

## Explanation–Recent Studies

### 1. Functionalism

Functionalist explanations assume that children use communicative functions to acquire linguistic forms. Communicative functions include semantic relations, pragmatic intentions, cognition, and informativeness. The set of functions is not clearly defined.

Bates & MacWhinney (1982)–functions ‘compete’ for linguistic resources, i.e., surface representations

‘divide the spoils’–each function maps onto its own surface representation, e.g., progressive /-ing/ versus the adverb ‘now’.

‘peaceful coexistence’–several functions may share the same surface representation, e.g., possessive and plural marking in English /-s/.

Acquisition procedure:

Step 1: Establish the basic functions, e.g., topic, comment and agent

Step 2: Competition between surface representations, e.g., agent and topic compete for expression by: 1. lexical items (buy/sell), 2. word-order, 3. morphology, 4. intonation

Step 3: Acquire the adult system of function to form mappings

Assessment

To date, the basic components of functionalist approaches are poorly defined.

The theory predicts that children begin with a universal set of communicative functions, but cross-linguistic studies reveal early differences between the functions children express

Hungarian and Italian children first use a comment-topic sequence

English children use an agent-action sequence

Karmiloff-Smith (1979) showed that children acquiring French articles used formal properties of nouns (phonology) rather than functional properties to determine article gender.

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### 2. Distributional Learning

A. MacWhinney (1982)

The model relies on three processing mechanisms:

1. rote: the use of memorized units, e.g., ‘Good morning’.

Accounts for redundant pronouns, e.g., ‘have it egg’ and redundant auxiliaries ‘what’s that is’

2. analogy: the use of primitive replacement sequences, e.g., ‘wait for it to {cool/dry}’

### 3. combination: more general rules for combining words

- a. functional dispositions: informativeness, complexity, agency, perspective
- b. item-based patterns: pivot-like combinations
- c. free patterns: use semantic relations to create general patterns of word combination
- d. class-bound positional patterns: adult syntactic combinations

#### Assessment.

The model features the specific to general sequence of word combinations that is typical of distributional models of acquisition.

MacWhinney identifies different mechanisms that children might use in combining words.

The model does not describe the interaction between its semantic and distributional components, or compels a child to switch between different methods for word combination.

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#### B. Maratsos & Chalkley (1980)–the best example of a distributional model of language acquisition

‘It is probable that what are called syntactic categories, such as verb, adjective, or gender class, are so called because they rest on differentiation among themselves by partly distributional distinctions among the sets of correlated semantic-distributional patterns in which their members appear’.

Step 1: Identify individual morphemes–although this process is not described, it is needed in any model of acquisition (c.f. Guasti 3.1)

Step 2: Form the first semantic-distributional patterns, e.g.,

Category X (words that take /-ing/)

|  
Word A (e.g., ‘run’)

Step 3A: Strengthen the patterns

1. Find other tokens of word A occurring in context X
2. Find other words that occur in the same context X, e.g.,

Category X  
/ | \  
Word A Word B Word C ...

Step 3B: Establish pathways between the patterns

Category X                      Category W  
|                      \                      /                      |  
Word A                      Word B                      Word C  
|                      /                      |  
Category Y                      Category Z

#### Step 4A: Pattern generalization and overgeneralization

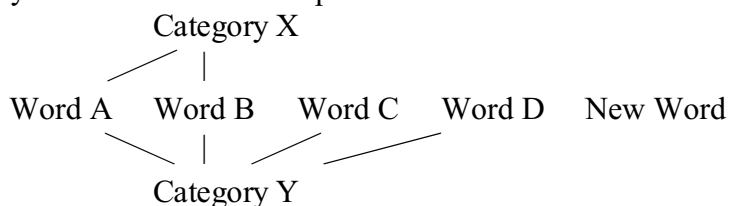
Established patterns ‘continually seek for occasions for application depending on their own proportional frequency of use’ (p. 193), e.g., ‘knowed’

Three factors that determine pattern generalization:

- i. frequency—how often the established words in a network are used in all categories
- ii. variety—how many different pathways are shared by the categories
- iii. directness—the extent to which the categories are connected through the same lexical items.

#### Step 4B: Inhibition of overgeneralizations

accuracy—the extent to which a pattern for a new word is connected to another pattern



#### Step 5: Correct the overgeneralizations through indirect negative evidence

##### Assessment

Their model provides a relatively detailed account of how children can use distributional properties to acquire adult categories.

