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COMMENT

Pretense and Possibility—A Theoretical Proposal About the Effects of Pretend Play on Development: Comment on Lillard et al. (2013)

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The review by Lillard et al. (2013) highlighted the need for additional research to better clarify the nature of the relationship between pretend play and development. However, the authors did not provide a proposal for how to structure the direction of this future work. Here, we provide a possible framework for generating additional research. This theoretical proposal is based on recent computational approaches to cognition, in which counterfactual reasoning plays a central role in causal learning. We propose that pretend play initially emerges as a product of the cognitive mechanisms underlying human learning and then feeds back to become critical for enhancing the optimal functioning of these same processes. More specifically, we argue that pretending is in fact 1 of several forms of counterfactual reasoning, which is essential to causal cognition—and that the act of engaging in pretend scenarios may provide early opportunities to practice the skills that were initially responsible for its appearance. Here, we provide a brief overview of this theoretical framework, consider how these ideas may be integrated with the previous work covered in Lillard et al.'s (2013) review, and suggest some empirically testable questions to direct future directions.

Keywords: pretend play, counterfactuals, causal learning, development

Lillard et al. (2013) have provided the field with an exceptional review of the literature on the role of pretend play for development. As they have noted, imaginative play has long been assumed to be critical for children's healthy cognitive, social, and emotional development, and these claims continue to have important implications for early education policy and practice. It is abundantly clear from their review that the current state of the evidence is insufficient to draw strong conclusions regarding the nature of the relationship between pretend play and optimal development. Given the widespread belief among educators and policymakers regarding the benefits of pretend play and the increasing movement toward child-directed learning, we agree that there is a clear need for a well-designed program of research to empirically test the assumptions underlying these claims.

However, after identifying the need for additional evidence, Lillard et al. (2013) did not provide a positive proposal to direct this research and instead ended their review with a rather inconclusive and somewhat deflationary position on pretend play. Although the methodological issues (i.e., failure to replicate, unmasked experimenters, poor control conditions, etc.) that are highlighted will be important to consider in future research, Lillard et al. failed to address what we believe to be the more fundamental issue: the lack of a coherent theoretical account of the cognitive mechanisms that underlie pretense (and play in general) that might underpin their beneficial effects on other areas of development. Historically, there have been relatively few theories that have sought to provide a unifying theory of the role of pretend play. Moreover, more theoretically sophisticated accounts of pretense have tended to interpret pretend play as an epiphenomenon of other abilities, such as metarepresentation or theory of mind, rather than as an activity that could shape learning or development (Baron-Cohen, 1995; Currie, 1995; Leslie, 1987; Lillard, 2001; Nichols & Stich, 2000).

The lack of a coherent theoretical framework following decades of research reflects the fundamentally puzzling nature of pretense itself: Children need to learn so much about the real world. So why do they spend such a large amount of time and energy engaging with unreal worlds? How could exploring manifestly false worlds improve their understanding of the real one? In addition to the paradoxical quality inherent to pretend play, there is an equally troubling paradox when designing a methodology for studying these behaviors. Lillard et al. (2013) defined pretend play in terms of four criteria: flexibility, positive affect, nonliterality, and intrinsic motivation. Each of these criteria is inherently linked to the spontaneity of these pretend activities—a characteristic that is extremely difficult to simulate in a laboratory setting.

Despite these obstacles, it will be important to have a set of testable predictions in order to produce research that is likely to generate interpretable data in the future. We therefore agree with Lillard et al.'s (2013) proposal that additional research is necessary to clarify the impact of pretend play on development (if any), and we further propose that identifying a unifying framework will be

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an essential first step in guiding the direction of future research, both theoretically and methodologically. The research described in Lillard et al. tended to relate very general measures of play or pretense to equally general measures of learning and development. But one lesson of the last 30 years of cognitive development research is that such very general measures miss the more fine-grained mechanisms and knowledge that underpin children's development. We suggest one potential relation between a specific kind of pretend play and a particular kind of cognition and learning—namely, the counterfactual reasoning that plays a fundamental role in learning our causal models of the world.

