# *Fast mapping in lexical development*

Fast Mapping in Lexical Development

The first time children encounter a new word, they form a 'rough-and-ready' hypothesis about its meaning on the basis of the linguistic and non-linguistic context in which the word is heard, a process known as *fast mapping*. Fast mapping is made possible by the child's possession of a set of word learning *biases* or *assumptions*, which serve to limit the set of hypotheses the child will consider about a new word's meaning. Fast mapping is particularly facilitated by the child's bias to avoid overlap between the meanings of words. Words are assumed to be mutually exclusive in their reference, such that each word's meaning contrasts with all others. Thus, on hearing an unfamiliar word, the child is immediately able to rule out all potential meanings for which she already has a label in her lexicon and *fast map* the word to a referent for which she has no lexical entry.

The term *fast mapping* was coined in the 1970s by Susan Carey and Elsa Bartlett, who demonstrated that 3- and 4-year-old children could learn the meaning of an unfamiliar word at their first encounter with it. Children were asked to bring their nursery teacher "the chromium tray, not the blue one, the chromium one". Drawing on their assumption that words contrast in meaning, children selected an unfamiliar olive-green tray over the alternative blue one; more than half of the children pointed to the correct colour among an array of nine coloured strips one week later, showing that they had retained the meaning of the word 'chromium'. Using a similar procedure, Tracey Heibeck and Ellen Markman showed that young children fast map words to shapes and textures as well as to colours, and that toddlers as young as 2 years of age rapidly acquire basic representations of words in the same way as older preschoolers. This work also showed that learning was equally robust whether a new label was introduced in an explicit contrast with a known word ("the chartreuse one, not the red one") or in an implicit contrast ("the chartreuse one, not the other one"), suggesting that children rely on the non-linguistic context as much as the linguistic context to draw inferences about a new word's meaning.

Since this early work, numerous experimental studies have confirmed that young children are immediately able to identify the referent of a new label by contrasting it with existing lexical entries. This work has largely focused on fast mapping of object names; studies typically present children with one unfamiliar object alongside one or more familiar objects and ask for the unfamiliar object by means of a novel label ("May I have the lep?"). Following this procedure, Carolyn Mervis and Jacqueline Bertrand demonstrated the significance of fast-mapping skills for children's lexical development between 16 and 24 months; they identified a close temporal relationship between a child's success at selecting a novel object in response to a novel label and the onset of a spurt in the child's vocabulary growth. *Preferential looking* studies have since been able to pinpoint the age of emergence of fast mapping ability more precisely. For example, Justin Halberda found that, at 17 months, but not before, infants looked longer at a picture of a novel object than at a picture of a name-known object when they were asked to "Look at the dax!"

How a label that has been successfully linked to the target referent in a fast mapping context becomes a known word in the child's lexicon is less well understood. Recent work distinguishes

the processes involved in forming initial word-referent mappings (*referent selection*) from those involved in establishing permanent entries in the lexicon (*novel word retention*). Jessica Horst and Larissa Samuelson found that, although 24-month-old children systematically selected an unfamiliar object from an array of familiar objects in response to a novel label, children were very poor at retaining the novel words introduced on these fast-mapping trials. Retention was boosted only when the experimenter held up and labelled the novel object following the child's selection. Horst and Samuelson suggest that, while the presence of familiar objects supports the child's initial selection of the unfamiliar target in response to a novel label, competition between the known and unknown objects subsequently hinders learning of the new word. Manipulation of the target's salience through ostensive labelling supports the child in inhibiting the competing influence of distracter items, facilitating retention of the new label.

Further work has explored the content of the lexical representation constructed at a word's initial exposure and how this develops over time. Success at fast mapping tasks requires only a sparse representation of a word's meaning (that 'chromium' does not mean 'blue', or that 'dax' does not mean 'car', e.g.) and the preliminary representations that are established in this way are therefore likely to include only partial information about the word. Research has shown that, after a single encounter, children may have an awareness of the domain to which a word belongs, shown by their offering of appropriate contrasts between the new word and existing items in their vocabulary (e.g. answering "soft", if prompted, "It's not fibrous because it's …"). However, a more detailed, adult-like understanding of the word is likely to be acquired through an *extended* or *slow mapping* process, involving multiple further encounters with the word in context. This is particularly the case for non-nominal word classes, although children may also require multiple encounters with the names of basic-level categories to gain a full appreciation of their semantic properties. Similarly, while one or two repetitions of a word may support the construction of a sufficiently accurate phonological representation for a child to be able to produce an approximation to the word form, many more exposures may be required for a child to show full mastery of a word's phonological detail.

It is worth noting that, although the term *fast mapping* was initially formulated to denote the child's ability to rapidly infer the reference of a new label in contexts that provide no explicit indication of its meaning, researchers often use the term more loosely to refer to word learning in ostensive as well as non-ostensive contexts, and to both *one-shot learning* and the learning that results from multiple exposures to word-referent pairings. This work has shown that, when the context presents little ambiguity about the pairings to be learned, toddlers as young as 14 or 15 months of age can acquire these on the basis of just a few simultaneous presentations of labels and their referents. Much work has investigated the nature of the mechanisms that support such rapid learning. For example, Lori Markson and Paul Bloom compared preschoolers' learning of associations between an object and a label ("koba") or an arbitrary fact (e.g. "my uncle gave this to me"). The equivalence of children's learning of names and facts in this study suggests that fast mapping may be a domain-general, rather than language-specific, learning mechanism.

The proposal that fast mapping depends on general cognitive processes is supported by reports of similar abilities in non-human species. Juliane Kaminski and her colleagues reported the case of Rico, a border collie with a vocabulary of around 200 words; under controlled conditions, Rico was able to fetch a named object with a 92% success rate. When Rico was asked to fetch an unfamiliar item amongst a set of familiar objects by means of a novel label, he demonstrated *exclusion learning* by selecting the unfamiliar object as the referent of the new word, and he remembered some of the new labels for several weeks. Rico's demonstration of fast mapping appears very similar to that displayed by young children, from its basis in an assumption of mutual exclusivity between words to the duration of the lexical entries acquired through this process.

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See Also:
Domain specificity in language development; Early word learning; Head-turn preference/ Preferential looking paradigm; Language learning in dogs; Lexical development; Slow mapping in lexical development; Vocabulary growth; Vocabulary spurt; Word learning strategies; Word learning: Constraints; Word-to-world mapping.

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