


## What Could Have Been Done?

### Counterfactual Alternatives to Negative Outcomes Generated by Religious and Secular

#### Children

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### Abstract

Recent research has shown that a religious upbringing renders children receptive to ordinarily impossible outcomes, but the underlying mechanism for this effect remains unclear. Exposure to religious teachings might alter children's basic understanding of causality. Alternatively, religious exposure might only affect children's religious cognition, not their causal judgments more generally. To test between these possibilities, 6- to 11-year-old children attending either secular ( $n = 49$ , 51% female, primarily White and middle-class) or parochial schools ( $n = 42$ , 48% female, primarily White and middle-class) heard stories in which characters experienced negative outcomes and indicated how those characters could have prevented them. Both groups of children spontaneously invoked interventions consistent with natural causal laws. Similarly, when judging the plausibility of several counterfactual interventions, participants endorsed the intervention consistent with natural laws at high levels, irrespective of schooling. However, children's endorsement of supernatural interventions inconsistent with these laws revealed both group similarities and differences. Although both groups of children judged divine intervention (i.e., via prayer) as more plausible than mental (i.e., via wishing) and magical (i.e., via magical powers) interventions, children receiving religious (versus secular) schooling were more likely to do so. Moreover, although children with a secular upbringing overwhelmingly chose naturalistic interventions as the most effective, children with a religious upbringing chose divine as well as naturalistic intervention. These results indicate that religious teaching does not alter children's basic understanding of causality but rather adds divine intervention to their repertoire of possible causal factors.

Keywords: possibility judgments, counterfactual thinking, religious cognition, social cognitive development, testimony, magical thinking

## Introduction

The ability to differentiate between what can and cannot happen is an important skill in a world of uncertainty. It governs much of our behavior and informs our understanding of the world (Flavell, Green, & Flavell, 1986; Woolley, 2000). Consequently, its developmental progress has been of interest to researchers and laypeople alike (Sharon & Woolley, 2006). Although Piaget (1928, as cited in Harris & Corriveau, 2019) initially portrayed young children as inherently prone to magical thinking and therefore lacking a firm grasp of cause and effect, contemporary discussion has reached a different conclusion. Evidence collected over several decades (Harris, 2012, 2013; Harris & Corriveau, 2019; Rosengren & Hickling, 2000; Sharon & Woolley, 2004; Weisberg, 2013; Woolley & Ghossainy, 2013) indicates that young children are quite conservative about what can really happen: They rarely appeal to supernatural forces as a causal explanation even in the face of unusual or unexpected events (Huang, 1930, 1943; Mead; 1932; Cornelius, Lacy & Woolley, 2011) and reject the possibility of magical outcomes in real life (Nancekivell & Friedman, 2017; Orozco-Giraldo & Harris, 2019; Subbotsky, 1994, 2010; Woolley & Cornelius, 2017; Woolley & Cox, 2007). Indeed, they express skepticism that even improbable events—let alone impossible events—can actually occur (Shtulman & Carey, 2007).

This early conservatism becomes more flexible as children develop. In accordance with the religious testimony they receive from their community, children come to believe that some supernatural beings (e.g., God, angels) are real whereas others (e.g., witches, ghosts) are pretend. Furthermore, they put their skepticism aside with respect to some “impossible” events (e.g., miracles) and increasingly judge those as “possible,” even if they continue to doubt the likelihood of other fantastical or magical events (Harris, 2012, 2013; Harris & Corriveau, 2019).

The current study builds on this prior research by asking how children reconcile a conservative stance towards what *can* happen with religious claims that challenge this stance.

### **Religious Claims and Credulity towards the Impossible**

Children readily understand and endorse religious claims regarding God (Harris & Koenig, 2006). Although they perceive God as similar to a person in some ways (e.g., attributing similar moral beliefs to God and to human agents, Heiphetz, Lane, Waytz, & Young, 2018), by the age of five, children also report that God has qualities that ordinary humans lack. For instance, they think that God—but not their mother—would know the contents of a closed container without checking what is inside (Barrett, Richert, Driesenga, 2001). In a similar fashion, they conclude that unlike their best friend, God never gets old and dies (Giménez-Dasí, Guerrero, & Harris, 2005). Lastly, many children refer to God as a creator of species (Evans, 2001) and expect God to answer their prayers (Woolley & Phelps, 2001). Thus, children consider God as a special being with extraordinary powers (Harris & Corriveau, 2019). By implication, testimony about God’s extraordinary capacities leads children to believe that God can make otherwise impossible events occur. In this case, children with a religious upbringing—who receive such testimony on a regular basis—would be expected to judge more beings as real and more events as possible than would children from secular backgrounds.

This is, indeed, what some recent studies have shown. Children who attend parochial schools or regularly participate in church services with their family are more likely to judge events and characters presented in a religious context as real than are children with no such experience. In one such study (Vaden & Woolley, 2011), 4- to 6-year-old children heard either religious stories about God as well as religious characters mentioned in the Bible or closely matched nonreligious stories with no references to God or religious characters. Although both

type of stories included ordinarily impossible events, children—particularly children from religious backgrounds—were more likely to judge the religious, versus nonreligious, stories as real. In a more recent study (Corriveau, Chen, & Harris, 2015), 5- to 6-year-old children from a religious background (i.e., attending church, going to a parochial school, or both) were more likely than children from a secular background (i.e., neither attending church nor a parochial school) to judge the characters in the religious stories as “real.”

Corriveau et al. (2015) showed that children with a religious upbringing were also more likely than their peers with a secular upbringing to judge the characters in fantastical stories (with magical elements but no divine intervention) as “real.” This finding is not limited to children from the United States, as children in Iran who were receiving an Islamic education showed a similar pattern (Davoodi, Corriveau, & Harris, 2016). This apparent receptivity of religious children towards the impossible is surprising and warrants further examination.

Although these studies indicate that religious testimony plays a role in children’s credulity about events that would ordinarily be considered impossible, they do not reveal the underlying mechanism for this effect. Thus, the main goal of the present study was to understand *how* religious exposure might shape children’s thinking about what is possible and what is not. One possible explanation for this credulity is that exposure to religious teachings alters children’s judgment about what might happen. This process could occur in two separate ways. Because much religious testimony includes events that contradict natural causal laws (e.g., water turns into wine or life continues after death), frequent exposure to such testimony might alter children’s basic conceptions of what is possible, making them think that natural causal laws do not always constrain events. On this hypothesis, frequent exposure to religious testimony would be associated with less skepticism toward events that go against natural causal laws, broadly

construed. Alternatively, exposure to religious testimony might have a narrower effect, with violation of natural causal laws only occurring as a result of divine intervention. On this latter hypothesis, children from religious backgrounds would believe that otherwise impossible events are possible, but only if those events are brought about by divine intervention. The current work tested these alternative hypotheses.

### **Counterfactual Thinking, Causality, and Possibility Judgments**

To determine how religious testimony might shape judgments of possibility, we examined children's counterfactual thoughts about events that are consistent, versus inconsistent, with natural causal laws. Counterfactual thinking refers to the generation of alternative scenarios to past events (Roese, 1997; but see Hoerl, McCormack, & Beck, 2011 for the ongoing debate about how to define this capacity). Such thinking plays a central role in people's notions of causality (Miller, Turnbull, & MacFarland, 1990; Wells & Gavinski, 1989). By generating different counterfactual scenarios to a given outcome, adults can evaluate which of these alternative scenarios could have led to a change in that outcome and thereby identify the likely cause. In a well-known demonstration of this process, Wells and Gavinski (1989) presented their participants with a scenario in which an employee dies due to an allergic reaction caused by a meal that her boss ordered. When participants learned that the boss had considered an alternative meal with no allergic ingredients, they judged his causal role in the employee's death as higher than when the alternative meal was described as also having the allergic ingredient.

Research by Harris and colleagues (1996) indicates that children can engage in such "thought experiments" to determine the cause of an event based on the availability of counterfactual alternatives. In one study (Experiment 3), 3- and 4-year-olds heard a story about a character who chose between either a black pen and a pencil (the experimental version) or a

black pen and a blue pen (the control version) to make a drawing. In both versions, the character chose the black pen and ended up with inky fingers. When reporting what the character should have done to prevent the outcome, children in the experimental condition were more likely to reference the rejected option, whereas children in the control condition were more likely to reference an action other than the rejected one.

