

## **Animals, Superman, Fairy and God:**

### **Children's Attributions of Nonhuman Agent Beliefs in Madrid and London**

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#### **Abstract**

There have been major developments in the understanding of children's nonhuman concepts, particularly God concepts, within the past two decades, with a body of cross-cultural studies accumulating. Relatively less research has studied those of non-Christian faiths or children's concepts of popular occult characters. This paper describes two studies, one in Spain and one in England, examining 5- to 10-year-olds' human and nonhuman agent beliefs. Both settings were secular, but the latter comprised a Muslim majority. Children were given a false-belief (unexpected contents) task in which they were asked to infer about three humans (mother, classmate, teacher), three animals (dog, bear, bird) and three supernatural beings (Superman, fairy, God). Similar false beliefs about humans, with subtle differences in inferences about animals and supernatural beings, were found between the two locations. In London different patterns for God between participants with a family religion, in particular Muslims, and non-affiliates, were identified as well as an association between religious beliefs and practice and inferences about God. Findings are discussed in the light of theory and research on the role of sociocultural inputs in children's theory of mind development and understanding of agency.

Keywords: nonhuman agents; God; false beliefs; Muslim; theory of mind

## **Animals, Superman, Fairy and God:**

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The study of social cognition involves in a large part the attribution of states of mind to other agents. Since infancy human agents are fundamental units of our social world where children use different rules for interactions with humans as opposed to objects (Itakura, Moriguchi, & Morita, 2013). This is often ascribed to one of the basic, central psychological processes that separate humans from animals: the ability to imagine others' thoughts, feelings, intentions or desires, while reflecting on our own minds, as a 'theory of mind' (ToM; Astington, Harris, & Olson, 1988; Baron-Cohen, Tager-Flusberg, & Lambardo, 2013; Wellman, 2014). While our capacity to 'mentalize' humans has been researched for over four decades, children's ability to infer the mental states of nonhumans, in particular God, began to be studied fairly recently (Barrett, Richart, & Driesenga, 2001; Rosengren, Johnson, & Harris, 2000). We aim to add to the literature of children's concepts of nonhumans, through two studies using the false-belief task, one in Madrid (secular setting) and another in London (secular with a Muslim majority).

Although by the second year of life infants may already attribute goals or dispositions to both humans and nonhumans (e.g., Luo & Baillargeon, 2010), the success that they present on those tasks, often based on observations or looking time, likely use a system distinct from the conceptual framework adopted for preschoolers (Sabbagh, Benson, & Kuhlmeier, 2013). As part of the gradual mastery of ToM, children tend to appreciate others' conflicting desires before they realize their differential beliefs (Wellman & Liu, 2004). This criterion of explicit inferences about agents' thoughts in a given situation is another reason behind the failure of younger children in the standard false-belief task (Harris, Ronford, & Bartz, 2017). This task, which often includes 'unexpected contents', involves children being shown a container whose contents may be hinted by a label (such as a known brand of confectionery) and asked what is

inside, before finding the unexpected objects (such as stationeries). Privy to this information, they are asked what other agents (such as friends), who are unaware of the switched contents, would expect to find inside, and the attribution of false beliefs (FB; expected contents), which conflicts with reality, is an indicator of ToM (Sabbagh et al., 2013).

While most children between 4 and 6 years start to expect that other humans have FB (Astington et al., 1988), ToM as a broader concept involving multiple categories of attributes (beyond beliefs), agents and situations is in fact highly plastic, continuing to develop through childhood into adulthood (Baron-Cohen et al., 2013). A central debate concerns how children acquire this skill, and for their attributions for nonhuman agents it has centered on what were originally coined ‘theory theory’ and ‘simulation theory’ (see Barrett et al., 2001; Barrett & Richert, 2003). The former posits that our evolving ToM is based upon a naïve or folk theory involving an adaptable set of concepts that are comparable to theories in scientific reasoning, drawing on any available data about agents and use these to generate predictions, inferences and explanations about novel cases or hypothetical situations. Simulation theory denies the deployment of any existing ‘theory’, but denotes that children use the contents of their own minds to ‘simulate’ others by imagining what they themselves would do in another’s ‘shoes’ to come to predictions or explanations about them (Ruffman, 1996).

Although both theories could accommodate anthropomorphic nonhuman attributions, theory theory offers a more flexible account for a wide range of agents. All children have the propensity for naïve theories, but these can be developed and refined as they grow and gather increasing (agentic) information. If the (human) self is relied upon for simulating predictions about agents of any kind, children will likely anthropomorphize nonhumans as human inputs are used unless they have salient reasons to think such agents have alternative information or properties. Many studies, since Barrett et al.’s (2001) seminal work, have found that children as young as 3-4 years of age readily accept that God is not subject to human constraints such

as lacking perceptual access (Barrett, Newman, & Richert, 2003; Di Dio, Isernia, Ceolaro, Marchetti, & Massaro, 2018; Knight, 2008; Knight, Sousa, Barrett, & Atran, 2004; Nyhof & Johnson, 2017; Richert & Barrett, 2005; Richert, Saide, Lesage, & Shaman, 2017; Wigger, Paxon, & Ryan, 2013). Other studies (Giménez-Dasí, Guerrero, & Harris, 2005; Kiessling & Perner, 2014; Lane, Wellman, & Evans, 2010, 2012; Makris & Pnevmatikos, 2007) have seen more anthropomorphic concepts at that age, but not among older preschoolers from around 5 years who also endorse other properties that differentiate God from humans, including a lack of bodily processes, lifecycle or death and the possession of extraordinary powers (Burdett & Barrett, 2015; Giménez-Dasí et al., 2005; Harris & Giménez, 2005). The understanding of the distinctive properties of God or deities pertains more to theory theory as children use varying information about these agents to attribute knowledge or other outcomes.

