Word Learning
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Word learning is a controversial area, but there are two facts that everyone agrees about. The first is that words really do have to be *learned*. Regardless of how much of conceptual structure and linguistic knowledge is innate, the specific links between sounds (or signs) and meanings must be determined on the basis of experience. No matter how intelligent a British baby is, for instance, she has to learn that dogs are called 'dogs', that sleeping is called 'sleeping', and so on.

The second agreed-upon fact is that children are strikingly good at this sort of learning. Children utter their first words by 12 months of age, are relatively proficient at word learning by 16–18 months, and eventually come to learn new words at a rate of well over ten new words per day.

Children's first words include personal pronouns (*me*), proper names (*Mommy*), prepositions (*on*), adjectives (*big*), verbs (*want*), and many classes of nouns, including those referring to whole objects (*dog*), substances (*water*), parts (*finger*), habitual activities (*nap*), and abstract notions (*story*). While children sometimes get confused about the precise meaning of word, serious mistakes almost never occur. This successful word learning occurs even in conditions in which children are not taught words in any non-trivial sense, such as when children are abused and neglected.

Minimal cues

Given how many words children come to know (about 10,000 words by age 6), one would expect them to be able to learn words in very minimal circumstances. This expectation is born out by several studies. For instance, children and adults were exposed to a new word in the context of a measuring game with six novel objects. The word was introduced in passing — 'Let's use the koba to measure which is longer… We can put the koba away now'. Children weren't asked to repeat the new word and weren't tested to ensure that they heard it. They were tested a full month later, by bringing out the same objects and asking them to 'Show me the koba'. Even 3-year-olds choose the correct object over half of the time, far better than chance. Furthermore, there were no age differences — 3-year-olds did just as well as adults. Further studies have found similar abilities even in 2-year-olds.

The problem of word learning

What precisely is so impressive about this ability? There is good reason to believe that it *is* impressive since, as far as we know, no species others than humans can learn words and certainly no computer has ever been construed that can do so. The problem of word learning is surprisingly deep, and the reason for this was most famously demonstrated by the philosopher W.V.O. Quine, who gave the example of a linguist witnessing a rabbit scurry by, and hearing a native say 'Gavagai'. It turns out that there is an infinity of logically possible meanings for this new word *gavagai*. It could refer to rabbits, but it could also refer to the specific rabbit named by the native, or to any mammal, or any animal, or any object. It could refer to the top half of the rabbit, or its outer surface, or to rabbits but only those that are scurrying; it could refer to scurrying itself, or to white, or to furriness. The linguist could exclude some of these interpretations through further questioning and further experience with the word, but some interpretations are harder to exclude. How could the linguist know that the native isn't using the word *gavagai* to refer, not to rabbits, but to time-slices of rabbits — to entities that only exist for the instant that the word is used? Or that the native isn't talking about, as Quine puts it, 'all and sundry undetached parts of rabbits'? Indeed, how could the linguist know that *gavagai* is a name at all, as opposed to the native clearing his throat, or making a noise to warn the animal away, or saying the equivalent of 'Look!' or 'I'm bored!'.

Quine used this example to defend a skeptical position about language — that there really is no such thing as the meaning of a word. But contemporary scholars in word learning have used it to support a different moral: Since children *do* solve these problems of reference and generalization, this suggests that they are somehow constrained or biased to favor some interpretations over others. For instance, in the *gavagai* situation, children, as well as adults, will tend to take the word as naming the entire object. They are not limited to an object interpretation, however. In other situations they can entertain non-object interpretations of a new word, which is a capacity necessary in order to learn adjectives (such as '*white*'), verbs (such as '*jumping*'), and so on.

How is the problem solved?

There are several cognitive systems that work together to make word learning possible. Some of these involve memory–word learning and require the capacity to encode, store, and access arbitrary mappings; in this case, between sounds (or signs) and meanings. There are also conceptual capacities. In order to learn words for kinds of objects, properties, and actions, say, the child has to have some non-linguistic understanding of what such words mean. One reason why children will never assume that *gavagai* means time-slices of rabbit is because these are

not natural hypotheses for a word learner to entertain — while categories like *rabbit* and *animal* are.