The model focuses on the acquisition of lexical categories rather than syntactic relations.

Pinker (1984) discusses two problems for the model:

- i. learnability—there is no account of how children acquire constraints on transformations, e.g.,  
\*Who did the fact that you met \_\_\_ stun me? c.f., Who did you meet \_\_\_?
- ii. efficiency—the model requires children to track every pattern for every word  
10 patterns x 1,000 words  
Many potential patterns are not used, e.g., third position, words following ‘snow’, etc.

Pinker suggests children use Universal Grammar to restrict their search

A stronger semantic component could also help the model be more efficient.

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#### C. More recent versions of distributional learning models include:

##### 1. **Parallel-Distributed Processing (PDP)**

Rumelhart & McClelland (1987) in MacWhinney, *Mechanisms of Language Acquisition*  
Smolensky (1988) Behavioral and Brain Science 11.1-74

## 2. Optimality Theory (OT)

Prince & Smolensky (1993, <http://rucss.rutgeres.edu/roa.html>)

The model contains three elements:

- i. GEN—a generator that creates a candidate set of outputs
- ii. CON—a language particular ranking of universal constraints
- iii. EVAL—a function that determines the optimal output. A violation of a lower ranked constraint is tolerated to satisfy a higher ranked constraint

Language acquisition is achieved by discovering the constraint ranking in the adult language from positive evidence.

A word order example

Constraints:

HF—Head First (put the head before its arguments), e.g., Det NP

CC—Check Case (subjects must move to Spec, IP to check case)

Tableaux

	High	Low
Candidates	HF	CC
Mommy go	*!	
☞ go Mommy		*?

	High	Low
Candidates	CC	HF
☞ Mommy go		*?
go Mommy	*!	

Assessment

Without a theory of constraints OT merely provides linguistic descriptions

Without a theory of the generator OT has no means of restricting the test to relevant candidates

## 3. Syntactic Bootstrapping (Fisher et al. 1994, *Lingua* 92.333-375, Syntactic and conceptual constraints on vocabulary growth)

Children extract basic syntactic information by noting the distribution of nouns, c.f.,

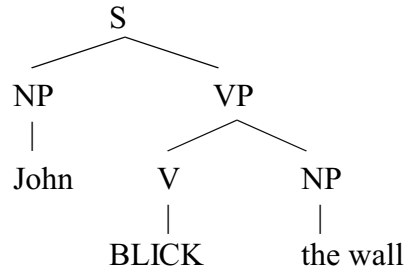
Mike BLICK the wall.

The wall BLICK.

Mike BLICK.

From this information children can learn something about the meaning of the verb and whether a verb is transitive or intransitive.

Children can then construct an elementary syntactic structure for the sentence, e.g.,



#### Assessment

Syntactic Bootstrapping is a more limited version of distributional learning; it focuses on the extraction of verbs.

There is no explanation for why distributional learning is limited to verbs.

The procedure would not work in languages with a high degree of argument omission, e.g., Japanese (see Pinker 1994, *Lingua* 92.377-410, How could a child use verb syntax to learn verb semantics?)

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#### 4. **Construction Grammar** (Wilson 2003, *JCL* 30.75-115, Lexically specific constructions in the acquisition of inflection in English)

Children begin with constructions based on particular lexical items (~ Maratsos & Chalkley). They then extract more general units by generalizing across lexically specific constructions.

Wilson tracked the use of copula *be*, auxiliary *be* and third person present tense *-s* in five children between the ages of 1;6 and 3;5.

He claims that the constructions children create with noun phrase subjects will be different from the constructions they create with pronominal subjects.

[Fig 2](#). Copula marking with third person closed-class and lexical NP subjects by time.

Wilson also finds variation between children in the closed class subjects they use with copulas ([Fig 4](#)):

#### Assessment

Wilson demonstrates one example of lexically specific constructions in children's language. It remains to be seen whether the approach can be extended to other syntactic constructions, e.g., verb + direct object, preposition + object, subject-auxiliary inversion, etc. Construction Grammar does not account for the development of adult syntactic generalizations, e.g., subject, constraints on movement rules.

