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The circle of life: A cross-cultural comparison of children's attribution of life-cycle traits

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Abstract

Do children attribute mortality and other life-cycle traits to all minded beings? The present study examined whether culture influences young children's ability to conceptualize and differentiate human beings from supernatural beings (such as God) in terms of life-cycle traits. Three-to-5-year-old Israeli and British children were questioned whether their mother, a friend, and God would be subject to various life-cycle processes: birth, death, aging, existence/longevity, and parentage. Children did not anthropomorphize but differentiated among human and supernatural beings, attributing life-cycle traits to humans but not to God. Although three-year-olds differentiated significantly among agents, five-year-olds attributed correct life-cycle traits more consistently than younger children. Results also indicated some cross-cultural variation in these attributions. Implications for biological conceptual development are discussed.

Keywords: Cognitive development; folk biology; cultural learning; cross-cultural comparisons; naïve biology; reasoning; anthropomorphism

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Will Superman die? If Superman is conceptualized as a human, a likely response would be that Superman will die someday. If he is conceptualized as another category of being that does not conform to the biological system that humans and other animals share, it could be that Superman will live forever. As children develop and experience the natural world, they learn to classify the beings and objects they come into contact with and make basic intuitive inferences based upon their classifications (Gelman & Markman, 1986). However, children live in a world where they encounter both biological kinds (e.g., animals and plants) and supernatural beings, such as Superman or God, who children learn about through some form of cultural input. Supernatural beings pose a challenge to children's biological classification. They have the markers of ordinary living things (e.g., having eyes or having a human form, etc.) but also have certain category-defying properties (e.g., invisibility, living forever). Do natural biological attributions apply given that these beings can be *super*-natural? Addressing children's acquisition of biological traits in a diverse set of beings may shed light on the influence of social and cultural input on children's understanding of living things.

Developmental psychologists have long been interested in how children acquire knowledge about living things. Research has documented that between 3- and 5-years-of-age, children appreciate that human and non-human animals share fundamental biological processes (e.g., birth, growth, and death) (Astuti & Harris, 2008; Atran, 1998; Barrett & Behne, 2005; Bering, 2002; Carey, 1985; Coley, 2007; Hatano et al., 1993; Inagaki & Hatano, 1996; Keil, 2007; Opfer & Siegler, 2004). For example, preschool-aged children are able to classify and differentiate that humans and other animals are born and grow older but artifacts do not (Heyman, Phillips, & Gelman, 2003; Rosengren, Gelman, Kalish, &

McCormick, 1991; Saylor, Somanader, Levin, & Kawamura, 2010). Developmentalists have concluded that these attributions are largely dependent on an intuitive understanding of biology that develops across the preschool period and these intuitions incline children to attribute biological properties to animate beings over inanimate ones.

How, then, do children understand beings that diverge from plants and animals in terms of their alleged biological properties (or lack thereof)? The inferences that supernatural beings provoke may challenge typical folk biological attributions. An investigation of children's intuitions regarding supernatural beings is compelling because these entities present an unusual hybrid of living and non-living traits. Many supernatural beings, such as ghosts and God, are not strictly biological and are unusual because they are animate but cannot be seen. Children learn about these entities through testimony and socio-cultural input (Harris & Corriveau, 2014; Harris & Koenig, 2006; Lane, Wellman, & Evans, 2012, 2014), yet evidence is not clear whether children rely upon intuitive biological reasoning to determine whether these beings conform to the biological processes of the natural world. Certainly, not all supernatural beings are completely non-biological (e.g., Superman, Jesus). And, despite decades of research exploring children's ability to classify biological beings, questions still remain. One such question is how broadly biological reasoning is applied to supernatural beings or whether children use other strategies or cultural knowledge to conceptualize these beings.

Some exploration of this question has already begun. According to research investigating children's earliest intuitions of the biological world, we might expect preschool-aged children to reason about minded supernatural beings (i.e., persons) via anthropomorphism: assuming other animate things are like humans regarding biological traits (Carey, 1985, 1999; Inagaki & Hatano, 2002, 2006; Piaget, 1929). In this stance, preschool-aged children begin to form inferences about non-human beings by using a human prototype.

The development of a mature understanding of the biological system requires fundamental conceptual change as children learn about the natural world and move from a human-centered model to a folk-biological model. Researchers propose that this human-based model is useful because humans share biological properties with other animals and this model can be applied as an analogy to think about the biology of other entities (Carey, 1985, 1995; Coley, 1995, 2007; Gelman & Wellman, 1991; Inagaki & Hatano, 2002, 2006; Keil, 2007).

