

## Language Acquisition is Language Change

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*According to the theory of Universal Grammar, the primary linguistic data guides children through an innately specified space of hypotheses. On this view, similarities between child-English and adult-German are as unsurprising as similarities between cousins who have never met. By contrast, experience-based approaches to language acquisition contend that child language matches the input, with nonadult forms being simply less articulated versions of the forms produced by adults. This paper reports several studies that provide support for the theory of Universal Grammar, and resist explanation on experience-based accounts. Two studies investigate English-speaking children's productions, and a third examines the interpretation of sentences by Japanese speaking children. When considered against the input children are exposed to, the findings of these and other studies are consistent with the continuity hypothesis, which supposes that child language can differ from the language spoken by adults only in ways that adult languages can differ from each other.*

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From the perspective of psycholinguists working within the theory of Universal Grammar, many aspects of adult grammar are innate and are expected to be in place at a very early age. Children are born with a set of universal linguistic principles, and a set of parameters that account for variation among languages (Chomsky, 1981). These innate linguistic parameters define a space of possible human languages—a space the child explores, influenced by her environment, until she stabilizes on a grammar that is equivalent to that of adults in her linguistic community. If this is correct then, at least as an idealization, language acquisition is a process of language change. At any given time children are speaking a possible

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human language, just not the language spoken around them. Of course, the adult languages spoken around the globe today constitute only a small subset of the possible human languages. Nevertheless, one expects to find many ‘linguistic errors’ by children to arise because children are trying out grammars with features that can be found in adult languages elsewhere on the globe. This acquisition scenario is called the continuity hypothesis (Crain, 1991; Crain & Pietroski, 2002; Goodluck, 1991; Pinker, 1984). If the continuity hypothesis is confirmed, this would provide dramatic support for the theory of Universal Grammar.

Alternative models of language development posit a greater role for experience in children’s grammar formation and, consequently, less innate linguistic knowledge. On such experience-based accounts of language development, children’s non-adult productions and comprehension take on a different character than on the Universal Grammar-based account. Children’s ‘linguistic errors’ are expected to reflect less articulated grammars than those of adults in the same linguistic community. Nevertheless, the child’s productions are modeled on the environmental input. A child who is in the process of learning language would not yet display full linguistic competence in any human language; such a child would have an imperfect grasp of the local language, which he or she would gradually modify in response to the environmental input. The child would not be expected to produce utterances that do not reflect the target language, but properties of some other natural language. Nor would the child be expected to interpret utterances in a way that is incorrect for the target language, but correct for some other language.

The present paper summarizes some recent evidence that appears to favor the continuity hypothesis, and which appears to resist explanation on many learning-theoretic accounts. We document four cases of children’s productions, and one case of their interpretations, which are not compatible with the target language. In each case, there is little or no positive evidence that could cause children to adopt the hypothesis they entertain. Furthermore, the evidence from children’s productions suggests that children are not simply producing less articulated versions of adult utterances; instead, children are seen to elaborate the structures used by adults. In each case, we suggest that children have adopted an option that is manifested in some other language. These ‘linguistic errors’ can be thought of as ‘misset’ parameters in the theory of Universal Grammar.

One interesting characteristic of parameters is that particular settings sometimes entail a cluster of properties. For example, Baker (2001) points out that once a child has settled on the fact that she is speaking a polysynthetic language, she should also allow noun incorporation, dislocated subjects and objects, certain causative structures and so on. This

is also true of the two production cases we discuss. We find that children produce a cluster of non-adult question structures, which are typical of some language, just not the one being spoken around them. In addition to these cases, we briefly review two findings from the literature where children appear to assume a more restricted grammatical hypothesis than their input would suggest. In both cases again, the language children speak resembles other languages, just not the one spoken around them. In the last section, we turn from production to comprehension. There we describe another case of a misset parameter. This example of continuity involves Japanese-speaking children's interpretation of disjunction. We find that Japanese children interpret disjunction in the same way as child and adult speakers of English, despite the absence of decisive evidence for this interpretation in simple sentences.

## THE MEDIAL-WH IN CHILD ENGLISH

The parade case of children's non-adult, but UG-compatible, productions is the 'medial-wh' phenomenon in child English. Using an elicited production task, Thornton (1990) found that about one-third of the 3–4 year-old children (of English-speaking parents) she interviewed consistently inserted an 'extra' wh-word in their long-distance questions, as illustrated in (1) and (2) (Crain & Thornton, 1998; Thornton, 1995).

- (1) What do you think what pigs eat?
- (2) Who did he say who is in the box?

This 'linguistic error' by English-speaking children is presumably not a response to the children's environment, since medial-wh constructions are not part of the primary linguistic data for children in English-speaking environments. It is not an impoverished structure—there is an extra word—but nor could these questions have been produced by merging the template for two simple questions. Such a strategy could work for (2), but not for (1). If one were to merge "What do you think?" and 'What do pigs eat?' the result would be "What do you think what do pigs eat?" Questions like this with the dummy "do" in each clause do not occur in these children's speech. Structures like (1) and (2) are attested in other languages, such as dialects of German and Romani (McDaniel, 1986; McDaniel *et al.*, 1995). An example from German is given in (3).

