ASL, however, likely takes a young child at least several years to master.

Finally, the movement parameter of signs typically is initially produced by young children with intermediate accuracy. Some sign movements, such as making contact with one's body or moving one's hand back and forth, are produced accurately by very young signers. Other movements, or combinations of movements, may require many months or several years to master. In general, the number and complexity of sign movements increase considerably with age and growth in vocabulary size.

Because young children often require many months or years before they learn to form various words or signs accurately, their caregivers early on will often accept incorrect pronunciations and respond to them fully. In some instances, the children's sign or word productions will be identical formationally for concepts that would clearly be expressed differently in adult utterances. This is known as child homonymy. The phenomenon of child homonymy occurs when a young child uses a single phonetic form for two (or more) linguistic targets for which adults would use phonetically distinct forms. This phenomenon has long been recognized as being present in children learning to speak, although it is not clear whether it occurs because the child is not yet able to produce certain adult sounds or does not yet perceive them. More recently, child homonymy has been shown to occur in sign-learning children as well. That is, young sign-learning children also produce homonymous forms (a single manual form is used by a child to represent two or more adult target signs). Moreover, the incidence of homonymy in sign-learning children does not differ significantly from that reported for typically developing children learning to speak. The young sign-learning children's highest incidence of sign homonymy, however, often takes place several months before the comparable peak incidence in the children learning to speak.

Conclusion

Acquisition of a sign language by children of deaf parents parallels in many ways the development of spoken language in hearing children. There is, however, some evidence that children learning to sign often attain certain early language milestones at somewhat younger ages than many of their speech-learning counterparts. Overall, the many similarities in language development across modalities suggest that the human capacity for language largely transcends its modality of expression.

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See Also: Age of Acquisition Effects; Baby Sign Systems; Child-Directed Speech (Features of); Home Sign; Language Development in Deaf Children; Milestones in Language Development; Phonological Development.

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Slow Mapping in Lexical Development

There is growing evidence that children often require considerable input and repetition to fully acquire a word—a phenomenon called *slow mapping* to contrast it with *fast mapping*. Fast mapping (also called quick incidental learning) has received considerable attention as a word-learning phenomenon. Fast mapping is defined as inferring a correct or near-correct word

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meaning from one or a few exposures to the word. It is considered noteworthy because inferring word meanings is theoretically a difficult, under-constrained inductive task. S. Carey and E. Bartlett first reported that young children mapped a new color word onto a novel color after hearing it just twice. Since then, dozens of studies have documented fast mapping in children age 2 and older in a handful of languages and in populations of children with developmental disabilities or risk factors. Most studies have examined fast mapping of object nouns, but a few have tested verbs and adjectives.

How Hard Is the Problem of Induction?

Several philosophers (Ludwig Wittgenstein, Nelson Goodman, and Willard Van Orman Quine) pointed out that a symbol could have infinite possible meanings, so learners might never converge upon a shared meaning. This makes fast mapping seem implausible, so some psychologists have assumed that it must reflect some robust a priori word-learning capacity. Other researchers, however, have noted that many nonspecific cognitive phenotypes (e.g., perceptual salience, generalization, forgetting, and active attention) strongly constrain what people talk about or assume others are talking about. Thus, the actual difficulty of word learning is unknown but is certainly not as intractable as sometimes portrayed by philosophers. Also, this difficulty is often greatly reduced in experimental studies, so fast mapping, when it occurs, might not be such a profound inductive feat. In fact, the historic Carey and Bartlett study did not actually show especially fast word learning: Children guessed the intended referent equally well whether or not a novel word was used, presumably by choosing the more distinctive referent.

