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8 The circle of life: A cross-cultural comparison of children's attribution of life-cycle traits
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33   Chadasha (Jerusalem), Shir Hadesh (Jerusalem), Kehillat Kol Haneshama (Jerusalem), and

34   Kehillat Ma'ale Adumim (Ma'ale Adumim, Israel).

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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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96   Will Superman die? If Superman is conceptualized as a human, a likely response

97   would be that Superman will die someday. If he is conceptualized as another category of

98   being that does not conform to the biological system that humans and other animals share, it

99   could be that Superman will live forever. As children develop and experience the natural

100   world, they learn to classify the beings and objects they come into contact with and make

101   basic intuitive inferences based upon their classifications (Gelman & Markman, 1986).

102   However, children live in a world where they encounter both biological kinds (e.g., animals

103   and plants) and supernatural beings, such as Superman or God, who children learn about

104   through some form of cultural input. Supernatural beings pose a challenge to children's

105   biological classification. They have the markers of ordinary living things (e.g., having eyes or

106   having a human form, etc.) but also have certain category-defying properties (e.g.,

107   invisibility, living forever). Do natural biological attributions apply given that these beings

108   can be *super*-natural? Addressing children's acquisition of biological traits in a diverse set of

109   beings may shed light on the influence of social and cultural input on children's

110   understanding of living things.

111   Developmental psychologists have long been interested in how children acquire

112   knowledge about living things. Research has documented that between 3- and 5-years-of-

113   age, children appreciate that human and non-human animals share fundamental biological

114   processes (e.g., birth, growth, and death) (Astuti & Harris, 2008; Atran, 1998; Barrett &

115   Behne, 2005; Bering, 2002; Carey, 1985; Coley, 2007; Hatano et al., 1993; Inagaki &

116   Hatano, 1996; Keil, 2007; Opfer & Siegler, 2004). For example, preschool-aged children are

117   able to classify and differentiate that humans and other animals are born and grow older but

118   artifacts do not (Heyman, Phillips, & Gelman, 2003; Rosengren, Gelman, Kalish, &

119   McCormick, 1991; Saylor, Somanader, Levin, & Kawamura, 2010). Developmentalists have

120   concluded that these attributions are largely dependent on an intuitive understanding of

121   biology that develops across the preschool period and these intuitions incline children to

122   attribute biological properties to animate beings over inanimate ones.

123   How, then, do children understand beings that diverge from plants and animals in

124   terms of their alleged biological properties (or lack thereof)? The inferences that supernatural

125   beings provoke may challenge typical folk biological attributions. An investigation of

126   children's intuitions regarding supernatural beings is compelling because these entities

127   present an unusual hybrid of living and non-living traits. Many supernatural beings, such as

128   ghosts and God, are not strictly biological and are unusual because they are animate but

129   cannot be seen. Children learn about these entities through testimony and socio-cultural input

130   (Harris & Corriveau, 2014; Harris & Koenig, 2006; Lane, Wellman, & Evans, 2012, 2014),

131   yet evidence is not clear whether children rely upon intuitive biological reasoning to

132   determine whether these beings conform to the biological processes of the natural world.

133   Certainly, not all supernatural beings are completely non-biological (e.g., Superman, Jesus).

134   And, despite decades of research exploring children's ability to classify biological beings,

135   questions still remain. One such question is how broadly biological reasoning is applied to

136   supernatural beings or whether children use other strategies or cultural knowledge to

137   conceptualize these beings.

138   Some exploration of this question has already begun. According to research

139   investigating children's earliest intuitions of the biological world, we might expect preschool-

140   aged children to reason about minded supernatural beings (i.e., persons) via

141   anthropomorphism: assuming other animate things are like humans regarding biological traits

142   (Carey, 1985, 1999; Inagaki & Hatano, 2002, 2006; Piaget, 1929). In this stance, preschool-

143   aged children begin to form inferences about non-human beings by using a human prototype.

144   The development of a mature understanding of the biological system requires fundamental

145   conceptual change as children learn about the natural world and move from a human-centered

146   model to a folk-biological model. Researchers propose that this human-based model is useful

147   because humans share biological properties with other animals and this model can be applied

148   as an analogy to think about the biology of other entities (Carey, 1985, 1995; Coley, 1995,

149   2007; Gelman & Wellman, 1991; Inagaki & Hatano, 2002, 2006; Keil, 2007).