- (3) Wer<sub>i</sub> glaubst du wer<sub>i</sub> nach Hause geht?  
'Who do you think who goes home?'

The medial-wh phenomenon accords with the expectations of the theory of Universal Grammar. And further investigation shows that the similarity of child English to a foreign language, adult German, runs deep. Other similarities emerge. For both adult Germans and American children, lexical (full, discourse-linked) wh-phrases cannot be repeated in the medial position. German-speaking adults judge (4) to be unacceptable, and English-speaking children never produce questions like (5), as indicated by the ‘#.’ Instead, children either produce a question with a reduced medial element like (6), or they produce the adult English structure with no medial-wh.

- (4) \*Wessen Buch<sub>i</sub> glaubst du wessen Buch<sub>i</sub> Hans liest?  
‘Whose book do you think whose book Hans is reading?’
- (5) # Which Smurf do you think which Smurf is wearing roller skates
- (6) Which Smurf do you think (who) is wearing roller skates?

Similarly, children never used a medial-wh when extracting from infinitival clauses. Nor is this permissible in languages that permit the medial-wh. Indeed, the insertion of medial-wh in infinitival complements is universally ungrammatical. So in German, a question with no medial-wh would be used, as in (8).

- (7) # Who do you want who to win?
- (8) Wen versucht Hans anzurufen  
‘Whom is Hans trying to call?’

The wh-phrases that children consistently avoid in questions like (5) and (7) are well-formed fragments of the local language; they appear in embedded questions: e.g., *He asked me which boy that is. I know who to play with.* Therefore, these questions could be formed by the kinds of ‘cut-and-paste’ operations that experience-based approaches invoke to explain how complex constructions are formed by combining simple constructions (e.g., Goldberg, 2003; Tomasello, 2000).

This complex pattern of linguistic behavior suggests that many children of English-speakers go through a stage at which they speak a language that is like (adult) English in many respects, but one that is like German (Romani etc.) in allowing for the medial-wh. There is nothing wrong with such a language; it just so happens that adults in New York and London do not speak it. But it is quite striking that many children of adults in New York and London *don’t* emulate their parents in this respect. Instead, these children speak like foreigners for a little while. Nevertheless, even children who speak like foreigners in certain respects do not differ from them in the acquisition of many other linguistic principles, including linguistic universals. Learning-based approaches to

language development owe an account of why children project beyond the data *in certain ways but not others*.

### WHY-QUESTIONS IN CHILD ENGLISH

We now turn to a second ‘linguistic error’ by children that can be explained using the theory of Universal grammar. The example is English-speaking children’s questions with the *wh*-word, *why*. It has been observed repeatedly that *why*-questions in child English differ in form from those produced by adults, and that these differences persist long after children have converged on adult forms for other question words, e.g., *what*, *who*, *where*, *how*. The main observation in the literature is that some English-speaking children’s *why*-questions lack inversion, as illustrated in (9).

- (9)
- a. Why that boy is looking at us? (2;4)
  - b. Why you gotta went to a conference? (2;5)
  - c. Why we can’t go in the upstairs bed? (2;5)
  - d. Why that’s not your sandwich? (2;5)
  - e. Why unicorns are pretend? (3;1)
  - f. Why Sophie has a magic bed? (4;5)
  - g. Why Daddy’s never coming to watch? (4;3)

The source of children’s failure to invert auxiliary verbs in *why*-questions has been extensively investigated (e.g., Berk, 2003; de Villiers, 1991; Labov & Labov, 1978; Rowland & Pine, 2000; Stromswold, 1990). As de Villiers (1991) and Berk (2003) note, the tendency for *why* to lack inversion in child English is mirrored in other languages—notably in French questions with *pourquoi*, and with Italian questions with *perché*. The cross-linguistic parallelism suggests that English-speaking children may be drawing on an option made available by Universal Grammar. If so, the expectation is that children’s *why*-questions should exhibit the cluster of properties found in, say, adult Italian *perché*-questions. Such a pattern would constitute further support for a UG-based approach to acquisition, and against a learning-theoretic account.

So, let’s take a brief look at Italian *wh*-questions. In our description of the facts, we lean heavily on theoretical work by Rizzi (1997, 1999) and a longitudinal case study by Thornton (2004). In Italian, *wh*-questions exhibit an operation much like subject-aux inversion in English, except that the main verb raises to a position adjacent to the *wh*-element in Italian, whereas an auxiliary verb assumes this position in English. For most *wh*-words in Italian, if the main verb is not adjacent to the *wh*-word, the *wh*-question is ungrammatical, as shown in (10). There are two exceptions to this, *perché* (why) and *come mai* (how come). For these *wh*-phrases,

questions with and without inversion are both grammatical, as (11a) and (11b) illustrate for *perché*.

- (10) a. Che cosa ha fatto Gianni?  
What has done Gianni  
'What did Gianni do?'  
b. \*Che cosa Gianni ha fatto?  
What Gianni has done  
'What did Gianni do?'
- (11) a. Perché Gianni è venuto?  
Why Gianni has come  
'Why did Gianni come?'  
Perché è venuto Gianni?  
Why has come Gianni  
'Why did Gianni come?'

