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14

The first language acquisition of complex sentences

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14.1 Introduction

14.1.1 'Complex' vs. 'simple'

The term 'complex sentence' generally describes all sentences which are not 'simple' sentences. It traditionally covers all cases where more than a single clause is involved, as in sentential coordination (e.g. *Mary dances and Anne sings*), adverbial subordinate clause adjunction (e.g. *Anne dances when Mary sings*), and cases where some form of sentence-internal clausal embedding is involved as in sentence complementation (e.g. [*Mary claims [that Anne wrote a book]*]) or relativization (e.g. [*Mary reads the book [that Anne wrote]*]) (brackets display the multi-clausal factor). This descriptive characterization is not fully valid however. Sentences with non-clausal coordination (e.g. *Mary and Anne wrote a book*) or various forms of nominal and verbal embedding or adjunction (e.g. *the enemy's destruction of the city*) fall between 'simple' and 'complex' categories. In fact any 'simple' sentence which involves an operation, such as question formation, implicitly involves a relation between distinct clausal variations.

In this chapter we will review highlights of recent research on sentence types commonly described as 'complex' in keeping with the traditional background. However we will do so in a manner which suggests that there is no firm line between 'complex' and 'simple' sentences.

14.1.2 Complex sentences as a core

Complex sentences in many ways provide a core domain for investigation of the acquisition and development of syntactic and semantic knowledge.

Their study can lead us in the investigation of the most basic aspects of syntactic and semantic knowledge, such as those summarized in (i)–(v).

- (i) *Hierarchical structure*: The elements of a sentence appear not merely in a temporal or linear order but also form a hierarchy of constituents
Example: Within the sentence *Mary sings [when Anne dances]* the bracketed clause forms a subordinate constituent
- (ii) *Order*: Not only words but also constituents may be related in different orders
Example: Some clausal constituents may appear initially or finally, as in *Mary sings [when Anne dances]* and *[When Anne dances] Mary sings*
- (iii) *Locality domains*: Hierarchical structure and order inform the range for some grammatical operations, e.g. anaphora (where the reference or meaning of a linguistic element depends on an antecedent)
Example: *Mary believes [that Anne admires herself]* permits coreference between *herself* and *Anne*, but not between *herself* and *Mary*.
- (iv) *Recursion*: Human language includes the capacity to generate an infinite set of sentences by having an operation apply to its own output
Example: *Mary believes [that Anne claims [that Paul thinks [that Chris says ...*
- (v) Linguistic principles such as *Structure dependence*: Operations in human language depend not merely on linear order but on structure (Chomsky 1988, Lust 2006: 55)
Example: Question formation involves operations that refer not simply to the order in which words appear but to their structural role, as in: *Is [the man [who is tall]] in the room?*

Complex sentences in essence make overt what may be only implicit in simple sentences. For example, they often reveal overt complementizers, which may introduce sentential complements (e.g. *Mary claims [that Anne wrote a book]*), and which are generally silent in simple sentences. They provide domains for reduction of redundancy, therefore leading to null sites or ellipsis (e.g. *Mary sings and Mary dances* → *Mary sings and \emptyset dances*) and implicate all the principles involved in these (e.g. principles of anaphora, which determine the interpretation of the null sites). They provide barriers for certain long distance operations.

Complex sentences provide a domain where various fundamental questions regarding the nature of a ‘Language Faculty’ can be more critically investigated. For example simple word associations, which may be involved in simple sentences (as in the ‘verb island’ constraint of Tomasello 1992 for example, and Ch. 5), cannot account for long distance operations and need not be confounded to the same degree that they are in simple sentences. Lexical and functional category development can be dissociated through investigation of complex sentence domains. Whereas linguistic principles such as structure dependence can be probed in simple sentences, they are more easily revealed in complex sentence structures.

While there is much research on the young child's first words and first simple sentences stemming from classic early work (e.g. Brown 1973), there has been relatively little work which has probed early formation of complex sentences (with a few exceptions, e.g. Bowerman 1979, Diessel 2004). The time may have come for a more comprehensive integration of research on complex sentence formation with a view towards assessing the underlying linguistic knowledge it reveals.

14.1.3 The purpose and structure of this chapter

Here we cull basic discoveries on the acquisition of complex sentences. In our brief review we examine what the child knows about the linguistic system that underlies complex sentence formation and related operations (e.g. i-v above) and how this knowledge is revealed throughout the course of development. To this end we focus on selected research that has probed the theory of Universal Grammar (UG) in language acquisition. This theory seeks to define 'both a set of universal *principles* which capture what underlies language structure across languages, and a finite set of *parameters* to account for possible crosslinguistic variation' and at the same time to explicate a Language Faculty which may account for the human capacity for language (Lust 2006: 55; see Chomsky 1981, 1988). Research on language acquisition in this framework investigates the degree to which knowledge of linguistic principles constrains language acquisition and affects its development. It emphasizes discovering the knowledge of the grammatical system underlying particular constructions, especially the capacity for recursion, hierarchical structure and structure dependence.

A contrasting perspective on language acquisition views complex sentences as built from simpler constructions, which are concrete instances of language use, i.e. individual pairings of form and function (e.g. Goldberg 1995). Under this approach language acquisition is a process of gradually building larger constructions from the experience of smaller ones. This general approach has been applied to the study of the acquisition of several types of complex sentences (see Diessel 2004 and references therein). This chapter cites exemplary research from this paradigm in the relevant sections below.

