

Linguistic Advance and Cognitive Style in Language Acquisition  
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Linguistic Advance and  
Cognitive Style in Language Acquisition

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Studies investigating factors which affect language acquisition have typically considered one, or at most two, linguistic domains as an index of a given child's relative advance - most often syntax (e.g., Furrow, Nelson, & Benedict 1979), sometimes with the addition of a measure of size of lexicon (e.g., Newport, Gleitman, & Gleitman 1977). Barnes, Gutfreund, Satterly and Wells (1983) included measures of semantic and pragmatic range as well as of syntax, but no estimate of lexical advance. Studies of individual differences in language acquisition strategy, similarly, have tended to concentrate on one domain, such as syntax (Horgan 1981) or phonology (Leonard, Newhoff, & Mesalam 1980). It will be our first concern in this paper to compare relative progress in our subjects across the four domains of phonology, morphology, syntax and lexicon, in order to examine the extent to which a child's language advances as a unified whole. Since we will show that the domains of phonology, morphosyntax, and lexicon in fact need not be acquired at the same rate, we will then go on to ask whether there is a unifying style that remains constant across domains even when overall levels of advance differ.

Method

We audio- and video-recorded the speech of ten 36-month-old first-born children, five boys and five girls, in their own homes in two settings, in conversation with the mother and with a familiar peer, for half-an-hour each. In addition, we ourselves interviewed the children, with audio-recording only, for approximately one hour during each of two visits within the same week, administering the McCarthy Scales of Children's Abilities (McCarthy 1972) as well as various phonological, morphological, and metalinguistic probes. All the audiotapes were transcribed by the second author and then checked by the first author against both audio and videotapes.

### Measures of Language Advance

We based our phonological analyses on the full audio recording for each child. The scoring followed the three-part evaluation devised by Magnusson (1983) in her work with Swedish language disordered children. The three parts are (1) a phonological process score, with a ranking as to developmental level (see Appendix I), (2) a range-of-application score, reflecting the number of contexts in which a process is applied by the child in question, and (3) a frequency-of-application score, differentiating between sporadic, inconsistent (25% to 75%), and regular use of a given process, in the contexts where it applies. The scoring for each part ranged from 1 to 3 and the separate scores were multiplied to arrive at a rating for each process; the sum of all these ratings was the child's overall phonological score.

In addition to the phonological analysis we established the relative intelligibility of the children through a blind rating procedure. Three-minute segments were chosen from two designated portions of the mother-child interaction recordings, one about 10 minutes into the session, the other 10 minutes later. These 20 samples, two from each child, were randomly ordered and copied onto two sides of a 30-minute tape so that each child was represented once on each side. Three coders with varying familiarity with children's speech but no knowledge of our subjects tallied fully intelligible and partially or wholly unintelligible utterances for each child. The proportion of unintelligible to total utterances was calculated; the children were then ordered by mean percent intelligible for each coder. Rank position points were assigned, with half-points for ties; the final ranking was based on the sum of rank position points for the three coders.

A picture book was used to elicit the plurals of 29 nouns, while a puppet game was used to elicit the past tense of 32 verbs exhibiting a variety of morphophonemic patterns (see Bybee and Slobin 1982). In assessing morphological advance both elicited and spontaneous forms were counted, using the full three hours or more of audio tape.

Syntactic measures included Mean Length of Utterance, based on the best of two sequential 100-word samples, longest utterance, and several noun phrase and verb phrase complexity measures, all based on the mother-child interaction session only. A complex

sentence score was arrived at by counting all multi-propositional sentences (excluding from this count auxiliaries, participial constructions, simple conjunctions, and and, let's, look, and see plus sentence) and dividing this sum by the total number of multimorphemic utterances.

In order to assess lexical advance a composite lexicon was constructed for all the words produced spontaneously during the mother/child interaction session (excluding inflectional and colloquial variants of a single word, words used only in recitations, and words that could not be interpreted in the given context). A "unique" lexicon was then made up for each child, consisting of all the words used by that subject alone or by one other child as well. A "core" list was also constructed, consisting of words used by 8, 9, or all 10 subjects. From the number of words in each child's "unique" lexicon we then subtracted the number of words on the core list which that child did not use. The "diversity" score thus arrived at was divided by that child's total lexicon, as represented by the mother-child session, to yield a measure of lexical advance which was biased as little as possible by differences in volume of talk during that session.

