

**Cognitive Developmental Foundations of Cultural Acquisition: Children's  
Understanding of Other Minds**

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Exeter College

University of Oxford

Submitted for the Degree of  
Doctor of Philosophy in Anthropology  
Trinity 2012



### **Dedication**

To my parents, for their enthusiastic response for anything I do and for their personal sacrifices that have helped me succeed in life.

And

To Michael, for his unconditional support and love, and for the warm memories and laughter that sustained me throughout this process.

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### **Abstract**

Psychological research suggests that children acquire cultural concepts through early developing cognitive mechanisms combined with specific cultural learning. An understudied area of cultural acquisition is children's understanding of non-human minds, such as God. This thesis gives evidence that young children need not anthropomorphize non-human minds in order to understand them. Instead, children have a general "theory of mind" that is tailored through experience to accommodate the various important minds in their cultural environment. The intuitive default is toward super-attributes, making children naturally inclined or "prepared" to acquire god concepts. Four empirical studies were conducted with 75 British and 66 Israeli preschool-aged children. In Study 1, children participated in an ignorance-based theory-of-mind task and were asked to consider the mental states of human and supernatural agents. Children at all ages attributed correct knowledge to the supernatural agents and ignorance to the human agents. In Study 2, children participated in two perception-based theory-of-mind tasks and were asked to consider the perspective of two super-perceiving animals, God, and two human agents. Three-year-olds attributed knowledge to the animals and God and, by age four, children could distinguish among agents correctly. Also, by age four, children recognized that aging limits the perception of human agents but not God's. In Study 3, children participated in a memory-based theory-of-mind task in which they were asked to consider the memory of God and differently aged agents. Children at all ages responded that God would remember something that the children themselves had forgotten. By age five, children responded that a baby and granddad would have forgotten. These results propose that preschool-aged children regard individual constraints when considering mental states. Study 4 focused on children's notions of immortality. Cultural differences were found. British children attributed immortality to God before correctly attributing mortality to human agents, and Israeli children attributed immortality to God and mortality to humans more consistently than did British children. Collectively, these studies indicate that children do not have to resort to anthropomorphism to reason about non-human agents but instead have the cognitive capacity to represent other types of minds because of early cognitive capacities. It appears that concepts vary in their degree of fit with early-developing human conceptual systems, and hence, vary in their likelihood of successful cultural transmission.

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# 1 Introduction

## 1.1 Introduction<sup>1</sup>

This thesis uses cross-cultural evidence and a cognitive science of religion approach to examine how children develop an understanding of other minds. An exploration of the cognitive tools or approaches that children use to understand the variety of other minds is the goal of this thesis. I specifically argue that (typically developing) children need not anthropomorphize when thinking of other minds. Instead, I argue that children have early developing cognitive mechanisms that aid children in advancing an understanding of human, non-human, and supernatural minds. The present thesis extends prior research by examining Jewish and Christian children's notions of human and non-human minds and also by investigating children's understanding of biological phenomena and constraints.

I commence the introduction by detailing the definitions of the specific terms I use in this thesis. In the subsequent section, I describe the importance of studying children as well as the importance for studying their developing understanding of a variety of minds other than their own. I also defend why I have chosen a cognitive science of religion approach rather than choosing an anthropological approach. Finally, I describe several limitations of prior work in this area and then concentrate on the specific research questions this thesis will address. I conclude the introduction with a short summary of the thesis.

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<sup>1</sup> I use the American Psychological Association (APA) referencing system in this thesis. I use this system because I have conducted four empirical studies in this thesis and the APA system provides guidance on how to report experimental methods and results. To be consistent with APA referencing and citation, I have written the thesis using American English spelling.

## **1.2 Theoretical Importance of Children's Developing Understanding of Other Minds**

Throughout human history religious ideas have persisted and spread within and across cultures (Hahn, 1972; Mithen, 2003/1996; Norenzayan, March 17, 2012; Roes & Raymond, 2003). In order for cultural and religious ideas to be successful, these ideas must be contagious enough to not only transmit between individuals but also to pass these ideas on to the next generation. Psychological research focusing on children's acquisition of cultural concepts indicates that pan-cultural cognitive biases may importantly constrain which ideas are passed down from parents to children. These same cognitive biases inform the types of cultural concepts that are easily acquired. Children provide a promising avenue for exploring the influence of vertical transmission of religious ideas as well as ideas that are constrained by early developing cognitive biases.

A growing area of developmental and cultural acquisition research is exploring how children acquire and understand a concept of other humans and supernatural agents, such as God. These studies endorse the view that certain cognitive mechanisms are present early in development and enable children to reason about other people and a variety of other minds and agents. These cognitive mechanisms work in tandem with cultural input to provide a rich understanding of other minds, including human, non-human, and supernatural minds.

How early do children acquire knowledge about other agents, and in particular, supernatural agents? Which attributes do young children apply to supernatural agents? This thesis will give cross-cultural evidence to support the view that very young children can readily acquire and apply knowledge about the minds of non-human and supernatural agents because of the character of early developing conceptual systems.

### **1.2.1 Definition of God, gods, and Supernatural Agents**

Supernatural agents and gods vary widely across cultures. In western traditions (particularly the Abrahamic traditions), gods are often omniscient, omnipotent, and immortal

whereas in other cultural traditions gods die, were once human, and have limited knowledge. Due to the variety of attributes of supernatural agents and gods, a definition is needed to clarify what “supernatural agents”, “gods”, and “God” represent in this thesis.

“Agent” will hereafter refer to a being conceived to be mentalistic, animate, self-propelled and able to make goal-directed actions (Barrett, 2008a). “Supernatural” will hereafter denote “counterintuitive.”<sup>2</sup> Counterintuitive, in the technical sense, refers to agents or objects with one or more properties that violate expectations of certain intuitive ontological categories, such as an animal, person, object (for more details, see Boyer, 2001 and Barrett, 2008a). Although the intuitiveness of ontological categories are partly and importantly a product of cultural background, certain basic ontological assumptions, such as humans having minds, have been demonstrated to be human universals (Atran, 2002; Boyer, 2001). Examples of counterintuitive concepts are animals that speak or an invisible rock. Both concepts violate natural intuitive understandings of the ontologies, “animal” and “bounded physical object,” respectively. A supernatural agent, then, has at least one counterintuitive property and is a self-propelled and mentalistic animate being.

Gods (little “g”) are supernatural agents but not all supernatural agents are gods. Using Barrett’s (2008b) definition, gods are socially strategic and intentional agents. Gods have the potential for full-informational access to humans because of specific counterintuitive properties, for instance, through an extraordinary ability to mind-read, by being invisible, or being all-knowing. Gods are relational and can act intentionally in the world based on their own beliefs and desires. Their knowledge or actions may help to motivate human actions and sometimes gods may influence moral and pro-social behavior (Atran, 2002; Boyer, 2001).

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<sup>2</sup> I use supernatural because it is a more commonly and widely used term. The term “counterintuitive” is a neologism and less ubiquitous. Counterintuitive ideas will be flushed out more in section 2.3.1.

Gods, however, come in a variety of forms. Following Pyysiäinen (2009), I use God with a capital “G” in the empirical studies to indicate a deity that is superlative in knowledge and power, is immortal, and has a creative or sustaining role in the natural world—attributes usually ascribed to God in the Abrahamic traditions. Hence, in this thesis, the term “God” refers to a god with attributes ascribed in Classical theism.

Defining “God” in these terms is strategic. First, given the vast diversity of god concepts (little “g”) an investigation of how all gods are acquired in childhood would be impractical. Therefore, the focus of this paper is on a sub-set of god concepts: God. The choice of God is partly due to previous research (from cognitive anthropology and developmental psychology that have focused on a Christian God), but also because God concepts (in Judaism, Christianity, and Islam) are so globally successful.

Second, prior work has largely focused on Christian cultures. The attributes of God in Islam and Judaism are very similar to Christianity, yet there have been no experimental comparisons of children’s developing notions of God in these religious traditions. A systematic exploration of the possible cultural/religious influences and cognitive biases involved in children’s developing understanding of God is important to further clarify whether children in similar traditions attribute the same concepts to God. As this thesis is a first step in exploring a tradition outside the Christian tradition, using a similar monotheistic tradition and another culture was important to see if a concept of God was similar in two different monotheistic traditions. As more studies develop to understand which concepts of God seem to be recurrent among monotheistic traditions, future research should importantly examine the similarities and differences in acquisition of concepts of God or god/s in smaller or local religions (and especially non-monotheistic traditions). If similarities persist across traditions, cognitive biases may influence certain God concepts.

Third, the Judeo-Christian-Muslim traditions are some of the most successful religious movements. In contrast, many religious movements are not successful. In a study examining 200 religious and utopian communes in the 19<sup>th</sup> century, the average lifespan of religious communes was 25 years (Sosis, 2000). The Abrahamic traditions, however, have spanned over 2,000 years. The anthropological record supports the conclusion that the largest and most complex societies contain “Big Gods.” These “Big Gods” are all-powerful and omniscient, and likely serve as a moral and social surveillance monitor to keep these larger societies in order (Henrich et al., 2010; Marcus & Flannery, 2004; Norenzayan, March 17, 2012; Roes & Raymond, 2003; Wright, 2009).

The cross-culturally recurrent attributions (omniscience, omnipresence, etc) given to a Judeo-Christian-Muslim God (e.g., God, YHWH, and Allah) indicate that cultural particulars do not account for all of religious expression. As anthropologists Pascal Boyer (2001) and Dan Sperber (1996) have proposed, religious ideas can be partly explained by our species-general cognition and how cognition limits and constrains the variability and transmission of cultural and religious ideas. God concepts are no exception.

## **1.2.2 Importance of Studying Children and Supernatural Agents**

In this next section, I argue that studying children’s conception of God is important for understanding the acquisition and transmission of God concepts. Through the empirical studies in this thesis, I will provide additional evidence to support the claims of other researchers that cognitive mechanisms may constrain and encourage certain cultural ideas about God. I also make a case for why I have chosen children to explore the transmission of cultural ideas, specifically God concepts.

### ***1.2.2.1 Why Study Supernatural Agents and God?***

People all over the world and across time have posited the existence of gods (little “g”) of various sorts. Gods, however, can also differ widely between cultures, as a wide body

of ethnographic research has demonstrated (Evans-Pritchard, 1971; Frith, 1939/1967; Keesing, 1982). In one culture, a god may take a more superlative form such as the omniscient and immortal God in the Christian and Jewish traditions, and in another culture a god may be a human-like spirit who has very limited powers and is mortal (Boyer, 2001; Knight, 2008). For example, Christian children may learn that God is all-loving in their Sunday school class whereas in another culture children may be taught that gods are unpredictable (Armstrong, 1993; Ono & Woodward, 2004).

While no one attribute (e.g., omniscience or immortality) of God is completely universal, certain attributes of supernatural agents—such as being invisible—are recurrent and widespread in many religions. These attributes are recurrent with little historical links to each other, and continue to be passed down to children and transmitted across cultures and throughout time (Boyer, 2001). In addition, while ethnography can provide rich portraits of religious worldviews and practices, cultural specifics cannot form a complete explanation for why these ideas are accepted and continue to exist in a wide variety of cultures. Nor can ethnography explain why people in different cultures and religions (specifically in Judeo-Muslim-Christian traditions) form similar conceptions of God regardless of religious tradition or view of God. For example, Judaism, Christianity, and Islam share the belief in one God who is invisible, omniscient, omnipotent, immortal and the creator of the world (Pyysiäinen, 2009). Such a view also appears in versions of Hinduism (Brockington, 1981; Flood, 1996; Swellengrebel, 1960), Sikhism (Cole, 1998; Nesbitt, 2005), the religious communities of the Druze (Firro, 1992; Obeid, 2006), Zoroastrianism (Boyce, 2007; Clark, 1998), Rastafarianism (Lewis, 1993), some African religious traditions, such as the Nuer (Evans-Pritchard, 1971), and some Native American religious traditions, such as the Zuni (Stevenson, 1904). Why are

those attributes so widespread? Perhaps children and adults have a bias or a predisposition<sup>3</sup> to think and accept such ideas.

Cognitive science suggests that our minds contain specialized domains of knowledge as a result of natural selection, and because of these domains humans produce similar ideas for supernatural agents (Hirschfeld & Gelman, 1994; Tremlin, 2006). Many of these domains of knowledge are explained in this thesis and help explain why “...there are only so many ways to build a god” (Tremlin, 2006). In other words, the mind constrains how people conceptualize God in very specific ways. In particular, examining children’s developing notions of God are important so that empirical research can reveal how social learning relates to intuitive, “maturationally natural” cognition, or the capabilities or faculties that are developed through time, and with the proper environmental input, to become a part of regular human processes (McCauley, 2011; McCauley & Lawson, 2002). Past research has explored how the mind constrains such divine concepts as divine knowledge and immortality (Barrett, 2001; Giménez-Dasí , Guerrero, & Harris, 2005; Knight, Sousa, Barrett, & Atran, 2004). The present thesis extends prior research by both examining Jewish and Christian children’s notions of other minds and investigating children’s understanding of biological phenomena and constraints.

#### ***1.2.2.2 Why Use Children?***

Preschoolers were the target age group identified for extending current research because preschoolers have had less cultural influence at this age than adults. Adults were also included in the sample because, in comparing adults and young children, we can identify early-developing default positions. Research has shown that children sometimes rely on their

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<sup>3</sup> This suggestion is not meant to imply that such a God does or does not exist. Whether or not a superlative God exists or assuming such a God may have revealed itself to some people, are concerns independent of this project. The focus here is on why such concepts appear to disseminate so readily and demonstrate high degrees of cultural stability.

intuitions over what parents tell them (Evans, 2000, 2001; Kelemen, 1999b; Kelemen, Callanan, Casler, & Perez-Granados, 2005). For example, American children raised in either religious or non-religious homes show a bias to endorse creationist accounts over evolutionary or spontaneous accounts (i.e., that beings suddenly appeared) (Evans, 2000). This preference holds until age eleven when children begin to take on the beliefs of their parents (Evans, 2000, 2001). These types of early cognitive development studies are of great consequence to other psychologists and social scientists, as results help establish the origin and maturation of various ideas, and specifically ideas about other types of minds.

Also, western children seem to have a natural propensity to believe in God and other supernatural beings (Barrett, 2004; Bering, 2011; Bloom, 2004, 2007; Evans, 2000; Hood, 2009; Kelemen, 2004; Knight et al., 2004; Petrovich, 1997, 1999). They can think of supernatural agents effortlessly and believe at an early age that the world and its many natural objects were created by a designer (Evans, 2001; S. A. Gelman & Kremer, 1991; Kelemen, 1999a, 1999c; Kelemen & DiYanni, 2005; Petrovich, 1997). This propensity towards believing in a designer reasserts itself in patients with Alzheimer's disease (Lombrozo, Kelemen, & Zaitchik, 2007) and in speeded conditions with normal functioning adults (Kelemen & Rosset, 2009). This natural tendency is part of the general make-up of the cognitive system (Baron-Cohen, 1995; Barrett, 2004; Barrett, 2012; Kelemen, 2004).

Thus, within the first five years, children develop the necessary mental tools to engage, experience, and learn about the world through basic knowledge in physics (Baillargeon, 2004; Baillargeon & DeVos, 1991; Heyman, Phillips, & Gelman, 2003), biology (Greif, Nelson, Keil, & Gutierrez, 2006; Hatano, Inagaki, Medin, & Atran, 1999; Hatano, et al., 1993; Inagaki & Hatano, 2006; Keil, 2007), and psychology (Bartsch & Wellman, 1989; Callaghan et al., 2005; Wellman, Cross, & Watson, 2001). Crucial to

cognitive development is the study of other minds and agents. These skills are essential to function in the world as will be detailed in the next chapter.

### **1.3 Rationale for Using a Cognitive Science of Religion Approach**

In this thesis, I will not be offering a new theory of religion nor a new cognitive science of religion approach. Instead, I will adapt current cognitive approaches to explore and further clarify children's acquisition of the concepts of human and supernatural minds. I use a cognitive science of religion approach to address issues such as how people acquire religious concepts, what makes these ideas successful, and possible explanations for how these ideas transmit within and across cultures. This approach is different from more familiar and traditional approaches. Attempts to account for the cross-cultural recurrence of religion have traditionally consisted of need-based and functionalist explanations for the origin of religion. While the focus of this thesis is not a critique of these approaches, I will briefly present my rationale for using a cognitive science of religion approach instead of these more traditional approaches. I argue against the sufficiency of three common classes of explanations of religion: (1) emotionalist accounts, that religion satisfies emotional needs; (2) functional need-based concerns, that religion functions to bring society together; and (3) intellectualist accounts, that religion helps to explain intellectual concerns. While helping to account for some features of religious thought, none of these types of accounts are sufficient to account for the origin and broad recurrence of God concepts, and none account for why God concepts are easily adopted by young children.

#### **1.3.1 A Rationale for not Using Emotionalist, Functionalist/Social Need, or**

##### **Intellectualist Accounts**

The claim that religion served a social need to alleviate anxiety about life's uncertainties and impending death has long been in scholarly literature (Freud, 1957/2001; Malinowski, 1948/1974). While emotional components are evident in religions, it is unlikely

that religion arouse (and persisted) to *exclusively* satisfy emotional needs (Boyer, 2001). Instead, the manner and content used by religions to satisfy emotional needs may have originated from fundamental cognitive mechanisms. Ideas about God as a father-figure or coming to terms with fear of death could stem from the same conceptual systems and biases that help us understand our physical, biological, and psychological world. Emotions could be interconnected with cognitive thoughts. In other words, these cognitive systems make us aware of threatening stimuli around us, the awareness may cause anxiety, and for some may motivate others to seek ways of alleviating anxiety, of which religion may be one. If this is true, a cognitive science of religion approach may better capture the origin of these ideas.

Alternatively, functionalists and social-need theorists decided that religion was created to maintain a moral society (Durkheim, 2001). Certainly there is a connection between society and religion. However, it could be posited the other way around: we have religion and a sense of morality because we have a social mind that makes society possible (Boyer, 2001). Society does not create morality or religion. Rather certain cognitive systems have created the ability to form groups and to think of similar ideas that create culture, morals, and society (Dunbar, 1998).

Finally, intellectualist approaches to religion arise from the belief that when people do not understand an event or origin, they seek explanation (Frazer, 1890/2009; Spencer, 1862/2009; Tylor, 1958/1871). Religion is seen as antiquated. Religion was created to give explanations to mysterious events and origins of the world and life. However, these religious explanations often do not provide sufficient explanation to these questions. Sperber (1996) argues that religion provides “relevant mysteries” rather than conclusive answers. Furthermore, if the intellectualist accounts were true and religion is a relic of pre-scientific thought, Evans-Pritchard (1965/1972) argued we would see these ideas dying out as rational thought becomes more and more developed. Instead, belief in Gods and other supernatural

agents continue to exist and coexist even in a post-modern and industrialized world (Bowie, 2006).

An intellectualist approach is also insufficient for this thesis because of its application of this position to young children. Do children create and transmit these ideas out of a need to explain certain intellectual concerns? Perhaps, but this is unlikely. Many young children believe in supernatural agents of varying sorts—from invisible friends to ghosts and the tooth fairy—without questioning their existence. As will be discussed in section 2.4, children easily accept that events were caused by someone (Kelemen, 1999a, 1999c), that God made animals, plants, and natural kinds (Petrovich, 1997), and can easily think of supernatural agents that are immortal (Giménez-Dasí et al., 2005) and knowledgeable (Barrett, Richert, & Driesenga, 2001; Knight, 2008; Knight et al., 2004; Lane, Wellman, & Evans, 2010, 2012; Makris & Pnevmatikos, 2007; Richert & Barrett, 2005).

Along the same lines, the reasons that adults claim are the reasons for religion, may not be the case with children. Children do not seem to have the same fear of death, have the same need for social cohesion, nor the same intellectual concerns. Nevertheless, these assumptions are not to be tested empirically in this thesis. This thesis is concerned with children's ability to adopt God concepts rather than adopting religion in general.

Much more could be said of these religious theories. While this thesis takes a different anthropological approach, a cognitive science of religion approach incorporates some of the merits from the functionalist, emotionalist, and intellectualist approaches. For example, from the functionalists, cognitive scientists are exploring the cognitive mechanisms responsible for a social mind and the importance of these structures to societies (Dunbar, 1998; Norenzayan & Shariff, 2008; Piazza, Bering, & Ingram, 2011; Rakoczy, Warneken, & Tomasello, 2008; Tomasello, 2009; Warneken & Tomasello, 2006). From the intellectualists, a cognitive science of religion approach acknowledges that human minds do try to make sense of their

world but often do so without direct intellectual reflection and also in specific and characteristic ways (Baillargeon, Kotovsky, & Needham, 1995/2002; Gopnik, Meltzoff, & Kuhl, 1999; Hirschfeld & Gelman, 1994; Spelke, Phillips, & Woodward, 1995/2002). From an emotionalist account, a cognitive science of religion approach also recognizes there are deep unconscious drives and structures that help motivate religious thought and action (Boyer, 2001; Konvalinka et al., 2011).

Again, each of the above accounts may be good justifications for why people choose to participate in religious activities, however, these reasons do not fully explain how these ideas came to be and why many of them have strikingly similar patterns cross-culturally (Boyer, 2001). As stated previously, many religious traditions conceive of gods and share similar attributes to a Judeo-Christian-Muslim God (Armstrong, 1993; Evans-Pritchard, 1971; Horniak & Yawney, 2001). In order to understand religion and the development of religious ideas it is necessary to further understand the psychological mechanisms that give rise to the beliefs put to social, emotional, and intellectual use.

In the next few chapters I demonstrate that the experimental methods of a cognitive science of religion approach are important for studying the foundations of supernatural agent concepts in development. By using the tools of cognitive science, the possible origin of children's and adult's maturationally natural religious ideas can be explored. Specific inference systems based in our mental architecture, detailed more in section 2.2, are what create various religious ideas and, if successful, transmit and spread to other minds and groups, generating recurrent patterns. Not all concepts survive. Only those that do are culturally selected and align with basic intuitive structures or domains (Boyer, 2001; Norenzayan, March 17, 2012; Tremblin, 2006). In this manner, all normally or typically functioning humans have the ability to acquire religious ideas (Norenzayan, Gervais, & Trzesniewski, 2012). In order to understand children's acquisition of a concept of human and

supernatural minds, investigating early developing cognitive processes of the mind is a likely starting place for looking at culture, religion, and specifically conceptions of God.

#### **1.4 Current Limitations and Research Questions**

There are several limitations and further clarifications needed from prior work concerning children's understanding of other minds. As will be detailed in chapter three, and in the introductions of each empirical chapter (chapters five to eight), very little research has focused on children's understanding of the specific constraints that shape knowledge acquisition of non-human agents. Prior research has largely focused on children's appreciation of beliefs, desires, thoughts, and perception of *human* minds (Apperly, 2011; Astington, Harris, & Olson, 1988; Harris, 1988; Lillard, 1998; S. A. Miller, 2012; Perner, 1991; Perner, Leekam, & Wimmer, 1987; Pillow, 1989; Repacholi & Gopnik, 1997; Wellman, 1990; Wellman & Bartsch, 1988; Wellman & Woolley, 1990). Children do not come into contact with human beings that are exactly identical, nor do they solely keep company with humans; they are daily exposed to non-human agents—such as super-heroes, God, imaginary friends, animals—in stories, television and movies, and in everyday culture. In addition, this body of research has emphasized that certain kinds of situation-specific constraints (e.g., line of sight, occlusion) may influence how one understands the knowledge stance of another and has de-emphasized the importance of individual constraints (e.g., age differences or disabilities) (Dowker, Hart, Heal, Phillips, & Wilson, 1994; Farmer & Dowker, 1995; S. A. Miller, 2000). For example, being able to see or hear a stimulus (situation-specific constraints), greatly affects whether another mind has absorbed a certain piece of knowledge. Also, whether the individual has the capacity to remember things well (individual constraints), may also influence how the person retains this bit of information. The overarching theme of this thesis is to clarify when children acquire notions about the abilities

of different human beings and other types of minds, such as animals, supernatural agents, and God.

Second, due to the diversity of results regarding children's understanding of the notion of divine knowledge, clarification and further work is needed. Barrett and colleagues (Barrett & Richert, 2003; Richert & Barrett, 2005) propose that the recurrence of many concepts of God are due in part to an early susceptibility to certain ideas and attributes because of early-developing cognitive mechanisms. Previous work has largely examined one attribute of God: divine knowledge (Barrett et al., 2001; Giménez-Dasí, Guerrero, & Harris, 2005; Knight, 2008; Knight et al., 2004; Lane et al., 2010, 2012; Makris & Pnevmatikos, 2007; Nyhof, 2010; Richert & Barrett, 2005). Divine knowledge is the ability to have full-access and strategic knowledge of another agent's thoughts, desires, memories, intentions, and actions. Although there are several aspects of divine knowledge, research has focused on only two aspects of divine knowledge: perception (Lane et al., 2010, 2012; Richert & Barrett, 2005) and knowledge attribution (Barrett et al., 2001; Giménez-Dasí et al., 2005; Knight, 2008; Knight et al., 2004; Lane et al., 2010, 2012; Makris & Pnevmatikos, 2007; Richert & Barrett, 2005). Additional research on children's notions of other aspects of divine knowledge is needed. Do children know knowledge is gained through these other cognitive systems and do they apply this understanding to humans and to God? If God is attributed with divine knowledge in a particular task, this does not necessarily mean that God is conceptualized as omniscient. Omniscience is to know much more than one thing (i.e. knowing what is inside a box); being omniscient requires knowing all things past and future, the future intentions of others, ones' secret desires, and so forth. To have divine knowledge, a being should know everything. This type of knowledge would transcend more intelligent and human mental characteristics such as having a good memory, being super-perceiving, being a mastermind at a certain skill, etc. Further exploration of other aspects of divine knowledge—

specifically the influence of aging and perception and clarification of previous work on knowledge attribution—is taken up in chapters five and six. This thesis also introduces an aspect of knowledge never tested before: memory. This novel dimension is taken up in chapter seven.

Third, there is debate about how and when very young children understand the mental capacities of non-human minds. Historically, researchers claimed that children come to understand God and animals through anthropomorphism, by thinking first of human properties and attributing these to non-human minds (Freud, 1957/2001; Kennedy, 1992; Piaget, 1929). Some evidence exists that children do anthropomorphize (Lane et al., 2010, 2012; Shtulman, 2008). In the past ten years, however, Barrett and colleagues (Barrett, Newman, & Richert, 2003; Barrett et al., 2001; Knight et al., 2004; Richert & Barrett, 2005) found that instead of attributing strictly human characteristics to other agents, four-and-five-year-old children may treat non-humans differently than humans. They also found that three-year-old children tend to over-attribute knowledge to human and supernatural agents until the age of five years, or when they have attained representational “theory of mind” reasoning, or the ability to think about another’s beliefs as distinct from reality. But perhaps the sorts of tasks used in these studies biased children to over-attribute knowledge (Birch & Bloom, 2003, 2007). One study was subsequently conducted to see if children were reasoning egocentrically, that is, generating responses based on their own knowledge of the contents of the box rather than a general human conception (anthropomorphism) or a default tendency to over-attribution of knowledge to all agents (Makris & Pnevmatikos, 2007). Whereas Barrett and colleagues have found that children are biased to over-attribute knowledge to all agents (including supernatural agents) and have flexibility when reasoning about non-human agents, Makris and Pnevmatikos found that the youngest children (3- and 4-year-olds) did not attribute super-knowledge to any agents. Instead children attributed ignorance to all agents,

including God. These conflicting results fuel a debate that needs clarification and cleaner methodology to explore children's reasoning about different kinds of agents. This debate is taken up in chapter five.

Fourth, limited research has been conducted on biological conceptual development concerning children's understanding of the death of a variety of agents. Only one other study has explored both human mortality and God's immortality (Giménez-Dasí et al., 2005). Giménez-Dasí and colleagues (2005) asked children a variety of questions including two questions on biological endpoints related to mortality (birth and death). Results showed that three-year-olds did not give any consistent response about mortality. In other words, three-year-olds did not report whether or not God or a friend would die (among other biological traits), perhaps because they do not have a clear conception of mortality. Further, there were no significant differences between children at age five and at age three, suggesting no developmental maturity of these biological concepts during that age range. The sample was Spanish children from Christian and non-Christian schools. Surprisingly, children in the religious schools, although directly taught about God, still did not significantly attribute immortality to God until age five. Due to direct religious education (i.e., going to a Christian school) or subtle enculturation (e.g. through holiday advertising) children may have been confused about questions of God's death and birth due to the salience of the Easter and Christmas stories. If the Spanish children in the study by Giménez-Dasí et al (2005) were confused about whether experimenters had been asking about Jesus (who was born and did die) versus God (who was not born and cannot die), perhaps responses from children from a Jewish background, in which a fully human divinity is absent, would be clearer. In other words, since cultural acquisition plays a role in a child's conceptual development of God, we should see more variability in Christian children's responses compared to Jewish children

who should respond more consistently that God is immortal. Exploring children's understanding of immortality and other biological knowledge is taken up in chapter eight.

Finally, a limitation of this area of research has been the focus on Christian samples and the Christian God. Additional cross-cultural research is needed to compare with the Christian samples as there have been only a few to date (Knight et al., 2004; Nyhof, 2010). The present research will use samples with Modern Orthodox Jewish children in Israel and both Christian and secular children in Great Britain as a comparison. Judaism was chosen as a comparison to Christianity for four reasons. First, Judaism is also one of the oldest existing religious traditions, persisting in one form or another for many millennia (Norenzayan, March 17, 2012; N. Solomon, 2000; Wright, 2009). Its prolonged existence suggests successful transmission and recurrence of a Jewish concept of God. Second and distinctly, Judaism shares similar divine attributes as Christianity. Members of both traditions believe in an omniscient, immortal, immutable God (Atkinson, 2004). By comparing these two traditions, possible cross-cultural differences can be examined while key theological properties remain constant. Third, according to the 13 Jewish principles by Maimonides (Maimonides, 1168/1981), Judaism accepts a God that has no physical form. Because Judaism rejects any human qualities of God, Judaism makes a good comparison sample to Christian children to resolve any possible anthropomorphic confusion with Jesus, as a God in human form. Finally, Judaism is a good comparison to a traditionally Christian society as it is important to be systematic in exploring possible nuances between two similar monotheistic religious traditions before examining other religious traditions that differ. Indeed, following the results of this thesis, further research should be conducted in a tradition outside the Judeo-Christian tradition to further explore claims that attributions of God are species-general rather than culture-specific.

## 1.5 Aims of Thesis

In light of these shortcomings, the main objective is to explore children's developing notions of other minds. In particular, this thesis aims to:

- (1) clarify results regarding the possible approaches (e.g., egocentrism, anthropomorphism, preparedness) children use to represent other types of minds;
- (2) clarify and extend work on divine knowledge using perception and memory tasks and to explore the influence of individual and situation-specific constraints in knowledge acquisition;
- (3) extend work on developing notions of biological phenomena;
- (4) explore children's notions of other minds using children in two different cultures and religious traditions.

## 1.6 Summary of Thesis

In the first three chapters, I lay out the importance for studying preschool children's early development of a concept of human, non-human, and supernatural minds. In chapter one, I defined the terms I use throughout the thesis. I also introduced the two samples that are used in four experimental studies and provided a rationale for the methodology used. In chapter two, I argue that the stability and transmission of a concept of God are largely due to domain-specific cognitive mechanisms. These mechanisms are briefly described and then evidence is given from the cognitive development literature to support the idea that children acquire certain religious ideas due in part to specific cognitive constraints. In chapter three, I lay out the importance for studying children's developing notions of other minds. I also describe the mechanisms that make reasoning about other minds fluid and intuitive. I describe the current shortage of literature pertaining to individual constraints that influence theory of mind reasoning and describe the current debate among many researchers regarding the approaches children use to reason about other minds. In chapter four I synthesize the

goals of the thesis and further describe the nature of the sample, participants, and provide more detail about the empirical chapters.

Chapters five to eight use cross-cultural evidence to explore British and Israeli children's notions of human, non-human, and supernatural minds. Chapters five to seven, specifically focus on mental properties. Chapter five introduces three approaches currently used in the field to describe children's developing notions of other minds and provides evidence that very young children can attribute correct knowledge to human and supernatural agents. Chapters six and seven build on chapter five by exploring situation-specific and individual constraints that influence knowledge acquisition and understanding of other minds. In both chapters, very young children take into account both situation-specific and individual constraints when reasoning about other minds and use this information to attribute knowledge to varying minds. Specifically, young children attribute knowledge to super-natural and extraordinary agents and attribute ignorance to animal and some human agents. In chapter eight, children were asked to consider the biological properties of human, non-human, and supernatural minds. Cultural and cognitive constraints were explored. Cultural differences were found, in that Israeli children attributed immortality to God and mortality to humans more consistently than did British children.

Finally, in chapter nine, I summarize the evidence obtained from this thesis to support the claim that very young children understand and are prepared to think about other minds. I suggest that early developing cognitive mechanisms support the concept of non-human and supernatural minds. To conclude, I comment on the implications of these results for future work, discuss the limitations of the present studies, and then offer some possible directions for further research.

## **2 Importance of Child Cognitive Development on Accounting For Cross-Cultural Recurrence and Cultural Stability**

### **2.1 Introduction**

In the previous chapter, I provided the definitions of various terms used in this thesis, detailed the rationale for sampling children, gave reasons for a cognitive science of religion approach for exploring the natural foundations of ideas about God, and introduced the research questions to be addressed throughout this thesis. In this chapter, I will argue that the cultural transmission and stability of religious concepts, and specifically a concept of God, is largely owing to domain-specific cognitive capacities. I will lay out the cognitive mechanisms that are largely responsible for conceptualizing God and supernatural agents. Finally, I will provide a current review of child development literature that puts forward a strong argument that cognitive constraints are influential in the transmission of God concepts.

### **2.2 Transmission and Stability of Concepts**

Anthropologists and other social scientists have documented the diversity and complexity of cultures. However, certain ideas and practices can be observed worldwide and over long periods of history. This recurrence requires broad transmission and general stability of ideas. What accounts for such transmission and stability? Certain cognitive systems that appear to develop normally in children across cultures have been cited as providing a transmission advantage and stability for recurrent cultural ideas (Sperber & Hirschfeld, 2004). Cultural stability requires a resistance to distortion and decay of concepts. Many researchers propose that the stabilizing factor is a child's propensity (and the adult's continued tendency) to acquire knowledge in particular ways, guided by domain-specific conceptual systems (Atran, 2002; Barrett, 2004; Boyer, 2001; Hirschfeld & Gelman, 1994; Sperber, 1996; Sperber & Hirschfeld, 2004).

Prior to the cognitive revolution, the tacit assumption was that children simply and passively acquired knowledge from their culture. Recent work in cognitive development has shown that children worldwide acquire similar ideas because of early developing and domain-specific conceptual systems (R. Gelman, 1978; Hirschfeld & Gelman, 1994). These conceptual systems are independent of one another and can be grouped into several domains, such as numeracy, language, biology, etc. Relevant to this thesis are three different knowledge bases that include a physical domain, or understanding basic physical properties and processes; a biological domain, or an understanding that living things grow, eat, die, have offspring, etc; and a psychological domain, or an understanding that other people have thoughts, desires, and beliefs.

Below is a brief review of each of these core domains of intuitive knowledge. This review is intended to support the view that children are not “blank slates” and receive all tutelage equally. Instead they are prepared which helps to account for cross-cultural recurrence and cultural stability of religious ideas, such as supernatural agent concepts. For more detailed and extensive reviews of each of these domain-specific conceptual systems, please see, Atran, 1990, 2002; Boyer, 2001; Hirschfeld & Gelman, 1994; Sperber, 1996; Sperber, Premack, & Premack, 1995. Following a description of each of these intuitive knowledge domains, I will provide evidence from the research in cognitive development to build an argument that supports an account that certain religious ideas are recurrent and widespread because they can be linked to constraints from domain-specific cognitive mechanisms.

### **2.3 Intuitive Knowledge Domains and Basic Mental Tools**

From the perspective of cognitive developmental psychology children are not the blank slates that scientists and philosophers once thought they were, but develop and learn with readily-equipped mental tools that structure learning (Gopnik et al., 1999). These

domain-specific conceptual systems enable a child or adult to rapidly make assumptions about the natural world, thereby facilitating learning underdetermined by experience or testimony. In many cognitive developmental studies, researchers have shown that children produce domain specific assumptions about the physical, biological, and psychological world (Baillargeon & DeVos, 1991; Carey, 1995; G. Hatano et al., 1993; Hirschfeld & Gelman, 1994; Meltzoff & Moore, 1995; Spelke & Kinzler, 2007). These intuitive assumptions have been titled, “innate beliefs” (Spelke et al., 1995/2002), “non-reflective beliefs” (Barrett, 2004), “maturationally natural” cognition (McCauley, 2000) or “developmental primitives” (Corrigan & Denton, 1996; Petrovich, 2005). For the sake of the present argument, I will discuss these assumptions as intuitive knowledge (Boyer & Ramble, 2001).

This section will begin with a brief background of these basic mental tools and core knowledge domains and give evidence that babies and young children have the necessary cognitive tools to categorize and learn about the world around them.

### **2.3.1 Intuitive Physics**

According to many prominent cognitive developmentalists, infants already have certain cognitive tools to understand their environment (Gopnik et al., 1999; Meltzoff & Moore, 1995; Spelke & Kinzler, 2007). Infants three-to-six months old appear to reason about physical objects according to four principles: cohesion, continuity, solidity, and contact (Baillargeon, 2004; Baillargeon et al., 1995/2002; Spelke & Kinzler, 2007; Spelke et al., 1995/2002; Sperber, Premack, & Premack, 1995). Infants are pre-verbal so understanding their reasoning about physical objects can be quite difficult. Consequently, in these experiments, the “looking-time procedure” has been used as a standard measure of attention and interest (L. B. Cohen, 1979; Slater, Morison, & Rose, 1984). Infants will typically look longer at interesting or unexpected events rather than expected events. When bored, infants generally look away.

Using looking-time methodologies (including the related habituation-dishabituation paradigm)<sup>4</sup> researchers have discovered that infants know that objects cohere and that these objects maintain their connectedness and boundedness even when in motion (Kotovsky & Baillargeon, 1994; Spelke et al., 1995/2002). These infants also understand that objects cannot launch themselves into motion (Kotovsky & Baillargeon, 1994, 1998; Oakes & Cohen, 1990). Much sooner than Piaget had predicted, infants also seem to understand continuity and object permanence, as infants are surprised when the objects roll behind a screen and do not appear on the other side (Moore, Borton, & Darbly, 1978) or when objects pass behind a screen with a window and these objects do not reappear in the window (Baillargeon & DeVos, 1991; Baillargeon & Graber, 1987; Wynn, 1992).

In sum, infants and some newborns (Valenza, Leo, Gava, & Simion, 2006) know that objects are continuous, cohesive, and contact is required for motion. These principles are important so that infants can perceive the contours of objects, can understand the entirety of a shape so that when it goes out of view there is still a mental representation of the complete object (Baillargeon & Graber, 1987; Moore et al., 1978), and can understand motion (Spelke & Kinzler, 2007).

#### Importance for Understanding Physicality and Relevance to Religious Ideas

This ability to think about an object in a given way and according to our inference systems is important for understanding religious ideas. When someone watches a magic trick where an item disappears or is made invisible, this violates default assumptions about the nature of physics. Invisibility (in addition to other properties such as flying) violates expectations about the physical properties of objects. When these violations occur (perhaps

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<sup>4</sup> In this procedure, infants are put in front of a display and exposed repeatedly to a stimulus. The longer infants are exposed, the more likely they will look away. Habituation occurs when looking time substantially decreases after the presentation of a stimulus. Dishabituation is when a new stimulus is presented and the infant shows an increase in looking time.

by accident, by magic, by a spontaneous idea, or in a story) these ideas may be associated with the work of a magician or a supernatural agent. This thesis does not directly cover children's understanding of violations of physicality. However, the early understanding of folk physicality impinges upon an early understanding and ability to think of agency (R. Gelman, 2002; Golinkoff, Harding, Carlson-Luden, & Sexton, 1984). Children's ability to detect agents enables them to distinguish between animate and inanimate objects, as well as living and non-living things, as will be discussed next.

### **2.3.2 Intuitive Biology**

Children also acquire intuitive biological knowledge, although a more mature understanding of biological phenomena develops later than intuitive physics, between five and eight years old. When developmental psychologists say that children have acquired intuitive biological knowledge, they are saying that when children see a living thing, such as a cat, they expect that it had parents that were cats and the cat will have kittens (and not puppies), it needs food and sleep to survive, and that it is made of natural materials—whether or not they have ever encountered the animal in question previously. And even though people have certain intuitions that living things reproduce, grow, and die, they also have intuitions that non-living things cannot reproduce, grow, and die.

