RELATING CHILD SYNTAX TO LEXICAL ACQUISITION

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Abstract

Over the past three decades various methods have been employed to tap the syntactic knowledge of native speakers. Some of these methods have also been adapted for use with children. The preferential looking paradigm has proved to be something of a breakthrough in this regard. After surveying a series of related preferential looking experiments, I present a framework which synthesises these results and also relates them to the central role in language played by the lexicon. The thesis advanced is that sophisticated methods of testing syntactic knowledge in infants show that such knowledge is not used until a certain stage of lexical development has been reached. Implications for theories of syntactic bootstrapping are also briefly discussed.

1. Background

To know a natural language one must acquire a lexicon. It might even be assumed that the more lexical items one's lexicon contains, the better. However, speaking and understanding involve more than stringing together items from a fixed store. Thus traditional grammar parses utterances into phrases / clauses, each of which in turn can potentially be analysed into smaller phrases / clauses, and so on in recursive fashion. Characterising a person's syntactic knowledge, that is precisely specifying those combinatory principles known over and above a stock of lexical items, remains a challenge to this day.

To respond to this challenge, one needs methods of tapping syntactic knowledge. A seemingly obvious starting point is a representative sample of speech, a corpus of utterances. Though in practice a field worker may be well advised to proceed in this way, the strengths and limitations of a corpus-based approach have long been made clear. Gleason states that the 'investigation of the grammar of any language proceeds from the examination of a corpus' (1955/1961:65), but goes onto warn us of the differences between describing a corpus and describing a language (1955/1961:195). Questions about representativeness, about sampling procedures and about errors are broached; identifying and characterising knowledge of ungrammatical expressions, however, is a particularly delicate matter. Thus supplementary modes of tapping syntactic knowledge discussed by Gleason include noting the absence of forms, as well as noting native speaker self-corrections and rejections of candidate expressions. Recent decades have seen the elicitation of grammaticality judgments not only supplementing, but often even replacing corpus-based accounts.

It is unsurprising that as a science develops, straight observation should give way to a certain extent to experimentation. Presenting a linguistic stimulus to an informant for evaluation can be construed as a form of experimentation (perhaps quite informal) particularly when stimuli consist of minimally contrasting sets of expressions. Such contrasts need not be as extreme as (1) versus (2) below; indeed, Chomsky (1995) stresses that much recent work has profited from contrasts such as (3) versus (4), both 'deviant' but differentially so:

(1) The cat sat on the mat.

(2) (**) Mat the on sat cat the.

(3) (7) What do you wonder whether Mary fixed?

(4) (*) How do you wonder whether Mary fixed the car?

In other words, degrees of (un)grammaticality can and do play a significant role in syntactic theory. To encode such knowledge, scales such as ** <* <?* <??<? have arisen. These have

recently become the objects of a certain amount of discussion, with Bard, Robertson and Sorace (1996) proposing what they view as a less problematic alternative (magnitude estimation), while experimental psycholinguists such as Gropen, Pinker, Hollander, Goldberg and Wilson (1989) use numerical (e.g. seven-point) rating scales. In other words, the variables used to tap syntactic knowledge are increasingly nowadays not discrete but at least potentially continuous. Discrete knowledge may emerge from a study employing a continuous variable (be it on inspection, or after statistical interpretation of the resulting distribution). Since most if not all aspects of performance are continuous, it makes sense to allow any aspects of syntactic knowledge that are discrete to emerge as discoveries. Of course, such considerations are a long way from sole reliance on the corpus- based analyses mentioned above, which I nonetheless would say they complement.

Given that claims about Universal Grammar, the initial state of the language faculty, or the feasibility of language acquisition play an explanatory role in much syntactic work since the l960s, it is unsurprising that considerable effort has been expended on tapping syntactic knowledge in children. Early attempts were largely corpus based, as one might expect (see, for instance, Brown 1973). Close scrutiny of transcripts of video-taped interactions continues to yield insights to this day. Thus Budwig (1995) draws our attention to individual differences in 'error' patterns, and to contrasts between child—child and child—caretaker interaction. Contrasts of the latter sort can be efficiently focused on by means of an essentially experimental manipulation of the environment. Indeed for a couple of decades, numerous types of explicitly experimental studies have been conducted on children, based on techniques ranging from picture pointing or act-out tasks to elicitation of acceptability judgments (see Ingram 1989). However, when exploring the very roots of syntactic knowledge, one is led to study children as young as one or two years of age, and it takes little imagination to foresee the numerous difficulties that can and do arise when conducting linguistic experiments on very young children. Pencil and paper tasks are typically out of the question, while uncooperative behaviour is a constant risk. Even so, recent developments such as the intermodal preferential looking paradigm described below show that ingenious methods of experimentally tapping linguistic knowledge in children barely past their first birthday do exist.