Rate of Word Learning

It is often assumed that the speed of children's word learning is reflected in their overall rates of vocabulary growth. Although estimates vary somewhat, the most convincing study, by Jeremy Anglin, suggests that children from first through third grades gain facility over about 4,500 words a year. Often, such statistics are translated into units of average words learned per day, presumably for the purpose of convincing the audience of children's astounding word-learning ability. Yet, the practice is misleading: There is no study of how many words, on average, children learn per day. The closest data come from studies of second-language learners' acquisition of words from a text passage after a single study session. Such studies often show that only a small proportion of novel words (less than 10 percent) are remembered. Thus, word learning by older children appears laborious and often unsuccessful. More generally, however, vocabulary growth statistics tell us nothing about the rate of learning any single word. Cross-sectional studies might reveal that vocabulary grows by 1,000 to 2,000 words a year, but it is possible that most or all of the words were learned slowly, in parallel, over many repetitions. Vocabulary growth statistics are uninformative about either the rate of learning any single word or about how much input preceded learning.

If data on vocabulary growth trends are in fact tangential to, or even misleading about, questions of word learning rate, other data might prove more informative. Specifically, starting with the parsimonious assumption that word learning proceeds much like other kinds of learning, a host of studies of animal and human learning suggest that the rate of learning all sorts of associations (including, perhaps, between words and referents) shows a predictable distribution, which approximates a normal curve. That is, a few items will be learned very fast, a few items will be learned very slowly, and most items will be learned over an intermediate number of exposures or repetitions. The question then becomes this: Does children's word learning deviate from this expected distribution? Do children learn relatively many words from very few exposures, yielding a skewed distribution of learning times? Unfortunately, there is no direct evidence for the question because few studies have tracked growth curves for word meanings over successive presentations. However, a recent study by G. O. Deák and A J. Toney tested preschoolers' comprehension after each of four unambiguous presentations of novel words for objects. Children's accuracy after one or two exposures was modest (about 45 percent correct; chance = 25 percent), rising to about 60 percent after three or four exposures. This suggests that fast mapping is not unusual, nor is it inevitable. But how common is it, in general? Is it robust enough to disconfirm the prediction that word learning follows normally distributed learning rates?

The Prevalence of Fast Mapping

Subsequent studies show a great deal of variability in children's word learning over a small number of exposures. In a handful of studies of older infants and toddlers, fast mapping appears variable and fragile. One study attempted to teach infants a single noun and

verb. After more than 20 repetitions, learning was evident in fewer than one-third of 9- to 11-month-olds, half of 12- to 14-month-olds, and three-fourths of 15- to 17-month-olds. Using very different methods (preferential looking), another study showed that 15-month-olds looked at a named object slightly more than another object after hearing the first object named three times. Results such as these suggest that 1-year-old infants can form perceptual biases to associate a visual stimulus with a distinctive word pattern after a few pairings, but across contexts the necessary number of pairings seems to differ widely. Also, in these studies, it is unclear whether infants or toddlers learn anything beyond a weak, low-level, visual–auditory association.

Studies of older children also reveal highly variable fast-mapping outcomes. For example, in one study, 4½-year-olds correctly identified referents of five novel words with about 33 percent accuracy after 13 presentations. Other studies show better performance (about 60 to 80 percent accuracy) after two to four presentations of a novel word. Thus, fast mapping clearly occurs, but its likelihood seems to depend greatly upon the details of the methods used.

Across these variable results, is it possible to infer whether fast mapping of words is more common than expected in a normal distribution of learning rates? A handful of studies directly compared children's fast mapping of words to other kinds of information: facts, gestures, pictograms, and so on. No study reported faster learning of words. One study found slower learning of words than facts or pictograms by 3- to 5-year-olds. Thus, fast mapping is not more likely for words.

What Is Mapped, and How Well?

It is likely that, even when children seem to learn some sense of a new word, they have incomplete understanding of its meaning. For example, children—especially young children—might require considerable input to induce the semantic relations of new words and other related words. It is assumed that children comprehend more words than they can produce, but it is also the case that children will produce words despite minimal or incorrect understanding. This might be true especially of words with abstract meanings. Such words include function words, mental-state verbs, and abstract nouns. For example, with regard to function words (e.g., articles), children may produce the word in frozen phases such as *dats-a* (that's a) without isolating the article. There is also much evidence that children use mental verbs such as *know*, *meant to* (i.e., intend), and *guess* despite serious gaps in their understanding of the concepts (as adults understand them). Finally, children sometimes use superordinate labels, number words, and quantifiers (e.g., *all gone*) before they understand the implied set-relational semantics. In many cases, it is unclear how long children will use these sorts of words before they fill in the critical aspects of meaning.