Several experiments provide evidence that young children (Heyman et al., 2003; Inagaki & Hatano, 1996) and even infants (Frye, Rawling, Moore, & Myers, 1983; R. Gelman, 2002; Golinkoff et al., 1984; Molina, Van de Walle, Condry, & Spelke, 2004; Spelke et al., 1995/2002) can distinguish between living and non-living things. Evidence further suggests that young children have a theory for growth (Atran, 1998; Medin & Atran, 2004). Children seem to understand that animals and plants increase in size and that artefacts do not grow (Inagaki & Hatano, 1996; Rosengren et al, 1991), and that plants, animals and humans need water/food that provide energy to maintain life and to grow (Inagaki & Hatano,

1996, 2004); a principle called “vitalism.” This finding has been replicated in Japan and Israel (Inagaki & Hatano, 1993), Australia (Morris, Taplin, & Gelman, 2000), and the United States (Inagaki & Hatano, 1993; J. L. Miller & Bartsch, 1997).

#### Importance of Understanding Biological Concepts and Relevance to Religious Ideas

A concept of “vitalism” is important for understanding life-cycle phenomena. According to a vitalistic framework, children form first a concept of life-cycle phenomena such as the idea that living things need sustenance and all living things grow. After a concept of “life” is formed, then children understand that living things will die. As will be detailed more in chapter eight, research indicates that children often come to a mature understanding of death by 8 years (Brent, Speece, Lin, Dong, & Yang, 1996; Koocher, 1973; Lazar & Torney-Purta, 1991; Slaughter & Lyons, 2003).

Other developmentalists propose that a concept of death develops much later because a concept of death is tied to more psychological considerations than solely a concept based in biology (Bering, 2011; Bering, Blasi, & Bjorklund, 2005; Bloom, 2007; Carey, 1985, 1995). In other words, although death involves the cessation of all biological functioning it also involves the cessation of psychological, cognitive, and emotional processes. Conceptualizing the cessation of psychological properties seems to be difficult for both children and adults (Bering & Bjorklund, 2004; Bering et al., 2005; E. Cohen, Burdett, Knight, & Barrett, 2011). Bloom (2007), Carey (1985, 1995) and Bering (2011; Bering & Bjorklund, 2004; Bering et al., 2005) advocate that it may be difficult to accept that living things will die because it may be hard to fully contemplate the complete termination of thinking or feeling. Thus, immortality and certain afterlife beliefs may develop because of the difficulty of accepting the cessation of all functioning, and hence, influence certain types of religious belief. Children’s notions of immortality will be explored in chapter eight and after-life beliefs will be mentioned later in this chapter.

### 2.3.3 Intuitive Psychology (Theory of Mind)

Another core domain is intuitive psychology which refers to the ability to attribute and reason about the mental states of another person, or what is known as Theory of Mind (ToM). Theory of mind is a fundamental shift or alteration in children's knowledge (Astington et al., 1988). This is an ability we employ every day, as we interact with others as social beings. These "mindreading" capabilities help humans to understand and communicate with others. Without these capabilities, social exchanges and communication would be very baffling.

Acquiring a mature understanding of ToM is a developmental achievement, as well as a critical one, that fully appears between four and five years old in typically developing children and begins to develop in infancy (Wellman et al., 2001). A common method used to test theory of mind in children is through cleverly designed tasks called "False Belief" tasks. A well-known test is called the Sally-Anne test developed by Wimmer and Perner (1983). In the Sally-Anne test children are asked to consider a story: Sally is going to go outside but has not finished with her chocolate yet. She decides to hide it in a box and put it in a cupboard. Anne walks in and moves the box to above the refrigerator. Children are asked, "Where will Sally look for her box with her chocolate when she returns?"

Children younger than age four or five fail this task because they confuse knowing where the box is and where Sally will look. Children younger than four or five years assume that all persons would understand the scenario just as they would: that just as he or she saw the box of chocolate placed on top of the refrigerator, anyone else would know the chocolate was there as well. Results have been replicated with different types of false belief tasks, including the droodle task (Chandler & Helm, 1984; Ruffman, Olson, & Astington, 1991; Taylor, 1988; Taylor, Cartwright, & Bowden, 1991), the secret game and code tasks (Barrett, Newman, & Richert, 2003); visual perception tasks (Moses & Flavell, 1990; Perner &

Davies, 1991; Pillow & Weed, 1997; Richert & Barrett, 2005); and the surprising contents task (Barrett et al., 2001; Hogrefe, Wimmer, & Perner, 1986; Knight et al., 2004; Lane et al., 2010, 2012; Perner et al., 1987). These results indicate that children younger than age five have a difficult time distinguishing between their present access to information and the false beliefs of another (or even their own previous false beliefs). Susan Birch (2005; Birch & Bloom, 2003) calls this the “curse of knowledge,” as children younger than four or five years cannot separate what they know and what a person might not know. In other words, they assume that everyone knows what he or she knows as well. Thus, a fully representational and stable understanding of theory of mind is not reached until four or five years (Bartsch & Wellman, 1995; Perner, 1991; Perner et al., 1987; Wellman & Bartsch, 1988; Wellman & Woolley, 1990). Wellman and colleagues concluded, after conducting a meta-analysis of 178 theory-of-mind studies, that there is substantial development of children’s understanding of theory of mind up until around age five (Wellman et al., 2001).

Although development of a fully representational understanding of mind occurs by the age of four or five, there is little doubt among researchers that children younger than four years have a rudimentary understanding of agency or the beliefs and desires of others. Infants have some capacity to think of mind for purposes of social interaction (Gopnik et al., 1999; Schaffer, 1989). For example, infants prefer to look at faces (Field, Cohen, Garcia, & Greenberg, 1984; M. H. Johnson, Dziurawiec, Ellis, & Morton, 1991), they can distinguish between objects and agents (R. Gelman, 2002; Golinkoff et al., 1984; Gopnik et al., 1999) and children as young as 18-months can understand an experimenter’s preference from verbal and facial expression (Repacholi & Gopnik, 1997). In addition, somewhere between nine and 12 months, infants develop the ability to engage in joint attention, or the ability to interact with another person mediated by an object (Carpenter, Nagell, & Tomasello, 1998; Liebal, Carpenter, & Tomasello, 2010; Liszkowski, Carpenter, Henning, Striano, & Tomasello,

2004; Tomasello, 1999). This activity is complex, requiring gaze following, coordination of objects and people, collaboration, and communication. Within the first year, infants also develop the ability to use emotional cues from a person's face to guide how the infant should behave (Baldwin & Moses, 1996; Walker-Andrews, 1997). This ability is known as social referencing. In test situations, a stranger walks into a room and the infant will look to the mother's face to gauge whether this person is safe or not. The infant is likely to react to the mother's facial cue, i.e., resuming play with a toy if the mother smiles down at the infant. Before the age of two, children also seem to understand desire psychology, or the understanding that others have desires that motivate actions. When trying to decipher what the experimenter would prefer to eat, children as young as 18-months old could understand the experimenter's preference due to his verbal and facial expression (Repacholi & Gopnik, 1997).

Other research proposes that very young children can make a distinction between who has knowledge and who is ignorant. Children as young as age three realize that the person who has looked inside of a box is knowledgeable about the contents of a box whereas the person who has not looked is ignorant (Pratt & Bryant, 1990). More recent work shows that, when requesting a toy, two-year-olds are more likely to name or gesture to their parent the location of the toy if the child knows the parent has not seen where it was hid (O'Neill, 1996). Three-year-olds will also selectively trust (and choose to learn from) more informed and accurate adults rather than ignorant ones (Koenig & Harris, 2005; Pasquini, Corriveau, Koenig, & Harris, 2007).

Controversially, some researchers have found evidence that suggests that infants may have a rudimentary understanding of false belief. The false belief tasks used to test preschoolers are measures that use explicit and verbal judgments from children. These methods would not be suitable to preverbal and physically limited infants. Using simplified

and indirect behavioral techniques, such as tracking eye movements or using looking-time procedures, new evidence with infants has shown that very young infants may have implicit understanding of false belief. In a modified false-belief paradigm, results indicate that 13-to-18-month-old infants expect an actor to search for a toy where she believes this toy is (rightly or wrongly-depending on the condition) hidden (Buttelmann, Carpenter, & Tomasello, 2009; Onishi & Baillargeon, 2005; Scott & Baillargeon, 2009; Song, Onishi, & Baillargeon, 2008; Surian, Caldi, & Sperber, 2007; Trauble, Marinovi, & Vesna, 2010; Yott & Poulin-Dubois). The question of how much infants understand the thoughts and intentions of others, and particularly whether they implicitly understand false belief, is controversial and researchers are not yet sure how to interpret these findings (S. A. Miller, 2012; Perner & Ruffman, 2005; Rakoczy, Ruffman, Garnham, Import, & Connolly, 2001; Ruffman & Perner, 2005; San Juan & Astington, 2012; Sodian, 2011). Indeed, if infants pass these implicit tasks, why do three-year-olds have such a hard time passing explicit false belief tasks?

Many studies have tried to answer this question by comparing young children's performance on both implicit and explicit measures. Using similar implicit techniques used with infants, children 2.5 years and older watched while Actor A hid a toy and left the room (Clements & Perner, 1994). Actor B then came into the room, hid the toy somewhere else and also left the room. Actor A came back into the room and the experimenter exclaimed, "I wonder where he/she will look?" Children's eye and gaze movements were recorded. Researchers found that 90% of children aged 2 years, 11 months and older could accurately look at the correct place where an actor with a false belief would look if he or she came into a room to look for a toy. However, only 45% of these children were able to explicitly explain that this person had a false belief. These results have been replicated several times and the majority of these studies demonstrate that children may have an implicit understanding of false belief but are unable to access this knowledge to make an explicit judgment about false

belief (Garnham & Perner, 2001; Garnham & Ruffman, 2001; He, Bolz, & Baillargeon, 2012; Low, 2010; Ruffman et al., 2001).

Other researchers propose that children younger than three years can understand belief and false belief using modified versions of explicit false belief tasks (Atance & O'Neill, 2004; Call & Tomasello, 1999; Chandler, Fritz, & Hala, 1989; Sullivan & Winner, 1991, 1993). For example, Atance and O'Neill (2004) had three-year-old children anticipate what was contained in a crayon box by having them grab another item (a piece of paper) that they could use with the imagined item (a crayon) in the crayon box. Then researchers opened up the box and showed children that there were candles inside the box. After closing up the box, researchers then asked children to state what they had originally thought was in the box. In a typical unexpected contents task (without this extra planning step) three-year-olds state that they always knew there were candles in the box. However, this extra planning step (selecting a piece of paper to use with the imagined and believed crayon) appeared to help children recall their prior false belief, or that they had thought crayons were in the box. Even though children could state their original belief, Atance and O'Neil (2004) were not sure whether children understood both the mental representation of thinking there are "crayons inside the box" and also the connection to their previous action (selecting a paper with which to draw/color), i.e., "I got the paper so that I could draw with the crayons I thought were in the box."

While many researchers agree that a significant shift in theory of mind understanding happens between age four and five, theory of mind development does not stop after the preschool years. Human behavior is complex and it would be absurd to assume that older children and adults have mastery of understanding and inferring the mental states of others (Apperly, 2011; S. A. Miller, 2012). These studies have used second-order false belief tasks, as well as other higher order theory-of-mind tests to examine later development of theory of

mind. The above research demonstrates that preschoolers can pass first-order belief tasks, or an understanding that another person can be ignorant or knowledgeable. However, people often think about second-order belief, or thinking about what one person thinks about another person. In these more complex tasks, participants are usually given a narrative where two actors are doing a joint activity and then one goes off to do something else (Perner & Wimmer, 1985). Actor B hears that Actor A will be doing one thing but instead Actor A does something different. Participants are then usually asked what Actor B thinks that Actor A is doing. Children usually cannot attribute the correct mental state to Actor B until after 6 years (Astington, Pelletier, & Homer, 2002; Banarjee, 2002; Coull, Leekam, & Bennett, 2006; Hayashi, 2007; Parker, MacDonald, & Miller, 2007; Perner & Wimmer, 1985), although with simplified methods one study found that five-year-olds could understand second-order beliefs (Sullivan, Zaitchik, & Tager-Flusberg, 1994).

Additional higher order tasks have been created to measure whether older children, adults, and non-typical populations (like autism) understand the behavioral complexities of emotion and facial expression (Baron-Cohen, Joliffe, Mortimore, & Robertson, 1997), faux pas (Baron-Cohen, O'Riordan, Stone, Jones, & Plaisted, 1999), and moral dilemmas (Barnes, Lombardo, Wheelwright, & Baron-Cohen, 2009). These tasks have shown to be variable in adult populations, with some gender differences (Baron-Cohen et al., 1997) and with atypical and typical populations (Barnes et al., 2009; Baron-Cohen et al., 1999).

With sensitive enough measures, adults have been shown to have some deficits in false belief tasks (Birch & Bloom, 2007; Mitchell, Robinson, Isaacs, & Nye, 1996). Birch and Bloom (2007) recommend that perhaps manipulating false belief tasks so that children are unaware of the contents of a box or the location of an item may help to advance the theory of mind by participants being less susceptible to the “curse of knowledge.” This type of task and the idea of a “curse of knowledge” is explored and tested in chapter five.

## Importance of Psychology and Relevance To Religious Ideas

If theory of mind is said to be a core aspect of intuitive psychology, it should be universal across cultures. Studies have shown that a fully-acquired theory of mind has minimal variation across typically developing people<sup>5</sup> (e.g. cultures, gender) (Baron-Cohen, 2002; Callaghan et al., 2005; Heelas, 1981; Knight et al., 2004; Liu, Wellman, Tardif, & Sabbagh, 2008; Perner, Ruffman, & Leekam, 1994). Children in China (Liu et al., 2008), England (Perner et al., 1994), Mexico (Knight et al., 2004), and Canada, Peru, Samoa, India, and Thailand (Callaghan et al., 2005) demonstrate a capacity for theory of mind understanding, although the exact onset of theory of mind may vary (Knight et al., 2004; Liu et al., 2008). Apart from the variation from cultural or linguistic factors, the large consensus of researchers suggest that children will gain a stable and robust theory of mind the same way and along the same trajectory cross-culturally (Astington et al., 1988; Harris, 1988; Wellman, 2012; Wellman & Miller, 2006) although there are some researchers that say more research is needed to explore the possibility that there might be cross-cultural differences in understanding cognitive abilities (Guavain, 1998; Lillard, 1998).

A representative theory of mind does not exclusively encompass the ability to think about human agents. Other types of agents, such as animals and supernatural agents, have minds, so a representative theory of mind should be applied across other minds as well. Every day, people come in contact with animals and extraordinary beings (in stories, movies, conversations). Thus, a person's theory of mind must accommodate a variety of different

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<sup>5</sup> In contrast, a non-typically developing person who struggles with taking the perspective of others is likely to be diagnosed with autism spectrum disorder, a well-known disorder labelled for its deficit in ToM. This disorder is characterized by individuals not being able to read another's expression, not making eye contact, not understanding emotion, and not grasping jokes or the context of stories. This inability to perceive and understand other people is problematic for these individuals, inhibiting communication and clear social interaction. People with autism are in a sense, blind to social cues, and thus Baron-Cohen (1995) has called this difficulty, "mindblindness."

minds. Theory of mind is important for constructing a concept of other minds and specifically for constructing a concept of God.

## **2.4 Support for Persistence of God Concepts**

This last section detailed evidence that children learn about the world in specific and constrained ways. These same constraints restrict notions or conceptions of religious ideas. Concepts of supernatural agents, and God in particular, are easy to conceptualize according to domain-specific knowledge. These ideas are considered “natural” (Barrett, 2012; Boyer, 2001; McCauley, 2000, 2011) because these type of agents play on our intuitive notions of the world and agency (i.e., these agents have minds and are animate) and persist because of minor violations to these intuitive ideas (i.e., minimal counterintuitive ideas such as an agent that walks through walls or lives forever). In other words, minor violations make conceptualizing these agents salient and easy to remember. These ideas are discussed in the next section.

### **2.4.1 Recurrence of God Concepts**

A variety of gods and supernatural beings are represented all over the world. Their continued presence in societies over thousands of years and their continued spread stimulates questions for why these ideas persist. Particular domain-specific conceptual systems in the mind specialize in understanding specific features of objects or agents around us and these specialized systems in turn help produce specific kinds of inferences about them. What “pushes” the systems to pay attention to particular cues in the environment? Part of the answer is that such mental systems are driven by relevance (Boyer, 2001).

Boyer (2001) hypothesizes that what makes many gods (and in particular, God) relevant is their access to strategic information. In other words, if God has strategic information, a person is more likely to entertain the existence of God and to talk about God. The idea that as familiarity (the more one talks about God) increases, credibility (belief in

God) also increases. This concept is a function of what Daniel Kahneman has called the accessibility heuristic (Kahneman, 2003). In contrast to gods, ordinary human beings only have limited access to relevant information—one human can only know with certainty what he himself is thinking and has only one-sided knowledge of an event. For example, if a person falls ill, God might know that it was due to the malevolent spell of a particular neighbor. Whereas a human has limited information, God has useful information which an individual may hope to gain. God is thus worth thinking about.

Counterintuitive agents, or those agents that have properties that are counter to normal ontological types (i.e., a talking toaster or an immortal spirit), may have special inferential potential. Agents such as ghosts, elves, Darth Vader, or God, supposedly take little effort to conceptualize and are interesting to talk about. Indeed counterintuitive agents are the most recurrent counterintuitive concepts in myths across cultures (Barrett, Burdett, & Porter, 2009). Counterintuitive agents—especially agents with mentality—draw attention because their counterintuitive properties generate further explanation by violating our expectations of spatiality, physicality, biology, animacy, and mentality (Barrett, 2008a). Because of the amount of inference generation, these agents are memorable and hence, more likely to be successfully transmitted to others. A successful transmission of a God concept to other people then generates a high possibility of recurrence of this idea through generations.

#### **2.4.2 God Concepts as Maturationally Natural**

Humans are intensely social beings with a propensity to look for agency in ambiguous situations. In cases of misfortune or strange circumstances, people in a wide variety of cultural contexts seek explanations based on supernatural agents. Supernatural agents tend to be considered powerful, and people in a variety of societies find it entirely plausible that a supernatural agent could orchestrate a catastrophe or heal a person from a sickness. Indeed, this idea is consistent with the intellectualist approaches to religion (Tylor, 1958/1871).

These concepts thus appear to be “natural” in the technical sense of arising with ease, speed, and flexibility in humans from any, or virtually any, cultural background (McCauley, 2000, 2011). These ideas are not “hard-wired” or innate, but rather arise through a combination of biological predisposition and interaction with the social and physical environment.

Robert McCauley (2000, 2011) has defined “natural” capacities to be abilities that people engage in effortlessly without any need for self-conscious or deliberate thought. In any society, such capacities include basic human faculties such as recognizing the face of a loved one. According to McCauley, a capacity can become “natural” in two different ways: one is through practiced naturalness and the other through maturational naturalness. Practiced naturalness occurs after one has rehearsed or learned something repeatedly to such an extent that it feels natural. Practiced natural capacities can be acquired at any age and are more individually and culturally specific. One example is learning to play an instrument well. This activity was not natural from the outset, but through practice this activity becomes effortless. Maturational naturalness, in contrast, applies to capacities that typically developing people universally acquire. These capacities become more and more “natural” and effortless due to the ongoing and early development of the brain in combination with necessary environmental conditions. Theory of mind is one such example. Three-year-olds do not yet have a mature theory of mind and only through normal development in addition to exposure to other minds will a child develop the ability to think of other minds as adults do. Maturationally natural processes occur largely because the right biological disposition is in place along with the correct environment to be able to master these skills. Whereas practiced naturalness can occur at any time during the lifespan, most maturationally natural processes occur within the first five years of life. Other examples include learning to speak a native language and learning to walk.

The timing of environmental input is pivotal for acquiring maturationally natural capacities. Evidence has shown that in cases where the biological disposition is available and environmental cues are lacking a person may not develop a maturationally natural capacity. For example, a well known and unfortunate case is of a young girl named Genie who never learned to talk (Rymer, 1994). During the first eleven years of her life, Genie was imprisoned in a closet and completely isolated from other people. This complete isolation resulted in an extreme impairment to verbally communicate for the rest of her life despite training.

Barrett (2012) argues that people have a maturationally natural tendency to believe in, or at least entertain the idea of, gods or God. Using the natural processes of intuitive knowledge, typically developing children have the capacity to think of other minds as well as supernatural minds. Children under five are still developing the mental tools of intuitive knowledge, so social scientists, by studying children at this age, can get a closer picture of how the mind is designed and functions as these mental tools and domains mature.

## **2.5 Evidence of Children's Susceptibility to Conceptualize Religious Ideas**

In the above sections I have presented evidence to support the idea that children and adults are equipped with several mental tools to understand and conceive of agents. This next section will tie these sections together to show how these specific mental tools work to render concepts of supernatural agents natural to children and adults. Below, I present specific studies in cognitive development to further make the case that religious ideas are formed from basic cognitive tools.

### **2.5.1 Teleological Reasoning**

Children (and adults) are prone to wonder what things are for and where things come from (Kelemen, 1999a, 1999c). As seen in the research from intuitive physics, infants understand that ordinary objects are not self-propelled so that when they see an object that

moves by itself, they find it interesting and look longer. Similar to an adult, if an adult hears something fall in the other room, likely the adult will wonder *who* dropped the object, as adults would intuitively assume that the object did not move and fall by itself. Indeed, human minds seem overly-attentive to look for purpose and the agent behind events. Children do this with ease. To question the purpose of things is called “teleological reasoning.”

Deborah Kelemen has conducted several studies examining children’s incorrigible “why” and “what” questions about why things work and what purpose these things have. These questions stem from a child’s intuitive response that all things have a purpose, something that Kelemen has titled, “promiscuous teleology”(Kelemen, 1999a). Children seem to have a compulsive desire to give a function for objects and beings (e.g. mountains were for climbing and babies were for loving) whereas adults are more apt to be selectively teleological and not ascribe a function (Kelemen, 1999b). Further results suggest that this promiscuous teleological bias continues with school-age (seven- and eight-year-old) children (Kelemen, 1999c) but does not necessarily continue with older children or adults. Nevertheless, evidence of a preference for teleological explanations were given when adults were tested under timed pressure (Kelemen & Rosset, 2009), in adults with Alzheimer’s disease (Lombrozo et al., 2007), and with adults lacking in formal education (Casler & Kelemen, 2008).

### **2.5.2 Origins**

Other research has explored children’s notions of the origins of things, other beings, and people. In an important study, Margaret Evans (2001) asked children from Christian fundamentalist and non-fundamentalist homes the origin of the sun bear, the tuatara (a lizard), and a human being. Children between five- and eleven-years-old have particular biases to how they understand the origins of animals and humans. Children at younger ages offer more creationist and spontaneous generation accounts (ie., “it just appeared” or “it came

out of the ground”) even when parents would never offer spontaneous generation accounts and half of parents of the children in this study would teach an evolutionary account. Not until eleven years of age do results indicate that parents’ opinions and teachings influence the way their child thinks about the origins of beings and animals. Similarly, Kelemen and DiYanni (2005) asked children whether certain living, non-living artificial items, and non-living natural things (e.g., rocks) were made by someone or made by something. Additionally they were asked if a certain event just happened, or if someone or something made it happen. Intelligent design responses were given for animals (73% of children), for non-living natural things (over half of children), and for natural events (a little under half of all children).

Two striking aspects can be drawn from Evans’ (2001) study. The first is that young children, despite being taught about evolution in school, find creationist and sometimes spontaneous-generation accounts much more compelling than evolutionary accounts. This result occurred even when many of the children were brought up in homes where evolutionary accounts were endorsed. Only after age 10 did children endorse the dominant beliefs of their own communities, especially when similar to their parent’s views (Evans, 2001). Several factors could explain these beliefs. Evolution is a counterintuitive concept that goes against many of the core intuitive knowledge concepts that children already have at this age. To suggest that an animal begets another very different animal could be very hard to understand when considering intuitive biology which maintains “like begets like.” In addition, a child’s tendency to think of a designer for objects and things may provoke a child to choose a creationist account over an evolutionary one.

A second notable finding that can be drawn from this study is that the oldest children (adolescents) gave responses about creationist or evolutionary views that were similar to the dominant view of their communities. Adolescents from creationist homes more frequently

gave creationist accounts, and children with parents who believe in evolution were more likely to respond with an evolutionary perspective. However, children younger than age 10, no matter what kind of household they were from, endorsed creationist or spontaneous accounts. This resistance shows that children often rely on their intuitions over what people tell them and are largely prone to think of design in the natural world.

### **2.5.3 Mind-Body Dualism**

An additional aspect of children's understanding of religious ideas is their tendency to see the world as both material and immaterial. Bering (2002, 2006, 2011; Bering & Bjorklund, 2004) and Bloom (2004) have argued that all humans are Cartesian dualists. In several studies concerning afterlife beliefs, children respond that mental functions persist after death whereas biological functions cease (Astuti & Harris, 2008; Bering & Bjorklund, 2004; Bering et al., 2005; E. Cohen et al., 2011; Harris & Giménez, 2005). These studies have shown some evidence for a cognitive bias towards dualistic thinking as similar results have been produced in America (Bering & Bjorklund, 2004), in Spain (Bering et al., 2005; Harris & Giménez, 2005), and in Madagascar (Astuti & Harris, 2008). However, recent data has motivated some criticism of this hypothesis. Cohen and colleagues (E. Cohen et al., 2011) demonstrated that certain physical and biological properties (e.g., seeing and hearing) may actually have been miscategorised in previous studies as these traits were seen to be both immaterial (possible without a body) and material (possible with a body).

Understanding the distinction between immaterial and material reasoning may develop around age four. Developing a concept of this distinction is important when trying to conceptualize living and non-living entities. Bering (2011) argues that the inability to conceptualize another mind as ceasing to have certain epistemic states, creates a barrier for accepting that a human is dead. Bloom (2004, 2007) further suggests that intuitive dualism is composed of two conceptual systems; one dealing with minds and the other dealing with

bodies. These biases, then, make it easy to think of beings without bodies, such as ghosts, ancestor spirits, and God. Further, these ideas may make it very difficult for children to come to a mature biological understanding of death. Perhaps children need to develop an understanding of biological phenomena first before understanding a concept of death (Astuti & Harris, 2008). Chapter eight examines this issue specifically.

## **2.6 Conclusion**

In this chapter I have pointed out that ideas about supernatural agents and God can arise from early-developing and domain-specific cognitive mechanisms (section 2.2). These mechanisms in conjunction with early cognitive biases of teleology and mind-body dualism, and early notions about origins cultivate ideas about God and other supernatural agents (section 2.4). These ideas are maturationally natural (section 2.3.2) and persist and transmit because of memorable and attractive counterintuitive properties associated with these ideas (section 2.3.1). The intuitive assumptions within the domain of psychology are particularly important for constructing a concept of God. In order to have a theory of mind, someone must be able to think of a person who may not be physically present and think about the desire and beliefs about that person. This type of thinking and ability strongly guides human thinking to effortlessly conceive of a god or a supernatural being, especially one that cannot be seen. In the next chapter, I develop this idea further by exploring the evolutionary and everyday importance for thinking about a variety of other minds.

### 3 Children's Reasoning About Non-Human Agents

#### 3.1 Introduction

In the previous chapter, I argued that children have certain cognitive biases that shape specific religious ideas. These religious ideas have been demonstrated cross-culturally and particularly in early child development. However, a more thoroughgoing reflection on children's development of a theory of non-human minds is called for.

In this chapter, I focus on the development of ideas of other minds, including human, animal, and supernatural minds. I argue that children have the ability to reason about other minds at a very young age and do so because of early developing cognitive mechanisms including their theory of mind. Understanding other minds, even human minds, can be a complex task. One must take into consideration the diversity of perceptual and cognitive abilities that make up *individual constraints*, such as aging, type of agent (e.g., dog, God), or education, as well as those capacities affected by *situation-specific constraints*, such as distance, line of sight, light intensity, and competing stimuli. "Individual constraints" are those specific cognitive limitations or special abilities that relate to a particular agent. This term is based on prior work that labelled these types of constraints for humans as "person variables" (Flavell & Wellman, 1977) or "person-specific cues" (Brosseau-Liard & Birch, 2011). Because this thesis is exploring children's understanding of other minds besides human minds, the usage of "person variables" or "person-specific cues" is no longer appropriate. The term "situation-specific" is taken from Brosseau-Liard and Birch (2011) and is meant to convey that the specific situation can determine the process of understanding what another mind knows.

In light of individual and situation-specific constraints, how do children take these various constraints into account when presented with various minds? Are some constraints

understood earlier than others? Do they have a single narrowly specified theory of mind for humans? Or do they have a single broad and flexible theory of mind that can accommodate many different types of minds? Though thinking of other minds can be complex, prior work indicates that young children seem to take many of individual and situation-specific constraints under consideration with ease.

In the following sections, I describe how children develop a general concept of agency and an understanding of different types of mind. I first discuss the evolutionary development of theory of mind, suggesting that while theory of mind may have evolved for cooperative purposes, it may have also evolved so that humans can understand the diversity of other minds. I then argue for the importance of understanding the various individual and situation-specific constraints of knowledge acquisition in children. Following this argument, I expand on a further cognitive mechanism, the Hypersensitive Agency Detection Device, which aids in thinking about non-human minds. Finally, I present three approaches that are used to understand children's development of a non-human theory of mind. I conclude with questions that are left unanswered and those specific questions this thesis will empirically examine through several cross-cultural studies (chapters five – eight, studies 1- 4).

### **3.2 The Evolution of Theory of Mind and Notions of Non-Human Agents**

Theory of mind may have developed because of selection pressures to cooperate with other humans and because of increasing group size (Dunbar, 1998). A fully representational theory of mind is postulated to have arisen some 30,000-40,000 years ago because of the existence of ancient cave drawings (drawn at about this time) depicting the first representations of other (unusual) minds, such as half-man and half-lion creatures (Hahn, 1972, 1993; Mithen, 2003/1996). These drawings support the claim that these early humans had the capacity to imagine such beings that did not exist (Baron-Cohen, 1999). This early

capacity to think about these half-animal and half-human creatures is the starting point for thinking about particular non-human agents, such as supernatural agents.

Some theorists believe that with the increasing pressure to cooperate in societies, ideas about supernatural agents developed as either a by-product (Atran, 2002; Barrett, 2004; Bloom, 2004; Boyer, 2001; Guthrie, 1993; Pyysiäinen, 2009), exaptation (Gould & Vrba, 1982), a multi-level adaptation (D. S. Wilson, 2005), or somewhere between an adaptation or exaptation (Bering, 2006; Bering & Johnson, 2005). Whereas promoters of the by-product view suggest that religion originated from (nonreligious) psychological mechanisms—such as theory of mind—that were adapted for everyday problems; an exaptation view would recommend that religion was either a co-opted adaptation or a co-opted by-product (Buss, Haselton, Shackelford, Bleske, & Wakefield, 1998). In other words, cognitive mechanisms help with social problems (original adaptation) but bias thinking to create religion. Culture and society constrain the design of religion (causal mechanism) and religion fulfills certain functions (religion's co-opted contribution towards survival).

Some researchers suggest that the institution of religion may have developed to promote prosocial behaviour and social cohesion through ritualized behavior (Mithen, 2003/1996) and through the jurisdiction of supernatural agents, such as God (Norenzayan, March 17, 2012; Roes & Raymond, 2003). Relevant to this thesis, Norenzayan (March 17, 2012) proposes that “high gods,” or supernatural agents that are omniscient and powerful, are increasingly common and have served a useful function in encouraging morality and cooperation because God is regarded as monitoring behavior. In various experiments, perceived supernatural surveillance has been shown to increase moral (Piazza et al., 2011) and prosocial behaviour (Gervais & Norenzayan, 2012; Henrich et al., 2010; Shariff & Norenzayan, 2007).

The same selective pressure that initiated thoughts about supernatural agents may have proven flexible to reason about other non-human minds. The domestication of dogs, for example, is speculated to have started 14,000 to 33,000 years ago (Germonpré et al., 2009; Ovodov et al., 2011). This practice enabled humans to use dogs for early warning detection and added protection from predators, and for more efficient hunting practices. In order to understand the behavior of dogs, one must be able to infer what their behavior means.

Having a theory of a dog's mind would be useful to understand that when a dog's hair stands on end and when he growls and barks in a particular direction, one would likely infer that the dog is expressing that some type of agent is near, and that the dog has perceived this agent by means not available to humans, as in superior hearing or smelling. A flexible theory of mind is also essential for successful hunting practices. For instance, if the hunter is aware that the antelope can hear or a bear can smell much better than humans, then the hunter can adapt his methods (try to be as still and quiet as possible as well as masking his scent) so that his prey is less likely to be aware of the hunter.

Mithen (2003/1996) claims that the ability to infer the mind of animals stems from hunter-gather (Upper Palaeolithic) ancestors who needed to control and predict animal behavior. Other work further proposes that these ancestors used anthropomorphism to understand animals (Kennedy, 1992). Though it may be that human minds co-opted a theory of human minds to other agents, it could be equally plausible that humans may have developed a much more flexible theory of non-human minds to accommodate the vast array of agents that imposed selective pressure on human ancestors. This flexible theory of mind mechanism may even help to understand the diversity of human behavior by recognizing the constraints and advantages certain minds may have.

### **3.3 Situation-Specific and Individual Constraints in Reasoning of Other Minds**

Even among human agents, the diversity of perceptual, cognitive, and personal abilities are wide ranging. Understanding the subtle and observable nuances of human behavior may be even more complex than trying to read animal behavior, particularly because of the human ability to mask internal states and to deceive. Decades of research on children's theory of mind have focused on children's ability to represent human minds (Astington et al., 1988; Baron-Cohen, 1995; Bartsch & Wellman, 1995; Buttelmann et al., 2009; Flavell & Wellman, 1977; Gopnik & Seiver, 2009; Moses & Flavell, 1990; Perner, 1991; Wellman, 1990; Wimmer, Hogrefe, & Perner, 1988). This research assumes that children acquire a concept of the mind that can be applied to all types of humans. Very little research has been conducted concerning the constraints and abilities of different types of human minds (not including non-human minds) and how children accommodate these differences, although a few researchers have mentioned the need (Dowker et al., 1994; Farmer & Dowker, 1995; S. A. Miller, 2000). A few studies indicate that children modify their speech when talking to younger children (as compared with adults) (Sachs & Devin, 1976; Shatz & Gelman, 1973; Tomasello & Mannle, 1985) and other studies indicate that children take age into consideration when thinking of knowledge and cognitive ability (Dowker et al., 1994; Farmer & Dowker, 1995).

An exploration of the tools or approaches that children use to understand the variety of other minds is the goal of this thesis. The aim of this chapter and the next section will be to elaborate on the specific cognitive devices used to detect agents and then to explain the theories that children use to understand other minds, namely the anthropomorphic, the egocentric, and preparedness hypothesis.

### 3.4 Additional Cognitive Mechanisms: HADD and ToM

Very young children can entertain ideas about other minds, including animals, supernatural agents, and God. However, understanding agency or even detecting agents, is a requisite skill. In this section, support will be given that even young infants can distinguish between agents and non-agents, and it is this early mental mechanism that allows humans to represent a variety of different types of minds.

In section 2.2.1, various studies were presented which supported the claim that infants seem to be equipped to know some core knowledge about physics. They understand that objects stay together in one mass, objects move in a continuous path, and in order for objects to move, contact must be made. Knowing that objects (non-agents) must be made to move is considerably different from agents, who have self-propelled and goal-directed movement. Infants also seem to understand the difference between agents and inanimate objects. The physical, biological, and psychological domains function in tandem to make sense of agency. Each of these cognitive systems enable children and adults to look at a dog and immediately know that he can be self-propelled, eat food, and move in a continuous path, etc. and that a rock would not have these abilities.

In concert with these other cognitive systems is a mental mechanism called the Agency Detection Device (ADD). This is a device that rapidly allows humans to identify and make sense of agents around them (Barrett, 2000; Guthrie, 2002). The ADD is responsible for becoming aware of agency. The ADD is hypersensitive to identifying agents (sometimes registering the presence of an agent even given only ambiguous evidence) and serves as a survival technique to warn for possible predatory agents and to give a person enough time to react in order to protect oneself. Justin Barrett (2004) has expanded this term to HADD, the Hypersensitive Agency Detection Device, to emphasize the tendency of this mental mechanism to *over*-attribute agency in the world. This over-attribution of agency has been

demonstrated in various studies and is a feature spanning from early childhood into adulthood (Baillargeon, 2004; Barrett & Johnson, 2003; Buresh & Woodward, 2007; Heider & Simmel, 1944; Rochat, 2001; Rochat, Striano, & Morgan, 2004).

In a seminal experiment, Heider and Simmel (1944) demonstrated that adults attribute agency to moving shapes. They showed adults a screen with geometric shapes floating around and participants were asked to report their observations. An experiment originally intended to test physical causality actually revealed that participants reported that they perceived the shapes chasing one another as well as attributing desires and emotions to the shapes. The motion of these objects and the seemingly goal-directed behavior of an object triggered HADD. In a similar study (Barrett & Johnson, 2003), participants in one condition watched marbles move around and attributed agency to the marbles itself. In a second condition, participants indirectly controlled the movement of the marbles and did not attribute agency. Participants were more likely to attribute agency when they did not know who was controlling the movement of the marbles. This study suggests that participants' HADD is activated with an unexplained movement of an object and people then search for a possible agent to account for the self-propelled movement.

Infants are also surprised by unexplained movement of objects. Philippe Rochat and colleagues (Rochat, Morgan, & Carpenter, 1997) showed babies aged three to five months two different computer displays. One display had two different colored disks making random patterns on the screen. The other display had two different colored disks "chasing" each other around the screen. Five-month-olds looked longer at the random display, which was a result similar to adults. The interpretation is that the random display did not have a pattern, so both infants and adults spent longer time trying to detect any agency. In other experiments, infants at nine months also understand role reversal in agents (i.e., noticing when the "chaser" disk becomes the "chased") (Rochat, 2001; Rochat et al., 1997; Rochat et al., 2004) and that

by 13 months infants can recognize certain agent-specific and agent-general goals (Buresh & Woodward, 2007).

As intimated above, HADD is triggered when objects move in ways that violate our intuitive assumptions concerning basic object mechanics, as in the case of the marbles “moving by themselves.” When there are no other agents present to explain an object’s behavior, “information from other mental tools and HADD searches for any known agents that might account for the self-propelled movement” (Barrett, 2004, p. 33). Barrett (2012) suggests that in order to understand agency, humans must understand two key characteristics. The first is that agents do not have to physically resemble other humans. There are different types of agents besides human agents. This characteristic is important for understanding other types of agents, such as the behavior of predators or prey. Second, humans must be able to think of agents they cannot see, otherwise they would not be able to predict where an agent may be or the likelihood of coming into contact with another agent. As suggested with HADD, both children and adults detect agency in ambiguous events (Barrett & Johnson, 2003; Heider & Simmel, 1944) and with non-traditional agents, such as objects or hidden agents (Baillargeon, 2004; Wynn, 1992).

Whilst HADD detects agents, ToM functions to predict and explain the behavior of agents. HADD is the primary mechanism for activating theory of mind. These mental tools work as a team to identify that an agent might be near (HADD), to predict behaviors and to understand another’s desires (ToM), and to confirm whether what triggered HADD is an object or an agent. In circumstances where an event occurs with no likely agent responsible, such as a vase falling in another room, it is unfathomable to think that this vase could have pushed itself off a ledge. Considering that objects self-propel themselves goes against our intuitive expectation that objects are inanimate. Accordingly, “until information arrives to say otherwise, HADD registers that the object is an agent, triggering ToM to describe the object’s

activity in terms of beliefs, desires, and other mental states” (Barrett, 2004, p. 33). Instead of attributing an inanimate object with agency, a person is more likely to attribute agency to counterintuitive and invisible agents, such as ghosts (Tremblin, 2006). And, if HADD detects agency even in the movement of marbles or 2-D geometric shapes as agents, then it would be surprising if ToM did not likewise readily attribute mental states to non-humans.

Perhaps these mechanisms are one of the reasons why children can conceptualize “imaginary” beings so well, as we will see below. In fact, in order to truly have a theory of mind, someone must be able to think of a person who may not be physically present and think about the desire and beliefs about that person. The act of mentally representing another person’s mind enables a person to understand more accurately the thoughts, feelings, and perceptions of another. This type of thinking and ability strongly guides human thinking to effortlessly conceive of a god or a supernatural being, especially one that cannot be seen. The question left, however, is whether mental states are attributed based on a human theory of mind or whether ToM has more flexible, general principles of operation for unfamiliar agents.

### **3.5 Three Approaches for Understanding Children’s Developmental Notions of Other Minds**

To best understand how children reason about other minds, I will present in the following section the most salient theories: Firstly, I introduce a human-based theory of mind approach called the anthropomorphic hypothesis. Following a description of this hypothesis, the preparedness hypothesis is presented to illustrate a more flexible theory of mind approach. Finally, an additional human-based theory, the egocentrism hypothesis, is presented.