The present chapter is organized as follows: section 14.2 reviews the acquisition of complementation, section 14.3 the acquisition of coordination, section 14.4 the acquisition of adverbial subordinate clause adjunction and section 14.5 the acquisition of relative clauses. In section 14.6 we briefly consider results of this overview with regard to leading questions regarding the study of language acquisition in the field today.¹

¹ Due to length limitations this chapter does not address additional issues related to complex sentences such as the acquisition of wh-questions and long-distance binding (e.g. de Villiers 1995). For these the reader is referred to Lust *et al.* (1994), Crain and Thornton (1998, Ch. 22), Guasti (2002, Ch. 6).

14.2 Complement clauses

14.2.1 The acquisition challenge

We may define ‘complement clauses’ as clauses embedded in one of the argument slots of the verb in the main clause. Complement clauses, as in (1)–(2), involve structural embedding wherein one clause is embedded within another. In addition they integrate structural phenomena such as the complementizer as head of a clause, the finiteness of the embedded clause, pro forms like pronouns or null sites, anaphora (e.g. principles of ‘control’, which semantically identify the null subject of a non-finite complement termed ‘PRO’ in certain generative theories), as well as specific lexicon involved in main verbs. There is considerable variation across and within languages in complement clauses especially regarding the degree of syntactic and semantic integration between the complement and the matrix clause. Specific dimensions of variation include whether the complement clause is finite or non-finite, whether the complementizer is overt or covert and whether it is +/- wh, as illustrated in (1)–(3).

- (1) finite, overt C, +wh
Mary asked whether they would leave.
- (2) finite, covert C, -wh
Mary said they would leave.
- (3) non-finite, overt C, +wh
Mary asked where to go.

Complements also vary with regard to the nature of their subject, i.e. overt as in (1)–(3) above or null as in (4)–(7) below. Complements with null subjects may vary with regard to the nature of the null subject and its relation with matrix clause arguments, that is, whether subjects or objects control them:

- (4) Subject control:
Mary_i tries [PRO_i to leave].
Mary_i promised Joe [PRO_i to leave].
- (5) Object control:
Mary told Joe_i [PRO_i to leave].

Languages vary in the form and function of complement clause as in the French examples (6) and (7), where the indirect object is marked by a preposition.

- (6) Marie a promis à Jean de partir
‘Mary promised (TO) John to leave.’
- (7) Marie a dit à Jean de partir
‘Mary told (TO) John to leave’

The child learning a given language needs to discover which type(s) of complement clauses occur in the target language and how these may vary within the language.

14.2.2 Complement structures in early spontaneous speech

Production of complement clauses has been reported even before MLU 2 in spontaneous speech (Bloom *et al.* 1980, 1989, Limber 1973), e.g. (8)–(10). These utterances may or may not reveal overt complementizers.

- (8) no Kathryn want play with self
(K11, age 22.3, MLU 1.92, Bloom 1970: 161)
- (9) Tu crois lé pieure là?
= *Tu crois qu'elle pleure là?*
you think COMP: she cry there
'Do you think she is crying there?'
(French, age 1;11, Dye 2005:17)
- (10) Chcem pić dzem w słoiku
I-want to-drink jam in jar
'I want to drink (the) jam in (the) jar'
(Polish, Jaś, age 2;0, Smoczyńska 1985: 643)

Bloom *et al.* (1989) documented very early clausal complements to English epistemic and perception verbs in children's spontaneous speech. Diessel and Tomasello (2001) analysed finite complement clauses in the spontaneous speech of children acquiring English, arguing that these clauses occur with only a few different verbs in early utterances. Diessel and Tomasello argue that the main clause verb serves only as a kind of epistemic or attention-getting frame for the clause, and thus that these utterances reflect only one proposition. This view, which suggests that early complement clauses do not reflect true grammatical embedding, contrasts with findings from a body of research uncovering grammatical constraints in early complements. We turn next to these findings.

14.2.3 Complement clause and control

Most of the acquisition research on complement clauses has focused on what has been termed 'control structures' (e.g. (4) (5)) and children's interpretation of the null subject of the complement. Early work uncovered a general preference for object as antecedent. Chomsky (1969) tested children (5–9 years) on the comprehension of structures like (11) and (12):

- (11) Bozo tells Donald PRO to hop up and down
- (12) Bozo promises Donald PRO to hop up and down

She reported that many children tend to interpret the matrix clause object as the controller of the embedded clause subject in both structures, incorrectly interpreting (12) to mean 'Bozo promises Donald that Donald would hop up and down'. This empirical finding was subsequently replicated (e.g. Cohen Sherman & Lust 1986, Eisenberg & Cairns 1994, Hsu *et al.* 1985, 1993). Similar findings have been reported for French and Spanish (Clark 1985 and references therein). Chomsky (1969) proposed that this behaviour could be explained by a minimum distance principle (MDP) (Rosenbaum 1967). The MDP has often been interpreted to mean that children choose the matrix object because it is the 'nearest', where 'nearness' refers to linear distance in the word string, reflecting a performance strategy.

Theoretically, if children could rely on a performance strategy such as the surface MDP they could bypass adult grammar. For example, Hsu Cairns and Fiengo (1985) tested sixty-four children aged 3;2 to 8;3 on complement and adjunct control structures through an act-out task and proposed several distinct 'stages' or 'grammar types': (i) object oriented (ii) mixed subject-object (iii) approaching adult and (iv) adult. As these authors point out their proposal raises the question of how or why the child might move from one stage to the next.

