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Children's understanding of physical possibility constrains their belief in Santa Claus



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ABSTRACT

What role does children's understanding of physical possibility play in their acceptance of adults' testimony about Santa? This question was addressed by comparing children's ability to differentiate events that do and do not violate physical laws to their skepticism toward Santa. Children aged 3–9 ($n = 47$) were asked (a) to generate information-seeking questions for Santa in a letter-writing task, (b) to explain how Santa accomplishes some of the feats he is purported to accomplish, and (c) to assess the possibility of various physically extraordinary events (unrelated to Santa), some possible and some impossible. Children who were better at differentiating possible events from impossible events had also begun to engage with the mythology surrounding Santa at a conceptual level, questioning the feasibility of Santa's extraordinary activities while also positing provisional explanations for those activities in the absence of a known answer. These findings suggest that children's acceptance of testimony about Santa – and possibly other forms of counterintuitive testimony – depends not only on the testimony they receive but also on the child's own understanding of physical possibility.

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1. Introduction

Much of what we know about the world comes from the testimony of others. Few adults have dissected a human body or performed astronomical calculations, yet most still know that the liver is

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in the abdomen and that the Earth orbits the sun. One of the prerequisites of learning from testimony is that we must trust what others tell us, but such trust need not be blind. There are many strategies one could use for discriminating trustworthy informants from untrustworthy ones, and children seem to adopt these strategies prior to formal schooling, preferring informants who are knowledgeable (Birch, Vauthier, & Bloom, 2008), familiar (Corriveau & Harris, 2009), consistent (Pasquini, Corriveau, Koenig, & Harris, 2007), and moral (Doebel & Koenig, 2013).

To date, research on how children learn from testimony has focused on children's evaluation of the source of novel testimony (Mills, 2013), yet their evaluation of the content of that testimony is just as important. Informants who are generally trustworthy may occasionally impart false information, and informants who are generally untrustworthy may occasionally impart true information. Testimony about Santa Claus is a prime example. Children receive this testimony from individuals who, by most measures, are trustworthy (e.g., parents, relatives, mentors), yet that testimony is not only false; it's highly implausible. Santa is purported to engage in activities that violate physical principles known even to infants, at least on an implicit level (Baillargeon, 2004; Spelke, 1990). For instance, Santa violates our expectations about spatiotemporal continuity by visiting all the world's children in a single night; he violates expectations about containment by entering children's houses through their narrow chimneys; and he violates expectations about support by flying through the air on a wooden sleigh. Despite these causal violations, young children believe in Santa more strongly than they believe in any other fantasy character (Sharon & Woolley, 2004), and they typically retain that belief until age 8 or 9 (Blair, McKee, & Jernigan, 1980; Prentice, Manosevitz, & Hubbs, 1978). Why do children so readily trust testimony that contradicts many of their most deeply entrenched causal expectations?

One possibility is that the testimony itself is sufficiently consistent across different informants. Parents, relatives, and mentors all seem to agree that Santa is real, and children may thus privilege the consistency of that testimony over any personal doubts to the contrary. Only when the testimony becomes mixed do children begin to waver in their belief. As Harris, Pasquini, Duke, Asscher, and Pons (2006) state in the following passage, "Admittedly, children's belief in Santa Claus . . . involves a mistake about reality, but the primary source of that mistake is almost certainly the testimony that children hear rather than some autonomous inclination to live in a fantasy world. . . . When older children abandon their belief in a particular special being it is probably not attributable to any change in their fantasy disposition or to a cognitive developmental advance but rather to a shift in the pattern of testimony that they receive." (p. 94). On this view, children's belief in Santa comes and goes with the ebb and flow of testimony about Santa, regardless, perhaps, of the child's conceptual understanding of that testimony.

Support for this view comes from research documenting direct correlations between children's belief in fantasy characters and the cultural support they receive for those beliefs. Children whose parents explicitly endorse the existence of Santa Claus and other event-related fantasy characters (i.e., the Easter Bunny and the Tooth Fairy) are more likely to believe in those characters than children whose parents do not (Prentice et al., 1978; Rosengren, Kalish, Hickling, & Gelman, 1994). Likewise, children whose parents engage in behaviors that presuppose the existence of a fantasy character – e.g., creating evidence that the character visited their house – are more likely to believe in those characters than children whose parents do not (Woolley, Boerger, & Markman, 2004; Boerger, Tullos, & Woolley, 2009). And children whose parents do not endorse the existence of Santa may still believe in Santa if exposed to cultural support for that belief outside the household, as documented among U.S. children raised in Jewish households (Prentice & Gordon, 1987) and in fundamentalist Christian households (Clark, 1998).

