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Children’s understanding of reality and possibility and its cultural transmission mechanisms

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Dissertation

CHILDREN'S UNDERSTANDING OF REALITY AND POSSIBILITY AND ITS CULTURAL TRANSMISSION MECHANISMS

by

YIXIN KELLY CUI

B.A., Tsinghua University, 2013
M.A., Columbia University, 2015

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Approved by

First Reader

Kathleen H. Corriveau, Ed.D.
Professor of Human Development

Second Reader

Melissa K. Holt, Ph.D.
Associate Professor of Counseling Psychology
Chair of Counseling Psychology & Applied Human Development

Third Reader

Paul L. Harris, D.Phil.
Victor S. Thomas Professor of Education
Harvard University

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CHILDREN'S UNDERSTANDING OF REALITY AND POSSIBILITY AND ITS CULTURAL TRANSMISSION MECHANISMS

YIXIN KELLY CUI

Boston University, Wheelock College of Education & Human Development, 2021

Major Professor: Kathleen H. Corriveau, Ed.D., Professor of Human Development

ABSTRACT

When learning about concepts that are difficult to experience first-hand, children must rely on information from others. One challenge for young children is that adults may provide differing information, yet few studies have examined how children reconcile conflicting beliefs from different sources. Across three studies, I explored children's understanding of reality and possibility in natural and supernatural domains from secular and Christian communities in a largely secular society, Mainland China. Two age groups were included, one group before formal schooling (5- to 6-year-olds), where children are mainly exposed to testimony from parents and their immediate circle, and one group after several years of schooling (9- to 11-year-olds), where the testimony from parents may support or conflict with school testimony. Specifically, in Study 1, children and their parents were asked to judge the existence of unobservable scientific and religious entities. Results showed that the ontological judgments of children from both age groups were in strong correspondence with their parents' beliefs, even when parental testimony may conflict with the testimony children receive in school. Study 2 expanded beyond Study 1 to explore children's understanding of fact and fiction in counter-intuitive processes. Study 2 also asked whether religious exposure from the immediate circle in a largely

secular society may extend Christian children's understanding of possibility in formal religious contexts to folk religious contexts, fantastical contexts or improbable contexts in general. It was found that with age, Christian Chinese children became less likely to extend their belief in the impossible via God's intervention to other magical or divine powers. Lastly, Study 3 examined and revealed the specific elements of parental testimony that might alert children to the existence or non-existence of unobservable concepts by analyzing parent-child conversations about unobservable scientific and religious concepts in both high consensus and low consensus domains.

Taken together, Study 1 and Study 2 demonstrated the weight of testimony from parents and the immediate community on children's understanding of possibility and facts when there is conflicting testimony in the larger society. Study 3 provided evidence on parental testimony as one possible cultural transmission mechanism. The final chapter addresses the significance and implications of these findings in the field of developmental science and education.

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CHAPTER 1: LITERATURE REVIEW

Introduction

One contemporary view of cognitive development holds that children are like scientists in the way they construct and revise their theories about the world (Gopnik & Wellman, 2012). Through observing and interacting with the surrounding physical and social environment, children gather data to revise their naive theories about physical, biological and psychological constructs. However, although learning from first-hand experience plays an important role in children's conceptual development, a great deal of knowledge in domains such as science, history, and religion cannot be acquired through first-hand experience. How do children make decisions about what is real and possible when there is no first-hand evidence available? In the era of post-truth with fake news, the ability to understand what is real and possible is critical in children's cognitive development, especially in the pursuit of truth.

By age five, children confidently affirm the existence of unobservable entities, i.e., challenging to experience first-hand entities, including scientific ones (e.g., germs and oxygen) and culturally endorsed ones (e.g., Santa Claus, God and the Tooth Fairy; Guerrero, Enesco & Harris, 2010; Harris, et al., 2006; Harris, Abarbanell, Pasquini & Duke, 2007). Children's beliefs in the existence of these entities do not seem to be constrained by their early-developing naïve theories about physical laws, given that many characteristics of culturally endorsed entities violate natural physical laws (Shtulman & Carey, 2007; Shtulman, 2009). Instead, research has indicated that one of the primary ways through which children learn about reality and possibility is in conversations and

discussions with other people, particularly trusted adults (e.g., Harris, 2012; Harris, Koenig, Corriveau, & Jaswal, 2017).

Nevertheless, it is not the case that the testimony children receive about the reality status of an entity is always consistent. Children's learning becomes more difficult in the face of conflicting information, such as inconsistent information from parents and from the broader society. Parental testimony has been a focus of children's social learning, in part because parents are the most familiar and authoritative source for young children, especially before formal schooling (e.g., Corriveau et al., 2009; Degner & Dalege, 2013) and because many studies have demonstrated the role of parents in children's understanding of reality and possibility (e.g., Woolley et al., 2004). The role of parental testimony in children's conceptions of unobservable entities may be less prominent as children age and become more integrated within their cultural communities. When children start formal schooling around the age of 6, their teachers and the curriculum content that they encounter in school are likely to become an additional major influence (Siegel, 2005). Around the same age, if not earlier, children start to read, and books can become another type of trusted source. Recent research has shown that, as compared to pre-readers, readers are more likely to trust written than oral information (Corriveau, Einav, Robinson & Harris, 2014). Thus, as children are exposed to more varied sources, especially after several years of formal schooling, the role of parental testimony in children's belief in the existence of unobservable entities may become less central. Indeed, if parents' testimony is inconsistent with the information that children receive from teachers, children's beliefs may ultimately diverge from those of their parents.

However, few studies have systematically examined children's understanding of reality and possibility when considering the match between parental testimony and other sources. One challenge is that it is exceptionally difficult to monitor the source(s) of children's knowledge in a pluralistic society such as U.S., where children are likely to be exposed to a variety of claims about what is real and possible through both parents and the community with diverse curricula and educational philosophies. In my dissertation, this challenge was tackled by focusing on two relatively homogenous communities as a test case: secular and Christian families in Mainland China. Whereas children from secular families receive uniform testimony about the existence of scientific phenomena and the nonexistence and impossibility of supernatural phenomena, children from Christian families receive conflicting testimony, i.e., testimony about the existence of scientific and religious phenomena from their parents, and testimony about the nonexistence and impossibility of supernatural phenomena from the school curriculum and the broader society. The goal of my dissertation is to explore how the match and mismatch between parental testimony and the testimony from schools and the broader society about natural and supernatural concepts might impact children's understanding of reality and possibility. Specifically, through experimental design, survey, and semi-structured naturalistic discourse analyses, I investigated children's beliefs in scientific and religious unobservable entities and events with fantastical, religious and realistic figures in a majority cultural group and minority cultural group in Mainland China. In addition, I also focused on examining the conversational cues in parent-child dyads as a mechanism that explains how children develop an understanding of reality and possibility

in the two communities.

This dissertation is organized into three separate studies:

Study 1 (Chapter 2) Children and adults' judgment of the existence of unobservable entities.

Study 1 (Chapter 2) aimed to explore how the aforesaid match or mismatch between parental testimony and testimony from the broader society in regard to natural and supernatural phenomena impacts children's ontological beliefs in religious and scientific entities. Two specific research questions were examined in Study 1: 1) What are children's and adult's beliefs about the existence of religious and scientific unobservable entities, and does this vary by exposure to formal schooling and community? 2) What is the relation between children and parents' judgments about religious and scientific unobservable entities and does this vary by exposure to formal schooling and community?

Study 2 (Chapter 3) Children's judgment of possibility in events.

Study 2 (Chapter 3) expanded beyond Study 1 to examine Chinese children's understanding of fact and fiction in events. Importantly, Study 2 explored whether religious exposure in a largely secular society may extend children's understanding of possibility in religious contexts to folk religious or fantastical contexts in general.

Study 3 (Chapter 4) Conversational cue as a mechanism of transmission

Study 3 (Chapter 4) examined specific conversational cues in discourses about religious and scientific entities as one mechanism for the cultural transmission of beliefs and understanding in reality and possibility.

Below, I first review the literature associated with factors that influence children's developing understanding of possibility and reality. I then review the literature on religious belief and cognition in Mainland China.

Factors that contribute to children's developing understanding of possibility

When it comes to children's understanding of what is possible and what is not, the results from past literature are mixed. Whereas most 5- to 6-year-olds firmly believe that unobservable scientific phenomena (e.g., germs, oxygen) exist, some doubt the existence of fantastical phenomena (e.g., monsters, fairies), and some on the other hand endorse the existence of supernatural phenomena (e.g., God, Santa Claus; Harris, Pasquini, Duke, Asscher, & Pons, 2006). Meanwhile, most children would doubt the possibility of finding an alligator under their bed, an improbable but possible event according to adult views (Shtulman & Carey, 2007). Some researchers argue that children initially believe that everything told by others is real, before they understand that some things can be pretend (Piaget, 1930; Sharon & Woolley, 2004; Bering, 2011; Barrett, 2012); other researchers argue for the opposite progression: children initially tend to be skeptical about everything told by others, before developing an understanding that some things are real (Woolley & Ghossainy, 2013). Below I review factors that may influence children's developing understanding of what is real and possible.

Cognitive constraints on possibility judgments. Children learn a great deal about the world through first-hand experience, such as observation and interaction with the physical world (Piaget, 1952). Obviously, perception, especially visual accessibility is an important source of knowledge about the world. Particularly, visual accessibility is a very

important cue to the status of existence for young children. When there is lack of visual evidence, however, young children may find it challenging to decide the reality status of such unobservable concepts. Indeed, Woolley and McInnis Brown (2015) found that children's concepts of visibility and reality status are intertwined. They asked 3-, 5- and 7-year-old children to judge the reality status and the visibility status of visible real (orange juice, teacher, bike) and unreal entities (SpongeBob, Mermaid, Magic wand), as well as invisible real (germ, air, song) and unreal entities (ghost, imaginary friend, magic spell). Across all age groups, children were more likely to judge the invisible entities as unreal, as compared to visible entities, and they were more likely to judge the real entities as visible, compared to unreal entities. The researchers also created a reality-visibility score. If children judged both the visibility and reality status correctly, they would get one point, and they got zero points if there was at least one wrong answer. The results showed that only 7-year-olds were significantly above chance in getting both the reality and visibility judgment correct. Clearly, children's ability to disentangle the relation between reality and visibility could help or constrain their understanding of the existence of unobservable phenomenon. Woolley and McInnis Brown (2015) also found that children's performance on this task is related to children's performance on Appearance-Reality distinction, which measures children's ability to recognize the reality of an entity when the appearance does not match the reality. In line with this finding, Corriveau and Harris (2015) found that children's understanding of false-belief and false-sign is associated with their ability to identify novel figures as real in the context of realistic narratives, and as pretend in the context of fictional narrative. The "reality-tracking

representation" is argued to be involved in both false-belief understanding and the appreciation of fictional narratives. The Appearance-Reality task can be considered as a measure of children's ability to mentally represent how reality may be in conflict with appearance (Lane & Harris, 2015). Similarly, Lane and Harris (2014) proposed that the development of mental representation ability is crucial for children to understand counter-intuitive concepts, such as the unobservable phenomena. Mental representations can help children and adults represent unobservable and counter-intuitive phenomena, which give rise to belief in their existence. Research on adults' imagination and belief may serve as support of this idea. Adults became more certain about the occurrence of events that were easy to imagine than events that were difficult to imagine (Garry, Manning, Loftus, & Sherman, 1996; Koehler, 1991).

Children also construct various theories to explain the physical world, such as naïve biology, naïve physics and naïve psychology through first-hand experience (Gopnik & Wellman, 1992; Carey, 1985; Smith, Carey, & Wiser, 1985; Spelke, Breinlinger, Macomber, & Jacobson, 1992). These naïve theories impact children's ontological understanding. However, unobservable phenomenon in both the supernatural and natural domains often defy young children's naïve theories developed through first-hand experience. For example, in the natural domain, children may form a naïve theory about the shape of earth through their daily first-hand experience with the earth. Indeed, children in elementary schools hold a mental model of flat earth early on (Vosniadou & Brewer, 1992; Vosniadou, 1994). A spherical shape of the Earth appears to be counter-intuitive to elementary schoolers. However, children do eventually construct a mental

model with a spherical Earth (Vosniadou & Brewer, 1992; Vosniadou, 1994). Similarly, the natural selection account of evolution is hard to construe for children and even adults. This difficulty is associated with several cognitive biases, such as the teleological bias to assign purpose or function to natural objects' properties (Kelemen, 2004), and the essentialist bias to view species members as having an unchanging essence (Gelman, 2003). However, even if children and adults show misconceptions about natural selection and evolutionary theory, such misconceptions can be corrected through appropriate intervention and instructions (Shtulman & Calabi, 2013; Kelemen et al., 2014).

In the supernatural domain, many fantastical and religious phenomena violate natural-physical laws, such as Santa Claus who flies on a sleigh and delivers gifts to all families in the world in one night, or a God who is omniscient and immortal. Children as young as 4 years old understand that physical violations are impossible (Shtulman & Carey, 2007; Shtulman, 2009). By the age of 5, children also attribute observed impossible and magical results to tricks (Rosengren & Hickling, 1994), and differentiate familiar historical realistic figures from familiar fantastical impossible ones (Corriveau, Kim, Schwalen & Harris, 2009). Between the age of 5 to 10, children also understand that all biological and psychological process would cease after death (Bering & Bjorklund, 2004; Harris, 2018). In spite of violation of the above naïve theories, many children still possess faith in supernatural phenomena such as God and Santa Claus (Prentice, Manosevitz, & Hubbs, 1978; Harris et al., 2006).

Given the substantive influence of the naïve theories and beliefs developed from first-hand experience, how do children become increasingly receptive to the existence of

counter-intuitive unobservable concepts in the natural and supernatural domain? Many have argued that belief in the unobservable is largely influenced by the testimony children receive from others (Harris & Koenig, 2006; Harris, 2007, 2012; Lane & Harris, 2014). According to past literature and reviews (Campbell & Corriveau, 2017; Lane & Harris, 2014; Woolley & Ghossainy, 2013), it is the relative strength of different second-hand evidence in support of or in conflict with the existence of certain unobservable phenomena, as well as the strength of cognitive bias gained through first-hand experience that drive children's developing understanding of what is real and possible in various domains. Below, I review social-cultural factors that influence the relative strength of first-hand and second-hand evidence when making reality and possibility judgments in both natural and supernatural domains.

Support from trusted adults. It has been argued that children's social learning, especially learning from others' testimony, is a rational process (Sobel & Kushnir, 2013). Children starting from three years old trust familiar adults more than unfamiliar adults (Corriveau & Harris, 2009). Children also prefer adults with competence and expertise (Lutz & Keil, 2002; VanderBorght & Jaswal, 2009). Among the various sources of testimony, parents are the most familiar and authoritative source for young children (Corriveau et al., 2009; Degner & Dalege, 2013). After formal schooling, teachers may be viewed as authoritative experts in the domains they teach (Siegel, 2005). The section below reviews literature on how testimony from trusted adults influences children's understanding of possibility and reality in different domains.

In the scientific domain, despite their first-hand experience that the Earth is

extended flat land, children eventually assimilate the claim that the earth has a round surface (Vosniadou & Brewer, 1992; Vosniadou, 1994; Harris & Koenig, 2006). Much of this knowledge is taught at school through teachers and textbooks usually starting in the second grade (Smith, 2015). Written information is shown to be a trustworthy source over oral information, especially for readers (Corriveau, Einav, Robinson & Harris, 2014). Through a picture-storybook intervention in the school context, Kelemen et al. (2014) found that 5- to 8-year-olds' conception of natural selection can be significantly improved. Shtulman and Calabi (2013) also found that college students' misconceptions of evolution can be improved through formal biology instruction.

In the supernatural domain, the scope of parental testimony in support of children's beliefs is not be limited to explicit verbal cues, but also extends to implicit verbal cues and supportive activities or rituals as non-verbal evidence. Prentice, Manosevitz, and Hubbs (1978) interviewed parents about the way they encouraged a belief in Santa Claus and the Easter Bunny, including how the characters were described, their ritual support of the related myth (e.g., hanging up stockings and receiving gifts from Santa or leaving money for Tooth Fairy), parents' description of any other fantastical phenomena such as imaginary friends, and parents' evaluation of the importance of children's belief. Parents' responses to the interview were coded as encouraging, discouraging, or ambivalent. A strong correlation was found between parental encouragement and children's belief in Santa and the Tooth Fairy. Parents who were rated as "encouraging" had children who were more likely to be believers. Rosengren, Kalish, Hickling, and Gelman (1994) found similar results through interviews with parents. They found that parents encouraged belief

in event-related characters (e.g., Santa Claus, Easter Bunny) more than generic supernatural characters (e.g., monsters, ghosts, fairies), and that children's belief in specific event-related entities was strongly correlated with parental encouragement.

In the experiments by Woolley and her colleagues (Woolley, Boerger & Markman, 2004; Boerger, Tullos, & Woolley, 2009), a novel fantastical figure, the Candy Witch, was introduced to children 3 to 7 years of age at a preschool and a private elementary school. The Candy Witch was described as a nice witch who likes candy and would exchange children's candy with a new toy on Halloween night. Parents were also asked to participate by making a phone call to the Candy Witch and telling her to come to their house at Halloween night to exchange children's candy for a toy. Parents were then asked about the number of activities they had engaged in to encourage their children to believe in the Candy Witch, such as drawing a picture of the Candy Witch and talking about her. Woolley et al. (2004) found that children of parents who agreed to participate in the myth had stronger beliefs in Candy Witch. In the follow-up study (Boerger et al., 2009), children with stronger beliefs in the Candy Witch also had parents who reported higher level of encouraging activities. More recently, Goldstein and Woolley (2016) examined the relation between children's understanding of a live version of Santa Claus and parental promotion of belief in Santa. They found that a positive correlation between the two. The more live Santas children have been exposed to, the more they were likely to believe that a live Santa is a real one. Parents who promoted Santa more often have children who are less likely to question who a live Santa is. Similarly, in regards to children's belief in religious phenomena, Evans (2001) found that 6-year-olds from

Christian fundamentalist and non-fundamentalist families endorsed God as the creator, and this tendency was more salient in the fundamentalist families, where a more conservative view of creationism is encouraged. Shutlman (2008) asked 5-year-olds and their parents to judge the existence of God and angels. Children's judgments were correlated with those of their parents. Tenenbaum and Hohenstein (2016) found a similar correlation when examining British 7- and 10-year-olds' endorsement of creationism and evolutionism alongside their parents' endorsement. Taken together, these results show that children's understanding of possibility and reality in both the scientific and supernatural domains is influenced by the testimony from trusted adults, especially their parents.

Religious exposure in the immediate community. Nevertheless, parents are not the only ones who influence children's belief in the existence of supernatural phenomena. Prentice and Gordon (1986) found that U.S. children in Jewish families where parents usually do not encourage the existence of Santa Claus, still believed in Santa if they were exposed to community support outside their families. Testimony from peers, other adults and even media in children's immediate community can play a role. Indeed, children start to lose their belief in Santa, the Easter Bunny and many other endorsed fantastical characters around the ages of 6 to 8 (Prentice et al., 1978); some of the reasons for the reduction in belief are due to the reduced encouragement from parents, the discrepant testimony from peers or other adults, as well as children's ability to discern the inconsistency with natural causal laws (Anderson & Prentice, 1994).

In contrast to their decreasing belief in the existence of fantastical figures with age,

children's belief in the existence of religious figures and miracles does not cease with age. Instead, there is even an increase of belief in religious phenomena as children age (Legare, Evans, Rosengren, & Harris, 2012). In contrast to the decreasing testimony in support of fantastical phenomena, parental support in the religious domain is usually in conjunction with support from religious schools and Sunday schools that parents bring children to, i.e., the immediate community. The dual influence of parents and the immediate community serve as consensus information and can thus strengthen the weight of testimony in support of the existence of religious phenomena, which usually go against children's understanding of natural causal laws derived from first-hand experience. Children starting from age 3 are sensitive to consensus and dissenting information and they trust consensus information over dissenting information (Corriveau, Fusaro & Harris, 2009). They sometimes even defer to information from a consensus in face of conflicting perceptual information (Corriveau & Harris, 2013). The influence of religious exposure from both parents and immediate circle is reflected in the large amount of cultural variation in what children believe to be possible in the supernatural domain.

A few studies on children's belief in the afterlife have recognized the influence of religious exposure. Bering, Hernández Blasi, and Bjorklund (2005) showed 4- to 9-year-old children from Catholic and secular schools a puppet-show where a mouse was eaten by an alligator. Children were asked about the biological and psychological function of the dead mouse. They found that children from Catholic schools were more likely to state that functions continue after death compared to beliefs reported by children from secular schools. Similarly, Lane, Zhu, Evans, and Wellman (2016) examined children's belief in

the afterlife in two different cultures, the U.S. and China, where the majority population is secular. They also manipulated the narrative context and presented death in either a medical or a religious context. They found that U.S. but not Chinese children's claims about the afterlife were affected by the narrative context. The U.S. children made persistence judgments about biological and psychological capacities after death more often in the religious context than the medical context. Such an effect was not observed in China, due to the secular culture. Nevertheless, the authors acknowledged that there are rituals about the afterlife to which Chinese children are exposed, such as memorializing ancestors and relatives who died by sweeping their tombs and offering sacrifices. Indeed, children in the same study were asked an open-ended question about what happens to a person after they die, and age-related increases in citing burial, religious ritual and the supernatural were found in both the U.S. and China.

Quite a few studies have examined children's understanding of ordinary and extraordinary events in a story setting. The influence of religious exposure at a familial as well as a community level is salient. Woolley and Cox (2007) presented 3- to 5-year-olds from secular and religious preschools with a set of stories that included realistic, fantastical and religious-oriented events. Parents were asked to fill out a survey that assessed their religious affiliation, as well as the number and type of religious activities they engaged their children in each week. Results showed that children from religious schools were more likely to judge miraculous events and characters in religious stories as having really happened, and this was more evident for children from highly religious families with a higher frequency of religious activities. Vaden and Woolley (2011)

followed up on this study and presented 4-, 5- and 6-year-olds religious and non-religious stories with matched settings and miraculous events. The religious stories always involved God's intervention whereas the non-religious ones did not. For example, Moses parting the red sea with the help of God was one of the religious stories, and the non-religious counterpart was Matthew parting the green sea by "stretching his hands over the water". They found that children from more religious families were more likely to judge the characters and events in the religious settings as possible, especially for familiar religious stories. Moreover, when asked to justify their belief in the existence of miraculous events, religious children often referred to God. In addition, it is worth noting that across both studies, older children (5- to 6-year-olds) were more likely than younger children (3- to 4-year-olds) to judge the religious stories and characters as possible (Woolley and Cox, 2007; Vaden & Woolley, 2011). In another study, Woolley, Chelsea and Lacy (2011) asked adults and children aged 8, 10, and 12 years old to explain how unusual or unexpected scenarios occurred, finding that older children appealed to supernatural explanations more frequently than younger children, but less frequently than adults. This age-related change in terms of endorsement of supernatural belief may reflect younger children's early skepticism about the counter-intuitive phenomena in the supernatural domain that go against natural causal laws, as well as their increasing exposure to, and acceptance of, the cultural transmission of religious concepts, rituals, and beliefs as children age (Woolley et al., 2011).

