Language Acquisition

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Every normal child acquires a language in just a few years. By four or five, children have effectively become adults in their abilities to produce and understand endlessly many sentences in a variety of conversational contexts. There are two alternative accounts of the course of children's language development. These different perspectives can be traced back to the NATURE VERSUS NURTURE debate about how knowledge is acquired in any cognitive domain. One perspective dates back to Plato's dialogue "The Meno". In this dialogue, the protagonist, Socrates, demonstrates to Meno, an Aristocrat in Ancient Greece, that a young slave knows more about geometry than he could have learned from experience. By extension, PLATO'S PROBLEM refers to any gap between experience and knowledge. How children fill in the gap in the case of language continues to be the subject of much controversy in cognitive science. Any model of language acquisition must address three factors, *inter alia*:

(1) the knowledge children accrue
(2) the input children receive (often called the PRIMARY LINGUISTIC DATA)
(3) the nonlinguistic capacities of children to form and test generalizations based on the input

According to the famous linguist Noam Chomsky, the main task of linguistics is to explain how children bridge the gap – Chomsky calls it a 'chasm' -- between what children ultimately know, and what they could have learned from experience, even given optimistic assumptions about their cognitive abilities. Proponents of the alternative 'nurture' approach accuse nativists like Chomsky of overestimating the complexity of what children learn, underestimating the data they have to work with, and undue pessimism about their abilities to extract information based on the input. We discuss the EXPERIENCE-DEPENDENT approach first, and then the NATIVIST approach.

1. **The experience-dependent (nurture) approach to language acquisition**

This solution to Plato's problem views language development on a par with the acquisition of knowledge in other cognitive domains: e.g., social skills, learning to count, learning to read, and so forth. So, the nurture approach invokes DOMAIN-GENERAL learning mechanisms to explain language development. These domain-general learning mechanisms embody general learning processes that are not specially tailored to acquire any particular kinds of facts about the world. Like knowledge in other cognitive domains, knowledge of language is accrued in a piecemeal fashion, based on statistical regularities in the input.

Advocates of the experience-dependent account highlight the availability of relevant cues in the input to children. These cues serve as the basis for the generalizations that children

form about language. These generalizations are formed using general purpose learning mechanisms including distributional analysis, analogy, cut and paste operations, and the like. The products of these learning algorithms are 'shallow' records which children keep of their linguistic experience. These are piecemeal records of construction types (a.k.a. templates/schemas/constructs) that encode linguistic patterns displayed by the input. Construction types are concatenated sequences of category labels such as *NP, V, neg, INF, P*, etc., drawn from an intuitively simple typology, and are learned solely from positive evidence (Pullum and Scholz 2002; Goldberg 2003, 2006). When children's generalizations extend beyond their experience, the supposition is that this is just an instance of a completely general induction problem that arises for all learning that involves projection beyond one's experience (Cowie 1999). According to Pullum and Scholz (2002), linguists need not suppose that children are innately endowed with "specific contingent facts about natural languages." If the data available to children are rich enough for them to determine the structures of human languages, given the right inferential techniques, then appeals to innately specified principles are at best a useful crutch for theorists -- and at worst a source of erroneous claims about alleged 'gaps' between the facts concerning particular human languages and the evidence available to children.

According to the experience-dependent (a.k.a. USAGE-BASED) account, all human languages contain a wide range of semi-idiosyncratic constructions that cannot be accounted for by universal, or innate linguistic principles. On any account of language development, these 'peripheral' constructions must admittedly be learned. According to the experience-dependent account, the same mechanisms that children use to learn these constructions are also used to learn the CORE PHENOMENA of human languages. The reasoning here is that the core phenomena of human languages are even more regular, and occur more frequently than the idiosyncratic patterns. If so, then the core phenomena should be even easier to learn (Goldberg 2006), with more frequently attested constructions being mastered earlier than less frequently attested constructions (Tomasello 2003). Once children have mastered the core construction types, these are merged into more and more complex patterns, until the language of the child approximates that of an adult in the same linguistic community. On the experience-dependent approach, then, child language is expected to match that of adults, more or less. Initially, child language will be a less articulated version of the adult language, but children will gradually converge on the target language.