While these findings support the claim that belief in Santa is culturally prescribed, they do not necessarily indicate that *disbelief* in Santa is as well. Indeed, the claim that children stop believing in Santa because the testimony they receive about Santa changes with age has at least two problematic implications. First, insofar that testimony about Santa comes from many different informants, it implies that all such informants collectively tailor their testimony to children of different ages, a seemingly implausible feat of coordination. Second, it implies that children never become skeptical of the Santa myth on their own and would continue to believe in Santa indefinitely if never persuaded otherwise. While there are no prospective studies of the factors that induce disbelief in Santa (to our knowledge), retrospective studies suggest that it is skepticism, not testimony, that plays the major

role. That is, when older children are asked how they discovered that Santa was not real, few claim that they were explicitly told so by others; rather, most claim that they discovered the truth on their own (Anderson & Prentice, 1994).

These considerations motivate a different account of the Santa phenomenon: children surely come to believe in Santa for reasons of testimony – they do not spontaneously invent the myth on their own – but they come to doubt Santa's existence not for reasons of testimony again but for reasons of *intellect*. That is, children come to doubt Santa's existence because they become increasingly attentive to the physical constraints that make Santa's existence impossible. One point in favor of this account is that at the same time that children begin to lose their belief in Santa, between the ages of 6 and 8 (Prentice et al., 1978), they are also gaining a more sophisticated understanding of physical possibility, learning to better differentiate what is possible in the real world from what is not (Shtulman & Carey, 2007; Shtulman, 2009; Weisberg & Sobel, 2012).

As early as age 3, children are able to distinguish ordinary events, like moving a marble with one's hand, from impossible events, like moving a marble with one's mind (Johnson & Harris, 1994; Rosengren et al., 1994), but they are unable to make the more subtle distinction between *improbable* events and impossible events until age 8 or later. That is, children younger than 8 typically judge improbable events, like eating pickle-flavored ice cream or finding an alligator under the bed, as impossible, failing to differentiate violations of empirical regularities (e.g., ice cream is sweet, alligators live in swamps) from violations of physical laws (e.g., objects cannot pass through other objects, objects fall when unsupported). To be clear, children of all ages judge events that violate physical laws as impossible, but their judgments appear to be based on superficial expectations about what typically occurs in the world rather than a more principled analysis of the event's underlying causal structure. Without such an analysis, children are bound to mistake improbable events for impossible events and unfamiliar entities for unreal entities (Woolley & Ghossainy, 2013).

These findings suggest that older children's disbelief in Santa may be a byproduct of their developing awareness of, and attentiveness to, the physical principles that Santa violates in the course of his extraordinary activities. Testimony about Santa's activities may strike even young children as incredible, given how skeptical they are toward the possibility of unfamiliar entities and events (Woolley & Ghossainy, 2013), but young children are not in a position to question that testimony *at a conceptual level* in the same way that older children are. In other words, young children may not possess the conceptual resources needed to question the extraordinary claims of a trusted authority (or set of authorities), let alone the intellectual motivation to do so. Baxter and Sabbagh (2003) provide some suggestive evidence supporting this idea. They asked parents of 2–7-year-olds to record the questions their children asked about Santa during the month of December. While children of all ages asked approximately the same number of questions, indicating seemingly equal levels of curiosity, the nature of those questions changed with age: younger children typically asked questions about Santa's ordinary, human-like properties (e.g., "Where does Santa live?"), whereas older children typically asked questions about Santa's extraordinary, nonhuman-like properties (e.g., "How can Santa Claus get around to all the houses in one night?").

