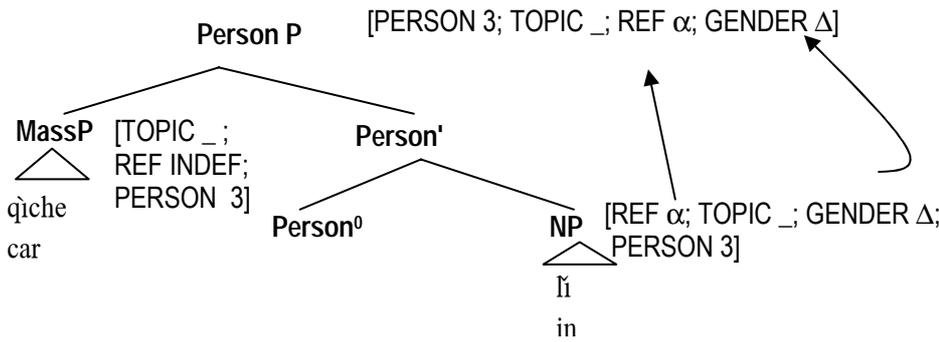


Fig. 23 Incorporated Locative

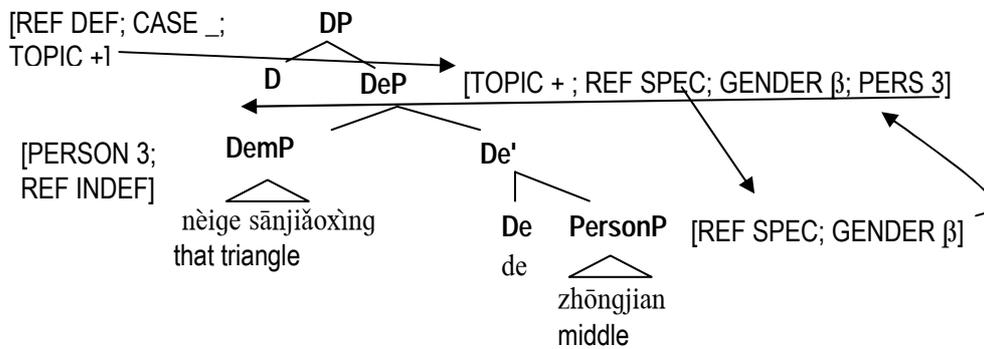


Fig. 24 Locative de structure

COMPLEX NUMERIC EXPRESSIONS

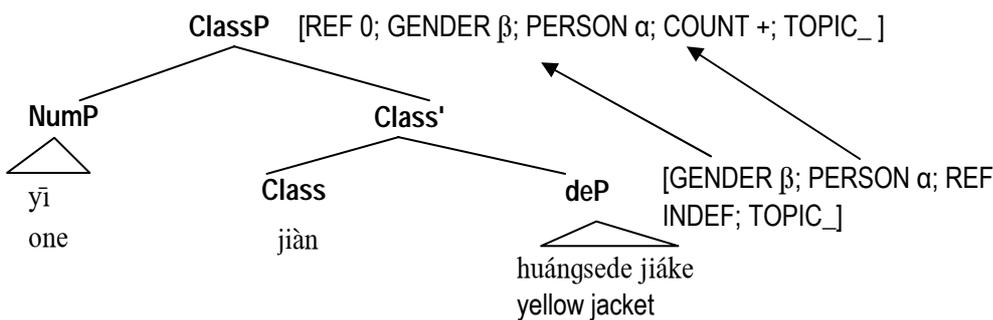


Fig. 25 Num-Class-deP-N

7.2.3 Summary of Developmental patterns in Minimalist terms

In the minimalist analysis of IL c-structures, nominals that appear to involve a single lexical head actually fell into two basic types. On the one hand there were truly one-word nominals: names, and pronouns, including demonstrative pronouns and covert ‘pro’ which all express the feature PERSON and because of this entered directly into agreement with predicates. On the other hand there were nominals constructed around nouns, which cannot merge directly with a verb because nouns and verbs

in this system have *no features in common*. Nouns express GENDER and require a REF value, but do not express PERSON (see Appendix J). Thus nouns must form a relationship with the functional head Person, before they can merge with a predicate. ‘Apparently bare NP’ is thus not *actually* bare NP unless it has generic reference; specific ‘NP’ is always dominated by a functional head.

On the basis of relationships between their interpretation and their distribution it was determined that apparently ‘bare’ referential NPs, the basic numeric expression, Num-CL-N, and the affine structure all include the *covert functional head* “Person” associated with entity-denotation and specificity. It expresses a valued feature of the same name, which attracts it to predicates.

The numeric expression, Num-Class-N, was also found to be a ClassP, in which N is the complement and Num is the specifier of Class, as proposed by Pan (1999) for the TL. The affine structure was found to require the involvement of a genitive Case deleter Poss, *and* the definite head D, as well as Person. (The link assumed in the MP between Case deletion and agreement for ϕ -features entails that D, which enters agreement with V, cannot *be* the Genitive Case deleter, since it acquires ϕ -values from the possessor NP, not the possessed NP.) Thus, despite the Num-Class-N structure containing more *overt* elements than any other structure in the first two IL samples, the minimalist analysis suggests that it actually contains *fewer* lexical items, combined in fewer phrasal levels, than the affine structure. (This comparison and others can be seen in Table 27 below).

MODIFIED NOUNS

The modified nominals that emerged a little later than plain nouns and numeric expressions, all involved a covert indefinite head, Mass. The lexical F-structure of Mass and Person, neither of which express Case, accounts for the restricted distribution of indefinite ‘bare NPs’ (actually PersonP) compared to definite ‘bare NPs’ (actually DP, where D requires Case). (As mentioned above, a full discussion of the role of Case in IL Mandarin can be found in Appendix H).

It was determined that the covert functional heads Person, Mass and Poss must play a role in valuing and deactivating nominal constituents embedded within another nominal, or otherwise blocking transmission of their feature values to either the head noun, or the verbal predicate. The particle *de*, which emerged around the same time as Mass, D and Poss, served this same function, but also allowed a wider range of constituents to modify N than the functional heads Person and Mass did. This seems to be because *de* *lacks* semantic content, and introduces DFs linked to Adjunct functions, not GFs linked to thematic structure, like a substantive predicate would (see Appendix K).

LOCATIVES

In the earliest locative structures, the locative *shàng* preceded a locus-denoting nominal. This *shàng* had to be analysed as a preposition ‘on’, that is, in Hale and Keyser’s terms, an underived predicate that can project a complement position *and* assign a θ -role (locus) (Hale and Keyser, 2002). Later, in the incorporated locative structure, locatives took on the distribution of a *derived* predicate.

These are lexemes selected as the complement of an abstract predicate or functional head (in this case, Person) resulting in the conflation of their own phonetic features with those of the predicate (in this case null). The complement's θ -role is then assigned to the specifier of the functional head, instead of being assigned to a complement of its own. (See Hale and Keyser, 2002 for a comparable derivation of the English 'denominal' verb 'to laugh' from the noun 'laugh' conflated with a covert predicate).

In the still later *non*-TL structure, the reverse locative, where a locative noun preceded *de*, and the locus followed it, it was *de* that functioned effectively as a preposition, comparable to English 'of':

57) yòubiān de zhège sānjiǎoxíng yǒu yuánxíng
left DE this.Class triangle have circle

To the left of this triangle, there is a circle

This occurred in only two ILs.

TL-like locative *de* structures, where a locative noun follows *de* and the locus-denoting argument precedes *de*, emerged a few weeks later than reverse locatives and were generally the last structure to appear in the Auckland study.

58) hěnxuō shù de zhōngjian
very many trees DE middle
In the middle of many trees

Though this structure is suggestive of syntactic *movement* of the locus past *de*, its position can also be attributed to *delayed first merge*, as in the conflation analysis of Hale and Keyser (2002). The locative noun can be analysed as a predicate derived through conflation with Person, as in incorporated locatives; PersonP is selected next as the complement of *de*, another abstract predicate; and the locus argument is finally merged as the specifier of *de*. This latter analysis was adopted because it avoids syntactic movement, and is therefore theoretically more economical than the alternative.

From this viewpoint, the main differences between locative structures and affine and associative *de* structures is the involvement in the former of a nominal predicate with *two* thematic arguments, a locus *and* a theme. The theme is realised *outside* the nominal structure, and again, this can be interpreted either as a consequence of syntactic movement, or as a consequence of delayed first merge, with the latter being preferable for reasons of economy. (In LFG terms, the use of locative nouns entails the assignment of a Subject GF to a distant theme, as well as the assignment of an Object GF to a locus.)

THE PSEUDO-RELATIVE CLAUSE

The pseudo-relative clause structure, which emerged around the same time as locative *de*, but was anomalous in having a modifier following the noun it modifies, seems to be a product of topicalisation at the sentential level, rather than embedding in nominal structure, putting it outside the scope of this study.

7.2.4 Three minimalist 'stages' in IL development

In the light of the minimalist analysis then, acquisition might be divided into three stages. In the first, lexical items that share few or no features are brought into relationship by way of functional heads that express features of both, forming a bridge between the two. In the second, items that *share many* lexical features are brought into structural relationship by functional heads that *prevent* them from entering agreement, either because the functional head deactivates one of them by fully valuing it, or because the head expresses only *some* features of each item it selects. Thus functional heads can be understood as serving an insulating function as well as a combinatorial role in the construction of syntactic objects.

Mastery of these two strategies, and the construction of the functional heads that they entail, laid the basic foundations of the IL syntactic system. Subsequent to this, in the third stage, structures like recursive possession and Num-Cl deP N emerged that mixed existing subconstituents and were clearly procedurally dependent on the prior mastery of the individual component elements. In a minimalist framework, recursion contributes to processing demands because each instance of merger carries a cost in terms of storage in the computational mechanism. This is discussed further below (and see Table 26).

Clearly, as embedded nominals become more complex, so does the exchange of values and the deactivation of features leading up to spellout. It also becomes necessary to implement genitive Case deletion *within* nominal structures.

EXCEPTIONS

However, the demonstrative determiner and definite ordinal marker were still exceptions to these overall patterns. They appear to be lexical items that are simply constructed relatively late in acquisition. This may reflect the relatively late integration of deictic information into syntactic objects with lexical heads, but this seems unlikely when some simple deictic forms, like demonstrative pronouns, are in evidence from the start of SLA.

In any event, the introduction of new deictic lexical items to the IL systems clearly altered the relationship between Class and Num, which, up to that point, had been so stable that classifiers could be analysed as lexical suffixes of numbers. To allow Dem-Class collocations to emerge may have required some re-construction of the classifier with a new set of features. The simplest account is that Class initially expressed unvalued Num, which only numbers could value; later Num and Dem expressed unvalued COUNT, a feature valued only by Class and exceptional nouns. This aspect of development is worthy of more focussed investigation.

This overview of IL development from a minimalist viewpoint affords a fresh perspective on the patterns of syntactic development described at the end of Chapter Five. It makes it clear that processing demands are a reflection of syntactic processes and relationships between items that are *covert*, as often as not. Moreover, in minimalist bare phrase structure, each level of c-structure may contain a single lexical head, or a head and up to two other 'syntactic objects'. This means, even when

covert lexical items are counted, constituents with the same number of lexical items overall may still involve different numbers of discrete c-structural levels (as discussed in detail in Appendix F), and if c-structural complexity *is* a relevant factor in the determination of processing demands, as suggested at the close of Chapter Six, they may entail quite different processing demands.

In short, there may be no *simple* relationship between the number of overt items in a string of IL output, its c-structural complexity and the processing demands associated with it. However the detailed and explicit analysis of IL derivations represented by the c-structure diagrams in Figs 13 - 25 above, made it possible to quantify a number of variables associated with each derivation, so that the impact of each individual factor on emergence time could be assessed. The results of this analysis are discussed next.

7.3 Processing demands of IL nominal structures

7.3.1 The demands of Minimalist operations

In the MP, processing demands relate in general terms to delays in the valuation and spell-out of lexical features. However several factors may contribute to such delays and no explicit claims have been made about the relative impacts of these on processing demands overall, and nor have specific developmental stages been posited as they have in the PT framework. To investigate the impact of different processing demands on emergence time, seven likely contributors to overall processing demands were identified. These included: the total number of feature types involved; the instances of feature copying; the number of lexical items, both overt and covert; the number of mergers, movements, and phases; and the longest storage time between first merge and spell-out for any one item (duration). These were then quantified for the 13 IL structures indicated in Figs 13 - 25 above, according to the derivations discussed in Appendix K, and for four simple lexical items: Names, Pronouns, little *pro* and N. This last item represents NPs in the early stages when there was no statistically significant distinction between definite and indefinite bare NPs. For reasons that will be made clear later on, two other structures were also analysed for processing demands that were produced by only two of the three Auckland learners. These were recursive possessives and reverse locatives. Their emergence ranks were derived by matching their average ET over the two ILs in which they occurred, with the nearest average for the other structures over three ILs.

Table 27 below shows the scores on the seven measures described above for these 19 IL constituents. The structures are listed in order of adjusted ranks for mean emergence times, shown in column 1 (see Table 18 Chapter Five).

(In Table 27, 'merges' and 'phases' refer to the number of each required to construct the nominal, excluding its merger with a predicate in the VP phase; \emptyset phases and \emptyset merges means the item is selected directly from the lexicon into a VP or sentential phase; † lex means all features but one are valued in the lexicon, before

the first syntactic merger; *Delay refers to the maximum number of mergers between first merge of any item till it is fully valued; 1= full valuation at first merge.)

Table 27. Processing demands in Minimalist derivations (19 structures)

ID number	rank mean ET	Structure	F types	values copied	overt items	covert items	merges	phases	delay*
1	1	Noun	2	1-2	1	1	1	1	0
2	1	Pron	4	2	2	0	0	lex	0
3	1	Name	1	1	1	0	0	0	1
8	1	Num-Class N	6	7	3	1	3	2	3
4	2	little pro	1	1		1	0		
7	3	Affine structure	4	7	2	3	4	3	3
9	4	Assoc <i>deP</i> (Poss)	5	9	3	3	5	3	4
11	5	AdjP N	7	6	3	2	4	2	3
12	6	Conjunct (min)	5	1	6	2	7	2	3
30	7	DP	6	4	1	2	2	2	2
18	8	Incorporated locatives	4	11	3	4	6	10	2
31	8	Recursive Poss	5	13	4	6	9	6	4
19	9	Mod <i>deP</i> (indef)	5	10	4	2	5	3	5
15	9	Pseudo-relative clause	6	12	3	6	8	5	3
16	10	Dem Class N	4	4	3	(2)	5	4	4
20	11	Num-Class <i>deP</i>	5	16	6	3	8	5	7
22	12	Ordinals	4	2	2		1	1	1
21	13	Locative <i>de</i> maximum	5	18	7	5	11	8	5
32	14	Reverse Locative	5-6	11	5	(2-3)	7	6	4

SAMPLE ANALYSES

The derivation of the basic numeric expression, Num-Class-N and the affine structure are described below to illustrate how the figures in Table 27 were arrived at. The calculation of derivations and processing demands for all structures is presented in detail in Appendices K and L.

The numeric expression Num-Class-N is compiled from a lexical array containing three overt lexical items, and one covert LI. Between them these four LIs contain six *distinct* feature *types*, as indicated by the bold labels in the following specifications: [Person {**PERSON** 3; **GENDER**_; **REF**_; **TOPIC**_}; Num {**PERSON**_; **MASS** -; **COUNT**_; REF INDEF}; Class {**COUNT**+; **GENDER**_; REF ∅; **TOPIC**_}; N {**GENDER** Δ, **REF**_}].

The strong head Class selects N first, then Num in a single strong phase, ClassP; the covert head Person then selects ClassP to form the argument PersonP in a second strong phase: a total of three mergers and two phases. N, Class and Person agree for GENDER and REF; Num and Class agree for COUNT, and each agrees with Person for PERSON. Num and Class are each valued by Person, but Class and Person each need a TOPIC value so neither is fully valued till PersonP merges with V, which would follow.

N is fully-valued as soon as it merges with Class but can only spell out when the second strong phase, PersonP, is closed; thus, N is stored for just one phase beyond its own. Then Num - Class will spell out at the next strong phase; 3 mergers take place while Class is in the derivation.

The derivation of the affine structure involves *four* mergers, and *three* phases: PossP (selection of the affine Pron by Poss), PersonP (selection of the kin-term, and PossP by PERSON) and DP (selection of PersonP by D). PossP involves a mutual exchange of PERSON and CASE values; Person P transfers GENDER, from N to Person, then to Poss. Likewise, DP involves a mutual exchange of PERSON and REF values, with the latter copied to both Person and N.

The pronominal affine is active for just one merger, and Poss, for two; while N and Person remain active throughout the derivation of DP, till their REF features are valued. D remains active at the close of DP, with Case the only unvalued feature, and PERSON visible on D. Altogether seven feature valuations take place in this derivation. The phonetic features of the null predicate, Person and the complement are (vacuously) conflated phonologically; this does not involve syntactic movement (Hale and Keyser, 2002).

As mentioned above, we see that although Num-Class-N involves more overt elements than the affine structure does, its derivation is somewhat less complex according to the assumptions of the MP.

NO MOVEMENT: THE PROCESSOR'S RESPONSE TO PROCESSING FACTORS OVER TIME

No discussion of minimalist processing demands seems complete without a consideration of movement, said to be a key contributor to processing demands. Precisely because it is deemed expensive, movement should be avoided wherever possible (Procrastinate). It is not surprising therefore that there was no clear evidence for movement in the IL structures considered here. However, one version of the minimalist program would entail movement in two early structures: the derivation of incorporated and de-marked locatives. Under Hale and Keyser's approach to thematic licensing applied here, a lexical predicate need not select its first argument as a complement. Instead, it can itself be selected as the complement of an abstract predicate, which then inherits the capacity to theta-mark an argument from its lexical complement. In this way, the merger of the argument, and hence valuation of its features is *delayed*, which violates ASAP, but movement is avoided, which satisfies Procrastinate.

Under the standard Theta-Theoretic Principle, a theme argument should be merged as the complement of a lexical predicate in order to be theta-marked, and under the LCA (Kayne, 1994) a complement follows the predicate it merges with. This would mean that either the locus or the theme in a locative structure, both of which precede the locative noun must have been merged first as the complement of that noun and then *moved* into its final position outside the immediate constituent headed by the locative noun, a violation of ASAP, because the specifier of a phrase generally spells out one phase later than the complement *and* a violation of Procrastinate. Since the MP always prefers the most economical derivation, the version of events proposed by Hale and Keyser and adopted here is preferable to the account forced by these standard assumptions. Nonetheless, the alternative could still be accommodated within the framework for calculating processing demands employed above. The movement would be reflected in the number of mergers and the length of the delay associated with the overall processing scores of locative structures.

From the breakdown of processing demands presented above it appears that both *delay* and *movement* are generally avoided during early production, but in later development, a *delay* of up to five mergers is tolerated before *any* evidence of possible movement appears. This is consistent with the claims of minimalism: five mergers is a minimum of two phases, and in principle, movement should *never* be necessary in any derivation shorter than two phases: it is a last resort to avoid spell-out, and spell-out takes place only after the *second* strong phase.

7.3.2 Developmental levels in Processability Theory

In contrast to the MP, where processing demands have not been systematically compared before, Processability theory makes explicit claims about the major contributors to processing demands, and their relative significance. In PT, the main factor contributing to processing demands is the storage of syntactic information in the processor. While lexical feature structures obviously determine which features *can* be stored, it is primarily appointment rules - the procedural implementation of generalisations about c-structures - that specify which features *must* be stored in procedures, and when, or where in c-structure, they can be retrieved from. So, in the PT framework processing demands can only be determined by reference to *c*-structures as well as lexical structures.

Though the LFG/PT framework allows a single linear string to have many alternative c-structural analyses, and lexical feature structure is also unconstrained, these very facts entail that the c-structures and lexical feature-structures determined by a minimalist analysis represent one *possible* set of c-structures and lexical f-structures for whose emergence PT should be able to account. On this basis, it is legitimate to use the c-structures derived through minimalist analysis to calculate processing demands within a PT framework²⁴.

THE STANDARD PT ACCOUNT

In the standard PT model, processing demands are represented in terms of six developmental levels, defined in terms of four types of procedure, categorial, phrasal, sentential and subordinating, and transitions between them. Structures are allocated to these levels ostensibly according to the kind of information transfers they entail. Only phrasal and sentential procedures, and the SOP, can implement appointment rules that assign a linear order to a number of different lexical categories. Sentential procedures are further distinguished from phrasal ones by the transfer of information delivered in separate conceptual iterations, which correspond roughly to NP and VP constituents.

²⁴ There is one general case however, where Bresnan's endocentric mapping principles predict a c-structure that is ill-formed in minimalist terms. This is in all *de* structures that link an optional modifier to a noun. Under the EMPs, the noun that follows *de* must be either its functional co-head, and c-structural sister (complement) or its specifier bearing a DF. Sisterhood would entail the sharing of all lexical features, so that whatever restrictions N placed on adjacent modifiers would apply to modifiers in Associative *de* structures as well. This is the case in locative *de* structures, but not in others, so locative nouns must be co-heads of *de* and other nouns must be specifiers. This departs from minimalist assumptions in two regards: there should be no specifier unless there is a complement, and each head should have at most one specifier. These differences in c-structure make some difference to the calculation of processing demands and this will be discussed as the need arises.

Apart from the categorial feature, which initiates categorial and later phrasal procedures, lexical features are not particularly significant to processing demands unless they enter agreement or licensing relations. Recall that agreement in the PT is not an essential concomitant of all syntactic relations as it is in the MP, but it is still more pervasive than overt morphology suggests.

C-structural complexity is deemed basically irrelevant to processing demands in the standard PT account. Thus all and any licensing and agreement relations that take place within purely nominal structures are classified as either categorial or phrasal, no matter how complex the nominal c-structure may be, unless an RC is involved.

Table 28 below allocates IL nominal structures to one of the six developmental levels of Processability Theory on the basis of the involvement of phrasal procedures, agreement, and inter-modular dependencies alone, as these are entailed by the lexical structures and c-structures described above.

Table 28: Processing Demands according to Processability Theory

Level	ID	Structure	Processes	RMET
Level 1:		Lemma	links concepts to phonetic features (PF)	
	3	Name		1
	1 /30	'Bare' NP		
	4	little pro		2
Level 2:		Categorial	links PF/ intrinsic F/ conceptual info / to Categorial F	
	2	Pron sg/PL	intrinsic F = Number	1
	8a	Number+Classifier	intrinsic F = Class	1
	9a	Pron+de	conceptual info = Possessor	3
	18a	fixed loc. compounds	intrinsic F = Locative	3
	22	*Ordinals	Prefix On Num; Intrinsic F = Def	11
Level 3:		Phrasal	Appointment rules: licensing and/or Agreement	
	8b	*Number.Class N	Agreement for Gender	1
	7	*Affine structure	licensing of poss'r by category (=c.Pron)	3
	9b	Associative DE	deP procedure	4
	12	Conjunction	conjunct procedure	5
	11	AdjP N	AdjP procedures and 'NP' procedure	6
	18b	Incorporated locatives	NP licensed by locative N in <i>NP</i>	8
	19	Mod DEP	Or ?Simplified S procedure ?	9
	31	Recursive Possession	phrase within a phrase	11
	16	Dem+Class N	Agreement for Gender	10
	20	Num-Class DeP N	Appointment rules constrain order	11
	21	Locative DE	Embedded phrase	13
	32	Reverse Locative	Embedded phrase	14
Level 5-6:		S or SC	sentential procedure	
	15	Pseudo-relative Clause	S modifies Topic N of a second S	12

This table includes the 19 structures shown in Table 27 above, indicated by the same ID numbers. Structures are arranged according to their processing demands, and their order of emergence (ranked mean ET) is shown in the rightmost column. Some structures occur more than once, either because they involve more than one process, each entailing a different developmental level (for example suffixation of Class on Num is 'lexical', while the agreement between Num-Class and N is 'phrasal') or because changes in the ILs over time reflect changes in the procedures used to generate identical sequences (for example incorporated locatives are counted as lexical, until variation in the combinations of locus and locative indicates they are *ad hoc* syntactic combinations, and hence 'phrasal'). (For a full

discussion of the allocation of structures to PT levels see Appendix L).

THE REVISED PT ACCOUNT

In Chapter Six, it was pointed out that Pienemann himself sees this six-level picture of development as overly simplistic, and it was argued that, in fact, the definition of levels is flawed. An alternative was proposed where processing demands are assessed on the basis of the nature of the mechanisms employed to force unification, the distance across which unifications were imposed and the number of discrete unifying processes implemented. The relevant mechanisms were lexical licensing, agreement, GF assignment, co-head relations, and functional uncertainty. Agreement could be mediated by way of co-head relations, the Adjunct GF, or argument GFs. Table 28 shows where these processes are involved in the IL nominal structures already discussed.

Table 29. licensing, agreement and GF assignment in nominal structures.

Level	ID	Structure	Process	details	RMET
	1/3/ 30	Name / N/	None		1
	4	Pro			2
	2	Pron	licensing	in Categorial procedure	1
3	8	Num.Class N	local licensing & agreement	Licensing of Num in ClassP, agreement with COUNT N unified in ClassP	1
	7	Affine structure			3
	9a	Possessive de		de is suffix, local licensing in NP	4
	12	Conjunction		licensing in ConjP; unification of categorial F	5
	11	AdjP N		Categorial Adj and N features license adjacency	6
	18	Incorporated locatives	Local DF and GF assignment	OBJ GF assigned in N or NP, licensed by N	8
	9b	Associative de ²⁵	Multiple DF/GF assignment and local licensing	(MOD and FOCUS) in deP; licensed by <i>de</i> and by ADJUNCT GFs	?
	19a	Mod deP (early)		as above	9
	16	Dem+Class N		Class-N agreement ; licensing of Dem by Class in <i>DemP</i> ,	10
	31	(Recursive Possession)		as for 9a above x 2	11
	22	Ordinal	?licensing	Categorial Num or phrasal OrdP	11
	20	Num-Class DeP N		as for 8 and 19a above, combined	11
5-6:	15	Pseudo-relative Clause	Functional uncertainty	SUBJ of Copula linked to TOPIC in S; licensed by local ADJUNCT GF	12
3:	21	Locative DE	co-head relation and functional uncertainty	locative N and de share <i>all/F</i> ; MOD and FOCUS DFs assigned in deP FOCUS DF licensed by local ADJ GF; MOD DF licensed in deP by OBJ GF of <i>N</i>	13
3:	32	Reverse Locative		MOD and FOCUS DFs assigned in deP ? FOCUS DF mapped to OBJ of N? ?MOD DF licensed by ADJUNCT GF	14
5-6:	19b	Mod deP with intransitive V		MOD and FOCUS DFs assigned in deP MOD DF mapped to ADJUNCT GF FOCUS DF licensed by SUBJ GF of <i>V</i>	?

²⁵ This refers to N de N structures that are not core possessives (see Chapter Three). The ET here is the average for six learners, those in Zhang's (2001) study and the Auckland study.

The most significant feature of this analysis, and one that has not been discussed above, is that *de* is treated as a functional head (as indicated by the MP analysis), which heads a phrase in which two DFs are assigned, MOD and FOCUS. The first is assigned to the modifier preceding *de*; the second is assigned to the nominal that follows *de*. This analysis is based on the constraints formalised in Bresnan's endocentric mapping principles, described in Chapter Two. Since neither element is a thematic argument of *de*, and both serve *discourse* functions (modifier and focal 'NP') both must be specifiers to which DFs are assigned. (For a full discussion of this and the other analyses represented in Table 28, see Appendix L.)

7.4 Processing demands and emergence orders

This section presents the results of correlations between emergence order and rankings of processing demands according to three theoretical models: the MP, PT and an LFG analysis.

7.4.1 Minimalist processing factors and adjusted mean emergence times

To evaluate the impact of each of the minimalist processing factors on emergence order, each processing score was treated as a set of ranks for the 19 structures under consideration and correlated (using Kendall's tau b) with their emergence order expressed once as adjusted mean ET and once as adjusted ranked mean rank (RMR; see Chapter Five for an explanation of how this was derived). The results of this analysis are shown on Table 30.

Table 30. Individual Processing factors and emergence order (19 structures)

Processing factor	S	K	H	adjusted mean ET	adjusted mean rank
P	.64 p=.0009	.54 p=.0038	.58 p=.0025	.60 p=.0007	.63 p=.0004
M	.61 p=.0012	.50 p=.0058	.59 p=.0058	.48 p=.007	.63 p=.0003
overt items	.54 p=.0056	.50 p=.0079	.48 p=.0143	.52 p=.004	.52 p=.004
covert items-	.52 p=.0074	.38 p=.0429	.50 p=.0095	.54 p=.003	.56 p=.002
copied F	.55 p=.0036	.46 p=.0111	.38 p=.0447	.52 p=.003	.54 p=.002
D	.54 p=.0053	.46 p=.0137	.40 p=.0382	.48 p=.007	.50 p=.006
F-types	.3413 n.s.	.2491 n.s.	.1767 n.s.	.34 ns	.36 p=.05

Each row in Table 30 represents a different processing factor. P is the number of phases; M the number of mergers; F-types is the number of distinct features in the structure; F the number of value tokens copied; and D the longest delay (in mergers) between insertion and spellout for any item. The columns H, S, and K represent correlations between each processing factor and the emergence order exhibited by Hannah, Sam, and Kazuko respectively. The two right-most columns represent

correlations between processing factors and mean ETs and ranked mean ranks (RMR) respectively. The solid lines enclose correlations below 50%, and those that are statistically insignificant.

Of the seven factors investigated, *all* but F-types were significantly correlated with emergence orders, most at $p < .01$, the rest at $p < .05$ (lightly shaded cells). However, only the number of phases and the number of mergers were *consistently* correlated at 50% or above. Other correlations varied with IL. The *best overall predictor* of emergence order was the number of phases; it correlated most highly with each of the two mean measures, and with two individual ILs. For Hannah's IL the number of *mergers* was a slightly better predictor, with a correlation of 59% compared with 58%.

The *worst* predictor of emergence order (after number of feature-types) for Sam and Kazuko was the number of covert items (52% and 38% respectively), but for Hannah, the number of copied features (38%). This indicates that individual learners respond differently to different processing factors.

Combinations of factors produced slightly higher correlations than single factors, as shown on Table 31. The highest correlation overall was that between emergence orders and the sum of mergers, phases and delay (P&M&D). This ranged from 57-64%. For Hannah, the correlation with phases plus mergers was higher by 4%. The substitution of covert items (C) for mergers (M) never improved the correlation. This shows that covert items are relevant only to the extent that they necessitate additional mergers; covertness, or phonetic content *per se*, makes no substantive difference to processing demands.

Table 31. Sum of processing demands and emergence order (19 structures)

Factor	S	K	H	adjusted mean ET	adjusted mean rank
P& M & D	.64 p<.001	.57 p<.001	.58	.61 p<.001	.62 p<.001
P & M	.60 p<.001	.52	.62 p<.001	.59 p<.001	.61 p<.001
P&C&D	.60	.51	.58	.57 p=.001	.60 p<.001
P&M & F & D	.61	.51	.49	.56 p=.001	.58 p<.001
P & F	.57	.50	.45 p=.02	.53	.54
P&C&F& D	.58	.49	.47	.56 p=.001	.57 p=.001
P& M & F	.55	.48	.47	.53	.54
P& C & F	.54	.46	.46 p=.02	.53	.56 p=.001

When the five structures with the most variable emergence times were excluded, correlations were higher still, as shown in Table 32. The first two rows of data in Table 32 show the correlations between individual emergence orders and the mean measures, mean ETs and RMR for the 14 most stably ordered structures. The following rows compare the correlations between emergence measures and combined and individual processing demands.

Table 32. Sum of processing demands and emergence order (14 structures)

Factor	S	K	H	mean ET	mean rank
mean rank	.94	.89	.90	.96	1
mean ET	.91	.90	.87	1	.96
phases	.81 p<.001	.75 p<.001	.61 p<.01	.78 p<.001	.75 p<.001
mergers	.77 p<.001	.73 p<.001	.64 p<.01	.76 p<.001	.73 p<.001
M&P&D delay	.76 .68	.73 .69	.60 .60	.71 .65	.67 .60
overt	.65 p<.01	.72 p<.01	.56 p<.01	.67 p<.01	.62 p<.01
covert	.68 p<.01	.62 p<.001	.54 p=.01	.69 p=.001	.66 p<.01
values copied	.62 p=.003 p=.004	.63 p=.005 p=.003	.47 p=.02 p=.03	.60 p=.001 p<.01	.55

Here the highest correlations of all are those between mean ranks or mean ET and number of phases (61-81%) or number of mergers (64-77%). The next highest is that between mean ET and the sum of merges, phases and delay (M&P&D) (60-76%). Somewhat surprisingly, the number of values copied generally has the lowest correlation, 10-20% lower than the highest scoring factor in each case. This indicates that, in a minimalist analysis, the construction of c-structure is a more significant factor in determining emergence order than the exchange of feature values in agreement.

7.4.2 Longitudinal effects: increases in individual processing factors over time

It was hypothesized that stages might be definable in terms of acquiring mastery over specific syntactic processes. In order to assess their relative contribution to total processing demands over time, the raw scores for phases, mergers and delays were converted to ranks on a scale from 1-6²⁶. This made it possible to compare their relative contributions in terms of a single standard scale. The results of this comparison are shown in Table 33, below. Emergence order is indicated by the two mean measures derived in Chapter Five; structures are ordered by adjusted mean ET. Shaded cells show points where processing *ranks* increased by one step or more; dotted lines indicate the stages on the implicational emergence hierarchy proposed in Chapter Three on the basis of the number of overt constituents; solid lines indicate stages on an implicational hierarchy for *processing* scores; structures above a solid line generally have a lower processing score than those below the solid line; exceptions are marked by an asterisk.

Four things are immediately evident from Table 33. Firstly, scores for all three factors are initially low and increase gradually over time: the first 6 structures to emerge all have processing ranks of less than 10, while five of the last seven have processing ranks of more than 10. Secondly, each processing factor develops at a *different rate* the first factor to reach its maximum score is the number of phases, in

²⁶ Correlations with the sum of *rank* scores are the same as those with the sum of *raw* scores: 61% (p <.001).

incorporated locatives, followed by delay, in Num-Class-deP N, then merger, in locative deP. Thirdly, the proportion in which the same factor contributes to processing scores varies considerably from *structure to structure*. For example, incorporated and reverse locatives have the same overall processing score of 12, but have quite different scores for phases and delay. This means interaction effects between processing factors and emergence ranks are potentially complex.

Finally, the stages identified through this analysis, do not coincide with the rough notional stages based on surface shape, and emergence time identified in Chapter Five. Recall that structures with a *minimum* emergence rank of 1, appeared to be mainly single words, but the affine structure, Num-Class-N *and*, under minimalist assumptions, referential ‘bare NP’, were all exceptions.

Table 33. Four processing factors and emergence order (19 structures)

Structure		Processing factors				emergence measures				Implicational scale
		P	D	M	Sum of PDM ranks	mean rank	ranked mean rank	mean ET	rank adjusted mean ET	
Stage I	Name	1	1	1	3	1	1	6.66	1	1
	Pron	1	1	1	3	1	1	6.66	1	
	Noun	2	1	1	4	1	1	6.66	1	
	Num-Class N	2	3	2	7	1	1	6.66	1	
	little pro	1	1	1	3	1.33	2	7.33	2	
Affine structure		3	3	3	9	1.33	2	7.66	3	↑PDM < 8
Stage II	dePPoss	3	4	3	10	2	3	9	4	2
	Conjunct (min)	2	3	4	9	2	3	9.5	5	
	AdjP N	2	3	3	8	2.33	4	10	6	
*DP		2	2	2	(6)	3.33	5	13	7	3 ↑8 ≤ PDM < 11
Incorp. locatives		6	2	4	12	3.5	6	14	8	
deP Mod (indef)		3	5	3	11	4	7	17.33	9	
Stage III	Dem Class N	4	4	3	11	4.33	8	19.66	10	4 ↑11 ≤ PDM < 13
	*Ordinals	1	1	1	(3)	4	7	21	11	
Num-Class deP N		4	6	5	15	4.33	8	21	11	↑PDM < 16
Recursive Poss		4	4	5	13	4.5	9	21	11	
Pseudo-RC		4	3	5	12	4.5	9	22.5	12	
Locative DE		5	5	6	16	5.33	10	24.66	13	5
*Reverse Loc		4	4	4	12	6	11	26	14	

Structures with a *minimum* emergence rank of 2 *and* a *maximum* of 4 were mainly ‘two-place’ nominals with phrasal modifiers of N; while those with emergence ranks *ranging* from 4 upwards were ‘three-place’ nominals, containing two modifiers for a single N. The first of these notional stages does actually coincide with the first stage based on processing demands (the affine structures is excluded from the latter, but this is not actually the case in two of the individual ILs; see discussion of individual ILs in Chapter Eight). However, the distinction between two and three-place nominals proved irrelevant when structures were analysed in minimalist terms. Not only did structures from those notional stages overlap in their emergence times, they are grouped quite differently in terms of processing scores, with no obvious *surface* similarities between structures with similar processing scores.

On this basis it is possible to construct a near-perfect implicational hierarchy for *mean* emergence times, where structures of one level generally have higher processing scores and later mean emergence

times, than structures of the previous level. This consists of five levels as indicated on Table 33 and summarized in Table 34 below. The three flaws in this abstract hierarchy are that DP, Ordinals and reverse locatives each have a *higher* mean ET than structures with comparable processing scores. (In Hannah's and Kazuko's ILs, AdjP was also later than comparable structures, see Chapter Eight.)

Note that, due to the variability in mapping ranks to real time, mean ET can distinguish between structures with the same mean rank, and scores for individual processing factors can distinguish between structures with the same total processing score: total processing demands in stages III and IV overlap, but they can be differentiated by reference to the score for mergers.

Table 34 Implicational hierarchy of processability and rank emergence order

sum P, M & D	Level	Mean ET	Ranked mean ET	Mean Rank
< 8	I	6.66 – 7.33	1-2	1-2
8 -10	II	7.66 -13	3-7	2-5
11-12; M ≤4	III	14-21	8-11	6-8
12-15; M>4	IV	21-23	11-12	8-11
>15	V	24.66+	13-14	*10

In other words, Table 34 represents an abstract, theoretically based, emergence order for 19 common Mandarin nominal structures. As mentioned earlier, nothing in a processing account *excludes* the possibility of late emergence for less demanding structures; however the case for a relationship between processing demands and emergence order is strengthened if we can account for these exceptions. This issue is addressed in Chapter Eight.

7.4.3 PT developmental levels and adjusted mean emergence times

To assess the standard PT account of emergence orders, the correlation between the developmental levels shown in Table 28 (page 166 above) and mean ET was calculated, also using Kendall's Tau b. This correlation was also high and significant (48%; $p=.005$), but this was due primarily to the wide range of ETs for structures of similar processing demands. For example, of the 24 entries in Table 28, 12 fall into developmental level three, the so-called phrasal stage. As a consequence, this stage covers a span of 11 distinct mean ETs. In addition, a number of phrasal structures actually emerged 7 points *later* than the earliest sentential ones. This means the phrasal stage as a whole overlapped with the sentential stage, reducing the whole developmental sequence to an implicational hierarchy of only two stages, early and late. Those 'stages' are indicated by the double lines in Table 28, above: structures above the double line had a mean ET of three or less *and* had processing demands at level two or less; those below the double line had a higher mean ET *and* higher processing demands.

It should be borne in mind that the variation in mean ETs is actually a *mathematical* product of inter-learner variability. After all, there were actually a total of only nine observation points at which samples of ILs were taken, each learner was sampled only eight times, and new structures only emerged in seven of these samples at most. Thus the mean ETs are not a true indication of discrete points in real time.

Nonetheless, structures classified as phrasal did emerge at almost every observation point, including the first and the last, and it is because of this that the data can only be divided into *two* implicational stages actually related to differences in developmental levels, despite the various manipulations of the data in Chapter Five that created the appearance of up to five discrete clusters of structures.

The lack of any relationship between mean ET and the proposed developmental levels is particularly obvious from the range of mean ETs (from 1-11) for structures in the second level, and from the fact that the mean ET for the one structure in the 5th-6th levels falls within the range for structures belonging to the 3rd. Even the broad two-stage contrast between early and late structures is flawed by the very late emergence of ordinals which are lexical structures, and the slightly early emergence of numeric expressions and the affine structure, both of which are phrasal.

This means, either the distinction between lexical and phrasal structures is not a valid one, or the phrasal level had been already reached within the first 6 weeks of acquisition, before observation began.

On the basis of this data then, there is really no clear evidence to suggest that the so-called developmental levels 3-6 identified by standard diagnostics of PT are actually ordered relative to each other in the SLA of Mandarin Nominal structures.

7.4.4 Refined PT model

In the refined PT model however, virtually every advance in phrasal processing, from local agreement to functional identity was associated with an increment in mean ET. To assess the effectiveness of the revised PT account as a predictor of emergence orders, each of the processes shown in Table 29 (p. 167 above) was assigned a rank score from 1-7 reflecting the number and complexity of the unification processes it involved as follows:

Table 35. Processing score in refined PT model

Process	Score
None	1
categorial licensing	2
local licensing & agreement	3
Local DF and GF assignment	4
Multiple DF/GF assignment and local licensing	5
Functional uncertainty	6
co-head relation <i>and</i> functional uncertainty	7

Obviously, uninflected one-word nominals provide no evidence for any processes under the assumptions of PT/LFG, so they are assigned the lowest rank. The 2nd, 3rd, 4th and 6th points on the scale reflect developmental dependencies. As explained in Chapter Six, the implementation of agreement (3) entails the ability to perform basic licensing (2) (i.e. to implement a constraint equation); local GF assignment (4) entails the ability to perform local agreement *and* local licensing; and functional uncertainty (6) entails the ability to assign and license *two* GFs across a distance. Multiple DF and GF assignments were ranked 5th, *below* functional uncertainty because they were associated with the

recursion or combination of already established structures and the Adjunct GF, which needs no lexical licensing, while the latter was associated with new collocations and obligatory GFs which need lexical licensing. The 7th rank was assigned to structures involving a combination of co-head relations and functional uncertainty; clearly the combination is more taxing in principle than functional uncertainty alone.

In some cases a structure was amenable to two competing analyses, and in each case its processing demands were ranked on the basis of the less demanding analysis. In general such structures seemed to emerge at a time consistent with that simpler analysis.

These ranks for processing complexity were correlated with the ranked mean ETs of the '*phrasal*' structures shown in Table 4 above, using Kendall's tau b. The correlation was .76% ($p < .0001$).

This confirms the predictions made in Chapter Six, that it is actually *quantitative* differences in the number of procedural dependencies involved and developmental dependencies between the different mechanisms by which unification is implemented that relate most closely to emergence order.

7.5 Conclusions

This chapter has presented results of a careful analysis of collocation constraints, constituent order, intended meaning, and prosodic patterns evident in the IL output which made it necessary to assume certain covert lexical items within the Mandarin ILs under study (see Appendices G – L for more detail), but also made it possible to ascertain the lexical feature-structure of both those covert items and the *overt* items evident in the three IL lexicons.

On the basis of that *lexical* analysis it proved possible to apply minimalist principles to ascertain the derivation and underlying c-structures of the 19 syntactic constituents that emerged in a relatively stable order during the first year of study by three learners with different L1s. Then, on the basis of these *syntactic derivations*, each structure was assigned to a developmental level according to the standard assumptions of PT; processing demands were also quantified according to the type and number of unification relations each structure entails in an LFG framework, and according to minimalist assumptions about the processes by which each structure is derived. Finally, the ranking of structures in terms of their relative minimalist processing demands, and in terms of their developmental levels, and in terms of their involvement in unification processes was compared to the ranking of the same structures with respect to two mean measures of emergence order, RMET and RMR, and in some cases to individual emergence orders.

The implications of these correlations are discussed in Chapter Eight.

Chapter Eight: Explaining Emergence Orders

8.0 Introduction

This chapter reflects on the significance of the correlations reported at the end of Chapter Seven, and pursues two unresolved issues: how to account for the variability in the emergence times of the same structures in different ILs and of structures with the same processing demands in the same IL, and how to relate the measures of processing demands considered in Chapter Seven to the pre-theoretical observations about developmental patterns made in Chapter Five. Recall it was observed there, that structures appeared to increase in c-structural complexity over time; that there were distinct developmental timetables for different functional domains: quantification, modification and complementation or predicate-argument structure; and that there was also a developmental pattern associated with *de* structures, where each category of modifier that occurred with *de*, appeared first in immediate collocation with *N*.

If the correlations between emergence times and processing demands reported in Chapter Five are to function as an explanatory model of IL development, they need to be related in some way to these observations. Section 8.1 summarizes the main conclusions we can draw from the results reported in Chapter Seven. Section 8.2 explains how the minimalist analysis can account for between-learner and between-structure variation, as well as development in separate functional domains; and section 8.3 explains how the PT model reveals SLA as a process of grammaticalisation, such that pragmatic and thematic relations are expressed by way of increasingly complex syntactic relations.

8.1 Processing demands and emergence times

8.1.2 Which model makes the most accurate predictions?

In Chapter Seven we saw that processing demands assessed in terms of minimalist processes were more highly correlated with the mean measures of emergence times (in the order of 60-80%), than was the division of structures into one of the six standard developmental levels of PT (which correlated at a level of 48%). However, a more explicit assessment of processing demands associated with licensing, agreement and GF assignment within an LFG framework distinguished between nominal structures with just as much sensitivity as the MP framework, producing a correlation of 76%.

8.1.3 Are the processing factors valid measures of processing?

These are high levels of correlation, and indicate that, *given a thorough lexical and syntactic analysis* to begin with, either PT/LFG or the MP can be used with reasonable confidence to relate processing demands to emergence times. On this basis, we can also conclude that the minimalist notions of merger, phases and delay, and the LFG notions of unification for licensing and GF assignment all constitute valid instruments for the measurement of processing demands that affect emergence order.

8.1.4 Which processes affect emergence order most?

The general impression formed in Chapter Five, that nominal structures become increasingly structurally complex, was confirmed by the minimalist analysis in a slightly indirect manner: though the number of *overt* lexical items contained in a constituent proved to be a very *poor* predictor of its mean emergence time, the number of mergers proved to be a very *good* predictor. This reflects the number of *theoretically motivated* lexical items, including *covert* functional heads involved in a structure.

However, the best *overall* predictor of emergence order was the number of *phases*, calculated within the MP model. Each phase represents up to two c-structural levels associated with a *single* head, a phrase. It is therefore this measure that corresponds most closely to the concept of c-structural complexity. The number of phases correlated with *individual* emergence orders for 19 structures at a level between 54-64%. For the 14 less variable structures among that 19, the number of phases correlated with individual orders at a level between 61-81%. This is a very high level of correlation indeed for *a single aspect* of syntactic processing.

For two learners, Hannah and Kazuko, the sum of mergers, phases and delay (P&M&D) produced slightly higher correlations with their individual emergence orders than phases alone. This indicates individual variation with respect to *specific* minimalist operations, a factor that will be explored further below.

8.1.5 Which processes affect emergence order least?

Somewhat surprising from the standpoint of PT, is the finding that agreement relations played a relatively minor role in the determination of emergence time, at least when those relations are analysed on the basis of minimalist assumptions. However it is important to understand that this relates directly to theoretical differences in the conceptualisation of agreement.

In PT, syntactic relations are a *sine qua non* for the implementation of agreement, or rather of unification generally. Only if language-specific c-structure rules cause two tokens of a single type to be mapped to the same functional structure will their values need to be unified. Moreover unification is costly only to the extent that it is delayed, necessitating information transfer and storage.

In the minimalist view, the relationship between agreement and syntactic relations is reversed: agreement, in the sense of an expression of identical feature *types*, is a *sine qua non* of merger. Because there are only seven distinct feature types in the entire IL system, and most items include between 3

and 5 features there is relatively little variation in the costs associated with agreement for structures with the same number of items. Moreover the 'costs' of agreement are generally low because it involves only copying, not unification, and the copying is always local, between two items in the same phrase. The main contributor to processing demands is a pattern of agreement that results in some unvalued feature(s) being structurally remote from the closest valued counterpart. Agreement viewed in this light adds an equal processing demand to all phases, so it is unlikely to be a good predictor of differences in processing demands.

In this model, storage effects are quantified in terms of the variable called 'delay', and this *was* one of the measures that correlated most highly with emergence orders.

In short, it is not the case that the results of the two analyses conflict about the major sources of processing demands; they simply quantify the costs of feature valuation and/ or unification in different ways. Where PT suggests that c-structural complexity contributes to processing demands only in so far as it increases the distance across which unification must be implemented, the MP suggests that agreement contributes to processing demands only to the extent that it is delayed by c-structural complexity. The MP analysis 'hides' the cost of agreement in a measure of c-structural complexity, while PT 'hides' the cost of c-structural complexity in the mechanisms by which agreement is enforced. However, both theories clearly point to an interaction effect between hierarchical complexity and feature-matching as the major factors underlying increases in syntactic processing demands.

Another point on which the theories agree is that neither the *number* of features expressed by lexical items, nor the type of feature (with the exception of GF features in the LFG framework) has a major impact on emergence order. It is the combination of features in *different* items that affects syntactic processes the most. This suggests that syntactic development is influenced more by language-internal factors – the way specific features are compiled into words – than general cognitive/ conceptual factors.

8.1.6 Do the predictions of the two theories agree?

Though the analyses seem to differ somewhat in their conclusions with regard to the impact of agreement or feature unification on emergence time, this is because they conceptualise agreement in such different ways. Otherwise, and despite other theoretical differences, their predictions are generally in agreement. The closeness of fit between the predictions of each model can be seen in Table 36, below, which compares categories of GF assignment in an LFG analysis, represented by column two, with those derived through a minimalist analysis, represented by the column 'Sum of PDM ranks'. Only the reverse locative and recursive possessive structures fall into different groups in the two analyses. Their emergence time is more consistent with the MP analysis than with the revised PT analysis.

Table 36. Comparison of stages in MP vs revised PT analyses

Mean ET	GF assignment	Structures	Sum of PDM ranks
7 weeks		Name; Noun; Pron; little pro; DP Num-Class N; Ordinals	<8
10.5 weeks	None: phrasal SOP	Affine structure; dePPoss AdjP N; Conjunct	8 -10
16 weeks	Simple: within the same phrase as the calling head	Incorp. locatives	11-12; M ≤4
22 weeks		deP Mod ; Dem Class N	
		Recursive Poss	12-15; M>4
	Transfer: within the matrix phrase Co-Head	Num-Class deP N; *Pseudo-RC	
	Functional control:	*Reverse Loc	
25 weeks	One GF mapped to another	Locative DE	>15

8.1.7 Does this *explain* emergence order?

To a certain extent these correlations can be said to explain emergence order. *If* we accept the basic premises of PT, (which are well-supported by psychological investigations of learning processes) that a speaker's total processing capacity is mainly limited by what they can process *consciously*, *and* that syntactic processes gradually become automatic, *and* that this occurs as a consequence of using processing routines repeatedly, it follows that the gradual automatization of processing will *reduce* the demands on conscious processing, and thus *increase* a learner's total processing capacity over time. It then follows that structures making greater processing demands will emerge later than those making smaller demands. The correlations indicate that this conclusion is supported by the empirical evidence.

However the minimalist analysis suggests equally clearly that *overall* processing demands do not tell the whole story; variation as to which factor is the best predictor for *individual* emergence orders indicates that each learner responds differently to different processing factors. The next section considers how well this variation in response to specific factors accounts for variations in emergence ranks.

8.2 The Minimalist account and inter-learner variability

Individual responses to different syntactic processes are illustrated in Tables 38 to 37 below. Structures in each table are ordered by *actual* ET for one individual learner. This results in a slightly different order in each table. (Recall that emergence orders correlated with each other at a level of 78% (Kendall's W; $\chi^2=48.84$; $p=.001$), which is high but not perfect.) Columns 2-8 represent sample times, and 'x' marks the time each structure emerged. Columns without 'x's are either missed samples (as indicated) or samples in which no new structures emerged. Columns 9-13 represent minimalist processing factors; as discussed in the previous chapter, the relative involvement of phases, mergers and delays is represented by scores on a scale from 1-6.

Table 37. Development of processing in Hannah's IL

Sample	H1	H2	H3	no data	H4	H5	H6	H7				
ET in weeks	6	8	11	14	21	24	26	28	P	D	M	Sum of PDM
Structure												
Name	x								1	1	1	3
Pron	x								1	1	1	3
Noun	x								2	1	1	4
Num-Class N	x								2	3	2	7
Affine structure	x								3	3	3	9
*little pro		x							1	1	1	3
Assoc deP		x							3	4	3	10
*DP			x						2	2	2	6
*AdjP N			x						2	3	3	8
*Ordinals					x				1	1	1	3
Conjunct (min)					x				2	3	4	9
Mod deP (indef)					x				3	5	3	11
Recursive Poss					x				4	4	5	13
Num-Class deP N					x				4	6	5	15
Dem Class N							x		4	4	3	11
Pseudo-RC							x		4	3	5	12
Incorp. locatives							x		6	2	4	12
Locative DE							x		5	5	6	16

Table 38. Development of processing in Kazuko's IL

Sample	K1	K2	K3	K4	K5	no data	K6	K7				
ET in weeks	6	8	11	14	21	24	26	28	P	D	M	Sum of PDM
Structure												
Name	x								1	1	1	3
Pron	x								1	1	1	3
little pro	x								1	1	1	3
Noun	x								2	1	1	4
Num-Class N	x								2	3	2	7
Affine structure	x								3	3	3	9
*AdjP N		x							2	3	3	8
Conjunct (min)		x							2	3	4	9
Assoc deP		x							3	4	3	10
*DP			x						2	2	2	6
Pseudo-RC			x						4	3	5	12
Mod deP (indef)				x					3	5	3	11
Dem Class N				x					4	4	3	11
Incorp. locatives				x					6	2	4	12
Recursive Poss					x				4	4	5	13
Num-Class deP N					x				4	6	5	15
*Reverse Loc							x		4	4	4	12
Locative DE							x		5	5	6	16
*Ordinals								x	1	1	1	3

Table 39. Development of processing in Sam's IL

Sample	no	S	S2	S3	S4	S5	S6	S7				
ETin weeks	data	1							P	D	M	Sum of PDM
Structure	6	8	11	14	21	24	26	28				
little pro		x							1	1	1	3
Name		x							1	1	1	3
Pron		x							1	1	1	3
Noun		x							2	1	1	4
Num-Class N		x							2	3	2	7
*DP			x						2	2	2	6
AdjP N			x						2	3	3	8
Affine structure			x						3	3	3	9
Conjunct (min)			x						2	3	4	9
Assoc deP			x						3	4	3	<i>10</i>
Incorp. locatives				x					6	2	4	12
*Ordinals					x				1	1	1	3
Mod deP (indef)					x				3	5	3	11
Dem Class N					x				4	4	3	11
Pseudo-RC					x				4	3	5	12
Num-Class deP N					x				4	6	5	15
Locative DE						x			5	5	6	16
*Reverse Loc							x		4	4	4	12

The solid horizontal lines in Tables 36-38 represent points where increases in processing demands accompany an increase in emergence rank. These constitute stage boundaries in an implicational hierarchy. In each stage the processing demands are higher than they were in the stage before, and emergence times are later; exceptions are marked by an asterisk. Dotted lines indicate an increase in processing demands for one or more factors that is *not* accompanied by an increase in emergence time.

8.2.1 Processing thresholds

From these tables it is evident that a developmental hierarchy appears in each IL. However, the stage boundaries in different ILs do not coincide. Kazuko's IL can be divided into five stages, Sam's into four stages, with his third stage corresponding to Kazuko's second and third, and Hannah's into only three; her last stage corresponds roughly to Kazuko's last *three* combined.

It is also apparent that each structure within a stage involves either one factor at a new level of demand, or all three factors at moderately high levels compared with structures from the previous stages (see bold figures). This suggests that learners reach a succession of *thresholds* that limit their *total overall processing capacity* for a time, but do not relate to any one particular process.

8.2.2 Individual responses to different processing factors

However, total processing thresholds seem to interact with *individual* responses to specific processes. Note that Pseudo-RC and incorporated locatives have the same *total* processing score (12) but they emerged at different times in each IL. The relevant facts can be seen most clearly by comparing Tables 38 and 37. Pseudo-RCs emerged ten weeks earlier in Kazuko's IL than in the other

two, while incorporated locatives emerged ten weeks *later* in Hannah's IL than in the other two. Because of this, both structures were assigned *adjusted* mean ETs in the *average* emergence order.

At the same time, note that for each structure, the score of 12 is made up from the three key processing factors in different ways. Pseudo-RCs have a relatively high score of 5 for mergers, but a moderate score of 4 for phases, while incorporated locatives have the highest possible score of 6 for phases, and a lower score of 4 for mergers. Crucially, Table 38 shows that in Kazuko's IL, the demands made by Pseudo-RC in terms of phases and mergers lies clearly within the range of demands for those measures made by the other structures that *she* produced on either side of it: conjunct structures in week 8, which score 4, just less than Pseudo-RC, for mergers, and two other structures ranked 4-6 for phases at week 14. Thus, her production of Pseudo-RC at week 11 is unexceptional in terms of *her own* development.

Sam's overall pattern of development is much like Kazuko's except the number of phases increased more gradually in his IL. He just reached the processing level required for pseudo-RC at week 14, and it appeared one sample later (week 21).

However, Hannah's development (Table 37) is somewhat different. Clear advances in phases and merger were not apparent in her IL till weeks 21 and 24 and they reached their peaks one sample later than delay. Thus, Hannah reached the level required for either pseudo-RC *or* incorporated locatives only at week 21. By *her* standards, incorporated locatives were 'late' in her IL by only one sample, and the relevant sample was actually the one at T4, for which Hannah was absent.

The ETs of these structures seem anomalous only from the viewpoint of *total* processing scores and *average* ETs. When individual factors and learner differences are taken into account, they are not anomalous at all.

This variation explains why the boundaries for implicational stages based on processing demands presented in Table 7 of Chapter Six did not coincide neatly with boundaries between stages based on mean ranks or mean ETs; the latter obscure individual differences between learners, and their relationships to specific processing factors.

At the same time, individual development can obscure more general patterns of development, forcing more structures to be included into a single stage than would otherwise be the case. In the most conservative analysis, we must treat Hannah's samples 4 and 5 as selections from a single developmental stage despite the fact that structures that emerged in those samples can be divided into two groups (the dotted lines) on the basis of their processing demands. Given the overall evidence that ETs do correlate with processing demands, we can hypothesise that Hannah's H4 structures with lower demands (9-11) may have actually emerged some time before week 21, closer to week 14, the interview she missed, while those with higher processing demands (13-15) may have emerged closer to week 21, when her fourth sample was actually taken. Similarly, the H5 structures with lower demands may have

emerged soon after the sample at week 21, while the structures with higher demands may more accurately represent her capacity *at* week 24.

In other words, in Hannah's broad third stage, some structures from each ET fall within the range of processing demands for more demanding structures from the previous sample, but not within the range of *less* demanding structures from that sample: structures do not generally lag behind by more than one sample. This kind of overlap could arise simply because Hannah took her time introducing new structures within her processing capacity, but equally it could be a function of sampling error masking a more finely graduated developmental sequence.

Note also that Hannah had acquired just as many structures as the others by week 24, despite the fact that her samples showed advances in phases and mergers only at week 21. Either her acquisition was extremely rapid after a late onset, or some of her 'late' structures had actually emerged earlier, but were missed due to sampling error.

8.2.3 Processing demands and development within functional domains

The breakdown of minimalist processing demands into separate factors also allows an investigation of development within different functional domains. Recall that in Chapter Five it was suggested that emergence order might be profitably viewed as a consequence of the overlap of independent sequences, one involving optional modification followed by complementation of N, the other involving quantifiers and demonstratives, with the latter emerging with the earliest locatives:

59) Affine structure > Assoc deP > adjP N > MOD deP / incorporated Loc > Locative de / RC
 Num-Class-N > > > Dem Class- N

The tables below show how development within each of these three functional domains relates to processing demands made by individual structures.

MODIFICATION OF N

Table 40 shows the processing demands and mean ET of the first four items on the first continuum above. There is a clear difference in mean ET between the first three items and the fourth, deP Mod. On this basis, we might revise the representation of the first continuum by collapsing the first three structures into a single stage:

60) adjP N / Affine structure / Assoc deP > MOD deP ...

Note that this break corresponds to the point at which a predicate combines with *de*. In LFG terms this necessitates some form of argument suppression or argument sharing. This is discussed below. The number of mergers and phases does not appear to differ significantly between the four structures, but there is an increase in both the number of feature values copied and the delay entailed

by feature valuation. This suggests that agreement relations might impact on emergence order in the MP account, when the demands associated with construction are otherwise equal.

Table 40. Modification of N

Structure	values copied	merges	phases	delay	Σ of 4 factors	Σ mpd	Mean ET
AdjP N	6	4	2	3	15	9	10
Affine structure	7	4	3	3	17	10	7.66
Assoc deP	9	5	3	4	21	12	9
Mod deP (indef)	10	5	3	5	23	13	17.33

SPECIFICATION OF N

Table 41 shows the structures in the specification continuum. Here the break in ETs comes between the first and second structures. Demonstratives introduce additional features *and* involve more phases and delays than numeric structures. The combination of a number and a modifier makes only a little difference to the overall totals.

Table 41. Numeric and demonstrative expressions

Structure	values copied	merges	phases	delay	Σ of 4 factors	Σ of mpd	mean ET
Num-Class N	7	3	2	3	15	8	6.66
Dem Class N	9	4	4	4	21	12	19.66
Num-Class deP	10	6	4	4	24	14	21

This differs somewhat from the PT analysis, where, as just mentioned, the introduction of the de structure means the introduction of GF assignment, which is seen in general terms as a significant increase. Recall though that the Mod de structure has been mastered prior to this, so the increase in demands here is associated with more *automatic* processing, not with *new* processes.

Now consider how these two continua relate to each other. The processing scores for Num-Class-N are very similar to those at the lower end of the modification continuum, while the scores for Dem-Class-N are very close to those, at the *upper* limit of that step and the lower limit of the next. Thus the early emergence of Num-Class-N and the later emergence of Dem-Class-N is precisely as the processing demands predict. The precise placement of Dem-Class-N relative to Associative de and Mod de depends on the individual learner's capacity for specific operations. Essentially, Dem emerges late because it is not as strongly attracted to Class as Num is, and to combine *both* requires more processing than using Num alone.

COMPLEMENTATION OF N IN LOCATIVE STRUCTURES

Finally, consider locative structures, as illustrated in Table 42. Except for the idiosyncratic and non TL-like reverse locative, their emergence order also relates directly to processing demands. Even though the MP does not count thematic-role assignment as a processing demand in its own right, it is reflected nonetheless in the number of mergers, which increases when one nominal is selected by

another because of the functional heads required to keep features of the predicate and its argument apart.

Table 42. Locative Structures

Structure	values copied	merges	phases	delay*	Σ 4 factors	Σ of mpd	mean ET
*Locative Prep.	5	4	3	3	15	10	11
Incorp. locatives	10	6	7-10	2	25-28	15-18	14
*Reverse Locative	11	7	6	4	28	17	26
Locative DE	18	12	8	5	43	25	24.66

* Non TL structures

It is clearly the increase in mergers that separates the TL-like locative de structure from the other locative structures *and* the other de-structures in the MP analysis. Locative de had the maximum score for number of mergers of any structure, and in each IL it appeared one sample later than Num-Class-deP N, which was one rank lower for that processing factor, but was otherwise comparable in its demands (see Table 40, above).

It is interesting to note that the reverse locative and the locative preposition, which are not TL-like, have lower processing scores than their TL counterparts in nearly every factor. In fact the demands of the reverse locative are so low that its emergence only at week 26 demands explanation. It can be understood partly as a consequence of being a non-TL structure, and partly as accommodation between interlocutors.

8.2.4 Accounting for structures that emerged 'late'

REVERSE LOCATIVES

Reverse locatives involve the same overt elements as the locative de structure, but make the same processing demands as the less demanding incorporated locative. In the former de must be analysed as a *preposition* which selects a locus-denoting complement, not as a functional head which conflates with locative complement and selects a locus-denoting specifier. Since incorporated locatives are present in the TL to which the learners were exposed, but reverse locatives are not, it is not surprising that incorporated locatives emerged at week 14 (T4), but reverse locatives did not.

In fact, reverse locatives occurred only when Sam and Kazuko interacted in week 26 (T7). By that time, both their ILs already contained incorporated locatives and Sam's IL already contained TL-like locative de structures, but T7 was the first point at which Kazuko produced the locative de structure, alongside the less demanding reverse locative. Her alternation between these two structures is precisely what we would expect of a learner on the cusp of acquiring the more demanding of the two. It is therefore really only Sam's use of the reverse locatives at T7 that is 'late'. This can be readily understood as accommodation to the presence of the reverse locative in Kazuko's output. In conversation with Hannah in earlier *and* in later samples, Sam's locative de structures were *all* TL-like.

