The Development of Imaginative Cognition[1]

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Introduction

Over the last ten years or so, many cognitive scientists have begun to work on topics traditionally associated with philosophical aesthetics, such as issues about the objectivity of aesthetic judgments and the nature of aesthetic experience. An increasingly interdisciplinary turn within philosophy has started to take advantage of these connections, to the benefit of all. But one area that has been somewhat overlooked in this new dialogue is developmental psychology, which treats questions about whether and to what extent children's intuitions about various aspects of aesthetic experience match those of adults, as well as the origins and developmental trajectories of these intuitions. The current paper reviews some recent work in developmental psychology that has the potential to inform philosophical research on a variety of topics – not necessarily because of this work tells us directly about what children think, but because learning what children's aesthetic intuitions are and how they develop can help us to better understand why adults have the intuitions that they do.

For example, consider the paradoxes of tragedy and horror: Why do we as adults enjoy fictions that make us feel sad, horrified, or even disgusted? One possibility is that these preferences are the result of cultural pressure or the output of a highly developed aesthetic sense. A different possibility is that we are attracted to these kinds of aesthetic experiences even as children. This latter option would suggest that the existence of these paradoxes result from some basic facts about how our aesthetic preferences work. Some suggestive recent work indicates that this might in fact be the case, since even

[1] The author would like to thank the organizers and attendees of the 2012 AHRC workshop on "Method in Philosophical Aesthetics: The Challenge from the Sciences" for their insightful comments and questions. Thanks also to Paul Bloom, Joshua Goodstein, Alison Gopnik, Alan Leslie, David Sobel, Lu Wang, and Michael Weisberg for their support of the projects reported in this paper.

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6-year-olds report liking scary and sad stories[2]. This is just one example of how empirical data about development can help to inform debates within the field of aesthetics.

This paper provides another, more extended, example of how recent empirical findings in developmental psychology can inform issues in philosophical aesthetics. The topic under consideration is that of how the imagination works. How is it that we are able to interact with stories and scenarios that do not reflect the truth of reality, and that we know to be fictional in this way? What is the nature of this cognitive capacity early in development? More importantly, how can knowing these origins inform our understanding of the ways in which this capacity changes (or remains the same) over the course of development? Answering these questions can provide fresh insight into two philosophical topics: how people decide which propositions hold true in fictional worlds, and under what circumstances people experience imaginative resistance. After reviewing recent empirical work that bears on these topics, this paper closes with some thoughts about the role that imaginative cognition plays in development.

What is imaginative cognition?

Roughly speaking, there are two kinds of cognitive acts: those that are aimed at reality, and those that are not. Into the former category fall those processes that help us to navigate the real world, such as our perceptual abilities. Into the latter category fall those processes that allow us to think about scenarios that do not necessarily reflect the truth of the real world, of which imagination is the primary example.

It is important to note that this distinction is based on what goal is currently driving the cognitive act, rather than on an actual categorical distinction between different types of cognitive processes. To see why this is the case, consider that most of our cognitive processes can be used for both types of act. For instance, we form memories of both real events and of events that we have merely imagined, and we draw inferences about events that happen in reality and events that happen in a fictional story using basically the same cognitive apparatus[3].

[2] L. Guillot & P. Bloom 'Are children interested in negative stories?' Poster presented at the biennial meeting of the Cognitive Development Society (2011).

[3] This is known as the "single code theory." See F. M. Bosco, O. Friedman, & A. M. Leslie, 'Recognition of pretend and real actions in

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Even still, there is a class of cognitive abilities that seem to be designed to operate without taking into account whether the scenarios they consider are true or false in the real world. This is sometimes described as the contrast between believing and pretending[4], although this class encompasses far more activities than just pretending. We can not only pretend, we can also create thought experiments, or suppose for the sake of argument, or tell a fictional stories, or envision a future possibility. All of these abilities are deployed for different reasons and have their own unique features. But what they have in common is precisely the fact that they can operate independently of what we take to be true. This kernel of commonality is the *imagination* – the ability to engage with entities and events that are not real. Given its role in this wide variety of cognitive tasks, it is clear that the imagination is a ubiquitous tool we use for understanding and interacting with the world around us. Being able to imagine what could possibly happen in the future can help us to plan and make decisions, and being able to consider an alternative past can help us to understand why things happened the way they did[5].