The testimony children receive through religious exposure not only influences their belief in religious narratives but may also extend to other domains beyond religion

when considering what is possible. Corriveau, Chen and Harris (2015) presented 5- to 6-year-olds stories that involved realistic events (e.g., the character was cured by doctors and medicine, fantastical events with magical power introduced by fairies or magical objects (e.g., the character was cured by a magical drink) and religious events with the intervention of God (e.g., the character was cured by Jesus). As expected, they found that U.S. children who went to Christian church or were in a parochial school, or both, judged the characters in religious stories to be real, whereas secular children with no exposure to religion judged the characters in religious stories to be fictional. Somewhat unexpectedly, children with a religious background were more likely to judge the characters in the fantastical stories to be real as well. The researchers suggested that religious exposure may have an impact on children's understanding of reality and possibility in general, not only in the religious context. Davoodi, Corriveau, and Harris (2016) extended these findings to a different country, Iran, where children are exposed to Islamic religious narratives frequently. Similar to narratives in Christianity (e.g., Bible stories), the intervention of God (i.e., Allah) for miraculous events is ubiquitous in the narratives in Islam (e.g., Koran stories). They found that Iranian children behaved similarly to religious children in the U.S. -- they were more likely to judge characters in fantastical settings as realistic than as fictional (although see Payir et al., in press; Orozco-Giraldo & Harris, 2019). Taken together, these studies seem to indicate that children's understanding of what is possible can be altered by their religious exposure, and this change can be broader than the religious domain. However, all the studies reviewed so far have been conducted in societies where religious beliefs are shared by the majority. What

would happen if children were growing up in a society where religious beliefs are in the minority? Does this effect of religious exposure on children's understanding of possibility extend to other domains and to older age groups? How would inconsistent testimonies on the existence of religious phenomena impact this relation? These are the questions I explored in my Study 2 (Chapter 3). I will situate the research questions in more detail in the following sections.

Community consensus and dissent. In the studies reviewed above, parents' support for the existence of supernatural phenomena usually reflected the beliefs in their community. However, such local support is not always in accordance with the broader community, and there can be divergent beliefs about different supernatural phenomena within and across communities as well. An extreme example is that historically, the Judaic and Christian communities were descendants of communities that believed in magic. Anthropologists found that the ancient worship of ancestral spirits and animal spirits is the same concept as "god". Cave paintings are evidence of people's belief in supernatural power and the early religious ideologies. Around the 14th century, in the wake of the Black Death, the idea of witchcraft co-existed with Christian beliefs, and witches were believed to get their power from Satan. People who were accused of being witches were punished and put to death. This phenomenon has been referred to as the "witch craze". It is not until the 18th century that churches regarded belief in witchcraft as superstition (Harris, 2012; Subbotsky, 2011). It has been shown that starting from age 3, children are sensitive to consensus and dissenting information and they trust consensus information over dissenting information (Corriveau, Fusaro & Harris, 2009). The next

section reviews how children may be sensitive to the consensus and dissent in beliefs about what is possible.

Harris, Pasquini, Duke, Asscher, and Pons (2006) asked 5- to 6-year-olds (Study 3) to judge the existence of scientific entities (germs, oxygen), endorsed special beings (God, Santa Claus, Tooth Fairy), and equivocal entities (ghosts, monsters, angels). Children were also asked to rate their confidence in the existence or non-existence of the items as "very sure" or "not very sure". They found that children confidently affirmed the existence of both scientific and endorsed entities, but not the equivocal entities. Moreover, the 5- to 6-year-olds were more confident about the scientific entities than the endorsed entities. The researchers inferred that children were sensitive to conversational cues, as well as community consensus about the unobservable in different domains (Campbell & Corriveau, 2017; Harris & Corriveau, 2014). Whereas scientific entities such as germs and oxygen are endorsed by almost everyone in a society, endorsed entities including the religious ones (e.g., God) and fantastical ones (e.g., Santa Claus) are not. Accordingly, conversational cues around scientific entities may assume its existence but qualify the existence of culturally endorsed entities with modulation of assertations such as "I believe" or "I think" (Canfield & Ganea, 2014). Indeed, beliefs about the existence of religious phenomena are quite diverse, especially in the U.S., a pluralistic society (Harris et al., 2006; Harris et al., 2012). Shtulman (2013) echoed these finding with data from young adults. He asked college students to complete a questionnaire about the existence of, their confidence in, as well as the perceived consensus around scientific entities (e.g., black holes, electrons, evolution) and supernatural entities (e.g., angels,

fate, ghosts, telepathy). He found that adults' existence judgments and their confidence rating were significantly correlated with their perception about the community consensus on each item. The college students were more confident in the existence of high consensus scientific entities (e.g., electrons and fluoride) than in the existence of supernatural entities and low consensus scientific entities (e.g., black hole and evolution).

Would these results be different in a society where testimony around religious concepts is homogeneous? Guerrero, Enesco and Harris (2010) followed up on Harris et al. (2006) and interviewed 4- to 6-year-old, 7- to 9-year-old (Study 1) and older 10- to 12-year-olds (Study 2) children from a Mayan community in Mexico, where there is a relatively homogenous set of supernatural and religious beliefs. They found that in contrast to their U.S. peers, 4- to 6-year-olds and 7- to 9-year-olds confidently endorsed both scientific and endorsed entities, and they were equally confident about the two groups of entities. In addition, the majority of these children also claimed that everyone else believes in the existence of the endorsed entities. The older 10- to 12-year-olds, however, did differentiate the two groups of entities – they were more confident about the existence of scientific entities than of the religious entities. The older children also judged that other people would be less confident in the religious entities, as compared to the scientific entities. The researchers explained that older children have more opportunities to be exposed to inconsistent talk about the endorsed concepts from various sources. Davoodi et al. (2018) obtained similar results in Iran, a Muslim-majority country governed by a theocratic regime. Both Iranian adults and 9- to 11-year-olds were more confident about the existence of scientific entities than religious entities, although

younger 5- to 6-year-olds expressed equal confidence in both domains. By implication, children are sensitive to dissent even in a relatively homogenous society. How would children be influenced in a society at the other end of the spectrum, where testimony in support of religious belief is restricted to a minority in a predominantly secular society? My dissertation chose to explore this question in Mainland China. Below, I review the religious status in Mainland China to better situate my research questions.

Religious status in Mainland China

Mainland China is regarded as a secular state with low levels of religiosity. A recent poll showed that 77% of Chinese respondents claimed to be atheist or agnostic (WIN-Gallup International, 2016) and, according to the 6th round of the World Values Survey, 79.4% of the Chinese participants viewed religion as not very important or not at all important in their lives (World Values Survey Association, 2014). In addition, when asked to choose from a list of important qualities that children should be encouraged to develop, only 1.2% of the Chinese participants indicated that devout religious belief should be encouraged. Due to the lack of valuation of religion and the sensitivity toward religious discourse in Mainland China, there is limited discussion about religion and religious phenomena in the broader society. Indeed, China is viewed as one of the least explicitly theistic societies in the world (Schachner, Zhu, Li, & Kelemen, 2017).

The testimony that children are exposed to through formal schooling also limits talk about religion. Indeed, the Education Law of the People's Republic of China (2015) declared that the state shall separate education from religion. Organizations and individuals may not employ religion to obstruct activities of the state education system.

To the knowledge of the authors, there are no state-registered preschools, elementary schools, or secondary schools that preach religious belief in Mainland China. The Chinese government imposes a uniform national curriculum on all elementary and secondary schools, which constitutes a compulsory education as defined by the law (OECD, 2016). Although elementary and secondary schools are allowed to design their own textbooks based on the national curriculum, public schools across the country use textbooks designed by national University Presses. Indeed, textbooks in elementary school express objections to superstitious beliefs, and many Chinese folk religious practices are viewed as superstitious practices (Feuchtwang & Ming-Ming, 1991). For example, in the Chinese Language Arts textbook for 3rd graders, one historical narrative recounts how a former official (Xi Menbao) called attention to the absurdity of people's belief in divine figures that live in the river, conveying the idea that supernatural beliefs should be abandoned. In addition, evolutionary theory is part of public education in Mainland China (Liang & Cobern, 2013) and is taught in both primary and secondary schools. Moreover, the curriculum for moral and political education, at the primary school level, is designed in accordance with Marxist theory, which represents religious belief as conflicting with science and modern history (Wang & Uecker, 2017). Thus, Chinese children receive little to no testimony in support of religion or supernatural beliefs in schools.

The few studies on religious cognition with Chinese children and adults confirmed the dominantly secular status of the nation. As reviewed above, contrary to their U.S. counterparts, Chinese children's understanding of afterlife was not influenced

by a religious vs. a medical narrative context (Lane, Zhu, Evans & Wellman, 2016). In addition, Rottman, Zhu, Wang, Seston and Clark (2017) found that despite a tendency to favor teleological explanations when burdened with a cognitive load, Chinese adults are less teleological than U.S. adults in general.

Despite the secular majority, China has seen a growth in religious belief – both Christian and Buddhist – during recent years (Stark & Liu, 2011). The number of Christians has escalated– from 4 million Christians in 1989 to about 70 million Christians in 2010 (Pew Research Center, 2012). Alongside the growth in Christian belief, however, the Chinese government still acts to supervise the spiritual life of Chinese citizens. Since the establishment of the Republic of China in 1949, the Communist Party of China launched the Three-Self Patriotic Movement (TSPM), which requires all Protestant churches to register under government supervision, to recruit state-approved clergies, and to preach state-sanctioned sermons. In the meantime, following — or in spite of — TSPM, house churches, a type of unregistered, or illegal church, have sprung up. At house churches, Chinese Christians enjoy the freedom of sharing the true gospels and holding various religious activities (like Sunday schools) (Aikman, 2012; Fulton, 2015; Lian, 2010; Stark & Liu, 2011).

In my dissertation, I chose to compare the minority Christian community to the majority secular community in Mainland China, especially given the interesting conflict between testimony from their parents and testimony from the secular education in regard to Christian religious belief after formal schooling. After the age of 6, children in the Christian community are not only influenced by their parents or teachers at Sunday

school. They also attend the same kind of public schools as children in the secular community, where discussion of religious phenomena does not occur, along with explicit and implicit objections towards superstition. The relation between the society and parental testimony in Mainland China provides an unusual opportunity for research on the role of consistency between testimony from mainstream cultural sources and testimony from parents or the immediate community in learning about possibility and reality, especially in the supernatural domain. The minority status of Christian children may lead to a different understanding of possibility compared to the findings on children who have religious exposure in the U.S. Studies on immigrants in the U.S. show that despite parents' efforts to maintain the heritage language in the next generation, children at mainstream schools fail to see the relevance of the heritage language in their life (Zhang & Slaughter-Defoe, 2009). However, few studies have empirically examined conceptions in the supernatural domain among Chinese children and adults (but see Lane, Zhu, Evans & Wellman, 2016; Rottman, Zhu, Wang, Seston & Clark, 2017; Schachner, Zhu, Li, & Kelemen, 2017). Indeed, to my knowledge, no study has examined beliefs in supernatural phenomenon among children from Chinese Christian families, partly due to the difficulty of data collection. The Christian community is a particularly small community within the massive secular majority (Stark & Liu, 2011). Thus, working with Chinese Christian families is difficult due to their minority status. To fill in this research gap, Study 1 and Study 2 (Chapter 2 and 3) examine how the match between parental testimony and the testimony from school and the broader society on religious concepts impacts children's understanding of reality and possibility. Specifically, Study 1 (Chapter

2) investigates children's and parents' ontological beliefs in scientific and Christian religious unobservable entities in the dominant secular community and the minority Christian community.

Despite the secular majority of people without any specific religious affiliation and the secular education in the school system, folk religious belief and practices, which involve supernatural powers and ideas, are never absent in the Chinese culture (Yang & Hu, 2012). Although the concept of "religion" was not introduced to China until the 20th century (Weller, 2017), the practice of supernatural beliefs can be dated back to prehistoric times. The term Chinese folk religion (Zhongguo Minjian Xinyang) encompasses all kinds of traditional practices such as ancestor worship, veneration of nature, a belief in ghosts, sacrificial rituals to spirits, divination, and shamanism, as well as aspects of Buddhism (e.g., belief in karma, reincarnation, and Buddha or bodhisattvas), Confucianism (e.g., filial piety and honoring ancestors), and Daoism (e.g., feng shui, and hierarchies of gods) (Yang & Tamney, 2011). There is a lack of an essential canon or organization, as well as a huge variation in what aspects adherents believe and practice (Yang & Tamney, 2011). Yang and Hu (2012) proposed that the number of adherents to folk religion in China may have been underestimated by scholars, partially due to its multitudinous and idiosyncratic nature and the difficulty of empirical measurement. Through a national survey, they found a total of 55.5 percent of folk religious believers in mainland China and concluded that folk religious believers are widespread in Chinese society, substantially outnumbering believers in institutional religions. The actual number of believers could be more than 55% since believers may not want to admit their beliefs

due to the label of superstition attached to folk religion (Goossaert & Palmer, 2011). In addition, there is a national holiday in early April, Qingming, when Chinese people sweep tombs and offer sacrifices to honor their ancestors and deceased relatives (Aijmer, 1978). The permeated folk religious belief in the Chinese culture can also be seen in tourism. Many tourists visit temples where prayers can be made (through kotow, burning incentives, and donation) to Buddha or bodhisattvas (Oakes & Sutton, 2010). A few temples are famous for being very "effective" in answering prayers. It is unclear however, how the secular education interacts with folk religious practices to influence children's understanding of possibility. Given the potential impact of folk religious belief on children's general understanding of possibility, Study 2 (Chapter 3) goes beyond Study 1 to examine Chinese children's understanding of fact and fiction in the power of both Christian religious agents, as well as folk religious agent.

Other demographics in Mainland China

China is classified as an upper middle-income country by the World Bank (Kraay, 2019). As of 2019, 59.7 % of the population of China is urban (Desa, 2019). According to the Seventh National Population Census in China (2021), 15.47% of the population reported a college degree; 15.09% reported a high school degree; 34.51% reported a middle school degree; and 24.77% reported an elementary school degree. The sample in this dissertation was recruited from mid- to high-SES families, with the majority of parents having a high-school degree or above. The generalizability of findings in this dissertation is discussed in the final Chapter.

Conversational cues and understanding of possibility

As reviewed above, children may pay attention to specific conversational cues and markers to determine the consensus around specific concepts. One study by Canfield and Ganea (2014) systematically examined how parents and older siblings talk to 3- to 5-year-old children about unobservable phenomena in different domains, including scientific entities (e.g., brain, germs, viruses), endorsed entities (e.g., God, Santa Claus, Easter Bunny), non-endorsed entities (e.g., unicorns, mermaids, dragons) and historical figures (e.g., Christopher Columbus, Mother Theresa, Princess Diana). They found that parents and siblings did talk about entities in these domains differently. Firstly, in terms of content cues, talk about scientific, endorsed, and historical entities was similar, but different from talk about the non-endorsed entities. Talk about the non-endorsed entities was more superficial and focused more on physical features, whereas talk about the other kinds of entities was more about internal features. In addition, more subtle variation was found in the pragmatic cues used when talking about scientific and endorsed entities. Parents tended to indicate a lack of certainty (e.g., "I think" or "I believe"), or a lack of consensus (e.g., "some people think that…") more often when talking about endorsed entities, whereas more confidence was indicated for scientific entities in the form of physical demonstration. Note that Canfield and Ganea (2014) did not assess parents' religiosity. It is reported that 60% of the families practice a religion. Parents' religious background may effectively influence their discourse content and style especially in the religious domain.

Do children possess a good understanding of the various conversational cues

presented by parents and siblings? Woolley, Ma and Lopez-Mobilia (2011) examined children's ability to use conversational cues to assess reality status. They showed children, ages 3 to 9, video clips of people chatting about novel entities with novel names. The videos involved four kinds of conversational cues about reality status, including explicit belief (e.g., "I believe in …", "… are really real"), explicit denial (e.g., "I don't believe in …", "… do not really exist"), implicit belief (e.g., "I saw a …", "I wrote a report about …"), and know real ("I know… they are real for sure"). They found that a few 3-year-olds could correctly made use of the explicit denial and "know real" conversational cues. These two cues were utilized skillfully by 5-year-olds to judge the reality status of novel entities. Five-year-olds also started to utilize implicit belief cues to make inferences about reality status, and this ability was further developed at ages 7 and 9. As for the explicit belief cue, it was viewed as a cue to imply people's doubts and varied opinions in the existence of a certain entity.

In Study 3 (Chapter 4), I study parental conversational cues as a possible mechanism for children's learning about possibility and reality, by coding and examining parents' discourse with children about both high and low consensus concepts in both the secular community and the Christian community.

Conclusion

This dissertation explores important questions in the field of social learning: how children in a secular society understand fact and fiction, and how children reconcile conflicting information from different sources, by examining two relatively homogenous communities. Study 1 and Study 2 examine children's understanding of reality and

possibility around entities and events. Given the results from the first two studies showing that children from the minority Christian community hold strong beliefs in the existence of Christian religious concepts and causal power of God even in the most explicitly secular society, Study 3 examines parental testimony and conversational cues as one possible mechanism for the cultural transmission of ontological and possibility judgments. Other mechanisms such as rituals, identity, and emotional factors are likely playing important roles as well and worth exploring in future studies.

CHAPTER 2: STUDY 1

Children and adults' judgment of the existence of unobservable entities

Introduction

As reviewed in Chapter 1, previous research on children's understanding of endorsed religious entities has been conducted in places where the existence of such entities is broadly endorsed by the cultural majority (Guerrero, Enesco & Harris, 2010; Harris et al., 2006; Harris, Abarbanell, Pasquini & Duke, 2007). The demography of religious affiliation in Mainland China provides a unique opportunity to assess children's perceptions of unobservable religious entities in a society in which the cultural majority does not endorse the existence of those entities. In particular, I was interested in comparing the beliefs of two understudied groups of children: Children raised in secular families who should receive relatively uniform testimony from both their parents and the larger community about the nonexistence of supernatural entities and children raised in Christian families who receive distinct testimony at home and at school regarding the existence of supernatural entities. The study in this chapter explored beliefs about religious (e.g., God) and scientific (e.g., germs) phenomena among children and their parents from the dominant secular community and from the Christian community in China.

Past research indicates that children can form a stable and accurate understanding of the reality status of common, unobservable phenomena by the age of 5 (Kalish, 1996; Woolley & Cox, 2007). Thus, to assess the role of experience with community testimony on children's judgments, I included 5- to 6-year-old children, who had not yet started or

had recently started formal schooling. This younger age group had, therefore, received limited exposure to testimony from the broader society about religious entities but could nonetheless be asked to evaluate their reality status. I also included 9- to 11-year-old children, who were more immersed in the broader society through several years of formal schooling. I also checked for similarities between parental testimony and children's beliefs by examining the relation between children's judgments and their parents' judgments. Previous research has shown that both children and adults express more confidence in the existence of scientific entities as compared to religious entities (Harris et al., 2006; Shtulman, 2013). However, these previous studies did not include information on the religious affiliation of the participants. The current study extends prior work by investigating the relation between religious affiliation (or lack thereof) and beliefs about the existence of religious as well as scientific entities. I chose three religious entities commonly accepted in the Judeo-Christian tradition: angels, Heaven, and God. For scientific entities, I chose three commonplace scientific entities: germs, electricity, and oxygen (Clegg, Cui, Harris, & Corriveau, 2019). I hypothesized that adults from the Christian and secular communities would differ sharply in their judgments about the religious entities but not the scientific entities.

With respect to children's developing beliefs in unobservable entities within the scientific domain, talk about such entities is likely to be widespread in both secular and Christian communities. Across different societies, including China, adults endorse the existence of the scientific entities that I asked children about (Clegg et al., 2019; Davoodi et al., 2018; Shtulman, 2013). Thus, assuming that children are exposed to adult

testimony about the existence of these scientific entities, I expected children to be confident about their existence across both communities and both age groups. I also anticipated that children's confidence might increase with age, given that older children are likely to have learned more about science than younger children in the context of formal schooling. In addition, Woolley and McInnis Brown (2015) found that children's belief in the existence of unobservable entities is related to their understanding of appearance versus reality, which develops between 3 and 7 years of age. It was also possible, however, that there would not be an increase in confidence between the younger and older age groups, because the unobservable scientific entities I asked children about included everyday entities that most children are likely to have heard about from a young age. In contrast, children's developing belief in unobservable religious phenomena is likely to vary by community and age group. In the following paragraphs, I elaborate on my hypotheses regarding each of the two communities.

As compared to the Christian community, secular parents may be less likely to talk to their children about religious phenomena due to the lack of valuation of religious belief (World Values Survey Association, 2014). By contrast, talk about commonplace, scientific phenomena is likely to be widespread. A plausible result of such paucity of talk about religious phenomena is that some young children may not have heard about particular religious entities. On the other hand, for those young children who have heard about various religious phenomena before formal schooling, there are various possibilities. First, studies of children's conceptual development indicate that young children often doubt the existence of novel, unobservable entities. With a certain amount

of exposure, however, children might dispel their doubts and hold beliefs in the existence of certain unobservable entities (Lane & Harris, 2014; Woolley & Ghossainy, 2013). Some parents might explicitly or implicitly imply either the existence or the nonexistence of unobservable religious phenomena in talking to their children. If so, parents' existence judgments are likely to be correlated with those of their children. Young children may also pick up cues about the existence or nonexistence of religious entities from other members of their immediate social circle (Harris et al., 2006; Shtulman, 2013). Thus, among younger children, children's beliefs about religious entities should reflect those of their parents and their immediate social circle, with secular children expressing doubt and Christian children expressing confidence in their existence.