### 3.5.1 The Anthropomorphism Hypothesis: A Human-based Theory of Mind

Because of ToM and HADD, children are able to make sense of agency. People are prone to believe in ghosts, angels, gods, God, the tooth fairy and many other agents that are invisible. Stewart Guthrie (1993) says that we are hypersensitive to attributing agency to objects, a tendency he deems *anthropomorphism*. We project human qualities and faces to computers, cars, inkblots, clouds, and other such things. These types of inferences come naturally and without deep reflection. Guthrie (1993) defines anthropomorphism as, “attributing human characteristics to nonhuman things or events” (pg 3). Guthrie further suggests that because the world is ambiguous and hard to understand, the human mind naturally tries to make sense from the perspective it is most familiar: the human.

According to the anthropomorphism hypothesis, children (and adults) treat all other agents—whether animals, other humans, or God—by thinking of humans first as a source for thinking of other agents and subsequently attributing human-like qualities to non-human agents, God, or any other super-human agent (e.g., superheroes or other less powerful gods). As children mature and acquire more sophisticated cognitive abilities, they begin to distinguish between humans and God. God becomes less and less anthropomorphic with maturity.

This hypothesis has been advanced historically by psychiatrist Sigmund Freud and psychologist, Jean Piaget. Their approaches are sketched below.

#### 3.5.1.1 Sigmund Freud

Sigmund Freud argued that God is an idealized superman, or more accurately, an exalted father figure (Freud, 1927). He stated that the need for a God is formed through the Oedipal Complex. When a person is born, an infant seeks its mother for all needs and protection. The mother figure is replaced by the father as the primary protector as the child ages. Freud believed that the father figure in the home was someone that symbolized

protection from the world. The strong presence of the father helped to mediate any anxieties that the child had. As the child grew up the father figure was replaced with a God that would help to protect from further dangers in the world. The adult's helplessness causes him to seek a stronger father-like figure and God is the all-powerful answer—someone who could protect the adult from the world's uncertainty. Thus, Freud advocates that belief in God is infantile, since humans have invented God, a father-figure, to cope with the pressures of an uncertain world from infancy. Freud (1957) summarizes this idea in his essay on Leonardo da Vinci:

Psycho-analysis has made us familiar with the intimate connection between the father-complex and belief in God; it has shown us that a personal God is, psychologically, nothing other than an exalted father, and it brings us evidence every day of how young people lose their religious beliefs as soon as their father's authority breaks down. Thus we recognize that the roots of the need for religion are in the parental complex (pgs. 73-74).

Freud's theory, however, was principally speculative with no grounding in systematic empirical data to support his theory of religion as he primarily used anecdotes from a patient population. Nevertheless, his theory has inspired others to find that there is a correlation of how children perceive personality traits of God and the personality of their father (Vergote et al., 1969), but such correspondence is even stronger with mothers (Rizzuto, 1979).

### ***3.5.1.2 Jean Piaget***

Rather than suggesting that God stems from a psychological need for a father, Jean Piaget emphasized that children conceptualize God similarly to their parents due to conceptual limitations. Piaget came to this conclusion because of two patterns of thinking he noted from his many observations with children. First, Piaget (1929) observed that,

the child begins by attributing the distinctive qualities of the divinity—especially omniscience and almightiness—to his parents and thence to men in general. Then, as

he discovers the limits of human capacity, he transfers to God, of whom he learns in his religious instruction, the qualities which he learns to deny to men (p. 268).

Even after this moment, when children realize that humans are fallible, Piaget still asserts that a child's concept of God is still anthropomorphic. Children will still think of God as an exalted human being with special powers, as the "man in the sky."

Second, Piaget noticed that many children seemed to believe that the natural world was created by humans, a phenomenon he titled "childhood artificialism" (Piaget, 1929). Because of these two tendencies, Piaget thought that abstract ideas of God were too complex and as a default, children naturally tended to think of God based on human ability. God was seen as an anthropomorphic being until the child realized the limitations of humans.

Through interviews, Piaget documented that this tendency to anthropomorphize God lasted until sometime after the Concrete Operation stage. The Concrete Operations period is roughly, according to Piaget, from the age of 7-11 years. During this period, children begin to have logical and organized thought. This period is also characterized by less egocentric thought. At this stage children experience a "crisis." Children begin to understand that, "there is necessarily a limit to this deification of the parents" (Piaget, 1929, p. 381) and no longer attribute parents with omniscience or omnipotence. They begin to realize distinctions between God and man. A child then, "paternalizes God at the moment when he ceases to regard his parents as perfect" (Piaget, 1929, p. 382).

Piaget also observed the second tendency, child artificialism, through interviews. For example, he interviewed children about natural things and when asked where clouds, trees and lakes came from, children responded that they were created by humans or a particular human named, "God." Here are two examples of interviews with children about the origin of the sun and the clouds.

Here is an example of Fran, aged 9, who tells the interviewer that the sun was made by men:

Interviewer: How did the sun begin?

Fran: It was a big ball.

Interviewer: How did it begin?

Fran: By getting bigger and bigger and then afterwards they told it go to up in the air.

It is like a balloon.

Interviewer: Where did this ball come from?

Fran: I think it is a great stone. I believe it is made of a great ball of it.

Interviewer: Are you sure of that?

Fran: Yes, sure.

Interviewer: How did it get made?

Fran: They made it into a big ball.

Interviewer: Who did?

Fran: Some men (Piaget, 1929, p. 265-266).

Another child, named Leo, aged seven and a half years, explains that night comes when a hand on the watch turns a certain hour. When further asked how the watch began, Leo responds, "God made it." When asked who God is and what does He do and why, Leo then responds, "A person," and that "God works for children" (Piaget, 1929, p. 292).

### ***3.5.1.3 Criticisms of the Anthropomorphism Approach***

Between the 1930's and 1980's, Freudian and Piagetian thought motivated research regarding children's early conceptions of God. In one study, Heller (1986) conducted interviews with children and asked them to write a letter to God and draw a picture of God. Children aged five to ten years were recruited from all different faith traditions in the state of Michigan. Findings suggested that children think of God anthropomorphically as a

superhuman. But these studies present severe demand characteristics: writing a letter or drawing a picture may bias a child to think of God in human terms (Petrovich, 1999).

There are further methodological concerns with Freudian and Piagetian conclusions. Freud's theory was largely based on speculation and case studies with no strong grounding in empirical data to support his theory of religion. Likewise, in Piaget's study above, leading questions and demand characteristics may have biased children to answer anthropomorphically. Other measures should be used to reduce potential bias. In addition, the frequency with which these children responded that God is like man was not reported. Without a larger dataset to explore the number of children who endorse these types of responses compared to those that do not, we cannot know whether there were possible alternatives, or whether all children indeed make this response. All Piaget has documented is that *some* children anthropomorphize God. Even if Piaget was correct in detecting a general pattern among the Swiss children he studied, the "anthropomorphism" of the youngest children, by his theory, was actually an over-attribution of might. That is, rather than treat God as human-like, much of Piaget's data support the idea that children treat adults as God-like, a theme developed by the preparedness hypothesis (see below). Also, although descriptive of children's thoughts at this age, Piaget did not collect comparison data with adults. Children may express seemingly unusual comments that Piaget was apt to say was due to early cognitive development, but these claims cannot be expressed with certainty without having asked adults. To adequately say that children are unique in their cognitive development at certain stages, a similar comparison with adults would need to be conducted to empirically claim a significant difference in the thinking between children and adults. Unfortunately, equivalent measures would need to be constructed so that children would not be biased, such as simplifying the questions but still being able to test the same idea or construct.

Several more studies lend support to the idea that children may attribute human-like limitations to all types of agents before they acquire an adult-like theory of mind (Inagaki & Hatano, 2006; Kuhlmeier, Bloom, & Wynn, 2004; Lane et al., 2010, 2012; Nye & Carlson, 1984; Rochat et al., 2004; Shtulman, 2008). Other researchers have also used this term to explain hunter-gatherer understandings of animals (Kennedy, 1992; Mithen, 2003/1996) and as an explanation for children's development of God concepts (Freud, 1927/1961; Lane et al., 2010, 2012; Piaget, 1929). In the most recent set of studies, Lane, Wellman, and Evans (2010; 2012) asked children in secular (2010) and religious (2012) schools to judge the knowledge states of several agents: Heroman, who "can see right through things"; Mr. Smart, who knows "everything"; a cat with night vision; God; and two humans. Results suggest that only the older (five-year-old) children differentiated between fallible minds (humans) and extraordinary minds (God, Heroman, etc.). Three-year-olds over-attributed knowledge to all agents. Four-year-olds in both samples attributed correct knowledge to some of the extraordinary minds (such as Heroman) but not to God. Lane and colleagues (2010; 2012) conclude that there is a period during the 4<sup>th</sup> year of age that children anthropomorphize supernatural agents.

### **3.5.2 An Alternative to the Anthropomorphism Hypothesis and a General Theory of Mind Approach: The Preparedness Hypothesis**

Counter to the anthropomorphism hypothesis, other studies recommend that young children may have the cognitive tools to learn and to reason about non-human and supernatural agents at a very young age (Barrett et al., 2001; Knight, 2008; Knight et al., 2004; Nyhof, 2010; Richert & Barrett, 2005). Barrett and Richert (2003; see also Richert & Barrett, 2005) argue for a more general theory of mind approach: a "preparedness hypothesis." This hypothesis is not innate or "hard-wired" but maturationally natural (Barrett, 2011; McCauley, 2000). The preparedness hypothesis has two components: The first

component of the preparedness hypothesis is that preschool children may differentiate among agents—they can understand that not all features of human minds apply to non-human minds. Children attribute human properties to other humans, but not *necessarily* to God’s mind. Research shows that children need not reason from an anthropomorphic viewpoint, but instead they may demonstrate an ability to reason about supernatural agents differently from other agents (Barrett, Richert, & Dreisenga, 2001; Richert & Barrett, 2005). Barrett and Richert (2003) argue that children have a general intentional agent device or theory of mind that is capable of processing not just human agents but other agents as well, including God, and other agents, such as animals.

The second component is that before age eight, children find some super-human properties of God more readily adopted than comparable dimensions of human agency. Because of this default assumption, children find it relatively easy to conceptualize God and other supernatural agents with super properties. Even before attributing correct properties to humans, children are cognitively equipped or “prepared” to acquire some non-anthropomorphic agent concepts. Recent research demonstrates that children, ages three to five, can attribute and reason about divine attributes such as immortality (Giménez-Dasí et al., 2005), divine knowledge (Barrett et al., 2003; Barrett et al., 2001; Knight, 2008; Knight et al., 2004; Richert & Barrett, 2005), and creative power (Evans, 2000, 2001) distinctly from human traits. These findings contradict the popularly-held theory that children must have an anthropomorphic understanding of God until at least age eight or nine years old. Piaget perhaps underestimated children’s cognitive ability to reason about the properties of humans and God. Piaget (1929) writes, “He is just a man like everyone else...” (pg. 381). Instead of thinking God as just another human being, children seem to think instead that all humans and God have supernatural abilities.

In chapter two, different theory-of-mind tasks were discussed and results have demonstrated that children younger than five years have a very difficult time understanding human minds. Barrett and colleagues (Barrett, Richert, & Driesenga, 2001) wondered whether children, although not able to distinguish between Mom and other beings, could distinguish between supernatural beings and other normal beings. They used a surprising contents task similar to Perner, Leekam, and Wimmer (1987) to test whether children are able to distinguish between various agents and God. In their study, an experimenter showed children a cracker box and then asked the child to tell the experimenter what he or she thought was in the box. Children would correctly respond, “Crackers.” The experimenter would then open the box to reveal that actually, there were rocks inside the box. After closing the box again, the experimenter would ask, “Do you remember what is inside the box?” Children would correctly respond, “Rocks.” Then, children were asked about another agent who might walk into the room and see the closed box, “If Mom saw this box for the first time, what do you think Mom would say is inside the box?” Eighty-two percent of three-year-olds confidently respond, “Rocks.” By five years, children respond differently. When the five-year-olds were asked what Mom would say is inside the box when she enters the room, eighty-seven percent of five-year-olds responded, “Crackers.” Five-year-olds are aware that Mom was not present when the experimenter showed the child that there were rocks instead of crackers inside the box, so they understand that Mom would have a false belief about what was actually inside the box.

This task is similar to the ones shared in chapter two, but Barrett and colleagues (Barrett et al., 2001) added God as another agent to see if there were different developmental patterns for God as a super-knowing agent. Children were asked, “If God saw this closed box for the first time, what would God think was inside the box?” Interestingly children in all age groups were likely to say that God would know there were rocks inside the box. At least in

this task, three-and four-year-olds' default assumption was to attribute knowledge to all agents, until around five years of age. Barrett and Richert (2003) argue that this sort of result is not properly regarded as anthropomorphism. Children are not using traits of humans to make sense of God, but rather treat all agents as god-like in their knowledge about the contents of the box and later learn human limitations. Further, children much younger than 7 or 8 years successfully distinguished between humans and God. This study demonstrates that children may reason non-anthropomorphically. The preparedness hypothesis offers that children's minds may have conceptual tools to think of super-natural attributes first over human limitations and abilities. As Barrett and colleagues demonstrated, God was not seen as human first, humans were more God-like first. This study weakens the argument for an anthropomorphism hypothesis.

The samples that these experiments relied upon were from Protestant Christian homes from the US. Using children that have learned about God's omniscience may influence children to respond in theologically correct ways, rather than anthropomorphizing. Perhaps children raised in a different cultural context would respond differently. A similarly adapted study was conducted with the Maya in Mexico (Knight, 2008). The Maya believe in several different gods, both traditional spirits and the Christian God. These rich and varied spirits allowed for an examination of children's ability to discriminate between gods'/spirits' abilities and human ability. A false belief task was given using a tortilla gourd instead of a cracker box, and underpants instead of rocks were used for the item inside the tortilla gourd (which normally holds tortillas). Children were asked about another human, various animals, the sun god, forest spirits (spirits who know everything within the confines of the forest), Chiichi (a group of minor spirits, that can easily be tricked or fooled and are not all-knowing), and Diyoos, the Christian God. As with Barrett and colleagues (Barrett et al., 2001), children showed no difference across age groups and said that Diyoos would know

that there were underpants inside the gourd. When examining the other spirits and gods, older children's responses were inconsistent about whether the forest spirits and sun god would know there were underpants inside the gourd, and were more likely to ascribe false belief to the Chiichi which was similar to children's responses about humans. Younger children still ascribed all-knowing characteristics to all the supernatural agents, the animals, and the human. Again, younger children's responses were consistent with the preparedness hypothesis, attributing knowledge to all agents as the default—even agents regarded by adults and older children as not super-knowing.

What about certain types of divine knowledge such as perception? Would children attribute super-smelling or super-seeing abilities to agents with special abilities (e.g. dogs or eagles) or to God? Another study was conducted by Richert and Barrett (2005) to test this idea. They gave children three different tasks (one at a time) to examine knowledge acquisition via auditory, visual, and olfactory perception. For the visual task, they showed children a picture from a distance that they were not likely to see, for the auditory task, they turned on music very lightly so that children were not likely to hear, and for the olfactory task they placed a canister of peanut butter far enough away that children would not be able to smell it. Children were then asked about other agents (a monkey and a puppet named Maggie), special agents (an eagle with good vision, a fox with good audition, and a dog with good olfaction), and God. Children were then allowed to see, hear, and smell the stimuli, and to return to their original spot in the room after coming closer to engage with the stimuli. At this point, children were in full knowledge of each of the stimuli and then were asked again about each agent including God. Children were also taught that eagles could see, foxes could hear, and that dogs could smell better than humans. Until age five, children were confused about whether Maggie (the human doll) or the monkey would be able to see, smell, or hear and were only at chance levels. But for the special agents and God, all age groups said that

they would be able to hear, smell, and see the stimuli above chance levels. Children above the age of five reported that normal agents would not be able to see, hear, or smell the stimuli significantly different from chance and that the special agents and God would be able to see, hear, and smell significantly above chance levels. An interesting point is that despite the opportunity to apply anthropomorphism to God to hear, smell, and see, children were not susceptible to this.

### **3.5.3 Another Human-Based ToM Approach: The Egocentrism Hypothesis**

Other research has also called into question whether children's responses are in accordance with an anthropomorphism position or a preparedness position. Instead, several researchers have explored whether children's responses reflect an *egocentric* position, or a bias to think that all other agents think the same way as the child (Birch, 2005; Harris, 1991; C. N. Johnson, 1988). These researchers endorse that very young children may reason in terms of their own knowledge or are so impressed by their lack of knowledge in ignorance belief tasks, that they are only able to attribute knowledge or lack of knowledge from their own perspective or knowledge state (Birch, 2005; Makris & Pnevmatikos, 2007). This hypothesis is theoretically similar to the anthropomorphism hypothesis in that both these theories posit that young children must use a human theory of mind for reasoning about God. The difference is that the egocentrism hypothesis further specifies that it is the child's own mind that is the source for analogical reasoning and not a generic human theory of mind.

This distinction between anthropomorphism and egocentrism is a new one, and a distinction that I would like to make in this thesis. In fact, Piaget did not distinguish between anthropomorphism and egocentrism. Egocentrism, for Piaget (1929), is when the child "...confuses his self with the universe" (pg. 125) and the child lacks the ability to distinguish between them. Anthropomorphism, or attributing human-like characteristics to other agents, stems from this type of thinking. Piaget thought that the child's abilities to see objects as

living and conscious (animism), their tendency to insist that humans created things (artificialism), and their bias to attribute human-qualities to objects and other agents (anthropomorphism), results from egocentrism. Piaget (1929) writes,

Since the child does not distinguish the psychological from the physical world, since in the early stages of his development he does not even recognize any definite limits between his self and the external world, it is to be expected that he will regard as living and conscious a large number of objects which are for us inert. This is the phenomenon we propose to study and we shall describe it by the current word 'animism.' (pg. 169)

Following Piaget, other researchers examined egocentrism in children. Egocentrism was then defined as “children’s tendency to attribute to another their own ‘perspective’” (Ruffman & Olson, 1989, p. 601). Prior research claimed that children displayed “egocentric” responses in a perspective taking task, sharing a secret (Marvin, Greenberg, & Mossler, 1976). In this task, a child and mother would exchange a secret (point to a toy) while the experimenter covered his or her eyes. Each person in the triad took a turn covering their eyes and letting the other two “exchange a secret.” By four years, nearly all children gave correct answers but the younger children made some distinct errors. The predominant error was for children to attribute knowledge to all agents. Marvin and colleagues concluded that these responses were evidence of egocentric thinking. To investigate whether children do attribute their own state of knowledge to others, Wimmer, Hogrefe, and Perner (1988) designed a false belief task that included a control condition. In this task, there were two conditions where the child did not have the same perspective as another agent. Thus, a correct response for the child would mean a different response for the other perspective. Results demonstrated that while children showed the same pattern of correct responses as Marvin and colleagues (1976), the pattern of errors were different. Only 14% of the sample gave “egocentric”

responses. In a replication, only 8% gave “egocentric” responses (Ruffman & Olson, 1989). Refining the methodology and including a control group, allowed Wimmer and colleagues to clarify prior results. In his book, Perner (1991) makes the argument that children are not egocentric. Rather, they are realists and report the reality of the situation (at least as they perceive it).

In the 1990’s many developmentalists were ready to put egocentrism aside (Perner, 1991; Ruffman & Olson, 1989; Wimmer et al., 1988) but more recent studies have re-investigated such biases (Birch & Bloom, 2003; Lane et al., 2010, 2012; Makris & Pnevmatikos, 2007). This new line of research is resurrecting an old argument. Birch and Bloom (2003) claim that instead of egocentrism, children may have a “curse of knowledge” when attributing knowledge to others who are more ignorant themselves. For children, the “curse of knowledge” is that it may be hard for them to inhibit the knowledge they have when thinking of the mental states of others. Additional research has explored these biases using supernatural agents. Makris and Pnevmatikos (2007) were concerned with the type of task used in Barrett and colleagues’ research (Barrett et al., 2001; Knight, 2008; Knight et al., 2004; Richert & Barrett, 2005). In their study, they asked three-to-five-year-old children to participate in both a false belief task and an ignorance task. The results for the false belief task were similar to previous work (Barrett et al., 2001; Knight, 2008; Knight et al., 2004; Nyhof, 2010; Richert & Barrett, 2005); younger children attributed knowledge to all agents until age five when they attributed correct ignorance to the human agents. In the ignorance task, three-year-olds attributed ignorance to all agents. Not until between four and five years of age, did children recognize that God probably would know the contents inside the box and the other agents would not. Were children biased by a “curse of ignorance” rather than a “curse of knowledge?” These various approaches for attributing knowledge and ignorance to

non-human and supernatural agents will be taken up experimentally in chapters five through seven.

### **3.6 Conclusion**

As this brief review demonstrates, researchers disagree how children come to understand human or non-human agents. The variation in results may be due to differing tasks (e.g., false-belief tasks versus ignorance tasks). Further, the variation may be due to the complexity of the tasks. Reasoning about human minds can be an intricate task, requiring consideration of various individual-specific and situational factors. Additionally, reasoning about non-human and supernatural agents requires consideration of their unique capabilities and constraints. Understanding other minds involves much more reflection to the variety of capabilities and constraints of different entities and the situations that affect knowledge acquisition.

The rest of this thesis will address some of these shortcomings by providing new empirical research. In particular it will ask: How does children's conceptual development accommodate various types of other minds? What individual or situation-specific factors are more readily accommodated than others? Do children have a single theory of mind or a more flexible theory of mind, able to accommodate multiple types of minds? Are there cross-cultural differences in children's understanding of other minds? What are the socio-cultural influences of children's understanding of other minds and biological phenomena? These are open questions. In the next chapter, I introduce and justify the cultural samples used in this thesis.

## **4 Focus of the Thesis and Description of Samples**

### **4.1 Focus of the Thesis**

In the last three chapters, I have tried to build up an argument that supports the notion that young preschool children have the cognitive capacities to represent other types of minds besides human minds. I have also tried to show that very little research has been conducted on how children perceive the variety of human minds and non-human minds. In addition, a small amount of work has explored both cognitive and cross-cultural similarities and differences in children's acquisition of a concept of other types of minds.

In light of these shortcomings, this thesis aims to build on prior research by contributing four experimental studies that broaden the scope of research on children's understanding of other minds. In the following four studies, two cross-cultural samples (the UK and Israel) and religious traditions (Anglican and Modern Orthodox Jewish) were used to study the cognitive and cultural contributions to conceptions of other minds, and particularly a conception of God.

### **4.2 Justifications for Sampling in the UK and Israel**

In chapter one, I argued that cross-cultural work in understanding God concepts needed. Here I provide further justification for the choice of British and Israeli samples.

In all four experimental chapters, research was conducted using two different cultural samples and religious traditions. The UK and Israel were chosen specifically as samples because of their Christian and Jewish religious traditions (respectively) as well as their differing socio-cultural and political climates. Choosing two Abrahamic traditions was deliberate. Before future research can be conducted with cultures or traditions with gods with different attributes, evidence should first isolate the differences and similarities among attributions of God. God in the Abrahamic traditions represents one of the most highly

recurrent and successful concepts (Norenzayan, March 17, 2012; Sosis, 2000). Since God concepts are similar in both traditions, it is easier to test for the influence of socio-cultural factors.

In the Jewish tradition, God has no physical form. As many researchers disagree on the bias that children adhere to when understanding other minds (a preparedness, egocentric, or anthropomorphic bias), using a tradition where God is specifically taught as a non-anthropomorphic deity is important. Children in previous samples were from Christian nations (Barrett et al., 2003; Barrett et al., 2001; Knight, 2008; Knight et al., 2004; Lane et al., 2010, 2012; Makris & Pnevmatikos, 2007; Richert & Barrett, 2005). This poses a problem because of an inherent anthropomorphism in the sample selected: i.e, Christians believe God took human form in the person of Jesus. Comparing whether young children acquire these cultural differences helps to clarify cultural and cognitive influences of acquisition of God concepts.

This thesis is largely focused on clarifying contradictory results of past studies focusing on children's representations of supernatural and extraordinary minds. I did not go to a traditional society to ask children to consider a diverse group of gods because further work needs to systematically test whether cultural or cognitive constraints influence such different responses from children in present work. With that said, work has been done to examine children's notions of a range of minor gods. Nicola Knight and colleagues (2004) asked Yucatec Mayan children about a diverse group of gods and results supported a preparedness hypothesis and suggested that children developed a cultural understanding about the specific mental nuances of each god at an early age and that children understood that God (all-knowing God) would have special knowledge access.

Finally, chapter eight investigates cross-cultural and cognitive influences on children's notions of developing a concept of death and other biological concepts. Exposure

to death through the media or personal experience may give Israeli children consequential knowledge of the inevitability of death compared to British children who have not been personally exposed to such ideas or experiences. Since early 2000, Israel has been involved in three wars: the second intifada (2000-2005), the Lebanon War (2006), and the Gaza War (December 2008 – January 2009). In addition to these wars, Jerusalem alone suffered 146 civilian casualties as a result of 31 suicide bombings in the second intifada and another 8 civilian casualties in 2008 when a gunman opened fire in a local school (Israel Ministry of Foreign Affairs, 2011). The odds are very high that families in Israel have at least one family member serving compulsory time in the military during the past ten years, making the impact of the wars and bombings very personal. Furthermore, in the six months prior to data collection, the Gaza War occurred. During this period, 367 of 2000 (18.3%) articles sampled from the Jerusalem Post concerned the conflict, the threat of missile attack, and terrorist related activities (Jpost, 2008-2009). Exposure to terrorism through media, even for as little as five minutes on a frequent basis, has been shown to cause various behavioral and emotional problems in preschool children (Brom, Pat-Horenczyk, & Baum, 2011; Wang et al., 2006). It is likely, in light of the above events, that many conversations in the home center around war and the threat of death, especially in periods of heightened conflict (Baum, personal communication, September 27, 2011). Due to children's exposure to violent human death, The Israel Center for the Treatment of Psychotrauma in Jerusalem was created to treat children's exposure to terrorism and other war-related traumas. Thus, exploring these specific cultural differences in attributions of immortality and mortality was important to investigating whether children's experience influences earlier understanding of certain biological phenomena.

### 4.3 Participants

#### 4.3.1 Israeli sample

Israel is a small country in the Middle East containing 42% of the world's population of Jewish peoples (Central Bureau of Statistics, 2010). Jerusalem is Israel's largest city with a current population of 772,982 residents of which 64% are Jewish. The current Israeli nation is a new one, composed of immigrants from many parts of the world, with strong influences from Europe, Eastern Europe, the Middle East, and North and South America. Judaism is the official religion of Israel.

Both family and education are important to Israeli society. Israel is a very family-oriented society. Israeli families are large, usually with 3.88 persons in each household (Central Bureau of Statistics, 2010). Education is also important in Israeli society. By law, all children must attend school starting at age five. Most children are enrolled much earlier (at 3 and 4 years) and attend a pre-compulsory kindergarten (or *gan*). According to recent statistics (The Jerusalem Institute for Jerusalem Studies, 2009), 40% of 3- to 4-year-old Jewish children attended pre-compulsory schools either in the ultra-Orthodox Educational Division or a state-religious school (not including nurseries or other non-officially recognized day schools). In the state-religious schools as well as Ultra-Orthodox schools, the curriculum is religious and the teachers, pupils, and supervisors are also religious Jews.

One hundred and thirty-four participants were interviewed. Sixty-six children (39 females), ranging in age from 2 years, 10 months to 5 years, 11 months,  $M = 4.26$ ,  $SD = .87$ , were interviewed. Ninety-two percent of children in this younger group were born in Israel ( $N = 61$ ). Six were born in the United States and 2 were born in England. An adult sample was recruited as a developmental endpoint. Because many of the studies were testing new ideas or a new task, asking an adult sample was necessary to make clear what a mature pattern of response would look like compared to children. Sixty-eight adults (45 females)

participated,  $M = 37.67$ ,  $SD = 10.19$ , ranging in age from 26 years to 88 years. Sixty-four adults (94%) were parents or grandparents of the children in the study. As an assessment of education, out of the 68 adults that participated, 59 (87%) had at least a master's degree or their partner had at least a master's degree.

Participants were recruited via three synagogues and online newspapers in Jerusalem and all children were being raised in a practicing Jewish household. The majority of participants considered themselves modern orthodox (97%,  $N = 135$ ), three participants considered themselves Conservative Jews (1.7%) and just two participants considered themselves Traditional Jews (1.1%). All participants attended religious services at least once a week. Religious services were usually Shabbat services during Shabbat, or any other services related to various Jewish holidays. To check children's understanding of HaShem (God), children were initially asked if they knew who "HaShem" was and were asked to tell the researcher a little bit about what he or she knew about HaShem. Children gave responses such as, "Ha-Shem answers prayers," or "HaShem lives in the sky." All children said they believed in HaShem. After participants completed the tasks, further questions were given to test children's and adult's overall intuitions about God. Items covered God's omniscience, omnipresence, omnipotence, and creative power. These items with children's responses are included in appendix 4. Responses are broken down by sample but also by the responses by preschool children, three-year-olds, and adults (age > 17).

Interviews were conducted in the language with which the child felt most comfortable. Thirty-six interviews were conducted in Hebrew by a native Hebrew-speaking research assistant. Interview questions were back-translated to ensure equivalence.

### **4.3.2 British Sample**

The UK has been described by many people as "secularized" or a "post-Christian" society (Fergusson, 2004). According to the 2001 census, 71.6% of people call themselves

Christian, and 15% responded that they were no religion (Office for National Statistics, 2005). The next two largest groups were Muslim (3%) and Hindu (1%). However, membership to a certain group does not equate with religious attendance. Sixty-three percent of people said they had not been to a religious service in the past year (Office for National Statistics, 2005). Whereas Israeli families contain larger households, the average household size in the UK is 2.4 (Office for National Statistics., 2011).

One hundred and twenty-three participants were interviewed. Seventy-five of these participants (35 females) were children, ranging in age from 2.7 years to 5 years, 11 months,  $M = 4.26$ ,  $SD = .89$ . Forty-eight adults (33 females) participated ranging in age from 20 years to 62 years,  $M = 32.92$ ,  $SD = 8.15$ . Children were from both Oxford, England and Wallyford, Scotland. British children were largely recruited from university nurseries and church crèches, as well as toddler groups and college sign-up sheets. Of those recruited from nurseries, five children came from atheist backgrounds and the parents of nine children chose not to comment on their religious background. However, all children were asked to tell the experimenter something about God. All 14 of these children could mention something relevant about God, such as, “God answers prayers,” or “God lives in my heart.” The rest of the children came from families who attended church or an Anglican church-affiliated group at least once each week. Adults were from a variety of backgrounds including Protestant, Catholic, and atheist, with the majority (30) professing Protestant backgrounds.

All interviews in the UK were conducted in English. After participants completed the tasks, further questions were given to test children’s and adult’s overall intuitions about God. Only a small sample of British children was asked about these items. Many of the nurseries where the studies were conducted had specific time constraints, so if time was available children were asked these further questions. Items covered God’s omniscience, omnipresence, omnipotence, and creative power. These items with children’s responses are

included in appendix 4. Responses are broken down by sample but also by the responses by preschool children, three-year-olds, and adults (age > 17).

### **4.3.3 Further Descriptions of Participants in Chapters Five Through Eight**

When the numbers of participants differ in each empirical study—due to participant attrition (perhaps because of shyness, fatigue, or too many “I don’t know” responses)—these differences will be noted in the methods section of each chapter.

## 5 Clarifying a Theory of Non-Human Minds: A Cross-Cultural Perspective

### Study 1

#### 5.1 Study 1: Introduction

Fundamental to cognitive and social development is a child's ability to recognize that other minds exist and to be able to distinguish among different minds. Children may differentiate among human minds but do they make a distinction among humans and non-humans, such as supernatural minds? Research concerning the developmental course of children's explicit reasoning about other human minds is well documented (Astington et al., 1988; Bartsch & Wellman, 1995; Perner, 1991; Wellman, 1990). Despite an abundance of theory of mind research, only a few studies have focused on children's theories of both human and non-human minds (Barrett et al., 2003; Barrett et al., 2001; Giménez-Dasí et al., 2005; Lane et al., 2010, 2012; Makris & Pnevmatikos, 2007) and even fewer have studied children's theories of non-human minds in different cultural contexts (Knight, 2008; Knight et al., 2004).

Researchers have suggested that children may conceptualize non-human minds using *anthropomorphism*, attributing a distinctively human theory of mind to non-humans (Lane et al., 2010; Piaget, 1929). A similar viewpoint is that children's reasoning about non-human minds is *egocentric* in that not just a general human mind is attributed but specifically one's own mental states are attributed to another mind (Harris, 1991; C. N. Johnson, 1988; Makris & Pnevmatikos, 2007). A third possibility is that young children have considerable flexibility to regard different kinds of intentional agents such as animals, humans, and supernatural agents. This *preparedness* hypothesis is more nuanced in that children recognize that different minds may have different perceptual access to the world and different cognitive abilities and limitations. That is, they may reason about others' mental states based upon a

theory of mind that pertains to different types of agents: e.g., a dog would not know what writing means because dogs cannot read but a dog could know what is in a closed container because it can use its superior sense of smell to form a true belief. This preparedness hypothesis has a second component: that the default assumption is to over-attribute knowledge (and hence a mind) to other intentional agents. Instead of reasoning anthropomorphically or egocentrically, or adopting a pessimistic stance regarding non-human knowledge or perceptual access, children may tend to attribute knowledge or perception to other agents better than oneself.

Early developmental theory on children's cognition was heavily influenced by Piaget (1929) and the notion that children anthropomorphize other agents. It is possible that anthropomorphic thinking *is* how children reason until around age five. Recent research indicates that children are prone to attributing human properties (e.g., thinking, speaking) to all types of minds until they have acquired a fully representational theory of mind (Inagaki & Hatano, 2006; Kuhlmeier et al., 2004; Nye & Carlson, 1984; Rochat et al., 2004; Shtulman, 2008). Even adults seem to have a tendency to anthropomorphize non-human agents (Barrett & Keil, 1996). Anthropomorphism may be an assumption available to children, but *must* they anthropomorphize? Research to date is not clear regarding the interpretation of children's responses about the capabilities of other minds, and specifically it is unclear whether children *have* to anthropomorphize.

A recent study illustrates the ambiguities surrounding how young children reason about non-human and extraordinary minds. Lane et al. (2010) showed 3- to 6-year-old children an appearance-reality task. Children were shown two boxes with slits on the top. One was dark while the other was illuminated by a lamp that revealed a small red frog. Once children said what was inside the lit box, they were asked to look into an unlit box and report what they saw inside. After children admitted to not being able to see inside the box, the

experimenter showed the child that there was another red frog inside the box. The experimenter then asked whether various agents [e.g. two supernatural agents (Heroman—who can both fly and also see through things—and God, who was not attributed with any description), an extraordinary human (Mr. Smart, someone who knows everything), a human (Mom), and a non-human agent (a cat, who can see in the dark)] could see inside the box if they came into the room for the first time. Similar to responses that align with a preparedness hypothesis, the youngest group (age 3:1 to 4:3) attributed knowledge to all agents. Children in the middle-aged group (age 4:3 to 4:6) generally attributed ignorance to the supernatural agents (including God), except for Heroman and the cat. Children in the younger and older age groups tended to attribute correct knowledge to God and Mr. Smart (i.e., that they would know what was in the box). Interestingly, 3- and 4-year-old children also failed to apply the instruction—that he knows what would be in the box—to Mr. Smart. Children may have interpreted “a person who knows everything” as knowing, for example, book knowledge rather than being able to do something supernatural, like reading minds. This same task was replicated with a religious sample from Christian preschools (Lane et al., 2012). Results matched the previous study except that children attributed knowledge to Mr. Smart at all age groups. Perhaps acquisition of socio-cultural input impacts children’s understanding of supernatural or extraordinary minds. While children over-attribute knowledge in the youngest age group, Lane et al. (2010; 2012) concluded that there is a sensitive period sometime during four years of age where young children attribute ignorance in an anthropomorphic fashion to God.

Alternatively, but similarly, children might have been giving *egocentric* responses, using their own knowledge states or firsthand experience as their presumption about others. That is, instead of drawing upon a general human theory of mind to reason about non-humans, they may use their own (human) mental states as the default: *when in doubt, non-*

*humans think and perceive what I think and perceive.* To illustrate, Makris and Pnevmatikos (2007) used an appearance-reality and an ignorance task to test whether children would attribute more human properties to supernatural agents. In the appearance-reality task, children were shown a dark box with a slit on the top. Children could not see what was inside until a light illuminated the interior to reveal a red block inside. Children were then asked whether a human puppet and God would really know what was inside the box. Three-year-old children reported that both the human and God would know there was a red block inside the dark box; it was not until age five that children accurately attributed ignorance to the human though they continued to attribute knowledge of the box contents to God.

In the ignorance task, the experimenter showed children a closed black shoebox and did not reveal the contents of the box (Makris & Pnevmatikos, 2007). Children were asked whether they knew what was inside the box and also whether a human and God would know the contents of the box. Not knowing the contents themselves, 3- and 4-year-old children attributed ignorance to both the human and God. Makris and Pnevmatikos argued that these ignorance judgments paired with the results in the appearance-reality task were produced by an *egocentric* viewpoint: because the children were in a state of ignorance, they attributed ignorance to others as well.

Both Lane et al. (2010) and Makris and Pnevmatikos (2007) framed their studies in response to research by Barrett and colleagues (Barrett, et al., 2003; 2001; Richert & Barrett, 2005). Richert and Barrett (2005) demonstrated that before children understood what human agents would see, hear, and smell, young children could understand that an eagle would be able to see, a fox would be able to hear, and a dog would be able to smell something that a child could not. Barrett et al. (2001) also showed that children as young as 3 years could respond correctly that a cat who can see in the dark, can see inside a dark box (see Richert & Barrett, 2005, Experiment 3). Barrett et al. (2001) argued that such data reveal that even

before acquiring a representational theory of mind, around age five, children may be cognitively “prepared” to distinguish between the mental states of various types of agents, and specifically appreciate extraordinary minds before understanding human minds. That is, children need not be strictly egocentric or anthropomorphic when reasoning about non-humans. Barrett further argued that children may also use an *over-attribution heuristic* (Barrett et al., 2001). In other words, when children recognize that certain knowledge or percepts can be had, they assume that others have this knowledge or these percepts until they have reasons to the contrary. Rather than assume others know (or perceive) just what the child does or assume that others are ignorant until proven knowledgeable, children may give others the benefit of the doubt.<sup>6</sup>

For example, Barrett et al. (2001) gave children a surprising contents false belief task in which the logical contents of a labeled box had been replaced by something different. Results demonstrated that when children know the unexpected contents (e.g. rocks) of a cracker box, children younger than 4-years tend to attribute knowledge to all agents, including human, non-human, and supernatural minds. These findings have been replicated using similar tasks (Barrett et al., 2003) and in different cultures (Knight, 2008; Knight et al., 2004). Across these different tasks, however, when children “correctly” attributed knowledge or perception to God (or special animals), children themselves also had access to the same information or percept. Hence, two explanations for this pattern of responses are available: (1) children give others the “benefit of the doubt,” or (2) children responded

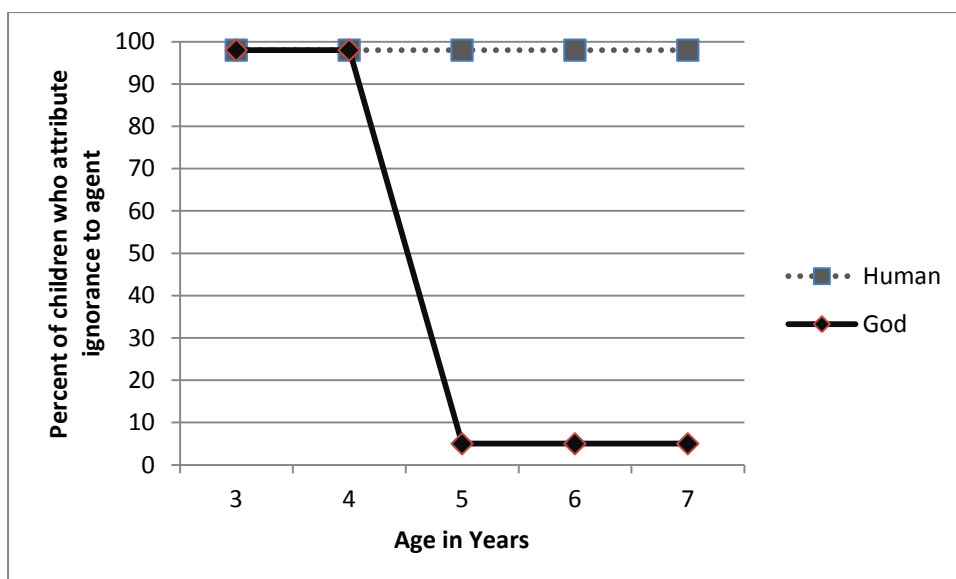
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<sup>6</sup> Such a default stance would be beneficial to children’s development. If children trust that their caregivers or people in authority know better than they do, children are likely to keep from doing certain things that might cause them harm. In a separate but related line of work, children and adults rely on the testimony from experts when determining who and what type of information to trust (Birch, Vauthier, & Bloom, 2008; Corriveau & Harris, 2009; Harris, 2007).

egocentrically and may be prone to a “curse of knowledge” bias or attributing knowledge to all agents because of the child’s own knowledge state (Birch & Bloom, 2007).