However, more recent studies indicate that counterfactual thinking may not always be necessary for children to reach causal judgments. For example, a study by German (1999) replicated Harris and colleagues' (1996) findings with negative outcomes but found no counterfactual references in children's explanations when the outcomes were positive. Most recently, Nyhout and Ganea (2020) found that children between 3.5 to 8-years-old tend to focus on protagonists' controllable actions when answering a counterfactual question about how a mishap (e.g., a wave knocking over a sandcastle) could have been prevented (e.g., "If he built it farther from the water"), whereas they tend to focus on uncontrollable natural events when reasoning about the cause of the mishap (e.g., "Because the waves smashed it down"). In sum, although disagreement exists about whether counterfactual reasoning, causal reasoning, and causal predictions align (see Spellman & Ndiaye, 2007, for a recent discussion from the adult literature), it is safe to say that they are interrelated abilities (Spellman, Kincannon, & Stose, 200) that emerge in early childhood (Harris et al., 1996).

Drawing on this past work, children in the current study were asked to make counterfactual intervention judgments in order to provide insight into their notions of causality. If religious testimony alters notions of causality broadly construed, then children with a religious background would be expected to be less skeptical of supernatural interventions in general (e.g., whether divine, mental, or magical), judging the efficacy of these interventions akin to

naturalistic interventions. Alternatively, if religious testimony only alters children's views of what is possible as a result of divine intervention—and not their views of what is possible in other circumstances—then children with a religious background would be expected to endorse divine intervention only, while denying the possibility of other supernatural interventions. The current work tested between these possibilities.

### **Overview of the Present Study**

The main goal of the current research was to assess how religious exposure might modify children's judgments of what is possible and what is not by examining their notions of causality as reflected in their counterfactual thinking. We presented younger (6- to 8-year-old) and older (9- to 11-year-old) children with short vignettes in which a character experienced a negative outcome (e.g., a farmer was unable to grow berries due to drought). We focused on a wide age range—spanning from kindergarten to sixth grade—for several reasons. First, earlier studies (Corriveau et al., 2009; Corriveau & Harris, 2015) suggest that, starting around five or six years old, children can clearly distinguish between realistic and fantastical outcomes using the story context (e.g., a farmer who planted fruits and vegetables in his field versus a farmer who ate a very big apple every day to live forever). Second, we wanted to assess potential age-related changes in children's possibility judgments in response to religious exposure. Because older children from religious backgrounds have had more exposure to religious testimony than their younger religious peers, one might expect a stronger interaction between religious background and intervention type in older children (i.e., differences in the evaluation of supernatural as compared to naturalistic interventions might be particularly pronounced among older religious versus secular children, whereas these differences might emerge in only a weak form among younger religious versus secular children). However, if a modest dose of religious exposure is



sufficient to influence children's judgments from an early age, then the patterns of responding across age groups might be similar. Finally, as discussed above, there is no clear consensus with respect to the exact age at which children begin thinking counterfactually (Beck & Riggs, 2014; Nyhout & Ganea, 2019), and recent studies reveal that this ability is refined throughout childhood (McCormack, Ho, Gribben, O'Connor, & Hoerl, 2018; Payir & Guttentag, 2016; 2019; but see Nyhout & Ganea, 2019, for recent evidence of mature counterfactual thinking even in younger children). Thus, testing a wide age range allowed us to ensure that we were capturing potentially relevant milestones in the emergence of counterfactual thought.

An additional goal of the present study was to examine children's *spontaneous* generation of interventions as well as their *elicited* judgments about the efficacy of various intervention types. Accordingly, after the presentation of each vignette, we first asked children how the outcome could have been prevented. Only after children had provided their spontaneous explanations did we elicit their judgments about the efficacy of four interventions: one consistent with natural causal laws (i.e., naturalistic) and three that violated those laws (i.e., supernatural)—divine intervention via praying, mental intervention via wishing, and magical intervention via magical powers.

Based on the two competing arguments introduced above, we anticipated two different patterns of results that might emerge. On the one hand, if a religious upbringing alters children's basic conceptions about what is possible and what is not, then children with a religious background would be expected to spontaneously bring some supernatural interventions to mind and to endorse mental and magical interventions as well as divine interventions. On the other hand, if religious exposure does not alter children's basic notion of causality, then children should rarely—if ever—invoke any supernatural forces spontaneously. This pattern would be

expected to emerge because children rarely invoke such forces to explain natural events (Huang, 1930; Mead, 1932; Cornelius et al., 2011) and deny the possibility of magical or fantastical events in real life (Subbotsky, 1994, 2010; Woolley & Cox, 2007). By the same token, all children should endorse a naturalistic intervention as an effective mechanism in preventing the outcome but deny such power to a magical intervention. Nevertheless, based on previous work showing that many children readily accept that God has extraordinary powers (Barrett, Richert, & Driesenga, 2001; Giménez-Dasí, Guerrero, & Harris, 2005) and endorse the efficacy of prayer (Woolley & Phelps, 2001), children might attribute greater efficacy to divine intervention than to mental and magical intervention, and this difference might be particularly evident among children with a religious background. Moreover, given previous research showing a decreased belief in the efficacy of wishing with age (Lane, 2011; Woolley, Phelps, Davis, & Mandell, 1999), older children may be especially likely to differentiate between the effectiveness of a divine intervention and wishing. Lastly, we expected that the majority of children with a secular upbringing would overwhelmingly choose naturalistic intervention as the most effective intervention whereas children with a religious background would endorse both naturalistic and divine intervention.

## Method

### Participants

A total of 96 6- to 11-year-old children ( $M_{age} = 8.95$  years,  $SD_{age} = 1.58$  years, 45 females) across three private schools (one parochial and two private secular) in a metropolitan city in NC, United States participated. Although no specific demographic information was collected, the participants were predominantly White and middle-class, but a variety of ethnic and socioeconomic backgrounds were represented (See Appendix C for more information

regarding participating schools). Five children (1 from the parochial and 4 from the private secular schools) were excluded from the analysis as they were older than 11 at the time of testing. We divided children into two groups based on the type of schooling they were receiving: parochial (Roman Catholic,  $n = 42$ ,  $M_{age} = 8.96$  years,  $SD_{age} = 1.55$  years, 20 females) and secular ( $n = 49$ ,  $M_{age} = 8.95$  years,  $SD_{age} = 1.62$  years, 25 females). We further divided the participants in each group into a younger group of 6- to 8-year-olds (parochial school:  $n = 23$ ,  $M_{age} = 7.73$  years,  $SD_{age} = 0.66$  years, 11 females; secular schools:  $n = 24$ ,  $M_{age} = 7.44$  years,  $SD_{age} = 0.62$  years, 10 females) and an older group of 9- to 11-year-olds (parochial school:  $n = 19$ ,  $M_{age} = 10.45$  years,  $SD_{age} = 0.79$  years, 9 females; secular schools:  $n = 25$ ,  $M_{age} = 10.39$  years,  $SD_{age} = 0.66$  years, 15 females). Adhering to our previous studies with a very similar design (Corriveau et al., 2015), our goal was to recruit at least 20 participants per group. Due to difficulties associated with recruiting participants for the studies regarding children's religious beliefs, and consent forms being returned in batches, we did not institute a specific stopping rule for this experiment. The sample size indicates the maximum number of participants we were able to recruit within the time frame designated by the schools. The dataset and the scripts for our statistical analyses are available at <https://osf.io/yt4sd/>

### **Materials and Procedure**

The experimenter tested participants individually in a quiet location at their school. She introduced the task using the following script: "After we experience something bad, we often find ourselves thinking about how things could have been different or thinking about what we could have done differently so that the bad event would not have happened. In other words, because we are not happy about bad events that happen to us or happen to other people that we love, we think about how these bad events could have been stopped from happening. For

instance, imagine that you ate too much ice cream and you got sick. You may think, ‘If only I had not eaten that much ice-cream, I would not feel sick now.’ Or imagine that you were going to take a field trip with your classmates and you were very excited about it. But it rained so heavily that the field trip got cancelled. Then you may think to yourself: ‘If only it had not rained that much, then we could have taken the trip.’ So, in this game, there are some people who experienced some bad events like the ones I have just described, and these people think about how they could have stopped these unpleasant events from happening. They have some ideas which they think could have stopped these bad events, but they are not sure which of their ideas is the best and I want you to help them decide. Let’s begin.”

Next, participants completed a warm-up trial using a sentence completion procedure adapted from Meehan and Byrne (2005). The purpose of this warm-up trial was to familiarize the participants with the test trials, which required them to generate a counterfactual alternative via sentence completion. The experimenter introduced the participants to a character named Allen, who received a bad grade on a math test. The experimenter said that Allen felt sad for the bad grade he received and asked the participants to complete a counterfactual statement in the following way: “Allen is going to whisper something in my ear about this and it is your job to guess how he finishes his sentence. So, Allen just said that he could have a better grade if ... Can you guess how he finishes his sentence?”