Recent evidence has challenged this framework (Herrmann, Waxman, & Medin, 2010; Medin, Waxman, Woodring, & Washinawatok, 2010; Waxman, Medin, & Ross, 2007). In a group of studies 4-year-olds demonstrated flexibility and differentiated between robots (an example of a hybrid entity who is both animate and non-biological) and living things (Jipson & Gelman, 2007; Okita, Schwartz, Shibata, & Tokuda, 2007; Saylor et al., 2010). This research suggests that children may be resistant to anthropomorphism as children acknowledged that animate artifacts such as robots share certain features of living things (e.g., seeing or thinking) but ultimately concluded they are not living. In another study, Herrmann and colleagues (2010) demonstrated that urban U.S. American 3-year-olds did not use humans as an analogy to reason about the biological traits of non-human animals. Herrmann and colleagues (2010) told children that people (or animals) have novel properties (e.g., "andro") inside them, and wanted to see if children would attribute these properties to other animals, plants and artifacts. Three-year-olds attributed novel biological properties to both human and non-human animals regardless of condition. Five-year-olds matched prior results (Carey, 1985), in that they were more likely to attribute novel properties from a person to other animals rather than attribute novel properties of an animal to a person. Herrmann and colleagues (2010) concluded that anthropomorphism is an acquired perspective, appearing sometime between 3- and 5-years-old.

Based on this work, we might expect young children to have more flexibility with regard to biological reasoning in supernatural agents than strict anthropomorphism might predict. Prior work has shown differences in children's biological reasoning based on their education and culture (Astuti & Harris, 2008; Ross, Medin, & Cox, 2007; Tarlowski, 2006; Waxman et al., 2007). Thus, we might expect some variation in children's ability to reason about life-cycle traits based on their exposure to certain traits, like death, and their knowledge about the being in question.

We are aware of only one study that has directly asked children to reason about the life-cycle traits of a supernatural being. Giménez-Dasí and colleagues (2005) asked 3-to-5-year-old Spanish children from both religious and non-religious schools four questions regarding various life-cycle traits of 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" index score. Four- and 5-year-olds consistently differentiated between biological and non-biological beings, attributing "mortality" to humans and immortality to God. In contrast, 3-year-olds did not clearly distinguish between God and their friend. Although older children differentiated between agents, im/mortality scores for God in all age groups were at chance levels, a score of 2 (out of 4).

Although results from this initial study are intriguing, this study raises two issues. First, although 3-year-olds did not reliably distinguish between biological beings and God (Giménez-Dasí et al., 2005), there is evidence that children of this age can distinguish between living and non-living entities (Heyman et al., 2003; Inagaki & Hatano, 1996; Saylor et al., 2010). Also, older children in their sample could differentiate between the agents, but their scores for God were close to chance. Questions remain whether children were at chance

because of lack of understanding of God, immature cognitive development, or both. As suggested above, religious or other cultural input may influence how children understand supernatural beings. 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." Anthropomorphism of God, particularly in the person of Jesus, is theologically sanctioned in a sense. If Spanish children answered the questions using God as Jesus, then God once *was* a baby and did die. To better test whether culture plays a role in children's understanding of the biology of supernatural beings, it is important to compare these results with a cultural context in which a fully anthropomorphic deity is resisted, such as in Judaism. God, in the Jewish tradition, is regarded as not having had parents, not having been a baby, not growing older with time, and never dying (Armstrong, 1993). If children in both a predominantly Jewish culture and a predominantly Christian one both begin to attribute life-cycle traits to humans and God simultaneously, it would be strong evidence that understanding the life-cycle aspects of the human experience are conceptually linked.

A second issue is that Giménez-Dasí and colleagues (2005) operationalized "mortality" as a composite score of four questions concerning: death, existence/longevity, aging, and babyhood. However, these questions index more accurately attribution of life-cycle traits. Both living forever/death and existence/longevity index immortality/mortality better than aging and babyhood which index more life-cycle traits. Further inclusion of other life-cycle traits (such as parentage) in this index would be interesting to index how much children attribute various traits to supernatural and human beings. Additionally, "mortality" was only examined as a composite score and Giménez-Dasí and colleagues (2005) did not report analyses of each item individually. Examination of individual items would be important to assess possible developmental differences in responses to each life-cycle trait.