DP AND ADJP-N

There were just three other structures whose emergence seemed later than expected: DP, AdjP-N and Ordinals. The late emergence of the first two can be explained by methodological factors. Recall that the emergence point for definite DP was taken as the point at which the distribution of definite and indefinite 'bare NPs' became *statistically* distinct. The statistical tests required many more tokens of both types than the standard emergence criterion of two tokens within a sample in each IL. Thus the ET for DP is very conservative.

Similarly, Adj-N collocations appeared in week 6 but were discounted, because they could not be distinguished from lexical compounds. Adj-N collocations were not counted as AdjP-N until the Adj was modified by an adverb, demonstrating that the collocation was *syntactic*. Thus, the emergence criterion for AdjP-N was also conservative.

This means the ETs assigned to AdjP-N and DP may well be inflated when compared to the ETs of other structures. In Kazuko's and Hannah's ILs, AdjP-N and DP may both be more properly assigned to level I; in Sam's IL, DP can also be assigned to an earlier stage, but AdjP-N and the affine structure *both* emerged later. In other words, AdjP-N and affine structures both fell naturally within *his* second stage, and the processing *threshold* separating Sam's first and second stages was *lower* than that for the other learners.

ORDINALS

Ordinals are the one structure whose late emergence remains unaccounted for: they emerged late in *all* three ILs, but there is no obvious reason for this revealed by the MP analysis of processing demands, or for that matter by the PT/LFG analysis. It is possible that ordinal structures involve more structural levels than were identified by the analysis of lexical features. If so, they would have higher processing scores than those posited here, but there may be factors other than processing involved. I leave this for future research to clarify.

8.3 The Emergence of Grammatical Functions

A slightly different, but equally orderly picture of syntactic development emerges when we consider the developmental continua for modification and complementation from the LFG perspective.

8.3.1 From athematic to thematic relations between nouns

In the PT model, the affine and early N *de*N structures of the first continuum might be understood as products of a phrasal equivalent of the SOP, i.e. an ordering based directly on thematic roles without the involvement of abstract GFs. In this scenario, *de* could be seen as a possessive suffix that can attach to either N or Pron. The phrasal SOP would need to order thematic roles on a

somewhat different basis from the sentential SOP, since no *event* is involved in the possessive relationship.

However, by week 16 de-structures clearly involved DF assignment associated with *de*. Recall that by this time relations between two constituents on either side of *de* were already varied and unrelated to any thematic role lexically specified by either constituent, but NP1 was always a modifier and NP2 was always focal. Modifier and Focus are *discourse* functions (DFs), and under Bresnan's Endocentric Mapping Principles (Bresnan, 2001), DFs must be associated with specifier positions in a *functional* phrase, in this case, *deP*.

The emergence of nominal *predicates*, in the form of locative nouns, then marks the onset of lexically licensed *GF* assignment. This occurred initially within a *categorial* procedure forming fixed locus-locative compounds (see discussion of this structure in Appendix L), and later within a phrasal procedure, forming *ad hoc* incorporated locatives.

The next structure to emerge was the pseudo-relative clause. Though there is no gap within the modifying clause itself, this structure involved the assignment of a TOPIC DF to an initial NP and the identification of a SUBJ GF from the main clause with that topic NP: a functional uncertainty equation implemented at the sentential level. The next structure to emerge was the locative *de* structure. In this structure, functional uncertainty was resolved by way of a functional identity equation within *deP*.

As discussed in Chapter Six, licensing, DF and GF assignment, and the resolution of functional uncertainty form an implicational hierarchy of processing demands where each process entails the one before.

8.3.2 From thematic roles to lexically specified GFs

PREDICATES WITHOUT LEXICAL FEATURES

The development of adjectival modification parallels that of modification using nouns. Because of the Completeness Condition, the lexical structure of verbs must *not* include GFs until a procedure has developed that can assign and unify GFs. Thus we must understand all early IL predicates, be they verbs, nouns or 'adjectives' as having thematic arguments that are *not* grammaticalised as lexical GF features. Such a lexical predicate might be incorporated into a noun's *categorial* procedure to form a compound noun, but a *phrasal* predicate (*AdjP*) could not. Note that in locative compounds, the head noun is the predicate, not the 'modifying' noun. It appears that predicate nouns can accept *nominal arguments* in their categorial procedure, but cannot accept *verbal modifiers*. Whether this is related to categorial differences between N and V or the thematic difference between modifiers and arguments remains to be determined.

AdjP-N collocations cannot be the product of the sentential SOP because this would interpret *AdjP* as a predicate and enforce the order N-*AdjP*, as attested in early IL predicative structures. *AdjP-N* must be the product of a *phrasal* procedure that licenses, or perhaps simply fails to exclude, a non-nominal element.

DF ASSIGNMENT AND THE ADJUNCT GF

The emergence next of the MOD *de* structure sees the assignment of the MOD DF to AdjP licensed by the freely available Adjunct GF. As in a basic associative *de*P structure, both FOCUS and MOD DFs would be licensed, and Extended Coherence would be satisfied by the annotation $(\uparrow GF) = \downarrow$ at the nodes where the DFs are assigned. This links the constituent inserted at that node to an unspecified GF within its mother's f-structure. As long as ADJ includes no lexical GF, the *Adjunct* GF will be necessarily included in the *de*P's f-structure to enable this condition to be satisfied.

GF ASSIGNMENT IN INTRANSITIVE RC

Lexically licensed GF assignment involves a little more processing. When 'Adj' acquires a Subj GF in its lexical structure, becoming effectively a V_i , that GF will remain unassigned in AdjP/VP (see Appendix L for a discussion of alternatives and why they are dispreferred). However, AdjP/VP has access to the MOD position in the *de*P procedure, and in that same procedure a FOCUS DF *needs* to be linked to a GF to satisfy Extended Coherence as just described. That Focus DF can be linked to an unassigned GF within a modifying VP by a simple extension to the licensing annotation at the FOCUS position, i.e. the inclusion of the DF MOD as a legitimate optional step along the path that it defines, giving: $(\uparrow(\text{MOD}) GF) = \downarrow$.

Not only does this satisfy the Extended Coherence Condition with respect to the Focus DF, it also satisfies the Completeness Condition with respect to V. Under this analysis the representation of the Mod *de* structure in LFG terms would be as shown below:

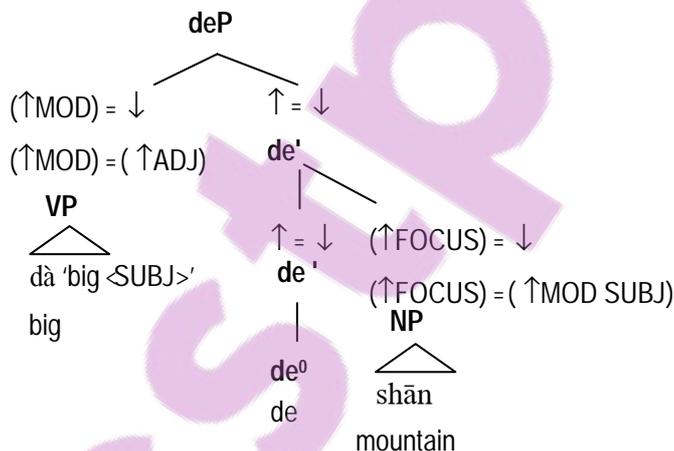


Fig. 26 The structure of Mod *de*P according to the EMPs

There is no *outward* difference between a structure where Adj has no lexical GFs, and a V_i *de*N structure, where it has one GF to assign. The point at which a learner of Mandarin becomes able to implement functional identity is *transparent* only in *locative* *de* structures.

8.3.3 From lexocentric to endocentric structures

The development of GF assignment cannot so readily explain the late emergence of Dem-Class-N and Dem-Num Class-N structures relative to Num-Class-N structures. However this progression *can*

be viewed as a development from a strictly semantic arrangement of quantifier-N, through an interim stage where a single phrasal procedure assigns a DF to *either* Num *or* Dem, and finally to something approaching the TL state of affairs, where Dem initiates a procedure of its own that accepts input from a prior procedure that combines Num and ClassP (containing NP).

Effectively this is development away from a flat lexocentric nominal structure, towards an endocentric nominal structure. Since the implementation of licensing and agreement relations between N, Class, Num and Dem become more demanding as the c-structure that separates them becomes more internally complex, we might see this as a natural developmental pathway, that is not followed until processing capacity allows. Equally, it might be seen as a way of allowing complex agreement relations to be resolved in stages, so that the consequences of earlier unifications restrict the possible outcomes at later stages. These are aspects of processing that warrant further investigation.

8.4 Conclusions

The MP model is able to effectively relate variations in the type and number of operations it assumes to variations in emergence times and variations between structures. The refined PT model paints a clear picture of developmental dependencies that shape emergence order as learners strive to adapt existing procedures to accommodate more lexical items to form more complex propositions, without compromising completeness and coherence. These developments are only marginally related to morphological agreement, and apparently entirely independent of any iteration effects associated with divisions of conceptual structure. In short, either model shows clear potential as a generalisable explanatory model of emergence orders in any natural human language.

The next and final Chapter of this thesis reviews the overall conclusions drawn from this research.

Chapter Nine: Conclusions

9.0 Introduction

The introduction to this thesis posed the question: to what extent can processing demands calculated on the basis of the MP and PT explain the natural acquisition order for Mandarin nominal structures? This chapter suggests an answer to that question based on the foregoing discussion. In doing so, it draws together the major conclusions of this research.

9.1 The natural order

In the preceding chapters we have seen firstly that there is indeed a natural acquisition order for nominal structures of Mandarin. Of 56 nominal surface structures observed in the data, 18 were ultimately identified as theoretically distinct, and productive in the ILs of three adult learners, and there was a 78% correlation between the emergence orders of these 18 structures in the three ILs. Two representations of an *average* emergence order were derived mathematically from these three individual orders: a ranking of mean emergence *times* (RMET) and a ranking of mean emergence *ranks* (RMR), as shown in Table 43.

Table 43. Two indicators of a natural emergence order for 18 nominal structures

Structure	RMET	RMR
Compound N	1	1
Name	1	1
Noun	1	1
Num-Class N	1	1
Pron	1	1
little pro	2	2
Affine structure	3	2
dePPoss	4	3
(Adv) Adj N	5	4
Conjunct (min)	6	5
hen duo N	7	6
dePMod (indef)	8	7
Incorporated Locatives	9	7
Pseudo-RC	9	7
Dem Class N	10	8
Num-Class deP	11	8
Ordinals	12	9
Locative DE	13	10

These average measures correlated with individual orders at a level between 82–89%, but neither was significantly correlated with the order in which the target structures were presented in teaching

materials. Therefore RMET and RMR can each be taken as an accurate reflection of a *natural* emergence order for these 18 nominal structures in adult Mandarin SLA.

Emergence rates

Ten of the structures observed in this study had also been observed in a previous study of three other similar learners (Zhang 2001), and a comparison of the results from both studies revealed that the six learners from the two studies combined, not only manifested identical emergence *orders* for most of the structures, most acquired them at similar *rates*. This means the mean emergence *times* for structures observed in these studies should also provide a reasonably accurate base-line for the expected emergence times for other learners subjected to a similar schedule of instruction, i.e. six hours a week for 24 weeks out of 30. This is shown in Table 44.

Table 44. Mean ETs for 18 nominal structures

Mean ET	Structures
7 weeks	Name; Noun; Pron; little pro; DP Num-Class N; Ordinals
10.5 weeks	Affine structure; dePPoss AdjP N; Conjunct
16 weeks	Incorp. locatives deP Mod ; Dem Class N
22 weeks	Recursive Poss Num-Class deP N; *Pseudo-RC *Reverse Loc
25 weeks	Locative DE

Differences between the two studies all appeared to be responses to intensive instruction or modelling to which the learners in Zhang's study were exposed, but those in the Auckland study were not. This intensive exposure was accompanied by relatively rapid acquisition of the relevant structures in only *one* IL; in the other two, it was accompanied either by elevated rates of production, which *quickly lapsed*, or by *delayed emergence*, or even *failure to acquire* the target structures in the observation period. These findings are similar to experimental findings on the effects of intensive instruction before the point of developmental readiness (Pienemann, 1984), as predicted by PT (Pienemann, 1998c).

Apparent patterns of development

The mean ETs fell into five categories suggestive of five developmental stages, however, it was not clear that structures within a 'stage' shared any particular structural or syntactic characteristics beyond the fact that their internal structures seemed to become more hierarchical over time. However, it was clear that locative structures, which involve predicate argument relations, always emerged a little later than structures that were superficially similar but involved only optional modification, and that the learners maintained a distributional distinction between definite and indefinite nominals from quite early on, but demonstratives determiners emerged late.

On this basis, it was suggested that development might be characterised in terms of two independent developmental hierarchies, one relating to modification and complementation; the other to the expression of quantification or indefiniteness and definiteness (see Chapter Five).

- 61) Affine structure > Assoc deP / AdjP N > MOD deP / N-N_{Loc} > Locative *deP* / Pseudo RC > *RC
 Num-Class-N > DP > Dem Class- N > Dem-Num-Class-N

The Dem-Class-N structure emerged around the same time as locative *de*, but the lexical features and syntactic processes involved in these two structures are not obviously related. Essentially, they emerged together because they have similarly complex hierarchical structures.

9.2 Processing demands correlate with emergence times

In Chapter Seven it was shown that all measures of emergence order correlated highly and significantly with processing demands calculated *either* on the basis of the MP *or* on the basis of LFG, and that the best overall predictor of emergence order was indeed c-structural complexity. In the MP model this was quantified as the number of *phases*. This correlated with individual emergence orders for 19 structures at a level between 54-64%, and for the 14 less variable structures at a level between 61-81%. In the refined PT model, c-structural complexity was associated with different unification mechanisms: structural licensing, lexical licensing, agreement, GF assignment and functional uncertainty (see discussion of ‘do-fronting’ and of the developmental dependencies between different unification processes in Chapter Six). A ranking of these processes correlated with mean emergence times at a level of 76%.

In contrast, the standard PT model, which largely downplays the relevance of hierarchical complexity within nominal structure, did not fare so well. There was only a 48% correlation between emergence times and developmental levels, and this arose because most structures were allocated to just one developmental level.

Feature valuation / unification

The main measure of agreement, number of values copied, actually had the lowest correlation with emergence order of any factor in the minimalist model (47-63%). This does not mean agreement is irrelevant to processing demands, it simply reflects the fact that processing demands increase as a function of an *interaction* between agreement and hierarchical complexity (see discussion of individual processing factors in Chapters Seven and Eight).

Lexical construction

Despite the premise of both theories that acquisition is partly or primarily a process of lexical construction, neither the acquisition of specific features, nor the total number of features involved in a construction appeared to have any impact on emergence order at all. In fact, all seven of the lexical features identified as necessary to the construction of IL nominals appeared to be present and operative

in the earliest IL samples. This supports the notion that lexical features themselves need not be acquired, perhaps because they are related to universal cognitive tendencies or to the practical requirements for effective communication between human minds. On the other hand, the features might be available because they were *acquired* during L1A. A search for evidence of specific lexical features in L1A might contribute some interesting insight to this question.

9.3 Expanding functional capacity but no clear stages

Though both analyses relate emergence orders clearly to processing demands, neither suggests that IL development falls into clear stages. In the minimalist analysis, structures emerging at similar times had similar total processing scores, and it was possible to construct implicational hierarchies of processing demands in each IL. However, the structures that emerged together at one time did not share any characteristics other than total processing demands; total processing demands did not increase in regular increments; and neither was there a constant combination of operations contributing to total processing demands, or a consistent increase in any *single* minimalist operation from stage to stage. In short, processing demands formed a *continuum* relating to total capacity, and did not fall into stages, except in so far as stages can be defined individually, by apparently random increases in total processing score.

The modified version of Processability theory developed above also provides no basis on which to postulate clear-cut stages. It favours the notion of initial developmental dependencies, gradually giving way to increasing and persistent procedural dependencies. (See discussion of procedural dependencies and their interactions with c-structural complexity in Chapter Six.) The first arise from the entailment of one process by another, for example GF assignment entails the ability to implement a constraint equation; the second arise from structural embeddedness which results in two values that need to be unified, being located in c-structural constituents with distinct f-structural representations. For example, this occurs when a constituent with a PRED value, to which a GF can be assigned, can only be found outside the immediate constituent in which the GF is lexically licensed (see discussion of SUBJ GF assignment in deP in Chapter Eight and Appendix L.)

Since all structures except the very earliest involve different numbers of different processes, and vary independently in c-structural complexity, there is no reason why they should form a set of discrete stages rather than a *continuum* of total processing demands. For this reason and others, stages may be difficult to define on theoretical grounds. Moreover, even if they can be defined, they might be too coarse a form of classification to allow meaningful separation of structures over time, or the theoretical grounds may be so abstract that they don't facilitate the classification of structures on the basis of surface characteristics, as we have seen. In short, stages may not be a valid or helpful way of analysing, describing or predicting IL development.

9.4 Implicit Processes that are *not* task-specific?

Another interesting observation is that emergence order correlated with *total* processing scores, regardless of how the total was made up. Demands at a single emergence time could be very high in one factor, compared to that factor at earlier emergence times, or moderately high in two or three factors, as long as a specific *total capacity* was not exceeded. This suggests that the processing mechanism *shares cognitive resources* across different processes.

The underlying premise of PT is that *automatic* processing is *task-specific*, and so is not a sharable resource, but automatic processing is augmented by attentional resources, that are not task-specific. The indication that expanding cognitive resources are shared in SLA is consistent with this view, but it also implies that some of the structures assessed here were *not* yet fully automatic. That is that an emergence criterion necessarily identifies structures prior to their full automatisation. At the same time, the analysis suggests that these structures were *not* products of *consciously* controlled or attended processes, because the factors they measure (merger, phases, and delay) to which the resources are theoretically directed, are not related to explicit or declarative knowledge about language. Few if any language teachers would employ minimalist descriptions of derivations to teach their students, and it is unlikely that students would *consciously* construct IL structures on the basis of attraction, merger and feature valuation, even if they were aware of minimalist theory.

Note also that the recursion or combination of specific structures was clearly associated with later emergence times than the use of those structures in isolation, and was associated with higher processing demands even in the PT framework. Since the initial independent use reflects the point at which the structures have become automatic, or nearly so, this indicates that c-structural complexity increased processing demands in some manner *unrelated* to automatisation. This is consistent with general observations that written language, which can be consciously adjusted, is more structurally complex than spontaneous spoken language, even among native speakers. There are clearly limits to the kind of linguistic structures that can be readily processed without the support of conscious reflection.

These two aspects of emergence – resource sharing and demands associated with recursion – raise some fairly deep questions about the links between task-specificity, automaticity, processing speed, and consciousness. Perhaps language acquisition makes use of cognitive processes that emerge implicitly, in response to experience, and are too fast for conscious thought, but are neither task-specific nor inevitable, as automatic processes are held to be. In fact, this would seem to be essential in a transitional system where early processes relate to lexical items and procedures that are by definition different from those in the target system. In fact too much automatisation would lead to early fossilization. For implicit acquisition (i.e. change to *unconscious* systems) to occur at all, some processing must occur at levels between the controlled conscious and the automatic unconscious. This is certainly worthy of further investigation.

9.5 Which theory is better?

Both theories needed significant extension or modification before they could be applied to Mandarin ILs. The standard six-stage version of PT was clearly insufficiently sensitive, and its stages were too inconsistently defined to adequately differentiate between the variations in processing demands associated with phrasal structures (see Table 27 and related discussion in Chapter Seven). At the same time, the view of the MP proposed in Chomsky (1999) depends to a large extent on stipulations and assumptions about *universal* lexical and constituent structure that are not actually consistent with the basic minimalist premise that all syntactic processing is a response to *local* economy constraints (see discussion of projection in Chapter Seven and in Appendix G). Moreover Chomsky's is essentially a theory of structure generation, not a theory of *acquisition*. To construct a minimalist theory of acquisition comparable to PT, the assumption that relative economy determines grammaticality had to be reframed as a link between specific operations and emergence order (see Section 2.4 in Chapter Two).

It is to Pienemann's credit that PT incorporates a formal theory of generative grammar, LFG, which makes it possible to modify and extend PT by integrating recent developments in that theory, like functional uncertainty equations, *or* even to extend the basic assumptions of PT to an entirely different conception of generative grammar, like that of the MP.

The minimalist approach made it possible to quantify individual processing factors and determine how individual learners responded to each (see Chapter Eight). It also allowed processing demands to be compared across different functional domains, so that unrelated structures could be ranked relative to each other. The constraints of minimalism that link lexical and constituent structures led to valuable insights about the possible function of covert functional heads, as mediators between lexical categories that have too little in common, and as barriers between lexical categories that have too much in common (see the discussion of embedded nominals in Appendix K.) It also provided a possible account of why very similar functional-lexical hierarchies appear to be instantiated in unrelated languages (see discussions of cross-linguistic variations in lexical structure in Chapter Six and in Appendix J), and of the way that lexical features and functional levels in nominal structure contribute to the conversion of a generic type-denoting noun into a referential entity-denoting argument (see discussion of 'bare' NPs in Chapter Six).

On the other hand, the minimalist characterisation of emergence orders in terms of processing demands remains abstract and obscure, as its operations are. In contrast, the revised PT model described processing demands in terms of mechanisms that form a natural developmental hierarchy, where one *type* of process entails another. This made it possible to see development in terms of a system of inter-dependent procedures instantiating c-structure rules, and as a gradual grammaticalisation of constraints on adjacency and of thematic relations, in the form of DF and GF assignment. It also made it possible to see how the processing demands associated with unification

were exacerbated as c-structural complexity increased. This provides a much more concrete and intuitively comprehensible view of language development than the rather abstract measures of processing demands produced by the minimalist analysis. It suggests that IL development is not just a matter of an increasingly automatic combination of lexical types based on unvarying lexical structure. Rather, universal constraints on syntactic well-formedness *together with* conceptual and semantic structure provide a driving force that pushes learners to modify simple syntactic procedures by a series of minimal changes so they can accommodate lexical items with richer lexical structures and build hierarchical structures of increasing complexity, in order to express more complex ideas.

Clearly, both theoretical accounts have provided valuable insights into the way acquisition proceeds. Both go beyond the conclusion that IL development involves an expansion of total processing capacity, to reveal various distinct and potentially quantifiable syntactic operations that combine and recur to increase processing demands. We can therefore say with confidence that *both* models *explain* emergence orders to a considerable degree.

Moreover, both theories can produce descriptions of acquisition order that are couched in terms of universals. This makes it possible to state generalisations about the expected impact of specific syntactic processes on SLA development in any language. At the same time, neither theory provides a quick-fix to the question of determining a natural acquisition order from first principles, because it is never *immediately* transparent which or how many features and processes are required to produce a given TL structure. This can only be ascertained through a detailed and systematic analysis of *output*.

In fact, the very nature of LFG and the MP as *generative* grammars entails that processing demands in ILs are defined essentially by the learners themselves. Thus, somewhat paradoxically, it is not possible to *predict* the order in which *IL* structures will emerge, until we know, *which* IL structures will emerge. Statistical correlations between structures and ETs for one TL may function as effective predictors for another set of learners learning the same TL, but it is not at all clear that patterns of emergence defined in terms of GF assignment, or numbers of phases and delays can be applied to generate predictions for other TLs, unless we assume that ILs will be based on the *same* lexical-feature system, and in the LFG framework, the same set of c-structure rules, as the specific TL.

It is easy to overlook the fact that this need not necessarily be so, the comparative fallacy. However, it is interesting that Mandarin IL nominal structures did largely conform to Mandarin TL structures. This is the one area in which it seems the MP offers a small conceptual advantage over LFG: it assumes that the language learner, like all language producers, is constrained by generative economy, and has no power over variations in syntactic output, *except* through the mechanism of adjusting lexical structure. Moreover it assumes that there is only *one* maximally economical grammar, i.e. one combination of lexical structures that can underlie the observed surface structures of a given TL. This means, in principle, a learner, *or* analyst, can begin with the least complex lexical structure possible, and arrive at exactly the same system as that instantiated by the TL, purely by identifying TL *words*, and adjusting their cognitive representation of these words in a minimal manner, until their

syntactic output matches what they hear. Effectively, that is the methodology that was employed here to determine the underlying constituent structure of IL Mandarin. This suggests, if nothing else, that there is some validity in the minimalist view of how language is constrained.

Starting from a premise such as this, it might be possible to relate *lexical* construction to the statistical contingencies evident in a TL corpus, as psychologists and corpus linguists seem eager to do, without assuming that *complete syntactic structures* will also be acquired according to the frequency with which they are produced in a native corpus. In the minimalist theory of acquisition, complex syntactic structures will emerge as a consequence of the way lexical items are constructed, which is related to the way lexical items are collocated, but the order in which structures, as opposed to lexical items, will emerge is still constrained by the economics of the processor, not by their frequencies in the input (or indeed in a 'corpus' to which learners may not actually be exposed to any significant degree). Moreover, frequencies in a corpus might themselves be understood as a consequence of procedural economy. The MP predicts that *native* speakers will always use the most economical means to assemble words into a proposition. Though this is clearly an idealisation, it stands to reason that across a large corpus, the more frequent structures will be those that are more readily processed. Thus frequencies and emergence orders are related, not as cause and effect, but as parallel symptoms of the same underlying dynamics: the compulsion towards derivational economy due to natural constraints on the capacity of the syntactic processor.

Until more is understood about the way lexical construction develops as a response to input, it appears that the most effective way to determine a natural emergence order for a new TL will be by observation and post-hoc analysis, not because current acquisition theories provide a poor account of emergence orders, but simply because the amount of syntactic and lexical analysis of the TL necessary to make valid predictions seems to take as long as any longitudinal observation of instructed learners, if not longer!

In sum, neither LFG nor the MP necessarily tells the whole truth about the generation of syntactic structures during SLA, but both provide interesting insights into SLA development and its relationship to processing demands associated with the construction of hierarchical constituents and the establishment of functional relationships. They complement each other well in that the MP provides a means to formulate and test hypotheses about lexical F-structure and its relationship to syntactic structure building, while LFG provides a means to investigate functional relations *independent* of c-structural concerns. By and large they point to much the same conclusions about the kind of processing that impacts on emergence times in SLA.; both theories are worthy of wider application within that field.

Appendix A: Mandarin Nominal Syntax

This appendix describes some typological characteristics of Mandarin and its basic sentence structure then describes Mandarin nominal structures beginning with morphologically simple pronouns and nouns and moving to more complex nominal structures. This covers the full range of *functions* represented by nominal structures in the learners' ILs, but it should be borne in mind that the underlying structure and derivation of learner sequences are not necessarily the same as those in the speech of mature native speakers.

Basic sentence structure

Mandarin is a tone language: each free morph has an inherent or citation tone which distinguishes it from other morphs with the same segmental structure.

Mandarin is an SVO language (Sun and Givon, 1985) in the sense that this is the word order in sentences where the entire verb phrase introduces new information about an established topic, the Subject (61a). However, 'scrambling' allows topical objects to appear before the verb giving SOV order (61b) and topicalisation allows an Object or a pragmatically relevant nominal to appear in sentence-initial position giving OSV (61c), or Topic SV(O) orders (61d).

- 61) a. tā míngtiān mài chē
3sg tomorrow sell car
He sells the car tomorrow
- b. Zhāngsān chē yǐjīng mài le
Z car already sell.ASP
Zhangsan, he's already SOLD the car
- c. chē tā yǐjīng mài le
car 3sg already sell.ASP
The car he's already sold
- d. jiājù Zhāngsān yǐjīng mài le yǐzi
furniture Z already sell.ASP chair
As to the furniture, Zhangsan has already sold the chairs

In addition, indefinite subjects may follow intransitive verbs, and patients of transitive verbs may function as subjects without morphological passivisation. These alternative word orders do not feature in the learners' speech.

Questions can be formed by addition of a sentence final particle *ma* to a declarative sentence, as in (62a), by reduplication and negation of the verb, as in (62b), or by addition of a reduplicated and negated copula, before the verb (62c), or at the end of the sentence (62d):

- 62) a. nǐ qù ma
2sg go Q-PRT
Are you going?

- b. nǐ qù bù qù
2sg go NEG go
Are you going or not?
- c. nǐ shì bù shì qù
2sg COP NEG COP go
Are you or are you not going?
- d. nǐ qù shì bù shì
2sg go COP NEG COP
You are going aren't you?'

A particle *ne*, sometimes glossed as a topic particle, can be optionally inserted after the initial nominal, and followed by a question or a statement:

- 63) a. nǐ ne qù bù qù
2sg TOP go NEG go
And you, are you going or not?
- b. jiājù ne Zhāngsān yǐjīng mài le yǐzi
furniture TOP Z already sell.ASP chair
As to the furniture, Zhangsan's already sold the chairs

This topic particle implies a question, if it follows an NP with no additional comment:

- 64) wǒ xiǎng qù. nǐ ne
1sg go go 2sg TOP
I intend to go. And you?

Apart from the question particle *ma*, there are a few other sentence final particles associated optionally with declarative statements: *ba* is suggestive, *wa* or *ya* indicate surprise etc.

- 65) nǐ qù ba/wa
2sg go TOP
You should go! / You're going!

Tense is not indicated formally; references to absolute times are made by way of adverbs. Verbs may be followed by aspect markers which indicate temporal relationships between events. The three most common aspect markers are *zhe* which marks the first in an adjacent pair of verbs and denotes simultaneity of actions; *le* which marks a verb denoting an action or event anterior to another, and *guò* which marks a verb denoting an action or event which is repeatable and has been completed at least once prior to the reference time. All are derived historically from verbs, but only the last retains its tone and full vowel quality when used aspectually; the other two are bound morphs.

- 66) a. wǒ zǒu.zhe kàn
1sg go.simultaneous see
I will see how it goes. lit: I will look as I go
- b. tā chu.qù.le kàn diànyǐng cái qīngsòng
3sg exit.go.anterior see movie just relax
Only when he has gone out to see a movie does he relax
- c. zhè tiáo lù wǒ zǒu.guò
this Class road 1sg go.experiential
I have walked on this road before

There is also a sentence final aspect marker *le*, which Li and Thompson suggest marks a 'change of relevant state'. This is close to the traditional definition of a perfect aspect marker, and it is analysed as such by Lilliane Huang (1987).

- 67) tā chūqù kàn diànyǐng le
 3sg exit.go see movie perfect
 He has (already) gone out to see a movie.

The two *le*'s can collocate, as long as they are not adjacent:

- 68) tā chūqùle kàn diànyǐng cái qīngsòng le
 3sg exit.go.anterior see movie just relax perfect
 It has come to be that he can only relax when he has gone out to see a movie.

In some dialects the forms differ suggesting that they are derived from different verbs.

As Mandarin is a 'pro-drop' language, the subject of a finite clause can be omitted under certain conditions.

- 69) A: nǐ qù bù qù kàn diànyǐng
 you go NEG go watch movie
 Are you going to see the movie?
 B: qù
 go
 [I'm] going.

The *object* of a clause can also be omitted *if* the intended referent is within the pragmatic presupposition.

- 70) A. wǒ yǒu qíézi. nǐ xiǎng chī ma
 1sg have eggplant you want eat Q-PRT
 I have [some] eggplant. Do you want to eat [some]? (i.e. understood *definite* Object.)
 Not: I have eggplant. Do you want to eat [a meal]? (i.e. *indefinite* Object.)
 B. wǒ xiǎng chī. nǐ yǒu méi yǒu miàntiáo
 1sg want eat you have NEG have noodles
 I want to eat [some /it]. Do you have any noodles?
 Not: I want to eat. Do you have any noodles?

This contrasts with non-specific reference, where a token or dummy object must appear, but is not interpreted literally:

- 71) wǒ xiǎng chī fàn. Nǐ yǒu méi yǒu miàntiáo
 1sg want eat rice you have NEG have noodles
 I want to eat (a meal). Do you have any noodles?
 Not: ?I want to eat rice. Do you have any noodles?

Nominal structures

Simple nominals

The simplest nominals consist of just one word: an overt pronoun, a name, or a noun.

OVERT PRONOUNS

The personal pronoun paradigm is simple and regular. There are three distinct base forms, one for each grammatical person, and these are used with singular reference; when pronouns are used to refer to more than one referent, a suffix *-men* is added.

Table 45. Pronoun Paradigm in Mandarin

Person	Sg	Pl suffix
1	wǒ	+men
2	nǐ	+men
3	tā	+men

As well as personal pronouns there are deictic pronouns *nà* ‘that’ and *zhè* ‘this’ which cannot host the bound morph *-men*; for plural reference a quantifier *xiē* ‘some’ is used.

- 72) a. zhè shì wǒ.de xiǎngfǎ
 this COP 1sg. POSS think.method
 This is my way of thinking
- b. zhè xiē shì wǒ.de
 this few COP 1sg. POSS
 These are mine

There are also interrogative pronouns: one for human referents, *shéi* ‘who’, and one for other referents, *shénme* ‘what’. These cannot host *-men* or be accompanied by a quantifier. Interrogatives appear in the same structural position as non-interrogative counterparts; there is no *wh*-movement.

- 73) zhè shì shénme
 this COP what
 What is this?

Names have the same distribution as personal pronouns, including the ability to host *-men*, but this is pragmatically marked.

- 74) zhè shì Lǐsì.de xiǎngfǎ
 this COP Li si POSS think.method
 This is Lisi's way of thinking.
- 75) zhè shì Lǐ-men.de xiǎngfǎ
 this COP Li -men POSS think.method
 ?This is the viewpoint of all those called Li.

As mentioned above, since Mandarin is a pro-drop language, nominals may be omitted entirely from discourse. In LFG and in minimalism optionally dropped nominals are treated as phonetically null pronouns. However, Huang (1987) argues that the null *Object* is anaphoric (i.e. a variable) not pronominal in the strict sense of allowing an antecedent within its governing category.

NOUNS

Nouns can be used in any grammatical function (GF) with no additional collocates. In other words, there are no obligatory (overt) articles or determiners in Mandarin. Interpretation of number *may* be retrievable from context, but often it is not (76).

- 76) shū tā kàn.le
 book 3sg read.ASP
 The book(s), (s)he has read

In contrast, the interpretation of a bare noun as definite, indefinite, generic or non-specific depends upon its position relative to the verb. Post-verbal bare nouns are interpreted as either non-specific, like miàntiáo 'noodles' in (71) above, or indefinite like shū 'book' in (77) below.

- 77) wǒ wàngle dài shū
 1 sg forget.ASP carry book
 I forgot to bring a book /any books

Both non-specific and indefinite nominals refer to a *type* of entity, but in the case of the former, the speaker has no specific *token* in mind, while in the case of the latter, they may or may not have a specific token in mind, but the addressee is not assumed to know which if any token is being referred to.

Preverbal bare nouns are either definite as in (76) above or generic as in (78) below, except with predicates that denote a quantity concept as in (79), where they are non-specific indefinites:

- 78) shū shǐ yòng zhǐ zuò.de
 book COP use paper make.de
 Books are made from paper.

- 79) zhèlǐ shū hěn duō
 here book very many
 There are many books here

Nouns are not inflected for case, gender or number except for the optional and pragmatically marked use of the suffix *-men* on nouns that denote kin or other social groups.

- 80) laǒshīmen hǎo
 teacher+MEN well
 Hello teachers

Although the translation of (80) suggests plurality, it has been argued (Chao 1968, Lu, 1947; Norman, 1988; Iljic, 1994, 1998 all cited in Li 1999b) that *-men* in this context actually expresses collectivity rather than plurality, because a *men*-inflected noun cannot be numerically quantified.

Quantified nominals

QUANTIFIED NOUNS: CLASSIFIERS, MEASURES AND NUMBERS

In numeric quantification of nouns, the number normally precedes the noun and in most cases a classifier or measure word must intervene between the two.

- 81) a. *sān shū
 three book

- b. *sān shǔi
three waters
- 82) a. sān běn shū
three **CL** book(s)
Three books
- b. sān bēi shǔi
three **cup** water
Three cups of water

A classifier is a lexical type that collocates with count nouns and whose form varies depending on the choice of noun. In this way it indicates grammatical classes of count nouns. The classifier is sometimes said to make the countability of a noun 'grammatically visible' (Doetjes, 1996).

Unexpectedly, a numeric expression cannot precede a noun inflected with -men.

- 83) *sān ge laǒshī.men
three CL teacher.MEN

This indicates that -men is somehow different from the plural affix in English.

There is generally only one correct choice of classifier for each noun, and the criteria for use are often stated in terms of natural properties of the referent of the noun. For example, the classifier *bǎ* is said to be for things that can be picked up in one hand and *tài* is said to be for electrical or electronic equipment. However, the choice of classifier is neither free nor determined solely by semantic or pragmatic factors: though some telephones can be picked up in one hand, the correct classifier for a telephone is *tài*, and though some chairs cannot be picked up in one hand, the correct classifier for a chair is *bǎ*. So, allocation of a noun to one class or another is arbitrary, within certain limits, and therefore must be lexically specified. Dictionaries list over 180 classifiers, but relatively few (around twenty) are in common usage. There is a default classifier *ge* for nouns with no lexically specified (or an obscure) classifier.

A measure word differs from a classifier in that it denotes a unit of measure, it can collocate with either count or mass nouns, and the choice of measure-word depends on context, and the speaker's communicative intention:

- 84) a. sān wǎn shū
three **bowl** book(s)
Three bowls of books
- b. sān wǎn shǔi
three **bowl** water
Three bowls of water

Although (84a) is pragmatically odd, it is acceptable, given a context where bowls are filled with books.

There are also nouns that tolerate neither a classifier nor a measure word when quantified. These include time-spans and locative units e.g. *tiān* day, *nián* year, *cì* instance, *tóu* end, *biān* side, which are inherently countable.

- 85) a. *sān tiān*
three days
Three days
- b. **sān ge tiān*
three CL day

Li and Thompson (1981) characterise the quantified nouns themselves as 'measures', and include such examples as:

- 86) *yī dúzi qì*
one stomach anger
A bellyful of anger

Here the common noun *dúzi* *stomach* is used as a measure, directly quantified by *yī* one. However, some nouns denoting measures of time do require classifiers: e.g. *xīngqí* 'week', *zhǒngtóu* 'hour'. So again, membership in the exceptional class is also arbitrary, and must be lexically specified.

QUANTIFIED PRONOUNS

In contrast to nouns, which follow a number and classifier or measure-word, pronouns must *precede* any numeric expression that quantifies their referent. According to Li (1990b) names hosting the bound morph *-men* can also precede a numeric expression, but nouns hosting *-men* cannot:

- 87) *tā.men sān ge rén*
3rdMEN three Class person
The three of them
- 88) a. *Zhǎngmen sān ge rén*
Zhang three Clas person
MEN s
The three Zhangs
- b. **laǒshī men sān ge rén*
teacher.MEN three Class person

NON-NUMERIC QUANTIFIERS

Non-numeric quantifiers vary in their position relative to a noun. The quantifier, *jǐ* functions as a non-specific digit (between 2 and 9) and also has an interrogative function. It requires a classifier when combined with count nouns.

- 89) a. *jǐ běn shū*
few CL book
A few books / How many books?
- b. *sānshí jǐ běn shū*
thirty few CL book
Thirty-something books / Thirty-how-many books?

- c. sānshí sān běn shū
thirty three CL book
Thirty-three books
- d. *jǐ shū
few book

The quantifier *xiē* 'some' functions like a non-individuating classifier; it cannot collocate with a classifier; it can immediately precede a count noun, but not a mass noun; it must follow the number *yī* 'one' (or a demonstrative, see below).

- 90) a. yī xiē shū
one few book
Some books
- b. *yī xiē běn shū
one few CL book

The quantifier *duō* 'many' functions more like a combination of number and classifier/ measure. It can immediately precede the noun or a measure word that measures the noun, but it cannot collocate with a classifier *or* a number. Also unlike the other quantifiers, pre-nominal *duō* *must* be modified by the weak adverb of intensity *hěn*, and *duō* can also function as a predicate, following the noun, in which case *hěn* is optional.

- 91) hěn duō shū
very many book
Many books
- 92) a. hěn duō (*běn) shū
very many CL book
- b. shū (hěn) duō
book very many
There are many books

The quantifier *shǎo* 'scarce' can also function as a predicate, but it cannot precede the noun it quantifies. It can however, function as an adverb.

- 93) a. *hěn shǎo shū
*very scarce book
- b. shū (hěn) shǎo
book very scarce
Books are scarce
- c. tāmen hěn shǎo yǒu shū
they very scarce have book
They seldom have books

On the basis of these distributional patterns we can conclude that *duō* and *shǎo* may belong to the same basic lexical class, with the latter a distributionally restricted sub-class, but each of the other quantifiers *jǐ* and *xiē* clearly belong to different lexical classes.

Demonstratives

Another context in which the TL requires a classifier to be used (with much the same exceptions as for numbers) is following a demonstrative. However, in this context, measure words are not required with mass nouns.

- 94) a. **nà shū*
that book
- b. *nà běn shū*
that CL book
That book
- c. *nà (bēi) shuǐ*
that (cup) water
That (cup of) water

Modified nominals

POSSESSIVE AND ASSOCIATIVE MODIFIERS

Mandarin has two complex nominal structures in which possessive relationships can be expressed. One is formally restricted, consisting of a pronoun followed immediately by a kin-term.

- 95) *wǒ bà*
1sg father
My dad

This structure cannot be used to express possessive relationships in general: a noun or name cannot be substituted for the pronoun, and the only nouns that can appear in the place of the kin-term, are certain mono-syllabic nouns denoting social institutions.

- 96) *wǒ guó*
1sg country
My country

This expresses the same sense of allegiance to the institution, as one would feel for one's family. To highlight its restricted formal and semantic nature, factors that are relevant to the calculation of processing demands, I refer to this as the affine structure, rather than a bare possessive.

The second structure in which possessive relations can be expressed is one where two nominals are separated by a bound morph *de*.

- 97) a. *tā.de bàbà*
3sg father
His father
- b. *wǒ.de guójiā*
1sg de country
My country

- c. gǒu.de gǔtōu
dog.de bone
The dog's bone

The use of *de* is obligatory unless the second noun is one that licenses the affine structure and the 'possessor' is a pronoun.

- 98) *gǒu gǔtōu
dog bone

Li and Thompson (1981) point out that the sequence NP *de* N is also used to express many relationships that are *not* possessive, and they label these associative, for example:

- 99) a. kēxué de fāzhǎn
science de development
The development of science (Li & Thompson, 1981, p. 114)
- b. yèwǎn de tiānkōng
night de sky
The night sky. (Li & Thompson, 1981, p. 115)

These semantic distinctions are significant for the analysis of the semantic structure of the bound morph *de*, and the way in which this may or may not relate to its syntactic role.

RELATIVE CLAUSES

A noun can also be modified by a relative clause, and it also precedes *de* and the modified noun:

- 100) nà běn bù kěyǐ niàn de shū
that CL NEG can read de book
That book which is not suitable to read

In Mandarin, relative clauses include clauses containing intransitive, property-denoting predicates.

These are words like *hóngsè* 'red', or *dà* 'big' which are typically rendered into English as Adjectives:

- 101) a. nà běn hóng.sè de shū
that CL red.colour de book
That book which is red (as red can be)
- b. nà běn hěn dà de shū
that CL very big de book
That very big book

These words form a sub-class of verb in Mandarin because they share the same distributional possibilities.

The distinction between verbs and adjectives is important to the calculation of processing demands in Processability Theory, since relative clauses, involving verbs, are held to be more difficult to process than adjectival modifiers. Li and Thompson (1981, p. 142-143) explain the lack of such a distinction in Mandarin thus: "the vast majority of adjectives may function as verbs in Mandarin. That is, they may be the nucleus of a verb phrase ... where they are followed by a sentence final particle ... They can also be negated". Their examples follow.

102) Zhāngsān pàng le
 Z fat CRS
 Zhangsan has gotten fat

103) Zhāngsān bù pàng
 Z not fat
 Zhangsan is not fat

Note the inchoative interpretation that arises in (102) where pàng is followed by the aspect marker le; this means le is the sentence-final le, not the post-verbal le, which marks anteriority. As mentioned above, Li and Thompson gloss this sentence-final le as a marker of a 'change in relevant state' (CRS). However, it is also possible to obtain the anteriority reading with pàng:

104) Zhāngsān pàng le diǎnr cái hǎokàn
 Z fat ANT little only good-looking
 Once Z gets a bit fatter, he will be good-looking / Now Z is a bit fatter, he is good-looking.

In (104) the adverb diǎnr 'a little' modifies pàng but is separated from it by the aspect marker le, showing that the latter is post-*verbal*, not clause-final le. Thus, pàng clearly qualifies as a verb.

Li and Thompson add that Mandarin does have some adjectives that *don't* function like verbs, and these are all 'absolute' or non-gradable. They give four examples: jiǎ 'fake', guófī 'state-founded'; xiànréng 'ready-made' and shàngděng 'top quality' (pp144-145):

105) a. *nèi fēng xìn jiǎ
 that CL letter fake
 b. *nèi fēng xìn jiǎ le
 that CL letter fake C RS
 That letter is fake
 c. *nèi fēng xìn bù jiǎ
 that CL letter not fake

They also point out that these words can directly precede a noun in attributive function, and then "the adjective-plus-noun phrase tends to acquire the feature of being a *name* for a category of entities" (Li & Thompson, 1981, p. 119). Their example with *jiǎ* follows:

106) bié shuō jiǎ huà
 don't say false speech
 Don't make false statements (Li & Thompson, 1981, p. 117)

While the evidence of (105) clearly distinguishes these non-gradable property-denoting words from verbs, the evidence at (106) does not. The Dictionary of Modern Mandarin includes, for example, the item sàichē (lit. 'race-vehicle'); sài is a verb meaning roughly 'vie with' or 'race', so sàichē is a verb-plus-noun phrase which names a category of entity, i.e. a 'racing bike', just like the 'adjective'-plus-noun phrase described by Li and Thompson. In fact, few lexical items of any kind can immediately precede a common noun without the use of de.

Generally then Chinese verbs are simply divided into two sub-classes: stative verbs, and dynamic verbs. Stative verbs include transitive experiential verbs, like *xiǎng* ‘think / intend’ as well as property-denoting verbs, like *hóng* ‘red’. Only the non-gradable property-denoting words that cannot function as predicates belong to a distinct class of Adjective in Mandarin.

Thus, Li and Thompson conclude that, though “*some* adjectives can appear *either* in a relative clause (that is, with the nominalizer *de*) *or* as a simple attributive adjective (that is, without the *de*) [...] a large number of adjectives can modify a noun *only with a nominalizing particle de*” (Li & Thompson, 1981, p. 118-120, my emphasis). In other words, Li and Thompson view pre-nominal ‘adjectives’ followed by *de* as relative *clauses*, not as *adjective phrases*.

Locative relations

In Mandarin, locative relations are expressed by way of locative nouns *biān* ‘side’ *shàng* ‘top’, *lǐ* ‘inside’, *nán* ‘south’, *zuǒ* ‘left’ and many others. These words are classified as nouns on the basis of their distribution (Li and Cheng, 1982). Most can either follow a number: *liǎng biān* ‘two sides’ or function as the object of a preposition: *wǎng nán zǒu* (towards South walk) ‘walk South’. However a few, like *lǐ* ‘inside’, occur only as bound morphs, attached prosodically either to the *right* of a common noun, as in *chēlǐ* ‘car-in’ or to the *left* of a free locative noun as in *lǐmian* ‘inside’.

This variable order of attachment identifies *lǐ* as a clitic (Bonet, 1995). Zwicky (1985) defines a clitic as a bound form that heads its own phrase in syntax, and whose position can be described by reference to a phrase, rather than a lexical item. Frequently, a clitic is not prosodically complete, and therefore becomes incorporated phonologically with an adjacent prosodic word, like ‘m’ in English *l’m*. Since free locatives can also be prosodically incorporated with a preceding common noun, as in *húbian* ‘lakeside’, or a following locative, as in *nánbian* ‘south side’, the clitic *lǐ* is most readily accommodated as a bound member of the same lexical class as other locatives, i.e. as a clitic noun, and the free nouns can be assumed to have simple clitic counterparts, i.e. clitic forms identical to the free forms.

For simplicity and clarity, I will refer to the items of the form N-N_{LOC} like *húbian* and *chēlǐ* as incorporated locatives, and to items of the form N_{LOC}-N_{LOC}, like *lǐmian* ‘inside’, as double locatives.

Locative nouns can predicate a relationship between an entity whose location is already known, a ‘locus’, and one whose location constitutes new information, a ‘theme’. As a label of thematic roles, ‘theme’ is conventionally applied to items whose role involves existence in, or movement to or from a location (Radford, 1990).

Incorporated locatives are prosodically attached to the right of the locus as in (107); double and other free locatives follow the locus but may be separated from it by the morph *de*, as in (108).

- 107) a. chē.lǐ yǒu rén
 car.in have people
 locus.loc theme
 In the car are some people (Lit: The inside of the car has people)
- b. rén zài chē lǐ
 people at car-in
 The people are in the car
- 108) a. (zài) chē (de) lǐmian yǒu rén
 at car de inside have people
 locus de locative theme
 In the car there are some people / The car has some people in it.
- b. rén zài chē (de) lǐmian
 people at car de inside
 theme locus locative
 The people are in the car

The explicit locative noun is obligatory, unless the locus-denoting nominal is a place-name:

- 109) Lǐsì zài Běijīng
 Lisi at Beijing
 Lisi is in Beijing

A locative also appears in deictic expressions, where it incorporates with a demonstrative.

Conventionally the locative is either *lǐ* or *bian* (in free alternation):

- 110) Lǐsì zài zhè.lǐ/ nà.bian
 Lisi at this.inside/ that.inside
 Lisi is here /there

The locus-denoting nominal may be omitted (together with *de*) only if its referent is retrievable from context. In (111), B's response is incoherent, because A's question contains no sensible antecedent for the locus implicit in B's answer: a road would not normally contain people within it.

- 111) A: nǐ wéishenme zhàn zài lùshàng
 2sg why stand at roadtop
 Why are you standing on the road?
- B: ?yīnwéi lǐmian yǒu rén
 because inside have people
 ?Because there are people inside.

In other words, an omitted locus *must* be interpreted as co-referent with some topical antecedent, like the Object of a verb.

While the locus and locative may or may not be separated by *de*, the theme is *always* separated from the locus and locative by a co-verb²⁷ such as *zài*, or a verb, typically the presentative *yǒu* 'have', or verbs denoting posture, such as *zhàn* 'stand', *zuò* 'sit':

²⁷ According to Li and Thompson (1981) co-verbs are a lexical class that function sometimes as main verbs, and sometimes as adjuncts to another verb, like a preposition. Ross (1991) argues that Mandarin 'co-verbs' are simply a sub-class of verb and there is no evidence for a separate class of preposition.

- 112) yuánzi.lǐ zuò.zhe hěn duō rén
 garden.in sit.ASP very many people
 Many people are sitting in the garden

The choice between the use of *zài* or a verb depends on whether the theme and locus are definite or indefinite. As mentioned above, an indefinite nominal must be post-verbal, but the nominal constituent that follows *zài* must *locate* a locus, that is it must be either a locative noun together with a preceding *locus*-denoting nominal, or a place-name. This means, when the theme is indefinite, thematic constraints prevent it from following *zài*, but pragmatic constraints prevent it from preceding *zài* if in doing so it is sentence-initial; this would render it definite:

- 113) rén zài chē (de) lǐmiàn
 people at car de inside
 The people are in the car
 NOT: Some people are in the car

The solution is to use a verb that takes a following *theme* such as *yǒu*, as in (107a), (108a), or a posture verb, as in (112). Both types of verb can replace *zài*, with corresponding changes in word order, as in the examples just cited, but *yǒu* can also appear initially, making the theme post-verbal even while it functions as the subject of *zài*:

- 114) yǒu rén zài chē (de) lǐmiàn
 have people at car de inside
 There are some people in the car
 NOT There are the people in the car.

These relationships between interpretation and distribution are important in a minimalist analysis of lexical F-structure, where feature values are acquired through agreement, and agreement can take place only in certain structural relationships (the checking domain). See discussion of the Phase Impenetrability Condition (PIC) in Chapter Two and in Appendix G.) A definite theme and locus may both be omitted, as instances of pro-drop, and interpreted from context, but the locative noun, is obligatory:

- 115) A: rén zài nǎ.lǐ
 people at where.in
 Where are the people ?
 B1: zài chē lǐmiàn
 at car inside
 Inside (the car)
 B2: *zài chē
 at car

In locative expressions that include *de*, like (108) and (113) above, the locus, *de* and the locative together make a sequence superficially similar to possessive and associative expressions. However, where Li and Thompson describe possessive *de* structures as 'one very important associative meaning' (Li & Thompson, 1981, p. 113), they include no locative structures in their examples of associatives. At

the same time, they treat locative structures *without* *de* as a different structural type altogether: the 'locative phrase'. It is clear that locatives and associatives do involve different syntactic relationships. In (116) below, the noun *qìchēfáng* 'garage' is modified by a possessor, and in (117) the modifier is absent. This absence has no effect on grammaticality, or coherence, and no specific possessor is necessarily assumed on the basis of context.

116) A: chē wéishénme bù kāi jìn wǒ de qìchēfáng
 car why NEG drive enter 1sg de garage
 Why does the car not drive into my garage?

117) A: chē wéishénme bù kāi jìn qìchēfáng
 car why NEG drive enter garage
 Why does the car not drive into the garage?

B: yīnwéi lǐmian yǒu rén
 because inside have people
 Because there are people inside (the car / the garage)

This contrasts with the absence of the locus-denoting nominal in (117) B. It *must* be interpreted as co-referent with one of the lexical antecedents in A's question. In short possessive and associative modifiers that precede common nouns are adjuncts, but the theme and locus denoting nominals in locative structures are arguments. Therefore, the locative noun itself is a predicate.

Like any predicate in Mandarin, double locatives like *lǐmian* can also *precede* *de* and an entity-denoting noun in an associative expression:

118) a. (lǐmiàn de) chē zhēn bàng
 inside de car real strong
 The car (on the inside) is great
 NOT: * the inside of the car is great.

b. gōngchǎng lǐmiàn de chē zhēn bàng
 factory inside de car real strong
 The car inside the factory is great

In this position, the locative expression restricts the reference of the noun following *de* by locating it relative to some other entity. However, something other than location is predicated of that entity, and the locative expression together with *de* can be omitted entirely, just like the possessor in (116). In other words, in this position, the locative expression as a whole functions as an optional modifier, not an argument. These distinctions between modifiers and arguments are important to the assessment of processing demands associated with the assignment of grammatical functions in the LFG framework (see Chapter Six).

The most complex nominal

The collocational restrictions discussed above illustrate that the Mandarin nominal structure contains a number of distinct structural positions preceding N. The most complex nominal can contain possessor, demonstrative, quantifier, classifier, and noun as well as optional modifiers. When pre-nominal modifiers concatenate, any modifier immediately preceding the final noun must be followed by

de, earlier modifiers may be followed optionally by de. There is some acceptable variation in word order, as shown in (120).

119) tā nà yī zhāng (dà de) (hái méi yòngguò de) zhuōzi
 3sg Dem one CL (big de) (still NEG use. ASP de) table
 That (big), (still unused) table of his

120) a. wǒ xǐhuàn de Zhāngsān de nà sān zhī qiānbǐ
 I like de Z de that three CL pencil

b. Zhāngsān de nà sān zhī wǒ xǐhuàn de qiānbǐ
 Z de that three CL I like de pencil

c. nà sān zhī wǒ xǐhuàn de Zhāngsān de qiānbǐ
 that three CL I like de Z de pencil
 Those three pencils of Zhangsan's that I like

Conjoint nominals

Nominals can also be conjoined. Mandarin conjunctions are subcategorised: hé conjoins nominals; yě conjoins clauses. The conjuncts joined by hé are usually identical categories with parallel structure; with multiple conjuncts, the conjunction must appear before the last, but may also appear between others.

121) a. wǒ xiǎng chī mǐfàn hé / *yě miàntiáo
 1sg want eat rice and/ *also noodles
 I want to eat rice with/*also noodles.

b. wǒ xiǎng chī mǐfàn *hé / yě xiǎng chī miàntiáo
 1sg want eat rice *and/ also have eat noodles
 I want to eat rice, and I want to eat noodles.

122) a. wǒ bàba hé wǒ māma hé wǒ dìdì...
 1sg father and 1sg mother and 1sg brother...
 My dad and my mum and my brother ...

b. xiǎng chī mǐfàn miàntiáo sùtiáo hé jīròu
 want eat rice noodles chips and chicken
 Want to eat rice, noodles, potato chips and chicken.

This concludes the description of TL nominals relevant to the current study. The counterpart IL nominals are described in Appendices D and K.

Appendix B: Data Collection

Elicitation Schedule

There were nine points at which elicitation sessions were held, spread through the first year of study. The following table shows the times of each session, and the tasks and learners involved. The column headed 'week' indicates the number of weeks elapsed since instruction began.

Table 46. Elicitation Schedule

Time-code	Week	date	Transcript code	Tasks /Topics	participants
T1	6	16/4/97	akunns1	free talk/ children	H1, K1
T2	8	30/4/97	akunns3A	holidays/bike shop	H2, K2
		30/4/97	akunns4	holidays/bike shop	
T3	10	14/5/97	akunns3B	the playground	H3, K3
	11	21/5/97	akunns6A	the playground	
T4	14	11/6/97	akunns7	men at work	K4
	15	18/6/97	akunns8	men at work	
T5	21	1/8/97	akunns9	taishan	H4,
	22	6/8/97	akunns10	taishan	K5
T6	24	22/8/97	akunns11	picnic	H5,
T7	26	5/9/97	akunns13	shapes	H6, K6, S6
T8	28	17/9/97	akunns 14	picnic	K7
		19/9/97	akunns15	snowy day	H7
T9	30	1 /10/97	akunns16	the beach	K8
		3/10/97	akunns17	the beach	H8

Elicitation Instruments

There were three categories of elicitation task. In each task each participant was given photographs or drawings that the others could not see, and asked to describe the contents of the pictures to the others. Then, as a group, they had to complete a task relating to those pictures. Each topic listed in the Tasks/Topics column of the table above was associated with one or more specific tasks, as indicated after the descriptions below.

1. Story-telling from sequential pictures

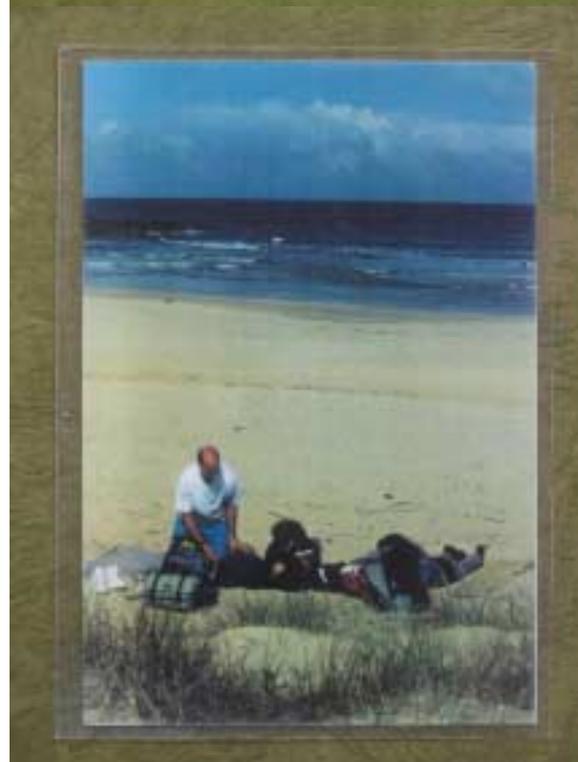
Task: Describe each picture then discuss the sequence in which the depicted events occurred.

Requirements: description; disambiguation of multiple referents; reference to time, place and sequential order.

Aim: to elicit specification of spatial and temporal relations; quantification and naming of referents; formation of open (constituent) and closed questions.

Topics for this task: picnic; taishan; the beach; snowy day; bike shop.

Sequence: *The Beach*



2. Spot the difference

Task: Discover which elements of your pictures are the same and which are different.

Requirements: description; disambiguation of multiple referents;

Aim: to elicit specification of spatial relations; the use of modified Nouns, quantification and naming of referents; deixis.

Topics for this task: the playground; snowy day; men at work; children; bike shop

Men at Work A



Men at Work B



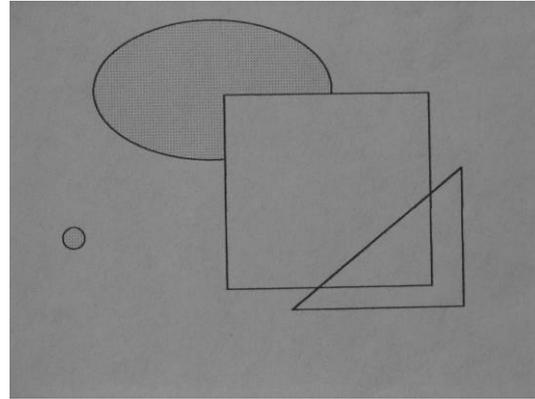
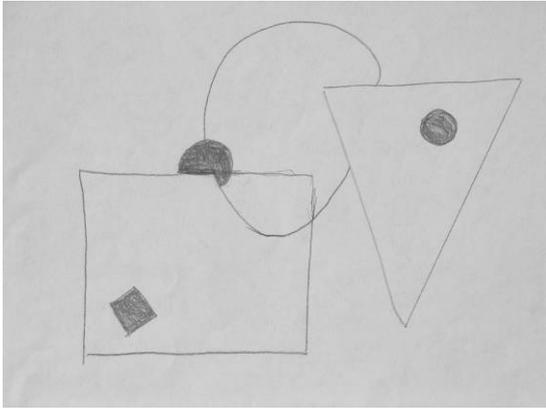
3. Draw what I see

Task: Describe your picture so the others can draw it. They can ask any questions they wish, and you must answer.

Requirements: use of topographical reference: above, below, left, right, under/behind, in front, rather than familiar attributes for disambiguation

Aims: elicit locative constructions and descriptions of size / orientation.

Shapes



Appendix C: Annotated Transcript Samples

In the following transcripts, I= Interviewer; A = Anna, a learner not included in the main analysis; H= Hannah, the Korean learner; K = Kazuko, the Japanese learner; S = Sam, the learner whose L1 is English.

At T1 (6 weeks after beginning study), most of the learners' utterances were only one word long; however some longer utterances did occur.

Early IL

Excerpt 1.1 -1.7 consistent constituent order at T1(K1)

A: dùi wǒ u a: (??)

A: correct, I ..

K: méi yǒu

K: have not

K: e (?hěn duō) a wǔ nián (xx) wǔ

K: e (? very many) a five years (xx) five

K: wǒ yě zài zhèr

K: I [was] also here

K: a wǒ zhù yījiǔjiǔ yījiǔjiǔliǎng nián

K: a I lived in the year of nineteen-nine.... 1992

A: a city () hànyu shì un zhège laugh zěnme shuō

A: a city () [In] Chinese un how do you say this?

A: wǒ shàng dàxué

A: I attend university

The longer utterances were generally fixed frames with variations only in one-word 'fillers' within the frame. The learners had little fluency in compiling novel utterances. This is evident from the near identity of structure from speaker to speaker. In the following extracts, the lines in the margins connect structurally identical utterances by different speakers. However, even at this early stage, there was some evidence of generative use of structural patterns, in the form of self corrections, and variations in the order of sub-parts of a formula.

Excerpt 2.3 cont'd

K:	e um <u>wǒ jiā yǒu bàba māma</u> yīge gēgē hé wǒ e um my family has father and mother one older brother and me	
l:	dōu zài zhèr yīqǐ zhù zài niú xīlá a xīnxīlán .. all here? do you live together in New a New Zealand? ..	
K:	<u>wǒ jià yǒu</u> a <u>wǒ jià zhù xīnxīlán</u> my family has a my family lives in New zealand	self-correction of formulaic start
l:	Hannah nǐ gēn wǒmen shuō Hannah you talk to us	Invitation to start
H:	am wǒ <u>wǒ jiào</u> um M-Z wǒ xìng J*** am I I am called um M-Z my surname is J***.	
l:	xìng J*** your surname is J***	
H:	a: () wǒ shì () wǒ shì () Hánguó rén () ah <u>wǒ zhù Àokèlán</u> a: () I am () I am () Korean () ah I live [in] Auckland	interweaving of formulaic sub-parts
H:	a um <u>wǒ jiā yǒu bàba māma</u> yīge dìdì hé wǒ a um my family has father mother a younger brother and me	

As the interview advanced, and learners were no longer able to rely on stock phrases without repetition, more constructive use of language became evident.