These gaps in word comprehension show that any assessment of the speed of mapping—fast or slow—is relative to the kinds of measures used. Learning is a complex, multivariate construct, but in most studies, learning has been estimated using an insensitive, minimally informative measure: Children are shown two or more objects, including the learned referent. The other referent is usually a distinctly different novel object or perhaps a familiar object. In some studies, children could answer correctly by picking whatever object the experimenter recently pointed out or talked about. Children need not choose an object based on any specific features, or subtle distinction, or specific association with a word or phonological pattern. An exacerbating problem is that, in many studies, children chose among only two or three objects. Choosing the right object by chance is quite likely. Moreover, because the objects and the word are so distinctive, children could choose correctly if they learned only the weakest association between any distinctive feature of the referent and any feature of the name. In short, most fast-mapping studies use extraordinarily loose criteria for learning. In several studies, however, children were taught several words for several referents and then had to pick out which referent was paired with each word. This is a better design, especially if additional experimental controls are used. However, such studies tend to report less robust fast mapping.

Very few studies have tested whether children retain functional knowledge of fast-mapped words. Even if children can pick out the referent immediately after learning the word, if that association is not retained, it is unclear how important fast mapping is for language learning. Two studies reported that 3- to 5-year-old children were above chance in recognizing fast-mapped objects after a delay of one to four weeks. However, another study reported that 24-month-olds forgot novel words after several minutes. Thus, fast-mapped representations might be quite fragile, especially in toddlers.

Another criterion for functional knowledge is the ability to use a word productively. The few

fast-mapping studies that tested children's production report very low performance, even for distinctive, easy-to-pronounce words. In sum, fast-mapped words seem to be fragile and of limited utility.

Some criteria for functionality remain virtually untested in studies of fast mapping. There is almost no evidence that children generalize fast-mapped words across wordforms (e.g., inflected forms), different referents, or different contexts (e.g., different speakers or locations). Critically, there is no evidence of fast mapping in naturalistic settings. In several studies, adults have taught infants or preschoolers words using controlled protocols but within relatively natural contexts (e.g., homes). These studies showed relatively slow learning. One study, for example, used a play-like interaction to teach children four novel words and the relations among them. Four- and 5-year-olds learned few words, even after more than 20 exposures and multiple reminders of the defining referent features. Also, the children made many errors about the semantic relationships between words, suggesting that they often learned incorrect associations even when there was sufficient information to learn the correct relations. Children age 6 to 7 did considerably better (about 75 percent accuracy), showing that the task was not intractable. The results suggest that, in more naturally rich and complex learning contexts, young children learn words more slowly than is suggested by the results of experimental studies using maximally simplified, stripped-down teaching and testing paradigms and low-threshold criteria for learning.

Who Is Fast?

Educators, researchers, and laypeople often imply that preschool-aged children are precocious language learners, acquiring new words like sponges. Astonishingly, there are virtually no comparisons of word-learning speed of preschool children and older children or adults. However, the aforementioned study shows that 6- to 7-year-olds are faster and more accurate word learners than 4- to 5-year-olds. Also, an adult control group in Deák and Toney's study greatly outperformed 3- to 5-year-olds in learning and remembering four novel words. Thus, what little evidence there is suggests that preschool children are slower word learners than older children and adults.

Conclusion

In optimal conditions, children as young as 2 years occasionally fast map novel words. However, even under optimal conditions, fast mapping is far from inevitable. There are several studies showing that, in slightly more challenging or ambiguous tasks, children learn most words much more slowly, with many errors and imperfect representations of meaning.

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See Also: Associative Processes; Cross-Situational Word Learning; Fast Mapping in Lexical Development; Lexical Development; Semantic Development; Symbol Formation; Vocabulary Growth; Word-Learning Strategies.

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Social Conventions, Learning of

Humans are an inherently cultural species. From the very first days of life, children are enveloped by norms, activities, objects, and symbols that are often unique