150   Recent evidence has challenged this framework (Herrmann, Waxman, & Medin,

151   2010; Medin, Waxman, Woodring, & Washinawatok, 2010; Waxman, Medin, & Ross, 2007).

152   In a group of studies 4-year-olds demonstrated flexibility and differentiated between robots

153   (an example of a hybrid entity who is both animate and non-biological) and living things

154   (Jipson & Gelman, 2007; Okita, Schwartz, Shibata, & Tokuda, 2007; Saylor et al., 2010).

155   This research suggests that children may be resistant to anthropomorphism as children

156   acknowledged that animate artifacts such as robots share certain features of living things

157   (e.g., seeing or thinking) but ultimately concluded they are not living. In another study,

158   Herrmann and colleagues (2010) demonstrated that urban U.S. American 3-year-olds did not

159   use humans as an analogy to reason about the biological traits of non-human animals.

160   Herrmann and colleagues (2010) told children that people (or animals) have novel properties

161   (e.g., "andro") inside them, and wanted to see if children would attribute these properties to

162   other animals, plants and artifacts.   Three-year-olds attributed novel biological properties to

163   both human and non-human animals regardless of condition. Five-year-olds matched prior

164   results (Carey, 1985), in that they were more likely to attribute novel properties from a person

165   to other animals rather than attribute novel properties of an animal to a person. Herrmann

166   and colleagues (2010) concluded that anthropomorphism is an acquired perspective,

167   appearing sometime between 3- and 5-years-old.

168   Based on this work, we might expect young children to have more flexibility with

169   regard to biological reasoning in supernatural agents than strict anthropomorphism might

170   predict. Prior work has shown differences in children's biological reasoning based on their

171   education and culture (Astuti & Harris, 2008; Ross, Medin, & Cox, 2007; Tarlowski, 2006;

172   Waxman et al., 2007). Thus, we might expect some variation in children's ability to reason

173   about life-cycle traits based on their exposure to certain traits, like death, and their knowledge

174   about the being in question.

175   We are aware of only one study that has directly asked children to reason about the

176   life-cycle traits of a supernatural being. Giménez-Dasí and colleagues (2005) asked 3-to-5-

177   year-old Spanish children from both religious and non-religious schools four questions

178   regarding various life-cycle traits of a friend and God: 1) "When there were dinosaurs in the

179   world, did ____exist?", 2) "Will _____get older and older or stay the same?", 3) "Will

180   ____die or go on living forever and ever?", and 4) "Was ____a little baby a long time ago?"

181   Answers to these four questions were summed for a "mortality" index score. Four- and 5-

182   year-olds consistently differentiated between biological and non-biological beings, attributing

183   "mortality" to humans and immortality to God. In contrast, 3-year-olds did not clearly

184   distinguish between God and their friend. Although older children differentiated between

185   agents, im/mortality scores for God in all age groups were at chance levels, a score of 2 (out

186   of 4).

187   Although results from this initial study are intriguing, this study raises two issues.

188   First, although 3-year-olds did not reliably distinguish between biological beings and God

189   (Giménez-Dasí et al., 2005), there is evidence that children of this age can distinguish

190   between living and non-living entities (Heyman et al., 2003; Inagaki & Hatano, 1996; Saylor

191   et al., 2010). Also, older children in their sample could differentiate between the agents, but

192   their scores for God were close to chance. Questions remain whether children were at chance

193   because of lack of understanding of God, immature cognitive development, or both. As

194   suggested above, religious or other cultural input may influence how children understand

195   supernatural beings. Giménez-Dasí et al. (2005) interviewed children in Spain, a place that

196   retains a strong Catholic cultural heritage, where Christmas and Easter are celebrated as

197   national holidays, and Mary is commonly referred to as "the Mother of God."

198   Anthropomorphism of God, particularly in the person of Jesus, is theologically sanctioned in

199   a sense. If Spanish children answered the questions using God as Jesus, then God once *was* a

200   baby and did die. To better test whether culture plays a role in children's understanding of

201   the biology of supernatural beings, it is important to compare these results with a cultural

202   context in which a fully anthropomorphic deity is resisted, such as in Judaism. God, in the

203   Jewish tradition, is regarded as not having had parents, not having been a baby, not growing

204   older with time, and never dying (Armstrong, 1993). If children in both a predominantly

205   Jewish culture and a predominantly Christian one both begin to attribute life-cycle traits to

206   humans and God simultaneously, it would be strong evidence that understanding the life-

207   cycle aspects of the human experience are conceptually linked.