Due to the lack of first-hand observations and personal experience with many agents, children learn a great deal from testimony, or what others tell them (Harris & Koenig, 2006). This applies not only to God, but also other invisible agents including scientific (e.g., germs, oxygen) or extraordinary entities (e.g., Santa Claus, fairies; Boerger, 2011; Guerrero, Enesco, & Harris, 2010). Still, like adults, they report greater confidence in the existence of scientific entities over religious, equivocal or impossible (e.g., monsters, flying pigs) or even endorsed beings (e.g., witches; Harris, Pasquini, Duke, Asscher, & Pons, 2006). Recent research shows also that adults with lower levels of religiosity than others express greater beliefs in scientific than religious entities (Clegg, Cui, Harris, & Corriveau, 2019).

Meanwhile, evidence has long shown that not only do religious and scientific beliefs coexist within adults (Harris, 1997), natural and supernatural explanations are often used by children and adults in a complementary rather than exclusive fashion, with some indications that both are founded on earlier intuitive explanations and further constructed and elaborated through socialization (Leagare, Evans, Rosengren, & Harris, 2012). Children may synthesize

biological (cessation of bodily functions) and spiritual (continuity of a ‘soul’) explanations to conceptualize death, for instance. They are also sensitive to the context in which fictional and religious events happen. They doubt that magic happens in ‘real life’ while accepting it as the narrative in fairytales or make-believe stories, and miracles as a credible religious-historical narrative (Corriveau, Kim, Schwalen, & Harris, 2009; Kim & Harris, 2014). This is a critical theoretical point around children’s understanding of agency and development of imagination; they represent agents, and events enacted by agents, regarded as true and possible or fictional and impossible, according to the nature of the given scenario (Harris, 2013). Hence the social and investigative context that can shape and influence children’s thoughts about supernatural agents should be considered (Rosengren et al., 2000).

Some research has systematically studied the role of religion, or even mere exposure to religious ideas, on children’s distinction between reality and fiction. For instance, children who attend church or are enrolled in faith schools are more likely than those with no religious exposure, to judge characters in fantastical and religious stories describing impossible events as real rather than fictional (Corriveau, Chen, & Harris, 2015). Meanwhile, the FB task with unexpected contents is arguably a comparably ‘context-less’ task, devoid of connotations of magic or fantasy or religious or miraculous narrative. It relies on children’s own prerogative to draw on the extraordinary properties of nonhuman agents and apply in this ‘context’.

Research that has considered children’s religious background in their nonhuman FB has amassed an emerging cross-cultural literature, particularly on God concepts. For instance, secularly schooled children may differentiate between humans and God’s minds by the age of 5, but this differentiation is earlier, by 4 years, among those who are religiously schooled, and God knowledge predicts the attributions of infallible minds to God and extraordinary agents (Lane et al., 2012). The early emergence of God-human distinctions is in line with the earlier studies on children of the Protestant faith (Barrett et al., 2001, 2003; Richert & Barrett, 2005).

Those sampling from the Catholic (Di Dio et al., 2018; Giménez-Dasí et al., 2005; Kiessling & Perner, 2014; Richert et al., 2017; Wigger et al., 2013) and other Christian denominations (Greek Orthodox, Makris & Pnevmatikos, 2007; Latter-Day Saints, Nyhof & Johnson, 2017), or communities with local deities but exposed to Catholic beliefs (ethnic Maya, Knight, 2008; Knight et al., 2004), have also identified the God-human distinction, but at slightly later ages. This could be due to their more anthropomorphic (Di Dio et al., 2018) or embodied (Nyhof & Johnson, 2017), i.e., more concrete, depiction of God.

Not until recently have the agent beliefs among children of non-Christian faiths been studied. The first known study, conducted in Iran, an Islamic theocracy (Nickpour & Joukar, 2011), found that children aged 3 through 7 years attributed the least FB to God and an angel while increasingly attributing FB to a magician with age. Recent studies of Muslim and other children across countries (Indonesia, Nyhof & Johnson, 2017; US, Richert et al., 2017) have found that Muslims tend to differentiate God and humans the most and those without family religion the least, in line with the relatively anthropomorphic concepts found in studies that have included non-affiliates (Giménez-Dasí et al., 2005; Lane et al., 2010, 2012). The data also shows that those from families with less anthropomorphic God concepts make stronger differentiations, and that older children's concepts are in line with their religious traditions. The clearer God-human distinctions that Muslims make may reflect the depiction of God as highly abstract, all-knowing and powerful (omniscience and omnipotence) within their faith (Richert et al., 2017). These findings highlight the role of cultural messages in children's conceptions of theological agents, similar to that in adults (Clegg et al., 2019).

While the key theological agent in FB works has been God, some have included other nonhumans such as animals or contrived beings with special capabilities, particularly in tasks featuring visual perception (Barrett et al., 2001; Richert & Barrett, 2005; Wigger et al., 2013), and children tend to attribute more human constraints to real animals than to 'special' agents.