The present study

This study examines cultural differences in children's understanding of biology in a diverse set of agents. To address the possibility that cultural representations of God impact children's tendency to anthropomorphize, we broadened the population to include children in two different countries with different national religions. We compared participants from a Jewish cultural context (Israel) with those from a traditionally Christian cultural context (UK). We 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. In a Christian context, where Easter depicts Jesus' death and at Christmas Jesus was a baby and had parents, we predicted that children may be unable to differentiate God from human agents until they fully understand these culturally-learned concepts. To investigate whether British participants distinguish between two supernatural entities that are and are not subject to regular life-cycle traits, we included questions about God *and* Jesus. We hoped the contrast between Jesus and God would highlight differential cultural input about both supernatural beings. We speculated that by including Jesus and God as separate beings, children would better distinguish between God in his biological human form (Jesus) and God as a non-biological being.

A further motivation was to examine children's understanding of life-cycle processes. We used similar questions to the study by Giménez-Dasí and colleagues (2005), but added a question regarding children's understanding of parentage, or whether children understand if a being had parents or not. We analyzed each item individually to explore responses for each life-cycle trait.

We hypothesized that Israeli children would be able to distinguish human from supernatural beings, and similar to Herrmann et al. (2010), all children would not need to initially anthropomorphize, or attribute life-cycle properties, to God. Children and adults *may*

resort to anthropomorphism (see Heiphetz, Lane, Waytz, & Young, 2015 for examples); at issue here is whether 3-to-five-year-olds categorically *must* anthropomorphize.

Method

Participants

We tested 140 children. Sixty-four children were Modern Orthodox Jewish from Israel, and 76 children were from the UK, see Table 1 for age and gender breakdown. Israeli children were recruited from Modern Orthodox Jewish synagogues and online newspapers and all identified themselves as Modern Orthodox Jewish. British children were recruited from nurseries, church crèches, and toddler groups. Five British children came from atheist backgrounds and the parents of nine children chose not to comment on their religious background. All 14 of these children could mention something relevant about God, such as, "God answers prayers." The rest of the children came from families who attended an Anglican church-affiliated group at least once each week. At the end of the experiment, all children were asked to tell the experimenter something about God to ensure that they knew the referent of "God," and all but one British child could do so.

We also wanted to compare children's responses with those of adults who have more mature biological understanding in addition to wider cultural understanding of supernatural beings. We recruited 68 Israeli and 48 British adults, see Table 1 for age and gender descriptions. The majority were parents of the children we tested. Other adults were recruited via university advertisements (UK), through synagogues (Israel), and online newspapers (both).

[Table 1 here]

Procedure

We asked participants a similar set of questions to Giménez-Dasí et al. (2005) but asked one additional question about parentage. Israeli and British children were questioned about a

Friend, their Mom, and God in counterbalanced order. The British sample was also asked about Jesus. Children were questioned about Jesus first and then asked about God to help children distinguish between the two.

Children were asked five questions in counterbalanced order.

1) Existence/longevity question: Each child was shown a picture of a velociraptor and a triceratops, and was asked if s/he could identify the animal. "Dinosaur" was an acceptable answer. If the child could not identify the animal, the experimenter asked whether the child had ever heard of dinosaurs. If the answer was "no," the child was not asked the dinosaur question. If the answer was "yes," the experimenter 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 [being]? Do you think [being] was alive when the dinosaurs were alive?" The original study asked whether dinosaurs "exist" (Giménez-Dasí, et al., 2005). We used "alive" because some researchers argue that the term "exist" is hard for children to understand (Emmons & Kelemen, 2014; Evans, 2008).
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 [being]? 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. What's going to happen to [being] next year and the year after that? Do you think [being] will get older and older or will [being] stay the same?" "Getting older" and "Staying the same" were counterbalanced.
4) Death question: "What will happen to [being] a long, long, time from now? Will [being] die someday or will [being] go on living forever and ever?" "Die" and "Live forever" were counterbalanced.

5) Parentage question: "Do you think [being] has a mom and dad?"

We conducted all interviews in a child's nursery or home.

Similar to Giménez-Dasí et al. (2005) an index was created to determine whether a child attributed life-cycle traits to each being. One point was given for each life-cycle trait attributed to each being. If the child did not attribute a life-cycle trait, the child received a score of 0 for that item. Thus, scores ranged from 0 (attributing no life-cycle traits to the being) to a score of 5 (attributing all life-cycle traits to the being). All participant responses were included. Children that responded, "I don't know," were given a score of .5 for that item. All items for each agent moderately inter-correlated, αs > .55; thus, following analysis of the index, we analyzed each item individually. Seven Israeli children and one British child answered, "I don't know" to all "die" questions. One Israeli child did not know whether any being would grow old and one British child did not know whether any being had been a baby. Finally, one Israeli and two British children did not know whether any beings existed during the time of the dinosaurs.