There are several other differences between *perché* on the one hand, and 'ordinary' *wh*-words, such as *che cosa* (what), on the other. The observed differences between *perché* and 'ordinary' *wh*-words led Rizzi (1999) to propose that *perché* sits 'higher' in the left periphery than ordinary *wh*-phrases, which move to CP (Rizzi's FocusP; cf. Rizzi, 1997). Because *perché* is positioned higher in the phrase marker, there is considerable latitude in the elements it can be combined with. With *perché*, other linguistic material can intrude between the *wh*-phrase and the main verb. As one case in point, subordinate clauses may intrude, as illustrated in (12). Example (13) shows that the intrusion of a subordinate clause is not permitted for *che cosa*.

- (12) Perché quando va a Milano Gianni compra il panettone?  
Why when (he) goes to Milan Gianni buys the panettone  
'Why does Gianni buy panettone when he goes to Milan?'
- (13) \*Che cosa quando va a Milano compra Gianni?  
What when (he) goes to Milan buys Gianni  
'What does Gianni buy when he goes to Milan?'

In addition, Italian *perché*-questions can be followed by phrases expressing contrastive focus, as in (14) whereas ordinary *wh*-questions cannot be, as (15) indicates.

- (14) Perché QUESTO avremmo dovuto dirgli, non qualcos'altro?  
 Why THIS (we) have should said, not something else  
 'Why should we have said THIS to him and not something else?'
- (15) \*Che cosa A GIANNI hanno detto (non a Piero)?  
 What TO GIANNI (they) have said (not to Piero)  
 'What have they said TO GIANNI (and not to Piero)?'

Italian *perché* can also be preceded (and followed by) Topic phrases, as illustrated in (16).

- (16) Il mio libro, perché, a Gianni, non glielo avete ancora dato?  
 My book, why, to Gianni, not to-him-it (you) have still given  
 'Why have you still not given my book to Gianni?'

Another interesting fact about Italian *perché*-questions concerns the interpretation of questions with two clauses. If there is no inversion in the main clause, then only one reading of the question is available. Thus, example (17) can only be asking why Gianni said he would resign; it cannot be asking about the reason for his resignation. With inversion, however, the question becomes ambiguous, as illustrated in (18). That is, (18) again has the interpretation we saw for (17); but, in addition, it can be interpreted as asking about Gianni's reason for resigning. This 'long distance' interpretation of (18) is analyzed as movement of *perché* from the embedded clause, by successive cyclic movement, to a landing site (the SpecCP position of the matrix clause) where ordinary *wh*-phrases reside. For this interpretation to arise, inversion is required, as it is for ordinary *wh*-phrases.

- (17) Perché Gianni ha detto che si dimetterà?  
 Why Gianni has said that self will resign  
 'Why did Gianni say that he will resign?'
- (18) Perché ha detto che si dimetterà?  
 Why has (he) said that self will resign  
 'Why did he say that he will resign?'

This cluster of properties of Italian *wh*-questions will suffice to examine English-speaking children's *why* questions, to see if they exhibit properties of Italian.

In a longitudinal study of one child, A.L., Thornton (2004) recorded over 900 *why*-questions, when A.L. was between the ages of 2 and 6 years. The first prediction is that A.L.'s *why*-questions should be compatible with a focus phrase immediately following *why*. The first prediction is borne out, although the empirical support is limited. The diary corpus offers just

one example in which the phrase immediately following *why* expresses clear contrastive focus.

- (19) Why **SOME OF YOUR MAKE-UP** I can't use? (and some I can) (5;2)

The second prediction is that A.L.'s *why* questions should be compatible with topic phrases (preceding and) following *why*. There is abundant evidence for the second prediction. As in adult Italian, A.L. allows topics in the position following *why*; time adverbials are particularly plentiful. Topic phrases are italicized in the examples in (20).

- (20) a. Why *every winter* there's a snowstorm? (4;3)  
 b. Why *every day when I wake up* the hall light isn't on? (5;1)  
 c. Why *last time in New Zealand* you didn't give me a bath? (5;2)  
 d. Why *everyday* we're still in the black car? (5;3)  
 e. Why *at Falling Water* kids can't come? (6;3)  
 f. Why *today* we got a sticker instead of a sticker and a picture? (6;4)

The third prediction is that A.L.'s *why*-questions should allow subordinate clauses with *if* and *when* preceding the main clause. Examples are provided in (21).

- (21) a. Why *when you was a kid* people called you "Rozzy"? (3;5)  
 b. Why *when I was a baby* I loved Boomer's dog food? (3;6)  
 c. Why *last year when I invited Emily and Julie to my party* Julie didn't play? (4;4)  
 d. Why *if he goes to jail* she can have his room? (5;0)  
 e. Why *when I went through security* it didn't beep? (6;4)

According to the fourth prediction, an inverted auxiliary in A.L.'s two-clause questions should express an interpretation that is not possible if inversion is absent. To investigate this prediction, all *wh*-questions by A.L. with the matrix verbs *think* and *say* were counted from age 3 years to 5 and a half years. With *wh*-phrases other than *why*, inversion occurred 100% of the time. For questions with *why*, only 4 of the 21 questions produced by A.L. lacked inversion. The four questions at issue are given in (22), and a sample of A.L.'s adult-like two clause questions with *why* is given in (23). The expectation is that the four non-adult two clause *why*-questions in (22) had only a 'local' reading questioning

the ‘thinking’ or the ‘saying’; (22d) clearly supports this interpretation. At any rate, 81% of A.L.’s two-clause *why*-questions with the verbs *think/say* have *do*-support, despite the fact that A.L. continued to fail to invert the majority of the time in one-clause *why*-questions.