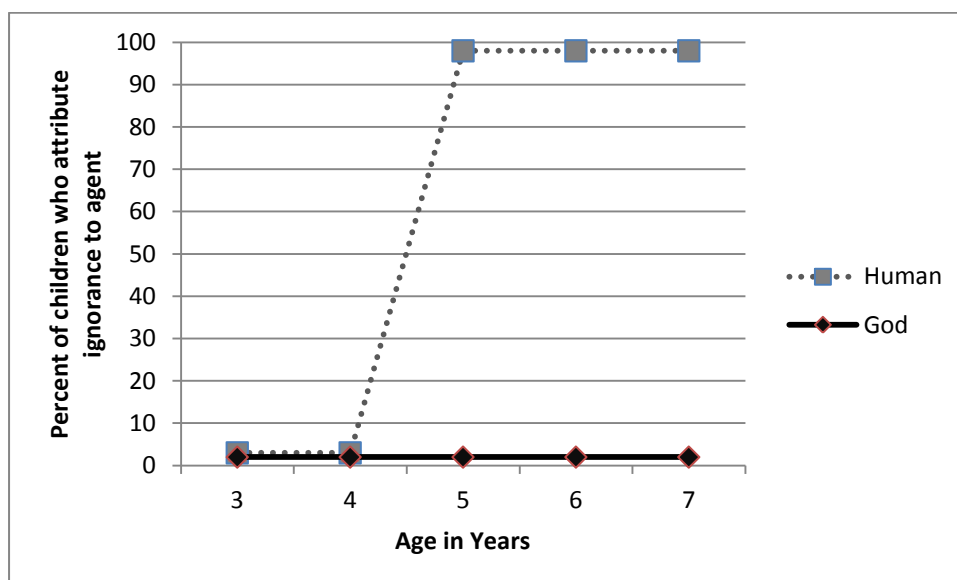
To summarize, when children reason about non-human and supernatural agents' mental states on theory of mind tasks, they may be biased to use egocentrism, anthropomorphism, or preparedness. A child using an egocentric perspective would assume that their knowledge of the box’s contents would be shared by another mind: *Since I know the contents of the box, everyone else (human or not) should know the contents of the box* and conversely, *If I do not know the contents of the box, no one else does*. If this is the predominant bias of 3-year-olds, we know they out-grow this bias by around 5-years-old when they can rightly state that others fail to know things that they themselves know. Another human-based perspective, the anthropomorphic hypothesis, emphasizes that if a child regards *other humans* as knowing (or not knowing), then the same is true for animals or supernatural agents. An anthropomorphism bias might be in place for children before and after acquiring a robust representational theory of mind. Thus, the ideal pattern of data that would support a human-based theory of mind would resemble Figure 1.

*Figure 1.* Ideal percentage of children who attribute ignorance to agents according to a human-based theory of mind (egocentrism and anthropomorphism) in an ignorance task



In contrast, the preparedness hypothesis would predict a tendency to over-attribute knowledge before children acquire a representational theory of mind. That is, unless they have a theory of another's mind that specifies otherwise, children would tend to attribute knowledge or perceptual access above the knowledge or access they have themselves: *If I do not know what is in the box, I still find it probable that at least some others do know.* In contrast to the anthropomorphic perspective, the ideal response pattern for the preparedness hypothesis emphasizes a child's ability to distinguish between different agent's minds before the acquisition of a fully representational theory of mind, around age five, see Figure 2.

*Figure 2.* Ideal percentage of children who attribute ignorance to agents according to a general based theory of mind (preparedness hypothesis).



Currently there is a lack of consensus about which approach (e.g. anthropomorphism, egocentrism, or preparedness) characterizes children's conceptualization of non-human minds. Also a scarcity of adequate cross-cultural comparisons exists to evaluate how broadly these approaches are used. In order to understand how universal or cultural an early theory of non-human minds is, research is needed to show the degree of cross-cultural similarity in developmental patterns.

### 5.1.1 The Present Study

The primary aim is to clarify the biases children have to reason about not only human minds but also non-human minds. From the studies cited in the introduction of the chapter, the pattern of results may be due to methodological differences. However, there remains the possibility that previous findings were the result of religious or cultural differences. Thus, to test whether previous findings were the result of religious/cultural or methodological differences, two important changes were made to the study by Makris and Pnevmatikos (2007).

First, children were sampled both in the UK and also in Israel. I chose a Modern Orthodox Jewish sample to avoid a religious tradition with a strong anthropomorphic focus on a deity in human form, as is the case in Christianity. I wanted to explore whether responses about God would be clearer from children who are not taught that God is also human (Jesus). Children sampled in the UK were mainly from Anglican churches and nurseries, and served as a more direct comparison with previous samples collected in Western, and historically “Christian” cultures. It could be that discrepancies in previous research were, in part, a function of different cultural frames for thinking about God. In Greek Orthodox Christianity, the backdrop for Makris and Pnevmatikos’ study (2007), the highly anthropomorphic icons of God are common-place, and at the same time, American Protestant children (Lane et al., 2012) may be confused about God’s mind unless given clear instruction distinguishing between God the Father and the human limitations of Jesus. Perhaps such differences in populations account for divergent findings and interpretations.

Second, novel agents were used in the present study, similar to Lane et al. (2010; 2012), with names that children would not easily associate with any other being. Children were introduced to Swec, a person “who has super-powers and can see through things,” and Bop, a person “just like you and me” (see appendix 1). Bop was used as a control for Swec,

as he was a novel agent but with human capabilities. These agents were introduced to further test whether children base their responses according to egocentrism, anthropomorphism, or preparedness. If children are prone to anthropomorphize, children should resist the teaching instruction and make similar predictions for the human agents and supernatural agents. Novel agents were also introduced as a way to test younger children's intuitive grasp of human and supernatural concepts. In an ignorance task, the anthropomorphism and egocentrism hypotheses would predict that young children would treat all agents as ignorant; a preparedness view would predict that young children would attribute knowledge to Swec more readily than attributing ignorance to Bop, even though Bop would be the more familiar agent ("just like you and me") and, hence, should be easier about whom to reason accurately.

The main objective was to clarify whether children draw on more human-based biases (anthropomorphism or egocentrism) or preparedness to conceptualize non-human and supernatural minds. Of interest is whether children in a tradition without a non-anthropomorphic God would make earlier distinctions between human and supernatural agents along with earlier and correct reasoning about God. I was also interested whether children would resist or consider two novel agents with explicit training of their limitation or exceptional abilities. There were two primary predictions. First, contrary to Makris and Pnevmatikos, (2007), I predicted that children younger than five years would be able to give correct ignorance responses for humans and correct knowledge responses for supernatural agents. However, I specifically predicted cultural differences in that the Israeli children would attribute knowledge to God earlier than previous work because of their understanding of a non-anthropomorphic God. Second, I predicted that before age five, children would respond to the explicit teaching instruction in the interview and attribute knowledge to Swec.

## 5.2 Methods

### 5.2.1 Participants

One hundred and forty-one children were interviewed (range = 2:5 to 5:11,  $M = 4.25$ ,  $SD = .88$ ) although 138 children completed the ignorance task. Three children did not complete the task due to shyness (one Israeli three-year-old) and two more due to being too tired (one British and one Israeli 5-year-old). Thus, a total of 138 children participated ranging in age from 2 years, 10 months to 5 years, 11 months,  $M = 4.25$ ,  $SD = .87$ . Sixty-four children (2:11 to 5:6;  $M = 4.26$ ,  $SD = .87$ ) were Modern Orthodox Jewish children from Jerusalem, Israel and 74 children (2:10 to 5:11;  $M = 4.26$ ,  $SD = .89$ ) were from the UK. Israeli children were recruited from local synagogues in Jerusalem, and all identified as Modern Orthodox Jewish. British children were recruited from nurseries, churches, and religious mom-and-toddler groups.

### 5.2.2 Materials

A small, unmarked orange box with a lid was used as a container to hold one of the unknown objects. Objects that were put inside the box were either a pen or a small, thick cardboard card used from a memory game.

### 5.2.3 Design and Procedure

Similar to Makris and Pnevmatikos (2007), children were given an ignorance task<sup>7</sup> in which they were shown an unmarked, unfamiliar box. The experimenter shook the box and asked the child if he or she knew what was inside the box. If children responded that they knew what was inside the box he or she was asked further questions (e.g., “Could you tell me

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<sup>7</sup> Several researchers have claimed that false belief tasks are not an effective way to measure theory of mind (Bloom & German, 2000; Leekam, Perner, Healey, & Sewell, 2008; Lohmann, Carpenter, & Call, 2005). These researchers believe that other tasks are simpler and that there is more to theory of mind than passing a false-belief task. Although this is not a focus of the thesis, the studies in chapter five, six, and seven provide ignorance tasks, rather than false-belief tasks, and focus on other aspects of mind (perception and memory) in an attempt to further understand children’s appreciation of the variety of cognitive abilities in a diverse grouping of other minds.

what is inside?”, “How did you come to know what was inside?”), until children admitted they did not know what was inside the box.<sup>8</sup> The experimenter then asked whether four agents, Mom, Bop, an ordinary person “just like you and me,” Swec, a person with super-powers who can see through things, and God, knew what was inside the box. For the full prompt, see appendix 1. To avoid prompting anthropomorphic thinking, no picture was given of any agent. Each agent was counterbalanced during questioning.

Design: Answers were coded as 0 for “yes” (e.g. “yes, [agent] knows what is in the box”) and a 1 for “no” responses (e.g. “no, [agent] does not know what is in the box”). Higher scores represent the attribution of ignorance and lower scores represent the attribution of knowledge. Answers for each agent (4: Mom, Bop, Swec, and God) represent the dependent variables. Age (3: 3-, 4-, and 5-year-olds) and sample (2: Israel and UK) represent the independent variables. All agents were counterbalanced so that each child received each agent in a different order.

### 5.3 Results

To test the developmental and cross-cultural pattern of responses for Mom, God, and two novel agents, the following analyses were conducted.

Logistic regression analyses were used to explore both the pattern of responses across age and whether the sample predicted the response. Both age and sample were entered as predictor variables and the response for each agent were entered as outcome variables. There were no issues of multicollinearity or outliers. The child’s culture (sample) did not predict different responses for each agent, see Figure 3 and Table 1.

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<sup>8</sup> Seven children responded that they knew what was inside the box. After further questioning, all seven children admitted they did not know what was inside the box.

Figure 3. Mean response of children who attributed ignorance to each agent by sample.

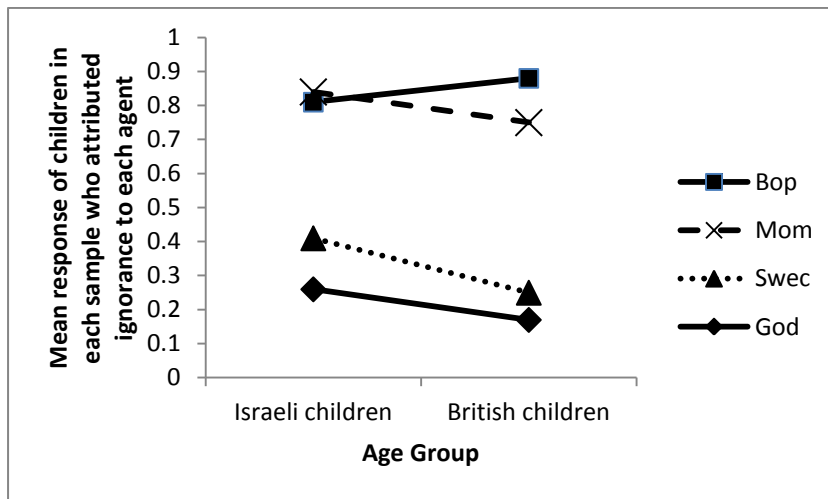


Table 1.

Percentage of Ignorance Responses For Each Agent by Sample

Sample	Agent			
	Bop %	Mom %	Swec %	God %
Israel	81	84	41	26
UK	88	75	25	17
Comparison of samples	UK = Israel	UK = Israel	UK = Israel	UK = Israel

Note. All comparisons between samples were not significant  $ps > .06$

However, age predicted “yes” or “no” responses for all agents except for Swec.

Children’s responses for Mom,  $B = 0.825$ ,  $Wald = 9.91$ ,  $p = 0.002$ ; Bop,  $B = 0.917$ ,  $Wald = 9.13$ ,  $p = 0.003$ ; and God,  $B = -0.745$ ,  $Wald = 8.26$ ,  $p = 0.004$ ; significantly differed across age groups. There were no age differences in responses regarding Swec; children at all ages attributed knowledge to Swec. As seen in Figure 4, older children attributed Mom and Bop with ignorance of the contents of the box more often than did younger children, and attributed God with knowledge more often than did younger children.

Figure 4. Mean response of children who attributed ignorance to each agent by each age group.

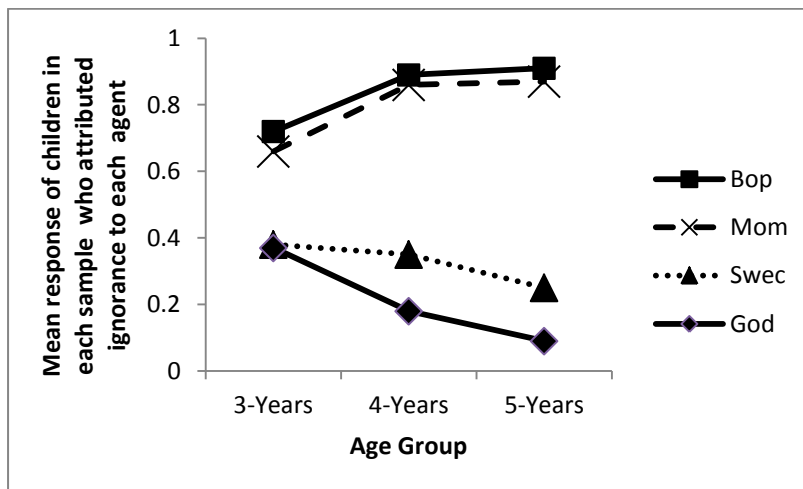


Table 2.  
Percentage of Ignorance Responses For Each Agent by Age

Age	Agent				Sign. Comparisons
	Bop %	Mom %	Swec %	God %	
3-years	72	66	38	37	Bop, Mom > Swec, God
4-years	89	86	35	18	Bop, Mom > Swec, God
5-years	91	87	25	9	Bop, Mom > Swec, God

Note. All comparisons between samples were not significant  $ps < .001$

A Wilcoxon-Signed Ranks test for matched pairs revealed significant differences among responses between the human agents (Mom and Bop) and those responses for the super agents (Swec and God). These differences were significant for children at all ages (age 3,  $z_s > 7.48$ ,  $ps < .001$ ; age 4,  $z_s > 4.32$ ,  $p < .001$ ; and age 5,  $z_s > 5.19$ ,  $ps < .001$ ), see Figure 4 and Table 2. Across all ages, children attributed Mom and Bop with *ignorance* mental states more than they did for Swec and God, whose scores tended to be lower, indicative of the attribution of knowledge. That is, each age group tended to answer that God and Swec knew what was in the container but that Mom and Bop would not. There was no significant differentiation among responses for Mom and Bop as well as responses for Swec and God across age groups.

## 5.4 Discussion

In this chapter, the primary aim was to clarify past research and identify response patterns that reflect possible theories that children may be using to conceptualize other minds; I was specifically interested in patterns across religious and cultural traditions. A secondary aim was to explore whether training children with two novel agents would aid young children in conceptualizing both human and supernatural minds, particularly with a novel supernatural agent, Swec. A discussion of the role of teaching instructions will be considered first, followed by a discussion of children's conceptualization of others' minds. Given that there were no differences across the cultural samples, possible explanations for the similarities across cultures and the reasons for discrepancies with previous research (Lane et al., 2010, 2012; Makris & Pnevmatikos, 2007) will be considered. This section will conclude with a more general discussion of the impact of these results on the general theory of how children conceptualize human and supernatural minds.

### 5.4.1 Teaching Instructions

As predicted, there were no age differences in attribution of knowledge to Swec, the fictional agent with special abilities. In fact, as illustrated in Figure 4, Israeli and British children at all ages—even 3-year-olds—differentiated between supernatural agents and human agents, contrary to previous research in which ignorance was attributed to all agents until age five (Makris & Pnevmatikos, 2007). These results suggest a few interpretations.

Notably, children resisted an egocentric response and instead attributed knowledge to Swec. Perhaps the teaching instruction for Swec was successful by impressing upon children Swec's super-perception. Given a little prompting with the teaching instruction 3-year-olds may have found it easy to attribute knowledge to Swec. This finding is in line with research by Barrett and colleagues (Barrett & Richert, 2003; Barrett, et al., 2001) that also supports the preparedness hypothesis and is consistent with its predictions that children should be able to

distinguish between agents at a young age. However, the results do not demonstrate an over-attribution bias (a second component of the preparedness hypothesis). Because the youngest children in the sample attributed Swec with knowledge, the data do not reveal any developmental shift. Perhaps sampling even younger children may reveal evidence of developmental change (i.e., from chance responding to consistent knowledge attribution to Swec).

Another possible reason that children differentiated Swec from the other agents could be that Swec's super-perceptual abilities were easier to conceptualize compared to agents with more specific and limited perceptual constraints. Lane and colleagues (2012) have suggested that children may find it easier to appreciate certain perceptual capacities over more extraordinary mental capacities. Specifically, Lane and colleagues (2010, 2012) found that children, at all ages, responded correctly for Heroman, an agent comparable to Swec in the current study. They did not, however, find that children correctly attributed knowledge to God until five years old. The differences between super-perception and super-knowing warrants further investigation and further research should explore the differences between "super-seeing" and "super-knowing."

#### **5.4.2 Cultural and Developmental Patterns**

Because Israeli children are taught about a non-anthropomorphic God, I expected Israeli children to attribute earlier correct attributions about God than the British sample. However, there were no sample differences. Moreover, by age three, both Israeli and British children gave correct responses for all agents. Lane and colleagues (2012) suggest that socio-cultural input influences children's grasp of supernatural minds. Both samples provided evidence that children had some understanding of who God is, and thus, their responses may reflect certain socio-cultural input (Lane et al., 2012). All Israeli children were Modern Orthodox Jewish who could give an accurate description of God, such as that God is

everywhere, that he knows everything, etc. Additionally, almost half of the British children who participated ( $N = 40$ ) were randomly selected to answer various questions about God following these theory of mind tasks. Over 90% of all randomly selected British children ( $n = 37$ ) said that God would know everything and when asked about God's location, 78% of children ( $n = 31$ ) gave an appropriate response (i.e., that God was everywhere, in Heaven, in his/her heart), whereas 22% were not sure where God was ( $n = 9$ ). Given these responses, I was confident that the majority of children in the present study recognized that God was not merely the name of an ordinary human.

Still, Israeli and British children's responses for all agents were markedly different from Greek Orthodox children in the study by Makris and Pnevmatikos (2007). One possible difference could be that some of the Greek children did not have a conception of a God that is super-knowing. Along the same lines, although their sample was Greek Orthodox children, there was no indication of how familiar the Greek children were with God. Makris and Pnevmatikos (2007) indicated that the children included in the analyses were only those children who knew who God was. Their article does not provide additional data on children's descriptions of God and whether they could provide any description beyond affirming or denying whether they knew who God was. Cultural differences relating to children's clarity regarding to whom "God" refers and God's properties may have led to differences between these results and Makris and Pnevmatikos (2007), but did not contribute to discernible differences between British and Israeli samples.

However, because there were no cultural differences, a more plausible reason why the results of the present study differed from the study by Makris and Pnevmatikos (2007) is methodological differences. Makris and Pnevmatikos (2007) only asked children about two agents: a human agent and God. Instead of using just a human agent (Mom) and God, the present study used Bop, a person just like you and me, and Swec, a person that can see

through things. As results demonstrate, there were no age differences for children's responses regarding Swec. These results suggest that very young children acquired a concept of Swec and attributed correct knowledge to him significantly above chance. Providing the context for the type of mind in question (telling children that Swec can see through things) may have helped children to acquire an understanding of the mental capabilities of Swec. And, according to a preparedness hypothesis, children would find Swec's super-perception an easy characteristic to understand.

### 5.4.3 Children's Response Patterns

As in previous studies (Barrett et al., 2003), children younger than five demonstrated an ability to attribute knowledge to God and to distinguish among different human and supernatural minds, making clear that children of this age need not use a human-based theory of mind bias. Unlike children who have participated in similar ignorance tasks (Lane et al., 2010; Makris & Pnevmatikos, 2007), young children in the present study did not use egocentrism or strict anthropomorphism to distinguish between different types of minds. So, what theories are children applying?

If children before age five (or before acquiring a representational theory of mind) do anthropomorphize, I would predict that, as with humans, *all* agents would be ignorant of what was inside the box. Likewise, children—who are ignorant themselves—would apply ignorance to all agents if applying egocentrism. Given that children in both samples attributed knowledge to supernatural agents and attributed ignorance to the human agents, I conclude that children were not conceptualizing non-human minds from a human-based approach (e.g., an anthropomorphic or an egocentric approach). I maintain that even before success with standard false-belief tasks, children are able to use a general theory of mind (rather than a human-based theory of mind) for different agents, and can appreciate supernatural minds without anthropomorphizing. Though children may resort to egocentric

simulation or theory-based anthropomorphism, they need not. A *general theory of mind* (based on a preparedness hypothesis) has broad parameters, erring on the side of over attribution of perception and knowledge, and is developmentally tailored to the properties of specific minds, be they human, non-human, or supernatural. The youngest children did not default to over-attributing knowledge, but did distinguish among supernatural and human agents. Responses from a younger sample may reveal further biases in children's understanding of supernatural minds.

In order to successfully attribute knowledge to Swec and God, children must override their own perspective—their own ignorance (Makris & Pnevmatikos, 2007) or the reality of the situation (Lane et al, 2010; 2012)—to attribute knowledge. In other words, children must represent that another knows something, even when this something is unknown to the child. Even though this task presents these potential representational difficulties for three-year-olds, they still successfully attributed knowledge to God and to Swec. Because 3-year-olds reasoned about Swec and God differently from chance, young children do not appear to be bound to reason anthropomorphically. And, as the children attributed knowledge to Swec while in a state of ignorance, they were also not reasoning egocentrically. That is, children could accommodate instruction about a super-perceiving novel agent and draw correct inferences even when faced with their own ignorance as a model. This finding may suggest that super abilities are easier for children to reason about (as argued by Barrett & Richert, 2003), but could also suggest that children are not terribly egocentric (contra Makris & Pnevmatikos, 2007) or “cursed” by their own knowledge state (Birch, 2005). Furthermore, roughly one-fourth of the sample (31 children out of 138) attributed knowledge to Mom. Twenty-seven of these children (mostly 3-year-olds,  $n = 17$ ) also attributed knowledge to God and Swec. Interestingly, young children over-attributed knowledge when they were ignorant themselves. This result speaks to a bias or default assumption to give other minds

the benefit of the doubt unless salient reasons exist to suppose restricted knowledge or perception.

Unlike Lane and colleagues (2010; 2012), the 4-year-olds in this sample attributed correct knowledge states to God and Swec and attributed correct ignorance states to Bop and Mom. Lane et al (2010; 2012) found that there might be a sensitive period (between age 4 and 4.5 years) where children attribute ignorance to God. The results could be explained in a few ways. Perhaps the children in Lane et al (2010; 2012) were confused about the teaching they had heard about God and whether he is a man (Jesus) or supernatural agent. However, because children from Lane et al (2012) were from religious preschools, this option may not be plausible. Second, it could be that children younger than 4 years over-attribute knowledge to all agents. Then, at age four, the default assumption changes to an anthropomorphism bias as children begin to deliberate between knowledge and ignorance as they are taught about God and also as they figure out the limitations of humans. Although Israeli and British children were not densely sampled between 4 and 4.5 years, children in this age group ( $n = 39$ ) responded above chance that God would be knowledgeable. In these samples, such a transitional period was not found.

If children, particularly 3- and 4-year-olds, anthropomorphize other agents or reason egocentrically, I would expect a close correspondence between their answers for humans and those for non-humans. No such a correspondence was found. In the Ignorance Task, answers regarding Mom were not significantly different from Bop, and answers regarding God were not significantly different from Swec. In addition, both responses for Mom and Bop significantly differed from responses for Swec and God. That is, children appeared to have one conceptual frame for reasoning about Mom and Bop, both human agents, and a different one for God and Swec, both supernatural agents. The data suggest that young children can

distinguish among agents at a young age and reason differently among them, challenging the claims that children *must* anthropomorphize or are necessarily egocentric.

I propose that it is easier for children to assume knowledge in cases of ignorance rather than to assume ignorance. That is, when children do not know what another agent would think, children may over-attribute knowledge as a default: “When in doubt, assume that another agent knows, sees, hears, etc.” It may be computationally simpler and an instance of error-management to assume that others know until having salient reasons to think otherwise (McKay & Dennett, 2009).

This early developing bias to over-attribute may be adaptive in that children are readily prepared to assume that others know better than they do and so children are receptive to testimony and instruction from parents and caregivers, assuming they have more knowledge or that they know best (Harris, 2007; Koenig, Clement, & Harris, 2004; Mills, Legare, Grant, & Landrum, 2011). Adults may also be prepared to over-attribute knowledge to new minds they come across. Indeed, it is more adaptive to assume that a fierce predator or hypothetical foreign intruder may have better knowledge or power than we ourselves do, so that we can better prepare ourselves for the encounter and do not underestimate the opponent.

Though the results prompt further explanation and clarification to how children cross-culturally and cross-religiously conceptualize non-human minds, I recognize the limitations of the present study. The data suggest that the youngest children could distinguish between agents. An unfortunate gap in the data is that I used forced choice responses that reveal that young children can reason and they do so very young, but not also *why* children and adults responded the way that they did. These additional justifications would provide supplementary and qualitative feedback of how the child was reasoning. These responses

may further indicate whether the child was guessing or whether a perceptual or mental feature was the key to attributing a knowledge or ignorance mental state.

#### **5.4.4 Conclusion**

In summary, the present studies advance theory of mind research by contributing a valuable cross-cultural comparison using ignorance tasks and featuring several different types of agents. The present results demonstrate that young children may be prepared to draw non-anthropomorphic inferences about supernatural minds at an earlier age than was once thought. Even 3- and 4-year-olds do not have to answer egocentrically or anthropomorphically when considering supernatural minds. Further, by default children appear prepared to attribute knowledge instead of ignorance. This default may be adaptive for children and perhaps even adults. This ability to reason differentially about types of minds together with a tendency to give the benefit of the doubt to others combines to make ideas of super-knowing gods relatively easy for children to acquire and use. Indeed, children in this study answered accurately (and more adult-like) regarding all agents. In a sense, children's theory of mind may be prepared to reason about many different types of minds.

## **6 Understanding Individual and Situational Constraints: British and Israeli Children's Understanding of How Perception Changes With Age**

### **Study 2**

#### **6.1 Study 2: Introduction**

A central feature of theory of mind achievement is the capability to understand that another's thoughts, desires, feelings, and percepts can be different from one's own (Astington et al., 1988; Gopnik et al., 1999; Perner, 1991; Wellman, 1990). A small area in the theory of mind literature has focused on children's understanding of non-human perception (Barrett et al., 2001; Lane et al., 2010, 2012; Richert & Barrett, 2005), that is, the ability for children to understand what a non-human animal or God sees, hears, smells, touches, and tastes that may be different from human perception. Perception is critical to knowledge, such that a failure to perceive properly may lead to a failure in knowing. Both situation-specific and individual constraints bear on perception and hence knowledge. Situation-specific constraints affect knowledge acquisition in a particular setting. For example, in order to understand the perspective of another and whether another has acquired knowledge, certain situation-specific constraints should be taken into account such as proximity, signal intensity, and competing or occluded stimuli. These situation-specific constraints are common in everyday activities, such as when trying to see something far off in the distance or not being able to hear a whispered conversation between two people. Additionally, certain individual constraints need to be considered when making judgments about the knowledge stance of another, such as individual visual acuity, hearing sensitivity, and age. For example, one might take the deterioration of hearing often associated with old age into consideration and speak loudly to compensate. These kinds of experiences give children opportunity to understand perceptual ability as it relates to situation-specific factors (proximity to a source) or individual

constraints. In this chapter, I explore Israeli and British children's understanding of certain situation-specific and individual constraints related to audio and visual perception of human, non-human (animals), and supernatural minds as well as what biases young children adhere to when discriminating among these different entities.

Most research to date has focused on situation-specific constraints, or what type of perceptual or perspective-taking experiences will influence knowledge (Chandler et al., 1989; Oneill, Astington, & Flavell, 1992; Pillow, 1989; Wellman et al., 2001; Wimmer & Perner, 1983). However, research on individual constraints is limited (Brosseau-Liard & Birch, 2010, 2011; Dowker et al., 1994; Farmer & Dowker, 1995; S. A. Miller, 2000; Taylor et al., 1991) and in need of further research. Taking both types of factors into consideration when trying to understand the pattern of children's responses is important, as it may reveal another layer of how children come to represent other minds.

In addition to children's understanding of individual and situation-specific constraints, and as detailed in chapters three and five, researchers also disagree as to how and when children learn to conceptualize and discriminate generally among human, non-human, and supernatural minds (Barrett et al., 2003; Knight et al., 2004; Lane et al., 2010, 2012). As noted previously, there are three accounts that are used to interpret children's pattern of responses for non-human minds: anthropomorphism, egocentrism, and preparedness.

In this chapter, these approaches are again applied to examine children's understanding of other minds when taking into account situation-specific constraints of perceptual access and individual constraints and capabilities related to perception. Perception is an important consideration as it is one type of knowledge acquisition and furthers theory of mind research by examining children's understanding of another cognitive ability: perception. Lane and colleagues (2012) have suggested that children may find it easier to appreciate perceptual capacities such as x-ray vision, even over more extraordinary mental

capacities, such as omniscience.<sup>9</sup> Children's early understanding of perception may provide a distinctive cognitive context to further investigate children's understanding of theory of mind and individual constraints in humans, non-humans, and extraordinary minds. By examining perception (and memory in chapter seven), this thesis extends theory of mind work by providing additional research on children's understanding of other cognitive abilities and individual constraints.

### **6.1.1 Children's Understanding of Perceptual Access**

The majority of work on perceptual perspective-taking has focused on visual perception. Perner (1991) argues that in order to have a representational theory of mind, children must be able to understand the causal connection between perceptual access and knowledge. Although children younger than four or five years do not have a fully representational theory of mind—or are unable to vocalize the differences between their own beliefs and others—visual perception research has shown that very young children may have a rudimentary understanding of theory of perception and can accomplish simple visual perspective-taking tasks (Yaniv & Shatz, 1988). Children as young as 2½ years of age can hide an object behind an occluder and can bear in mind whether another observer would be able to see the object or not (Flavell, Shipstead, & Croft, 1978). In addition, at 3 years of age, children realize that visual orientation of objects is important to understanding what perspective another person can see from their vantage point (Flavell, et al., 1978; Masangkay et al., 1974). By 4½ years of age children understand that a certain amount of close distance is necessary in order to perceive a stimulus (Flavell, Flavell, Green, & Wilcox, 1980; Pillow

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<sup>9</sup> Lane and colleagues (2012) suggest that exposure to media about super-heroes and other extraordinary agents may influence children's readiness to reason about these types of agents. Some researchers suggest that supernatural agents are compelling and appear early in development because of certain counterintuitive properties, such as reading minds, flying, or having x-ray vision. While minimal counterintuitive concepts are certainly relevant, this chapter does not have the space to fully discuss these ideas. For further discussion, please consult: Boyer (2001) and Boyer and Ramble (2001) .

& Flavell, 1986; Yaniv & Shatz, 1988). At 5 years of age, children finally understand that an object seen by two people may have a different appearance depending on their distance or where they sit (Flavell, Everett, Croft, & Flavell, 1981). This developmental achievement at 5 years of age indicates that by this time, children seem to have developed a consistent theory of visual perspective-taking and can understand differences in visual perspective-taking.

Though there has been substantial research regarding children's knowledge about other's visual experience, less is known about their understanding of the auditory modality. Only a few studies have addressed representational theory of mind as it relates to audition (Mossler, Marvin, & Greenberg, 1976; Richert & Barrett, 2005; Yaniv & Shatz, 1988). Similar to the studies in theory of mind and visual perception, these initial studies have shown that when predicting the auditory perspective of others, 3- to 5-year-old children consider proximity of the sound, (Yaniv & Shatz, 1988) and four-year-olds consider auditory access, or being able to differentiate among individuals who have or have not had access to auditory information (Mossler et al., 1976). Children also take different minds into account. In one study, children as young as three years of age recognized that an animal, such as a fox, and a supernatural mind (God), would be able to hear a very quiet stimulus that children could not hear themselves (Richert & Barrett, 2005). However, these same children were at chance when responding whether human agents would be able to hear the same stimulus. In conclusion, further understanding of children's conception of the auditory modality is needed in order to understand how children come to acquire knowledge via other modes of perception.

### **6.1.2 Understanding Perceptual Access in Relation to Individual Variables**

As noted above, focusing on how perception is understood may be a fruitful component for exploring children's understanding of theory of mind and how others acquire knowledge. Understanding another's perceptual experience is complex as there are both

situation-specific and individual constraints that influence an individual's perceptual acuity. One example, and the focus of this chapter, is the relationship between aging and perceptual abilities. In most individuals, visual and auditory perception becomes frail with age. For a child to understand why his grandmother does not know what is in the candy jar, he may have to consider situation-specific constraints such as the possibility that his grandmother's line of sight is occluded by something in front of the candy jar but also may have to appreciate the individual constraint of grandma's diminished visual acuity. Acquiring this knowledge is important for fluid interaction with individuals who differ in their visual and auditory perception, such as the very young, the elderly, or disabled persons. Children may need to learn to adjust their speaking volume or visual access in order to engage with disadvantaged perceivers. Although children as young as 4 ½ years old may understand that distance and occlusion make perceiving a stimulus difficult, when do they understand that individual constraints, such as age-related ability, are important as well?

By age three, children have an idea that growth and aging is unidirectional (Rosengren, Gelman, Kalish, & McCormick, 1991), that certain psychological traits remain the same and others change (Heyman & Gelman, 2000), and by age four, children have some understanding that knowledge increases with age and through learning (Taylor, Esbensen, & Bennet, 1994). Young preschool-aged children may have the cognitive tools necessary to be able to reason about perceptual constraints but few studies have investigated whether children understand age-related perceptual differences. Three-year-olds modify their speech when talking to younger children (Sachs & Devin, 1976; Shatz & Gelman, 1973; Tomasello & Mannle, 1985) and they understand that adults would know certain types of knowledge over babies (Farmer, 1995; Taylor et al., 1991). However, when given the choice, 3-year-olds base their attribution of knowledge on situation-specific constraints rather than using the age

of the person (adult versus child) as a factor for attributing greater knowledge (Pillow & Weed, 1997).

To my knowledge, only two studies have focused on children's understanding of theory of mind in relation to age (Farmer & Dowker, 1995; Taylor et al., 1991). In one study (Farmer & Dowker, 1995), preschool children aged 3- to 5-years-old watched three different versions of a traditional Sally-Ann task (taken from Wimmer & Perner, 1983). In each version two dolls looked at two boxes. One doll took a tea-cup out of one of the boxes. The second doll left the room while the first doll hid the tea-cup in the other "wrong" box. The doll returned and participants were asked where the second doll would look for the tea cup. In each version the age of the doll that leaves the room varied: 1) a doll of the same age as the child, 2) a baby doll, and 3) an adult male doll. Results revealed that children of all age groups were more likely to attribute false beliefs to the baby than to a peer, and more likely a peer than to an adult. Farmer and Dowker (1995) concluded that children's understanding of age differences emerges early, perhaps earlier than a fully developed representational theory of mind. Such a conclusion was supported by Farmer and Dowker's interpretation of children's justifications for their responses; children often commented explicitly on the age of the agent. Taylor and colleagues (1991) asked children to participate in a similar theory-of-mind task and reason about a baby, child, and adult, but children only responded correctly after four years of age.<sup>10</sup> Thus, these data reveal that children may have some expectations concerning the abilities and constraints of particular individuals, even before they have a mature or adult-like understanding of other minds.

In addition to the limited research examining children's understanding of age as an individual constraint, little research has investigated children's understanding of agents with

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<sup>10</sup> However, Taylor et al. (1991) did not recruit three-year-olds.

exceptional abilities. Examining children's understanding of such abilities provides further exploration of how children not only understand the constraints of other minds, but also how they represent the exceptional abilities of other minds. In other words, examining children's understanding of exceptional abilities provides an opportunity to examine the extent to which children adjust their responses for an agent's knowledge based on the lack of individual constraints of the agent. Four studies to date have investigated children's understanding of perception with human and extraordinary agents (Barrett et al., 2001; Lane et al., 2010, 2012; Richert & Barrett, 2005). In these studies, children as young as three (Barrett, Richert, & Driesenga, 2001; Richert & Barrett, 2005) and four years (Lane et al., 2010; 2012) recognize that agents with extraordinary perceptual skills (a super-seeing cat or a super-hero) can perceive a stimulus in the dark.

In one particular study, Richert and Barrett (2005) asked 3- to 7-year-old children about three sensory modalities: seeing, hearing, and smelling. They designed a perspective-taking task that occluded either sight, sound, or smell of the stimulus (e.g. a tape player that played almost inaudible music, or a piece of paper so far that the child could not see what was on it). When children acknowledged they could not see, smell, or hear, depending on the sensory condition, children were allowed to see, smell, or hear the stimulus. Afterwards they were asked whether two human agents, an animal with an extraordinary sense (e.g., a fox with special ears, or a dog with a good nose), and God would perceive the stimulus. The two youngest groups of children attributed knowledge states to the exceptional agents (e.g., the special animal and God) above chance but did not respond different from chance for the human agents. The older children significantly differentiated among agents and attributed knowledge to the special animals and God and ignorance to the human agents and non-special animals.

In these experiments, children differentiated the minds of the exceptional agents from human agents, supporting the preparedness hypothesis. These results also suggest that even young children can successfully attribute exceptional perceptual abilities to special animals and to God. Agent concepts may be flexible enough that children accommodate nonhuman properties easily. As stated above, only the older group of children responded differently from chance that humans would be unable to perceive the stimulus. The lack of consistent responses for the human agents may be due to confusion about the specific individual constraints of these two agents. It is possible that children responded differently to the human agents as a direct result of their own personal experience with these agents in their own lives; perhaps a child's friend or mother has glasses or a hearing aid, or perhaps the child's friend is too young, and his or her mother is very old. Individual constraints may play a necessary role in children's conceptualizations of other minds.

### **6.1.3 The Present Study**

In order to investigate preschool children's understanding of individual and situation-specific constraints when thinking of other types of minds, I sampled both religious Modern Orthodox Israeli children and secular and religious British children. Previous research focusing on children's understanding of extraordinary and supernatural minds has largely focused on children from Christian cultures which may account for divergent findings and interpretations of children's reasoning strategies (Barrett et al., 2001; Lane et al., 2010, 2012; Richert & Barrett, 2005). Thus, I sampled secular and religious children in the UK for the sake of more direct comparison with previous samples collected in historically "Christian" cultures. Additionally, I sampled a Modern Orthodox Jewish sample to test children from a religious tradition with distinctly different views of God's physical form. Jewish children are taught that God is a non-anthropomorphic deity. Specifically, Jewish children are taught that God has no bodily form whereas in Christian societies, children are taught that Jesus is the

human form of God. This instruction may make it difficult for children in predominantly Christian societies to distinguish between an almighty God and the humanly limited Jesus.