In considering the imaginative capacities of young children, pretending and comprehending fictional stories are the two imagination-based abilities that are studied most often, since these are the abilities with which children are most explicitly familiar. Hence the conclusions that are drawn from this research apply most directly to these kinds of representations. But because the same underlying cognitive mechanism – the imagination – is responsible not only for pretending and story creating, but also for all of the other activities

play by 1- and 2-year-olds: Early success and why they fail,' *Cognitive Development*, **21** (2006), 3–10; T. S. Gendler & K. Kovakovich, 'Genuine rational fictional emotions,' in M. Kieran (Ed.), *Contemporary debates in aesthetics and the philosophy of art* (Oxford: Blackwell, 2005); S. Nichols, 'Imagining and believing: The promise of a single code,' *The Journal of Aesthetics and Art Criticism*, **62** (2004), 129–139.

[4] A. M. Leslie, 'Pretense and representation: The origins of "Theory of Mind,"' *Psychological Review*, **94** (1987), 412–422; S. Nichols & S. P. Stich, *Mindreading: An integrated account of pretense, self-awareness, and understanding other minds* (New York: Oxford University Press, 2003).

[5] A. Gopnik, C. Glymour, D. M. Sobel, L. E. Schulz, T. Kushnir, & D. Danks, 'A theory of causal learning in children: Causal maps and Bayes nets,' *Psychological Review*, **111** (2004), 3–32; D. Lewis, 'Causation,' *Journal of Philosophy*, **70** (1973), 556–567; D. S. Weisberg & A. Gopnik, 'Pretense, counterfactuals, and Bayesian causal models: Why what is not real really matters,' *Cognitive Science*, **37** (2013), 1368–1381.

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mentioned above, discovering how children respond to pretend scenarios and fictional stories can shed light on this wider class of representational activities.

What's the difference between reality and fiction?

One of the first questions we must ask when considering how young children cognize and respond to imagined scenarios is whether they understand that these scenarios are indeed imagined. If a child fails to understand that the events in a story have not actually happened in real life, he or she cannot really be said to be *imagining* the story[6].

Luckily, several decades of diligent work in developmental psychology have discovered that children do make a robust reality/fiction distinction[7]. Most of these studies use explicit response measures to draw this conclusion, for example, by asking children to label pictures as "real" or "make-believe," or by asking children to sort pictures into different boxes that represent the two categories. These studies rely on the fact that children understand and properly use words like "make-believe" or "fictional"[8]. Some recent work has begun to rely on more spontaneous or implicit measures of children's understanding, which has permitted the field to test children's understanding of the nature of the reality/fiction distinction at younger and younger ages. In one of these

[6] See J. Piaget, *Play, dreams and imitation in childhood* (New York: Norton, 1962).

[7] For example, A. Bourchier & A. Davis, 'Children's understanding of the pretence-reality distinction: A review of current theory and evidence,' *Developmental Science*, **5** (2002), 397–413; C. Golomb & R. Kuersten, 'On the transition from pretense play to reality: What are the rules of the game?' *British Journal of Developmental Psychology*, **14** (1996), 203–217; A. Samuels & M. Taylor, 'Children's ability to distinguish fantasy events from real-life events,' *British Journal of Developmental Psychology*, **12** (1994), 417–427; J. D. Woolley & V. Cox, 'Development of beliefs about storybook reality.' *Developmental Science*, **10** (2007), 681–693. For review, see D. S. Weisberg, 'Distinguishing imagination from reality' in M. Taylor (ed.), *Oxford Handbook of the Development of Imagination* (New York: Oxford University Press, 2013).

[8] J. D. Woolley & H. M. Wellman, 'Young children's understanding of realities, nonrealities, and appearances' *Child Development*, **61** (1990), 946–961.

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studies[9], researchers presented three-year-olds with a pretend scenario in which a puppet used an object functionally in a game, rather than according to its pretend identity. For example, an experimenter would establish a pretense whereby a pen was a toothbrush, and then the puppet would draw with the pen. Children tended to object to the puppet's actions, but only when the puppet had been present for the establishment of the pretend identity. When the puppet was absent for the establishment of the pretend identity, children did not object. These results demonstrate that three-year-olds understand that the rules that govern pretend games are context-specific and should not spill over into reality. Several studies have also used data about the duration or direction of children's spontaneous looking to determine how they think about different kinds of pretend scenarios[10].

More work should be done at the younger end of this age spectrum to determine more precisely when this distinction is in place, although such work cannot rely on verbal measures and is thus hampered by difficulties in interpreting children's spontaneous responses. For example, suppose a child laughs or expresses surprise at someone drinking tea from an empty cup. Is she demonstrating her understanding that this is a non-literal scenario, or merely registering the fact that this is an odd example of a drinking event? Answering this question has the potential to tell us whether children learn at some point that there are different types of representations, only some of which are meant to reflect reality, or whether this type of understanding is in some sense a basic, unlearned property of our cognitive systems. Unfortunately, we currently lack a good method for telling the difference between these two options.