208   A second issue is that Giménez-Dasí and colleagues (2005) operationalized

209   "mortality" as a composite score of four questions concerning: death, existence/longevity,

210   aging, and babyhood. However, these questions index more accurately attribution of life-

211   cycle traits. Both living forever/death and existence/longevity index immortality/mortality

212   better than aging and babyhood which index more life-cycle traits. Further inclusion of other

213   life-cycle traits (such as parentage) in this index would be interesting to index how much

214   children attribute various traits to supernatural and human beings. Additionally, "mortality"

215   was only examined as a composite score and Giménez-Dasí and colleagues (2005) did not

216   report analyses of each item individually. Examination of individual items would be

217   important to assess possible developmental differences in responses to each life-cycle trait.

218   **The present study**

219   This study examines cultural differences in children's understanding of biology in a

220   diverse set of agents. To address the possibility that cultural representations of God impact

221   children's tendency to anthropomorphize, we broadened the population to include children in

222   two different countries with different national religions. We compared participants from a

223   Jewish cultural context (Israel) with those from a traditionally Christian cultural context

224   (UK). We expected that Modern Orthodox Jewish Israeli children, of a culture in which God

225   was never a baby, did not have parents, and never did die, would distinguish between an

226   immortal God and mortal humans. In a Christian context, where Easter depicts Jesus' death

227   and at Christmas Jesus was a baby and had parents, we predicted that children may be unable

228   to differentiate God from human agents until they fully understand these culturally-learned

229   concepts. To investigate whether British participants distinguish between two supernatural

230   entities that are and are not subject to regular life-cycle traits, we included questions about

231   God *and* Jesus. We hoped the contrast between Jesus and God would highlight differential

232   cultural input about both supernatural beings. We speculated that by including Jesus and God

233   as separate beings, children would better distinguish between God in his biological human

234   form (Jesus) and God as a non-biological being.

235   A further motivation was to examine children's understanding of life-cycle processes.

236   We used similar questions to the study by Giménez-Dasí and colleagues (2005), but added a

237   question regarding children's understanding of parentage, or whether children understand if a

238   being had parents or not. We analyzed each item individually to explore responses for each

239   life-cycle trait.

240   We hypothesized that Israeli children would be able to distinguish human from

241   supernatural beings, and similar to Herrmann et al. (2010), all children would not need to

242   initially anthropomorphize, or attribute life-cycle properties, to God. Children and adults *may*

243   resort to anthropomorphism (see Heiphetz, Lane, Waytz, & Young, 2015 for examples); at

244   issue here is whether 3-to-five-year-olds categorically *must* anthropomorphize.

Method

246   **Participants**

247   We tested 140 children. Sixty-four children were Modern Orthodox Jewish from

248   Israel, and 76 children were from the UK, see Table 1 for age and gender breakdown. Israeli

249   children were recruited from Modern Orthodox Jewish synagogues and online newspapers

250   and all identified themselves as Modern Orthodox Jewish. British children were recruited

251   from nurseries, church crèches, and toddler groups. Five British children came from atheist

252   backgrounds and the parents of nine children chose not to comment on their religious

253   background. All 14 of these children could mention something relevant about God, such as,

254   "God answers prayers." The rest of the children came from families who attended an

255   Anglican church-affiliated group at least once each week. At the end of the experiment, all

256   children were asked to tell the experimenter something about God to ensure that they knew

257   the referent of "God," and all but one British child could do so.

258   We also wanted to compare children's responses with those of adults who have more

259   mature biological understanding in addition to wider cultural understanding of supernatural

260   beings. We recruited 68 Israeli and 48 British adults, see Table 1 for age and gender

261   descriptions. The majority were parents of the children we tested. Other adults were

262   recruited via university advertisements (UK), through synagogues (Israel), and online

263   newspapers (both).

264   [Table 1 here]

265   **Procedure**

266   We asked participants a similar set of questions to Giménez-Dasí et al. (2005) but asked

267   one additional question about parentage. Israeli and British children were questioned about a

268   Friend, their Mom, and God in counterbalanced order. The British sample was also asked

269   about Jesus. Children were questioned about Jesus first and then asked about God to help

270   children distinguish between the two.