Elsewhere, we have proposed an account of pretense that is based on the idea that childhood exploratory play is closely tied to the processes underlying causal cognition (see Buchsbaum, Bridgers, Skolnick-Weisberg, & Gopnik, 2012; Gopnik, 2009; Walker & Gopnik, in press). This account suggests that pretense is a distinctive type of exploratory play that shares the same cognitive mechanisms as an equally distinctive type of causal inference: counterfactual reasoning. Whereas a number of researchers have previously remarked on the similarities between pretend play and counterfactual inference (Amsel & Smalley, 2000; Harris, 2000; Hoerl, McCormack, & Beck, 2011; Lillard, 2001), they have not provided an account of why counterfactual reasoning itself might be useful. Counterfactual inference appears to suffer from the same paradox as pretense. Why would inferences about the consequences of false premises be useful in understanding the real world?

Here, we attempt to provide an explanation of the essential role of counterfactual reasoning by considering this capacity from the perspective of recent "probabilistic modeling" accounts of human reasoning and learning (e.g., Chater, Tenenbaum, & Yuille, 2006; Glymour, 2003; Griffiths, Charter, Kemp, Perfors, & Tenenbaum, 2010; Pearl, 2000). In what follows, we provide a brief overview of this theoretical framework, consider how these ideas may be integrated with the previous work covered in Lillard et al.'s (2013) review, and suggest some future directions.

Linking Pretend Play With Causal Cognition

During the same period that pretend play is most prominent, between 3 and 5 years of age (Singer & Singer, 1990), children are also deeply engaged in the process of developing abstract, coherent representations of causal relationships in a variety of domains. Developmental "theory theorists" (e.g., Carey, 1985; Gopnik & Meltzoff, 1997; Wellman, 1990; Wellman & Gelman, 1998) have long proposed that this causal knowledge can be understood as a set of theories that are revised over the course of development in a process that is analogous to scientific theory change. Recently, there has been major progress toward building a precise computational theory describing the representations and learning mechanisms that may account for this process (Gopnik et al., 2004; Gopnik & Schulz, 2007; Griffiths & Tenenbaum, 2009).

Much of this work is the product of a much larger movement in cognitive science that has resulted in the rise of probabilistic modeling accounts of learning and reasoning. According to these accounts, the acquisition and revision of causal knowledge are supported by powerful learning mechanisms that allow children (and adults) to integrate incoming information with their currently held theories to update their "causal models"—that is, representations of coherent networks of causal relationships (e.g., Gopnik et al., 2004; Griffiths, Sobel, Tenenbaum, & Gopnik, 2011). Causal models are useful, both ontogenetically and evolutionarily, because once you know how one thing is causally connected to another, this knowledge supports a host of inferential processes that allow you to make predictions about future events, consider the consequences of possible actions, and perform successful interventions on the world. For example, between the ages of 2 and 4, children have developed a causal theory of the mind: They understand the complex causal relations between perceptions, beliefs, and desires. Having this knowledge allows children to generate explanations for the actions of others, form inferences about novel events, and guide their interactions with other people in a complex social environment (Wellman, Phillips, & Rodriguez, 2000).

Recent advances in computational accounts of causal models suggest that this early developing ability to reason about causal relationships may also be tied to our ability to imagine possible worlds and to reason and learn counterfactually (e.g., Gopnik & Schulz, 2007; Pearl, 2000; Woodward, 2003). According to these accounts, the purpose of causal knowledge, and the feature that distinguishes it from other kinds of knowledge, is that causal relations have the additional requirement of counterfactual dependence: A proper interpretation of the claim *X causes Y* is that, all else being equal, *if you intervened to change X that would lead to a change in Y* (Pearl, 2000). In other words, in some other possible world, in which the cause had not initiated the underlying causal mechanism, the effect would not have occurred at all. This ability to reason about causal dependencies allows the learner to generate predictions about future interventions ("what would happen if I were/were not to do *X*?") and engage in classic "backward" counterfactuals ("what would have happened if I had/had not done *X*?"), as well as follow the causal sequence of these representations to their most likely outcomes.