Following the warm-up trial, the experimenter proceeded to the test trials. All children received three stories in a random order, each involving a character who experienced an undesired outcome. For instance, one of the stories reads as follows (see Appendix A for the full script of the three scenarios): “*This is George. He is a farmer. He used to plant strawberries on his farm. One summer, there was no rain so the plants did not have any berries. George felt*

*really sad about what happened and later thought to himself about how things could have been different so that he could have had many berries.*” The experimenter read the story to the children as she presented a related illustration printed on a card.

After the presentation of each story, the experimenter first asked children to generate a counterfactual alternative via the sentence completion procedure they had practiced in the warm-up trial (e.g., “*George said to himself, ‘I could have had many berries, if ...’ Can you guess how he finished his sentence?*”).

Next, children learned about four counterfactual scenarios that the character was considering, one at a time and in a random order. These alternative scenarios, each involving a different causal mechanism, included a naturalistic intervention (e.g., “*If I had brought some water from the dam for my farm, then my plants would have been loaded with berries*”), a divine intervention (e.g., “*If I had prayed really hard at night, then with the help of God, my plants would have been loaded with berries*”), a mental intervention (e.g., “*If only I had wished really hard that I had many berries, then my plants could have been loaded with berries*”), and a magical intervention (e.g., “*If only a fairy flew over the plants spraying some special water, then my plants could have been loaded with berries*”).

After the presentation of each counterfactual alternative, the experimenter asked the children to judge its plausibility (e.g., “*What do you think? Do you think George would have had many berries if he had brought some water from the dam?*”). Children responded by saying “yes” or “no” and were asked to justify their response (e.g., “*Why do you think so?*”). Lastly, in two steps, the experimenter asked children to choose the option that could have been most helpful for preventing the undesired outcome among the four presented (e.g., “*So what if you pick two of these choices? Which two choices you think could have helped George have many berries?*”),

“What if you pick between these two? Which one do you think could have been the most helpful?”)

This study was approved by the Human Subjects Institutional Review Board at the fourth author’s institution (protocol number: 4631E, study title: Children's and Adults' Understanding of the Invisible and the Impossible).

## Results

All children completed the warm-up trial with no issues. The first author coded the responses to the warm-up trial into the categories of either *naturalistic* (responses that did not violate natural causal laws) or *supernatural* (responses that did violate these laws). All of the counterfactual alternatives children generated in this phase were naturalistic (e.g., “If I had studied more/harder/better,” “If I had paid more attention/focused more,” “If I had practiced more,” “If I had not played video games”). A second researcher, blind to the hypotheses of the study, also coded all of the responses using the same scheme and achieved perfect consistency with the first coder (Cohen’s  $\kappa = 1$ ). Below, we first present the results for the counterfactual generation task in which children provided their spontaneous counterfactual possibilities. Next, we present children’s plausibility judgments as a function of type of counterfactual alternative, schooling, and age. Lastly, we present children’s “best option” judgments as a function of schooling and age.

### Counterfactual Generation

To assess participants’ spontaneous generation of counterfactual possibilities, we analyzed the extent to which they generated supernatural counterfactuals. As with the warm-up trial, the first author and a second researcher coded all the responses into the categories of either *naturalistic* or *supernatural* and achieved perfect consistency (Cohen’s  $\kappa = 1$ ). Because each

participant generated a counterfactual alternative for every story, we obtained a total of 273 responses from 91 participants across the three stories. Among those 273 responses, all but five were naturalistic (e.g., “If only he had watered them more,” “If he had used a ladder to climb over the walls,” “If only she had made a shopping list”). Among the five supernatural responses, four proposed divine interventions (e.g., “He could have prayed for the rain”) and one proposed mental intervention (i.e., “If he had wished”).

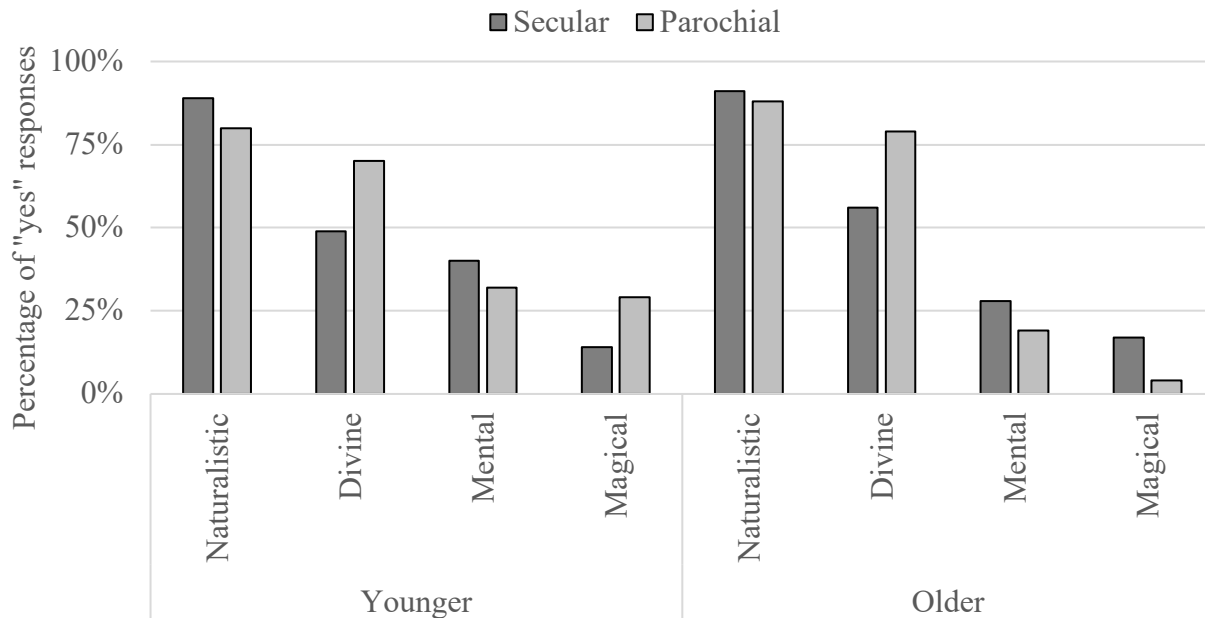
### **Plausibility Judgments**

The open-ended responses provided above show that regardless of age or religious background, children rarely generated supernatural counterfactuals. However, children sometimes endorse ideas that they may not propose themselves (Dunlea & Heiphetz, 2020; Payir & Guttentag, 2016). Thus, we examined children’s judgments about the plausibility of the counterfactual interventions with which they were presented.

Figure 1 shows the percentage of “yes” judgments for each type of counterfactual intervention as a function of schooling and age. Inspection of Figure 1 indicates that children were more receptive towards naturalistic intervention regardless of type of schooling and age group, whereas they expressed skepticism towards mental and magical intervention. However, children’s judgments for non-naturalistic interventions also varied by both school type and age.

**Figure 1**

*Percentage of children's "yes" responses for different types of alternative interventions by school type and age group.*



To confirm these conclusions, we ran a mixed effects binomial logistic regression analysis with the *glmer* function of the *lme4* package in R statistical software (version 3.4.2). Mixed models are especially advantageous for repeated measures designs where one participant provides multiple data points that correlate with one another. By systematically accounting for both item-level and subject-level variability, mixed models ensure that data points are treated independently (Demos & Salas, 2017). In our model, we entered Counterfactual Intervention (Naturalistic [the reference category], Divine, Mental, Magical), School (Parochial vs. Secular), Age (Younger vs. older), and all possible two-way interactions between these three variables as fixed effects. To account for the potentially confounding effect of Gender (Female vs. Male), we also entered Gender and Gender X School interaction as fixed effects. Participant and Story were



entered as random effects to account for within-participant variability. The results of this analysis are provided in Table 1.