On this account, linguistic generalizations are based on information-structure, including TOPIC (matters of current interest), FOCUS DOMAIN (what is newly asserted), and BACKGROUNDED elements (e.g., presuppositions). The communicative function of a construction type is essential in accounting for its distribution in a language. For example SUBJECTS are the default devices for marking the topic of a clause. Once communicative function is taken into account, an explanation of cross-linguistic generalizations follows. Such generalizations (recurrent patterns) are claimed to be the by-product of general cognitive constraints, such as analogical processes, processing factors, and discourse-pragmatic factors (Goldberg 2006). Nevertheless, the experience-dependent account anticipates substantial variability among the constructions that appear in different human

languages. As noted, the experience-dependent account attempts to avoid the conclusions of nativists about the innate specification of universal linguistic principles. On this account, children only (re)produce linguistic expressions that they have experienced in the input, at least at the earliest stages of language development. This proposal is called CONSERVATIVE LEARNING. If true, conservative learning renders innate linguistic principles unnecessary for language learning. Language development consists, instead, in developing constructions based on exposure to strings of words that learners encounter in their experience. Tomasello (2000) defends the conservative learning model of language acquisition, for verbs. Essentially, young children's productions of verb forms are limited to forms that they have previously encountered in the input, at least for children younger than three. After 3, children start to form more abstract adult-like linguistic categories. When children make 'errors', these are purged from children's grammars by (direct or indirect) NEGATIVE EVIDENCE (lack of understanding, corrective feedback), ENTRENCHMENT (being drowned out by the frequency of a different expression), and PRE-EMPTION (e.g., adult recasts using an alternative expression). These usage-based mechanisms assume the role played by innate constraints on the nativist account (Cowie 1999; but cf. Crain and Pietroski 2001, 2002).

Recently, developmental psycholinguists have been exploring the possibility that linguistic facts can be learned without the kinds of abstract or implicit principles that have been proposed in the 'nature' approach to language development. One relevant discovery is that children are able to effectively learn certain linguistic properties based on statistical regularities in the input. For example, Saffran, Aslin and Newport (1996) showed that 8-month-old children could exploit statistical learning to extract information about transitional probabilities from the input (i.e., how likely one item is to follow another). Infants inferred the existence of word boundaries between three-syllable pseudowords (nonsensical combinations). Those three-syllable sequences that crossed a word boundary were not treated by the child subjects as a 'word' during the post-test phase of the study, because there was a lower probability for such sequences to be repeated if they crossed a word boundary than if they were part of a 'word.' The second development concerns the nature of the input available to children. It has recently been argued that the input contains relevant features in sufficient abundance to support statistically based acquisition of several seemingly complex facts about language (Pullum and Scholtz 2002; MacWhinney 2004).

The conclusion reached by proponents of the experience-based account is that children can extract the relevant generalizations from what adults actually say, in the circumstances in which they say them. However, critics have pointed out limitations in statistical learning mechanisms (e.g. distributional analysis). While the statistical learning mechanism most often cited in the literature is capable of extracting information about the transitional probabilities of three-syllable sequences, Yang (2004) showed that the same mechanism *cannot* reliably segment sequences of monosyllabic words (also see Marcus 1999; Marcus, Vijayan, Smith 1996). This is problematic, because sequences of monosyllabic words make up the majority of the input directed to English-speaking children. The statistical learning mechanism is effective, however, if it is guided by a linguistic constraint -- that each word contains a single primary stress (Yang 2004).

It has also been pointed out that statistical learning mechanisms can learn things that human children cannot learn. For example, a study by Read and Schreiber (1982) found that 7-year-old children are sensitive to structural notions like subject noun phrase, as long as such phrases contain more than one word. But the Read and Schreiber study also found that 7-year-olds *cannot* learn STRUCTURE-INDEPENDENT rules, like 'drop the first four words of a sentence'. Similarly, Smith and Tsimpli (1995) showed that adults are unable to learn structure-independent rules for question formation. To the extent that statistical learning mechanisms *are* able to form structure-independent generalizations, these mechanisms are apparently quite unlike human minds.