Results

Understanding of the life-cycle across cultures

We first explored whether children in two different cultures differentiate the life-cycle traits of human versus supernatural beings (as represented by the life-cycle index scores). Table 2 presents answer rates for each being, by age and cultural group. Following Giménez-Dasí et al. (2005), we broke our sample into age groups. Grouping each age by year allowed us to examine potential interactions between age, cultural group, and being. A 3 x 2 x 4 repeated measures ANOVA was conducted with each being (3: Mom, Friend, and God) as the within-subject factor, and cultural group (2: British and Israeli children) and age (4: three-, four-, and five-year-olds, and adults) as the between-subjects. Mauchly's test indicated that the assumption of sphericity had been violated, $X^2(2)= 121.55$, $p < .001$,

therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity. This analysis revealed a significant main effect of being, $F(1.41, 320.63) = 1099.32$, $p < .001$, $\eta_{p^2} = .83$; age, $F(3, 227) = 26.26$, $p < .001$, $\eta_{p^2} = .26$; and cultural group, $F(1, 227) = 3.88$, $p = .05$, $\eta_{p^2} = .02$. There were also interactions among responses regarding the life-cycle for each being and cultural group, $F(1.41, 320.63) = 27.07$, $p < .001$, $\eta_{p^2} = .11$; among responses regarding the life-cycle for each being and age, $F(4.24, 320.63) = 104.64$, $p < .001$, $\eta_{p^2} = .58$; and an interaction in responses for each being, age, and cultural group, $F(4.24, 320.63) = 4.92$, $p < .001$, $\eta_{p^2} = .06$.

[Table 2 here]

Differences in responses for each being by cultural group were explored through pairwise comparisons with Bonferroni adjustments, collapsing across age. These comparisons revealed that there was an effect of cultural group for life-cycle responses for Mom, $p = .008$, and God, $p < .001$, but there was no effect between cultural groups for responses for Friend, see Figure 1. Israeli participants attributed more life-cycle attributes to Mom, $M = 4.18$, $SD = .07$, than did British participants, $M = 3.92$, $SD = .07$, and Israeli participants also attributed fewer life-cycle attributes to God, $M = .76$, $SD = .09$, than did British participants, $M = 1.52$, $SD = .09$.

[Figure 1 here]

Post-hoc comparisons using the Tukey HSD test with Bonferroni corrections were used to analyze differences in life-cycle index between age groups and being. Participants in each of three age groups were more likely to attribute life-cycle traits to Friend, Ms >3.11, and to Mom, Ms >2.95, than to God, Ms <1.92, ps <.001. These distinctions increased with age. Five-year-olds were significantly better at attributing life-cycle traits to both human beings, Ms >4.55 than 3-year-olds, Ms <3.11, and 4-year-olds, Ms <3.98, ps <.005.

However, 5-year-olds were less likely to attribute life-cycle traits to God, M =.98 compared to 3-year-olds, M =1.92, p =.001.

We further examined each age group against chance responding for these dichotomous questions (a test value of 2.5 out of 5 items), and results suggest that Israeli children of each age attributed life-cycle traits to human agents and culturally correct traits to God. British children attributed life-cycle traits to the humans by age 4 and rejected them for God by age 5, see Figure 2. British three-year-olds significantly attributed more life-cycle traits than not to their Friend, but not to their Mom or to God.

[Figure 2 here]

Finally post-hoc comparisons using the Tukey HSD test with Bonferroni corrections were used to examine the interaction of cultural group, age, and being, see Table 2. Three- and 4-year-old Israeli children, were more likely to attribute to Mom more life-cycle attributes than British children. Four- and 5-year-old Israeli children, were also less likely to attribute to God life-cycle traits than were British children. No other significant differences were found.