2. The preferential looking paradigm: Study A

Experiments using the preferential looking paradigm (see Hirsh-Pasek and Golinkoff 1991 for further details) can be described as a rudimentary kind of multiple choice test. A child is seated facing two video screens while an audio-taped message emanates from a speaker placed centrally between the two screens. Suppose the screen on the left shows a female prominently displaying a banana while simultaneously eating a biscuit; suppose further that the screen on the right shows the same female eating the banana while prominently displaying the biscuit. When an audio such as 'Look! She's eating the banana' is played, an experimental subject who understands English clause structure should 'choose' the video on the right. Significantly, children with a mean age of 14 months have been found to look longer at the matching (i.e., in this case, right hand side) screen under controlled and replicable conditions. Confronted with two scenarios both of which involve eating and both incorporating a clearly visible banana, they indicate via the duration of visual fixation that they prefer the screen that packages both the eating and the banana into a coherent whole. Is this evidence for syntactic knowledge (e.g. of a VP constituent) possessed by children whose productive output consists of holophrases (one word utterances)? This is one of the main questions that I will address in the remainder of this paper. My approach will involve comparing the findings of several experiments instantiating variants of the preferential looking technique with young children of different ages. Studies conducted to date are

sufficiently intriguing to allow one to hazard an attempt at a synthesis of the various findings reported so far.

3. Study B

I will begin the synthesis by summarising the results of a fairly intricate experiment conducted by Naigles (see Naigles 1996) with 28-month-old girls. Before the crucial test phase of the experiment, the children are shown videos of a novel 'action complex' involving two actors (X and Y for our purposes, but in reality different animal characters for the children). An example of a novel action complex consists of X forcing Y into a bending position while X and Y both simultaneously execute large arm circles. Suppose the screen on the left hand side later shows only the forcing of Y by X into a bending position, while the screen on the right shows no forcing or bending but only the simultaneous execution of arm circles by both X and Y. A fairly neutral auditory instruction (e.g. 'Look, gorping!') would be expected to lead to preferential *looking* at the (non-linguistically) more salient screen, if any. However, knowledge of language can be shown to have an effect if during the pretest phase (i.e. during the viewing of the unsplit 'action complex') the child hears a message of the form 'X is gorping Y; Y is gorping'. Here what I have introduced as the left hand side screen turns out to be preferred during the test phase. The child hears the syntax of verbs like *bend* or *break (X is bending Y; Y is bending),* and is thereby induced to focus on the 'causative' component of the novel action complex, as evidenced by visual fixation time when the two components of the complex are separated during the test phase. It is worth pointing out that children are not fazed by made-up pseudo-verbs such as *to gorp* - after all, they are learning new vocabulary items on a daily basis. Note that using *to gorp* rather than *to bend* forces experimental subjects to concentrate on syntax rather than verb recall.

The experiment was also conducted using the syntax of non-causative, 'contact' verbs such as *hit* or *touch.* Here adults allow X-verb-Y (e.g. X *is touching / hitting Y),* but not both X-verb-Y and Y-verb to describe the same scenario. Rather, for any single scenario, a native speaker will allow X *is hitting Y* together with *X is hitting.* To test whether children respond differently to 'X-verb-Y; Y-verb' versus 'X-verb-Y; X-verb', various additional tests were performed. The central one again involves a (new) novel action complex (this time incorporating X contacting *Y* in some distinctive manner while X and Y simultaneously also execute some repeated synchronous action) introduced in the pretest phase. Again the two components of the complex are split in the test phase, during which an instruction such as 'Find gorping' is heard. Longer visual fixation once again indicated the ability to factorise a complex scene into components, an ability triggered by the syntactic material heard during the pretest phase (X-verb-Y; X-verb). Here the 'contact' component was preferred over the 'synchronous' component of the complex.