2. **The nativist (nature) approach to language acquisition**

Whereas the experience-based account of language acquisition speaks of 'core phenomena', the nativist account speaks of CORE GRAMMAR. The nativist solution to Plato's Problem supposes that children are biologically fitted, as part of the human genome, with a UNIVERSAL GRAMMAR (e.g., Chomsky 1965, 1975, 1986). The Universal Grammar account views language acquisition as, at least in part, the by-product of a domain-specific computational mechanism. Universal Grammar contains the core PRINCIPLES of language, i.e., principles that are manifested in all human languages. In addition, Universal Grammar spells out particular ways in which human languages can vary. These points of variation are called PARAMETERS. Taken together, the principles and parameters of Universal Grammar establish the boundary conditions on what counts as a possible human language. Children are seen to navigate within these boundaries in the course of language development. The universal principles enable children to rapidly and effortlessly acquire any human language without formal instruction and despite the considerable latitude in the experiences of different children. As noted earlier, according to nativists, children's linguistic knowledge is vastly underdetermined by their experience. Concrete instances of ways in which children's linguistic knowledge is underdetermined by their experience are called POVERTY-OF-THE-STIMULUS arguments. Based on a series of such arguments, nativists have concluded that children are innately endowed with certain linguistic knowledge, namely the principles and parameters of Universal Grammar.

3. **The poverty-of-the-stimulus argument**

The arsenal of arguments and evidence in support of the nativist account of language acquisition has taken several guises. Here we will rehearse three kinds of poverty-of-the-stimulus arguments offered by advocates of the nativist account. According to Fodor (1981: 258) the argument from the poverty-of-the-stimulus is "*the* existence proof for the possibility of cognitive science."

3.1. **Constraints:** First, experimental investigations have shown that children do not violate core linguistic principles, even in cases where they might be tempted to violate such principles if they were to adopt general-purpose learning algorithms. An illustration is offered in (4) and (5). In (4a-b) the pronoun *he* can be semantically related to a preceding expression, *Obama* in (4a) and the Wh-word *who* in (4b). That is, (4a) can be

paraphrased as *Obama thinks that he, Obama, will buy a Prius*, and (4b) can mean *Which x is such, that x thinks x will buy a Prius*?

(4) a) Obama thinks he will buy a Prius.
b) Who thinks he will buy a Prius?

These interpretations are impossible, however, in superficially related examples, as illustrated in (5). In these examples, the pronoun *he* cannot be related to *Obama* in (5a) or to *who* in (5b)

(5) a) He thinks Obama will buy a Prius.
b) Who does he think will buy a Prius?

Chomsky proposed that the same linguistic principle governs both of the examples in (5), prohibiting the pronoun *he* from being semantically linked with another expression in these sentences (Chomsky 1981, 1986).

Since the core linguistic principle under discussion dictates what meanings *cannot* be assigned to sentences, the principle is often referred to as a CONSTRAINT on interpretation. The critical observation is that constraints are negative facts about human languages. To 'learn' a constraint on interpretation, then, children would need to have access to information about what meanings strings of words *cannot* have. As far as we know, this kind of information is not available in the primary linguistic data, much less a 'regular' part of the evidence available to children (see Pinker 1990; Chierchia 2004; Crain 1991; Crain and Pietroski 2001, 2002). One possible source of direct negative evidence is corrective feedback. After careful scrutiny of parent-child interactions, however, researchers have concluded that this kind of negative evidence is not available at the right time or in sufficient abundance to promote learning of negative constraints (e.g., Bowerman 1988; Brown and Hanlon 1970; Morgan and Travis 1989; Marcus 1993). In the absence of negative evidence, it is difficult to see how children could 'learn' such constraints. Moreover, even if negative evidence were available, children may not avail themselves of it. There is no evidence that children exposed to negative evidence use it to purge their grammars of incorrect hypotheses (Newport, Gleitman and Gleitman 1977).