After several years of formal schooling, two different outcomes seem feasible. First, any differences in the beliefs of children from the secular and Christian communities may wane or disappear. Recall that in school, Chinese children are uniformly exposed to testimony casting doubt on the possibility that supernatural entities exist. Such testimony may lead older children, including those with Christian parents, to develop a critical stance toward the existence of unobservable religious entities and become less confident of their existence. However, it is also possible that Christian children may retain their religious beliefs. In the Christian community, believers are expected to transmit the gospel to others, including the next generation (Fulton, 2015; Lian, 2010). Thus, precisely because their children are likely to be exposed to messages outside of the home that contradict parents' early teachings about religion, Christian parents in China may be exceptionally motivated to transmit their beliefs and to talk

about religious phenomena with their children. Accordingly, I might expect to see a persisting correspondence between the beliefs of Christian parents and their children regarding the existence of unobservable religious entities.

In sum, two specific research questions were examined in this chapter:

1) What are children's and adult's beliefs about the existence of religious and scientific unobservable entities, and does this vary by exposure to formal schooling and religious exposure?

2) What is the relation between children's and parents' judgments about religious and scientific unobservable entities and does this vary by exposure to formal schooling and religious exposure?

Method

Participants

Sixty-five secular and 49 Christian children and their parents from mid- to high-SES preschools and elementary schools were recruited 4 urban cities (Beijing, Tianjin, Jinan and Shanghai) in Mainland China. With the exception of two parent-child dyads from the preschool and elementary school sample, the remainder of Christian children and their parents were recruited through snowball sampling by research assistants who self-identified as Christian. Note that the Christian Chinese research assistants were critical because without connections to believers in Mainland China, it would be impossible to access a large number of Christian families. All children in the older age group attended public elementary schools. There were 34 5- to 6-year-old secular children (16 girls, M_{age} = 6;2 years), and 31 9- to 11-year-old secular children (18 girls,

M_{age} = 10;3 years); 29 5- to 6-year-old Christian children (9 girls, M_{age} = 6;1 years), and 20 9- to 11-year-old Christian children (10 girls; M_{age} = 9;10 years). In total, the group of parents consisted of 114 adults (85 mothers, M_{age} = 38;2 years). All parents were asked about their religious denomination in a questionnaire to confirm their religious identity. The 65 secular parents indicated "no religious denomination", and the 49 Christian parents identified as "Protestant". Each family received a book with a value of 15 RMB as a gift for participation.

Data on parents' level of education was also collected. Among the 114 respondents, 21% reported holding a "high school diploma", 13.3% reported an associate degree, 44.7% reported a bachelor's degree, and 15.8% reported a graduate degree as the highest level of education completed. A small number of parents, 7.9%, did not answer this question.

Given that parent-child dyads were asked potentially sensitive questions regarding their beliefs about scientific and religious entities, all information was collected anonymously. This approach was approved by the Institutional Review Board, with approval number 4631E, entitled "Children's and Adults' Understanding of the Invisible and the Impossible".

Procedure

Parents' judgments of unobservable entities. Parents were asked about their beliefs in the existence of 3 religious entities (Angel [Tian Shi], Heaven [Tian Tang], God [Shang Di]), and 3 scientific entities (Germs [Xi Jun], Electricity [Dian], Oxygen [Yang Qi]). Parents indicated their ratings on a 7-point scale ranging from "it definitely

exists" (7) to "it definitely does not exist" (1).

Children's judgments of unobservable entities. Children were first given two warm-up items (a real entity – dogs, and an impossible entity – flying dogs) in a fixed order and were asked if they were real or not real. All children correctly categorized these two warm-up items.

Next, children were given the 6 test items (3 religious items — Angel, Heaven, God and 3 scientific items — Germs, Electricity, Oxygen). Items were written on cards and presented in a random order. Children were first asked, "Have you heard about [entity]?" If children answered no, testing was discontinued for that item. If children answered yes, they were then asked, "Is there really [entity]? Is [entity] real or not real?' Immediately following the existence question, children were asked about their certainty, "You said that [entity] is real/ not real. Are you very sure or not very sure about your answer?"

Results

Parents' judgments of the unobservable entities

To assess the internal consistency of the scientific and religious items, Cronbach's alpha was computed. Consistency was high in both domains ($\alpha = 0.92$ for scientific, and $\alpha = 0.97$ for the religious entities). Given the high consistency among the entities in each domain, two composite score for parents' beliefs about the entities were created, one for each domain. The mean scores for secular and Christian parents' beliefs about the existence of the religious and scientific entities are shown in Figure 2.1, with higher numbers indicating more confidence that the entities exist.

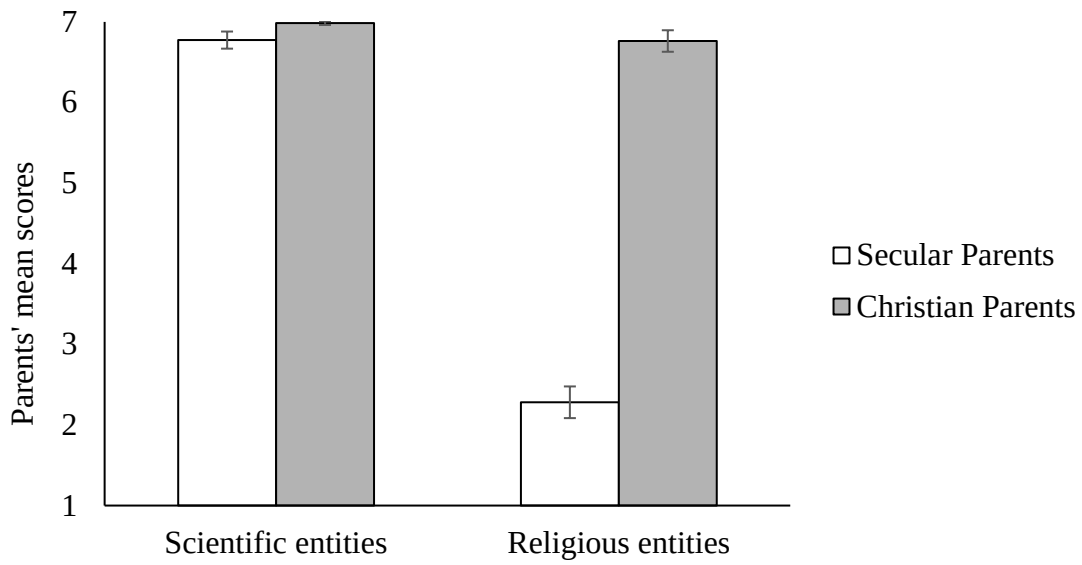

Figure 2.1. Mean scores of secular and Christian parents by entity type.
Error bars represent standard error.

Inspection of Figure 2.1 shows that both secular and Christian parents were very confident about the existence of the scientific entities with very low variability in their judgment. Christian parents were also very confident about the existence of the religious entities, whereas secular parents were confident that the religious entities do not exist. To confirm these conclusions, a 2 X 2 ANOVA was conducted on parents' mean existence judgment scores (range from 1-7), with religious affiliation as a between-subjects variable and entity type (scientific vs. religious) as a within-subjects variable. The results revealed significant main effects of religious affiliation, F (1, 111) = 276.41, $p < .001$, $\eta^2 = .71$, and entity type, F (1, 111) = 259.15, $p < .001$, $\eta^2 = .71$, as well as a significant interaction between religious affiliation and entity type, F (1, 111) = 210.87, $p < .001$, $\eta^2 = .65$. Tests of simple effects showed that secular (M = 6.72, SD = 0.94) and Christian parents (M = 6.94, SD = 0.21) were equally confident about the existence of scientific

entities, F (1, 111) = 2.64, p = .107, η^2 = .03. However, a significant difference was found for religious entities. Christian parents were quite confident about their existence (M = 6.71, SD = 0.87), whereas secular parents were quite skeptical about their existence (M = 2.37, SD = 1.55), F (1, 111) = 308.06, p < .001 η^2 = .72. Finally, tests of simple effects also showed that both secular and Christian parents were more confident about the existence of the scientific entities as compared to the religious entities, $F_{secular}$ (1, 111) = 533.13, p <.001, η^2 = .83, $F_{Christian}$ (1, 111) = 3.95, p <.05, η^2 = .03, although, as inspection of Figure 2.1 confirms, the mean difference was much larger among secular parents (M = 4.35) than among Christian parents (M = 0.23), t (111) = 14.51, p <.001.

Children's judgments of unobservable entities

Item familiarity. I first examined children's overall familiarity with the items by examining the number of entities from each domain that children said that they had heard about. Table 2.1 displays the percentage of children who had heard of all three, two, one, or none of the entities in each domain by age group and religious background. Inspection of Table 2.1 shows that almost all children, regardless of age or religious background, had heard about all three scientific entities. In addition, most 9- to 11-year-old children from both religious and secular backgrounds had heard about all three religious entities. However, younger children's familiarity with the religious entities depended on their background – secular 5- to 6-year-olds reported less familiarity with the entities than their religious peers. To confirm these results, a chi-square test of independence was performed to examine the relation between family background and the number of children who had heard about all three religious entities in the younger age group. The

chi-square test confirmed that younger Christian children were more likely than younger secular children to have heard about all three religious entities, χ^2 (1, 62) = 11.88, p < .001.

Table 2.1 *Percentage of children who had heard of a given number of items (0-3) in each domain*

Domain	Item familiarity	5- to 6-year-olds		9- to 11-year-olds	
		Secular (n = 34)	Christian (n = 29)	Secular (n = 31)	Christian (n= 20)
Scientific	0 items	0.0%	0.0%	0.0%	0.0%
	1 item	0.0%	0.0%	0.0%	0.0%
	2 items	2.9%	6.9%	3.2%	15.0%
	3 items	97.1%	93.1%	96.8%	85.0%
Religious	0 items	17.6%	3.4%	0.0%	0.0%
	1 item	26.5%	3.4%	0.0%	0.0%
	2 items	23.5%	17.2%	6.5%	5.0%
	3 items	32.4%	75.9%	93.5%	95.0%

Existence judgments. For the entities that children had heard about, children's replies to the two test questions concerning each entity were combined to yield four categories per entity (see Harris et al., 2006): very sure about nonexistence, not very sure about nonexistence, not very sure about existence, and very sure about existence. Note that because the four categories of children's responses were produced via children's answers to two separate, forced-choice questions, I treated these four categories as

ordinal, rather than continuous indices of children's confidence in a given item. A four-point continuous scale would require equal distances between each point.

Figure 2.2 displays the proportion of children's responses, for each type of entity (religious and scientific), falling into each of the four categories by age group and religious affiliation. Inspection of Figure 2.2 indicates that both 5- to 6-year-old and 9- to 11-year-old secular and Christian children were very sure about the existence of the scientific entities with very low variability in their judgment. By contrast, whereas Christian children were mostly very sure of the existence of religious entities, secular children were often very sure of their non-existence. Thus, the overall pattern of judgment by both age groups was similar to that of their parents.

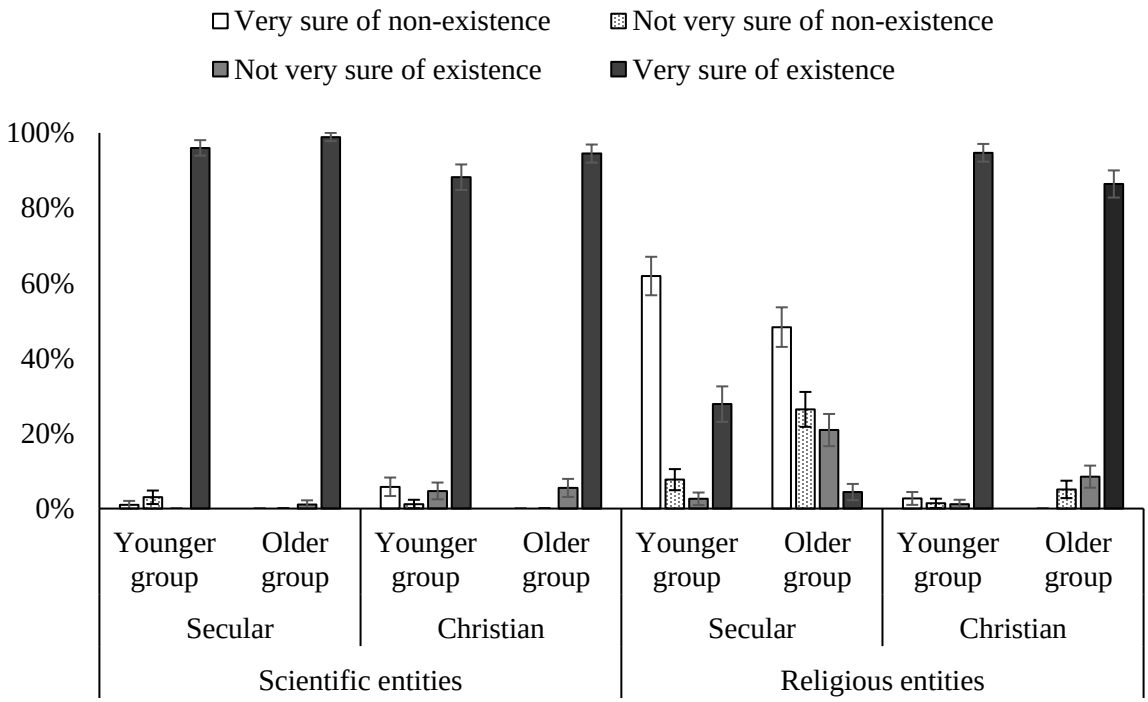

Figure 2.2. Children's judgments about entities from each domain (religious and scientific) by age group and religious affiliation.

To confirm these conclusions, I conducted a mixed-effects ordinal logistic regression analysis on children's existence judgments, with “very sure of non-existence” as the reference level. The mixed-effects ordinal logistic regression allowed us to consider the variability within each individual by including each entity individually in the model. The initial model included entity type (scientific vs. religious), religious affiliation (based on parents’ reported affiliations; religious, secular), and age group (younger, older) as fixed effects, and participant as a random effect to account for within-subject variability. Adding the interaction between religious affiliation and entity type as a fixed effect significantly improved the model fit, χ^2 $(df = 1) = 94.95$, $p < .001$, and this interaction was retained in the final model. Adding other interaction terms in the model did not significantly improve the model fit. As summarized in Table 2.2, the final model revealed significant main effects of religious affiliation and entity type, as well as a significant interaction between religious affiliation and entity type. The main effect of age group was not significant.

To further explore the significant interaction between religious affiliation and entity type, I first ran two mixed-effects ordinal logistic regressions on children’s judgments of the scientific and religious entities separately, with religious affiliation as a fixed effect and participant as a random effect. To account for multiple comparisons, I applied a Bonferroni correction and adjusted alpha level to 0.025. The results showed that Christian children and secular children were equally confident of the existence of scientific entities (β = -0.88, SE = 0.61, p = 0.15, OR = 0.41, CI [0.13 – 1.36]). By contrast, Christian children were more likely than secular children to be confident of the

Table 2.2 *Mixed-effects ordinal logistic regressions on children's existence judgments, with "very sure of non-existence" as a reference group*

	β (SE)	*Z*	Odds Ratio	95% CI for OR	
				Lower	Upper
Intercept (Level 1)	-6.6 (0.69)	0.76	1.34	0.63	2.84
Intercept (Level 2)	-5.44(0.63)	3.56	4.28	1.92	9.52
Intercept (Level 3)	-4.48(0.6)	5.58	11.2	4.79	26.1
Age Group (Younger as reference)	0.09(0.42)	0.21	1.09	0.47	2.52
Religious affiliation (Secular as reference)	5.55 (0.64)**	8.63	992	263	3740
Entity type (Religious entities as reference)	6.89(0.68)**	10.18	258	73.2	913
Religious affiliation*Entity type	-7.02(0.82)**	-8.56	0.001	0.001	0.004
-2LL	-304.34				
AIC	624.69				

** $p < 0.01$

existence of religious entities (β= 8.88, *SE* = 1.30, $p < 0.001$, *OR* = 41.71, *C*I [10.76 – 161.64]). I also ran two mixed-effects ordinal logistic regressions on children's judgments of each type of entity in the secular community and Christian community respectively to further explore the interaction between entity type and parental religious affiliation, with entity type as a fixed effect and individual child as a random effect. I accounted for multiple comparisons and adjusted critical p-value to 0.0125. The results showed that secular children were more likely to be confident of the existence of the scientific as compared to the religious entities (β = 7.33, *SE* = 0.82, $p < 0.001$, *OR* = 1524.7, *C*I [302.02 – 7697.05]). Christian children, however, were equally confident of the existence of religious and scientific entities (β = -0.11, *SE* = 0.45, $p = 0.80$, *OR* =

0.89, *C*I [0.37 – 2.16]). Thus, the overall pattern of judgment by secular children and by Christian children was very similar to that of their parents. In one respect, however, Christian children differed from their parents: whereas Christian children were equally confident about the existence of religious and scientific entities, their parents were somewhat more confident about the existence of scientific entities. The relation between parents' judgments and their children's judgments is discussed in more detail in the next section.

The relation between parents' and children's judgments. To examine the relation between parents' and children's judgments, I planned to analyze responses in the scientific domain and the religious domain separately. However, given the low variability of both children's and parents' judgments about the existence of scientific entities (i.e., consistently high levels of confidence in the existence of the scientific entities), only the relation between parents' and children's judgments about the religious entities could be analyzed through a mixed-effects ordinal logistic regression model. In the model for religious entities, the dependent variable was children's existence judgments for each religious entity, with "very sure of non-existence" as a reference group. The initial model included parents' judgments of each entity (range 1–7), religious affiliation (based on parents' affiliation; religious, secular) and age group (younger, older) as fixed effects, and participant as a random effect to account for the within-subject variability. Adding the interaction between religious affiliation and parents' judgments as a fixed effect significantly improved the model fit, χ^2 (df = 1) = 8.35, p < .01, and was retained in the final model. Adding other interaction terms in the model did not significantly improve the

model fit. As summarized in Table 2.3, the final model revealed significant main effects of religious affiliation, parents' judgments, and age group, as well as a significant interaction between religious affiliation and parents' judgments.

Table 2.3 *Mixed-effects ordinal logistic regression models on children's existence judgments of religious entities*

	β (SE)	*Z*	Odds Ratio	95% CI for OR	
				Lower	Upper
Intercept (Level 1)	0.003(0.003)	1.314	1.00	1.00	1.01
Intercept (Level 2)	1.75(0.003)**	671.008	5.75	5.72	5.78
Intercept (Level 3)	3.17(0.003)**	1223.863	23.85	23.73	23.97
Religious affiliation (Secular as reference)	-7.74(0.003)**	-2869.95	0.001	0.001	0.001
Parents' judgments	0.07(0.003)**	26.08	1.07	1.07	1.08
Age Group (Younger as reference)	-0.38(0.003)**	-141.78	0.68	0.68	0.69
Religious affiliation*Parents' judgments	2.22(0.003)**	825.44	9.22	9.18	9.27
-2LL	-196.33				
AIC	408.65				

** $p < 0.01$

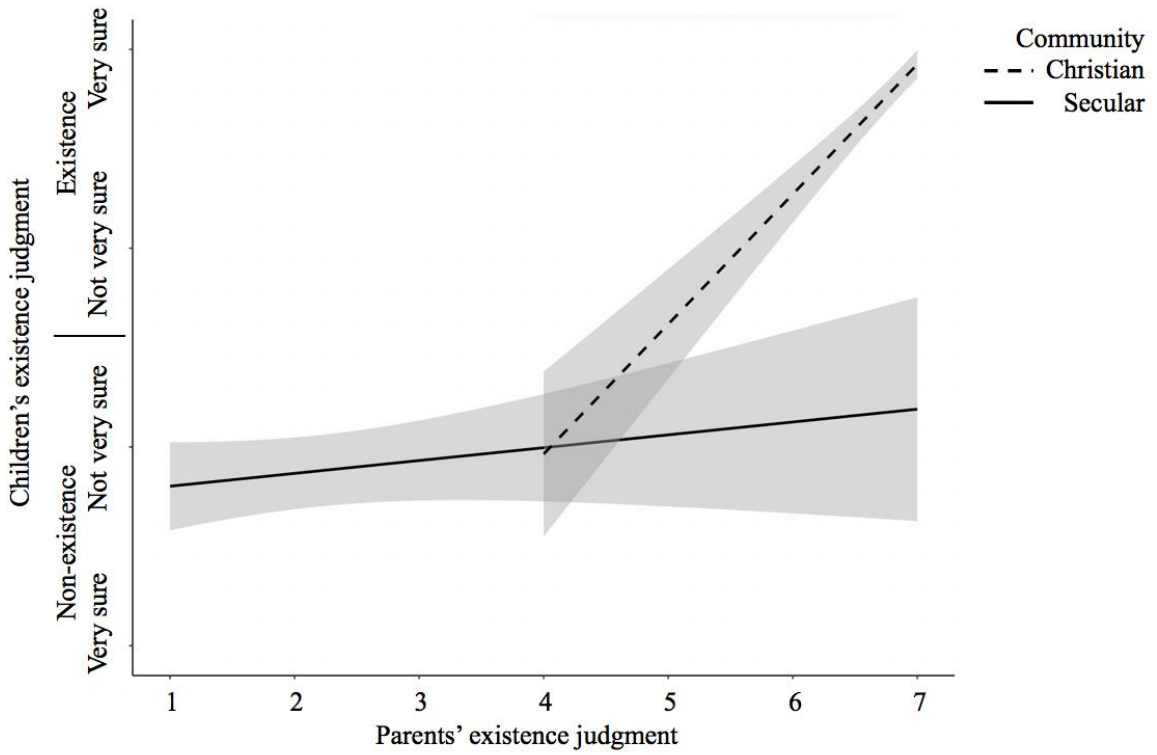

Figure 2.3. The relation between parents' judgments and children's judgments with respect to the existence of unobservable religious entities.

The interaction between religious affiliation and parents' judgments is illustrated in Figure 2.3. To further explore this interaction, I ran two mixed-effects ordinal logistic regressions on judgments of the religious entities by secular and Christian children respectively, with parents' judgments and age group as fixed effects and individual child as a random effect. To account for multiple comparisons, I applied a Bonferroni correction and adjusted alpha level to 0.025. For secular children, the regression showed that neither parents' judgments (β = 0.10, *SE* = 0.18, *p* = 0.55, *OR* = 1.11, *C*I [0.79 – 1.57]) nor age group (β = -0.24, *SE* = 0.71, *p* = 0.73, *OR* = 0.78, *C*I [0.19 – 3.13]) had a significant main effect on children's judgments. As illustrated in Figure 2.3, in the secular community, parents' mean scores for the religious entities showed very little variation

across all four levels of children's existence judgments, confirming the lack of any relation between parents and children. In the Christian community, by contrast, there was a significant main effect of parents' judgment (β = 3.92, *SE* = 1.97, $p < .01$, *OR* = 50.37, *C*I [1.06 – 240.18]) on children's judgments. The main effect of age group was not significant (β = 0.18, *SE* = 2.89, $p = 0.95$, *OR* = 1.20, *C*I [0.0042 – 345]). As shown in Figure 2.3, Christian parents who were more confident about the existence of the religious entities had children who were also more confident about the existence of the religious entities. Note that the judgment scores of Christian parents range from 4 to 7 as shown in Figure 2.3.