Nevertheless, the overall message of this body of work is that children do understand the difference between imagination and reality, at least by the age of three, and likely earlier. This is itself a substantial cognitive achievement, but recent work in my lab and others has discovered that children's understanding of the difference between reality and fiction is even more nuanced than this. Not only do young children separate the real world from the realm of the

[9] Study 1 of E. Wyman, H. Rakoczy, & M. Tomasello, 'Normativity and context in young children's pretend play,' *Cognitive Development*, **24** (2009), 146–155.

[10] K. H. Onishi, R. Baillargeon, & A. M. Leslie, '15-month-old infants detect violations in pretend scenarios,' *Acta Psychologica*, **124** (2007), 106–128; D. S. Weisberg, L. Wang, & A. M. Leslie, 'How do young children conceptualize socially constructed pretend scenarios?' (under review).

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imagination, they also make separations between multiple imagined worlds[11]. In this study, we presented a group of four-year-old children and a group of adults with pictures of fictional characters and real people and asked them three types of question. The fantasy/reality questions probed these participants' ability to tell who was real and who was fictional, from the participant's own point of view: "Is Batman real or is he make-believe?" The within-world questions then shifted their perspective to that of one of the fictional characters and asked what that character would think of a secondary character within the same story: "What does Batman think about Robin? Does Batman think that Robin is real or make-believe?" The fantasy/fantasy questions retained this focus on a fictional character's beliefs but asked participants to report this beliefs about a character from a different story: "What does Batman think about SpongeBob? Does Batman think that SpongeBob is real or make-believe?"

Children and adults responded to these questions in the same way: Batman is in fact fictional, but he believes that Robin is real and he believes that SpongeBob is fictional. This latter response is particularly intriguing, since it suggests that Batman views SpongeBob in the same way that we view SpongeBob: as a fictional character, a denizen of fictional world that is separate from his own. Children and adults thus see the realm of fantasy as populated by multiple, separate fictional worlds. Contact between them is no more possible than it is between our world and any of the many fictional worlds we know about.

However, as argued earlier, understanding fictional stories is not the only way in which our imaginative capacities are deployed; they're also used for creating and understanding a wide variety of non-real scenarios. Given this, one would expect the intuition that different representations are separate to extend beyond fictional stories to other types of representation.

Several examinations of children's interactions with pretend games shows that this is indeed the case. Children create separate representations for the different pretend games that they play in addition to doing so for the different fictional stories that they know about[12].

[11] D. Skolnick & P. Bloom, 'What does Batman think about SpongeBob? Children's understanding of the fantasy/fantasy distinction,' *Cognition*, **101** (2006), B9–B18.

[12] P. L. Harris & R. D. Kavanaugh, 'Young children's understanding of pretense,' *Monographs of the Society for Research in Child Development*, **58** (1993); D. S. Weisberg, L. Wang, & A. M. Leslie, 'How do young children

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In our first study of this issue[13], two experimenters set up two different pretend games with a group of three- and four-year-old child participants. Within each pretend game, there was a stuffed animal character, controlled by the experimenter. There was also a pile of colored blocks within easy reach of the child, which were used throughout the experiment as pretend objects within the games. First, the experimenters asked for each child's help in setting up the two pretend games, in sequence. For example, the first experimenter asked the child to help her doll to take a bath. The child decided what the doll needed for her bath, such as a towel, and pretended that one of the blocks was a towel within that game. The second experimenter then set up an analogous game with a teddy bear who needed to take a nap.

To test whether children represent these two games as separate, as they do with fictional stories, we set up a situation that could potentially have involved a crossover. For example, the second experimenter announced that it was time for the bear to take a bath, so he needed a towel. On hearing this, children had a number of choices of how to respond. One option was to move the towel from the doll's game into the bear's game. Although this would be a simple and parsimonious way of responding to the situation, it would involve breaking the boundary that potentially exists between the two games. If children represent the games as separate, the doll's towel is inaccessible to the bear, no matter how appropriate it is to solve his current problem. If this is how children see things, then they should select a new block to serve as the bear's towel. This is exactly what they did.

This response tendency is especially interesting because children create and have control over these pretend interactions in a way that they do not for fictional stories. The experimental setup involved both experimenters sitting with the child in the same physical space, so that everyone could see what was going on in both games. Given this, it would have been quite easy to cross an object from one game to the other. But that's not what happened; children preferred to invest a new object with the appropriate pretend identity and keep the two games distinct.

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conceptualize socially constructed pretend scenarios?' op. cit.; E. Wyman, H. Rakoczy, & M. Tomasello, 'Normativity and context in young children's pretend play,' op. cit.

[13] Study 1 of D. S. Weisberg & P. Bloom, 'Young children separate multiple pretend worlds,' *Developmental Science*, **12** (2009), 699–705.