Maratsos (1974) predicted that if the MDP were a simple performance strategy then children would misinterpret null subjects in passive, object-control sentences such as (13), because here PRO is nearest to the *by* phrase not to the syntactic subject.

(13) Mary_i was told by Joe [PRO_i to leave].

The results of an act-out task with forty 4 and 5 year olds did not support this prediction; children correctly interpreted (13) (see also Goodluck 1978, Tavakolian 1978).

In addition, Cohen Sherman (1983) and Cohen Sherman and Lust (1986, 1993) provided evidence against the stage theory. They tested developmental groups of children on both comprehension and production on both non-finite subject and object control structures (14a,b) and finite (non-control) structures (14 c,d) with and without pragmatic lead (i.e. a preceding sentence introducing one of the arguments of the main clause).

- (14) (This is a story about Tom/Billy)
- a. Tom_i [promises Billy_j [PRO to eat the ice cream cone]].
 - b. Tom_i [tells Billy_j [PRO to eat the ice cream cone]].
 - c. Tom_i [promises Billy_j [that he_{ijk} will drink the milk]].
 - d. Tom_i [tells Billy_j [that he_{ijk} will drink the milk]].

Seventy-two children (3 to 8 years) were tested in a production (elicited imitation) and a comprehension (act-out) task. Results replicated previous findings regarding preference for matrix object as controller. However, they additionally revealed a correlation between PRO and infinitival

complements on the one hand and between lexical pronouns and finite complements on the other hand, suggesting that children know about the finite/non-finite distinction in embedding types and about the distribution of null or lexical subjects in each. Children did not allow pragmatic context (in the form of pragmatic lead) to influence interpretation of the subject in infinitival clauses (14a,b) but did so in the interpretation of the subject of finite complements (14c,d) suggesting that children know that control of null subjects in non-finite complement structures is obligatory. The results of Eisenberg and Cairns (1994) support the early availability of grammatical knowledge of control.

Young children acquiring Mandarin Chinese (ages 2;6 - 5;0, mean age 3;9, N = 95) have also been shown to distinguish control from non-control structures (Chien & Lust 1983, 1985). They distinguished grammatical subjects from topics in these control structures, reducing redundancy in an imitation task in sentences like (17) to produce (18) but resisting this in sentences like (15). A reduction of topic as in (16) is ill-formed since it appears to yield a topic-controlled gap in an obligatorily subject-controlled position.

(15) Xiǎohuá, jiějie x huān Xiǎohuá dài màozi.
Xiǎohuá, older sister like Xiǎohuá wear hat
'Xiǎohuá, (her) older sister likes Xiǎohuá (to) wear (a) hat'

(16) * Xiǎohuá_i, jiějie xīhuān Ø_i dài màozi.

(17) Xiǎohuá, bàba x huān baoa kàn diànshi.
Xiǎohuá, father like father watch TV
'Xiǎohuá, (her) father likes (her) father to watch TV'

(18) Xiǎohuá, bàba_i xīhuān_j Ø_i kàn diànshi.

Cohen Sherman and Lust concluded that a principle of minimal distance that is structure dependent selects the object as the 'unmarked' option in control structure like (14a,b). Pinker (1984) suggests that the child's preference for object interpretation is a default hypothesis reflecting what crosslinguistically is the unmarked option; verbs like 'promise', which are rare across languages, would require additional learning.

14.2.4 Distinguishing complement from coordinate clauses

Children acquiring Mandarin also differentiate complement from coordinate structures (Chien & Lust 1983, 1985). They distinguish the anaphora in 'control' constructions like (15) from that in coordinate sentences. Young children's ability to distinguish complement and coordinate structures has also been shown in English (Cohen Sherman & Lust 1993). Complement sentences as in (14) were compared with sentences involving coordination (19).

- (19) a. [The turtle_i tickles the skunk_j] and [Ø_{i,*j} bumps the car].
b. [The turtle_i tickles the skunk_j] and [he_{i,*j} bumps the car].

In an act-out task children chose different antecedents for the two sentence types, favouring the object in complement structures, but the subject in coordinate structures.

14.2.5 Summary of findings on complementation

There is evidence for early productivity of complement clauses in child language and evidence that children know about the distribution and interpretation of empty category subjects (e.g. PRO) in these clauses as well as about a principle of minimality involved in assigning reference to the embedded subject. This principle appears to reflect structure dependence. At the same time children's errors in antecedent choice reveal that they are acquiring language-specific lexical knowledge such as the distinction between subject and object control verbs such as *promise* and *tell*.

14.3 Coordination

14.3.1 The acquisition challenge

Coordination provides perhaps the most basic recursive device of natural language grammars, illustrated in the Dr Seuss (1965) example in (20) and a paradigm case of complex sentence formation. (For an in-depth discussion of the complexities of coordination and its acquisition see Lust *et al.* in press.)

- (20) When tweetle beetles fight, it's called a tweetle beetle battle, **and** when they battle in a puddle, it's a tweetle beetle puddle battle. **And** when tweetle beetles battle with paddles in a puddle, they call it a tweetle beetle puddle paddle battle. **AND**

Although seemingly simple, coordination involves many of the most fundamental syntactic aspects of language knowledge, including structural configuration. Various constituents can be coordinated and must obey certain structural constraints, ruling in sentential coordination (21a) and phrasal coordination (21b), but ruling out (22), where a noun phrase and a verb phrase are conjoined.