## Additional References

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- Peters, A. M. 1983. *The units of language acquisition*. Cambridge: CUP.
- Rowland, C. F. & Pine, J. M. 2000. Subject-auxiliary inversion errors and wh-question acquisition. *JCL* 27.157-181.

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### 3. **Semantic Bootstrapping** (Pinker 1984, 1989)

Children rely on semantic properties to establish their initial formal grammatical categories and relations. ‘The categorization of words can be inferred from their semantic properties, and their grammatical relations can be inferred from the semantic relations in the event witnessed.’ (p. 40) Afterwards, children can use the properties of Universal Grammar to acquire more abstract parts of the grammar.

#### Acquisition Heuristics

##### 1. Learnability Condition

Children only use positive evidence to acquire the adult language

##### 2. Continuity Condition

Assume that ‘the child’s grammatical rules should be drawn from the same basic rule types, and be composed of primitive symbols from the same class, as the grammatical rules attributed to adults in standard linguistic investigations’ (p. 7).

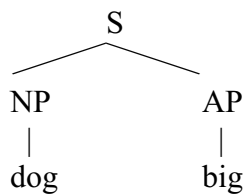
#### Semantic Bootstraps (Table 7.21)

Syntactic properties	Semantic bootstrap
<i>Lexical Categories</i>	
noun	Name of person or thing
verb	Action or change of state
adjective	Attribute
preposition	Spatial relation, path, or direction
sentence	Main proposition
<i>Syntactic Relations</i>	
subject	Agent of action; cause of causal event; subject of attribution or location
object	Patient or Theme
oblique	Source, Goal, Location, Instrument
<i>Cases</i>	

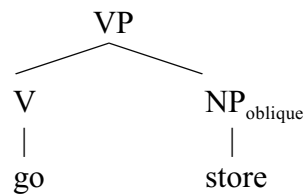
nominative	Agent of transitive action
accusative	Patient of transitive action
dative	Goal or Beneficiary
Features	
tense	Relative times of event, speech act, and reference point
aspect	Durativity
<i>Configurations</i>	
sister of X	Argument of X

Two child structures that create problems for the continuity assumption

Predicate adjectives



Locative prepositional phrases

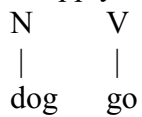


The adult predicate adjective structure contains a copula. The adult locative structure contains a preposition.

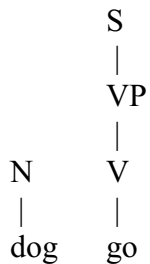
Step 1: Acquire the underlying semantic notions

Step 2: Semantic Bootstrapping

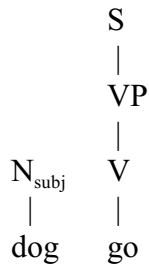
Step 3: Apply the existing phrase structure rules



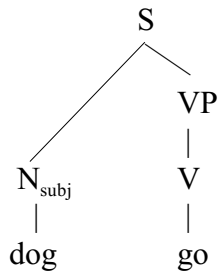
Step 4: Apply X-bar theory



Step 5: Assign grammatical functions



Step 6: Connect the unattached branches



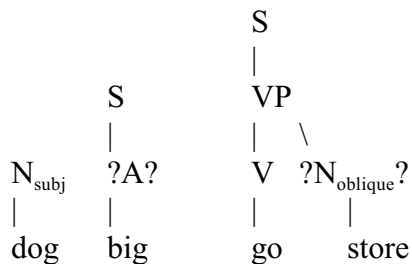
Step 7: Create and strengthen phrase structure rules, e.g.,

$S \rightarrow N_{subj} \{VP/?A?\}$   
 $VP \rightarrow V \{?N?_{oblique}/N_{object}\}$

Step 8: Store and strengthen the lexical entries, e.g.,

$dog \rightarrow N$   
 $go \rightarrow V [(\_\_?N?_{oblique})]$   
 $big \rightarrow ?A?$   
 $store \rightarrow ?N?$

Step 6 creates problems for the child's predicate adjectives and locative phrases



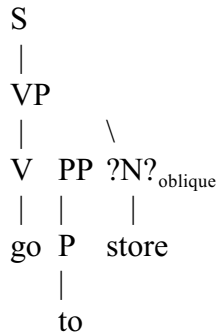
Pinker uses **orphan** nodes to solve this problem. The ancestor node has temporary custody of the orphan node in the child's grammar.



