The Influence of First-Hand Testimony and Hearsay on Children's Belief in the Improbable

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Abstract

Children (3.5-8.5 years; *n*=105) heard claims about the occurrence of improbable or impossible events, then were asked whether the events could really happen. Some claims were based on informants' first-hand observations and others were hearsay. A baseline group (*n*=56) reported their beliefs about these events without hearing testimony. Neither first-hand claims nor hearsay influenced beliefs about impossible events, which remained low across the age-range. Hearsay (but not first-hand claims) did influence beliefs about improbable events. Preschoolers expressed greater belief following hearsay, compared to their beliefs following first-hand claims and compared to the baseline group's beliefs. By contrast, older children expressed *less* belief following hearsay, compared to their beliefs following first-hand claims and compared to the baseline group's beliefs.

Keywords: testimony; belief; hearsay; improbable phenomena

The influence of first-hand testimony and hearsay on children's belief in the improbable

Adults' claims can influence children's beliefs about a wide variety of topics and phenomena (e.g., Bascandziev & Harris, 2010; Chan & Tardif, 2013; Jaswal, 2004). Yet children are savvy consumers of such claims; they believe certain types of claims and certain types of informants more than others. For example, they are more likely to believe claims about physics that are consistent with their intuitions (e.g., a claim that a novel object can sit on a table) than claims that conflict with their intuitions (e.g., a claim that a novel object can float above a table); and they are more likely to believe such claims when presented by a mechanical expert than by an animal expert (Lane & Harris, 2015). The current study examines how the *source* of informants' claims—whether claims are based on first-hand observation or on hearsay—influences children's beliefs about improbable and impossible events.

Young children understand that people may gain knowledge first-hand, through direct observation, or second-hand, through communication with another person (e.g., Lane, Brink, Wellman, & Evans, 2016a; Pratt & Bryant, 1990). Moreover, when acquiring new information, preschoolers take into account their informants' access to knowledge. For example, if one of two informants look inside a novel box and then both make conflicting claims about the box's contents, preschoolers typically trust the claim made by the informant who saw the box's contents (Robinson, Champion, & Mitchell, 1999). We examine the beliefs of children ranging from 3- to 8-years after they hear claims based either on informants' first-hand observations or on hearsay. For these claims, informants identify their sources using *evidentials*–markings for the source of speakers' knowledge (Dendale & Tasmowski, 2001). Children from various linguistic backgrounds begin to produce and understand evidentials during the preschool years (Matsui & Fitneva, 2009; Papafragou, Li, Choi & Han, 2007). In the current study, to identify that their

knowledge is based on first-hand observation, informants preface testimony with a *direct* evidential, "I saw someone…"; and to identify that their knowledge is based on a second-hand source, informants preface testimony with an *indirect* evidential, "Someone told me…" We additionally compare these children's beliefs to those of children in a *baseline* condition, who are not given any testimony.

Prior work has revealed an age-graded decrease in children's preference for second-hand testimony, over first-hand testimony, when both types of claims are presented sequentially. Fitneva (2008, Study 2) presented Bulgarian kindergarteners and third-graders with pairs of Bulgarian-speaking informants who offered conflicting information about a story protagonist's activities. Some informants mentioned that their knowledge was gained via first-hand perception ("[X happened]; I saw that", English translation), and others noted that their knowledge was gained via hearsay ("[X happened]; someone told me", English translation). Fitneva found an age-graded decrease in children's preference for testimony that was based on second-hand (rather than first-hand) information. Using a similar paradigm, Matsui and colleagues (2006) also found an age-graded decrease starting at 5-6 years in Japanese children's preference for second-hand (vs. first-hand) claims (3-4 year-olds showed no preference). Because these studies had children *choose* between first-hand testimony and second-hand testimony, it is unclear whether their developmental trends reflect an increasing distrust of second-hand claims, an increasing trust in first-hand claims, or both; we directly address these issues in the current study by examining children's beliefs following one claim at a time and by comparing their beliefs to those of children in a baseline group.

