

Word-to-World Mapping or Syntactic Cues? Lexical Development in First Language Acquisition

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Abstract

In the acquisition of words, the most complicated question that several studies have tried to efficiently answer is how children learn words, particularly how they attain words' meanings. It has always been hard to explain the rapid development of children's lexicons. The present paper discusses different accounts for lexical development starting from the time children begin segmenting words from fluent speech till the time they have to match concepts and words. It looks into different accounts for concept-word matching and highlights their pros and cons. The argument is that Word-to- World mapping is insufficient for identifying words that are abstract. Mapping contingencies are another problem; a child will not hear the word 'open' every time the door is opened. Constrained-word learning can help children identify some words in the prelexical stage before they have access to syntactic cues. By the time children get access to the syntactic cues, they can effortlessly identify concrete and abstract words without much help from cognitive abilities. Studies have shown that in spite of the cognitive level adults reach, they could not identify the meanings of novel words in the absence of syntactic cues. Identifying words is strongly influenced by syntactic cues; little help comes from semantics and cognitive development.

Keywords: constrained-word learning, mapping, statistical mechanism, syntactic/ semantic cues, cognitive development.

1. Introduction

Language learning involves a complicated perceptual task from the very beginning. During the first months of life, children get exposed to the sounds of the language and at the onset of language learning, the primary task is segmenting sounds from the flow of speech. Once

identification of sounds is accomplished, the focus of learning moves to the learning of words. Equipped with the sounds of the language, children will then face the startling complexity of identifying words. They need to match concepts with words in the language, but the problem lies in the fact that all do not neatly map to words. Also, concepts are not all alike, and what might work for some might not work for others. Only after storing recognizable words do children begin to observe the distribution and arrangement of these words in sentences. The question to be answered here is: how does learning of ordering of words take place?

2. Learning Mechanisms and Word Segmentation

For children to learn the language, they have to use different mechanisms. The most well-known mechanisms that account for language acquisition are Experience-dependant mechanism and Experience-independent mechanism. The Nativists, advocates of Experience-independent mechanism (e.g., Chomsky 1965, 1975, and 1986) argue that environment is not enough for children to acquire the infinite number of structures and children possess an innate ability that helps them acquire the language efficiently. The Nativists favors Experience- independent mechanism because it can account for the rapid growth in knowledge of structures in children. The Naturists, advocates of Experience-dependent mechanism,(e.g., Pullum and Scholz (2002)) , however, asserts the role positive evidence plays in language acquisition and how children extract information from the environment to help them acquire the language.

Emphasizing the role dependent-learning mechanism plays in words segmentation, Saffran, et al. (1996) argued that there is a statistical mechanism in place in the domain of language acquisition which can segment words in a speech stream by computing the transitional probabilities between adjacent syllables. In this study, syllables are presented one after another devoid of pause; some syllables are paired 100% while others are paired 33%. Words are defined as a sequence of syllables whose transitional probabilities are high. So syllables with transitional probabilities 1.0 are words, whereas, a sequence with one high and one low transitional probability (e.g. 1.0 and .33) is not a word. Learners can identify word boundaries using this little information from very little exposure to stimuli.

The process of segmentation is rather difficult taking into account that fluent speech is inconsistent when it comes to boundary cues such as pauses. Nevertheless, children can segment words from fluent speech and then could recognize them when presented in isolation. This argument asserts that experience-independent mechanism is powerful and it can account not only for word segmentation, but also for other aspects of the language.

The premise that this mechanism is subject to linguistic constraints has been further explored. Bonatti, et al. (2005) argued that functional difference between consonants and vowels in language has a bearing on the role they play in the lexical tasks. Vowels have a grammatical function (i.e., duration, pitch, and intensity, which are in different degrees responsible for prosody), whereas, consonants have a lexical function (quality which is manifested in place and manner of articulation). Since vowels have a grammatical function while consonants have a lexical function in a word segmentation task involving statistical computations, transitional probabilities would be calculated only on consonants and utilized to segment the speech stream. .

In natural speech, Statistical learning alone cannot help children segment words from speech, so children use other innate abilities besides statistical learning. This is also the same account offered by Chomsky in the Poverty of Stimulus which states that positive evidence cannot account for the infinite number of sentences that children are able to produce. This explains the dominance of Experience-independent approach over the experience- dependant one. Also, the transitional probabilities between monosyllabic words in natural speech will be confusing taking *the cat sat on the mat* as an example. Using Statistical information only, the child will not know exactly where to place a boundary since the number of options is high. One of the options will be *the cats at on them at*.