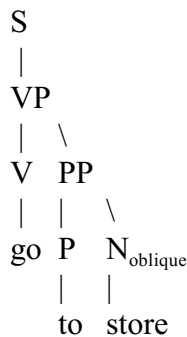
Creating an empty node (c.f. L. Bloom) would create a discontinuity problem. Such nodes also violate the Competence Assumption in that there is no evidence for them.

Children adjust the attachments of the orphan nodes when they acquire the appropriate functional morphemes

e.g., the child acquires the preposition in the sentence ‘go to store’



The child then adjusts the attachment of the orphan node, giving the PP permanent custody



The uniqueness principle forces children to weed out orphan attachments from their grammar.

### Step 10: Distributional learning

Children use structure-dependent distributional learning to acquire aspects of the adult grammar that are not semantically transparent.

Pinker includes a justification for five of his assumptions about the nature of the children’s rules:

- i. Order and composition in phrase structure rules. Do children acquire phrase structure rules that combine linear order and phrasal composition, e.g.,  $VP \rightarrow V + NP$ ? If so, children acquiring free word order languages (e.g., Finnish, K’iche’) should initially produce utterances with strict word orders. If not, children acquiring strict word order languages (e.g., English),

should initially produce utterances with variable word orders. The evidence Pinker cites for Finnish, Luo and Samoan (Bowerman 1973) supports the idea that children begin with phrase structure rules that specify a word order as well as phrasal composition. K'iche' data do not support this hypothesis (Pye 1992), e.g. Al Tiya:n SV 1%, VS 17%, OV 6%, VO 75%.

ii. Identity of categories across positions. Do children use noun phrases in both the subject and object positions? Children like Kathryn only use single nouns and pronouns as subjects while using articles and adjectives with nouns in the direct object position. Assuming different categories in the child's grammar leads to a discontinuity between the child and adult grammars. Pinker claims that the differences across positions in the children's language mirrors distributions found in the adult language. Subjects tend to be animate, and thus produced as proper nouns or pronouns. New information is introduced in the object position, and marked with articles and adjectives. Inspection of children's data shows some expanded NPs in the subject position, e.g., Adam 'Dale Panda march' and 'Dale shoe right there'.

iii. Use of syntactic categories and rules. Do children use syntactic or semantic categories and rules? Evidence of semantic restrictions on children's use of verb inflections (e.g., past tense) would support the semantic hypothesis. A definitive test has not appeared as yet. (It is difficult to objectively define the semantic restrictions independently of inflectional use.) Pinker shows that expanded NPs occur in a variety of semantic roles, e.g., patient of action 'pull Dale bike', object of experience 'see Daddy car', predicate nominal 'dat Dale baby', and locative 'spill Mommy face'.

Pinker also discusses Braine's argument concerning the initial use of locatives for Kendall and Seppo. Pinker argues that the locative rule for these children includes an orphan node, e.g.,

$S \rightarrow ?N?_{\text{oblique}}$

The locative is not generated by the verb phrase rule,  $VP \rightarrow PP$  (Locative).

iv. Limitations on the length of children's sentences. What accounts for the omission of obligatory constituents such as subjects, verbs and objects in children's sentences? Pinker considers four hypotheses:

1. He rejects Bloom's deletion rules because:
  - a. the rules do not account for all of the apparent deletions in the data
  - b. the rules violate formal conditions on deletion rules in transformational grammar
  - c. there is no positive evidence for deletion rules in the input
  - d. deletion rules create a discontinuity that the children would have to unlearn
2. He rejects Brown's hypothesis that children's rules are incomplete because the children use categories in the appropriate order and produce sequences in which the missing elements are inserted.
3. He rejects McNeill's hypothesis that the missing elements are optional because:
  - a. it has the same problems as deletion rules
  - b. if it were true, the children should occasionally produce complete sentences
4. Pinker argues in favor of processing limitations, but does not provide independent support. (c.f., P. Bloom 1990. 'Subjectless sentences in child language.' *Linguistic Inquiry* 21.491-

504.)

v. Universal symbols. Do all children use the same set of universal symbols, e.g., VP? Pinker acknowledges Bowerman's arguments against the VP, but proposes the logical argument that children must have innate knowledge of the categories since they are part of the adult grammar. 'The use of universal adult symbols in children's first rules, then, is simply the theoretical commitment that the child's early rules are continuous with their later ones and with adult ones' (p. 165).