Note that there are situations in which experimental subjects prefer to look at the screen depicting just the synchronous action (e.g. the circling of arms). One such situation occurs *if,* in the experiment sketched immediately above, instead of 'X is gorping Y; X is gorping' children hear a syntactically neutral message such as 'Look, gorping!' during the pretest phase. One can thus be fairly confident that it is syntax, and not intrinsic interest value that triggers test phase preferences. However, it is worth repeating that this syntactic knowledge is exhibited by 28-month-old girls, but not 28-month-old boys. In a follow up study it was found that 33-month-old boys do exhibit this knowledge. There is an interesting correlation here with size of a child's productive vocabulary. The 28-month-old girls tested had larger vocabularies than the boys of the same age; when boys 'catch up' in terms of vocabulary size, they also 'catch up' in terms of syntax-induced preferential looking. I will offer some

speculations below on the extent to which this lexicon—syntax connection should be viewed as more than just an accidental correlation. But first we should introduce one more study.

4. Study C

Because Study B reveals syntactic knowledge only after a certain vocabulary threshold is reached, it is worth revisiting the question posed at the end of Study A: did the 14-month olds exhibit knowledge of constituent structure (e.g. VPs)? A series of experiments conducted by Naigles and Koenig (see again Naigles 1996) suggest that a certain amount of caution is in order.

In what I am referring to as Study C, the experimenters tested 15 month olds by initially showing a scene involving two familiar puppets engaged in a novel action plus an additional novel puppet. At this (pretest) point in time, an audio message was also played. During the subsequent test phase, the initial scene was split (e.g. novel action to the left; novel puppet to the right) and an instruction such as 'Find kradden' given. Children exposed to the initial audio message (a) ('There's a doggie and a kitty and (a) kradden') later looked preferentially at the novel puppet during the test phase. So did children initially exposed to (b) ('There's kradden'). By contrast, those hearing (c) ('There's a doggie and a kitty. And there's kradden!') preferred the novel action.

These results tend to support the view that something other than (just) syntax prompts the behaviour of one year olds. Clearly the syntax of the 'kradden' audios underdetermines subsequent screen preferences - we cannot simply substitute real lexical items (e.g. *bend, touch)* as in Study B to make predictions based on adult grammatical competence. What then, apart from syntax, could trigger the 15 month olds' preferences? The experimenters suggest prosody plays a role. Certainly it is well known that one year olds can differentiate contrasting prosodic contours. However, to the extent that (a) - (c) differ prosodically, they do so in order to package information differently at a discourse level. Thus message (a) ('There's a doggie and a kitty and (a) kradden') treats each of *doggie*, *kitty* and *kradden* on a par - three distinct but equal pieces of new / noteworthy information are presented. These bits of information are packaged differently in message (c) ('There's a doggie and a kitty. And there's kradden!'). I tend to agree with the interpretation offered by the experimenters, viz, that (c) is more akin to a topic-comment structure. In (c), two entities (both familiar) are singled out; then something comment- worthy about them is added. This leads to a preference for the action screen, in contrast to (a) and (b).

5. Discussion

The following overall picture now emerges. Children at the one-word stage are capable of using discourse considerations to process longish utterances, a fact that is surely important for speedy vocabulary acquisition. Information packaging and prosody can direct the child's attention to that aspect of the world that is being talked about. It thus seems most parsimonious to apply this line of reasoning to the findings in Study A.

Take the audio message 'She is eating a banana'. Prosody and information packaging considerations converge on the focal nature of the final noun. End-position stress and focus is normal in English. Why, however, should one be asked to focus one's attention on the banana? Presumably because something significant occurs with respect to it - e.g. being eaten. This by itself will correctly predict a preference for the matching screen in Study A.