1.1. A preliminary study

We sought to replicate Baxter and Sabbagh's findings (2003) using a publicly available archive of emails sent to Santa at <http://emailsanta.com>. Anyone who sends an email to Santa through this website is asked to provide their age, name, and location, and a random selection of such emails (screened for appropriateness of content) can be accessed on a separate page. From this website, we downloaded 392 emails sent by children aged 4–9 and retained for analysis only those emails that included an information-seeking question ($n = 45$). The questions were then coded for whether they were *factual* or *conceptual* in nature. Factual questions sought additional information about the "mundane" aspects of Santa's existence, like his location or his appearance. Examples include, "Did you get a new reindeer named Olive?" and "How tall is the North Pole?" Conceptual questions, on the other hand, sought information specifically about the physical constraints that Santa is purported to violate. Examples include, "How do you fit through a chimney?" and "How do you know I'm being bad?" The

essential difference between conceptual and factual questions is that the conceptual questions were requests for explanations whereas the factual questions were requests for details.

Two coders independently classified all 45 questions as either factual or conceptual, and agreement between them was 89%. Disagreements were resolved through discussion. In total, 30 questions were coded as factual and 15 were coded as conceptual. Consistent with [Baxter and Sabbagh's \(2003\)](#) findings, frequency of conceptual questions increased with age. Whereas only three of the 19 emails sent by 4–6-year-olds were conceptual, 12 of the 26 emails sent by 7–9-year-olds were conceptual. A chi-square analysis revealed a statistically reliable association between age and frequency of conceptual questions, $\chi^2(1, n = 45) = 4.56, p < 0.05$, indicating that older children requested more explanations for Santa's extraordinary activities than younger children.

1.2. Overview of the main study

These preliminary findings suggest that children become more skeptical of Santa's extraordinary activities with age. However, perhaps children who choose to send emails to Santa are more inquisitive than those who do not, and perhaps parents who encourage their children to send emails to Santa are more supportive of the Santa myth than those who do not. Moreover, the role that parents played in composing the questions, the accuracy of the age information included in the emails, and the criteria used to select emails deemed appropriate for public viewing are all unknown. We thus undertook a more controlled investigation of the changing nature of children's interpretation of the Santa myth. Specifically, we asked children between the ages of 3 and 9 to (a) generate five information-seeking questions for Santa and (b) explain how Santa performs five of the physically extraordinary feats he is purported to perform. We then analyzed those responses in terms of the children's understanding of physical possibility, as measured by their ability to differentiate improbable events from impossible events ([Shtulman & Carey, 2007](#)). Our hypothesis was that, as children demonstrated a more sophisticated understanding of physical possibility, they would not only generate more conceptual questions for Santa, but would also posit provisional explanations for Santa's extraordinary activities in the absence of a known explanation.

2. Method

2.1. Participants

Participants were 47 children (mean age 6.4 years; range 3.8–9.8) recruited from local daycares ($n = 23$) and elementary schools ($n = 24$) in southern California and tested on site. Children of this age could be expected to believe in Santa (all reportedly did) but still vary in their reasoning about physical possibility. Participants came from low- to middle-income households, and their ethnicities were representative of the region as a whole (40% Latino, 30% White, 24% Asian, 6% other). Approximately half were female.

2.2. Procedure

Participants completed three tasks: (1) writing a letter to Santa, (2) answering questions about Santa, and (3) assessing the physical possibility of extraordinary events (unrelated to Santa). Participants completed the tasks in this order to ensure that responses to the two Santa-related tasks were not influenced by their responses to the possibility-judgment task. While the reverse may have occurred – that is, children's responses to the Santa-related tasks may have influenced their responses to the possibility-judgment task – previous research has found that children's possibility judgments are largely impervious to priming ([Amsel, Clark, & Allen, 2013](#); [Opitz, 2013](#); [Shtulman & Carey, 2007](#)).

Prior to the main tasks, children were asked two preliminary questions: (1) Who is Santa Claus? and (2) Where does Santa Claus live? These questions were used to assess whether children were familiar with the Santa myth and whether they seemed to believe that myth. We did not ask any direct questions about belief due to concerns from school administrators that asking such a question would raise the possibility of Santa *not* existing. Three 4-year-olds claimed not to know who Santa

was, so they were administered only the possibility judgment task and their data are not reported below. All other children ($n = 47$) provided responses that suggested not only that they knew who Santa was but also that they believed in his existence (e.g., “Santa is an old man in a red suit who brings me presents at Christmas”).