As seen in Table 1, the main effect of School,  $\beta = -0.57$ ,  $SE = 0.64$ ,  $z = -0.89$ ,  $p = .38$ , Age,  $\beta = 0.73$ ,  $SE = 0.56$ ,  $z = 1.29$ ,  $p = .19$ , Gender,  $\beta = 0.01$ ,  $SE = 0.42$ ,  $z = 0.02$ ,  $p = .982$ , and the interaction between School and Gender,  $\beta = 0.14$ ,  $SE = 0.61$ ,  $z = 0.24$ ,  $p = .813$ , did not reach significance. In other words, we did not find that children's judgments of Naturalistic Intervention varied across age, gender, or school type. As expected, the main effect of Counterfactual Intervention was significant when comparing Naturalistic Intervention to Divine Intervention,  $\beta = -2.53$ ,  $SE = 0.42$ ,  $z = -5.99$ ,  $p < .001$ , to Mental Intervention,  $\beta = -2.98$ ,  $SE = 0.43$ ,  $z = -6.84$ ,  $p < .001$ , and to Magical Intervention,  $\beta = -4.20$ ,  $SE = 0.48$ ,  $z = -8.72$ ,  $p < .001$ . These findings indicate that overall children judged Naturalistic Intervention as more plausible compared to each of the remaining interventions.

The interaction between School and Counterfactual Intervention was significant when comparing Naturalistic Intervention to Divine Intervention,  $\beta = 1.88$ ,  $SE = 0.50$ ,  $z = 3.80$ ,  $p < .001$ . This finding reveals that the effect of School on “yes” judgments differed for Divine Intervention as compared to Naturalistic Intervention; children from the secular schools judged Naturalistic Intervention (90%) as more plausible than Divine Intervention (52%), whereas children from the parochial school did not significantly distinguish between Divine Intervention (74%) and Naturalistic Intervention (83%). Lastly, the interaction between Age and Counterfactual Intervention was significant when comparing Naturalistic Intervention to Mental,  $\beta = -1.33$ ,  $SE = 0.52$ ,  $z = -2.55$ ,  $p = .011$ , and Magical,  $\beta = -1.51$ ,  $SE = 0.58$ ,  $z = -2.60$ ,  $p = .009$ , Interventions. This finding shows that the effect of Age on “yes” judgments differed in Mental

and Magical Intervention as compared to Naturalistic Intervention, with older children judging the former two interventions as less plausible compared to younger children.

**Table 1**

*Results from the mixed effects binomial logistic regression model predicting the likelihood of children's "yes" judgments using counterfactual intervention (naturalistic as the reference category), school type, age, and gender as predictors.*

	$\beta$ (SE)	z	OR	95% CI for OR	
				Lower	Upper
<b>Intercept</b>	2.38 (0.54)***	4.37	10.79	3.72	31.35
<b>School Type</b>	- 0.57 (0.64)	- 0.89	0.57	0.16	2.00
<b>Age</b>	0.73 (0.56)	1.29	2.07	0.69	6.27
<b>Gender</b>	0.01 (0.42)	0.02	1.01	0.45	2.28
<b>School X Age</b>	- 0.41 (0.61)	- 0.68	0.66	0.20	2.20
<b>School X Gender</b>	0.14 (0.61)	0.24	1.15	0.35	3.81
<b>Counterfactual Intervention</b>					
Naturalistic – Divine	- 2.53 (0.42)***	- 5.99	0.08	0.03	0.18
Naturalistic – Mental	- 2.98 (0.43)***	- 6.84	0.05	0.02	0.12
Naturalistic – Magical	- 4.20 (0.48)***	- 8.72	0.01	0.01	0.04
<b>School X Counterfactual Intervention</b>					
Naturalistic – Divine	1.88 (0.50)***	3.80	6.59	2.49	17.44
Naturalistic – Mental	0.21 (0.52)	0.41	1.24	0.45	3.39
Naturalistic – Magical	0.81 (0.56)	1.44	2.25	0.74	6.80
<b>Age X Counterfactual Intervention</b>					
Naturalistic – Divine	-0.12 (0.50)	- 0.24	0.89	0.34	2.35
Naturalistic – Mental	-1.33 (0.52)*	- 2.55	0.26	0.09	0.73
Naturalistic – Magical	-1.51 (0.58)**	- 2.60	0.22	0.07	0.69

*Note: \*  $p < 0.001$ ; \*\*  $p < 0.01$ , \*\*\*  $p < 0.05$ . OR = Odds Ratio. CI = Confidence Interval.*

To examine the relative differences between the types of Counterfactual Intervention, we reran our model two more times, each time setting a different Counterfactual Intervention as the reference category. For the sake of simplicity, we discuss only the significant results from these models in the subsequent text. The tables summarizing the parameters resulting from these analyses can be found in Appendix B.

When the reference category for Counterfactual Intervention was Divine, the results showed a main effect of School,  $\beta = 1.32$ ,  $SE = 0.59$ ,  $z = 2.23$ ,  $p = .026$ ; children attending the parochial school were more likely to judge Divine Intervention as plausible compared to children attending the secular schools. There was also a main effect of Counterfactual Intervention when comparing Divine Intervention to Magical Intervention,  $\beta = -1.67$ ,  $SE = 0.39$ ,  $z = -4.30$ ,  $p < .001$ , showing that overall children judged Divine Intervention as more plausible compared to Magical Intervention. The interaction of School and Counterfactual Intervention was also significant when comparing Divine Intervention to Mental,  $\beta = -1.67$ ,  $SE = 0.43$ ,  $z = -3.83$ ,  $p < .001$ , and Magical,  $\beta = -1.08$ ,  $SE = 0.49$ ,  $z = -2.55$ ,  $p = .011$ , Interventions. These interactions indicate that, compared to children from the secular schools, children from the parochial school were more likely to judge Divine Intervention as more plausible than Mental and Magical Intervention. Lastly, the interaction of Age and Counterfactual Intervention was significant when comparing Divine Intervention to both Mental,  $\beta = -1.22$ ,  $SE = 0.44$ ,  $z = -2.80$ ,  $p = .005$ , and Magical,  $\beta = -1.39$ ,  $SE = 0.50$ ,  $z = -2.78$ ,  $p = .006$ , intervention, showing that older children were more likely than younger children to judge Divine Intervention as more plausible than Mental and Magical Intervention.

When the reference category was Mental Intervention, results revealed a main effect of Counterfactual Intervention when comparing Mental Intervention to Magical Intervention,  $\beta = -1.22$ ,  $SE = 0.39$ ,  $z = -3.17$ ,  $p = .002$ . This finding shows that overall, children judged the former as more plausible than the latter.

In sum, our results revealed both striking similarities and differences between children from parochial and secular schools. Independent of type of schooling and age, children were more likely to judge interventions that did not involve a causal violation as plausible compared

to interventions that did involve such a violation. However, we also observed differences in plausibility judgments based on school type. When comparing Natural Intervention to Divine Intervention, children from the parochial school were likely to judge both as plausible, whereas children from the secular school judged Natural Intervention as more plausible than Divine Intervention. Children from the parochial school were also more likely to judge Divine Intervention as plausible compared to both Mental and Magical Interventions. Finally, the results also revealed some age differences. Compared to younger children, older children were more likely to judge Natural and Divine Interventions as more plausible than both Mental and Magical Interventions.

### **Justifications**

To assess the basis for children's judgments about the plausibility of counterfactual interventions, we analyzed how children justified their judgments. Because our goal was to assess whether children focused on the possibility or the impossibility of the suggested causal mechanism in an intervention when making a plausibility judgment, we coded the justifications into one of the following four mutually exclusive categories: (1) *Possible*, in which the child provided an explanation for the possibility of the suggested causal mechanism (e.g., "Water is what makes things grow", "Because God can just make it rain and then it can grow all the berries", "If you wish really, really hard, it will happen"); (2) *Impossible*, in which the child provided an explanation for the impossibility of the suggested causal mechanism (e.g., "I don't think it is gonna rain by praying"; "Magical water doesn't exist"; "Because wishing won't affect the berries"); (3) *Equivocal*, in which the child expressed uncertainty about the possibility of the causal mechanism (e.g., "There is a 50/50 chance that this will work", "Sometimes praying helps and sometimes it doesn't"); (4) *Other*, in which the child did not focus on the suggested