- (22) a. Why you just think Boomer’s [the dog] cute? I’m cute too. (3;7)  
 b. Why you said there’s no trunk in this car? (4;3)  
 c. Why he thinks a back brace protects his leg? (4;4)  
 d. Why they said they might be going to a movie? Why did they say that? (4;11)
- (23) a. Why do you think Santa’s not coming this year? (3;10)  
 b. Why do you think that Boomer came in with us? (4;2)  
 c. Why do you think that Mommy would not wanna watch he show? (4;6)

To summarize, the properties of English-speaking child’s *why*-questions have been found to match, in considerable detail, the properties of *why*-questions in adult Italian. The cross-linguistic parallel is not limited to the possibility of non-inversion in matrix clauses, but extends to (i) compatibility of focus phrases immediately following *why*, (ii) use of topic phrases, (iii) the possibility of a preceding subordinate clause, and (iv) obligatory inversion in two clause questions. In sum, an entire cluster of properties emerges along with the non-inverted matrix *why*-questions. These observations lend strong support to the continuity hypothesis, which maintains that child language can differ from the language spoken by adults in the same linguistic community, but only in ways that adult languages can differ from each other (cf. Crain, 1991; Crain & Pietroski, 2002).

Experience-based accounts of language learning would be hard-pressed to explain these data. First, this group of properties is not manifested in the environmental input to children learning English. Children learning English are not exposed to large quantities of non-inverted *why*-questions, let alone ones with intruding focus or topic phrases, or preceding subordinate clauses and so on. It would also be surprising, on experience-based accounts, to find all of these properties of *why*-questions to emerge in tandem. On a data-driven account, these properties would be expected to emerge one by one, as the child encountered evidence for each individual ‘construction’ (e.g., Tomasello, 2003). The empirical evidence from A.L. runs counter to this expectation. This error, too, can be construed as a misset parameter.

## THE SYNTACTIC SUBSET PRINCIPLE

Whether the issue is form or meaning, if language learners admit into their language only expressions (and interpretations) they have actually encountered in the linguistic environment, then they will undergenerate; their grammars will generate only a subset of the expressions of the adult language. Such learners would not achieve the stable state that allows for production and comprehension of sentences never before encountered. As Pinker (1990, p. 6) remarks, "... children cannot simply stick with the exact sentences they hear, because they must generalize to the infinite language of their community." By the time children achieve the stable state, they are able to project beyond their data so as to produce and comprehend (an unbounded number of) novel sentences. Undergeneration does not always favor the data-driven account of language development. In fact, undergeneration can constitute counterexamples to the model. It would be problematic for the experience-based learning accounts, for example, if young children systematically disregard the primary linguistic data and, instead, restrict their use of verbal morphology in specific ways. This pattern of children's behavior is expected, however, if their grammars are constrained by the Syntactic Subset Principle (Berwick, 1985).

According to the Syntactic Subset Principle, children are expected to initially adopt the grammatical hypothesis that corresponds to the most restricted setting of the parameters of the theory of Universal Grammar, regardless of the properties of the language spoken by adults in the linguistic community. One example of undergeneration comes from a study of children's use of past tense morphology by Broman Olsen and Weinberg (1999). These authors adopt Broman Olsen's (1997) definitions of aspectual classes, which derive different classes using features that are semantically privative (+ versus 'unmarked'), rather than equipollent (+ versus -). For example, verbs that specify certain kinds of events are designated as [+telic], whereas 'atelic' verbs are simply unmarked for telicity. The aspectual feature [+telic] is specified on verbs that refer to completed events with clear results, such as *made, closed, broke, came, fell, found, gave, got, lost, spilled, fixed*. Atelic verbs lack this aspectual feature; these verbs include *saw, seed, had, bit, bumped, licked, choked, did, stuck*. As Broman Olsen and Weinberg point out, the perfective is restricted to [+telic] verbs in Korean; cross-linguistically this is "the most restrictive mapping between grammatical morpheme and verbal class" (p. 533). Therefore, children learning less restrictive languages, such as English, are expected to mirror adult-Korean in this aspect of verbal

morphology. This prediction is based on a particular variant of the continuity assumption, as the following quote makes clear:

“Our model’s assumptions (innateness and the restriction of relevant input to positive examples only) require that the child’s initial hypothesis be the most restrictive. “Most restrictive” is defined with respect to the range of possible adult languages; environmental input therefore serve to relax initial hypotheses. For example, the mapping between imperfective affixes and verbal forms is restricted to the lexical aspectual class of events in Chinese. Since Chinese is a possible final state in the child’s linguistic development, the Syntactic Subset Principle requires that the child assume initially that the restrictions that apply in Chinese also apply to English (Berwick, 1985).” (p. 533)