- (21) a. Ben's band bangs and Bim's band booms
 b. [[Bim] and [Ben]] lead bands with brooms
- (22) *[[Ben] and [bang booms]] make tweetle beetles happy

Various forms of anaphora productively apply in coordination. Antecedents may either precede or follow the proform or gap, ((23)–(28)) illustrating this variation. Coreferential elements are underlined.

- (23) Tweetle beetles battle and [*they*]/[\emptyset] use paddles
- (24) Tweetle beetles \emptyset and Pudgy Wuggies carry paddles

- (25) Tweetle beetles carry [Ø] and [Ø] use paddles
- (26) Tweetle beetles make [Ø] and Pudgy Wuggies carry [paddles]
- (27) Tweetle beetles battle in puddles and pudgy wuggies do [Ø] too
- (28) Tweetle beetles battle pudgies and so do wuggies [Ø]

Constraints apply to these operations, as in (29) or (30).

- (29) * Tweetle beetles carry paddles and use [Ø]
- (30) *Tweetle beetles battle in puddles and Pudgy Wuggies [Ø]

Coordination is also a domain for syntactic constraints on various operations. For example, there are constraints against wh-questions reaching into the coordinate clause as in (31), and also constraints requiring 'across the board' operations, as in (32) where the 'what' question must apply in both clauses:

- (31) *What do Tweetle beetles carry paddles and [Ø]
- (32) *What do Tweetle beetles like [Ø] and Pudgy Wuggies hate paddles.

In the acquisition of coordination, then, the child must assemble knowledge about constituent structure anaphora, and a wide array of essential linguistic operations. This knowledge must provide the infinite but constrained productivity involved in these recursive structures. Coordination also involves semantic and pragmatic factors such as those related to temporal order, or causality. Specific coordinating connectives may integrate such features in their morphology (e.g. 'but' integrating a negation feature, or 'because' integrating causality). Children must integrate their developing cognitive, syntactic, semantic and pragmatic knowledge; in doing so they will, for example, overcome an 'order of mention strategy' (e.g. Beilin & Lust 1975, Clark 1973).

Coordination varies across languages in how it is realized including whether coordinate connectives are overt (e.g. they are not in Mandarin (33) or (34)), whether and how they vary morphologically across coordination types and the degree to which coordinate and adverbial clause structures are distinguished syntactically and/or semantically.

- (33) suanlah-tang
sour-hot soup
'hot and sour soup'

(Chao 1968/1976: 483)

- (34) wo mai piao jin - qu
I buy ticket enter-go
'I bought a ticket and went in/I bought a ticket to go in'

(Li and Thompson 1981:595)

The child must then not only acquire a constrained, productive grammar of coordination, but map that to a language-specific lexicon and grammar.

14.3.2 Coordination in early spontaneous speech

Sentential coordinations as in (35)–(36) appear to be developmentally primitive; they are in place when phrasal or reduced coordinations appear, e.g. (37).²

(35) There water and there water (group MLU 2.36, Lust & Mervis 1980)

(36) Mae de matta no sorede Yū-chan ga nete-ta keredo
front at waited FP and Yū NOM sleeping-was however
'Ø waited at the front and Yū was sleeping though'
(33 months, Lust *et al.* 1980)

(37) Tora to raion kowai n da yo
tiger and lion frightening is GEN COP FP[EMPH]
'(The) tiger and (the) lion are frightening!'
(34 months, Lust *et al.* 1980)

Examples from left-branching languages such as Japanese show early productivity of the left-branching embedding representation of coordination, as in (38) from Japanese child speech and (39) from a comparable study of Sinhala (Gair *et al.* 1998).

(38) Kore ni notte yochien iku no
this in ride-GER Ø kindergarten go FP
'Ride on this and go to kindergarten'
(36 months, Lust *et al.* 1980)

(39) mamə [gedərə gihilla] kəæmə kəæwa
I home go-LA food eat-PAST
'I went home and ate'³
(2.11, Gair *et al.* 1998)

14.3.3 Early coordination is not a 'simple' developmental primitive

A review of experimental research on the acquisition of coordination relative to adjunction has *not* supported the claim that early coordination involves simple linearization or juxtaposition (Lust 1994). For example, in a study of coordination with VP-ellipsis structures like (40), children as young as 3;0 were found to compute multiple interpretations of the 'does

² See Lust (1981) and deVilliers *et al.* (1977). Note that 36 and 37 are examples from Japanese.

³ LA is a conjunctive participle; it can sometimes have the semantic meaning of 'when'.

too' clause, including those in (40a-d), while ruling out ungrammatical interpretations like (40e) and others.

- (40) Oscar bites his apple and Bert does too
- a. O_i bites O_i 's apple and B_j bites B_j 's apple *ijj*
 - b. O_i bites O_i 's apple and B_j bits O_i 's apple *iji*
 - c. O_i bites B_j 's apple and B_j bites B_j 's apple *ijj*
 - d. O_i bites E_k 's apple and B_j bites E_k 's apple *ikjk*
 - e. * O_i bites O_i 's apple and B_j bites E_k 's apple *ijk*

Within the domain of coordination, children thus demonstrate competence for ellipsis knowledge of ambiguity, variable binding and structure-dependence (see Foley *et al.* 2003). Here coordination does not appear to be a 'simple' early structural type.