Excerpt 2.4 (Still later in H1)

l:	nǐ zài nǎlǐ chūshēng Where were you born?
A:	<u>wǒ zhù xīnxīlán</u> I live in NZ
l:	nǐ zhù zài zhèr dàn nǐ hěn xiǎo de shíhòu nǐ zài nǎlǐ () zài Àodàlìyà ma You live here but when you were very small, where were you? () in Australia?
A:	a: bù shì um a () hànyu zěnmē shuō "born" a: no um a () how do you say "born" in Chinese?
l:	"chū shēng"
A:	"chūshēng"
l:	shēng born {wǒ chū} "sheng" "born" {I was bo}..

Excerpt 2.4 cont'd

- A: {wǒ chūshēng} wǒ chūshēng Samoa New construction including vocab item just supplied
 {I was born} I was born in Samoa
- I: m
- A: Samoa um wǒ zhù yī nián Àdǎlìyà addition of duration adverb **within** NVN string
 Samoa um I live one year Australia
- I: aha
- A: um um () yī iǔjiǔyī nián a () hu wǒ come laugh code-switching
 um um () [in] 1991 a () hu I come

Excerpt 2.5

- I: Have you been any other countries apart from New Zealand To Hannah
- H: shì {a:}
 yes
- I: shénme dìfāng
 What places?
- H: um () shíbā ge gōu compound number, classifier and lexical error
 um () 18 countries 'gōu' 'dog' for 'guó' 'country' = original collocation
- H: wǒ zhīdào Saudi de Jeddah um um
wǒ zhù Saudi de Jeddah
 I know Jeddah in Saudi um um
 I live in Jeddah in Saudi

Locatives

Locative Preposition: zài shàng huà 'at on picture'

In the first excerpt, the Interviewer models the correct TL order for *shàng* and suggests some contexts where Kazuko might have heard the word. Note Kazuko's own gloss for this word is the English *noun* 'top'. In the second excerpt, Kazuko uses the word *shàng* in a description. The two excerpts were separated by 16 utterances in which no locative occurred.

Excerpt 3.1 (K2)

- I: kěyǐ shuō "yǒu shù zài huà shàng" "zài" "at" huà shàng ()
 you can say: the trees in the picture: zài is "at" hua shang.
 shàng dòng ba shàng shàngwú shàng kè nège shàng (writes the character)
 You understand "shang" don't you, it is the "shang" in "Morning", and "begin class", that "shang".
- K: its top

Excerpt 3.2 (16 utterances later)

K: liǎng liàng zìxíngchē a: () huà *zài shàng huà sh a shù *zài shàng huà
two bicycles a: () picture at top picture a a tree at top picture

Comments

Kazuko knows the form and meaning of *shàng*, has heard the TL order, glosses it with a noun, but places the locative immediately following *zài* 'at'. Since *zài* is otherwise followed by a placename or demonstrative in her IL, she is treating *shàng* like those words: a type of noun or pronoun. However, unlike those words, the locative takes a following locus-denoting NP, *huà* 'picture'. Thus it shares characteristics with the preposition *zài*. Cross-linguistically, prepositions can take other prepositions as complements but nouns do not generally take bare noun complements. Therefore this use of *shàng* is classified as prepositional.

Incorporated locatives: zài chuán 'at the boat'

The difficulties with locatives persist for some time. At T4 (week 15) Kazuko attempts the use of the locative noun, but asks for help each time. The interviewer first tries prompting with just a preposition *zài* 'at', but apparently Kazuko feels there is more to it.

Excerpt 4.1 (K4)

K:	a rén liǎngge rén no on the boat a people two people no on the boat	prompt for help
I:	zài at	
K:	zài zài chuán () m() at at boat () m ()	No Locative Noun

Excerpt 4.2

K:	zài how do you say it on the shore or	
I:	zhè shì hǎi shì ma shì hǎibiān this is the sea is it? Is it the sea side?	Model N-Loc
K:	hǎibiān sea side	repeats N-Loc
I:	ok hǎi is sea, biān, biān is side nǐ zài shuō yībiān zhège wèng zài nǎr say it again. Where are these pots?	explains structure
K:	o zhège wèng zài huò hǎibiān o this pot at (.huò h) sea side	repetition

Excerpt 4.3

I:	shénme dìfang bù yīyàng {bu yiyang} what parts are different	Elicitation cue
K:	{bù yīyàng} different	
I:	m liǎng zhāng huà m the two pictures	
K:	a: () tāmen tāmen a () <u>tāmen zai chuan</u> a: () they they a () they at boat	N without locative again
K:	biéde biéde huà um yǒu liǎngge a <u>tāmen bù zài chuán</u> other other picture um have two-CL a they not at boat	
I:	mm?() tāmen zài nǎr mm? () where are they?	
K:	tāmen <u>zài um hǎibiān</u> they at sea-side	fixed collocation
I:	mhm	
K:	a bùshì yìge yìge rén <u>zài () hǎibiān</u> yìge rén <u>zài chuán</u> a no one.cl one.cl person at () seaside one cl person at boat	fixed collocation and non-use of locative in same utterance

Comments

The final line above makes it clear that at T4, Kazuko treats *biān* 'side' as part of a fixed lexical item *hǎibiān* 'sea-side' not as an item related to the more distant *zài* 'at', or indeed as the main predicate of the structure.

Syntactic locatives: *zài* N- *biān* 'by N'

After exposure to some modelling, Sam began to over-generalise the use of *biān*. The next excerpt shows an exchange where the Interviewer responds to another learner (A) with models of the locative construction. Sam can hear this, though he does not participate. The second excerpt is a few minutes later, Sam responds to and uses *húbiān* 'lakeside', for the first time, but *fails* to use a locative with a different N *chuán* 'boat'; in other words, he treats *húbiān* as a fixed lexical item. The third excerpt includes further modelling, again prompted by the other learner, A, then a little later (excerpt 4) Sam uses this precise form, but its placement is not TL like. In the picture he describes, the tree is behind the cart, and the building behind the tree. The TL order to explain the first fact would be either 'tree zai cart de houbian' (theme zai locus de locative) or 'cart de houbian you tree' (locus de locative you theme); Sam's order is neither: 'cart zai houbian tree' (theme zai loc domain). Sam's use of the *zài ... biān* pattern is clearly productive, but the pattern is not integrated with sentence structure in a TL way. Excerpt five, shows Sam finally using a TL order (theme zai domain loc) but the domain is represented by a quantifier, which, in the TL, would not precede the N it quantifies.

Excerpt 5.1 (S3)

- A: a "next to" () jiào shénme
what is "next to" called
- I: um hh laugh
- A: beside
- I: m zài x biān biān pángbiān next to x at x side models zài N biān
m at X side side beside next to X at X side
- A: o tāmen a gòngzuò zài shuǐbiān implements pattern
o they work at water-side

Excerpt 5.2

- A: húbiān zài húbiān
lake-side at lake-side
- S: whats o dùì tāmen tāmen tāmen shì zài húbiān fixed collocation húbiān 'lake-side'
What's Oh right, they they they are at the side of the lake
- S: a boat zhōngwén zěnmē shuō
a how do you say "boat" in Chinese?
- I: chuán
- S: ok tāmen shì zài chuán Sam uses zài 'at' with no locative
ok they are at the boat

Excerpt 5.3

- A: um um behind Sam is present as Interviewer models use of zài N biān
- I: zài hòubian
- A: zài hòu
at behind
- I: zài hòubian at the back side of something

Excerpt 5.4

- S: tuōchē hòu o zài hòubiān a () yīge shù ma S uses zài plus locative *before* locus
cart back o at back-side a () one-CL tree Q-PRT
behind o at the back the cart a () is there a tree?
- A: a dùì um a wǒde huà um yǒu yī is it yīge yīge shù yīge shù A checks Classifier-N agreement
yes my picture has one is it one 'ge' one tree
- S: yīge shù zài hòubiān um yǒu building zěnmē shuō S uses zài plus locative and presentative yǒu
one-CL tree at back-side um have building how say
at the back the tree is how do you say "building"

Excerpt 5.5

- S: a hái yǒu a duō shù () um um zài dōubiān S uses biān as ?noun following Q
S: a also have a many trees um um at all side

Comments

This is as near to the TL order as Sam gets in this interview: *duō shù* 'many trees' is the item to be located, and precedes the predicate, but the combination of the quantifier *dōu* 'all' and the locative *biān* is not TL-like. Nonetheless it suggests that Sam does count the locative *biān* as a N, 'side' not as a P, 'by'; the error arises because he misplaces the quantifier *dōu* 'all', whose placement in the TL is exceptional.

TL-like locatives : a zài N de lǐmian yǒu... 'inside N there is..'

At T7 the three learners engage in a task where each describes an abstract arrangement of shapes coloured in black and white to the other two. The listener must draw what the speaker describes and may ask questions to check their comprehension. In this extract, Sam describes what he has drawn based on what Kazuko has said. He uses several variants of TL locative structures, exhibiting not only his mastery of the TL word order for zài, the locative and the locus, but also a sensitivity to the definiteness or indefiniteness of the theme, using the presentative yǒu without zài where it is indefinite, and using zài with theme omission where the latter is definite.

Excerpt 6.1 (S6)

- S: um wǒ hái yǒu () a yī a () yīge luǎnxíng a: luǎnxíng pèng a sānjiǎoxíng a
I also have a an oval a: the oval is touching a triangle
- S: () a luǎnxíng de shàngmian yǒu yīge () fāngxíng uh a: báisède fāngxíng locative de;
() a above the oval there is a square () uh a white square indefinite theme with yǒu
- K: fāngxíng m
square m
- S: a báisède fāngxíng a lǐmian yǒu hēisède fāngxíng Incorporated locative;
a inside the white square there is a black square indefinite theme with yǒu
- K: dùì
right
- S: a wǒ wǒ yě yǒu um () yīge a () bàn sānjiǎoxíng () hēisède
a I I also have um () one a () half triangle, () black
- K: a bù shì yīge um bàn yuánxíng
a no it's a um half-circle
- S: o ok () um a: () zài a zài hēisède a yuánxíng de lǐmian? locative de;
o ok () um a: () is it inside the black circle? definite theme elipsis

Appendix D:

IL Lexical Categories and Constituent Order

IL lexical categories

The ILs provided distributional evidence for eleven distinct nominal categories and for the inclusion of predicate 'Adjectives' in the class of verbs. Categories that differ from those of the TL are: the inclusion of demonstratives and numbers in a single class; the inclusion of non-numeric quantifiers and 'Adjectives' in a single class; the classification of the ordinal and classifier as bound affixes.

Table 47. IL lexical categories in order of emergence

Emergence Time	Free Morphs	Bound Morphs
T1-2	Pron N Numbers Preposition (zài) Nominal Conj (Kazuko)	Possessive DE Classifier
T3-4	Num _{Dem} Attributive Adjective ±wh / Q Locative N (bian) Locative P (shang) Nominal Conj (Sam& Hannah)	
T5-6	Det Dem (Sam) Locative N (shang etc)	Attributive DE Ordinal Prefix (Sam & Hannah)
T6 -T9	Det Dem (Kazuko) Wh-Det Conj _{Int}	Ordinal Prefix (Kazuko)

IL constituent orders

22 structures found in all ILs

1. N:

hànzì hányǔ jiào hangul
Chinese characters, [in] Korean [are] call[ed] "Hangul" (S1)

2. PRON:

tā zài ... wàimian tāmen zhēn áide
(3sg) is ... outside **they (3 pl)** very short (K1)

3. NAME:

wǒ jiào um M, wǒ zhù Aòkelán
I [am] call[ed] M, I live [in] **Auckland** (H1)

4. PRO:

wǒ xǐhuān bù xiǎng
I like [it] [I] NEG intend [to]' (S1)
cf

wǒ xǐhuān hànǚ wǒ xiǎng qù zhōngguó, wǒ bù xué rìyǔ
I like **Chinese** I intend to go to **China** I NEG study **Japanese** (S1)

5. COMPOUND N

wǒ um xǐhuān hànǚ kè tāmen zhōngguórén
I um like **Chinese class** (S1) They [are] Chinese (= **China-people**) (K1)

6. NUM N

wǔ nián
five year(s) (K1)

7. AFFINE STRUCTURE

wǒ nǎinai yèye zhù um hánguo
1sg grandma, grandpa live [in] Korea
My g.mother and g.father live in Korea (H1)

8. NUM-CL-N:

yī.ge gēgē *liù.ge nián *liǎng something zìxíngchē
two.CL older.brothers (K1) six CL year (H1) two something bicycles (S1)

9. DEP POSS

[wode **jiujiu**] de jia
1sg.Poss uncle Poss home
my uncle's home (S4)

10. (ADV) ADJ (PREDICATIVE)

tamen zhen aide
they very short (K1)

11. (ADV) ADJ-N (ATTRIB)

hěn dà zìxíngchē
very big bicycle (H2)

12. CONJ

tā a chuán huáng hé hóng hé lán yīfu
3sg a wear yellow **and** red **and** blue clothe(s) (K2)

13. PRONOMINAL DEM

zhè jiào Kxxxx
It / this [is] call[ed] Kxxxx (K2)

14. NUM-CL –ADJ N

liǎng bǎ cháng yízi
two CL long seat[s] (S2)

15. *PSEUDO REL CL

wǒde huà um um heh zhège yī jiā qù cháojíshìchǎng
my picture this one family go supermarket (H5)

16. DEM-CL-N

zhè.ge huà
this.CL. picture (H4)

18. POSTP

tāmen shì zài hú.bian
they are at [the] lake.side (S3)

20. NUM-CL DEP N

yī.tiáo qiánlánsè de níúzǎikù
1.CL lightblue DE jeans

22. ORDINAL

zhè shì dìyī
this is ORD.one (= the first)

32 idiosyncratic structures

1. BARE NUM

tāmen shì sìshí suì
3pl Cop. 40 age
They are **forty** (K4)

2. Q (HEN DUO/ DOU)

wǒ bù huì kàn hěn duō
1sg Neg can see very much
I can't see much(S8)

3. NUM-CL

yīgè dǎ qiú yīgè zuò shénme
one.CL hit ball one.CL do what
One is playing ball, one is doing what? (S5)

5. DEM-CL

zhègè shì jiā
this is house
This is a house (S7)

7. MOD DEP

hěn xiǎo de yuánxíng shì hēisède
very small DE circle COP black. DE
The very small circle is a black one (S6)

17.(HEN) DUO-N

hěn duō rén
very many people (K3)

19. MOD DEP

dǎ.qiú de rén
play.ball DE people (H5)

21.LOCATIVE DEP

hěn duō shù de zhōngjian
very many trees DE middle
(= in the middle of many trees)

dōu nán
all hard
[They are] all hard (S1)

4. ORD-CL

zhè shì dì sāngè
this is ord.three
This is the third (S8)

6. *ADJ

wǒ xǐhuān là
1sg like piquant
I like piquant [food] (K3)

8. POSSESSIVE PRONOMINAL

wǒ.de yě um wàimiàn
1sg.Poss also um outside
Mine is also um outside (H1)

9. REL CLAUSE

méi yǒu um dǎ qiú de rén
 NEG have um hit ball DE person
 There is no -one playing ball (K3)

11. ADJ MOD DEP N

hěn xiǎo hēisède fāngxíng
 very small black. DE square
 A very small black square (K6)

13. *DEM-N:

zhèi huà yǒu liǎng.gè.rén
 this picture have two CL people
 This picture has two people (S3)

15. [[BAREPOSS] N DE] N

[[wǒ māma de mèimei] de nǚer]
 My mother's sisters daughter (K5)

17. *NUM-N

sān hànzi
 three characters (S4)

19. DOUP

tāmen dōu yǒu shūbāo
 3pl all have bag
 They all have bags (S7)

21. FRACTIONS (NUM-N-FRAC):

qī diǎn bàn
 seven o'clock half
 half past seven (H6)

23. DEP POSS NUM -CL N

wǒde yīzhāng huà
 1sg DE one-CL picture
 One of my pictures (H5)

10. *REVERSE LOC

zài shàngmiàn de luǎnxíng yǒu...
 at top DE oval have
 *On above the oval there is... (K6)

12. WH-N:

shénme míngzi nǐ bān
 what name which class
 What name? which class? (S2)

14. DEM-CL {ADJP/DEP} N

zhègè hěn dà de fāngxíng
 this.CL very big DE square
 This very big square (K6)

16. DEPPOSS [{DEP MOD / ADJ} N]

wǒ de um gāo rén
 My tall person (S4)

18. *Q-N:

tāmen yǒu a duō dōngxi
 3 pl have a much things (S3)

20. Q + ATTRIBUTION (ADJP NUM-CL N)

hěn dà a yīge sānjiǎoxìng
 very big one-CL triangle
 One very big triangle (H6)

22. * Q NUM-CL N

nǐ yǒu duōshǎo yītiáo xiàn
 2sg have how.many one-CL lines
 How many one lines do you have? (S6)

24. * DEPPOSS NUM-N

tāmen de yījiā
 3pl DE one-family
 their family (H5)

25. POSS ORD-NUM N

wǒde dìèr huà
1sg DE ord two picture
My second picture (K7)

27. *DEM-CL NUM N

*zhège yī jiā
This.cl one family (H5)
This family

29. *MOD DEM CL NUM CL N

zuǒmian nèige liǎngge xíng
left-side that-CL two-CL shape
Those two shapes on the left (H6/46)

31. *INT-Q DEM CL N

jǐ zhège zhège mén yǒu
int-Q this.CL this.CL gate have
How many of these gates (K5)

33. N-N APPPOSITION

wǒde yī.zhāng huà yǒu yījiā sìge rén
1sg DE one.CL picture have one family four.CL person
My picture has a family of four (H5)

26 DEM-(?+NUM)-CL (*DE) N

nèige yuánxíng
that-CL circle
that circle (H6)

nèige de hànzì
that(+one)-CL DE character
that character (H4)

28. *DEM CL NUM CL N

zhège sānge rén
this.CL three.CL person
These three people (K8)

30. *DEM-Q-N:

nèi yī jiǎo
That one corner (S7)

32. INTERROG CONJUNCTION

zài zuǒbiān hái shì zài yòu...
at left.side or at right...
On the left or on the right..? (S6)

Frequency of common structures

Table 48. Frequencies of 22 structures common to each IL

Structures	K1	S1	H1	K2	S2	H2	K3	S3	H3	K4	S4	H4	K5	S5	H5	K6	S6	H6	K7	S7	H7	K8	S8	H8
pron/Name	20	17	14	11	23	16	25	55	36	45	60	12	75	37	24	1	19	8	49	33	28	68	66	39
N	14	29	5	17	18	10	19	64	20	39	43	10	36	26	19	29	19	17	47	45	30	83	29	30
Num-CL-N	2	4	6	8	9	4	11	25	1	26	25	7	20	14	18	7	9	22	10	4	4	28	10	5
pro	6	5	6	2	6	4	2	4	23	4	18		10	4		9	10	4	8	14	2	6	2	9
bare poss	6		4	2	5		3												1			1	1	
Adj P (pred)	(1)	3		2		3		1	1	17	10			5			3			3				
deP Poss	(1)		(1)	4	12	2	14	11	11	9	17	3	16	2	5	1	3	3	13	6	5	10	5	10
Num-Cl-Adj N					4		2		2		1						2							
(adv) Adj-N				5		(1)	3		5	2	4	4	1				6			2			1	
(hen) duo-N							1	1	4	1	4			2	2					3	11		2	
Mod deP										4	14	12	2			10	4	2	1	3	1	9	5	2
Dem-CL-N				1				(1)		12	4	(1)	19	1	5	4	1		4	2	6	11	3	2
Incorporated Locative	1			1				8		5			1	9	6		4	2	3	3		7	3	
*Pseudo Rel Cl						(1)	2				4			3	2		1			2			1	
Num Cl deP N											6	3	2			5	2							
Locative deP														4	6	4	15	21		5	5	3	2	
Ordinal											7	2	1	5	5				1		2		1	
Num N	3	1	1				1			2	3		2	1	(2)		3	4	2		2	5		
he	1			3	5		3			4	55	5	4		1	4	96		1					
Pronominal Dem		3		2						16			3			8			1		3	15		

Table 49. Sequences as Scores for 22 structures; all learners (KHS) and Book (B)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
K	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	4	4	4	4	5	6	7
H	1	1	1	2	1	6	1	1	2	2	3	4	7	6	5	5	3	5	4	4	5	4
S	1	1	1	1	1	4	2	1	2	1	2	2	1	2	4	4	4	3	4	4	5	4
B	1	1	1	1	1	1	1	1	1	1	2	1	3	1	x	1	x	3	5	x	x	7

Frequency of idiosyncratic structures

Figures in brackets were counted as unproductive because of identical tokens.

Table 50. Idiosyncratic structures in Hannah's IL

Year One	H1	H2	H3	H4	H5	H6	H7	H8
	T1	T2	T3	T5	T6	T7	T8	T9
Num	4	4	-			1		
N-N apposition	2				3			
Pronominal deP	5	-	-			1		
Complex Poss: (barePoss N) deN				4	4		3	1
haishi				2				
Dem-Num-CI (*de) N				1	4	5		
Q-N			1		2	4	2	
deP Poss Num-CL N					2		5	
* depPoss Num-N					2			
Dem-CI Num N					*1	1		
AdjP Num-CI N						3		
* Dem CI Num CL N						4		
depPoss deP Mod N						2		
*Dem-N							4	
pronominal Dem-cl					1		1	
Mod – Dem *CI Num CL						1		
Num-N-Frac						1		
Dem-CI-AdjP N						1		
*Num-CL-N	1							
wh-N			1				1	

Table 51. Idiosyncratic structures in Kazuko's IL

Year 1	K1	K2	K3	K4	K5	K6	K7	K8
Num	2			3	2			
Pronom Adj			2					
wh-N		1	1					7
(barePoss N) deN	1				2			
reverse loc						12	4	6
*Q/Num-N			1				2	
deP Poss di-Num N							2	
pronominal Dem-cl								3
haishi						1		2
*Dem-cl-Num-cl N								2
N-N appos	1			1			1	2
Pronominal PossP		1						
RC			1					
Pronom Num-CI			1					
recursive deP poss					1		1	
DouP					1		1	
int-q dem cl n					1			
Mod deP adj N						1		
Dem-CI deP N						1		
dep Poss Num-CL N						1		

Table 52. Idiosyncratic structures in Sam's IL

Structure	S1	S2	S3	S4	S5	S6	S7	S8
	T2	T3	T4	T5	T6	T7	T8	T9
*Q/Num N		4 / 3	6 / 0	0/4	1			
wh-N		5			2			
*Dem-N			3		1			
deP Poss dem-CL N					2			
pronominal Num-cl					2			
*reverse loc						12		
Pronominal deP			1			6		
haishi					1	1	1	
Num (CL)	0	(2)						3
pronominal Dem-cl								3
DouP						1		1
deP Poss Num-CL N						1		1
Pronominal Dou	1		(2)					
ordinal + CL								(2)
N-N Apposition		1			1			
* Q Num-CL N						1		
recurs deP poss				1				
deP Poss Adj N				1				
Pronominal Q (hen duo)				1				1
*Dem-Num-N						1		
Dem-Num-CL N						1		

Emergence orders

Table 53. Order of structures in Textbook (24 Structures only)

	elapsed weeks	6	8	11	14	21	24
	Textbook units	1.1-1.4	1-5	1-6	Revision	2.1-2.4	3.1-3.4
code	structure						
1	N	x (1.1)					
2	pron	x					
3	Name	x					
4	pro	x					
5	Compound N	x					
6	Num-N	x					
7	bare poss	x					
8	Num-CL-N	x					
9	deP Poss	x					
10	(adv) Adj (predicative)	x					
14	Num-CL-Adj N	x					
16	Dem-CL-N	x					
20	Ordinal (heading only)	x					
-	Num	x					
-	wh-N	x					
-	Dou	x					
12	he	x (1.4)					
11	(adv) Adj-N		x				
13	Pronominal Dem			x			
18	Incorporated Locative			x jiali		haibian	
-	Complex Poss			x			
-	pronominal Dem-cl			x			
19	Mod deP					x	
-	haishi					x	

Table 55. Emergence Order for Kazuko

Sample Code	K1	2	3	4	5	6	7	8
Time code	T1	2	3	4	5	6	7	8
elapsed weeks	6	8	11	14	21	24	26	28
1-wd Nom								
N	x							
pron	x							
Name	x							
Num	x							
pro	x							
Adj N?/ Compound N	x							
Num N	x							
2 place NP								
bare poss	x							
[Num-CL]-N	x							
(adv) Adj (predicative)		x						
deP Poss		x						
(adv) Adj-N		x						
Conjoint NPs: he/ye		x						
Pronominal Dem		x						
[Num-Cl] -Adj N			x					
Pseudo Rel Cl			x					
Dem-CL-N				x				
(hen) duo-N				x				
Incorporated Locative				x				
Mod deP (true rel)				x				
Three place NP								
Complex Poss: (barePoss N) deN					x			
recursive poss deP					(1)			
Num-Cl deP N					(2) ²⁸	x		
*reverse loc						x		
Locative deP						x		
Mod deP Adj N						(1)		
Dem-Cl deP N						(1)		
Poss deP [Num-CL] N						(1)		
Poss de-Ord Num -N							x	
wh-N								x
Haishi						(1)		x
*Dem-CL Num-CL N								x
Pronominal Dem-cl								(3)

²⁸ Both dePs are colour terms, where de might be an invariant part of the colour name.

Appendix E:

Distribution of IL Lexical Categories

This appendix includes descriptions of the collocational possibilities for the overt IL lexical types identified in Chapter 5 and statistical evidence demonstrating when lexical items with some shared collocational possibilities become statistically distinct. This is followed by notes about the nature of the lexemes that made up each distributional class and about the functions, or other relevant characteristics of the 22 structures that occurred in all ILs.

IL Lexical Categories

Nouns, pronouns and numbers

Nouns (N), Pronouns (Pron), and Numbers (Num) were distributionally distinct from the time of the first interview (See Table 57, pg 246). The frequency of Names was too low ($n = 23$) to allow statistical evidence of distinct distribution (see Table 58). They were grouped with Pron on the basis that they do not denote generic types like N, or quantities like Num, but refer to specific entities.

Pron preceded N but N did not, except in compounds (see Table 59), and N followed the classifier (Class) but Pron did not (see Table 60), while Num preceded Class but Pron and N did not (see Tables 61 and 62). Only Pron ever included the suffix *-men*.

Pron and N also served different pragmatic functions in the ILs: Pron was used for sentence-initial topical entities, and N and Names for post-verbal newly introduced or non-topical entities. This conforms to proposed discourse universals (Dubois, 1987; Givon, 1983), demonstrating a sensitivity to formal and pragmatic factors by the learners.

Pronouns

As well as overt personal pronouns, the Pron class included covert 'pro' (pronominal ellipsis), demonstrative pronouns, and possessive pronouns.

COVERT PRO

Covert pro occurred in all ILs by T2. Sentences like (123a) containing no overt Object, or (1b) containing no overt argument alternated in the same IL with sentences like (124a) containing an overt pronominal Object, and (2b) containing two overt arguments.

- 123) a. wǒ xǐhuān
1sg like
I like [it]
- b. bù xiǎng
Neg intend
[I] don't intend [to] (S1)

- 124) a. wǒ xǐhuān hànyǔ
1sg like Chinese
I like Chinese (S1)
- b. wǒ xiǎng qù zhōngguó
1sg intend go China
I intend to go to China (S1)
- c. wǒ bù xué rìyǔ
1sg Neg study Japanese
I don't study Japanese (S1)

This indicates that the ellipsis in (123) is not a consequence of performance limitations; it is an option exercised in accordance with TL norms. For convenience these missing elements are referred to as "pro", the null pronominal in binding theory, but see Huang (1982) and Rizzi (2000) for discussions on other possible analyses of this null item in the TL and in SLA, respectively.

DEMONSTRATIVE PRONOUNS

Demonstrative pronouns appeared at T2 in the speech of Sam and Kazuko. For Sam zhè / zhèr and nà all appeared to be interchangeable deictic elements. For example, he used first one, then the other in response to the question 'What's in the photo?'

- 125) zhèr yǒu a... sān .. a ge rén
Dem have a... three ...a Class person)
This has / here there are three people (S3)
- 126) nà shì a: ... liǎng a liǎng zhāng zhuōzi
that is a: ... two a: two Class tables
There/ that (?) is two tables (S3)

In Kazuko's IL, the form zhè appeared to function as a 3rd person pronoun 'it'. For example, immediately after mentioning a restaurant in which she worked part-time, she said: zhè jiào K*** fāndiàn 'zhe' is called K*** restaurant'. The term 'zhè' has a linguistic antecedent, but the restaurant itself is not present in the speech context, so zhè is not deictic, it is anaphoric. These demonstratives were classified as Pronouns because they were neither followed by classifiers, as later demonstratives were, nor preceded by them, as N was.

POSSESSIVE PRONOMINALS

Hannah used de-marked pronouns as possessive pronominals. Until de began to follow other lexical classes it was treated as a pronominal affix.

- 127) a. zhè shì shéide
this is who.de
whose is this? (H1)
- b. wǒde yě wàimiàn
1sg de also outside
Mine outside too (H1)

Numbers

Though Pron, and Num both immediately preceded N, Num also immediately preceded Class, and Pron did not. On this basis, Num was significantly different from Pron (see Table 61), and, in Kazuko's IL, distinct from Adj also (see Table 64; recall also that the few potential Adj were actually counted as part of the noun till Adj*P* clearly emerged). Num was also distinct from non-numeric Q (Table 65).

Demonstratives in the Dem-Class-N string were not initially distinct from numbers (see Tables 68 and 69), but were distinct from both Pron and Adj, for Kazuko at T4 (see Table 66), and for Sam at T5 (see Table 67, and 71), but not. The appearance of ordinals at T5 and T6 (see below) provided a new environment where Num could appear but Dem did not. However, the frequency of demonstratives and ordinals was so low that the difference was not statistically significant (see Table 74). Only if all instances of Dem and Num in Kazuko's IL from T1 to T9 were combined did the difference between them reach statistical significance (see Table 73).

Locative nouns

Initially, Sam used the locative *biān* 'side' like any other noun: after other locatives, *zài hòubiān* 'at back-side', *zài qiánbiān* 'at front-side'; after a non-locative noun, *nánrénbiān* 'men-side'; and after a quantifier, *dōubiān* 'all-side(s)' (for examples of use see Appendix C). Only the first two of these usages are TL-like; *nánrénbiān* is prosodically odd: the bisyllabic noun *nánrén* sounds better in a locative *de* structure with a free double locative: *nánrén de pángbian* (men *de* side-side) 'beside the men'. The final example is odd because the quantifier *dōu* 'all' precedes the locative noun; in the TL *dōu* must *follow* any N it quantifies. The non-TL collocations prove the structures are not rote-learned chunks, but are the product of Sam's own generative processes.

Since non-numeric quantifiers all belonged to the class Adj in the ILs, (see below, and Tables 64 and 72), the way Sam used *biān* with *dōu* was consistent with his use of nouns generally: nouns did incorporate with other nouns, or with Adj to form compounds.

Later, *all* the learners began to use a variety of conventional double locatives, *wàimiàn* 'outside', *shàngmiàn* 'top-side / above', *zhōngjiān* 'middle-between / in the middle', following *de* e.g. *zài shù de zhōngjiān* (at tree *De* middle) 'in the middle of the trees'. Since *de* was followed by a noun in every other case, this is also clear evidence that the double locative compounds were nouns in the ILs, and that therefore a single locative, as the head of the compound, was also a noun.

Possessive *de*

Initially, the form *de* appeared only after pronouns in possessive relations, or as a part of a fixed form, such as *yīge nánde qī sèi* (one-Class male *de* seven season) 'one boy is seven' and *zhēn āide* 'real

short'. The latter were treated as non-productive, since the simpler forms *nán* and *ǎi* did not also occur in the same ILs. In contrast, the possessive *de*, as in (128), increased in frequency from just two occurrences at T1, to 12 at T2.

- 128) *tā.de gāozhōng*
 3sg.POSS high-middle
 His high-school (S1)

As mentioned above, the distribution of *de* was distinct from that of any other nominal element.

Classifiers

There were 38 instances of the Num-Class-N collocation in T1 and T2 samples combined. Since Num and N each appeared without Class, the classifier was clearly a distinct morph in the ILs, but it was not demonstrably a *free* morph because it appeared in only one context: after Num. The distribution of N was significantly distinct from that of Class by T2 (Table 63).

The most frequent form of Class was the TL default form, *ge*, but Hannah and Sam also used one other classifier each, *zhī* (with *gǒu* 'dog') at T1, and *liàng* (with *chē* 'car') at T2, respectively. This alternation of classifiers after the same number is evidence that the Num-Class collocation was productive in their ILs. In fact, in one interview, Sam asked for the correct classifier form for vehicles, demonstrating his explicit awareness of the syntagmatic and paradigmatic status of classifiers, and sensitivity to their obligatory nature.

Determiners

DEMONSTRATIVES

Num and Dem became distinct in Sam's IL at T5 when he began to combine the two. In (129) the form *nèi* co-occurs with the number *yī*, so *nèi* cannot be an incorporation of *nà* 'that' and *yī* 'one' as it is in the TL.

- 129) *nèi yī.ge jiǎo nèi yī jiǎo*
 that one.Class corner that one corner
 That one corner, that one corner (S6)

In Kazuko's IL Dem and Num became *statistically* distinct at T9 (Table 73; $\chi^2 = 57.47$ $p < .000001$), when they also appeared together in (130).

- 130) *sān.ge rén zhè.ge sān.ge rén chī zǎofàn*
 three.Class people dem.Class three.Class people eat breakfast
 Three people, these three people are eating breakfast (K8)

Kazuko's repetition of the number-classifier sequence in (130) is a self-correction, where she starts to use the number first, and then apparently decides it should *follow* the demonstrative. Obviously we cannot be sure of this, but it is unlikely that she would otherwise repeat the same numeric expression in quantification of a single noun. Note that Kazuko also repeats the classifier,

which is not TL-Like, but is consistent with a grammar where Class is a lexical suffix selected by both Dem and Num, rather than a clitic that attaches to DemP *or* NumP.

This use of the demonstrative was labelled demonstrative determiner (Det_{Dem}), mainly because it places Dem at the left-most position of the most complex nominal structure that the learners produced (excluding some with recursively embedded possessors).

INTERROGATIVES

By T6, the interrogatives *něige* 'which', which first occurred in Sam's IL at T3, *shénme* 'what', and *duōshǎo* 'how much' also became significantly distinct from Sam's Adj (Table 75). Sam surely knew by then that the form *ge* in *něige* was the classifier, but he also knew that demonstratives could precede numbers. His other interrogatives, *shénme* and *duōshǎo*, could not be numbers since they never collocated with classifiers, so they were assigned to a separate pre-N class which was labelled DET_{wh}.

Predicate Adjectives

In all ILs predicative 'adjectives' (Adj) *followed* nouns, e.g. *hànzì nán* 'Chinese characters [are] difficult' (S1); or the negator *bù*, 'not' e.g. *tā bù féi* 'he [is] not fat' (H1); or an Adverb, e.g. *tāmen zhēn ǎide* 'they [are] really short' (K1). The use of negation and absence of a copula in the IL structures made these lexemes distributionally indistinguishable from IL verbs. In contrast, nouns used as predicates followed the copula *shì*.

Attributive Adjectives

Initially, it was not possible to distinguish statistically between Adj-N compounds and N-N compounds, or to distinguish formally between a lexical Adj-N compound and a *syntactic* AdjP-N collocation. Thus at T1 and T2, the same lexeme could be a stative verb, or a noun, by IL standards. However, at T3, the functional intensifier 'hen' began to appear, before both predicative and attributive Adj, indicating that in the latter, the modifier was neither a noun, nor a bare lexical head; it formed a phrase with the adverb. At the same time, *hěn* never appeared before a dynamic verb, and dynamic verbs did not precede N at this stage. On this basis, collocations such as *dà shù* 'big tree' were counted as instances of Adj-N from T3 on. Note that this is a departure from the norms of TL syntax that reflects the absence of a collocational possibility in the TLs: the relative clause structure where VP precedes N.

ADJECTIVAL Q

Non-numeric Quantifiers (Q) were mainly²⁹ represented by *duō* 'many/much', and *shǎo* 'few' ³⁰. The distribution of Q was not entirely TL-like: in the TL when the Q *duō* 'much/many' is a pre-nominal modifier it is preceded obligatorily by *hěn*, but both Sam and Kazuko use *duō* without *hěn*:

131) *tā.men yǒu duō dōngxi*
 3.pl have many things
 They have many things (S3)

132) *tā.men chuán duō yīfu*
 3.pl wear many garment
 They wear many clothes (K4)

Quantifiers also had a statistically different distribution from Num: in nine instances altogether, Q was never followed by Class, whereas Num was, on 44 out of 48 occasions (Table 65; Fisher's exact test: $p < 0.0000001$).

In fact, the distribution of Q was virtually identical to that of Adj: both first appeared following N in predicative function, then appeared pre-nominally in attributive function; neither preceded Class, and either both were optionally preceded by *hěn* (H&K), or neither was (S). The pre-N position and the optionality of *hěn* made the quantifier *duō* a member of the category Adj in Sam's and Kazuko's ILs.

Sam's IL also contained a quantifier *shǎo* [ʃao] as in 133).

133) *wǒ shuō shǎo rìyǔ yě shǎo hànǔ*
 1sg speak few/small Japanese also few/small Chinese
 I speak few/ small Japanese also few/ small Chinese (S2)

This form is phonetically similar to two different TL forms, *xiǎo* [çiǎu] 'little/small', and *shǎo* [ʃǎu] 'few/scanty', but neither has the distribution of Sam's [ʃao]. The TL [çiǎu] is a stative predicate that can be used predicatively or attributively but not with an abstract noun like *rìyǔ* 'Japanese'. The TL [ʃǎu] *shǎo* is a Quantifier used only predicatively. Sam's usage may be influenced by the polysemous English 'little', which functions as a pre-nominal Q in 'I speak [(a) little] Japanese', or it may be over-generalisation of the attributive function to all Adj, that is, all stative predicates, a consequence of his including quantifiers in his Adj category. A distinction between non-numeric Q and Adj became possible only after the attributive de emerged, and Q and Adj

²⁹ There is variation between speakers in the use of *jǐ* 'few', an item classifiable in terms of TL distribution, as a non-specific/interrogative Numeric quantifier. However instances of use are too few in early stages to allow analysis.

³⁰ The distribution of *shǎo* in the TL is more like that of English 'scarce'; it is predicative only, however in the ILs *shǎo* is used like English 'few' or Mandarin *duō* 'many', as both a predicate and a pre-nominal modifier.

began to collocate in fixed order. For Kazuko, Q, Adj and Interrogatives (see below) remained distributionally indistinguishable for the whole year.

INTERROGATIVE ADJ

Interrogatives occurred only occasionally. Hannah's initial use was at T4 in the question: *shénme chīde-dōngxi* "what food" (H4). Though this was an isolated instance, the following item had just been elicited by her, so the combination was clearly productive: she could not have learned it in advance. Similarly, Kazuko produced *zhe shì shénme piàn* (lit.: 'This is what slice?') at T2, to mean 'What photo is this?'. The TL term for 'photo' is *zhàopiān*, but Kazuko used an idiosyncratic shortened form. Again, this lexical error indicates the collocation was productive, not a rote-learned string. By T4, Kazuko's use of *shénme* was distributionally distinct from her use of pre-N Numbers and Demonstratives ($\chi^2_{53.01}$, $p < 0.0000001$), but not from Adj. In principle, Adj can be modified by Adv, while wh-elements cannot, but, in practice Kazuko used *hěn* so infrequently that no statistical difference could be established between them even by T9. There was therefore no basis on which to propose a pre-N interrogative class distinct from Adj, for either Kazuko or Hannah.

Sam's IL used four different forms of interrogative from T3 on: *duōshǎo* 'how many' and *něi*, *něige*, 'which' and *shénme* 'what'. He used *shénme* only in a fixed collocation, but he said *něi bàn* to mean 'what (kind of) work', and *něige yǔyán* to mean 'which language(s)'. Like Kazuko's use of *piān* Sam's use of *bàn* is a lexical error; it actually means a 'shift', but Sam explained how he deduced that *bàn* means 'work' by comparison of *shàng kè* 'go to class' and *shàng bàn*, colloquially translated as 'go to work'. Also *ge* is not the appropriate classifier for *yǔyán* 'language'. The fact that a native speaker would not use these collocations indicates that Sam invented them: they are products of his own IL system, where *bàn* is a noun meaning 'work', and where *něi* is an interrogative determiner or adjective. The only indication that Sam's interrogatives might be distinct from Adj is the alternation of two forms *něi* and *něige*. Sam has certainly used the classifier *ge* by this time, and he may recognise the *ge* following *něi* as that classifier. If so, this would exclude *něi* from his class of adjectives, which do not precede classifiers. However, it is not clear that he has analysed *něige* in this way because he never uses any other classifier after *něi* and he may intend the contrast between *něi* and *něige* to indicate something else, like the contrast between 'what' and 'which'. In the absence of clear evidence that *ge* was used after *něi* as a classifier, *něi* and *něige* were both included in the class of adjectives, just like Kazuko's and Hannah's use of *shénme*.

Ordinal marker

The Ordinal marker *dī* was distinguishable from other lexical categories by its position immediately prior to Num. It forms a distributional category of its own. As nothing ever intervened between *dī* and Num, and *dī* did not precede any other lexical type it was treated as a prefix rather than as a free morph.

A locative Preposition

Unlike *biān* 'side', which was used as a noun, the locative *shàng* was first used as a preposition in the phrase *zài shàng huà* 'at on picture' meaning 'in the picture' (K2) (see Appendix C). This was deemed unproductive at that time, but a similar structure appeared in Sam's IL at T4 and T5 e.g. *tāmen gòngzuò shàng chuán* 'they work on [the] boat' (S3). In each case, the locative *shàng* preceded a noun referring to an entity and followed another predicate. In Kazuko's case, the predicate was the preposition *zài* which elsewhere in her IL took an NP after it. Thus the locative and following noun appeared to form a constituent that could be an NP. Interestingly, Kazuko herself glossed the word *shàng* as 'top', an English noun. However, cross-linguistically, nouns do not generally take bare noun complements, while prepositions can take other prepositional complements as well as NPs. On this basis *shàng* was classified as a Preposition rather than a noun in this context.

Sam's use of *shàng chuán* was clearly intended as a locative adjunct to his sentence, and there was no parallel between this and his use of NP; for him, *shàng* was clearly a preposition like *zài*.

Attributive *de*

At T4-T5 a variety of modifiers began to precede *de*. For Hannah these were all colour terms, where the morph *de* always follows the form *sè* 'colour' so this was not clear evidence of productive use. However, Sam and Kazuko both used various non-colour terms: *yōumò de diǎnyǐng* 'humorous *de* movie', **shǎode hángúohuà* 'little *de* Korean' (S4); *hěn dà de wèng* 'very big *de* jar' (K5), *hěn duō de dōngxi* 'very many *de* things' (K7). Some of these were clearly adjective *phrases* in their ILs, so here it became clear that *de* was a clitic, not a possessive *suffix*.

Conjunctions

Nominal conjunctions were distinguishable by the fact that they followed a sequence of nominals each referring to a different entity, and were invariably followed by a pronoun. Kazuko used the TL form *hé* 'and' in at least three such contexts, with different sequences of preceding items. Sam used the TL form *yě* 'also', where the TL would use *hé* (as well as mis-using the quantifier *shǎo*): *wǒ shuō shǎo rìyǔ ... yě shǎo hànǔ yě shǎo hángúó yǔ* 'I speak little Japanese, also little Chinese also little Korean'. The fact that this is non target-like use indicates that it was productive. Hannah, used *hé* in a

non target-like variation on a structure practiced in class: **tāmen de yījiā yǒu... yīge gēge hé mèimei* 'their family has ... an older brother and younger sister'. Therefore this was also judged productive (and see the discussion on the oddness of this combination of conjuncts, p. 244, below).

INTERROGATIVE CONJUNCTION

The interrogative conjunction *háishì* 'or' as in (134), was only marginally productive. Hannah used it only once, and Kazuko and Sam used it once in one interview and once or twice in another.

134) wǒ bù zhīdào qù gōngyuán huò lái gōngyuán **háishì** lái gōngyuán
 1sg NEG know go park or-decl. come park or-interrog come park
 I don't know [if they] are going to the park, or- coming from the park or coming from the park. (S5)

However, each usage was in a different structural context, so it was clearly productive for Sam and Kazuko, even though it was infrequent. The self-correction in (134) also indicates a grasp of the TL conditions on its use only in interrogatives. In (134) it is in an embedded question, and Sam first used the declarative form, then repeated the second conjunct, including the verb *lái* and its complement, with the interrogative form. The fact that the verb phrase was repeated makes it clear that this *was* a repetition, and not a third option in the question.

SUMMARY

To sum up, the ILs provided evidence for eleven distinct nominal categories, and for the inclusion of predicate 'adjectives' in the class of verbs. The categories that differ from the TL were the initial classification of demonstratives as a subset of numbers, and of non-numeric quantifiers as a subset of adjectives. There was no clear evidence to determine whether the ordinal and classifier were free or bound morphs, they were counted as bound, except when later theoretical analysis suggested otherwise (see Appendix K).

Statistical comparisons of distribution

The statistical evidence supporting the conclusions drawn above is shown in the tables below. Tables are ordered according to the timing and number of IL samples from which the data they present is drawn, starting with the earliest samples. All tables show observed frequencies; expected frequencies are shown in brackets where relevant. (No separate figures are given for Hannah because frequencies of some items in her data were too low to permit statistical comparison).

T1-T2

Table 57 gives the frequencies for all instances of referential nominal lexemes in the first two samples. The addends are frequencies for Sam, Kazuko and Hannah respectively. The lexeme *sùì* as in: *tā shíliù sùile* (3sg 16 *sùì*.Asp) 'he is 16' (H2) was counted as a separate context because it was not clear whether it should be classed as a noun 'season', or a predicate 'be aged'. It resembled N more

closely *because* it was preceded by Num, but it never occurred alone or in other structures like other Ns.

Table 57. Frequencies of referential elements in T1—T2 in all ILs combined

	_N	_ Class	_ sui	Class_	Num_	else	Sum
Num	7+3+1=11	17+20+11=38	∅+2+10=12	∅	∅	∅	61
Pron	5+8+4=17	∅	∅	∅	∅	33+12+22=67	84
Name	∅	∅	∅	∅	∅	2+11+10=23	23
N	∅	∅	∅	17+10+11=38	7+3+1=11	69+50+21=140	189
	28	38	12	38	11	230	357

Table 58. Names were infrequent (E<5).

	_N	else	Sum
Pron	17	67	84
Name	0 (3.65)	23	23
	17	90	107

Table 59. N vs Pron, before N at T2 (summed across all ILs)

	N	Class	else	Sum
Pron	17 (5.45)	0 (12.18)	67	84
N	0	38	151	189
	17	38	207	262

Fisher (2-tailed) p=0.0110077

Table 60. N vs Pron, after Class at T2 (summed across all ILs)

	Num(Class)_	else	Sum
Pron	0 (12.18)	84	84
N	49	140	189
Sum	49	224	273

Yates corrected $\chi^2=24.81$; p=0.000006.

Table 61. Num vs Pron at T2 (all ILs)

	_sui	_Class	else	Sum
Num	12 (5.05)	38 (15.98)	11 (39.97)	61
Pron	0 (6.95)	0 (22)	84 (55)	84
	12	38	95	145

$\chi^2=105.13$, p<0001

Table 62. Num vs N at T2 (all ILs)

	_(Class) N	else	Sum
Num	49 (11.95)	12	61
N	∅	189	189
	49	201	250

$\chi^2=183.77$, p<0.0000001

Table 63. Class vs N at T2 (all ILs)

	Class_	Num_	else	Sum
Class	0 (6.36)	38	0	38
N	38	11	140	189
	38	49	140	227

$\chi^2=165.80, p<0.0000001$

Distribution at T3**Table 64. Adj vs Num for Kazuko (T1-T3 combined)**

	_N	_Class	Sum
shénme	2	∅	2
Num	4	23	27
Adj	10	∅	10
	16	23	39

Fisher's exact test: $p=0.00001$

Table 65. Q vs Num by T3 (all ILs)

	_Class	_N	Sum
Q _{decl}	0	9	9
Num	44	4	48
	44	13	57

Fisher's exact test: $p=0.0000001$

Distribution, T4 – T6**Table 66. Dem vs Adj for Kazuko (T1-T4 combined)**

	_N	_Class	Sum
Dem	∅	13	13
Adj	12	∅	12
	12	13	25

Yates corrected $\chi^2= 21.15, p<0.0000042$

Table 67. Dem vs Adj for Sam (T5)

	_Class	else	Sum
Dem	4	∅	4
Adj	∅	27	27
	4	27	31

Fisher's exact test $p=0.000032$

Table 68. Dem and Num *not* distinct for Sam (T1-T5 combined)

	_N	_Class	else	Sum
Num	11	81	7	99
Dem	3	5	3	11
	14	86	10	110

$\chi^2=8.15, p >0.01$

Table 69. Dem and Num *not* distinct for Kazuko (T1-T5 combined)

	_Class	else	Sum
Num	71	9	80
Dem	33	∅	33
	104	9	128

Fisher's exact test, $p = .056$

Table 70. Dem and Num *not* distinct for Sam (T1-T6 combined)

	_N	_Class	else	Sum
Num	12	95	14	121
Dem	4	10	3	17
	16	105	17	291

n.s. $p > 0.01$

Table 71. Dem vs Adj for Sam (T1-T6 combined)

	Class	adv	_N	else	Sum
Dem	10	∅	4	3	17
Adj/Q	1	12	43		56
	11	12	47	3	73

$\chi^2 = 27.54$, $p = 0.0000046$

Distribution by T9

Table 72. Adj vs Q for Kazuko (T1-T9 combined)

	_N	_Class	_de	else	Sum
Adj	19	∅	35	4	58
Q	3	∅	1	∅	4
shenme	7	∅	∅	∅	7
	29	∅	36	4	69

$\chi^2 = 99.25$, $p = 0.000001$

Table 73. Num vs Dem for Kazuko (T1-T9 combined)

	_Class	_N	ord_	else	Sum
Num	125	17	3	7	152
Dem	53	∅	-	37	90
	178	17	3	44	242

$\chi^2 = 57.47$, $p < 0.00001$

Table 74. Num and Dem still *not* distinct for Sam (T1-T9 combined)

	_Class	else	Sum
Num	131 (127)	30 (33.2)	161
Dem	19 (22)	9 (5.77)	28
	150	39	189

n.s. Yates corrected $\chi^2 = 1.9$, $p = 0.16$

Table 75. Interrogative Det distinct from Adj for Sam

	adv_	else	Sum
Wh	∅	8	8
Adj	27	42	69
	27	50	77

Fisher's exact test, $p < 0.044$

Constituent orders for 22 common structures

This section discusses the way the IL categories established above were combined to create recurrent structures. In the initial interviews (T1 and T2) most nominals were single words: numbers, pronouns, and simple and compound nouns. Compounding was initially restricted to N-N compounds, such as *zhōngguó-rén* 'China-person'; *hánguó-yǔ* 'Korea – language'. Suffixation was also evident: the 3rd person pronoun occurred with and without the plural suffix *-men*. The remaining structures are described in groups according to meaning or function.

Possessive structures

In the affine structure e.g. *wǒ nàinài* 'my grandma' the possessor was always pronominal, as in the TL, and by T3 both 1st person pl and 2nd person sg possessors had appeared. With one exception, *wǒ huà* 'my picture', the noun following immediately after a pronoun was restricted to kin-terms, *bàba* 'dad', *lǎolǎo* 'grandma', and *jiā* 'family'. Kazuko, Sam and Hannah also used *de* in target-like manner between a range of possessors and non-kin terms: *Saudi de Jeddah* 'Saudi's Jeddah' (H1); *wǒde huà* (1sg.de picture) 'my picture' (K2).

Basic Numeric expressions

The Num-Class-N collocation was frequent in the first two IL samples ($n = 25$) as well as Target-like exceptions ($N = 7$): these were almost exclusively in dates: *yījiǔjiǔyī nián* (1991 year) 'the year 1991' (K1), but there was one instance of real quantification: *wǔ nián* (five year) 'five years' (K1). The classifier was sometimes omitted where omission is not lexically licensed in the TL, but there was only one instance of insertion of a classifier between a number and a noun where one would not be used in the TL. This simply demonstrates misclassification of a certain noun, not an inability to perform agreement.

The ordinal marker preceded numbers in the ILs, as in the TL, except for one occasion where Sam used it *following* a *wh*-element to create an interrogative ordinal *něi dì* 'which one?' The TL structure is *dìjǐ* where the ordinal marker *dì* precedes the interrogative digit *jǐ* 'how many (less than ten)'. This interrogative digit did not occur in Sam's IL, and his collocation *něi dì* confirms that his interrogative demonstrative *něi* is not a member of the class of numbers by this time, but suggests

that he considers *dī* to be either a number or a noun in its own right. As this combination was not productive by the criteria of emergence, it is not considered further.

The IL number with ordinal-marking was generally used as a pronominal, with no overt N or Classifier following, as in 135) below.

- 135) zhè shì dī.yī
 this is ORD.one
 This is the first

Predicate and Attributive Adjective Phrases

Adjectives appeared following pronouns and modified by the adverbs *hěn* / *zhēn* 'very/truly' in the very first samples.

- 136) a. tā zhēn ǎide
 3sg true short
 He is really short (K1)
- b. tā zhēn táoqì
 3sg true naughty
 He is very naughty (H1)

These utterances were supplied as comments about people depicted in photos or known to the speaker, but not to the addressee. Therefore they can be interpreted as comments about a topic, or predications in which the property-denoting word functions as the main information content, i.e. a predicate.

The same and other property-denoting words began to appear in pre-N position, with and without the adverb *hěn* 'very' at T3. They were used to differentiate entities of similar types, as for example when Hannah discussed the kinds of food she liked to eat (see extract from H3/K3 in Chapter Five, p. 93). This indicates that property-denoting words in pre-N position served a different function, restrictive attribution, from those following pronouns. This form-function mapping is the same as that employed in the TL.

Formally, this attributive structure provides evidence of hierarchical relations within nominal structure: *hěn* modifies Adj, not N, and the combination [[*hěn*] Adj] then modifies N. As discussed above, both the predicate and attributive classes included non-numeric quantifiers.

Attributive DE

In addition to the use of *de* in Associative structures, *de* also appeared between AdjP and N, in the Mod *de* structure. Since AdjP and NP are clearly distinct *phrasal* categories in the ILs, *de* could be analysed as either two distinct but homophonous suffixes, one attaching to N and one to Adj, or as one *clitic* able to follow any phrasal modifier of N (see discussion in Chapter Three, and analyses in Appendices J and K).

Locatives

COMPOUND LOCATIVE NOUNS AND PREPOSITIONS

As mentioned above, early locative statements either employed deictic pronominals ‘zher’ ‘here’ and ‘nar’ ‘there’, or used the preposition ‘zài’ but no explicit locative: ‘zài chuán’ - ‘at boat’. The first locative to appear as the head of a locative compound was ‘biān’ ‘side’, as in ‘hǎibiān’ ‘seaside’. The first clearly *productive* use of a locative noun was Sam’s placement of ‘biān’ after common nouns, as in 137).

- 137) tāmen shì zài hú.biān
 they are at lake.side
 They are at [the] lake.side (S3)

This is open to three analyses: suffixation, compounding, or postposition. The first was excluded because there was at least one instance where *biān* followed a quantifier, not a noun. This suggested it was a free noun in Sam’s IL. The last was excluded because there was no evidence for any other postpositions in the ILs. This left compounding, a lexical rather than a syntactic process.

PRODUCTIVE LOCATIVE INCORPORATION AND LOCATIVE *DE* STRUCTURES

Later this process was extended to include more locatives and more preceding nouns, rather than conventional combinations.

- 138) zhè.ge lánzi qìchē lǐ
 this.Class basket car -in
 This basket is in the car (H5)

- 139) yǒu sìge rén zài qìchē lǐ qù gōngyuán
 have four.Class person at car -in go park
 There are four people in a car going to the park (H5)

Collocations like ‘qìchē-lǐ’ ‘car-in’ are not conventional the way ‘sea-side’ and ‘outside’ are, so these are not so clearly cases of lexical compounding; they appear to reflect the *ad hoc* generation of a complex nominal structure where a bound locative noun follows a noun denoting a reference point, and a third nominal denotes a theme, which can be located by reference to the locative compound.

Thematically related, but structurally distinct from lexical compounding are locative *de* structures, where the clitic *de* intervened between the noun denoting the reference-point, and a free double locative compound:

- 140) zhè.ge sānjiǎoxíng de yòubiān yǒu yuánxíng
 this.Class triangle de left have circle
 To the left of this triangle is a circle

These were also evident in all three ILs.

In addition, there were two other productive structures involving a locative. One was the use of *shàng* as a preposition, as in *zài shàng huà* 'at top picture' and *gòngzuò shàng chuán* 'work on the boat'. The other was a kind of Topic-comment structure that occurred only in Sam's IL.

LOCATIVE 'COMMENT'

The Topic-comment structure involved a double locative compound:

- 141) *yī.ge shù zài hòubian yǒu building*
 one.Class tree at behind have building
 To mean : 'Behind a tree is a building' (S3)

Here, Sam was describing a photograph to his interlocutor, who could not see it, so they could each determine how it differed from a picture his interlocutor could see, but Sam could not. The tree and building he referred to were both first mentions (indefinite), and he wanted to locate one relative to the other. However, Sam's structure is at best ambiguous, at worst incoherent, because it is not clear which nominal is intended as the theme and which as the reference point. There were trees both in front of and behind the building in question, though the more obvious tree was in front. This suggests that Sam's intention was to use the tree as a reference point, by which to locate the building as a theme. However, In the TL, a nominal preceding *zài* would be a theme, not a reference point; the reference point would either immediately precede the locative, or precede it with only *de* intervening.

Sam produced several different tokens of this structure, so it was counted as productive, but it was analysed as a Topic-Comment structure on the basis that the first referring expression *yīge shù* 'a tree' established the spatial framework for what followed, a basic function of a Topic in such structures (Li & Thompson, 1981).

Pseudo-relative Clause

The Pseudo-relative clause can also be understood as a Topic-comment structure. This involves an NP followed by a clause, S2, which contains its own topic and a predicate, for which the initial NP serves as a topic/Subject. In other words, one sentence is physically contained within another. In (142) the initial topic is '*wǒde huà: zhège yī jiā* 'this family'

- 142) *wǒde huà zhège yī jiā qù chāojīshìcháng shì dīyī*
 my picture this one family go supermarket is first
 [S1 [NP1_{TOPIC}] [S2 [NP2_{TOPIC}] [Comment]] [Comment]]
 My picture, [where] this family go to the supermarket, is the first (H5)

The comment in S2 restricts the reference of the initial NP1, but unlike a true relative clause, S2 contains no gap to which NP1 can be linked. This is reminiscent of an example of a Topic-Comment structure cited in Li and Thompson (1981, p. 96):

- 143) *nèi chānghuǒ xìngkūi xiāofāngduì lái.de kuài*
 that Class fire lucky fire.brigade come.de fast
 That fire, its lucky the fire brigade came so fast

Here also, the topic nominal *nèi chǎng huǒ* bears no GF in the comment.

Num-Class Mod N

More complex nominal structures involved modification of a noun by two separate units, for example, numeric expressions and AdjP, or an attributive *de* structure. But for one isolated instance that emerged later than the other structures, the modifier intervened consistently between the Num-Class sequence and the noun, suggesting a stable generative process limiting word order. In a binary branching structure with Class treated as a suffix, this entails, minimally, three levels of structure:

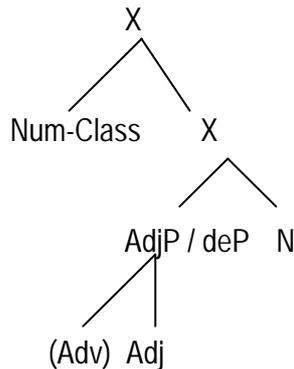


Fig. 27 Minimal expression combining Num, Class, Adj and N

There was agreement between the classifier and the noun, but the intervening modifier was not involved in that agreement relation.

Conjunctions

Between them, Kazuko, Hannah and Sam used conjunctions to combine a range of conjunct types: colour terms, *huáng hé hóng* 'yellow and red', and days of the week *xíngqīwǔ hé xíngqītiān* 'Friday and Sunday' (K2); modified nouns: *zǐsède máoyī hé hēisède niúzǎikù* 'purple jersey and black jeans' (H4) and a pronoun with a possessive *de* structure: *wǒ hé wǒde péngyou* 'me and my friend' (H4); English words, *kěnéng wǒde kèběn yǒu* 'apron' *hé* 'overalls' 'perhaps my textbook has 'apron' and 'overalls' in it' (S3), and, with the wrong conjunction, quantified nouns: *shǎo lǎdīng yě shǎo fǎyǔ* 'scarce Latin also scarce French' (S2).

However, on one occasion, Hannah used *hé* to join non-parallel structures.

- 144) *tā.men de yī.jiā yǒu sì.ge rén ...*
 3.pl de one.family have four.Class person
 Their family has four people...
- ... *bàba.māma hái yīge gēge hé mèimei*
 parents also one.Class brother and sister
 [the] parents, also one brother and sister (H3)

In TL terms, this is ungrammatical because *hé* must conjoin parallel components so the conjunct must be the sub-constituent [*gēge hé mèimei*] 'brother and sister' which refers to two entities and so is semantically plural, but falls within the scope of the singular number, 'yī'. The number

cannot be interpreted distributively across the two conjuncts, so this creates a semantic conflict. In Hannah's IL then, either 'hé' 'and' selects conjuncts with different structures, or number unification was not functioning at this point. For a more detailed and theoretically motivated analysis of all these nominal structures, see Appendix K.

Appendix F:

Structural indeterminacy

DP or not DP? Alternative views of nominal structure

Analysis of syntactic structure is inevitably plagued by structural indeterminacy. While we can directly observe the order of overt prosodic words, we cannot observe the underlying syntactic relationships between them, and the nature of those relationships, and their representation, depends to a great extent on the theory of syntactic derivation one adopts. This impacts upon the analyst's ability to calculate processing demands for syntactic structures, because the calculation of those demands depends in turn on the assumptions one makes about syntactic structure. This problem is particularly pertinent to the analysis of nominal structure, because this is an area of some controversy.

Many working in the LFG framework assume a lexocentric structure for English nominals (see Sells, 1985; Dalrymple, 2001; Bresnan, 2001), where N heads an NP that contains all other nominal sub-constituents, but scholars working in transformational frameworks, and most recently within the minimalist programme (MP), tend to assume the existence of functional levels between a noun and a theta-marking predicate, the maximal level being generally referred to as DP (Cinque, 1999; Bernstein, 2001; Longobardi, 2001; Ritter, 1993; Cheng & Sybesma, 1990).

On the basis of cross-linguistic and dialectal variation in the order of nouns and various types of adjectives in Romance and Germanic languages, Longobardi (2001) suggests that adjectives should be understood as specifiers of different functional heads, arrayed in a set order between NP and DP and that there are a maximum of three functional levels (FPs) distributed among these other Functional heads, into which N can move. Which if any of the three positions are actually accessible to N varies parametrically between languages.

Candidates for these three FPs include one associated with grammatical number (Ritter, 1999), one associated with Gender P (Picallo, 1991), and, in Scandinavian, one just above NP associated with definiteness (Longobardi, 2001). Bernstein (1999) suggests an additional level between DP and a number phrase in which the demonstrative appears as a specifier. In total this gives a nominal structure as in Fig. 28 below.

The existence of NumP is widely accepted, and most scholars agree that free articles are heads of D, while Demonstratives are specifiers, at a lower level, but the other candidates are more controversial. Ritter (1993) argues that Gender is just a feature of N, not a functional head, and while Longobardi suggests that the Scandinavian definite enclitic *-en*, which can be found suffixed

to N, actually heads an FP just above NP, others view it as a head of DP, which attaches to N after N-D movement.

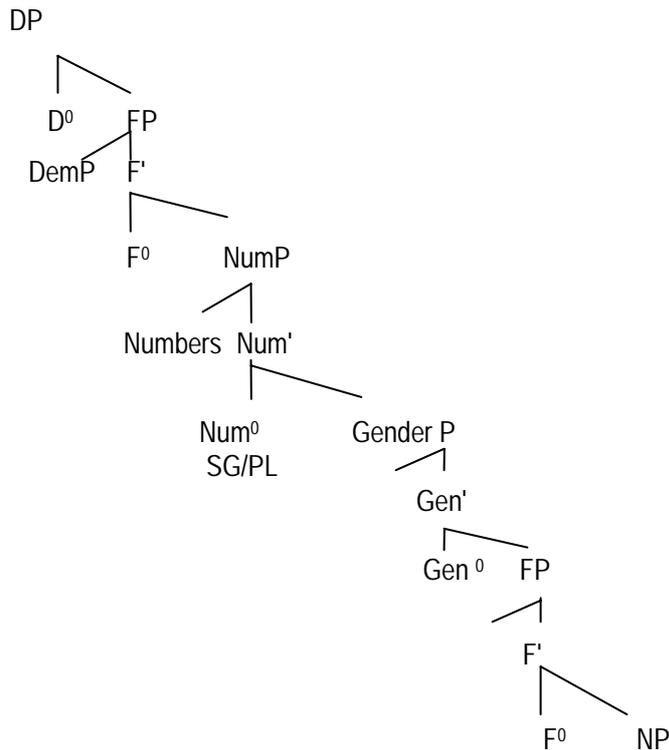


Fig. 28 Extended Nominal Structure

Different Views on the Mandarin DP

Chinese scholars working in the Chomskyan tradition tend to agree on the presence of two FPs above NP, but that view is based mainly on the analysis of constituent order among demonstratives, numbers and classifiers. Almost everyone agrees that classifiers head a Classifier Phrase (ClassP), which immediately dominates NP, comparable to the Gender Phrase proposed by Picallo (1991) for Catalan. However, one exception is Gao (1994) who argues for a lexocentric structure where Num and Class are both contained within NP.