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This line of research shows that children understand not only the difference between reality and fiction, but also what would be fictional from the point of view of a particular fictional world. That is, they separate different imagined representations. This is a substantial cognitive achievement that develops early and does not appear to change over the course of development. Although these two facts cannot be taken as definitive evidence that these abilities are unlearned, they do suggest that these response tendencies arise from some basic capacity that is common to all types of imaginative cognition, including fictional stories, pretend games, past and future counterfactuals, and so on.

These results additionally bear on questions of how we know which propositions hold true within the context of a given fictional scenario. Specifically, they suggest that children (and adults) import information about relationships between worlds into imagined representations. The fact "SpongeBob is a fictional character" is true in reality, so when we create a representation of Batman's world, this fact is included in that representation. That is, Batman believes SpongeBob to be fictional because we do; his beliefs about what is fictional are parasitic on ours. This obviously cannot be the whole story: The fact "Batman is a fictional character" is also true in reality but should not hold in Batman's world. Nevertheless, this analysis suggests that our decisions about what is true in any given fictional world are generally based on our understanding of reality. This paper next turns to a broader analysis of this claim.

What belongs in an imagined scenario?

The research just reviewed shows that children and adults understand the relationships that hold among different imagined scenarios. But what are their intuitions about the content of any given imagined scenario? How much of the real world is imported into an imagined scenario, how much comes from the scenario's explicit setup (e.g., counterfactual premise, fictional text), and how much is created out of whole cloth? These issues have been treated extensively by philosophers[14], who generally agree that fictional worlds are based on reality. One simple implementation of this argument is the

[14] For example, G. Currie, *The nature of fiction* (Cambridge, UK: Cambridge University Press, 1990); D. Lewis, 'Truth in fiction,' *American Philosophical Quarterly*, **15** (1978), 37–46; K. L. Walton, *Mimesis as make-believe* (Cambridge, MA: Harvard University Press, 1990).

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Principle of Minimal Departure[15], which argues that a given fictional world should be as similar to reality as possible, differing in only those parts of the world that are necessary for implementing the story. This principle works quite well to address the issue raised above: The people who inhabit Batman's world should not believe that Batman is fictional, even though the people who inhabit reality should. So when we construct Batman's world, we need to modify our representation to delete this real-world fact from that representation. There is no reason to delete similar facts about other fictional characters, though, which explains why the fact "SpongeBob is a fictional character" still holds true for the people in Batman's world.

Does this principle capture how people actually decide what is true in a fictional world? Previous studies about people's intuitions about the content of imagined scenarios in the adult psychological literature have generally answered this question in the affirmative; people bring to bear their normal psychological tools and their expectations for how the real world operates to their understanding of imagined words[16]. Our first study[17] was designed to determine more specifically the degree to which this was the case.

This study presented adults with three stories that varied in their similarity to the real world: one in which no laws of reality were broken, one in which the main character had special powers but which was otherwise realistic, and one in which many laws of reality were broken. We then asked adults to judge whether a set of facts, all of which were true in the real world, were also true in the world described by the story. These facts fell into four categories: contingent (e.g., who the current President is), conventional (e.g., what people usually eat for dessert), scientific (e.g., which direction the sun travels across the sky), and mathematical (e.g., $2 + 2 = 4$).

Overall, across all types of stories and all types of facts, our participants judged that the real-world facts would remain true in the fictional world. When considered by story, our participants judged that most real-world facts remained true in the realistic story, and

[15] M. Ryan, 'Fiction, non-factuals, and the principle of minimal departure,' *Poetics*, **9** (1980), 403–422.

[16] For example, R. J. Gerrig, *Experiencing narrative worlds: On the psychological activities of reading* (New Haven, CT: Yale University Press, 1993); E. J. Marsh, M. L. Meade, & H. L. Roediger, 'Learning facts from fiction,' *Journal of Memory and Language*, **49** (2003), 519–536; D. A. Prentice, R. J. Gerrig, & D. S. Bailis, 'What readers bring to the processing of fictional texts,' *Psychonomic Bulletin & Review*, **4** (1997), 416–420.

[17] D. S. Weisberg & J. Goodstein, 'What belongs in a fictional world?' *Journal of Cognition and Culture*, **9** (2009), 69–78.

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the number of facts judged true in the story fell off linearly as the stories became less realistic. We found the same linear pattern when considering types of facts: Mathematical facts were the most likely to hold true across all three stories, followed by scientific, conventional, and contingent facts, in that order.