14.3.4 Distinguishing coordination from complement and adverbial clauses

Several studies across languages have provided evidence that young children distinguish coordinate from adjoined or embedded clauses, both syntactically and semantically. As noted in section 14.2.4, children distinguish complement and coordinate structures in English and Chinese. Additional evidence comes from a study investigating pro-drop in subordinate clauses where children acquiring English (2;2 to 4;5) imitated structures like (41)–(42) (Núñez del Prado *et al.* 1993).

(41) Mickey sings and Mickey/he whistles.

(42) Pluto coughs when Pluto/he wakes up.

In their imitations children reduced the second subject (noun or pronoun) to a null subject significantly more in coordinate structures (15.3 per cent of all items) than in subordinate structures (2.4 per cent of all items). When they imitated adverbial structures like (42), they reduced the noun to a pronoun or retained the pronoun.

14.3.5 Crosslinguistic variation

Left-branching languages (such as Chinese) differ systematically from right-branching languages (such as English), as reflected in children's early forms of coordination. For example, in elicited imitation, English-speaking children (ages 1.11–3.1, mean age 2.6) found the [V [O+O]] structure (43) most accessible (Lust 1977) but Chinese-speaking children (ages 2.0–4.5, mean age 3.3) found the [[V+V] O] (44) significantly more accessible (Lust & Chien 1984).

(43) [Eat [the crackers and the cake]]

(44) [[XI-yi-xi ye ca-yi-ca] wawa]
[[wash and dry] the doll]

These results provide evidence that children consult the branching direction (or head direction) of the grammar of the language they are acquiring and that this parameter of variation affects early, even simple, sentence formation. Research on Japanese coordination (Lust & Wakayama 1979, 1981) supports this view. The effects of right- and left-branching language differences on simple sentences is also seen in studies of subject pro-drop in simple sentences (Mazuka *et al.* 1986, 1995, cf. Bloom 1990a) (See also Weissenborn 1992).

14.3.6 Conclusions on the acquisition of coordination

Children distinguish coordinate and adjoined or embedded clauses, both syntactically and semantically, early in acquisition. Directionality in the specific language being acquired influences coordination (both in anaphora direction and in the direction of phrasal coordination). Sentential coordinations appear to be developmentally primitive; they are in place when phrasal or reduced coordinations appear. Children integrate pragmatic and cognitive knowledge over the course of development in coordination. The course of acquisition continuously integrates general linguistic principles and language-specific knowledge.

14.4 Adverbial subordinate clauses

14.4.1. The acquisition challenge

Sentences with adverbial subordinate clauses adjoin one clause to another:

(45) Jane uses a computer [when she works]

Although it appears closely related to a coordinate clause, the adverbial clause domain provides different possibilities for syntactic and semantic operations. For example, subject pro-drop is not allowed in the adverbial subordinate clause domain in English (46), although it is in coordinate clauses (47).

(46) Jane uses a computer [when she/* \emptyset works]

(47) Jane uses a computer and \emptyset works

Diessel (2004: 152–156) summarizes several syntactic, semantic and pragmatic factors which distinguish coordinate and adverbial subordinate clause structures.

Adverbial clauses may vary in finiteness and in the type of syntactic domain they provide, distinguishing (46) and (48) in terms of whether a lexical pronoun or a null subject is allowed and distinguishing the type of anaphora they involve (e.g. bound or free).

(48) Jane uses a computer [when *she/ \emptyset working]

Table 14.1. Types of knowledge that must be integrated in adverbial clauses

Universal features of language	Language-specific features
<ul style="list-style-type: none"> • Hierarchical structure • Adjunction • Clausal architecture • Constraints on anaphora 	<ul style="list-style-type: none"> • Directionality • Lexical forms for anaphoric elements • Lexical and semantic knowledge of connectives

Depending on the language, adverbial clauses may also vary in directionality appearing either in postposed/right-branching position as in (46) above or in preposed/left-branching position, as in (49) below:

(49) [When she/ *Ø works], Jane uses a computer

It has been hypothesized that the unmarked direction of adverbial subordinate clause adjunction in a language reflects the ‘principal branching direction’ of a language as either right or left, and that this determines systematic differences between right- and left-branching languages. This directionality interacts with the reference of pronominal elements. In (46) and (49), coreference is possible between the subjects of the two clauses but it is not in (50), reflecting a violation of one of the principles of anaphora (Principle C) (See Crain & McKee 1985, Lust *et al.* 1992 for discussion of acquisition of this area).

(50) *She_i uses a computer when Jane_i works.

Table 14.1 summarizes the universal and language-specific features of language knowledge that a child must integrate in the domain of adverbial clauses.

14.4.2 Adverbial clauses in early spontaneous speech

Children acquiring English tend to produce temporal clauses very early, as in the examples in (51) and (52) from a 2 year old. These clauses may be introduced by an overt element, as in (52) or not, as in (51). They may appear before the main clause, as in (51), or after, as in (52).