Most scholars agree that ClassP is dominated by a phrase *headed* by numbers (Pan, 1990; Tang, 1990; Cheng & Sybesma, 1999), but Li (1999b) suggests, along lines proposed by Ritter, that ClassP is dominated by a *functional* number phrase whose head is the plural suffix *-men*, and whose *specifier* is a numeral. To maintain a clear distinction between a phrase headed by lexical numbers and one headed by grammatical Number, I will refer to the latter henceforth as Plural P (PluP). However, in an attempt to explain the unacceptability of *-men* occurring on any but a small set of nouns denoting social roles, some argue that *-men* is simply a lexical suffix that expresses collectivity not plurality (Iljic, 1994, 1998). This undermines its possible status as a head of a functional phrase that selects a numeric specifier

Pan who initially supported the view that NumP dominates ClassP later revised it to suggest that NumP is actually the specifier of ClassP (Pan, 1999), making ClassP parallel to the I-E functional PluP, rather than to Gender P.

In a more obvious contrast with the I-E analyses, nearly all Chinese scholars see the Demonstrative (Dem) as the head of the Chinese DP on the basis that the demonstratives *nà* 'that' and *zhè* 'this' each combine with the number *yī* 'one' to form a single prosodic word: *nèi* and *zhèi*, and because nothing can ever intervene between them. This leads them to conclude that Num moves to Dem by Head movement, and therefore DemP dominates the lexical NumP. However, this assumption is incompatible with Kayne's Linear Correspondence Axiom (LCA) (Kayne, 1994) under which movement always leads to adjunction of the moved item to the *left* of the target. Under that assumption, the attested Dem-Num order would indicate that NumP must dominate DemP if their incorporation is a result of movement, and this is an order that nobody suggests.

In Pan's 1999 analysis, the inseparability of Dem and Num is used to support the claim that Num is the *specifier* of ClassP, and Dem c-commands ClassP. Both this analysis and Li's (1999) analysis, where numbers are specifiers of the functional PluP, are compatible with Kayne's LCA, but they also both mean that the incorporation of Dem and Num is the simply prosodic incorporation of a head and an adjacent specifier, not associated with syntactic movement at all.

There is one notable exception to the view that Dem is the head of Mandarin DP. Cheng and Sybesma (1999) consider the Classifier in both Cantonese and Mandarin to be a definite determiner base-generated just above NP, like the Swedish definite enclitic, but moving into D at surface structure so that it precedes NP. In the spirit of Longobardi, (1994), they then make use of 'empty' DP (which arises when the Mandarin Classifier fails to move) to explain the different distributions of definite and indefinite nominals in Mandarin.

However the analysis is decidedly forced. The claim that the Mandarin classifier is inherently definite, is based on evidence from *Cantonese* structures, and on the assumption that the classifier is identical in both languages. Chang and Sybesma then argue that the Mandarin classifier fails to express its definiteness because it is obligatorily dominated by "NumP" which is occupied by a covert existential operator making it indefinite. This "NumP" is therefore a functional phrase like Ritter's and Li's. Moreover, it is then obligatorily dominated by an *empty* DP, which they say falls subject to the ECP. The ECP requires empty categories be governed by a theta-marker or a lexical antecedent (Haegeman, 1990), thus "NumP" and ClassP are "not-so bare" phrases, restricted to post-verbal positions.

One major problem with this analysis is that the ECP applies to empty *categories*, that is, to syntactic elements that are present in syntax, but are *phonetically* empty, not to phrasal levels with

no syntactic content at all. This means an empty DP will *not* restrict the distribution of a NumP with overt contents, as Cheng and Sybesma suggest. On the other hand, a covert D would do so, but it would also impose a definite interpretation, since in their analysis, indefiniteness is associated with NumP, not with DP.

Cheng and Sybesma are forced to assume a covert D, or *iota* operator in any event, to account for *definite* 'not-so-bare' NP. However, since Cinque (1999) suggests that *iota* operators are only licensed where there is *no overt* definite head, Cheng and Sybesma are then forced to argue that Mandarin demonstratives, which are clearly overt and definite, are not heads of DP. This leaves them with no way to account for the fact that the string Dem-Class-N *can* escape lexical government. According to their analysis, DP must dominate NumP, and Dem is not the head of DP so the empty DP should restrict the distribution of this string to post-verbal positions. Cheng and Sybesma themselves see no solution to this problem and simply "leave the demonstratives and what position they occupy as topics for future research" (Cheng & Sybesma, 1999, p. 539).

Also problematic for Cheng and Sybesma's analysis is the observation (Li, 1999a) that certain Mandarin predicates can take indefinite pre-verbal Subjects. Li argues that there are actually two kinds of indefinite expression, entity-denoting and quantity-denoting. The first cannot escape government, and so cannot appear as the Subject of a verb that requires an entity-denoting argument: *sānge chuáng zài fángzi lì, 'three beds are in the room', the second *can* escape lexical government and so *can* function as the Subject of a verb that requires a quantity-denoting argument, as in sānge chuáng jiù gòule 'three beds are enough'. Following Cheng and Sybesma's line of thought, Li (1999a) suggests that the entity-denoting expression is a not-so-bare 'NumP', dominated by an 'empty' DP, but the quantity-denoting expression is a *truly* bare 'NumP', with DP optionally omitted, and so not subject to the ECP. While this appears to endorse Cheng and Sybesma's reasoning, it actually undermines a key point in their argument, that NumP is *obligatorily* dominated by empty DP.

In fact, a great deal of the complexity in Cheng and Sybesma's analysis of Mandarin stems from their initial assumption that Mandarin classifiers have the same feature structure as the classifiers of Cantonese. It is this claim that ultimately forces them to assume not only the defective nature of the supposedly definite classifier in Mandarin, but also two empty categories, one of which is itself theoretically exceptional (and see Matthews & Pacioni, 1997; and Doetjes, 1996 for arguments that Classifiers in Cantonese are *not* inherently definite).

Yet another view of Mandarin nominal structure, also inspired by assumptions of universal uniformity, is that proposed by (Simpson, 2001). He suggests that it is the particle *de* that heads the Mandarin DP. This conclusion is based on a comparison between Mandarin relative clauses (RCs) and RC structures in other languages. Simpson argues, following Kayne (1994), that RCs, as well as Associative structures where a noun is modified by another nominal, are derived by movement from

unattested structures like those at (145) where the particle *de* selects a functional phrase, XP, that contains a DemP specifier and a CP complement.

- 145) a. **de* [_{XP}[_{nà wèi}] [_{CP} [_{IP}*rén niàn shū*]]]
de [[that CL] [_{CP} [_{IP} person read book]]]
- b. **de* [_{XP}[_{CP} [_{IP}*wǒ e shū*]]]
de [[[1sg have book]]]

In the case of associative structures, the complement is said to include a *covert* predicate of possession, making it essentially clausal and therefore an RC. In both cases, an NP is extracted out of the embedded clause to the specifier of CP, then the residual IP – now a clause with a gap - moves past CP, DemP and XP to land in the specifier of DP. This produces the structure shown in Fig. 29.

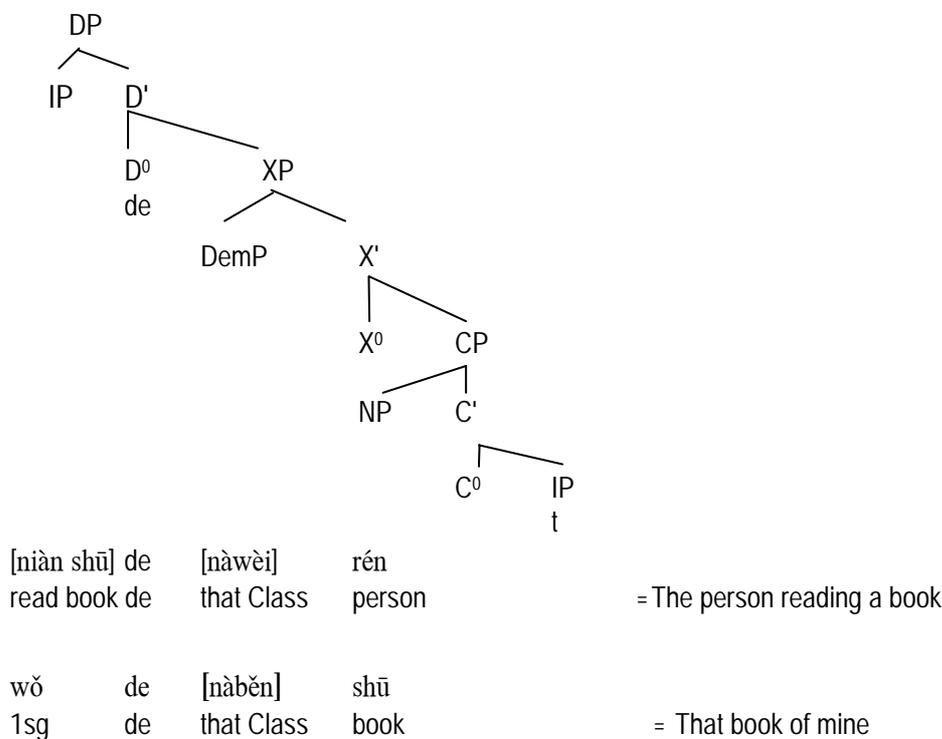


Fig. 29 Mandarin DP according to Simpson (2001)

Simpson suggests that, though DemP and NP are initially closer to *de* than IP is *de* can only attract and attach to an IP. (This is also why he argues for the presence of a covert predicate in the associative structure). There is clear evidence though that the modifier in associative structures cannot be understood as an IP with a covert possessive predicate. Firstly, the overt possessive predicate *yǒu* lexically selects the negator *méi* (146a); neither this negator nor the more usual verbal negator *bù* can be used in associative structures (146b).

- 146) a. wǒ méi yǒu de shū
 1sg NEG have DE book
 The book(s) that I don't have

- b. *wǒ méi /bù de shū
 1sg NEG / NEG DE book

This shows that these structures do not include the predicate levels that support verbal negation, so there is no evidence for the presence of an IP here. Since there is no IP there is actually no basis on which to assume the presence of a CP (see Charters, 2004 for more detail).

Again, the complexities of this analysis stem, in part, from the assumption that nominal and RC structures are the same in all languages, no matter what the surface configurations and interpretations suggest. But even with no CP or IP in Associative structures, what remains is still evidence that *de* is a functional head that selects a nominal complement. This does make *de* potential candidate for the head of a Mandarin DP.

It is patently clear then that the determination of constituent-structure on the basis of surface word order is not a straightforward affair. With so much controversy over basic TL nominal structures, and so many analyses of limited aspects of nominal structure that conflict with other partial analyses, it is simply not possible, even if it were desirable, to determine IL structures on the basis of a consensus view of TL Mandarin structures.

This brings us then to a consideration of the methodologies available for deducing c-structures from strictly surface phenomena, such as the constituent order in the IL utterances described in Chapter Five. This issue is addressed in Chapter Seven, and discussed in detail in Appendix G.

Appendix G:

Minimalist constraints on c-structure

This appendix considers Minimalist constraints that relate c-structure to surface phenomena, particularly constituent order and prosody.

The choice of projector: ϕ -completeness and Case

In each merger of two syntactic objects, it is the choice of projector that determines which item becomes the head, and the number of times the head has previously projected that determines whether the other item becomes a specifier or a complement. Thus syntactic relations are constrained in the MP by whatever constrains attraction in the first instance and projection in the second. However, if we are to extrapolate conclusions about a word's syntactic position in a phrase from observations of constituent order, there must also be constraints on the possible linear relationships between a head and its specifier and complement.

Kayne's LCA

Chomsky suggests that the MP might adopt Kayne's (1994) Linear Correspondence Axiom (LCA) to constrain relationships between c-structure and linear order. Kayne (1994) suggests there must be a 1-1 correspondence between linear precedence and asymmetrical c-command: if A precedes B, it asymmetrically c-commands B, and vice versa.

He defines c-command as follows:

- 147) X c-commands Y iff
- i) X and Y are categories, and
 - ii) X excludes Y, and
 - iii) every category that dominates X dominates Y.

Assuming, as the MP does, that phrases are binary-branching, then by this definition a specifier asymmetrically c-commands the head that selects it, and a head asymmetrically c-commands all sub-constituents of its complement and hence asymmetrically c-commands the complement as a whole. In simple terms, this means that a head is always to the left of its complement when it spells out, and a specifier is always to the left of a head.

Because specifiers and adjuncts are both left-adjoined sisters of functional heads in the MP view of phrase structure, another consequence of Kayne's definition of c-command is that there can be at most one specifier *or* adjunct per phrase. This is because two left-adjoined items would c-command each other, making it impossible to determine their linear order. Thus under the LCA, each adjunct must be the specifier of a distinct functional head, the same conclusion that Cinque (1994, 1996, 1999) and

Longobardi (1994, 2001) came to, on the basis of empirical evidence relating to the distribution of arguments relative to adverbs, and nouns relative to adjectives.

However various scholars have noted that for precisely the same reason, Kayne's LCA poses a problem for the complement-head relationship in the MP, because a complement may be no more than a single lexical item, and in this case the head and complement would c-command each other too (Chomsky 1995; Uriagereka 1998; Moro 2000; Richards, 2003) so *their* relative order could not be established. The LCA seems therefore to exclude a possibility predicted by the MP conception of phrase construction. While some scholars are exploring alternative conceptions for the head-complement relation, the LCA, and much other work in formal and functional syntax revolves around the premise that there *is* an asymmetry between Objects and Subjects, and hence between complements and specifiers. It is therefore not yet clear exactly how the assumptions of the LCA can be implemented in a minimalist framework.

In any event, the order, and hence the syntactic relationships in which lexical items appear at spell out, is not necessarily the order and syntactic relationships established when they are first merged. The process of syntactic derivation is precisely the process that changes relationships from those established at the point of first merge to those existing at the point of spell out. To calculate processing demands then, we need to establish the position of each item at first merge, *and* each step involved in building the structures that spell out.

Stipulations about the choice of projector

While maximal match determines which items attract, and the LCA relates surface order to constituent order at spell out, the choice of projector at first merger is simply stipulated. Firstly Chomsky suggests that "phases are configurations of the form F-XP, where XP is a substantive root projection, its category determined by the functional element F that selects it." (Chomsky 1999, p. 11). Since the MP rejects categorial features, the reference here to categories, must be taken as a short-hand for distinctive *clusters* of features that differentiate lexical types.

Selection by ϕ -features

In fact, Chomsky suggests two ways in which the selection of substantives by functional heads might arise as a consequence of feature attractions. Both suggestions hinge on the notion of ϕ -completeness. As explained in Chapter Two, in order to delete Case, a nominal must contribute a complete set of ϕ -feature-values to a functional head; to be ϕ -complete means to express this complete set. Completeness should not be confused with interpretability: finite T is ϕ -complete even though it has no interpretable ϕ -features; conversely, expletive *there* is said to lack the feature Person, so it is ϕ -incomplete, but the ϕ -features that it does express are all interpretable.

Chomsky suggests that attraction between heads might be reduced to identity of ϕ -completeness, so that C, which is always ϕ -complete, always selects ϕ -complete T, while active and transitive V, which are also ϕ -complete, select T only if it is ϕ -complete; passive, raising or unaccusative V are always ϕ -incomplete and select ϕ -incomplete T, that is the non-finite T that is unable to delete Case.

Alternatively, he says, T may be ϕ -complete 'only when necessary' (Chomsky, 1999, p. 6). Then, if passive, raising or unaccusative V selects T, both are ϕ -incomplete, but if C selects T, both are ϕ -complete.

This variation in ϕ -completeness creates a set of distinct distributional categories as illustrated in Table 76. 'X' means the feature is present; '(X)' means there are two subtypes of a class, distinguished by the presence/absence of that F; '?' indicates an issue that will be discussed further below. It can be seen at a glance that no two items are identical; that C and D are similar, accounting for similarities in their distribution; that Adj is a class intermediate between nominals and verbs; and that Case and uninterpretability of ϕ -features are generally linked. Thus, category membership can be seen as an epiphenomenon of specification for Case and other features. Categorical features themselves are redundant.

Table 76. The F-structure of key lexical types

category label	C	D	T	v	V	ADJ	N	Expletive
ϕ -complete (interpretable)							X	
θ -assigner				(X)	X	(X)	(X)	
ϕ -complete (uninterpretable)	X	X?	(X)	(X)	(X)			
triggers case-deletion	(X)	?	X	(X)				

Still, attraction based on ϕ -completeness does not make it clear why ϕ -complete C selects TP, rather than ϕ -complete DP, or VP. Nor does the proposal explain why the theta-marker V projects when it merges with DP, but the functional head T projects when it merges with the theta-marker *vP*.

Selection by predicates and functional heads

Thematic relations are handled by another stipulation. Chomsky suggests that predicate-argument relations fall subject to a Theta-Theoretic Principle (TTP) which stipulates that: 'Pure Merge in θ -position is required of (and restricted to) arguments' (Chomsky, 2000, p. 103), so "the theta-role of the argument is determined by the position of first merge" (1999, p. 27). This means that arguments must be merged to a projection of the head that theta-marks them, they cannot move into that position. We can deduce from this that the ability to project should be a fundamental lexical attribute of predicates, and not of arguments, and that theta-role assignment is a concomitant of merger to a projection of a predicate.

However, an argument is often a complex SO that is derived through successive mergers. So, strictly speaking every part of an argument has already merged with some other item before the

argument as a whole merges with a predicate. In other words, an SO can become an argument only once it has *exhausted* its capacity to project, and is merged with a predicate.

Chomsky attributes the TTP to Hale and Keyser (1993), but more recently, they have argued (Hale & Keyser, 2002) that a lexical item's ability to project in syntax is *not* entirely predictable from its semantic content in the lexicon. For example, they say that in the English VP 'put the books on the shelf', 'the books', is lexically licensed as a semantic argument of the P 'on', not as a semantic argument of the verb 'put'. The lexical V 'put' selects a *single* complement, a PP structure [the books on the shelf], but in syntax, 'the books' appears as the DO of 'put', because the preposition 'on' is unable to project a specifier position *in syntax* (see discussion Hale & Keyser, 2002, p. 7f). Hence in the syntax, the DP that is merged as the DO of 'put' is *not* its semantic argument, and while the *first* syntactic merger of the preposition 'on' is a projecting merger with one of its semantic arguments, its *second* syntactic merger is a *non-projecting* merger with another predicate, even though 'on' still has an unassigned thematic-role. Note that Hale and Keyser do not suggest that the DP *moves* from a specifier of PP to a complement of VP; rather they claim that the 'internal subject' of P is mapped to a syntactic complement position in VP.

Conversely, the verb 'put' selects only one semantic argument, but is associated with *two* syntactic projections, a DO and a prepositional complement. Thus, the verb 'put's ability to project *two* syntactic complement positions is a consequence of its ability to select one specific type of lexical complement, i.e. one that has an *internal* semantic subject, as well as a complement. In this model, the ability to project a syntactic position is clearly *un*-related to thematic structure.

Similarly, Hale and Keyser (2002) argue that English adjectives also belong to a lexical type that has an 'internal Subject', but unlike Prepositions, they *cannot* project even a single syntactic position. They are therefore 'parasitic' on predicates that project an excess position in syntax. These predicates include the derivational suffix '-en', and the copula 'BE'. According to Hale and Keyser, the phonetic features of '-en' are 'conflated' with those of the adjective it selects, so for example, '-en' conflates with 'red' to produce 'redden'. 'Conflation' is a *phonological* relationship restricted to a head and its *complement*, and occurring as a concomitant of merge; it does *not* involve syntactic movement. In other words, the suffix '-en' merges with the lexical Adjective 'red' in syntax, *before* the Adj assigns its thematic role. Since 'red' does not theta-mark '-en', it must be '-en' that selects 'red' and projects a complement position, and since 'red' is merged as a complement, it *cannot* project for syntactic reasons, even though it has a theta-role to assign. Again, this means firstly that the ability to project in syntax cannot be predicted from thematic content, and secondly that an argument need not be merged with the lexical predicate that licenses it.

In short, where Chomsky (1999) suggests that arguments must be merged in positions *adjacent* to the predicate that θ -marks them, Hale and Keyser actually propose deferred 'gratification' of theta-assignment. Moreover, the inability to project a syntactic position is unrelated to any inherent characteristics of the lexemes involved.

In view of such complications, Chomsky later proposed a weaker claim that " θ -structure and similar semantic roles are based on pure Merge of XP to substantive LIs *or their projections*" (Chomsky, 2000, p. 127, my emphasis). Here the reference to XP, makes it clear that the argument may be a complex constituent that has been previously involved in mergers, and the reference to 'projections' of a substantive, actually refers to functional heads which select lexical heads and assign theta-roles inherited from their complements. Chomsky also suggests that if θ -roles are assigned "configurationally as a structure [v v[V V ...]], then v too *is a relevant selector*" (2000, p. 134, my emphasis). Covert predicates like those suggested by Hale and Keyser may be seen as functional 'light' verbs, v, or 'projections' of the overt lexical predicate, V.

Most importantly, Hale and Keyser also suggest that there is *cross-linguistic variation* in the way concepts are mapped to possible lexical and syntactic argument structures and mention explicitly that property-denoting words like 'red' readily license projection of a syntactic position in some languages. Mandarin is one language where a perfectly grammatical sentence can be formed from just a noun and a property-denoting word as in: chēzi hóng 'car red' (meaning 'the car is red'). However, given the proposal that languages include covert predicates, and one predicate can support other parasitic overt predicates, it is not really clear how we should establish when a surface position is directly projected by the predicate we see, and when it is licensed by a covert predicate. The difference has clear implications for the calculation of economy, since covert predicates need to be merged, and movements may ensue before surface word orders are arrived at, each merger and movement detracting from overall economy. While economy predicts which derivation is preferred given a specific lexical structure, it is not held to predict which lexical structures occur.

At best then, we can say that arguments should *generally* be merged adjacent to the predicate that theta-marks them, or to a predicate that selects that predicate, but how covert predicates can be identified is not so clear. Considerations of theoretical economy suggest we should avoid the assumption of covert predicates where a simpler analysis presents itself, but, as we shall see below, this is not the assumption usually made in minimalist analyses.

Selection in Modifier-Head relations

A similar kind of stipulation is made with regard to adjunction. Chomsky suggests that an "adjoined element α leaves the category type unchanged: the target β projects" (2000, p. 133). In other words, an adjunct is merged to a projection of the modified item. More precisely, given the standard assumption that substantives are selected only by functional heads, a modifier (substantive) must be the specifier of a functional head that has selected the modified substantive as its complement. This makes the structure of modification more or less the same as that proposed by Kayne (1994), on the logical basis of the LCA, and by Cinque (1999) on the empirical basis of cross-linguistic comparisons of adverb order. Cinque argues that possible orders for collocating adverbs are restricted because each

semantic adverb type is merged as the specifier of a distinct functional head, and those functional heads are distributed in fixed order, above VP. Among these heads that select modifiers are other functional heads which can attract an argument as their specifier.

In minimalist terms, functional levels that attract movement express an EPP feature which can be deleted only by movement, and so they project positions into which DP can move. This produces alternative positions for DP relative to the same adverb in some languages. Longobardi's discussion of *Adjectives* (2001) in nominal structure reached similar conclusions.

Essentially though, Chomsky's proposal that the 'target' of adjunction projects is little more than stipulation. Like complex arguments, complex adjuncts must not merge with the SO containing the modified item until they have finished projecting themselves, but how this outcome is forced under minimalist assumptions is far from clear. Moreover, the explanation that modifiers must be adjoined because their adjunction leaves the 'category type' of phrase unchanged is clearly at odds with the minimalist assumption that there are no categorial features, and attraction is purely a consequence of similarity in ϕ -completeness. Since the one functional head must attract both the substantive modifier, and the modified substantive, all three must be similarly ϕ -complete or ϕ -incomplete, and the question of a change of category type cannot arise.

In short, these stipulations about thematic and modifying relationships indicate the desired outcome at a specific derivational moment, when an argument merges with a predicate, or an adjunct merges with the SO it modifies, but they do not directly address the issue of how that outcome is assured in the MP, let alone how we can determine the steps taken to ensure that outcome by looking at output.

Prosody and syntactic structure

The MP also makes some predictions about relationships between prosody and syntactic structure. Syntactic movements recombine lexical items and syntactic objects, until they spell out to PF. Items that spell out together form a single prosodic unit. Chomsky has made various proposals about the extent of a derivation that spells out on each occasion. The proposal in "Derivation by Phase" (1999), which I follow here, is that what spells out corresponds to the complement of a strong head. More specifically, the complement of one strong phase spells out at the completion of the next strong phase. If every phrase were strong, then in any series of prosodic units, the right hand unit would be a complement, and each prosodic unit to its left would include one head and any specifier selected by that head. For example, the phrase at (148) is composed of four prosodic units, as indicated by the brackets.

- 148) [wǒ de] [hěn dà de] [hái méi qíguò de] [zìxíngchē]
 1sg de very big de still NEG ridden de bicycle
 Spec Head [Spec] Head [Spec] Head NP

The first must consist of a specifier and a head, thus *de* must be a head and the pronoun *wǒ* must be its specifier. *De* must be strong, since the unit to its right is a single prosodic unit, and that unit must include the specifier and head of *de*'s complement, and so on. The NP is the complement of the final *de*.

Wherever a weak head occurs, a single prosodic unit will include that weak head and both its complement and its specifier to its right and left respectively, as well as a series of dominating heads and c-commanding specifiers, up to and including the specifier of the closest strong head, minimally the very next head. For example, if we extend Hale and Keyser's analysis of adjectives, or Chomsky's assumptions about modification to Mandarin stative verbs, the second prosodic unit in (148), [hěn dà *de*], must include a covert functional head which selects the stative verb *dà* 'big' as its complement and the adverb *hěn* 'very' as its specifier. This group spells out as a single prosodic unit together with the strong head 'de', which selects that unit as its specifier.

However, even if we can distinguish strong phrase boundaries from weak phrase boundaries, specifiers may be optional, and heads may be covert, so it is not necessarily possible to determine which items in a single prosodic unit are actually heads and which are specifiers. We have simply assumed a covert head linking *hěn* and *dà*. To further complicate matters, recall that Hale and Keyser (2002) suggest that a head can conflate with its *complement* to form a single prosodic word, like 'redde*n*'. If this is so, then surface structure prosody cannot help us to distinguish specifier-head units formed by merger, from head-complement units formed *at merger* by conflation.

In any string of three prosodic words A, B and C, there are still several possible underlying c-structures, as shown in Fig. 30 below: (i) A and B could form a complex specifier of C; (ii) A could be a specifier of B and C its complement; (iii) A could be a specifier of a covert head (X) and B, the specifier of C, whose original complement was X; or (iv) B and C could form a complex complement of A, etc.

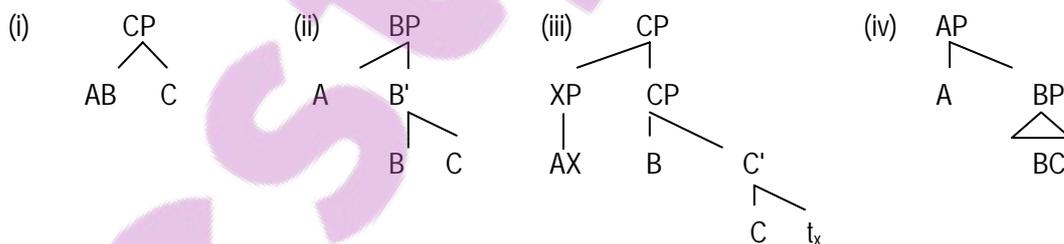


Fig. 30 Alternative structures consistent with Kayne's LCA

Universal Hierarchy of heads

Given a set of abstract lexical feature-structures, economy conditions may well dictate the constituent structures they will create, however, it is not the case that those constituent structures can be readily or directly determined by the observation of the linear order in which prosodic words occur. In fact, despite the claims that merger is purely a consequence of maximal match and economy, minimalist analyses generally approach the question of derivation not by working backwards from the

order of items in output, or by working forwards from an analysis of lexical feature structures and maximal match, but by simply assuming a fixed universal order of functional and substantive heads, commencing at a nominal argument, 'NP' or DP, then progressing through VP, vP, TP and CP, and then assuming facts about their lexical F-structures.

For Indo-European languages there is extensive cross-linguistic data to support the assumed order of heads, but as discussed in Chapter Two and in Appendix F, different linguists often propose different orders for different languages (Bernstein, 1997, 2001; Eubank 1993, 1994, 1996; Longobardi 1994, 2001; Pollock, 1989; Ritter 1991, 1993). Where non-IE languages like Mandarin are concerned, controversy is especially rife (Cheng & Sybesma, 1999; Li, 1999a, b; Simpson, 2001).

Even if a universal order of heads could be established empirically, a minimalist framework must still account for it in terms of attractions between features, and the selection of a projector in each instance of merger. For example, arguments which are merged as complements and items to be modified, must each be more strongly attracted to the predicate or functional head with which they merge, than arguments merged as specifiers and modifiers, respectively. By the same token, predicates that merge with other predicates before they have assigned their theta-roles, must be more strongly attracted to those predicates than they are to their own arguments. The questions then arise: what combination of features do complements share with their selectors that specifiers lack? What feature is shared by a parasitic predicate and its functional host, but not by other predicates?

We are also left with questions about the choice of projector. Even if lexical structure were uniform, it is not clear how it relates to the ability to project. Both items in an agreement relation are equally attracted to each other, therefore, the choice of projector must relate to some factor other than attraction of feature types, some factor which differentiates *any* two items that merge.

To sum up: the MP does not fully explain why some arguments become complements rather than specifiers, why modifiers and modified SOs are each merged with functional heads rather than with each other or why some LIs compile themselves into a DP before any of them becomes attracted to a predicate. At the heart of this problem is a lack of clarity about the licensing of projection. Attract can bring two LIs together, and the LCA or some other mapping principle may relate syntactic status as a specifier head or complement to surface word-order, but neither can determine the intermediate step: the choice of which of two LIs projects to become the head of the resulting SO. A resolution to this question is proposed in Chapter Seven, and expanded on in Appendix H.

Appendix H:

Some new Minimalist proposals

Why predicates project

In Chapter Seven, it is argued that the act of projection can be related to the number of unvalued features expressed by two items as they merge: the item with more features should project because this minimizes a) the delay until a complement spells out, and b) the chance of constructing an invisible SO. One way to account for the projection of predicates then, is to assume that they express more unvalued features than nominals. It stands to reason that they will express more features *per se*, because they need to attract nominals, as well as functional heads like Tense and to do so, they must share features with both. The fact that more of these features will be *unvalued* on predicates than on their arguments follows from the fact that an argument has generally been through previous mergers as it was compiled from separate substantive and lexical heads. During this process some of its features will almost certainly have been valued through agreement. Ideally every act of merger should result in the valuation of some feature otherwise it will not be the preferred merger. The features that remain unvalued on the argument after it has been compiled will be precisely those that are not expressed, or not valued on *any* nominal item, but *are* expressed and valued on a predicate. In the best-case scenario, an argument will have just one unvalued F that any predicate can value, allowing the argument to spell out at the close of the next strong phase after it is theta-marked by merger with V.

Differentiating complements from specifiers

The more difficult issue surrounding thematic structure is how to account for the fact that a transitive predicate must be more strongly attracted to one of its two nominal arguments than the other. Only then can it be said to *maximally* match just one, so that that one will be the clear choice for first merge and so form a complement. The assumption that this choice must be based on considerations of economy has some interesting consequences for our understanding of nominal derivations. The MP assumes that *all* nominal arguments are DPs activated by Case, or otherwise constrained to supply all of a specific ϕ -set to a predicate. If this is true then clearly it cannot be the ϕ -features that account for the predicate's stronger attraction to one nominal argument over another. On some occasions, semantic features may differentiate between arguments, such that a predicate and complement share semantic features that the specifier does not. For example a DP 'the pizza' will presumably share semantic features with the predicate 'eat' that the DP 'the rock' does not, so that 'eat' will attract 'the pizza' as a complement, but not 'the rock'. However, this will not always be the case: the proposition 'the ink is in the pen' is theoretically derived from a lexical array {in, the, the, ink, pen, is}, but

the same array must also give rise to 'the pen is in the ink'. Since 'the pen' and 'the ink' each satisfy the semantic restrictions imposed by the predicate 'in', it is not clear why the predicate should sometimes attract one as its complement and sometimes the other. The speaker's intention cannot play a role within syntax, unless that intention is somehow encoded in the formal features of the *numeration* before the derivation commences, because the features in the numeration are the only stimulus to which the syntactic mechanism can respond.

We might consider the introduction of thematic features to differentiate specifiers from complements, but this does not resolve the problem either. Clearly, the lexical feature-structure of predicates could plausibly include θ -features encoding the types of θ -roles that they assign, such as an agent feature and a patient feature. This would entail that θ -features exist in the universal pool of F, and are therefore eligible to become incorporated into any lexical item, *or to form the basis of LIs in their own right*. The combination of a θ -feature and one other unvalued feature expressed by N would construct an LI attractive to any N, and any such LI could then be added to a numeration each time an identical θ -feature occurred in a selected predicate. Once in the numeration, each such θ -item would become incorporated into an argument structure, and once the argument was fully assembled, it would be attracted to the counterpart θ -feature expressed by the predicate, thus strengthening the attraction between predicate and argument. However, a transitive predicate would still express two θ -features, and each would attract a different argument to the same degree.

One minimalist account of predicates selecting one nominal as complement over another is that the two nominals actually have *distinct* feature *types*. More specifically, the nominals that end up as specifiers must either lack some feature that complements and predicates share, or they must express some feature that complements and predicates both lack. Only then will complements be a consistently better match for predicates than specifiers are.

What motivates extraction of a nominal from VP?

The obvious choice of a feature to differentiate complements from specifiers is one related to topicality. Lambrecht (1987) defines a 'topic' as an NP that denotes a referent within the pragmatic presupposition that a predication is about. In contrast, a 'focus' is defined as an NP denoting a referent *outside* the pragmatic presupposition. The pragmatic presupposition is the set of referents and information about referents that a speaker assumes the addressee has ready access to, at the time of speech. According to Dubois (1987), topicality is typically associated with Subjects (specifiers), while Objects (complements) tend to be foci. However, Lambrecht observes that *pre*-verbal Objects are always *topical*, and *post*-verbal Subjects are generally focal (the exceptions being extra-posed Subjects). Thus topicality is clearly associated with an argument's structural position, relative to the verb that theta-marks it.

In fact, Chomsky (1995) invokes a TOPIC feature in his discussion of ‘scrambling’ i.e. the object movement which gives rise to SOV order in languages that are basically SVO. Chomsky sees this feature as an *optional* feature added to a derivation for pragmatic reasons, and valued through movement to a position outside VP. Thus, it is associated only with extracted *complements*. Neither extracted specifiers nor *in situ* complements are said to express the TOPIC feature. Subject extraction is said to be motivated by Case alone.

Case and Extraction from VP

In fact, both the standard analysis of Subject extraction, and the account of scrambling motivated by TOPIC are problematic. First consider Subject extraction motivated by Case. A Subject is assumed to have an unvalued Case feature which V cannot delete, because each head can delete Case only once, and Subjects, at least of transitive verbs, start off as specifiers, that is as the second of two arguments to be merged. The fact that any verb can delete Case only once makes Case exceptional, because generally features are deleted under match: a valued F can enter many agreement relations valuing and hence deleting counterpart features on any number of other items. The idea that Case is exceptional is related to the idea that it is actually a *reflex* of the valuation of *other* features, i.e. ϕ -features. Since any unvalued feature can be valued only once, this accounts for one-off Case deletion. (For a more complete discussion, see Appendix I, p. 287.)

However, if Case deletion is simply a reflex of the valuation of a predicate's ϕ -features, then intransitive V should delete Case too; it must have unvalued ϕ -features to attract its argument, and they must be successfully valued, or the derivation would crash. However, if intransitive verbs *were* Case deleters, their Subjects would *always* follow them. To resolve this problem, Chomsky simply suggests that V_i is 'defective': either it cannot delete Case *despite* being fully valued, or Case requires valuation of *all* ϕ -features *at one time* and V_i lacks a crucial ϕ -feature. After this, the question of intransitive VP is simply 'set aside' (Chomsky, 1995).

To further complicate matters, some intransitive verbs *can* retain an argument within VP, but *only if it is indefinite*. For example, the sole argument of the English verb 'come' can follow the verb in a certain narrative style, but only if it is indefinite:

- 149) a. (That night) there came three people to the tent
 b. *(That night) there came those people to the tent

In Mandarin, an indefinite argument of the semantic counterpart *lái* appears *obligatorily* as a post-verbal argument, (150); it may precede the Verb that theta-marks it only if in doing so, it follows the presentative verb, *yǒu*, as in (150c). A definite argument of the same verb is obligatorily extracted, as in English (151), and *cannot* follow the presentative verb, as shown in (151c).

- 150) a. láile sān.ge rén
 came three people
 Three people have arrived

- b. *sān.ge rén láiile
*three.Class people arrive.ASP
- c. yǒu sān.ge rén láiile
have three.Class people arrive.ASP
- 151) a. *láiile nàge rén
come.ASP that.Class person
*Came that person
- b. nà.ge rén láiile
that.class person come.ASP
That person came
- c. *yǒu nà.ge rén láiile
have that.Class people arrive.ASP

The obvious minimalist account of this correlation between extraction and referential value is to explain it in terms of different feature-structures for definite and indefinite arguments (Longobardi, 2001; Cheng & Sybesma, 1999; and Li, 1999a). However, these proposals hinge on the assumptions that the post-verbal indefinites include a DP level that is *empty*, and constrained (by the Empty Category Principle, or ECP) to positions that are ‘lexically governed’, and that the definite DP moves either to *obtain* a definite value for a referential feature, or because it *has* a definite value for a referential feature. For expository purposes I will call this feature REF, and assume it has two possible values, DEF(inite) and INDEF(inite)³¹. In minimalist terms, if DP moves to *acquire* a DEF value, then REF is an *uninterpretable* F of D; otherwise, REF is an *interpretable* F of D.

The first problem for a minimalist account is the assumption of a truly empty DP level. In bare phrase structure, no level is projected except by a lexical head, and the head must express at least one feature that affects the outcome of the derivation. If a DP level is present, it must be headed by D. D may be covert, but it must express the feature [REF] since, in the absence of Categorical features *per se*, this is what identifies it as ‘D’. Longobardi suggests as much in his analysis of Italian (1994); he suggests that covert D is *plural* and *indefinite*. However, Cheng and Sybesma’s (1999) analysis of the Mandarin DP seems based on a DP that is empty of *all* syntactic content (see Appendices A and F).

Secondly, minimalism abandons the ECP *and* the notion of lexical government, in favour of an account of distribution based entirely on maximal match and derivational economy. In the absence of categorial features *per se*, overt and covert ‘D’s should have not only identical feature-*types*, but also identical feature-*status* for each type, that is a feature that is interpretable on one D should be interpretable on all, and in some circumstances, it should be concluded that they have the same feature-*values*. *Overt* Ds include *definite* articles and possessive heads (Szabolsci, 1981, 1983; Abney, 1987), but *not* indefinite articles, which are typically derived from, or cognate with the number ‘one’. Many analyses of DP (e.g. Ritter, 1993; Li, 1990a) suggest that plurality and indefiniteness are actually features associated

³¹ Alternatively there might be a feature \pm DEF or \pm INDEF.

with a lower structural level, NumP, not with DP, and therefore not with ‘D’³². Thus, *overt* D is clearly *interpretable* as definite. To count as an instance of ‘D’, a covert item should have the *same* basic F-structure and range of values as overt D. This makes Longobardi’s proposal that covert ‘D’ is necessarily plural and indefinite and acquires this status through agreement problematic. It is not impossible that a covert element should have these characteristics, but it is by no means clear that it should be characterised as a covert counterpart of D, and a head of DP.

Thirdly, and, crucially, the syntactic mechanism responds only to feature-*types* not to feature-*values*. In fact, a valued F is invisible to the computational mechanism, unless it is accompanied by an *unvalued* F in the same syntactic object. If both overt and covert D have the same feature-*types*, and the same types each have the same *status* in the lexical array, as either valued or unvalued F, both will *always* attract exactly the same feature-*types* in other lexical items. In other words, if a definite DP is extracted *because* it is definite, as Li (1999a) proposes, this equates to saying it is extracted because its *valued* REF feature is visible, due to the presence of some *other unvalued* F. As a consequence, an indefinite DP (if such exists) should also be extracted because *its* valued REF feature would also be visible due to the presence of the same other unvalued F. As long as definite and indefinite arguments are both viewed as DPs, i.e. as identical clusters of valued and unvalued feature-*types*, we *must* conclude that they will have *exactly the same* distribution, no matter what the values of their REF features are.

The extraction of definite but not indefinite arguments actually implies that they contain *different* feature-*types*, not just different values for the same feature-*type(s)*: definite arguments are valued through agreement with a head *outside* VP, while indefinite arguments are fully valued through agreement with V.

Given all this, a definite argument is a DP that has a valued REF feature, and it should not be extracted from the complement of an intransitive VP unless it has *another* feature that intransitive V cannot value. In addition, either V itself is strong, or some other strong head lies between VP and the head outside VP that *can* value the DP. It is this that makes the DP and the head that can value it invisible to each other, unless the DP moves. Though it may well be a REF value that is required by the higher head, the DP that can provide that value must express some other unvalued F, firstly to make it visible, and secondly to justify its movement into the periphery of its immediate VP, a violation of ASAP, excused as a Last Resort.

The standard assumption is that this last unvalued feature is Case. If we assume that definite and indefinite arguments are both DPs, and that DP expresses unvalued Case, indefinite DP would be extracted from VP as well. The only possible account of the failure of indefinite DPs to move is then to assume that the strength of intransitive V *varies along with the value* of DP’s REF feature. A DP complement can remain inside VP only if the head that selects it is weak: the complement can then

³² In this view we might represent ‘D’ as expressing an intrinsically valued feature [DEF] that is entirely *absent* from other functional heads in nominal structure, not a variably valued feature [REF].

enter agreement with an item outside its own phrase. We must assume then that V_i or some higher functional head is weak when the argument is indefinite, but strong when the argument is definite; in the first instance D's Case can be deleted *in situ*, by some head outside VP, in the second DP must be *extracted* to delete Case. This is the solution proposed by Chomsky.

However, this 'solution' contravenes two basic minimalist assumptions. First it requires the syntactic mechanism to access the *value* of the REF feature, which in theory it cannot do. Interpretation of values is performed by a discrete module of the mechanism, LF, *after* spell out. The syntax cannot 'look-ahead' to ascertain the future outcome of spell-out; it can only proceed on the basis of such information as is available within the current phase. Thus it is not clear how the necessary co-variance could be implemented. Secondly, strength of a given phase is a parameter, set once and for all during acquisition, and it is expressed as an EPP feature. Features are introduced to syntax only as a part of lexical items, and these are constructed once only during acquisition (see Appendix I). This means if a specific head in a given language is weak, it lacks an EPP feature, and, once acquisition is complete, it should be *always* weak. In addition, if EPP features *were* optional, then *in situ* Case deletion would be *obligatory*: the choice to omit the EPP feature and make a phase weak would always be more economical since it would obviate the need for extraction.

Thus the standard proposal that Subject extraction is motivated by the need for Case is by no means an ideal minimalist analysis. It depends upon a number of stipulations that are not clearly related either to economy conditions, or to specific fixed feature-structures of lexical items, and it contravenes a number of fundamental assumptions regarding look-ahead and variability.

Scrambling

Chomsky's proposal that Objects are scrambled in order to value a TOPIC feature is problematic for similar reasons. Firstly, only definite Objects are generally scrambled, and their scrambling is optional. So we have again the problem of apparently optional features. No single head within the nominal should *sometimes* include a TOPIC feature, and sometimes not. Suppose TOPIC were a (covert) lexical item in its own right, as proposed above for θ -features. It could then be selected from the lexicon as required, but it would still need to attract some nominals, but not others, bringing us back to the original problem: there would need to be a feature expressed only by nominals that attract the Topic LI, and not by other nominals.

In addition there is again the presence of an optional EPP feature outside VP, and *its* presence would have to co-vary with the presence of the TOPIC feature in a nominal. Further, a scrambled DP does not move to the Subject position, where Case is deleted, so presumably a Subject's Case could have been deleted in this lower position too. So, we then have to explain why the Subject and Object move to different destinations in terms of different F-structures for Subjects and Objects, even though, in this case, *both* are definite *and* topical.

Despite the same pattern of covariance between a referential value and extraction of DP, Chomsky's proposals involve separate motivations for scrambling and Subject extraction, implying coincidental linking between Case and definiteness on the one hand, and between topicality and definiteness on the other, and entailing the problematic co-variance for two different functional heads. Ideally these facts should be captured by a single unified account.

Finally, the proposed link between Case and the valuation of ϕ -features is not motivated by any consideration of economy or interface requirements: it is not a truly minimalist account of the distribution of nominal structures.

A new analysis: Verbs do not delete Case; they value TOPIC

In fact, as long as we assume that definite and indefinite arguments are *both* DPs, a minimalist account of their different distributions is problematic. This points the way to a simpler and therefore preferable account of the distribution of definite and indefinite Subjects *and* Objects. Definite and indefinite nominals are *not* both DPs; they have *distinct* feature-structures. Moreover, V must *generally* value the last unvalued feature of indefinites, but not that of definites. As mentioned above, empirical evidence indicates that this feature is related to a nominal's pragmatic status as a topic or a focus. According to Lambrecht (1987) pragmatic status is entirely predictable from a nominal's position relative to V (Lambrecht, 1987) because post-verbal nominals are never topical in the sense of being what the proposition is about. Given this, we would expect any feature associated with topicality to be valued in VP: a transitive verb's complement will generally be focal and an intransitive verb's complement will generally be topical, (with presentative structures being the main exception). In other words, the assumption that a complement DP is extracted from VP because a verb cannot value a feature associated with topicality is counter-intuitive. The verb's thematic structure generally predicts which of its arguments is topical and which focal. This information can be formalized as a binary feature: \pm TOPIC or \pm FOCUS, the choice being moot, because no matter what value a verb assigns to its complement, it will assign *the same value* to its specifier, as long as both express the feature unvalued. For no reason other than expository convenience I will call the feature TOPIC.

The fact that V will assign the same value to any and all of its arguments that express the feature means firstly that the abstract feature value is not linked directly to the pragmatic interpretation of the arguments; the function of the abstract value is purely procedural: it renders the less complex argument invisible and thus syntactically inactive. Secondly, it means that extraction must be generally motivated by some *other* feature that definite nominals express and V cannot value: Case in this analysis. In short, indefinite arguments do not express Case, and V cannot delete Case, it values TOPIC. This makes indefinites more strongly attracted to verbs than definites are. In addition, some head above V must be strong, forcing movement of a definite nominal to delete Case.

Finally, the inability to value Topic is a lexical characteristic and this allows the possibility that certain exceptional verbs lack that feature, or a value for that feature, so that an argument will *always* be

extracted from their complement position: the argument's unvalued TOPIC feature will still make it visible to the verb, so it will be attracted by other shared features, but the verb will not de-activate the argument. This affords an account of the extraction of numeric expressions from the complement of Mandarin intransitive predicates that require quantity-denoting arguments: those predicates *always* fail to value TOPIC (see Appendices A and F for a discussion of numeric Subject in Mandarin.)

The obligatory extraction of complements from passive VPs, whose heads are *lexically* transitive, must then be explained in terms of a verb's *losing* its usual ability to value TOPIC. Since lexical construction is a one-time process, we must assume that the feature TOPIC cannot be optionally removed from any verb-form, but we might assume that a *value* can be removed as the verb is selected from the lexicon. In fact this follows from the assumption underlying interpretable features, i.e. that features may be given *alternative* values as they are selected from the lexicon. If alternative values can be added, the value must be absent to start with.

Another possible account is that a passive marker is a strong adjectival head that selects V as its complement, along lines proposed by Hale and Keyser (2002, and see the discussion of conflation in Appendix G) and inherits all the features of V except its TOPIC feature, but cannot project. It must then be selected by a functional head that *can* project so the verb's theta-role can be assigned.

Case and thematic saturation

The Topic analysis outlined above also provides an account of the connection between Case-deletion and theta-role assignment, long acknowledged in Burzio's Generalisation (Haegemann, 1994). According to Hale and Keyser (1993, 2002), thematic saturation, that is the assignment of *all* a predicate's theta-roles, is normally a pre-cursor to selection of a predicate's extended structure by a functional head. Only in certain cases can theta-role assignment be delayed, while one predicate is selected by another. However, V's own f-structure cannot signal the point at which it is thematically saturated. A transitive V could inherit all the ϕ -values it requires from its *complement*, leaving it activated only by features to be valued by sentential heads (TAM features), yet it would still be thematically incomplete. Two questions arise: what normally delays a verb's selection by a higher head, long enough for it to assign *all* of its theta-roles, and once it has, what triggers its selection by that functional head? The answers to both, I suggest, relate to the *absence* of any inherent Case feature in V. In the Topic analysis, V itself *does not express Case*, only [\pm TOPIC]. The presence of a *visible* i.e. unvalued TOPIC feature on an indefinite nominal makes it a closer match with V than a definite DP is, because the latter expresses Case, and V does *not*. Assuming V can *deactivate* the indefinite by valuing TOPIC, the indefinite nominal will be merged as a complement, in preference to a definite nominal, and it will be deactivated before it ever becomes visible to a head outside VP. Ideally, V is also strong, so the indefinite can spell out at the close of the next strong phase.

It is only at the point where a *definite Case*-expressing *DP* is merged with *V*, that Case is introduced into *VP*, making *VP* attractive to a functional Case-deleting head like *T*. As a specifier, the *DP*'s features will be visible outside *VP*, *even if VP* is strong. In fact, since *DP* needs Case, and *V* cannot delete Case, *DP* should be more strongly attracted to *v* or *T* than it is to lexical *V*. Either these functional heads that do delete Case *lack* some ϕ -feature shared by *DP* and the verb, so *DP* and *V* are a better match for each other than either is for that functional head, or a *DP* really is merged with *v* or *T*, and the thematic role is assigned *after VP* merges with the functional head. Either way, in this account Case-deletion *coincides precisely with the thematic saturation* of *V*.

In this way the distribution of Topic and Case features through nominal and verbal heads contributes to the delayed selection of *VP* by *v* or *T* etc. Topic can be seen as a kind of last resort feature, necessary to *delay* the attraction of *VP* and upper levels until thematic saturation is achieved, and Case can be seen as both a necessary means to maintain the visibility of just one set of ϕ -features to *T*, *and* as a procedural signal that thematic saturation has been achieved, licensing selection of *VP* by a functional head.

By associating Case with *definite* nominals *only*, a clear relationship emerges between Case and thematic saturation that *is* related to the operations of the computational mechanism. Case can now be a standard feature deleted under match, but expressed *only* by functional heads, not lexical heads. This applies potentially to Genitive case assignment in *DP* as well, an issue explored further in Chapter 7 and in more detail in Appendices J and K.

Scrambling and Subject extraction

We can also see how this connection between Case deletion and thematic role assignment unifies Subject extraction and scrambling: as long as *V* and a head above *V* are both strong, and cannot delete Case, then *DP* will be extracted out of *VP*, if not to a Subject position, then to an alternative Case position (Scrambling and Left-dislocation). There is no need for special stipulations to explain why indefinite arguments of intransitive Verbs remain in *VP*: they need a Topic value but *not* Case.

This also explains why Case positions may be available, but not necessarily utilized: if Case deletion reflects the need of a functional head for ϕ -features, *every* case-deleting head would need to enter agreement with *some DP* to inherit those features, and this would necessitate weak and strong variants of *every* functional head. On the other hand, if Case is procedurally independent of ϕ -features, functional heads may simply vary with respect to what ϕ -features they need, if any.

In the Topic-analysis then, it is not necessary to postulate variation in the strength of *VP*. Only if the predicate is exceptional, in failing to value TOPIC, will an indefinite nominal be extracted from *VP*.

All that remains is to account for *definite* nominals that remain within *VP*. This is discussed in Appendix J, after the feature-structures of Mandarin Nominal LIs have been presented in some detail.

To sum up, in the Topic analysis discussed above, projection can be plausibly related to economy constraints interacting with the distribution of unvalued features across two maximally matched items.

This implies that predicates will project when merged with arguments. However to account for a transitive predicate's stronger attraction to indefinite arguments than definite arguments, we are forced to assume that definite and indefinite arguments have distinct feature structures: while both express TOPIC, only the former expresses Case, and verbs value TOPIC, but do not express Case.

This Topic analysis has several advantages over the standard Case analysis. Firstly it obviates the need to treat Case as an exceptional feature deleted as a reflex of the valuation of other features. It is not that verbs delete Case only once; they do not delete Case at all. The link to ϕ -features can then be understood more simply as the need for predicates to express some unvalued F of nominals in order to attract them and assign their theta-roles. Secondly it resolves problems associated with variable strength of the same head. A head is consistently weak or strong, what varies from V to V is the ability to value the TOPIC feature, and this variation is *independent* of the variation in nominal types, the ability to value TOPIC affects definite and indefinite nominals differently, because of differences in their own feature-structure, but a verb's *inability* to value TOPIC affects both types of arguments in the same way: it forces either one to move. In addition the TOPIC analysis can be plausibly related to the basic function of predications in narratives: to make one nominal a topic and another, a focus. It also allows for an explanatory account of the link between Case assignment and theta-role assignment, allows Object and Subject extraction to *both* be treated as movements for Case, and finally, it maintains maximal uniformity between Mandarin and other languages. Though the proposals above have been developed primarily through a consideration of Mandarin, they show clear potential for successful application to other languages, including English, and Italian. The detail of that application is well beyond the scope of this thesis, and is necessarily left for future research to investigate.

Appendix I: The Minimalist Lexicon and Lexical Uniformity

The nature of the lexicon

In analysing syntactic derivations according to the MP, it is important to appreciate the nature of the lexicon in the MP. It is not a set of concepts mapped to phonemic features, like the *sign* of de Saussurean conception, but a set of stable clusters of valued and unvalued abstract features active in syntactic processes. In fact, the relationship of abstract features to phonemic form is somewhat uncertain. Like Pienemann, Chomsky suggests on the one hand that words in the lexicon are already inflected (Chomsky, 1995), on the other, that the lexicon is 'Bloomfieldian' (Chomsky, 2000), with only word-roots and idiosyncratic features stored in the lexicon. Regular inflections (features and values) would then be added by morphological processes as roots are selected. Elsewhere still, Chomsky explicitly allows the possibility of a distributed morphology (Halle and Marantz, 1993) where some phonemic values are mapped to abstract features, only after syntactic computations are complete (Chomsky, 2000, p. 119).

This last view is actually inevitable given the notion that it is the transfer of feature-values during the syntactic computation that drives a derivation forward. As values of uninterpretable features become available only during the derivation, their phonemic reflexes cannot be incorporated with roots within the lexicon. The overall implication then is that *some* phonetic features are stored within the lexicon, while others are accessed at various points during the derivation, or at spell-out.

The independence of syntactic word-hood and phonetic and prosodic word-hood is also entailed by the minimalist conception of Case relations. As explained in Chapter Two and in Appendix H, the deletion of Case is associated with the valuation of ϕ -features, signalled, in some languages, by an overt reflex which indicates the specific functional head that has deleted an argument's Case. In the MP, accusative Case is associated with the functional 'light verb' v , and nominative Case with the functional head T. Since T and v assign different Cases, and each argument's Case can be deleted only once, T and v must inherit ϕ -feature values from different arguments, typically a Subject and Object respectively. A single lexical item cannot have two copies of the same features and have each valued through agreement with a different counterpart, so this means T and v must be distinct lexical items (i.e. stable feature clusters) in the lexicon. Thus, a transitive verb-*form* inflected for tense may be a single *prosodic* word, but in minimalist terms it is a combination of *three distinct LIs*: lexical V, functional v and T. It makes no sense then to think of a tense-inflected verb *within the lexicon*, the features form a unit *only in*

syntax, and it is only PF that imposes on them the appearance of a single prosodic word. Moreover, the option of doing so is clearly parametric: languages like Mandarin have no tense forms at all, and aspect markers, which do have overt reflexes, are free morphs.

Detectable variety

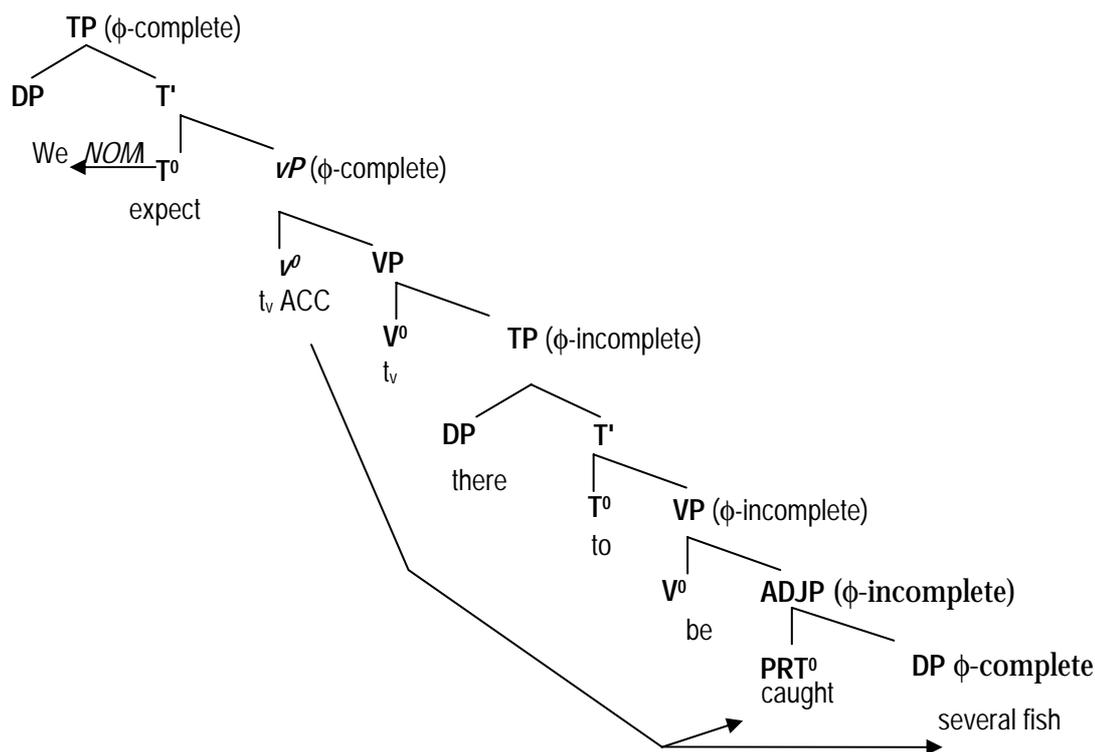
Another important aspect of the minimalist lexicon is its cross-linguistic variability. According to Chomsky (1999, p. 2), “languages [are] uniform, with variety restricted to easily detectable properties of utterances”. One might be tempted to assume that ‘easily detectable properties’ include overt morphology, but Chomsky argues at some length that similar languages share lexical F-structures, *despite morphological differences*. For example, the suggestion introduced in Appendix G that a universal hierarchy of functional heads can be accounted for by a universal pattern of ϕ -feature distribution is based on a discussion of the Case system in Icelandic participial constructions (Chomsky, 1999). In the Icelandic structures at (152), the case of the direct object (DO) varies with the verb and verb form: in a) the verb is unaccusative and the DO ‘a man’ is nominative; in b) the verb is a passive participle and the DO ‘several fish’ is accusative.

- 152) a. there is likely to [arrive a man_{Nom}]
 +Nom theta-marker
- b. we expect there to be [caught_{Acc} several fish_{Acc}]
 +Acc theta-marker

Chomsky argues that this is because the verb-forms corresponding to ‘arrive’ and ‘caught’ that theta-mark the DOs in (152) both lack a crucial type of ϕ -feature, and this prevents them from deleting Case. Because of this, the DO must delete Case by entering agreement with a more distant head: the head of T in (152a), and the functional head ν dominating ‘expect’ in (152b) (see Fig.31 below).

Chomsky sums up the discussion with the comment that: “under the uniformity principle... we conclude that Case is assigned in the same way *even where not overtly manifested*” (1999, p. 13, my emphasis). Thus, Chomsky assumes that *all* languages have LIs corresponding, not only to the unaccusative and participial verbs of Icelandic, but also to Icelandic T, and ν . Even languages like Mandarin, which have no morphological evidence of tense or agreement, and no clear basis on which to distinguish Adj from V, are assumed to have T and functional ν , participles and unaccusatives constructed from the same combinations of valued and unvalued ϕ -features.

Likewise, the claim that C is universally ϕ -complete (see Appendix G), is based on the observation that C expresses overt agreement in *some* languages. Chomsky’s position on lexical variation then is that, all languages have *identical* combinations of complete and incomplete ϕ -features comprising an identical range of recurrent lexical types, *barring evidence to the contrary*. This is despite the fact that each lexicon is constructed independently during acquisition. In short, according to Chomsky, it is the *absence* of these ϕ -features and ϕ -feature clusters for which compelling evidence must be found.

Fig. 31 ϕ -completeness and Case assignment

The proposed 'universal' ϕ -features of N / DP

In general terms, we might understand the nominal argument as a bundle of valued ϕ -features, while the functional heads v , T, and C are bundles of *un*valued ϕ -features, perhaps with other distinguishing interpretable F as well. However, the identity of the features that make up the ϕ -set is far from settled. The controversy over the proper analysis of DP (see Longobardi, 2001; Cinque, 1994, 1996, 1999, and the discussion in Appendices A and F) illustrates how scholars are continuing to 'unpack' categorial labels into more and more specific lexical Fs. Moreover, though Chomsky, acknowledges that it is DP that enters agreement with a predicate, he and many others still tend to use the label 'NP' to refer to the entire nominal argument. For example Chomsky states that 'N' is ϕ -complete and activated only by Case. In fact, if we adopt a Case account of the distribution of nominal arguments, then it must be DP that is activated by Case, because it is DP that is attracted to the predicate, not N. Thus it is only DP that must be ϕ -complete, not N.

Furthermore, even though DP must be ϕ -complete, the ϕ -features of DP need not originate as interpretable features of D: DP could acquire features by merger with other nominal heads. As long as other heads are visible within DP, they can contribute values to the predicate that are not expressed by D itself. Or, D could *inherit* ϕ -values through agreement with these heads. Thus both the identity of

necessary ϕ -features and their distribution through a nominal argument are still very much open to debate.

Chomsky assumes the key ϕ -features include GENDER, NUMBER and PERSON, because these features are often overtly expressed, but even in English it is clear that this cannot be so.

Gender

As discussed in Chapter Six, in a language like French or German, nouns fall into two and three classes respectively, identified by the form of articles and adjectives collocating with the noun. Since articles and adjectives vary together, depending on the noun they appear with, class membership or gender is assumed to be a lexical feature-value of the noun, transferred to the determiner and adjective. Membership in these syntactic classes is semantically arbitrary in the sense that it often disregards any natural gender that the referents of the nouns might have. (See the discussion of Gender in Chapter Six.)

However, English nouns provoke no such arbitrary alternations in the form of articles or adjectives. Though English nouns denoting animate referents may include a specification of *natural* gender (woman/ man/ eunuch; ewe/ram/ wether; mare/ stallion/gelding etc) most nouns are gender-neutral, even when they denote animals (human, sheep, horse etc). So the status of gender as a formal ϕ -feature of English N is clearly debatable. English pronouns on the other hand *do* express gender, but it is still *natural* gender of the referent, not arbitrary membership in a syntactically relevant sub-class of nouns. Referents that lack natural gender, like machines, may sometimes be referred to by a gendered pronoun, typically *she*, but this is a function of the speaker's *attitude* toward the machine (and toward females), not a function of the chosen noun. This is clear evidence that, for most English speakers, neither natural nor syntactic gender is encoded by most English nouns. Under the principle of economy, the feature Gender should therefore be *excluded* from the set of formal features expressed by English nouns: nothing in the syntax depends upon the presence of such a formal feature. If English nouns lack a gender feature, it then follows that English verbs cannot *require* a Gender value in order to delete Case. Therefore, Gender is *not* a universal ϕ -feature.