271   Children were asked five questions in counterbalanced order.

272   1) Existence/longevity question: Each child was shown a picture of a velociraptor and a

273   triceratops, and was asked if s/he could identify the animal. "Dinosaur" was an

274   acceptable answer. If the child could not identify the animal, the experimenter asked

275   whether the child had ever heard of dinosaurs. If the answer was "no," the child was

276   not asked the dinosaur question. If the answer was "yes," the experimenter asked

277   each child: "Right now there aren't any dinosaurs in the world. But a long time ago

278   there were lots of dinosaurs in the world, like this [show picture]. Now what about

279   [being]? Do you think [being] was alive when the dinosaurs were alive?" The

280   original study asked whether dinosaurs "exist" (Giménez-Dasí, et al., 2005). We used

281   "alive" because some researchers argue that the term "exist" is hard for children to

282   understand (Emmons & Kelemen, 2014; Evans, 2008).

283   2) Baby question: "A long time ago, were you ever a little baby, just like

284   this? [Experimenter shows child a newborn-size baby doll]. How about [being]? Was

285   s/he a little baby a long time ago?"

286   3) Aging question: "Let's think about a moment a long, long time from now. What's

287   going to happen to [being] next year and the year after that? Do you think [being] will

288   get older and older or will [being] stay the same?" "Getting older" and "Staying the

289   same" were counterbalanced.

290   4) Death question: "What will happen to [being] a long, long, time from now? Will

291   [being] die someday or will [being] go on living forever and ever?" "Die" and "Live

292   forever" were counterbalanced.

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

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

295   Similar to Giménez-Dasí et al. (2005) an index was created to determine whether a child

296   attributed life-cycle traits to each being. One point was given for each life-cycle trait

297   attributed to each being. If the child did not attribute a life-cycle trait, the child received a

298   score of 0 for that item. Thus, scores ranged from 0 (attributing no life-cycle traits to the

299   being) to a score of 5 (attributing all life-cycle traits to the being). All participant responses

300   were included. Children that responded, "I don't know," were given a score of .5 for that

301   item. All items for each agent moderately inter-correlated, αs > .55; thus, following analysis

302   of the index, we analyzed each item individually. Seven Israeli children and one British child

303   answered, "I don't know" to all "die" questions. One Israeli child did not know whether any

304   being would grow old and one British child did not know whether any being had been a baby.

305   Finally, one Israeli and two British children did not know whether any beings existed during

306   the time of the dinosaurs.

307   **Results**

308   **Understanding of the life-cycle across cultures**

309   We first explored whether children in two different cultures differentiate the life-cycle

310   traits of human versus supernatural beings (as represented by the life-cycle index scores).

311   Table 2 presents answer rates for each being, by age and cultural group.   Following

312   Giménez-Dasí et al. (2005), we broke our sample into age groups. Grouping each age by

313   year allowed us to examine potential interactions between age, cultural group, and being. A 3

314   x 2 x 4 repeated measures ANOVA was conducted with each being (3: Mom, Friend, and

315   God) as the within-subject factor, and cultural group (2: British and Israeli children) and age

316   (4: three-, four-, and five-year-olds, and adults) as the between-subjects. Mauchly's test

317   indicated that the assumption of sphericity had been violated, $X^2(2)= 121.55$, $p < .001$,

318   therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of

319   sphericity. This analysis revealed a significant main effect of being, $F(1.41, 320.63)$

320     $=1099.32, p < .001, \eta_{p^2}= .83$; age, $F(3, 227) =26.26, p < .001, \eta_{p^2}= .26$; and cultural group,

321     $F(1, 227) =3.88, p = .05, \eta_{p^2}= .02$. There were also interactions among responses regarding

322   the life-cycle for each being and cultural group, $F(1.41, 320.63) =27.07, p < .001, \eta_{p^2}= .11$;

323   among responses regarding the life-cycle for each being and age, $F(4.24, 320.63) =104.64, p$

324     $< .001, \eta_{p^2}= .58$; and an interaction in responses for each being, age, and cultural group,

325     $F(4.24, 320.63) =4.92, p < .001, \eta_{p^2}= .06$.