(51) Child (sitting in his car seat): I get out!
 Mother: Not yet!
 Child: Get home, get out.
 Mother: Yes. Then you’ll get out.
 (2;1,23, Clark 2003: 259)

(52) The toast make a noise when you put butter on.
 (2; 4,26, Clark 2003: 259)

14.4.3 Adverbial clauses and principles of anaphora

Configuration, directionality and finiteness of the adverbial clause domain interact with the determination of reference for anaphoric elements in adverbial clauses. Lust *et al.* (1986) probed knowledge of these interactions in a study of structures like (53)–(56) in English.⁴

(53) Pronoun, forward: Billy dropped the penny [when he saw the cat]

(54) Null, forward: Johnny washed the table [when \emptyset drinking juice]

(55) Pronoun, backward: [When he coloured the books] Tommy drank milk

(56) Null, backward: [When \emptyset dressing the baby] Daddy dropped the book

Using both imitation and act-out tasks, Lust *et al.* found that children acquiring English distinguished between the null and overt proforms in these structures according to the finiteness of the subordinate clause (e.g. in an imitation task they frequently converted the null subjects in non-finite sentences to pronoun subjects with tensed predicates.)

Within a given language, both the directionality and the interpretation of the anaphora appear to vary according to the configuration of the clause. For example, in Hindi in clauses introduced by the adverbial *jab* ‘when’, children were found to generalize directionality over null and overt anaphora, linking a forward antecedent-proform to right-branching structures, and a backward antecedent-proform to left-branching structures (Lust *et al.* 1995). In Sinhala and Japanese, children differentiated two types of adverbial clauses in terms of their finiteness, their configuration (position at which the adverbial clause was joined) and the anaphora involved (e.g. Gair *et al.* 1998, Lust *et al.* 1985, Oshima & Lust 1997). These results reveal that knowledge of the structure of adverbial clauses is integrated with knowledge of different forms of anaphora and with knowledge of directionality of adjunction within and across languages; this knowledge is evident from an early age.⁵

14.4.4 Conclusions on adverbial clauses

Study of the acquisition of adverbial clauses demonstrates that children integrate knowledge of hierarchical structure (e.g. attachment of an adverbial clause at different hierarchical points in a sentence), recursion (e.g. through capacity for adjunction) and the lexicon (e.g. various proforms either lexical or null), with language-specific directionality, with constraints on anaphora and with the meaning of the connectives that introduce adverbial clauses.⁶

⁴ Also see Goodluck (1981). ⁵ Also see Mazuka (1996, 1998).

⁶ See, for example, Winskel (2004) and references therein for discussion of the acquisition of temporal clauses in terms of their semantic content.

14.5 Relative clauses

14.5.1 The acquisition challenge

Relative clause structures like those in (57) reflect the linguistic property of recursion.

(57) This is [[[*the train* [that hit *the bus* [that bumped *the car* [that ...

Other relative clauses are illustrated in examples (58)–(61) (from Tavakolian 1981). In each of these examples, the relative clause is bracketed and the head of the clause italicized. The examples vary depending on whether the main clause subject or object is modified (58, 59) vs. (60, 61) and whether the gap within the relative clause appears in subject (58, 60) or object position (59, 61).

(58) SS (main clause subject is modified; gap in subject position)

The *sheep* [that jumps over the rabbit] stands on the lion.

(59) SO (main clause subject is modified; gap in object position)

The *lion* [that the horse kisses] knocks down the duck.

(60) OS (main clause object is modified; gap in subject position)

The horse hits the *sheep* [that the duck kisses]

(61) OO (main clause object is modified; gap in object position)

The duck stands on the *lion* [that bumps into the pig]

Languages differ in a number of grammatical features associated with relative clause. For example, in Mandarin the head of the relative clause may be lexically specified (62) or null (63) (from Mandarin, Packard 1987). (The *e* indicates the gap; Packard glosses the modification marker *de* with the abbreviation MOD.)

(62) wo kan e_i de shu_i
I read e_i MOD book_i
'books which I read'

(63) wo kan e_i de Ø_i
I read e_i MOD Ø_i
'the one(s) which I read'

Korean permits internally headed relative clauses, as in example (64) from K.-Y. Lee (1991). (See Andrews 1985 for examples of syntactic features associated with relative clauses in other languages.)

(64) chayk pilyekanke nayil kackookessumnita
book borrow-go-PAST-COMP tomorrow bring-COMP-come-FUT-DECL
'(I) will bring back the book I borrowed tomorrow.'

In dimensions of relative clause syntax such as the overt realization of the elements appearing as head at clause boundaries and in gap position, languages vary in what they permit.

14.5.2 Relative clauses in early spontaneous speech

Reports of early production of relative clauses in English natural speech include structures like the examples in (65)–(66) (also see Hamburger 1980, Tomasello Ch. 5).

(65) Look I got!
= Look what I've got (showing a cookie he had been given)
(1;11,22, Clark 2003: 251)

(66) Herb work ə big building have ə elevator'n it
= Herb works in a building that has an elevator
(2;0,9, Clark 2003: 251)

These proto-relatives may be characterized by the presence of a clause or a clause-like segment in a typical noun phrase position (65) or juxtaposed to a noun phrase (66).

14.5.3 Lexically headed relative clauses

Much of the early work on the acquisition of relative clauses focused on children's interpretations of relative clauses that differed in whether they modified a main clause subject or object, and in whether they included a gap in subject or object position within the relative clause, as in (58)–(61) above. For example, in a study of English lexically headed relative clauses with twenty-four children aged 3 to 5 years, Tavakolian (1981) reported that the children interpreted relative clauses modifying a main clause object as if they modified the subject, corresponding to a coordinate structure, as in (67). A total of 63 per cent of the interpretations of OS structures were of this nature.