A number of studies have been conducted to see how young children interpret structures like those illustrated in (4) and (5) (see Crain and Thornton 1998). The findings are consistent with the expectations of Universal Grammar. Essentially, as soon as they can be tested (by 3-years of age), children have been found to adhere to several linguistic constraints, including the constraint on when pronouns cannot be semantically related to expressions in the same sentence, as in (5). Apparently, children do not need to avail themselves of mechanisms such as entrenchment, pre-emption and indirect negative evidence to acquire the information encoded in constraints. The early acquisition of the constraints therefore provides prima facie evidence for a Universal Grammar, because children evidently have linguistic knowledge for which there is no corresponding experience.

3.2. **Deep linguistic principles**: A second kind of poverty-of-the-stimulus argument has been offered. The nativist account of language acquisition is reinforced by the observation that children have command of 'deep' linguistic principles, i.e., abstract principles that tie together a variety of linguistic phenomena that appear, superficially, to be unrelated. It is instructive to ask whether children could have plausibly learned such principles on the basis of evidence available to them. If that seems unlikely, and experimental investigations reveal that very young children adhere to such principles, then one can tentatively conclude that these principles are due, at least in large part, to Universal Grammar. One example involves a series of asymmetries that are found in sentences with the UNIVERSAL QUANTIFIER, e.g., English *every*.

It is useful to partition sentences with *every* into two parts, (a) the SUBJECT PHRASE and (b) the PREDICATE PHRASE. The critical observation is that different things happen in each of these phrases. One difference concerns where the word *any* can appear. As (6) illustrates, *any* can appear in the subject phrase of a sentence with *every*, but the sentence is anomalous with *any* in the predicate phrase, as indicated by '*'.

(6) a) Every [linguist who has **any** brains] [bought a car]
b) Every [linguist who bought a car] [has ***any** brains]

A second asymmetry concerns the entailment relations among sentences. Example (7a) shows that it is valid to substitute the specific expression *Prius* for the more general expression *car* in the subject phrase of a sentence with *every*. If the sentence with the general term (*car*) is true, so is the sentence with the specific term (*Prius*). This pattern of inference is not valid in the predicate phrase, as shown in (7b).

(7) a) Every [linguist who bought a **car**] [received a rebate]
⇒ Every [linguist who bought a **Prius**] [received a rebate]

b) Every [linguist who received a rebate] [bought a **car**]
*⇒ Every [linguist who received a rebate] [bought a **Prius**]

The third asymmetry is in the interpretation of DISJUNCTION, e.g., English *or*. Notice that *or* expresses a different meaning in (8a) than in (8b). Example (8a) generates a CONJUNCTIVE ENTAILMENT that can be paraphrased as follows: *every linguist who bought a Prius received a rebate **and** every linguist who bought a Civic received a rebate*. In (8b) *or* has its ordinary 'disjunctive' (not both) meaning.

(8) a) Every [linguist who bought a Prius **or** a Civic] [received a rebate]
b) Every [linguist who received a rebate] [bought a Prius **or** a Civic]

In view of these (and other) asymmetries involving the universal quantifier *every*, let us ask how likely it is that children encounter relevant linguistic input. A casual (or even intensive) examination of what adults actually say does not reveal the generalizations we have presented -- much less the deeper principle that explains them. For example, it is highly unlikely that English-speaking children are informed that the word for disjunction

or has a different interpretation when it appears in the subject phrase of a sentence with the universal quantifier, as in (8a), than it does when it appears in the predicate phrase, as in (8b). Nevertheless, 3- to 5-year old children correctly distinguish the interpretation of disjunction in the subject versus the predicate phrase of the universal quantifier (Gualmini, Meroni and Crain 2003; Meroni, Gualmini and Crain 2006).