These results demonstrate that adults do not construct fictional stories out of whole cloth; facts that are true in reality also tend to hold true in stories. These results also demonstrate that adults have clear and consistent intuitions about aspects of story worlds that are not explicitly defined by a story's text, and indeed that are not even relevant to the events of the story. Further, these results suggest that the Principle of Minimal Departure, or similarly simple ways of capturing truth-in-fiction, does not tell the whole story. Although our participants did generally judge that real-world facts remained true in fiction, their likelihood of doing so was affected by how different the fictional world was from the real world. The sun still rises in the east and sets in the west, even in our most fantastical story, but this was seen as less likely to be the case in this story than in the wholly realistic one. Thus, any theory about truth-in-fiction should take into account something like story genre. Adults, at least, have some expectations about how stories work in general (e.g., worlds with some violations of real-world structure may contain others), and this knowledge combines with real-world facts to determine what holds true in any given fictional world. The same is true when it comes to thinking about the type of fact itself: Adults know that contingent facts are more variable than mathematical ones, for example. This means that the former are generally less likely to hold true in a story and more vulnerable to being deleted from a story world than the latter, even if no specific information is provided about either.[18]

Our next step was to ask where these intuitions come from. Do children behave like adults with respect to these issues, as they do with the reality/fantasy distinction? Are some aspects of their performance adult-like and some immature? Or are their intuitions at odds with those of adults, suggesting a longer and possibly more complicated developmental trajectory?

To answer these questions, my colleagues and I presented four-year-old children with a similar task to the adult one just described[19].

[18] I am grateful to Gregory Currie for his insightful discussion of these issues.

[19] D. S. Weisberg, D. M. Sobel, J. Goodstein & P. Bloom, 'Young children are reality-prone when thinking about stories,' *Journal of Cognition and Culture*, **13** (2013), 383–401.

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Although we had asked adults to use a scale to make an explicit judgment about the content of a story world, we anticipated that this kind of response would be difficult for our preschool-aged subjects, so we changed the design somewhat. Children in this study were presented with one of three types of story: a Realistic one, in which all of the events could possibly happen in reality, a Fantastical one, in which many laws that govern reality were broken, and a Letter, which presented the same text as the Realistic story but which was described as being an explicit reflection of something that had actually happened. The text of these stories presented the same sequence of events, but the way in which these events came about different by condition. For example, the main character decides to go to the ice cream store in both stories. In the Realistic story and the Letter, he walks to the store; in the Fantastical story, he teleports to the store.

Once we set up story world by reading the child a few pages, we pretended that the next page of the book (or letter) had fallen out and had gotten mixed up with pages from other books (or letters). We told the child that his or her job was to help us figure out which page came next in the story that we had been reading. Although not explicitly stated, the goal of this question is the same as the goal of the questions in the adult study: Given what has already happened in this story, what other sorts of events belong within this context? Children's choices were always between a possible event, which did not break any real-world laws, and an impossible event, which did. Once they chose an event, we thanked them without giving any positive or negative feedback and continued reading the story.

There were eight places over the course of the story where children were asked to choose which event should come next. We averaged these eight responses together to obtain an overall measure of how children in each condition responded. We also tested a group of adults in exactly the same procedure to provide a direct comparison for children's responses.

We found that children and adults did not differ in their responses to the Letter. Participants in both age groups judged that only possible events, not impossible ones, belonged in this context. This suggests that children understood the task of filling in the event sequence with appropriate events, lending credence to their behavior in the other two conditions. Here, performance differed markedly between the adults and the children. As would be expected from their behavior in the previous study, adults tended to choose the possible pictures to continue the Realistic story and the impossible pictures to continue the Fantastical story. This demonstrates their

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understanding that the two stories set up different types of worlds in which different events are more or less likely to happen.

Children, on the other hand, tended to choose the possible pictures to continue both types of story. Although this tendency makes a certain amount of sense for the Realistic story, it is somewhat puzzling in the case of the Fantastical story. There are already a good number of impossible events taking place in this story, so why should children have trouble putting additional impossible events into this context? One possibility was that they simply didn't see the impossible events in the Fantastical story as being impossible. This seemed unlikely, since we chose the impossible events to make up the Fantastical story based on previous studies in which children have judged precisely these types of events as "make-believe." Nevertheless, we explored this option by using video clips rather than picture books to present the story, reasoning that children may be better able to perceive the fantastical nature of the story if it was presented in a more visually salient way. Results from the video study confirmed those from the storybook study: Children preferred to include possible, not impossible, events in the videos when given the choice of how to continue the story.

A different possibility for this response tendency could be that children dislike the impossible events and want to avoid choosing them as a general principle, not because of anything in particular about the stories. To test this, we recruited separate groups of children to look just at the possible and impossible choice pictures from both the storybook and video studies. In the absence of any story context, we asked children to choose which of the two pictures they liked better. Children in these control conditions were split evenly between their choices of the possible and the impossible pictures. Importantly, children's level of choosing the impossible pictures in this task (about 50%) was significantly different from their level of choosing the impossible pictures in the course of the "complete the story" task (about 30%). This indicates that children do not have a general tendency to avoid the impossible pictures, hence that their tendency to choose the possible pictures in the "complete the story" task genuinely reflects something about the way that they view story worlds *per se*.