3. From Segmentation to Mapping

In the first six years of life, children acquire a large number of words and the question has always been how this astonishing feat is accomplished. It is a complicated process to look into the acquisition of words because of the diversity in meaning and classes these words have. As children grow up, they encounter new concepts and they need to figure out which word in the

language expresses a certain concept. The controversial point here is that what help the children figure out concepts and their words.

3.1. Word-to-World Mapping

The first solution takes word-to-world mapping to be an effective strategy. Gleitman, L. R., & Gleitman, H. (1992) argued that children map things to the things they represent. Children might hear someone saying the word *open* simultaneously with the door being open, in testing this, we could show children an object just to help them get the concept and repeat the word that stands for it. This mapping procedure works mostly with common concrete nouns because when it comes to what comes earlier, concrete nouns are acquired before verbs. Nouns can label objects, but verbs can't. Verb acquisition is based to some extent on relationship between entities. For example, to understand *hit*, one needs to understand the type of relationship between the hitter and the one being hit, the type of contact as well as the argument structure.

The imperfection of mapping verbs to their real world contexts arises because of mapping contingencies. Children won't hear the word *open* every time the door gets open. People mostly say greetings as they enter. Most of the times, objects and things are abstract. Pointing to the couch, telling a child to sit, will be confusing when there is a doll on it.

The other confusing issue is extracting the relevant word from the whole utterance. In a single utterance, there are words that the child does not know and there are other irrelevant accompanying scenes. In asking the child 'Do you want chocolate?' there would be facial expressions, some other moves and some abstract words like *want*. It might be argued that children discard the words they do not know, but how can we account for the incorrect pairing that children sometimes do. Again, in telling a child to sit down pointing to the couch and there is a doll on it, the child might go and pick the doll up.

In favor of word-to world-mapping, it can be argued that it can only work with the most frequent words, mental verbs and abstract words are acquired later. This argument, however, posits another problem especially with paired verbs. Children would find it difficult to figure out

the meaning of *get/give* in a context like ‘Marry gave the book to John’ where using *get* also ends up in John getting the book.

3.2. Constraints on Word Meanings in Early Language Acquisition

Children successfully manage to learn the words of their native language despite the fact that positive evidence is insufficient and their processing abilities are limited. One possible explanation for these striking abilities is that children put some constraints when building hypothesis regarding word meaning. They can use a noun to refer to the whole object, then they extend the concept to forms of the same kind and then they learn to identify one single label for every object. These constraints, however, are not sufficient to explain the whole process of a strikingly rapid word acquisition. Another possible explanation is that children, besides the above-mentioned constraints, do need to make use of some other syntactic and semantic information in the acquisition of words. In brief, the interaction of the syntactic/semantic information with the constraints is a valid explanation for the tremendous growth of children vocabulary?

The question is, how does this precisely happen? How can we account for this speed taking into consideration the number of meaning possibilities of a novel word? The argument provided here is dependent on age. Children who are old enough can use different tools to figure out the possible meaning candidate, discarding other possible meanings. Markman, E., (1990) argued that Children can use the syntactic word class to narrow down the number of meaning possibilities. They can take the novel word to be synonymous for other existing word and since they know the syntax and the meaning of the existing word, they can interpret the novel word accordingly. They can also make use of both positive and negative evidence to get the right inference. Young children have no access to the above-mentioned ways and hence, word-learning constraints would be critical for children who cannot make use of syntactic classes to limit the meaning possibilities. Children are predisposed to prefer certain hypotheses over others and this limits their hypotheses of possible word meaning.

Would it be possible to postulate that constrained forms of word learning alone are efficient to account for children's early word acquisition, not forgetting that children do not rely on syntactic classes and other cues at this certain age? If this claim comes to be true, then word learning is not as complex as it is always briefed. It seems hard to approve this because the nature of words falsify this claim and the diversity of classes words can have do assert that word learning is a complex process that calls for the interaction of many constraints and hypotheses.

This argument can be reformulated but also in favor of constrained forms of word learning. Since it is hard to exclude other sources of information, one could argue that in early stages, children rely heavily on constraints to figure out words possible meaning. To elaborate this more, we can take constrained word learning as a default assumption which is important for word learning. Children, before reaching the default stage, undergo another stage in which they accumulate words and use them but with no reference. It is called the *prelexical stage*. The next stage involves a developmental shift where children start labeling object. This labeling requires some constraints and that's when constrained form of word learning takes place as a default assumption to help children limit their hypotheses and end up with one label for every object. To sum up, we can argue that constrained forms of word learning can account for the strikingly rapid spurt of word acquisition in early age, right after the prelexical stage.