Ontological distinction between Jesus and God

We also explored whether children and adults in a Christian context (UK) made different life-cycle attributions to Jesus and God. A 2 x 4 repeated measures ANOVA was conducted with each being (2: Jesus and God) as the within-subject factor, and age (4: 3-, 4-, 5-year-olds, and adults) as the between-subject factor. This analysis revealed a significant main effect of being, $F(1, 69) = 25.02$, $p < .001$, $\eta_{p^2} = .27$. There was no interaction effect or a significant effect of age. British children significantly differentiated between Jesus and God, $t(71) = 4.62$, $p < .001$, Cohen's $d = 1.09$. Children were less likely to attribute God with life-cycle properties, $M = 1.98$, $SD = 1.39$, than Jesus, $M = 2.72$, $SD = .99$. We used one-sample t-tests (with 2.5 as a test value) to determine whether responses for Jesus and God

were significantly different from chance. Responses for God were significantly below chance, suggesting that children correctly rejected life-cycle properties, $t(71)= 3.21$, $p = .002$, Cohen's $d = .76$, but responses for Jesus did not significantly differ from chance, *ns*. Adults were significantly more likely to attribute life-cycle traits to Jesus, $M = 3.07$, $SD = .69$, than children, $M = 2.72$, $SD = .99$, $t(114) =2.02$, $p =.046$; and less likely to attribute life-cycle traits to God, $M = .23$, $SD = .53$, than were children, $M = 1.98$, $SD = 1.36$, $t(113) =8.09$, $p < .001$.

We ran binomial tests to examine children's and adult's responses for each item individually, see Table 3. Only 5-year-olds consistently responded for 4 of 5 items and most ages were more likely to attribute babyhood and parentage to Jesus than other traits. No age group (except adults) consistently responded regarding whether Jesus ages.

[Table 3 here]

Children's attributions of each life-cycle trait

The life-cycle index served to demonstrate whether children *generally* attributed life-cycle features to each entity, but the modest inter-correlations of these items suggest that they are not always attributed in concert. Hence, we analyzed children's level of attribution of each life-cycle item individually using two-tailed binomial tests for each being, with each age and cultural group treated separately to test whether children attributed biologically correct traits to humans and culturally correct traits to God, see Table 4. All adults reliably attributed each life-cycle trait to the human agents and rejected each life-cycle trait for God. Below we discuss children's responses.

[Table 4 here]

Existence/longevity. Older children were more likely to reliably appreciate that Friend and Mom did not exist during the time of the dinosaurs and were more likely to attribute existence during the time of the dinosaurs to God.

Parentage. Overwhelmingly, children in both cultural groups regarded human beings as having parents. However, there were differences in responses for God between cultures. Israeli children of all ages reliably responded that God would *not* have parents but only 50% (32) of British children said that God did *not* have parents.

Babyhood. The majority of children from both cultural groups understood that their friend had once been a baby, but only children older than four years reliably responded that Mom had once been a baby. Similar to the parentage item, only Israeli children reliably responded that God had never been a baby whereas British children were at chance.

Aging. Four- and five-year-olds in both cultural groups reliably attributed aging to a friend. Overall, five-year-olds were more likely to respond that Mom would get older with age. British three-year-olds also attributed their mom with never aging. Only Israeli four- and five-year-olds responded reliably that God would not age.

Death. By five years, children in both groups reliably responded that Mom and Friend would die. By four years children could reliably respond that God would live forever. British three-year-olds also responded that their friend would never die.

Discussion

The present study provides evidence that children can distinguish beings that are subject to life-cycle processes from those that are not, and they can do so from an early age. Results also suggest that culture influences children's attribution of life-cycle traits. First we discuss results from the life-cycle index and then discuss individual life-cycle traits.

Life-cycle index

Contrary to prior results (Carey, 1995; Giménez-Dasí et al., 2005; Inagaki & Hatano, 1996), our results suggest that before age 5, British and Israeli children appropriately attributed life-cycle properties to humans and regarded God as separate from these biological processes. Children did not necessarily resort to using anthropomorphism as a model nor did

children acquire an anthropomorphic perspective with age (Herrmann et al., 2010). Instead children, especially older preschoolers, differentiated among humans and God for multiple life-cycle traits. This differentiation is consistent with related evidence that suggests that young children and infants can distinguish animate from inanimate objects (Kuhlmeier, Bloom, & Wynn, 2004; Molina, Van de Walle, Condry, & Spelke, 2004) and living from non-living things (Heyman et al., 2003; Inagaki & Hatano, 1996; Saylor et al., 2010). Perhaps children reason initially according to agency, rather than anthropomorphism. Children may not categorize beings as human or not, but whether or not they are agents. Other work suggests that anthropomorphism may not be children's initial conceptual framework but that cultural input may encourage human-centered reasoning (Ganea, Canfield, Simons-Ghafari, & Chou, 2014; Waxman, Hermann, Woodring, & Medin, 2014).