#### Assessment

Pinker provides a detailed account of the steps children take in acquiring the adult grammar. The detail of Pinker's arguments provides many points where his ideas can be tested empirically. Many of his arguments receive such support.

Pinker shares with Bloom an attempt to implement something like the Competence Assumption avoiding rules that are overly general or overly specific.

The weakness of his account is typical of recent models of language acquisition. Pinker picks and chooses data from different children rather than systematically analyzing the data from each child. We can not evaluate the observational adequacy of his proposals for a single child.

#### Specific problems for Semantic Bootstrapping:

i. Not all languages have the same set of syntactic categories. Some languages lack an adjective category, some a noun category (Salish), and some languages have a positional category (Mayan).

ii. The semantic bootstraps are not universal

Guasti (2002: 95) lists the following 'tend to be correlated' properties of subjects

a. the agent of action verbs

b. the argument that occupies the leftmost position in the sentence

c. the function that an object assumes in passive sentences

d. the constituent whose grammatical features are encoded by verb agreement affixes

Problems exist for each of these

a. an action verb restriction would lead to a discontinuity with the adult grammar

b. Languages like K'iche' (VOS) place subjects in the sentence final position

c. Some languages do not have passives; some languages have antipassives, etc.

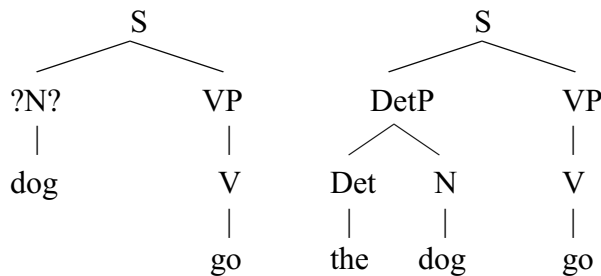
d. Languages with ergative agreement only pick out the subjects of transitive verbs

iii. Languages use different case systems, e.g., Accusative vs. Ergative (Mayan), and possibly different phrase structures, e.g., Deep Accusative vs. Deep Ergative (Dyirbal)

iv. Some languages (e.g., Algonkian) grammaticalize animacy

v. Orphan nodes create a discontinuity with the adult grammar.

a. What can be an orphan node?



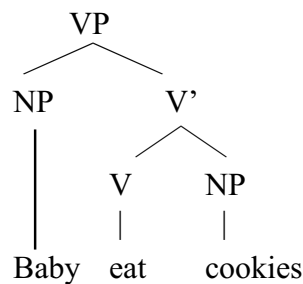
b. How do you attach an orphan node? They lie outside X-bar theory.

c. How long do children wait before making the orphan attachment permanent?

#### 4. Structure Building (Radford 1990)

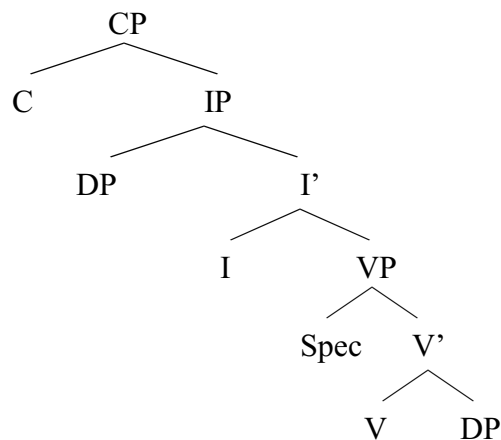
Much current work on the acquisition of morphology begins with the distinction between lexical (N, V, Adj and P) and functional (Det, Tense, Agreement, Comp) categories. These approaches assume that children's grammars either lack functional categories or lack access to such categories. Children may begin with 'small clauses' rather than the adult clause structure

Child Structure



(Allison 1;10)

Adult Structure



Children lack Infl (Inflection) – no auxiliaries, infinitival *to*, tense, agreement

- “ lack Comp – no preposed auxiliaries, wh-phrases and complementizers
- “ lack expletive pronouns – required by Infl ('no morning' = It's not morning)
- “ lack nonthematic *of* ('cup tea' = a cup of tea, Stefan 1;5)
- “ lack determiners ('reading book' = I am reading a book, Hayley 1;8)
- “ lack possessives ('mommy milk' = mommy's milk, Kathryn 1;9)
- “ lack pronouns ('baby eat cookies' = I eat cookies, Allison 1;10)
- “ lack subjects – required by Infl ('want Lisa' = I want Lisa, Hayley 1;8)

Radford claims these functional categories mature around 20 months of age ( $\pm 20\%$  or from 17 to 23 months)

## Assessment

The structure building hypothesis illustrates the use of linguistic theory to predict specific strengths and weaknesses in children's grammar. In particular, it predicts the parallel development of a wide variety of functional categories.