Children participated in two perceptual ignorance tasks: a visual task where children had to look at a stimulus (a paper with an inconspicuous pencil drawing of a flower) some distance away and also an auditory task where children listened to a radio playing very soft music. Richert and Barrett (2005) asked children to respond about each agent after they let children view, hear, or smell the (previously) unknown stimulus, making them aware of the stimulus. Unlike Richert and Barrett (2005), children in this study did not view or hear the stimulus before being asked the questions about the other agents to ensure that this task would be an ignorance task (and not a false belief task). Similar to Richert and Barrett (2005), I asked children to predict the perspective of five agents: two human agents, their mother and a friend, God, and two special animals, a dog that can hear really well but has terrible eyes and an eagle with excellent eyes but terrible ears. God was included because despite cultural differences in the physical or biological nature of God, the theologies in Christianity and Judaism regard God as all-powerful and knowledgeable (and thus, probably knows the picture on the wall or what music is playing). By testing children with other agents possessing contrasting perceptual constraints and abilities, I hoped to explore how children take into consideration the individual (constraints and ability) and situation-specific (proximity and perceptual accessibility) constraints in predictive perceptual perspective taking. The present study included four predictions:

First, if the preparedness hypothesis is correct, I predicted that there would be more correct knowledge responses than ignorance responses for the special animals. That is, if the younger children have more flexibility in reasoning about different agents and/or are biased toward full perceptual access (preparedness hypothesis), then they should readily incorporate the teaching about the special animals and accurately attribute them greater perceptual access

than humans. In contrast, if children before age five are unable to understand that others can have different perceptual abilities than their own (egocentrism) or that non-humans have different perceptual capacities than humans (anthropomorphism), they will be unable to incorporate the teaching instruction that another mind has different, non-human perceptual abilities. The special agents represent super-perceiving agents but do not represent agents with a cultural narrative attached to them. Thus, cultural context should not influence reasoning about the special animals.

Second, I wanted to test whether children's understanding of perceptual knowledge differed by sample. There could be several lines of prediction for populations: First, regardless of population, if children are prone to anthropomorphize or use egocentrism (more human-based theories), children should treat God and the special animals as human, and attribute ignorance. A preparedness bias would suggest that children are prepared with the cognitive tools to think about different kinds of agents' minds differently. Additionally this bias predicts that children in both samples should attribute knowledge (perceptual acuity) to the special animals and God before they have developed a fully representational theory of mind at 5 years of age. Second and along a different line, the preparedness bias is not immune to the influence of cultural knowledge. If cultural input influences response, British children may be more likely to attribute ignorance to God than the Israeli children, as a result of their exposure to Jesus, who presumably is conceptualized as having human-like perceptual limitations. Israeli children, who do not have this same cultural experience, would be less likely to follow this same pattern. In other words, this cultural knowledge of knowing Jesus is God in human form may influence British children to think anthropomorphically about God. However, because study 1 (chapter five) found no differences among populations, suggesting no cultural differences, predictions will align with the results from chapter five: I predicted that there would be no differences among populations and children

would attribute correct knowledge (perceptual acuity) to the special animals and God and ignorance (inability to perceive) to the human agents.

Third, I wanted to test whether children's understanding of perceptual knowledge differed by children's age. Like Richert and Barrett (2005), I predicted no differences in responses for God and the special animals. However, I predicted that children's responses would be at chance for human agents until age four or five years, or that responses would show no discernible pattern. Because the children would be in a state of ignorance (or perhaps are still developing an understanding of human limitation), they would be unsure regarding what another human might know. Thus, the pattern of responses would be at chance, with no definitive pattern of knowledge or ignorance responses. Note that this chance level responding is still consistent with the preparedness hypothesis as this hypothesis suggests that extraordinary mental capacities are easier to conceptualize than more limited and constrained (human) minds. This is importantly different from the egocentrism and anthropomorphism hypotheses that would predict that children would attribute ignorance to all agents.

Fourth, I also tested children's understanding of individual constraints. After completing each task, children were asked whether their Best Friend, Mom, and God "get older." This was added as a check to see whether children believed that these agents age. If children said "yes," I then asked, "Do you think when [agent] is older that he/she will be able to see the picture/hear the radio?" If children said "no," I asked, "many, many years from now, do you think [agent] will be able to see the picture/hear the radio?" I predicted this added step in perspective taking (reasoning about age) would require a developed representational theory of mind and only the older children would provide accurate responses (that Mom and Best Friend would likely not be able to see/hear the stimulus when older, and God and the special animals would be able to see/hear the stimulus). Since previous research

suggests 4-year-olds understand that adults would understand a specific type of knowledge over babies (Taylor et al., 1991), I predicted that between four and five years, children appreciate age as a constraint in human perspective taking. I also predicted, similar to results in study 1 (chapter five) that children of all ages would respond that God could see and hear regardless if he aged or stayed the same.

To summarize, I made four predictions: (1) that children would attribute more knowledge responses over ignorance responses to the special animals, demonstrating a preparedness bias rather than an anthropomorphic or egocentric bias; (2) that children in both samples would attribute correct knowledge to the special agents and ignorance to the human agents; (3) that there would be no age differences for responses regarding God and the special animals but the accuracy of responses for the human agents would improve with age; and (4) that older preschoolers would make more correct judgments about perceptual acuity for the human agents as constrained by age than younger preschoolers, but that there would be no differences in responses for God among all age groups.

## **6.2 Methods**

### **6.2.1 Participants**

The entire sample consisted of 141 children. Sixty-six children (2:10 to 5:6;  $M = 4.26$ ,  $SD = .87$ ) were Modern Orthodox Jewish children from Jerusalem, Israel, and 75 children were from the UK (2:7 to 5:11;  $M = 4.26$ ,  $SD = .89$ ). These children were the same children as study 1. Only 135 participants completed the task. Four 3-year-olds (two Israeli and two British) and two 4-year-olds (one British and one Israeli) were excluded because they were not able to sustain focus to answer the questions.

### **6.2.2 Materials**

Two stuffed toys, a plush bald eagle and a plush dog, were used as the animal agents. For the visual task, an A4 white piece of paper with a faintly drawn picture of a flower in the

center of the paper was used. A small battery-operated hand-held radio was used for the auditory task.

### **6.2.3 Procedure**

Children were interviewed individually. Agents and sensory tasks were counterbalanced during questioning. Before beginning the tasks children were asked to describe God and to tell the experimenter who God is. This description helped the experimenter know whether or not the child had heard of God previously. Five British children came from atheist backgrounds and the parents of nine children chose not to comment on their religious background. All 14 children could mention something relevant about God, such as, “God answers prayers,” or “God lives in my heart.” Most children were from families who affiliated themselves with the Church of England. Nevertheless, all children were asked to tell the experimenter something about God to ensure that they knew the referent of “God.” All Israeli children were from the Modern Orthodox community and mentioned something relevant to God: “God is everywhere,” or “God knows everything.”

***Audition Task.*** Children were shown a small radio. Children watched as the experimenter held the radio and turned the radio on. No sound was audible. Participants were asked if they could hear music. If they said “yes,” further questions were asked until children admitted they could not hear any music. In order to test which reasoning bias children use, it was essential that children acknowledged that they were ignorant. The task proceeded when the answer was “no.” Next, the experimenter placed the plush eagle and dog next to the child. At the beginning of the task, children were instructed that, “the eagle had good eyes and can see really far but does not have good ears and cannot hear well,” and that “the dog has good ears and can hear really well but does not have good eyes and cannot see very far.” Children were then asked, “Do you think [agent] can hear the music?” The experimenter asked children to reason about an eagle, dog, Mom, a friend, and God in

counterbalanced order. Following their response children were also asked whether Mom, their friend, and God “got older.” Regardless of children’s “yes or “no” responses, children were further asked if Mom, their friend, or God would be able to see the picture many, many years from now, see appendix 2 for further details. The aging questions applied only to the human agents and God. Prior research suggests that young children (age < 5 years) may not understand the mortality of human beings and the immortality of God (Giménez-Dasí et al., 2005), so exploring children’s specific understanding of growth and age was important. Children were not asked to consider the aging of animals, as communication or relating to an old or very young animal is not likely to be as necessary or salient as it would be to relate to a baby or older person.

***Vision Task.*** Each child watched while an experimenter put up a picture on a far wall. The experimenter told the child that he or she had drawn something on the piece of paper and asked the child whether he or she could see the picture. If the child said “yes,” further questions were asked until she or he admitted not seeing the picture. The task proceeded if the answer was “no.” Next, the experimenter placed a stuffed eagle and dog next to the participant. Children were asked, “Do you think [agent] can see the picture?” Children were asked to reason about the same agents: an eagle, dog, Mom, a friend, and God. Following their response children were also asked whether Mom, their friend, and God “got older.” Regardless of children’s “yes or “no” responses, children were further asked if Mom, their friend, or God would be able to see the picture many, many years from now. See appendix 2 for further details.

### 6.3 Results

Three age groups were created. Twenty-two Israeli children (range = 2 years 11 months to 3 years 11 months;  $M = 3.27$ ,  $SD = .32$ ) and 26 British children (range = 2 years 7 months to 3 years 10 months;  $M = 3.38$ ,  $SD = .32$ ) comprised the younger group of three-

year-olds, a total of 48 children. Seventeen Israeli children (range = 4 years 0 months to 4 years 10 months;  $M = 4.11$ ,  $SD = .27$ ) and 22 British children (range 4 years 0 months to 4 years 11 months;  $M = 4.4$ ,  $SD = .29$ ) comprised the middle group of four-year-olds, a total of 39 children. The oldest group were 5-year-old children comprised of 27 Israeli children (range = 5 years 0 months to 6 years 0 months;  $M = 5.27$ ,  $SD = .34$ ) and 21 British children (range = 5 years 0 months to 5 years 11 months;  $M = 5.41$ ,  $SD = .31$ ), a total of 48 children.

### **6.3.1 Egocentric/Anthropomorphic vs Preparedness Strategy Using the Special Animals**

Initial analyses were conducted to explore the first prediction: whether children attributed knowledge more often than ignorance by testing children's responses for the special animals. A score of 1 was given if the child responded correctly for each agent regarding their ability or lack thereof. Thus, calculated total scores could range from 0 to 4. A score of 4 correctly indicated that the eagle could see (+1) though the dog could not (+1) and that the dog could hear (+1) though the eagle could not (+1). Conversely, a child who received a score of 0 would have given the opposite responses, indicating that the eagle could not see (+0) though the dog could (+0) and that the dog could hear (+0) though the eagle could not (+0). A score of 2 indicates that children were correct on 2 of four correct responses for the two animals and also incorrect for 2 other responses.

In total, 58% ( $n = 38$ ) of Israeli children and 82% ( $n = 57$ ) of British children attributed correct knowledge and ignorance to both special animals, receiving the maximum score of 4. An independent samples t-test demonstrated differences across samples,  $t(133) = 7.95$ ,  $p = .006$ . One-sample t-tests within each sample for each age group against a test value of 2 showed that children's scores were significantly more accurate than would be expected by chance,  $ts > 6.63$ ,  $p < .001$ , see Table 3. Even the scores from Israeli and British three-

year-olds demonstrated more correct attributions more often than incorrect attributions,  $t(21) = 3.31, p = .003$ , and  $t(25) = 6.16, p < .001$ , respectively.

Table 3.

*Total Attribution of Knowledge Score (4 out of 4) for Special Animals*

Special Animal Score			
	Sample	M	SD
Age 3	British (n = 26)	3.08*	.89
	Israeli (n = 22)	2.64*	.90
Age 4	British (n = 22)	3.23*	.92
	Israeli (n = 17)	2.94*	.89
Age 5	British (n = 21)	3.57*	.81
	Israeli (n = 27)	3.37*	.79

Note. \* $p < .05$

### 6.3.2 Perceptual Understanding Across Children's Age and Sample

The second and third predictions were examined by exploring age and sample differences in children's responses about perceptual acuity across all the agents. Responses were coded as 1 if the child responded that the agent in question could perceive the stimulus and coded as 0 if the child responded that the agent could not perceive the stimulus. A score of 2 indicated that a child responded that the agent could both see and hear the stimulus. A score of 0 indicated that a child responded that the agent could not see or hear the stimulus. This reverse coding (as compared to chapter 5) better reflects whether perception increases or decreases with age. A repeated measures ANOVA with each agent (4: Special animal, Best Friend, Mom, and God) as the within-subject factor and Age (3: 3-, 4-, and 5-year-olds) and Sample (2: Israel and UK) as the between-subject factors was conducted to measure children's attributions of knowledge. The assumption of sphericity was violated, so values using the Greenhouse-Geisser have been reported. This test revealed a significant main effect

for agent,  $F(2.74, 345.52) = 76.85, p < .0001, \eta_p^2 = .38$ , Greenhouse-Geisser adjusted.

Analyses also revealed significant two-way interactions of agent and age,  $F(5.48, 345.52) = 10.40, p < .0001, \eta_p^2 = .14$ , Greenhouse-Geisser adjusted; and agent and sample,  $F(2.74, 345.52) = 3.6, p = .02, \eta_p^2 = .03$ , Greenhouse-Geisser adjusted.

### 6.3.2.1 Sample Effects

To explore the interaction effect of sample and agent, planned comparisons with a Bonferroni adjustment were conducted. As predicted, both samples followed the same trend, Israeli and British children responded that the super-animals and God would perceive the stimulus and the human agents would not, see Figures 5 and 6. Although responses for both cultural samples were above chance (test value = 1),  $t_s > 2.06, p_s < .05, \text{Cohen's } d = .62$ , British children responded more consistently,  $M = 1.63, SD = .09$ , that the super-animals would perceive the stimulus than did Israeli children,  $M = 1.14, SD = .09, t(133) = 3.52, p < .0001$ .

Figure 5. Mean response of Israeli children who attributed knowledge to each agent by each age group.

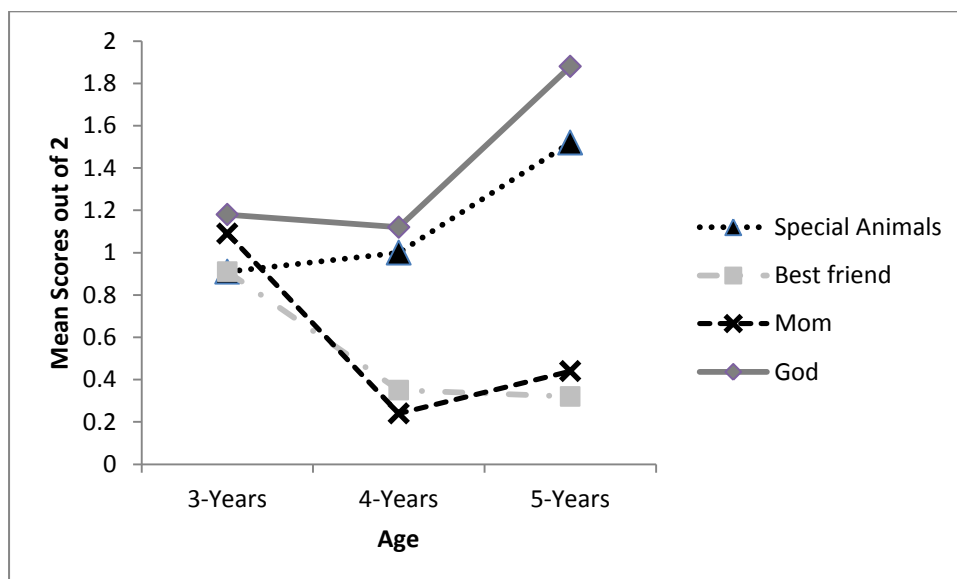
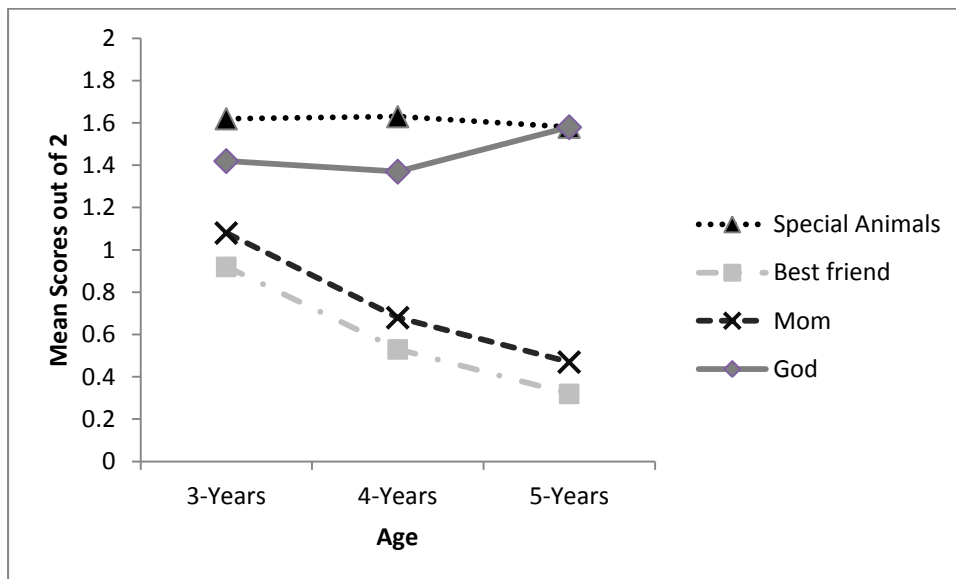


Figure 6. Mean response of British children who attributed knowledge to each agent by each age group.



### 6.3.2.2 Age Of Child Effects

I next explored the interaction of the age of the child and agent with planned comparisons with a Bonferroni adjustment. Analyses revealed that there were significant differences among age groups for all agents. Three-year-old children's scores differed between Best Friend,  $M = .92$ ,  $SD = .11$ , and the super-perceiving agents: God,  $M = 1.30$ ,  $SD = .11$ ; and the super-animals,  $M = 1.26$ ,  $SD = .11$ ;  $t_s > 2.4$ ,  $p_s < .02$ . As predicted by the preparedness hypothesis, both 4- and 5-year-old children attributed knowledge to each super-agent, God and the special animals, and these responses were significantly different from responses of ignorance to each human agent,  $p_s < .001$ . There were no differences in responses between God and special animals and also between Best Friend and Mom for all age groups.

The interaction by age group was also examined. Three-year-olds responded significantly above chance that the super-animals and God would perceive each stimulus,  $t_s > 2.5$ ,  $p_s < .02$ , see Table 4. As predicted, three-year-old children's scores for the human agents were not significantly different from chance. All four- and five-year-olds had scores for each

agent that were different from chance,  $ts > 2.39$ ,  $ps < .02$ . By age 4 children responded significantly different from chance that their Mom would not perceive the stimulus,  $ts > 6.32$ ,  $ps < .0001$ . Consistent with a preparedness hypothesis, children at all ages responded significantly different from chance that the super-animals and God would perceive the stimulus,  $ts > 2.06$ ,  $ps < .05$ .

Table 4.  
*Mean Responses For Each Agent by Age Group For Both Samples*

Age	Best Friend		Agent Mom		God		Special Animal	
	M	SD	M	SD	M	SD	M	SD
3-years	.92	.11	1.08	.11	1.30*	.11	1.26*	.10
4-years	.42*	.13	.48*	.13	1.32*	.12	1.33*	.12
5-years	.30*	.12	.43*	.11	1.70*	.11	1.57*	.11

Note. \* $p < .05$ . These means are significantly above and below chance (value = 1)

### 6.3.3 Children's Understanding of Individual Constraints: Perception and Aging

To address the final prediction regarding the developmental trajectory of children's understanding of aging, two sets of analyses were conducted and are reported below. The first set of analyses determined whether children attributed knowledge (the ability to see or hear a stimulus) to an agent when the agent is older. This set of analyses first set out to answer how children conceptualize the perceptual acuity of older agents. The second set of analyses explored the direction of children's responses for each agent at present and in the future, or whether there was a change in response among the agent's present ability to perceive the stimuli (i.e., seeing or hearing the stimulus) and the agent's ability to perceive the stimuli in the future.

First, analyses were conducted to explore children's understanding of perceptual acuity after the passage of time. A score of 1 was given if the child responded that the agent in question could perceive the stimuli (e.g., auditory or visual) when older and a score of 0 if the child responded that the agent could not perceive the stimuli (e.g., auditory or visual)

when older. Scores were summed for each agent and ranged from 0 to 2, combining both the visual and auditory perception of each agent. A score of 2 represented that the child always attributed knowledge (perceptual acuity) to the aged agent, or the ability to see and hear the stimulus when the agent was many years older. A score of 0 represented that the child never attributed the aged agent with knowledge (inability to perceive), or not being able to see or hear the stimulus when older. A score of 1 indicated that the aged agent was attributed with either the ability to either see or hear, but not both. Initial analyses were conducted to explore what responses children gave when asked if an agent would get older. Three-, 4-, and 5-year-olds' scores were significantly above chance for both human agents, demonstrating that Mom and Best Friend would get older,  $t_s > 1.5$ ,  $p < .0001$ ,  $r_s > .31$ . Three-year-old children's responses for whether God would age or not were not significantly different from chance,  $t(45) = .5$ , *ns*. Four-and-five-year-olds responded significantly different from chance that God does not get older,  $t_s > 4.1$ ,  $p < .05$ ,  $r_s > .85$ , suggesting that for the older children, that God stays the same. Further analyses revealed significant differences among samples for God among three-year-olds,  $F(1, 125) = 8.59$ ,  $p < .004$ ,  $\eta_p^2 = .06$ , and five-year-olds,  $F(1, 125) = 10.91$ ,  $p = .001$ ,  $\eta_p^2 = .08$ . Israeli 3- and 5-year-olds were more likely to respond that God would not age,  $M = .68$ ,  $SD = .17$ , and  $M = .26$ ,  $SD = .16$ , respectively; compared to British 3- and 5-year-olds who were more likely to respond that God would age,  $M = 1.39$ ,  $SD = .17$ , and  $M = 1.05$ ,  $SD = .18$ , respectively.

A repeated measures ANOVA with each Agent (3: Best Friend, Mom, and God) as the within-subject factor and Age (3: 3-, 4-, and 5-year-olds) and Sample (2: Israel and UK) as the between-subject factor was conducted to measure children's attributions of perception. Children's summed responses for whether the agent could perceive the stimuli were the dependent variable. This revealed a significant main effect for agent,  $F(2, 242) = 26.21$ ,  $p <$

.0001,  $\eta_p^2 = .18$ . Analyses also revealed a significant two-way interaction of agent and age,  $F(4, 242) = 10.86, p < .0001, \eta_p^2 = .15$ .

The age and agent interaction was explored using three additional repeated-measures ANOVA's for each age group, revealing no differences among agents for three-year-olds,  $F(2, 88) = .65, ns, \eta_p^2 = .02$ . Significant differences were revealed among agents for the four-year-olds,  $F(2, 88) = .65, p < .0001, \eta_p^2 = .02$ , and five-year-olds,  $F(1.74, 74.92) = 41.73, p < .0001, \eta_p^2 = .49$ . Four-and-five-year-old children significantly differentiated between God and each human agent above chance,  $ps < .05$ , see Table 5. Thus, children responded that the perceptual acuity of humans would be worse with age, and that God's perceptual acuity would still be strong (or stay the same) with the passage of time. For all age groups, there were no differences in responses for God and among responses for Best Friend and Mom,  $ns$ .

Table 5.

*Mean Responses of Perceptual Ability After Many Years for Each Agent by Age Group*

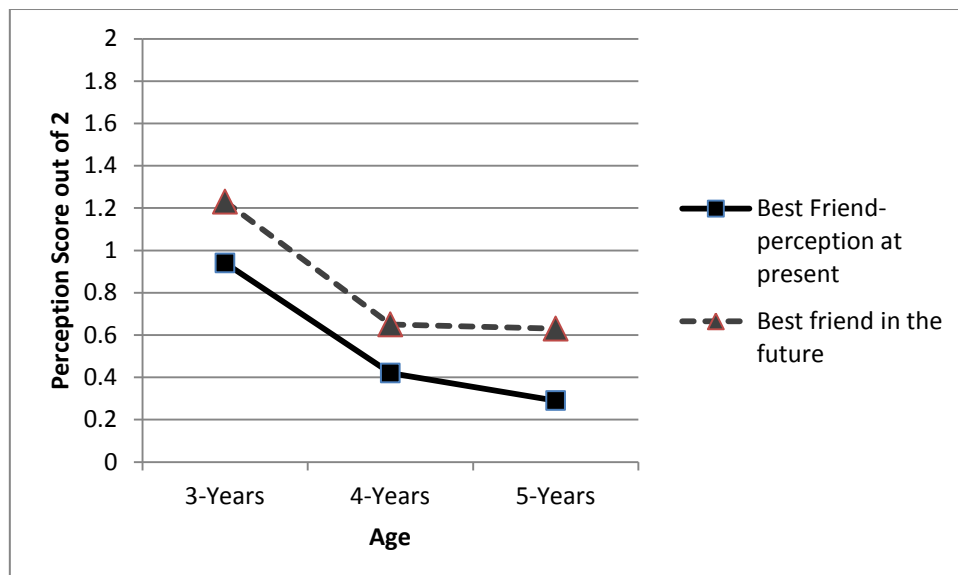
Age	Agent						Significant Comparisons
	Aged Best Friend		Aged Mom		God		
	M	SD	M	SD	M	SD	
3-year-olds	1.24	.14	1.13	.13	1.13	.13	<i>ns</i>
4-year-olds	.74	.15	.76	.14	1.26	.15	God > BF, Mom*
5-year-olds	.66	.12	.57	.11	1.64	.10	God > BF, Mom*

Note. \*  $p < .05$  for comparisons where responses for God demonstrate that with time God will perceive the stimulus whereas the humans agents (Best Friend and Mom) will not.

In a second set of analyses, I explored differences between children's responses of the agent's present ability to perceive the stimuli and the agent's ability to perceive the stimuli when older. Three separate repeated measures ANOVA's were conducted with each agent (either Best Friend, Mom, and God) with Age (3: 3-, 4-, and 5-year-olds) and Sample (2: Israel and UK) as the between-subject factor and Response (2: agent at present and aged agent) as the within factors.

I analyzed the human agents first. In the analysis for Best Friend, there was a significant main effect of age of the child,  $F(2, 124) = 10.32, p < .0001, \eta_p^2 = .14$ , as well as a significant effect for the difference in responses for the agent at present and in the future,  $F(1, 124) = 15.88, p < .0001, \eta_p^2 = .11$ . There was no effect of sample,  $F(1, 124) = .29, ns$ . Three-year-olds,  $M = 1.08, SD = .11$ , attributed their Best Friend with the ability to perceive more often than the 4-year-olds,  $M = .53, SD = .12$ , and 5-year-olds,  $M = .46, SD = .11$ , see Figure 7. Additionally, across all ages and in both samples, children attributed more ignorance responses to their Best Friend at the present time,  $M = .56, SD = .81$ , and children attributed less knowledge (perceptual acuity) responses to the aged Best Friend,  $M = .88, SD = .90, t(130) = 1.55, ns$ . Stated a different way, children were more likely to attribute more perceptual access when their best friend is older, although their responses still showed a general trend that their best friend would not be able to perceive the stimulus.

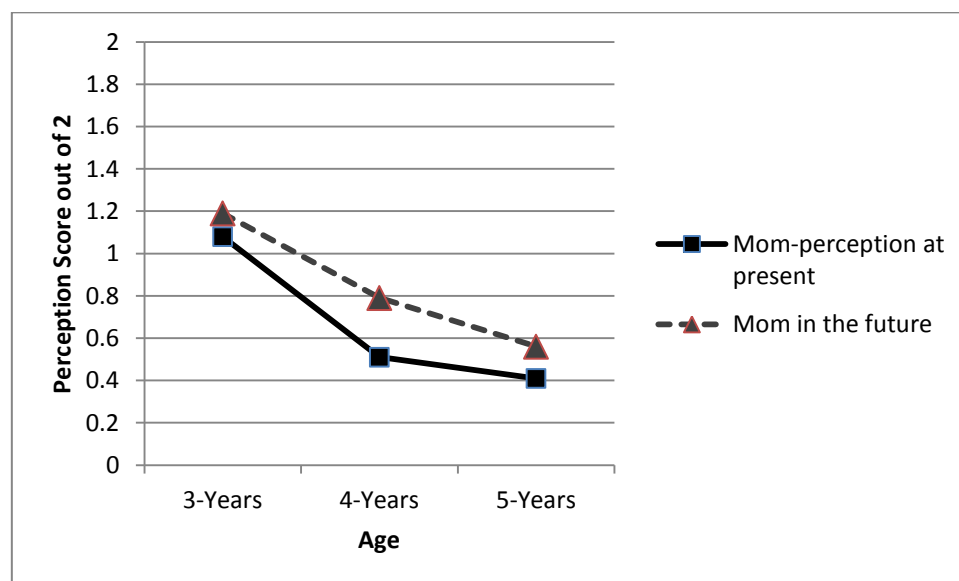
Figure 7. Mean responses of children who attributed perceptual ability to Best Friend at present and in the future.



In the analysis for Mom, there was a significant main effect of age of the child,  $F(2, 127) = 9.47, p < .0001, \eta_p^2 = .13$ , as well as a significant effect for the difference in responses for the agent at present and in the future,  $F(1, 127) = 6.91, p = .01, \eta_p^2 = .05$ . There was no

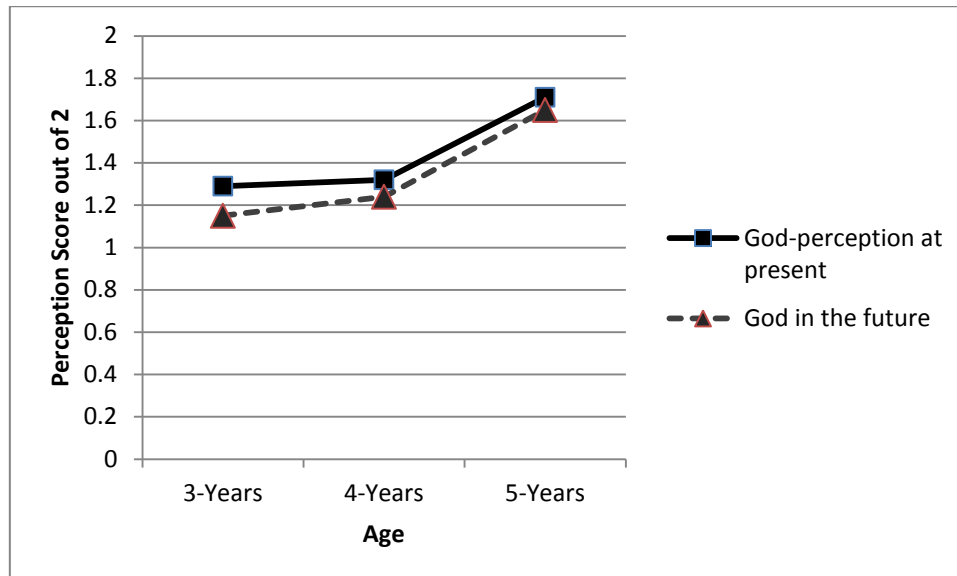
effect of sample,  $F(1, 127) = 1.72, ns$ . Three-year-olds,  $M = 1.11, SD = .11$ , attributed Mom with the ability to perceive more often than did four-year-olds,  $M = .64, SD = .12$ , and five-year-olds,  $M = .49, SD = .11$ . Similar to responses for Best Friend, children's responses (all ages) for aged Mom were slightly higher,  $M = .84, SD = .85$ , than their responses for whether Mom can perceive the stimuli in the present circumstances,  $M = .69, SD = .82$ . Children's responses for both Mom at present and Mom in the future were significantly different from chance,  $t_s > 4.28, p_s > .03$ , see Figure 8. Thus, children attributed more perceptual access to aged Mom, even though their responses still showed a general trend that their Mom would not be able to perceive the stimulus.

Figure 8. Mean responses of children who attributed perceptual ability to Mom at present and in the future.



Finally, children's responses for God were examined. There were no main effects of sample,  $F(1, 125) = .002, ns$ , or among responses for God in the present or God in the future,  $F(1, 125) = 3.36, ns$ . There was a main effect of age of the child,  $F(2, 11.21) = 5.48, p = .005$ . Three-year-olds,  $M = 1.22, SD = .11$ , and 4-year-olds,  $M = 1.28, SD = .12$  responded less consistently that God would perceive the stimulus as the five-year-olds,  $M = 1.68, SD = .11$ , but across all age groups there was consistency between God at present and God in the future, see Figure 9.

Figure 9. Mean responses of children who attributed perceptual ability to God at present and in the future.



#### 6.4 Discussion

The present study examined British and Israeli preschoolers' understanding of situation-specific and individual constraints in two perspective taking tasks. There were four predictions. First, as predicted, children gave more knowledge responses over ignorance responses for the special animals, demonstrating a preparedness bias rather than an anthropomorphic or egocentric bias. Second, Israeli and British children similarly attributed ignorance to the human agents and knowledge to the super animals and God. Third, as predicted there were no age differences for knowledge responses regarding God and the special animals but after age four years children gave more ignorance responses for the human agents. Finally, and contrary to prior prediction in this chapter, children attributed more knowledge responses (perceptual access) to aged humans and as children aged they attributed more knowledge responses to God. Findings related to each of these hypotheses will be discussed in turn.

#### **6.4.1 Egocentrism, Anthropomorphism vs. Preparedness for the Special Animals**

In the present study, children differentiated among agents without apparently needing to resort to egocentrism or anthropomorphism. Children in all age groups did not blindly attribute to the special animals their own state of ignorance but tended to attribute ignorance or knowledge to the appropriate animal and their corresponding perceptual capability. These results suggest that young children begin with a general concept of agency and may differentiate among agents and their individual constraints. If children had simply reasoned egocentrically, they would have been prone to responding that the special animals, regardless of their reported capabilities, would not be able to see or hear the stimuli. Likewise, if children must anthropomorphize, they would also respond that none of the agents would be able to perceive the stimuli and subsequently would treat all agents similarly.

#### **6.4.2 Perceptual Understanding Across Children's Age**

Similar to Richert and Barrett (2005), Israeli and British three-year-olds attributed knowledge to God and the super-animals significantly different from chance and were at chance levels for the human agents. By age four, children attributed correct knowledge responses to the animals and God and correct ignorance responses to the human agents. Children in prior studies (Richert & Barrett, 2005; Yaniv & Shatz, 1988) did not attribute correct knowledge and ignorance to all agents until age five.

Past research questioned whether children differentiate among minds, or whether children just relate their own state of knowledge to other minds. One goal of the current study was to explore whether the “curse of knowledge” extended to general ignorance tasks (Birch & Bloom, 2007). Richert and Barrett (2005) gave children auditory and visual perceptual perspective-taking tasks but revealed the stimuli, similar to a false belief task. Instead, in the present study an ignorance task was used and Richert and Barrett's (2005) methods were adapted by using the same auditory and visual perspective-taking tasks but not

revealing the stimuli. Even though the experimental tasks differed, the results reported here are consistent with those of Richert and Barrett (2005). Regardless of children's knowledge or ignorance of the stimuli, children demonstrated they were able to suspend their own ignorance to infer the knowledge state of other agents and to differentiate among different minds.

These findings are in contrast to an anthropomorphism hypothesis that would suggest that children attribute human limitations to God or other special beings. In addition, if children were using an egocentric viewpoint, the youngest children should eagerly apply their own perspective (ignorance) to all agents before using a more representational theory of mind. Instead of attributing their own perspective or human-like limitations to the super-animals and to God, children of all ages attributed knowledge. As the results indicate, even the youngest children found it easy to apply the teaching instruction that the special animals had special faculties (sight, hearing). Applying special abilities may have been easier than trying to apply limitations and constraints. Furthermore, children resisted giving God human limitations (e.g., human audition or human vision). Remarkably, without teaching instructions to rely upon, children applied their previous knowledge of God to predict that God would see or hear the stimulus in each task. This response was different from each child's own ignorant perspective. Thus, children were not egocentrically applying their own state to others (contra Makris & Pnevmatikos 2007).

Given that even the youngest children could easily attribute knowledge states to the special animals and to God, the data do not support the conclusion that children were conceptualizing other agent's minds from an egocentric or anthropomorphic perspective. The present study asked children to reason about God's perceptual abilities. This type of question might bring to mind for children that God has ears or has eyes. If it is the case that children picture God as human, children should anthropomorphize their responses and respond that

God cannot hear or see the stimulus. Even with these potentially anthropomorphic cues, children of all ages resisted anthropomorphizing God. Instead, children's responses were consistent with a preparedness interpretation of their theory of mind. Consistent with the results presented in chapter five, these findings suggest that children are able to use a flexible theory of mind for other types of agents.

### **6.4.3 Perceptual Understanding Across Samples**

Children in both samples followed the same trend; children significantly attributed the special animals and God with knowing the visual and auditory stimuli. Furthermore, older children in both samples responded that humans would be ignorant. Contrary to predictions, children in the British sample responded more consistently than the Israeli sample that the special animals would be able to perceive the stimuli. While it is not entirely clear why British children performed significantly better, I suggest a possible explanation. Results show that the younger British group was slightly older ( $M = 3.38$ ) than the youngest Israeli group ( $M = 3.27$ ). Older children may have had experiential advantage and/or a more developed theory of mind. Other possible explanations may include differential exposure to animals or cultural narratives about animals with special abilities. Yet, despite the overall differences in responding, both samples responded above chance that the special animals would perceive and know the stimulus. Thus, it is possible that to understand these differences, future research will need to explore the influence of age at a microgenetic level, the influence of pet ownership or other meaningful contact with animals, and the influence of other cultural variables that may impact children's understanding of agency, intention, and perceptual and knowledge attribution of animals.

### **6.4.4 Individual Constraints: Perceptual Acuity of Aged Agents**

By age four, children in both samples responded that perceptual constraints after aging would limit the human agents but not limit God. As predicted, the youngest children

did not respond significantly different from chance. However, by four years children responded significantly different from chance. Notably, this is younger than what has been found in other theory of mind tasks (Astington et al., 1988; Perner, 1991; Perner et al., 1987). In order for children to understand that the human agents would not be able to perceive the stimulus, children took into account two things: that their Mom's or their friend's vision/audition would not improve with age, and if they were not able to perceive the stimulus currently, they would not be able to see or hear the stimulus in a number of years.

One explanation for children's better performance at a younger age compared to previous studies might be the focus on perceptual ability. Previous studies have shown that children as young as three and four years understand that living things grow (G. Hatano et al., 1993; Rosengren et al., 1991) and by age five, that living things are mortal (Giménez-Dasí et al., 2005). Other work recommends that children younger than five may understand perceptual ability before understanding other knowledge states (Lane et al., 2010, 2012). However, these studies have not taken both growth and perceptual constraints into account. Results from the present study reveal that by four years, children's understanding of the individual constraint of aging is possible and that children did not need to incorporate egocentric or anthropomorphic thinking when thinking about other minds. Rather, children were able to differentiate among agents in terms of perceptual capabilities and differences in age.

Furthermore, young children not only responded that humans would grow and perceptual acuity would change with age (in this case perceptual access would increase), but also responded that God would not grow older, and God would be able to perceive the stimulus in either task regardless of the time (present or future) in question. Children again resisted applying human constraints to God, even when asking whether God would grow older and whether God could hear or see. However, there were cultural differences. British

children were more likely to respond that God would age than Israeli children. Cultural input, or that Jesus is conceptualized as a human, may interfere with British children's conceptualization of God. Regardless, there were no differences in sample for children's responses that God's perceptual acuity would stay the same with age. This result may indicate that a concept of God is part cultural input and part the influence of the preparedness bias.

Although responses that perceptual acuity would decrease with age became more accurate for the four- and five-year-olds, children still rated aged Mom and aged Best Friend with better perceptual acuity than Mom and Best Friend at the present time. Children were not asked to justify their answers.<sup>11</sup> Children at this stage of development are growing and getting better at activities. Perhaps they equate, to some extent, that getting older means getting better at an activity.

#### **6.4.5 Conclusion**

The pattern of results discussed here, specifically that children could reason through situation-specific and individual constraints regarding multiple types of minds, suggest that children need not anthropomorphize or use an egocentric viewpoint. Instead, children may base their thinking on a general theory of mind, and their thinking is developmentally tailored to be able to think of a variety of minds, including non-human minds. In keeping with the preparedness hypothesis, these results imply that children have a ready grasp of the limitations and special abilities of a variety of minds.

The current results provide additional evidence for the preparedness hypothesis.

Cross-culturally and cross-religiously, preschool children differentiated among agents at an

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<sup>11</sup> Although all children were not asked to justify their answers, some follow-up questions were asked to some of the children. They justified their answers by sighting growth and development. For example, a few justifications were, "when [agent] is older, he will have bigger eyes" or "when [friend] grows up she will be better at hearing."

early age and took into consideration both individual and situation-specific constraints.

Further research should explore other religious and cultural traditions to verify this pattern of developmental acquisition of a theory of other minds. The complex nature of understanding a variety of constraints in humans, animals, and gods with limiting constraints needs further exploration beyond just perceptual constraints. While the present study examined visual and audio acuity in addition to age constraints, other individual and situation-specific constraints should be explored in future studies. With this in mind, the next chapter explores children's understanding of the influence of age on memory in varying aged agents and agents with different abilities.