#### Results: Language Advance

Correlation of the phonological rating with the results of the blind coders' assessment of intelligibility proved highly significant ( $r = .77$ ,  $p < .005$ ). The phonological score alone will be used for comparison of advance across domains, as it seems to reflect the children's relative phonological progress most directly.

Errors in both past tense and plural formation were calculated as a percentage of total past tense and plural tokens used in an effort to assess morphological advance; the two scores failed to be significantly correlated, however ( $r = .45$ ). Errors in plural formation occurred only during the elicitation task for 6 of the 10 children, and overall only 14% of the errors occurred in spontaneous speech, though half again as many plural forms were used spontaneously as were elicited, on average. In contrast, all of the children made some spontaneous errors in past tense formation, though overall fully 79% of the errors were made during the past tense probe in spite of the fact that twice as many past tense forms were used spontaneously, on average. The past tense score thus seems

somewhat more representative of the children's morphological abilities and will be used for comparison here.

Figure 1 shows the intercorrelation of several commonly used syntactic measures. Our three-year-olds are generally quite advanced (mean MLU = 3.97, range 2.4 to 4.62, i.e., nearly Stage V [Brown 1973], while mean upper bound or longest utterance is 16.1 morphemes, range 11-23). Thus the measures based on simple morpheme count are not really adequate for all the children, as relative disposition to communicate may affect the results as much as syntactic ability (see Vihman, Simmons, Carpenter and Langman, in prep.). The number of complex sentences, though correlated at a relatively low level with MLU and not at all with longest utterance, is highly significantly correlated with number of main verbs per utterance ( $r = .86$ ,  $p < .001$ ) and it is marginally correlated with number of noun phrases per utterance. It is the complex sentence score that seems to capture syntactic ability or relative advance most directly for these children, with the least influence from irrelevant situational factors and differences in volubility.

	longest U	main Vs/ utterance	NPs/U	complex S/ multimorph.U
MLU	** .79	+.49	** .75	.42
longest U		.42	.40	.29
main Vs/U			.38	** .86
NPs/U				+.54

Figure 1. Correlations between syntactic measures  
 \*\*  $p < .01$ , \*  $p < .05$ , +  $p < .10$

Figure 2 presents the results of a comparison of the phonology score, the number of past tense formation errors over all past tense forms attempted, the complex sentence score for the mother-child interaction session, and the lexical diversity score also based on the mother-child interaction session. The only significant correlation is that between morphology and syntax ( $p < .05$ , one-tailed.) Thus, relative advance does not appear to be even across domains.

morphology

syntax

lexicon

	(past tense)	(complex S)	(diversity)
phonology	.21	-.13	-.05
morphology		*.55	-.25
syntax			.10

Figure 2. Correlations across domains of language advance

\*\*  $p < .01$ , \*  $p < .05$ , +  $p < .10$

It was not the case, then, that the children who used a particularly high proportion of complex sentences were also the children who used the most diverse vocabulary or who made the fewest phonological substitutions. Nevertheless, it was our impression that the individual children could be recognized through a characteristic language style or strategy across domains. To test this impression we analyzed two aspects of what may be viewed as individual style in language acquisition: relative consistency in the application of linguistic rules or processes and a gestalt or holistic approach to language production as against a more analytic or systematic approach.

#### Measures of Language Style

It was a straightforward matter to establish relative consistency in the application of phonological processes, given the phonological scoring system used. For each child we simply calculated the number of "two-point" or "inconsistent" frequency ratings out of all cluster reduction and segment substitution processes applied and ranked the subjects accordingly. The prosodic or "whole word" processes were not included in this analysis because there was no way to objectively assess consistency in this case. In fact, "regular" use, or "3", was virtually never scored for these processes, and sporadic use was the rule.

For syntax the way to assess consistency was less obvious. In order to create a parallel with the phonological score, however, it was decided to assign each child a rating of 1 to 3 with respect to each of the major independent areas of application of syntactic processes. The areas scored are listed in Appendix II.