This is perhaps to be expected as the latter have the relevant faculty that can ‘tackle’ the task (e.g., super eyesight). What is less clear is whether children draw on the attributes of popular occult figures. For example, Barrett et al. (2001) argue that, if a child knows that Superman “can see through things”, this knowledge can be imported into a ToM (p. 53). We know that endorsement of other supernatural beings, such as witches, Santa and Tooth Fairy (Guerrero et al., 2010; Harris et al., 2006), varies and that children sometimes accept magic or miracles (Corriveau et al., 2009, 2015). Exploring children’s concepts about the minds of more agents in this genre can shed further light on their understanding of agency.

We aim to examine how children infer about nonhumans’ minds using an unexpected contents task, first in a secular setting within a wider context with a historic Catholic culture, then in another secular but more diverse setting with a Muslim majority, an under-researched group. In our work, we included God, Superman and fairy as well-known supernatural agents and several humans and animals varying in familiarity to children (from mother to an insect). We are, however, not only interested in FB or attributions of extraordinary powers. Much of the research has used forced choices (e.g., sweets or rocks) or has dichotomized the answers to examine preschoolers’ nonhuman concepts in relation to human FB. In our samples aged 5-10 years, most children will have acquired FB, which provide a useful reference-point, but considering the range of agents and ages, we expect a wider repertoire of concepts that reflect children’s varying knowledge of agency and ToM development.

### **Study 1: Madrid**

Previous studies on children’s understanding of nonhumans in Spain have been based in both non-secular (Catholic) and secular settings (Giménez-Dasí et al., 2005; Guerrero et al., 2010; Harris & Giménez, 2005). These have highlighted their recognition of God’s omniscience or omnipotence by 5 years of age. The early understanding may be a facet of the long history of Catholic traditions even for those who do not worship or actively practice the faith; religious



and God ‘references’ can be a part of public discourse (Harris, 2013) on which even children may readily draw to infer about God properties. As such, we predict that, apart from the FB attributions to human agents, Spanish children from the age of 5 years should infer that God, with the extraordinary powers, would ‘bypass’ FB, or be able to ‘know’ the contents in the container (and answer ‘rocks’). We expect that this attribution would become more apparent with age as children gather knowledge of God properties. We expect a similar pattern, if to a lesser extent, for the other supernatural beings (Superman and fairy) as most of their popular media depictions portray extraordinary powers, but for specific functions (e.g., super vision, magic), which children might not as readily apply in the FB context. For animals, we expect that children would largely anthropomorphize, more than attributing extraordinary powers, according to the previous research reviewed in the introduction.

## **Method**

### *Participants*

The sample totaled 72 (37 female;  $M_{\text{age}}=6.99$ ,  $SD_{\text{age}}=1.65$  years) children in three age groups (24 5-6, 24 7-8, and 24 9-10 years). They attended a public elementary school on the outskirts of Madrid with primarily middle-class families. The school served a Spanish majority with a very small number of ethnic minorities and our sample comprised White Spaniards. Religious practice details of individuals were unobtainable, but the teachers confirmed that participants, as with most of Spain (CIS, 2019), came from culturally, but largely non-practicing, Catholic families. The school did not provide any religious education or activity within its curriculum.

### *Materials*

The principal material consisted of a container with unexpected contents. This container was cylinder-shaped and had held 150 grams of chocolates of a well-known brand (Smarties) and was labelled as such. The Smarties were replaced by small rocks totaling the same weight as

the original contents. In our piloting with other children, some had explored the container by shoving or shaking it with the lid remaining shut and remarked that the sounds made were similar to what would have been produced had the chocolates remained.

For the animal agents, we used photographs of the typical specimens (a Labrador, a brown bear, and a red-and-black ladybird), so that children could use them as “examples” to infer about “real” animals’ beliefs, rather than fictional or media characters that may possess extraordinary or anthropomorphic features that they could draw on. It was, however, decided that drawings or photographs would not be used for supernatural agents, including Superman and fairy, so that children would use their own concepts about these agents, rather than being led to draw on any particular variant of popular media characterizations, which varied a great deal in terms of anthropomorphic and supernatural properties.

### *Procedure*

Children were seen individually by a female experimenter, who explained that she wanted to know how children predict “what others would think about some things”. She presented the Smarties container, with the lid closed, and asked the child, “What do you think is inside this tube?” (all the responses were “Smarties”, “chocolates” or “sweets”). She then opened the lid, poured out some of the rocks from the container and asked the child to examine the rest of the contents inside. After that she returned the poured rocks into the container, closed the lid, and asked the child, “What’s inside this tube?” (all participants answered “rocks” or “stones”) and “What did you think was inside before I opened it?” (all answers were the same as previous). Then she started asking about each of the nine agents’ beliefs (in randomized order) about the contents of the container, each with the same phrasing, “What would [a] \_\_\_ think was inside this tube?”, recording the answer that each child gave for each agent. All children completed the task and were thanked on completion. The procedure took up to 20 minutes to administer.

### **Results**

We first examined age and sex differences and found that neither affected response patterns ( $ps > .05$ ). Children's responses about each agent's belief were categorized as those presented in Table 1. The majority of children gave the standard FB response ("Smarties") for humans. Above half of the sample attributed FB also to Superman and fairy, but under half did to God and the animal agents. Collapsing the other responses into one response-type and comparing this with FB across agents found that FB attributions to the three human agents did not differ from each other, but from all other agents (see Table 1).

