

Fast mapping

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In a classic study by Carey and Bartlett (1978), preschool children were presented with two trays and prompted to: “Bring me the chromium tray, not the blue one. The chromium one.” One week later, a new task context was used to test what children thought ‘chromium’ refers to (e.g., “Show me the chromium one”). Results show that 3- and 4-year-olds were able to learn the meaning of ‘chromium’ even after a single exposure. This phenomenon was termed ‘fast mapping’. It captures the mental process of narrowing down the meaning of a word during a casual experience. In the current essay, we briefly summarize the research on this phenomenon and offer a perspective on its impact within the field of cognitive development.

The central aspect of the classic fast mapping experiment was to present children with a contrast: The two trays were identical in shape and size, and they differed merely in color. Thus, the meaning of ‘chromium’ was highly constrained, both in the availability of objects (there were only two trays to choose from) and in the specific contrast that was made (“bring me the chromium one, not the blue one”). At the same time, the learning is nevertheless remarkable. The new word was uttered in a context that is not primarily about word learning, and children were able to remember it for at least a week. Even 2-year-olds were found capable of such fast mapping.

Subsequent research sought to further specify the context in which children engage in fast mapping. For example, is fast mapping restricted to color terms, or can it be expanded to other content as well? And does the contrast have to include an explicit alternative (e.g., the mention of an alternative color), or is a generic comparison sufficient? Findings show that fast mapping is by no means restricted to color. However, it matters whether children know many or few words within a domain. For example, the fast mapping effect is more pronounced with color terms than with texture terms, likely because children know far more color terms than texture terms. Similarly, the salience of the feature matters as well: The fast mapping effect is more pronounced with shape terms than color terms, likely because shapes are more salient in a language-learning context than color. At the same time, an explicit contrast is not needed. Fast mapping was found even when children heard: “Bring me the chromium one, not the other one.”

What are the processes that underlie fast mapping? One possibility is that children engage in some sort of hypothesis testing, analogous to what a scientist might do when faced with uncertainty. According to this argument, children think: “Because the new word is juxtaposed with ‘blue’, it has to be a color”. The problem is that such hypothesis testing requires an advanced cognitive machinery to track the various possibilities of word meaning. It is therefore doubtful that young children would employ such cognitive machinery without being prompted explicitly. And even if they would be capable of such a feat, a hypothesis-testing account could not address the question of how children can remember the newly-learned word days after it was uttered.

Another suggestion is that fast mapping relies on innate assumptions about how language is used. A prominent proposal is the presence of the ‘mutual exclusivity’ assumption, the knowledge that each word refers to something unique. According to this proposal, children who hear a novel word assume that it has to refer to something unique. For example, children might know that ‘chromium’ refers to something other than ‘tray’ or ‘blue’, given that the latter words are already known. This allows children to narrow down the options of what the new word could refer to without explicit hypothesis testing. Another proposal is that children follow the ‘principle of contrast’, the knowledge that contrasting words are from the same domain. For example, the contrast between ‘chromium tray’ and ‘blue one’ might trigger the inference that ‘chromium’ is a color.

Yet another possibility incorporates ideas from complexity. In complex systems, behavior emerges as a result of an alignment of factors, not as the result of a linear chain of events. The requirement for emergence is an interconnected network of elements, namely to trap and recycle activation (rather than merely letting it pass through). The weather is such a network: When there is an alignment of humidity, air pressure, landscape, temperature gradient, and so on, energy can get trapped in tornados, hurricanes, cyclones, etc. A child’s prior experience is likely to be organized in such complex networks. When a new experience aligns with this existing network, it falls into place, giving rise to phenomena such as aha-moments, insights, or ultra-fast cognition. Under this perspective fast mapping is merely another example of emergence.

More generally, fast mapping shows the impressive ability of children to learn. It helps explain the steep learning curve during language acquisition. And it gives credence to the claim

of implicit learning: the process by which information is remembered spontaneously, even when there is no specific requirement to learn. Crucially, findings on fast mapping illustrate the importance of background knowledge during learning. This speaks for the crucial relevance of continuous enrichment to avoid learning difficulties. Perhaps if children have enough background knowledge, even difficult academic materials could be acquired spontaneously.

Further Readings:

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