Error analyses were based in all cases on the entire transcript for each child. Copula use was assessed on the basis of the proportion omitted relative to the number of opportunities the child's total

recorded utterances afforded. WH-constructions included both questions and relative clauses. Ordering errors and do-omissions were scored as WH errors, but not copula omission. Intrasentential agreement errors included mass-count errors (e.g., those hundreds of food), subject-verb and modifier-noun number agreement, and tense and pronoun agreement across clauses. The assessment of functor-omission errors was based on obligatory functors other than the copula and auxiliary do, including omission of articles, prepositions, particles, and pronouns. The only remaining error types of any significance were lexical and redundancy errors, both of which will be discussed below.

For the copula, 90% or higher use - Brown's criterion level for establishing acquisition (1973) - was scored "regular use", or 1, while 25% or less was scored "sporadic", or 3. Inconsistent use fell in between. For past tense formation, where the error range was considerably wider and no standard acquisition point has been established, we set 25% to 50% use as the "inconsistent" range. Errors in WH-constructions ranged from zero to about 13%. Accordingly, "inconsistent use" was set at a lower level here.

For the two remaining areas there was no apparent way to gauge "opportunities". Assessment of the proportion of all errors represented by each type would not be enlightening with regard to consistency of use. Though some such standard as total utterances used during the mother-child session - or total recorded utterances - might have been used to control for differences in volubility, we concluded that raw numbers of errors would not be misleading in these instances, since in effect virtually every multi-word utterance provides the opportunity for agreement errors or omissions of some kind, and the most complete consistency can clearly be displayed through silence. In the absence of any other natural range, we used the mean and standard deviation to establish a consistency rating for each of these areas: Numbers of errors half a standard deviation or less above and below the mean were scored as "inconsistent use". A syntactic consistency summary score was then arrived at by tallying, for each child, the number of "inconsistent" ratings out of the five areas considered.

Table I shows a few examples of WH errors alongside error-free constructions of the same kind by the same children. Notice that our method of assessing "inconsistency" in syntax essentially by picking out the children with a range of errors that is intermediate

relative to the group as a whole is workable only where the errors of particular children fail to fall into specific patterns or subtypes. Thus, if all of Sean's WH errors involved DO-omission in HOW-questions, say, it would be wrong to interpret his intermediate error rate of 8.2% as representing inconsistency in the application of WH inversion and/or DO insertion rules. Inspection of the data shows that no such consistent subpatterns obtain in these areas.

Table I. Inconsistency in the formation of WH constructions.

Deborah	*I will show you where are they. I don't know where they are.
Emily	*Now what we're gonna do with them? Now what are we gonna do?
Jonah	*Why we need the other boxes? Why did you put these here?
Sean	*How you open this? How do you get the man on?
Susie	*Know what's my dad's name? Know where my picture blocks are?

The prosodic phonological processes were taken to be characteristic of a gestalt approach to phonology, in which words tend to be perceived, stored, and produced as a whole, with minimal analysis into segments. Prosodic errors affect whole words, syllables, or phonotactic positions rather than specific segments and they often involve changes in the ordering of segments or even syllables within the word. Consonant harmony, which is applied with some regularity by English-speaking two-year-olds (a range of 5% to 32% has been reported for three subjects: cf. Vihman 1978), was still being used sporadically by all but one of our subjects, while metathesis, consonant insertion, syllable deletion and final consonant deletion were used by 5, 6, 7, and 8 subjects, respectively; the remaining prosodic processes listed on the handout were used by one child each. A "gestalt phonology" score was obtained by calculating for each child the proportion of the total phonological error score represented by the prosodic processes.

A sample of the lexical errors found in our data is presented in Appendix III. We included semantically-based malapropisms (microphone for stethoscope), blends (thermophephone for thermometer, with probable

influence from telephone or microphone or both), missed collocations (do a joke for make a joke), missed derivation (stoppened), and phonologically based errors (softer guy for faster guy, quite in his mouth for right in his mouth). In addition, we included compact innovations or "compressions" used in lieu of longer conventional expressions (I can make a own house for him in lieu of I can make him a house of his own) as well as the reverse, paraphrases of expected words or idioms (be a friend together in lieu of be friends, the flipping thing in lieu of spatula). Finally, we also included a number of errors in choice of functor, particularly the WH words (WH errors alone account for 15 out of 107 lexical errors, or 14%). Excluded were errors of omission (e.g., Are you love?, where 'in love' seemed to be intended, or forever ever, with missing and), since these were included in the syntactic error analysis, and errors followed immediately by self-correction, since these suggested on-line analysis, the antithesis of gestalt style as we are conceiving of it.