3.3. Structure-to-World Mapping and Cognitive Development

As we move ahead we need to point out why it is hard to label our concepts. In order to figure out the reason beyond this, we need to consider systematic asynchronies in aspects of vocabulary development. In other words, to understand why some particular types of words are learned earlier across languages, why nouns are over-represented and verbs are under-represented and why action verbs are dominant in children early vocabulary despite of the fact they get exposed to verbs like think and look more often.

The first explanation relates this systematic growth to cognitive issues. Using a word is related to the accessibility of the concept regardless of whether the word is frequent or not. Some concepts require a level of mentality development within the learner to decode them. The noun-

before- verb acquisition seems to support this explanation. Even though children get exposed to verbs and nouns from the early stages, nouns predominates children's vocabulary. This predominance can be accounted for by looking at the typical-object labeling functions of nouns and the relational functions of verbs.

The second explanation adds another level and relates word learning several stages in the development of the language where every stage has its own abilities and biases rather to conceptual development. In this explanation, word learning involves two levels. The first level is called word-to-world mapping procedure where learners label the objects they perceive. For example, for a child to know the word for the concept *cat*, he has to see the cat when the word *cat* is uttered. The second level is the sentence-to-world mapping procedure where vocabulary gets rich and diversified. This level involves a process called syntactic bootstrapping of the lexicon.

To test both explanations, an experimental analysis was conducted by (Snedeker, Brent, and Gleitman, 1999; Gillette, Gleitman, Gleitman and Lederer, 1999; and Snedeke, 2000). The first purpose of these experiments to test whether adults can identify words from partial information or in the absence of any cues assuming they are conceptually mature learners. The second was to infer from the results something regarding structure-to-word mapping procedure.

For the stimuli, Gillette et al. (1999) videotaped mothers while interacting with their 18-24 children in an unstructured way. The maternal speech included the 24 most frequent nouns and the 24 most frequent verbs. 6 video clips were selected in which the mother was uttering each of these words and each video clip started 30 seconds before the mother uttered the word and ended 10 seconds afterwards to give the observers the gist of the extralinguistic information that might help them in identifying the words.

The participants had to watch the clips with no audio but a beep was included to indicate the exact event when the mother uttered a mystery word and they had to jot down their guesses, of whether the uttered mystery word is a verb or a noun. Being limited to extralinguistic

information, the participants could identify 45% of nouns and only 15% of verbs. This clearly demonstrates that adults show noun dominance over verbs which is the case shown by children. The dramatic result is that every noun was identified at least by one participant but a third of the verbs were unidentified. In short, participants identified the words using word-to world-mapping, that's why they identified verbs very poorly.

To test whether this identification effect is because of mental development or it has to do with stages of abilities related to language development, the experiment was extended. The participants were 82 and the materials were taken from the same six video tapes but the focus this time was only on verbs because they were the most troublesome. The experiment involved several conditions. In the first condition, the participants were provided with videos accompanied by extralinguistic contexts but the videos were mute. In the second, participants were given a written list of nouns and pronouns that were uttered with the verbs. In the third condition, the participants were given a list of scrambled maternal sentences, and in the last condition; they were given the syntactic frames of the mystery words.

The major findings were that participants showed concreteness in their learning. When extralinguistic contexts were provided, learners showed noun dominance over verbs. But when they were provided with syntactic cues, they effortlessly identified the abstract and concrete verbs. This confirms the claim that the explosion of vocabulary does not have much to do with learners being wiser than with their being aware of semantically relevant syntax.

4. Syntactic/ Semantic Bootstrapping

Let's have a look at the semantic content of the verb and the structure of the sentence. The relationship is strong between them and there is no doubt that sentences are the linguistic device that carries the proposition. The various structures the sentence takes are the result of the different thoughts they express, the proposition that the verb 'laugh' expresses requires special structure which is different from the structures required to express the thoughts of the verb 'put' and 'smack'. In short, we can say that the selection of a certain structure is semantically determined.

However, this semantic/ syntactic linkage does not work all the times and it gets at its worst with disparate verbs that subcategorize for different arguments like substitute/ replace. Fisher, et el. (1991).