(67) Stimulus: The sheep jumps over the *rabbit* [that stands on the lion].
Interpretation: sheep jumps over rabbit, sheep stands on lion

Using an act-out task to test children's understanding of relative clauses, Goodluck and Tavakolian (1982) found that the animacy of an embedded object influenced whether children could successfully act out a sentence containing a relative clause. If the object was animate, as in (68), it was harder than if the object was inanimate, as in (69).

(68) The dog kicks the horse that knocks over the sheep

(69) The dog kicks the horse that knocks over the table.

Hamburger and Crain (1982) reported that when the context supplied two exemplars of the head noun (e.g. two horses for (68)), thus satisfying a felicity condition, children aged 3 to 5 years produced fewer errors with OS sentences. (For related research see Crain & Thornton 1998, Kidd & Bavin 2002 and references therein.)

Some production studies have also probed the distinction between subject and object relative clauses. Demuth (1995b) investigated production of relative clauses in the spontaneous speech of three children acquiring Sesotho (one sampled at ages 2;6 and 3;0, one at 2;6 and 3;2 and one at 4;0-4;1). By the age of about 3, the younger children use as many subject relative clauses as the child at four years of age. In contrast, the number of object relatives increases from almost none at 3 years of age to 40 per cent of relative clauses at age 4. Demuth also reports that in the early data children frequently use the relative suffix on the embedded verb in Sesotho (glossed RL below), but that the clause-boundary relative marker (glossed REL) is either missing or is included only in cases where it also represents agreement. The example in (70) illustrates a child's omission of REL and inclusion of RL (both markers are obligatory in the adult language).

- (70) Mane enkile teng
 = mane moo ke-e-nk-ile-ng teng
 LOC REL 1SG-9PN-take-PERF-RL there
 'Over there where I took it'

(Sesotho child 2;6, Demuth 1995b)

Demuth concludes that a developmental trend from subject to object relative clauses exists in Sesotho, and that children initially distinguish relative clauses from other clauses (as indicated by the verbal suffix), but have not yet determined the syntactic status of the REL marker.

The overt realization of the elements appearing at clause boundaries has also been investigated in the acquisition of French. Labelle (1990) conducted an elicited production study with 108 children (3-6 years old) acquiring French. The study elicited relative clauses by asking children to choose one of two pictures to put a sticker on. The pictures depicted a character or object involved in two different activities; the most natural way to distinguish them would be to use a relative clause (e.g. for an object relative clause *The ball that he is catching* or *The ball that he is throwing*). In this study children produced the complementizers that introduce subject and object relative clauses (*qui* and *que*) far more frequently than the overt operators that introduce oblique relative clauses (e.g. the locative relative clause marker *dans laquelle* 'in which'). See also Guasti and Shlonsky (1995) and Foley (1996).

14.5.4 Findings for free or headless relatives

The term 'headless' refers to the absence of a nominal head, as in example (71). A series of studies has compared the development of lexically headed

relative clauses like those discussed in section 14.5.3, and ‘free’ or ‘headless’ relative clauses. In a study of ninety-six children between the ages of 3;6 and 7;7 Flynn and Lust (1981) tested headless relative clauses, as in (71), and lexically headed relative clauses, as in (72)–(73). Examples (72) and (73) differ in whether or not there is semantic content in the head (*balloon* versus *thing*).

(71) Fozzie Bear hugs [what Kermit the Frog kisses]

(72) Ernie touches [the balloon [which Big Bird throws]]

(73) Cookie Monster eats [the thing [which Ernie kicks]]

Using an elicited imitation task they found that children performed significantly better on the free relatives than on the lexically headed; there were no significant differences for structures involving head nouns with semantic content and those without. These findings indicate that, consistent with early spontaneous speech data, headless relatives may be developmentally primitive. The authors argue that free relatives provide an especially direct route to nominalization of the clause, and to subsequent embedding under an NP within the main clause.

A primacy for headless relatives appears to also characterize the acquisition of Mandarin Chinese. Packard (1987) analysed the spontaneous speech of twenty-seven Taiwanese children in two age groups (2;0–2;5 and 2;6–2;11), counting examples of nominal modifiers with the *de* marker, including forms with and without overt heads. In Packard’s full set of 6,209 utterances, referring expressions with *de* modification appeared in both age groups, but the percentage of such utterances with a lexical head increased from 18.7 per cent of referring expressions in the younger group to 47.3 per cent in the older group.

In Korean, K.-Y. Lee (1991) analysed the spontaneous speech of thirty six (ages 1;4 to 3;9; see also Lee *et al.* 1991). She reports findings pointing to the earlier productivity of relative clauses without a lexical nominal head than with a lexical head. Lee found that children produced relative clauses like (74), which are introduced by the clause marker/complementizer *kes*.

(74) Mok-ey ke-nun-ke ya?
 Neck-LOC wear-PRES-COMP INT?
 ‘Is it the one (you) wear on the neck?’ (referring to her mother’s necklace)
 (Korean, 1;11, K.-Y. Lee 1991)

Kes operates as a complementizer in adult Korean but generally does not appear in adult relative clauses of this form.⁷ Children nevertheless insert *kes*, a finding compatible with Murasugi’s (2000) report that children

⁷ *Kes* introduces sentential complements and also appears at the boundary of internally headed relative clause structures (K.-Y. Lee 1991).

acquiring Japanese insert the particle *no* in relative clauses where it is not grammatical in adult Japanese:

- (75) *buta san-ga tataiteru no taiko*
 piggy-NOM is-hitting *no* drum
 'the drum that the piggy is playing'
 (Japanese, 2;11, Murasugi 2000: 235)⁸

Murasugi argues that *no*, which is a genitive marker, can instantiate the head of CP. In both Japanese and Korean, children appear able to generalize an element appearing in complementizer position in the adult grammar to introduce relative clauses. In Quechua also, children spontaneously produce more headless relatives than other forms (Courtney 2006). Taken together, these findings suggest a developmental path that leads from the free relative to the lexically headed form. It may be the case that when the free relative more directly corresponds to the lexically headed form it assists the acquisition of lexically headed forms. (Foley 1996). Children appear to be integrating knowledge of adjunction with other grammatical components needed for embedding within a nominal phrase.