The lexical errors seem to us to reflect a holistic approach to language production, in which precision or even conventional usage in lexical choice is given a relatively low priority. In syntax a phenomenon we would expect to be related to gestalt style is the incorporation of unanalyzed formulas into sentences, sometimes in ill-designed combination with one another (cf. R. Clark 1974), e.g., from different children, How about this will be a nice one?, What all of it has sugar in it? (protesting the idea of eating candy), or I wondered how to looking for this game. Though formulas clearly play an important role in everyday speech production (cf., e.g., Bolinger 1976, Fillmore 1976), it is their misuse or miscombination that stands out as an error and that may suggest overreliance on the holistic strategy. Only 26 such utterances could be identified with any confidence on our transcripts.

Finally, we view redundancy errors, in which the same word, concept, or grammatical function is expressed twice in a single utterance, as characteristic of the opposite approach, reflecting an effort at on-line analysis and control of the utterance as it is being produced. Some examples, from three different girls:

Mommy, could I have another cup to put one cup here?  
Now you're sick now.

Bought some a little ice cream.

For comparison we used raw numbers of lexical errors and of instances of gestalt syntax and percentage of redundancy errors over all errors. The latter appeared to offer the best insight into analytic strategy in syntactic production.

### Results: Language Style

Figure 3 shows the results of our statistical comparison of the several measures of consistency and gestalt style. Comparison of the phonological and syntactic "inconsistency" ratings, first of all, yields a marginally significant correlation ( $r = .62$ ,  $p < .05$ , one-tailed). Gestalt phonological style is related to the lexical error score at roughly the same level ( $r = .61$ ), while gestalt syntax shows a marginally significant association with the number of lexical errors ( $r = .47$ ). Syntactic redundancy shows a marginally significant inverse correlation with gestalt phonology ( $r = -.47$ ) and tends to be negatively associated with lexical errors as well, though not at a significant level ( $r = -.44$ ). Inconsistent phonology is also inversely related to syntactic redundancy at a significant level ( $r = -.61$ ) and is associated with gestalt phonology and lexical errors at a marginally significant level ( $r = .50$  and  $.54$ , respectively). It should be mentioned, finally, that of the cognitive style measures, none correlate significantly - either positively or negatively - with any of the measures of linguistic advance, with the exception of the lexical error ranking, which correlates significantly with the lexical diversity ranking ( $r = .55$ ).

Measures	B	C	D	E	F
A inconsist. phonology	*.62	+.50	+.54	.12	*-.61
B inconsist. syntax		-.09	.26	.00	-.09
C gestalt phonology			*.61	.16	-.47
D lexical errors				+.47	-.44

E gestalt syntax	-.25
F redundancy (=analytic syntax)	

Figure 3. Correlations between measures of language style  
 \*\*  $p < .01$ , \*  $p < .05$ , +  $p < .10$

The correlations confirm our impressions of a common approach to the separate domains of phonology, morphosyntax, and lexicon. Inconsistency in the use of phonological processes is related to inconsistency in the application of grammatical transformations; a holistic approach to phonology is related to a holistic approach to word selection. Inconsistency in phonology is also inversely related to the analytic approach to syntax represented by our redundancy measure.

### Conclusion

Studies of aptitude in second language acquisition have suggested that "phonetic coding", "auditory" or "phonological" abilities are independent of grammatical ability, which may well have a separate cognitive base (cf. Snow and Hoefnagel-Hohle 1979, Carroll 1981). Our data support the idea that phonology and grammar, or morpho-syntax, depend on somewhat different abilities, and suggest further that progress in lexical development may draw on yet a third relatively autonomous set of skills, or perhaps simply on an independent configuration of those skills which underlie phonological and grammatical development.