A developing distrust in second-hand testimony (vs. first-hand testimony) found by Fitneva (2008) and Matsui et al. (2006)—across two countries and languages, with testimony

that focused on different topics—may reflect general shifts in children's social-cognitive development. Matsui and Miura (2009) propose that children's understanding of second-hand evidentials reflects a developing understanding of second-order mental states (e.g., "She thinks that he thinks …"). As well, we speculate that these age-trends partly reflect a developing understanding that speakers may intentionally say things that contradict what they think (Ackerman, 1983; Filippova & Astington, 2008; Peterson, Wellman, & Slaughter, 2012). This understanding may lead children to interpret certain second-hand evidentials (e.g., "Someone told me") as markers of implicit disagreement and attempts by the informant to *distance* herself from the original source ("She thinks differently from what he said"). This may lead children to reduce their *own* belief in the possibility of the novel events about which the informant speaks. Thus, we predicted that, with increasing age, children's beliefs will be more negatively influenced by second-hand testimony; older children will demonstrate less belief in events following second-hand testimony, as opposed to first-hand testimony or no testimony.

Based on Matsui and colleagues' (2006) finding that 3- and 4-year-olds show no preference for first- or second-hand claims, one possibility is that preschoolers' beliefs will be equivalent following either claim type and will be no different from baseline. Yet, as discussed earlier, children's reaction to such claims might differ when they are presented claims individually rather than in succession—children might show no preference when faced with conflicting claims, but might believe each individual claim if they are presented separately (e.g., Vanderbilt, Heyman, & Liu, 2014). Matsui and colleagues (2006) suggest that preschoolers take hearsay at face value, assuming that the speaker believes that what the original informant said is true. In this case, we would predict that children will believe in events more so (relative to the baseline group) whether they are presented first-hand claims or second-hand claims.

Other work inspires the prediction that preschoolers might be convinced even *more* by hearsay than by first-hand testimony, particularly if preschoolers interpret second-hand claims as evidence of consensus (rather than the speaker distancing herself from the claim). Preschoolers might interpret evidentials such as "Someone told me…" to suggest that both the original 'someone' and the current informant attest to (and thus agree about) the event, giving that claim greater weight than a comparable first-hand claim. Indeed, prior research demonstrates young children's sensitivity to speakers' consensus. If all but one member of a group (i.e., the majority) label a novel object one way, and a lone dissenter labels that object differently, preschoolers then identify that object using the label provided by the majority (Corriveau, Fusaro, & Harris, 2009). And if preschoolers overhear two people agree about the existence of novel entities, they are more likely to believe in such entities themselves (Woolley, Ma, & Lopez-Mobilia, 2011).

We focus on children's beliefs about the potential occurrence of improbable and impossible events. Preschoolers typically assert that both improbable events (e.g., someone drinking onion juice) and impossible events (e.g., someone turning applesauce into an apple) cannot really happen (e.g., Shtulman & Carey, 2007). Between the ages of 4- and 8-years, children increasingly believe that improbable events can indeed occur; whereas children across this age range maintain that impossible events cannot occur. These developmental patterns suggest that beliefs about improbable (rather than impossible) events might be most malleable and responsive to the influence of other factors, including testimony. Indeed, Lopez-Mobilia and Woolley (2016, Study 2) demonstrated that an informant's affirmative testimony about the reality of novel animals increased 6- and 8-year-olds' beliefs about animals with atypical (yet possible) qualities (e.g., a fish that is as big as a car). However, such testimony had little influence on beliefs about animals with *impossible* qualities (e.g., a snake that eats lightning).

Thus, we anticipated that effects of first- or second-hand testimony would be most prominent for beliefs about improbable events, and that both forms of testimony would have little to no effect on beliefs about impossible events.

Method

Participants

Children ranging from 3.5 to 8.5 years in age (n=161, 96 boys) were interviewed at a museum in Cambridge, Massachusetts (n = 122; M_{age} = 5.7 years, Range: 3.5-8.3) and in school or home settings in California's bay area (n = 39; M_{age} = 6.2 years, Range: 3.8-8.5). Data were collected between May 2014 and July 2015. Children represented multiple ethnic and racial backgrounds, but those in Massachusetts were primarily European American and those in California were primarily European American or Asian American. Most children were from middle- to upper-middle-class socioeconomic backgrounds. Six additional children participated but were excluded from analyses: three ended the interview early, one was notably distracted, there was experimenter error for one, and parental interference for one. Approximately two-thirds of the children (n = 105; M_{age} = 5.9 years, Range: 3.5-8.5) watched videos in which informants made claims about events; after each video children judged the likelihood that those events could really occur. The final third of the sample (n = 56; M_{age} = 5.6 years, Range: 3.5-8.3) served as a baseline comparison group – these children were asked identical questions about whether the events could really occur but did not receive testimony.