What is the source of these asymmetries between the subject phrase versus the predicate phrase of sentences with *every*? Researchers working in formal semantics within the framework of Universal Grammar contend that these seemingly disparate linguistic phenomena share a common semantic property, known as DOWNWARD ENTAILMENT (Chierchia 2004; Crain, Gualmini and Pietroski 2005). To the extent that the experience-dependent account lacks semantic properties like downward entailment, it owes us an alternative account of the various phenomena that are associated with this property in human languages. Even more problematic for the usage-based account is the fact that the same cluster of linguistic phenomena crops up in language after language. For example, if the sentences in (8a-b) are translated into Japanese or Chinese, or any other language, as far as we know, the same differences in interpretation arise (Crain 2008; Crain and Khlentzos 2008). This casts further doubt on the experience-dependent account. To the extent that information structure and communicative function play little or no role in explicating these phenomena, these mechanisms are only a fraction of the machinery needed to account for semantic interpretation. The asymmetries in interpretation that we have described are more likely to be reflections of a mental system that imposes certain structures more or less independently of experience. In recent work, more and more linguistic universals are coming to light, adding to the demand for further abstract properties in the analysis of human languages (Crain, Thornton and Khlentzos 2008).

3.3. **Parameter setting and the Continuity Hypothesis**: According to the experience-dependent account, the child's hypotheses about the local language is driven by what the child hears; children's linguistic errors are expected to arise from less articulated grammars than those of adults in the same linguistic community. The child would not be expected to produce utterances that do not reflect the target language, but properties of some other human languages. According to the nativist perspective, by contrast, children should be expected to sometimes follow developmental paths to the adult grammar that would be very surprising from a data-driven perspective. From the nativist perspective, children are free to try out various linguistic options (compatible with Universal Grammar) before setting parameters in a way that specifies some particular human language, like Japanese or English.

An extension of this line of thought is called the CONTINUITY HYPOTHESIS (Pinker 1984; Crain 1991, 2002; Crain and Pietroski 2001). According to the Continuity Hypothesis, child language can differ from the local adult language only in ways that adult languages can differ from each other. The idea is that at any given time, children are speaking a possible human language -- just not the particular language spoken around them. If this is correct, we should not be surprised if English-speaking children exhibit some constructions characteristic of German, Romance or East Asian languages, even in the absence of any evidence for these properties in the primary linguistic data. Such

mismatches between child and adult language may be the strongest poverty-of-the-stimulus argument for a Universal Grammar (UG). Here is one example of children's non-adult, but UG-compatible, productions.

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 where this word is asking about the content of an embedded clause, as illustrated in (9a-b) (Crain and Thornton 1998; Thornton 1996).

(9) a) Who do you think who is in the box?
b) What do you think what Cookie Monster eats?

This '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. However, structures like (9) are attested in other languages. An example from German is given in (10).

(10) Wer_i glaubst du wer_i nach Hause geht?
'Who do you think who goes home?'

By contrast, children never used a medial-Wh when extracting from infinitival clauses, as in (11). Nor is this permissible in languages that permit the medial-Wh, as the ungrammaticality of the German example in (12) illustrates. Indeed, insertion of medial-Wh in infinitival complements is universally ungrammatical, as far as we know.

(11) Who do you want who to win?
(12) Wen versucht Hans anzurufen?
'Whom is Hans trying to call?'

This complex pattern of linguistic behavior by English-speaking children suggests that they go through a stage at which they speak a language that is like (adult) English in many respects, but one that is also like German, in allowing for the medial-Wh. There is nothing wrong with such a language; it's just that adults in Los Angeles and Sydney do not speak it, yet the children of some adults in Los Angeles and Sydney do. As a final comment, it should be clear that the medial-Wh phenomenon accords with the Continuity Hypothesis.

This concludes our brief review of the main debate in language acquisition: whether the development of language is better explained by an experience-dependent account, or by an account that attributes innate linguistic knowledge to children. Only time will tell which account is closer to the truth.

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Useful Websites

The Linguist List -- 'world's largest online linguistic resource'
http://www.linguistlist.org/

Linguistic Society of America (LSA)
http://www.lsadc.org/info/student-resources.cfm

Video Resources

Movies on the LSA website
http://www.uga.edu/lsava/Archive.html

The Human Language Series, especially Part 2 'Acquiring the Human Language'
http://www.thehumanlanguage.com/page1.html

Suggested Books for Students

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