The proportion of "rocks" responses also varied between the agents; more were given to God than other agents, in particular humans. Collapsing the other responses and comparing this with "rocks" confirmed that God received this attribution more than all other agents, and found that the other two supernatural beings also received more than did mother (in Table 1).

Just under one third of responses for animal agents referred to 'other objects' (mostly foodstuffs such as dogfood or bone for dog, fruit for bear or "bugs" for ladybird, or objects in their habitats like toys or plants). This response-type, which is largely absent for humans, was given by fewer participants for supernatural beings (such as "kryptonite" for Superman, wand for fairy, or crucifixes for God). Collapsing other responses and comparing with other objects found that animals were given more other objects than all the other agents and that Superman and fairy also received more of this type of responses than all humans (see Table 1).

One response that few children gave is that an agent would "not know" what was in the container. This is notably absent for humans and God, but the frequency varied between other agents. Collapsing other responses and comparing with "not know" found that ladybird was given more of this response than all other agents except dog and bear (in Table 1).

For each response-type, the scores of the three agents within each category (humans, animals, supernatural beings) were summed (e.g., for FB: Smarties scored 1, other responses

0) to form the agent-category scores (scale 0-3; see Table 2). A one-way repeated measures analysis of variance comparing the categories, for each response-type, confirmed the agent-category effect. Post hoc tests found that more FB was attributed to humans than to animals and supernatural beings, which did not differ from each other. More ‘extraordinary powers’ (rocks) were attributed to supernatural beings than to humans or animals, which received more of these attributions than humans did. More ‘other’ attributions were made to animals than to humans or supernatural beings, which received more than humans did. Finally, more ‘ignorance’ (agent “would not know”) attributions were made to animals than to supernatural beings and humans, which did not differ from each other (see Table 2).

### **Study 1 Discussion**

The set of results support the key hypotheses in that most children from age 5 years attributed FB to human agents, more so than to other agents, and that they were more likely to attribute extraordinary powers to God than to the other agents. Still, the level of extraordinary powers attributions was slightly lower than that for FB, and this did not vary with age. These results suggest, in secular settings, that knowledge or application of God properties might be limited, or that children’s God concepts may be relatively anthropomorphic in a traditionally Catholic country. For our further work, it would be informative to obtain children’s religious practice details and examine the association between practice and application of God properties.

Of interest are also the similar patterns for the other supernatural beings (which did not receive more attributions of extraordinary powers than most agents, except for mother) and animals for this type of attributions as well as the ‘other’ attributions to animals. These indicate that a substantial minority of participants neither anthropomorphized nor attributed extraordinary powers to nonhumans. The typical responses, foods that the children expected the animals to eat, suggest that they were actively imagining the potential goals or desires of

animals (to find food) and applying that to the context. This is also evident in the attributions to supernatural agents, but to a lesser extent. At the same time, children were also more likely to infer that the animals would “not know” compared to other agents, if this result needs to be treated with caution as such responses were rare. Considering that we asked children what the agents would ‘think’, this also suggests that they saw animals as a different ‘genre’ of agents with different agendas. These findings, especially the ‘alternative’ responses about nonhuman agents including God that pertain to neither FB nor extraordinary powers, are worthy of more investigation, with more culturally diverse samples, in view of the variety of obtained here.

## **Study 2: London**

The existing studies that have examined more diverse samples have shown that children who come from religious families, compared to those who do not, generate more inferences about God as having extraordinary powers that may enable access to situations without perceptual limits or perform actions that violate the natural order (Corriveau et al., 2009; 2015; Lane et al., 2012). In particular, studies with Muslim children using FB tasks show more application of the omniscient and omnipotent God concept, which is pertinent in their faith, compared to other children, especially those who are unaffiliated to any religion (Nyhof & Johnson 2017; Richert et al., 2017). The research also indicates that variations in God-other differentiation are related to variations in children’s religious experience. This may include beliefs (in God) or practice (e.g., prayers or other worship rituals directed at God; Richert & Granqvist, 2013). Although it is likely that children with a family religion have more religious experience, it is possible for non-affiliates to have such ‘basic’ engagement, while the level of experience can also vary between those of different faiths or other background characteristics.

The children in this sample came from diverse backgrounds but all attended the same secular setting. As such, we predict that, apart from a similar overall pattern for the agents as

Study 1, children with a family religion should be more likely to infer extraordinary powers about God and answer ‘rocks’. Additionally, Muslim participants, who formed a majority in the current setting, would be more likely than other children to make this inference. Finally, we examine children’s religious beliefs and practice and God attributions. We hypothesize a positive association so that the higher a child’s level of beliefs and practice, the more likely s/he would attribute extraordinary powers to god (rocks response).

## **Method**

### *Participants*

The sample totaled 76 (43 female;  $M_{\text{age}}=7.39$ ,  $SD_{\text{age}}=1.65$  years) children from the same age groups (23 5-6, 25 7-8, and 28 9-10 years) as Study 1. They attended a state-funded primary school on the outskirts of London with a highly diverse population largely of South Asian and North African backgrounds while most White pupils had non-English European backgrounds. Though the school was secular with no religious education or activity, over half of the pupils had Islam registered as their family’s religion, and the sample reflected that; 39 Muslims, 23 other faiths (17 Christians, 3 Sikhs, 2 Hindus and 1 Jain) and 14 with no registered religion.