Procedure

For children who watched informants make claims about events, the experimenter explained, "I'm trying to figure out whether different things can happen in real life. So, I asked some people whether those things can happen, and they made videos for me with their answers.

We'll watch those videos to see what those people say. Okay? Then I'll need your help figuring out whether those things can really happen." The event type (improbable vs. impossible) was manipulated between-subjects—52 of 105 children (M_{age} = 5.9 years, Range: 3.7-8.5) received testimony about improbable events; the remaining 53 children (M_{age} = 5.9 years, Range: 3.5-8.3) received testimony about impossible events. The source (first-hand vs. second-hand) was manipulated within subjects—in two videos, an informant provided first-hand claims (e.g., "I saw someone drink onion juice") and in two videos, an informant offered second-hand claims (e.g., "Someone told me they drank onion juice"). Each of the four videos featured a different informant. All informants were European-American women ranging from their mid-20s to early-30s; all had brown hair and similar skin tones. The order in which claims were presented was blocked by source-type, and block presentation order was balanced between participants. To introduce the first-hand block, the experimenter said, "In these videos, the people are going to tell us about things they *saw*." To introduce the second-hand block, the experimenter said, "In these videos, the people are going to tell us about things that *other people told them*." The pool of 24 events is provided in Supplementary Materials. Each participant evaluated four events from the pool; events in the pool were presented at a similar frequency across participants. Supplementary Materials provide additional information about counterbalancing and how claims were distributed across participants.

Following each video, children were asked (a) whether the event could really happen (e.g., "So, what do you think? Could a person drink onion juice in real life, or not?"), and (b) how sure they were about their answer (e.g., "Okay, you think that a person [*could/could not*] drink onion juice in real life. Are you very, very sure or just a little sure?"). Belief ratings were scored such that 0 = very sure the event could not happen, .33 = a little sure the event could not

happen, .66 = a little sure the event could happen, and 1.00 = very sure the event could happen. This scoring yields continuous measures of children's belief similar to measures used in prior studies (e.g., Lane et al., 2016b; Woolley, Boerger, & Markman, 2004; Woolley & Van Reet, 2006); such measures have greater statistical variance (compared to dichotomous measures), thus increasing the opportunity to detect relations with other focal variables. Children's ratings for the two first-hand claims were averaged together as were children's ratings for the two second-hand claims to create *first-hand belief* and *second-hand belief* scores, respectively.

For children who were not given testimony (the *baseline* group) the experimenter began by explaining that, "I'm trying to figure out whether different things can happen in real life. I'll need *your* help figuring out whether those things can really happen." Each of four events per child (e.g., turning applesauce back into an apple) was prefaced with, "I'm wondering whether someone could [x]", and children were asked whether that event could happen in real life. The event type (improbable vs. impossible) was manipulated between subjects in the baseline condition, as it was for the testimony conditions—27 of 56 children in the baseline condition were asked about improbable events; 29 were asked about impossible events. For these children, belief ratings across the four items were averaged for a single *baseline belief* score (Supplementary Materials include item-level descriptive statistics).

Results

For background, we first examined age-graded trends in children's baseline beliefs about the focal improbable and impossible events. This analysis included only children who evaluated events without hearing testimony (n = 56). These analyses (presented in Supplementary Materials) revealed developmental trends in children's baseline beliefs which paralleled those found in prior research (e.g., Shtulman & Carey, 2007). As shown in Figure 1, with increasing

age, children more often reported that improbable events could really occur, but children across the age-range agreed that impossible events could *not* really occur.

In what follows, we examine how first-hand and second-hand testimony influence children's beliefs about the possibility of these events. We anticipated that the influence of testimony would vary depending on the nature of the events—testimony would influence children's beliefs about improbable events, but have little impact on their beliefs about impossible events. Thus, the following analyses assess children's belief about improbable events separate from their beliefs about impossible events.