The critical contrast concerns telic verbs versus atelic verbs. In a search of the CHILDES database (see MacWhinney & Snow, 1985), Broman Olsen and Weinberg found that young children’s productive use of regular past tense (-ed) and irregular past tense endings were significantly correlated with telic verbs; only 17% of past tense endings occurred with atelic verbs. By contrast, past tense endings appeared significantly more often with atelic verbs (56%) than with telic verbs in the speech of caretakers to these children. As a descriptive generalization, young children are undergenerating in the use of past tense morphology. Children are obviously not tying their language to the input. Instead, it appears that children initially establish a one-to-one mapping between form and meaning, disregarding much of what they encounter in the input. The mapping is not one-to-one for adults speaking to adults; nor is it one-to-one in caretaker speech to children. Children who show this pattern of behavior are largely unresponsive to the input. Consequently, patterns that are robustly attested in adult data, such as the relationship between ‘-ed’ and [+durative] verbs, are not replicated in early child speech. To explain this, Broman Olsen and Weinberg turn to the continuity hypothesis.

Another example of undergeneration is problematic for the experience-based model. The finding comes from a study of the acquisition of Hebrew by Armon-Lotem and Crain (1998). In adult Hebrew, the genitive construction is marked by the preposition *shel* ‘of’. This construction occurs with both mass and count nouns in adult Hebrew. The occurrence of *shel* is limited to inalienable relations, however, such as the part/whole relations in the (a) examples of (24). The genitive construction cannot be used to refer to alienable relations, however, as illustrated by the ungrammaticality of the (b) examples.

- (24)
- | Inalienable  | Alienable   |
|--|---|
| (a) ha-yad shel ha-ish.<br>'the-hand of the-man'<br>"the man's hand."                  | (b) *ha-ec shel ha-ish.<br>'the-tree of the-man'<br>"the man's hand."               |
| (a) ha-galgal shel ha-traktor.<br>'the-wheel of the-tractor'<br>"the tractor's wheel." | (b) *ha-even shel ha-traktor.<br>'the-rock of the-tractor'<br>"the tractor's rock." |
| (a) ha-gargerim shel ha-orez.<br>'the-grains of the-rice'<br>"the grains of rice."     | (b) *ha-egozim shel ha-orez.<br>'the-nuts of the-rice'<br>"the nuts of the rice."   |

One kind of genitive construction in English is formed by the possessive marker, 's, which relates two noun phrases. As in Hebrew, the English genitive construction cannot be used to express certain alienable relations (e.g., *\*the truck's rocks*), but it can be used to express inalienable possession (e.g., *the truck's wheels*). English is more restrictive than Hebrew in its use of the genitive, however. The genitive in English cannot be used for mass nouns (e.g., *\*the rice's grains*).

Based on the Syntactic Subset Principle, Hebrew speaking children are expected to initially restrict the use of *shel* in a way that mirrors English, but not adult Hebrew. This is exactly what happens. Hebrew-speaking children consistently avoid *shel* with mass nouns like *rice* in (24), despite the widespread use of *shel* by adult speakers in referring to substances. Young Hebrew-speaking children distinguish between inalienable and alienable relations for count nouns only. Hebrew-speaking children's more restrictive mapping of sound and meaning provides further evidence that young children initially draw distinctions that are not motivated by the primary linguistic data, but stem from Universal Grammar.

## DISJUNCTION IN CHILD JAPANESE

Another source of evidence for the continuity hypothesis comes from a recent study of children's comprehension of disjunction in Japanese. The study revealed that the interpretation given by Japanese children to disjunction in negative sentences is similar to the interpretation of such sentences in English, but quite unlike the interpretation that adult speakers of Japanese give these sentences. Again, the point is that children apparently ignore the input, in accord with the Syntactic Subset Principle. This case is different from all of the preceding examples, however, because this is an instance of a linguistic phenomenon involving comprehension.

According to one of De Morgan's laws of propositional logic, disjunctive statements that occur within the scope of negation logically entail two negative conjunctive statements, as in (25):

$$(25) \quad \neg (P \vee Q) \Rightarrow \neg P \wedge \neg Q$$

In English, there are sentences with truth conditions that closely resemble the inference in (24). Consider (26), for example, in which the disjunction operator, *or*, appears under negation. The truth conditions can be recast using conjunction, as in (26). In what follows, we will call this interpretation of a disjunctive statement its 'conjunctive interpretation.' The conjunctive interpretation contrasts with the truth conditions that are associated with exclusive-*or*.

- (26) John didn't eat ice cream **or** cake.  
John didn't eat ice cream **and** didn't eat cake.

In contrast to English, the Japanese disjunction operator *ka* appears to be less faithful to the laws in logic. Sentence (27) is a word-by-word translation of the English sentence in (26), but it does not exhibit the same pattern of inference, i.e., *ka* does not have the conjunctive interpretation:

- (27) John-wa aisu **ka** keki-wo tabe-nakat-ta.  
John-TOP ice cream or cake-ACC eat-neg-past  
John didn't eat ice cream **or** didn't eat cake

In (27), the negated disjunction *ka* can only have the 'disjunctive' interpretation, associated with exclusive-*or*. To convey the meaning in (26), Japanese speakers use the form "...*mo*...*mo*," which literally is "...*also*... *also*," as in (28).