Discussion

This study examined beliefs about the ontological status of unobservable scientific and religious entities among children and adults with different religious backgrounds in Mainland China, a largely secular society. I also examined the relation between the beliefs of children and their parents and the extent to which that relation was associated with consistency between parents' beliefs and those of the larger community. Both Christian and secular adults were very confident about the existence of unobservable scientific entities such as germs and oxygen. Christian adults were also confident about the existence of unobservable religious entities such as God and Heaven even if they expressed slightly less confidence in the existence of these religious entities as compared to the scientific entities. Secular adults, by contrast, were skeptical about the existence of the religious entities. Like their parents, Christian and secular children were very confident about the existence of the unobservable scientific entities. Also similar to

their parents, Christian children were confident about the existence of the unobservable religious entities, whereas secular children were skeptical. Thus, the overall pattern of belief was similar for children and adults from the same backgrounds. Christian children resembled Christian adults and secular children resembled secular adults.

When I looked more closely at the relation between the beliefs of parents and the beliefs of their children, no analyses could be conducted for the scientific entities due to near universal confidence in their existence. In the case of religious entities, however, children's beliefs were correlated to their parents' beliefs in the Christian sample, whereas no such relation was observed in the secular sample. In the following paragraphs, I first discuss adults' beliefs in the two domains for each community. I then consider children's beliefs. Finally, I discuss the relation between parents' beliefs and children's beliefs with respect to each domain and for each community.

It is not surprising to find that parents from both communities were very confident about the existence of unobservable scientific entities. These results echo the findings of Shtulman (2013) and Davoodi et al. (2018), showing that college students in the U.S. and adults in Iran express little doubt about the existence of such familiar and widely known scientific entities. With respect to the religious domain, the judgments of secular and religious parents followed the anticipated consensus within their respective communities. Whereas Christian parents were confident about the existence of the religious entities, secular parents expressed skepticism. These findings are also consistent with the finding of Shtulman (2013) that college students' confidence in the existence of both scientific and supernatural entities was significantly correlated with their perception of the

community consensus regarding such entities. Finally, it is noteworthy that, like the secular parents, even the Christian parents were more confident of the existence of scientific as compared to religious entities, arguably because they are aware of the societal consensus and prevalence of beliefs about familiar scientific entities such as germs, as well as the lack of consensus about the existence of unobservable religious entities such as God, despite their fundamental role in Christian doctrine.

Children expressed a strong belief in the existence of unobservable scientific entities in both communities. There was also low variability in both communities, similar to the judgments of their parents. Children may have heard about these widely known scientific entities from a variety of sources, such as parents, teachers, TV shows, or textbooks. Importantly, these sources are likely to be consistent with each other, effectively generating a community consensus.

The results for children's belief in unobservable religious entities were both novel and informative. In the secular community, a considerable number of 5- to 6-year-olds had not heard about some, or indeed any, of the religious entities. This result corroborates the paucity of testimony available to young children in the larger secular community of Mainland China about the existence of religious unobservable entities that are central to the Christian faith (e.g., God and Heaven). Without such testimony, it is difficult for children to form a belief in the existence of the relevant, unobservable entities. For secular children who had heard about the religious entities, despite the variability of children's and parents' judgments, I did not find a significant correspondence between parents' judgment and their own children's judgment. Does this mean that children

spontaneously arrive at their own assessment of the existence of unobservable religious entities? I doubt this possibility because the mean judgments of children were similar to the mean judgments of parents in the secular community. Both parents and their children were similarly skeptical about the existence of unobservable religious entities. Thus, a more plausible explanation is that children in the secular community attend to subtle cues about the ontological status of religious entities from a variety of sources, such as parents, peers, cartoons, storybooks, and so forth, to form beliefs consistent with the consensus in their community (Harris, 2012; Harris et al., 2006; Shtulman, 2013). Future research should explore the influence of various sources beyond parental testimony on secular children's judgment of religious entities, as well as the way that these sources might change with age. For the time being, it is reasonable to conclude that most children living in China have little or no exposure to testimony affirming the existence of Christian religious entities.

More 5- to 6-year-olds had heard about the religious entities in the Christian community as compared to the secular community, implying greater access to religious testimony in the Christian community. In addition, children's mean existence scores were similar to their parents' mean existence scores. Effectively, both parents and their children subscribe to the existence of the religious entities. More importantly, parents' endorsement of and confidence in the existence of religious entities was positively associated with the pattern of endorsement and confidence displayed by their children in both age groups. It is plausible that parents' degree of confidence in their beliefs is transmitted through conversational cues, just as parents talk differently about historical as

compared to fantastical entities (Canfield & Ganea, 2014; Woolley, Ma, & Lopez-Mobilia, 2011). Indeed, as noted in the introduction, due to the minority status of Christian belief in Mainland China, Christian parents may be highly motivated to talk about religious entities that are fundamental to their faith in order to sustain the beliefs that distinguish them as a minority group (Chavkin, 1989; Cho, Cho, & Tse, 1997; Fulton, 2015; Lian, 2010). The conversational cues that Christian parents use to convey their confidence in the existence of unobservable religious phenomena warrant further exploration. It is also important to keep in mind the possibility that Christian children may not learn exclusively from their parents but also from other members of the Christian community to which their parents are likely to be affiliated.

I did not find any change in Christian children's ontological judgments about religious entities before and after the start of formal schooling, and nor did I find any age-related change in the association with parents' judgments. Indeed, Christian children from both age groups were as confident about religious entities as they were about scientific entities. There are several possible explanations for the stability in children's beliefs. First, as mentioned, children in the Christian community may learn about religious entities from sources other than their parents and may already be exposed to these sources by age 5 through community events such as church services and Sunday schools. Exposure to these different sources might help children infer a community consensus about the existence of unobservable religious phenomena, despite the secular consensus in the broader society. Moreover, Christian parents are likely to echo this community consensus via discussion in the home. Such consensus information from

various familiar and self-identified sources may serve to provide a sense of belonging and may even override the alternative consensus information in the broader society. This inference is based on observations that Christian participants identified themselves as "Christian", and many have explicitly expressed that "We Christians believe in God."

Second, although 9- to 11-year-old Christian children are likely to encounter objections toward superstitious beliefs in textbooks, it is possible that they differentiate such superstitious beliefs from their Christian beliefs and view them as two different systems. Admittedly, miracles in Bible stories, such as walking on water, are not fundamentally different from the magical or supernatural powers described in fantastical stories—in each case there is a violation of natural causal laws. Nevertheless, adults who believe in Christianity do differentiate Biblical miracles from other types of supernatural transformation and have faith in the former but not the latter. Corriveau et al. (2015) found that 5- to 6-year-old Christian children were more likely to view stories as real if they included a Biblical miracle rather than a magical or fantastical transformation. It remains an open question as to how far 9- to 11-year-olds differentiate between religious miracles and the superstitious beliefs that are criticized in Chinese textbooks. Future exploration of this question could help to assess the impact of textbook and broader school-based criticism on the beliefs of Christian children.

Finally, despite talk about superstition in elementary school in China, there is not much explicit talk about belief in a specific religion, including Christianity, until secondary school. As reviewed in the introduction, there is little discussion of religious phenomena in the larger society of Mainland China. The paucity of testimony about other

religions and religious beliefs may allow Christian children to develop a firm confidence in the existence of unobservable phenomena in Christianity that persists into late childhood. Guerrero et al. (2010) interviewed children in Spain, where there is a relatively homogenous set of religious beliefs. They found that only older children aged 10 to 12 years but not younger ones (4- to 6-year-olds and 7- to 9-year-olds) differentiated between the scientific and religious entities—they were more confident about the existence of scientific as compared to religious entities. By implication, older children have more opportunities to be exposed to inconsistent talk about endorsed concepts from various sources. Thus, Christian children in Mainland China may eventually have more confidence in scientific as compared to religious entities, just like their parents, through exposure to the mainstream, secular beliefs in the community. To summarize, several different factors likely contribute to the correspondence between Chinese Christian children and their parents' belief in the religious entities through age 11. As stated in the literature, multiple factors including the credibility and quality of sources and information, children's cognitive abilities to decipher that information, and the affective context are likely to influence children's evolving beliefs and attitudes (Lane & Harris, 2014; Woolley & Ghossainy, 2013). The extent to which our results can be applied to other contexts or domains where parental testimony does not match the broader cultural pattern is an important topic for future research.

One limitation of my approach is that in order to present children with simple and easily understood questions about the existence of unobservable entities, the scales used for children and parents were different. Parents' judgments were measured with a 7-point

Likert scale, whereas children's judgments were assessed through two binary questions that yielded a categorical score. It would be desirable for future studies to employ a rating scale for children's judgment that more closely matches the rating scale for parents. Our study is also limited by the relatively small number of older children in the Christian sample compared to other groups, mainly due to the challenges associated with recruiting people who self-identify as Christians in Mainland China, as discussed earlier in the section on participants. However, despite limited numbers, clear patterns emerged in our results, suggesting an association between testimony and ontological beliefs among Christian populations in China. In addition, among secular children, familiarity with the religious items was low, especially among the younger children. This limited the sample size in this group, possibly affected comparisons to the Christian sample. Although mixed-effects ordinal logistic regression analyses allowed us to make use of every data point available for each participant, it is recommended for future studies to expand the sample size with a view to reaffirming these conclusions. Finally, beyond the documented association between community consensus and children's beliefs about unobservable entities, children's developing cognitive and conceptual abilities are also likely to influence their representations of the unobservable and merit inclusion in future research (Lane & Harris, 2014; Woolley & McInnis Brown, 2015).

In summary, Study 1 is the first to examine the judgments of children and their parents concerning the ontological status of various unobservable scientific and religious phenomena in two different samples in Mainland China—one belonging to the larger secular majority and the other to the Christian minority. Children's beliefs about religious

phenomena were found to be similar to those of their parents. Thus, although the Christian children were growing up in a society where most adults profess skepticism about religious entities, they expressed confidence in such entities, paralleling the beliefs of their parents.

CHAPTER 3: STUDY 2

Children's understanding of fact and fiction in stories

Introduction

Some studies reviewed in Chapter 1 (Corriveau, Chen, & Harris, 2015; Davoodi, Corriveau, & Harris, 2016) have indicated that children's understanding of what is possible can be altered by their religious exposure, and this impact may extend beyond the religious domain. Children with religious exposure are more likely to judge characters in fantastical settings as realistic than as fictional. However, all the studies reviewed so far have been conducted in societies where religious beliefs are among the majority. What would happen if children were growing up in a society where religious beliefs are the minority? Study 2 examined whether and to what extent religious exposure could alter children's understanding of what is real and fictional in Mainland China, one of the least explicitly theistic societies in the world.

Given the minority status of religious believers in Mainland China, Study 1 (Chapter 2) examined Chinese Christian children's belief in three unobservable religious entities, including God, Heaven and Angel, in comparison to the majority secular children. It was found that the Christian Chinese children in both the younger age group, and the older age group were highly confident about the existence of the three religious entities, even though the older 9- to 11-year-old Christian children should have encountered secular beliefs at school, which would be in conflict with the religious beliefs, endorsements, and practices from their immediate family and surrounding community. Several possible explanations for this lack of age-related change in belief

were discussed in Chapter 2. One is that there are two different consensuses at play in the Chinese Christian sample: the secular consensus in the broader community vs. the familiar and self-identified consensus in their Christian community, espoused by their parents as well as teachers and peers at Sunday school. Indeed, these children are very aware of their minority status and justify their belief by citing the source (typically their family) of their knowledge (Davoodi et al., 2020). The reinforcement from various sources within the Christian community and possibly communities outside of the country (e.g., Christian communities in other countries) likely provide strong cues and a sense of belonging to Christian children and adults in China, which could help to maintain belief in such entities even with strong, school-based testimony to the contrary.

Another non-mutually exclusive explanation for the lack of age difference between the younger and older Chinese Christian samples is that even though older children may have encountered objections towards the existence of supernatural power at school, they are likely to treat such superstitious belief and their beliefs in a Christian God's power as two separate and independent domains. This is possible given that adults who have a firm belief in God and Biblical miracles do not judge a witch with supernatural power or a fairy with magical power to be real, even though there are fundamental similarities in their causal properties – they all violate the natural physical laws. To what extent would Chinese Christian children expand their flexible understanding of possibility in the religious domain to other supernatural domains from early to late childhood? Recent studies (Payir et al., in press; Davoodi et al., under review) found that the effect of religious exposure on children's possibility judgment may be restricted to the domain of

religion, especially as children get older. However, these studies only tested magical powers vs. religious powers. The current study explored whether exposure to one specific religious belief would influence children's possibility judgment in other religious powers, by comparing children's judgment of story possibility across 5 domains: stories that involve a Christian religious power, a folk religious power, a magical power, an improbable event, and a realistic event. I included 5- to 6-year-old and 9- to 11-year-old Christian children in comparison to secular children, similar age groups to Study 1.

As reviewed in Chapter 1, folk religious beliefs and practices, which involve supernatural powers and ideas, permeate Chinese culture, regardless of family religious status (Goossaert & Palmer, 2011; Yang & Hu, 2012). Chinese folk religion (Zhongguo Minjian Xinyang) encompasses many traditional practices such as ancestor worship, veneration of nature, a belief in ghosts, sacrificial rituals to spirits, divination, and shamanism, as well as aspects of Buddhism (e.g., belief in karma, reincarnation, and Buddha or bodhisattvas), Confucianism (e.g., filial piety and honoring ancestors), and Daoism (e.g., feng shui, and hierarchies of gods; Yang & Tamney, 2011). Given the profound impact of folk beliefs on Chinese culture and daily life, it is also possible that secular children whose parents do not have any specific institutionalized religious affiliations could still be influenced by folk religious beliefs and practices, thus developing a more flexible understanding of what is real and fictional. In partial support of this interpretation, Lane, Zhu, Evans, and Wellman (2016) examined children's belief in the afterlife in the U.S. and China. Children were asked an open-ended question about what happens to a person after they die, and both US and Chinese children displayed

similar age-related increases in their belief in the importance of burial, religious ritual and the supernatural. Nevertheless, when a story about a person who died was presented in either a medical or a religious context, U.S., but not Chinese children's belief in the existence of the afterlife was affected by the narrative context. Note that no information about family religiosity was included in this study, making it challenging to determine the mechanisms associated with any country-based similarities and differences.

To examine Chinese children's understanding of fact and fiction in the folk religious domain, this study also included a folk religious figure, *Guanyin*, the most popular Buddhist deity, as well as a folk religious figure in China. Exploring children's' belief in the existence of Guanyin should help to determine the extent to which Chinese Christian children will extend their beliefs or disbeliefs in impossible events beyond formal religion. Guanyin is especially popular among Chinese children because of the story about this deity in the famous novel, *Journey to the West*, which has been adopted in numerous cartoons, movies, and story books. To my knowledge, no study has ever explored Chinese children's belief in the causal power of *Guanyin*.

As reviewed in Chapter 1, although Chinese Christian children have been exposed to Christian beliefs, the secular education has also exposed them to testimony about the implausibility of supernatural causal mechanisms. Because of this exposure, it seems less likely that older Christian children will extend the belief in the existence of Christian causal properties to other supernatural and fantastical domains. This contrast between religious and non-religious supernatural causes may be more salient as children age.

In addition to the domain of magical power and the supernatural power of a

Buddhist deity, I also ask if Chinese children, especially Christian children would extend their flexible understanding of possibility in the domain of religion to unusual, extraordinary events that do not violate any natural causal laws. Although 4-year-olds readily categorize impossible events (e.g., eating lightning) as not possible, their ability to recognize the possibility of improbable but possible events (e.g., finding an alligator under your bed) develops with age (Shtulman & Carey, 2007; Shtulman, 2009). If Chinese Christian children's exposure to religious narratives impacts their judgments of possibility beyond the religious domain, Christian children may be more likely than secular children to judge improbable events as real.

Taken together, Study 2 aims to explore how age and religious exposure in a secular society influence children's judgment and justifications about what is real and fictional by examining 5- to 6-year-old and 9- to 11-year-old secular and Christian children's judgment of stories with supernatural powers, realistic and unusual events in China.

Method

Participants

Fifty-three secular and fifty-one Christian children from mid- to high-SES preschools and elementary schools were recruited in urban cities (including Beijing, Tianjin, Jinan and Shanghai) in Mainland China. Christian children were recruited through snowball sampling by research assistants who self-identified as Christian. Note that the Christian Chinese research assistants were critical because without connections to believers in Mainland China, it would be impossible to access a large number of

Christian families. All children in the older age group attended public elementary schools. A power analysis indicated that a sample size of 20 per age group and per community group would be needed. There were 32 5- to 6-year-old secular children (M_{age} = 6;2 years), and 21 9- to 11-year-old secular children (M_{age} = 10;1 years); 30 5- to 6-year-old Christian children (M_{age} = 6;10 years), and 20 9- to 11-year-old Christian children (M_{age} = 9;10 years). Parents of participating children were asked about their religious denomination in a questionnaire to confirm their religious identity. The 53 secular parents indicated "no religious denomination," and the 50 Christian parents identified as "Protestant."

Procedure

The procedure was adapted from Corriveau, Chen and Harris (2015) and was divided into two phases. The warm-up phase and the testing phase.

Warm-up Phase

Children were presented with two boxes: one labeled "real" with an illustration of a teacher standing by a blackboard, and one labeled "pretend" with an illustration of a giraffe painting a picture. The experimenter told the child, "Sometimes, I hear stories about some things that really happened. For example, you might have heard a story about an accident that really happened a long time ago. But sometimes I hear stories about things that are pretend. For example, you might hear a story about a house and all the people inside rising from the ground and floating in space. So, in this game, I have pictures of things that happened, but they're all mixed up and I want you to help me. Some of the things that happened are real. So, I want you to put those in the real box.

Look, this is a picture of a teacher and she is really teaching. So, this box is for the stories that are real. But some of the things that happened are pretend. So, I want you to put those in the pretend box. See, this is a picture of a giraffe painting. Can giraffes really paint? No, so this box is for the stories that are pretend. Let's begin." Children were then provided with four pictures of events, two real ones (people building houses and people rowing) and two pretend ones (a flying elephant and a talking frog). Children were invited to place each picture in one of the two boxes. For example, the experimenter would show a picture of building houses and ask "is building a house out of wood real or pretend? Which box should I put this picture in? The 'real' box or the 'pretend' box?" Feedback was provided following each warm-up trial.

Testing Phase

After the last warm-up trial, the experimenter said, "Now I'm going to tell you some stories and ask you to put the picture in the 'real' or the 'pretend' box, and then I'm going to ask you why you decided to put the picture there." The experimenter then presented each child with fifteen stories and pictures: three with religious events where God is the divine intervention, three with religious events where the Buddha deity (*Guanyin*) is the divine intervention, three with magical events, three with unusual and extraordinary events, and three with realistic events. Specifically, children were asked "could what happened in the story happen in real life? Shall I put the picture in the 'real' box or the 'pretend' box?" After children made a choice, a justification was requested by the experimenter, "So you put the picture in the 'pretend' (or 'real') box. Why do you think it goes in the 'pretend' (or 'real') box?"

In total, 15 story contexts were adapted and created, based on Corriveau, Chen and Harris (2015). For each story context, 5 versions of events were created. In the religious-God version, an impossible event was brought about via the divine intervention of God. In the religious-Buddha version, an impossible event was brought about via the divine intervention of Buddha (Guanyin). In the magical version, the same impossible events did not include any reference to divine intervention but was instead presented as magical. In the realistic version, the impossible events were modified as possible events with human intervention. Finally, in the unusual/extraordinary version, the impossible events were modified as improbable events which may still happen in real life but are rare events. For example, the versions of a story in which the protagonist tries to feed the hungry people in her town were as follows: 1) Religious-God: The protagonist turns a loaf of bread into many loaves with the help of God, 2) Religious-Buddha: The protagonist turns a loaf of bread into many loaves with the help of Buddha (Guanyin), 3) Magical: The protagonist turns a loaf of bread into many loaves with her magical powers, 4) Realistic: The protagonist goes to a nearby town to buy bread, and 5) Unusual: The protagonist finds many loaves of bread in the forest and takes them to her town.

The assignment of a particular story context to one of the 5 story types (Religious-God, Religious-Buddha, Magical, Realistic, Unusual) was systematically varied across children. For example, for a fifth of the participants, the protagonist who tries to feed the hungry people in her town was a character in a religious-God story; for the second fifth of participants, the protagonist who tries to feed the hungry people in her town was a character in a religious-Buddha story; for the third fifth of participants, she

was a character in a magical story; for the forth fifth of participants, she was a character in an unusual story; and for the remaining fifth, she was a character in a realistic story. The presentation order of the 15 stories was also randomized.

Results

Preliminary analyses showed that all children from both communities passed the 4 warm-up trials. Below, I first present results on children's judgments about the possibility status of different narratives and events. I then explore the relation between children's judgments and their justification of that categorization.

Possibility Judgments about Events

Figure 3.1 presents the average percentage of real judgments for each story type by religious affiliation and age group. Inspection of Figure 3.1 indicates variation by age and religious exposure-related in children's judgments of event possibility for most story types, particularly with respect to the religious stories. To explore the effects and interactions of Religious affiliation (secular, Christian), Age group (younger, older) and Story type (religious-God, religious-Buddha, magical, unusual, realistic) on children's possibility judgments, I conducted a mixed-effects binomial logistic regression model on the "Real"/ "Not real" responses using the glmer function of the lme4 package in R statistical software. The model included Religious affiliation (secular as reference), Age group (younger children as reference), Story type (religious-God story as reference), and all the interaction terms as fixed effects, participant ID and the 15 story contexts as random effects to account for variability within each story context and each participant's response to the possibility judgments. The backward elimination approach was adopted

so that variables were excluded if they did not significantly contribute to the model. The best fitted model included a significant three-way interaction between Religious affiliation, Age group and Story type. Removing the three-way interaction would significantly reduce the model fit, χ^2 $(df = 1) = 100.93$, $p < .001$. The coefficient of the best fitted model is summarized in Table 3.1.