Testimony's Influence on Belief in the Improbable

To compare children's beliefs about improbable events following first-hand testimony vs. second-hand testimony, a multilevel regression model predicted children's beliefs as a function of their Age, Testimony-source (first-hand vs. second-hand), and the interaction between Age and Testimony-source, $R^2 = .08$, $\chi^2(3) = 11.93$, $p < .01$. For these and all regression analyses, a full set of coefficients (including *z*-values, *t*-values, and confidence intervals) are presented in Supplementary Materials. This analysis revealed a significant interaction between Age and Testimony-source, $b = -.13$, $p < .001$; depicted in Figure 2. When presented first-hand testimony, there was an age-graded, albeit non-significant, increase in children's beliefs about such events, $b = .03$, *ns*. In contrast, when children were given second-hand testimony, there was a highly significant age-graded *decrease* in children's belief that the improbable events could occur in real life, $b = -.09$, $p < .01$.

To further investigate how the source of testimony influences belief across development, we used General Linear Hypothesis (GLH) tests to compare beliefs about improbable events after hearing first-hand testimony vs. second-hand testimony. These analyses compare whether

the lines depicted in Figure 2 differ at three specified points: 4-, 6-, and 8-years. At 4-years, children expressed greater belief that the improbable events could really happen when they had heard second-hand testimony, rather than first-hand testimony, $\chi^2(1) = 7.83$, $p < .01$. At 6-years, they expressed similar beliefs about improbable events whether they received first-hand or second-hand testimony, $\chi^2(1) = .98$, *ns*. At 8-years, children expressed greater belief that the improbable events could really happen when they had received *first-hand* testimony, rather than second-hand testimony, $\chi^2(1) = 7.19$, $p < .01$.

We next examine whether children's beliefs following the provision of testimony differ from the beliefs of the baseline group who heard no testimony. Because children in the baseline group were drawn from the same population and were the same age as children in the testimony group, the beliefs of children in the baseline group should be comparable to the pre-testimony beliefs of children in the testimony groups. To compare children's beliefs following testimony relative to their peers' beliefs at baseline, we conducted separate analyses for comparisons of beliefs following first-hand testimony to baseline beliefs and for comparisons of beliefs following second-hand testimony to baseline beliefs. Scores for all three measures—*first-hand belief*, *second-hand belief*, and *baseline belief*—were based on answers to the same questions and were scored using the same scale, so they can be directly compared. However, the two testimony belief scores were each based on the average of two questions whereas the baseline belief score was based on the average of four questions, so we anticipated that there would be unequal error variances between these variables. Thus, we used quantile regression, which estimates the conditional median rather than the conditional mean. This semiparametric analysis involves no assumptions about error distribution (Petscher & Logan, 2014). Bootstrapped standard errors were used, based on 10,000 replications.

We first compared children's beliefs about improbable events following first-hand testimony to the control sample's beliefs about those same events. An initial regression model included age as the sole predictor of belief, a subsequent model included both age and whether children received first-hand testimony (vs. no testimony), and a final model additionally included the interaction of age X receiving first-hand testimony. Age did not interact with children's receipt of first-hand testimony, so we focus on the second model. Children's belief that improbable events could occur increased marginally with age (b = .06, p = .07). However, children's beliefs were not affected by whether they received first-hand testimony (vs. no testimony; b = -.04, *ns*). Thus, children's belief that improbable events can really occur increased equally (and modestly) with age, whether they received first-hand testimony or no testimony.

To compare children's beliefs about improbable events following second-hand testimony to the baseline sample's beliefs, a similar sequence of quantile regression analyses were conducted. There were no main effects of age or second-hand testimony (vs. no testimony) on belief. However, age significantly interacted with children's receipt of second-hand testimony in predicting belief, b = -.17, $p < .05$. When children did not receive testimony, there was a marginal age-graded increase in their belief that improbable events could really happen, b = .06, p = .097. In contrast, as reported earlier, following second-hand testimony, there was a significant age-graded *decrease* in beliefs about such events, b = -.11, $p < .05$.