2.2.1. Questions for Santa

In the first task, participants were told that the experimenter was writing a letter to Santa and that she needed their help coming up with questions to ask him. The experimenter explained that, because it was summer, Santa was not yet ready to take requests for toys and that their questions should be requests for information instead. When children generated a request for toys, they were reminded of this stipulation and asked to formulate a different question, perhaps a question about Santa’s elves, his reindeer, or the North Pole—suggestions provided to the children in that order. An unexpectedly large proportion of children, 19 of 47, were unable (or unwilling) to generate any information-seeking questions for Santa even after three reminders. These children (mean age 5.3) were moved directly to the second task. The remaining 28 children (mean age 7.2) were encouraged to generate a total of five information-seeking questions.

It is not clear why the task of generating information-seeking questions proved so difficult for the youngest children, particularly in light of evidence that children of this age are fairly adept at seeking task-appropriate information from context-appropriate informants (Chouinard, 2007; Mills, Legare, Bills, & Mejias, 2010). Some possible explanations are (a) that children were asked to generate questions for an informant who was not physically present, (b) that children were asked to seek information in the absence of an immediate, concrete goal for which that information might be relevant, and (c) that children were asked to seek information about an event (Christmas) that was not particularly salient at the time of testing (July). Under these conditions, only older children reliably generated information-seeking questions, a trend also observed in the preliminary study described above. That is, 8–9-year-olds emailed more than twice as many information-seeking questions to Santa than 4–5-year-olds, though the mode of communication is surely partly responsible for that trend.

As in the preliminary study, children’s questions were coded as factual or conceptual depending on whether they presupposed the truth of the Santa myth and merely sought additional clarification (a factual question) or challenged the conceptual underpinnings of the myth altogether (a conceptual question). Questions coded as factual included, “Is the North Pole cold?”, “What are your elves’ names?”, and “What do your reindeer do during the summer?”. Questions coded as conceptual included, “How do you fit inside a chimney?”, “How do you make your sled fly?”, and “How can you see everyone in the whole wide world?”. As can be seen from these examples, use of the term “how” was a fairly reliable indicator of whether the question was conceptual; 74% of questions beginning with “how” were coded as conceptual, whereas only 13% of questions beginning with a different term were coded as conceptual (e.g., “When you travel around the world, do you really give gifts to everyone?”). Nevertheless, all questions were coded in terms of content, not just form. Critically, conceptual questions were requests for explanations, such that the type of information that would constitute a reasonable answer was not pre-specified by the question itself. As in the preliminary study, all questions were classified as either factual or conceptual by two independent coders. Overall agreement was 94%, and disagreements were resolved through discussion.

2.2.2. Questions about Santa

In the second task, participants were asked whether they believed that Santa engages in five particular activities, and, if so, how. Participants were told, “I heard that Santa [does X]” and then asked, “Do you think that’s true?” If they agreed that it was, they were then asked, “How do you think he [does X]?” The five activities were (1) traveling around the world in a single night, (2) knowing whether every child has been naughty or nice, (3) making all Christmas toys in a single factory, (4) flying in a reindeer-drawn sleigh, and (5) entering houses through their chimneys.

Participants’ explanations were coded for evidence of a causal, or quasi-causal, mechanism. Clearly, the activities defy explanation, but we sought to assess whether children viewed the activities as potentially *explainable*, even if they were unsure of the correct explanation. Thus, explanations coded

as causal included. “He makes multiple trips” (an explanation for how Santa travels around the world in a single night); “He has cameras all around the world” (an explanation for how Santa knows whether every child has been naughty or nice); “He has millions of elves who help him make the toys” (an explanation for how Santa makes all Christmas toys in a single factory); “The reindeers are attached to yarn” (an explanation for how Santa’s reindeer fly); and “He takes off his jacket” (an explanation for how Santa fits down the chimneys of the houses he visits). Explanations *not* coded as causal were those that merely reiterated the activity to be explained (e.g., “the reindeers fly”), those that cited irrelevant information (e.g., “some apartments don’t have chimneys”), and those that appealed only to magic without hinting at any other possible mechanism (e.g., “he does that by magic”). Explicit appeals to ignorance (e.g., “I don’t know, you have to tell me”) were also coded as non-causal. All responses to the activity-explanation task and the justification portion of the possibility-judgment task (described below) were coded by two independent coders; inter-coder agreement was 86%.