This picture of development as a process of integrating grammatical components is supported by findings from the acquisition of Tulu. In an elicited imitation experiment Somashekar (1999) compared the development of several relative clause types in monolingual children aged 2;5 to 6;6. These types included the verbal adjective, where the embedded verb inflects for tense but not agreement; in another type the correlative the embedded verb inflects for both tense and agreement, as in (76).

- (76) [*yeer_i kuuli dekk-ye-naa*] *aaye_i eDDennaaye.*
 who_i teeth washed-3MASC.SG.-Q *he_i good:3MASC.SG*
 'He who brushed (his) teeth is good.'

Children often converted correlatives (and other relative clauses) to verbal adjectives. Importantly, when they did so they also frequently made the required change on the inflection of the embedded verb, including the tense marker but omitting agreement, as required by the syntax of Tulu. Such frequent conversions in Somashekar's data suggest that children begin early to integrate the syntax of clausal structure with the syntax of embedded verb inflection.

14.5.5 Semantics in relative clauses

Additional recent work on relative clauses has examined various cognitive semantic aspects of relativization (e.g. Ozeki & Shirai 2005 for Japanese and Korean). Fragman *et al.* (2007) report children's early awareness of the restrictive/non-restrictive distinction in English.

⁸ Murasugi's gloss assumes *buta san* (noun and honorific) is a single lexical item.

14.5.6 Conclusions on relative clauses

Research findings suggest that while lexically headed relatives develop over time, free or headless relatives appear foundational to the development of lexically headed forms. While some studies propose a developmental course in which complex relative sentences expand from simple sentences (e.g. Diessel & Tomasello 2005), the patterns of development reviewed here cannot be so described.⁹ For example, at very early stages Tulu-speaking children reveal a capacity to relate clausal structure and verbal morphosyntax. Korean-speaking children add a clausal head *kes* and Japanese-speaking children add *no* to early relatives, even when not occurring in the adult language in these structures. These results are consistent with children's continuous access to a capacity for complex sentence structure and recursion, and with the need to acquire and integrate language-specific knowledge, such as branching direction, verbal inflection and lexical forms (e.g. of elements introducing and potentially heading relative clauses).

14.6 Conclusion

In this chapter we have suggested that just as there is no clear grammatical distinction between simple and complex sentences, so there is no fundamental distinction in acquisition between simple and complex sentences. The data do not support a view that complex sentences develop from simple sentences in an additive fashion. For example, sentences with relativization and/or complementation do not simply expand from simple sentences, and early coordinated and adverbial sentences do not reflect flat juxtaposition of component parts. A second example is the apparent absence of a stage at which children's early grammars allow coordination but not adjunction (Lust 1994).¹⁰ In several studies young children were found to distinguish coordinate from non-coordinate structures, apparently consulting the clausal and hierarchical structure of their language in order to do so. It does not appear that at a first 'stage' children have competence only for simple sentences and at a subsequent 'stage' they gain competence for complex sentences.

Instead, there is evidence for complex sentence grammar from the beginning of productive combinatorial speech. Children's language shows an early sensitivity to parametric crosslinguistic variation in grammatical factors related to complex sentence formation, such as directionality of adjunction and to finite/non-finite distinctions in clausal adjunctions. This has led some to speculate as to how these early sensitivities might arise even before the child speaks a first word (Mazuka 1996).

⁹ See also Crain *et al.* (1990) for a contrasting view of development.

¹⁰ See Tavakolian (1978), Lebeaux (1990), Cohen Sherman and Lust (1993) and Cairns *et al.* (1993).

While there clearly is an effect on complex sentence formation from the development of simple sentence grammar, at the same time there is evidence that the grammar of complex sentences also affects child simple sentence formation early in development.

We have also discovered evidence of developmental phenomena. For example, sentential coordinations appear developmentally primitive relative to other types of coordination. Relative clauses without lexical heads appear developmentally primitive to those with heads. Yet the form of development we observe here is not a simple addition of one concrete construction to another. For example, the developmentally primary sentential coordinations or relative clauses without nominal lexical heads are both complex structures, superficially at least as complex as the coordination and relative clause types they provide foundations for.

In general, our review coheres with Bloom's (1970: 138) observation that in early language acquisition, 'increase in structure or complexity [i]s not a matter of simply increasing length of utterance by adding structure to structure or adding elements within a structure'. Development appears to involve integration of language-specific structure, the lexicon, and cognitive and semantic features, with potentially universal syntactic knowledge in the course of mapping to a specific language grammar.

Suggestions for further reading

- Bloom, L., Rispoli, M., Gartner, B., & Hafitz, J. (1989). Acquisition of complementation. *Journal of Child Language*, 16, 101-120.
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