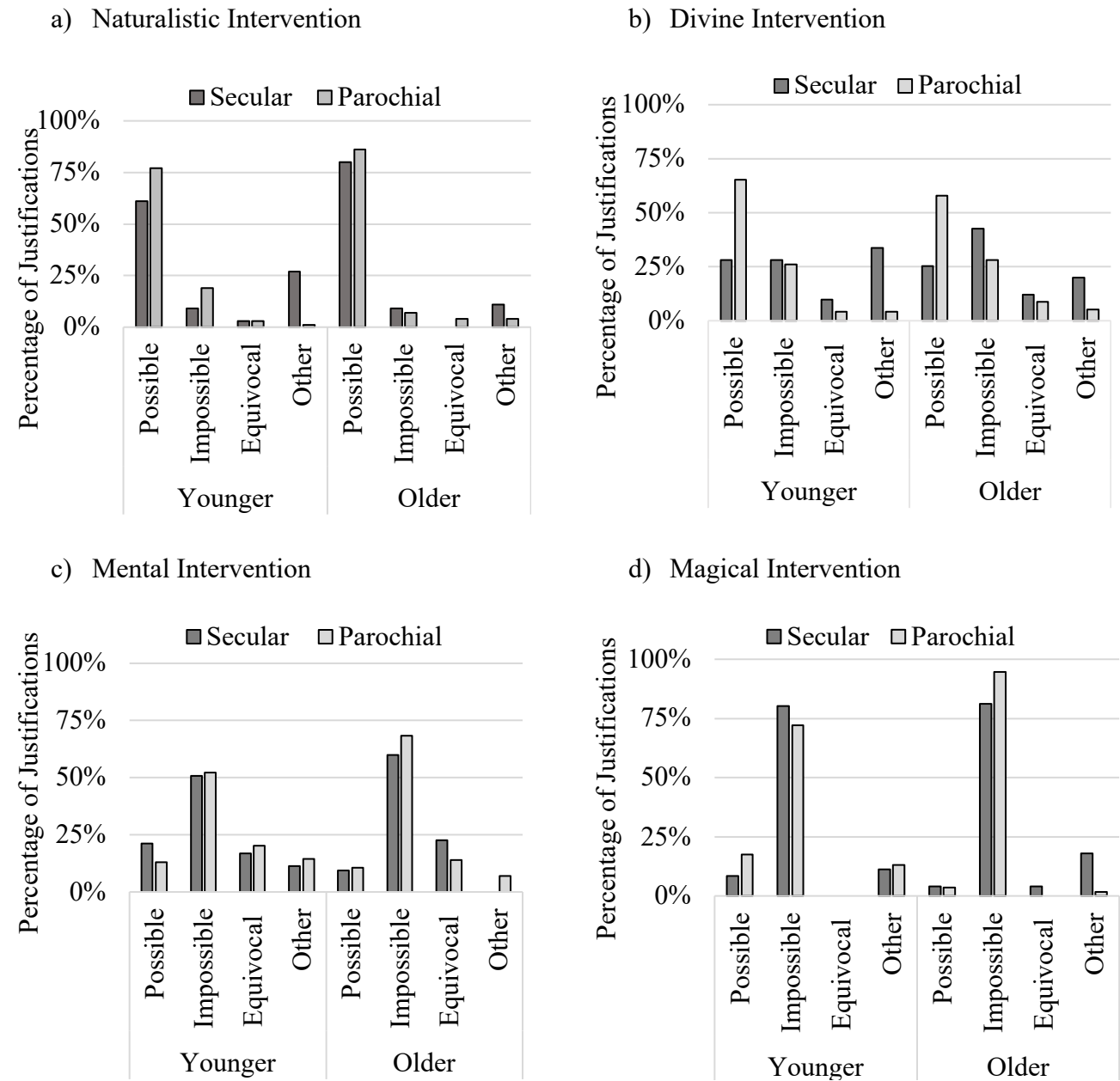
mechanism (e.g., “It is not nice to ask your friends to bring juice to your own party”; “God won’t help you take down the walls, because he does not want the people in the city to get harmed”) or provided answers such as “don’t know” or “just because.” A second researcher separately coded all responses, and the agreement between the two coders was high (Cohen’s  $\kappa = .90$ ).

Disagreements were resolved via discussion.

Figures 2a-2d display the percentage of justifications falling into each of the four justification categories as a function of school type and age for Naturalistic (Fig. 2a), Divine (Fig. 2b), Mental (Fig. 2c), and Magical (Fig. 2d) Interventions. An initial inspection of these figures reveals that children’s justifications show a pattern similar to their plausibility judgments, which varied mainly by intervention type. Children from the secular and parochial schools primarily justified their judgments for the Naturalistic, Mental, and Magical Interventions in similar ways. They referred to the *possibility* of Naturalistic Intervention but to the *impossibility* of Mental, and especially of Magical, Intervention. There was also a small percentage of *equivocal* justifications, provided for Mental Intervention in particular and to a lesser degree for Divine Intervention. However, the two groups of children differed in their justifications for the Divine Intervention (see Fig. 2b).

**Figure 2**

*Percentage of each justification type (possible, impossible, equivocal, other) by school type and age group for (a) naturalistic, (b) divine, (c) mental, and (d) magical intervention.*



To confirm these conclusions, we analyzed children's justifications using mixed effects binomial logistic regression with the *glmer* function of the *lme4* package in R statistical software (version 4.0.1). In all subsequent analyses, we excluded *other* justifications, as these were uninformative, and focused on the remaining three categories of justifications. As noted above, children's primary justifications shifted by intervention type; they provided mainly *possibility*-oriented justifications for Naturalistic Intervention whereas they mainly provided *impossibility*-oriented justifications for Magical and Mental Interventions. For Divine Intervention, however, children provided a mix of both *possibility*- and *impossibility*-oriented justifications. Lastly, children provided a small number of *equivocal* justifications. These mainly emerged in response to Divine and especially for Mental Interventions but were largely absent for Naturalistic and Magical Interventions, with a few exceptions ( $n = 6$  and  $n = 3$ , respectively). Accordingly, we first examined the likelihood of providing *possibility*-oriented in comparison to *impossibility*-oriented justifications for all counterfactual interventions. Next, we examined the likelihood of providing *equivocal* in comparison to non-equivocal (i.e., *possibility*- and *impossibility*-oriented) justifications for Divine and Mental Interventions.

To examine the likelihood of *possibility*-oriented in comparison to *impossibility*-oriented justifications, we ran a binomial logistic regression model with Counterfactual Intervention (Naturalistic [the reference category], Divine, Mental, Magical), School (Parochial vs. Secular), Age (Younger vs. older), and all possible two-way interactions between these variables as fixed effects. To account for the potentially confounding effect of Gender (Female vs. Male), we also entered Gender and Gender X School interaction as fixed effects. Participant and Story were entered as random effects to account for within-participant variability. For the sake of simplicity,

we discuss only the significant results in the subsequent text, but all parameters can be found in Table 2.

The results of this analysis confirmed the patterns in Figure 2. As summarized in Table 2, the main effect of Counterfactual Intervention was significant when comparing Naturalistic Intervention to Divine,  $\beta = -2.00$ ,  $SE = 0.51$ ,  $z = -3.95$ ,  $p < .001$ , Mental,  $\beta = -3.20$ ,  $SE = 0.53$ ,  $z = -6.04$ ,  $p < .001$ , and Magical Interventions,  $\beta = -4.60$ ,  $SE = 0.60$ ,  $z = -7.67$ ,  $p < .001$ . These findings indicate that overall children provided significantly more *possibility*-oriented justifications for Naturalistic Intervention compared to each of the remaining interventions. The interaction between School and Counterfactual Intervention was significant when comparing Naturalistic Intervention to Divine Intervention,  $\beta = 1.32$ ,  $SE = 0.56$ ,  $z = 2.35$ ,  $p = .019$ . This finding shows that the effect of School on the probability of providing *possibility*-oriented justifications differed for Divine Intervention as compared to Naturalistic Intervention, with children from the parochial school providing more *possibility*-oriented justifications for Divine Intervention as compared to children from the secular schools. Lastly, the interaction between Age and Counterfactual Intervention was also significant when comparing Naturalistic Intervention to Divine,  $\beta = -1.25$ ,  $SE = 0.57$ ,  $z = -2.20$ ,  $p = .028$ , Mental,  $\beta = -1.94$ ,  $SE = 0.64$ ,  $z = -3.00$ ,  $p = .003$ , and Magical,  $\beta = -2.28$ ,  $SE = 0.73$ ,  $z = -3.11$ ,  $p = .002$ , Interventions. This finding shows that the effect of Age on the probability of providing a *possibility*-oriented justification differed for Divine, Mental and Magical Interventions as compared to Naturalistic Intervention, with older children providing fewer *possibility*-oriented justifications for each of the former three interventions compared to younger children.