### *Materials*

The FB task with the same agents as in Study 1 was given to this sample. Additionally, this sample received a few semi-structured questions on God belief and religious knowledge and practice: whether they believed in God; whether they had a religion, and if so, what that was; and, whether they conducted prayers or other forms of worship or religious practice.

### *Procedure*

The procedure was conducted by another female experimenter. After the FB task, children were asked about their religious beliefs and practice: “*Do you believe in God?*”, “*Do you have a religion?*”, (if previous answer was affirmative) “*What is your religion?*” and “*Do*

*you pray to God or worship God, or do anything like that?*”. Some children were asked to elaborate if the initial answer was unclear. The combined procedure took up to 25 minutes.

## **Results**

Before examining the religious group differences, we performed largely the same analyses as for Study 1 (see Table 3). One minor difference is the larger number ( $N=16$ ) of children who responded that they did “not know” what at least one agent would think were the container’s contents (cf.,  $N=1$  in Study 1) and this response will be explored separately. Examination of age and sex differences did not return any significant effects.

The majority of children attributed FB to human agents, but the extent of this varied as mother and classmate received more “Smarties” responses than teacher. Still, all humans received more FB attributions than most other agents did (except for the teacher-Superman difference; in Table 3). For the “rocks” response, God received this inference more than did all other agents, while Superman, fairy and bear also received more than mother did.

Notably, around half of the responses for animals referred to ‘other objects’ (similar range of objects as in Study 1). These responses, while rare for humans and God, were given particularly for fairy, in terms of both a larger amount and a wider variety (e.g., “fairy dust”, “magic beads”, “unicorns”).

The other two response-types pertained to the participant answering that agents would “not know” what was inside the container or that they *themselves* did “not know” what agents would think. The former appeared more for the animals while the latter only for a few agents, in particular God. As these were relatively rare, although overall differences across the agents were found (see Table 3), post hoc results were not significant (with Bonferroni corrections).

After turning the data into the combined agent-category scores, the one-way repeated measures ANOVAs showed an agent-category effect for all attributions, except for children’s

‘own ignorance’ (see Table 4). Post hoc tests found that more FB was attributed to humans than to animals and supernatural beings, which received more FB attributions than animals. Participants attributed more extraordinary powers to supernatural beings than to animals and humans, which did not differ from each other. They also made more of the other attributions to animals than to humans or supernatural beings, which received more of these attributions than humans did. Finally, animals received more ‘ignorance’ attributions than did humans and supernatural beings, which did not differ from each other (see Table 4).

To examine response variations as a function of participants’ religion, God belief and religious practice, first we assessed each response for each agent by cross-tabulation: children with a family religion versus those without; Muslims versus other faiths versus those without; Muslims versus non-Muslims. We found that those with a family religion (51.6%) were more likely than those without (21.4%;  $\chi^2=4.19, p=.02$ ), and also Muslims (56.4%) more than non-Muslims (35.1%;  $\chi^2=3.46, p=.03$ ), to attribute extraordinary powers to God (rocks response).

Participants’ own responses to the religion questions matched their registered family religions (95% agreement). Hence, we only summed the religious items (no God belief or no prayers/worship 0, affirmative 1; i.e., a 0-2 scale) and examined how this aggregate religious score was associated with each response-type for God. Note that the religious score varied by family religion,  $F(2,73)=23.76, p<.001, \eta_p^2=.39$ . Muslims ( $M=1.74, SD=.50$ ) scored higher than children of other faiths ( $M=1.09, SD=.67$ ) and those without ( $M=.64, SD=.50; ps<.001$ ), who did not differ from each other. A binary logistic regression, for each response-type, with religious score as the covariate and group as a categorical covariate, found that only religious score explained a significant amount of variance for the rocks response, Wald statistic=4.12,  $p=.04; B=.48, SE=.48, \text{Exp}(B)=2.66$  (model Nagelkerke  $R^2=.25$ ). Another response explained by the religious score was own ‘don’t knows’, Wald statistic=6.02,  $p=.01; B=-1.83, SE=.75, \text{Exp}(B)=.16$  (model Nagelkerke  $R^2=.25$ ). Hence, the more religious the child the more likely



s/he would attribute extraordinary powers, and the less religious the more likely s/he would claim his/her own ignorance about God's thoughts.

## **Study 2 Discussion**

Similar to Study 1, the majority of children attributed FB to the humans as an agent category more than to other agent categories. Intriguingly, less attribution of this kind was made to the teacher than to mother or classmate (though it was still more than most other agents, except Superman). Spontaneous accounts by the children giving 'other' responses include the idea that their teacher had a part in 'setting up' the experiment and the fact that confectionery or cracker containers were used for collecting items or storing stationeries ("class tins") in the school. Hence the context in which children see an agent, including the activities or relation they share, can impact the inferences they make about the agent.