Although children in this study could differentiate at an early age, Israeli children were less likely to attribute life-cycle traits to God than British counterparts. This difference could be due to particular socio-cultural input and testimony (Harris & Koenig, 2006; Lane et al., 2012). In Israel, children are taught about God's all-powerful attributes. In contrast, British children may receive similar cultural input about God but also about Jesus, a human being that is God, but was born, had parents, grew older, and died. Understanding such a complex God concept may be very confusing and could have muddled children's responses.

To better characterize how socio-cultural input plays a role in understanding such a complex supernatural being, we questioned British children about Jesus and God. To date, the extent to which socio-cultural input can conflate questions about the biological processes of God with the human characteristics of Jesus is unknown. Thus, the aim of these questions was to determine whether children from a Christian context would differentiate between Jesus and God. Unlike the children in the study by Giménez-Dasí and colleagues (2005), British children understood that God would not be subject to life-cycle processes. Children at

all ages, however, responded at chance levels concerning Jesus. However, individual item analyses of children's responses showed that children were much more likely to attribute Jesus with having been a baby or having parents compared to aging, dying, or existing during the time of the dinosaurs. This developmental pattern for Jesus was very similar to the attributions British children made to the human beings, suggesting that children understood cultural input and attributed Jesus with some human-like qualities.

Individual analyses of life-cycle items

Although children differentiated between God and humans concerning life-cycle traits, analyses of each item showed developmental variation. We examine these differences below.

A notable difference is that three-year-olds were more likely to respond that their friend had been a baby and had parents above chance levels, whereas responses were at chance levels for a friend's existence/longevity and aging. One possible explanation is that daily exposure to having parents, having siblings, and seeing other people with their children make the traits of parentage and babyhood obvious for children to attribute to human beings, especially compared to questions of existence, death, and aging. Another explanation is that the life-cycle 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 biological ones. Future 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 children's understanding of reproduction (Emmons & Kelemen, 2014). A further possibility is that death, aging, and existence/longevity are more complex concepts. Seventy percent of British and Israeli three-year-olds reported that their friend would not die but go on living, and it was not until age five that most attributed eventual death, aging, and existence/longevity to both their friend

and mother at levels above chance. However, both populations significantly rejected eventual death for God by age 4. Our data are consistent with the claim that children do not develop a mature concept of death until later, between the ages of 5 to 7 years (Slaughter & Lyons, 2003; Speece & Brent, 1984). These results are also consistent with claims by many researchers (Bering & Bjorklund, 2004; Bering, Blasi, & Bjorklund, 2005; Bloom, 2004, 2007; Carey, 1985; Harris & Giménez, 2005) that folk psychology may interfere with a concept of death and existence/longevity (or a concept of pre-life, see Emmons and Kelemen, 2014), and children may find the termination of epistemic states hard to imagine. 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, 2013). A further consideration is that when using familiar people, children may resist the idea that their friend or mother might die (Poling & Evans, 2004). Future studies could try to tease apart whether responses reflect reluctance to think about the question, whether folk psychology is interfering, or whether children require development and knowledge to understand the concept of death, longevity, and aging. A final limitation could be that our choice of the word "alive" for the longevity item was confusing: a "no" response may mean children attribute longevity to God, but a "yes" response could mean they attribute "life" to God.

Conclusion

These results suggest that 3-to-5-year-old children do not unswervingly anthropomorphize but have conceptual flexibility and can distinguish between supernatural and human beings. In addition, sociocultural input influences attribution of life-cycle traits. Further research is needed to understand how young children reason about the biological world, and in particular, how children understand the place of humans, other animals, and the variety of supernatural beings they encounter. More cultural work is needed to understand

the variation or similarities of socio-cultural input that children receive regarding the biological (or non-biological) properties of human, animals, and supernatural beings. An important goal would be to concentrate on the influences of early education, as well as cultural and religious beliefs and practices, on biological conceptual development.

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Table 1. *Description of gender, mean age, and age range of each age group by sample.*

Sample	Age group	Gender	Mean age (*SD*)	Age range
Israeli	3-year-olds (*n* = 23)	12 females, 11 males	3 years; 3 months (.32)	2;10 – 3;11
	4-year-olds (*n* = 17)	10 females, 7 males	4 years; 4 months (.27)	4;0 – 4;10
	5-year-olds (*n* = 24)	14 females, 10 males	5 years; 2 months (.23)	5;0 – 5;6
	Adults (*n* = 68)	47 females, 21 males	37 years; 7 months (10.19)	26 - 88
British	3-year-olds (*n* = 30)	21 females, 9 males	3 years; 4 months (.32)	2;7 – 3;10
	4-year-olds (*n* = 24)	14 females, 10 males	4 years, 4 months (.28)	4;0 – 4;11
	5-year-olds (*n* = 22)	16 females, 6 males	5 years, 4 months (.31)	5;0 – 5;11
	Adults (*n* = 48)	39 females, 9 males	32 years; 10 months (8.32)	20 – 62

Note: *There were significantly more females than males in the British sample, $t(141) = 5.54$, $p < .001$. However, analyses showed no gender effects for any analyses in the results.*

Table 2.