2.2.3. *Judgments of physical possibility*

In the final task, participants were told of 10 physically extraordinary events and asked whether they thought each could occur in real life. Five events violated physical laws and should thus have been judged impossible; the other five violated empirical regularities, but not any physical laws, and should thus have been judged possible. Impossible events were walking through a wall, walking on water, turning applesauce into an apple, traveling back in time, and eating lightning for dinner. The possible, yet improbable, events were growing a beard to one’s toes, eating pickle-flavored ice cream, drinking onion juice, painting polka dots on an airplane, and finding an alligator under the bed. These events, which were adapted from Shtulman and Carey (2007), were intermixed and presented in a random order. For each event children were asked, “Have you ever seen someone [do X]?” If they claimed they had not, they were then asked, “Could a person [do X] in real life?” And if they denied that a person could do so in real life, they were asked, “Why couldn’t a person [do X] in real life?”

Responses to the final question were coded for evidence of a causal mechanism, similar to responses from the previous task. That is, children’s justifications for why an event was impossible were coded for evidence of a physical constraint or physical principle that would preclude that event from occurring. For instance, when considering the event of walking on water, children who claimed that “people are heavier than water, so they will fall down” or “water can be easily broken; it’s not a solid” were coded as having provided a causal explanation. Children who merely reiterated the event (e.g., “because it’s water”) or who mentioned alternative events that could happen in place of the target event (e.g., “you can swim, but you cannot walk”) were not coded as having provided a causal explanation, as they failed to isolate the particular principle at issue.

3. Results

Given that our main hypothesis was that children’s reasoning about Santa becomes more skeptical as their understanding of physical possibility becomes more sophisticated, we review children’s possibility judgments first and then analyze their responses to the Santa-related tasks in terms of those judgments.

3.1. *Judgments of physical possibility*

Consistent with prior research (Shtulman & Carey, 2007; Shtulman, 2009), children’s possibility judgments for the improbable events, as displayed in Table 1, were significantly correlated with their age in months, $r(45) = 0.52, p < 0.001$. That is, younger children tended to deny the possibility of improbable events, whereas older children tended to affirm the possibility of those same events. There was no correlation, however, between children’s judgments for the impossible events and their age in months, $r(45) = 0.06, ns$, as all children tended to deny the possibility of those events. While children did tend to judge one of the impossible events as possible (out of five), there was no particular impossible event that children consistently misclassified.

Also consistent with prior research, there was a significant correlation between judging improbable events possible and providing causal explanations for why the impossible events could not occur,

Table 1

Mean number of improbable and impossible events judged possible (out of five) by children of different ages; standard deviations are in parentheses.

Age	<i>n</i>	Improbable events	Impossible events
3–4 Years	16	2.0 (1.5)	0.9 (1.2)
5–7 Years	16	3.0 (1.7)	0.6 (0.6)
8–9 Years	15	3.9 (1.1)	1.2 (0.7)

$r(45) = 0.35, p < 0.05$. Children who correctly affirmed the possibility of improbable events, like drinking onion juice or finding an alligator under the bed, were also more likely to pinpoint the actual physical principles that would preclude the occurrence of impossible events, like walking through a wall (e.g., “a wall is a solid”) or eating lightning for dinner (e.g., “it has electricity so you can’t digest it”). In other words, children’s ability to provide causal explanations for their possibility judgments tracked their ability to differentiate events that are genuinely impossible from those that are merely improbable.

Thus, as expected, children in the current study varied substantially in their understanding of physical possibility, with some denying the possibility of any event that appeared odd or unusual and others denying the possibility of only those events that adults would agree are impossible. While the former appeared to conflate notions of probability and possibility, the latter showed evidence of differentiating them, both in their judgments and their justifications. To assess how children’s understanding of physical possibility was related to their belief in Santa, we calculated a *possibility judgment score* for each child by subtracting the number of impossible events judged possible from the number of improbable events judged possible. Theoretically, these scores could range from -5 to $+5$, but no child judged more impossible events possible than improbable events possible. Rather, the actual scores ranged from 0 to 5, with 0 indicating no differentiation between improbable and impossible events, and 5 indicating a perfect differentiation. The mean score was 2.1, and the modal score was 3. Only one child earned a score of 5, and that child was included with the group that earned 4’s in Figs. 1 and 2.