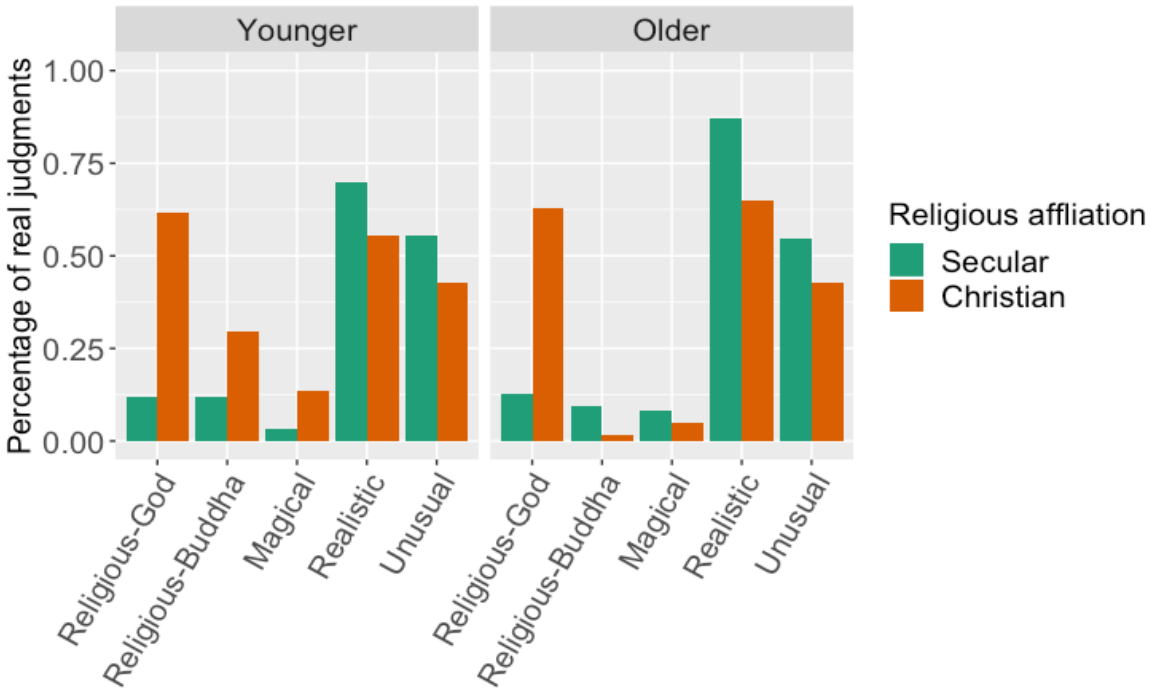

Figure 3.1. Percentage of real judgments for religious-God, religious-Buddha, magical, realistic, and unusual stories by religious affiliation and age group.

Table 3.1 *Mixed-effects binomial logistic regression models on children's possibility judgments of events*

	B (SE)	*z*	Odds Ratio	95% CI for OR	
				Lower	Upper
Intercept	-2.241***	-6.078	-2.241	-2.964	-1.519
Religious affiliation (Secular as reference)	2.882***	6.185	2.882	1.969	3.780
Age Group (Younger as reference)	0.008	0.156	0.089	-1.030	1.208
Story type					
Religious-Buddha vs. Religious-God	0.001	0.000	0.000	-0.912	0.912
Magical vs. Religious-God	-1.438*	-2.130	-1.438	-2.761	-0.115
Realistic vs. Religious-God	3.199***	7.642	3.199	2.378	4.019
Unusual vs. Religious-God	2.466***	6.104	2.466	1.674	3.258
Religious affiliation * Age group	-0.120	-0.167	-0.120	-1.534	1.293
Religious affiliation * Story type					
Religious-Buddha vs. Religious-God	-1.642**	-2.834	-1.642	-2.777	-0.506
Magical vs. Religious-God	-1.276	-1.616	-1.276	-2.823	0.272
Realistic vs. Religious-God	-3.586***	-6.748	-3.586	-4.628	-2.545
Unusual vs. Religious-God	-3.406***	-6.518	-3.406	-4.431	-2.382
Age group * Story type					
Religious-Buddha vs. Religious-God	-0.373	-0.499	-0.374	-1.843	1.095
Magical vs. Religious-God	0.894	0.979	-0.894	-0.896	2.684
Realistic vs. Religious-God	1.115	1.58	1.115	-0.268	2.500
Unusual vs. Religious-God	-0.084	-0.134	-0.084	-1.314	1.145

Religious affiliation * Age group * Story type					
Religious-Buddha vs. Religious-God	-3.067*	-2.28	-3.067	-5.704	-0.431
Magical vs. Religious-God	-2.076	-1.723	-2.076	-4.438	0.285
Realistic vs. Religious-God	-0.618	-0.709	-0.619	-2.330	1.092
Unusual vs. Religious-God	0.098	0.12	-0.098	-1.490	1.686
Num. of Observations	1,547				
Num. of Groups	104				
Log Likelihood	-721.962				
AIC	1,485.925				

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.0$

To clarify the three-way interaction, I ran a mixed-effects binomial logistic regression model on children's possibility judgments within each story type separately, with Religious affiliation, Age group, and Religious affiliation by Age group interaction as fixed effects and participant as a random effect. I applied Bonferroni corrections to the adjusted *p*-value for the multiple comparisons ($\alpha = .05/5 = .01$). The results showed that in the religious-God story type, there is a significant main effect of Religious affiliation (*B* = 3.506, *SE* = 0.071, *z* = 4.984, *p* < .001, *OR* = 3.506, *CI* [2.127, 4.885]). Christian children across both age groups (62%) are more likely to judge the religious-God stories as real, as compared to secular children (12%). The main effect of Age group (*B* = 0.181, *SE* = 0.717, *z* = 0.251, *p* = .082) and the Religious affiliation by Age group interaction (*B* = -0.164, *SE* = 0.937, *z* = -0.175, *p* = .086) were not significant.

In the religious-Buddha story type, there is a significant main effect of Religious affiliation (*B* = 1.338, *SE* = 0.524, *z* = 2.553, *p* = .01, *OR* = 1.338, *CI* [0.311, 2.365]) as well as a significant interaction between Religious affiliation and Age group (*B* = -3.275, *SE* = 1.277, *z* = -2.566, *p* = .01, *OR* = -3.275, *CI* [-5.778, -0.773]). The main effect of Age group (*B* = -0.253, *SE* = 0.643, *z* = -0.393, *p* = .694) was not significant. To further explore the interaction between Religious affiliation and Age group, I ran a mixed-effects binomial logistic regression model on children's possibility judgments within each religious affiliation group separately, with Age group as fixed effects and participant as a random effect. I applied Bonferroni corrections to the adjusted *p*-value for the multiple comparisons ($\alpha = .01/2 = .005$). In the secular group, the main effect of Age group was not significant (*B* = -0.246, *SE* = 0.549, *z* = -0.448, *p* = .654). Both age group (% cases on

average) were not likely to judge the religious-Buddha story as real. In the Christian group, the main effect of Age group was significant (B = -3.705, SE = 1.186, z = -3.124, p = .002). Older Christian children (% cases) are less likely to judge religious-Buddha story as real than younger Christian children (% cases).

In the magical story type, neither the main effects of Age group (B =0.717, SE = 1.596, z = 0.449, p = .653) and Religious affiliation (B = 1.626, SE = 1.418, z = 1.147, p = .251) nor the interaction between the two (B = -1.897, SE = 2.181, z = -0.870, p = .384) were found significant. All children were unlikely to judge the magical story as real (% cases on average).

In the realistic story type, the main effect of Age group was marginally significant (B = 1.141, SE = 0.486, z = 2.348, p = .019). Across both communities, older children are more likely to judge the realistic stories as real. The main effect of Religious affiliation and the Religious affiliation by Age group interaction were not significant.

In the unusual story type, no main effects of Age group (B = -0.024, SE = 0.397, z = -0.059, p = .953), Religious affiliation (B = -0.559, SE = 0.364, z = -1.539, p = .124), or the effect of Religious affiliation by Age group interaction (B = 0.023, SE = 0.565, z = 0.041, p = .968) were found. Children across both communities and age groups are relatively receptive to the unusual stories.

Children's Justification about their Possibility Judgment

Recall that children were also asked to justify their possibility judgments. Children's justifications of these judgments were coded in terms of whether or not they mentioned the relevant causal mechanism in each story. The mechanism refers to the

story content that defines the story type. For example, consider the version of the story described in the method section where a protagonist tries to feed the hungry people in her town. The justification was coded as "mentioning the mechanism" if the participant mentioned the protagonist could or could not turn a loaf of bread into many loaves of bread with the help of God, Buddha (Guanyin), or with her magical power in the religious-God, religious-Buddha, or magical story type, respectively. For the realistic or unusual story type, the justification was coded as "mentioning the mechanism" if a participant mentioned that it is possible or not possible for the protagonist to go to a nearby town to buy bread, or to find many loaves of bread in the forest. The first author and a research assistant coded all justifications. Agreement between the coders was 91% (Cohen's K = .83). Disagreements were resolved through discussion.

Figure 3.2 shows the percentage of justifications mentioning mechanism for each story type judged as "Pretend" and "Real" by religious affiliation and age group. Inspection of Figure 3.2 shows that older children were more likely than younger children to mention the mechanism across the board. When stories were judged as pretend, both secular and Christian children were more likely to refer to mechanism as pretend for religious-God, religious-Buddha, and magical stories than realistic and unusual stories. For religious-God stories specifically, secular children were more likely to refer to mechanism than Christian children when the stories were judged as pretend, whereas Christian children were more likely to refer to mechanism than secular children when the stories were judged as real. For the small number of cases when religious-Buddha stories and magical stories were judged as real, a very low percentage of these cases involved

references to mechanism as real. By contrast, for realistic and unusual stories, 50% or more of the cases involved references to mechanism as real. To understand how children justify their possibility judgment in each story type, I ran a mixed-effects binomial logistic regression model on whether children mentioned mechanism within each story type separately, with Religious affiliation, Age group, Possibility judgment and all the interaction terms as fixed effects and participant as a random effect. Below I present data for each story type.

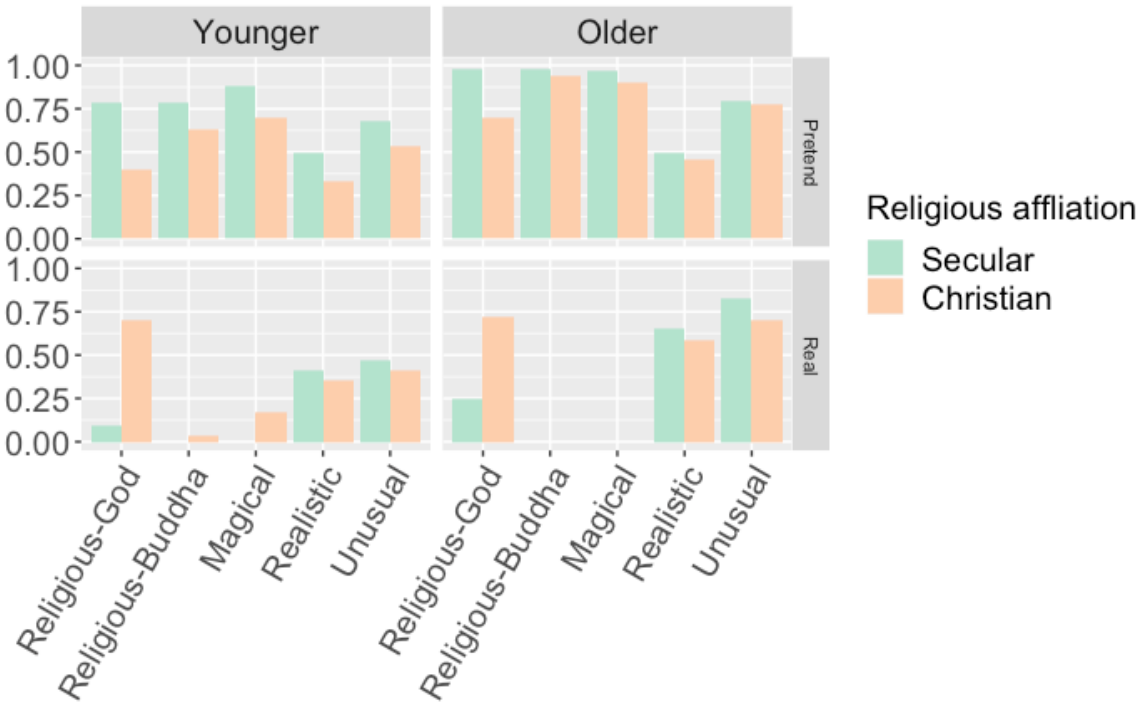

Figure 3.2. Percentage of justifications mentioning mechanism for each story type judged as "Pretend" and "Real" by religious affiliation and age group.

Religious-God. For the religious-God story type, there is a significant main effect of Religious affiliation (B = -2.002, SE = 0.661, z = -3.030, $p < .01$), Age group (B = 3.006, SE = 1.149, z = 2.617, $p < .01$), and Possibility judgment (B = -3.963, SE = 1.284,

z = -3.087, p < .01), as well as a significant interaction between Religious affiliation and Possibility judgment (B = 5.389, SE = 1.436, z = 3.753, p < .01). The other interaction terms were not significant. To further explore the interaction between Religious affiliation and Possibility judgment, I ran a mixed-effects binomial logistic regression model on whether children mentioned mechanism with the "Real" and "Pretend" judgment separately, with Religious affiliation and Age group as fixed effects and participant as a random effect. I applied Bonferroni corrections to the adjusted p-value for the multiple comparisons (α = .05/2 = .025). When the judgment of religious-God story is "Real", the main effect of Religious affiliation (B = 3.056, SE = 0.919, z = 3.323, p < .001) was significant. The main effect of Age group (B = 0.346, SE = 0.572, z = 0.605, p = .545) was not significant. Across both age groups, Christian children (70.5% cases) were more likely to refer to the mechanism as real than secular children (17% cases) (see Figure 3.3). When the judgment of religious-God story is "Pretend", the main effect of Religious affiliation (B =-2.691, SE = 0.733, z = 3.672, p < .001) and Age group (B = 2.236, SE = 0.766, z = 3.037, p < .001) were significant. Christian children (55% of cases) were less likely to refer to the mechanism as pretend than secular children (88% of cases). Older children were more likely to refer to the mechanism as pretend than younger children across the board.

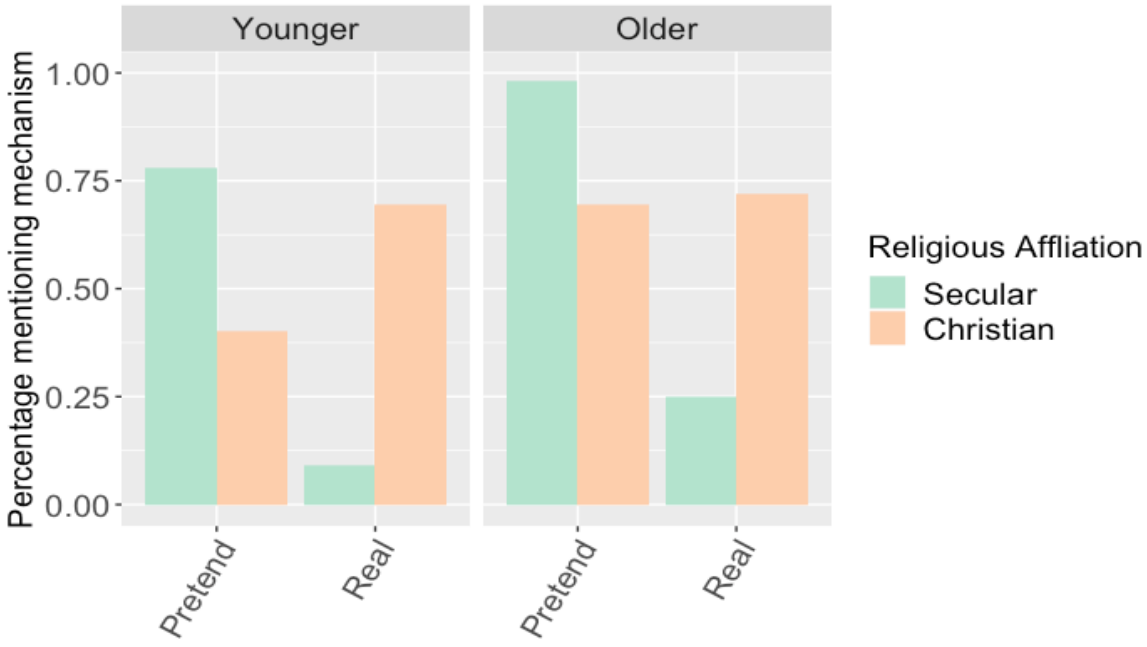

Figure 3.3. Percentage of justifications mentioning mechanism for religious-God stories judged as "Pretend" and "Real" by religious affiliation and age group.

When children did not mention the mechanism to justify their judgment, we coded children's justifications into 2 main categories. The first is when children provided uninformative responses, such as, "I don't know", or "It feels like real/pretend". The second category is when children mentioned other aspects of the story, such as the premise of the story to justify their judgment, e.g., "the story is real because it is possible to have no food to eat". Lastly, another interesting category came up among older secular children when they justified religious stories as real by providing a coincidence explanation, i.e., they referred God's power and the outcome in the story as a coincidence, e.g., "it rained because of coincidence right after people's prayer", or "it could rain not because of God's power but because of coincidence". Table 3.2 presents the percentage of justifications not containing mechanism for religious-God stories

judged as “Pretend” and “Real” by religious affiliation and age group. According to the table, older children in both communities produced fewer uninformative justifications than did younger children. In addition, more than half of the older secular children provided coincidence explanations as their justification when judging the religious-God story as real.

Table 3.2 *Percentage of justifications not mentioning mechanism for religious-God stories judged as “Pretend” and “Real” by religious affiliation and age group.*

Judgment of story	Religious affiliation and age group	Uninformative	Other aspects	Coincidence
Real	Christian younger age group	31%	7%	0%
	Christian older age group	5%	25%	0%
	Secular younger age group	54%	36%	0%
	Secular older age group	0%	17%	62%
Pretend	Christian younger age group	59%	3%	0%
	Christian older age group	13%	17%	0%
	Secular younger age group	16%	10%	0%
	Secular older age group	0%	1%	0%

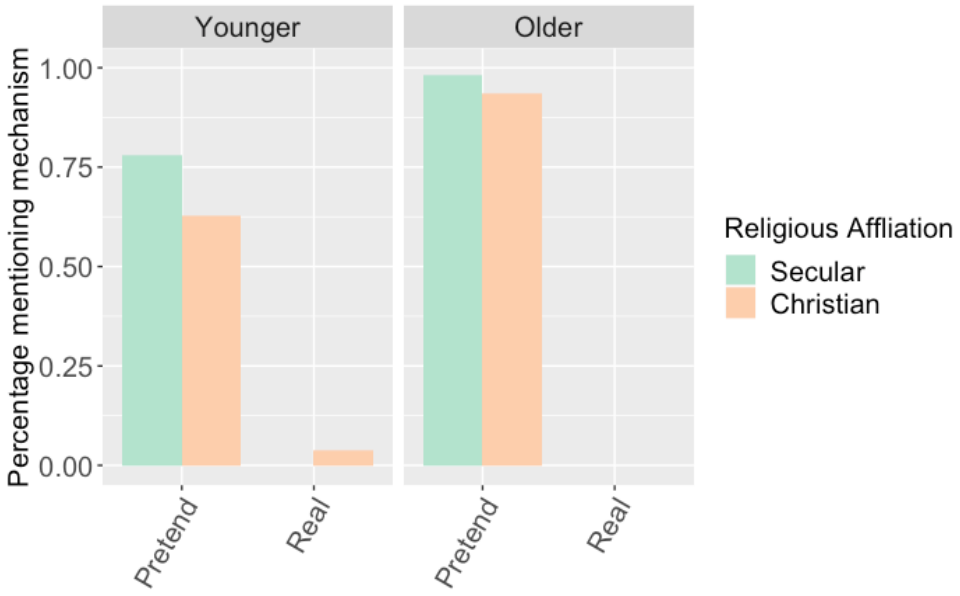

Figure 3.4. Percentage of justifications mentioning mechanism for religious-Buddha stories judged as "Pretend" and "Real" by religious affiliation and age group.

Religious-Buddha. For the religious-Buddha story type, Figure 3.4 shows that when the Buddha story was judged "Real", only 4% of the cases in the younger Christian group (1 case) mentioned mechanism. All other justifications did not involve a reference to mechanism. Recall that the overall percentage of cases when the religious-Buddha story was judged as real was relatively low. For those cases where children did not mention the mechanism when judging the Buddha story as real, Table 3.3 (top panel) shows the percentage of different justifications provided by Christian and secular children out of the total cases judged as "Real". In addition to the categories described in the religious-God story, one specific kind of justification came up among Christian children: 14% of cases in the younger Christian group and one child in the older Christian age group cited the Bible to justify the "Real" judgment of the religious-Buddha story, e.g., "I heard about this in the Bible". The majority of cases (60%) were justified with

uninformative responses (e.g., “I don’t know”, or “it feels like real”) by younger Christian children. Also, 8% of cases from younger Christian children mentioned coincidence (e.g., “it could be a coincidence; it just happened that they prayed to Buddha and it rained the next day”). When judging the Buddha story as “Real”, the younger secular children provided uninformative responses for 42% of cases, mentioned other aspects of the story for 33% of cases, and provided a coincidence explanation by referring Buddha’s power and the outcome in the story as coincidence for 25% of cases; 100% of the older secular children (6 out of 6 cases) provided a coincidence explanation.

Table 3.3 *Percentage of justifications not mentioning mechanism for religious-Buddha stories judged as “Pretend” and “Real” by religious affiliation and age group.*

Judgment of story	Religious affiliation and age group	Uninformative	Other aspects	Coincidence	Citing Bible
Real	Christian younger age group	60%	14%	8%	14%
	Christian older age group	0%	0%	0%	100% (1 out of 1 case)
	Secular younger age group	42%	33%	25%	0%
	Secular older age group	0%	0%	100% (6 out of 6 cases)	0%
Pretend	Christian younger age group	28%	9%	0%	0%
	Christian older age group	6%	0%	0%	0%
	Secular younger age group	14%	9%	0%	0%
	Secular older age group	0%	3% (1 out of 1)	0%	0%

When the judgment of the religious-Buddha story was “Pretend”, I ran a mixed-effects binomial logistic regression model on whether children mentioned mechanism or

not, with Religious affiliation, Age group and the interaction as fixed effects, and participant as a random effect. The main effect of Age group was marginally significant (B = 3.289, SE = 1.732, z = 1.899, p = .05). The main effect of Religious affiliation (B = -2.036, SE = 1.326, z = -1.536, p = .124) and interaction (B = 0.781, SE = 2.291, z = 0.341, p = .733) were not significant. Across both communities, older children (96% cases) were more likely to refer to the mechanism as pretend than younger children (70.5% cases). As for the few cases where children did not refer to the mechanism as pretend, Table 3.3 (bottom panel) shows the percentage of different justifications provided by Christian and secular children out of the total cases judged as "Pretend".

