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Preschoolers fast map and retain artifact functions as efficiently as artifact names, but artifact actions are the most easily learned

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ABSTRACT

To become skilled artifact users, children must learn the actions and functions associated with artifacts. We investigated preschoolers' ability to fast map an action, function and name associated with a novel artifact, and retain the new mapping long term following brief incidental exposure to the artifact being used. In Experiment 1, 3- and 5-year-olds ($N = 144$) were tested 1 week after two exposures to a novel action, function, and name. Participants performed well on comprehension tests of all three kinds of information. In Experiment 2, 3-year-olds ($N = 100$) were exposed to these three kinds of information only once. Retention of the action–artifact link was above chance levels, whereas retention of function and the name was not. Finally, in Experiment 3, 4-year-olds ($N = 128$) performed well on an action production task *1 week* after brief exposure. In contrast, their performance on a name production task *immediately* after exposure was poor. Our data suggest that preschoolers can retain function information about a novel artifact from minimal exposure, similar to their ability to learn an artifact name. Crucially, their ability to remember action–artifact mappings is markedly better than their ability to remember functions and names.

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Introduction

Following Carey and Bartlett's (1978) introduction of the concept of "fast mapping" and Markson and Bloom's (1997) demonstration of the long-term retention of fast-mapped object names and facts, there has been renewed interest in what kinds of information are learned from limited exposure (e.g., Casler, 2014; Deák & Toney, 2013; Holland, Simpson, & Riggs, 2015; Horst & Samuelson, 2008; Riggs, Mather, Hyde, & Simpson 2016; Vlach & Sandhofer, 2012). Fast mapping describes the learning that takes place from brief exposure (one or a few exposures) to novel information about an object. It would seem that some words (e.g., object names) and some other kinds of information (e.g., actions made with objects) can be retained long term by young children (2–4 years) following brief exposure *at least under certain circumstances*. Most recently, Riggs et al. (2016) compared fast mapping and retention of actions and object names, introducing preschoolers to either a novel word that named a novel object or a novel action employed to *use* the novel object. A week later, children recognized the target object linked with the novel action at above chance levels, and their comprehension of the object–action link was as good as their comprehension of the object–name link.

The current research investigated the fast mapping of the functions associated with artifacts (i.e., manufactured objects) in addition to actions and names. The *function* of an artifact is the effect it has when used (e.g., slicing is the function of a knife) and is encoded conceptually. In contrast, all actions are the product of sensorimotor representations. Although many actions do not use objects (e.g., dancing), artifact use usually combines a *specific* action with a *specific* artifact. When encoding the *action* made with an artifact, the sensorimotor representation formed must incorporate both the action made by the body and the artifact on which the body acts. A specific action–artifact combination brings about a specific effect. This is often a change to an object or a substance, which we refer to here as the artifact's "substrate." For example, when a hammer (the artifact) is used, it is grasped by its handle with the head oriented away from the body, and the arm and wrist are moved in such a way (the artifact's action) as to bring the head of the hammer into contact with a nail on a surface (the artifact's substrate). This contact drives the nail into that surface (the artifact's function).

Our definition of artifact function is consistent with that of previous theorists (e.g., Bloom, 1996; Kelemen, 1999; Kemler Nelson, Frankenfield, Morris, & Blair, 2000). Like these theorists, we propose that an artifact's function is encoded in a conceptual representation that encompasses what it means to use the artifact (e.g., a knife slices bread when used). A considerable amount of previous research has investigated the "richness" of young children's conceptual understanding of artifact function. For example, do children conceptualize an artifact's function as reflecting the intention of the specific person who originally designed it (e.g., Jaswal, 2006)? In contrast, we focus on the basic understanding that the function of an artifact reflects the effect it has when used. This basic understanding of function (in combination with the necessary sensorimotor representation) is sufficient to use most artifacts.

The actions and functions associated with an artifact's use are of particular interest when investigating the scope of fast mapping for two reasons. First, artifact use has a central role in human behavior. As with language, skilled artifact use separates humans from the rest of the animal kingdom. In comparison with other animals—even other primates—we use a staggering number of sophisticated artifacts, each with a dedicated function (Casler & Kelemen, 2005). Fast mapping could facilitate children's acquisition of the knowledge needed to use them. Indeed, their ability to fast map this knowledge could help to explain, in part, why humans' use of artifacts so greatly exceeds that of other animals.

Second, the order in which children learn artifact–action and artifact–function associations is relevant to a fundamental question about the nature of children's learning. Embodied cognition suggests that conceptual knowledge develops from motor behavior (e.g., Marshall, 2016; Piaget & Inhelder, 1969; Shapiro, 2011). From this perspective, young children's artifact knowledge will be built on sensorimotor representations formed from the actions made with them. There is considerable evidence to suggest that actions are central to the artifact representations of adults (e.g., Beauchamp & Martin, 2007; van Elk, van Schie, & Bekkering, 2009), but this account of artifact representation has received less attention in the developmental literature (although see Hahn & Gershkoff-Stowe, 2010). In