In fact, even in Mandarin, which clearly does have syntactic Gender (see the discussion of classifier-noun agreement in Chapter Six), it can be argued that Gender is not a ϕ -feature. In precise counterpoint to English, Mandarin *pronouns* do *not* differentiate gender, natural or otherwise, and nor do they select a classifier. Arguably then, Mandarin *pronouns* have *no* lexical Gender feature. This means the functional heads that attract Pronominal DPs and delete their Case must not *require* a Gender value, so again, Gender cannot be a ϕ -feature of Mandarin either. Though it clearly *is* a lexical feature of Mandarin nouns and classifiers, it is not essential to the deletion of Case. This indicates not only that gender is *not* a universal ϕ -feature as Chomsky suggests it is, but also that evidence for a feature does not equate to evidence for a ϕ -feature, in the sense of a feature necessary for Case deletion.

Number

Similar arguments can be made about Number. Chomsky suggests that Number is a necessary ϕ -feature, universally interpretable for 'N', but this contradicts proposals by Chierchia (1998) that nouns in classifier languages, like Chinese, are inherently plural, and by Doetjes (1996) that nouns in classifier languages are *unspecified* for Number, but are inherently *mass*.

It is important here to differentiate clearly between a mass reading for N and a generic reading. A mass reading relates to the physical attributes of *tokens* of an entity that delimit how they can be organised or distributed in space; a generic reading includes all and any tokens of a certain type of entity, regardless of the way those tokens are delimited or organised in space. Thus 'water' and 'chicken' are both mass in (153a) and generic in (153b), below. The use of a measure word 'bowl', in (153c) maintains the mass reading for the *noun* 'water', but makes the matrix *DP* countable, and thus specific, while the addition of a definite article maintains the *generic* reading of the DP 'the chicken' but *removes* the mass reading. The addition of a plural Number marker to 'chicken' in (153d) introduces a count reading, which, again, entails specificity:

- 153) a. The bowl is full of water/ chicken.
 b. Water / the chicken may exist on other planets too.
 c. The bowl of water / the chicken has been found on another planet.
 d. Chickens have been found on another planet.

The example at (153a) shows that English bare nouns are inherently mass, just as Doetjes suggests for nouns in Classifier languages: when the noun 'chicken' is used alone as an Object only the mass interpretation is possible, and in (153b) as a Subject of a verb of existence, the NP 'water' is both (semantically) mass and (referentially) generic, while the DP 'the chicken' is most naturally interpreted as generic rather than as singular. This shows that neither the English noun *nor* the definite article necessarily expresses number. Since b) is grammatical, the modal 'may' must not *require* a Number value in order to delete Case on 'water' or on 'the chicken'. In (153c), the tensed auxiliary 'has' seems to be valued SG for Number, but interestingly, this does not exclude the interpretation of the Subject nominal 'water' as *mass*, i.e. *non-count*, and does *not* affect the interpretation of either Subject as generic. Again, this suggests that the English NP and DP both *lack the Number feature altogether*; if either expressed Number, it would be forced to agree with the singular T because it is T that has deleted the Subject's Case feature. If the DP *lacks* Number, then the *lexical* verbs in (153a - c) must not require a Number value to delete Case either.

The nominal suffix +s in (153d) *negates* the mass interpretation of a bare N. This means English N must express an *uninterpretable* Mass feature which is valued [-] by the plural head +s. This means, in turn, that when +s is absent, the mass feature of N must receive a value from some other head. Arguably a covert *singular* head would not assign a +Mass value, so to gain a mass interpretation for the Subject of a tensed sentence, there must be two distinct covert heads, one valuing T singular, and one valuing N + Mass (along the lines proposed by Longobardi (1994) for Italian).

It appears then that English nouns, determiners, lexical verbs and modals do *not* express Number, but nouns at least, express an unvalued Mass feature, and the plural suffix +s expresses its valued counterpart, (-Mass). This accounts for the attraction between +s and N, and the presence of a Number feature in +s-marked nouns.

Features as Functional heads

On the other hand, English T *does* appear to express Number, as evident from the *singular* suffix '+s' (on a verb). There are three ways this might be interpreted. First, Number might be an *inherent* feature of the English lexical item, T, and '+s' is simply a head of T with values [TENSE PRESENT; NUMBER SG] incorporated with V. Alternatively, T might be valued for Number through agreement with an argument, and '+s' is the *reflex* of that agreement marked on T, but carrying *no specification as to tense*. The third possibility is that '+s' is a late-inserted portmanteau morph combining *inherent* tense information and an *inherited* value for Number.

The idea that Number is an *interpretable* feature of T, might seem to contradict the idea that lexical items only express values for features that are inherently associated with their denotation, but the head '+s' could be argued to signal Number alone, because its alternation with the past tense form '+ed' can be explained by morphological constraints: an English Verb root can support just one overt inflection, so the '+s' suffix is automatically excluded from V whenever V hosts the past tense inflection, '+ed'. In this scenario, '+s' would occur only in the context of non-past events, that is in the absence of a past tense form from the numeration, even if *formally* '+s' expressed no tense value at all.

On the other hand, if Number *is* an *uninterpretable* ϕ -feature of English T, it must always be valued, even though that feature is not contributed by either Det or N. Thus, Subject nominals in tensed sentences must always include a number feature contributed by an optional head *within* DP, but neither N nor D. This is basically Ritter's (1993) analysis of number marking in English. Since no feature can be added to N or D after the lexicon has been compiled, the only way an optional feature can be introduced is by way of an optional *lexical item*, attracting N or D in the syntax. Assuming the '+s' in T is a reflex of *agreement with* such an optional LI, then that LI must be covert when its value is singular. Most simply this singular head alternates with the plural head expressed as '+s' on N. As argued above, though plural +s forms a prosodic word with N, this does not make the feature expressed by +s a feature of N, it only indicates that they are output in the same strong phase, and either N is strong and takes '+s' as a complement, or '+s' heads a strong functional phrase which takes NP as its complement, but N then moves to the right of '+s'. Ritter (1991) suggests the latter, with Numerals accommodated as specifiers of the functional phrase whose head is '+s', and which I refer to as PluP, to differentiate it from lexical NumP whose head is a numeral; a covert singular head is simply an alternative head of the same phrase, PluP.

As discussed in Appendix A, this analysis has been extended by Li (1999b) to the Mandarin suffix -men. However, where the English N is said to move by head-movement, allowing plural nouns to

follow the numbers in Spec, PluP, Li argues that in Chinese, the entire NP moves to Spec, PluP, thus excluding the collocation of men-marked nouns and numbers in Mandarin. Unfortunately, in the MP, this elegant account of Chinese collocation restrictions cannot work because of special characteristics associated with the landing sites of movement. Movement is always into an EPP position, i.e. a position licensed by a feature which must be deleted by merger into a specific specifier (or head) position. Chomsky suggests that these EPP positions are *outer* specifiers distinct from the thematic inner specifier predictable from the semantic content of the head. Since Numbers clearly relate semantically to grammatical Number, and are entirely optional, the position they occupy cannot be an EPP position, it must therefore be *distinct* from the specifier position into which an NP would move to delete an EPP feature. Moreover, even if the positions were the same, merger is always preferable to movement: thus it would always be preferable to merge a number to delete the EPP feature rather than move the NP. A minimalist account must explain the collocation restriction between Mandarin Numbers and -men in terms of attraction between features and economy. Since the issue does not arise in the ILs under study here, I leave this issue for future research.

Returning to the English example above, as independent lexical items, +s and its covert singular counterpart can be added freely to a numeration as required to value T. However some Subjects of tensed verbs can have a generic or mass reading. This means, the covert mass head, which values the mass feature of N, must also contribute a Number value to T. Presumably a [-] value or some equivalent.

In short the facts of English interpretations relating to genericity, countability and Number have led to the conclusion that Mass and Number features are distributed differentially through NP, DP, VP and T. This same distribution helps explain why NP, DP and VP which all *lack* Number, are more strongly attracted to each other than any of them is to TP, which requires Number. Effectively, a DP must attract a Number expressing item if it is to be integrated with T. This makes Number a ϕ -feature in English with respect to T, but *not* with respect to V or *v*³³.

Mass

Another conclusion to be drawn from the discussion above is that English includes a covert Mass feature/ functional head. This feature can also account for the use of classifiers in classifier languages. Doetjes argues that classifiers make countability 'syntactically visible', so a quantity can be specified. In minimalist terms, syntactic 'visibility' resides in expressing an *unvalued* feature, so Doetjes' insight translates most felicitously into minimalist terms as a claim that classifiers value an otherwise unvalued

³³ Yet another explanation for the generic interpretation of a DP that ostensibly agrees with +s in English is that +s expresses something other than [Num: SG]. For example, if it expressed a [- Plural] value this would be consistent with any non-plural interpretation, including singular, and the non-count interpretations: generic and mass. In this case, the English ϕ -feature would not be a Number feature with alternating singular and plural values, but a \pm Plural feature. The conclusion would still be that Number is not a universal ϕ -feature, but a universal notion expressed through different feature configurations in different languages.

feature of numbers, which we might plausibly call [\pm Mass] (or [\pm Count]). Generally only count nouns have lexically selected classifiers³⁴, and these classifiers typically denote some physical attributes shared by individuated tokens of a generic type. Thus classifiers are associated in a fairly transparent way with the contrast between Mass and Count notions, among others.

The need for classifiers to accompany Mandarin numbers and demonstratives can be explained in terms of the latter items expressing an unvalued feature, while classifiers express its valued counterpart, sometimes + and sometimes – depending on the classifier itself.

In Mandarin though, there is no clear evidence for the obligatory expression of grammatical Number, in the sense of a Sg/Pl distinction, at all. There is not even any evidence for Tense.

Since English and Mandarin Ns can both function as arguments with no clear expression of Number, we must conclude that Number is *not* a crucial ϕ -feature. On the other hand, some Mass/Count feature appears to be associated with nominals in most languages, and Number features are not excluded from DP entirely. It is simply that their role may not be what has been previously supposed, and the nature of the features and their distribution across lexical items may vary from language to language.

Person

This leaves the last of Chomsky's three proposed universal ϕ -features: Person. In English, a bare noun is generally interpreted as 3rd person, that is, as referring to neither the speaker nor the addressee. However this is not the case in all languages. In Chinese it is quite common to use a full NP as a form of address, i.e. with 2nd person reference. This could be interpreted as ambiguity, with a noun being optionally valued either 2nd or 3rd person, but it could equally be interpreted as evidence that nouns do not express the feature Person at all. Only Mandarin Pronouns make explicit reference to the feature Person.

Both in principle then, and in practice, N is not necessarily ϕ -complete. Moreover, the lexical feature structure of N is not cross-linguistically uniform and nor is the set of features crucial to the valuation of a predicate, the ϕ -features. In fact, evidence suggests that English T and *v* require different feature values, even though both can delete Case. Thus the very notion of a set of features necessary to the deletion of Case is brought into question. If ϕ -completeness is a valid concept at all, it must be defined differently for different functional heads and in different languages.

³⁴ Mandarin non-count nouns may select different classifiers too: yú 'rain' can select the classifier zhèn 'burst', which would be inappropriate for a mass noun like tǔ 'earth', while the latter can select the classifier dùì 'pile', which is inappropriate for the former.

Case, ϕ -features, and the distribution of nominals

It is not only the identity of the ϕ -set that is open to question, but the manner in which it contributes to Case deletion. In fact, Chomsky acknowledges that Case itself is problematic and, ideally should be dispensed with altogether. In the meantime, as indicated above, he follows George and Kornfilt (1981) in describing case as "a reflex of agreement" (Chomsky, 1999, p. 12). Specifically, he states that: "Structural Case is not a feature of the probes (T, v) but it deletes under agreement if the probe is appropriate -- ϕ -complete...Case itself is not matched, but deletes under matching of ϕ -features" (Chomsky, 1999, p. 4). Moreover, deletion of the ϕ -set must occur in 'one fell swoop': "Its features cannot selectively delete: either all delete, or none" (Chomsky, 2000, p. 124).

When Chomsky says that "case deletes under agreement" this seems to imply that Case is a feature which deletes like any other, but the statement that "Case is not matched" clearly entails that there is no valued counterpart to match a nominal's Case feature. In fact, it would be problematic if Case were deleted through agreement, since then, one valued Case feature could agree with and sequentially delete many unvalued nominals. Then the need for Case could not explain the distribution of nominals in sentences, the main contribution of Case Theory to the transformational model.

Chomsky's description of Case as "a reflex of Agree holding of (probe, goal)" (Chomsky, 1999:13), or "a reflex of an uninterpretable ϕ -set" (Chomsky, 2000, p. 122) rather than a matching of case features serves to 'explain' one-off Case deletion, but it also means that Case itself cannot attract DP to v, since the latter does not *express Case per se*. Hence attraction must be motivated by ϕ -features.

At other times though, Chomsky clearly speaks of Case as if it *were* a feature whose value is copied from T or v to the nominal. For example, he states explicitly that "T *values and deletes* structural case for N" (1999, p. 5, my emphasis). Also, in discussing Icelandic participle structures, like "I expect there to be caught several fish" mentioned above, and shown again in Fig. 32 below, Chomsky refers to the nominative case on the post-verbal DP as *a member of its ϕ -set*. "Prt is adjectival: *its ϕ -set* may therefore consist of (unvalued) number, gender, *and Case*, but not person" (Chomsky, 1999, p. 14, my emphasis).

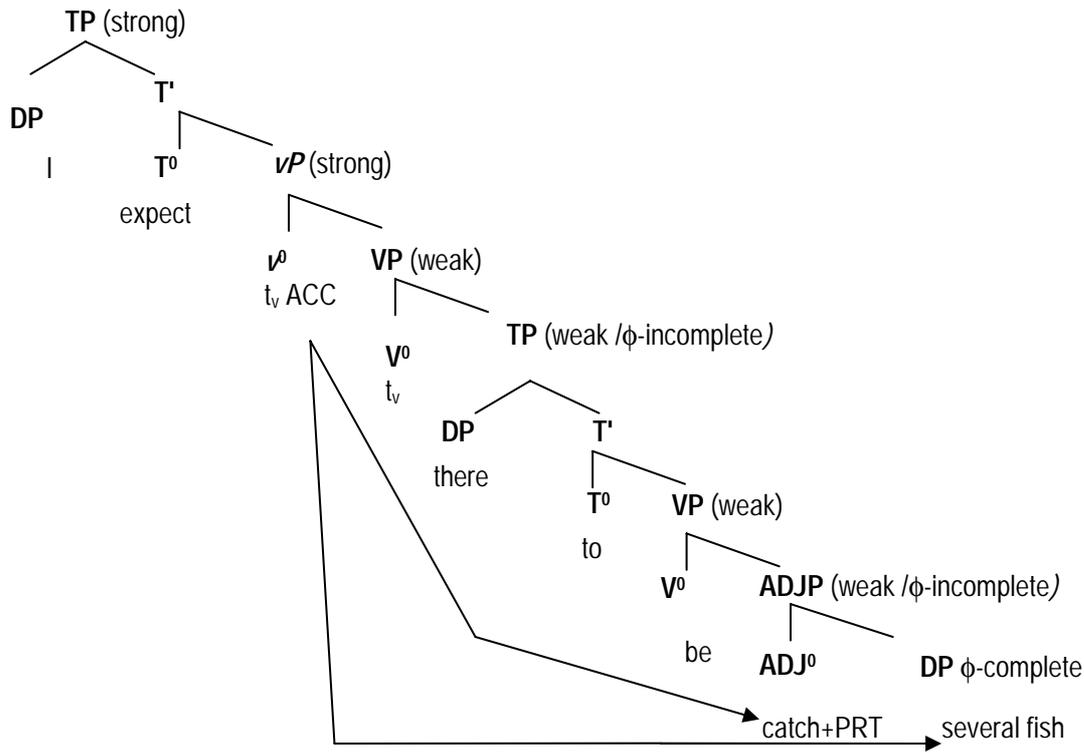


Fig. 32 Case deletion in Participial constructions

If Case were a member of the ϕ -set of PRT and 'N' as Chomsky suggests, it would have to delete 'in one fell swoop' along with number and gender. Yet Chomsky says specifically: "number and gender receive the values of DO and delete... But Case is unvalued for both PRT and DO" (Chomsky, 1999, p. 14, my emphasis). Clearly, if there is a Case feature it *cannot* be a member of the ϕ -set that deletes in 'one fell swoop'. Case is treated nonetheless as a feature of PRT, and PRT's failure to delete Case is said to be due to its being ϕ -incomplete: it does not express Person.

This raises the question of how a computational mechanism which simply 'sees' any features that are visible in the current array can 'know' which constituents are ϕ -complete and which are not. As both the ϕ -features that are expressed on PRT can be valued by N, they can both be deleted in 'one fell swoop' when PRT selects N and theta-marks it. So it would seem that PRT's Case *should* be deleted through agreement with N. However accusative case is not generally understood as a reflex of case deletion by N, and moreover, PRT's Case is said not to delete until PRT enters agreement with V. Therefore Case deletion must involve something more than a reflex of agreement for ϕ -features.

In fact Chomsky proposes that PRT's Case eventually deletes "at the next stage, [when] the probe T/v matches the (still visible) goal PRT, *valuing its case feature* ... the probe matches the DO, *valuing the case feature of DO* as well as its own features, (since DO is ϕ -complete)" (1999, p. 14). This is problematic because, if the DO does have more features in common with T/v than PRT does as this treatment suggests, then, under maximal match the first agreement relation to form should be one between T/v and the DO. In that case, the DO's ϕ -features would be copied to T/v in one fell swoop, leaving V

fully valued, and so *unable to inherit any ϕ -features from PRT*. If, for some reason, T/v did enter agreement with PRT first, then V would inherit PRT's ϕ -features, and delete its Case, but it could not then receive *all* the DO's ϕ -features, and delete Case on DO.

Only if V deletes Case on PRT *without receiving any ϕ -features*, can it then delete Case on the DO. In short, this analysis depends crucially on the treatment of Case as a feature that can be valued under match, *even when V receives no ϕ -feature values in return*. In any scenario, Case deletion cannot be simply a reflex of the one-swoop copying, match, or inheritance of a ϕ -set.

Not only are Case and the ϕ -set each problematic independently, their interactions are problematic too. Case is not a feature that becomes valued through agreement, yet, it is a 'property' of both T/v and N, which prohibits N from spelling out, and has distinct 'reflexes' in different relationships. It is a kind of pseudo-feature, valued in some manner not fully understood.

The Construction of the Lexicon

Lexical uniformity or no vacuous features?

The preceding discussions of the realisation of features on the one hand, and the deletion of Case on the other, both point to the same conclusion: in the MP, the ultimate constraint on c-structure is the lexicon itself. Despite his assumption of lexical uniformity, Chomsky actually allows that the lexicon can vary from language to language, even to the extent of employing different features. He says that "acquiring a language involves at least selection of the features [F], [and] construction of lexical items Lex ..." (2000, p. 100). This clearly challenges the idea of cross-linguistic uniformity. If lexical construction is a selective process performed by individual learners, it would be very surprising indeed if all learners of all languages happened to select precisely the same subset of features and construct precisely the same set of lexical items from that selection.

Chomsky suggests that cross-linguistic uniformity reduces operative complexity, but in fact it contradicts another key minimalist constraint: that against vacuous features. Features that have no phonetic content, no impact on interpretation *and* no impact on distribution, have no place in a language's feature-inventory at all. It is on this very basis that Chomsky excludes Categorical Features.

The assumption that *all* features overt in *any* one language must be employed in all actually makes for a huge degree of redundancy, both in the number of universal features overall, and the selection of features made in each language. The flaw in Chomsky's argument is due to his neglect of the fact that linguistic systems develop only in individual human organisms. This means economies can only be assessed in biological terms on the basis of the languages instantiated in each individual's linguistic system. Since c-structure depends on lexical structure, and the lexicon is constructed during acquisition, the initial state of the minimalist lexicon must consist entirely of the universal *pool* of features, either in isolation, or in some conceptually organised network reflecting basic perceptual and cognitive

universals. Each *individual instantiation* of the computational mechanism can then select from this set to construct a lexicon which, observation suggests, resembles fairly closely the lexicon of the speakers whose output the learning individual is exposed to. The developing system must then select the most economical combination of the lexical items it has itself constructed, to derive the structures it perceives. The mechanism might even re-construct its lexicon if it can determine that a different set of features or lexical items would lead more efficiently to the desired output, than its current set, but it cannot determine the most efficient means to reproduce *the entire set of possible human languages*, most of which it will never encounter.

Thus, each speaker's individual linguistic system should select the minimal set of features necessary for construction of its *own target language*, not the set that best accounts for variation across *all* languages. To suggest otherwise is to confuse the local economy of the computational mechanism with the explanatory economy of a universal theory.

The principle of feature-economy

To the extent that acquisition conforms to minimalist principles then, a learner's system should strive to reduce the lexical system it employs to the minimum set of features required *for the target language*. Or, rather, since acquisition involves *construction* of a lexicon, it follows that learners gradually *augment* their selection of features and their types of LIs only as they are compelled to by their attempts to interpret and produce structures of the TL. In this light, the most compelling evidence *against* the presence of a feature is an account of syntactic structures where it is superfluous.

This can be formalised as a principle of *feature-economy*, rather than a principle of uniformity:

- 154) No feature will be assumed in any language unless there is compelling phonetic, interpretative, or procedural³⁵ evidence for its presence.

This principle does not preclude the presence of covert features, it simply places the burden of proof on those who propose that a feature is present, rather than on those who propose that it is absent. In particular, when studying acquisition, no features, including Case and EPP features need be assumed until their presence can be justified by evidence from the IL itself. This does not constitute a claim that UG is irrelevant to ILs; rather it acknowledges that in the MP, UG is reduced to just two operations, merge and copy, and the limitations of the mechanism and its interfaces.

This view that lexicons are potentially variable is also more in line with Hale and Keyser's representations of lexical structure, where similar concepts are expressed by clearly different lexical types in different languages (Hale & Keyser, 2002). The difference between English adjectives and Mandarin stative predicates is one case in point; the lexical feature structures that Chomsky assumes for N /DP are another.

³⁵ By procedural evidence I refer to situations where some unvalued F must be present to account for certain derivational outcomes, especially continued activation after all interpretable F appear to be valued. Case is one feature of this type, EPP features are another.

The stability of the Lexicon

Chomsky also claims that the construction of 'Lex' is a 'one-off' process. Since, lexical acquisition actually continues all our lives, and, as discussed above, a derivation clearly can create prosodic words from items that are separate in the lexicon, I take this to mean simply that once a given selection of features have formed connections stable enough to allow them to be stored together in the lexicon as one item, then that combination of features cannot be broken apart and recombined by syntactic or phonological processes in the course of a derivation. Effectively, any changes to such a lexical feature-structure constitute the loss of the original LI *from the lexicon*, and/or the addition of a *new LI to the lexicon*.

Economy and constituent-structure

Having established the nature of the minimalist lexicon, it is useful to consider how LIs can combine. Ultimately, this also impacts upon the structure of lexical items. There are some local economy constraints that impact upon the way lexical items combine and become re-arranged as the derivation proceeds. The economy principles, ASAP, maximal match, Procrastinate, and shortest move, the distribution of EPP features across phrases, and the status of functional heads as strong (triggering spell-out) or weak (remaining in the computation) all affect the ultimate c-structural configuration that spells out.

ASAP requires features to be valued and spelt out as quickly as possible. Effectively this means that a feature cannot resist inheriting a value when it is merged into a syntactic object where a valued counterpart is visible. It also underlies maximal match: two lexical items or SOs will merge only if the attraction between them is stronger than any other attraction in the current numeration because this maximises the chance that most features will be valued as a result. In practice, it is possible that no features will be valued, because the mechanism is sensitive only to the presence of visible feature *types*, not to the presence or nature of individual feature *values*.

Given appropriate lexical F-structures, maximal match means certain items will be more strongly attracted than others, so they will merge. However, maximal match cannot determine which of two maximally matched items will project. Thus its impact on c-structure is limited.

Finally, features can communicate only while they are in the syntactic component (the computational mechanism), and there are limits on this period of time: at certain intervals sections of the derivation must spell out to PF. Spell-out is initiated by a 'strong phase' and the portion that spells out is always the complement of the *previous* strong phase. The strength of a phase is determined by its head, so essentially strength is a kind of lexical feature. If the portion of a derivation that spells out contains an unvalued feature, the derivation will crash, a waste of all the computational energy expended up to that point. Considerations of economy therefore dictate that this should be avoided wherever possible. They also determine whether merger or movement (copy & merge) can be

implemented to avoid such an outcome: if the SO includes a predicate with an undischarged theta-role, or an EPP feature, another SO or LI can be merged as a specifier of the first, introducing new features that might value those of the complement. Alternatively, if an EPP feature is available but nothing is left to be merged, an SO can be moved out of the complement that is about to spell out, into the periphery. This allows the unvalued feature to remain in the computational mechanism, and also affects the surface order of constituents at PF.

Maximal match, the strength of heads, thematic-roles and the availability of EPP features are all determined by reference to lexical features. Thus, ultimately it is economy interacting with the distribution of features across lexical items that determines c-structure in the MP.

Systematic but variable lexicon

Generally minimalist accounts simply assume a cross-linguistically stable hierarchy of functional heads. In principle, such a hierarchy might be explained as a consequence of attractions between features, but Chomsky's assumptions about the lexical-feature structure of nominal elements and the associated account of Case deletion are both seriously flawed. Case itself is problematic, the identity and distribution of ϕ -features within DPs is far from clear, and so is the relationship between ϕ -features and Case. There is also evidence for cross-linguistic variation in the identity of ϕ -features, which raises the question of whether it is actually plausible to assume general cross-linguistic uniformity at all.

The conclusions about predicate-argument relations and extraction from VP discussed in Appendix H form part of a larger pattern whereby economy predicts that heads with more unvalued features project to create complements out of heads with fewer unvalued features. Taken to its logical conclusion, this has various interesting implications for the structure of the lexicon. Crucially, some features of each LI must be unvalued in the lexicon, because only if an LI has unvalued F will it be active in syntax. Thus every syntactically functional LI must have some feature that cannot be mapped to surface forms. The acquisition of a language-specific syntax is thus reduced to the acquisition of the right combination of uninterpretable and interpretable features for each lexical item. This presents the interesting possibility that learners' lexical forms may initially be fully valued, comprising only semantic and phonetic features. In the MP, this alone would prevent them from being combined to make syntactic structures. The acquisition of minimalist syntax would then proceed by the addition of *unvalued* features to each LI encoding its attractiveness to other LIs.

Secondly, to the extent that identical-*looking* constituents have different distributions, or interpretations, they must actually have different feature structures, with some features expressed by covert elements. To the extent that lexical construction cannot occur within the syntax, these covert elements must be lexical heads in their own right, that can be optionally introduced into a numeration.

Thirdly, since the mechanism cannot determine which of two *identical* items, or two items with equal numbers of unvalued features should project, it follows that the only pairs of LIs to which the

mechanism can react are those that are unequally structured. That is, in any numeration there must be only one pair of LIs that is maximally matched and for any selected pair of LIs, the choice of projector must be uniquely determined by lexical-structure. This then entails that the only workable lexicon is one that consists of a continuum of non-identical lexical types where each type is maximally matched to just one other type. For example, to say that only C selects finite T, and only T selects *v* is to say that one feature from the universal pool is used in construction of all lexical items classified (by linguists) as C and a *different* feature is included in the construction of items classified as tokens of *v*, while items classified as T expresses both features. Likewise in modification, each modified substantive, for example N, must share a feature with the functional head that selects it, and each modifier, like Adj, must share a different feature with that functional head so it is merged as its specifier, and not as the complement *of the substantive*. The head expresses both the features, attracting it to both items, but it must share more features with the modified head, since it selects this as its complement.

LIs that match perfectly, or that have no match might well be constructed in the process of acquisition, and so might be selected for a numeration, but those numerations will not produce convergent structures, because the choice of projector will not be clear. Effectively such lexical items, should they arise at all, will be trapped within the initial steps of the syntactic processor, unattested at PF because they can never spell-out.

In principle then, no *particular* set of features or lexical items is necessarily more economical than any other. It is only particular *arrangements* of features that are required, such that they create a lexicon of minimally distinct lexical types that fall naturally into a continuum based on maximal matching. This makes the assumption of specific universal lexical types largely superfluous, while still capturing the generalisation that lexicons have similar structural characteristics cross-linguistically.

The cost of projection and movement point to the same conclusions: firstly the cost of projection creates a selective pressure for every phase to be strong, so that the features contained within its complement will spell out at the earliest possible point. Then, the cost of moving a complement that is *not* fully valued creates a selective pressure in favour of heads that attract complements they *can* fully value. In practice this means two items that are maximally matched should differ ideally by just one feature, the feature that keeps the projector active after merger.

Basically, then, as we move up any c-structural hierarchy, the lexical feature-structure of the heads must become increasingly complex. Specifiers are exceptions; they may express fewer features than the heads and complements they attract.

The proposal outlined above, that each modifier is a specifier of a distinct functional head, also has interesting implications for the lexical F-structures of that functional head, the modifier, and the modified item. Each SO with a functional head must have an uninterpretable F that will attract it to a subsequent phase; a manifestation of the continuum of features that I suggest is an inevitable consequence of the mechanism's design. If this feature is actually supplied by the *specifier* of the next functional head, i.e. by the next modifier, there is no obvious reason why the *same* functional head

cannot simply be reiterated. A stable hierarchy of modifier types would still arise, as long as each *modifier* expresses an unvalued feature of the higher level modifier. Thus it could be differences in the F-structures of successive modifiers that determines the structural hierarchy, not features of the functional head itself. The Mandarin *de* falls into place as just such a re-iterative functional head.

We can also gain some insights into typologies. If all words express many features, as a way of minimizing projection, it follows that many types of words will be mutually attractive, so word order will be relatively free. However if each word expresses few features, the number of words that match and value each other will be restricted too, so word order will be relatively stable. This seems to capture certain key aspects of typological variation in human languages in the same way that the Bresnan's (2001) distinction between lexocentric and endocentric phrase structures does (see Chapter Two).

Conclusions

The MP framework forces us to the conclusion that some LIs are abstract and covert, and therefore impossible to recognise from phonetic cues alone; they are evident only through analysis of the system as a whole. I have argued, contra Chomsky, that lexical feature structures are more likely to vary from L to L, than to be uniform, and that ϕ -features in particular may vary from language to language and do not necessarily include Gender, Number and Person, as Chomsky suggests. In fact, they may vary also from lexeme to lexeme within one language. For example, it appears that English T may require a Number feature, while English Modals and lexical V do not.

Nonetheless all lexicons are shaped by the same pressures: economy conditions arising from the limitations of the computational mechanism. A careful consideration of these limitations with respect to the selection of a projector in each instance of merge has led to the useful conclusion that projection is licensed for the item of a maximally matched pair that has more unvalued F, and that this then constrains the nature of the lexicon. Lexical items must fall into a continuum of minimally distinct F-clusters, such that for any possible combination of maximally matched items, the choice of projector is unequivocal.

Appendix J:

IL Lexical Feature Structures

In Minimalism the identification of lexical feature structures is "an empirical issue" (Chomsky, 1999), because the theory sets clear limits on constituent-structure and its relationship to lexical feature-structure: c-structures must be binary branching; projection must be licensed by unvalued features; only features in the periphery of one phase are generally accessible to those in the next; and any given c-structure must be derived from the *minimal* lexical feature-structure in the *most economical* way. Chapter Seven and Appendix H explained how economy dictates that the item of a pair that will project is the one with more unvalued F. Together these principles place clear constraints on the lexical feature structures that can be extrapolated from a given sequence of lexical items. This appendix sets out a methodology for the analysis of lexical feature structure, based on those constraints, and then presents the F-structure analysis of the IL lexical items identified in Chapter Five.

The lexical feature structure of each IL lexical item is summarised in Table 77; Table 78 illustrates how these different lexical F-structures give rise to a continuum of lexical types. Since conclusions about the f-structure of one lexical item depend inevitably on prior conclusions about the F-structure of its collocates, the discussion of lexical structures presented here necessarily includes some analysis of constituent structure, anticipating some topics covered more thoroughly in Appendix K.

Methodology

Determining feature-status and feature- type

As mentioned earlier, the basic minimalist premise is that features are *absent*, unless there is good evidence for their presence. Such evidence consists of a) an overt reflex, b) regular variation in *interpretations* of the same form, or c) regular variations in the *distribution of the same form*. The last two arise because of covert items. Since each lexical item is constructed only once, it cannot vary in its F-structure (though it may be replaced or accompanied by a phonetically identical LI with different features). Therefore, alternative interpretations for a single form must indicate the presence of one or more covert features, with different values delivered to LF at different times. Similarly, variations in distribution of a single form relative to the same set of collocates, indicates the optional involvement of a covert *lexical item*. In other words there are two phonetically identical syntactic objects, one including a covert item the other not. The covert item contributes features that make the SO attractive to items it would not otherwise be attracted to.

Variations in distribution associated with *no* change in meaning, indicate the involvement of an *abstract* feature, such as Case, that has no semantic content.

The identity of specific feature *types* and their status as valued or unvalued is revealed by the recurrent meanings associated with one lexical item. Some aspects of meaning will be *invariant*, some will *co-vary* with the choice of collocates, and some will vary *regardless* of collocates or context. These variations reflect respectively, intrinsic interpretable features; *optionally valued* interpretable features; and *uninterpretable* features, valued through agreement.

Locating features by reference to economy

A consideration of constraints on the visibility of features, and other economy conditions is also relevant to the analysis of feature-structures. ASAP requires a feature to be valued at the first opportunity; the minimal link condition (MLC), prefers agreement between the closest matched items; and Last Resort prefers merger pure over movement. In 'Derivation by Phase' (DBP, 1999) Chomsky also proposes a version of the Phase Impenetrability Condition (PIC) whereby visibility is restricted to a single strong phase: each uninterpretable feature must either collocate with a valued counterpart within the space of one strong phase, or move into the next strong phase. To enable such movement, the complement of one strong phase is retained within the computational mechanism until the close of the subsequent strong phase. This means, when a word spells out, the last feature for which it inherited a value will have a valued counterpart within the same strong phase (see Appendix G).

The extent of a phase is also limited by the dual pressures of ASAP, favouring quick spell-out, and Last Resort, favouring merger over movement. Together these two conditions create a procedural preference for short-lived strong phases containing just a few maximally matched items, with few or no intervening weak phases. Though each weak phase increases the chance that an unvalued feature will find a counterpart, and so not need to move, it also increases the delay till spell-out, violating ASAP and forcing more information to be held within the computational mechanism. Ideally then unvalued features will be valued within one or at most two relatively compact constituents after first merger, both satisfying ASAP *and* avoiding movement. From this, some rules of thumb were derived and employed to arrive at the lexical feature structures presented in Chapter 7.

Rule for a Complement's F-structure:

- 155) Ideally, for any AP that is a *complement* of X, the item that values A's last feature, will be X, or a specifier of X.

The complement rule follows from the fact that AP will spell out at the end of the strong phase *after* the one in which AP receives its last value. Suppose X is strong, selecting AP as a complement. Then X may or may not project a specifier position before being selected as the complement of another head, Y. This gives: Y [_{XP} (Spec) X [AP]], as illustrated below.

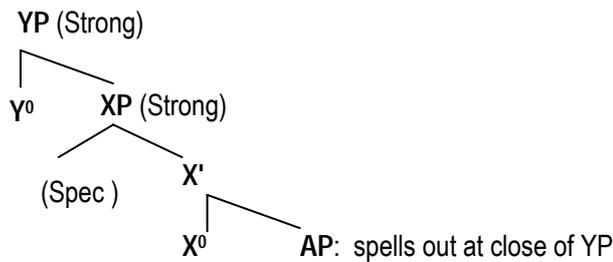


Fig. 33 Spell-out at close of second phase

AP will be invisible to Y (under the PIC). If AP were not fully valued through agreement with X or its specifier³⁶, it would have had to move *before* XP was attracted to and merged with Y. This is because X must project the position into which AP would move and once XP has merged as a complement, X can no longer project. The mechanism cannot look ahead to see what features of Y will become available to XP after it has merged, this would be equivalent to AP's being visible to Y.

Thus in the structure shown in Fig. 33, AP must have become fully valued by entering agreement with X, or X's specifier, before they merged with Y. The specifier can value AP because it is within the same phase. Nonetheless, AP will not spell out till XP is contained within another strong phrase.

Suppose YP is this strong phase, the ideal option. Also ideally, XP is fully valued after its merger with Y, and can spell at the subsequent strong phase, and so on. In this way, in the ideal scenario, the periphery of XP, containing X, and any specifier, will spell out immediately after AP does. Thus AP will be adjacent to X in PF, and the feature of AP which kept it active till just before spell-out should correspond to one of the features that was already valued within XP before XP was selected by Y.

Because the complement AP is, by definition, the *first* item to merge with X, X could only provide that value if it were an *interpretable* feature of X. The specifier could provide any value it expressed as a consequence of its prior mergers, but not any value it expressed through agreement with Y or some later merged item. Thus the value last acquired by AP should be found on an adjacent head, or the nearest c-commanding phrase. In addition, this head and phrase should form a single intonation unit, separate from AP because AP spelt out first, and the head and specifier spelt out later but at the same time as each other.

Though X or its specifier could move away from AP once AP is valued, this is more taxing and therefore dispreferred. Evidence against this ideal scenario would be collocation patterns where neither the closest c-commanding head to AP, nor the closest c-commanding phrase (the specifier of that head) could *possibly* express the last feature that activated AP, for example, evidence that AP sometimes moves away from those items same. In this way, economy conditions exclude an infinite number of alternative derivations.

³⁶ Recall that according to Chomsky (1999), checking relations are limited only by visibility: a specifier or head can value a complement, and vice versa, because they are contained within a single phase, and each is visible to the other. In previous versions, checking was possible only in Spec-Head relationships.

Rule for heads and specifiers

A similar 'rule' holds for heads and specifiers.

- 156) Ideally, for any *head*X or specifier BP, the item which valued its last feature, will be part of the constituent YP that immediately contains XP.

When the last feature of a head is valued, it becomes invisible and can no longer project. If it is merged as the complement of a strong head without valuing its last feature, it need not move. Ideally then the last value a head receives will be from the head that selects it as a complement, then it will become invisible at the same moment that it becomes unable to project. This entails that every lexical head except the ultimate maximal level, must have a feature that *neither* its complement nor its specifier(s) can value.

In short, movement is evidence of a partial *mismatch* of features between a head and its arguments. In the least complex, and therefore the most preferred system, the head and its arguments will share the feature they cannot value, so eventually, after movement where necessary, both will be valued simultaneously. This will lead to complement, specifier and head spelling out, in that order, as one intonation unit.

Locating strong phase boundaries

These rules apply whenever one strong head selects a strong phrase but a structure may involve *weak* phases as well as strong. Then the features which value a complement may be beyond the limits of its own phase. One indication of the left-edge of a strong phase is alternations in possible locations for a given phrase relative to a constant set of words. Under the LCA, the rightmost position that a phrase can occupy is necessarily closest to its point of first merger (Kayne, 1994), and each position to the left of that represents a landing site for phrasal movement, and hence the boundary (outer specifier) of a strong phase. This is the approach employed by Cinque (1994, 1999) and Longobardi (2001) to support their analyses of internal structure for TP and DP. In addition, periphery of a strong phase, containing the strong head and its specifier(s), will often be spelt out as one prosodic unit, after the phrase as a whole has been selected as the complement of another head. Thus, the right-hand element of any prosodic unit is a good candidate for a strong head, and the left-hand constituent of such a unit is a good candidate for the specifier of a strong phase. For example, Bernstein (1997, 2001) suggests (along lines proposed by Giusti, 1993) that the French particle '-ci' in (157) occupies the head position of a Functional projection (FP) below DP, and that the demonstrative *ce* is its specifier. A complex NP like [délégué du ministère] 'minister's delegate' can precede the two, by moving from NP to an adjoined position at the left edge of FP, as shown in (157a). The demonstrative can then move past the adjoined NP to land in D⁰, giving (157b).

- 157) a. [DP *le* [FP [délégué du ministère]₁ [*ce*] -ci t₁]
 [DP *the* [FP [NP *delegate of-the minister*] [*this*] here]
 This delegate of the minister

- b. [DP ce [FP délégué du ministère -ci t₁]]
 [DP this [FP delegate of-the minister here]]
 This delegate of the minister (from Bernstein, 2001, p.552)

The particle ‘-ci’ forms a single prosodic unit with the item it follows, whether that item is the demonstrative ‘ce’, as in (157a) or a complex NP like [délégué du ministère] as in (157b). In morphological terms, it is a clitic rather than a lexical inflection or a free morph. In the MP framework, this prosodic pattern is evidence that the particle ‘-ci’ and the constituent to its left have spelt out together. Moreover, assuming NP originates at the lowest level in nominal structure, the complex NP [délégué du ministère] must have moved, and so must occupy an outer specifier position, that is the left-edge of a strong phase. Thus, minimally, barring the presence of covert items, FP is a strong phase and ‘-ci’ is its head.

In contrast, a weak head will be prosodically inseparable from its complement, which should *follow* it. This seems a likely analysis for the demonstrative-number unit in Mandarin, where the demonstrative is always monosyllabic, the number may be a complex phrasal construction, and nothing ever intervenes:

- 158) a. Nà yī ge rén > nège rén
 that one Class person > that.Class person
 That person > That person
- b. Nà yī bǎi bāshíwǔ běn shū
 that one hundred eighty-five Class book
 That one hundred and eighty-five books
- > *Nèi bǎi bāshíwǔ běn shū
 > that hundred eighty-five Class book
 *That one hundred and eighty-five books

Note that phonetic incorporation occurs when yī ‘one’ follows the demonstrative as a lexical item, indicating that they are clearly output as one prosodic unit, but not when the same form follows as the first *digit* of a complex phrasal number. This means in (158b), Dem and Num are not a single prosodic word; however, they are still a single prosodic *unit* because nothing ever intervenes between them.

In short, given some initial assumptions on the nature of features and constraints on entering agreement, then an analysis of word order variation, interpretation, obligatory collocations and prosodic boundaries all contribute to an understanding of lexical feature structures. The following section illustrates the basic processes described above with respect to selected IL lexical items. Then, distributional and semantic evidence is presented for the identity and feature structure of each IL lexical type. The discussion proceeds from items that are most readily analysed as isolates, because they can and do occur alone, to items that never occur alone, and whose f-structure can therefore only be determined by reference to other items. This does not reflect the order in which words and features emerged in the ILs.

Selected examples of lexical analysis

The discussion of pronouns below illustrates the identification of an abstract feature with an optional value, linked to semantic content and an overt phonetic reflex. The discussion of the classifier-noun collocations illustrates the identification of a pair of corresponding features one interpretable, one uninterpretable, where the latter has a reflex after valuation, but the former does not. The discussion of numeric quantification shows how valued and unvalued counterparts of an abstract feature are identified in the absence of any overt reflex at all, (other than the root form, or reflexes of other features of the words).

IL Pronouns: overt interpretable reflexes

Each IL contains three different forms of singular pronoun, each associated with a different value for PERSON. The value of each form is constant, regardless of its collocates. Therefore the PERSON values are not inherited through agreement with any collocate. The lexicon could contain three distinct lexical pronouns, each differentiated by an *intrinsic* value for PERSON, or *one* lexical pronoun with a PERSON feature to which a variable value ,1st 2nd or 3rd, is added as it is selected from the lexicon. The difference has no consequences for procedural demands: in the MP, the feature PERSON is *interpretable* in either case, and in PT terms, the value would be added directly from conceptual structure in a Pronoun's categorial procedure.

Classifiers and Nouns: overt agreement with a covert F

Classifier–Noun collocations provide a more complex example. In the TL, different nouns collocate with the same classifier-form but different forms of classifier do not generally collocate with the same count noun. The referents of the nouns that share a classifier generally share some physical or social attribute, and on this basis we can say that Mandarin nouns and classifiers share a GENDER value. In the MP, two values cannot be forced to match if they are both interpretable to begin with, so either the noun or the classifier must have uninterpretable GENDER. Since any GENDER value will be copied as a matter of course to any uninterpretable GENDER feature, it is the item whose interpretation *varies* for GENDER that must have the uninterpretable F in the lexicon. This is the classifier.

Effectively then, TL Mandarin has just *one* classifier in the lexicon which takes on different phonetic forms at PF, after a GENDER value has been acquired through agreement.

In the ILs, the facts about distribution are not quite the same, but they lead to much the same conclusions. Each IL has at least three classifier forms, one the default form *gē* which learners use with almost every count noun, and the others, forms that occur with just a few specific count nouns. Sometimes, the same noun appears with either the default form or a more selective form, but this *does not force the noun to be interpreted differently* with respect to its GENDER. Essentially then, no IL nouns inherit GENDER values from any classifier, but at least *some* IL nouns contribute a GENDER value

that is *sometimes* mapped to a specific classifier form. Again this indicates that one underlying lexical classifier has an unvalued GENDER feature. A single instance of classifier-noun agreement is enough to indicate that learners can and do implement such agreement, and that is all we are concerned with here.

Numbers and Classifiers: a covert reflex and agreement with a covert F

A third example which throws more light on the feature-structure of classifiers and nouns is the licensing of numbers in quantity expressions. Only a few Mandarin nouns can be quantified without the presence of a classifier. As the only source of ungrammaticality in the MP is a feature unvalued at spell-out, this constraint indicates that numbers lack some feature value that exceptional nouns can contribute, but which is more usually contributed by a classifier.

The feature-type can be determined by the meaning expressed by all classifiers and by these exceptional nouns, and relevant to numeric quantification. The nouns that do not require a classifier are *all* count nouns, and the classifier itself expresses countability. This is captured by a feature [COUNT], with Numbers being uninterpretable, [COUNT_], and classifiers and exceptional nouns being interpretable, [COUNT +].

Covert lexical items: variations in interpretation and word order

The presence of covert GENDER on nouns and covert COUNT on classifiers is indicated by obligatory collocations. Another type of evidence for covert features is a change of interpretation associated with a change in word order. For example, a Mandarin 'bare' NP varies between definite and indefinite interpretations in post- and pre-verbal positions respectively, as shown in (159).

- (159) a. láile rén
 came people
 Some people have arrived
- b. rén lái
 people arrive.ASP
 The people have arrived

In the IL data, referential bare NPs occurred only six times in the total combined output from the first two samples from each learner, but nonetheless, the pattern seen in the TL is evident here as well: the four post-verbal nominals were all first mentions, i.e. indefinite, and the two pre-verbal ones referred to established referents, i.e. they were definite. (160) provides an example where the identity of the postverbal N *xiǎoshuō* is unknown to the addressee (indefinite) until it is named in the subsequent clause, beginning at the verb *jiào* 'named'.

- 160) wǒ kàn xiǎoshuō jiào 'Great Expectations'
 1sg read novel call 'Great Expectations'
 I read a novel called "Great Expectations (H2)

Similarly, in line 1 of (161) below, the N *shǔi* is a first mention (indefinite/generic), but when Sam repeats at line 8, it is an established referent (definite). Since there is no verb in that clause, this is

not clearly pre-verbal, but it is the first item in the utterance. When Sam puts the question again, at line 14, the definite bare N *shǔi*, is clearly in pre-verbal position.

- 161) Excerpt from (S3)
1. [A: o tāmen a gōngzuò zài shuǐbian
o they a work at waterside
They are working by the water
 2. S: o hǎo]
o o.k.]
 -
 - 5 A: a um um o tāmen bù xǐhuān a oo a () gōngzuò
a um um o they neg like a oo a () work
They don't like working
 - 6 S: tāmen bù xǐhuān gōngzuò
they don't like work
 - 7 A: duì hahah]
right haha]
 - 8 S: sh shǔi um a stream zhōngwén zěnmē shuō?
sh water um a stream Chinese how say?
water, um how do you say 'stream' in Chinese?
 - 9 l: hé huáng hé dyunno huáng hé is the yellow river
l: 'he', yellow river, dyunno? huang he is the yellow river
 - 10 S: 'hé' isn't that 'drinking'
 -
 - 14 S: ok um shǔi shì hé ma
ok um water is river Q-PRT
Is the water a river?

This pattern of distinctive distribution continued throughout the subsequent samples also, and reached statistical significance when the samples up to and including T4 were all combined (see Appendix D). The only post-verbal NPs that were *not* first mentions were either in immediate repetitions of a VP, eg 'yòng chē... lá chē', 'use a cart ... pull a cart' or the NP was definite (familiar to the addressee), but not topical (what the predication was about). This pattern matches the TL pattern of distribution precisely.

There is no overt marker associated with this variation in interpretation, but it affects the referent of N, not any other item. This indicates that the structure containing the noun, minimally the noun alone, expresses a referential feature with definite or indefinite values: [REF {DEF/INDEF}]. This feature cannot be *optionally* valued, because it would then vary *independently* of N's distribution. Therefore the referential feature of the N must be *uninterpretable*, and NP must move in order to *acquire* a definite value.

The closest *overt* item that might provide such a value is the predicate, but it cannot be the predicate that values NP's REF feature, because then Subjects and Objects, which enter agreement with the same verb, would necessarily have the same REF value. Therefore, the REF value of N must

be inherited from a *covert lexical item* that enters agreement with N, *before* N merges with the predicate. To enter agreement with N, this covert item must either project a phrase of its own and select NP as its complement, or be selected by N, as a complement or specifier within NP. I assume the former, since that is the pattern seen with overt expressions of REF (i.e. Dem), and because N is a substantive and the covert element is not its argument.

In short, the simplest way to account for the correlation between interpretation of definiteness and distribution of apparently bare NP is actually to assume *two* covert heads, one indefinite and fully valued inside VP, the other definite and attracted out of VP. Note that it is not the REF feature which causes the attraction between a definite 'NP' and a head outside VP, but another feature introduced by the definite head, but not by the indefinite head.

I propose, along standard lines, that the covert definite head is D, and the relevant feature that attracts DP out of VP is Case. On the other hand, departing from standard assumptions, I suggest that the covert *indefinite* head is a functional head distinct from D, which does not express Case. I call this head Mass. (For further discussion see the section on Case and Topic in Appendix H.)

Analysis of Lexical items

This section presents the complete f-structural analysis of each lexical item found in the ILs. This includes some abstract items necessary to account for distribution, as outlined above.

Pronouns

Personal Pronouns appear as arguments of a range of thematic verbs, as subjects of copular predicates, and as affines ('possessors') in the affine construction. Clearly, overt personal Pronouns express the F Person; they are also always definite, so they express [REF DEF]. Since they do not denote a natural class of entities, and do not collocate with Classifiers in the ILs, there is no evidence that they express grammatical GENDER.

The closest collocate of the pronoun is the suffix, '-men'. The fact that '-men' is a *suffix* rather than a prefix has implications for the derivation of Pronouns. Baker (1985) proposes a 'Mirror principle', whereby the order of suffixes from left to right on a root is the reverse of the order of functional heads from top to bottom in phrase structure, and Cinque (1999) argues that, under feature-checking theory (as per Chomsky, 1999), this is an inevitable consequence of the root's movement up through different functional levels as each suffix is 'checked' or matched against each different functional head in turn. This argument has been used to infer the universal order of functional heads, from observation of the order of semantically similar suffixes across related languages (see for example, Pollock, 1989; Belletti, 1990; Chomsky, 1995; Cinque, 1999), and Li 1999a, (following Ritter 1991) argues specifically that ':-men' is a functional head in Mandarin.

If this view is correct, then the root of the Mandarin pronoun, which expresses PERSON should begin as the *complement* of a functional phrase which expresses quantity, headed by, or checking '-men'.

In fact, this is precisely the analysis that Li (1999b) proposes. In the TL this analysis can be supported by evidence that -men inflected names and pronouns must *precede* numeric expressions rather than follow them as uninflected nouns do³⁷: thus, pronouns and names appear to move from N to adjoin to ‘-men’. However, in the ILs discussed here, ‘-men’ appears only on Pron, so it is most easily explained as a reflex of an optionally valued *interpretable* Q-feature, [Number PL] or [MASS +]³⁸.

Assuming then that REF, quantity-features and PERSON are all intrinsically interpretable features of IL pronouns they must be kept active by some other feature with no semantic content, rendering the other valued features visible till this last F is valued and deleted. Minimally, deletion occurs at the point where Pron is assigned its theta-role, i.e. when it is selected by V, a Copula or as the ‘possessor’ in an affine structure. Arguably then, this feature is Case. However, the fact that pronouns can remain in the complement of transitive verbs indicates that they can be fully valued within VP, and in the account of extraction from VP proposed in Appendix H, it was suggested that verbs cannot delete Case. One possibility is that transitive verbs are weak in Mandarin, so Case is deleted *in situ* by agreement with a more distant head. If this is right, then a transitive verb’s *specifier* could also be valued in Spec VP and would not need to move into a higher phrase, *unless* VP were dominated by a strong head that cannot delete Case. Aspect could be such a head, but the ILs do not include Aspect markers at this stage. In fact there is little evidence for functional heads above lexical VP in the ILs. Another possibility is that pronouns are activated only by unvalued Topic, but attract D when it is in the numeration, because they share the REF feature (and D might also express Topic). Case might then *appear* to be an optional feature of pronouns, but would actually be introduced by optional inclusion of D in the numeration. This aspect of IL F-structure remains somewhat unclear and warrants further investigation.

Common Nouns

Nouns appear in the ILs as bare arguments, but unlike pronouns, they can be interpreted as generic. This interpretation is available whether the noun is in initial or final position.

- 162) a. hàn.zì nán
 Chinese characters difficult
 Chinese characters are difficult (S1)
- b. wǒ bù yáng dòngwú
 1sg NEG raise animal
 I don't raise any animals (K1)
- Not I don't raise the animal

³⁷ Men-inflected nouns cannot collocate with numeric expressions at all in the TL.

³⁸ Recall that -men is sometimes said to be a marker of collectivity rather than plurality (Ilic, 1994). Chen (1984) reports learners using men-inflection on inappropriate nouns, in collocation with numbers, and in the wrong order: * Num-Cl -N+men. For these learners -men may function as a plural marker, agreeing with numbers, but this is ungrammatical in the TL.

This indicates that generic reference is inherent to N: it does not depend upon NP's entry into different agreement relations, so it is not associated with an uninterpretable feature.

In contrast, a post-verbal bare noun may not have a *specific* interpretation unless it is *also* preverbal with respect to a second predicate, like xiǎoshuō 'novel' which precedes the predicate jiào 'to be called' in (160) above. A post-verbal modified noun can also be optionally interpreted as specific as in (163).

- 163) wǒ xǐhuān hànyǔ kèběn
 1sg like Chinese. language textbook
 I like the Chinese textbook (S1)
 or I like Chinese textbooks (as a genre)

Sam offered the utterance at (163) as an elaboration of what he likes about studying Chinese. In context, the referent was specific because Sam had in mind not Chinese textbooks generally, but the text-book he used in class; it was not definite reference because the referent was a first mention and the addressee, the interviewer, was not expected to know which text-book this was. This indicates that a specific interpretation can be added to a nominal *through its interaction with another element*, a pre-nominal modifier. The same applies with respect to the effect of the predicate jiào 'to be called' in (160) above, whose semantics entail specificity. This means, specificity *is* valued through agreement, and is thus a reflex of a distinct feature from that expressing generic reference. I suggest that specificity is entailed by the grammatical feature PERSON.

PERSON: the feature and the functional Head

The feature PERSON expresses the relationship of a referent to the speech context: 1st and 2nd Person are interlocutors and 3rd Person is not. Thus, specification of a PERSON value entails that the speaker has a *specific* referent in mind: one whose relationship to the speech-context is known. As a bare noun has generic reference, rather than specific reference, and no relationship can be established between a generic type and the speech context, the noun itself must not contribute a value for PERSON, and since unvalued features are not tolerated, a noun N must not express the feature PERSON at all.

This means, in *specific* 'bare NPs', where a PERSON value *is* retrievable, that feature and its value must have been introduced by a *covert* head syntactically associated with N. This covert head will be referred to as 'Person'. Its feature-structure and syntactic role are discussed further below.

It is the feature PERSON of the head Person that enters agreement with a modifier or predicate in the examples at (163), and either imparts to them or inherits from them a specific value for a referential feature.

A referential feature for N

As described above, *referential* 'bare' NPs, as opposed to generic bare NPs, occurred only six times in the first two samples of all three ILs combined, and as in the TL, the definiteness of referential 'bare' NPs varied with their distribution: the two pre-verbal instances were both definite, while the four post-

verbal ones were all indefinite (see discussion of (160) and (161) above.) This indicates that by T4, all learners treated N as having an *uninterpretable* referential feature, valued through agreement: [REF _].

MASS and D: two covert functional heads

Definite and Indefinite 'NP's

Since the basic denotation of N is generic, the definite and indefinite values associated with 'bare' NP must be expressed by one or more covert heads, each attracted to N. The standard assumption is that the definite head is D, and this is adopted here. As discussed in Appendix H. The link between distribution and referential value is explained most simply by the idea that definite D expresses some feature *other* than REF, that cannot be valued in VP, i.e. Case, while indefinite nominals are *not* DPs. They are dominated instead by a covert *indefinite* head that does not express Case and is fully valued *inside* VP. Indefinite nominals may be *non-specific* so the head that expresses indefiniteness is *not* Person, which entails specificity. I call it Mass, a head associated with numeric *and non-numeric* quantity-expressions (like dà 'big').

'Mass' was chosen because 'bare' NPs do not express Number. Sam's comment in (163a) above about his Chinese text-book must have a singular referent, because the learners used just one Chinese textbook; but his discussion in (164a) below, relates to study generally, so here, the 'bare' NP kè is most naturally interpreted as plural '*classes*'. Likewise, Hannah would certainly have read only one copy of 'Great Expectations' (163b), whereas, the woman mentioned in (164b) wore, a *pair* of shoes, both white, so, in that utterance, xiē most naturally has a plural referent.

- 164) a. wǒ xǐhuān hàn yǔ kè
 1sg like Chinese lesson
 I like Chinese lessons (S1)
- b. yī-ge nǚrén chuān báisède xiē
 one-CL woman wears white shoe
 A woman is wearing white shoes (H4)

There are a number of ways in which this variability in the nature of N's referents might be explained. N could be ambiguous, i.e. optionally valued for either of two possible NUMBER values, singular and plural, as Chomsky (1995) suggests. Alternatively, it could be *uninterpretable* for Number, and inherit a NUMBER value through agreement. This would entail the existence of two covert heads, one singular, and one plural. Finally, it could be unspecified, having *no* NUMBER feature at all, with the interpretation depending purely on context and world-knowledge.

Chomsky's proposal is that N is optionally valued, but this is impossible to maintain: it would preclude N from ever inheriting a number value, so N could be plural even when combined with the singular number, yī 'one', or singular when collocating with a plural number. This is a consequence of using a copying approach to agreement.

We can also exclude the possibility that Mandarin N is valued through agreement because nouns in the same structural position can have either a singular or a plural referent. Though this might arise

through agreement with covert numbers, we can exclude those by a consideration of restrictions on numeric arguments. In the TL, Num-Class-N can function as the Subject of certain predicates, but Class-N cannot, and in early ILs, the Class-N sequence is always preceded by an overt number. Thus there is no legitimate string *0_{Num}-Class-N with the same distribution as Num-Class-N either in the TL or in the ILs. We can also exclude a covert plural functional head: since it is not associated with differences in distribution, a covert plural marker would be indistinguishable from an absent marker, and so is excluded by considerations of economy.

Chierchia (1998) proposes that nouns in classifier languages are *inherently* plural, but this is unworkable under minimalist assumptions: if N were inherently plural, it would always be plural, which is clearly not the case.

Since Mandarin N has neither interpretable, nor uninterpretable NUMBER, the only possible conclusion is that it has no NUMBER feature at all. This means the apparent ambiguity of bare N with respect to number, is actually vagueness, and any appearance of agreement between N and numbers is illusory: numbers simply express an inherent value which N is incapable of contradicting³⁹.

The same arguments apply to the feature MASS, which Doetjes (1996) proposes is universal for N. In the ILs studied here, there is neither formal nor distributional distinction between nouns denoting mass entities, like 'water', and those denoting individuated entities, like 'shoes'. While there is evidence for such a feature, there is no reason to assume it is expressed by the IL nouns. Basically then, most IL nouns express only valued GENDER and unvalued REF.

± COUNT: Numbers, classifiers and exceptional nouns

In the ILs of the first year, a classifier occurred only in the sequence number-classifier-noun, which was initially the most common form of indefinite nominal (nine out of the 13 indefinite nominals in the first six samples combined; the other four were all 'bare NPs', which I have argued, is actually PersonP, i.e. NP merged with the head Person). The primary function of the classifier can be best understood through an analysis of constraints on the numeric quantification of nouns. (Classifiers do not occur with non-numeric quantifiers which, in the ILs initially form a distributional class with 'Adj'.)

The basic function of a noun is to denote a generic type. Types are conceptual categories with no physical existence apart from the tokens that instantiate them. Since they have no physical existence, types as such, cannot be located in the real world; and if they cannot be located they cannot be quantified, except as types. Thus a Mandarin noun like *jī* 'chicken' denotes a type, and the strings * *yī jī* '*one chicken' and * *liǎng jī* '*two chicken' are ungrammatical, because a type cannot be quantified.

The basic function of a classifier is to define the physical boundaries or characteristics that distinguish the *tokens* of some type, so that tokens can be located and quantified (Doetjes, 1996; Kearns,

³⁹ Note that the lack of any covert Num does not preclude a covert indefinite head; see discussion of Mass, below.

2000). Many types of entity have physical tokens that are clearly bounded or individuated, like chickens, people, and cups, while other types have tokens that are (to human senses) amorphous, or mass-like, like water, air, or meat. Thus, many classifiers like *piān* 'slice', *gēn* 'metal bar', *tóu* 'head' encode distinctive characteristics like shape, composition, body parts, or some other characteristics that is inherent to every token of the same type, giving them all the same distinctive shape; others simply entail individuation, either for a specific type like *pǐ* (for equine animals, and things historically transported by horse), or for many types, like the default classifier *ge* which can be used with most count nouns. Many, commonly called measure words, denote entities that are themselves defined by shape and/or size, like *bèi* 'cup', *wán* 'bowl' and can be used to measure or delimit other entities, whether those entities are inherently individuated, or are amorphous masses.

Addition of *any* classifier renders a nominal countable as a whole, but the *choice* of classifier determines whether the noun is interpreted as individual-denoting or mass-denoting. For example a specific classifier, *zhī* identifies an individuated token of the type *jī* 'chicken' (among others): *yī zhī jī* 'one chicken', *liǎng zhī jī* 'two chickens'; a measure word like *wán* 'bowl' identifies an amorphous token of the same type: *yī wán jī* 'one bowl of chicken', *liǎng wán jī* 'two bowls of chicken'. English uses number morphology to achieve a similar effect, but in Mandarin it is generally the classifier, not N or Number that determines whether a referent is to be understood as individuated or as a mass.

This explains in semantic terms why quantifiers and demonstratives generally require classifiers; tokens can be quantified and located in space, but types cannot. To implement such a selection by way of agreement, we must conclude that numbers introduce an *unvalued* feature relating to quantification, whose value is supplied by classifiers. Since numbers clearly express valued Number (SG/PL), I have called this feature COUNT.

Since countability is an attribute of *tokens*, a classifier should generally select an item that denotes an individuated entity, like PersonP, not one denoting a generic type, like most NPs. However, some nouns, like *tiān* day or *biān* side, neither require nor tolerate a classifier. These generally denote extents of time or space, and as such are inherently individuated, and cannot be treated as amorphous. They must also express [COUNT +], but need not express GENDER. The uninterpretable feature [REF _] accounts for the activation and distribution of *all* nouns as bare NP, so there is no need to assume a Case feature for N.

The Classifier selects and values N

Agreement between the noun and classifier is also evident in the earliest IL samples. As discussed above, this is captured by the feature [GENDER] valued inherently on N. Since N is the only item that introduces a GENDER value, it is essential that the classifier enters agreement with N as or *before* N's REF feature is valued since valuation of that F renders N invisible. For example, if a number merged with N before a classifier did, the Number would value N's REF feature with an indefinite value -

Numbers in isolation are clearly interpretable as indefinite so they must have a REF feature that is already valued in or as they are selected from the lexicon. Then N would become invisible, and Class would be unable to converge because it could not value its GENDER feature. Several points indicate that Num does *not* express GENDER. First numbers are not dependent on a GENDER feature: they can occur without nouns (for example in counting); secondly, no generic type of entity can be interpreted from the use of numbers alone; and thirdly, numbers cannot attract nouns that clearly express GENDER. Thus the classifier must select N before a number does.