Means and Standard Deviations of Life-cycle Scores for each Being by Age and Cultural Group.

	Friend		Mom		God	
	British *M* (*SD*)	Israeli *M* (*SD*)	British *M* (*SD*)	Israeli *M* (*SD*)	British *M* (*SD*)	Israeli *M* (*SD*)
Age group						
3 (*n* = 53)	3.10 (1.03)**	3.09 (1.16)*	2.70 (0.88)	3.13 (0.97)*	2.30 (1.29)	1.91 (1.20)**
4 (*n* = 41)	3.83 (1.05)**	3.88 (1.05)**	3.58 (1.18)**	3.82 (1.24)**	2.25 (1.42)	0.82 (0.88)**
5 (*n* = 46)	4.41 (0.85)**	4.63 (0.71)**	4.50 (0.74)**	4.46 (0.66)**	1.45 (1.26)**	0.75 (1.26)**
Adults (n = 46)	5.00 (1.05)**	4.96 (0.21)**	5.00 (0.00)**	4.97 (0.35)**	0.23 (0.53)**	0.06 (0.24)**

Note. Significantly different from chance (test value 2.5 out of 5 items) by t-test, *p < .05, **p < .001.

Table 3.

Percentage of Attributed Life-Cycle Trait Responses for Jesus by British Children.

	Existence/ Longevity+ %	Parentage %	Babyhood %	Aging %	Death %
3 years (n = 30)	50.0	76.7*	53.3	46.7	43.3
4 years (n = 22)	77.3*	77.3*	77.3*	54.5	40.9
5 years (n = 20)	65.0**	95.0**	80.0*	60	85**
Adult (n = 46)	76.1**	97.8**	100**	90.1**	100**

*p < .01, **p < .0001, + Higher scores for this item reflect responses that the being would not be alive during the time of the dinosaurs.

Table 4.

Percentage of Attributed Life-Cycle Trait Responses by Age and Cultural Group for Being

	Existence/ longevity++		Parentage		Babyhood		Aging		Death	
	British %	Israeli %	British %	Israeli %	British %	Israeli %	British %	Israeli %	British %	Israeli %
Friend										
3 (*n* = 53)	60	52.2	90**	91.3**	80*	73.9*	50	65.2	30*	30.4
4 (*n* = 41)	58.3	70.6	100**	94.1**	91.7**	70.6	87.5**	88.2*	45.8	64.7
5 (*n* = 46)	95.5**	91.7**	100**	100**	72.7+	87.5**	95.5**	95.8**	77.3**	87.5**
Adults (*n* = 46)	100**	95.6**	100**	100**	100**	100**	100**	100**	100**	100**
Mom										
3 (*n* = 53)	50	47.8	86.7**	82.6*	60	65.9	26.7*	69.6	46.7	43.5
4 (*n* = 41)	70.8	76.5*	95.8**	82.4*	83.3*	82.4*	58.2	70.6	50	70.6
5 (*n* = 46)	95.5**	86.5**	100**	95.8**	77.3*	83.3*	95.5**	91.7**	81.8**	87.5**
Adults (*n* = 46)	100**	97.7**	100**	100**	100**	100**	100**	100**	100**	100**
God										
3 (*n* = 53)	43.3	56.5	56.7	17.4*	36.7	30.4	53.3	56.5	40	43.5
4 (*n* = 41)	16.7**	29.4	54.2	5.9**	66.7	0**	62.5	23.5*	25*	23.5*
5 (*n* = 46)	9.1**	4.2**	36.4	8.3**	50	16.7*	40.9	29.2+	9.1**	16.7**
Adults (*n* = 46)	0**	5.8**	2.1**	0**	15.5**	0**	8.8**	0**	0**	0**

Note: + $p = .06$; * $p < .05$; ** $p < .00$, Significantly different from chance (test value .5 out of 1) by binomial test,; ++Higher scores for this item reflect responses that the being would not be alive during the time of the dinosaurs.

Figure Captions

Figure 1. Life-Cycle score (out of 5) using standard error bars for each being according to cultural group.