326   [Table 2 here]

327   Differences in responses for each being by cultural group were explored through

328   pairwise comparisons with Bonferroni adjustments, collapsing across age. These comparisons

329   revealed that there was an effect of cultural group for life-cycle responses for Mom, $p = .008$,

330   and God, $p < .001$, but there was no effect between cultural groups for responses for Friend,

331   see Figure 1. Israeli participants attributed more life-cycle attributes to Mom, $M = 4.18, SD =$

332     $.07$, than did British participants, $M = 3.92, SD = .07$, and Israeli participants also attributed

333   fewer life-cycle attributes to God, $M = .76, SD = .09$, than did British participants, $M = 1.52$,

334     $SD = .09$.

335   [Figure 1 here]

336   Post-hoc comparisons using the Tukey HSD test with Bonferroni corrections were

337   used to analyze differences in life-cycle index between age groups and being. Participants in

338   each of three age groups were more likely to attribute life-cycle traits to Friend, $Ms >3.11$,

339   and to Mom, $Ms >2.95$, than to God, $Ms <1.92$, $ps <.001$. These distinctions increased with

340   age. Five-year-olds were significantly better at attributing life-cycle traits to both human

341   beings, $Ms >4.55$ than 3-year-olds, $Ms <3.11$, and 4-year-olds, $Ms <3.98$, $ps <.005$.

342   However, 5-year-olds were less likely to attribute life-cycle traits to God, $M = .98$ compared

343   to 3-year-olds, $M = 1.92$, $p = .001$.

344   We further examined each age group against chance responding for these

345   dichotomous questions (a test value of 2.5 out of 5 items), and results suggest that Israeli

346   children of each age attributed life-cycle traits to human agents and culturally correct traits to

347   God. British children attributed life-cycle traits to the humans by age 4 and rejected them for

348   God by age 5, see Figure 2. British three-year-olds significantly attributed more life-cycle

349   traits than not to their Friend, but not to their Mom or to God.

350   [Figure 2 here]

351   Finally post-hoc comparisons using the Tukey HSD test with Bonferroni corrections

352   were used to examine the interaction of cultural group, age, and being, see Table 2. Three-

353   and 4-year-old Israeli children, were more likely to attribute to Mom more life-cycle

354   attributes than British children. Four- and 5-year-old Israeli children, were also less likely to

355   attribute to God life-cycle traits than were British children. No other significant differences

356   were found.

357   **Ontological distinction between Jesus and God**

358   We also explored whether children and adults in a Christian context (UK) made

359   different life-cycle attributions to Jesus and God. A 2 x 4 repeated measures ANOVA was

360   conducted with each being (2: Jesus and God) as the within-subject factor, and age (4: 3-, 4-,

361   5-year-olds, and adults) as the between-subject factor. This analysis revealed a significant

362   main effect of being, $F(1, 69) = 25.02$, $p < .001$, $\eta_{p^2} = .27$. There was no interaction effect or

363   a significant effect of age. British children significantly differentiated between Jesus and

364   God, $t(71) = 4.62$, $p < .001$, Cohen's $d = 1.09$. Children were less likely to attribute God with

365   life-cycle properties, $M = 1.98$, $SD = 1.39$, than Jesus, $M = 2.72$, $SD = .99$. We used one-

366   sample t-tests (with 2.5 as a test value) to determine whether responses for Jesus and God

367   were significantly different from chance. Responses for God were significantly below

368   chance, suggesting that children correctly rejected life-cycle properties, $t(71) = 3.21$, $p = .002$,

369   Cohen's $d = .76$, but responses for Jesus did not significantly differ from chance, ns. Adults

370   were significantly more likely to attribute life-cycle traits to Jesus, $M = 3.07$, $SD = .69$, than

371   children, $M = 2.72$, $SD = .99$, $t(114) = 2.02$, $p = .046$; and less likely to attribute life-cycle

372   traits to God, $M = .23$, $SD = .53$, than were children, $M = 1.98$, $SD = 1.36$, $t(113) = 8.09$, $p <$

373   $.001$.

374   We ran binomial tests to examine children's and adult's responses for each item

375   individually, see Table 3. Only 5-year-olds consistently responded for 4 of 5 items and most

376   ages were more likely to attribute babyhood and parentage to Jesus than other traits. No age

377   group (except adults) consistently responded regarding whether Jesus ages.