Another peculiarity was the relatively high proportions (around half of the sample) of 'other' attributions made to the animals, higher than FB, which were not the case in Study 1, where more children anthropomorphized. There were also more of the 'not know' responses (including children *themselves* not knowing, which was practically absent in Study 1). While the other objects that participants were similar to those in Study 1, the higher levels of these attributions and own ignorance suggest a greater amount of imagination and uncertainty that may be related to children's exposure to, or representations of, these agents. The higher level of pet ownership in Spain versus the UK (Statista, 2019) may offer a potential backdrop, but it is unclear whether more exposure to domestic animals leads to more anthropomorphism, or less exposure to more imagination or lack of 'knowledge', about animals' minds generally (as the genre included non-domestic animals) without data on children's exposure to animals.

Cross-country specificities also apply to the supernatural agents. Though the response *pattern* for this category is similar to that in Study 1, fairy received a far larger amount and a

wider variety of *other* attributions. This may reflect, perhaps more in Anglophone spheres, its status as a prominent fantasy figure in childhood (Boerger, 2011). Fairies frequently feature in popular fiction and televised programs with miscellaneous paraphernalia such as the items named by our participants, even though the history of fairytales rests largely on old folklore (Duggan, Haase, & Callow, 2008). The same did not apply to Superman perhaps because, as a superhuman figure with a history in certain genres such as older comics or movies, children know less about this agent and tend more to ‘default’ on FB, or because those portrayals tend to anthropomorphize him (in a human-like form or with human sentiments) as well as capture his extraordinary powers.

Lastly, similar to Study 1, children attributed more extraordinary powers to God than all other agents. However, unlike in Study 1, where God received more FB attributions than those of extraordinary powers, more children in this study attributed the latter. This might be an artifact of the sample with a theist majority in terms of family religion and is supported by the other results that children with a family religion, Muslims in particular, were more likely than those without, and non-Muslims, to make this attribution to God, where the level of this response was associated with the level of religious beliefs and practice. Also, unlike in Study 1, where a minority that did not attribute false beliefs or extraordinary powers to God made other attributions, that minority here were more likely to state that they did ‘not know’ what God would think. This may be due to the noticeable minority of unaffiliated children (and is supported by the finding that these children were more likely to state that they did not know about God’s thoughts), while most of the Spanish population, from which Study 1’s sample was drawn, is culturally Catholic (if non-practicing; CIS, 2019). More work could verify the relationship between children’s religious background, practice or education and mentalization about God or divine figures.

## **General Discussion**

We set out to study how school-aged children differentiate human and nonhuman agents by using the FB task. Taken together, our two studies of those differing in cultural backgrounds indicate several facets of their inferences about agents' minds. First, by 5 years of age, most children attribute FB to humans, regardless of background. Second, a significant proportion, especially among those in London, neither anthropomorphized nor attributed extraordinary powers to some nonhumans. Third, children do not attribute more extraordinary powers to Superman and fairy than most other agents tested. Fourth, children attribute relatively more extraordinary powers to God, and finally, the degree of this attribution varies as a function of religious faith, belief and practice.

That the majority of the children from both Spain and England attributed FB to the majority of human agents from 5-6 years old is in line with the large body of literature that documents most children as having acquired a ToM for at least humans from as young as 4 years of age as an adaptive function that separates us from other species (e.g., Baron-Cohen et al., 2013; Wellman, 2014). The lack of age differences suggests that the basic function is already well-established by 5 years old. The fewer FB attributed to a particular human agent (teacher) in London that may be explained by the alternative functions of the task's key tool (container) within their setting indicates that children draw on their knowledge about agents and the context which they operate in when making attributions (Rosengren et al., 2000).

The same process is also evident in children's inferences about the nonhuman agents, particularly those animals. Although the FB task is said to be 'context-less', children seem to draw on their knowledge or assumptions about these agents' desires or intentions (to forage) and name the items within the agents' normal environments when inferring about their mind. The focus on primitive desires or goals may be because children tend to recognize conflictual desires before differential beliefs as part of the gradual mastery of ToM skillset (Wellman & Liu, 2004; Wellman, 2014). Alternatively, or additionally, this approach to the task might be

more likely for inferring about nonhuman agents due to their assumed nature or unfamiliarity (versus humans). Although widely viewed as sentient beings at least in Western cultures, real animals are not often represented in terms of the ‘higher-level’ functions (such as thoughts or planned behavior), versus being objectified as pets, wildlife or food, in the media (Packwood Freeman, 2011). For children, their conceptions about these agents may derive from personal encounters, pet ownership (for dog and ladybird) and testimony through the media (especially for bear). This may in part explain the differences between agents within the category as well as the variations between the two countries; children’s interactions with, and education about, animals can vary across environments. Further research could examine children’s experience and knowledge in this domain in relation to their representations about animal cognition. This category of nonhuman beings is also informative about children’s understanding of agency as many children show awareness that ‘false’ beliefs may not apply. With the FB task originally designed for human agents, who would be ‘tricked’ by the “Smarties” label, animals—which cannot read or do not rely heavily on vision—would draw on other senses such as olfaction or not ‘see’ the container in the same way humans would and might lack meaningful ‘beliefs’ (beliefs with propositional structure that could be subject to deception due to verbal or written cues) altogether. Further work could examine children’s perceptions of the different ‘genres’ of agents’ in terms of capacity for thoughts also in relation to their backgrounds.