3.2. Questions for Santa

The 28 children who did the letter-writing task generated a total of 133 questions for Santa; 59% were coded as factual and 41% as conceptual. These data are displayed in Fig. 2 as a function of children’s possibility judgment scores. Possibility judgment scores were significantly correlated with the number of conceptual questions generated, $r(45) = 0.34, p < 0.05$, but were not significantly correlated with the number of factual questions generated, $r(45) = 0.11, ns$. The correlation between possibility judgment scores and conceptual questions remained significant even after excluding the 19 participants who failed to generate any information-seeking questions at all, $r(26) = 0.38, p < 0.05$. This correlation did not remain significant, however, after controlling for children’s age in months, $r(45) = 0.06, ns$, as

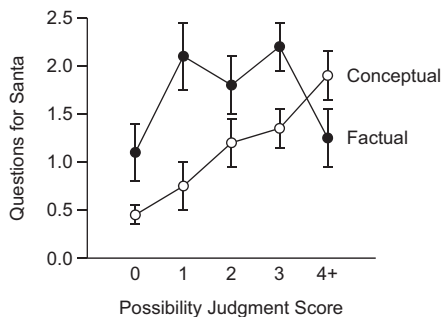


Fig. 1. The mean number of factual and conceptual questions that children generated for Santa as a function of their possibility judgment scores.

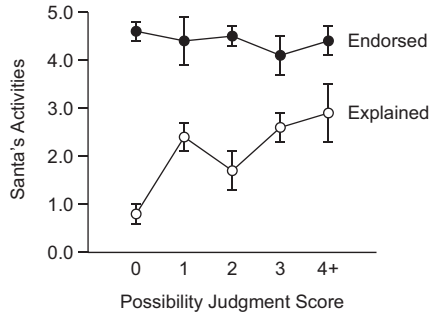


Fig. 2. The mean number of Santa's activities that children (a) endorsed as real and (b) explained via a quasi-causal mechanism as a function of their possibility judgment scores.

the zero-order correlation between conceptual questions and age was stronger than the zero-order correlation between conceptual questions and possibility judgment scores, $r(45) = 0.59$ vs. $r(45) = 0.34$. Nevertheless, these results suggest that older children, who are typically more sophisticated than younger children in their understanding of physical possibility, are also seemingly more curious about the conceptual mysteries (and inconsistencies) in the mythology surrounding Santa.

3.3. Questions about Santa

In the second Santa-related task, children were asked whether they endorsed the claim that Santa engages in five extraordinary activities. Children's endorsements were uniformly high: 83% agreed that Santa travels around the world in a single night, 94% agreed that Santa knows whether every child has been naughty or nice, 87% agreed that Santa makes all Christmas toys in a single factory, 96% agreed that Santa flies in a reindeer-drawn sleigh, and 87% agreed that Santa enters houses through their chimneys. These findings are consistent with Boerger (2011) findings that children between 4 and 9 clearly recognize that Santa has extraordinary (non-human) properties, yet strongly endorse Santa's existence.

On average, children endorsed 4.4 out of the 5 activities; endorsements were not correlated with their age in months, $r(45) = -0.17$, *ns*, or with their possibility judgment scores, $r(45) = -0.11$, *ns*. Only two children endorsed fewer than three activities, but these children did not seem to deny Santa's existence. Rather, they merely questioned certain aspects of the Santa myth (e.g., whether Santa uses an actual sleigh to deliver presents).

For every activity endorsed, children were asked to explain how Santa might perform that activity. A total of 40% of those explanations were coded as causal (or quasi-causal); the remaining responses either reiterated the activity without providing an explanation (25%), referenced only magic (14%), referenced only irrelevant information (10%), or were admissions of ignorance (11%). The question that elicited causal explanations from the greatest number of children (24 of 47) was how Santa makes all Christmas toys in a single factory; the question that elicited causal explanations from the fewest children (12 of 47) was how Santa flies in a reindeer-drawn sleigh.