Under minimalist assumptions, the only means to ensure this order of mergers is by maximal match, so the classifier must share *more* features with N than the number does. Therefore, the classifier must express not only uninterpretable GENDER, which makes it dependent on N, but also valued REF, which makes N dependent on it. This way Class will select N before Num does without delaying the valuation of N's REF feature, which would be a violation of ASAP. In the TL, the value of the classifier's REF feature can be identified as non-specific because this is the interpretation afforded by a bare ClassP. However bare ClassP does not occur in the ILs, so its value is semantically indeterminate. I represent this by a \emptyset value. Arguably, this is a transitional stage comparable to that proposed above for GENDER features on early Classifiers.

In short, the features of N, [GENDER Δ] and [REF $_$] are a subset of the features of the classifier [GENDER $_$; REF \emptyset ; COUNT +]: the simplest and therefore the only acceptable minimalist account of their close relationship.

The Classifier selects and values Numbers

Now some basic features have been established for N and Class, further conclusions can be drawn on the basis of attractions and maximal matches for these features. Since numbers must be less well-matched to N than classifiers are and do *not* express GENDER, they must be attracted to *classifiers* by the feature COUNT, for which they inherit a [+] value. The Number and Classifier also form a prosodic unit which indicates that they form the periphery, specifier and head, of a single phrase. Thus the Classifier projects to select the Number, as proposed by Pan (1998) not vice versa, as most other analyses of the TL would have it (See Appendix DP or not DP). Henceforth I will refer to the Num-Class-N sequence as 'numeric ClassP', and the sequence Class-N without Num as 'non-numeric ClassP'.

In the TL, there is evidence that numbers remain visible in Spec, ClassP: numeric ClassP and bare NP can both be the subject of a Q-predicate, as in (165a) and (165c), but non-numeric ClassP cannot, as in (165b):

- (165) a. yī bǎ yǐzi jiù gòule
 one class seat thenenough
 One seat is enough (no more seats are required)

- b. *bǎ yǐzi jiù gòule
class seat then enough
*Some seat is enough
- c. yǐzi jiù gòule
seat then enough
The chair is enough
- OR
Chairs are enough (i.e. nothing *other than* chairs is required)

This contrasts with post-verbal position, where all are acceptable:

- 166) a. wǒ yào yī bǎ yǐzi
1 sg want one class seat
I want one seat (not more)
- b. wǒ yào bǎ yǐzi
1 sg want class seat
I want some seat (any *one* will do)
- c. wǒ yào yǐzi
1 sg want seat
I want a seat / some seats (any will do)

Non-numeric ClassP has a singular interpretation in post-verbal position, but cannot be extracted like a numeric expression can. This indicates that non-numeric ClassP is fully valued inside VP, while the Number in the specifier of numeric ClassP must retain an unvalued F which makes ClassP visible to the computational mechanism, and attracts it out of VP, to function as a Subject. The fact that non-numeric ClassP cannot do likewise indicates that its interpretation as denoting a singular referent is not a consequence of a covert Number, and it does not express the feature that keeps the Number active, either as a valued or as an unvalued feature. This F must be either Case or TOPIC because GENDER, REF, COUNT, NUMBER and/or MASS are all expressed within ClassP. Since the ILs contain no non-numeric ClassP, we need not concern ourselves further with this issue here.

Nonetheless, the classifier, as head of the entire numeric expression, must also express a feature that remains unvalued *after* agreement with its complement, NP, and its numeric specifier. Minimally, this is the ϕ -feature associated with specificity and required by predicates: a PERSON feature. This gives Num-Class-N the structure in Fig. 34 below.

The choice of PERSON for the feature that activates ClassP can be further justified through a process of elimination, and from semantic evidence. Firstly, once Class has been in agreement with N and a number it cannot remain unvalued for any feature they express valued. This excludes REF, GENDER, COUNT, and NUMBER. Of conventional features, this leaves just PERSON, TOPIC and CASE.

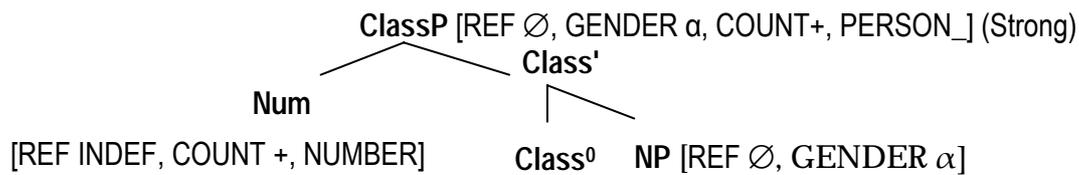


Fig. 34 Lexical F-structures in Num-Class-N

Secondly, post-verbal numeric expressions in the ILs were all *specific* indefinites: they had 3rd Person reference. Thus numeric ClassP must include a PERSON feature. Thirdly, until T6, the main overt collocate of a numeric expression was a predicate; in Kazuko and Sam's ILs, numeric expressions were never moved out of VP. This means numeric ClassP satisfies and is satisfied by the predicate, so it must contain *all* necessary ϕ -features. Minimally, this is PERSON, the only feature expressed by Pronouns *and* by referential NPs in Mandarin. If ClassP expressed Case, or an unvalued TOPIC feature we'd expect it to be extracted, at least some of the time, but it is not.

Finally, though PERSON is clearly valued by the time a specific indefinite merges with V, it is also clear that specificity is beyond the logical semantic entailment of the overt items, N, Class, and Number. N has a *generic* interpretation, not a specific one; the Classifier has no clear referential value at all, it simply signals countability, (and in the TL bare ClassP is *non-specific* or *arbitrary*); and quantification does not entail specificity either: it is possible to imagine a precise number of *arbitrary* tokens of a type, without *specific* tokens even being in existence (e.g. 'five unicorns'). Since a numeric expression can be either specific or non-specific, it follows that the feature PERSON must be *optionally* introduced to a numeric expression, as it is to a 'bare' NP, by addition of the covert head, Person. It is the head Person then that a numeric ClassP must attract, and the obvious way to do so is through expression of an unvalued PERSON feature.

The head Person

Since most predicates require an entity-denoting referential argument, both definite and specific indefinite 'NPs' must include the covert head Person, and since D expresses its own REF feature, and valued features cannot be forced to agree, Person must have an *unvalued* REF feature, not a valued one. This means it is not Person that provides the INDEF value to an indefinite nominal. In a numeric expression Person will inherit the non-specific [REF ∅] value from Class, and in indefinite 'bare' NP it must attract the covert indefinite head, Mass.

To remain visible *after* merger with ClassP, PersonP *must* express an unvalued feature that has not been valued through agreement with the number or the classifier. Again, this can only be TOPIC, or Case, and as discussed in Appendix H, the simplest account is that indefinite nominals generally express *unvalued* TOPIC.

Mass is activated only by unvalued PERSON. (Effectively, it is a covert predicate of quantity; see discussion of modification below). Therefore it must be Person that projects, when these two merge, making MassP the specifier of PersonP, the latter remaining visible because of unvalued TOPIC.

Nominal predicates and Genitive case

We now have a good overview of the basic feature structure of Nouns, Numbers and Classifiers, and there has been cause to postulate three covert heads, D, Person and Mass. Arguments advanced in Appendix H led to the rejection of the notion that all nominal arguments need Case, in favour of one where indefinite nominals are attracted to predicates by the feature TOPIC. These conclusions arose directly from considerations of economy constraints, which is precisely how a minimalist analysis *should* be advanced.

As nominal structures become more complex, the presence of an unvalued TOPIC feature takes on a new significance. Indefinite nominals, now to be understood as PersonP, begin to appear as *embedded* modifiers of another Noun, for example in possessive structures like:

167) māma de māma
 mother de mother
 Mum's mum (K1)

Since PersonP requires a TOPIC value, but is never extracted out of a matrix nominal structure, the heads which integrate PersonP and the noun it modifies must either value TOPIC themselves or else be weak, so that TOPIC is valued through long distance agreement. The simplest structure where this issue arises is the affine structure.

The affine structure is restricted to the expression of certain types of *social* relationship, as in wǒ nǎinai 'my grandmother'. At its heart are kin-terms and certain other nouns like guó 'country / nation', dānwèi 'work-unit', xiào 'school' *etc* denoting social institutions to which one can belong, as if to a family. For the purposes of this discussion, I include all such nouns under the label 'kin-term'. These nouns all name one party in a relationship, and select a pronominal *argument* denoting the other party in the same relationship. In short, they are nominal *predicates*.

A kin-term in the TL is indefinite when quantified, as evident from the fact that it can follow intransitive V: lái.le liǎngè dìdì (come.ASP two CL younger-brother all) 'there came two younger brothers..'. An affine structure on the other hand cannot: *lái le wǒ dìdì * 'there came my younger brother...'. The affine structure is thus *necessarily* definite, *and* activated by Case. Given the analysis of lexical f-structures thus far, we can therefore conclude, that the affine structure as a whole is a DP; the kin-term and its affine argument are dominated by a covert D.

In the ILs also, the affine structure was always definite, invariably a *subject* and *preceded* rather than followed intransitive Verbs. Thus in the ILs, as in the TLs, the affine structure was apparently a DP, activated by Case.

Kin-terms are derived predicates

In a Minimalist account, the first projection of a predicate is always a *complement* and basic order is VO or head initial. On this basis, the kin-term should *precede* its argument, not follow it as it does in the affine structure. Moreover, the Mandarin affine structure is similar to the Hebrew ‘construct state’ structure, discussed by Ritter (Ritter 1989, 1991). The Hebrew ‘construct state’ structure is also a possessive structure formed by juxtaposition of two nouns, and though it has the expected order: ‘possessed-possessor’, Ritter notes that children acquiring Hebrew as L1 pass through a stage where they employ the order ‘possessor-possessed’ (the TL order in Mandarin). She suggests that *this* order is actually more basic, but given minimalist assumptions, the early emergence of this order requires some explanation.

I suggest this word order can be understood in terms of Hale and Keyser’s (1993) analysis of derived predicates. They propose that ‘de-nominal’ predicates like laugh (V) come about through phonological conflation of a noun, laugh (N) and a null predicate, at the point of merger. Conflation is licensed only in a head-complement relation. The lexical item retains the head-complement structure from which it is derived, so the verb’s complement position is, effectively, already filled. An agent /creator theta-role assigned *by the null predicate*, must therefore be realised as its *specifier*, giving ‘she laughed t’, rather than ‘she -ed a laugh’ or ‘laughed she’.

Extending this logic to the affine structure, we can hypothesize that the structure actually involves a null predicate which selects the kin-term as its *complement*, whereupon the two conflate. The pronominal ‘possessor’ is then merged with this conflated head-complement structure, and must therefore be merged as a *specifier*. Under this analysis, since the affine is merged directly into the specifier position of the conflated predicate structure, no movement is required; the attested IL order is procedurally basic in minimalist terms.

A consideration of nominal feature structure supports this analysis. The affine argument is *always* a pronoun and the kin-term a noun. If merged directly, the pronoun’s interpretable [REF DEF] value would be copied to the noun, making it definite and de-activating it. However, the kin-term in an affine structure is *not* necessarily definite; it is only *specific*. A speaker who has more than one older brother may refer to 我哥哥 ‘my older brother(s)’ and the addressee will not know *how many* or *which* older brother(s) are meant. Moreover, the N 哥哥 clearly has a Person value distinct from that of the ‘possessor’ pronoun 我 ‘1sg’, and it is the person value of the ‘possessed’ N that is shared by the structure as a whole. Therefore the noun must be associated with a PERSON F that is not only distinct from that expressed by the pronoun, but is also prevented from entering agreement with the Pronoun. In short, the kin-term must be selected by the covert head, Person *before* it enters agreement with its argument.

In effect then, the covert head Person *is* the null predicate with which the kin-term is conflated before assigning its theta-role. Person can be legitimately called a relational predicate because its basic

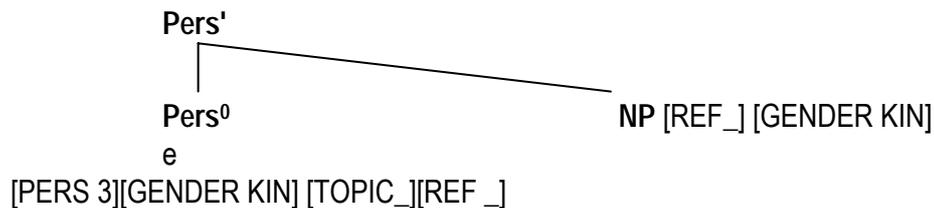
function is to assert a relationship between a specific referent and the speech-context. A kin-term complement simply provides semantic content that helps identify the specific referent.

Since Person must select the kin-term before the pronoun does, it must be the better match for N. The Pronoun and N share the REF feature, so Person must express REF too, *and* an additional feature that N expresses and Pron does not. This can *only* be GENDER.

N must remain active after merging with Person, because it must license the merger of the affine argument; the only other noun that can take a nominal argument directly is a locative noun. This means the REF feature of PERSON must be *unvalued*. It is on this basis that we can say that Person is *not* the head which contributes a 'REF INDEF' value (see discussion of Mass above). Person entails only *specificity*, by way of its valued PERSON feature.

Though Person has an *unvalued* REF feature it must also have *another* unvalued feature, because on occasion it selects ClassP as its complement, and Class can value REF (as attested by the fact that it is strong and must fully value N). If Person did not have an additional unvalued F, the classifier would deactivate it before it could merge with a predicate. Minimally this unvalued F is TOPIC, as proposed above.

In the affine structure then, Person and NP will merge before the pronoun is merged, and we will have the structure as follows:



Numeration: {Pron [REF DEF][PERS {1/2/3}] [CASE /TOPIC _], D, Poss}

Fig. 35 'Possessed NP' in Affine structure

Now, the Pronoun must be theta-marked, but if it is merged as specifier of PersonP, it will value that head's REF feature with a DEF value. PersonP would then be *definite*, but still activated by TOPIC, not by Case. This Topic feature would be valued in VP and the affine structure, headed by PersonP, would be stranded in post-V position. Since this distribution is not attested, we conclude that PersonP does not inherit its Ref value from a Pronominal possessor, and the affine structure is activated by Case, not by TOPIC. This means, PersonP must inherit its DEF value from D. The question is: what prevents it from inheriting a REF value from Pron?

Basically, the only explanation is that the [REF DEF] feature of Pron is already invisible when the possessor argument is merged. In other words, the numeration must contain another head, that is a better match for Pron than PersonP is, and which selects and deactivates Pron *before it* merges with PersonP. This is the Genitive Case deleter.

Genitive Case deletion

This head can be 'identified' by considering what feature activates Pron, and needs to be valued to make it invisible. Recall that since Person is covert, it cannot simply make Pron invisible by being strong, it must value the last feature(s) of Pron⁴⁰. The feature activating Pron is either Case, or TOPIC. Recall that Pron, DemP and definite 'bare NP' are all obligatorily extracted from the complement of an intransitive verb, indicating that all include a Case feature, yet DemP and Pron, but *not* definite 'bare NP' can remain in complement of a transitive verb. To account for this, it was proposed (see Appendix H) that DemP and Pron do not express Case as part of their inalienable lexical F-structure, but will attract D, which *does* express Case, when D is in the numeration. Thus extracted pronominal and DemP arguments are actually DPs, and unextracted counterparts are not.

The conventional assumption is that a possessor expresses Case, which is deleted as a reflex of agreement with a *nominal* head giving rise to a *Genitive* reflex. Suppose this applies in Mandarin, even though there is no overt Case. Then the pronominal 'possessor' in the affine structure is really a DP; D has selected and merged with Pron. If, as Chomsky proposes, Case deletion is a reflex of the valuation of ϕ -features, and crucially of PERSON, then a covert head must select this Pronominal DP and delete its Case, inheriting its PERSON value as it does so. Clearly this covert head cannot be the matrix D that carries the Person value of the affine structure as a whole and enters agreement with the predicate; if it were, the affine structure would have the Person value of the pronominal 'possessor' and not that associated with the 'possessed' N.

The genitive case deleter must therefore be a covert head distinct from D, and located *within* the 'possessor' constituent⁴¹. I label this covert genitive case deleter 'Poss'.

Identity and Features of the Genitive case assigner , Poss

Just as D cannot delete Case because it must inherit a PERSON value that is passed on to a predicate outside DP, so Poss cannot possibly express unvalued Case because it does *not*, apparently, transfer a PERSON feature anywhere. Ideally it is deactivated immediately after deleting the possessor's Case, at the very point at which it merges with the 'possessed' PersonP. Given this, Poss must express a combination of features that *first* attracts the pronominal DP 'possessor', and *only then* attracts the kin-denoting PersonP. The first relationship must deactivate Pron, but *not* Poss, so that PossP and PersonP can be integrated next. This means Poss must express an unvalued feature, that a Pronoun (and D) cannot value (recall that *only* Pronouns can appear as arguments in this structure). The obvious choice then is GENDER: the only feature expressed by N but *not* by a Pronoun. Not only will unvalued

⁴⁰ This is a consequence of the definition of the periphery of a phrase in terms of its *phonological* left edge (Chomsky, 1999).

⁴¹ Several alternative analyses were attempted - such as relying on the better match between two tokens of D, than that between an embedded PersonP and the predicate - but all led to more complex deviations or more departures from standard assumptions to account for recursive possessives - such as different reflexes of Case linked to the valuing of different ϕ -features; partial valuation of a predicate by different heads; one Case value being *shared* by several heads; other unidentifiable

GENDER keep Poss active after it merges with Pron, it will also *necessarily* attract the possessed N or kin-term, since N is the *only* source for a GENDER value. The GENDER value of N will still be visible in PersonP, because Person, and therefore N is unvalued for REF.

The derivation then is that the Pronominal DP attracts Poss and N attracts the functional head Person; then PossP is merged as the specifier of PersonP, and theta-marked as the argument of the kin-term.

One strength of this analysis is that it accounts for what is otherwise a perplexing characteristic of the affine structure: the constraint against a *lexical* ‘possessor’, i.e. one containing N. The minimal specific nominal containing N is PersonP; if PersonP were chosen as a specifier of Poss, instead of Pronominal DP, PersonP would value GENDER *and* PERSON on Poss, and PossP would be rendered invisible and fail to merge.

Now consider if Case deletion is *not* tied to valuation of ϕ -features, but simply deleted under match. Predicates still need to inherit at least one ϕ -feature, minimally PERSON, from at least one argument, minimally a complement, but not in order to delete Case, simply in order to converge. Even under these circumstances, Poss must still be distinct from D, because, as before, whatever deactivates the Pronoun possessor must do so *before* that Pronoun can enter agreement with the possessed N. If the case deleter were D, then, again, D would inherit a PERSON value from the possessor, and transfer it to V or T. A distinct Poss on the other hand, would simply *not* express PERSON. It would only need to express [CASE GEN], to deactivate Pron, and [GENDER_] to attract it to PersonP. The unacceptability of non-pronominal possessors still falls out of this analysis, and since it is simpler than the first option, requiring no special stipulations, it is to be preferred.

On the other hand, if the Pronoun were activated only by *TOPIC*, and not by Case, then some head other than the main predicate would need to *value* TOPIC ([-]), otherwise the Person feature of Pron would also remain visible. A TOPIC feature on Poss, combined with its [GENDER _], would make it more strongly attracted to PersonP, than to Pron, and when it merged with PersonP, both would be immediately deactivated.

The simplest workable scenario then, is that Poss expresses [GENDER_] and deletes Case on the Pronominal DP under a straightforward match. To value its GENDER feature, PossP is then merged in the specifier of PersonP, and deactivated. PersonP is still activated by TOPIC *and* by unvalued REF.

Insertion of D to value REF introduces Case to the entire structure forcing its movement out of VP.

DE: a predicate of locatability

Given the role of Poss in insulating a 'head' noun from the ϕ -features of its specifier, it is clear why Genitive Case is associated not just with semantically possessive structures, but with any nominal structure that embeds another nominal. This includes de-constructions, the next complex structure to emerge after affine structures. This structure reveals more about features of D and features of de.

Recall that the de-construction consists of the particle de separating two nominals and that for convenience these nominals are referred to as 'NP1' and 'NP2'. Prosodic evidence indicates that NP1 and de form the periphery of a phase: in some cases, the final N is omitted, retrievable only from context, or the two can recur, e.g. [[wǒde] māma de] bàba (1sg de mother de father), or a pause can appear between de and NP2, e.g. [wǒde] a [liǎngge sānjiǎoxìng] (1 sg de ah two triangles) (S6), however NP2 does not ever *precede* NP1. This indicates that de is a head and NP1 a specifier, but that their phase is not necessarily strong (and see Appendix K for semantic and syntactic arguments that lead to the same conclusion).

The de-construction differs from the affine structure in three ways. Firstly it permits a greater range of specifiers; NP1 manifests overtly, not just as a pronoun, but also as a definite 'bare' NP, a place name, an affine structure, another de-construction or, eventually, a Demonstrative Phrase. These are illustrated at (168a) to (e), respectively. Secondly, the NP2 in a de-construction cannot always license the affine structure (see (169)); and thirdly it expresses a greater range of thematic relationships, including partitive (168b) and loose associative relations ((168d) and (e)).

- 168) a. māma de māma
mother de mother
Mum's mum (K1)
- b. Saudi de Jeddah
Saudi de Jeddah
Jeddah in Saudi (H1)
- c. [wǒ màma] de bàba
1sg mother de father
My mum's dad (K1)
- d. wǒde huà de rén
my picture de person
The person in my picture (H4)
- e. nèige huà de sānjiǎoxìng
that.Class picture de triangle
The triangle in that picture (H5)

- 169) a. *māma māma
mother mother
- b. *Saudi Jeddah
Saudi Jeddah

- c. *wǒ māma bàba
1sg mother father

Though the possessors in the de-construction are more variable in form, they are still generally *definite* nominals. This indicates the presence of the definite head D. The 'possessor' must generally contain a DP, activated by Case. The Case-deleting head Poss must be present as it is in the affine structure: assuming de transfers or permits to be transferred, the ϕ -features that value the main predicate, it must not enter agreement with the ϕ -features of the 'possessor'. The simplest account is that Poss blocks the transfer of these features in the de-construction, as it does in the affine structure, by valuing the possessor for Case, while *failing* to inherit any PERSON value.

The features of D and De

However, a definite DP, unlike a pronoun, also includes the covert *head* Person, activated by unvalued TOPIC, and expressing a GENDER feature. The possessor DP's TOPIC feature must be valued before the possessor can merge with de, or its ϕ -features will still percolate up to the main predicate. However, Poss must not enter agreement with the GENDER feature of the 'possessor' PersonP. If it did Poss would be deactivated prematurely. It is essential in this system then, that D value TOPIC as well as REF, *and* that D *not* express GENDER. This confirms the conclusion arrived at by a comparison of the meanings retrievable from pronominal arguments that GENDER is *not* a ϕ -feature of Mandarin V.

Also as mentioned in the discussion of extraction in Appendix H, the presence of a TOPIC feature on D makes for a stronger attraction between DP and a predicate (or any other functional head that expresses TOPIC). Assuming then, that D *is* inherently valued for TOPIC, Poss need not be. The lack of any TOPIC feature on Poss effectively draws a barrier between topicality within PossP, and topicality at higher levels. This is entirely desirable: in practice, the single argument of Poss is *never* topical at the sentential level.

There was just one instance in the IL database, where a possessor argument was arguably generic rather than definite. The speaker described a photograph as containing a gòngyuán de lù (park de road) 'park road'. Since the speaker had no actual knowledge of the road's location, and in fact, it was not in a park, the specifier gòngyuán was arguably generic, used to characterise the *type* of road, rather than referential, used to denote a *specific* location. Generic NP is bare NP and does not express TOPIC, so here, de can simply select and value *two* NPs directly, one as a complement, the other as a specifier. There is no need for Poss or D in this structure, and no Case is involved.

De, of course, must attract its complement, before it attracts its specifier, so the two arguments in a de-construction must be distinct in some regard. Moreover, NP2 is never extracted from its complement, so it must be fully valued there. This suggests that de is either weak, or a REF value is available within deP. Most simply, this is contributed by de itself. Given its function of locating an

otherwise unlocatable referent, by introducing a modifier, it follows that *de* should exclude already definite complements, and since it cannot *interpret* the value of its complement, it follows that it must *ensure* its value by assigning it itself. In pragmatic terms, *de* values NP2 [DEF], because once *de*P closes, NP2 *has been made* locatable. Since *de* deactivates NP2, and sometimes follows a classifier that agrees with NP2, the feature GENDER that deactivates Poss, and values Class must be copied to *de* from N. Therefore *de*, unlike D, expresses [GENDER_] ⁴². Assuming a PERSON value is essential to a predicate, *de* must also express an inherent [PERSON 3] value, (1st and 2nd Person referents are generally expressed as Pron, not as nominals containing *de*), or else inherit this from its complement (which in some cases can be more complex than a bare NP) or attract PersonP after PossP has merged.

Like any transitive predicate, *de* must remain active after the merger of its second argument 'NP1' (in fact PossP), but cannot be activated by Case or by any feature valued on its arguments, i.e. GENDER, or PERSON. *De* itself includes a *valued* REF feature, so TOPIC is the only possible activator of *de*P. Though I argued in Appendix H that a *verbal* predicate *generally* has a valued TOPIC feature, *de* clearly attracts a different kind of complement from that of a verb: a bare NP. It can do this most simply by the features REF and [GENDER_]. It is this that makes *de* active within *nominal* rather than sentential syntax.

Once thematically exhausted *de*'s phrase will function only as an argument; it is therefore appropriate that it should remain activated by unvalued TOPIC, so it will then be attracted to a *verbal* predicate. (However, it could also be attracted to the unvalued TOPIC of another *de*, hence constructing recursive *de*-constructions).

Mass: the functional head that constructs "AdjP"

'Adjectives' are distinguished by their collocation with a degree adverb such as *hěn* 'very' or *zhēn* 'truly' to form 'AdjP'. The earliest 'Adjectives' to emerge were ones denoting size and non-numeric quantities, the two being initially indistinguishable on the basis of distribution. In recent analyses (see for example Cinque, 1999) a modified item is seen as the complement of a functional head and a modifier, like the adverb, is the specifier of that head. If this is correct then the ILs at this stage included a functional head that was strongly attracted to words denoting gradable concepts, so it selected one of these as its complement, and somewhat less strongly attracted to degree adverbs, so it selected them as its specifier.

The feature that attracts Adj and adverbs to this head can be determined by reference to the kind of meanings all AdjPs shared in the ILs. As just mentioned, the first 'Adjectives' to emerge were words denoting size, and non-numeric quantifiers, which unlike numeric quantifiers collocated directly with N and did not collocate with Class, or with numbers. This suggests that they did not express GENDER, COUNT, REF or NUMBER, any of which might attract them to Class and/or Numbers. It is also

⁴² Here we see further evidence that *de* is *not* the head of D as Simpson (2001) suggests; see Appendices A and G.

significant that adjectival modifiers initially occurred only in indefinite constituents. In other words, non-numeric quantifiers render a nominal indefinite, even though they don't express the quantity features that relate to individuated tokens like COUNT and NUMBER. The indefinite value must be associated with a different quantity feature associated with any entity that has a physical manifestation. I call this feature [MASS]. Thus the feature [MASS] is associated with indefiniteness and also serves to distinguish non-numeric quantifiers and size-denoting Adj on the one hand from numbers on the other.

Like Person, the head that introduces this feature [MASS] is named after the feature: Mass. In short, Mass is a covert functional head, that attracts quantity-denoting words. In Hale and Keyser's terms it is also potentially, an abstract predicate that allows Adj and non-numeric quantifiers to function as syntactic predicates, something Numbers cannot do, by selecting them as lexical complements.

The degree adverb on the other hand is athematic, so its insertion must be licensed by an EPP feature, making Mass a strong head. Economy dictates that this strong head should be omitted when no adverb is in the numeration. This is because inclusion of the EPP feature would force the costly and vacuous movement of Adj from the complement to the specifier of MassP. In other words, 'AdjP' is actually MassP; Adj with no adverb is, most simply, lexical Adj with no functional head.

A head that combines 'AdjP' and N

In both TL and IL Mandarin, adjectival modifiers, whether bare Adj or MassP, always precede the noun they modify. Under the LCA this indicates that the two items are one of the following: a) a specifier and head; b) a head and complement; or c) a specifier and a complement. However, a) can be ruled out because in the MP, only predicates and functional heads project specifier positions, and the modified nouns in question are not predicates. At the same time, b) can be ruled out precisely because the noun is *modified* by the AdjP, and is not its argument. Thus the attested order can only arise through option c): one or more covert predicates or functional heads selects the modified nominal as a complement and the modifying Adj or MassP as a specifier. This means there must be a functional head that is maximally matched with the nominal constituent, and slightly less well-matched to a constituent containing Adj or MassP. For the moment, let's call this head X.

In a minimalist account, the only thing that can prevent Adj from merging directly with an entity-denoting nominal, is Adj's lack of any feature expressed by such nominals: minimally, REF, GENDER and PERSON. To forge a connection between an entity-denoting nominal and Adj, some head X must express one of these, along with some feature that Adj *does* express, minimally, MASS. As discussed above, the head Mass expresses MASS and REF, but both are interpretable F. It must also express another F to make it visible. If this were GENDER, to would be intractably attracted to N because each could fully value the other, but then neither would be visible to enter further mergers. On the other hand, as an abstract predicate (of quantity), Mass is likely to express unvalued PERSON, the

basic ϕ -feature that attracts entity-denoting nominals to predicates so they can be theta-marked. If Mass expresses unvalued PERSON, it will attract PersonP rather than N (which does not express PERSON), value the REF feature of PERSON and N simultaneously, and create an indefinite 'NP' as required. In this way the involvement of Mass accounts neatly for the functional association between modification and indefiniteness.

At the same time, since the function of modification is to locate a *specific* instance of an entity, and PersonP is the minimal specific entity-denoting nominal, Person *is* the obvious head to select Adj or MassP as a specifier (and see Appendix IL C-structures for more explicit arguments in favour of this analysis) and link it to otherwise generic NP.

Since Mass is a covert predicate associated with quantity, it may also be activated by unvalued TOPIC, the feature that I have suggested is unvalued on *lexical* predicates of quantity- in the TL, and motivates the occurrence of indefinite Subjects. Expression of unvalued TOPIC would make Mass a better match for specific PersonP than for generic NP, and would also attract MassP to sentential heads, which can value TOPIC, when a predicate fails to do so. As long as MassP is never the complement of a strong overt head like Class, which cannot value Topic, MassP's TOPIC feature can be valued when the nominal as a whole is merged with V.

However, some IL utterances include definite de-constructions (which are DPs) with indefinite specifiers (which are MassPs). The ILs include no overt predicates of quantity and provide no evidence for the regular extraction of indefinite arguments from VP. Further research is required, with a larger database of indefinite nominals, to firmly establish the identity of the feature that keeps Mass active in IL Mandarin.

De in modification with AdjP

Much as a Possessive de-construction allows a greater range of specifiers than the affine structure does, so too, the Mod de-construction clearly involves a functional head that is less semantically restricted in its choice of complement (Adj) than the covert head Mass. The Mod de-construction includes such structures as *hěn dàde um mén dàde shān* 'very big de gate, big de mountain' (K5), but also includes colour terms, and attributes such as *jiù*, 'old' *xīn* 'new' *piàoliang* 'handsome' etc, and marginally, *sentential* modifiers (Rel clause) which did not appear in IL bare AdjP structures at all. However, the elaboration *within* the non-nominal modifier does not affect the basic deP structure proposed above, and is beyond the scope of this thesis, so that development is not discussed further here.

Conjunctions

At around the same time that the de structures appeared, nominal conjunctions also began to emerge. The earliest instances were a formulaic structure: a series of quantified kin-terms followed by the nominal conjunction *hé* 'and', then the pronoun *wǒ* (1st person). This nominal conjunction was clearly distinct from a verbal and sentential conjunction, *yě* 'also', except in Sam's IL. Since *hé* can

combine any two nominals of comparable structure, including definite DPs and DemPs, it is most probably distinguished from *yě* by expression of (unvalued) REF, a feature expressed at every nominal level from N to D, but *not* by V. The ConjP as a whole inherits the Person value of its complement, so it must express unvalued PERSON, but equally this is always valued by the complement, which is generally pronominal. Since DP or DemP complements would also immediately value REF, *hé* must express some other feature that its arguments cannot value. This can only be one of the features that is valued by a predicate or a sentential head, rather than a nominal: CASE or TOPIC: this aspect of structure remains somewhat indeterminate, given the limited IL data available.

D and 'little pro'

The analysis of N and its immediate collocates, Class, Num, and optional modifiers, has revealed more about the nature of the uppermost levels of Nominal structure, associated with definiteness. However some aspects remain unclear because they depend on a more thorough analysis of verbal and sentential feature structure, which is beyond the scope of this thesis, or because the IL data provides too few distributional contrasts to allow firm conclusions to be drawn.

D is covert, definite, [REF DEF] and activated by Case; it expresses valued TOPIC, or some other feature unvalued on Mass, and it expresses PERSON, if this is necessary, either for Case deletion, or to value a predicate. If necessary, it inherits the value for PERSON through agreement with the covert head Person. Given this, the null pronoun, *pro* is almost identical to D.

Little *pro* is also always definite, and always topical, so like DP it must be activated by Case. Moreover it must express PERSON, because the value is retrievable at LF. However, it may either express a variably valued PERSON feature, or it may be initially unvalued and attract the *head*, Person. If the latter, then *pro* must also value GENDER, and this then provides an account of the use of a classifier without an overt noun: *pro* can substitute for the overt noun and value Class for GENDER. This makes *pro* minimally distinct from D, which must *not* express GENDER (for reasons relating to the deletion of Genitive case).

Demonstrative pronouns and demonstrative determiners

The early ILs include demonstrative pronouns *zhè / nà* *this / that*, but their frequency is so low that their distribution is not significantly different from that of personal pronouns. Nonetheless, demonstrative pronouns do not occur as an affine argument in 'bare Poss', or take the suffix *-men*, as personal pronouns do. The former can be explained simply if the demonstrative *pronoun* expresses (unvalued) GENDER. Recall that GENDER deactivates Poss, the genitive Case assigner, before it can merge with a possessed N or PersonP. The latter can be explained in the ILs, by simply omitting *-men* as a lexical inflection of the demonstrative pronoun.

A Demonstrative pronoun can only be interpreted as [PERSON (3rd)]; this may also arise as an entailment of the specification of distance *from* the speech context, implying that the referents identified

by way of demonstratives are not part of that context, i.e. not 1st or 2nd Person. There are no significant distributional or semantic contrasts in the ILs between the two forms of Dem, zhè and nà so rather than a feature [FAR ±], I use the feature label [LOC +] for both. The [REF DEF] value is entailed by this locative feature: the speaker assumes the listener can locate the referent from a relatively vague indication of location. This places the referent within the pragmatic pre-supposition.

Demonstrative 'Determiner'

The Dem-Class-N structure, which emerged at T4, was the first in which Dem accompanied a Noun and also the first in which a classifier appeared *without* a number. The absence of Dem from early definite nominals containing N suggests that either Dem needs some value that N (and/or PersonP) cannot generally supply, and/or it expresses semantic content that is superfluous to the production of a definite nominal, so that its omission is generally preferred. In fact, both appear to be true. Clearly the key semantic difference between Dem and the only definite alternative, D is the deictic content of the former. If a referent is so topical and unambiguous that it can be located *without* deixis, then covert D provides sufficient content to locate it. The presence of D is evident because it leads to the nominal being merged as a specifier rather than a complement (see Appendix H). If deixis *is* required, then there must be a specific *token* of a type that needs to be located. The feature that indicates token-hood in this system is COUNT; a feature which only classifiers and some exceptional nouns can value. Since the demonstrative determiner collocates directly with these nouns and otherwise with classifiers, we can conclude that it must express unvalued COUNT.

Therefore Dem the determiner, which appeared in the ILs only at T4, must be understood as a distinct lexical item from pronominal Dem, which appeared at T2. Clearly a demonstrative *pronoun* does not express COUNT, since it occurs without classifiers.

There is also evidence from locative structures, that Dem the determiner, unlike pronominal Dem, does not express GENDER. In locative structures as at (170), a locative predicate ĭ selects a 'bare' NP complement qìchē in preference to a Dem-Class-N constituent zhège lánzi which is merged later.

170) tā fàng zhè.ge lánzi qìchē.ĭ
 3sg put dem.Class basket car.in
 He put this basket the car (H5/12)

This suggests that the determiner Dem is not as good a match for the features of the locative ĭ as N or PersonP. Since all express the feature REF, the difference must relate to the other feature shared by N and Person: GENDER. In other words Determiner Dem like D does not express GENDER. However, a DemP *contains* a classifier, which *does* express GENDER, so ClassP must be fully valued within DemP, making it invisible. ClassP requires a TOPIC value, but Dem appears to be unvalued for TOPIC: something keeps it active after merger with ClassP, but unlike DP, DemP arguments are not necessarily extracted from VP, so it is not activated by Case. Assuming DemP is activated by unvalued

TOPIC, it must be weak, allowing ClassP to be valued without movement. When DemP is extracted from VP, it must be because D is present in the numeration: since D is valued for TOPIC, and D and Dem both express REF, D will attract and deactivate DemP, projecting to form a DP with DemP as its complement.

Thus, Determiner Dem includes unvalued COUNT, unvalued TOPIC but no GENDER or Case, while pronominal Dem includes valued GENDER and unvalued Case, but no COUNT. These structural difference between pronominal Dem and determiner Dem helps explain why nominals involving a Dem-Class collocation appear only at the end of year one, (T4-5), even though both Dem and Class are present independently in the learners' ILs almost from the start. In short, the late emergence of the Dem-Class-N structure may be related more to the processes by which features are allocated to lexical items, than to processing demands *per se*.

As to the first occurrence of Class without a Number in the Dem-Class-N structure, we can hypothesise that early IL classifiers had an unvalued Q-feature that only Numbers could value i.e. NUMBER or MASS. Effectively, this accounts also for their behaving like suffixes of Num. If demonstrative Dem also expressed this F, either [NUMBER SG] or [MASS -], this would naturally attract and value Class without the involvement of Num. In support of the idea that TL Dem and Class each express a quantity feature, is the fact that a Class-N sequence and a Dem-Class sequence are each interpreted as singular in the TL even though no number is present. The presence of an unvalued Q-feature on IL Class would also explain why the learners still do not use bare ClassP, a legitimate TL structure missing from the IL data entirely. Ultimately though, to reach the TL state, the IL classifier must cease to be *dependent* on Num or Dem. It will still attract both, if they are in the numeration, as long as they both express unvalued COUNT.

The Ordinal Marker

Like demonstrative structures, Ordinal numbers, *dì-Num* are also definite. The ordinal locates a specific token of a type by reference to its location in a sequence of tokens. In the TL, an ordinal is not generally used for non-specific reference as in English: the first(person) to arrive will win the prize. Instead, in circumstances like this, the adverb *xīān* 'initially' would be used in a verbal construction with a pro Subject or an indefinite pronominal, as in (shéi) *xīān lái xīān chī* '(whoever) comes first, eats first'. Since ordinals are *always* definite, the simplest assumption is that they express REF DEF themselves.

In the ILs, ordinals generally occur with no classifier, as in *zhège huà shì dì yī* 'this picture is the first'. Since Num requires a COUNT value, the IL ordinal must express interpretable COUNT, and since the ordinal cannot occur without a number, it must also express an unvalued Q-feature supplied by Num, most simply NUMBER itself. This effectively excludes the ordinal marker from occurring with non-numeric quantifiers, which is desirable as that combination is unattested. Num also introduces unvalued PERSON, so either the ordinal is optionally valued for PERSON, or the covert head Person is involved. If *dì* has interpretable PERSON, it must be activated by some other feature so it will remain

visible to V, minimally TOPIC. (In the TL, ordinals seem to be activated by Case, as they cannot remain in the complement of an intransitive verb. Thus, either D is also involved or the ordinal simply expresses optionally valued PERSON and is activated by Case. Since the latter allows immediate spell-out of Num in the complement of *dì*, it is to be preferred.)

Locative Nouns

The locative *shàng* appeared first as a Preposition ‘on’, a lexical type beyond the scope of this study. Later, (at T4), *shàng*, *biān* and *lǐ* began to be used as nouns, ‘top’, ‘side’ and ‘inside’ respectively, in structures with the order: (theme)-locus-locative.

- 171) a. yǒu sìge rén zài qìchē.lǐ qù gòngyuán
 have four CL person at car.in go park
 theme locus locative
 There are four people in a car (lit.: at the inside of a car) going to the park (H5)
- b. tā fàng zhè.ge lánzi qìchē.lǐ
 3sg put dem.class basket car.in
 theme locus.locative
 He put this basket in the car(H5)

These locative nouns can have a referential value different from that of the noun they follow. For example, in (171a), *qìchē* is indefinite, but the locative *lǐ* is definite: there can be only one ‘inside’ for any one referent. Locatives like *biān* ‘side’ can be definite or indefinite, regardless of the value of the locus-denoting noun. Since the referential values of locatives and their locus-denoting argument vary independently, the argument must be valued for REF, by merger with covert D or Mass, before it merges with the locative predicate. In most cases the locative must do the same before it merges with the locus-denoting argument. This makes sense: since neither could value the REF feature of the other, each would be more strongly attracted to a functional head that can. This also accounts for the argument-predicate order, which suggests the predicate is merged as the complement of a functional head before assigning its thematic role.

Since *lǐ* appears to be *inherently* definite, and 3rd person, it must be activated by some unvalued feature other than REF or PERSON. As a noun it must express valued GENDER if it is to attract and deactivate Person or the genitive case deleter Poss. It sometimes has a definite locus argument which requires CASE, so *lǐ* must either express valued GENDER and attract Poss, or express valued CASE itself. This leaves TOPIC as the most likely unvalued feature to activate *lǐ*.

The other locative predicates are essentially the same except for their unvalued REF: they must attract Mass or D at some stage in the derivation of the nominal structure as a whole. (See Appendix H.)

This feature-structure makes the nominal predicates clearly distinct from verbal predicates which have valued TOPIC, unvalued PERSON and no REF feature. They also differ from other nouns which have no PERSON or TOPIC features.

Complex numeric expressions: a TOPIC feature for the Classifier

Num-Class DEP N

At T4-5, existing elements began to appear in new collocations. First, de-marked modifiers began to collocate with a Numeric expression:

- 172) yī jiān huángsède jiākè
 one.class yellow.coloured jacket

This is the first IL structure in which it becomes clear that the classifier remains active after entering agreement with a valued PERSON feature. This conclusion stems from the analysis of the de-construction as one where de selects PersonP as its complement, then the AdjP huángse ‘yellow’ (or sometimes a MassP) as its specifier. All elements within deP are visible to Class, i.e. still in the computational mechanism. Class is attracted to deP because it requires GENDER and PERSON values, both of which are visible in PersonP, the complement of de. Since Class is strong and must project *twice* to delete its EPP feature, and because de is thematically saturated, it must be Class that projects and deP must be merged as the complement of CLASS. After merging with deP, Class must be kept activated to select Number as its specifier, deleting its EPP feature. Class must also remain active after merging Number. Since Class has inherent REF and COUNT, has inherited PERSON, and GENDER values from deP and NUMBER from NumP, and it cannot express CASE (because it is restricted to post-verbal position), the unvalued feature of Class must be TOPIC.

That same unvalued feature is now expressed on PersonP, deP, MassP and Class, making all of them, and all their features visible within the current phase. While Class and MassP, being in the periphery, are both visible *outside their phase*, items in the complement of ClassP are not, because Class is both strong and overt. Unless they move to the periphery of a strong head, they can only enter agreement with Class or MassP. This means a TOPIC value will not become available to these items, until ClassP itself is merged as the argument of V (or some other head that values TOPIC, such as D). Recall also that the complement of the *previous* strong head will spell out as soon as ClassP is selected by any other head. This means PersonP, the complement of de, will remain in the derivation long enough to inherit a TOPIC value from the classifier only if de *is weak*.

The emergence of the combined numeric and modifying structures provides the first direct evidence of a weak head, indicating the capacity to store more syntactic information in the mechanism than was previously the case.

Dem-Num-Class N.

By the same token, we must conclude also that determiner Dem is weak, since at about this time it begins to select the ClassP, with an unvalued Topic feature as its complement. In this case it is Dem that enters agreement with V, not Class. If Dem were strong, ClassP's complement would need to move to spec DemP in order to value TOPIC. Such movement is unattested in the ILs. (In the TLs it is

possible but not obligatory, indicating the optional involvement of a covert strong head). As Dem's phase is weak, Dem-Num incorporation, where it occurs, must be purely prosodic incorporation, or head-complement conflation, not associated with syntactic movement. This is consistent with the stable word order: Dem-Num, rather than a change in order to Num-Dem which the LCA predicts in cases of movement.

Note that if either Person or Class were activated by Case instead of TOPIC, and if Case deletion were linked to valuation of the predicate's ϕ -features, then Person and Class could not 'get' Case, because it is Dem that provides the ϕ -features to V in this structure. One covert Case deleter would be required for each of these heads. The simpler analysis is therefore that Person, Class and Dem are all activated by TOPIC alone, as I have argued, and definite arguments are activated by Case only when selected by D (which also values TOPIC). Extraction of DemP from VP indicates the inclusion of covert D in the nominal structure, introducing case, while the retention of DemP in VP indicates the absence of D.

Complex Ordinals

Finally at this stage, ordinal expressions begin to combine with possessives, which reveals a little more about their structure. As mentioned above, an ordinal marker makes a numeric expression definite, so it has inherent [REF DEF].

173) wǒde dìèr huà
 1sg.de di-two picture
 My second picture

Since the ordinal marker can only appear with Numbers, and in the ILs, Classifiers are not generally used in this structure, we can conclude that IL ordinals express inherent [COUNT +] themselves. To then combine with a possessive *de*, they must remain activated by some feature, not valued on their complement: TOPIC or PERSON. PersonP can select the modified N as a complement then select *dì*P as its specifier.

Conclusions

Lexical F-structures and Lexical types

This Appendix has presented a thorough analysis of the feature-structures necessary and sufficient to account for the productive output of the three learners, in the nominal domain. The methodology was based on general minimalist principles constraining the way in which features and words in a derivation can and cannot interact. The results of the analysis are summarised in Table 77 below. Table 78 then shows how the lexical F-structures shown on Table 77 fall into a continuum reflecting the relative strengths of the attractions between feature-clusters, thereby creating lexical types.

The features on the left hand side of Table 78 are most common and contribute to the general attractiveness of nominal elements to each other; those on the right-hand side are less common and contribute to differential selections among nominal heads. Almost all the lexical items express PERSON *and* REF. Only common nouns and the classifier do not express PERSON, and only predicates and functional case deleting heads do not express REF. Collocation restrictions depend generally on the distribution and status of the features Topic, Gender, Case and Count. Note that lexical types at either extreme, generic N and functional *v*, have fewer nominal features and fewer shared features than those in the centre. Thus the central types are necessary to bring the peripheral types into syntactic relationship.

This is precisely the kind of lexicon that I suggested (in Chapter Seven and in Appendix I) would be necessary to implement a relatively stable system of hierarchical levels in syntactic structure.

Table 77. The Feature-structure of Nominal Lexemes in Mandarin ILs

Lexeme		Interpretable F	Uninterpretable F	Comments
Predicates	Verbs	[θ-FEATURE(s); TOPIC -]	[PERSON _ ; S* _]	S* = features that keep predicates active after φ-features are valued.
	v	[CASE ACC; TOPIC -]	[PERSON _ ; S* _ ; θ _]	
Predicate Nouns	Kin-terms	[θ Kin; TOPIC -; GENDER Δ]	[PERSON _ ; S* _]	
	Locative N	[θ locus, theme; GENDER Δ]	[PERSON _ ; REF _ ; TOPIC _]	Some locative nouns like ǐ have interpretable REF
Referential N	Generic N	[GENDER Δ]	[REF _]	
	Exceptional N	[GENDER Δ; COUNT +]	[REF _]	Require no classifier in Numeric quantification
	Pronouns	[PERSON{1/2/3}; REF DEF; NUM {SG/PL}]	[CASE]	The null pronoun expresses the first three features, but lacks the [MASS] feature (it is not inflected with -men]
<i>Demonstrative pron</i>		[REF DEF; DEIXIS +; LOC+; PERSON 3 ; GENDER β]	[CASE _]	The demonstrative pronoun is typically a Subject, hence activated by Case and extracted from VP.
Numbers	yī 'one'	[NUMBER SG; (REF INDEF)]	[COUNT _] and [PERSON _], or [TOPIC _] or [CASE]	the alternatives relate to different stages of acquisition:
	'plural' num and jǐ 'some'	[NUMBER PL; (REF INDEF)]	[COUNT _] and [PERSON _] or [TOPIC _] or [CASE]	Numbers express indefiniteness at least till the emergence of the ordinal marker.
<i>Classifier</i>		[COUNT +; REF 0]	[GENDER _] and [TOPIC _]	Class is strong
<i>Demonstrative det</i>		[REF DEF; DEIXIS +; LOC+; PERSON 3]	[COUNT _; TOPIC _]	Unvalued COUNT is associated with the demonstrative that selects (numeric) ClassP, not with the pronominal demonstrative. Dem is weak; its incorporation with Num is phonological, not syntactic. DemP may remain within VP, and so it is activated only by TOPIC, which V can value
Bound morphs	de	[REF INDEF]	[TOPIC _ ; PERSON _ ; GENDER _]	a weak functional predicate
	dǐ	[REF DEF; COUNT +; PERS 1/2/3]	[NUM _; CASE _]	ordinal prefix
	-men	[NUM PL]	A lexical suffix, it is not syntactically active in the ILs	
Covert heads	Person	[PERS 1/ 2 / 3]	[GENDER _ ; REF _ ; TOPIC _]	Person is strong.
	Poss	[CASE GEN; TOPIC -]	[PERSON _ ; GENDER _]	The function of Poss is to deactivate all PERSON features of embedded arguments so that only the 'possessed' N enters agreement with the predicate that theta-marks the entire nominal.
	Mass	[MASS ±; REF INDEF]	[PERSON _ ; (TOPIC _)]	covert Mass is involved in modification of N, and in indefinite 'bare' NP
	D	[REF DEF]	[PERSON _ ; CASE _]	D is weak. The lack of a Topic feature means predicates that don't value Topic, like zài 'at' can still select a DP argument.

Table 78. Distribution of Features across lexical types: a lexical continuum

v	[PERSON _]		[TOPIC -]		[CASE ACC]		[θ _;S* _]
Poss	[PERSON _]		[TOPIC -]	[GENDER _]	[CASE GEN]		
Verbs	[PERSON _]		[TOPIC -]				[θ-FEATURE(s);S* _]
Kin-terms	[PERSON _]		[TOPIC -]	[GENDER Δ]			[θ Kin; S* _]
Locative N	[PERSON _]	[REF _]	[TOPIC -]	[GENDER Δ]			[θ domain, theme;S* _]
Mass	[PERSON _]	[REF INDEF]	(TOPIC _)			[MASS ±]	
Numbers	[PERSON _]	[REF INDEF]	[TOPIC _]			[COUNT _]	[NUM {SG/PL}]
de	[PERSON _]	[REF INDEF]	[TOPIC _]	[GENDER _]			
Person	[PERS 1/ 2/ 3]	[REF _]	[TOPIC _]	[GENDER _]			
Demons Det	[PERSON 3]	[REF DEF]	[TOPIC _]			[COUNT _]	[DEIXIS +;LOC+]
Pronouns	[PERSON{1/2/3}]	[REF DEF]			[CASE _]		[NUM {SG/PL}]
đi	[PERSON{1/2/3}]	[REF DEF]			[CASE _]	[COUNT +]	[NUM _]
Demons Pron	[PERSON 3]	[REF DEF]		[GENDER Δ]	[CASE _]		[DEIXIS +;LOC+]
D	[PERSON _]	[REF DEF]			[CASE _]		
Class		[REF 0]	[TOPIC _]	[GENDER _]		[COUNT +]	
Exceptional N		[REF _]		[GENDER Δ]		[COUNT +]	
Generic N		[REF _]		[GENDER Δ]			

Appendix K:

IL constituent structures

Lexical nouns are type-denoting or generic but most predications typically involve arguments that are entity-denoting or referential. Thus, the only arguments that are arguably not syntactically derived are generic nouns, and Pronouns, which derive their inherent referential nature from deictic, rather than syntactic means. Even an ostensibly 'bare' referential NP is derived through merger of a lexical noun and at least one functional head. This appendix sets out the steps and results of the analysis of IL c-structures underlying the nominal constituents described in Chapter Five, based on the lexical feature-structures described in Chapter Seven and justified in detail in Appendix J. It starts with the simpler structures composed of just one *overt* lexeme, and proceeds through constituents of increasing morphological complexity.

'Bare' NPs

According to the assumptions of the MP, and the analysis of IL lexical structures discussed above, nouns must acquire a REF value and become associated with the PERSON feature before they can merge successfully with a predicate. Thus, both definite and indefinite 'bare NPs' must include the covert head Person. Since PersonP can collocate with either definite or indefinite overt items (Dem and Num respectively) its REF value must vary in agreement with them, so Person must have *unvalued* REF.

Despite its inability to value N's REF feature, Person expresses that feature as well as GENDER. This makes Person one of the two items in the IL lexicon most closely matched with N (the other being the classifier). As long as a numeration contains Person but no classifier, N will be attracted to the former, before any other head. The first step in formation of any referential 'bare' NP is therefore the selection of N by Person. Since Person has more unvalued F than N, Person projects (see Appendix H) and NP becomes its complement.

Since PersonP is still unvalued for REF, it must attract an additional head. In ostensibly bare indefinite 'NPs' this is the head, Mass. Mass is activated only by unvalued PERSON, and so is fully valued by merger with PersonP. It must therefore be Person that projects when these two merge, selecting Mass as its specifier. Both Person and N inherit a [REF INDEF] value as a consequence. Since Mass is not a thematic argument of Person or NP, Person must be a strong head. This is optimal for the selector of NP: it allows the now fully valued NP to spell out ASAP (at the close of the next strong phase).

As argued in Appendices H and J, indefinite 'NPs' generally remain within VP, so they must become fully valued when they enter agreement with V, or with a head outside a weak VP. For reasons explained in Appendix H, the premise adopted here is that the feature which attracts *all* nominals to V,

and the last feature to be valued on indefinite arguments is TOPIC. Case is expressed only by definite nominals and attracts them *out* of VP to be valued by T or some other sentential head, because V cannot value Case.

In short, indefinite 'NPs' are actually PersonP's activated only by TOPIC, not by Case. This gives indefinite 'bare' NP the structure shown in Fig. 36.

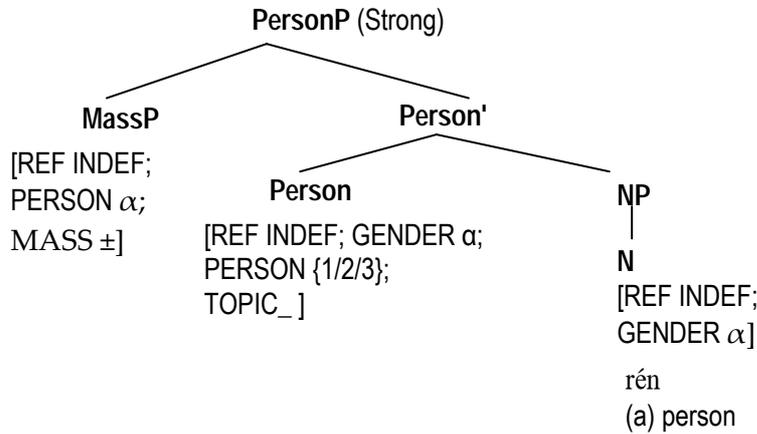


Fig. 36 Indefinite 'bare NP'

In *definite* bare NP, Mass is absent from the numeration, and definite D is present instead. D introduces Case and values the Noun's and Person's REF features. This time, D has more unvalued F, and so, ideally, *it* projects allowing strong PersonP to close and NP to spell out ASAP. Person's TOPIC feature can be valued by the predicate because even if D is strong, it is covert, and PersonP will not spell out till the close of a subsequent strong phase. The definite 'NP' is really a DP as shown in Fig. 37.

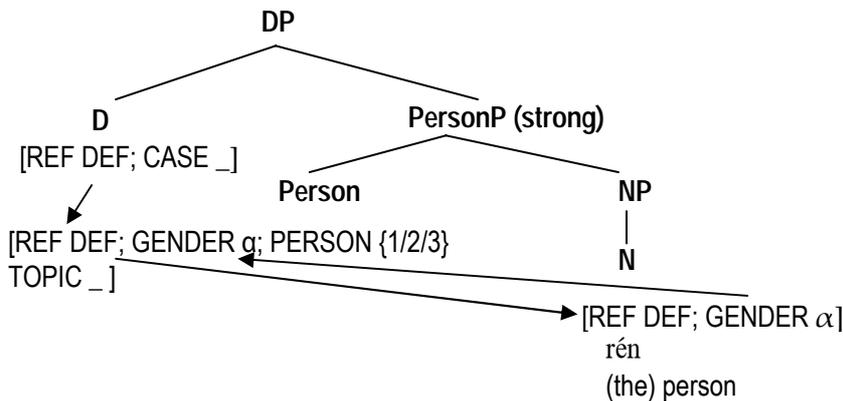


Fig. 37 Definite 'bare NP'

Early complex nominals

Other than 'one-word' nominals, the earliest structures to emerge in the ILs were the numeric expression Num-Class-N, which is always indefinite, and the affine structure, Pron-kin-term, which is always definite. These exemplify a number of issues that arise in accounting for selection and distribution by way of lexical F-structures. First consider Num-Class-N.

The indefinite Num-Class-N Constituent

In any complex Mandarin nominal, N is always final and generally prosodically independent. This indicates that it does not move before spellout; it is the first nominal element to be fully valued and spelt out. The features of N, [GENDER Δ ; REF _], are a subset of the features of the classifier: [GENDER _; REF 0; COUNT +; TOPIC _]. Moreover, N's only unvalued F can be valued by the classifier, and at the same time, one of the classifier's unvalued F can be valued by N *alone*. This makes N and Class the best matched items in the nominal lexicon. Given this, N and Class must merge where possible, and N cannot project, because it will become invisible upon merger. In any event, ClassP has more unvalued F, so it should project for reasons of local economy.

Though Class must enter agreement with N before N spells out, it is *Num* and Class that form an inseparable prosodic unit, which ultimately can be separated from N in the ILs. This indicates that the Number is the *specifier* of Class (the structure proposed by Pan 1998 for the TL): they form the periphery of ClassP. Since Num is not a thematic argument of Class or N, this means Class is strong, and NumP is inserted to delete an EPP feature. Again this is ideal since it allows NP to spell out ASAP.

Though NP is invisible outside ClassP, the classifier now includes the GENDER value inherited from N, and is still activated by TOPIC. Assuming PERSON is an essential ϕ -feature required by predicates, Person must be in the numeration, and it will be attracted to Class because it too requires a GENDER feature. Class was the better match for N in the first instance because it immediately values N's REF feature.

Thus the *specific* indefinite entity-denoting Num-Class-N sequence used in IL utterances is actually PersonP, with a numeric ClassP as its complement as shown in Fig. 38⁴³.

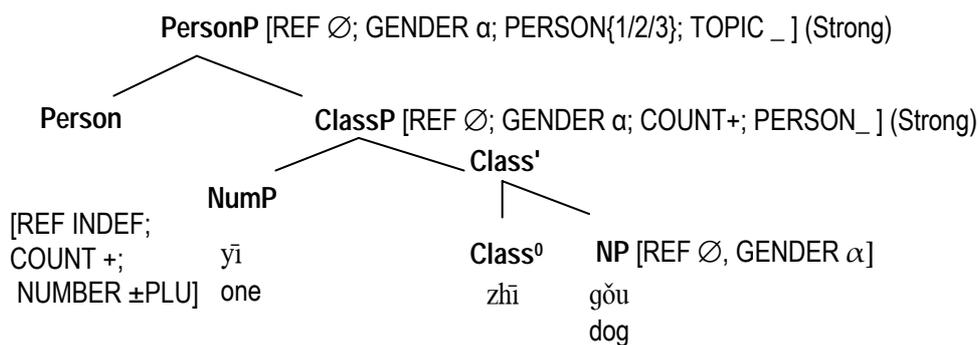


Fig. 38 Indefinite Num-Class-N

This PersonP will not be so strongly attracted to MassP, because it has already inherited a REF value from Class⁴⁴. It will be more strongly attracted to a predicate that can value its last unvalued F, TOPIC.

⁴³ The TL also includes indefinite quantity-denoting numeric expressions that function as the Subject of certain predicates (see discussion of Li 1999a, in Appendix F These can be understood as expressions derived without the involvement of the head Person.

The affine structure:

As discussed in Appendix J, the affine structure is the earliest structure to integrate two nominals with different referents into a single argument. The constituent structure of the affine structure must be such that values of features expressed by both the kin-term and its pronominal argument are free to vary independently, while those of the noun, but not the pronoun, are transferred to the predicate that assigns a theta-role to the structure as a whole. It was argued there that the kin-term is actually a derived predicate, constructed through the merger of the head Person and the kin-term. The numeration for an affine structure therefore includes a kin-term, a pronoun, and the covert heads Person, two tokens of D (one to dominate the ‘possessor’ Pron, and one because the structure is definite overall), and Poss (to delete Case on the pronominal DP argument). The order of mergers is dictated entirely by the lexical features of these items, and economy conditions. The covert head Poss has unvalued GENDER, perhaps unvalued PERSON, and [CASE GEN]; it will naturally attract the kin-term, which can value GENDER, as well as the Pronoun, and the covert head Person, which can each value PERSON. However, N is better matched to the head Person than to Poss, since N and PERSON share GENDER *and* REF. At the same time, merger of Poss and the pronominal DP is preferred to merger of Poss with Person or N, because the first will lead to deletion of Case on Pron and valuing of PERSON on Poss, whereas the other mergers would deactivate no item. PersonP will therefore be assembled in parallel with the construction of PossP, giving two separate structures:

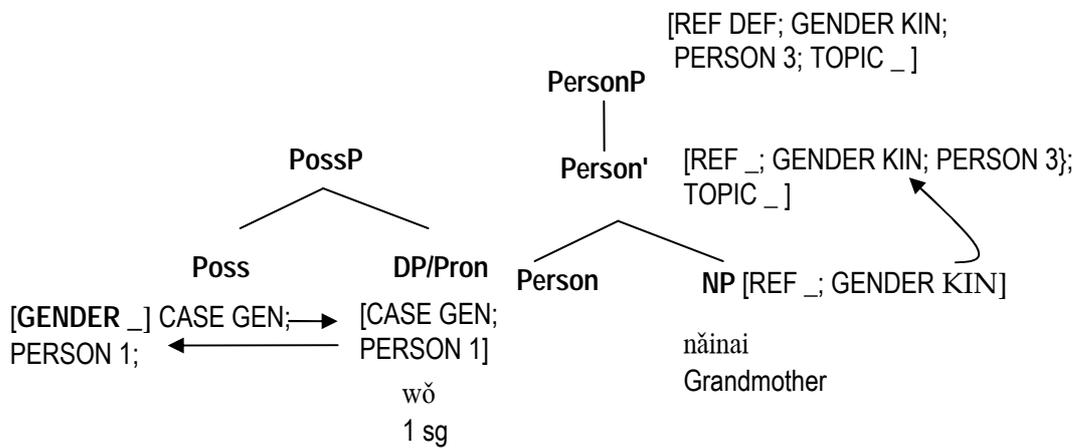


Fig. 39 PossP and PersonP in affine structure

Once PersonP and PossP are formed, PersonP must project and select PossP as its specifier, theta-marking and deactivating it. (Recall that Person is understood either as an abstract predicate of relationship, or as an abstract predicate that inherits a theta-role from the kin-term through conflation (Hale and Keyser, 2002)). The head Poss has effectively isolated the head Person from the REF value of the pronominal possessor; Pron is made invisible by deletion of its Case feature when it enters

⁴⁴ The classifier's value cannot be clearly identified in the ILs due to the absence of 'bare' ClassP arguments; in

agreement with Poss; Poss is made invisible by deletion of its GENDER feature when it enters agreement with Person and N.

Person's REF feature is still unvalued, making PersonP still visible and maximally attracted to a functional head that can value REF, *and* TOPIC together. Moreover, the thematic potential of the kin-term is exhausted, making PersonP suitable as an argument for another predicate. The PersonP attracts the head D, valued DEF, and activated by Case. As discussed above, covert D allows PersonP to be visible to a predicate, and hence able to inherit a TOPIC value. The complete c-structure of the affine structure is therefore as shown in Fig. 40. The entire affine structure is activated by Case and Topic expressed by D and Person respectively.