These counterfactual inferences contrast with simple predictions. For example, if I know there is a correlation between smoking and lung cancer I can accurately predict that if someone smokes more they are more likely to get cancer. However, I can also accurately use the correlation between yellow nicotine-stained fingers and cancer to make a similar prediction. But knowing that there is a causal link between smoking and cancer and not between yellow fingers and cancer allows me to do more than this. It also allows the past counterfactual inference that had he not smoked he would have been less likely to get cancer and the future counterfactual that smoking prevention programs will make cancer less likely. These counterfactuals don't hold for the merely correlational relationship between yellow fingers and cancer.

The consideration of counterfactual possibilities is therefore central to reasoning about causal structure. Indeed, there is substantial evidence that identifying a particular causal structure supports a set of inferences about the effects of real and imagined interventions on a causal system, regardless of whether they have ever been observed or even whether they *could* ever be observed (Gopnik et al., 2004; Meder, Hagmayer, & Waldmann, 2009; Sloman, 2005). Reasoning about causal relationships therefore actively generates possible worlds, some of which are factual (they exist) while others are counterfactual (they do not exist). Although we do not necessarily engage in conscious tracking of counter-

factuals when we are reasoning causally, the activity of imagining brings these underlying counterfactuals to the surface (Sloman, 2005). Imagining new possible worlds, as we do in fiction and pretense, may therefore be defined as the process by which the implied counterfactuals in our causal models become explicit.

Counterfactuals also play an important role in learning. In fact, the ability to disengage from the actual state of the world is necessary for moving beyond simple, data-driven learning to engage in inductive inference. For example, in Bayesian learning (e.g., Griffiths et al., 2010; Griffiths & Tenenbaum, 2005), a learner must modify his or her existing causal model to produce some alternative model and then assess the fit between the evidence generated by this alternative and the actual evidence observed in the real world. The mechanisms underlying the formation and revision of causal models are very powerful, but they are also quite computationally demanding because the learner must consider a range of possible models in order to select the most likely one to account for their observations. Despite the complexity of this task, we often observe this generation and exploration of alternative models emerge spontaneously in very young children's pretend play. Like learning and reasoning about causal models, pretend play requires that children generate patterns of evidence from an initially false premise and reason about the outcomes of this alternative model of the world.

We propose, therefore, that pretend play enables children to exercise the cognitive abilities that are necessary for counterfactual reasoning—setting false premises (assuming a possible world in which there is "tea" inside the empty cup) and following the effects of this counterfactual premise downstream. From this perspective, not only does causation give pretend play its logic (young children are quite proficient at tracking the causal rules in pretend worlds; e.g., Harris, 2000; Onishi, Baillargeon, & Leslie, 2007; Skolnick & Bloom, 2006), but the very act of engaging in pretend play promotes the development of causal learning. Just as play hunting or fighting in nonhuman animals gives the young opportunities to practice and perfect those skills in a protected setting, pretend play gives children a chance to practice and perfect the distinctive cognitive operations involved in counterfactual thinking.

Pretend play is only one of several forms of child-directed play that fosters the development of different aspects of causal cognition. In much the same way that exploratory play allows children to discover the causal structure of the physical world (Cook, Goodman, & Schulz, 2011; Schulz & Bonawitz, 2007; Gopnik & Schulz, 2007), pretend play promotes engagement in counterfactual reasoning, which is essential to learning causal relations across domains (see Gopnik, 2009). Just as exploratory play allows children to discover new facets of the actual world, pretend play allows them to uncover new aspects of possible worlds. Significantly, however, we would predict that each of these types of play might have quite specific and different influences on learning and development.

