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## Cognitive Development



# Imagination and the generation of new ideas



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### ABSTRACT

A variety of theories have been put forth to explain the function of imagination, most notably that imagination engages and develops children's theory of mind and counterfactual reasoning. Here, we propose that a primary role for imagination is as a cognitive mechanism for efficiently generating new ideas without observing new evidence. Learners must generate hypotheses before they can assess the truth of these hypotheses. Given infinite possibilities, how do learners constrain the process of hypothesis generation? We suggest that learners represent abstract criteria for the solution to a problem and generate solutions that, if true, would solve the problem. As a preliminary test of this idea, we show that, in the absence of any fact of the matter (i.e., when neither prior knowledge nor statistical data distinguishes competing hypotheses), 4–6-year-olds (mean: 63 months) systematically converge on solutions to problems, consistent with an ability to imagine the abstract properties of causal problems and their solutions.

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## 1. Introduction

Imagination pervades human experience. Children begin engaging in pretend play as toddlers (Fein, 1981; Singer & Singer, 1992), and although cultural and parental attitudes affect the amount and content of imaginary play (Gosso, Morais, & Otta, 2007; Haight, Parke, & Black, 1997), researchers have observed imagination in every culture where they have looked (Farver & Shin, 1997; Farver &

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Wimbarti, 1995; Haight, Wang, Fung, & Williams, 1999). As adults, we are avid consumers and creators of fiction (Harris, 1998; Oatley, 1999), and we respond viscerally and emotionally to imagined scenarios (Carruthers, 2009; Vrana & Lang, 1990). Moreover, we invent fictions even in the pursuit of facts: we confabulate in the face of neurological disorders (Phelps & Gazzaniga, 1992), in defending the bases of our decisions (Nichols & Stich, 2000), and in the construction of autobiographical memory (Kopelman, 1987).

Why do we make things up? Given the uncertainties and complexities of the real world, why do we spend cognitive effort on unreal worlds? Arguably, we do so precisely because the real world is uncertain and complex. Thinking about possible worlds may prepare us for future events in the actual world. Any version of this account, however, must contend with Fodor's farcical endorsement of it:

... what if it turns out that, having just used the ring that I got by kidnapping a dwarf to pay off the giants who built me my new castle, I should discover that it is the very ring that I need in order to continue to be immortal and rule the world? It is important to think out the options betimes, because a thing like that could happen to anyone and you can never have too much insurance. (Fodor, 1998, p. 212)

The sheer fecundity of our imagination poses a problem for functionalist accounts. If the primary role of fantasy is to explore possible realities (the "conundrums we might face someday"; Pinker, 1997, p. 543), shouldn't we have more realistic fantasies?

Still, it does not seem unreasonable to suppose that a universal, early emerging cognitive ability must be good for *something*. One possibility is that imagination provides an attractive package for ordinary cognition (Boyd, 2009). By embedding useful knowledge in extraordinary events with heightened emotional content, learners may be better able to access important cultural skills or facts. Consistent with this, researchers have suggested that imaginative engagement might support a range of cognitive abilities, including creativity, intelligence, problem solving, symbolic reasoning, language development, theory of mind, narrative skills, social skills, causal reasoning, emotional regulation, and executive function. Dismayingly, however, a recent exhaustive review of the literature found little to no evidence that imaginative play supports cognition in any domain for which a benefit has been proposed (Lillard et al., 2013). Of course, the fact that cognitive development is robust to variations in imaginative engagement need not mean imagination is irrelevant to cognition. Cognitive development is also robust to variations in sight and hearing; this does not make perceptual abilities epiphenomenal. Nonetheless, the absence of evidence for any direct causal relationship between pretense and cognitive outcomes makes determining the role of imagination especially challenging.

The challenge is magnified by the polysemy of the central concept. As discussed, imagination may be involved in everything from the play of toddlers (Singer & Singer, 1992) to the confabulatory behavior of neuropsychiatric patients (Kopelman, 1987). We might limit our study of imagination to its manifestation in better-understood aspects of cognition (mental imagery, theory of mind, or counterfactual reasoning). However, although it is clear that our abilities to simulate future states, represent events to which we do not have immediate access, and reason through the consequences of false premises are critical to cognition, it is less clear that describing these abilities as imaginative adds to what we already know about such cognitive processes.

Given this state of affairs, we suggest a new approach. One way to understand the role of imagination in cognition may be to consider it in relationship, not to those aspects of cognition that are relatively well understood, but to other puzzles of cognitive science. Here we focus on the problem of how learners think of new ideas.

At first glance, the topic of how learners generate new ideas might seem like a well-studied problem, and the last place to look for unsolved puzzles. Decades of work in cognitive development have investigated the processes underlying theory change and conceptual change (Carey, 2009; Gopnik & Wellman, 2012; Schulz, 2012). However, in the (understandable) focus on how learners change their beliefs in deep, far-reaching ways, a more commonplace mystery may have been obscured: the mystery of ordinary thought.

To illustrate what we mean, consider two questions, united only in that you probably have not considered them before: (1) What should you name a theater company focusing on new works? (2)

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