A further system involves children's appreciation of the mental states of other people, what is sometimes called 'naïve psychology' or 'theory of mind'. There is abundant evidence that children will take a word as referring to a given object if and only if there is evidence that the speaker intended to refer to that object. If an 18-month-old hears a novel label as she is playing with a novel toy, she will only assume that the word is a name for the toy if the label is spoken by someone who is also attending to the toy. If she just hears a disembodied voice naming the object as she is looking at it (e.g. 'A dawnoo! There's a dawnoo!'), the word is not mapped onto that object.)

Another study tested babies in a context in which they were given one object to play with while another object was put into a bucket that was in front of the experimenter. When the baby was looking at the object in front of her, the experimenter looked at the object in the bucket and said a new word, such as 'It's a modi!'. 18-month-olds looked at the experimenter and redirected their attention to what she was looking at, in this case, at the object in the bucket. And when later shown the two objects and asked to 'find the modi', children assume that the word refers to the object the experimenter was looking at when she said the word — not the object that the child herself was looking at.

More sophisticated intentional capacities are displayed by 24-months olds. In one study, an adult announced her intention to find an object — 'Let's find the toma!' — and then picked up and nonverbally rejected (by frowning) two other objects before picking up a third object and smiling. Despite the temporal gap, children inferred that this third object was what

'toma' referred to. In another study, an adult used a novel verb to declare her intention to perform an action (e.g. 'I am going to blork!'), proceeded to do an action 'accidentally' (saying 'Whoops!) and then performed another action, with satisfaction (saying 'There!' with a pleased expression). Children connected the verb with the action the speaker seemed satisfied with, not the accidental one. Such studies indicate that young children infer the intention of the speaker (through attention to cues that include line-of-regard and emotional indications of satisfaction) when determining the referent of a new word, for both nouns and verbs.

Finally, even young children attend to the syntax of a word when determining what the word means. The classic study showing this was done by Roger Brown, who showed preschoolers a picture of a strange action being performed on a novel substance using an unfamiliar object. One group of children was told 'Do you know what a sib is? In this picture, you can see a sib' (count noun syntax), a second group was told 'Have you seen any sib? In this picture, you can see sib' (mass noun syntax), and a third group was told 'Have you seen sibbing? In this picture, you can see sibbing' (verb syntax). The preschoolers tended to construe the count noun as referring to the object, the mass noun as referring to the substance, and the verb as referring to the action. Subsequent research has found that syntactic cues can help children to learn words belonging to a range of different ontological categories, and might play an especially important role in how they learn the meanings of abstract verbs such as 'thinking' and 'receiving'.

Research to date suggests that children learn words through a set of diverse capacities, including memory, an appreciation of the categories and individuals that make up the external world, an

understanding of the beliefs and intentions of other people, and a sensitivity to syntax. An act as seemingly simple as a 2-year-old learning the word *rabbit* draws upon many of the capacities that are central to the human mind.

Suggestions for further reading
1. Baldwin DA, Moses LM: **Early understanding of referential intent and attentional focus: Evidence from language and emotion.** In *Children's Early Understanding Of Mind: Origins and Development.* Edited by Lewis C, Mitchell P. Hillsdale, NJ: Erlbaum. 1994: 133-156.
2. Bloom P: *How Children Learn the Meanings of Words.* Cambridge, MA: MIT Press; 2000.
3. Gleitman LR: **The structural sources of word meaning.** *Lang Acquisition* 1990, 1:3-55.
4. Markman EM: **Constraints children place on word meanings.** *Cognitive Sci* 1990, 14:57-77.
5. Markson L, Bloom P: **Evidence against a dedicated system for word learning in children.** *Nature* 1997, 385:813-815.

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