- 1- John substituted a horse for a cow.
- 2- John replaced a cow with a horse.

The argument we need to address here is that to what degree the semantic generalization accords with the syntactic structure. For example, the proposition putting requires someone who does the putting, something to be put and a place to be put on, these entities can be represented by the number of the arguments the verb put requires. This type of mapping is regular but does the child expect mapping to be this straightforward for all propositions?

It is obvious that mapping is not always regular since sentences subcategorize for different frames. The verb can express the same thought but appears in different syntactic frames, consider the following example: Fisher et el (1991)

- 3-Evelyn closed the door. (NP V NP)
- 4-The door closed (NP V)

In (3), there is an agent who does the closing, but in (4) the focus is more on the action of the door being closed. The first NPs in these sentences do not have the same theta role, the subject of (3) is agent and the subject (4) is patient. To sum up, the proposition of the verb seems not to rely on item-specific information of the lexical entries the verb categorizes for; the clause structure could have some semantic content. For example, the syntactic frames of the verb ‘give’ helps the child infer that this verb involves transfer, and he would associate mental transfer to the verb ‘tell’. To conclude, the structural/semantic linkages can determine certain aspects of the verbs but the idea of identical relationship is hard to prove.

As discussed above, there are several constraints on what can be lexicalized as a verb, that’s why it is said a picture is worth a thousand words. These thousand words are the problem of language acquisition. Identifying a verb requires a prior knowledge of the arguments, the

relationship between the arguments. Besides, the surface structure of the sentence has some correlations with other aspects of semantics. In short, encoding verbs requires a sophisticated perceptual, conceptual and pragmatic knowledge.

To test the role syntax plays in cluing verb meaning, Fisher et al (1994) conducted an experiment pairing both the linguistic input and the extralinguistic input. Structured sentence representation is provided to test whether prior knowledge of the arguments of the sentence can help facilitate verb learning. The experiment used paired verbs; like chase and flee, give and receive. If the learner could identify the novel verb within a syntactic structure and requires an interpretation that fits both scenes and structure, there would be a solution for the mapping of the following paired verbs. Fisher et al (1994)

5-Look, biffing!

6-The rabbit is biffing the ball to the elephant.

7-The elephant is biffing the ball from the rabbit.

Having no syntactic framework, the listener who is watching the scene in (5) will interpret it as related to the meaning of *give*. Listening to sentence number (6) will confirm his choice, but looking into sentence (7), the listener would rather go for ‘receive’ than ‘give’. The clues that are available in the second and the third examples are the prepositions (to, from) and also the position of the arguments (elephant, rabbit) in the structure.

The participants were three and four-year-old children (mean age 3; 8). They were taught to describe actions using nonsense novel verbs. The scenes involved a single event but with two interpretations. To know the predictions, children were asked about what they thought the words meant. The method involved video-taped scenes, a sentence that contains a nonsense word is uttered and the participants have to interpret what it means. Puppets actors were used to perform the actions in the scene.

The results show that observing a scene is insufficient for fixing the meaning of the novel verbs. The choice of verbs was powerfully influenced by the syntactic structure of the sentence.

This does not mean that semantics is not of much help. The semantics clues that reside in syntax help figuring out the meaning of verbs. The semantic of arguments help much in parsing meaning. The subject of transitives is agent which helps differentiating chase from flee. Knowing that a verb expresses mental acts would make the learners think of sentential complement. In short, the surface syntactic structure of the verb requires understanding its semantic meaning.

5. Conclusion

Children in the first months learn the sounds of the language. After that, they succeed in segmenting words from speech. Learning the sounds and segmenting the words is not the result of learning experience. Rather it is a result of some other innate abilities because experience-dependant mechanism cannot account for the rapid development in children' vocabulary. In other words, it cannot solve Plato's problem which is how come children know more about the language than what they have learned from experience.

The problem gets more complicated when children are in the stage of learning concepts and their words. Word-world mapping can help the children identify common concrete words but it never works with abstract words. Other mapping contingencies might also distract children. To minimize these contingencies children place some constraint to reduce the number of possible hypotheses.

Of all the cues, it is argued that syntactic cues are the most powerful in identifying words. If children are aware of the syntactic cues, they can easily identify both concrete and abstract words. Semantic cues are of much help especially when the syntactic /semantic correlation is regular. Regarding cognitive development, it is argued it does not make much different because in the absent of syntactic cues even adults cannot identify novel words.

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