- (28) John-wa aisu **mo** keki **mo** tabe-nakat-ta  
John-TOP ice cream also cake also eat-neg-past  
John didn't eat ice cream **and** didn't eat cake

At this point, one might suspect that Japanese *ka* is not logically equivalent to English *or*. However, Goro (2004) points out that Japanese *ka* and English *or* yield identical conjunctive interpretations when they are embedded in a subordinate clause, and when negation appears in the main clause. The following examples illustrate the similarity between *ka* and *or* when they appear in a sentential complement (29), and in a relative clause (30).

- (29) a. John didn't say that Mary could speak English **or** Japanese.

- John didn't say that Mary could speak English **and** he didn't say that Mary could speak Japanese
- b. John-wa Mary-ga eigo **ka** nihongo-wo hanaseru-to iwanakatta  
John-TOP Mary-NOM English or Japanese-ACC speak-can-COMP say-neg-past  
John didn't say that Mary could speak English **and** he didn't say that Mary could speak Japanese
- (30) a. John didn't see a student who can speak English **or** Japanese  
John didn't see a student who can speak English **and** he didn't see a student who can speak Japanese
- b. John-wa eigo **ka** nihongo-wo hanaseru gakusei-wo minakatta  
Taro-TOP English or Japanese-ACC speak-can student-ACC see-neg-past  
John didn't see a student who can speak English **and** he didn't see a student who can speak Japanese

This parallelism suggests that Japanese *ka* does have the same semantics as English *or*, but that this meaning fails to surface for some reason in simple negative sentences, such as (27). Passing over details (see Goro, 2004; Szabolcsi, 2002), we conclude that the disjunction operators in both English and Japanese disjunction receive the conjunctive interpretation, as illustrated in (29) and (30), but this fact is obscured in simple Japanese sentences due to some linguistic property specific to Japanese.

These considerations invite us to ask how Japanese children interpret disjunction in simple sentences with negated disjunctions. If children's behavior is tied to experience, their interpretation of sentences like (27) should conform to that of adults, in apparent violation of De Morgan's laws. At some point, however, they will learn to assign the conjunctive interpretation of *ka* in more complex sentences, such as (29) and (30). On this scenario, Japanese children acquire the conjunctive interpretation of disjunction in later stages of acquisition, since this interpretation requires more complex data.

In contrast, the UG-based approach predicts just the opposite pattern of behavior by children. This approach supposes that the inference schema in (25) and the semantic properties of disjunction are innate (e.g., Crain & Pietroski, 2002). If so, the conjunctive interpretation of disjunction under

negation “comes for free,” and does not have to be learned from experience, irrespective of the child’s target language. What Japanese children have to learn is the language-specific property of Japanese that prevents the schema in (25) from applying in simple negative sentences. Until Japanese children learn this, their interpretations of negated disjunctions in simple (and complex) sentences should essentially be the same as the interpretations assigned by English-speaking children and adults. In other words, the UG-based approach predicts that there is a stage in language acquisition in which Japanese children interpret negated disjunctions conjunctively, in apparent disregard to the vast majority of input they encounter. This makes the acquisition of Japanese disjunction in negative sentences an interesting research question. As we have seen, experienced-based approaches and the UG-based approach make opposite predictions about the course of acquisition.

An experiment by Goro and Akiba (2004) was designed to examine Japanese children’s interpretations of negated disjunctions. The experiment used a Truth Value Judgment task (Crain & Thornton, 1998). One experimenter acted out a short story about an “eating-game.” In the game, there were 12 animals who are each asked to eat vegetables that they don’t like: a carrot and a green pepper. Four of those animals eat both the carrot and the green pepper; 4 of them eat only one; 4 of them eat none. Each animal gets a different prize depending on how well they did: those who ate both vegetables get a gold medal; those who ate only one of the vegetables get a blue medal; and those who ate none get a black cross [for more detailed description of the protocol and the logic behind this design, see Goro and Akiba (2004)]. After the story, Kermit the Frog puppet tries to guess how well each of the animals did in the game, using the color of the prizes they were awarded as a clue. The crucial test cases are the puppet’s guess about those animals with a blue medal, that is, those who ate only one of the vegetables. For example, the puppet utters the following test sentence for one of those animals, the pig, who ate the carrot but not the green pepper:

- (31) Butasan-wa ninjin **ka** piiman-wo tabe-nakat-ta  
 Pig-TOP carrot or pepper-ACC eat-neg-past  
 Literally: ‘The pig didn’t eat the carrot or the pepper’

Under the adult Japanese disjunctive interpretation of *ka*, the sentence means “The pig didn’t eat the carrot or didn’t eat the pepper” and therefore matches the situation. However under the conjunctive interpretation of *ka*, the sentence means “The pig didn’t eat the carrot and didn’t eat the pepper” and is false, since he did eat one of the vegetables and got a blue medal, not a black cross. If children have an adult-like

interpretation of negated disjunction in Japanese, they should accept the sentence. However, if children assign the conjunctive interpretation to *ka*, then they should reject the puppet's statement.