378   [Table 3 here]

379   **Children's attributions of each life-cycle trait**

380   The life-cycle index served to demonstrate whether children *generally* attributed life-

381   cycle features to each entity, but the modest inter-correlations of these items suggest that they

382   are not always attributed in concert. Hence, we analyzed children's level of attribution of

383   each life-cycle item individually using two-tailed binomial tests for each being, with each age

384   and cultural group treated separately to test whether children attributed biologically correct

385   traits to humans and culturally correct traits to God, see Table 4. All adults reliably attributed

386   each life-cycle trait to the human agents and rejected each life-cycle trait for God. Below we

387   discuss children's responses.

388   [Table 4 here]

389   **Existence/longevity**. Older children were more likely to reliably appreciate that

390   Friend and Mom did not exist during the time of the dinosaurs and were more likely to

391   attribute existence during the time of the dinosaurs to God.

392   **Parentage.** Overwhelmingly, children in both cultural groups regarded human beings

393   as having parents. However, there were differences in responses for God between cultures.

394   Israeli children of all ages reliably responded that God would *not* have parents but only 50%

395   (32) of British children said that God did *not* have parents.

396   **Babyhood**. The majority of children from both cultural groups understood that their

397   friend had once been a baby, but only children older than four years reliably responded that

398   Mom had once been a baby. Similar to the parentage item, only Israeli children reliably

399   responded that God had never been a baby whereas British children were at chance.

400   **Aging**. Four- and five-year-olds in both cultural groups reliably attributed aging to a

401   friend. Overall, five-year-olds were more likely to respond that Mom would get older with

402   age. British three-year-olds also attributed their mom with never aging. Only Israeli four-

403   and five-year-olds responded reliably that God would not age.

404   **Death**. By five years, children in both groups reliably responded that Mom and Friend

405   would die. By four years children could reliably respond that God would live forever.

406   British three-year-olds also responded that their friend would never die.

407   **Discussion**

408   The present study provides evidence that children can distinguish beings that are

409   subject to life-cycle processes from those that are not, and they can do so from an early age.

410   Results also suggest that culture influences children's attribution of life-cycle traits. First we

411   discuss results from the life-cycle index and then discuss individual life-cycle traits.

412   **Life-cycle index**

413   Contrary to prior results (Carey, 1995; Giménez-Dasí et al., 2005; Inagaki & Hatano,

414   1996), our results suggest that before age 5, British and Israeli children appropriately

415   attributed life-cycle properties to humans and regarded God as separate from these biological

416   processes. Children did not necessarily resort to using anthropomorphism as a model nor did

417   children acquire an anthropomorphic perspective with age (Herrmann et al., 2010). Instead

418   children, especially older preschoolers, differentiated among humans and God for multiple

419   life-cycle traits. This differentiation is consistent with related evidence that suggests that

420   young children and infants can distinguish animate from inanimate objects (Kuhlmeier,

421   Bloom, & Wynn, 2004; Molina, Van de Walle, Condry, & Spelke, 2004) and living from

422   non-living things (Heyman et al., 2003; Inagaki & Hatano, 1996; Saylor et al., 2010). Perhaps

423   children reason initially according to agency, rather than anthropomorphism. Children may

424   not categorize beings as human or not, but whether or not they are agents. Other work

425   suggests that anthropomorphism may not be children's initial conceptual framework but

426   that cultural input may encourage human-centered reasoning (Ganea, Canfield, Simons-

427   Ghafari, & Chou, 2014; Waxman, Hermann, Woodring, & Medin, 2014).

428   Although children in this study could differentiate at an early age, Israeli children

429   were less likely to attribute life-cycle traits to God than British counterparts. This difference

430   could be due to particular socio-cultural input and testimony (Harris & Koenig, 2006; Lane et

431   al., 2012). In Israel, children are taught about God's all-powerful attributes. In contrast,

432   British children may receive similar cultural input about God but also about Jesus, a human

433   being that is God, but was born, had parents, grew older, and died. Understanding such a

434   complex God concept may be very confusing and could have muddled children's responses.