## **7 Further Exploration of Individual and Situation Constraints: British and Israeli Children's Attributions of Memory to Other Minds**

### **Study 3**

As seen from chapters five and six, children responded differently for supernatural and human minds and did not need to resort to anthropomorphism or egocentrism for conceptualizing other minds. Instead, young children might have a flexible, general theory of mind (the second component of the preparedness hypothesis) that is tailored to reason differentially about a diverse set of agents. Study 1 (chapter five) demonstrated that even the youngest of Israeli and British children could differentiate among different types of agents. Further, Study 2 (chapter six) demonstrated that understanding another's perceptual access is contingent on children's understanding of individual constraints: the type of agent and whether the human agent was young or old. Adding to chapters five and six, the objective of this chapter is to explore Israeli and British children's conceptions of the memory capabilities of other minds.

#### **7.1 Study 3: Introduction**

As described in chapters three, five and six, a representational theory of mind requires a multi-faceted understanding of a variety of mental phenomena including an appreciation of beliefs, desires, emotions, and intentions. Memory is another important mental capacity of the mind. To represent the memories of others, one must consider various processes and features of memory. One process entails an understanding that knowledge can be encoded, retained, and retrieved over a period of time. Another important feature of memory is that knowledge may fail to be remembered;<sup>12</sup> that is, knowledge may be forgotten. In other

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<sup>12</sup> Another problem with memory and knowledge acquisition could be that information was never fully acquired or encoded. Although important to note, this is not a focus for this chapter.

words, to have a memory, one must have gained knowledge; whereas to forget, one must have had previous knowledge that one can no longer recall. A further aspect of memory is individual variability. Not everyone has the capacity to remember knowledge as well as everyone else. Therefore, in order to have a representation of the memory of another mind, one must take into account not only the prior and present knowledge states of an individual, but also his or her individual capacity to remember that knowledge.

Memory is an important mental capacity because it is at the core of knowledge acquisition. Nevertheless, to date there is little work regarding the relationship between theory of mind and individual constraints such as differences in memory abilities. Thus, the research presented in this chapter focuses on preschool children's understanding of individual constraints in memory. This should give a broader picture of the types of factors or capabilities children may or may not consider when developing a representation of human and non-human minds. Do children think that animals have a good or bad memory? Do children think that God has a good memory? Do children understand that human memory is variable?

### **7.1.1 Children's Understanding of Memory**

By age two-and-a-half years, "remember" is one of the first mental verbs used (Limber, 1973) and by age three, children can distinguish between the verbs "forget" and "remember" (Shatz, Wellman, & Silber, 1983). However, an understanding that "remembering" and "forgetting" are linked to knowledge acquisition and previous mental states seems to develop much later in the preschool years, at five or six years of age (Kreutzer, Leonard, Flavell, & Hagen, 1975; Lyon & Flavell, 1993, 1994; Macnamara, Baker, & Olson, 1976; Wellman & Johnson, 1979). Indeed, the concept of memory or knowledge retention may be difficult for preschoolers. For example, in one study Friedman (1992) asked 4- to 6-year-old children to remember several past events. Four-and 5-year-olds

remembered specific events at certain time points (e.g., yesterday, last weekend, last summer), but only 6-year-olds could discriminate past memories from more recent events (Friedman, 1992). Another study demonstrates that not until five years of age, do children understand the relationship between past and future events (Busby & Suddendorf, 2010). Other studies have shown that between the ages of 4- to 6-years-old, children recognize that forgetting occurs, that the more items you have to remember makes remembering more difficult (Kreutzer et al., 1975), that memory is fallible not just because it is subject to forgetting, but also because it is subject to distortion (Jaswal & Dodson, 2009), and that the memory of an event or the location of an object would be harder to remember with a longer passage of time (Kreutzer et al., 1975; Lyon & Flavell, 1993; Wellman, 1978). In short, previous research has shown that the understanding of memory, like other aspects of a developing theory of mind, is a complicated task that gradually develops over time, and usually approaches adult-level understanding by the age of six.

Although previous research has explained how much children might understand the concept and meaning of “memory,” it has neglected three important considerations: (1) understanding the experience of forgetting; (2) cross-cultural differences in applying the experience of forgetting to other minds besides human minds; and (3) individual differences, that is the individual constraints that influence mental processes (such as age). These considerations will be evaluated below in light of previous work and form the basis for the three objectives of this study.

### **7.1.2 Understanding the Experience of Forgetting**

Given the relative poor performance of younger preschoolers on various memory tasks in the above studies, one might expect that preschool-age children do not comprehend the association of memory and forgetting with prior knowledge states. However, previous work has not made the experience of “forgetting” a relevant experience. In other words, these

children were never directly or personally involved in the task or in the experience of forgetting themselves. For instance, in prior work children had to either recall past events or watch a third-party scenario where one of two dolls or puppets tries to remember a scenario (Kreutzer et al., 1975; Lyon & Flavell, 1993, 1994; Macnamara et al., 1976; Wellman, 1977; Wellman, Collins, & Gliberman, 1981). Only children older than 5 years responded well to these tasks. The conclusions from these studies—that young children cannot fully understand memory until five or six years—may be unreliable for two reasons: (1) One reason is that research has demonstrated that memories can be distorted (Loftus & Palmer, 1974; Tversky & Marsh, 2000) and (2) personal relevance may be important when recalling an event (O'Sullivan, 1997; Sperber & Wilson, 1995; Tomaszczyk, Fernandes, & MacLeod, 2008; Velasco & Bond, 1998; D. Wilson & Sperber, 2004). In other words, children may not have responded accurately because of possible confounding factors in the methodology. For instance, if people are prone to forget certain details of prior events, or add details that never happened, then memories cannot be trusted. Also, if the event is not personally relevant, people have a higher likelihood of forgetting the event. So, if children did not do well on prior tests because they were trying to remember irrelevant events that happened awhile ago, their mental representation of “forgetting” may have been inaccurate. To overcome these issues, children in this study received a task where their own forgetfulness was made immediate and relevant.

### **7.1.3 Cross-Cultural Differences in Children’s Representation of the Memory of Other Minds**

As described in this chapter, previous work on children’s understanding of ordinary, extraordinary, and supernatural minds has largely focused on cultures with a dominant Christian tradition without many cross-cultural comparisons (Barrett et al., 2001; Lane et al., 2010, 2012; Makris & Pnevmatikos, 2007). These studies have produced divergent results

and theoretical interpretations, perhaps due to the complexity of asking children about a God who is considered to be a man (Jesus). Thus, isolating a non-anthropomorphic God without the complexity of different physical forms is important to clarify previous results and to distinguish between early intuitive development and cultural development of supernatural minds. To explore possible intuitive and cultural constraints, examining a culture and tradition with a similar Abrahamic God that is non-anthropomorphic helps to isolate and compare cultural differences or intuitive similarities. Therefore, in this study I sampled secular and religious children in the UK and religious Modern Orthodox Jewish children in Israel.

However, if children do not attribute anthropomorphic characteristics to God, as in the previous chapters, perhaps the methodology (using an ignorance belief task) may account for prior differences in past work (Lane et al., 2010, 2012; Makris & Pnevmatikos, 2007).

Other research is not conclusive concerning how young children understand minds other than human minds. Do children assume that animal or supernatural minds will remember or forget? Previous work on children's understanding of other minds suggests three possibilities<sup>13</sup>. First, pre-school children may initially represent non-human minds with the same beliefs, abilities, and constraints of memory as those associated with humans (*anthropomorphism*) (Lane et al., 2010, 2012; Piaget, 1929). Applying this bias to memory tasks, young preschool children would then project human qualities to other agents. If the human capacity would be to remember, for example, the names of five new people at a party, young children would attribute memory to all minds—human or non-human—as this feat is reasonably within normal human abilities. However, if the task in question were, for

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<sup>13</sup> I will not go into full detail of these three hypotheses as these will have been described more fully in the introductory chapters and repeatedly throughout chapters 5 and 6. However, they are briefly mentioned here to bring to light what these hypotheses might predict for exploring a theory of understanding the memory of others.

example, memorizing every word in a 100,000 page book, children would not attribute this seemingly impossible task to humans, and so would not credit animals or God with such an ability either.

A second possibility is that children may *egocentrically* apply their knowledge state (Makris & Pnevmatikos, 2007). In a memory task, children would then attribute being able to remember something to other minds if they themselves are able to remember the thing or would attribute forgetting to other minds if they themselves had forgotten.

Finally, if the preparedness hypothesis is correct, young preschool children may have relevant conceptual systems in place to differentiate minds that would be more likely to forget from minds that would be able to remember (Barrett et al., 2003; Barrett et al., 2001; Knight, 2008; Knight et al., 2004; Richert & Barrett, 2005). That is, three- to five-year-olds need not attribute the same memory to all agents. Preparedness further predicts that children would be biased to attribute better memory to others than what might be merited from a strictly anthropomorphic or egocentric perspective. The child may reason, “when in doubt, others remember.”

#### **7.1.4 Individual Constraints For Memory**

In addition to understanding the experience of forgetting and cross-cultural constraints, understanding individual constraints, or individual differences in the capacity to remember, may be important for understanding the mental states of others. For example, an elderly person may have difficulty remembering recent events when compared to an 8-year-old. In addition, children might think that an animal may or may not have the capacity to remember. For example, cats are often let outside because they remember where home is and will come back. Do children understand that they can leave the cat outside and that the cat will remember how to get home? Or when a child teaches a dog a trick, does the child understand that the dog will remember this trick?

If children understand and think about animal minds, how will they understand memory in an exceptional mind? As chapters five and six have shown, young children understand that God has different cognitive abilities than humans. If children attribute God with knowledge in false-belief and perspective-taking tasks, perhaps children will attribute God with a good memory. Little is known about children's conceptions of the nuances and constraints of another's memory, especially among different types of minds.

While numerous studies have documented that children do not understand various constraints of memory (Friedman, 1992, 2004, 2005, 2007; Jaswal & Neely, 2006; Kreutzer et al., 1975; Lyon & Flavell, 1993, 1994; Macnamara et al., 1976; Shatz et al., 1983; Wellman, 1977, 1978), only one study could be found that addresses children's conceptions of age-related individual constraints regarding memory. In this study, 3- to 5-year-old children answered a battery of questions exploring the development of metamemory, or a person's knowledge of the processes of memory as well as one's capability to remember (Wellman, 1977). Children were given drawings of a pair of boys with contrasting abilities and characteristics. Both boys were attempting to remember three items. Differences contrasted between each pair of boys were based on: each boy's memory strategies (getting help, mnemonic cues), individual constraints (age), and task demands (the types of items, noise level, time). After children observed a pair of drawings, the experimenter asked each child which of two boys found it easier to remember different items. Of interest to this chapter, one situation depicted an individual constraint contrast: a baby and an adult trying to learn three items. In other words, just over one-third (14 of 38 children, 36.8%) of all children aged 3- to-5- years recognized that a baby would find it more difficult to remember three items than an adult. The study did not address whether children were guessing or if they overestimated the memory capacities of either agent. Indeed, prior research documents that preschoolers may overestimate memory capacities of others (Wellman et al., 1981). Such

bias is consistent with a preparedness bias. Thus in the present study, it was important to determine whether children over-attribute memory; whether they appreciate the cognitive constraints of other minds with regard to memory; or whether they do not appreciate cognitive constraints and instead treat all agents as forgetting, as might be predicted if children reason egocentrically or anthropomorphically about memory.

### **7.1.5 The Present Study**

To summarize, the experiment in this chapter had three objectives: First, I aimed to extend theory of mind research by investigating whether children attribute remembering or forgetting to various agents in a memory task. Second, I aimed to explore Israeli and British children's pattern of responses or possible biases when reasoning about the capabilities of different aged human minds, extraordinary minds, and animal minds. Third, because previous studies have neglected individual constraints in memory and theory of mind tasks, the present experiments were designed to explore children's reasoning about individual constraints when considering other minds. Further exploration of the three theoretical accounts contrasted in this thesis (anthropomorphism, egocentrism, and preparedness) were investigated using a novel memory-based theory of mind task.

Unlike other theory of mind tests, the present study used a novel memory-based theory of mind task where the correct answer for human adults is not clear. Children played a memory task until they could no longer remember where the card was. However, although the child could no longer remember where the card was, it is plausible that another agent (e.g., his or her mother) could remember where the card was located. Therefore, in this task the pattern of egocentric and preparedness responding is very clear while an anthropomorphic response is unclear. For example, if children's responses cohere to an egocentric pattern, they would respond that all agents cannot remember. In contrast, the preparedness hypothesis predicts that children would tend to attribute a good memory to agents (better than

their own) and would also distinguish memory capacities among agents (particularly, Swec and Bop, but possibly among God, Mom, and Dog, too). An anthropomorphic pattern of responses, however, is unclear. An anthropomorphic response for God could be at chance, reflecting the variation in human memory. Or, if children have not yet learned that human memory capacities vary, then their best guess at a human's memory is their own in a given situation. Hence, egocentrism and anthropomorphism would be indistinguishable in this task. If, however, children have learned about the diversity of human memory capacities, then they might attribute different levels of memory to the different humans (Baby, Granddad, and Mom). If anthropomorphism is what children use to reason about God or Dog, then both would be treated similar to any one of the humans. If God were treated similar to the human with the best memory, it would not be clear whether the pattern of results was due to anthropomorphism or preparedness. Only egocentrism would be ruled out. Given these interpretive challenges, children's response patterns were assessed in regard to anthropomorphism, egocentrism or preparedness.

Because this is a novel test, an adult sample was also collected to explore adult responses on the same task. Understanding what the adult-like responses would be for this task was important for noting what the mature pattern of responses in children should resemble. Adults received the same protocol as the children except that they were asked about a "Friend" instead of "Mom." As this chapter is concerned with possible variation in memory because of age differences, I wanted to ensure that children's representation of "Mom" and adult's representation of "Friend" would mentally represent an agent with roughly the same age.

Applying the results from chapters five and six and in accordance with the three objectives, I made these predictions: According to the first objective, I predicted that children younger than age five would distinguish among the varying agents in a task where

forgetting is made more relevant. Second and in conjunction with the second objective, I predicted there will be no cultural differences between samples. Finally, in accordance with the third objective and a preparedness hypothesis, I also predict that children younger than 5 years will be able to correctly attribute Swec and God with remembering. Whereas insufficient evidence exists to suggest how children will respond according to individual constraints, results from chapter six demonstrated that children are sensitive to the cognitive constraints and perceptual abilities of other minds. Age differences may be an individual factor that children will bear in mind when thinking of the memory capacity of another mind. I further predicted that children would respond that Bop, Baby, Dog, and Granddad were likely to forget the location of the card. Because the aptitude for memory varies in human agents in this task, there were no specific predictions and responses were exploratory.

## 7.2 Methods

### 7.2.1 Participants

One-hundred and forty one British and Israeli children participated. However, 138 children (76 female),  $M = 4.24$ ,  $SD = .88$ , completed the task. Three British 3-year-olds did not complete the task due to inability to stay focused on the task. In all there were 54 3-year-olds,  $M = 3.30$ ,  $SD = .32$ , range: 2 years, 7 months to 3 years, 11 months; 40 4-year-olds,  $M = 4.37$ ,  $SD = .26$ , range: 4 years to 4 years, 11 months; and 44 5-year-olds,  $M = 5.26$ ,  $SD = .27$ , range: 5 years to 5 years, 11 months. A total of 72 British children (41 female) and 66 Israel children (39 female) participated ranging in age from 2 years, 10 months to 5 years, 11 months. Because this was a novel task, an adult sample,  $N = 114$ ,  $M = 35.72$ ;  $SD = 9.74$ , was also tested to compare the pattern of children's responses against the pattern of responses for adults. Forty-six British adults and 68 Israeli adults participated.

### 7.2.2 Materials

Up to 10 7.5 x 7.5 cm cards were used for the memory task, see appendix 3. Each card depicted a farm animal, such as a cow, pig, or sheep. A 10 x 10 cm sized wind-up magnetic fishing game was also used. A realistic Boston Terrier stuffed dog (approximately life-sized), a 70 cm long Granddad puppet, and a 40 cm long baby doll were used to represent a dog, an older male, and a baby, respectively. No puppets were used to represent Mom, God, Swec, or Bop.

### 7.2.3 Procedure

British and Israeli children and adults were interviewed individually. Order of presentation for each agent was counterbalanced during questioning.

Participants were shown four farm animal cards to start with and told to try and remember where each animal was placed. The cards were turned over and children moved to the side of the table where they were given a distraction task, a wind-up fishing game. Participants were given a magnetic fishing pole and instructed to catch as many fish as they could before the wind-up mechanism stopped. This distraction task took five minutes. When the game finished the experimenter directed the participant's attention back to the turned over farm animal cards and asked the participant if he or she could point to a target card (e.g., the cow). Targets were counterbalanced among the four available farm animal cards. If the participant remembered the target card correctly, the above procedure was repeated, adding two more cards each time, until the participant responded incorrectly.

Children played the memory game until they could no longer remember the location of a target card. This ensured that each child had a relevant experience of "forgetting." Children were then asked if various agents could recall where the card was located. Different agents were used to demonstrate different minds. Different aged puppets (e.g., a baby and granddad puppet) were used to portray agents of differing age. Two imaginary agents were

also used: “a person who does not remember well,” called Bop, and “a person who remembers really well,” called Swec. These agents were used to test children’s understanding of age-related memory differences. If children understood “forget” correctly, they should correctly respond that Bop would not remember the location of the card. If children understood “remember” correctly, they should also respond that Swec would remember the location of the card. A dog puppet was also added to the range of minds to test children’s understanding of memory in “dumb” or constrained minds. Similar to the experiments in chapters five and six, the agents Mom and God were again used to compare possible similarities or differences with past work (Barrett et al., 2001; Lane et al., 2010, 2012). To avoid prompting anthropomorphic thinking, no picture was given of God, so likewise no picture was given for Mom, Swec, or Bop. Adults received the same protocol, except that they were asked to consider the perspective of a friend, rather than their Mom. See appendix 3 for full prompt.

## 7.3 Results

### 7.3.1 Children’s Responses on a “Forgetting” Task

To investigate the first objective, whether children attribute remembering or forgetting to various agents in a memory tasks, the following analyses were conducted.

Answers were coded as 0 for “yes” responses (e.g. “yes, [agent] remembers the location of the card”) and a 1 for “no” responses (e.g. “no, [agent] does not remember the location of the card”). Across all ages, 81.9% ( $n = 113$ ) of children responded that God and Swec would remember the location of the card, see Table 6. Children also attributed remembering to Mom (61.5%,  $n = 83$ ). Only 23.5% ( $n = 32$ ) responses for Bop and 37.8% ( $n = 51$ ) responses for Baby suggested that Baby and Bop would remember. Just under half of children (48.9%,  $n = 65$  for granddad and 41.5%,  $n = 56$  dog) responded that granddad and dog would remember.

### 7.3.2 Cross-Cultural Differences

To examine the second objective, whether responses differed by cultural sample, Kruskal-Wallis tests were used to evaluate responses for each agent by sample. All assumptions were met. Analyses failed to find significant differences between both samples for any agent. This confirmed the prediction that responses from children in the UK and Israel do not differ cross-culturally.

### 7.3.3 Individual Variables

Finally, the third objective focusing on individual constraints was examined. Analyses for the child sample are presented first, then the adult sample, and then appropriate comparisons are drawn.

#### 7.3.3.1 Child Sample

To test the possibility that children younger than five years would attribute forgetting to Bop, Baby, and Granddad; and remembering to Swec and God, Kruskal-Wallis tests were conducted.<sup>14</sup> Analyses failed to find significant age differences for Granddad, Dog, Mom, and God ( $ps > .172$ ). Thus children at all ages responded similarly for Granddad, Dog, Mom, and God. Kruskal-Wallis tests also revealed significant differences among age groups for Swec,  $H(2, N = 136) = 10.61, p = .005$ ; Baby,  $H(2, N = 135) = 8.31, p = .016$ ; and Bop,  $H(2, N = 136) = 20.68, p < .001$ , see Figure 10. Analyses to examine “forget” and “remember” response differences for Granddad, Dog, Mom, and God will be presented first. Follow-up analyses for Swec, Baby, and Bop are reported second.

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<sup>14</sup> Some children responded that they did not know the answer to the question. “I don’t know” responses were excluded from analyses as they did not provide relevant answers to predictions. There were no “I don’t know” responses for God, thus 138 children responded with either a yes or no response. Three “I don’t know” responses were excluded each for the agents: dog, the baby, and Mom; and two each regarding Bop and Swec, and 5 for Granddad. This left 135 total responses for dog, baby, and Mom, 136 total responses for Bop and Swec, and 133 responses for Granddad. The majority ( $n = 3$ ) of these responses came from 3-year-old children.

To test prediction three, whether children answered that Granddad, Dog, Mom, and God would “forget” or “remember,” one-sample binomial tests were run and responses were measured against chance (1 out of 2 (forget or remember) responses). Children attributed knowledge/remembrance of the target card to God,  $z = 7.41$ ,  $p < .001$ , see Table 6. Children did not respond above chance whether Granddad or Dog would remember or forget. Additionally, children attributed a good memory to Mom,  $z = 2.58$ ,  $p = .01$ .

Table 6.

*Percentage of Children’s Attribution of Remembering of Target Card*

	Agent						
	Dog	Baby	Mom	Granddad	Bop	God	Swec
Children of all ages	41.5%	37.8%	61.5%	48.9%	23.5%	81.9%	83.1%

Mann-Whitney  $U$  tests were used to examine age differences of children for Swec, Baby, and Bop, with a Bonferroni adjustment ( $p < .016$  for significance) for each agent.

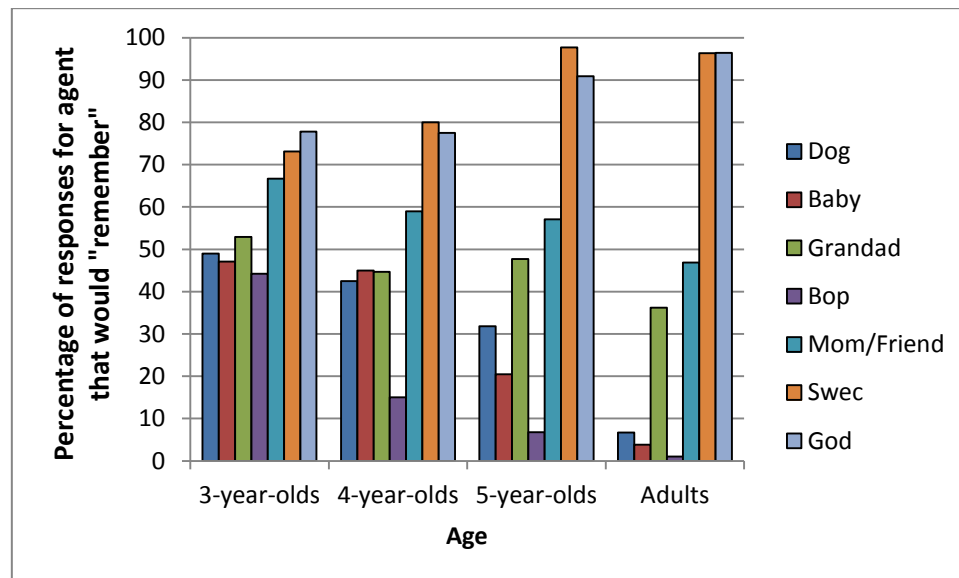
Analyses were first conducted to examine the differences in responses for Swec. Mann-Whitney  $U$  tests indicated a significant difference between 3- and 5-year-olds,  $U = 862$ ,  $p = .001$ , and between 4- and 5-year-olds,  $U = 1,714$ ,  $p = .009$ . A one-sample binomial test was used to calculate whether children gave responses difference from chance (remember or forget responses). By four years of age, children responded that Swec would remember,  $z_s > 3.65$ ,  $p < .001$ .

Responses for Baby were significantly different between 3- and 5-year-olds for,  $U = 1,420$ ,  $p = .007$ . Older children’s responses for Baby were more suggestive that Baby would not remember the target card than responses from the younger children. Five-year-olds significantly attributed “forget” responses to Baby,  $z = 3.77$ ,  $p < .001$ .

Finally, Mann-Whitney  $U$  tests indicated that responses for Bop were significantly different between 3- and 4-year-olds,  $U = 1,344$ ,  $p = .003$ , and also between 3- and 5-year-

olds,  $U = 1,572, p < .001$ . Older children were more likely to say Bop “forgot.” By four years, children significantly responded that Bop would “forget,”  $z_s > 3.5, p_s < .001$ .

Figure 10. Children’s attributions of memory to each agent.



Notes. There were no differences among children for Dog, Grandad, Mom, and God. Among adults and children, there were no differences for Grandad, Mom/Friend, and God.

### 7.3.3.2 Adult Sample

The adult sample was also examined to explore what an adult-like response would be for this novel memory-based theory of mind test. To test whether there were differences in samples across all agents, Kruskal-Wallis tests were used. Results revealed significant differences between the British and Israeli samples for responses regarding Friend (Mom equivalent),  $H(1) = 12.86, p < .001$ . British adults (70%) were more likely to attribute a good memory to Friend than Israeli adults (33%). There were no other differences between samples for any other agent.

Further analyses were conducted to explore adult “forget” and “remember” responses for each agent. Cochran’s Q statistic for within subjects comparison (for agent: Mom/Friend, Baby, Granddad, Dog, Bop, Swec, and God) was conducted to compare differences among

responses for each agent.<sup>15</sup> Analyses revealed that there were significant differences among agents (Cochran's  $Q = 241.97, p < .001$ . Overwhelmingly, 96% of adults said that God and Swec would remember the location of the card and adults overwhelmingly agreed (94.3-99%) that a Dog, Baby, Granddad, and Bop would not remember the location of the card, see Table 7 and Figure 10. To test whether children responded that an agent would "remember" or "forget," one-sample binomial tests were conducted. Analyses confirm that adults responded that Dog, Baby, Granddad, and Bop would be likely to forget significantly different from chance,  $ps < .001$ . Analyses also confirmed that adults were likely to respond that Swec and God would be likely to remember significantly different from chance,  $ps < .001$ . Responses for Friend were not significantly different from chance.

Table 7.  
*Percentage of Adult's Attribution of Remembering of Target Card*

	Dog	Baby	Friend (Mom)	Agent Granddad	God	Bop	Swec
Adults	6.7%	3.8%	46.9%	36.2%	96.4%	1%	96.3%

### 7.3.3.3 Differences Among Children and Adults

To examine the differences among forget/remember responses among children and adults, further analyses were conducted. Kruskal-Wallis tests revealed no differences among adult and children's responses for Granddad, Mom/Friend, and God. Children and adult did not strongly attribute Mom/Friend or Granddad with being able to forget or remember. Both children and adults strongly attributed God with being able to remember.

Kruskal-Wallis tests, however, revealed differences among responses for age groups for Dog,  $H(3) = 40.45, p < .001$ , Bop,  $H(3) = 57.04, p < .001$ , Swec,  $H(3) = 27.63, p < .001$ ,

<sup>15</sup> In the adult sample,  $N = 114$ , "I don't know" responses were excluded. These included 9 for dog, 8 for baby, 20 for granddad, 16 for Friend, 7 for Swec, and 3 for God.

and Baby,  $H(3) = 49.95, p < .001$ . All responses of three-year-olds and adults differed.

Adults were more likely to attribute “remember” to Swec,  $U = 2,118, p < .001$ , and “forget” to Dog,  $U = 3,773.5, p < .001$ , Bop,  $U = 3,874, p < .001$ , and Baby,  $U = 3,835, p < .001$ .

All responses of four-year-olds and adults differed. Adults were more likely to attribute “remember” to Swec,  $U = 1,776, p = .002$ , and “forget” to Dog,  $U = 2,824, p < .001$ , Bop,  $U = 2,372, p < .001$ , and Baby,  $U = 2,965, p < .001$ .

Not all response for five-year-olds and adults differed. There were no differences in response for Swec. However, adults were more likely to attribute “forget” to Dog,  $U = 2,910.5, p < .001$ ; Bop,  $U = 2,473.5, p = .049$ ; and Baby,  $U = 2,745, p = .001$ .

#### 7.4 Discussion

In this chapter, I introduced a novel memory task to explore children’s understanding of another’s memory and to add to the existing literature on children’s theory of mind. The first objective was to explore children’s responses on a memory task using a relevant task that gave children first-hand experience of forgetting. Children did not egocentrically apply their own forgetfulness to God or the other agents. Children treated the agents differently. Israeli and British children attributed God with a good memory across all age groups. Additionally, children correctly attributed a good memory to Swec by age four. The human agents and dog were much more variable in children’s response patterns. The second objective was to assess any cross-cultural differences as well as patterns in responses for the varying agents. There were no sample differences among children’s responses for any agent. The third objective was to note children’s responses toward agents of different ages (how they understand individual constraints). Most children responded correctly for Bop, Swec, and Baby somewhere between three and five years old. However, the only agent that children consistently responded was that God would remember where the target card was located.

Children correctly responded about the extraordinary agents much earlier than the more forgetful agents. Each of these objectives will be discussed more fully below.

#### **7.4.1 Salience of “Forgetting” Task**

Prior research asked preschoolers to recall past events or to make distinctions between the words “forget” and “remember” (see chapter introduction). However, these studies relied on the accurate recall of remembering and forgetting. Accurate recall may be difficult as research has shown that recalled memories cannot be trusted (Loftus & Palmer, 1974) and other research points to the possibility that the relevance of the task is important to understand memory (O’Sullivan, 1997; D. Wilson & Sperber, 2004). By changing the methodology and giving children a task that made their experience of forgetting relevant, children may be more likely to understand the experience of “forgetting.” As predicted by a preparedness bias, results from both samples confirmed that preschoolers are able to consider various memory constraints and capacities of other agents before age five, even when they could not remember the target card in the task. Children were clearly not reasoning according to egocentrism. That children anthropomorphized agents is unlikely because at no age did children treat all agents similarly. Whether children’s responses were anthropomorphic is unclear as responses for the human agents showed so much variation that there was no discernible pattern. A clear anthropomorphic response was not predicted as memory capacities are largely variable in humans. If children were using an anthropomorphic framework, responses would be the same amongst all human agents. Indeed, there is the possibility that three-year-olds used a human model (a less strict form of anthropomorphism) for some of the agents. For example, it is possible that children’s understanding of Baby formed their understanding about thinking of the mind of a Dog and that their understanding of Mom formed their understanding about thinking of the mind of God. Nevertheless, there is little evidence for such an interpretation. Responses for Mom and God were statistically

different,  $z = 3.94$ ,  $p < .001$ , implying that children did not think in the same way about both agents. However, there was no significant difference between Baby and Dog. Although there is no difference, the data do not elucidate whether children were using their understanding of a baby to reason about the memory of a dog.

Unlike the children in Wellman's (1978) study, by 5 years of age, children attributed "forgetfulness" to the baby differently than what would be expected by guessing. Children intentionally received a task that made the forgetting relevant. Arguably the relevant experience of forgetting helped children to mentally represent the possible mental states of the other agents, making it easier for children to imagine that another human being may have trouble remembering the location of the card. Note, however, that children had forgotten themselves and roughly half of the children (particularly the three-year-olds) were essentially saying that a baby would remember something that they themselves had forgotten. Such responses challenge egocentrism but fit comfortably with preparedness.

Because young children responded with consistent patterns for many of the agents at an early age, using a task that is relevant to children may increase conceptual clarity so that children can easily represent the mental states of other minds. In other words, having an applicable task breaks down possible cognitive demands of recall, allowing the child to be able to reason about the similar or dissimilar cognitive capacities of other minds.

#### **7.4.2 Cross-Cultural Understanding of Other Minds**

Similarly to chapters five and six, there were no distinct cross-cultural differences. Earlier than five years of age, Israeli and British children distinguished among different types of minds in a similar pattern. Thus, despite the theoretical reasons for exploring these two cultures, there were no major differences. The lack of cultural differences suggests certain specific developmental patterns within two different cultures. Although there were no cultural differences between British and Israeli children, these results cannot be broadly

generalized to children in all cultures. Additional replications using other cross-cultural samples need to be completed.

Further, the specific developmental pattern that British and Israeli children's responses followed was consistent with a preparedness bias. The pattern of responses supports the view that children take into consideration individual constraints. According to one part of the preparedness hypothesis, children are able to represent the minds of other agents earlier than five years of age. Indeed, responses for Israeli and British children younger than five years demonstrated that children differentiate among different types of minds, mirroring prior work (Barrett et al., 2001; Richert & Barrett, 2005).

The second component of the preparedness hypothesis is that children are biased to attribute knowledge when they are not certain about an agent. In the case of the memory task, a young child's default response (before a mature and representational understanding of theory of mind) might be to attribute a better memory to another agent.<sup>16</sup> British and Israeli children did not over-attribute a good memory to all agents. However, the majority of British and Israeli children initially attributed their mom with a good memory. Children may assume that their mothers know more than they do and attribute knowledge or better memories to their mothers. As mentioned above, mothers encourage children to remember autobiographical events (Fivush, Habermas, Waters, & Zaman, 2011; Rudek & Haden, 2005; Welch-Ross, Fasig, & Farrar, 1999) and often use "remember" words with their children (Furrow, Moore, Davidge, & Chiasson, 1992). Children may associate these experiences with their mother.

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<sup>16</sup> But because this task does not have an absolute standard for responses, attributing a good memory may not be the only option for preparedness. For example, if children do not attribute "forget" significantly to any agent, they are still attributing better memory to another agent compared to their own ignorance perspective.

In short, children did not resort to applying anthropomorphism to the agents. A correct anthropomorphic response is difficult to establish in a memory task where human memory is variable. As this task does not require clear right or wrong answers as in a typical false belief task, a typical response for a human agent is unclear. Indeed, Mom or granddad might be able to remember cards in a memory task. Nevertheless, if children's responses for Granddad, Bop, Baby, and Mom were similar to their responses for dog and the supernatural agents, an anthropomorphism strategy may have been used. But, children did not respond in this pattern; children gave different patterns of responses for different agents.

The design of the memory task allows for the possibility for variation in responses for some of the human agents, such as Granddad or Mom. Unlike other theory-of-mind tasks, there were no correct answers for agents like Mom or Granddad. These agents could very well be represented as having the cognitive capacities to remember information very well or they may not. This ambiguity may force participants to have to think about the individual constraints and capacities of these individuals in order to assess whether this agent can be attributed with a good memory or not.

### **7.4.3 Understanding Individual Variables**

I predicted that very young preschoolers would respond that the agents with individual constraints (Bop, Baby, Granddad, and Dog) would be attributed with not remembering where the card was, and that the agents that are not constrained by limitations (Swec and God), would be attributed with remembering. British and Israeli children of all ages accurately represented the memory capacities of God, and by four years, most children responded that Swec would remember. With age, older children could reliably respond that Bop (by four years) and Baby (by five years) would not remember. As predicted, children younger than five years could consider different memory capacities for many different agents.

Both the adult and child samples responded that Bop and Baby would not remember where the card was, and that Swec and God would remember. These results are consistent with the initial results found in the previous chapter. In chapter six, results demonstrated that British and Israeli children understood perceptual and aging constraints by four years of age. Thus, when children are asked to think about an agent and are given the added aid of a specific individual constraint (in the form of a cognitive limitation or special capacity), they may find that this added information provides an important social cue. This social cue may help children to apply the specific individual constraints to the agent in question. Indeed, by providing children with specific social cues, their pattern of responses may have less variation because the agent is less ambiguous.

Unexpectedly, all children's responses for Granddad and Dog showed no distinct pattern. There could be several explanations for these results. First, there could be the possibility that half of children responded that Dog or Granddad could remember and the other half responded that they would forget, cancelling out any significant differences in responding. In the case of Granddad, half of children (51.1%) responded that Granddad would forget, whereas 58.5% of children responded that the Dog would forget. At least in the case of Granddad, results could reflect a group of children who honestly stated their grandfather's ability to remember. Another possible explanation is that responses reflect differential experience with pets or older persons. More experience may be potentially related to better understanding of a dog's or an elder's abilities. Yet, even so, the variability of canine intelligence and the memory faculties of the elderly can vary widely. Or, perhaps instead of amount of experience, the type of personal experience is key. One child may have a granddad or dog who is very clever and another child may have a dog or granddad with a poor aptitude for memory. Justifications of these responses would be helpful in determining which type of experience or intuition children adhere to. Finally, the inconsistency with

which children and adults responded for Grandad may demonstrate that people are not sure about the memory capacities of an individual or someone old in age. Indeed, older individuals may be both wise but may also be forgetful. Additionally, the age of Grandads could be variable with ages ranging from 50+ years. In the case of children, their understanding of the memory capacity of dogs is unclear. A dog may have various perceptual capabilities (i.e., a good sense of smell that can locate a lost toy) but terrible memory capacities.

These results are in contrast to the adult population that responded that the dog and granddad would not remember. Perhaps adults know from experience that the probability is likely that an older person and a dog would not remember the location of the card. Also, an adult response may be more logical than a preschooler or their granddad is much older than a child's grandad. A few qualitative responses from adults suggested that "a dog would never remember where the card was, he wouldn't care." Additionally, they proposed that granddad would be too old to have a good memory. While these responses were given during the experiment, justifications were not collected from all participants. Further research should collect justifications for their responses.

Another unexpected result was that children across all ages responded that their mother would remember. That children represent Mom with a good memory may very well be the case, as their mother could have a good memory. Additionally, mothers use a lot of "remember" language (Furrow et al., 1992). They are one of the key factors in the development of autobiographical memory in children (Fivush et al., 2011; Rudek & Haden, 2005; Welch-Ross et al., 1999). Thus, children may easily associate certain memory activities with their mother.

Interestingly, Israeli and British adults differed in their attributions of memory to their friend (an aged matched agent for the Mom for children). British adults were more likely to

attribute a good memory to their friend than were Israeli adults. An explanation for why British adults rated their friend as having a good memory is unclear. A possible explanation for the difference between samples as well as between Israeli adults and children's responses, could be actual memory capability. Perhaps British adults viewed their friends as having a good memory.

Adults and children of all ages attributed a good memory to God and by four years of age children attributed Swec with a good memory. Even though children came from a standpoint of "forgetfulness" they were still able to consider a different viewpoint, that God would better remember the location of a card, and by age four, that Swec would better remember the location of the card compared to the child. Because children attributed a good memory to Swec and God, they were not attributing egocentrism to these agents. If children were anthropomorphizing, they would have attributed the same memory stance as Baby and Mom to the supernatural agents. But because children did not attribute Baby with forgetting until five years of age and attributed Mom with remembering, children were not using a broad human-based theory for reasoning about the supernatural agents. It may be plausible that children were using their understanding of Mom to then reason about Swec and God, however, there were significant differences among responses for Mom and God. Further, children did not apply this model to their responses for Grandad, another human adult. If anything, this result may reflect a tendency to over-attribute memory, a component in line with the over-attribution of knowledge of the preparedness hypothesis.

This tendency to over-attribute may boost children's ability to understand and transmit ideas about supernatural agents. Children at a young age seem drawn to narratives about supernatural agents such as fairies and super-heroes. Because young children can accommodate these ideas so readily, their ability to understand non-human theory of mind

may be more robust than prior work suggests (Lane et al., 2010; Makris & Pnevmatikos, 2007)

There are several limitations to both these experiments. The present work did not obtain justifications for children's understanding of another's memory. Justifications may provide further insight into the variable pattern of responses received for Granddad, Dog, and Mom. Further work should also explore other memory-based theory of mind tasks to fine-tune how children come to understand the nature of knowledge retention in other minds.

#### **7.4.4 Conclusion**

The present results provide further insight into the developing nature of children's theory of other minds. Specifically, these results advance theory of mind research by examining the influence of individual constraints on children's representations of the memory of others. Children take into consideration individual constraints when thinking about other minds and they are able to do this at an early age. These results provide further evidence that children may not need to anthropomorphize or use egocentrism to reason about God. Instead, children find it easy to reason about God and other non-human minds. Children may have a prepared capacity to reason about other minds from an early age, and this early ability may help to promote transmission of ideas of supernatural agents, such as God and Swec.

In the next chapter, the preparedness hypothesis will be applied to another supernatural attribute: immortality, and to another domain: biology. Cross-cultural differences will be tested to see whether Israeli children, in a culture where they experience threat of war in an intense political climate, understand various life-cycle phenomena earlier than do British children.

## **8 Children's cross-cultural and cross-religious notions of parentage, birth, aging, death, and immortality**

### **Study 4**

The empirical chapters and studies presented up until this point focused on children's understanding of mental capacities. Results suggest that before children have a fully representational understanding of minds, children take into consideration both individual characteristics (age of individual, personal capacity, perception) and situation-specific factors (proximity, occlusion). In addition, children younger than six years are not bound to anthropomorphize other agents. Rather, children are more flexible in their understanding of other minds.

Although research has begun to focus on children's understanding of other types of entities, particularly their minds, very little research has focused on children's understanding of and ability to distinguish biological traits in human and supernatural entities. When can children distinguish those properties that would belong to biological entities (animals and humans) from non-biological entities (many supernatural agents)? In this chapter, I continue to investigate children's understanding of other entities by exploring how they understand and distinguish the biology of a variety of agents. Do children first understand immortality before they understand mortality? Does the preparedness hypothesis apply to children's notions of the life cycle?