The results are as follows. First, the adult control group ( $N=10$ , Age 29–32, Japanese monolingual non-linguists) accepted the crucial test sentences 100% of the time (20/20). This result clearly shows that the experiment is properly designed so that the crucial test sentences are in fact judged to be true by those who have the disjunctive interpretation of negated *ka*. In contrast, children ( $N=30$ , Age 3;7–6;3, Mean: 5;3, Japanese monolingual) accepted the crucial test sentences only 25% of the time (15/60). When they were asked to explain the reason for their negative judgment, most children said either “Because the pig did eat the carrot” or “Because it is only the pepper that the pig didn't eat.” These results, combined with children's explanation for their negative judgment, strongly suggest that Japanese children are assigning the conjunctive interpretation to *ka* in simple negative sentences. Consequently, it is concluded that Japanese children's interpretation of negated disjunctions is different from the interpretation of Japanese adults, but is more similar to the interpretation of English-speaking children/adults (see Gualmini & Crain, 2002 for the experimental study on the English-speaking children's interpretation of negated disjunctions). A experience-based account would not anticipate such an outcome.

An account based on learning could object that children's interpretation of *ka* in simple negative sentences was an instance of ‘overgeneralizing.’ Recall that Japanese *ka* and English *or* both yield conjunctive interpretations when they appear in a subordinate clause, with negation in the main clause. It is conceivable that children extended the interpretation of *ka* from embedded sentences to simple negative sentences. While this explanation of children's errors is logically coherent, the study by Goro and Akiba (2004) included several control conditions which render this kind of learning scenario unlikely. In one control condition, children were asked to judge sentences containing ...*mo*...*mo*. Recall that expressions of the form *A mo B mo* in simple negative sentences yields the conjunctive (“not A and not B”) interpretation in adult Japanese:

- (32) Butasan-wa ninjin **mo** piiman **mo** tabe-naka-ta  
 Pig-TOP carrot also pepper also eat-neg-past  
 “The pig didn't eat the carrot and didn't eat the pepper”

Children performed almost without error in this control condition. For those animals who got a blue medal (i.e., those who ate only one of the vegetables), children correctly rejected sentences containing ...*mo*...*mo* 95% of the time (57/60); for those animals who got a black cross (i.e.,

those who ate none of the vegetables), they correctly accepted the sentences 100% of the time (60/60). In short, Japanese children showed adult-like performance in interpreting ...*mo*...*mo* in simple negative sentences. It is important to point out that ...*mo*...*mo* has a different interpretation when it appears in embedded contexts, just as *ka* does. When ...*mo*...*mo* appears in a subordinate clause and when negation appears in the main clause, it typically yields a ‘not both’ interpretation, as in (33).

- (33) John-wa Mary-ga eigo **mo** nihongo **mo** hanaseru-to iwanakatta  
 John-TOP Mary-NOM English also Japanese also speak-can-  
 COMP say-neg-past

“John didn’t say that Mary could speak both English and Japanese”

This cannot mean “John didn’t say that Mary could speak English **and** didn’t say that Mary could speak Japanese”

- (34) John-wa eigo **mo** nihongo **mo** hanaseru gakusei-wo minakatta  
 Taro-TOP English also Japanese also speak-can student-ACC  
 see-neg-past  
 “John didn’t see a student who can speak both English and Japanese”

This cannot mean “John didn’t see a student who can speak English **and** didn’t see a student who can speak Japanese”

Thus, children’s adult-like performance with the ...*mo*...*mo* construction in simple sentences makes it unlikely that they overgeneralize from embedded contexts to simple clauses in negative sentences with *ka*.

The results of this study provide further support for a UG-based approach to language acquisition. The non-adult linguistic behavior that Japanese children show with respect to the interpretation of negated disjunctions conforms to the pattern that is observed in another natural language, namely, English. Given this, the UG-based approach concludes that children’s nonadult interpretation is presumably another instance of the realization of innate linguistic knowledge. In contrast, the data poses a serious challenge for data-driven learning approaches. Japanese children’s behavior does not pattern with adults’ behavior, and there is no obvious source of confusion within the positive input that is available to children.

## CONCLUSION AND FUTURE DIRECTIONS

The pattern of children's adult and non-adult linguistic behaviors is the key to distinguishing between the competing accounts of child language development. The UG-based approach embraces the assumption that child languages can differ from the local adult language only in ways that adult languages can differ from each other (Crain, 1991; Crain & Pietroski, 2002; Goodluck, 1991; Pinker, 1984). Children who adhere to this assumption are expected to 'try out' constructions that are unattested in the local language. At any given time, children will be speaking a possible human language, just not the language spoken around them. Eventually, of course, children converge on a grammar that is sufficiently like that of other speakers of the local language; at that point, language change is no longer initiated by the input. The nature of the differences between child and adult language is a trademark of the Universal Grammar approach to child language.

Many questions remain unanswered. For one thing, we would like to know if the entire pattern of *why*-questions observed for the child A.L. is manifested by other English-speaking children. It will be important to investigate other clusters of properties that are tied together within linguistic theory, as well as other cases of children projecting beyond their experience. In any event, the findings of the studies described in the present paper illustrate the kind of evidence that can be used to adjudicate between a UG-based approach to child language and an experience-based approach.