435   To better characterize how socio-cultural input plays a role in understanding such a

436   complex supernatural being, we questioned British children about Jesus and God. To date,

437   the extent to which socio-cultural input can conflate questions about the biological processes

438   of God with the human characteristics of Jesus is unknown. Thus, the aim of these questions

439   was to determine whether children from a Christian context would differentiate between

440   Jesus and God. Unlike the children in the study by Giménez-Dasí and colleagues (2005),

441   British children understood that God would not be subject to life-cycle processes. Children at

442   all ages, however, responded at chance levels concerning Jesus. However, individual item

443   analyses of children's responses showed that children were much more likely to attribute

444   Jesus with having been a baby or having parents compared to aging, dying, or existing during

445   the time of the dinosaurs. This developmental pattern for Jesus was very similar to the

446   attributions British children made to the human beings, suggesting that children understood

447   cultural input and attributed Jesus with some human-like qualities.

448   **Individual analyses of life-cycle items**

449   Although children differentiated between God and humans concerning life-cycle

450   traits, analyses of each item showed developmental variation. We examine these differences

451   below.

452   A notable difference is that three-year-olds were more likely to respond that their

453   friend had been a baby and had parents above chance levels, whereas responses were at

454   chance levels for a friend's existence/longevity and aging. One possible explanation is that

455   daily exposure to having parents, having siblings, and seeing other people with their children

456   make the traits of parentage and babyhood obvious for children to attribute to human beings,

457   especially compared to questions of existence, death, and aging. Another explanation is that

458   the life-cycle traits of parentage and babyhood map onto different biological modes of

459   construal than the traits of aging and death. Indeed, babyhood and parentage may have more

460   social associations than biological ones. Future research should explore the relationship

461   between these traits. For example, more work is needed to investigate whether children

462   understand the link between parentage and being a baby, as well as children's understanding

463   of reproduction (Emmons & Kelemen, 2014). A further possibility is that death, aging, and

464   existence/longevity are more complex concepts. Seventy percent of British and Israeli three-

465   year-olds reported that their friend would not die but go on living, and it was not until age

466   five that most attributed eventual death, aging, and existence/longevity to both their friend

467   and mother at levels above chance. However, both populations significantly rejected eventual

468   death for God by age 4. Our data are consistent with the claim that children do not develop a

469   mature concept of death until later, between the ages of 5 to 7 years (Slaughter & Lyons,

470   2003; Speece & Brent, 1984). These results are also consistent with claims by many

471   researchers (Bering & Bjorklund, 2004; Bering, Blasi, & Bjorklund, 2005; Bloom, 2004,

472   2007; Carey, 1985; Harris & Giménez, 2005) that folk psychology may interfere with a

473   concept of death and existence/longevity (or a concept of pre-life, see Emmons and Kelemen,

474   2014), and children may find the termination of epistemic states hard to imagine. Even

475   adults, who explicitly reject a life after death, answer that some psychological (but not

476   biological) states continue after death (Bek & Lock, 2011; Bering, 2002; Huang, Cheng, &

477   Zhu, 2013). A further consideration is that when using familiar people, children may resist

478   the idea that their friend or mother might die (Poling & Evans, 2004). Future studies could

479   try to tease apart whether responses reflect reluctance to think about the question, whether

480   folk psychology is interfering, or whether children require development and knowledge to

481   understand the concept of death, longevity, and aging. A final limitation could be that our

482   choice of the word "alive" for the longevity item was confusing: a "no" response may mean

483   children attribute longevity to God, but a "yes" response could mean they attribute "life" to

484   God.

485   **Conclusion**

486   These results suggest that 3-to-5-year-old children do not unswervingly

487   anthropomorphize but have conceptual flexibility and can distinguish between supernatural

488   and human beings. In addition, sociocultural input influences attribution of life-cycle traits.

489   Further research is needed to understand how young children reason about the biological

490   world, and in particular, how children understand the place of humans, other animals, and the

491   variety of supernatural beings they encounter. More cultural work is needed to understand

492   the variation or similarities of socio-cultural input that children receive regarding the

493   biological (or non-biological) properties of human, animals, and supernatural beings. An

494   important goal would be to concentrate on the influences of early education, as well as

495   cultural and religious beliefs and practices, on biological conceptual development.

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

		Gender	Mean age (*SD*)	Age range
Sample	Age group			
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

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

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678   Table 2.

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

	Friend		Mom		God	
	British	Israeli	British	Israeli	British	Israeli
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*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)**

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

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699 Table 3.