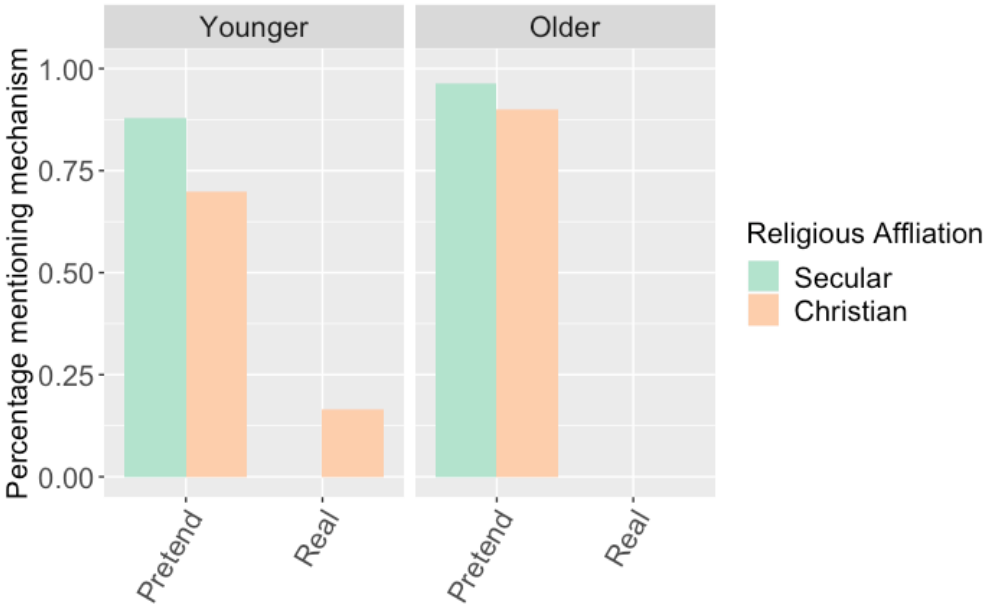

Figure 3.5. Percentage of justifications mentioning mechanism for Magical stories judged as "Pretend" and "Real" by religious affiliation and age group.

Magical. Similar to the religious-Buddha story type, Figure 3.5 shows that when the Magical story was judged "Real", only 16% of the cases in the younger Christian

group (2 out of 12 cases) mentioned mechanism. All other justifications did not involve a reference to mechanism. Recall that the overall percentage of cases when the Magical story was judged as real was very low. Table 3.4 (top panel) shows the percentage of different justifications not mentioning mechanism provided by Christian and secular children out of the total magical cases judged as "Real". One more interesting type of justification showed up for the magical stories judged as real. 17% of the cases judged as real by younger Christian children mentioned that it is not a magical power but God's power that made this happen. Similar to the religious stories, 100% of the older secular children (5 out of 5 cases) provided a coincidence explanation.

Table 3.4 *Percentage of justifications not mentioning mechanism for magical stories judged as "Pretend" and "Real" by religious affiliation and age group.*

Judgment of story	Religious affiliation and age group	Uninformative	Other aspects	Coincidence	Citing Bible	God's power
Real	Christian younger age group	33%	8%	17%	8%	17%
	Christian older age group	0%	0%	0%	100% (3 out of 3)	0%
	Secular younger age group	67%	0%	33% (1 out of 3)	0%	0%
	Secular older age group	0%	0%	100% (5 out of 5)	0%	0%
Pretend	Christian younger age group	27%	3%	0%	0%	0%
	Christian older age group	10%	3%	0%	0%	0%
	Secular younger age group	10%	3%	0%	0%	0%
	Secular older age group	3%	0%	0%	0%	0%

When the judgment of the magical story was “Pretend”, I ran a mixed-effects binomial logistic regression model on whether children mentioned mechanism or not, with Religious affiliation, Age group and the interaction as fixed effects, and participant as a random effect. No significant effects were found. Across the board, children were very likely to refer to the magical power mechanism as pretend. As for the small proportion of cases where children did not refer to the mechanism as pretend, Table 3.4 (bottom panel) shows the percentage of different justifications provided by Christian and secular children out of the total cases judged as “Pretend”.

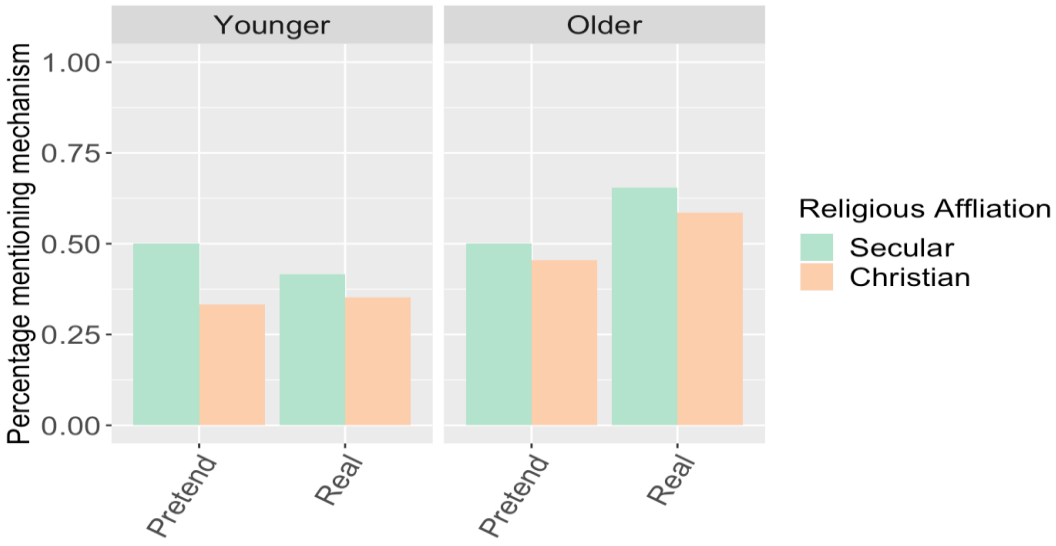

Figure 3.6. Percentage of justifications mentioning mechanism for Realistic stories judged as “Pretend” and “Real” by religious affiliation and age group.

Realistic. The three-way model in the realistic story type yielded no significant main effects of Religious affiliation, Age group, and Possibility judgment nor any significant interactions. Children mentioned the mechanism for 50% of the cases when judging the realistic story as “Real” across the board (see Figure 3.5). This is not surprising, since unlike the other types of stories, the mechanism part of the realistic story

is not dramatically different from the other aspects of the realistic story. Table 3.5 (top panel) shows the percentage of different justifications not mentioning mechanism out of the total cases judged as "Real" provided by Christian and secular children. Note that uninformative justifications (e.g., "if feels like real", "I don't know") are very common among older children here, given that there is no violation or unexpected, unusual events in the realistic story.

Table 3.5 *Percentage of justifications not mentioning mechanism for realistic stories judged as "Pretend" and "Real" by religious affiliation and age group.*

Judgment of story	Religious affiliation and age group	Uninformative	Other aspects
Real	Christian younger age group	17%	14%
	Christian older age group	40%	17%
	Secular younger age group	23%	16.5%
	Secular older age group	40%	24%
Pretend	Christian younger age group	20%	11%
	Christian older age group	0%	52%
	Secular younger age group	25%	25%
	Secular older age group	0%	50%

Across the board, children mentioned the mechanism for 42% of the cases when judging the realistic story as "Pretend" on average. For these cases, children did not accept the realistic mechanism proposed in the stories. For example, in one of the stories, the strawberry grew after a while, which some children thought was too fast. For those cases where children did not mention the mechanism when judging the Realistic story as "Pretend", Table 3.5 (bottom panel) shows the percentage of different justifications provided by Christian and secular children. Here, around 50% of the realistic story were judged as pretend by older children due to the fact that children did not accept some of the premises or the set-up of the story, claiming, for example that no king exists

nowadays, or no one wears armor now.

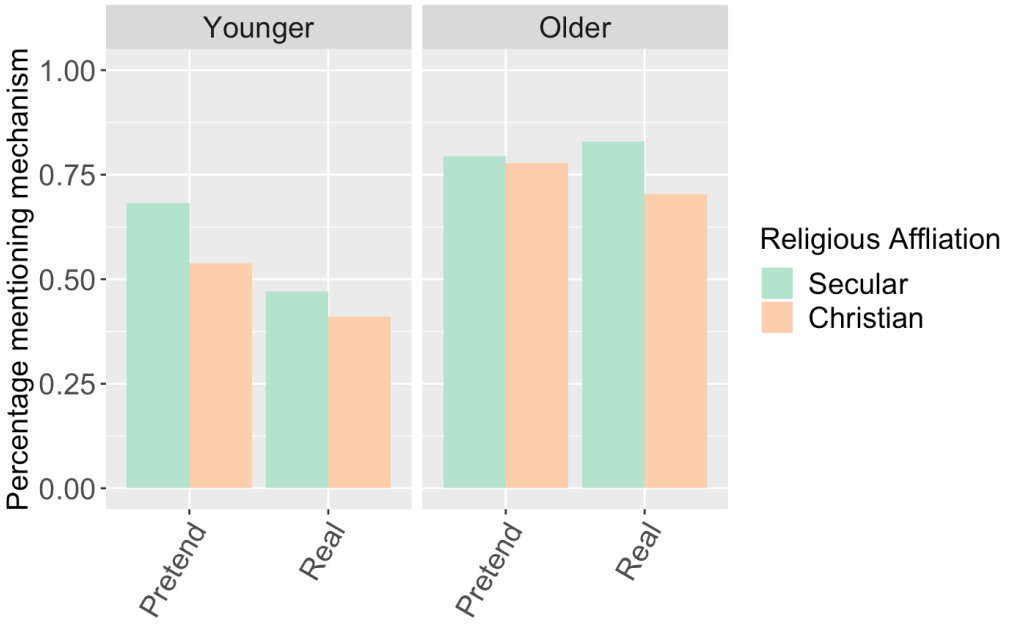

Figure 3.7. Percentage of justifications mentioning mechanism for Unusual stories judged as "Pretend" and "Real" by religious affiliation and age group.

Unusual. The three-way model for the unusual story type yielded a significant main effect of Possibility judgment (B = 0.781, SE = 2.291, z = 0.341, p = .733). Religious affiliation, Age group and the interactions were not significant. Children were more likely to mention mechanism when judging the unusual story as pretend (73% of the cases on average) than when judging it as real (58% of the cases on average) (see Figure 3.6).

Table 3.6 showed percentage of justifications not mentioning mechanism for unusual stories judged as "Pretend" and "Real" by different religious affiliation and age group. Similar to the realistic story, many children especially older children judged the unusual story as pretend because they did not accept some of the premises or the set-up in the story.

Table 3.6 *Percentage of justifications not mentioning mechanism for unusual stories judged as "Pretend" and "Real" by religious affiliation and age group.*

Judgment of story	Religious affiliation and age group	Uninformative	Other aspects
Real	Christian younger age group	20%	18%
	Christian older age group	18%	12%
	Secular younger age group	34%	15%
	Secular older age group	18%	0%
Pretend	Christian younger age group	40%	11%
	Christian older age group	0%	24%
	Secular younger age group	43%	26%
	Secular older age group	0%	23%

Discussion

Study 2 examined how age and religious exposure in a secular majority society influence children's judgment and justifications about what is real and fictional by looking at how 5- to 6-year-old and 9- to 11-year-old secular and Christian children in China judge the reality status of stories that include supernatural powers, as well as realistic and unusual events. Children were also asked to justify their judgments. There was a clear impact of religious background on the judgment of religious stories containing an intervention by God in both age group. The impact of religious background on the judgment of religious stories containing an intervention by Guanyin was weaker and only found in the younger age group. There were no effects of religious affiliation on children's judgments about magical, realistic and unusual stories. Below, I discuss the results for Christian and secular children in each domain.

First, all children in both age group passed the warm-up. They were able to

differentiate events that could happen in real life and events that violate natural physical laws and are impossible in real life. This is in line with past literature showing that children starting from 4 years old understand what is real and fictional (Corriveau et al., 2009; Shtulman & Carey, 2007).

It is also not surprising to find that majority of Christian children in both age groups categorized the religious stories describing interventions by God as "real" whereas secular children categorized these stories as "pretend." This finding is consistent with results from Study 1 as well as previous research (Woolley & Cox, 2007; Corriveau, Chen & Harris, 2015; Cui et al., 2020). It confirms the effect of religious exposure on children's understanding of what is real and pretend. Children with exposure to beliefs and practices invoking God's power are more willing to entertain the possibility of exceptions to natural physical laws when it comes to intervention by God. Further analyses of children's justifications confirmed this conclusion. The majority of Christian children who judged the religious-God story as real referred to the mechanism, i.e., the causal power of God's intervention as real. In contrast, the majority of secular children judged the religious-God story to be pretend and referred to the mechanism as impossible in real life.

The results from the stories that contain the supernatural power of *Guanyin* are interesting. Some younger children judged this type of story as possible in real life. Although the number of Buddha stories judged as real was around half of the number of God stories judged as real by Christian children, that is significantly more than by secular children. However, further analyses of children's justifications showed that only one case

was justified by referring to the intervention of *Guanyin* as possible. The majority of cases were justified by "I don't know", "It feels like real", or by mentioning other aspects of the story that do not involve *Guanyin's* power as real. In a small number of cases (14%), children mentioned that they had heard similar stories in the Bible, providing some evidence that children extend their belief of God's intervention to other supernatural domains. Another 8% invoked coincidence as an explanation by referring to *Guanyin's* power and the outcome in the story as a coincidence thereby denying the power of *Guanyin.* Furthermore, only one case of the *Guanyin* story was judged real by an older Christian child citing Bible. This pattern is very similar to Iranian children's judgments and justifications of magical stories in Davoodi et al. (under review), where some younger children showed a "carry-over" effect of religious exposure and judged magical stories as real, while their justifications were largely uninformative; older Irian children rejected the possibility of magical powers, referring to the magical interventions as not real. One interpretation of these results in the current study is that given the minority status of the Christian community, as well as the monotheistic nature of Christianity, Christian parents are likely to be highly motivated to emphasize God as the only divine figure who has causal powers or to deny the power of other supernatural agents when appropriate. Such differentiating remarks might lead Chinese Christian children to be less susceptible to extending the impact of religious exposure to other supernatural domains. This kind of differentiating talk may be more frequent as children get older, when children are exposed to a variety of supernatural agents.

Another non-mutually exclusive interpretation focuses on children's fully-fledged

understanding of physical possibility and its related cognitive mechanism. Although children starting from 4 years old understand that it is impossible to violate natural-physical laws (e.g., walk through the wall), children's understanding of physical possibility and the violation of natural-physical law in early childhood is not solid. They are not able to fully understand that improbable events that do not violate natural-physical laws (e.g., finding an alligator under bed) can happen in real life until later in childhood or even adulthood (Shtulman & Carey, 2007; Shtulman, 2009). Children who were able to differentiate the improbable from impossible were able to offer explanations identifying the related physical principles. Shtulman and Yoo (2015) also found that children's ability to differentiate improbable events from impossible events co-occurs with children's skepticism towards Santa between the age of 6 to 9. Children who had a better grasp of physical possibility in terms of improbable and impossible events also asked more conceptual questions about the feasibility of Santa than factual questions. Clearly, before children truly understand physical possibility, it does not occur to them how Santa makes his sled fly. What cognitive mechanisms drive children's full understanding of physical possibility? Shtulman (2009) speculated that children's ability to imagine and mentally represent the circumstances that allow improbable events to happen may help them to grasp the possibility. Another interpretation entertained by both Shtulman and Carey (2007) and Woolley and Ghossainy (2013) is that young children rely on their own experience to make possibility judgments. They tend to view events that are unfamiliar or unusual as not possible, effectively collapsing impossible and improbable events into one category. Indeed, the development of children's

understanding of physical possibility may benefit from their developing metacognition, possibly EF, and the ability to think abstractly. Future studies are needed to explore these speculations. This interpretation is consistent with the findings that some Christian 5- to 6-year-olds were more likely to judge the *Guanyin* narratives as real than their secular peers without providing any informative justification. These 5- to 6-year-olds may have not developed stable understanding of physical possibility. Once a firm understanding of physical possibility had been established, older Christian children in the sample were able to make a more clear-cut distinction between the power of God and other supernatural powers.

I did not find any difference between Christian children and secular children in their judgments of the magical stories. Indeed, children across the board judged more than 90% of the magical stories as pretend. They justified this judgment by pointing out that the alleged mechanism, i.e., the magical power, was impossible. If some younger Christian children have not developed a complete understanding of the difference between God's power and *Guanyin*'s power, why did they respond differently to the magical story? This might indicate a general skepticism or la ack of endorsement of magical and fantastical powers in China. No fantastical characters such as Santa, Tooth Fairy, or Easter Bunny and the related practices, such as receiving Christmas gifts from Santa or money in exchange of teeth are endorsed in Chinese culture. Without such an endorsement of fantastical powers, children are more likely to treat magical and fantastical power in stories as merely fictional. Indeed, 5- to 6-year-olds in China (8% cases on average) were less receptive to the magical stories than both their secular and

Christian U.S. counterparts (13% for secular and around 40% for Christian, Corriveau et al., 2015).

Another result worth noting is that among the small number of secular children who judged the God, Guanyin, and magical stories as real, the majority of older children and some younger children mentioned coincidence as an explanation. This is indeed a denial of supernatural power among secular children. Thus, the folk religious beliefs and practices that permeate Chinese culture seem to have little impact on children's beliefs, at least with respect to the power of *Guanyin* or to magical powers. It is likely that the influence of secular education is much stronger than the influence of folk religious culture. In addition, since there is no formal organization or institution for folk religion, parents with folk religious practices may not have a stable belief or affiliation to any organization. Given the superstition label attached to folk religion, parents with folk religious beliefs or practices may not be as motivated to talk to children about them as much as Christian parents talk about Christian beliefs or practices. Furthermore, young children may not have much chance to participate or be exposed to any folk religious practice (Lane et al., 2016). Indeed, our study is limited in not measuring the specific folk religious beliefs or practices that each child may have been exposed to. However, they are very difficult to measure since they encompass multiple aspects and people vary in what they believe or practice.

Lastly, I did not find any impact of religious exposure on children's judgment of realistic and unusual stories. Moreover, the percentage of younger children who categorized the unusual story as "real" appears higher than what is reported in Shtulman

& Carey (2007; 2009). Such a difference is likely because the unusual events in the current study appear more probable than in past studies. Whether children find it possible or not may be related to children's own experience with similar events. It is notable that quite a few children doubted certain aspects and the set-up of the realistic and unusual stories when judging them as pretend. For example, some children noted that no kings exist nowadays (although they do in some monarchies), or that soldiers do not wear armor now. Yet these features are not impossible in the sense of violating natural physical laws. In other words, the features that are being denied by children are more like the improbable events in Shtulman and Carey (2007). Indeed, there was a marginal age-related increase in children's acceptance of the realistic stories, implying that older children are more accepting of improbable events. Nevertheless, even with this design limitation, I still obtained stable results as presented here.

In conclusion, Study 2 showed that both age and religious exposure influence what children in China judge to be real or fictional and how they justify their judgments. With age, Chinese Christian children are less likely to extend their belief that God can bring about the impossible to other magical or divine powers. These findings not only replicate but also extend recent findings in the U.S. and Iran (Payir et al., in press; Davoodi et al., under review) that the effect of religious exposure on children's understanding of causal possibility may be restricted to the specific religious domain that children are exposed to intensively.

CHAPTER 4: STUDY 3

Parent-child discourse about unobservable entities

Introduction

As reviewed in Chapter 1, 5- to 6-year-old children in the U.S. confidently affirmed the existence of both scientific (e.g., germs, oxygen) and endorsed entities (e.g., God, Santa Claus, Tooth Fairy), but not the equivocal entities (e.g., ghosts, monsters) (Harris et al., 2006). These children were also asked to justify their existence judgments on the unobservable scientific, endorsed and equivocal entities. Their justifications were coded into three kinds: Encounter (the child had or had not seen or experienced the entity before), Source (the child referred to the source of their knowledge, e.g., "Mom told me"), and Generalization (the child described a property of the entity – often, a causal property, e.g., "germs make me sick"). The results indicated that children justified the scientific and endorsed entities in a similar manner -- they mainly provided Generalization justifications, often mentioning the properties, especially the causal properties, of a given unobservable entity. In contrast, they did not provide as many Generalization justifications for the equivocal entities.

This similar pattern of justification for the scientific and endorsed domains, and the distinction between the justification for the equivocal entities, together with the different levels of confidence in these entities may reflect the similar and different kinds of testimony that children receive across various domains. Indeed, adults may not refer to the existence of germs or oxygen explicitly in their daily life. It is more common for people to assume their existence and talk about their properties, especially their causal

properties such as “germs make people sick” (Harris & Koenig, 2006; Harris, 2012). By contrast, the causal properties of the equivocal entities may be discussed less often. Indeed, there are studies showing that children attend to both explicit belief statements (e.g., “I believe in cusk”) and implicit belief statements (e.g., “I know about cusk”) when making decisions about societal consensus regarding the existence of entities (Woolley, Ma, & Lopez-Mobilia, 2011; Dore, Woolley, & Hixon, 2019).

Canfield and Ganea (2014) systematically examined how parents and older siblings talk to 3- to 5-year-old children about unobservable phenomena in different domains, including scientific entities (e.g., germs), endorsed entities (e.g., God), non-endorsed entities (e.g., unicorns) and historical figures (Mother Theresa). Parents and siblings talked about the entities in these domains differently. In terms of content cues, comments on the non-endorsed entities were more superficial and focused more on physical features, whereas comments on the other kinds of entities were more about internal features. In addition, a subtle difference was found in the pragmatic cues used when talking about scientific as compared to endorsed entities. Parents tended to indicate a lack of certainty (e.g., “I think” or “I believe”), or a lack of complete consensus (e.g., “some people think that…”) more often when talking about endorsed entities, whereas more confidence was indicated for scientific entities. These differences in pragmatic cues might explain how children gain an understanding of community consensus, and also why children showed variation in their confidence in the existence of scientific and endorsed entities in Harris et al. (2006). By treating conversational cues in parent-child discourse as an example of the conversational cues that children are exposed to, Study 3

examines a plausible mechanism for children's learning about possibility and reality.