**Table 2**

*Results from the mixed effects binomial logistic regression model predicting the likelihood of children's possibility-oriented justifications using counterfactual intervention (naturalistic as the reference category), school type, age, and gender as predictors.*

	$\beta$ (SE)	z	OR	95% CI for OR	
				Lower	Upper
<b>Intercept</b>	1.92 (0.65)**	2.98	6.85	1.93	24.28
<b>School Type</b>	-0.04 (0.67)	0.06	0.96	0.26	3.60
<b>Age</b>	0.79 (0.60)	1.33	2.21	0.69	7.14
<b>Gender</b>	0.28 (0.44)	0.65	1.33	0.57	3.13
<b>School X Age</b>	0.12 (0.63)	0.19	1.13	0.33	3.84
<b>School X Gender</b>	-0.27 (0.62)	-0.44	0.76	0.23	2.55
<b>Counterfactual Intervention</b>					
Naturalistic – Divine	-2.00 (0.51)***	-3.95	0.13	0.05	0.36
Naturalistic – Mental	-3.20 (0.53)***	-6.07	0.04	0.01	0.12
Naturalistic – Magical	-4.60 (0.60)***	-7.67	0.01	0.00	0.03
<b>School X Counterfactual Intervention</b>					
Naturalistic – Divine	1.32 (0.56)*	2.35	3.73	1.24	11.20
Naturalistic – Mental	-0.09 (0.62)	-0.15	0.91	0.27	3.10
Naturalistic – Magical	0.76 (0.68)	1.11	2.14	0.56	8.15
<b>Age X Counterfactual Intervention</b>					
Naturalistic – Divine	-1.25 (0.57)*	-2.20	0.29	0.10	0.88
Naturalistic – Mental	-1.94 (0.64)**	-3.00	0.14	0.04	0.51
Naturalistic – Magical	-2.28 (0.73)**	-3.11	0.10	0.02	0.43

*Note:* \*  $p < 0.001$ ; \*\*  $p < 0.01$ , \*\*\*  $p < 0.05$ . OR = Odds Ratio. CI = Confidence Interval.

Next, we examined the likelihood of providing *equivocal* in comparison to non-equivocal justifications (i.e., collapsing across *impossibility*- and *possibility*-oriented justifications) using the model above. Given that Naturalistic and Magical Interventions led to very few equivocal justifications, we excluded them from the analysis. None of the interaction effects reached significance ( $ps \geq .167$ ). Therefore, we dropped them from the analysis and reran our model with only the main effects. The parameters of the final model are provided in Table 3. Confirming the observations drawn from Figure 2, Counterfactual Intervention was the only significant predictor,  $\beta = 0.81$ ,  $SE = 0.28$ ,  $z = 2.89$ ,  $p = .004$ , indicating that overall children

provided more *equivocal* justifications for Mental Intervention as compared to Divine Intervention.

**Table 3**

*Results from the mixed effects binomial logistic regression model predicting the likelihood of children's equivocal justifications using counterfactual intervention (divine as the reference category), school type, age, and gender as predictors.*

	$\beta$ (SE)	Z	OR	95% CI for OR	
				Lower	Upper
<b>Intercept</b>	-1.95 (0.39)***	-5.03	0.14	0.07	0.30
<b>School Type</b>	-0.48 (0.33)	-1.46	0.62	0.32	1.18
<b>Age</b>	0.05 (0.33)	0.16	1.06	0.56	2.00
<b>Gender</b>	-0.40 (0.33)	-1.22	0.67	0.35	1.27
<b>Counterfactual Intervention</b>					
Divine – Mental	0.81 (0.28)**	2.89	2.25	1.30	3.92

*Note: \*  $p < 0.001$ ; \*\*  $p < 0.01$ , \*\*\*  $p < 0.05$ . OR = Odds Ratio. CI = Confidence Interval.*

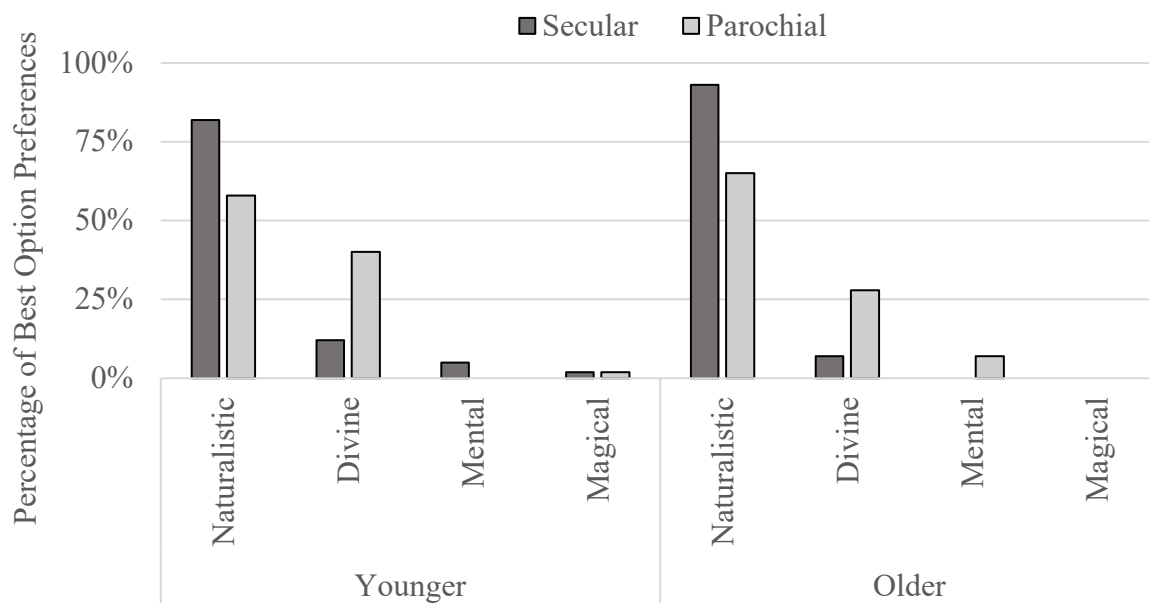
In sum, analysis of children's justifications consolidated the conclusions drawn from their plausibility judgments. Regardless of school type and age, children overwhelmingly referred to the possibility of Natural Intervention and the impossibility of Magical Intervention when justifying these judgments; equivocal justifications were extremely rare for these two interventions. We found some notable differences, however, based on type of schooling. When comparing Natural Intervention to Divine Intervention, children attending the secular schools were less likely to judge the latter as plausible compared to children from the parochial school. Although children mostly referred to the impossibility of Mental Intervention, they also provided a considerable number of equivocal responses for this intervention. Lastly, as compared to younger children, older children were more likely to provide possibility-oriented justifications for Natural Interventions than they were for the rest of the intervention types.

### **Best Option Preferences**

To explore which of the four counterfactual intervention types children judged as most plausible, we turned to their best option preferences. Figure 3 displays the percentage of these preferences for each counterfactual intervention by participants' schooling and age. Inspection of Figure 3 indicates that overall, children judged Mental and Magical Interventions as the least plausible and Naturalistic Intervention as the most plausible counterfactual alternative, regardless of age and type of schooling. However, the type of schooling was associated with their preferences for Divine Intervention.

### Figure 3

*Percentage of children's "best option" preferences for different types of alternative interventions by schooling and age group.*



To confirm these patterns, we analyzed best-option preferences using mixed binomial logistic regression with the *glmer* function of the *lm4* package in R statistical software (version 4.0.1). Given that only a few children indicated Mental and Magical Intervention as the best option ( $n = 7$ , and  $n = 2$ , respectively), we excluded these intervention types from the analysis

and examined the likelihood of selecting Divine Intervention in comparison to selecting Naturalistic Intervention. We entered School (Parochial vs. Secular), Age (Younger vs. Older), and their interaction as fixed effects. To account for the potentially confounding effect of Gender (Female vs. Male), we also entered Gender and Gender X School interaction as fixed effects. Participant and Story were entered as random effects to account for within-participant variability. None of the interaction effects reached significance ( $ps \geq .30$ ). Therefore, we dropped them from the analysis and reran our model with only the main effects. The parameters of the final model are provided in Table 4. Confirming the observations drawn from Figure 3, there was a significant effect of School,  $\beta = -2.60$ ,  $SE = 0.79$ ,  $z = -3.27$ ,  $p = .001$ , indicating that, compared to children from the secular schools, children from the parochial school displayed a less marked preference for Naturalistic over Divine Intervention.