Even given this reassurance, it is still possible that children misunderstand some aspect of our test question. Consider that we are asking them to do a somewhat difficult task: They need to listen to a story, abstract away from the concrete features of the story to figure out what kind of world we are presenting (what might be called its genre), and then figure out which of the two choice options we are

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presenting fit most naturally within that abstract category. This is likely to be a difficult task for four-year-olds regardless of their beliefs about different kinds of stories. Can they perform this task at all, leaving aside the question of story worlds? To determine whether they can, we created a simplified set of impossible events and presented these to children in three different conditions. Children in the Story condition were told that the events formed a story, as in the previous study. Children in the Desire condition were told that they were all events that the experimenter particularly liked. Children in the Word condition were told that all of the events were "blickish" or another nonce word with an adjectival form. In all cases, children were asked to choose which of two additional pictures belonged in the story, or was one that the experimenter liked, or was also "blickish:" an impossible event or a possible event.

We designed the Desire and Word conditions to determine whether children could form an abstract category of the type that they needed to in order to solve the "complete the story" task. If children can learn a new word that described this category, for example, this would show that they possessed the prerequisite abilities to match impossible pictures to Fantastical stories, hence that their tendency not to do so in the "complete the story" task really reflects some aspect of how they think about stories and not any general cognitive limitation.

This is precisely what we found. Children in the Story condition tended to pick the possible event at test, as in our previous studies, but children in the Word condition tended to pick the impossible event. Children in the Desire condition were split evenly between the two events, possibly because they assumed that the experimenter's preferences would match their own preferences for a roughly equal number of impossible and possible events.

The important message from all of these studies is that children, unlike adults, would prefer stories to contain possible, non-rule-violating events, even when the story context could potentially permit events that are impossible. This does not seem to be due to a general preference for or against impossible events, nor is it due to a failure to understand the nature of the genre-matching task. Rather, at least in preschool, children seem to prefer to make the stories that they hear match reality as closely as possible.

Why should this be the case? One likely possibility is that this is a simple matter of immaturity: Children can interact with imagined worlds from early ages, but simply lack the creativity or motivation to venture too far from reality in these interactions. On this view, what happens over the course of development involves children

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becoming more willing or able to consider unrealistic events in their imagined scenarios – contrary to the popular view, which holds that young children are wildly imaginative and creative and lose this ability as they get older.

In a recent paper[20], we proposed a somewhat more refined version of this hypothesis, which speculates that the reason that children stick close to reality in their imagined endeavors is because they are still learning about how reality works. Because they are unsure about many aspects of the structure of reality, they prefer to rely on what they know. When they become secure enough in their real-world knowledge, they can begin to imaginatively explore possibilities in which this knowledge is violated. This view predicts, somewhat paradoxically, that it is those domains of knowledge that children hold more strongly and understand more deeply that are more likely to be counterfactualized in the context of a fantastical fictional story.

To test this hypothesis, we contrasted events from two domains: physics, which children understand very well from a very early age, and biology, a full understanding of which is still developing in the preschool years. As in previous studies, we created sets of possible and impossible events. In this case, the impossible events were impossible because they violated some principle either of physics (e.g., a character walks through a wall) or of biology (e.g., a character never needs to sleep). The possible events presented the realistic analogues to these events (e.g., a character walks through a door and needs to sleep when he's tired). Rather than creating stories and asking children to complete them, in this study we simply presented these pairs of possible and impossible events to preschoolers without prior context and asked them to choose which picture they would like to put in their story. There were six such choices, three in the physics domain and three in the biology domain.

We found, as in previous studies, that children's choices were primarily of possible rather than impossible events. This is an especially interesting tendency since this task presented no prior story context to match and no task other than to create a story of their own design. Even with such loose constraints, children still preferred to put realistic as opposed to fantastical events into their stories. But an examination of those events for which children did choose the impossible member of the pair confirms our hypothesis: Children were more likely to pick impossible physical events than impossible

[20] D. M. Sobel & D. S. Weisberg, 'Tell me a story: How children's developing domain knowledge affects their story construction,' *Journal of Cognition and Development* (in press).

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biological events. This suggests that children's overall attraction towards realistic events in stories is at least partially a result of their developing understanding of the real world. The more they know about some aspect of reality, the more comfortable they feel leaving it behind to explore alternative structures. This implies that our world-construction abilities develop in tandem with our knowledge of reality: The more we know, the more we can imagine.