The number of causal explanations that children provided (out of five) was correlated both with their age in months, $r(45) = 0.51$, $p < 0.001$, and with their possibility judgment score, $r(45) = 0.51$, $p < 0.001$. The latter correlation is illustrated in Fig. 2. Whereas all children tended to endorse the idea that Santa engages in physically extraordinary activities, only children with higher possibility judgment scores attempted to explain those activities. The correlation between possibility judgment score and number of activities explained remained significant even after controlling for children's age in months, $r(45) = 0.34$, $p < 0.05$, indicating that children's understanding of physical possibility independently predicted the degree to which they posited explanations for Santa's activities.

Of course, children's explanations did not cite causal mechanisms sufficient to explain the target activities because those activities are not physically possible. Whether children were aware of

this fact is unclear, as we did not assess children's confidence in their explanations. Still, at least one finding suggests that children may have recognized the tentative nature of their explanations: children who provided more causal explanations in the activity-explanation task also generated more conceptual questions for Santa in the earlier letter-writing task, $r(45)=0.51$, $p<0.001$. This correlation remained significant even after controlling for children's age, $r(45)=0.30$, $p<0.05$. Thus, children who spontaneously exhibited conceptual curiosity about Santa's extraordinary activities (when given the open-ended prompt to generate questions) also tended to posit their own explanations for those activities when pressed for one later.

4. Discussion

All children in the present study claimed to believe in Santa and his extraordinary activities, but not all children reasoned about Santa in the same way. Those who were better at differentiating possible events from impossible events had also begun to engage with the mythology surrounding Santa at a conceptual level, questioning the feasibility of Santa's extraordinary activities while also positing provisional explanations for those activities in the absence of a known answer. While older children were more likely to exhibit conceptual curiosity about Santa than younger children, age itself was not the (only) driving factor; children's understanding of physical possibility was a significant predictor of children's ability to generate explanations for Santa's extraordinary activities independent of age.

These findings suggest that children's acceptance of the Santa myth may depend on more than just the nature of the testimony they receive; it may also depend on children's own conceptual abilities. While few would deny that children are exposed to more complex, and perhaps more honest, forms of testimony as they age, the testimony itself may not be sufficient to explain concurrent changes in belief. Children's interpretation and evaluation of that testimony appears to play an important role as well. To be clear, these findings do not suggest that children come to believe in Santa because they are gullible or fantasy-prone, but they do suggest that some children may stop believing in Santa because they reach a level of conceptual understanding at which the Santa myth no longer appears credible, regardless, perhaps, of the testimony they continue to receive in support of the myth. As a case in point, a friend of one of the authors had wholeheartedly encouraged her son to believe in Santa and had assumed that he did until she came upon a piece of wrapping paper with the following note scrawled on the back: "If Santa uses this paper, Mom is Santa!" Incidents of this nature may not be all that uncommon if children's skepticism toward Santa arises from within as often as it is induced from without.

That said, a major caveat of the current study is that we did not measure skepticism per se, but rather curiosity (in the letter-writing task) and inventiveness (in the activity-explanation task). Measuring skepticism was not a viable option, given ethical concerns on behalf of parents and educators about the unintended consequences of such measurement; curiosity and inventiveness were thus measured in its place. Directing a pointed, conceptual question to Santa would seem to constitute at least an indirect form of skepticism, and, consistent with prior studies charting the decline of belief in Santa (Blair et al., 1980; Prentice et al., 1978), children who directed the most such questions to Santa were typically at the cusp of no longer believing in Santa. Still, future research should assess skepticism directly (as in Harris et al., 2006, or Sharon & Woolley, 2004), possibly tracking the same children longitudinally across the transition from belief to disbelief. If children's understanding of physical possibility does play a causal role in their eventual rejection of the Santa myth, then children who are on the verge of rejecting the Santa myth should be identifiable as such prior to actually doing so.