**Table 4**

*Results from the mixed effects binomial using school type, age, and gender as predictors.*

	$\beta$ (SE)	Z	OR	95% CI for OR	
				Lower	Upper
<b>Intercept</b>	-3.69 (0.95)***	-3.89	0.025	0.00	0.16
<b>School Type</b>	2.60 (0.79)**	3.27	13.43	2.83	63.62
<b>Age</b>	-1.04 (0.73)	0.16	0.36	0.09	1.48
<b>Gender</b>	0.77 (0.70)	1.11	2.17	0.55	8.51

*Note: \*  $p < 0.001$ ; \*\*  $p < 0.01$ , \*\*\*  $p < 0.05$ . OR = Odds Ratio. CI = Confidence Interval.*

In sum, children's judgments regarding which counterfactual intervention could have been most helpful in preventing the undesired outcome varied depending on the type of school they attended. Naturalistic Intervention was a clear-cut preference for children from the secular schools. By contrast, although the majority of children from the parochial school also chose the Naturalistic Intervention (61%), a sizeable minority (35%) indicated that the Divine Intervention was the best option.

### Discussion

Previous research suggests that, in accordance with the testimony in their community, children from religious backgrounds readily believe in God and judge miracles as real despite their overall skeptical stance towards events that are inconsistent with natural causal laws (Barrett, Richert, Driesenga, 2001; Giménez-Dasí, Guerrero, & Harris, 2005; Harris & Corriveau, 2019). Does this imply that exposure to religious content leads to a fundamental change in children's basic understanding of causality? To answer this question, we asked children attending secular and religious schools how an undesired outcome could have been prevented and invited them to judge the plausibility of counterfactual interventions that are consistent, or inconsistent, with natural causal laws.

Regardless of the school they were attending, children spontaneously invoked counterfactual alternatives that were consistent with natural causal laws when indicating how the undesired outcome could have been prevented. The paucity of supernatural causes in children's spontaneous explanations is consistent with earlier findings showing that children invoke natural explanations even in the face of unexpected or unusual events (Huang, 1930, 1943; Mead, 1932; Woolley et al., 2011). Indeed, in the current study, the five responses coded as supernatural occurred only after children had heard examples of supernatural interventions when listening to the stories. Therefore, it is possible these responses merely echoed the types of examples provided by the experimenter.

Similarly, when judging the plausibility of counterfactual interventions, children from both religious and secular backgrounds systematically endorsed interventions consistent with natural causal laws. This finding supports earlier studies showing that children judge story events as possible when these events do not violate natural causal laws (Corriveau et al., 2009, 2015).

However, children's judgments regarding the counterfactual interventions that were inconsistent with natural causal laws revealed both similarities and differences between children attending parochial as compared to secular schools. In line with their skeptical stance toward events that depart from ordinary reality (Shtulman & Carey, 2007; Subbotsky, 1994, 2010; Woolley & Cox, 2007), children from both groups systematically denied that mental and magical interventions could have altered the outcome. However, children attending parochial schools put this skeptical stance aside when it came to judging the type of supernatural cause that their community endorsed. Thus, they were more likely than children attending secular schools to judge the divine intervention as plausible. Consistent with previous research (Lane, 2020), they were also more likely than their peers attending secular schools to judge divine intervention as more plausible than mental intervention. The differences between the two groups of children were also apparent in the justifications they provided for their plausibility judgments. Whereas children attending parochial schools often affirmed the possibility of divine intervention in their justifications, children attending secular schools were divided about the possibility versus impossibility of this type of intervention. Nevertheless, both groups of children affirmed the impossibility of the mental, and especially the magical, interventions.

The type of school children attended was also related to their choice regarding which intervention would have been most helpful in preventing the outcome. Children attending secular schools overwhelmingly picked the naturalistic intervention as the most helpful and judged all supernatural interventions as useless at similar rates. Although the majority of children attending the parochial school also indicated that the naturalistic intervention was best, a sizeable minority chose the divine intervention, differentiating the divine intervention from the rest of the supernatural interventions.

Lastly, our results revealed some age differences. Older children were more likely than younger children to judge mental and magical intervention as implausible compared to both naturalistic and divine intervention. In other words, older children not only differentiated naturalistic intervention from mental and magical interventions at higher rates, but they also differentiated divine intervention from the remaining two supernatural interventions at higher rates. This is consistent with previous work in which older children judged the events and characters in religious stories—where there was a reference to a divine intervention—as real more often compared to those in closely matched, nonreligious stories (Vaden & Woolley, 2011).

In sum, the responses of children from religious and secular backgrounds differed only in the case of divine intervention. Therefore, with respect to the two competing hypotheses discussed in the introduction, our results lend support to the hypothesis favoring a relatively narrow role for religious testimony in shaping children’s understanding of causality. In other words, religious testimony does not fundamentally alter children’s basic notion of causality, but rather extends the range of causal factors that they entertain. It is noteworthy that, regardless of their background, children rarely invoked any supernatural force for a natural event when given an open-ended invitation to say how it might have been forestalled, but they did endorse the efficacy of divine intervention when explicitly asked about it. This may also explain why religious children in prior work (Corriveau et al., 2015) were less likely than secular children to judge that, protagonists in magical stories were not real. If children pay attention to story contexts to make the real/pretend distinction, it is possible that the similarity between the magical and religious stories in that study, which were all adapted from the Bible, led to a spillover from the religious stories to the magical stories. Lastly, although it is possible that the

school setting might have had an effect on the judgments of children from the parochial school, we think that this effect is likely to be minimal given the previous research suggesting that the effect of religiosity on children's possibility judgments is unlikely to be context specific (Vaden & Woolley, 2011).

The current work extends the previous literature on possibility judgments in several ways. First, unlike the previous studies indicating that these judgments varied based on children's exposure to religious teaching (Corriveau et al., 2015; Vaden & Woolley, 2011), we used a more naturalistic approach by examining whether children spontaneously bring supernatural ideas to mind before they were prompted with such cues. Second, we assessed children's possibility judgments across a variety of ordinarily impossible causal interventions—divine power, wishes, and magic—and across a wide age range that spanned from early to late childhood. Third, we employed a new tool to study children's possibility judgments: counterfactual thoughts about past events.

Our findings indicate that religious background, as indexed by attendance at a parochial school, is associated with credulity towards ordinarily impossible events brought about by divine intervention, but not by wishes or magic. However, attending a religious school is only one way that religiosity could be measured. Thus, pending further research, it may be safer to regard schooling as an index of a broad set of differences between the two groups of children. Nevertheless, as discussed by Corriveau et al. (2015), there is evidence that any type of religious exposure—be it via attendance at religious services or via schooling—is sufficient to lead to differences in children's narrative judgments. Lastly, because the children from the parochial school were Christian, these findings would not necessarily generalize to children from other



religious backgrounds. Future studies could test how testimony in different religious communities that do not teach Christian beliefs shape children's possibility judgments.

The current work also adds to the literature on the coexistence of natural and supernatural explanations. Previous research suggests that two seemingly incompatible conceptions of the same phenomenon—one scientifically informed and the other based on religious beliefs—coexist side by side within the same individual (Legare, Evans, Rosengren, & Harris, 2012; Payir et al., 2020; Shtulman & Legare, 2019). Evidence for such explanatory coexistence has emerged for a variety of phenomena, such as death (Astuti & Harris, 2008; Harris & Giménez, 2005), illness (Gelman & Raman, 2004; Legare & Gelman, 2008; Nguyen & Rosengren, 2004), and human origins (Evans, 2001; Evans & Lane, 2011). Consistent with this evidence, our results indicate that children who are exposed to religious testimony on a regular basis endorse naturalistic and divine intervention at similar rates. Indeed, by demonstrating that the gap between divine intervention and the other supernatural interventions widens with age, this study shows that children become more accepting of supernatural ideas that are endorsed by their culture and discard the ones that are not as they get older, adding to previous evidence (Harris & Gimenez, 2005; Richert, Saide, Lesage, & Shaman, 2016; Rosengren et al., 2014; Shtulman, Foushee, Barner, Dunham, & Srinivasan, 2019).

Lastly, our findings also have implications regarding how children think about counterfactuals. Research with adults suggests that counterfactual thought is “rational” (Byrne, 2007); when adults generate counterfactuals, they tend to stick with realistic alternatives. They do not invoke the suspension of natural causal laws (e.g., “she would not have fallen if there had not been gravity”, Seeleu, Seeleu, Wells, Windschitl, 1995, as cited in Byrne, 2007) or focus on impossible antecedents (e.g., “if kangaroos had no tails, they would topple over”, Lewis, 1973,

as cited in Byrne, 2007). Because developmental research has largely focused on when counterfactual thinking ability first emerges, rather than how children use it spontaneously in everyday life, the contents of children's counterfactuals are largely unknown (see Nyhout & Ganea, 2020, for an exception and further discussion). By showing that children imagine counterfactual alternatives that closely align with realistic possibilities, the current study provides developmental evidence that counterfactual thought is "rational" (see Byrne, 2007, for a further discussion).