#### **8.1 Study 4: Introduction**

Death and the threat of death is a primal concern for humans (Becker, 2011/1973). The animals on our dinner tables were once alive but are now dead. Many of our day-to-day behaviors concern safety for life and limb. The end of life is marked by emotionally evocative community rituals. Consequently, understanding death and its inevitability is a

critical developmental achievement. The current study uses a cross-cultural and developmental framework to explore when children begin to understand the inevitability of human death and how such understanding relates to other features of the life-cycle and to humans as biological entities.

Despite a number of studies on children's representations of biological phenomena, prior research has not directly compared two different cultures in three related areas: children's acquisition of a concept of death, the developmental acquisition of a concept of death in relation to other life-cycle concepts, and whether children make ontological distinctions among biological and non-biological entities. Addressing these concerns may shed light on fundamental issues in cognitive development, namely the influence of social and cultural input on children's understanding and acquisition of biological concepts and their understanding of biological entities.

Below I briefly review literature concerning the three topics that motivate the present study and then turn to the study itself. The present study examined three- to five-year-old Israeli and British children, using a variation of a research protocol first used by Giménez-Dasí, Guerrero, and Harris (Giménez-Dasí et al., 2005).

### **8.1.1 Children's Attribution of Death and General Life-Cycle Biological Phenomena**

Research indicates that a mature concept of death includes, but is not limited to, five subcomponents: (1) universality, the notion that all living things will die; (2) inevitability, or the idea that a living thing will eventually die; (3) irreversibility, or that once a living thing is dead, it cannot be brought to life again; (4) cessation, or that all mental and bodily functioning ceases with death; and (5) causality, or that death is caused by the breakdown of the body. Many researchers suggest that between the ages of three and five children understand universality and irreversibility (Brent et al., 1996; Slaughter & Lyons, 2003), by age seven or eight, children understand cessation and causality (Bering & Bjorklund, 2004;

Koocher, 1973; Lazar & Torney-Purta, 1991; Slaughter & Lyons, 2003), and of interest to this particular study, between the ages of five and seven children understand a concept of inevitability (Speece & Brent, 1984).

Although children develop a concept of the inevitability death between the ages of 5- and 7-years old, other research shows that children acquire other biological concepts earlier. Children as young as age three can grasp the difference between living and non-living things (Heyman et al., 2003; Inagaki & Hatano, 1996), that living things increase in size but artifacts do not grow (Inagaki & Hatano, 1996; Rosengren et al., 1991), and that living things need water and food to maintain life and to grow (Inagaki & Hatano, 1993, 1996, 2004; J. L. Miller & Bartsch, 1997; Morris et al., 2000). Four-year-olds understand that living things grow (Rosengren et al., 1991) yet their essence is unchanging. For example, children realize that a person's race does not change across the lifespan or through birth and inheritance (S. A. Gelman & Hirschfeld, 1999; Hirschfeld & Gelman, 1994; G. E. A. Solomon, Johnson, Zaitchik, & Carey, 1996). This collection of knowledge—in addition to other biological phenomena—is referred to as folk biology.

Prior research has debated how children come to acquire and understand folk biological knowledge. Developmental work focusing on children's understanding of life-cycle phenomena offers various theories (Bering et al., 2005; Bloom, 2004; Carey, 1985; Inagaki & Hatano, 2002; Slaughter & Lyons, 2003). One theory, suggests that ideas about death could be tied to other more general biological understanding. Inagaki and Hatano (2002) propose that there may be various modes of construal within the biological domain to help children understand other biological phenomena. They specifically propose that a child's concept of life (and of death) is based on an intuitive vitalistic mode of construal that children adopt to reformulate previously learned biological concepts. The emphasis on understanding "life" and "life energy" is central to children's thinking and reasoning about

other related life-cycle phenomena. If children do use a vitalistic framework, both Carey (1999) and Slaughter and Lyons (2003) suggest that children need to build a coherent concept of “life” before they understand a concept of death.

According to other developmentalists, such as Bloom (2007), Carey (1985, 1995) and Bering (2011; Bering & Bjorklund, 2004; Bering et al., 2005), children may frame a notion of death based upon psychological considerations rather than solely based upon folk biology. For example, understanding the death of a human (in comparison to a garden snail or earthworm) involves appreciating the cessation of mental function as well as physiological function. Bering (2011) suggests that the inability to simulate oneself or another agent as no longer having certain epistemic states creates a conceptual obstacle for accepting human death—particularly the cessation of those epistemic states. Bloom (2004; 2007) argues that humans are intuitive dualists and the conceptual system concerned with minds is different from the system dealing with bodies. Thus, an understanding of the inevitability of human (psychological) death may not develop in tandem with other biological phenomena, even those concerning other aspects of the life-cycle such as once having been a baby, having parents, and aging over time. One way of investigating such a possibility is to directly compare children’s attributions of life-cycle phenomena (babyhood, parentage, and aging) to attributions of death. Are such attributions made on a similar developmental schedule?

According to a dualistic and vitalistic framework, I have reason to predict that young children would understand the concepts of babyhood and parentage earlier than a concept of death. However, exploration of children’s explicit understanding of the notion that biological beings have parents and were once babies has not been directly investigated in previous work.

### 8.1.2 Ontological Distinctions Among Biological and Non-Biological Entities

A neglected area of children's comprehension of the biological inevitability of death is the extent to which children apply their understanding of the inevitability of death to supernatural agents. Carey (1995) has stated that understanding biological knowledge is contingent on children's ability to classify living and non-living entities. Children as young as three and four years understand the difference between living things (e.g., plants and animals) and artifacts (Heyman et al., 2003; Inagaki & Hatano, 1996; Rosengren et al., 1991), but research has not examined whether young children classify supernatural beings as biological entities and, hence, make relevant attributions. If the preparedness hypothesis can be applied outside of folk psychology and to the domain of folk biology, perhaps young children find immortality easier to understand than understanding the inevitability of death in humans. That is, perhaps children begin by assuming that all intentional agents will simply go on living indefinitely until they learn that some beings (humans and animals) will eventually die, and that learning about the mortality of some beings does not necessarily transfer to all. Such a developmental pattern appears consistent with both preparedness and with Bloom's intuitive dualism.

As suggested above, if the chief difficulty for children recognizing the inevitable death of humans is the interference of folk psychology (Bering & Bjorklund, 2004; Bloom, 2004, 2007; Carey, 1985), then we might likewise see that children do not tend to anthropomorphize God (or other gods) in this regard. That is, if it is hard to conceptualize minds as eventually dying, children will be unlikely to attribute the inevitability of death to gods, especially if they are not regarded as embodied biological beings. In contrast to the anthropomorphism of gods on many traits that psychologists and other scholars have alleged (e.g., Guthrie, 1993; Lane et al., 2010, 2012; Piaget, 1929), we might expect that attribution

of immortality to gods (or their failure to be subject to death) would be very early developing, earlier than attribution of the inevitability of death (mortality) to humans.

In one study, three-to-five-year-old children in Spain were asked to respond to four questions addressing the mortality of humans and God (Giménez-Dasí et al., 2005).

Giménez-Dasí, et al. (2005) asked Spanish children from both religious and non-religious schools four questions regarding a friend and God: 1) “When there were dinosaurs in the world, did \_\_\_\_ exist?”, 2) “Will \_\_\_\_\_ get older and older or stay the same?”, 3) “Will \_\_\_\_ die or go on living forever and ever?”, and 4) “Was \_\_\_\_ a little baby a long time ago?”

Answers to these four questions were summed for a “mortality” score. Three-year-olds did not clearly distinguish between God and their friend or answer differently from chance (a score of 2 out of 4). In contrast, five-year-olds consistently attributed “mortality” to humans, the same age at which they reliably denied such properties to God. “Mortality” here, however, was operationalized as a composite score of four questions concerning: death, having been alive with the dinosaurs, aging, and babyhood. The specific items were not compared, nor was the death item contrasted with the others. Further, the Spanish children may have been confused by the referent of “Díos” in the study because of the predominantly Christian context. If Díos meant Jesus, then Díos once was a baby and did die. Perhaps the apparent degree to which children attribute mortality to God was inflated. This confusion might be reduced in a cultural context where there is no form of a human deity, such as in Israeli Judaism. God, in the Jewish tradition, is regarded as not having had parents, not having been a baby, and not growing older with time. If children begin to attribute all of these traits and inevitable death to God simultaneously, it would be strong evidence that understanding these aspects of the human experience are conceptually linked.

### 8.1.3 The Variability of Understanding Death Across Cultures

Across cultures, children are exposed to other children with parents and to babies, and are aware that they and others are growing older and bigger. However, exposure to death may vary markedly from place to place. On one hand, such a difference may impact when and how understandings of death develop (Gutiérrez & Rosengren, 2011), but only if conceptions of death enjoy a degree of independence from other biological life-cycle reasoning. On the other hand, if children's understanding of the inevitability of death in humans is almost entirely dependent upon acquiring vitalistic reasoning—or folk biology generally, or even a more abstract appreciation of inevitability—then variations in children's acquisition of a concept of death from one culture to the next could be minimal.

Do children living in a war-threatened culture (e.g., in Israel) attribute mortality to humans earlier than children who are not exposed to such a threat (e.g., in the UK)? Exposure to death through the media or personal experience may give Israeli children consequential knowledge of the inevitability of death compared to British children who have not been personally exposed to such ideas or experiences. Culture and political climate may influence children's conception of death (Brent et al., 1996; Candy-Gibbs, Sharp, & Petrun, 1984; Florian & Kravetz, 1985; Kalish & Reynolds, 1976; Schonfeld & Smilansky, 1989). Schonfeld and Smilansky (1989) asked both Israeli and American children aged 4- to 12-years-old about different components of death. The youngest Israeli children demonstrated a concept of irreversibility and cessation earlier than did American children. The authors conclude that Jewish-Israeli children's early development of a concept of death is attributed to Israel's security problems. However, the measures used conflated the concept of "inevitability" with the concept of "universality." In other words the definition for inevitability was synonymous with universality. Thus, the lack of differences among samples

may be attributed to an unreliable construct of “inevitability” and it is unclear whether children differentiate amongst these concepts.

#### **8.1.4 The present study**

Three questions, then, motivate the present study: (1) Does an understanding of inevitable death develop in tandem with other features of the human life-cycle biology such as having parents, having been a baby, and growing older with passing time? (2) Is inevitable death attributed to nonhumans such as God? (3) Is the attribution of inevitable death susceptible to cross-cultural variation? To consider these questions I replicated and extended the study by Giménez-Dasí et al. (2005). I sought to resolve several interpretive ambiguities from their study. First, I wanted to re-examine and clarify results regarding children’s developmental acquisition of death and mortality. In their study, it was not clear whether their “mortality index” had strong construct validity: was it actually measuring children’s understanding of mortality or a broader understanding of the life-cycle, or something else? Likewise, as reliability analyses or inter-correlations of items were not conducted on the four questions administered, we cannot be certain that a single construct was being measured.

A further motivation for replication, and to specifically explore the developmental acquisition of death, was to broaden the populations under consideration. Giménez-Dasí et al. (2005) interviewed children in Spain, a place that retains a strong Catholic cultural heritage, where Christmas and Easter are celebrated as national holidays, and Mary is commonly referred to as “the Mother of God.” Additionally, children attending Christian schools comprised half of the sample. Due to direct religious education or more passive general enculturation, children may have been confused about the questions on death and birth, particularly in relation to God. For example, there may be some confusion regarding the question, “Was God a baby a long time ago?” If God means Jesus, then adults too might answer, “Yes.” What would be the response with children from a culture where a god

without biological traits was not relevant? To answer these questions, I compared participants from a Jewish cultural context (Israel) with those from a traditionally Christian cultural context (UK). I expected that Modern Orthodox Jewish Israeli children, of a culture in which God was never a baby, did not have parents, and never did die, would distinguish between an immortal God and mortal humans earlier than age five. Israel also served as a useful comparison to the United Kingdom because of its relatively heightened threat of war and violence. Because of this threat I expected that Israeli children would appreciate the inevitability of death of humans at a younger age than British children.

In addition, I included questions about God *and* Jesus for the British sample to explore children's ontological distinctions among biological and non-biological entities. The addition of questions about Jesus was meant to contrast with the referent "God" and to reduce possible confusion. I speculated that by having Jesus and God as separate agents under consideration, children would be able to distinguish between God in his biological human form (Jesus) and God as a non-biological being.

Finally, to address previous concerns about omnibus composites, I analyzed each item individually (parentage, babyhood, aging, and death). I predicted that both Israeli and British children under five years of age would be able to answer questions about life-cycle traits above rates expected by chance alone. I also hypothesized that attributions of death to humans would be given at a later age than attributions of other life-cycle traits.

## 8.2 Method

### 8.2.1 Participants

The entire sample included 141 children. Sixty-six children (range = 2 years 10 months to 5 years 6 months;  $M = 4.24$ ,  $SD = .87$ ) were Modern Orthodox Jewish children from Jerusalem, Israel, and 75 children were from Oxford, England and Wallyford, Scotland (range = 2 years 7 months to 5 years 11 months;  $M = 4.26$ ,  $SD = .89$ ). Israeli children were

recruited from Modern Orthodox Jewish synagogues and online newspapers and all identified themselves as Modern Orthodox Jewish. British children were largely recruited from university nurseries and church crèches, as well as toddler groups and college sign-up sheets. Of those recruited from nurseries, five children came from atheist backgrounds and the parents of nine children chose not to comment on their religious background. All 14 children could mention something relevant about God, such as, “God answers prayers,” or “God lives in my heart.” Most children were from families who affiliated themselves with the Church of England. Nevertheless, all children were asked to tell the experimenter something about God to ensure that they knew the referent of “God.” Analyses were run to see if there were any comparable differences between responses from religious and non-religious homes and those who chose not to comment. There was no difference between samples,  $t_s < 1.27$ , *ns*. The rest of the children came from families who attended an Anglican church or an Anglican church-affiliated group at least once each week.

### **8.2.2 Procedure**

I asked participants the same set of questions as Giménez-Dasí et al. (2005). I asked two additional questions: one was whether an agent had parents and the other whether God could be killed. I asked this latter question to note differences in understanding between “kill” and “die.” In both the Jewish and British samples, the children were questioned about a friend, their Mom, and God. Agents were counterbalanced. To avoid unnecessary distress, I did not ask whether their Mom or their Best Friend could be killed. The British sample was also asked about Jesus. To see if mentioning Jesus provided a contrast to lessen the confusion about God, children were questioned about Jesus first, then asked about God.

Children were asked six questions in counterbalanced order. The first four questions comprised the mortality index from Giménez-Dasí, et al. (2005).

- 1) Dinosaur question: Each child was shown two pictures of dinosaurs, one of a velociraptor and one of a triceratops, and was asked if s/he could identify the type of animal. “Dinosaur” was an acceptable answer. If the child could not identify the animal s/he was prompted with another question to see if s/he had ever heard of dinosaurs. If the answer was still “no,” the child was not asked the dinosaur question. If the answer was “yes,” the experimenter then asked each child: “Right now there aren’t any dinosaurs in the world. But a long time ago there were lots of dinosaurs in the world, like this (show picture). Now what about [agent]? Do you think [agent] was alive when the dinosaurs were alive?”
- 2) Baby question: “A long time ago, were you ever a little baby, just like this? [Experimenter shows child a newborn size baby doll]. How about [agent]? Was s/he a little baby a long time ago?”
- 3) Aging question: “Let’s think about a moment a long, long time from now. Many, many years from now do you think [agent] will get older and older or will [agent] stay just the same?” [“Getting older” and “Staying the same” were counterbalanced].
- 4) Death question: “What will happen to [agent] a long, long, time from now? Will [agent] die someday or will [agent] go on living forever and ever?” “Die” and “Live forever” were counterbalanced.
- 5) Parentage question: “Do you think [agent] has a mom and dad?”
- 6) Death of God question: “Do you think God can be killed?” In the British sample, I also asked, “Do you think Jesus can be killed?”

Interviews were conducted in familiar environments to the children, either at their nursery or in their home.

### 8.3 Results

#### 8.3.1 Reliability of Mortality Index

Answers for “mortality” responses (e.g. “[agent] will die someday”) were coded as 1 and ‘immortality’ responses (e.g. “[agent] will live forever and ever”) were coded as 0. Kuder-Richardson 20 reliability analyses were conducted with the first four questions in both samples. In the Israeli sample, with all four items, reliability was low,  $r = .51$ , with the Dinosaur question being most poorly correlated with the other items. Hence, the Dinosaur question was removed<sup>17</sup> to increase reliability to  $r = .86$ . The results were similar with the British sample. With the four item scale, reliability was also low,  $r = .70$ . The Dinosaur question was removed and reliability also increased for the British sample,  $r = .85$ .

The remaining three questions (e.g. the Baby, Aging, and Death question) were summed to produce a mortality index score ranging from 0 to 3. Analyses using this index were used to compare results from Giménez-Dasí, et al. (2005), and to further assess any developmental and inter-agent differences in attributing life-cycle biological traits generally. Also, given that the index score contains mixed response types (forced choice vs. “yes” or “no” responses) and further specifies which traits were attributed to particular agents at different ages, analyses were supplemented by considering single-item analyses of parentage, babyhood, aging, and death, as well as exploring the relationship among these variables.

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<sup>17</sup> The Dinosaur question may not have correlated for several reasons. Many children may not have had previous knowledge of dinosaurs. On several occasions, parents suggested that many children did not really know what a dinosaur was. Further, the question could have been influenced by children’s understanding of extinction or perhaps to their understanding of existence and the relationship between present time and the ancient past. Indeed, research has shown that children have a hard time understanding extinction (1989) and also that young children do not understand dinosaurs as extinct (Poling & Evans, 2004). Unsurprisingly then, the intercorrelation of the remaining three items was stronger without the Dinosaur question.

### 8.3.2 Understanding of Death Across Cultures

Sixty-six Israeli children and 75 British children participated. Two Israeli children were excluded from analyses because, after a few questions, they withdrew from the experiment due to shyness. Additionally, another 7 Israeli children (all were under 4.5 years,  $M = 3.47$ ,  $SD = .65$ ) and 9 British children (6 were under 4.5 years,  $M = 4.01$ ,  $SD = .82$ ) were excluded from these analyses because these children did not provide enough codable responses to generate a mortality index. However, these children were included in the individual analyses of each item below, as their responses were not dependent on a 3 point score, and I wished to preserve as much data as possible. In the Israeli sample, seven children were excluded because the children answered, “I don’t know” and following the task, the mother or father informed the experimenter that his/her child did not know what “to die” meant and that they had not discussed this concept before. Another two were excluded as these children did not offer yes or no answers to questions about whether their friend and Mom would die or live forever.<sup>18</sup> Finally one child did not know whether any agent would grow old or die. A total of 57 Israeli children completed all the questions comprising the mortality index regarding both Friend and Mom, and 56 children completed all the questions regarding God. These 57 children included 19 three-year-olds, 16 four-year-olds, and 22 five-year-olds.

In the British sample, a total of 9 children were excluded from the composite mortality score analyses because two children did not know whether any agent had been a baby, four children did not know what the word “die” meant, and three children responded with a majority of “I don’t know.” Because the responses were “I don’t know,” I did not feel confident that these children understood the questions nor were these responses able to be

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<sup>18</sup> Interestingly, the same two children answered that God would live forever.

coded, so I excluded them from analysis. In total, 66 British children (range: 2 years 7 months to 5 years 11 months) completed the three questions included in the mortality index.

To examine more closely developmental differences while retaining sufficient statistical power, two age groups were created by median split at 4.5 years. Thus, all children that were aged 4 years and six months and younger were put into the category, “younger.” All children 4 years and 7 months and older were put into the category, “older.” Twenty-eight Israeli children (range = 2 years 11 months to 4 years 5 months;  $M = 3.56$ ,  $SD = .51$ ) and 35 British children (range = 2 years 7 months to 4 years 4 months;  $M = 3.57$ ,  $SD = .49$ ) comprised the younger group, a total of 63 children. Twenty-nine Israeli children (range = 4 years 6 months to 5 years 7 months;  $M = 5.03$ ,  $SD = .35$ ) and 31 British children (range 4 years 6 months to 5 years 11 months;  $M = 5.11$ ,  $SD = .42$ ) comprised the older group, a total of 60 children. Table 8 presents answer rates for each item by age group, sample, and agent.

Table 8.

*Percentage of “Yes” Responses by Age and Sample For Each Life-Cycle Trait and Agent*

		Parentage		Babyhood		Aging		Death	
		Younger	Older	Younger	Older	Younger	Older	Younger	Older
<b>Friend</b>	British	94.1%	100%	85.3%	82.1%	58.8%	96.4%	38.2%	71.4%
	Israeli	92.9%	100%	71.4%	86.2%	71.4%	100%	50%	89.3%
<b>Mom</b>	British	91.2%	100%	67.6%	78.6%	35.3%	82.1%	47.1%	67.9%
	Israeli	82.1%	96.6%	71.4%	86.2%	70.4%	86.2%	60.7%	92.9%
<b>God</b>	British	61.8%	40.7%	50%	42.9%	50%	50%	32.4%	14.3%
	Israeli	14.3%	0%	17.9%	10.3%	39.3%	24.1%	32.1%	6.9%

A repeated measures ANOVA was conducted on children’s mortality index scores with each agent (3: Mom, Friend, and God) as the within-subject factor and age group (2: younger and older group) and sample (2: British and Israeli children) as the between-subject

factors. Mauchly's test indicated that the assumption of sphericity had been violated ( $X^2(2) = 23.24, p < .001$ ), therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity. This revealed a significant effect for agent,  $F(1.47, 164.65) = 198.01, p < .001, \eta_p^2 = .64$ , and age group,  $F(1, 112) = 7.12, p = .009, \eta_p^2 = .06$ , and an interaction of agent and sample,  $F(1.47, 164.65) = 20.16, p < .001, \eta_p^2 = .15$ , and agent and age group,  $F(1.47, 164.65) = 27.67, p < .001, \eta_p^2 = .19$ .

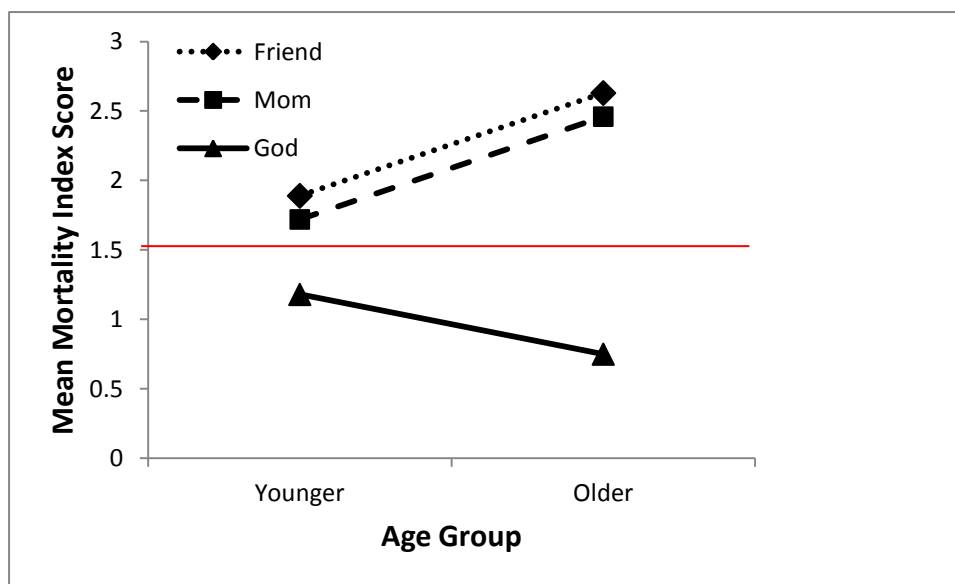
Interactions were explored by conducting two further individual repeated measures ANOVAs by age group and by sample. The first individual repeated measures ANOVA was conducted for age group collapsing across sample. Analyses revealed a significant effect for agent,  $F(1.54, 181.05) = 97.67, p < .001, \eta_p^2 = .46$ , Greenhouse-Geisser adjusted, and a significant interaction for age group and agent,  $F(1.54, 181.05) = 22.63, p < .001, \eta_p^2 = .16$ , Greenhouse-Geisser adjusted. Post hoc comparisons using the Tukey HSD test with Bonferroni corrections were used to analyze differences among agents. Results indicated that younger children's mortality scores for a Friend,  $M = 1.89, SD = .91$ , and for God,  $M = 1.18, SD = .92$ , significantly differed from chance (test value = 1.5 out of 3 questions) in opposite directions, suggesting attribution of "mortality" to a friend and "immortality" to God,  $ts > 3.05, p = .001$ , Cohen's  $ds > .39$ . Children's responses for God were significantly different from their responses for Friend and Mom,  $ts > 3.66, p < .01$ , Cohen's  $ds > .63$ . There were no significant differences in responses between Friend and Mom,  $t(60) = 1.46, ns$ .

In the older group, mortality scores for Friend,  $M = 2.63, SD = .59$ , and Mom,  $M = 2.46, SD = .82$ , were significantly greater than chance,  $ts > 8.46, p < .001$ , Cohen's  $ds > 1.03$ , and those scores for God were less than chance, indicating a denial of "mortality,"  $M = .75, SD = .94, t(56) = 6.16, p < .001$ , Cohen's  $d = .78$ . Older children produced significantly (and correctly) different scores between God and both the friend and Mom,  $ts > 9.63, p < .001$ ,

Cohen's  $d$ s > 1.91. Children's scores did not differentiate between Friend and Mom,  $t(55) = 1.92$ , *ns*.

Between each age group, the older group responded more consistently for each agent than the younger group,  $t$ s > 2.36,  $p < .05$ , Cohen's  $d$ s > .44, even though the younger group attributed mortality to Friend and immortality to God greater than chance, see Figure 11.

Figure 11. Mortality Score (out of 3) for Age Group.



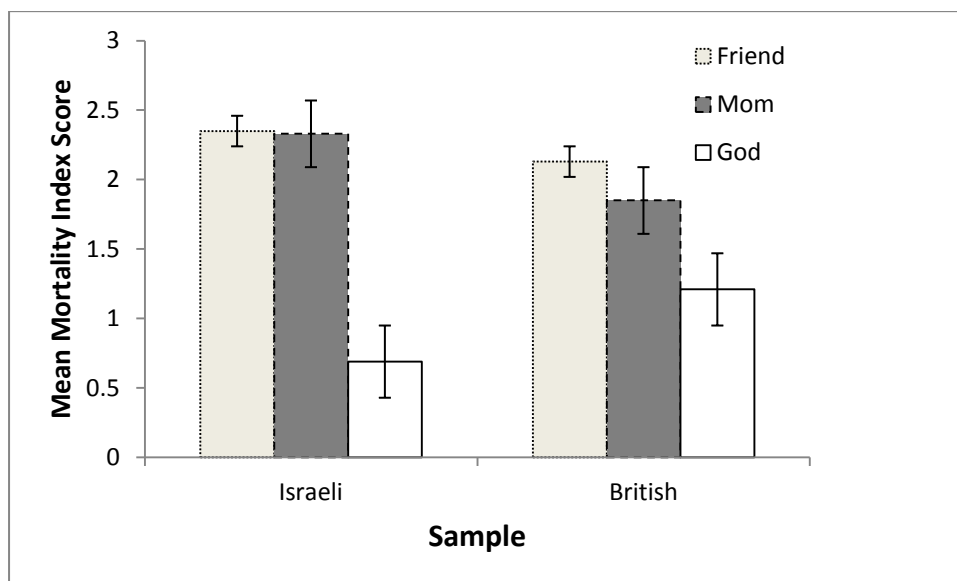
The second repeated measures ANOVA was conducted comparing samples and collapsing across ages. Analyses revealed significant main effect for agent,  $F(1.52, 173.78) = 90.30$ ,  $p = .001$ ,  $\eta_p^2 = .44$ , and a significant interaction effect between samples and agents,  $F(1.52, 173.78) = 12.23$ ,  $p = .001$ ,  $\eta_p^2 = .09$ . Post-hoc comparisons using the Tukey HSD test with Bonferroni corrections indicated that Israeli children's mortality scores for Friend,  $M = 2.35$ ,  $SD = .12$ , and Mom,  $M = 2.33$ ,  $SD = .13$ , and also God,  $M = .69$ ,  $SD = .13$ , were significantly different from chance,  $t$ s > 6.91,  $p < .001$ , Cohen's  $d$ s > .89. Children's scores did not differentiate between Mom and Friend on this measure.

Similarly, British children's mortality score for Friend,  $M = 2.13$ ,  $SD = .82$ , Mom,  $M = 1.85$ ,  $SD = 1.02$ , and God,  $M = 1.21$ ,  $SD = .96$ , were significantly different from chance,  $t$ s

$> 2.35$ ,  $p < .05$ , Cohen's  $d$ s  $> .29$ . In addition, British children's scores significantly differentiated between Friend and Mom,  $t(61) = 2.48$ ,  $p = .02$ , Cohen's  $d = .29$ . In other words, British children more often made mortality attributions (i.e., greater mortality index scores) to a friend,  $M = 2.13$ ,  $SD = .11$ , than to Mom,  $M = 1.86$ ,  $SD = .12$ .

Between samples, significant differences were found between British and Israeli children's responses for Mom  $t(115) = 2.73$ ,  $p = .007$ , Cohen's  $d = .51$ , and for God,  $t(117) = 3.35$ ,  $p = .001$ , Cohen's  $d = .62$ . Israeli children,  $M = 2.35$ ,  $SD = .91$ , produced higher mortality scores than British children for Mom,  $M = 1.85$ ,  $SD = 1.02$ . Additionally, Israeli children,  $M = .65$ ,  $SD = .86$ , produced significantly lower mortality scores for God than British children did,  $M = 1.21$ ,  $SD = .96$ , see Figure 12.

Figure 12. Mortality Score (out of 3) for Sample with Standard Error Bars.



### 8.3.3 Ontological Distinction between Jesus and God

Out of concern that children in a Christian context may confuse Jesus, who has biological attributes, with God during questioning, I included questions about both Jesus and God in the British sample, hoping the contrast would sharpen responses. To test for distinction between Jesus and God, two paired-samples t-tests for each age group were conducted to determine whether children differentiated between Jesus and God. One-sample

t-tests (with 1.5 as a test value) did not find that British children in either age group produced mortality scores for Jesus different from chance,  $ts < 1.10$ , *ns*. However, the older group's mortality score for God,  $M = 1.06$ ,  $SD = .99$ , was significantly less than that for Jesus,  $M = 1.59$ ,  $SD = .57$ ,  $t(28) = 2.73$ ,  $p = .01$ , Cohen's  $d = .64$ . The younger group did not differentiate between Jesus and God,  $t(33) = 1.67$ , *ns*, on this measure.

However, there were differences in responses for Jesus and God. In the youngest group, children were more likely to respond that Jesus had been a baby,  $M = .68$ ,  $SD = .47$ , than God,  $M = .5$ ,  $SD = .51$ ,  $t(33) = 2.24$ ,  $p = .03$ , Cohen's  $d = .39$ . In the older group, more children responded that Jesus would have been a baby,  $M = .79$ ,  $SD = .42$ , than God,  $M = .43$ ,  $SD = .51$ ,  $t(27) = 3.38$ ,  $p = .002$ , Cohen's  $d = .64$ , and that Jesus would have had parents,  $M = .89$ ,  $SD = .32$ ; God,  $M = .41$ ,  $SD = .51$ ,  $t(26) = 4.32$ ,  $p < .001$ , Cohen's  $d = .84$ .

### **8.3.4 Children's Attributions of Life-Cycle Traits: Parentage, Babyhood, Aging, and Death**

Because two items were forced choice items and the other two were "yes" or "no" response items, individual analyses for each life-cycle item (e.g., parentage, babyhood, aging and death) were run. Children previously excluded from the mortality index analyses due to incomplete measures were included below for the individual questions they did answer.

*Parentage.* Since parentage has not been previously studied in this manner, preliminary analyses assessed whether children appreciate this biological property and if so, at what age. Overwhelmingly, children in both samples regarded human agents as having parents, but only Israeli children significantly rejected parentage for God,  $z = 5.33$ ,  $p < .001$ ,  $r = .49$ . One-sample binomial tests were used to calculate whether each age group of children gave responses significantly different from chance, 1 out of 2 (yes or no) responses. All agents for both age groups were significantly different from chance,  $zs > 3.21$ ,  $ps < .001$ . In the Israeli sample, 95% (52) of all children sampled understood that a friend would have

parents and 87% (48) of Israeli children knew that Mom would have parents. Additionally, 89% (49) of Israeli children knew that God would *not* have parents. Even three-year-olds, considered alone, were significantly different from chance when reasoning about each agent, Friend: 89.5%,  $z = 3.44$ ,  $p = .001$ ,  $r = .78$ ; Mom: 84.2%,  $z = 2.98$ ,  $p = .003$ ,  $r = .68$ ; God: 15.8%,  $z = 2.98$ ,  $p = .003$ ,  $r = .68$ . Similarly, in the British sample, 93.3% (61) of the 3- to 5-year-old children knew that a friend and Mom had parents,  $z = 7.78$ ,  $p < .001$ ,  $r = .99$ , and  $z = 7.31$ ,  $p < .001$ ,  $r = .94$ , respectively. Differing markedly from the Israeli sample, only 50% (32) of British children said that God did *not* have parents. Neither British age group was significantly different from chance responding for God,  $z_s < 1.38$ , *ns*.

*Babyhood.* Children's understanding of babyhood (i.e., whether an agent was once a baby) was also explored with the question, "was \_\_\_ a little baby a long time ago?" In both samples, both the younger and older groups responded that their Friend and Mom had once been babies, a response significantly greater than would be expected by chance,  $z_s > 2.00$ ,  $p < .05$ , see Table 8. However, while Israeli children in both age groups responded that God was never a baby,  $z_s > 3.10$ ,  $p < .001$ , neither age group of British children responded consistently whether God had been a baby or not,  $z_s < .75$ , *ns*.

*Aging.* A Wilcoxon-Signed-rank test was used to determine whether children responded more affirmatively to "do you think \_\_\_\_\_ will get older and older?" versus "will \_\_\_\_\_ stay just the same?" In the British sample, the younger group did not show consistent responses for any agent,  $z_s < 1.72$ , *ns*. However, nearly 70% of the younger Israeli group said that Mom would stay the same and would not age, see Table 8. The younger Israeli children affirmed "grow" responses for a friend,  $z = 2.51$ ,  $p = .01$ ,  $r = .49$ , and rejected them for Mom,  $z = 2.12$ ,  $p = .03$ ,  $r = .42$ , significantly differently from chance. Similar to the British children, Israeli children's responses concerning God were not consistently different from chance,  $z = 1.13$ , *ns*. The older children in both samples answered significantly different

from chance that Friend and Mom would grow older,  $z_s > 3.14$ ,  $p < .001$ . Only the Israeli children answered consistently that God would stay the same,  $z = 2.79$ ,  $p = .005$ ,  $r = .38$ . A Wilcoxon signed-ranks test indicated that Israeli children responded that God would stay the same significantly different from the British sample,  $z = 2.03$ ,  $p = .042$ ,  $r = .19$ .

*Death.* To further assess children's attributions of death, responses for the question "Will \_\_\_ die someday or go on living forever and ever?" were examined separately. A Wilcoxon-Signed-rank test was used to determine whether children responded more affirmatively to "live forever" or "die" for each agent. The younger group in both samples did not significantly deviate from chance responding for either human agent,  $z_s < 1.37$ , *ns*. Both the Israeli and British children were more likely to attribute God with "live forever" responses than "die" responses,  $\chi^2(62) = 5.28$ ,  $p = .022$ . Analysis of the older groups indicated that Israeli children responded significantly different from chance for all agents,  $z_s > 1.89$ ,  $p < .001$ . British children, on the other hand, only attributed "die" responses to Friend,  $z = 2.27$ ,  $p = .02$ ,  $r = .43$ , and "live forever" responses to God,  $z = 3.78$ ,  $p < .001$ ,  $r = .71$ , see Table 8.

Responses for whether God could be killed differed greatly from responses regarding whether God would die. Twenty-three of the 26 Israeli children in the younger group said that God could not be killed,  $z = 4.16$ ,  $p < .001$ ,  $r = .77$ . All but one of the older Israeli children (27 of 28) said that God could not be killed,  $z = 5.01$ ,  $p < .001$ ,  $r = .95$ . Similarly, 88.7% (55 out of 64) of all British children said that God could not be killed,  $z = 4.004$ ,  $p < .001$ ,  $r = .5$ , and 77.4% (48 out of 64) said that Jesus could not be killed,  $z = 2.63$ ,  $p < .001$ ,  $r = .33$ .

#### 8.4 Discussion

The present study was conducted to examine at what age, in two different religious traditions and cultures, children understand life-cycle biological phenomena in relation to

human and supernatural agents. In addition, I aimed to explore whether an understanding of inevitable death coincides with an understanding of other biological phenomena related to the life-cycle.

#### **8.4.1 Mortality, Death, and Immortality Analyses**

In contrast to results from Spanish children in the study by Giménez-Dasí et al. (2005), and in addition to previous work (Carey, 1995; Inagaki & Hatano, 2006), British children appropriately attributed mortality to humans before age five. Additionally, younger children attributed immortality to God at a younger age (> 5 years) than the Spanish children in Giménez-Dasí et al. (2005). Still, according to the mortality index score, Israeli children attributed mortality to Mom and immortality to God more consistently than did the British children.

Perhaps Israeli children's exposure to violence and death in a culture with threat of war creates added environmental experiences that enhanced children's early attributions of mortality to humans. Several studies recommend that a certain exposure to death, whether through culture or personal experience, may enhance children's understanding of death (Florian & Kravetz, 1985; Poling & Evans, 2004; Schonfeld & Smilansky, 1989). Indeed, Poling and Evans (2004) suggest that children may have a "less sophisticated" understanding of death if they have parents who do not talk about death with their children. It could be that exposure to threat of war and violence gives Israeli children more experience with the idea and possibility of mortality than realized by British children (Florian & Kravetz, 1985; Schonfeld & Smilansky, 1989). If British children were given more detailed education about biological phenomena perhaps British children's attributions of mortality to humans would increase. As previous research has documented, teaching children about biological phenomena seems to advance their knowledge of biology and death (Slaughter & Lyons, 2003).

Additionally, the present design limits some interpretation of age-related differences. Seventeen children in the younger group were excluded from the mortality index because they had at least one response that was “I don’t know” or missing. A missing response on one question excluded a child from being included in the full analyses of the mortality index. Because of this, individual analyses were conducted on each question to understand responses for each question and to increase the sample size. Although research should densely sample within this younger age group to clarify children’s understanding of mortality, individual analyses of each item demonstrated that young children understood babyhood and parentage at an early age.

#### **8.4.2 Ontological distinctions among biological and non-biological entities**

Contrary to the presumption that children of this age anthropomorphize God on all dimensions, the younger children in both samples regarded God as living forever. If exposure to death and talk of death drives children’s appreciation of human mortality, what accounts for children answering in a theologically correct manner at an earlier age? All Israeli children were Modern Orthodox Jewish recruited directly from Jerusalem synagogues. In light of this Jewish children may be more likely to respond that God is immortal. Instead, I found that both samples attributed immortality to God.

These results may be interpreted in several ways. These findings support Barrett’s preparedness hypothesis that children younger than age five may attribute super-properties to intentional agents as a developmental default that is gradually displaced, and that children can also distinguish the properties of supernatural agents from humans, instead of only anthropomorphizing (Barrett & Richert, 2003). These results—for instance, that approximately two-thirds of the younger group said that their friends would “live forever”—may reflect children not yet successfully overriding a developmental default to assume that *all* agents (human or divine) will go on living forever. Although the preparedness hypothesis

was originally aimed at theory of mind reasoning, these results could extend to another divine attribute: immortality.

Another possible explanation for these results is that these results may reflect a general agent concept, “all agents have minds and the cessation of mental faculties is difficult to imagine.” Thus, very young children may not understand what it means to “exist.” These results are consistent with the claims by Bloom (2004, 2007), Carey (1985), and Bering and Bjorklund (2004) that folk psychology may interfere with a concept of death, and children may find the termination of epistemic states hard to imagine (Bering et al., 2005; Harris & Giménez, 2005). Even adults, who explicitly reject a life after death, answer that some psychological (but not biological) states continue after death (Bek & Lock, 2011; Bering, 2002; Huang, Cheng, & Zhu, in press). Children may find it hard to conceptualize that a person does not exist before birth (or in the womb) or after death. For example, 5-to-6-year-olds have responded that they were psychological and biological beings prior to conception (Emmons, 2011, in preparation). It is possible that children may not have a concept of immortality *per se* (i.e., what it means to live forever) but rather young children may simply assume that people and God have always existed and always will (Evans, 2008). Instead of immortality being a positive attribute (living forever) it could be a negative attribute (not failing to live). Nevertheless, in this study children were asked whether others would “go on living forever and ever” and it was this phrasing that the youngest children tended to affirm for God and their friends.