We further explored children's beliefs about improbable events following second-hand testimony (vs. no testimony) at ages 4-, 6-, and 8-years, using GLH tests. At 4-years, children who had heard second-hand testimony about improbable events expressed *greater* belief that such events could really happen, relative to age-mates who received no testimony, $F(1, 75)$ = 3.87, p = .05. At 6-years, children expressed *equivalent* belief in improbable events whether they

had received second-hand testimony or no testimony, $F(1, 75) = .64$, *ns*. At 8-years, in contrast, children reported *less belief* in improbable events following second-hand testimony relative to age-mates who received no testimony, $F(1, 75) = 5.27$, $p < .05$.

Testimony's Influence on Belief in the Impossible

To examine the influence of testimony on children's beliefs about impossible events we conducted analyses identical to those described previously, but among children who were asked to judge impossible events. Complete analyses are presented in Supplementary Materials. These analyses revealed that children's belief in impossible events were similar whether they were presented first-hand claims, second-hand claims, or no testimony; and results did not vary by age.

Discussion

Children are offered messages that have the potential to influence many of their beliefs (Harris, 2012). We explored how far first- and second-hand claims influence children's beliefs about the potential occurrence of improbable and impossible events. At four-years of age, children reported greater belief that improbable events could really occur after they heard second-hand claims about those events when compared to similarly-aged children's beliefs at baseline, and when compared to their own beliefs following first-hand claims. But across the age-range, there was a significant age-graded decrease in belief in the real-life possibility of these events after children had heard second-hand claims about such events occurring. Thus, by 8-years of age children demonstrated less belief that improbable events could occur following second-hand testimony, relative to similarly-aged children's beliefs at baseline, and relative to their own beliefs following first-hand testimony.

In contrast to hearsay, first-hand claims had no influence on beliefs about improbable events. Whether children received first-hand claims or no claims, there was a modest age-graded increased belief that such events could occur. We suspect that first-hand testimony had no influence because of young children's fairly firm beliefs that improbable (and impossible) events cannot really occur—e.g., they typically continue to demonstrate disbelief after they are asked to imagine the events occurring (Lane et al., 2016b) and even after they are shown pictures of the events occurring (Shtulman & Carey, 2007). These findings make it even more compelling that the youngest children *did* express greater belief in such events after hearing second-hand claims. Thus, although older children might prefer testimony that is based on first-hand observations rather than hearsay when both forms of testimony are offered *sequentially* (Fitneva, 2008; Matsui et al., 2006), first-hand testimony alone does not necessarily encourage children's belief, at least not belief in the sorts of events that children reasoned about in the current study.

These data demonstrate how the perceived "quality" of testimony can change across development. For young children, increased belief in the potential occurrence of improbable events following second-hand testimony may reflect their interpretation of such testimony as indicating consensus (at least, consensus among two people). This account gains support from research demonstrating preschoolers' preference for testimony provided by a consensus rather than a minority (e.g., Corriveau et al., 2009). With development, this gives way to decreasing belief following second-hand testimony. This latter pattern emerged in the current data and is consistent with patterns found among children in other cultures, using different languages, with testimony focused on different topics (Fitneva, 2008; Matsui et al., 2006). Our favored interpretation of these patterns, forwarded in the introduction, is that general social-cognitive developments underlie these age-differences (see also Matsui & Miura, 2009). Older children

construe the speaker's use of an indirect evidential like "Someone told me [x]", as a sign that the speaker is distancing herself from the source and does not necessarily agree with the source. This would be consistent with general developments in children's theory-of-mind, particularly in their understanding that speakers may intentionally say things that contradict their beliefs (e.g., Ackerman, 1983; Filippova & Astington, 2008; Peterson et al., 2012). However, different evidentials have been used across these studies (grammaticalized versus lexicalized) and may be interpreted differently by children; thus comparisons across studies are speculative pending further research. Indeed, similar cross-linguistic developmental patterns may reflect the influence of different factors for different languages (Robinson, 2009). For example, children may interpret evidentials as reflections of speaker *certainty* for some languages more than others, due to whether evidentials are grammaticalized or lexicalized.