One limitation of the findings of Canfield and Ganea (2014) is that they did not assess the impact of religiosity on how parents talk about different entities. According to the past literature and the results of Studies 1 and 2, parents' religious background is highly correlated with children's belief in the reality status of unobservable phenomena, especially in the religious domain. Thus, conversational cues about religious entities are likely to vary based on the religious background of parents. Indeed, McLoughlin et al. (2021) found that parents reporting higher religiosity produced fewer cues to uncertainty and mentioned belief variation less often when discussing unobservable entities with their children. The current study examined the conversational cues produced by both Christian and secular parents when they talk about scientific and religious entities with their children in a largely secular country.

Study 3 also contributes to the literature by considering another factor, notably community consensus, to explore what conversational cues might signal variation in the community consensus regarding the reality status of a given entity type. Canfield and Ganea (2014) studied the conversational cues of parents and siblings when talking about scientific entities (e.g., germs), endorsed entities (e.g., God), non-endorsed entities (e.g., unicorns) and historical figures (Mother Theresa). All these entities are arguably high consensus entities because the majority of people in the community will affirm the existence of the scientific, historical and endorsed entities, and the non-existence of the non-endorsed entities. However, there are also low consensus entities in both the scientific and religious domain, where people do not agree on their reality status. Indeed,

adults are more confident of the existence of high consensus scientific (e.g., electrons, fluoride), and supernatural entities (e.g., God, Heaven) than of the existence of low consensus scientific (e.g., black holes, evolution) and supernatural entities (e.g., ghosts, reincarnation, telepathy) (Clegg et al., 2019; Shtulman, 2013). Similar to adults, children's confidence in the existence of equivocal entities (ghosts, monsters) is much lower than their confidence in the existence of scientific and endorsed entities. It is very likely that conversational cues implying certainty, expertise, and community consensus vary between high consensus and low consensus entities. Accordingly, the current study included low consensus entities in both the scientific and religious domains to explore how conversational cues vary by community consensus.

In addition to the conversational cues about certainty, expertise, and community consensus included in Canfield and Ganea (2014), the current study aimed to explore two more conversational cues that may vary by domain and consensus. The fist cue is explicit mention of reality status. As reviewed above, adults may assume the existence of high consensus scientific entities such as germ and oxygen. Thus, they may not explicitly talk about the existence of high consensus scientific entities in their daily life, in comparison to low consensus entities. In addition, children's differential justification of high consensus scientific and endorsed supernatural entities versus justification of equivocal entities may reflect different amount of talk in regard to the causal properties of high and low consensus entities. Thus, in the current study, I also coded whether parents engaged in causal talk differently for the different kinds of entities.

Lastly, relations between parental linguistic cues and children's ontological

judgment on different entities will be explored to directly test the influence of parental talk and linguistic cues on children's ontological judgments.

Method

Participants

32 secular and 31 Christian children and their parents from mid- to high-SES preschools and elementary schools were recruited in urban cities (including Beijing, Tianjin, Jinan and Shanghai) in Mainland China (n = 50 mothers; 31 boys). The total sample size was appropriate (N = 46 minimum) for 90% power in a mixed design with four groups, four measures per participant, $\alpha = .05$ and expecting a medium effect size ($f = 0.25$; see Canfield & Ganea, 2014; McLoughlin et al., 2021). Families who participated were given books and gifts valued $15 as incentives. Christian families were recruited through snowball sampling. Some of the participants who were willing to participate in Study 3 were recruited from Study 1 and Study 2. There were 16 5- to 6-year-old secular children (M_{age} = 6;2 years), and 16 9- to 11-year-old secular children (M_{age} = 10;1 years); 16 5- to 6-year-old Christian children (M_{age} = 6;10 years), and 15 9- to 11-year-old Christian children (M_{age} = 9;10 years). Parents of participating children were asked about their religious denomination in a questionnaire to confirm their religious identity. The 32 secular parents indicated "no religious denomination," and the 31 Christian parents identified as "Protestant". Table 4.1 presents the distribution of parents' level of education in each community. The majority of parents had some college education.

Table 4.1. *Distribution of parents' level of education in each community*

	Secular parents	**Christian parents**
Graduate/Professional degree	28.1%	13.3%
Some college/College degree	68.8%	70.0%
High school or less	28.1%	16.7%

Procedure

Before the parent-child conversations took place, and following the procedure adopted in Study 1, children were presented with 10 unobservable entities and asked with respect to each entity about their familiarity with it ("Have you heard about [entity]?") its existence if they had heard about the entity ("Is/are there really [entity]? Is/are [entity] real or not?") as well as their certainty about its existence ("Are you very sure or not very sure?"). Children and parents discussed these items in the next phase: there were 3 religious high-consensus entities: Angel, Heaven, God; 3 scientific high-consensus entities: Germ, Electricity, Oxygen; 2 religious low-consensus entities: Reincarnation, Ghosts; and 2 scientific low-consensus entities: Alien and Hypnotist (Clegg et al., 2019; Shtulman, 2013). For the low consensus entities, definitions were provided for Reincarnation, Alien, and Hypnotist after the familiarity question, given that children's understanding of these entities can be variable.

Parent–child dyads were asked to discuss the entities in a quiet setting, either in a classroom or in their home. Parents were told that the researchers were interested in how children learn from conversations about things that they cannot see or experience

directly. The instruction asked parents and children to discuss 10 unobservable entities presented on index cards, with 3 religious high-consensus entities: Angel, Heaven, God, 3 scientific high-consensus entities: Germ, Electricity, Oxygen, 2 religious low-consensus entities: Reincarnation, Ghost, and 2 scientific low-consensus entities: Alien and Hypnotist (Clegg et al., 2019; Shtulman, 2013). Parents were instructed to shuffle the index cards and discuss these entities with their child in a random order, in the way they were accustomed to. No time constraints were placed on the conversations.

Coding of parent discourse

Parents-child conversations were transcribed. Given the focus on understanding the conversational cues parents use and their relation to children's beliefs, only the content of parental statements was coded. Parents' questions or direct repetitions of their child's statement were not coded. In addition, the time spent on individual entities was calculated.

Following Canfield and Ganea (2014), 4 aspects of parents' discourse were coded. First, the total number of modulations of assertion (e.g., "to think", "to believe", "to figure", "to feel like", "to suppose", "to wonder"; in Chinese, "认为", "觉得", "相信", "信", "感觉") as well as other lexical cues to uncertainty (e.g., use of "maybe", "might", "perhaps", "possibly", "could be", "kind of", "not sure"; in Chinese, "可能", "也许", "或许", "好像", "不确定") that parents used when discussing each entity were coded. For example, for a parent who said "I think Aliens may exist but I'm not sure; 我觉得外星人可能存在但是我也不确定", three cues to uncertainty were coded in this

sentence, i.e., “think”, “may”, “not sure”.

Second, parents’ cues to dissent in the community were coded for whether parents mentioned variation in belief. For example, “Some people think Aliens exist, but many do not” was coded as mentioning variation of belief.

Third, whether parents explicitly mentioned the reality status of an entity (e.g., “God is made up”, “We believe in God”, “Oxygen exists”, “Germs are real”) was coded.

Lastly, the total number of elaborations that included an entity as a causal agent was coded. For example, “God brings us joy and peace” were coded as 2 elaborations involving God as a causal agent.

YKC and a trained research assistant coded all of the Chinese transcripts. A second research assistant, unaware of the aims of the study, performed reliability coding on approximately half of the transcripts. Reliability was high for the total number of uncertainty terms produced when discussing the entities (intraclass correlation coefficient (ICC) = .89, 95% CI [.82, .96]), whether parents mentioned the reality status (96% agreement, α = .95) and belief variation (97% agreement, α = .94). Agreement was also acceptable for the total number of causal agent references (ICC = .91, 95% CI [.86, .96]). Any disagreements were resolved by discussion between the coders.

Results

Preliminary analyses

Preliminary mixed-effects models revealed no effects of child or parent gender on the time spent talking about each topic or on the coded features of parent talk (all *p*’s > .31). so this variable was not included in further analyses.

To investigate whether parents spent different amounts of time on different topics or across different communities and age groups, I ran a linear mixed-effects model on parents' time spent on each entity, with religious affiliation, age group, and entity type (high consensus religious, high consensus scientific, low consensus religious, low consensus scientific), and all the potential interactions as fixed effects, and family ID as a random effect to account for variability within each parent-child dyad and entity. Results yielded no significant main effects of religious affiliation, age group or entity type, and no significant interactions (p's > .05). On average, parents spent 76.26s (SD = 47.69) discussing the individual high consensus scientific entities, 70.73s (SD = 62.77) discussing the individual high consensus religious entities, and 73.23s (SD = 49.87) discussing the individual low consensus scientific entities, and 78.31s (SD = 52.31) discussing the individual low consensus religious entities.

In addition, mixed effect analyses were conducted to investigate whether the amount of time spent was associated with each coded conversational cue. There was a main effect of time spent on all the coded conversational cues (p's) < .05. Thus, time spent was included in all subsequent models exploring parental conversational cues.

Parental conversational cues

To investigate whether parents' conversational cues varied by different topics, religious communities or age groups, I first ran mixed-effects models on parental conversational cues (linear models for continuous variables, i.e., cues to uncertainty, causal elaborations, and binary logistic models for binary variables, i.e., variation in belief and explicit reality status), with religious affiliation (secular vs. Christian), age

group (younger vs. older), and entity type (4 levels), and the potential interactions as fixed effects, and family ID as a random effect to account for variability within each parent-child dyad and entity. Time spent on each entity was always included as a control variable. The backward elimination approach was adopted so that variables were excluded if they did not significantly contribute to the model. Preliminary analyses showed that for all the conversational cues, adding the interaction between age group and any other predictors did not significantly improve the models. Only the main effect of age group was sometimes a significant predictor. To better understand the significant interactions between the entity type (4 levels) and religious affiliations in the best fitted models, I separated the entity type variable into two variables, domain (scientific vs. religious), and consensus (high vs. low). I then ran similar models on each parental conversational cue, with age group and time spent as control variables, and replacing the original entity type variable (4 levels) with domain (scientific vs. religious) and Consensus (high vs. low). Taking the backward elimination approach, the best fitted models in regard to each conversational cue are presented below.

Additionally, the effects of use of conversational cues on children's existence judgements (ordinal variable) were explored using a series of mixed-effects ordinal logistic regression models, for each cue. The purpose of these analyses was to understand whether the pattern of testimony accounted for significant variance in children's confidence in the existence of the unobservable entities, irrespective of domain type and religious background.

Cues to Uncertainty

The mean number of uncertainty terms that parents produced when discussing each entity is presented in Figure 4.1[1].

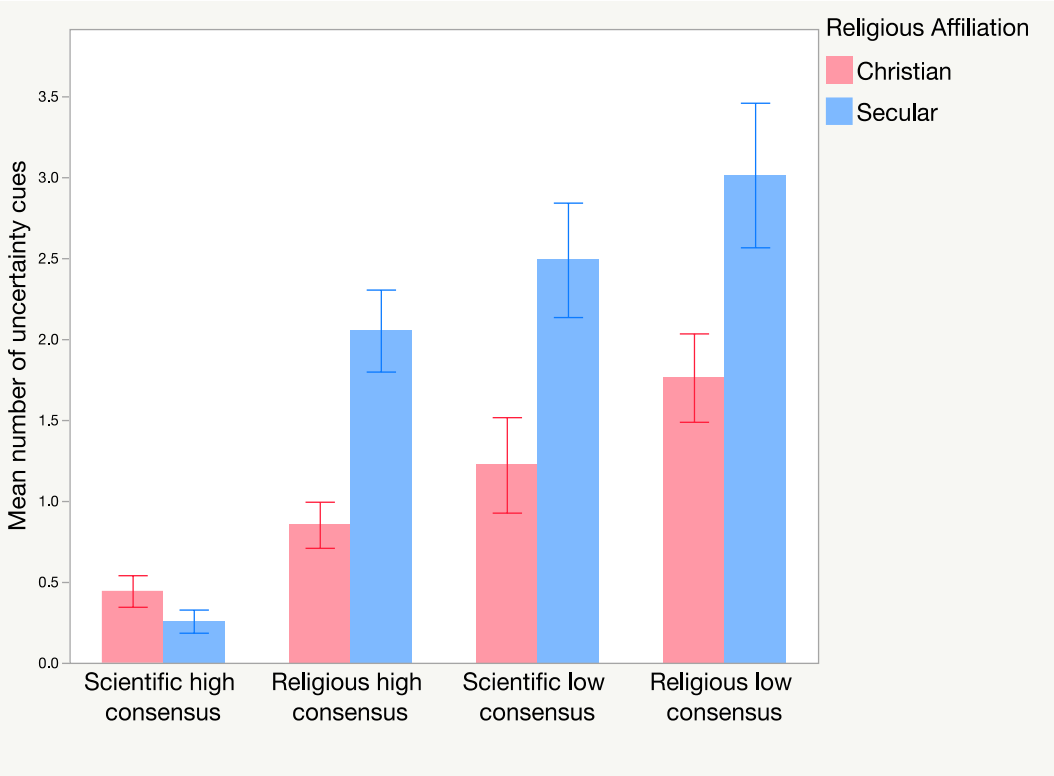

Figure 4.1. Mean number of uncertainty cues by entity type and religious affiliation

The results of the best fitted mixed-effects linear regression model revealed a main effect of age group, $\beta = 0.567$, $SE = 0.247$, $p < .05$. Parents of older children are likely to generate more cues to uncertainty, controlling for time spent talking about the entity. The model also generated a significant three-way interaction between religious affiliation, domain, and consensus, $\beta = -1.290$, $SE = 0.601$, $p < .05$. I further explored the

[1] Note that the figure may not be 100% accurately reflecting the results, since time spent on each item and the variance within individual families controlled the models cannot be reflected in a figure.

three-way interactions in 2 separate ways in order to answer the research questions. I first ran the post-hoc analyses by consensus type, and then ran the post-hoc analyses by religious affiliation.

For the post-hoc analyses by consensus type, I ran separate mixed-effect linear regression models on parental uncertainty cues when talking about the high consensus entities and the low consensus entities, with age group, and time as control fixed effects, religious affiliation (secular vs. Christian), domain (science vs. religion), and their interaction as test fixed effects, and family ID as a random effect. Bonferroni correction was applied, and alpha level was adjusted to .025. In the high consensus model, a significant interaction between religious affiliation and domain were found, $\beta = 1.439$, $SE = 0.297$, $p < .001$. To further explore this interaction, follow-up linear regression models in each high consensus domain were conducted, with alpha level adjusted to .0125. The results showed a significant main effect of religious affiliation (Christian as the reference group) in the domain of religion, $\beta = 1.217$, $SE = 0.323$, $p < .001$: secular parents produced more cues to uncertainty when talking about the religious entities than Christian parents. There was no effect of religious affiliation in the domain of science, $\beta = -0.211$, $SE = 0.134$, $p = .120$. In the low consensus model, adding the interaction between religious affiliation and domain did not significantly improve the model so it was removed. The final model yielded a significant main effect of religious affiliation, $\beta = 1.015$, $SE = 0.419$, $p < .025$. In comparison to Christian parents, secular parents produced more cues to uncertainty when talking about low consensus entities in both domains. The main effects of domain and age group were not significant (ps >.025).

For the post-hoc analyses by religious affiliation, I ran separate mixed-effect linear regression models on uncertainty cues for secular and Christian parents, with age group, and time as control fixed effects, domain (science vs. religion), consensus, and their interaction as test fixed effects, and family ID as a random effect. Bonferroni correction was applied, and alpha level was adjusted to .025. For the model with secular parents, a significant interaction between consensus and domain were found, β = -1.375, *SE* = 0.484, $p < .01$. To further explore this interaction, follow-up linear regression models in each domain were conducted, with alpha level adjusted to .0125. The results showed a significant main effect of consensus in both the domain of science, β = 2.127, *SE* = 0.252, p = 8e-14, and domain of religion, β = 0.871, *SE* = 0.321, p = .008. Across both scientific and religious domain, secular parents are more likely to produce cues to uncertainty when talking about low consensus entities than high consensus ones. However, the amount of difference between high and low consensus entities is larger in the scientific domain than the religious domain, likely due to the low number of uncertainty cues in the high consensus scientific domain. For the model with Christian parents, the interaction between domain and religious affiliation was not significant, $p = .931$. After removing the interaction term, there was a significant main effect of consensus, β = 0.877, *SE* = 0.165, $p < .01$, as well as a significant main effect of domain, β = 0.440, *SE* = 0.160, $p < .01$. Christian parents were more likely to produce cues to uncertainty when talking about low consensus entities than high consensus ones, and when talking about religious entities than scientific ones.

To explore the relation between parents' cues to uncertainty and children's

existence judgements, a mixed-effects ordinal logistic regression model was conducted on children's existence judgments. The model revealed a significant main effect of uncertainty cues, β = -0.278, SE = 0.038, z = -7.281, $p < .001$, OR = 0.757, 95% CI = [0.702, 0.816]: the number of parental cues to uncertainty was negatively correlated with their children's confidence in the existence of the entities.

Variation in Belief

The average proportion of parents who mentioned variation in belief when discussing each entity is presented in Figure 4.2. As shown in Figure 4.2, no parents mentioned variation of belief in the high consensus scientific domain and rarely did so in the low consensus scientific domain.

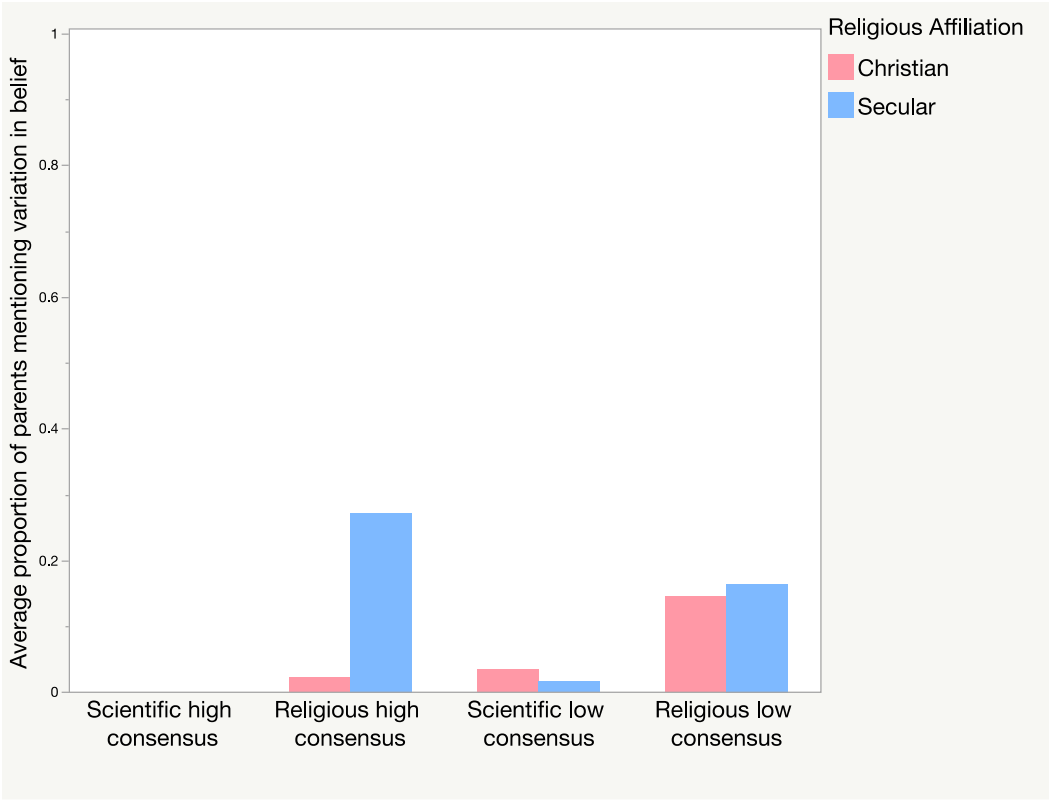

Figure 4.2. Average proportion of parents who mentioned variation in belief by entity type and religious affiliation

The best fitted model of the mixed-effects logistic regression revealed a main effect of age group, $\beta = 0.925$, $SE = 0.003$, $p < .001$, OR = 2.52, CI [2.51, 2.54]. Parents of older children are more likely to mention variation of belief when talking about all entities, controlling for time spent talking about the entity. The model also generated a significant three-way interaction between religious affiliation, domain, and consensus, $\beta = -1.988$, $SE = 0.003$, $p < .01$, OR = 0.136, CI [0.137, 0.138]. To further understand the three-way interaction, I ran separate post-hoc mixed-effect linear regression models on parental uncertainty cues with consensus, age group, and time as control fixed effects, religious affiliation (secular vs. Christian), domain (science vs. religion), and their interaction as test fixed effects, and family ID as a random effect. Bonferroni correction was applied, and alpha level was adjusted to .025. In the high consensus model, since the dependent variable in the scientific domain is a constant (0), the interaction between domain and religious affiliation were not included. Thus, any significant main effects should be driven by the religious high consensus entities. The model revealed a significant main effect of religious affiliation (Christian as reference), $\beta = 3.541$, $SE = 1.089$, $p < .01$, OR= 4.08, CI [0.345, 291.45]. Secular parents are more likely than Christian parents to mention variation of belief when talking about religious high consensus entities. In the low consensus model, the interaction between domain and religious affiliation was not significant, $p = .418$. After removing the interaction term, there was a significant main effect of domain, $\beta = 1.969$, $SE = 0.644$, $p < .01$, OR=2.026, CI [7.167, 25.323]. Parents were more likely to mention variation of belief when talking about the religious low consensus entities than the scientific low consensus entities. The

main effect of religious affiliation was not significant, β = -0.035, *SE* = 0.479, *p* = .942.

To explore the relation between parents' mention of belief variation and children's existence judgements, a mixed-effects ordinal logistic regression model was conducted on children's existence judgments. However, the model returned null coefficients, probably due to the lack of data in many cells.