Another possibility may be that children are hesitant to consider the inevitable death of their friend and mother. Poling and Evans (2004) have suggested that when using familiar people, children may resist the idea that their friend or mother might die. Indeed, this item may be emotionally loaded. Future research should include human agents that the child is not

familiar with to eradicate any hesitation children may have had when considering their mother's death.

One final aspect of this research relevant to understanding children's development of the distinction between biological and non-biological entities is children's reasoning specific to the person of Jesus and the entity of God. In addition to modifying the mortality index (Giménez-Dasí et al., 2005), British children were also questioned about the possible distinction between Jesus and God. To date, the extent to which children in a Christian context conflate questions about God with the human characteristics of Jesus is unknown. Thus, the aim of these questions was to determine whether British children would differentiate between Jesus and God. Children at all ages responded at chance levels for Jesus in the mortality index, suggesting that children may be guessing or there were no clear patterns of thinking. Results from the younger children's responses revealed no difference in their thinking between Jesus and God. However, the results for the older group showed significant differences in their thinking between Jesus and God. When looking at the individual items, both younger and older British children responded that Jesus had been a baby and the older children responded correctly that Jesus had parents and God did not. The younger children did not differentiate between Jesus and God, except for the single item on babyhood.<sup>19</sup>

The younger group's chance levels of responding for Jesus or for God could be indicative of several lines of reasoning. It could be that children were guessing because adding Jesus may have confused them. Further, it could be that there were too many children in the British sample who did not have a fully developed notion of the physical and biological properties of Jesus. Whereas British children were at chance responding regarding whether

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<sup>19</sup> Children's early understanding of babyhood will be discussed below in the section on life-cycle traits.

Jesus would die, over 70% said he could not be killed. Thus, a supernatural agent with biological properties (Jesus) may be very confusing to a child, as children younger than 4.5 years responded that God is immortal. Children may find that a powerful non-biological deity (God) is easier to understand than a more limited one (Jesus). Indeed a God that is perceived as all-powerful may help explain why the young Israeli children overwhelmingly state that God could not be killed, even when children's responses were at chance about whether God would die.

The older group differentiated between Jesus and God in the mortality index and also for the items of babyhood and parentage. Older children may have a better grasp of certain biological traits (Carey, 1985; Inagaki & Hatano, 2002). They may also have additional cultural information from religious education from Sunday school or school that would help education children on the differences between Jesus and God.

### **8.4.3 Life-cycle Traits**

I examined the developmental onset of various life-cycle traits in addition to their relationship to children's attribution of death. As predicted, results suggest that the concept of death may develop later in children than other biological concepts, such as babyhood and parentage.

The youngest groups of both samples tended to respond that their friend and Mom had parents and were once babies at an earlier age than they would respond that Mom and Friend would die. Perhaps daily exposure to having parents, seeing friends with parents, having siblings, and seeing other people with their children make the traits of parentage and babyhood more evident and easier for children to attribute at an earlier age, especially compared to death and aging. If this is the case, perhaps this is why British children responded at chance levels when reasoning about whether God had been a baby or had parents. Indeed, if there is a relationship with exposure or cultural input, this may reflect the

increase in responses between the younger and older groups of British children responding that Jesus had been a baby and had parents, especially since children learn about these ideas through Sunday school, school, or experiencing Easter or Christmas. Additionally, cultural exposure would also help explain why Israeli children responded above chance that God would not have parents and would not have been a baby at an early age.

Another possible explanation is that the biological traits of parentage and babyhood map onto different biological modes of construal than the traits of aging and death. Indeed, babyhood and parentage may have more social associations than purely biological ones and death may not strictly adhere to a vitalistic framework. Since this is the first direct exploration of children's understanding of various life-cycle traits, more research should explore the relationship between these traits. For example, more work is needed to investigate whether children understand the link between parentage and being a baby, as well as whether having siblings influence attributions and conceptualization of these two biological traits. In addition, more research is needed to explore whether biological traits and which particular ones map onto different biological modes of construals. Accordingly, specific investigation is needed to explore additional life-cycle traits, such as children's understanding of reproduction, and also to explore when children developmentally understand this concept (Emmons, 2011).

Whereas questions regarding babyhood and parentage showed consistent responses for human agents across all age groups, responses for questions regarding aging and death developed later. Although aging and death developed later, only the older Israeli children's responses demonstrated more correct and consistent responding for *all* agents than did British children. Israeli children seemed to have a more mature understanding of aging and death for all agents. Further research should test the idea that media exposure and political climate affects biological knowledge, and specifically, biological knowledge about death.

#### **8.4.4 Conclusion**

In sum, the present study supports the notion that social and cultural input may enhance the acquisition of various biological concepts in early childhood. These findings suggest that exposure to violence and threat of war may facilitate a mature understanding that humans eventually die. These results also propose that very young children attribute immortality to agents--or assume that others will not die--before they understand human mortality. Why inevitable death is not the default—either because of failure to understand epistemic states as tied to having a living body or because they assume that others have always existed—remains an open question. Additionally, results indicate that an understanding of some biological phenomena related to the life-cycle may develop earlier than others. Further research should explore more specifically the types of cultural and religious experiences that enhance biological conceptual development.

## 9 Summary of Thesis

Developmental research has documented that young children acquire many cultural concepts with ease because of early developing cognitive mechanisms. Four studies (chapters five through eight) were designed to explore the cognitive and cultural contributions of children's developing conceptions of the minds of others, including their perceptual and memory abilities, and the extent to which these other minds are attributed a biological life cycle. Across these studies, ignorance-based theory-of-mind tasks were used to test the pattern of responses and to identify the possible biases that children use to represent different minds.

The primary objective of this thesis was to explore children's developing notions of other minds. I proposed that children do not need to anthropomorphize other minds, but have early developing cognitive capacities that enable young children to think about non-human minds differently than human minds.

Throughout this thesis, several primary research questions were examined to address the limitations of previous research and extend understanding of the development of children's thinking about human and non-human minds. This thesis sought: 1) to clarify results regarding the possible approaches children use to represent other types of minds (chapter five), 2) to clarify and extend work on divine knowledge using perception and memory tasks and to explore the influence of individual and situation-specific constraints in knowledge acquisition (chapters six and seven), 3) to extend work on developing notions of biological phenomena (chapter eight), and 4) to explore children's notions of other minds using children in two different cultures and religious traditions (chapters 5-8).

The key findings are summarized below.

## 9.1 Brief Summary

In chapter one, I provided the motivation for using children and using a cognitive science of religion approach. I argued that studying children helps inform how humans develop certain ideas about the world. Certain ideas, such as supernatural concepts, are highly constrained by domain-specific assumptions that we hold as a normal part of cognitive development. In order to understand how ideas about other beings—including cultural ideas about God—develop and persist, a cognitive and experimental approach is best suited to experimentally test whether there are certain domain-specific assumptions that influence cultural ideas. These domain-specific assumptions, detailed in chapter two, provide inferences regarding persons, objects, and biological entities. The domain-specific assumptions about the natural world generate cognitive biases towards teleological thinking, mind-body dualism, and the origins of things, other beings, and people. As I detailed in chapter three, children learn about the minds of others in very constrained and specific ways. Cognitive mechanisms constrain how concepts develop and which ideas persist. These cognitive mechanisms detect agency (HADD) and trigger thoughts about the intentions and thoughts of others. Three approaches (egocentrism, anthropomorphism, and preparedness) were discussed in chapter three. In chapter four, descriptions were given regarding the British and Israeli samples.

The primary objective of chapter five (study 1) was to test the development of children's understanding of other (i.e., non-human) minds and to clarify the methods used in this task to highlight the biases children may be using to understand other minds. Currently, there is disagreement among researchers regarding the approach children use to understand other types of minds. Two possible explanations for the inconsistency in results across these studies are differences in methodology and in sample. Thus, chapter five was designed to address the limitations from previous work to try to clarify the approach children use to think

about other minds. The results of Study 1 (chapter five) confirm that children are able to represent and reason about many different types of minds at an early age, and they do not have to resort to anthropomorphism. Instead, young children might have a flexible, general theory of mind that is tailored to reason about different agents.

The primary objective for chapter six (study 2) was to explore children's ability to take into account both situation-specific and individual constraints in their reasoning about others' minds. Specifically, children attributed perceptual knowledge to the animals and God from three years of age, consistent with the preparedness hypothesis. Children also showed flexibility in understanding theory of mind: older children continued to attribute knowledge to God and the animals, but no longer overextended that knowledge to human agents, contrary to anthropomorphism but consistent with the preparedness hypothesis. That is, they reasoned flexibly about which minds had access to knowledge. By four years, children began to take into consideration the age of the agents, and attributed correct perceptual ability to the human agents and God.

Chapter seven (study 3) built on chapter six by examining whether the preparedness hypothesis applies to another individual constraint: memory. Again, chapter seven revealed that children consider individual constraints on memory. Children at all ages responded that God would remember something that the children themselves had forgotten. By age four, children responded that the Baby and Bop, an agent who did not have a very good memory, would have forgotten like themselves and Swec, an agent with a good memory, would remember. These results suggest that preschool-aged children take age and individual constraints into consideration when considering other's mental states. Children did not show egocentrism.

Finally, the main aim of chapter eight was to extend the research on children's notions of biological phenomena by exploring the developmental and cross-cultural differences of

varying life-cycle properties and whether children applied these properties to both biological and non-biological entities. Although there were no detected cultural differences for children's understanding of mental properties, cultural differences were found for children's understanding of immortality using a life-cycle approach. Specifically, British children attributed immortality to God before correctly attributing mortality to human agents. The older group of Israeli children attributed immortality to God and mortality to the human agents more consistently than did British children. Additionally, both Israeli and British children's knowledge of certain biological phenomena (babyhood and parentage) emerged earlier than did others (death and aging).

## **9.2 Implications**

### **9.2.1 For Child Development**

Research regarding children's theory of mind has been one of the most well-researched topics in developmental psychology (Astington et al., 1988; Baron-Cohen, 1995; Bartsch & Wellman, 1989; Buttelmann et al., 2009; Call & Tomasello, 2008; Flavell et al., 1978; Gopnik & Wellman, 1994; Gordon, 1986; Harris, 1988; C. N. Johnson, 1988; Penn, Holyoak, & Povinelli, 2008; Perner, 1991; Wellman, 1990). However, researchers in the last decade have only just begun to study how children represent the minds of non-human agents (Barrett et al., 2001; Giménez-Dasí et al., 2005; Lane et al., 2010, 2012; Makris & Pnevmatikos, 2007; Richert & Barrett, 2005). Studying children's understanding of non-human minds is particularly important as researchers try to understand how children make sense of the many different types of agents that children often come into contact with besides humans.

Piaget, as well as a few contemporary developmentalists (Lane et al., 2010; 2012; Makris & Pnevmatikos, 2007), suggested that children form an understanding of other non-human minds via anthropomorphism. Nevertheless, as reported in chapters five through

eight, the results supported a preparedness hypothesis. Specifically this thesis gives evidence to support the notion that even very young children have a general and flexible theory of mind, able to incorporate outside knowledge to represent different types of minds. Children younger than five, the age at which typically developing western children should have acquired a mature understanding of other minds, responded correctly for God, many human minds, and many animal minds (e.g., the special animals in chapter six). The pattern of children's responses did not correspond to an anthropomorphism bias or egocentrism. This does not mean that anthropomorphism cannot be used as a reflective tool to represent the thoughts, desires, or beliefs of another. The point is that children *can* use other cognitive tools available to them to understand minds different from theirs, and that they need not reason solely in an anthropomorphic or egocentric manner about other minds. Indeed, children in this study were selective in their responses for other agents. Children were especially selective when given information about individual constraints; they incorporated this new information and were discriminating when attributing knowledge to various agents.

The fluidity with which children applied knowledge regarding the special animals and pretend agents (e.g., Swec and Bop) implies that children may be receptive to certain individual constraints. In other work, very young children are sensitive to individual differences and hence, very selective in who they learn to trust: children are more likely to trust those who are confident (Birch, Akmal, & Frampton, 2010; Jaswal, 2004), accurate (Corriveau & Harris, 2009; Corriveau, Meints, & Harris, 2009; Fusaro, Corriveau, & Harris, 2011), familiar (Corriveau & Harris, 2009; Kinzler, Corriveau, & Harris, 2011) and similar (e.g., Kinzler et al., 2011). This work suggests an early ability to recognize and distinguish agent-specific information and individual-specific constraints. In this thesis, children readily applied agent-specific information and individual constraints to the task at hand. These added social cues (e.g., memory ability, age, perceptual ability) may provide context for

understanding specifically the competence of another mind. Discerning differences among individuals may be important for fluid social interaction and learning. Before acquiring a mature understanding of other minds, children in these studies could take individual constraints into account when perspective taking. Similar to previous studies children's responses demonstrated a nuanced capacity to understand the variability of other minds consistent with their cognitive abilities (Brosseau-Liard & Birch, 2011; Dowker et al., 1994; Knight, 2008).

### **9.2.2 For Phylogeny and Preschoolers' Understanding of Non-Human Minds**

Results suggest that children can represent other minds at an early age and have a tendency to over-attribute knowledge. Evolutionary psychologists and anthropologists may find these results interesting because these cognitive biases may be widespread and have survival value. If children are able to think about other minds with ease, this ability would seemingly enhance a child's ability to survive. Assuming that a chief of a tribe is more learned, or that father knows best, may encourage deference or obedience to those in authority. Prior research suggests that assuming that another knows more may be computationally simpler and an instance of error management (McKay & Dennett, 2009).

Studying children's understanding of non-humans provides a window into how human ancestors may have understood non-human agents. Certain selective pressures in our evolutionary past initiated thoughts of non-human agents as evidenced by cave drawings of both supernatural agents and animals (Hahn, 1972, 1993; Mithen, 2003/1996). Noting whether children anthropomorphize or have a general and flexible theory of agency may illuminate how humans have evolved the tendency to think of other minds. Certainly, the ability to identify and understand other agents is necessary and fundamental for engaging with the world. Because young children *can* reason about animal and supernatural minds,

this early understanding is indicative that certain cognitive capacities are in place early in development that facilitate quick understanding of other types of agents.

### **9.2.3 For Cross-cultural Recurrence of Cultural and Religious Ideas**

As suggested above, the fluidity with which children understand that special animals and supernatural agents have certain special capacities, could be suggestive of certain intuitive conceptual systems. Other researchers have recommended that supernatural ideas are intuitive or natural (Bloom, 2007; Kelemen, 2004; McCauley, 2000, 2011; McCauley & Lawson, 2002) and are interesting and compelling (Boyer, 2001; Boyer & Ramble, 2001). It could be that these agents' extraordinary abilities (or counterintuitive properties) violate the expectations for certain ontological categories, and thus children are keen to pay attention to these agents. Research suggests that this fascination also applies to adults (Barrett & Nyhof, 2001; Tweney, Upal, Gonce, Slone, & Edwards, 2006). Additionally, as suggested by Barrett (2012, see also McKay and Dennett, 2009), it may be computationally simpler to consider those extraordinary minds where limitations are few and their abilities are many. The preparedness hypothesis specifies that children have a tendency to over-attribute knowledge to other agents. If children consider the super-abilities of agents simpler and easier to reason about, then a three-year-old's early ability to reason correctly about these agents is expected.

Although children's responses generally conformed to the preparedness hypothesis in this study, in other work (Lane et al., 2010, 2012; Makris & Pnevmatikos, 2007), children appeared to answer anthropomorphically or egocentrically. Children in the present studies also performed extraordinarily well compared to prior samples (Lane et al., 2010, 2012; Makris & Pnevmatikos, 2007). The consistent pattern of responses for British and Israeli children could be for a variety of reasons. One reason could be the intellectual and educational background of both samples. The UK sample was primarily children from the city of Oxford, a highly educated population. Similarly, the Israeli sample contained families

where the majority of families were well educated. Indeed, 87% of parents had at least a Masters degree. Nevertheless, I have no data for direct comparisons between the level of education of parents in my samples in comparison to prior work (Lane et al., 2010, 2012; Makris & Pnevmatikos, 2007) or another university city. Further, no clear link between parents' education and children's performance on theory of mind tasks has been established.

The majority of the children in both samples were from religious homes, with some awareness of God. As Lane et al. (2012) suggest, certain socio-cultural inputs can facilitate an appreciation for supernatural agents, such as God. Like Lane et al. (2012), young children in chapters six and seven responded correctly that the super-perceiving animals (e.g., the eagle and dog) would be attributed with knowledge, but children in the present studies did so before children responded correctly for the human agents. However, unlike Lane et al. (2012) children at all ages responded correctly for God. While socio-cultural inputs are certainly influential in acquisition of a concept of God—otherwise how would children know the referent of “God”?—the responses from children from non-religious homes were not detectably different from children in religious homes (chapter eight), or between two different religious traditions. Although I do not completely disregard the influence of certain socio-cultural input nor the influence of education (certainly input such as an initial concept of the type of being, the being's name, and the types of supernatural abilities are important in developing a concept of the being), certain cognitive biases and constraints must be important in the acquisition and persistence of these ideas. For instance, Knight (2008) showed that Mayan children's performance on a false-belief task that probed their understanding of various animals and gods was underdetermined by adult instruction regarding the various beings. The youngest children treated all gods and animals as super-knowing, even if adults regarded some of the gods as no more informed than a human. It appears that in many

situations, children default to over-attributing knowledge to others before a mature representation is formed.

The possible difference, and the most likely interpretation of differences between the present studies and prior work suggesting anthropomorphism and egocentrism, could be methodological. One difference was that the special agents that were included in the studies on mental states were specifically chosen because of their relevant capacities to the specific task (e.g., a dog that could hear well, or Swec, a person who has a very good memory). These cues may have helped children clue in to their specific abilities rather than guessing. Lane et al. (2010; 2012) used other agents with specific characteristics, as well, but also added other superpowers that may have confused the children (e.g., Heroman who can fly and see through things). Another difference was that the present studies used an ignorance task. Children may have found that the contrast of being ignorant and having to apply knowledge to other agents a simpler task than reasoning from a standpoint of having knowledge, a “curse of knowledge.” Even though children were ignorant in each of these tasks, very young children were still able to apply knowledge to those minds with super-capacities (e.g., super animals and super-agents).

In the present sample, the similarity of British and Israeli children’s responses could be attributable to certain early developing cognitive biases. Children from two different populations (Israel and the UK) demonstrated similar responses in their understanding of the mental states of others (chapters five through seven). This similarity may support the idea that children acquire similar ideas through early developing and domain-specific conceptual systems. Ideas about God, or other supernatural agents, such as Swec, play on our intuitive notions of the world and agency yet violate certain intuitive ideas (God knows everything) (Barrett, 2012; Boyer, 2001; McCauley, 2000). Ideas about God may be maturationally natural (Barrett, 2012; McCauley, 2000, 2011) as the development of these ideas coincides

with the development of theory of mind and a natural tendency to understand agency. As demonstrated in this thesis, young children understand the abilities of supernatural minds and were also able to understand the complexities of the specific constraints of human and animal minds to also reason about their capabilities.

It could also be that the cultures in the UK and Israel are very similar, and that the religious traditions of Christianity and Judaism encourage the type of thinking demonstrated in these studies. Some of the conclusions above may still be premature until more research is conducted with other traditional societies. My guess would be that there are certain universal characteristics of supernatural agents, such as the attribute of invisibility as Boyer (2001) has suggested. Divine knowledge seems to be a concept understood by small children, so I would predict that omniscience could be a common attribute among traditional societies and one reserved for more “higher” gods.

Finally, although children’s responses for mental states followed the same developmental course in two cultures, the results from chapter eight recommend that there may be cultural differences in the acquisition of certain biological knowledge. Israeli children demonstrated a more consistent pattern of responses about death for both the human agents than did British children who responded correctly for only one human agent (friend). Cultural influence or individual exposure may enhance children’s understanding of certain biological concepts (Florian & Kravetz, 1985; Poling & Evans, 2004; Schonfeld & Smilansky, 1989). Israeli children live under different existential threat (Brom et al., 2011; Wang et al., 2006) than do British children and their likelihood of having experienced death in a personal manner, because of war or threat of war, may make their understanding of death more sophisticated.

The results from chapter eight also indicate a need for a re-conceptualization of children’s understanding of intuitive biological phenomena. In comparison with other

biological constructs, death and growth developed much later than biological concepts of parentage and babyhood. Certain biological concepts may map onto different modes of construal; more specifically, certain concepts, such as babyhood and parentage, may not adhere to a vitalistic framework as once thought. Instead, babyhood and parentage may map onto a different mode of construal such as concepts related to reproduction. The daily exposure of families with babies and children with parents may make parentage and babyhood very easy to assimilate. The concepts of birth, growth, and death may be more complicated because children may have limited experience or exposure to the birth or death of animals or humans, and changes in growth may be very difficult to notice without tracking for long periods of time. Understanding a concept of death also has additional complications. Certain cognitive biases towards dualism or afterlife beliefs may make the concept of death more difficult to understand than other biological concepts. Future research should take possible cultural differences and exposure to death into consideration when developing a folk theory of biology.

### **9.3 Limitations and Future directions**

Data from chapters five through seven suggest that young children have the capacity to consider a variety of non-human minds. Very young, preschool-aged children could represent different types of minds easily and accurately in many of the tasks. However, these results have some limitations.

#### **9.3.1 For Developmental samples**

Very young children performed very well on these tasks. Data, however, were not collected with children younger than age three, making the earlier developmental trend unclear. Additional research should be collected with denser sampling in the younger age groups using adapted and simpler methods. However, considerable adaptation would need to be made to make the task suitable for children younger than three who have more limited

language skills. More detailed sampling should also be collected with young three-year-olds, as well as older children and adults, to more fully understand the developmental trajectory of understanding other minds (i.e., to help determine whether younger children over-attribute knowledge to other agents, whether they anthropomorphize, etc). Perhaps even younger children have some ability to take into account various non-human identities as well as take into account certain individual constraints when taking the perspective of others. Moreover, denser sampling of the younger children could reveal a curvilinear developmental pattern similar to Lane et al. (2010; 2012).

Additionally, although research assumes that subsequent to theory of mind acquisition (around age five) people retain a stable ability to conceptualize human minds, it is unclear the extent to which knowledge of individual constraints influences the way in which that agent's mind is conceptualized and how this changes interactions with that agent. As an adult gets to know another person and their capabilities, it is likely that the adult adjusts his/her concept of this person. Or, perhaps adults start with a "standard" human concept and then adjust accordingly as one gets to know the other person's capabilities and constraints. In addition to future exploration of the stability of human concepts, additional research should explore the stability of concepts of supernatural minds. How does theological reflection and other cultural learning influence more intuitive concepts of God? Prior research (Barrett & Keil, 1996) has documented that adults express theologically learned concepts of God (that God is omnipresent), but often resort to more anthropomorphic concepts (that God is in one location at a time) when faced with too many cognitive demands (recalling the location of God in a story). This thesis demonstrated that children attribute some theologically correct concepts of God; perhaps adults learn to anthropomorphize. Such a possibility is consistent with findings from two studies from India (Barrett, 1998; Chilcott, 2011). These studies demonstrated that

the degree to which adults anthropomorphize increases with age. Further research should examine whether anthropomorphism is a learned bias.

In relation to the above, the current research presented cross-sectional data. The limitation of this type of sampling is that the data do not reveal the developmental transition within individuals from immature to mature understanding of theory of mind reasoning. Future research should explore the developmental acquisition of a theory of other minds longitudinally. In this type of research design, the progression of understanding other minds in both religious and non-religious samples of children can be charted and compared. Various theory-of-mind tasks could be used to assess children's acquisition of this idea in relation to acquisition of other minds (e.g., human minds).

### **9.3.2 For Cross-Cultural Work**

This thesis provides data from Israel, a sample within the Judeo-Christian tradition. Comparing an Israeli sample to a British sample is particularly appropriate to explore both developmental and cross-cultural differences in children's developing understanding of other minds to test whether cultural input influences tendencies towards anthropomorphism, egocentrism, or preparedness. Results suggest that Israeli and British children do not need to anthropomorphize non-human agents. However, further research needs to measure whether children in other cultures and traditions have a tendency to anthropomorphize. A future direction would be to sample a more traditional cultural group and to evaluate children's intuitive development of supernatural concepts. An important contribution of this thesis was to experimentally test whether young children in Christianity and Judaism have similar or different conceptions about a similar type of God (a "high" God). This thesis provides evidence that in two different religious traditions with a similar God, children do not use anthropomorphism and instead early and easily develop notions of a super-knowing, immortal God. Since Jewish and Christian traditions have similar concepts of God, further

research in traditional societies can explore the similarities and differences of children's concept of god (little "g") and how these conceptions differ from the Judeo-Christian traditions.

Further research should also measure the degree of exposure to the various concepts that were tested. For example qualitative data was not gathered in the present study regarding the amount of religious education, degree of exposure to concepts of God, and children's relative exposure to the death of animals or humans. Indeed, this type of data is very hard to gather accurately, but some qualitative data from parents about their religious involvement, the frequency of conversation in the home (regarding death or God), and whether children had been exposed to a death in the family (animal or human) would be helpful as sociocultural input is important to gauge how much children already know about a certain concept. Additional qualitative data could help bring to light possible explanations for children's early responses regarding their concept of God or biological phenomena.

### **9.3.3 For The Study of Individual Constraints and Other Types of Minds**

This thesis presents further data on children's conceptualizations of individual constraints. Research is needed to explore additional constraints, such as intelligence and finer exploration of age differences. For example, the exploration of children's understanding of intelligence could tell us more about the types of people children would seek to answer questions or learn something new. Although many researchers have begun to explore individual constraints in gauging another's confidence (Birch et al., 2010; Jaswal, 2004) and competence (Corriveau et al., 2009; Mills et al., 2011; Souza & Legare, 2011), more research is needed to better understand how children conceptualize and understand other minds.

Finally, the scope of the type of minds used in this thesis is somewhat limited. Earlier research has shown that children distinguish among animal minds (Richert & Barrett, 2005)

and different types of supernatural minds (Knight, 2008; Knight et al., 2004), but much more research should be conducted using other kinds of animal minds and a range of limited and powerful supernatural agents. Further investigation could continue to clarify the biases in the pattern of responses that children may have when trying to understand other minds.

Additionally, using samples with very different notions of God or god, would highlight further whether children certain cognitive mechanisms influence the transmission and persistence of certain supernatural agent concepts.

#### **9.4 Conclusion**

The studies reported in this thesis give little reason to suppose that children have a solely human agent concept (an anthropomorphic understanding) or egocentric understanding of other minds. Instead children have a much more flexible and general theory of other minds. Results also indicate that children are more “prepared” to think of supernatural concepts over more human concepts because they err in the direction of over-attributing knowledge, perception, memory, and immortality to others. Their rich interaction with humans must teach them human limitations in these regards. This thesis proposed that early developing conceptual systems tailor children’s ability to accommodate specific cultural information about other minds. With age and with increased interaction with the minds of animals, humans, and cultural representations of supernatural agents, preschool-age children become increasingly accurate in their ability to understand other minds. These findings challenge the notion that learning the properties of gods and other non-humans is a simple matter of indoctrination. Rather, it appears that agent concepts vary in their degree of fit with early-developing human conceptual systems, and hence, vary in their likelihood of successful cultural transmission.

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## Appendix 1

### Prompt for Study 1 (chapter five)

Prompt:

Ignorance Task: (Experimenter) Here is a box. Inside this box I have hidden something inside [shake the box]. Can you see what is in the box? [child responds]. Do you know what is inside the box? [child responds]

*[added teaching component-all agents counterbalanced]* I have a friend named Bop. Bop is just like you and me and cannot see inside the box. Do you think Bop knows what is inside the box? [record responds]. I have another friend named, Swec. Swec has super-powers and can see inside the box. Do you think Swec knows what is inside the box? [child responds]. Do you think your mom knows what is inside this box? [child responds]. Do you think God/Ha-shem knows what is inside this box? [child responds].

## Appendix 2

### Prompt for Study 2 (chapter six)

#### Prompt for Perception Tasks:

Both tasks were counterbalanced.

#### Prompt for Visual task:

Experimenter: I want you to observe the piece of paper on the wall over there. Can you see anything on the piece of paper? Can you tell me what you see on the piece of paper?

[*added teaching component*] I have here two friends who see the piece of paper as well.

This dog [puppet] is just like you and me and cannot see very far away. This eagle [puppet], on the other hand, can see things from far away.

*Questions:* [counterbalanced] Do you think the dog can see the picture? Do you think the eagle can see the picture? What about your best friend, do you think he/she would be able to see the picture? And your mom, do you think she would be able to see the picture? Do you think God would be able to see the picture?

Will your best friend get older? Do you think when your best friend is older that he/she will be able to see the picture? [If the answer for getting older is “no,” do you think many years from now your best friend will be able to see the picture?] What about your mom? Will your mom get older? Do you think when your mom is older that she will be able to see the picture? [If the answer for getting older is “no,” do you think many years from now your mom will be able to see the picture?] Will God get older? Do you think when God is older that he will be able to see the picture? [If the answer for getting older is “no,” do you think many years from now God will be able to see the picture?]

Prompt for Auditory task:

*Experimenter:* I have here a radio and want you to listen to the music. [click on button – it is hardly audible].

[*added teaching component*] I have here two friends who are listening to the radio as well. This eagle [puppet] is just like you and me and cannot hear very well. This dog [puppet], on the other hand, can hear things even when they are really quiet.

*Questions:* Do you think the dog can hear the music? Do you think the eagle can hear the music? What about your best friend, do you think he/she would be able to hear the music? And your mom, do you think she would be able to hear the music? Do you think God would be able to hear the music?

Will your best friend get older? Do you think when your best friend is older that he/she will be able to hear the music? [If the answer for getting older is “no,” do you think many years from now your best friend will be able to hear the music?] What about your mom? Will your mom get older? Do you think when your mom is older that she will be able to hear the music? [If the answer for getting older is “no,” do you think many years from now your mom will be able to hear the music?] Will God get older? Do you think when God is older that he will be able to hear the music? [If the answer for getting older is “no,” do you think many years from now God will be able to hear the music?]

### Appendix 3

#### Prompt for Study 3 (chapter seven)

Experimenter: Today we're going to play a game. I have here four cards with farm animals on them. [Experimenter lays the four cards down as a square, see Figure 13]. I want you to look at these now for a few seconds...(wait 5 seconds) and now I would like you to turn them over. [Child turns them over].

*Figure 13.* Picture of memory card game.



Experimenter: Good job. Now we're going to play another game. [Place magnetic fish game in front of child, see Figure 14]. I want you to see how many fish you can grab with this fishing pole in two minutes. I'll sit here and time you. I'm going to wind up this toy. Ready, go.

*Figure 14.* Picture of magnetic fish game.



Experimenter: Fantastic. How many fish did you catch? [child responds]

Experimenter: Now we are going to go back to the farm animal cards. Can you remember where the [target] card is? (Target card could be: cow, horse, pig, goose) [Child turns over card].

*If the child turns over correct card, go to prompt A. If the child turns over the incorrect card, go to prompt B.*

Prompt A:

Experimenter: Correct! You remembered the right card! Now I am going to add two more cards. I want you to look at these now for a few seconds...(wait 5 seconds) and now I would like you to turn them over. [Child turns them over].

Experimenter: Excellent. Now we're going to play another game. [Place fish game in front of child]. I want you to see if you can grab even more fish with this fishing pole in two minutes. I'll sit here and time you. Ready, go.

Experimenter: Fantastic. How many fish did you catch? [child responds]

Experimenter: Now we are going to go back to the farm animal cards. Can you remember where the [target] card is? (Target card could be: cow, horse, pig, goose, duck, cat, or dog) [Child turns over card].

Prompt B:

Experimenter: Oh, that's too bad, that's the [distractor] not the [target]. Did you forget which card is the [target]?

[Child responds- saying yes, he or she forgot].

Experimenter: [all agents are counterbalanced] If mom were here right now, do you think she would have remembered where the [target] card is? I have a friend named, Bop, who doesn't remember things very well. Do you think he would have remembered where the [target] card is? I have another friend, Swec, who remembers things very well. Do you think Swec would remember where the [target] card is? Do you think God would remember where the [target]

card is? [show child the dog] Do you think the dog would remember where the [target] card is? [show child the baby doll] Do you think a baby would remember where the card is? [show child the granddad puppet] Do you think Granddad would remember where the card is?

## Appendix 4

### Children's and Adult's Responses Regarding Their Intuitions About God

Table 9.

*Percentage of Preschool Children's Responses for Various Descriptions of God*

Question:	Percentage of Israeli children who responded "Yes" N = 49 (20 three- year-olds, 17 four- year-olds, 12 five- year-olds)	Percentage of British children who responded "Yes" N = 28 (14 three- year-olds, 11 four- year-olds, 3 five- year-olds)
Does a dog know everything?	20%	46.2%
Does God know everything?	74%	88.5%
[Tell me something you did yesterday]. Does God remember what you did yesterday?	64%	70.8%
[What happened a long, long time ago?] Does God know what happened a long, long time ago?	64%	70.8%
[What is something you are going to do tomorrow?] Does God know what you will do tomorrow?	56.9%	73.1%
[Let's think about what you might be like when you are older]. Do you think God knows what you will be like when you are older?	66%	70%
Do you think God knows how many freckles you have?	66%	50%
Do you think God knows what your Mum is thinking right now?	56.4%	56%
[Think about something nice that you did for {a friend}]. Does God know you did something nice for [friend]?	68.6%	95.8%
[Think about something not so nice that you did for {a friend}]. Does God know you did something not so nice to [friend]?	62.7%	54.2%
[Here is Nancy. She walks from here to here]. Can Nancy be in two places at the same time?	18%	30%
Can God be in two places at the same time?	75.7%	69.6%
How many different places can God be?	Many different places: 60% Up to 5: 12.2% I don't know: 27.8%	Many different places: 61.9% Up to 5: 28.6% I don't know: 9.5%
Can God make your Mum taller?	42.9%	43.8%
Would God ever make your Mum taller?	18.4%	40.9%
Can God make your Grandmother younger?	38.8%	34.4%
Would God make your Grandmother younger?	20.4%	31.8%

Do you think God could turn a cow into a horse?	32.7%	37.5%
Would God ever turn a cow into a horse?	16.3%	23.8%
Can God turn a seed into a plant in one second?	34.7%	41.9%
Would God ever turn a seed into a plant in one second?	12.2%	19%
Can God do everything?	70.8%	85.7%
Where is God?	Heaven: 78.4% Heart: 2% Everywhere: 7.8% I don't know: 11.8%	Heaven: 46.8% Heart: 3.6% Everywhere: 14.3% I don't know: 35.3%

Question:	Percentage of "Yes" responses from Israeli children	Percentage of "Yes" responses from British children	Examples:
Are there some things that God doesn't know?	16% (70.9% said "no")	30% (65% said "no")	-God doesn't know how to ride a bicycle." (Israeli 4-year-old) --"God does not know what will happen the day after Thursday." (British 5-year-old)
Is there anything that God can't do?	18.8% (79.2% said "no")	24.1% (72.4% said "no")	-"God cannot do cartwheels or scoot around the garden." (British 6-year-old) -"God cannot draw on the paper." (British 3-year-old) -"God cannot turn things into other things." (British 5-year-old) -"God cannot ride a bicycle." (Israeli 4-year-old) -"God cannot jump." (Israeli 3-year-old) -"God cannot fly." (Israeli 3-year-old)

Table 10.  
*Percentage of Three-year-old Responses for Various Descriptions of God*

Question:	Percentage of Israeli children who responded "Yes" (N = 20)	Percentage of British children who responded "Yes" (N = 14)
Does a dog know everything?	38.1%	42.9%
Does God know everything?	42.9%	85.7%
[Tell me something you did yesterday]. Does God remember what you did yesterday?	28.6%	71.4%
[What happened a long, long time ago?] Does God know what happened a long, long time ago?	38.1%	61.5%
[What is something you are going to do tomorrow?] Does God know what you will do tomorrow?	28.6%	64.3%
[Let's think about what you might be like when you are older]. Do you think God knows what you will be like when you are older?	57.1%	60%
Do you think God knows how many freckles you have?	52.4%	38.5%
Do you think God knows what your Mum is thinking right now?	47.6%	42.9%
[Think about something nice that you did for {a friend}]. Does God know you did something nice for [friend]?	50%	100%
[Think about something not so nice that you did for {a friend}]. Does God know you did something not so nice to [friend]?	54.5%	46.2%
[Here is Nancy. She walks from here to here]. Can Nancy be in two places at the same time?	28.6%	33.3%
Can God be in two places at the same time?	60%	41.7%
How many different places can God be?	Many different places: 55% Up to 5: 10% I don't know: 35%	Many different places: 50% I don't know: 50%
Can God make your Mum taller?	40%	29.4%
Would God ever make your Mum taller?	30%	21.4%
Can God make your Grandmother younger?	40%	23.5%
Would God make your Grandmother younger?	25%	28.6%
Do you think God could turn a cow into a horse?	35%	17.6%
Would God ever turn a cow into a horse?	25%	15.4%
Can God turn a seed into a plant in one second?	30%	37.5%
Would God ever turn a seed into a plant in one second?	15%	15.4%
Can God do everything?	57.9%	80%
Where is God?	Heaven: 63.6% Heart: 4.5% Everywhere: 9.1% I don't know: 22.7%	Heaven: 40% Heart: 13.3% Everywhere: 13.9% I don't know: 33.3%

Question:	Percentage of “Yes” responses from Israeli children	Percentage of “Yes” responses from British children	Examples:
Are there some things that God doesn’t know?	9.5% (81% said “no”)	36.4% (63.6% said “no”)	-“God does not know how to make magic” (Israeli 3-year-old) -“Of course not. He knows everything” (British, 3-year-old)
Is there anything that God can’t do?	16.7% (58.3% said “no”)	24.1% (72.4% said “no”)	-“God cannot do cartwheels or scoot around the garden.” (British 6-year-old) -“God cannot draw on the paper.” (British 3-year-old) (Israeli 3-year-old)

Table 11.  
*Percentage of Adult Responses for Various Descriptions of God.*

Question:	Percentage of Israeli children who responded "Yes" N = 67 (Range: 17 years to 88 years)	Percentage of British children who responded "Yes" N = 21 (Range: 17 years to 62 years)
Does a dog know everything?	0%	0%
Does God know everything?	91.3%	100%
[Tell me something you did yesterday]. Does God remember what you did yesterday?	95.7%	100%
[What happened a long, long time ago?] Does God know what happened a long, long time ago?	97.1%	100%
[What is something you are going to do tomorrow?] Does God know what you will do tomorrow?	87%	95.2%
[Let's think about what you might be like when you are older]. Do you think God knows what you will be like when you are older?	88.4%	100%
Do you think God knows how many freckles you have?	95.7%	100%
Do you think God knows what your Mum is thinking right now?	97.1%	100%
[Think about something nice that you did for {a friend}]. Does God know you did something nice for [friend]?	94.2%	100%
[Think about something not so nice that you did for {a friend}]. Does God know you did something not so nice to [friend]?	94.2%	100%
Can God be in two places at the same time?	97.1%	85.7%
How many different places can God be?	Many different places: 94.1% Up to 5: 4.4% I don't know: 1.5%	Many different places: 94.1% I don't know: 5.9%
Can God make your Mum taller?	63.8%	62.9%
Would God ever make your Mum taller?	5.8%	6.5%
Can God make your Grandmother younger?	55.1%	45.7%
Would God make your Grandmother younger?	8.7%	6.5%
Do you think God could turn a cow into a horse?	60.9%	57.1%
Would God ever turn a cow into a horse?	5.8%	6.3%
Can God turn a seed into a plant in one second?	62.3%	61.8%
Would God ever turn a seed into a plant in one second?	11.6%	6.7%
Can God do everything?	71%	72.2%
Where is God?	Heaven: 1.4% Heart: 4.3% Everywhere: 92.8% I don't know: 1.4%	Heaven: 10% Heart: 3.3% Everywhere: 83.3% I don't know: 3.3%

Question:	Percentage of “Yes” responses from Israeli sample	Percentage of “Yes” responses from British sample	Examples:
Are there some things that God doesn't know?	17.4% (76.8% said “no”)	19% (81% said “no”)	<ul style="list-style-type: none"> <li>-“God doesn't know what he doesn't know” (Israeli, age 35)</li> <li>-“He lets me choose but knows what I am going to do” (British, age 34)</li> </ul>
Is there anything that God can't do?	27.5% (68.1% said “no”)	25% (72.2% s said “no”)	<ul style="list-style-type: none"> <li>-“God cannot change what has already happened.” (Israeli, age 36)</li> <li>-“God cannot influence personal choice” (Israeli, age 33)</li> <li>-“God cannot make <math>1 + 1 = 3</math>, or do anything illogical” (British, age 38)</li> <li>-“God cannot do wrong” (British, age 38)</li> </ul>