Beyond that, our analysis of possible relatively unified cognitive approaches to these separate domains or tasks has yielded suggestive results. It has traditionally been held that children who are acquiring a linguistic form add it progressively to their speech, with percentages of correct usage mirroring directly their level of competence with that particular form (cf. Brown's 90% criterion). The notion of "across the board" changes has been challenged in the realm of phonology, however (cf. Macken 1980, Vihman 1982), and our data further suggest that children can add new linguistic devices in different ways, depending on

how consistently they try to apply their new knowledge to the task of speaking. Furthermore, children with high error rates need not be those with less mature language but may instead sometimes be those who are less conservative in the application of newly acquired rules or forms: Recall the correlation between number of lexical errors and the lexical diversity score, and see also Horgan (1981).

Gestalt style has been identified in the past in the language of one child each in connection with phonology (Waterson 1971, Macken 1979), morphology (Vihman 1982), syntax (Peters 1977), and the lexicon (Vihman 1981). Work by Stoel-Gammon and Cooper (1981) on phonology and by Bretherton, Snyder, McNew and Bates (1983) on syntax and the lexicon suggests that stylistic differences can be identified in groups of children as early as the one- to two-year-old stage. Little formal work has been undertaken to date on individual style in adult speech, though Fillmore (1979) and others have suggested areas that might profitably be investigated. If our identification of relative consistency in rule use and of analytic vs. holistic strategies across domains can be confirmed on a larger sample and if either stylistic factor can be traced from an earlier stage to the period we have examined here, we would look next to adult language, where individual differences in "fluency" in the broadest sense are well known to exist, but where precise documentation may be considerably more difficult to arrive at.

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Appendix I. Phonological Rating

#### Processes affecting sequential structure

##### (a) Prosodic (or 'whole word') processes

syllable deletion (3)  
 final consonant deletion (3)  
 reduction of variation (3)  
 consonant insertion (3)  
 metathesis (3)  
 consonant harmony (2)  
 contiguous assimilation (2)

##### (b) Cluster reduction

Cr clusters (3)  
 sC clusters (3)  
 Cl clusters (2)

##### Segment substitution processes

lateralization (3)  
 deletion of medial D (flap) (3)  
 velar fronting (3)  
 stopping (2)  
 affricate reduction (2)  
 palatal fronting (2)  
 gliding (2)  
 interdental fricative substitutions (1)

#### Appendix II. Consistency in Syntax

##### 1. Copula use

% omission/all opportunities

- 10%-25% = 2  
mean 11.61, SD 10.4 (range .9%-35.3%)
2. Past tense formation  
% errors/all attempted (tokens)  
25%-50% = 2  
mean 34.9, SD 17.6 (range 5.9%-73%)
3. WH constructions  
% ordering errors + DO omission/all attempted  
5%-10% = 2  
mean 7.93, SD 3.85 (range 0-12.8)
4. Intrasentential agreement  
raw number of errors  
8.0-14.4 = 2  
mean 11.2, SD 6.5 (range 5.5-23)
5. Omission of functors (articles, prepositions, particles, pronouns)  
raw number  
15.5-23.5 = 2  
mean 19.5, SD 8.03 (range 15.5-40.8)

### Appendix III. Sample of Lexical Errors

unmarked semantic error  
B blend  
D derivational error  
G grammatical functor  
P paraphrase  
ph phonologically-based error  
\* compression  
n = total lexical errors

Subject	Wordused	Wordintended	Type	n
Andrew	keylock	lock (X keyhole)	B	9
	where	how	G	
	sports	stones	ph	
Deborah	roadtrack	railroad	B	16
	very	way (over here)	G	
	be a friend			
	together	be friends	P	
	(I can make) a	...a house of		

	own house for him	his own	*	
Emily	ned until at nighttime dress	needle (X thread) after tonight test	B G P ph	6
Jonah	microphone because from here	stethoscope so that goes here	G *	19
Molly	sometime quite in his mouth	once right in his mouth	ph	8
Sean	iceskate sticker toward the flipping thing send	ski stamp near/by spatula lend	G P ph	17
Susie	wires thermophephone (X telephone, microphone?) why another thing ripping	needle thermometer what something else wearing ripped/ torn	B G P *	10
Thomas	paper dandeflower where's	page dandelion who's, what's (X4)	B G	8
Timmy	naughty stoppened softer guy	angry stopped faster guy	D ph	9