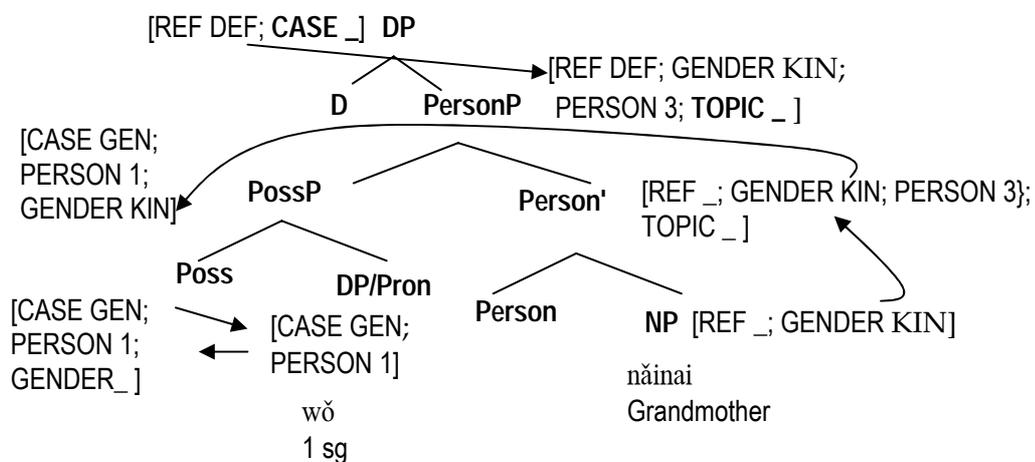


Fig. 40 Complete Affine Structure

The Possessive *de*-Construction

The next complex structure to emerge was the possessive *de* construction, e.g. *wǒ de māma* (1sg DE mother), 'my mother'. Here, the possessor manifests overtly as a definite 'bare' NP, a place name, an affine structure, another *de* construction or, eventually, as a Demonstrative Phrase. These are illustrated at (174a) to (e), respectively

- 174) a. *māma de māma*
 mother de mother
 Mum's mum (K1)
- b. *Saudi de Jeddah*
 Saudi de Jeddah
 Jeddah in Saudi (H1)
- c. [*wǒ māma*] de *bàba*
 1sg mother de father
 My mum's dad (K1)

- d. wǒde huà de rén
my pictureDE person
The person in my picture (H4)
- e. nèige huà de sānjiǎoxíng
that.Class picture DE triangle
The triangle in that picture (H5)

As shown in Appendix J, the *de*-construction permits a greater range of ‘NP1’ and of ‘NP2’ than the affine structure. The noun that follows *de* is not always relational and so it is not necessarily open to analysis as a predicate derived through conflation. Thus, the affine structure is not simply a counterpart of the *de*-construction with a covert *de*. Instead, it is clear that *de* licenses the use of a nominal modifier for another nominal. In short, *de* is a functional head that selects first a nominal complement, and then a nominal specifier, and imposes the relationship of modification upon them. The various items that precede *de* form a prosodic unit with it, but can also appear elsewhere *without de*. This indicates that NP1 is a phrasal specifier and *de* is the head of a phase, and the two spell out together, while N is the complement of that phrase (see Charters, 2004, and Charters, forthcoming for further discussion of this analysis).

Since the possessor in a *de*-construction is generally definite, the numeration for the entire structure must include, minimally, *de*, two nouns, Person, D and Poss. The Gender value of one N attracts Person and Person attracts D which values the TOPIC and REF features of Person. D is most strongly attracted to the Case-deleting functional head Poss, while *de* is attracted to the GENDER value of the other N. *De* has an unvalued TOPIC feature, which keeps it active after merger with N, and it expresses GENDER which attracts it to Poss.

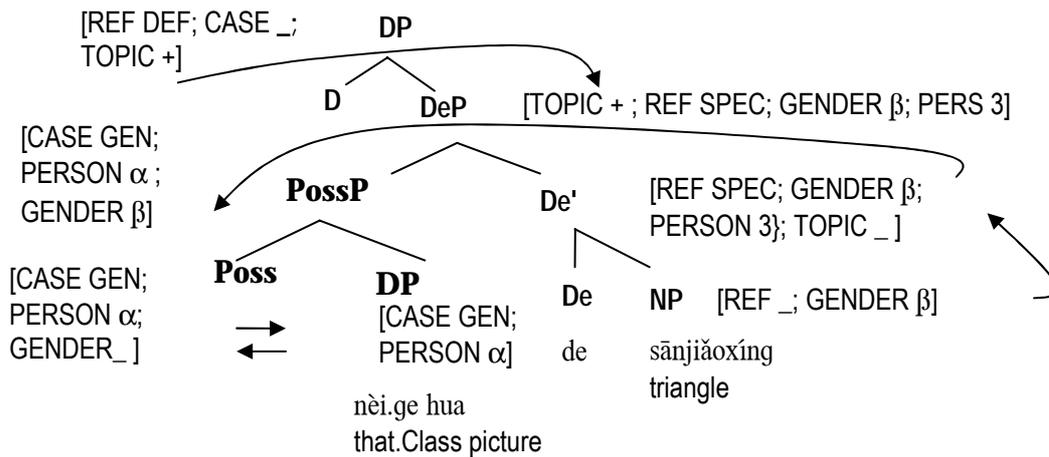


Fig. 41 Possessive *de* structure

After selection of its specifier, *de* is unable to project further, activated only by unvalued TOPIC and ready to be merged as an argument. It may be selected directly by V, and remain within VP, but since a *de*-construction is sometimes extracted from VP, to function as a Subject it must also sometimes attract D, introducing Case. This means that *de*-constructions have the c-structure shown in Fig. 41 above.

Attributive modification

‘Adjectives’ were distinguished from nouns and verbs in the ILs by their collocation with a degree adverb such as *hěn* ‘very’ or *zhēn* ‘truly’ to form ‘AdjP’. ‘AdjP’ emerged first as a predicate, e.g. *tā zhēn āide*⁴⁵ (3sg true short) ‘She is really short’ (K1) then appeared soon after as a modifier immediately preceding N: *hěn dà zìxíngchē* ‘very big bicycle’ (H2). From week 20, it began to precede de in the Mod de-construction, which was generally *indefinite*.

AdjP and MassP

The derivation of structures where AdjP is a predicate is beyond the scope of this thesis, but it will be discussed briefly, because its analysis bears on the analysis of attributive AdjP. Firstly the predicative use provides clear evidence that ‘Adj’ and a degree adverb form a constituent ‘that *excludes* N. In recent analyses (see for example Cinque, 1999) each adverb type is seen as a specifier of a different covert functional head, which selects the modified item as its complement. In the case of AdjP then, a functional head must select the adjective as complement, then the adverb as specifier. As discussed in Appendix J, this head was identified as a covert indefinite head, *Mass*, on the basis that the earliest ‘Adjectives’ to emerge in the ILs were non-numeric quantifiers and other words denoting gradable properties, and degree adverbs express similar concepts related to the delineation of entities conceptualised as masses rather than the enumeration of entities conceptualised as individuals.

Along lines proposed by Hale and Keyser (2002), the head *Mass* might be understood as a *predicate* of degree, which selects a gradable property as its complement, so that the adverb, which expresses a specific degree, is merged as its specifier. In other words, what was labelled ‘AdjP’ at the pre-theoretical descriptive stage in Chapter Five, is actually *MassP*, containing the covert head *Mass*, a bare Adj as its complement, and an adverb as its specifier, as shown in Fig. 42.

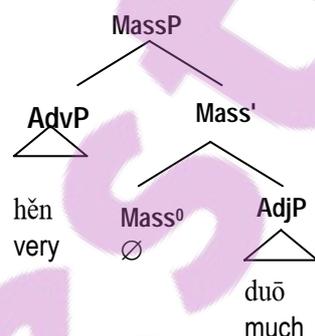


Fig. 42 ‘AdjP’ = *MassP*

Though *Mass* is arguably a predicate, the degree adverb is athematic, so its insertion must be licensed by an EPP feature, which makes *Mass* a strong head, and the degree adverb optional, at least in principle. However, the inclusion of the adverb is preferable to its omission, because it obviates

⁴⁵ In the ILs, *ǎi* ‘short’ never occurred alone, so *ǎide* is treated here as an unanalysed form, not as *ǎi+de*.

movement. When a numeration contains no element that can be merged to delete an EPP feature, the feature must be deleted by movement, which is more costly than merger. This affords a nice account of why the semantically optional and virtually meaningless⁴⁶ adverb *hěn* is generally used. Besides this, the complement of a covert head, like *Mass*, is visible even without movement (under the version of the PIC in Chomsky, 1995), so in fact economy dictates that a covert strong head like *Mass* should always be omitted unless its inclusion is justified by factors relating to its lexical f-structure. Such a factor is the apparent inability of a lexical Adj to attract a nominal constituent (see Appendix "IL F-structures") without support from a functional head.

Predicate Adj

Though Adjectives *are* lexical predicates, the order observed in predication with an Adj is not the order we'd expect if Adj selected the nominal as a complement, rather it is NP-AdjP. As discussed in Chapter Seven, Hale and Keyser (2002) suggest that predicates which cannot project a syntactic complement position arise simply because they are one logically possible lexical type, and that this type of predicate is parasitic on other predicates that can select it as a complement and then project a specifier position that their own semantic structure does not license. The parasitic predicate's thematic role is then mapped to the specifier of the abstract host predicate. For example, they argue that the English suffix *-en* is a host predicate that selects an English Adjectives like *red* as its complement, producing the form *red-den* through a phonological process, conflation, which melds the phonetic features of the host and complement as they merge. They represent this by the structure at Fig. 43.

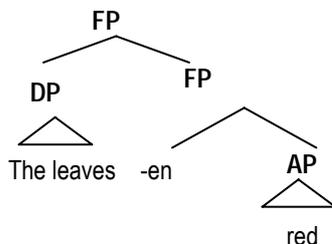


Fig. 43 Conflation (after Hale and Keyser, 2002, p. 12)

Moreover, they suggest that this particular predicate structure is employed in many languages to express the concepts expressed by English adjectives. This is parallel to the construction of denominal predicates applied to the affine structure above. In both TL and IL Mandarin then, it appears that Adj functions as a predicate only when a *covert* predicate selects Adj as its *complement* and *then* selects an entity-denoting nominal as its specifier. Alternatively, this covert head may select the functional projection *MassP* as its complement (that in turn selects an Adj as complement and Adv as specifier), and a nominal as specifier. This accounts for the predicative use of AdjP/ *MassP*.

⁴⁶ Though often translated as 'very', *hěn* actually has no intensifying semantic effect; it is typically explained in terms of maintaining balanced prosody.

AdjP-N

However, when a noun is *modified* by an AdjP, giving the order AdjP-N, a functional head must select *N* as a complement, and then select Adj or MassP as a *specifier*, the reverse of what is necessary to account for predicate AdjP. In Appendix J, it was proposed that the functional head in modification is Person. Minimally then, the numeration for a structure where N is modified by 'AdjP' must include: Mass, Adj and Adv (to form 'AdjP'), and N, and Person to form an entity-denoting nominal. The derivation stems from their lexical F-structures as follows: within this set of items, Person is more strongly attracted to N, and vice-versa, than either is to Mass. This is because N expresses an unvalued REF feature, which both Person and Mass share, but Person also expresses an unvalued GENDER feature, which Mass does not express and N alone can value. N and Person will merge, with Person projecting as it has more unvalued F. Meanwhile, Mass will project and merge with Adj, giving the structure in Fig. 44.

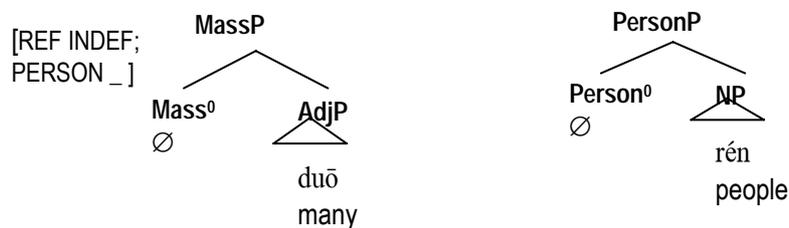


Fig. 44 First step in construction of AdjP N

As Mass is strong it must project again to delete its EPP feature. It is activated only by unvalued Person, but if it selects PersonP as a specifier, MassP will become inactive and invisible, PersonP will be unable to project again, the degree adverb will not be merged, and the derivation will crash. On the other hand, if it selects the degree adverb, which matches its Mass feature, it can still delete its EPP feature and avoid movement of Adj, which is visible because Mass is covert. Thus "AdjP" is created.

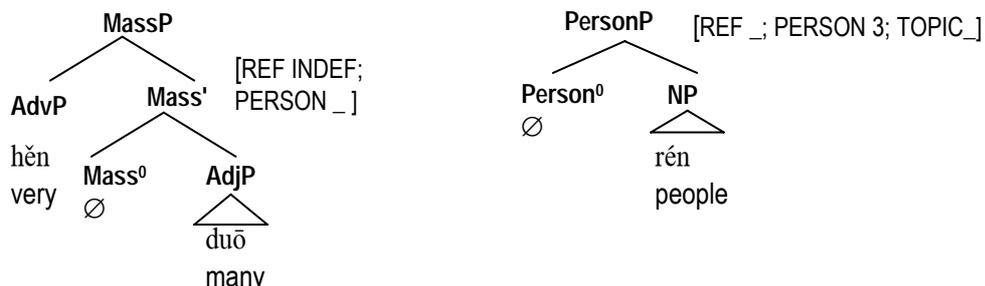


Fig. 45 Second step in construction of AdjP

PersonP is also strong, so it projects to merge 'AdjP' as its specifier, giving the order (Adv) Adj N, as attested, for example in *hěn duō rén* 'very many people', and the structure shown in Fig. 46:

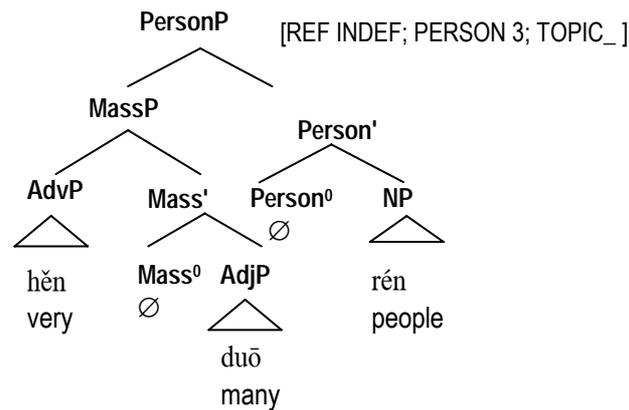


Fig. 46 Final c-structure of AdjP-N

MassP will value both Person's and N's REF features at the same time, allowing NP to spell out ASAP. PersonP remains visible due to unvalued TOPIC, and will therefore be attracted to a Verb, where it will generally be de-activated, thus accounting for its prevalence as an Object, rather than a Subject.

Mod DeP

One or two samples *after* 'AdjP' began to precede N in the ILs, it began to appear in the 'Mod de-construction'. As in the possessive de-construction, 'AdjP' clustered prosodically with *de* suggesting that the two together form the periphery of a phrase, and this de-construction also allowed a wider range of AdjP types than the unmarked AdjP-N construction.

Initially the AdjP in a Mod *de* construction was either one of those already seen in unmarked modification: *hěn dàde um mén dàde shān* 'very big *de* gate, big *de* mountain' (K5), or a colour term e.g. *qiánlán.se-de* 'light blue.coloured'. Colour terms were often modified by degree adverbs like *qián* 'light / shallow', which differ from those used with size and quantity modifiers; they are lexically selected by the Adj. From week 29 (late in Stage two), *de*-constructions also began to include attributes such as *jiù*, 'old' *xīn* 'new' *piàoliang* 'handsome' etc, which did not appear in IL bare AdjP structures, and *sentential* modifiers (Rel clause) also appeared sporadically (i.e. too seldom to count as productive). The emergence of Mod *de* in the ILs also marked the first point at which quantifiers became distributionally distinct from property-denoting words: the former never formed a constituent with *de*.

This increase in the range of modifier types suggests that the functional head that selects the attribute and its specifier in a *de* construction is less semantically restrictive than the covert head *Mass*. In other words, just as the affine structure is not a possessive *de*-structure with a covert *de*, the AdjP-N structure is not the Mod *de* structure with a covert *de* either. The implication is that the covert head *Mass* emerged first and could introduce quantity-related modifiers, but subsequently, a different covert head provided a means of modification that was more semantically flexible. (TL evidence suggests this head is one associated with sentential levels: the 'AdjP' modifier in a *de*-construction can be negated,

while the ‘AdjP’ in the non-de construction cannot. However, this elaboration *within* the specifier does not affect the basic deP structure proposed above, and since the focus of this research is on *nominal* structure, that issue is not pursued further here.) The Mod de structure is illustrated in Fig. 47.

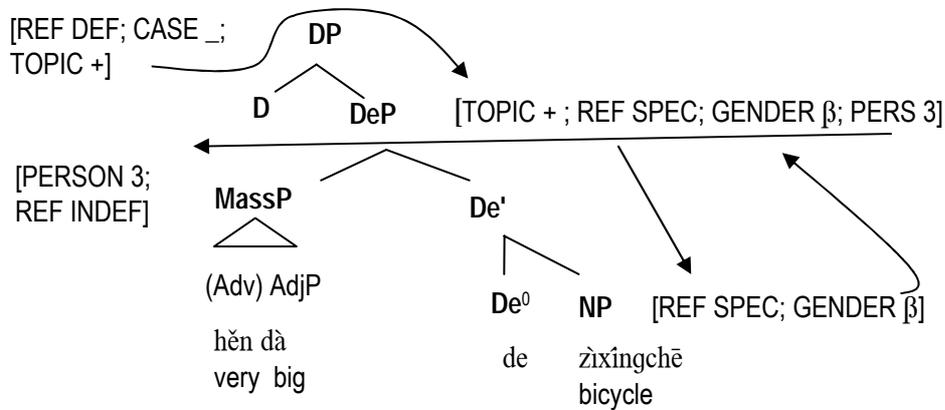


Fig. 47 Mod de structure

Conjunctions

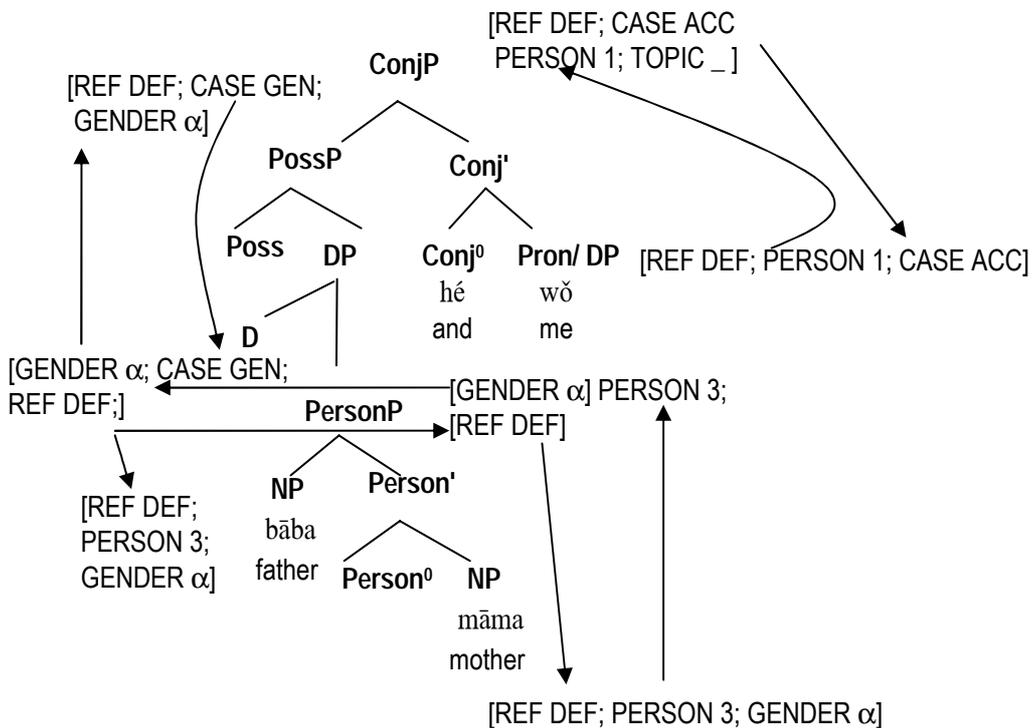


Fig. 48 Conjunction

Nominal conjunctions are like the Poss de-structure in that they involve the embedding of one nominal within another. The conjunction hé ‘and’ expresses unvalued REF, PERSON, and Case or TOPIC (see Appendix J). It selects a complement, typically pronominal, and must then project either an unlimited number of specifier positions (contrary to the LCA), or a single position that can hold a

complex of recursively embedded items. This must involve a covert functional head that can conjoin two nominal constituents without entailing any thematic relation between them. In the ILs the first conjunct was generally a DP (i.e. definite bare NP eg *māma* ‘mother’), which requires Case, and expresses GENDER. This means the genitive case deleter is involved. The second conjunct may also require case; most simply, *hé* itself deletes Case on its complement. A tentative structure is shown in Fig. 48 above, but this structure warrants further investigation based on a more varied set of instances than the present corpus provides.

Ordinals

In the ILs, ordinal numbers, *dì*-Num, generally occur with no classifier, and as a complement of the copula *shì*, as in *zhège huà shì dì yī* ‘this picture is the first’. The IL ordinal is +COUNT, expresses PERSON (either valued or unvalued) and requires a NUMBER value supplied only by Num. If the covert head Person is involved, it could merge with Num first, since Num will remain activated by unvalued COUNT, and will be visible in the complement of covert PersonP. If the ordinal is optionally valued for PERSON, *dì* would select Num first then attract Person, in which case *dì* must be weak, so that the number in its complement will be visible to Person. Either way *dì* must be activated by some additional F, minimally TOPIC (since TOPIC is valued in VP, and ordinals don't function as Subjects in the ILs). This gives ordinals the structure below.

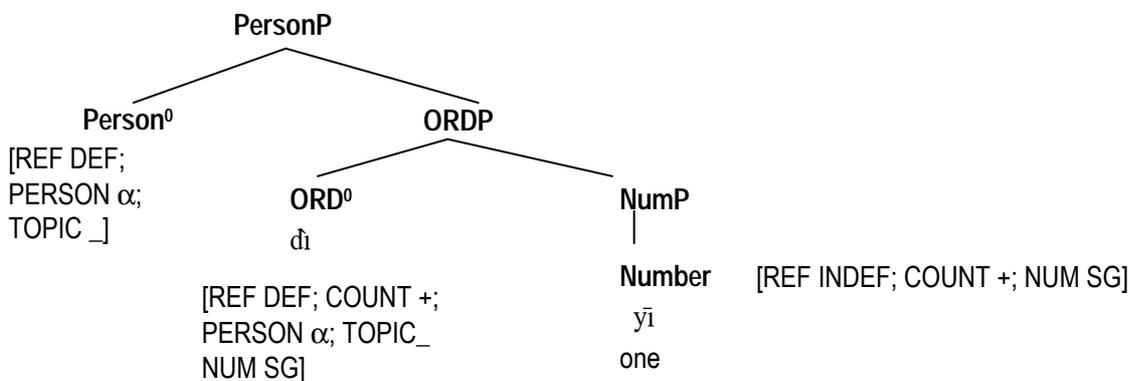


Fig. 49 Ordinal structure

Demonstrative phrases

At the end of year one, (T4-5), demonstratives began to collocate with classifiers. Before this, ClassP occurred only in indefinite (numeric) expressions, and definite nominals were all ‘not-so-bare NPs’ dominated by covert D. Demonstrative Dem expresses unvalued COUNT, but remains activated after merger with ClassP, by unvalued TOPIC.

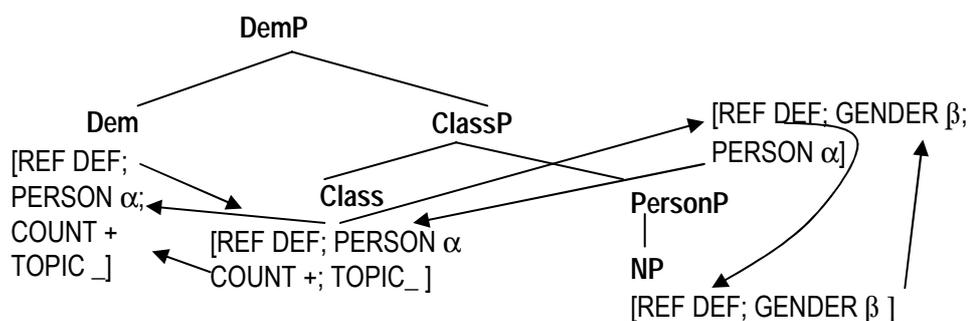


Fig. 50 Dem-Class-N

Locatives

Incorporated Locatives

The locatives *shàng* 'top', *bian* 'side' and *lǐ* 'inside' appeared in the incorporated locative structure, preceded immediately by a locus argument (*qìchē* 'car' in (175a) and b)), d accompanied by a theme (in the sense of a located entity: *sìge rén* 'four people' and *zhège lánzi* 'this basket' in a) and b) respectively):

- 175) a. *yǒu sìge rén zài qìchē lǐ qù gōngyuán*
 have four.CL person at car.in go park
 There are four people in a car going to the park (H5)
- b. *tā fàng zhège lánzi qìchēlǐ*
 3sg put dem.class basket car.in
 He put this basket the car (H5)

Of primary interest here is the derivation of the single prosodic word composed of the locus-denoting nominal: *qìche* 'car', and the locative element: *lǐ* 'inside', since it is this unit that functions as an argument of the Preposition *zài*. Since the theme argument is not an immediate constituent of the locative noun's phrase, its integration is beyond the scope of this thesis, but it would certainly contribute to the processing demands of the sentence overall.

The locative noun *lǐ* is inherently definite but the locus-denoting noun in (175a) is indefinite (a first mention). This means the latter must enter agreement with the indefinite covert head *Mass* before merging with the locative predicate *lǐ*. Moreover, since the locus-denoting argument *precedes* the predicate, it must be the specifier of a functional head that has previously selected the predicate as its complement. This is because the first argument that merged directly with a predicate would be a complement, and according to the LCA, it would then *follow* the predicate noun⁴⁷. If the argument were merged first as the *complement* of the locative predicate, it could only precede the predicate if it had

⁴⁷ This is an instance where the MP departs significantly from the earlier Principles and Parameters approach. Under the latter, the argument-predicate order could simply reflect a head-final parameter setting for the Mandarin NP. Even in that framework, the order makes Mandarin exception in mixing head-initial order in VP and head-final order in NP (see Huang, 1982/1998, for a proposal on how this should be accommodated in the P&P framework).

subsequently moved to an *athematic* specifier position, deleting an EPP feature. Only functional heads project EPP positions, so, whether the argument is in its position of first merger, or a position to which it has moved, it occupies the specifier of a functional phrase. Movement is costly, so the preferred derivation is one where merger of the argument is simply delayed until after the predicate is merged with a functional head. The predicate can then conflate with that head, and inherit from it a theta-role that will be assigned to its specifier (Hale and Keyser, 2002).

The obvious choice for the functional head involved in incorporating locatives is Person; the same head with which a kin-term conflates in affine structures. Firstly, Person entails locatability (generally by reference to the speech context). Secondly it is attracted by GENDER, REF, PERSON and TOPIC features, all of which are expressed by *lǐ*. As a noun, *lǐ* must express GENDER, and it is always definite so it must express valued REF; *lǐ* is always 3rd person, so it must be inherently valued for PERSON, but it must be activated by some *unvalued* F, and that cannot be Case, since it is not restricted to pre-verbal positions. This leaves TOPIC as the only possible feature to activate this locative noun.

Once merged with the locative predicate, the functional head Person will be valued DEF. It would attract the locus-denoting noun, but it is more strongly attracted to the locative because unlike the locus-denoting noun, the locative expresses PERSON and TOPIC. The indefinite head Mass must be in the numeration too, and it is as good a match for the locus-denoting noun as Person, so while Person merges with the locative, Mass will merge with the locus-denoting noun. Then, since Person is strong, it will project to select the locus-denoting MassP as its specifier: MassP inherits the PERSON value from PersonP, which explains why a locus-denoting noun in this structure can only be 3rd Person.

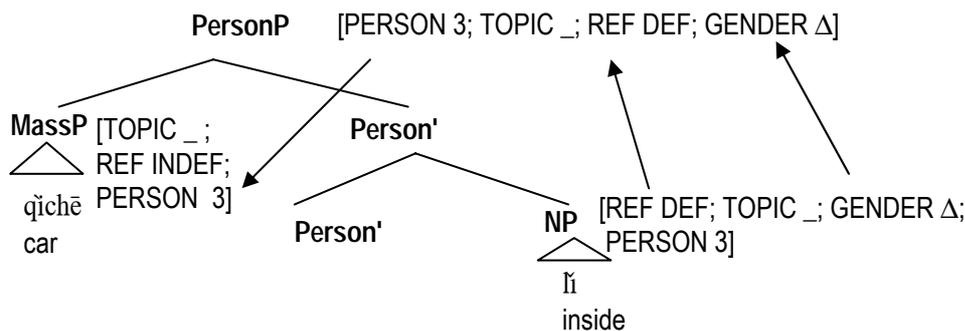


Fig. 51 Incorporated Locative: indefinite locus and definite head

The locus is indefinite, the locative is definite, and the structure remains activated by TOPIC.

This feature will be valued when the PersonP merges with V.

Unlike *lǐ*, other locative nouns have *variable* REF values. They must acquire these values through agreement, like common nouns do. When both locus and locative are indefinite, the simplest derivation is still like that of the structure above. The locative predicate will merge with Person, while the locus-denoting N merges with Mass; Person will select the MassP as its specifier, and Person and the locative noun will each inherit a [REF INDEF] value from MassP, TOPIC will be valued later by merger with a

predicate. If Person selected the locus-denoting N instead of the locative predicate, the predicate could not conflate, its locus-role would go unassigned, and the derivation would crash as a result.

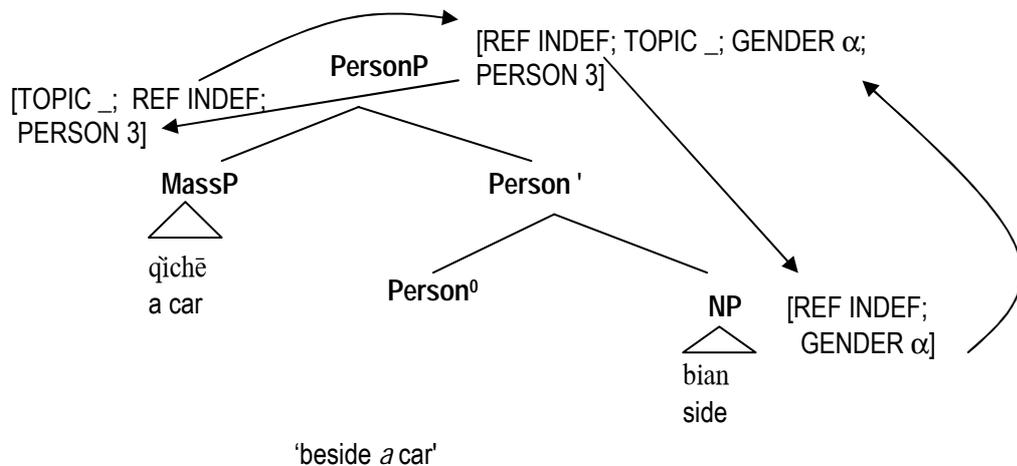


Fig. 52 Incorporated Locative: indefinite locus and optionally valued head

A locative with a *definite* locus will involve a Case feature; the definite nominal must contain either D activated by Case, or Dem which attracts D. Since the locus is never extracted from the locative's immediate constituent, Case must be available within that phrase. In most instances, this can be explained by involvement of the covert head Poss. Since Poss requires GENDER, and D does not express it, PossP must enter agreement with the locative PersonP before the latter is made invisible by valuation of its TOPIC feature in agreement with D. Thus D remains the maximal projection of the nominal structure as a whole:

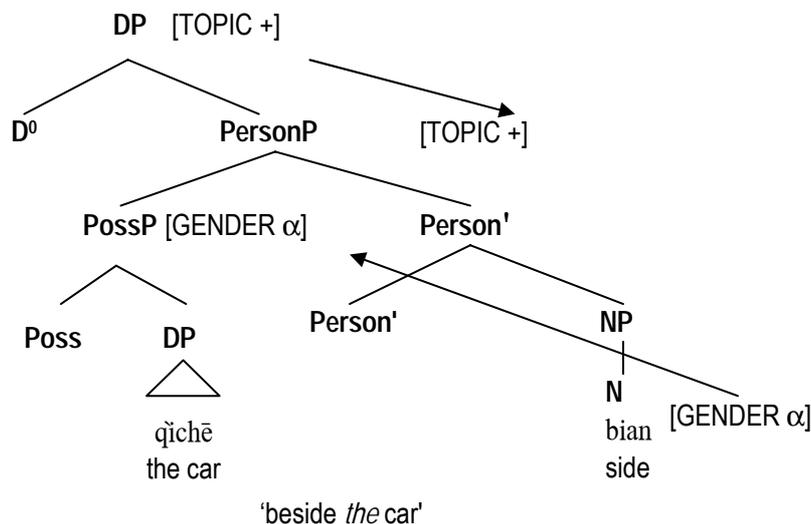


Fig. 53 Incorporated locative: definite locus

Generally then, we can understand the locative structure as involving a 'derived' predicate in the sense that the locative noun is a complement of the covert functional head, Person, and the locus-denoting nominal is the second selection of that functional head. The locus is not a moved constituent, but one whose merger is delayed, in order to allow it referential independence from the nominal predicate that attracts it.

The theme argument

Arguably, a locative proposition is not complete until the locus-locative combination, e.g. *qìchē lǐ* ‘in the car’ is integrated with a theme, e.g. *zhège lánzi (zài) qìchē lǐ* ‘this basket [is] (at) the inside of the car’ (in (175) above). Hale and Keyser propose that in structures like ‘put the basket in the car’, both theme *and* locus arguments are licensed by the semantics of the relational predicate ‘in’; the predicate ‘put’ selects this complex lexical argument structure as its complement and licenses only the *agentive* argument. ‘The basket’ appears to function as an object of ‘put’ in the syntax, but it is really a semantic argument of ‘in’. If this is correct, then Hannah’s use of the counterpart predicate *fàng* ‘put’ in *fàng zhège lánzi qìchē lǐ* (‘put this basket car-in’) does not necessarily mean that the theme theta-role assigned to *zhège lánzi* originates with that predicate.

Some indirect evidence in support of Hale and Keyser’s view is the fact that the structure [locus-locative] never occurs without some retrievable theme. So the question arises: how might the theme be integrated in the syntactic derivation of a locative structure, when the preposition *zài* intervenes between the theme and the locus-locative combination?

If, as proposed above, the locus-denoting nominal occupies the specifier of a PersonP, dominating a locative noun like *bīān*, this leaves the specifier of a dominating MassP or DP as the next available location for the merger of the theme. ASAP precludes any further delay. If the theme is merged within MassP or DP it must be *moved* to merge again as the specifier of the preposition *zài* ‘at’, where it appears. The preposition *zài* must select the entire complex locative DP as its complement, with the theme already merged within it, and *zài* must delete Case on that DP, or else be weak since the DP as a whole does not move. Since the theme will be visible in Spec DP if *zài* is weak, but the theme is *extracted*, either *zài* or some functional head to the left of *zài*, is strong. Moreover, *zài* cannot delete Case on two items at once. This is the first evidence from the ILs that Case deletion may be tied to the provision of a ϕ -feature, or otherwise limited to one Case deletion per head.

After extraction to the specifier of *zài*, the theme can enter agreement with a higher Case deleter. This is generally the Nom-Case assigner, ‘T’. I assume *zài* is activated by an Aspectual or modal feature, as any non-nominal predicate must be.

The derivation of these locative constructions follows in a relatively straightforward way, from the basic feature-structure proposed for N, Person and D. The pragmatic requirement that the REF features of each N be valued independently, and the consequent insertion of distinct Person heads for each N makes the structural configuration theme [locus locative], and the extraction of the theme argument virtually inevitable. These are the first structures where syntactic movement is arguably involved.

Free Double Locatives

Double locatives like *límian* ‘inside’, *dùimian* ‘opposite’ and *hòubian* ‘behind’, are superficially similar to incorporated locatives, but they are comprised of two locative predicates, not an argument and a locative. The first locative functions as a restrictive modifier of the second, which in the ILs is either *miàn* ‘face’ or *biān* ‘side’. In (176a) and (b) below we see that these double locatives differ from the monosyllabic forms *lǐ* and *biān*, in that they are free forms.

- 176) a. *dùimian wǒde wóshì yǒu xǐzǎojiān*
 opposite my bedroom have bathroom
 Loc reference locus theme
 definite indefinite
 There is a bathroom opposite my bedroom (Zhang, 2001, Sharon: 3).
- b. *yīge shù zài hòubian yǒu... building zěnmeshuō*
 one.Class tree at back have... building how say
 reference Locus Locative
 indefinite existential indefinite
 ? A tree, behind is a... how do you say building? (S3)

Example a) is from Zhang's (2001) study. Here, the double locative appears to function as a preposition: a weak predicate with a definite internal argument, and the theme extraposed. The PP *dùimian wǒde wóshì* ‘opposite my bedroom’ is then selected as the specifier of the existential verb *yǒu* ‘have’, a TL structure outside the scope of this study.

Sam's utterance at (176b) above employs *yǒu* in the same way: the theme, ‘building’ is theta-marked as the complement of the existential verb *yǒu*, and a PP *zài hòubian* ‘at the back’ functions as its Subject. The double locative behaves like a DP argument of *zài*, with the same processing demands as any other definite ‘bare NP’.

The sentence-initial argument, this time the locus, and not the theme, is not integrated as a syntactic argument of the locative, but treated as a sentential topic. This puts it outside the scope of this study, which is concerned only with nominal internal structure.

De-marked Locatives

Reverse Locatives

The first de-marked locatives emerged late in Stage Three, at week 24 (T6). Initially, these were reverse locative structures, where the order of semantic elements is non-TL like: the *locative* was followed by *de*, and so it was *de* which functioned as a preposition, with a locus-denoting complement. As in incorporated locatives, the theme was expressed outside the locative's constituent:

- 177) *yòubiān de zhège sānjiǎoxíng yǒu yuánxíng*
 right DE this.Class triangle have circle
 To the right of this triangle, there is a circle

In this example, the locative, *yòubiān* ‘right-side’ appears to select an intransitive deP as its complement. That deP's complement is a complex definite nominal, comprising a demonstrative,

classifier and noun. Assuming the demonstrative in the locus-denoting argument is dominated by D, this *de* must function as a Case-deleting Preposition. Essentially then, this structure is like the English one used as the free translation of (177). The speaker’s L1 is Japanese, but similar structures occurred in the ILs of Sam, and Sharon, one of the students in Zhang’s (2001) study, both of whom are native speakers of English.

TL-like *de*-marked Locatives

In the TL structure, *de* precedes the locative predicate noun, and the locus denoting nominal precedes *de*.

178) hěn duō shù de zhōngjiān
 very many trees DE middle
 In the middle of many trees

This construction emerged a few weeks later than reverse locatives. The locus argument appears to be the specifier of *de*. I can find no motivation for its extraction to this position from within the complement, so I conclude that it is simply merged directly in the specifier of *de*, not moved there. I suggest this is a consequence of the complexity of the locus arguments occurring at this stage (T7), and the fact that phases are assembled in parallel.

Generally, at this stage, locus arguments were quite complex nominals in their own right, e.g. *nèige yīge sānjiǎoxíng de zhōngjiān* ‘the middle of that-class one Class triangle’ (H6). As discussed above the locative noun must be valued for REF before the locus-denoting argument is merged with it, and it must value Person with GENDER so that Person can contribute a PERSON value to the predicate. The locative noun need only merge with Person and it will attract *de*, (which requires PERSON and GENDER values); meanwhile, the locus argument also involves two or three mergers: if it is definite, N with Person, Person with D, and D with Poss, or if it is indefinite, N with Person and Person with Mass. The locative PersonP can merge with *de* while the locus-denoting PersonP is merging with Mass or D.

Then, *de* must select the locus-denoting argument before merging with D. It can then merge as the complement of D and the theme should be merged as the specifier of D. Presumably D is strong so its specifier must be extracted to a position to the left of *zài* to delete Case.

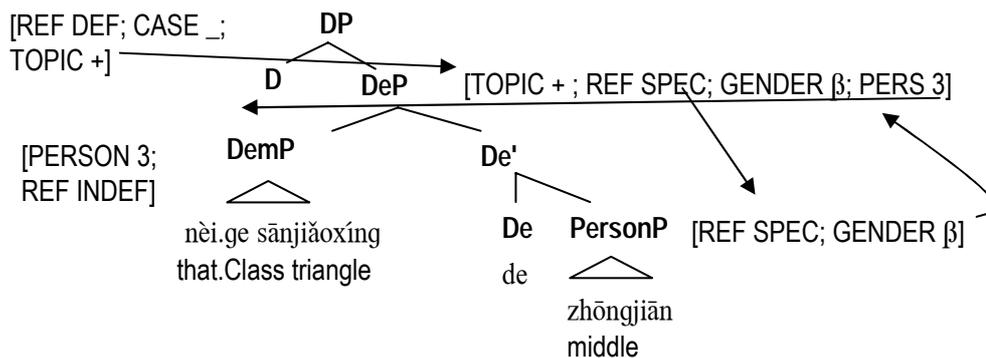


Fig. 54 Locative *de*-structure

Complex numeric expressions

Num-Class-DEP-N

At T4 -5, de-marked modifiers began to collocate with a Numeric expression:

- 179) yī jiān huángsède jiákè
 one.class yellow.coloured jacket
 A yellow jacket

Recall that in construction of the modified N huángsède jiákè 'yellow jacket', de selects PersonP as a complement, and the phrase huángsède as a specifier, and de and its complement PersonP remain active because of unvalued TOPIC. To integrate this deP with a numeric expression, de only needs to merge with ClassP, rather than with D. Class is strong and must project twice. It must also inherit a GENDER value while N is visible, so it selects deP as its complement, before projecting to select Num and delete its EPP feature. This gives the structure in Fig. 55.

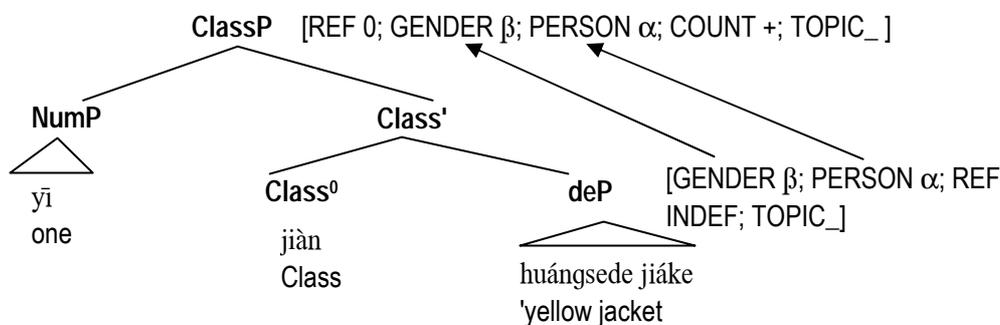


Fig. 55 Num-Class-deP-N

This is the first IL structure in which it became clear that Class remained active after entering agreement with a valued PERSON feature (expressed within deP). Therefore Class must express some additional unvalued feature, other than PERSON, most simply TOPIC (see discussion in Appendix J). Recall that if PersonP is to be valued for TOPIC while in the complement of overt de, de must be weak. Then PersonP will remain in the derivation when the strong ClassP closes and its TOPIC feature is valued; de will inherit TOPIC from Class, and Person will inherit it from de.

Dem-Num-Class-N

By the same token, we must conclude that Dem, which begins to select ClassP at this time, is also weak. (Note that if either Person or Class were activated by Case, they could not 'get' Case, because it is Dem that enters agreement with V. The simpler analysis is therefore that Person and Class are both activated by TOPIC, as I have argued). Note also that as Dem's phase is weak, Dem-Num incorporation, where it occurs, must not be derived by movement, but *must* be purely prosodic incorporation, as necessary also in Pan's and Li's analyses of Mandarin TL structures (see Li, 1999a, and Pan, 1999, and the discussion of Mandarin DP in Appendix A). This is consistent with the stable word order: Dem-Num, rather than a change in order to Num-Dem.

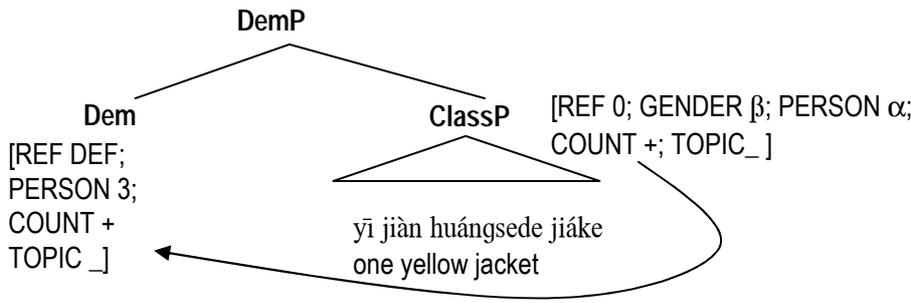


Fig. 56 Dem-Num-Class-N

Complex Ordinals

Finally ordinal expressions began to combine with possessives, as in (180), which reveals a little more about their structure.

- 180) wǒde dìèr huà
 1sg.de ORD-twopicture
 My second picture

As mentioned above, an ordinal marker makes a numeric expression definite, so it has inherent [REF DEF]. Since the ordinal marker can only appear with Numbers, and in the ILs, Classifiers are not generally used in this structure, we can conclude that IL ordinals express *inherent* [COUNT +]. To then combine with a possessive de, they must remain activated by some feature, not valued on their numeric complement: TOPIC or PERSON. PersonP can select N as a complement, then select OrdP as its specifier, before merging with de (see Fig. 57.) On the basis of the derivations described above, it was possible to quantify a number of variables that potentially contribute to processing demands overall. These are discussed in Chapter Seven and in Appendix L.

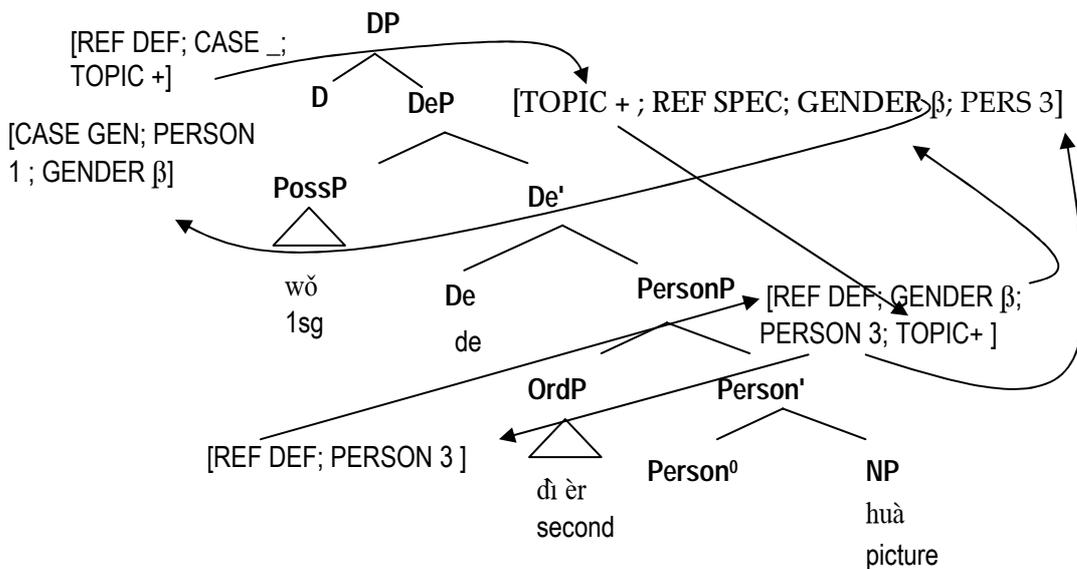


Fig. 57 Complex Ordinal Structure

Appendix L: Processing Demands

This Appendix consists of three sections, each establishing the processing requirements entailed by the consistently ordered IL structures identified in Chapter Five, from a different theoretical perspective. The first section quantifies the number of lexical items, features, mergers, phases in total, and phases throughout which some unvalued feature is stored, based on the lexical f-structures and c-structures discussed in the minimalist analyses described in Appendices J and K. The accumulated results of the derivational analyses are presented *first* in Table 79, (page 352). The derivations on which this quantification is based are discussed in sections following that, arranged according to elicitation times.

In the second section, structures are assigned to one of the six developmental levels of standard Processability theory. The allocation of structures to each stage is shown in Table 80 (page 361), then discussed. Finally, the third section presents an alternative representation of processing demands in terms of GF assignment and other mechanisms that enforce unification in LFG (see Chapter Six). This is presented in Table 81 (page 375), followed by a discussion of the mechanisms involved in each structure.

MINIMALIST DERIVATIONS AND PROCESSING DEMANDS

Overview

Table 79, overleaf, brings together the findings for the minimalist analysis of structures from all samples. The structures shown on that table include the 18 most stably ordered structures produced by all three learners (see Table 9 of Chapter 5, p. 101) and two others produced by only two of them: recursive possessives and reverse locatives. Only 19 rows appear in Table 79, rather than 20, because ‘AdjP N’ stands for both [(adv) Adj]-N and [(adv) Q]-N; and noun includes simple and compound Nouns. The first two turned out not to be statistically distinct, and the last two are not treated differently in minimalism. On the other hand definite DP *is* treated as a separate category from N.

The 19 structures are listed in order of emergence, represented by adjusted ranks for mean emergence times shown in column 1 (see Chapter Five)⁴⁸. The headings ‘Merges’ and ‘Phases’ refer to the number of each required to construct the nominal, *excluding* its merger with a predicate in the VP phase. ‘Delay’ refers to the maximum number of mergers between first merge of an item and its full valuation; 1= full valuation at first merge. 0 phases and mergers means the item is merged directly from the lexicon into a VP or sentence. The annotation ‘† lex” means all features but one are valued *in* the lexicon, before the first syntactic merger.

⁴⁸ The emergence ranks from recursive possessives and reverse locatives were derived by matching their average ET, with the nearest average over three ILs for the other structures.

Table 79. Overview of processing demands in Minimalist derivations (19 structures)

Rank mean ET	Structure	ID number	F types	Values copied	Overt items	Covert items	Merges	Phases	Delay
1	Noun	1	2	1-2	1	1	1	1	0
1	Pron	2	4	2	2	0	0	lex	0
1	Name	3	1	1	1	0	0	0	1
1	Num-Class N	8	6	7	3	1	3	2	3
2	little pro	4	1	1		1	0		
3	Affine structure	7	4	7	2	3	4	3	3
4	Associative deP	9	5	9	3	3	5	3	4
5	AdjP N	11	7	6	3	2	4	2	3
6	Conjunct (min)	12	5	1	6	2	7	2	3
7	DP	30	6	4	1	2	2	2	2
8	Incorporated locatives	18	4	11	3	4	6	10	2
8	Recursive Poss	31	5	13	4	6	9	6	4
9	Mod deP (indef)	19	5	10	4	2	5	3	5
9	Pseudo-relative clause	15	6	12	3	6	8	5	3
10	Dem Class N	16	4	4	3	(2)	5	4	4
11	Num-Class deP	20	5	16	6	3	8	5	7
12	Ordinals	22	4	2	2		1	1	1
13	Locative DE maximum	21	5	18	7	5	11	8	5
14	Reverse Locative	32	5-6	11	5	(2-3)	7	6	4

Structures from T1-T2

BARE NP

Before T4, there was no clear statistical relationship between the distribution and interpretation of bare NPs. However, the affine structure, already in use at T1, indicated the involvement of the functional head PERSON in construction of any referential nominal, and this in turn indicates the involvement of some unvalued F activating N: REF. Minimally then, for each nominal argument, at least one feature must be valued through agreement with a functional head before NP can spell out.

NUMERIC EXPRESSIONS

Num-Class-N is created in a single strong phase, ClassP, but before this structure can function as an argument, the covert head Person must be included. It heads a second strong phase, PersonP. N is ready to spell-out as soon as it is merged with Class, and can spell out when PersonP is selected by a predicate. Class and Person both require a TOPIC value, which also becomes available at that point, so Num and Class are spelt out together at the *next* strong phase. N, Class and Person agree for GENDER and REF; Num and Class agree for COUNT, and each agrees with Person for PERSON. Num also expresses MASS, and Class and Person each express TOPIC. Neither is fully valued till PersonP merges with V.

AFFINE STRUCTURES

The derivation of the affine structure also involved three phases: PossP (selection of the affine Pron by Poss), PersonP (selection of the kin-term and PossP by PERSON) and DP (selection of PersonP by D). PossP involves a mutual exchange of PERSON and CASE values; Person P transfers GENDER from N to Person to Poss. Likewise, DP involves a mutual exchange of PERSON and REF values, with the latter copied to both Person and N. The pronominal affine is active for just one merger; Poss, for two; and N and Person remain active throughout the derivation of DP, till their REF features are valued. D

remains active at the close of DP, with Case the only unvalued feature, and PERSON visible on D.

Altogether seven feature valuations take place in this derivation.

The phonetic features of the null predicate, Person and the complement are (vacuously) conflated phonologically; this does not involve syntactic movement (Hale and Keyser, 2002).

Though Num-Class-N involves more overt elements than the affine structure, it is no more complex in procedural terms. It involves the same number of features, lexical items, and agreement relations, but fewer mergers, and fewer phases. The comparison is evident in Table 79, above.

ASSOCIATIVE DEP

The early Associative *de*-structures were those expressing kin or possessive relationships. The 'possessor' was PossP, formed as in the affine constructions described above. Recall that as Pron expresses a valued PERSON feature, it can value Poss without requiring prior syntactic derivation; it is therefore the best (most economical) match for Poss. Poss and Pron merge as do the 'possessed' N2 and Person, so the latter can inherit GENDER. Then the resulting PersonP is selected by *de* which inherits GENDER, and PERSON. In a fourth merger, *de* selects PossP as its specifier, PossP inherits GENDER and is deactivated, and then, *de*P is selected by D, valuing REF on *de*, Person and N, and TOPIC on Person. D also introduces Case. This is a total of three phases: PossP, *de*P and DP, with nine agreement relations.

Structures from T3-T4

ADJP

The emergence of modified nominals saw the introduction of the covert quantity-predicate Mass, which selects 'Adj' as its complement, and the degree adverb as its specifier into the IL systems. This creates a phrase, MassP, that can be selected as the specifier by the covert predicate of relationship, Person, after the latter has selected NP as its complement. This is a step towards the construction of indefinite 'bare NPs' also, which by this stage, had a clearly distinct distribution from that of definite 'bare NPs' (i.e. DPs). In the construction of these 'NPs', N introduces two features: REF and GENDER, but Person introduces two more PERSON and TOPIC. Mass and D each introduce another two: MASS and Case respectively, as well as TOPIC. GENDER is copied from N to Person, REF is copied from Mass or D to Person and to N, and PERSON is copied to Mass or, perhaps to D. TOPIC and Case are valued only after the nominal has merged with V.

The compilation of a modified nominal involves a total of four mergers, in two phases. At least two features must be valued by selection of Adj and Adv by Mass; N transfers GENDER to Person; PERSON, and REF values are exchanged between Mass and Person, and the REF value is then transferred to N, a total of six separate copied features. TOPIC remains unvalued on Person.

The derivation of de-marked modification equates to a combination of AdjP and an associative de-structure. The numeration includes, minimally, de, one noun, Person, and the components of MassP: Mass, ADJ and optionally, Adv. Mass expresses valued REF but no GENDER, while de and Person both express REF and unvalued GENDER; they share more features with N than Mass does. Since de can value N's REF feature, and Person cannot, de is the preferred selector of N. De will select N while MassP forms, valuing GENDER and REF, then de will select MassP, as its specifier, valuing PERSON on Mass. Person will then project to select and deactivate deP, valuing its own REF and GENDER and the PERSON features of Mass and de, and introducing Topic. Should the modified N be intended as a definite nominal, D would be included in the numeration also, and would select PersonP. Note that D, like Mass, expresses no GENDER, so it will not compete with de for selection of N. De-marked modification requires at least three phases – MassP, deP and PersonP. Ten feature values are copied.

After week 29, AdjP was selected by an additional or alternative level of structure, less semantically restricted than MassP, potentially an existential level. This adds at most one phase to the derivation.

EARLY LOCATIVES : COMPOUNDS AND PREPOSITIONS

Early locative structures included fixed collocations of a noun and locative in the TL order, e.g. húbiān 'lake-side'. These are lexical compounds, syntactically DPs, occurring as the complement of the preposition zài, which deletes their Case. The locative presents the same processing demands as any other definite 'bare NP'.

Later, the locative shàng emerged in a non-TL structure, where it precedes a locus-denoting nominal, as in zài shàng huà to mean 'at the top of the picture' (K2), or gōngzuò shàng chuán 'work on [the] boat' (S3). This locative functioned as a preposition. The locus-denoting N must be selected by Person, valuing GENDER, then PersonP is selected by the locative, to value the PERSON feature of the latter, and receive a TOPIC value in exchange. The resulting phrase must then be selected by D to value the REF features of Person and of N, which is visible because Person is covert. This addition makes the locative structure into a nominal, activated by CASE, and attractive to either the true TL preposition, zài 'at' or to a functional head modifying V.

The located entity appears as a Subject, apparently theta-marked by the P zài 'at' or V, gōngzuò 'work' etc. The locatives in these Stage 2 structures are therefore intransitive predicates, much like a kin-term in an affine structure, but, unlike the kin-term, their argument follows them. This suggests that they are not derived de-nominal predicates, like kin-terms, but simple underived intransitive predicates which can select a complement. In syntax, the construction of the locative-locus constituent involves three phases, PersonP, Locative P and DP. Features valued during the derivation include GENDER, REF(x 2), PERSON, and TOPIC, and Case is also introduced.

CONJUNCTION

The conjunction first emerged in descriptions of family structure. This involved production of a series of up to four kin-terms, ending with a conjunction and then the pronoun *wǒ* (1st person). Each type of kin-term must be quantified separately, so the learners were forced, by pragmatic intention, to produce a structure where each term was elaborated and fully valued, except for TOPIC/Case, before it was selected by the conjunction, and the conjunction was thus close to the predicate. That is to say, the conjunction dominates several levels of nominal structure, rather than being dominated by those levels. Formally, this series consists of two definite bare NPs (mothers and fathers being typically unique), two Numeric ClassP constituents, a pronoun, and the Conjunction phase. Effectively, the Conjunction adds just one phase to the total required for the derivation of all the conjoined items separately.

INCORPORATED LOCATIVES

By T4, the locative forms *shàng*, *biān* and *lǐ* began to be used as nouns in the incorporated locative structure:

- 181) *yǒu sì.ge rén zài qìchē lǐ qù gōngyuán*
 have four.CL person at car.in go park
 There are four people in a car going to the park (H5)

Minimally then, the construction of the locus-locative subconstituent involves the parallel derivation of two PersonPs, and their merger in a third MassP phase, with one PERSON feature, two independent GENDER and two independent REF features valued as a consequence. Addition of a definite theme involves at least an additional definite 'bare DP', its merger with the locative MassP, and its extraction to the specifier of PP, a total of four more phases and one movement, and another five features copied (REF twice, and GENDER, PERSON and TOPIC once each).

The *maximally* complex incorporated locative structure would involve an additional two DP phases, and one PossP phase; a total of ten phases. The locus-denoting, theme-denoting, and locative nouns would each be ready to spell out after two phases: Person, and Mass/D.

FREE DOUBLE LOCATIVES

The double locatives *dùimian* 'opposite', *hòubian* 'behind' etc. appear to sometimes function as prepositions heading S-initial topics, as in (182)

- 182) *dùimian wǒde wōshì yǒu xǐzǎojiān*
 opposite my bedroom have bathroom
 There is a bathroom opposite my bedroom (Zhang, 2001. Sharon: 3).

Both the prepositional structure and S-initial topics are outside the scope of this study (but see discussion in appendix K).

PSEUDO-RELATIVE CLAUSE

The pseudo-relative clause structure involves a nominal whose reference is restricted by a *following* clausal structure. However the nominal and following clauses do not form a single prosodic unit, as evident from the pausing in the examples that follow:

- 183) a. wǒdebóbo a zhù T. a yě yǒu sìge érzi
 my uncle (a) live T. (a) also have four-Class son
 My uncle (ah) lives in T.K. (ah) also has four sons (S4)
- b. wǒde huà um () um heh () zhè.ge yī jiā qù cháojíshìchǎng shì dìyī
 my picture this.Class one family go supermarket is first
 My picturethis family goes to the supermarket... is first (H5)

This prosody prevents an analysis where the initial nominal and the following restrictive clause are merged as a single complex constituent in the specifier of the second predicate. If that were so, they would be spelt out together, in one prosodic unit. At the same time, this structure cannot be understood as the successive output of three separate numerations, one producing a relatively simple nominal, an associative deP, the next two producing clausal structures, with the results simply falling together after spell-out. This is because all features in each sub-structure must be fully valued at spell-out, or the derivation would crash, cancelling the numeration. Since the structure was successfully spelt out, the two predicates must have each received ϕ -features from *different* DPs, and the initial possessive DP must have been merged as the complement or specifier of one of them. It is clear that it that DP is not an argument of the predicate qù which is nearest to it: the basic thematic structure of that predicate is complete within the structure zhège yījiā qù cháojíshìchǎng 'this family goes to the supermarket'. This means it could only have been merged with the copula shì. Since it is not adjacent to the copula in the output, the S-initial nominal must be 'moved' past the intervening clausal structure, in order to value some feature through agreement with some (covert) functional head. Assuming the structures in a) and b) are analogous, the initial nominal wǒde bóbo is likewise moved from a phrase were it was theta-marked by yǒu. Again, these are movements within *sentential*, rather than nominal structure, and hence beyond the scope of this thesis. However, for the sake of comparison with purely nominal structures, we can calculate that the entire modified structure involves at least three times the processing that production of a single possessive deP requires, since the same nominal must be merged a minimum of three times.

Structures from T5-T6

ORDINALS

Ordinals are apparently no more complex than the basic Num-Class-N structure; the ordinal simply selects a numeric ClassP as its complement, exchanging NUM and COUNT values, and is activated by Case.

RECURSIVE DE-STRUCTURES

Recursive de-structures like [[[wǒ] bàba] de] māma] and [[[[[wǒ] de] māma] de] mèimèi] are clearly related to earlier simple structures like [wǒ] bàba] and [[[māma] de] mèimèi]. They require derivation of an associative deP and its selection as specifier of a second associative deP. The number of phases and features copied in the first deP structure is three and nine respectively (see above). The second deP involves another three mergers (N and deP₁ with de₂, and the resulting deP₂ with Person) and a further four features copied: GENDER and REF are exchanged between N and de₂ then copied to the

dominating Person head. No feature values are exchanged between the specifier and de; they agree for unvalued TOPIC.

NUM-CLASS DEP N

The combination of a numeric expression and a de-marked modifier has some significant implications for the issue of selection on the basis of universal functional hierarchies vs. local economy, as discussed in Chapter Five. Up till now in simple numeric expressions, the noun has been selected as the complement of the classifier. This was justified on the basis that entering agreement with a number would deactivate N, by valuing its REF feature (indefinite), making N's GENDER invisible, and thus preventing the classifier from converging (see Appendix J, p. 309 for details). However, when modifiers become incorporated into quantified nominals at Stage 3, the modifier phrase intervenes between Class and N.

The usual pre-minimalist assumption is that the modifier is *adjoined* to NP, and the whole NP is selected by Class. In recent versions of phrase structure though, modifiers are specifiers of functional heads, which select the modified item as complement. In minimalism though, items in a numeration *compete* for selection of each other, and the outcome is determined purely by maximal match and local economy. Thus there is no sense in which the classifier *must* select N, unless they can be shown to be *always* the best match for each other.

The numeration necessary for this structure must contain, as well as the obvious overt items, the covert head Person, (which is required to value Num, de, the elements of the modifier phrase, and eventually the predicate with which the argument will merge), and the covert head Mass, that assembles AdjP. The noun, classifier, de and Person all express the features GENDER, and REF. Only de and Class can *value* N, but Person is *covert*, and so would allow N's REF feature to be valued *in situ*. From the perspective of local economy, strong Person is a better match for N than weak de, and de is as good a match for N as Class.

Moreover, de and Person attract each other, since de expresses unvalued PERSON, while Class does not, and attracts Num by their shared feature COUNT. Thus Person will select N and project, then be selected by de giving [_{deP} de [_{PersonP} ∅ [NP]], valuing N and allowing it to spell-out at the next strong phase.

Meanwhile, Class and Num form a constituent. Not having merged with N, Class has no complement, but, since Class is strong, and cannot value Num's PERSON feature, it is preferable that Num should project and select Class as its complement, giving the order Num-Class as observed. Thus movement of unvalued Num is avoided, as required under Last Resort. This assumes that Num is weak. Class can be valued for GENDER and TOPIC *in situ*.

A functional head (Mass or some other, depending on the modifier) selects Adj and Adv exchanging at least one value with each and remaining activated by unvalued PERSON and / or GENDER (since the items it selects are not nominal). Both these features are valued but visible in deP which is activated by TOPIC.