There are many ways to phrase first-hand claims and second-hand claims. In the current study, and in prior work, the origins of second-hand information were not specified; informants' second-hand claims referred either to a nondescript "someone" ("Someone told me [x]"; Fitneva, 2008) or to no one at all ("I heard [x]", Matsui et al., 2006). Perhaps these types of second-hand claims are especially likely to induce doubt among older children—they may interpret the absence of a specific source as the informant implying disassociation with (and perhaps disagreement with) the original source. Conceivably, children might interpret informants' claims of having seen something unusual or hearsay about someone saying that they did something unusual as bragging, and this might induce children's skepticism. Future research is needed to investigate these issues and to examine how children's (and adults') beliefs are influenced by claims marked with different evidentials, for example when speakers specify their sources and

referents (e.g., “John told me [X]”, “Someone told me John [did X]”, or “The teacher said that [X]”).

Neither first-hand testimony nor hearsay influenced children’s beliefs about impossible events, which remained low across the age-range. Thus, this work adds to a growing body of research revealing that, contrary to popular wisdom, young children do not simply believe everything that they are told but instead demonstrate skepticism toward many claims (Lane & Harris, 2014; Woolley & Ghossainy, 2013). These and other findings (e.g., Lopez-Mobilia & Woolley, 2016) motivate questions about what types of testimony may increase children’s beliefs about impossible events and entities. Questions of how children’s beliefs about the improbable and impossible are influenced by socio-cultural factors (e.g., media about extraordinary events) and developing cognitive factors (e.g., counter-factual reasoning) are ripe for future research.

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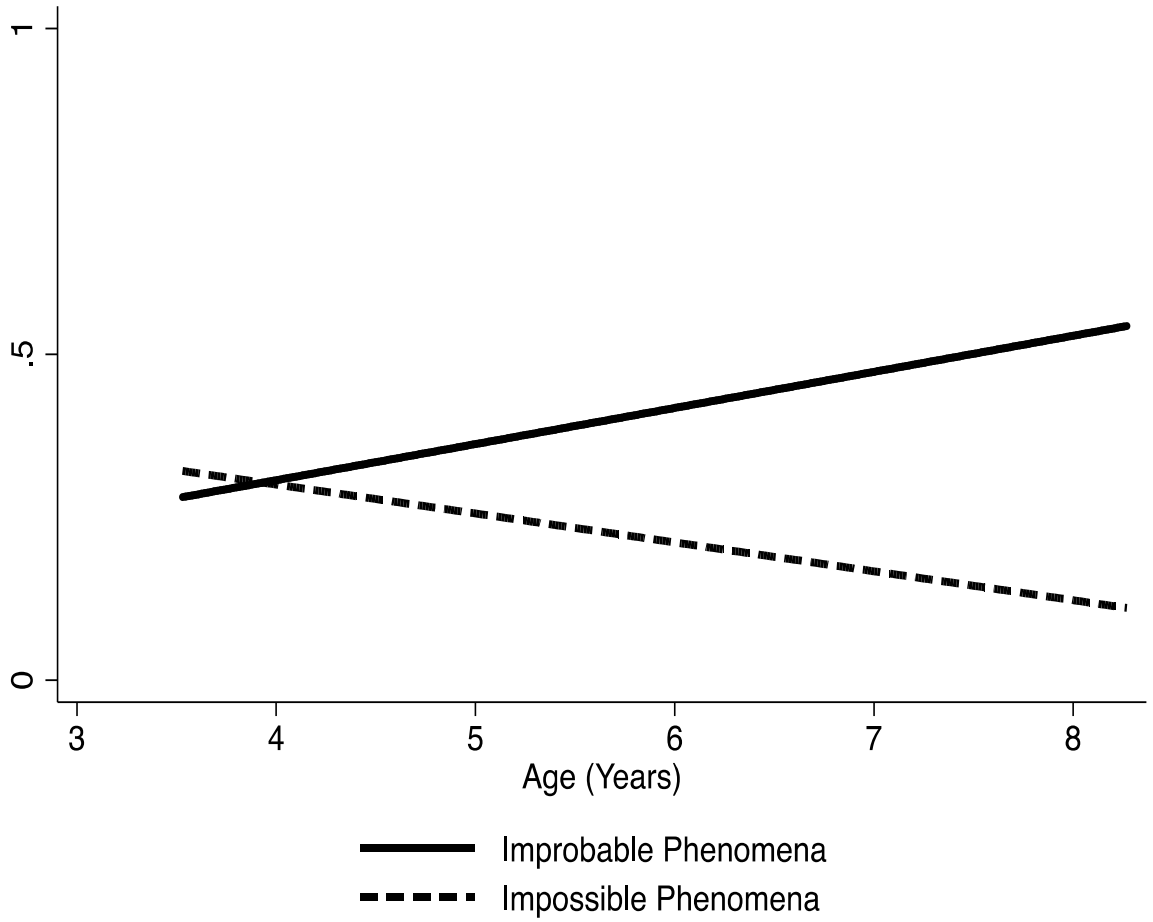

Figure 1. Fitted belief among baseline participants as a function of age, for improbable events (solid black line) and impossible events (dashed black line).