700 *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**

701 *p < .01, **p < .0001, + Higher scores for this item reflect responses that the being would not
702 be alive during the time of the dinosaurs.
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721 Table 4.
722
723 *Percentage of Attributed Life-Cycle Trait Responses by Age and Cultural Group for Being*
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	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**

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

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

741   cultural group.

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

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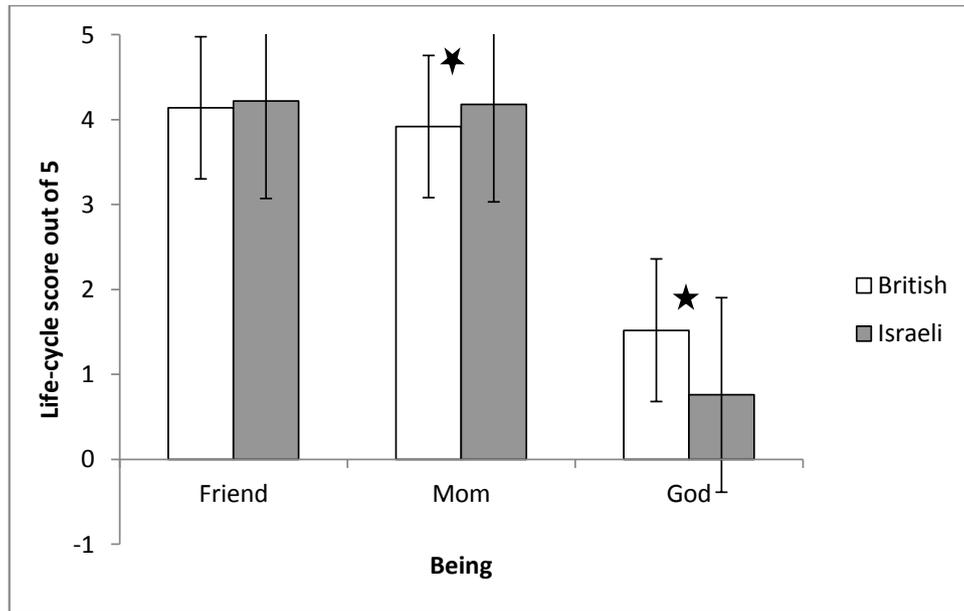
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764 *Figure* 1.

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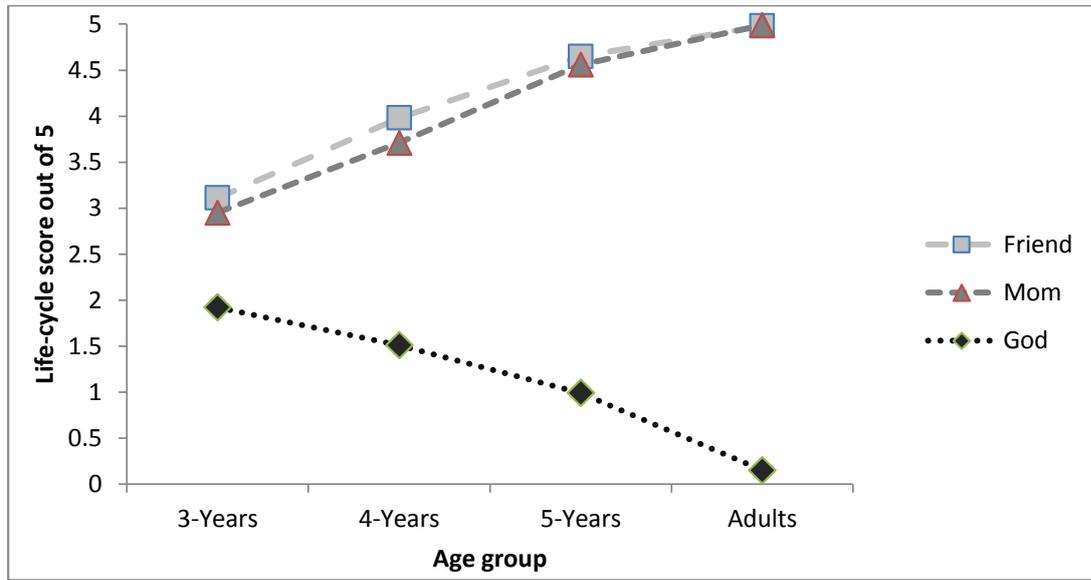
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781   *Figure* 2.

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