The results of this series of studies have some interesting implications for the phenomenon of *imaginative resistance*, which occurs because there are some real-world facts that we can never leave behind when we construct imagined scenarios, either because we are unwilling or unable to do so[21]. Many theories of imaginative resistance have suggested that it occurs primarily for those facts that are central to the structure of reality or to our conceptions thereof, such as logical or moral facts. The results of the adult study I reviewed earlier[22] support this argument, since those subjects were more likely to retain mathematical facts even in the face of a fantastical fictional story. But the current developmental results paint a different picture. Four-year-old children were more willing to consider violations of physics-based events than violations of biology-based events, since their understanding of the latter is still tenuous at this age. This suggests that imaginative resistance may occur not only for those events that we see as structurally central to the real world, but also for those events about which we feel some kind of uncertainty.

The fact that imaginative resistance occurs for two contrasting categories of facts in turn suggests that there may be two different mechanisms driving this phenomenon. When we experience imaginative resistance to facts that we see as central to reality, this may occur because of a genuine inability to imagine a world in which these facts are different. But when we experience imaginative resistance to facts about which we are uncertain, this may occur because of reluctance to step too far outside of the boundaries of our current, and weak, knowledge. In turn, this analysis suggests that the "cure"

[21] See T. S. Gendler, 'The puzzle of imaginative resistance,' *Journal of Philosophy*, **97** (2000), 285–299; T. S. Gender, 'Imaginative resistance revisited' and J. Weinberg & A. Meskin, 'Puzzling over the imagination: Philosophical problems, architectural solutions,' in S. Nichols (ed.), *The architecture of the imagination: New essays on pretense, possibility and fiction* (Oxford: Oxford University Press, 2006).

[22] D. S. Weisberg & J. Goodstein, 'What belongs in a fictional world?' op. cit.

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for imaginative resistance should differ across these two cases. The former type may never subside or be overcome, whereas the latter should disappear with an increase in knowledge in that domain.

However, we should be careful not to take this last point too far, since increased knowledge can impose its own limits on our imaginative abilities. A series of studies have shown that adults tend to get stuck on the structure of reality even when they are trying to exercise their imaginative capacities[23]. For example, adults who were asked to draw alien creatures that were wildly different from Earth animals tended to preserve many of the key features of the real animals, such as bilateral symmetry[24]. So the idea that more knowledge leads to less imaginative resistance and more imaginative freedom is the start of the story, but not the whole story, and more work is needed to map this developmental trajectory in detail.

How do we think about improbable events?

The research discussed thus far has looked at issues of black-and-white distinctions, such as the difference between fiction and reality, or between events that are entirely ordinary and events that are impossible because they break some natural law. But there are also cases that involve somewhat more shades of gray, such as events that may be unfamiliar to children but not necessarily impossible. This category of *improbable* events provides an interesting arena in which we can use the "complete the story" procedure to probe children's understanding of the nuances of the reality/fantasy distinction.

Previous work suggests that young children have a poor understanding of improbable events[25]. As reviewed earlier, four-year-

[23] S. Brédart, T. B. Ward & P. Marczewski, 'Structured imagination of novel creatures' faces,' *American Journal of Psychology*, **111** (1998), 607–625; T. B. Ward, 'Structured imagination: The role of category structure in exemplar generation,' *Cognitive Psychology*, **27** (1994), 1–40; T. B. Ward & C. M. Sifonis, 'Task demands and generative thinking: What changes and what remains the same?' *Journal of Creative Behavior*, **31** (1997), 245–259.

[24] T. B. Ward, 'Structured imagination: The role of category structure in exemplar generation,' op. cit.

[25] A. Shtulman, 'The development of possibility judgment within and across domains,' *Cognitive Development*, **24** (2009), 293–309; A. Shtulman & S. Carey, 'Improbable or impossible? How children reason about the possibility of extraordinary events,' *Child Development*, **78** (2007), 1015–1032.

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olds can explicitly report that possible events are possible and that impossible events are impossible. However, they tend to mis-categorize improbable events as impossible. That is, children tend to see events that are unfamiliar or unusual as being in the same category as events that can't actually happen. We began our study of this issue by replicating this effect[26]. We created three sets of events: ordinary (e.g., Moe has a pet cat), improbable (e.g., Moe has a pet squirrel), and impossible (e.g., Moe has a pet dragon) and asked children to categorize them. As in previous work, children's judgments were accurate except for the improbable events, which they tended to say were impossible.