### **Conclusions**

This study significantly extends recent research examining the impact of religious teaching on children's possibility judgments. Regardless of religious background, children invoked naturalistic counterfactual interventions when thinking about how a negative outcome could have been prevented. When provided with different alternatives, however, children from parochial schools were more likely than children from secular backgrounds to endorse divine intervention. These findings indicate that a religious education does not alter children's basic understanding of causality but rather adds divine intervention to their repertoire of possible causal factors.

## Appendix A

### George Story

This is George. He is a farmer. He used to plant strawberries on his farm. One summer, there was no rain so the plants did not have any berries. George felt really sad about what happened and later thought to himself about how things could have been different so that he could have had many berries.

#### Counterfactual Alternative with Naturalistic Intervention

*“If I had brought some water from the dam for my farm, then my plants would have been loaded with berries.”*

#### Counterfactual Alternative with Divine Intervention

*“If I had prayed really hard at night, then with the help of God, my plants would have been loaded with berries.”*

#### Counterfactual Alternative with Mental Intervention

*“If only I had wished really hard that I had many berries, then my plants could have been loaded with berries.”*

#### Counterfactual Alternative with Magical intervention

*“If only a fairy flew over the plants spraying some special water, then my plants could have been loaded with berries.”*

### Pamela Story

This is Pamela. One day Pamela was holding a special party but she forgot to buy juice for her friends before the party started. Her friends only had water to drink, so they did not enjoy the party much, which made Pamela really upset. She later thought to herself about how things could have been different so that she could have had some juice to give her friends.

## Counterfactual Alternative with Naturalistic Intervention

*“If I had called my friends beforehand, then they could have brought some juice for me to give them.”*

## Counterfactual Alternative with Divine Intervention

*“If I had prayed really hard, then with the help of God, the water I gave my friends could have turned into juice.”*

## Counterfactual Alternative with Mental Intervention

*“If only I had wished really hard that I had some juice, then I could have had some to give my friends.”*

## Counterfactual Alternative with Magical intervention

*“If only I had my magical bottle filled with water, then the water could have turned into juice as I poured it into my friends’ glasses.”*

**Chris Story**

This is Chris. He is a soldier. One day his army was trying to get into a city, but the city was surrounded with very high walls. Because they could not get into the city, Chris and his army lost the battle. Chris felt really sad about what happened and later thought to himself about how things could have been different so that he could have entered the city and won the battle.

## Counterfactual Alternative with Naturalistic Intervention

*“If I had found some huge tree trunks to ram the walls, then the walls could have fallen down and we could have entered the city.”*

## Counterfactual Alternative with Divine Intervention

*“If I had prayed really hard, then with the help of God, the walls could have fallen down and we could have entered the city.”*

Counterfactual Alternative with Mental Intervention

*“If only I had wished really hard that the walls of the city fell down, then the walls could have fallen down and we could have entered the city.”*

Counterfactual Alternative with Magical intervention

*“If I had ridden a horse around the city and played my magical guitar, then the walls could have fallen down and we could have entered the city.”*

## Appendix B

**Table B1**

*Results from the mixed effects binomial logistic regression model predicting the likelihood of children's "yes" judgments using counterfactual intervention (divine as the reference category), school type, age, and gender as predictors.*

	$\beta$ (SE)	Z	OR	95% CI for OR	
				Lower	Upper
<b>Intercept</b>	- 0.15 (0.48)	- 0.31	0.86	0.34	2.19
<b>School Type</b>	1.32 (0.59)*	2.23	3.73	1.17	11.85
<b>Age</b>	0.61 (0.48)	1.28	1.84	0.72	4.73
<b>Gender</b>	0.01 (0.42)	0.02	1.01	0.45	2.28
<b>School X Age</b>	- 0.41 (0.61)	-0.68	0.66	0.20	2.20
<b>School X Gender</b>	0.14 (0.61)	0.24	1.15	0.35	3.81
<b>Counterfactual Intervention</b>					
Divine – Naturalistic	2.53 (0.42)***	5.99	12.53	5.48	28.65
Divine – Mental	- 0.45 (0.34)	-1.31	0.64	0.33	1.25
Divine – Magical	-1.67 (0.39)***	-4.30	0.19	0.09	0.40
<b>School X Counterfactual Intervention</b>					
Divine – Naturalistic	-1.88 (0.50)***	- 3.80	0.15	0.06	0.40
Divine – Mental	-1.67 (0.44)***	- 1.31	0.19	0.08	0.44
Divine – Magical	-1.08 (0.49)*	-2.19	0.34	0.13	0.89
<b>Age X Counterfactual Intervention</b>					
Divine – Naturalistic	0.12 (0.50)	0.24	1.12	0.42	2.96
Divine – Mental	-1.22 (0.44)**	-2.80	0.30	0.13	0.70
Divine – Magical	-1.39 (0.50)**	-2.78	0.25	0.09	0.66

*Note: \*  $p < 0.001$ ; \*\*  $p < 0.01$ , \*\*\*  $p < 0.05$ . OR = Odds Ratio. CI = Confidence Interval.*

**Table B2**

*Results from the mixed effects binomial logistic regression model predicting the likelihood of children's "yes" judgments using counterfactual intervention (mental as the reference category), school type, age, and gender as predictors.*

	$\beta$ (SE)	z	OR	95% CI for OR	
				Lower	Upper
<b>Intercept</b>	0.60 (0.48)	- 1.24	0.55	0.22	1.41
<b>School Type</b>	- 0.36 (0.59)	- 0.60	0.71	0.22	2.23
<b>Age</b>	- 0.61 (0.49)	-1.23	0.55	0.21	1.43
<b>Gender</b>	0.01 (0.42)	0.02	1.01	0.45	2.28
<b>School X Age</b>	- 0.41 (0.61)	-0.68	0.66	0.20	2.20
<b>School X Gender</b>	0.14 (0.61)	0.24	1.15	0.35	3.81
<b>Counterfactual Intervention</b>					
Mental – Naturalistic	2.98 (0.43)***	6.84	19.60	8.35	45.96
Mental – Divine	0.45 (0.34)	1.31	1.56	0.80	3.05
Mental – Magical	-1.22 (0.39)**	-3.17	0.29	1.14	0.63
<b>School X Counterfactual Intervention</b>					
Mental – Naturalistic	-0.21 (0.52)	- 0.41	0.81	0.29	2.22
Mental – Divine	1.67 (0.44)***	3.83	5.33	2.26	12.56
Mental – Magical	0.60 (0.48)	1.24	1.82	0.70	4.70
<b>Age X Counterfactual Intervention</b>					
Mental – Naturalistic	1.33 (0.52)*	2.55	3.80	1.36	10.59
Mental – Divine	1.22 (0.44)**	2.80	3.38	1.44	7.95
Mental – Magical	-0.35 (0.49)	-2.78	0.84	0.32	2.22

*Note: \*  $p < 0.001$ ; \*\*  $p < 0.01$ , \*\*\*  $p < 0.05$ . OR = Odds Ratio. CI = Confidence Interval.*

### Appendix C

The data were collected in North Carolina, in a mid-sized metropolitan city with approximately 300,000 residents. Although the two major groups are European American (48.4%) and African American (40.4%), the city has a rapidly growing Latino (7.5%) and Asian (4%) population. Information regarding the participating schools is presented in Table C1.

**Table C1**

*Information regarding the participating schools*

	<b>School 1</b>	<b>School 2</b>	<b>School 3</b>
	<b>Private/Parochial</b>	<b>Private/Secular</b>	<b>Private/Secular</b>
<b>Type of School</b>	Mostly serving Catholic families but applicants of all faiths are welcome.	Day School	Montessori School
<b>Range of Tuition (Kindergarten to 8<sup>th</sup> grade)</b>	\$6,355-\$9,230	\$18,615-\$24,200	\$8,268-\$19,500
<b>Students by SES</b>	Mostly middle to upper-middle class; need-based financial assistance provided	Mostly middle to upper-middle class families; about 28% of students are on a scholarship	Mostly middle to upper-middle class families; about 25% of students are on a scholarship
<b>Students by ethnicity (%)</b>			
<b>White</b>	70	83	72
<b>Hispanic</b>	13	2	1
<b>Black</b>	6	8	8
<b>Asian</b>	4	4	11
<b>Pacific Islander</b>	0	0	1
<b>Two or more ethnicities</b>	6	3	7



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