Cultural factors may also explain children’s conceptions of supernatural agents, such as fairy. The level of alternative attributions to this agent was comparable to that for the other supernatural agents in Madrid, but more of these responses were made in London. Consisting of artefacts from modern television and popular fiction, they reflect the cultural milieu around this fantasy figure to the contemporary child in the UK. Yet, despite appearing to be familiar, most children did not attribute extraordinary powers to fairy (similar to Superman). This may be due to the FB task not being cued with fantastical or magical notions to which children are

sensitive (Corriveau et al., 2009, 2015). It might also be that ‘fairy’ is a generic representative of a range of characters, or that extraordinary powers are simply not that central to children’s thoughts about fantasy figures (Boerger, 2011). Further research should examine more of the contextual factors that influence children’s attributions to a variety of supernatural agents.

The impact of cultural factors is clearest when considering the inferences about God. While Spanish children attributed more FB rather than extraordinary powers to God, British children did the reverse. Whether this is due to the more anthropomorphic concept of God in Catholicism, Spain’s traditional religion, or the majority-Muslim British sample is difficult to ascertain without the relevant measures of God concepts. Yet the finding that children with a family religion, Muslims in particular, were more likely to attribute extraordinary powers to God, compared with non-affiliates and non-Muslims, indicates the role of faiths in children’s thoughts about God’s minds in line with previous research (Nyhof & Johnson, 2017; Richert et al., 2017). The subsample of non-affiliates was small, but the finding they were more likely to state their ignorance of God’s minds, with that of the association between religious beliefs and practice and attributions of extraordinary powers, supports the role of sociocultural inputs in children’s conceptions of theological agents. It is argued that the cultural context (such as a religious family or faith school) in which children are exposed to, and develop, God concepts offer a ‘preliminary structure’ of those concepts (Richert et al., 2017). Various factors within it then shape and scaffold their understanding, such as religious experience and engagement in discourse about divine agents (which include prayers and other worship rituals).

The overall findings strongly suggest that children are not simply anthropomorphic in their nonhuman concepts (cf., simulation theory): many do not simulate to those agents their own perspective (FB). They can actively draw on their knowledge about an agent, or at least assumptions about its goals, desires or intentions, at times considering its environments, and apply that information in their predictions. This is more akin to a flexible theory of concepts

that can adapt to various hypothetical situations (cf., theory theory; Barrett et al., 2001, 2003). Clearly, though, different children have different access to agentic information (such as those of different faiths or none with regards to God concepts) and differ in their readiness to apply such information (such as the cross-cultural differences in inferences about animals or fairy). These findings suggest that their perhaps initially intuitive concepts are malleable and can be further constructed and elaborated through socialization (Leagare et al., 2012).

The relatively low percentage of children that attributed extraordinary powers to God overall may reflect the secular settings contrasting those in earlier studies that sampled from religious families or faith schooling (Barrett et al., 2001, 2003; Makris & Pnevmatikos, 2007; Richert & Barrett, 2005). The relatively large proportions of children making the alternative attributions to other nonhumans compared with those and recent studies (Di Dio et al., 2018; Nyhof & Johnson, 2017) may reflect the current samples' older ages (versus predominantly preschoolers in previous research), or the more open-ended method of investigation. Either would indicate that children could consider more possibilities about the agents and apply in this context. The lack of any developmental pattern may mean that either those concepts or their application do not change substantially for that age range, or that the FB task does not capture the change sufficiently. Some research does suggest that supernatural agent concepts from middle childhood, which differ from preschoolers, are already similar to those of adults (Boerger, 2011; Di Dio, 2018). However, further research should use FB with other tasks to elicit children's understanding of agency as in some studies (e.g., Giménez-Dasí et al., 2005; Nyhof & Johnson, 2017). Similarly, we only took basic measures of God belief and worship practice; more studies should include other aspects of religious background such as parental engagement and God concepts (cf., Richert et al., 2017) for a more comprehensive measure.

In sum, these studies reinforce the idea that children are not merely anthropomorphic when thinking about the minds of nonhuman agents. They actively draw on data available to

them about these agents and use it to make predictions according to the context, but that data and their readiness to use it can vary based on their environment and background. The ways in which different children differentiate agents' minds have implications for their conceptual development (Baron-Cohen et al., 2013; Harris, 2013; Wellman, 2014). The current and other studies (Nyhof & Johnson, 2017; Richert et al., 2017) call for greater diversity in the samples and more consideration of cultural factors in the research of this development.

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Table 1. Percentages of Spanish children's responses to the Smarties task for nine agents.

	Smarties	Rocks	Other objects	Agent "not know"	$\chi^2$ ***
<u>Humans</u>					
Mother	88.9 <sup>a</sup>	9.7 <sup>d</sup>	1.4 <sup>d</sup>	0 <sup>d</sup>	100.75
Classmate	84.7 <sup>a</sup>	12.5 <sup>c</sup>	2.8 <sup>d</sup>	0 <sup>d</sup>	86.58
Teacher	81.9 <sup>a</sup>	13.9 <sup>c</sup>	4.2 <sup>d</sup>	0 <sup>d</sup>	77.58
<u>Animals</u>					
Dog	41.7 <sup>c</sup>	20.8 <sup>c</sup>	31.9 <sup>a</sup>	5.6 <sup>c</sup>	20.78
Bear†	38.9 <sup>d</sup>	20.8 <sup>c</sup>	31.9 <sup>a</sup>	6.9 <sup>c</sup>	43.33
Ladybird†	41.7 <sup>c</sup>	15.3 <sup>c</sup>	30.5 <sup>a</sup>	11.1 <sup>b</sup>	40.17
<u>Supernatural beings</u>					
Superman	58.3 <sup>b</sup>	22.2 <sup>b</sup>	18.1 <sup>b</sup>	1.4 <sup>d</sup>	75.92
Fairy	52.8 <sup>b</sup>	23.6 <sup>b</sup>	20.8 <sup>b</sup>	2.8 <sup>d</sup>	37.00
God	45.8 <sup>c</sup>	41.7 <sup>a</sup>	12.5 <sup>c</sup>	0 <sup>d</sup>	14.25
Friedman $\chi^2$ ***	148.16	59.71	93.93	43.94	