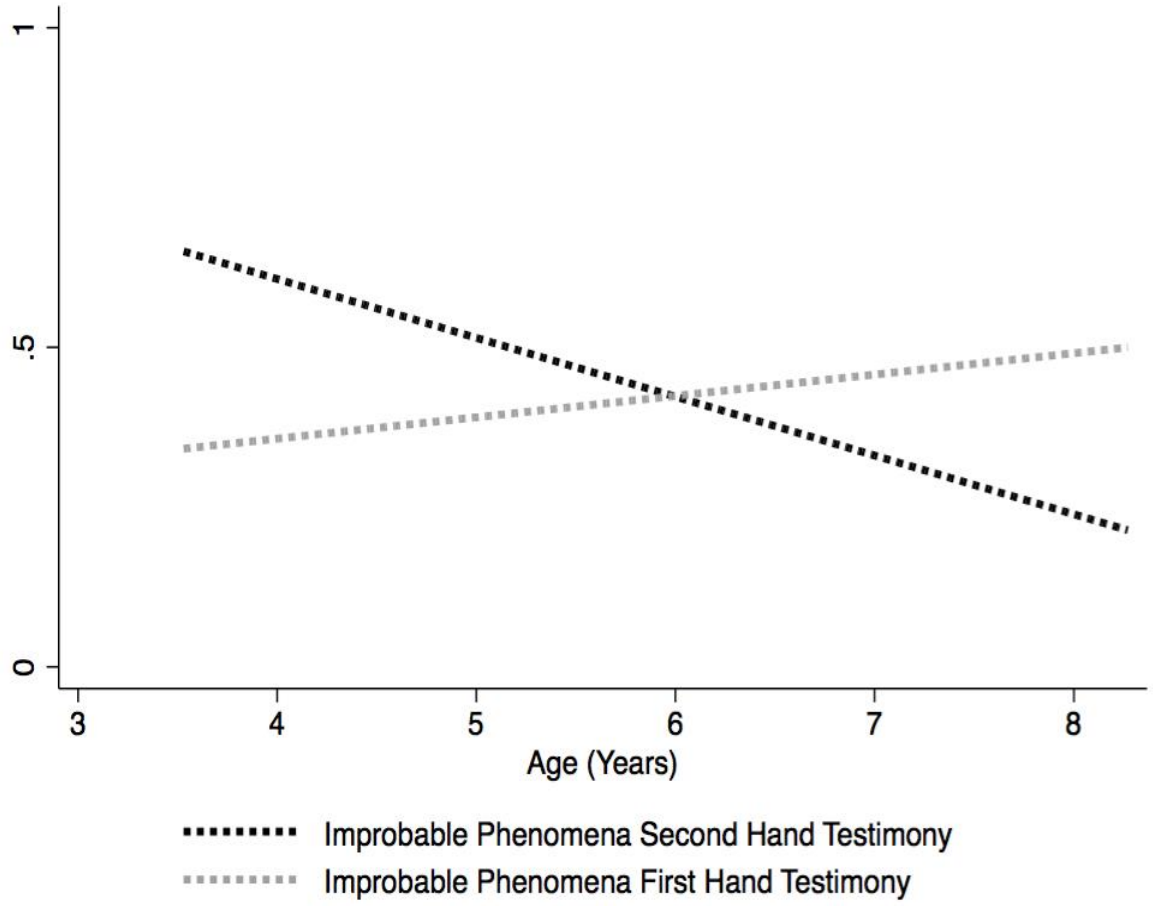

Figure 2. Fitted belief as a function of age, for improbable events mentioned through second-hand testimony (dotted black line) and for improbable events mentioned through first-hand testimony (dotted grey line).