### Problems:

- i. The absence of functional categories leads to a discontinuity between child and adult grammars. Radford solves this dilemma by appealing to maturation.
- ii. The model lacks observational adequacy; Radford only discusses supportive examples.
- iii. The model does not account for the gradual development of morpheme use.
- iv. The model does not account for variation in morpheme use between children acquiring English, c.f. Wilson 2003.
- v. The model cannot account for the early use of functional morphemes in some languages, e.g., Innuktitut, Italian, K'iche', Polish, Turkish.

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### 5. Full Competence (Hyams 1992, Poeppel & Wexler 1993)

These authors claim that children know all of the principles and parameters for the adult language from the time they begin to produce their first utterances.

These researchers appeal to several sources of evidence to support their claims:

- i. children generally follow adult word orders.
- ii. children are aware of constraints on verb placement in verb second (V2) languages.

e.g., German

Main clause	Subordinate clause
Simone <u>braucht</u> das.	Simone wird das <u>lesen</u> .
'Simone <u>needs</u> that.'	'Simone will <u>read</u> that.'

- iii. children produce sentences with constituents in the complementizer.

e.g., German (Andreas 2;1)

Eine Fase hab ich  
a vase have I  
'I have a vase.'

- iv. children use functional morphemes (e.g. tense) early in some languages.
- v. children generally use functional morphemes correctly in all languages.

The limitations in early speech are assumed to arise from specific features of child grammars:

- i. children's grammar has limitations on the number of functional categories it can handle, e.g., it can check tense or agreement features, but not both (Schütze & Wexler 1996), or it can mark individual-level predicates (nouns and adjectives), but not stage-level predicates (Becker 2000).
- ii. children lack pragmatic principles that would force them to use functional morphemes (Hyams 1999).

#### Assessment

The full competence hypothesis accounts for the high degree of accuracy found in children's utterances. The hypothesis draws on cross-linguistic data for support.

#### Problems:

- i. The proposed limitation mechanisms are discontinuous with adult grammar.
- ii. The model lacks observational adequacy; it doesn't account for all the properties of children's sentences, e.g. missing verbs, prepositions.
- iii. The model does not account for the development of sentence structure.
- iv. The hypothesis does not account for variation between children acquiring English.
- v. The hypothesis does not account for cross-linguistic variation, e.g., early passives in Innuktitut, K'iche' and Sesotho.

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## 6. Performance accounts

### i. Sentence length (P. Bloom 1990; 1993 *Linguistic Inquiry* 24:721-734)

Longer sentences require more processing resources, and children have more limited resources than adults. Children drop subjects to compensate for limited processing resources since the processing load is greatest at the beginning of the sentence.

Bloom found that children were more likely to drop subjects when they produced sentences with long verb phrases.

Gerken (1991) found that two-year-old children were more likely to omit articles from subject noun phrases (31%) than from object noun phrases (18%) in an imitation task.

#### Assessment

Performance accounts of missing elements can potentially account for all of deficits found in children's utterances, not just missing subjects.

Problem: Bloom's hypothesis is not supported in K'iche' where the word order is VOS.

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### ii. Metrical accounts of subject omission (Gerken 1991, Demuth 1992, Santleman 1998, Pye 1983)

Children prefer words and sentence forms with S(w) trochaic feet, e.g.,

banana            I want a cookie  
w S w            w S    w S w

Children are likely to omit prosodically weak elements (pronouns, articles, prepositions, etc.) in subject position. Demuth provides a prosodic account of missing verb inflection in Sesotho (Bantu). Pye (1983) found support for metrical account of verb inflection in K'iche'.

Metrical/prosodic accounts of omission still need to be worked out in detail.

Metrical accounts would not explain verb omission.

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