Naigles (1990) conducted a preferential looking study using auditory stimuli of the form 'X is pilking Y' *(pilk* of course being a pseudo-verb). Visual stimuli however were as for Study B. Children around the age of 25 months were found to thereby prefer the causative action during the test phase. Presumably, as above, focus on Y draws attention to the change of state

specific to Y. Thus a test-phase instruction such as 'Find pilking' is connected with a change of state interpretation (the 'causative' scene) and so the novel verb is acquired as a prototypical causative (hence transitive) verb. On the other hand, a pretest-phase audio along the lines of 'X and Y are puking' conveys focus on an action and is connected with the screen preferred in the absence of syntactic (transitive or intransitive) prompting — this happens to be the 'non- causative' (or 'synchronous') screen: (see Naigles & Kako (1993) for details). Under these conditions, a patientless, intransitive verb *(pilk)* is acquired.

Once lexical entries are acquired or constructed in all their richness, the principles of syntax (hitherto largely dormant) can become active, triggering phrasal and clausal representations. Here it seems appropriate to invoke syntactic notions like the Projection Principle (see Chomsky 1981:29 for an early formulation), according to which syntactic structure is projected, subject to certain constraints, from lexical properties. Working backwards from several sentential contexts to deduce a lexical property is what the girls (and the older boys) in Study B show evidence of. This so-called 'syntactic bootstrapping' is conditional, it would appear, upon sufficient knowledge of the kind of lexicon one is dealing with (i.e. projecting), knowledge that would naturally be correlated with vocabulary size. Earlier stages of acquisition (Studies A and C; Naigles 1990) have as their goal the building up, in a sense, of precisely the kind of lexicon one is dealing with. Discourse-based strategies, I suggest, are operative to this end.

The idea that children take a while to ascertain all the details of a lexical entry is hardly a new one. It is a recurring theme in the field of child language. (See, for instance, Clark 1973 for an early view on overextensions, and Clark 1993 for a series of principles of lexical acquisition.) Recent preferential looking studies of overextensions also invoke notions such as maturing or 'immature' lexical entries. Naigles & Gelman (1995) discuss how for many children studied, the entry for *cow* is less mature than that for *dog* or *cat.* In fact, adult non-standardisms involving such pairs as *militate / mitigate* are surely a continuation of the same sort of phenomenon.

Why should lexical entries require 'maturing' or refinement? To some extent, the richness of the entries entertained within present day theories provides a ready answer. The days of simple subcategorisation frames along the lines of Chomsky (1965) are long gone. Theories that address the mutually constraining effects of syntactic principles and lexical properties (e.g. Jackendoff 1991 or Levin & Rappaport Hovav 1995) make quite specific proposals about the detailed representation of the lexical specifics of verbs. To cite a quick example, Levin & Rappaport Hovav *(1995:24)* propose the following schematic structure for the verb *to pocket:*

(5) [x CAUSE [y BECOME P_{loc} POCKET]]

In their theory, intransitive uses of *to break* derive from the fuller lexical entry of transitive *break,* and so forth.

The foregoing is consonant with the view expressed by Chomsky (1993:50) in 'identifying general principles of language that can be attributed to initial endowment, with options of variation restricted to subparts of the lexicon.' Once enough of the lexicon is in place, syntax can simply 'kick in', and in fact can then aid further lexical acquisition. Lexical acquisition is the child's real challenge. In Chomsky (1993:61), Bilgrami puts it thus: 'the lexical aspects of language are to be thought of as bringing in an agent's *perspective* on things in the world.' The early stages of lexical acquisition are aided by information packaging-type clues telling the child what to focus on and what aspects of perspective play a crucial role.

As Pinker (1989, Chapter 2) reminds us when discussing such famous close but non-synonymous doublets as *loading hay into the cart / loading the cart with hay*, one crucial element in the acquisition of lexical entries of verbs is the identification of 'affected objects'. That one and two year olds concentrate on this problem of the affected object is the lesson I would like to draw from experiments such as Naigles (1990). Focus helps to set transitivity encoding at the level of the lexicon. Once a lexicon is sufficiently firm, syntactic knowledge can be tapped, and can even be seen aiding subsequent lexical learning. Experimental techniques thus play a non-trivial role in unravelling the mysteries of syntactic knowledge; furthermore, the role of the lexicon is in many ways central. It seems that one way to empirically test the line of reasoning I have pursued here is to employ the preferential looking paradigm to a splitting of a transitive scenario into what the Agent does on the one hand, and what happens to the Patient on the other. My prediction is that early on, *ceteris paribus*, the latter will be focused on.

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