Explicit Reality Status

The average proportion of parents who mentioned the reality status of the entities when discussing each entity is presented in Figure 4.3. The best fitted model of the mixed-effects logistic regression included only main effects. Adding any interaction terms did not improve the model fit. The main effect of age group was not significant, β = 0.137, *SE* = 0.285, *p* =.630. There was a significant main effect of domain, β = 0.739, *SE* = 0.191, *p* < .001, OR = 2.094, CI [1.440, 3.045], as well as consensus, β = 0.913, *SE* = 0.194, *p* < .001, OR = 2.492, CI [1.704, 3.645]. Parents were more likely to explicitly mention reality status when talking about the religious entities than the scientific entities. In addition, parents were also more likely to explicitly mention the reality status when talking about low consensus entities than high consensus entities.

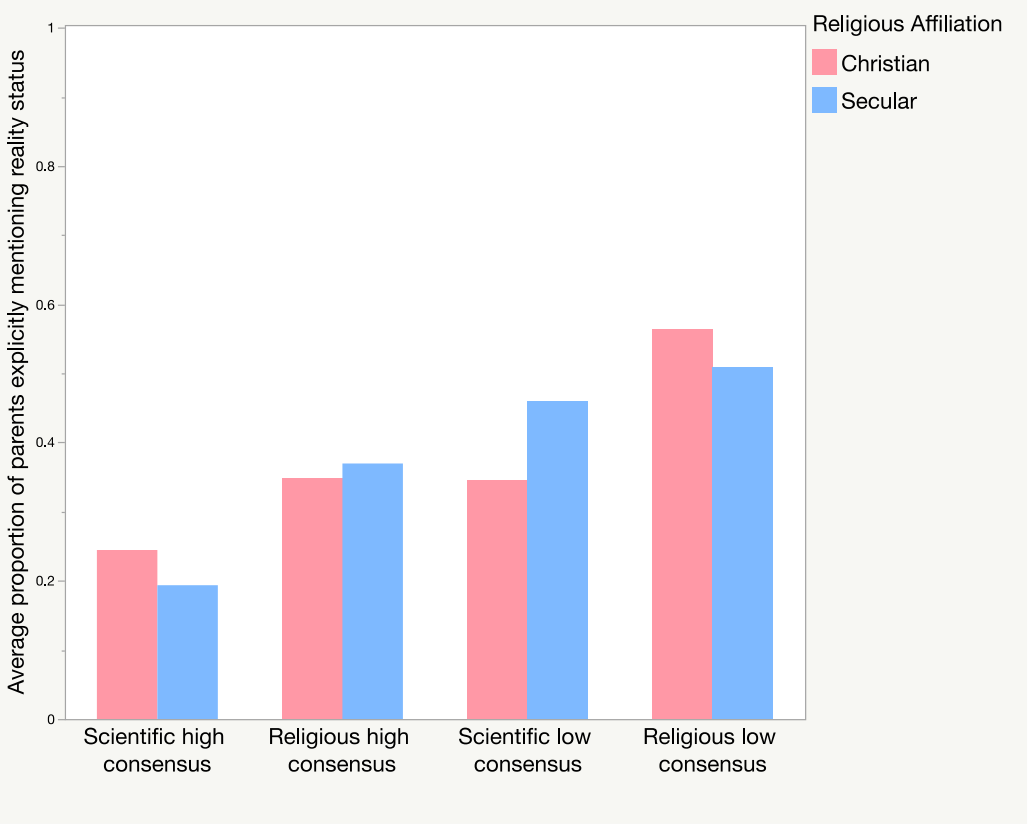

Figure 4.3. Average proportion of parents who explicitly mentioned reality status by entity type and religious affiliation

To explore the relation between parents' mention of explicit reality status and children's existence judgements, a mixed-effects ordinal logistic regression model was conducted on children's existence judgments. However, similar to the belief variation cue, the model returned null coefficients.

Causal agent elaborations

The mean number of causal agent elaborations that parents produced when discussing each entity is presented in Figure 4.4[2].

[2] Note that the figure may not be 100% accurate since time spent on each item and the variance within individual families cannot be reflected in the figure.

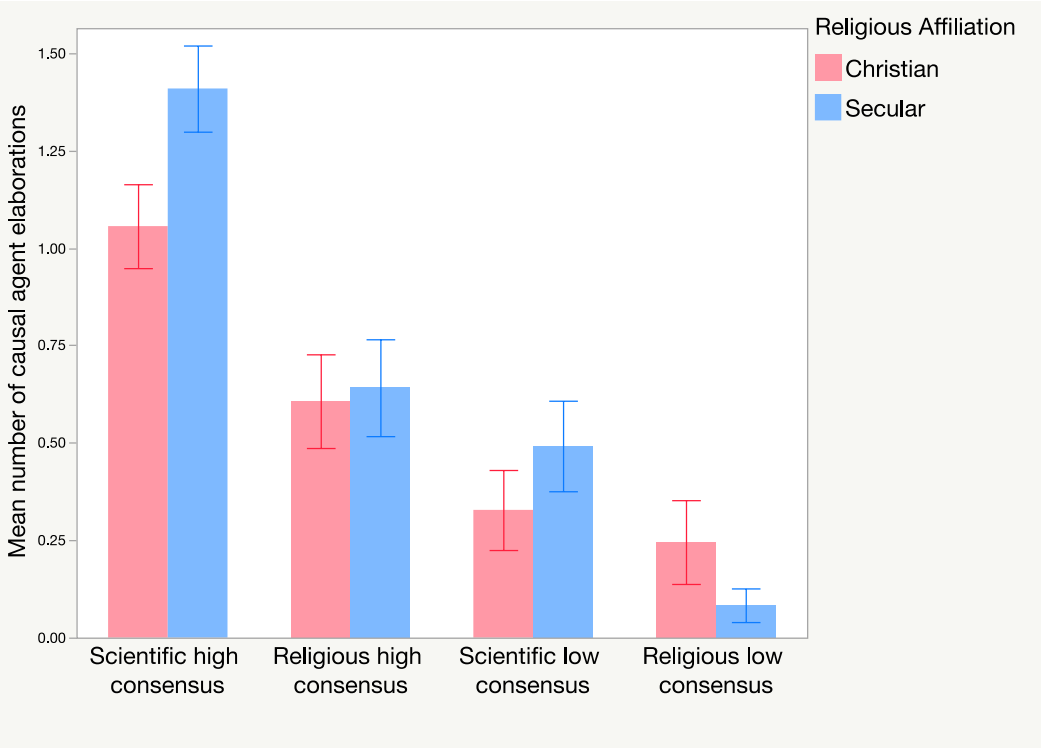

Figure 4.4. Mean number of causal agent elaborations by entity type and religious affiliation

The results of the best fitted mixed-effects linear regression model included a significant interaction between domain and consensus, $\beta = 0.313$, $SE = 0.155$, $p < .05$. The main effects of age group, $\beta = 0.051$, $SE = 0.096$, $p = .594$, and religious affiliation, $\beta = 0.104$, $SE = 0.095$, $p = .282$ were not significant. To further explore the interaction between domain and consensus, I ran separate mixed-effect linear regressions in the scientific and religious domain, with consensus as the test fixed effect in each model. Results revealed significant effects of consensus in both the scientific, $\beta = -0.819$, $SE = 0.107$, $p = 4e\text{-}13$, and the religious domain, $\beta = -0.504$, $SE = 0.113$, $p = 1e\text{-}5$; however, the difference between high and low consensus in the scientific domain is more significant than the difference in the religious domain. In other words, across both

scientific and religious domain, parents were more likely to talk about causal agent elaborations when talking about high consensus entities than low consensus ones. In addition, the amount of difference was larger for the scientific domain than the religious domain, likely due to the high number of causal agent elaborations in the high consensus scientific domain.

To explore the relation between parents' causal agent elaborations and children's existence judgements, a mixed-effects ordinal logistic regression model was conducted on children's existence judgments. The model revealed a significant main effect of causal agent elaborations on judgments, $\beta = 0.726$, SE = 0.109, z = 6.688, $p < .001$, OR = 2.066, 95% CI = [1.670, 2.556]: the number of causal agent elaborations that parents produced was positively correlated with their child's confidence in the existence of the unobservable entities.

Discussion

Study 3 examined conversational cues as a possible mechanism for children's learning about possibility and reality, by coding and examining parents' conversations with children about both high and low consensus scientific and religious entities. Parents and their children came from both the secular community and the Christian community in China. The results revealed systematic differences in the conversational cues produced by parents depending on the entity type and on parents' religious affiliation. Below, I discuss the results for each conversational cue in turn.

Results for cues to uncertainty replicated and extended the previous work in the U.S. (Canfield & Ganea, 2014; McLoughlin et al., 2021). Generally, the more cues to

uncertainty parents used, the less confident children were in the existence of an entity. In the high consensus domain, parents seldom produce cues to uncertainty when talking about high consensus scientific entities, and there were no differences depending on the religious background of the parents either, as expected. For the high consensus religious entities, however, secular parents produced many more cues to uncertainty than Christian parents. This result is interesting in two ways. On the one hand, it shows that in terms of the number of cues to uncertainty, Christian parents talked about high consensus religious entities in a more similar way to high consensus science entities than did secular parents. This is in line with Christian children and parents' high confidence in the existence of such high consensus religious entities (e.g., God, heaven, and angel) in Study 1 (Cui et al., 2020). On the other hand, secular parents and their children also judged the same religious entities with a relatively high consensus in Study 1 (Cui et al., 2020), i.e., they were confident about the non-existence of the same high consensus religious entities. Why would secular parents produce more cues to uncertainty than Christian parents even though both of them are confident about their judgments? One interpretation is that it is more natural to include cues to uncertainty when expressing denial of existence as opposed to endorsement of existence. From another perspective, although there is a relatively strong consensus around the non-existence of the high consensus religious entities among the secular adults than around the low consensus entities, the confidence level of the secular parents may not be as strong as that of the Christian parents. Accordingly, as shown in Study 1, more secular children had divergent judgments from the majority view (very sure of non-existence) than did their Christian counterparts.

Given the limitation of the 7-point Likert scale in Study 1, future studies should explore this possibility.

The current study also extended previous studies by including low consensus entities. Both secular and Christian parents were more likely to produce cues to uncertainty when talking about low consensus entities than high consensus ones. This is in line with the past literature on both adults' and children's lower level of confidence in the existence of low consensus equivocal entities (Clegg et al., 2019; Harris et al., 2006; Shtulman, 2013). Starting from the age of 4 years old, children are very sensitive to cues to uncertainty in people's talk. They are less likely to trust the information from informants who express uncertainty and modulate their claims (Einav & Robinson, 2010; Jaswal & Malone, 2007; Sabbagh & Baldwin, 2001). The results of the current study provide further evidence that children pick up cues to uncertainty when acquiring beliefs about what is real and possible. Surprisingly, secular parents produced more cues to uncertainty when talking about low consensus entities across both domains than Christian parents. Christian parents may have more certainty about low consensus entities and generate fewer uncertainty cues, because religious text might indicate the existence of some low consensus entities, such as ghosts. Past literature indicates that religious individuals are skeptical of more contentious entities (Shtulman, 2017).

Similar patterns were found with respect to whether parents mentioned variation of belief or not, which could serve as a cue to consensus or dissent. In the high consensus domain, no one mentioned variation of belief in the high consensus scientific domain. In other words, no dissent was mentioned when parents talk about high consensus scientific

entities. For the high consensus religious entities, Christian parents seldom mentioned any variation of belief, whereas secular parents were more likely to do so. Again, these results highlight the fact that Christian parents approach high consensus scientific and religious entities similarly. This pattern is very similar to the pattern found in the U.S. (McLoughlin et al., 2021). In the context of the secular majority culture in China, Christian parents are highly aware of the different views in the society, but they seldom talk about these views when talking to their children. It is possible that Chinese Christian parents may not want to alert their children to such variation because it might confuse them.

Both secular and Christian parents were more likely to mention variation of belief when talking about the low consensus religious entities than the low consensus scientific entities. This may highlight the fact that beliefs in the religious domain are more institution-based than in the scientific domain, making belief variation for the low consensus religious entities more apparent than for the scientific entities.

Results for the explicit mention of reality status were more straightforward. Parents were more likely to explicitly mention the reality status when talking about the religious entities than the scientific entities. Parents were also more likely to explicitly mention the reality status when talking about low consensus entities than high consensus entities. Put another way, parents were more likely to assume a shared understanding of the reality status when talking about entities they were more confident about, especially the high consensus scientific entities. This is again in line with the hypothesis proposed in

the introduction, replicating and extending findings in the U.S. with high consensus entities (McLoughlin et al., 2021).

Lastly for elaborations about causal agents, across the scientific and religious domains, both secular and Christian parents were more likely to produce causal agent elaborations when talking about high consensus entities than about low consensus entities. Indeed, the more parents produced causal agent elaborations the more confident children were in the existence of an entity. This result provided evidence for the speculation in past literature that children receive different kinds of testimony from adults. Thus their justification for the existence of scientific and endorsed entities are different from their justification for the existence of equivocal entities, and marked with fewer elaborations, especially causal elaborations (Harris & Koenig, 2006; Harris, 2012). Furthermore, the number of causal elaborations in the high consensus scientific domain is much higher than in all the other domains. It is likely that children are also sensitive to variability in the amount of causal elaboration talk when expressing their belief and confidence in particular entities.

Taken together, Study 3 provided evidence that conversational cues, including cues to uncertainty, cues to consensus, explicit mention of reality status and causal agent elaborations, do vary by different domains, degree of consensus, and parents' religious background. As reviewed in Chapter 1, other factors such as non-verbal input, religious rituals, and children's cognitive constraints are likely to influence children's evolving beliefs as well (Lane & Harris, 2014; Woolley & Ghossainy, 2013). This study provided evidence for testimony as one possible mechanism for how children acquire an

understanding of reality and possibility. Future studies should explore the role of other possible mechanism as well.

CHAPTER 5 GENERAL DISCUSSION AND IMPLICATIONS

My dissertation permits a richer understanding of the impact of testimony, especially conflicting testimony on children's understanding of reality and possibility. It enriches the research on social learning, which has been conducted mostly in WEIRD (Western, Educated, Industrialized, Rich, and Democratic) cultures (Henrich, Heine & Norenzayan, 2010). By purposely choosing cultural communities with special socio-cultural contexts, my dissertation enabled an exploration of an important question in the field of social learning: how do children reconcile conflicting information from different sources? The challenge in studying this research question lies in the difficulty of identifying the specific source of conflicting information. This challenge was tackled in this dissertation by examining two relatively homogenous communities as a test case. Conducting cross-cultural work and making use of distinctive socio-cultural contexts as natural quasi-experiments also served the ecological purpose well.

The results from Study 1 and Study 2 showed that even in the most explicitly secular culture, children from the minority Christian community hold a strong belief in the causal power of God and the existence of religious phenomena that violate natural causal laws. Such beliefs remain stable even after some years of formal schooling, a context in which Christian children may come across testimony conflicting with their belief. This may highlight the significance of the strength or weight of evidence that is in support of vs. against the existence of certain phenomena. Children's initial understanding of reality and possibility is constrained by their first-hand experiences and naïve theories. They likely go through a skeptical phase when first encountering novel

concepts, whether scientific or religious. Later, testimony and cultural transmission, especially from trusted adults and community consensus play an influential role and can even override early cognitive biases. Chapter 4 (study 3) provided evidence on how conversational cues may vary by domain and by parents' religious background. Children's sensitivity to these conversational cues serves as a basis for grasping the direction of testimonial evidence — either in support of or against the reality of a given entity. Secular children in China encounter little conflicting evidence or information. Thus, it is not surprising to see their uniform non-endorsement of the causal power of God or the existence of Christian entities. For the Christian children, however, the strength of evidence in support of their belief may be stronger and override the evidence against their belief. As reviewed throughout the dissertation, given that Christian parents are very aware of their minority status in the society, they may be motivated to talk to their children about Christian concepts such as God as a causal agent. Study 3 examined the different conversational cues parents use when talking to children about entities in different domains, providing evidence of testimony as a transmission mechanism.

In addition to parents' testimony, children in the Christian community may receive all sorts of corroborating information including verbal and non-verbal cues from church services and Sunday schools. Rituals such as prayers, worship, and group gatherings with friends, pastors, and Sunday school teachers could all contribute to a strong consensus for the Christian children. With all these group activities, children's identification with the Christian community may also play an important role in their beliefs. In informal conversations, Christian children indeed implied that they are very aware of their identity,

"We Christians believe in God". Furthermore, it has been argued that belief in religion has an emotional meaning (Bering, 2006). It helped people in ancient times to fight the fear of death, to deal with the feeling of loss and mortality, and to comprehend the meaning of life. Legare et al. (2012) reported the co-existence of natural and supernatural explanations in three "existentially arousing" domains across many cultures and starting from childhood: the origin of species, the causes of illness, and the nature of death. On the one hand, the scientific explanations in these domains may sometimes be opaque. On the other hand, all three domains are associated with strong emotions and existential anxieties (Legare & Visala, 2011). The studies in my dissertation did not focus assessing the influence and weight of non-verbal ritualistic activities, self-identity, and emotional factors on children's belief in religious phenomena. These are important future directions for the field of child development and religious cognition.

The secular education in Chinese primary schools focuses on objections to superstitious beliefs and teaches evolution implicitly (i.e., it teaches that hominids are the ancestors of contemporary human without explicitly introducing the concept of evolution). The results from Chapter 3 (Study 2) indicate that Christian children treat superstitious beliefs and related folk religious concepts as separate systems from their own belief in the power of God and the existence of Christian beliefs. In this way, apparently conflicting claims can co-exist. There is more explicit teaching against institutionalized religions in secondary school textbooks. It is still an open question as to how adolescents in the Christian community grapple with the conflicting information from schools and their immediate circles, which is worth exploring in future studies.

As discussed above, multiple factors including the credibility and quality of the sources of verbal and non-verbal information, children's ability to analyze that information, and the affective context can all play a role in shaping children's evolving beliefs and attitudes. The extent to which the results of my dissertation can be applied to domains other than the supernatural domain and to other cultural contexts is an important topic for future research.

Lastly, my dissertation contributes to the field of child development by systematically studying within-culture variabilities in children's belief. Many existing cross-cultural studies tend to view a country as monolithic, without recognizing the cultural diversity within each country. Chinese culture has been historically viewed as a secular culture, with collectivist traditions and values. However, as demonstrated in my dissertation, large variation exists within this large culture; thus, it is of vital importance to study within-culture differences in the field of child development. One important aspect of within-culture variability, SES, was not systematically examined in the current study. The sample in this dissertation is mainly from mid- to high-SES families in urban cities. However, around 40% of the population in mainland China is not urbanized. The extent to which the findings in this dissertation can be extended to low-SES families in rural areas is an important open question worth exploring in future research. Children in lower SES families are more likely to live with their grandparents (Zhang & Wu, 2021). Accordingly, input from grandparents should be considered when conducting research with lower-SES families.

Educational implications

By focusing on how children make judgments about entities that they cannot evaluate via first-hand evidence, my dissertation elucidates how children resolve conflicting information from different sources, suggesting strategies to help children learn better in face of information explosion. My dissertation highlights the fact that the impact of the exposure that young children have to specific cultural beliefs is not always confined to those particular contexts, but sometimes extends to the ways in which they approach problems in the classroom. That is, when learning about an unknown entity or cause that they have not yet heard of, it is likely that they will recruit their cultural knowledge (which may include their knowledge of religious beliefs and practices) when making inferences about this new information. The results from Chapter 2 (Study 1) highlight the important role of parental belief in shaping young children's beliefs about the existence of the unobservable. By understanding that their learners may have such varied beliefs in the classroom, teachers may be better equipped to approach teaching new information. Similarly, the results from Chapter 3 (Study 2) — especially the results from the story Guanyin — indicate that such beliefs may extend beyond the original learning context to similar contexts. Young Chinese Christian children were more likely to believe in the existence of Guanyin's causal powers, presumably because they were recruiting knowledge from their understanding of God's causal powers when making inferences about Guanyin. Again, understanding that children may be making such inferences is important for teachers to be aware of — especially as classroom learners become more diverse.

Chapter 4 (Study 3) revealed the conversational cues that may contribute to children's conceptual development, specifically their understanding of possibility and reality. Children are sensitive to different conversational cues and can readily acquire the information expressed by these cues. This result focusing on how certain conversational cues can influence children's learning is important because parents and educators can actively choose what conversational cues to use. In particular, parents and educators can learn from the relation between the specific cues and children's beliefs as described in Chapter 4, thereby becoming more aware of the consequences of their way of talking and interacting with children. This can inform their future interactions with children when transmitting the kind of information they value. It is important to note, however, that this dissertation only focused on unobservable religious and scientific entities. In future research, it would be important to explore the conversational cues that are used when discussing visible entities and causes in order to explore the extent to which similar cues are employed. Moreover, it seems important to explore teachers' knowledge of the cues surrounding the information they are conveying to young children. In the current pre-service teaching curriculum, the focus is much more on the teaching of content. The current study highlights the equal importance of being made aware of the conversational cues in which the content is embedded, and the importance of alerting young teachers to their salience for learners when they are acquiring new concepts.

The findings from my dissertation on the Christian community also have implications for other families from minority or under-represented backgrounds, such as racial minority groups, LGBT families, or immigrant families. These families sometimes

have concerns about their children's non-acceptance of family values, which may be different from mainstream values. The results from Chapter 2 and 3 (Studies 1 and 2) provide evidence that children up to 11 years old from a minority group within a largely homogenous majority can hold stable beliefs in accordance with the values of their family. In addition to noting specific ways to talk to children, finding and engaging in culturally relevant communities and group activities may also be meaningful for minority families.

Finally, the results from all three studies speak to the importance of exploring diverse learners. Multiculturalism is a major focus in today's classrooms. The findings from my dissertation highlight that simply focusing on secular Chinese learners without including a minority group (Chinese Christian children) would limit the generalizability of my findings. Moreover, the focus on a cultural minority group in my dissertation should help educators better understand how members of under-represented groups might think about certain phenomena in a dramatically different way from members of the majority group. It can be difficult for children from under-represented groups to evaluate information, especially when it is in conflict with what they have learned at home. Knowing how children with different religious and cultural backgrounds think can help educators understand the distinctive characteristics and needs of different groups. Being aware of children with different cultural backgrounds is helpful for educators seeking to understand students' cultural identity and design culturally responsive curriculum and practices (Blue, Mupinga, DeLuca & Kelly, 2018). The divergent beliefs of different groups and their related cognitive effects should draw educators' attention and inform

pedagogical approaches to diversity in the classroom.

In conclusion, I believe the findings of my dissertation have implications, not only for the developmental science community but also for the educational science community. I have highlighted an important mechanism through which young children learn to distinguish between religious, supernatural and scientific entities and causes. I have also highlighted why such findings will be of use to the educational community. Future work should explore additional ways in which young children learn from others, as well as the extent to which such findings extend to other cultural groups.

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