Figure 2. Life-Cycle score (out of 5) for each age group.

Figure 1.

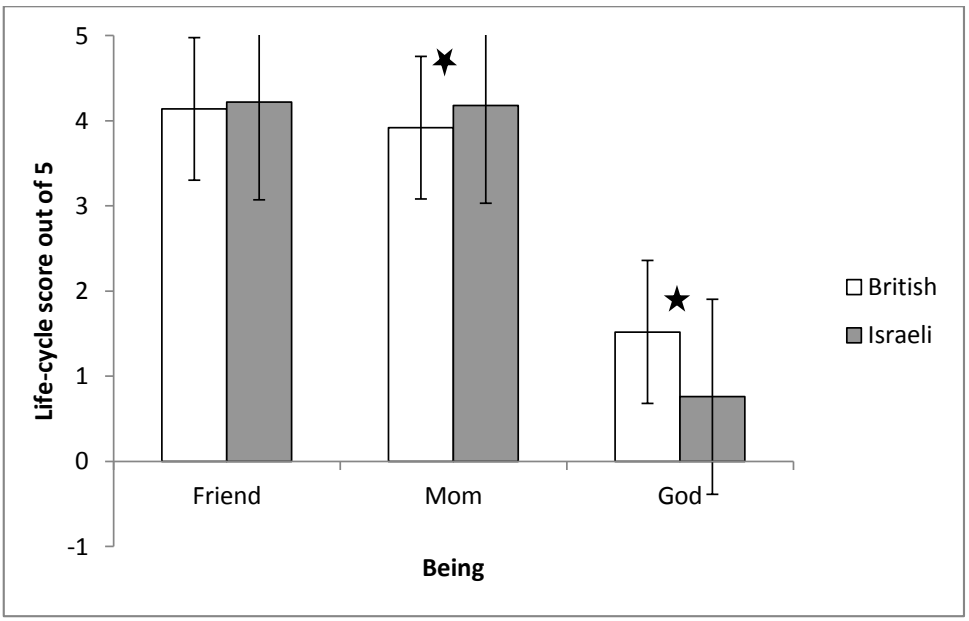
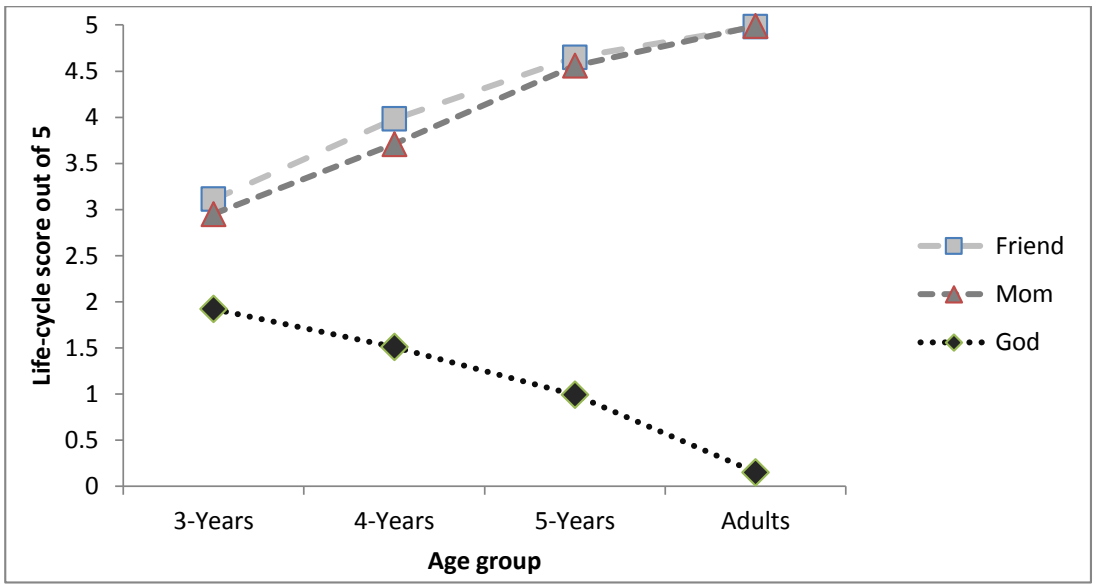

5
4
3
2
1
0
-1
Life-cycle score out of 5
Friend
Mom
God
Being
British
Israeli

Figure 2.


Life-cycle score out of 5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
3-Years
4-Years
5-Years
Adults
Age group
Friend
Mom
God