But we doubted that children really lack an understanding of this category. We suspected that their difficulty with the categorization task was a difficulty in explicitly reporting on the status of these events, not with understanding that they could potentially happen in reality. To test this hypothesis, we presented these same children with a version of our "complete the story" task. In this case, children saw stories made up entirely of events from the improbable set. Then, one group of children was given the choice to continue this story with another improbable event or an ordinary event. In this condition, children did not show a preference; either event was seen as an appropriate addition to the story. A second group of children was given the choice to continue the story with another improbable event or an impossible event. Here, children significantly preferred the improbable event. This behavior demonstrates that children do not believe that improbable events are impossible; if that were the case, they would have seen the two choice events in this condition as belonging to the same category and would have been unable to distinguish between them. So while an explicit understanding of improbability develops after the age of four years, children at this age can demonstrate their knowledge of the difference between improbable and impossible events within a helpful story-based context.

What role does the imagination play in development?

Thus far, this review has focused on two lines of work examining children's abilities to create and interact with imagined representations. Some aspects of these abilities develop early and remain relatively

[26] D. S. Weisberg & D. M. Sobel, 'Young children discriminate improbable from impossible events in fiction,' *Cognitive Development*, **27** (2012), 90–98.

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unchanged over the course of development: Even three-year-olds distinguish real from imagined representations and different imagined representations from each other. But other aspects of these abilities take longer to mature and undergo a good deal of developmental change: Four-year-olds, unlike adults, tend to construct realistic imagined worlds, possibly because they their knowledge of the real world is not yet secure enough to consider different kinds of counterfactuals.

Both of these aspects of children's imaginative capacities play an important role in development. As argued earlier, the imagination allows us not only to interact with fictional stories and pretend games, but also to create causal counterfactuals, future hypotheticals, and scientific thought experiments, among other types of representation. The ability to separate multiple imagined representations is at the heart of using these more "serious" imagined scenarios appropriately. Consider future planning: In order to decide whether to do X or Y, one needs to imaginatively work through the consequences of doing X and the consequences of doing Y. But when making this decision, one must be able to represent these two possible futures as separate from each other, so that the two sets of consequences do not bleed into each other[27].

Many have argued that this is the basic purpose that our imaginative capacities serve: evaluating past and future counterfactuals[28]. These counterfactuals are used in planning, as in the example above, and also in learning, as we evaluate possible ways that the world could be. Our default tendency to be "stuck on reality" when imagining fictional worlds makes a good deal of sense, considered within this framework. In order to learn from an imagined scenario or to use one (or more) in planning, these scenarios must be appropriately similar to reality. This will allow the conclusions that we draw

[27] See D. S. Weisberg & A. Gopnik, 'Pretense, counterfactuals, and Bayesian causal models: Why what is not real really matters,' op. cit.

[28] For example, R. M. J. Byrne, *The rational imagination: How people create alternatives to reality* (Cambridge, MA: MIT Press, 2005); A. Gopnik, *The philosophical baby: What children's minds tell us about truth, love, and the meaning of life* (New York: Farrar, Straus, and Giroux, 2009); C. Hoerl, T. McCormack & S. R. Beck, *Understanding counterfactuals, understanding causation* (Oxford, UK: Oxford University Press, 2011); M. Seligman, P. Railton, R. Baumeister, & C. Sripada, 'Navigating into the future or driven by the past,' *Perspectives on Psychological Science*, **8** (2013), 119–141; D. S. Weisberg, 'The vital importance of imagination' in M. Brockman (ed.), *What's next? Dispatches on the future of science* (New York: Vintage Books, 2009).

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within the context of an imagined world to transfer appropriately to the real world. To put the same point the other way around, if our imagined scenarios were too different from reality, we would be easily drawn into imagining unrealistic or unlikely scenarios that would then not be helpful in navigating reality.

This argument provides additional insight into the issue of imaginative resistance. If we accept that imagination is crucial to planning, then a bias to stick closely to reality in our imagined representations is a feature, not a bug, of the planning system. Because engaging with fictional worlds is tied up with our ability to create representations that will be useful in visualizing our own futures, our inability (or unwillingness) to consider extremely far-fetched possibilities keeps the process of making plans appropriately realistic, and hence appropriately useful.

From our examination of the development of these two aspects of imaginative cognition, then, we can already begin to see some of the important features of the adult imaginative system. We have also learned that some of these features, like the ability to distinguish among representations, seem to be basic properties of this system. Others, like the ability or willingness to imagine unrealistic scenarios, develop later, although even this fact gives us some insight into the basic cognitive problems that our imaginative capacities allow us to solve. Taking developmental psychology seriously can thus help to advance the study of some aspects of philosophical study of aesthetics. More broadly, engaging philosophers, psychologists, anthropologists, and others in dialogue about these issues in the best tradition of cognitive science can lead to a deeper understanding of how and why our aesthetic capacities work.

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