Integrating This Framework With Previous Research

Upon consideration of the topics that were covered in Lillard et al.'s (2013) review, we would argue that causal cognition subsumes many of these domains. For example, understanding psychological causal relations underpins the development of theory of mind, while understanding physical causation leads to sophisticated tool use, conservation, successful problem solving, and creativity. Additionally, causal knowledge across all domains contributes to planning, executing effective interventions (both in the social and nonsocial world), syllogistic reasoning, and even processes involved in self-regulation. However, if pretend play primarily contributes to the development of just one distinctive aspect of causal reasoning—the ability to consider counterfactual alternatives—then this constitutes *only one* of the many components that likely lead to development in each of these domains. It is therefore not surprising that Lillard et al. report great variation in the role of pretend play on development across domains and that each of the areas reviewed yield different patterns of results. For example, the ability to hold multiple possibilities in mind is likely necessary but certainly not sufficient for developing the concept of conservation. It therefore makes sense that Lillard et al. found no compelling evidence for the effect of pretend play in this domain. On the other hand, engaging in pretend scenarios may indeed be sufficient for the development of syllogistic reasoning—because, as the authors point out, reasoning about false premises is definitional to pretend play. Indeed, this domain is one in which the evidence does seem to support a causal role of pretense on development (Lillard et al., 2013).

Suggestions for Directing Future Research

The framing of Lillard et al.'s (2013) review drew heavily from Smith (2010), who outlined three possible models for the role of pretend play on development: (a) pretend play is *crucial* to optimal development, (b) pretend play helps some aspects of development but is only one possible route (*equifinality*), and (c) pretend play is an *epiphenomenon* of some other selected-for capability, but itself makes no contribution. Based on what we currently know, it is possible that pretend play is simply an epiphenomenon of children's general causal knowledge and counterfactual inference abilities. However, a more intriguing possibility is that pretend play itself plays a role in the development of causal thinking and learning as we have proposed here (see also Buchsbaum et al., 2012; Walker & Gopnik, in press). We therefore propose a fourth possibility—an *interaction*—in which pretend play initially emerges as a product of the cognitive mechanisms underlying human learning and then feeds back to become critical for enhancing the optimal functioning of these same processes. More specifically, we propose that pretending is in fact one of several forms of counterfactual reasoning, which is essential to causal cognition—*and* that the act of engaging in pretend scenarios may in fact provide early opportunities to practice the skills that were initially responsible for its appearance.

This model of play generates a series of testable predictions, some of which we have already begun examining in our lab. For example, a recent correlational study has established the first empirical evidence that pretend play and counterfactual reasoning may share the same underlying cognitive mechanism (Buchsbaum et al., 2012). In this study, preschool-aged children were taught about a novel causal system, in which a certain type of object activates a machine that plays music. After children had learned this novel causal relationship, the experimenters examined whether these children would make appropriate counterfactual inferences

about the causal structure, whether they would import this causal structure into pretend play scenarios, and whether these two activities were correlated with each another. Results indicated that children who performed better in the counterfactual task also applied appropriate causal constraints in the context of their pretend play. Additionally, children's performance on counterfactual reasoning questions was significantly correlated with their engagement in causally coherent pretense. Importantly, these correlations were not due to age, executive function, or general cognitive development (as indicated by performance on conservation tasks). These findings therefore link pretend play with a distinctive human form of causal inference—counterfactual reasoning. However, these results only provide initial, correlational data. We are therefore currently assessing whether engaging in causal pretense scenarios improves children's subsequent counterfactual reasoning and their ability to form inferences about both complex causal structures and probabilistic causal systems.

Lillard et al. (2013) have provided a great service by outlining the work that has already been done and pointing to the gaps in our current knowledge. Here, we have attempted to extend this work by proposing one possible unifying theory to guide the direction of future research. This theory proposes that pretend play is facilitated by the mechanisms underlying causal cognition and subsequently provides an opportunity for children to practice reasoning from, and learning about, causal models. Pretend play and counterfactual reasoning involve the same cognitive machinery: The ability to consider unreal events, to separate representations of those events from reality, and to think about the outcomes of those events if they had occurred. These abilities are essential to learning. Therefore, just as physical play provides nonhuman animals with the opportunity to practice skills that they will need as adults (e.g., Bekoff & Byers, 1998), we argue that pretend play provides children with the opportunity to practice the cognitive skills necessary for causal cognition. This model of learning therefore serves as a possible unifying theory underlying the role of pretend play that—even if ultimately proven incorrect—generates a set of empirically testable questions to direct future research.

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