Another limitation of the present study is that we did not assess whether or how changes in the testimony children receive about Santa coincides with changes in their understanding of physical possibility. It is possible, for instance, that becoming aware of the physical impossibilities inherent in the Santa myth is necessary for inducing skepticism toward Santa but not sufficient for doing so; changes in testimony may be needed as well. Indeed, these two factors may play a synergistic role in inducing skepticism, as indicated by Rosengren and Hickling (1994) finding that parents claim to alter how they respond to questions about Santa, moving from direct, affirmative responses to more evasive responses as their children grow older. The nature of this interaction could be explored directly

by assessing the relation between children's understanding of physical possibility and their belief in Santa across communities with demonstrable differences in the consistency of their Santa-related testimony (e.g., Jewish communities vs. Christian communities). If consistent testimony in support of the Santa myth effectively blocks children's conceptual curiosity on the matter, then children who receive consistent testimony should grow skeptical of Santa later than children who receive inconsistent testimony, even after controlling for differences in their overall understanding of physical possibility.

At least one study suggests that this is not the case. [Anderson and Prentice \(1994\)](#) interviewed 9–12-year-olds who had stopped believing in Santa only a few years earlier and compared the age at which they stopped believing to the strength with which the Santa myth was endorsed in their household (as assessed by separate interviews of the children's parents). Although a modest correlation was found between children's age of disbelief and their parents' overall attitude toward Santa, no correlations were found between age of disbelief and the number of Santa-related beliefs that parents reported having verbalized (e.g., that Santa comes to the house at Christmas, that Santa's sleigh is pulled by reindeer) or between age of disbelief and the number of Santa-related behaviors that parents reported having initiated (e.g., hanging stockings for Santa to fill, leaving food for Santa to eat). Apparently, parents who actively encouraged their children to believe in Santa were no more effective at maintaining that outcome than parents who only moderately encouraged such a belief.

Of course, [Anderson and Prentice's \(1994\)](#) findings do not preclude the possibility that testimony from informants other than children's parents plays a major role in inducing disbelief. They also do not preclude the possibility that testimony holds different weight for different children. While some children might stop believing in Santa because they were told that Santa does not exist by a trustworthy informant (adult or peer), and other children might stop believing because they come to find the myth conceptually implausible, most children likely stop believing due to some combination of the two factors. How testimony about Santa shapes, and is shaped by, children's developing appreciation of the physical limitations on Santa's activities is a topic ripe for future research.

Our findings shed light on the emergence and decline of a characteristically "childish" belief – belief in Santa – but they also point to two broader conclusions regarding the relation between testimony and belief. First, children's learning from testimony is dependent not only on the characteristics of the informant conveying that testimony but also on the content of the testimony being conveyed. Recent research on how children learn from testimony has typically avoided the issue of content altogether, using the endorsement of novel object labels ([Koenig, Clément, & Harris, 2004](#)) or novel object functions ([Scofield, Gilpin, Pierucci, & Morgan, 2013](#)) as a measure of whom children deem trustworthy. Lessons learned from this "selective trust" paradigm will likely need modification if the issue of content is taken into consideration. Indeed, this paradigm stands in sharp contrast to an older research tradition, beginning with [Vygotsky \(1978\)](#) and extending in recent years to [Cole \(1996\)](#) and [Rogoff \(2003\)](#), which has explored the dynamics of cultural transmission from a content-specific perspective. Much of this work, however, has presupposed that the informants driving the process of cultural transmission are trustworthy, or at least viewed as trustworthy by children. In fact, the informants most typically studied in content-specific paradigms are the children's own parents ([Callanan & Oakes, 1992](#); [Gleason & Schauble, 1999](#)). Both lines of research – research on selective trust and research on cultural transmission – could profit from an integration of their methodologies.

Second, research on children's understanding of the fantasy-reality distinction has typically been devoted to identifying factors that lead to the acceptance of fantastical ideas, whether it be fantasy characters ([Woolley et al., 2004](#)), magical events ([Chandler and Lalonde, 1994](#)), or imaginary companions ([Taylor, Cartwright, & Carlson, 1993](#)); much less work has been devoted to identifying factors that lead to the *rejection* of such ideas. One's understanding of physical possibility may be such a factor, though other possible factors include evidential reasoning ([Chinn & Brewer, 1998](#)) and metacognitive abilities ([Amsel et al., 2008](#)). With regard to physical possibility, studies that have assessed conceptions of physical possibility beyond childhood have documented considerable variability even among adults ([Shtulman, 2009](#); [Shtulman & Tong, 2013](#)), and this variability may track fantastical beliefs other than just belief in Santa. The relation between one's understanding of physical possibility and one's acceptance of physically extraordinary entities and events could thus be explored across the lifespan.

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