So far, a minimum of two values have been copied in construction of the modifier Phrase, five in the construction of (incomplete) deP, and one (COUNT) in construction of Num-Class, totalling eight. There have been a total of five mergers, and four phases (PersonP, deP, NumP and FP).

The modifier phrase is activated by PERSON, and perhaps GENDER, required by its complement (a predicate) as well as its head. Both features can be valued by deP but neither by the numeric expression which expresses them *unvalued*, as well as TOPIC, which deP *cannot* value. Local economy requires the modifier phrase to merge as the *specifier* of de, and so be deactivated. GENDER and PERSON are copied to the head of FP and its complement, and remain visible in the weak deP.

The Numeric expression must be merged next, as the specifier of a *subsequent* functional head, (since de is weak and cannot project an EPP position)⁴⁹. Since the final constituent is indefinite, this is most likely the covert head Mass. Mass and the numeric expression each inherit GENDER and PERSON from deP.

This second stage of the derivation involves copying of a further eight features, and a further three mergers, in one new phase, MassP. Altogether the Num-Class-deP N structure involves copying of 16 features, in eight mergers and five phases, with three constituents assembled concurrently. The head Person, which was inserted in the first merger is still unvalued for TOPIC, a delay of 7.

Suppose instead, the classifier selected N first. It would attract Num second, since only these two share the feature COUNT, giving [_{ClassP} [NumP] Class [NP]], or perhaps, [_{NumP} Num [_{ClassP} Class [_{NP} N]]]. Either way, this numeric expression would be activated by TOPIC (in Class), and PERSON (in Num) and would be attracted next to Person, the only head that could value one of these features, ie. PERSON, and also expresses the other. It would project, since it would deactivate Num, and if it was ClassP that selected Num then Class has already projected twice. PersonP would then be selected by de, which inherits Person, and selects the modifier, as in a simple de-structure. As long as de is weak, Person and Class can be valued for TOPIC in situ. This gives the order AdjP de Num-Class N, unattested in the ILs. Either de is optionally definite, or D must be included in the derivation too, to render the nominal definite as a whole. The derivation involves four – six phases (ClassP, PersonP, deP, MassP and possibly NumP and DP), 10-11 features copied (including two within MassP, and 1 to D), and a delay of *five –six* mergers (Num, Person, de, MassP, DP, and a predicate) before Class can be valued for TOPIC. It is a little more complex than the structure attested in the ILs, though movement is *not* necessarily involved.

DEM-CLASS-N

The sequence Dem-Class-N also appears at this stage, and later, sporadically, Dem-Num-Class-N. The Dem-Class-N structure is the first where class appears without a number. Up till then, the classifier has behaved as if it is dependent on a value contributed by Num. We can hypothesise then, that early IL

⁴⁹ It might be the case that Class selects the modified deP as a complement, then selects Num as a specifier, but under current assumptions, this would make PERSON invisible in the complement of ClassP. However, as Class is strong, it might have an EPP feature, and attract Person to adjoin to it, by head movement, allowing Num, and

classifiers may have an unvalued Q-feature that only Numbers can value i.e. NUMBER or MASS. I have suggested that the feature attracting Dem to Class in a non-numeric ClassP could be COUNT, explaining why a demonstrative determiner first appears without numbers. Another possibility is that Class and Dem share one of the Q-features NUMBER or MASS: in the TL a Class-N sequence and a Dem-Class sequence are each always interpreted as singular, i.e. either [NUMBER SG] or [MASS -], even though no number is present. Either would account also for the later-emerging attraction of Dem for numbers. So it appears that around this time in IL development, some Q-feature may be ascribed to Class and its unvalued counterpart to Dem, initiating an attraction between Dem and Class and/or Num.

As discussed in Chapter Six, DemP must also include a PERSON feature, so Dem either expresses PERSON (variably valued) itself, or attracts the head Person. Dem must also attract D, to value TOPIC on Class (and on Person, if it is present). In short, the Dem-Class-N structure involves at least two phases, ClassP and DemP, and perhaps two others: PersonP and DP. Minimally, GENDER and REF are exchanged between N and Class, a Q-feature between Class and Dem, and a TOPIC feature copied to Class from Dem. Potentially, if Person and D are involved, GENDER REF and TOPIC are all copied to Person as well, PERSON is copied to D, and TOPIC from D via Dem. Thus there are between four and nine features copied.

A somewhat similar structure is one that combines a numeric ClassP with a de-marked modifier of N: Num-Class deP N. Here deP is derived, as above, but in the last phase, is selected by Class, not by a predicate. Class then projects again and selects NumP, as in the Num-Class-N structure. This involves 5 phases, and more than ten instances of feature copying.

DE-MARKED LOCATIVES

Reverse Locatives

The first de-marked locatives to emerge were the reverse locative structures, where the order of semantic elements is not TL-like: the locative is followed by de, which functions as a preposition, with a locus-denoting complement. As in incorporated locatives, the theme is expressed outside the locative's constituent:

- 184) yòubiān de zhège sānjiǎoxíng yǒu yuánxíng
 right DE this.Class triangle have circle
 To the right of this triangle, there is a circle

As discussed in Appendix K, this structure is like the English one used as the free translation of (184); de functions as a Case-deleting preposition. The construction of this deP involves just one more phase than construction of the DemP it selects as its complement, and one more agreement relation, in which Case is deleted. The integration of deP with the locative yòubian then involves, minimally, one more phase: either NP or Person P selects deP as a complement, with the locative being either the head or specifier respectively.

ultimately the predicate, to be valued for PERSON. Even so, de would need to be valued for TOPIC. The proposal

 TL-like de-marked Locatives

In the TL structure, *de* precedes the locative noun, and the locus-denoting nominal precedes *de*:

- 185) hěn duō shù de zhōngjian
 very many trees DE middle
 In the middle of many trees

This construction emerged a few weeks later than reverse locatives. It involves selection of a free locative noun, first by Person, then by *de*, which values REF, then the merger of a locus-denoting argument. Recall that a locative must be valued for REF before the locus-denoting argument is merged, otherwise the locative will be forced to agree with its argument. When the locative is a fully elaborated DP, *de* must delete Case on it, since it remains in the complement of *de*, and it is further from any higher Case-deleting predicate than the locus-denoting argument, and *de*P itself are. Since they are also potentially, DPs, their feature structures will be identical, and economy dictates that only the closest can enter agreement with a higher predicate.

*De*P remains activated by unvalued TOPIC, and either attracts D which requires Case and makes the whole structure definite, or remains indefinite, and attracts some other predicate. This predicate must project to allow merger of the theme argument. Since *de* deletes Case on its complement, if at all, the theme's Case must be deleted by the head Poss. It is unclear whether the theme is merged first within the DP and then extracted, or if its merger is delayed, and licensed through agreement between the locative and the predicate that selects it. In any event, up to three fully elaborated DPs are involved in this locative structure, the locus and theme, each potentially a modified or possessed DP (5 phases), and the locative itself, a *de*P selecting PersonP and selected by D (3 phases) making it the most complex nominal in the study. The PersonP that dominates the locative predicate cannot spell out until an entire DP is constructed and merged with Poss, and then with it. This is the longest delay yet between selection of a head and spell out of its phrase: potentially a delay of 5 phases.

NOMINAL PROCEDURES

The six developmental levels of Processability Theory

In this section the nominal structures discussed above are assigned to one of the six developmental levels identified in PT. As in the previous section, the results are summarized first in tabular form (see Table 80), then discussed below. Structures are arranged on Table 80, in order of the level of processing demands they each entail (column 1) and their order of emergence (ranked mean ET) is shown in the *last* column.

Table 80. Structures classified by developmental level

Level	Procedure Structure	Processes	Ranked mean ET
Level 1:	Lemma Name, 'Bare' NP Little pro	links concepts to phonetic features (PF)	1 2
Level 2:	Categorial Pron sg/PL Number+classifier Pron+de Fixed loc. compounds *Ordinals	links PF/ intrinsic F/ conceptual info / to Categorial F intrinsic F = Number intrinsic F = Class conceptual info = Possessor intrinsic F = Locative Prefix On Num; Intrinsic F = Def	1 1 3 3 11
Level 3:	Phrasal *Number-classifier N *Affine structure	Appointment rules &/or Agreement Agreement for Gender Restriction on category of poss'r (=c Pron)	1 3
	Assoc.de Conjunction AdjP N (Locative PPshàng ⁵⁰) Incorporated locatives ?Mod deP (Recursive Possession ⁵¹) Dem+Class N Num-Class deP N Locative de Reverse Locative Dem (Class) Num (Class) N	Poss'r in NP Agreement for number Adv in AdjP and AdjP in 'NP' locus NP in 'PP' locus NP in NP ?Simplified CP procedure and no GFs Embedded phrase Agreement for Gender Appointment rules constrain order Embedded phrase Embedded phrase Appointment rules constrain order	4 5 6 7 8 9 11 10 11 13 14 15
Level 4:	SOP+ saliency (*S-final Locative PP ⁵²)	Allows CWO string + additional item PP adjunct	8
Level 5-6:	S or SC ?Mod deP Pseudo-relative Clause	GF assignment ?GF mapped from Adj to head N ?GF mapped from embedded S to initial N	9 12

Structures from T1-T2: basic nominals

LEXICAL INFLECTION

A number of nominals at T1 were one-word nominals about which Processability theory has little to say, unless they are inflected like Pronouns. Lexical inflections are evidence for the operation of Categorial procedures, a level two process. The 'plural' marker *-men* qualifies as a lexical morph in Processability terms, because information on quantity is assumed to be present in conceptual structure, and made available in the same iteration as the Person features that activate the Pronoun. Suffixation requires that the form *-men* be assigned an identifying feature that can be expressed in the lexical entry of Pron, and linked to the expression of quantity in conceptual structure.

⁵⁰ Produced by only two learners in my study.

⁵¹ Different kinds used by different learners.

⁵² Used by one learner only (Sam).

Affine structures

The affine structure wǒ nǎinai 'my grandmother' can only be the product of a *phrasal* procedure. Though Pienemann (1998c) suggests that a free definite article can be inserted into a lemma's categorial procedure by a 'Functorisation rule', the fact that the affine *must* be a *pronoun* i.e. must have the categorial feature, PRON, excludes the possibility that the pronoun is inserted in an N's *categorial* procedure to form a compound word. In a compound word, only one of the two items can bear a categorial feature which licenses inflections. Since the pronoun's categorial feature must come into play to license its selection, the pronoun lemma must have initiated its *own* categorial procedure, before it was combined with the kin-term. The affine structure must therefore be the product of a *phrasal* procedure that combines output from two *distinct* categorial procedures, N and Pron.

The two terms cannot be ordered by the SOP either, firstly, because the SOP refers only to the actor-action-undergoer roles, and NVN categories neither of which apply here, and secondly, if the SOP were *extended* to include thematic roles assigned by nouns, we would still expect the reverse order, because the pronoun is not agentive. Finally the SOP operates only on flat serial structures, not hierarchical ones. To produce an utterance such as Hannah's wǒ nǎinai zhù Hánguó 'my grandmother lives in Korea' (H1), containing an affine structure *within* a predication, the SOP would have to be applied cyclically, ordering items at two distinct levels: first the pronoun and kin-term, then the resulting unit and the verbal predicate. This is counter to the very notion that a serial order principle is a pre-syntactic purely *linear* ordering strategy. An extended SOP poses as many problems as it solves.

To produce an affine structure within a larger ordered structure requires a processing step between the categorial and full proposition procedures, which makes reference to a categorial feature, Pron, and orders Pron relative to N. This is by definition, a phrasal procedure, indicative of processing at level three.

The only alternative is to propose an independent ordering principle *like* the SOP but operating at the *phrasal* level and mapping *different* roles in a *different* order from the sentence level SOP. The product of that phrasal level SOP would then be ordered by the higher level SOP. This is so similar to syntactic processing that it is doubtful that it would actually afford any processing advantage.

Numeric structures

At T1 and T2, learners produce utterances with quantified nominals containing different classifiers for different nouns such as:

- 186) a. wǒ jiā yángē yī zhī gǒu
 my family keep one Class dog
 My family keeps a dog (H1)
- b. nà shì liǎng zhāng zhuōzi
 that is two Class tables
 There are two tables (S1)

Overextension to nouns that do not take classifiers in the TL indicates that the productions are

generative, not fixed forms:

187) *liù. ge nián
 six class years
 Six years (H1)

Distributional evidence suggests that the classifier may be viewed, initially, as a suffix of Num, incorporated during a categorial process (level two) (see discussion of Dem-Class-Num-Class -N below). However, Num and N are clearly distinct: each can appear alone. Moreover, neither can function as a predicate in a proposition, and they are not related by any event such that they might be ordered by the SOP; like the affine structure, they can only be combined in a phrasal procedure.

AGREEMENT

Assuming the classifier is a suffix on the number, there is no need to assume a licensing feature (COUNT) in the PT model. A classifier cannot possibly appear without a number anyway, for morphological reasons, and when a number appears without a classifier, this can be understood as simply a null reflex of a specific classifier, that is, for a specific value of the feature GENDER. The presence of the classifier is determined purely by the categorial procedure for number. This explains the total absence of 'ClassP' arguments in the ILs.

To implement agreement between the noun and the classifier/suffix of a number, the lexical entry for both numbers and nouns must contain a feature specification: [GENDER = $\hat{\uparrow}$ (GENDER)] (my GENDER is the same as my mother's) and an appointment rule to ensure that Num and N are combined under the same mother node. The feature specification is a level one process, but the implementation of an appointment rule is a level *three* process. The mother node where the feature specifications are unified could be part of either the NumP procedure, or the NP procedure; there is no way to decide, but either way, the inherent GENDER of N will be copied to that node, and back down to the number, determining the form of the classifier – phrasal agreement.

Structures from T3-T4: modified nominals

FIXED INCORPORATING LOCATIVES: LEXICAL COMPOUNDS

The fixed collocations of a noun and locative, as in Kazuko's use of *hǎibian* 'sea-side', represent nothing more than a single lexical item calling a categorial N procedure. Sam generated some novel collocations like *nánrenbian* 'men-side', which appear to be productive compounding, licensed by the specific form *bian*. Though Pienemann has little to say about compounds, the fact that output is a single categorial word whose collocational possibilities are dictated by the head means they can only be the product of the head's categorial procedure. Apparently then, in Sam's IL, the locative noun could call another lemma into its own *categorial* procedure. This is still essentially a level two process.

Associative de

The slightly later emergence of Associative de-structures, relative to the affine structure, cannot be explained by frequency in the input. The Associative de-structure is necessarily more frequent in TL conversation, because it occurs with a much wider range of meanings than the affine structure and combines a much wider range of collocates. This is evident even in the learners' textbook. In the first 42 pages, Associative de-structure occurred roughly four times as often as the affine structure (35:9), and it appeared ten times before the *first* occurrence of the affine structure. The Associative de-structure was also used in taped dialogues, to which the learners listened repeatedly, and featured in a production exercise.

Nor can its slightly later emergence be explained by lack of contexts for use: the use of the affine structure at T1, indicates that the more restricted context for use of affine structures *did* arise at the outset, and in each such context the de-marked possessive is an acceptable alternative.

Finally, the later emergence of the Associative de-structure cannot be explained by procedural demands as defined in Processability theory either. In a PT analysis, the particle *de* that separates a modifier from the noun it modifies must be involved in a unification process. If it is called into the procedure of the *modifying* phrase, its categorial feature must be accessed by that procedure; and if it initiates its *own* procedure, its appointment rule must specify the nature of the modifiers it will accept, and check the features of such modifiers as are delivered to it. Either way then, information is exchanged between *de* and the modifier it follows. These are phrasal processes, but phrasal procedures are already evident at T1 in the use of numeric expressions. Thus, the fact that Associative de-structures did not appear productively in my study till T2, cannot be readily explained by Processability theory.

AdjP N

The unmarked attributive AdjP ((adv) Adj) appeared at T3 (H3, S4). These must also be the product of phrasal procedures, because the Adj has its own modifier; Adj must call an AdjP procedure that accepts an adverb as input, then produces an AdjP to combine with N. Since only certain intransitive Adj/Q appear in this context, we might also assume that a constraint equation is in force restricting access to the pre-N position, on the basis of delivery of the correct categorial or semantic feature, an agreement process.

Conjoined Nominals

Another structure involving agreement at this stage is the conjoined Nominal. Mandarin conjunctions are restricted in the lexical categories they may join: *hé* can join only Nominals (NPs / NumPs/ DPs), *yě* can join only Vs or VPs. The conjunction's phrasal procedure must check the categorial features of multiple input items against those specified by its appointment rule. Additional agreement processes are required to ensure that the distribution of the conjoint nominal is appropriate to

its input components. For example, where *yīge gēge* is grammatical, Hannah's utterance **yīge gēge hé mèmèi* 'an older brother and sister' is not: the use of a singular number and classifier conflicts with the number of the conjunct which is plural. In Hannah's IL then, there is a *failure* to implement an agreement process between the output of the conjunction's procedure and the item that selects it.

Such a failure is not predicted by the theory, but could be explained as inappropriate appointment rules or lexical feature-structures, rather than by an inability to perform phrasal agreement. This is a weakness of the theory: apparent failures in processing can always be ascribed instead to deviant lexical F-structure or procedures.

SOP PLUS SALIENCY (LEVEL 4)

Locative prepositions

At this stage, Sam and Kazuko also began to use the structure [X V/P shàng NP]. Since this string contains four items and two predicates: V/P and shàng, it cannot possibly be a product of the SOP, which assigns at most three positions, only one of which is to a predicate. It must involve a phrasal procedure called by shàng which calls the locus-denoting NP into it; at this stage, NP procedures do not include any preceding element except Adj/Q. This makes shàng's phrase a PP, a new procedure type, but one outside the scope of this study.

A similar logic can be applied to Kazuko's use of *zài shàng huà* 'at top picture' (K2; T2). Her previous use of *zài* indicates that it selects a single additional item into its procedure, formerly, N. So *shàng huà* 'top picture' must form a single constituent in Kazuko's IL, in order to be selected here by *zài*. This would also suggest that *zài* is beginning to select locative input, rather than nominal input, and could mark the onset of the changes required to link *zài* to the use of locative predicates. This begs the question of why the locative shàng's phrasal procedure develops only at T4, when the more complex Numeric procedure is already present at T1.

GF ASSIGNMENT AND SIMPLIFIED SENTENTIAL PROCEDURES

Mod de

At T4 (week 14), the first de-marked attributive 'adjectives' appeared. All three learners had already used predicative 'adjectives' and unmarked AdjP modifiers by T3. Given that 'adjectives' are really verbs, and that de-marked AdjPs are therefore relative clauses (see Li & Thompson, 1981), their late emergence is not necessarily surprising: a relative clause structure is a level six procedure because it requires a variation from the basic sentential procedure. However the question arises as to whether AdjP or VP can be selected as modifiers within deP *without* a special relative clause procedure, and therefore appear *before* level six processing is possible, as certain unmarked Adjectives do.

Recall that in Minimalism, modification by Adj depends on the acquisition of a functional head, *Mass*, which forms a link between Adj and a noun by introducing both Q-features (because early

modifiers all expressed notions of quantity) and REF. In the MP model, the de-marked structure is expected to emerge later than the unmarked AdjP-N structure, simply because the former involves an extra phase. However, in a standard Processability account, the number of levels of phrasal embedding is deemed irrelevant to processing demands. The factor that makes a relative clause more demanding in this theory is the involvement of a new procedure dedicated specifically to the construction of a subordinate clause.

According to LFG, the relative clause procedure must map a GF from a predicate within the RC to another GF outside the relative clause, accounting for the 'gap' within it. This mapping requirement might account for the initial exclusion of AdjP/VP from the nominal procedure. If the embedded predicate 'Adj' calls for a GF but there is no relative clause procedure, then the GF cannot be assigned, which is a violation of the Completeness Condition (see Chapter Six). However, if Adj calls for a GF, it must also do so when it functions as a *main* predicate, and structures with predicative Adj had already emerged at T1.

So, *either*, early Adj and V do *not* call for any GFs, in which case no violation would arise from including them within a nominal structure, *or* the learners can *already* assign GFs at T1. This would require at *least* level 4 processing capacity: a simplified S-procedure plus saliency. The saliency of a final predicate could support the transfer of its GF to another peripheral item, i.e. the Subject NP.

However, to assume level 4 processing at T1 would seriously undermine the notion that early productions are significantly limited by reduced processing capacity. Suppose instead that Adj and V do *not* initially call for GFs. Another way to account for their late entry into NP and deP would be to exclude them *explicitly* by way of a constraint equation specifying what can be accepted into NP and deP. This is essentially Zhang's proposal: she suggests the contexts for the use of de extend as de acquires *more features* over time. Presumably, those features are accessed by a constraint equation in the de P procedure, allowing more phrasal categories to enter its holder.

Unfortunately, the assumption of early constraint equations is also somewhat counter to the general spirit of Processability Theory. A procedure with *no* restrictions is simpler than one which imposes a constraint, because the latter necessitates the exchange of information between input and holder. Note that we cannot explain the initial absence of Adj from NP on the basis of delay caused by the prior construction of AdjP: a similar delay would be entailed in the construction of affine and possessive de-structures, and they emerged at T1. Nor can it be due to iteration effects: Pienemann explicitly includes adjective-noun agreement as a *phrasal* process, entailing that the modifier and N are delivered to the processor in one and the same iteration.

Conversion of Adj in a simplified 'CP' procedure

Nonetheless, we might still view a delay in Adj gaining access to an NP procedure as a natural consequence of the way phrasal procedures are linked to their heads. Since de and N themselves are nominals, they must call procedures that respond to the categorial feature of nominals, i.e. N. Two

nominals might then gain access to the *same* procedure simply because their categorial features are identical. An Adj or V would be excluded for the same reason.

This then raises the possibility that non-nominal lemmata gain access to a nominal procedure only by prior association with a procedure that accepts nominal *and* non-nominal input, but produces output with a nominal category. In other words, the onset of adjectival modification might be understood as a consequence of the development of a new *phrasal* procedure that accepts Adj/V input, but outputs a phrase with a categorial N label acceptable to NP and deP procedures. In essence, this is the *basis* of a CP procedure, a procedure whose output has the internal structure of a clause, but whose distribution is like that of a nominal. However, the procedure need not initially be one that maps GFs. Assuming Adj and V initially make *no* GF calls, this procedure need do nothing than more accept Adj/V input, and output an 'NP'; it need not be a fully fledged RC procedure. I will refer to it as a simplified CP.

This proposal goes well beyond any specific proposal put forward by Pienemann, but it is in line with the basic logic of his theory, that simplified versions of procedures precede fully functional versions. It allows us to explain the use of adjectival *predicates* at T1, *without* GF assignment, and level 4 processes, while also explaining the delay in emergence of adjectival *modifiers*: the new 'simplified CP' procedure needs to be developed, and linked to appropriate input items before they can be incorporated into an NP. Its emergence may also be associated with the development of VP procedures, which also need to accept both V and N input.

Note the similarity between this proposal and the conclusions drawn from the minimalist analysis, that the adjectival modifiers contain a covert functional head *Mass*. In the procedural grammar of PT, Adj/V *modifiers* involve a CP procedure, and this also entails the existence of a head 'C' that can initiate the CP procedure. This C head is apparently covert.

The development of a simplified CP procedure represents the first of several steps that are logically necessary for the development of a fully functional SC/RC procedure in an LFG framework. Before any GF can be mapped from a clause to the head of an NP, the clause must first gain admission to the NP's procedure, and the mechanisms that transfer information from the clause to the N must be established. Obviously it will be easier to construct the new procedure and relationships *before* the complexity of GF assignment becomes an issue; what better way to start than by accepting only nouns and pronouns, since these are generally athematic elements, which do not call for GFs. The Associative de-construction can be understood then, as reflecting the first step in establishment of a basic mechanism for transferring simple categorial information from a modifier to a head noun. The simplified 'CP' procedure then provides the next step: the mechanism that allows Adj or V categories into deP and thereby into a standard NP procedure. The stage is then set for the next step: the introduction of GFs to the lexical structure of Adj and V, and their assignment in more complex structures. In this view, Adj and V become nominalised, not *because* they enter a procedure with de, but *in order to* enter that procedure. This explains why de is also used with items that are *already* nominal: its basic function is not as a nominaliser, but to form a link between a phrase and a head N.

is ungrammatical in the TL, so, the embedded sentence is not readily understood as an addition to a standard NP procedure. In addition, assuming the SOP is the only means to order items at the propositional level, it would select a *single* NP, wǒde huà, as NP1, and *then* the copula to which it is related, as V. The simplified sentence procedure of level four cannot assign an item to an *internal* position, between NP1 and V, such as occupied by the embedded sentence.

Thus we can conclude that the embedded sentence is either a) placed in second position at the S-level, by an application of a *true* sentential rule, indicating processing at level five, or b) it is a genuine relative clause, linked by GFs to the Subject of a sentence, inside the Nominal constituent, indicative of processing at level *six*.

Structures from T5 -T6: different subconstituents

'INTERPHRASAL' AGREEMENT IN COPULA CONSTRUCTIONS (LEVEL 5)

The emergence of ordinals provides one of the few contexts where unification of number by interphrasal agreement can be observed in Mandarin. As ordinals are unique identifiers, they are necessarily singular, so when they occur as copula complements, the Subject must be singular also. At T2, Sam used a demonstrative subject with an explicitly plural copula complement, producing an error in agreement: nà shì liǎng zhāng zhuōzi 'that is two tables'. This could be due *either* to incorrect specification of the number feature on the demonstrative, or to an inability to unify number.

By T5, there was evidence of agreement in this same context, for example in utterances like those at (189):

- 189) a. zhè.ge huà shì dīyī
 this.Class picture Cop first
 This picture is the first (H4).
- b. liǎng miàn de fāngxíng hé liǎng miàn de sānjiǎoxíng shì píngxíngde
 two side de square and two side de triangle Cop parallel
 Two sides of the square and two sides of the triangle are parallel (S6)

As there can be only one 'first', the complement NP in (189a) is clearly singular, while the predicate píngxíngde 'parallel' used by Sam in (189b) demands a plural Subject, which Sam provides in the form of a conjoint structure. These examples are both evidence of successful unification for number between predicate and Subject: the level *five* process of inter-phrasal Agreement.

MORE PHRASAL STRUCTURES

Productive incorporating locatives

At T6 and T7, in structures like zài qìchēlǐ 'in the car' the preposition zài 'at' began to select a complement that is neither a simple noun, as in the earliest PPs, nor a second PP, headed by shàng, as at T4. Instead it is a complex structure that can involve any bound or free locative head, preceded by any semantically appropriate noun. The simplest analysis would have the locative select the preceding noun within its categorial procedure, as suggested above. The N-locative sequence would count as a single word, and the 'PP' could be understood as a product of the SOP. However, since at least some of the

locative heads are free lemmata, they would be expected to call their *own* phrasal procedure, not to enter that of another free word. An alternative analysis is that each locative calls a distinct *locative*NP procedure, which searches for a locus-denoting NP to include in its holder. Maximally then this involves level three processing, embedding of one phrasal constituent within another.

Dem-Class- N

As discussed in the last section, the demonstrative was present in the ILs from T1 or T2, as was the Num-Class combination, but Dem began to combine with Class and N only at T4 or later. Since in PT, lexical items need not be distinguished by different feature-specifications, and their combinations are implemented by way of appointment rules, not feature attraction, the Num-Class-N, and Dem-Class-N strings can both be analysed as simply two-place nominals, with the classifier a lexical suffix on either. In fact, the distribution of Dem was not *statistically* distinct from that of Num at this time and so there is nothing in PT that can account for the relatively late emergence of the Dem-Class combination. Also, as with numeric expressions, nothing in the theory really allows us to determine whether NP calls Dem+Class, or there is a DemP procedure, as well as a NumP procedure, each of which call NP. Either way, Dem-Cl-N structures between T4 and T7 can be classified as simply level three phrasal procedures.

Locative deP

The locative deP construction requires only that a locative noun call an NP procedure which selects a deP as input, and that the deP procedure accept a locus-denoting nominal phrase rather than a possessor or adjectival phrase. Both of these were attested before the locative deP emerged, and in the standard PT model, there is no basis on which to suppose that introduction of a locus-denoting nominal places any more demands on processing than introduction of a 'possessor' or attributive modifier in other de-constructions. The obvious difficulties the learners encountered with this structure might be explained as a failure to associate locatives with the correct type of procedure in TL terms, i.e. with an NP procedure rather than a PP procedure. Clearly, they also had difficulty integrating the locative deP structure with a preposition, and into a sentence structure. This is consistent with the idea that it is really the thematic nature of locatives that delays their emergence. However standard PT provides no mechanism to account for such problems in terms of processing demands.

Num-Class deP N

Even the appearance of two independent modifiers before a single N, the most striking feature of later samples, still only entails level three processing, since all processing below the sentential level belongs to level three or lower. An interesting aspect of the emerging three-place nominals though, is that a comparison of ILs actually provides evidence that de-marked possessors and de-marked Adj were assigned to *different* positions within a complex nominal. When quantification and a deP component first combined, it was with an Mod de, not an associative deP, and the Mod deP always *followed* the classifier. However, when possessive de combined with a numeric expression, it always *preceded* the number, and hence the classifier, and also preceded a Mod deP, or an AdjP. Though none of these complex structures

is produced by *all* learners, the view is clearly shared between them that Associative de precedes Mod de / AdjP. At this stage then, there must have been a constraint within the procedure that produced these complex nominals, such that there were *two distinct* deP positions, with the left-most accepting only an associative deP, while the right-most accepted only a Mod deP. Schematically, the learners' nominal structures were ordered thus:

(190) Associative deP- [Num-Class]- [Mod deP] -N .

Assuming there was just one deP procedure, to produce both associative and Mod dePs, these ordering restrictions could only be enforced at a higher structural level, i.e. the level of the matrix procedure which accepted them as input and assigned them a linear position. To implement such a constraint, the categorial feature of the modifying phrase *within* the deP would have to be delivered to the phrase *containing* the deP and checked against constraining equations at each positions in that matrix holder. This involves the transfer of information across a phrasal boundary, i.e. the deP boundary.

However, this information transfer does not qualify as 'interphrasal' agreement in the terms of the PT, because the level where the information is delivered is not a *sentential* procedure, and the information combined does not come from two distinct iterations. Pienemann assumes that number information and information about attributes that identify N's referent are both available within the same iteration as the conceptual material that selects the N lemma itself (see discussion of English 'NP' in Pienemann, 1998c, and discussion of Swedish in Pienemann and Hakansson, 1999).

What this does suggest though is that any procedure that licenses AdjP/VP to enter into deP must assign to it a categorial feature that is *distinct* from the nominal feature of the possessive, so the resulting dePs will be distinguishable to the matrix structure that places them on either side of a quantifier. This undermines somewhat the suggestion made above that AdjP modification might only become possible when AdjP has been associated with a Nominal categorial feature, giving it access to deP. On the other hand, deP cannot simply accept a GF-calling predicate as input, because then *every* deP procedure would have to include an equation to map or assign a GF, and whenever de selected a modifier that did *not* call for a GF, there would be a violation of the Coherence Condition, which states that every GF that is *assigned* must be called for by a lexical entry.

By hypothesizing a *distinct* CP procedure, to assign a categorial feature to a modifying Adj, that procedure can be developed to map the GF from the predicate to an external phrase and we can still maintain a *single* deP procedure to accept either a non-predicate modifier, a DP, or the output of CP. A GF will be mapped within deP only if a mapping equation is *inherited* from a CP modifier. At this point then, when GFs are assigned if not before, a nominalising procedure must accept AdjP input and output a phrase with a categorial feature, that is *distinct* from N, but which admits it into a deP procedure, and thence into the *post*-classifier position in a complex NP. Most simply, this distinct categorial feature is, 'C' the feature of a clausal argument.

In addition, at this stage if not before, the de procedure must be amended to admit both CP and NP/DP, transferring whichever categorial label it receives to the next procedure it enters, in constructing

the nominal with two sub-constituents. Once a distinct C categorial feature is established, it can be used in a constraint equation on the holder position following the classifier.

Despite the apparent complexity and lateness of these developments, according to the theory, the assignment of a categorial feature is only a level *one* process, and placement of a constraint equation in a phrasal holder is a level three process. Both are already evident in the placement of Num-Class or Pron before N at T1. Thus, the developments evident in the ILs can be accommodated by the generative model of PT, but they do not obviously account for the late emergence of these particular late-emerging structures.

Structures after T6: Still more phrasal structures

DEMONSTRATIVE DETERMINERS

After T8, the distribution of the demonstrative became statistically distinct from that of numbers, when the two began, marginally, to collocate. Around that time, Hannah and Kazuko each produced structures with two classifiers *Dem-CL Num-CL N, or with one and an exceptional N that takes no classifier, *Dem-CL Num-N. This is consistent with a failure to recognise the Demonstrative and classifier forms as separate morphs (see above). However, in her next sample (H7), Hannah alternated Dem-CL-N with a TL-like Dem-N structure. This indicates that she *had* now analysed Dem as a separate morph from class, and that agreement was now functioning between N and Dem. The apparent *double* classifier construction at H6 was therefore a combination of an *unanalysed* demonstrative and a Num-Class unit, with N. This makes it a *three*-place Nominal, like that combining Num-Class and de Mod at (T4-5).

In Kazuko's IL, the demonstrative never appeared again without the classifier attached, and demonstratives and numbers do not collocate again in her or Hannah's ILs. It is therefore impossible to determine whether they continued to treat the classifier as a suffix of both Dem and Num, or whether they were beginning to treat it as an independent head.

In Sam's IL though there was direct evidence for a free classifier. Sam never produced double classifiers. Instead, in S6, he produced a range of Dem-Num / Dem-Class sequences: *nèi yīge jiǎo* 'that one-class corner', *nèi yī jiǎo* 'that one corner' and, *nèige miàn* 'that Cl face'. Since he used at most one classifier in each nominal, it could not be a suffix of *both* Dem *and* Num, and since it was present whether Dem or Num was absent, it could not be a suffix of either; it was a free morph. As a free morph, the classifier should have called its own *phrasal* procedure, and another *phrasal* procedure would need to determine of the classifier *phrase*. By T9 there was direct evidence of this in Sam's IL, in the way he used ordinal structures.

AGREEMENT BETWEEN THE CLASSIFIER, NUMBER AND NOUN

At T9, Sam used both two ordinal-*pronominal* structures, one ending with a *classifier*: *dìyī gè* (ORD one-Class) 'the first one', and one ending with a *number*: *zhè shì dì sān* (this is Ord-three) 'this is the third'. Since the classifier appears without a noun in the first, it cannot be inserted by a functorisation rule in NP, and since

the number appears without a classifier in the second, the classifier cannot be inserted in NumP. Sam must have reanalysed the classifier as a free morph that called its own phrasal procedure.

This means a system of constraint equations was now required such that either features of N and Dem/Num together determined when and where the classifier would appear, or features of the classifier and exceptional nouns determined when a number or demonstrative could appear. As discussed above, this indeterminacy is inevitable within an LFG framework.

In Processability theory, each item initially calls its own phrasal procedure, and if they are to share a common node across which information can be passed, they must first come to be combined into a *single* procedure. However, unlike minimalism, neither LFG nor Processability theory places any inherent constraints on ways in which they can combine, that is on possible phrase structures. There are many sets of appointment rules that could account for the observed collocation patterns, from a series of binary combinations, like NP => (ClassP) N, and NumP=> Num NP; DemP => Dem NumP; to a flat structure headed by any of the items: DemP/NumP/ClassP/NP => Dem Num Class N.

Nonetheless, *whatever* procedure positions the classifier in Sam's IL at T9, it must receive a feature (GENDER) from the NP procedure, which determines the form of Class, and whatever procedure positions numbers, it must receive a feature from the classifier or an exceptional noun (COUNT), to license their use. In addition, whatever procedure positions Dem must ensure that Class is present, by receiving the same feature (COUNT) from Class, or from an exceptional N, perhaps transferred via NumP. This approximates the system of phases entailed by the minimalist analysis of numeric expressions, based on attraction between features, but without the same severe constraints on attractions or on linear arrangements.

Whatever set of appointment rules Sam adopted, in the PT view, they must have included both constraint equations on three of the four positions (e.g. 'insert Number here iff COUNT and GENDER are both available'), and instructions to copy the features GENDER and COUNT to every dominating node until they reached a node that dominated all four items. From there the same instruction must have copied the features down every node till they reached the relevant constraint equation. These copying instructions would also have to have been included in the new lexical entry for Class.

The constraint equations required here are comparable to those implementing V2 word order in German, or Subj-Aux inversion in English Yes/No questions. These are defined as level five procedures *only* if they involve the GF Subject, and as level four procedures *only* if they involve a sentence-initial position, accessed by way of the saliency principle. The same kind of constraint at phrasal level is still classified as only a level *three* procedure.

OTHER LATE STRUCTURES

Most other structures emerging after T8 also clearly involved the combination of two already established sub-constituents, such as Poss deP Mod deP -N ; Poss deP ordinal-Num-N - possibly involving GF assignment, as discussed above (under Num-Cl deP N) - and *Dem-Cl AdjP N, which occurred in H6, where Dem-Cl was actually unanalysed (see above). This requires only a constraint

equation accepting Dem in initial position. As with other three-place nominals, each sub-constituent is output by its own procedure, and one procedure must combine them together, but it is not possible to say whether the structures were produced by alternative applications of the same three-place procedure (say DP), or alternative combinations of different procedures, such as DP vs. DemP vs. NumP etc.

Subordinate Clause Procedure, unattested (level 6)

The final level of processing postulated by Processability theory is that of sub-ordinate clauses. As there was only one instance of a transitive relative clause, which would indicate the mapping of GFs to a head N, there was no evidence from Nominal structure that learners had reached level six processing by the end of their first year of study, other than the somewhat ambiguous evidence from pseudo-relative clauses, discussed above.

This concludes the discussion of IL development from the standard PT perspective. The results are summarized on Table 80 above. The final section of this appendix discusses the same developmental path with reference to the implementation of various unification mechanisms in the nominal structures. This constitutes a refined version of PT.

THE REFINED PT ANALYSIS

Table 81 below presents a summary of the processes of unification involved in each of the IL structures discussed above. The processing level of each structure according to the standard model is shown in the first column, but the structures are *ordered* according to their mean ET, shown in the last column.

The discussion that follows the table explains the analysis in detail. It reveals a pathway of syntactic development that proceeds from processing athematic structures to handling a relatively fixed mapping from function to linear order, and finally culminates in the process of resolving functional uncertainty on an *ad hoc* basis, within the universal constraints proposed by LFG. Again, the discussion follows the order in which the relevant structures emerged.

Table 81. Licensing, agreement and GF assignment in nominal structures

Level	ID	Structure	Process	details	RMET
	1/3/ 30	Name / N/	None		1
	4	Pro			2
	2	Pron	licensing	in Categorical procedure	1
3	8	Num.Class N	local licensing & agreement	Licensing of Num in ClassP, agreement with COUNT N unified in ClassP	1
	7	Affine structure			3
	9a	Possessive de		de is suffix, local licensing in NP	4
	12	Conjunction		licensing in ConjP; unification of categorial F	5
	11	AdjP N		Categorial Adj and N features license adjacency	6
	18	Incorporated locatives	Local DF and GF assignment	OBJ GF assigned in N or NP, licensed by N	8
	9b	Associative de ⁵³	Multiple DF/GF assignment and local licensing	(MOD <i>and</i> FOCUS) in deP; licensed by de and by ADJUNCT GFs	?
	19a	Mod deP (early)		as above	9
	16	Dem+Class N		Class-N agreement ; licensing of Dem by Class in <i>DemP</i> ,	10
	31	(Recursive Possession)		as for 9 above x 2	11
	22	Ordinal	?licensing	Categorial Num or phrasal OrdP	11
	20	Num-Class DeP N		as for 8 and 19 above combined	11
5-6:	15	Pseudo-relative Clause	Functional uncertainty	SUBJ of Copula linked to TOPIC in S; licensed by local ADJUNCT GF	12
3:	21	Locative DE	co-head relation and functional uncertainty	locative N and de share <i>a//F</i> ; MOD and FOCUS DFs assigned in deP FOCUS DF licensed by local ADJ GF; MOD DF licensed in deP by OBJ GF of <i>N</i>	13
3:	32	Reverse Locative		MOD and FOCUS DFs assigned in deP ? FOCUS DF mapped to OBJ of N? ?MOD DF licensed by ADJUNCT GF	14
5-6:	19b	Mod deP with intransitive V		MOD and FOCUS DFs assigned in deP MOD DF mapped to ADJUNCT GF FOCUS DF licensed by SUBJ GF of <i>V</i>	?

Athematic relations between nouns

THE AFFINE STRUCTURE AND THE SOP

The affine structure was among the earliest phrasal structures to emerge, and it appears to involve thematic role assignment. However formal *GF* assignment can be excluded on the basis that firstly, the pronominal element is *not obligatory* - a kin-term has a denotation, and a set of connotations, by which it can identify a generic type of referent, without support from an affine referent, and secondly the first item must be a Pronoun, it cannot be a noun or name.

This means the position that precedes the kin-term is not one in which a GF is stored that can be freely added to *any* constituent with a PRED value. In fact, the affine structure sounds like a prototypical product of the SOP, it involves an inflexible mapping of a single semantic relationship, kinship to two specific lexical categories, Pron and N. This suggests that, when basic phrasal holders first develop,

⁵³ This refers to N de N structures that are not core possessives (see Chapter 3). The ET here is the average for 6 learners, those in Zhang's study and the Auckland study.

learners treat *them* initially as linear sequences of semantic roles, using an SOP like that proposed at the propositional level⁵⁴.

DF assignment

THE ASSOCIATIVE *de* PHRASE

The affine and early N *de* N structures might be understood as products of a phrasal level SOP, with *de* a lexical suffix attached to the possessor N or Pron, but by week 16 *de*-structures were used to express a broad range of relationships and often involved two nouns which were *not* relational or predicate nouns. Clearly such structures cannot be viewed as a sequence ordered on the basis of thematic or semantic roles (Wen, 1999). In fact, the only generalisation true of NP1 in the associative *de*-structure is that it modifies NP2 in order to locate the referent of NP2 in the mind of the addressee. Such modification clearly serves a discourse function (DF), which we can simply call [MOD]. NP2 also has a discourse function, that of Focus, i.e. an NP whose referent is outside the pragmatic presupposition (Lambrecht, 1987). In short, the MOD and FOCUS functions are *imposed* on NP1 and NP2 respectively, *by virtue of their positions* relative to *de*.

According to Bresnan's endocentric mapping principles, DFs are associated with specifiers in a phrase with a functional head. In PT terms, NP1 and NP2 must be inserted in peripheral positions of the holder activated by *de*. Thus, while *de* may begin life in the PT model as a lexical suffix marking possession, it very soon takes on the role of a functional head licensing two DFs, much as it does in the MP framework discussed above.

In the PT framework, this development is procedurally quite simple: NP1 and NP2 need to be delivered to the phrasal procedure activated by *de*, and the positions in which they are inserted must bear the annotations: $\uparrow[DF] = \downarrow$ where DF = MOD and FOCUS respectively, and $\uparrow[DF] = \uparrow[GF]$. The first of these makes N1 function as a modifier, and N2 as a Focus; the second links the DF associated with a specifier position to any one GF within *de*P as required by extended coherence. Since associative *de*-structures do not necessarily involve a predicate, the GF that licenses these DFs must generally be the freely available ADJUNCT GF. This means there is no need to retrieve a GF value from a specific lexical head, unless a predicate with a GF feature happens to be involved.

So, in the LFG framework, the associative *de*-structure has the composition shown in Fig. 58, much as entailed by the minimalist analysis (see Chapter Seven, p. 156, Fig 17.) One important point of difference between this structure and that entailed by a minimalist account is that the EMPs allow a head with two specifiers and no complement, but the MP (or more specifically Kayne's LCA (Kayne, 1994)) assumes that each phrase can have at most one specifier, and a specifier position cannot be formed unless there is a prior complement. Clearly there is a need for further research into the ways that discourse

⁵⁴ It is unclear whether the affine structure is also a product of the SOP in native speech, or an example of GF assignment. Given the assumptions in LFG that all GFs must be called by lexical items and each GF called for must

functions might be mapped to c-structural positions, and into the possibility of an additional covert head in these associative de-structures.

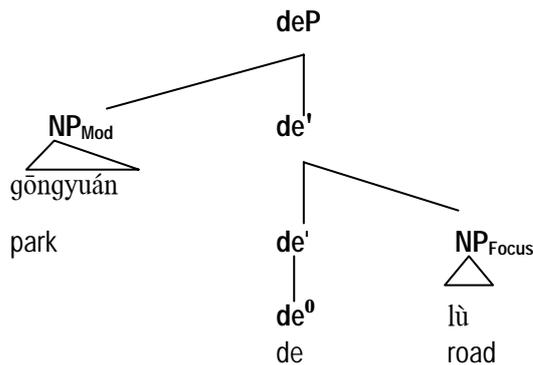


Fig. 58 LFG analysis of associative de structures

GF assignment within a categorial procedure

FIXED LOCATIVE COMPOUNDS:

In contrast to the earlier associative de-structures, like that in Fig. 58, incorporated locatives involve thematic relations and GF assignment. The earliest incorporated locatives were fixed compounds like *húbian* 'lakeside' which emerged alongside or just after MOD deP, *after* the superficially similar affine structures. The crucial difference between affine and locative structures is the logical relationship between the two components. Unlike the kin-terms in affine structures, locative nouns like *biān* 'side' have no denotation independent of their locus-denoting argument. Thus, they cannot serve the pragmatic function of locating a focal entity, without an additional noun denoting a locus as a reference point.

The obvious implication is that a locative noun's lexical structure *necessarily* includes a GF feature to which the locus role is linked. This makes the use of a locative noun without a locus argument ungrammatical. As soon as locative *forms* have been acquired, learners must include a GF feature in the f-structure associated with that form, and should set out to link their GF to a PRED value in whatever structures they can produce. Fixed collocations like *húbian* 'lakeside' suggest that this is initially achieved within in a *categorial* procedure.

In the TL, combinations like *húbian* 'lakeside' form a single prosodic word, (much as in English) with attendant loss of tone on the locative N2. This prosodic compound cannot itself be used as an N2 with another locus-denoting N: **hú de húbian* 'the lakeside of the lake' and this indicates that the locative noun's GF is assigned to the incorporated locus-denoting N within the lexical compound. This is comparable to N-V incorporation in English: the compound word 'fox-hunt' cannot take an object – 'to fox-hunt foxes' because, in compounding, the object GF of the predicate is assigned to the incorporated argument, making it unavailable to be assigned to an independent item (Baker, 1988).

be assigned to a functional structure, GF-assigning kin-terms must always have affine arguments but they might be covert, i.e. instances of anaphoric control.

Without recourse to IL grammaticality judgements, it is not possible to say that the ILs exclude-structures like *hú de húbian* 'the lakeside of the lake', but such structures are unattested in the ILs, as is the use of locative nouns *without* a preceding locus-denoting noun. On this basis, it is reasonable to assume that locative compounds in the ILs involve GF assignment, rather than some kind of categorial or phrasal SOP, which could not *force* a locus denoting N to appear.

Thus incorporated locatives like *húbian* *lake-side* have the *lexical* structure:

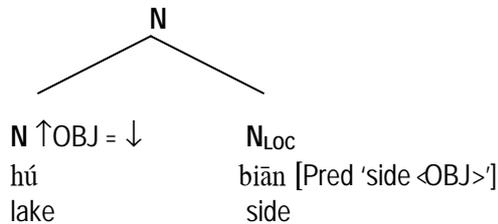


Fig. 59 LFG analysis of incorporated locatives

Note that the dominating node is still a *lexical* category, N, not a phrasal one NP. Their invariant structure in early usage forces us to classify these locative structures as lexical items. The locative noun calls for one GF, OBJ, which must be assigned within its *categorial* procedure to another N. Though Pienemann does not discuss the derivation of lexical compounds, the fact that syntactic relationships exist between their parts means that they must have a derivation something like this in his procedural grammar.

THE EXCLUSION OF ITERATION EFFECTS

If, as Pienemann claims, prosodic integration reflects conceptual unity, this prosodic integration means that a locative noun and its argument are delivered in a single conceptual unit. Therefore, the emergence of incorporated locatives so much later than affine structures cannot be a consequence of any inter-modular dependence effects, i.e. delays while the syntactic module awaits fresh input from the conceptual module. Since incorporated locatives are the product of a single categorial procedure, their late emergence cannot be a consequence procedural dependencies, or developmental dependencies either: the categorial procedure need not wait for input from another procedure, so the prior development or completion of any other procedure is irrelevant. Since the late emergence of incorporated locatives is not due to intermodular, procedural *or* developmental delays it follows that GF assignment constitutes a significant processing demand *in its own right*. Moreover, it is more significant to emergence time than the categorial/phrasal distinction. The emergence of incorporated locatives alongside Mod de-structures and *after* AdjP-N structures is consistent with the conclusion that the first involves local GF assignment, the second involves local DF assignment, and the third involves only local licensing.

GF assignment in a phrasal procedure

INCORPORATED LOCATIVES

Some incorporated locatives are *not* amenable to analysis as lexical compounds because the locative predicate itself is a bi-syllabic compound, and the argument is clearly phrasal. In the following example, the argument is a possessive deP.

- 191) zài wǒ de wōshì dūi.miàn
 at 1sg DE bedroom opposite.side
 On my bedroom's opposite side

Given the analysis proposed above, the emergence of these structures later than the fixed lexical compounds can be understood as a combination of a developmental dependency, and a procedural dependency. Locatives with a *phrasal* argument can only be produced by a *phrasal NP* procedure, assigning a GF to output from another *phrasal* procedure, in this case, a deP procedure. First the deP procedure must be acquired, this is the developmental dependency. Once acquired, it can produce output such as *wǒde woshi* 'my bedroom' that qualifies semantically as a locus-denoting phrase. However, the NP procedure initiated by a locative N cannot assign its Object GF to this constituent until it has been produced by the deP procedure and delivered to the NP procedure. This is a procedural dependency which necessitates the storage of a phrasal constituent *within the syntactic processor*. The same effects are entailed by recursive possessive structures, which have a similar mean ET.

Where GF assignment alone makes locative N more taxing than attributive Adj, the storage effects entailed by embedding make phrasal modifiers more taxing than one-word modifiers. Thus, *GF assignment and storage effects contribute independently to processing loads*.

GF transfer and Functional uncertainty

LOCATIVE DE-STRUCTURES: GF TRANSFER WITH SALIENCE

The next structure to emerge after incorporated locatives was the pseudo-relative clause. As mentioned earlier, this proved to be a Topic-comment structure, rather than a true RC structure. However it illustrates a point with respect to the relative demands of GF assignment in different contexts. In the pseudo-relative clause at (192), a full sentence restricts the reference of an initial topical NP; a comment on that topic follows after the restrictive sentence:

- 192) wǒde huà [zhège yī jiā qù cháojíshìcháng] shì dīyī
 TOPIC [restrictive modifier] predicate
 1sg DE picture [this.Class one family go supermarket] COP first
 My picture, this family goes to the supermarket, is first (H5)

As mentioned earlier, this is not a *true* relative clause because the sentence contains no gap, and the initial NP has no thematic role within the restrictive sentence. Nonetheless, the structure involves the transfer of a SUBJECT GF from the copula that follows the restrictive sentence to the topic NP that precedes it. It *cannot* be a product of the SOP; the SOP enforces adjacency between an NP with a specific thematic role and the predicate that entails that role and, firstly, copulas do not entail thematic roles, and secondly, the copula is separated from the initial NP, which is clearly its SUBJECT. Thus, the presence of

the copula entails at least a simplified S-procedure. The copula's lexical structure must include a SUBJECT GF, but the copula in this structure forms a prosodic constituent with its complement which excludes the initial NP and the restrictive sentence. Thus, the copula must initiate a phrasal procedure in which its OBJ GF is first assigned, *then* initiate the S-procedure where the Subject GF is assigned. Thus the Subject GF must be copied from one procedure to a matrix procedure before assignment is possible. The assignment must also be licensed by a unification process that matches the GF assigned in this S-procedure to the one specified by the copula. In principle, this unification may be facilitated by the saliency of the initial NP.

FUNCTIONAL UNCERTAINTY

The next structure to emerge was the locative *de*-structure. In this structure, functional uncertainty is resolved by way of a functional identity equation. The examples at (193) show that the NP preceding *de* in a locative *de*-structure receives a GF licensed by the locative noun. Both (193a), where a locative noun appears without a locus-denoting argument and (193b) where the locus is adjacent to the locative noun, are unacceptable. In (b) *de* can only be interpreted as part of a nonsensical embedded locative 'chē de shù' 'the trees of the car'. In a locative *de*-structure, as at (193c), the locus-denoting NP precedes *de*, in the position associated with a MOD DF, but it is also clearly associated with the OBJ GF of the locative noun.

- 193) a tāmen zài ∅ de zhōngjian
 3pl at ∅ de middle
 *They are amidst
- b. tāmen zài chē de hěn duō shù zhōngjian
 3pl at car de very many trees middle
 ?? They are amidst the car's trees
- c. tāmen zài hěn duō shù de zhōngjian
 3pl at very many trees de middle
 They are amidst many trees

Since both the OBJ GF and the MOD DF *must* be assigned (under the completeness condition), and since the DF must be linked to a GF (under the extended coherence condition) and since there is only one overt argument available for both functions, the MOD DF *must* be linked to the OBJ GF by a functional uncertainty equation. Moreover, According to the EMPs, a predicate with a GF to assign must be the c-structural sister and f-structural co-head of a functional head. To produce this structure then, the learners' *deP* procedure must have been modified to include the equation $\hat{\uparrow}\text{MOD} = \hat{\uparrow}[\text{GF}]$ in the initial specifier position, to satisfy extended coherence, and the co-head equation $\hat{\uparrow} = \downarrow$ at the positions containing *de* and its *complement*, the locative NP, to allow the locative noun's OBJ GF to be copied to *deP* and so linked to the MOD DF. The relevant c-structure is as follows:

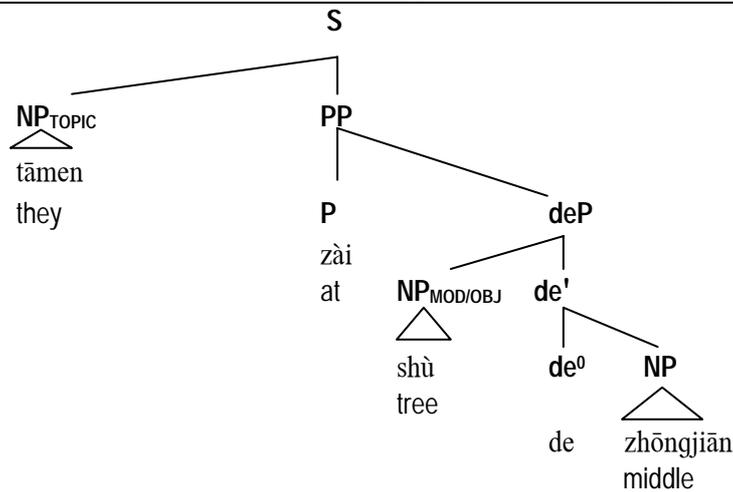


Fig. 60 LFG analysis of locative de-structures

The very late emergence of locative de-structures, which is clearly *not* due to either categorial or iteration effects *is* arguably due to the storage effects arising from functional uncertainty. GF assignment is not fully satisfied within the NP procedure where the GF feature is lexically expressed; it must be transferred to a matrix procedure, just as in the assignment of a Subject GF in a sentential procedure. Moreover, in this case, the position to which it is transferred, is *not* a salient one.

From semantic to grammaticalised predicates

PREDICATES BEFORE GF ASSIGNMENT

The development of adjectival modification parallels that of modification using nouns, described above. Because of the completeness condition, the lexical structure of verbs must *not* include GFs until a procedure has developed that can assign and unify GFs. Assuming that these processes are initially beyond the processing capacity of novice learners, we must understand all early IL verbs and 'adjectives' as having thematic arguments that are *not* grammaticalised as lexical GF features. As a consequence the omission of those arguments may make for semantically incomplete propositions, but it is grammatically acceptable because the completeness and coherence conditions are not invoked. In processing terms, such verbs are precisely comparable to a referential N that has *no* logical arguments in the first place.

Initially, such a lexical V might be incorporated into a noun's *categorial* procedure, as a second noun would be in a compound noun. However *phrasal* AdjP could not gain access to a categorial procedure of N, and nor can AdjP-N collocations be the product of the SOP. This would interpret AdjP as a semantic predicate and would therefore produce the order N AdjP, as seen in early IL *predicative* structures. Nor can the AdjP-N collocation be the product of GF assignment by N to AdjP, because the AdjP is optional. Thus, the only way the attributive AdjP-N collocation can be produced initially, is as the product of a *phrasal* procedure that simply includes one position licensed to accept the category AdjP, (at least quantity and size-denoting AdjP, the only ones to appear adjacent to N in the ILs) and one position licensed for N. In fact, it is not even necessary to add features to the initial position to allow insertion of AdjP, all that is required is that the *final* position be licensed for nouns alone. Then, any other category delivered to this

two-place procedure will *necessarily* be inserted in the initial position. This is local licensing with neither thematic relations nor GF assignment involved.

The emergence next of the Mod de-structure can be seen as a simple consequence of the delivery of AdjP products to the phrasal procedure initiated by *de*, instead of to this interim procedure, and as a consequence, the assignment of the MOD DF to AdjP. Whether Adj is classified as Adj or V, a VP's categorial V feature will allow it access only to the initial position in the *deP* procedure, i.e. the position that is not associated obligatorily with N, and in which at some point in development, the DF assignment equation $(\uparrow\text{MOD}) = \downarrow$ and the functional uncertainty equation $\downarrow = (\uparrow\text{GF})$ are both expressed. The first of these makes VP function as a modifier; the second links it to an Adjunct GF as required by extended coherence. In principle, it could be linked to a GF introduced by a lexical co-head of *de*, but in the absence of such a co-head (and these seem to be restricted to locative nouns) it can in practice be linked only to the freely available Adjunct GF. In short, this structure provides evidence of local DF assignment *and* a functional uncertainty equation linking a DF to an Adjunct GF but no *lexical* licensing.

GF ASSIGNMENT IN INTRANSITIVE RC

Lexically licensed GF assignment involves just a little more processing. For a VP procedure to lexically license the assignment of an could OBJ GF, it need only include a position annotated $(\uparrow\text{OBJ}) = \downarrow$; the OBJ GF feature would then be added to any constituent inserted there, and a unification process would search for the same GF in the lexical structure of some V. Thus we might expect transitive VPs combining V and an Object to emerge around the same time as the Mod *deP* structure. Even so, those VPs would not be immediately incorporated into nominal structure as RCs, since this involves more processing still, because once OBJ GFs are specified in lexical structure, we might expect SUBJ GFs to be specified as well, and the assignment of the SUBJ GF involves GF transfer by a co-head relationship which is more complex than local GF assignment.

Under the assumptions of LFG, the SUBJ GF is assigned in the S-procedure, not within the VP procedure. Thus if SUBJ GFs are added to the lexical structure of verbs before an S-procedure has developed, those verbs will only be able to function in contexts where their SUBJ GF can be linked to some other GF or to a DF in a procedure that has already developed. As we have seen, the *deP* procedure is just such a procedure.

So suppose a verb has a lexical GF that has *not* been assigned within VP, presumably because no constituent with a PRED value is available. By the time *deP* has developed to the point where it can accommodate associative de-structures it contains two specifier positions, the Mod position and the Focus position, each bearing the equation $(\uparrow\text{DF}) = \downarrow$, where the DF is Mod or Focus respectively. The second position is also restricted to constituents with the category N. The VP can be inserted as a modifier in *deP* and its unassigned GF can then be linked to the focus position in either of two ways. First, the *deP* procedure could be modified so it transfers the GF feature from VP to *deP* by the way of a co-head equation $\downarrow = \uparrow$, or a more specific agreement equation: $\downarrow(\text{GF}) = \uparrow(\text{GF})$, added to both the Mod

node and the deP's head node. Alternatively, the path in the functional uncertainty equation at the focus position could be extended to include *embedded* GFs as potential licensors of the focus DF. This would only require the addition of the label MOD as an optional element in the path, giving: $\uparrow((\text{MOD}) \text{GF}) = \downarrow$.

The second option is preferable on several counts. Not only does it satisfy completeness with respect to V, it also satisfies extended coherence with respect to the Focus; the change is minimal, involving a single entry in a single location; paths are expected to be optionally extensive, whereas agreement relations are expected to be fixed and local; deP already has a co-head position and it *follows* de; at this stage in development, de is clearly associated with a *nominal* co-head, not a verbal one.

In short, deP is a *nominal* procedure that, with only a slight change to the structure it has developed through its early use in associative de-structures, can provide a context in which a verb's lexical GF can be assigned. Under this analysis the representation of the Mod de-structure in LFG terms would be as shown below:

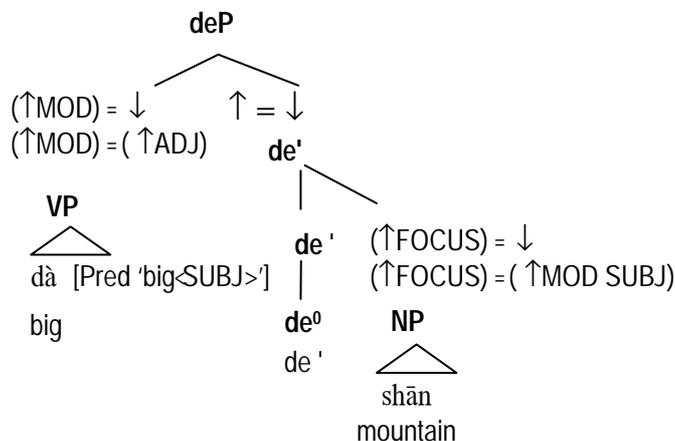


Fig. 61 GF assignment in Mod deP / RC

Again, this is much the same as the derivation suggested by a minimalist analysis (see Chapter 7, p. 156, Fig 19), except that here there are no covert functional heads, and de has two specifiers but no complement.

There is no *outward* difference between an Adj de N structure comparable to the deP in Fig. 58, where the modifier has no lexical GF to assign, and a V_i de N structure, where a verb has only one GF to assign, as in the diagram above. The point at which a learner of Mandarin becomes able to implement functional identity *is* evident only in locative de-structures.

Not also that, as long as V calls for only *one* GF, and that GF is mapped to a DF, no S-procedure needs to be initiated, and, in fact, throughout the entire first year, the ILs included no items that would provide direct evidence of a sentential procedure: no modals, aspect or sentence adverbials. This means the processes up to and including the introduction of V_i P into deP *can* all be legitimately analysed as *phrasal* procedures, despite the involvement of GF transfer effects and functional identity.

However, this also means that intransitive RC is simpler to process than transitive RC, because the latter *must* involve an S-procedure whenever the verb's *Object* is the GF linked to the focal NP. In short, this analysis provides two ways in which we might account for the delay between emergence of Mod

de-structures and transitive relative clauses. The earliest Mod de-structures may involve predicates without GF features, but almost as soon as a MOD DF can be licensed in a de phrase, we'd expect OBJ GF assignment to be implemented in VP. This immediately makes it more demanding to incorporate VPs where OBJ GFs are assigned into nominal structures where MOD and Focus DFs are also being licensed by Adjunct GFs. On the other hand, VPs which introduced unassigned *SUBJ*GFs can be integrated into deP without the complication of awaiting a prior assignment of OBJ GF, and their SUBJ GF can be used to license the Focus DF, instead of an Adjunct GF.

From this discussion it is clear that the satisfaction of the completeness condition through GF assignment introduces processing complexities that can readily account for certain aspects of nominal emergence order, but are entirely unrelated to the crossing of any particular constituent boundary associated with S, or with the combination of items derived from separate iterations of conceptual structure.

From lexocentric to endocentric structures: the separation of Dem-Num and Class

The development of GF assignment cannot so readily explain the delays in the emergence of Dem-Class-N and Dem-Num Class-N structures relative to the Num-Class-N structure, however this progression might be also viewed as a development from a strictly semantic arrangement of quantifier-N produced by a phrasal equivalent of the SOP, through an interim stage where a single phrasal procedure assigns a specifier function to either Num *or* Dem, and finally to something approaching the TL state of affairs, where Dem initiates a procedure of its own that accepts input from a prior procedure that has already combined Num and Class with NP. Effectively this is development away from a flat lexocentric nominal structure, towards endocentric hierarchical nominal structure. Since the implementation of licensing and agreement relations between N, Class, Num and Dem become more demanding as the c-structure that separates them becomes more internally complex, we might see this as a natural developmental pathway, that is not followed until processing capacity allows. Equally, it might be seen as a way of allowing complex agreement relations to be resolved in stages, so that the consequences of earlier unifications restrict the possible outcomes at later stages. These are aspects of processing that warrant further investigation.

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