## REFERENCES

- Armon-Loten, S., & Crain, S. (1998). Interface conditions on child language. In A. Dimitriadis, H. Lee, C. Moisset, & A. Williams (Eds.), *Proceedings of the 22nd Annual Penn Linguistics Colloquium*. (pp. 13–23). Philadelphia, PA: University of Pennsylvania.
- Baker, M. (2001). *The Atoms of Language*. New York: Basic Books.
- Berk, S. (2003). Why "why" is different. In B. Beachley, A. Brown, & F. Conlin (Eds.), *BUCLD 27* (pp. 127–137). Somerville, MA: Cascadilla Press.
- Berwick, R. (1985). *The Acquisition of Syntactic Knowledge*. Cambridge, MA: The MIT Press.
- Broman Olsen, M., & Weinberg, A. (1999). Innateness and the acquisition of grammatical aspect via lexical aspect. In A. Greenhill, H. Littlefield, & C. Tano (Eds.), *BUCLD 23* (pp. 529–540). Somerville, MA: Cascadilla Press.
- Chomsky, N. (1981). *Lectures on Government and Binding*. Dordrecht: Foris.
- Crain, S. (1991). Language acquisition in the absence of experience. *Behavioral and Brain Sciences*, 14, 597–650.
- Crain, S., & Pietroski, P. (2002). Why language acquisition is a snap. *The Linguistic Review*, 19, 163–183.
- Crain, S., & Thornton, R. (1998). *Investigations in Universal Grammar: A Guide to Experiments on the Acquisition of Syntax and Semantics*. Cambridge, MA: MIT Press.

- de Villiers, J. (1991). Why questions? In T. Maxfield & B. Plunkett (Eds.), *UMOP Special Edition: Papers in the Acquisition of Wh* (pp. 155–175). Amherst, MA: GLSA.
- Goldberg, A. (2003). Constructions: A new theoretical approach to language. *Trends in Cognitive Science*, 7, 219–224.
- Goodluck, H. (1991). *Language Acquisition: A Linguistic Introduction*. Cambridge, MA: Blackwell.
- Goro, T. (2004). Japanese disjunction and the locality of positive polarity. Poster presented at the Georgetown University Round Table, Washington DC.
- Goro, T., and Akiba, S. (2004). The acquisition of disjunction and positive polarity in Japanese. In V. Chand, A. Kellehar, A. Rodríguez, & B. Schmeiser (Eds.), *WCCFL 23* (pp. 251–264). Somerville, MA: Cascadilla Press.
- Gualmini, A., & Crain, S. (2002). Why no child or adult must learn De Morgan's laws. In B. Skarabela, S. Fish & A. Do (Eds.), *BUCLD 26* (pp. 243–254). Somerville, MA: Cascadilla Press.
- Labov, W., & Labov, T. (1978). Learning the syntax of questions. In R. Campbell & P. Smith (Eds.), *Recent Advances in the Psychology of Language III: 4b* (pp. 1–44). New York: Plenum Press.
- McDaniel, D. (1986). *Conditions on Wh-Chains*. Unpublished PhD dissertation, City University of New York.
- McDaniel, D., Chiu, B., & Maxfield, T. (1995). Parameters for *wh*-movement types. *Natural Language and Linguistic Theory*, 13, 709–753.
- MacWhinney, B., & Snow, C. (1985). The child language exchange data system. *Journal of Child Language*, 12, 271–296.
- Pinker, S. (1984). *Language Learnability and Language Development*. Cambridge, MA: Harvard University Press.
- Pinker, S. (1990). Language acquisition. In D. N. Osherson & H. Lasnik (Eds.), *An Invitation to Cognitive Science: Volume 1: Language* (pp. 199–241). Cambridge, MA: The MIT Press.
- Rizzi, L. (1997). The fine structure of the left periphery. In L. Haegeman (Ed.), *Elements of Grammar*. Dordrecht, The Netherlands: Kluwer Academic Press.
- Rizzi, L. (1999). On the position Int(errogative) in the left periphery of the clause. Ms. University of Siena.
- Rowland, C., & Pine, J. (2000). Subject-auxiliary inversion errors and *wh*-question acquisition: 'what do children know?' *Journal of Child Language*, 27, 157–181.
- Stromswold, K. (1990). *Learnability and the Acquisition of Auxiliaries*. Doctoral dissertation, MIT.
- Szabolcsi, A. (2002). Hungarian disjunctions and positive polarity. In I. Kenesei, & P. Siptár (Eds.), *Approaches to Hungarian 8*. Budapest: Akadémiai Kiadó.
- Thornton, R. (1990). *Adventures in Long-Distance Moving: The Acquisition of Complex Wh-Questions*. Doctoral dissertation, University of Connecticut.
- Thornton, R. (1995). Referentiality and *wh*-movement in child English: Juvenile D-Linkuency. *Language Acquisition*, 4, 139–175. (Special Issue on the Acquisition of Wh-Questions.)
- Thornton, R. (2004). Why continuity. In A. Brugos, L. Micciulla, & C. Smith (Eds.), *BUCLD 28* (pp. 620–632). Somerville, MA: Cascadilla Press.
- Tomasello, M. (2000). Do children have adult syntactic competence? *Cognition*, 74, 209–253.
- Tomasello, M. (2003). *Constructing a Language: A Usage-Based Theory of Language Acquisition*. Cambridge, MA: Harvard University Press.