†Percentages do not sum to 100; 1.4% ( $N=1$ ) answered they "did not know"

a > b, c & d; b > d;  $p_s < .01-.001$  (Wilcoxon Z, with Bonferroni-corrections)

\*\*\*all  $p_s < .001$

Table 2. Mean scores (scale 0-3) for attribution to agent false-beliefs, extraordinary powers, other-beliefs and ignorance among Spanish children (standard deviations in parenthesis).

	False beliefs	Extraordinary powers	Other attributions	Agent Ignorance
Humans	2.58 (.90) <sup>a</sup>	.36 (.89) <sup>c</sup>	.08 (.33) <sup>c</sup>	.00 (.00) <sup>b</sup>
Animals	1.22 (1.31) <sup>b</sup>	.57 (1.01) <sup>b</sup>	.94 (1.27) <sup>a</sup>	.26 (.71) <sup>a</sup>
Supernatural beings	1.53 (1.14) <sup>b</sup>	.88 (1.05) <sup>a</sup>	.49 (.89) <sup>b</sup>	.04 (.26) <sup>b</sup>
<i>F</i>	50.85	16.12	26.14*	8.91*
df	2, 142	2, 142	2, 123*	2.86*
<i>p</i>	<.001	<.001	<.001*	.002*
$\eta^2_p$	.42	.19	.27*	.11*

a > b > c, *ps*<.01–001 (paired-samples *t*, with Bonferroni corrections)

\*with Greenhouse-Geisser corrections

Table 3. Percentages of British children's responses to the Smarties task for nine agents.

	Smarties	Rocks	Other objects	Agent would not know	Child did not know	$\chi^2$
<u>Humans</u>						
Mother	90.8 <sup>a</sup>	5.3 <sup>d</sup>	2.6 <sup>d</sup>	0	1.3	175.68***
Classmate	81.6 <sup>a</sup>	13.2 <sup>c</sup>	3.9 <sup>d</sup>	0	1.3	183.87***
Teacher	65.8 <sup>b</sup>	15.8 <sup>b</sup>	7.9 <sup>c</sup>	2.6	7.9	137.47***
<u>Animals</u>						
Dog	30.3 <sup>d</sup>	14.5 <sup>c</sup>	46.0 <sup>a</sup>	7.9	1.3	40.84***
Bear	21.1 <sup>e</sup>	21.1 <sup>b</sup>	44.8 <sup>a</sup>	6.6	6.6	14.16**
Ladybird	25.0 <sup>d</sup>	11.8 <sup>c</sup>	51.3 <sup>a</sup>	7.9	3.9	47.16***
<u>Supernatural beings</u>						
Superman	53.9 <sup>c</sup>	26.3 <sup>b</sup>	17.1 <sup>b</sup>	1.3	1.3	96.11***
Fairy	36.8 <sup>d</sup>	19.7 <sup>b</sup>	36.9 <sup>a</sup>	3.9	2.6	51.42***
God	39.5 <sup>d</sup>	46.1 <sup>a</sup>	3.9 <sup>d</sup>	1.3	9.2	67.68***
Friedman $\chi^2$	186.72***	67.51***	168.08**	24.00**	18.20*	

a > b, c, d & e; b > d & e; c & d > e;  $ps < .01-.001$  (Wilcoxon Z, with Bonferroni corrections)

\* $p < .05$ ; \*\* $p < .01$ , \*\*\* $p < .001$

Table 4. Mean scores (scale 0-3) for attribution to agent false-beliefs, extraordinary powers, other beliefs and ignorance, and own ignorance, among British children (SD in parenthesis).

	False beliefs	Extraordinary powers	Other attributions	Agent ignorance	Own ignorance
Humans	2.39 (.83) <sup>a</sup>	.34 (.68) <sup>b</sup>	.14 (.45) <sup>c</sup>	.03 (.16) <sup>b</sup>	.11 (.31)
Animals	.76 (1.11) <sup>c</sup>	.47 (.74) <sup>b</sup>	1.42 (1.27) <sup>a</sup>	.22 (.65) <sup>a</sup>	.12 (.40)
Supernatural beings	1.30 (1.03) <sup>b</sup>	.92 (.95) <sup>a</sup>	.58 (.79) <sup>b</sup>	.07 (.34) <sup>d</sup>	.14 (.39)
<i>F</i> *	84.72	21.58	53.35	6.11	.39
<i>df</i> *	2, 136	2, 135	2, 127	2, 104	2, 138
<i>p</i> *	<.001	<.001	<.001	.008	.7
$\eta^2_p$ *	.53	.22	.42	.08	(NS)

a > b > c; *ps*<.01–001 (paired-samples *t*, with Bonferroni corrections)

\*all with Greenhouse-Geisser corrections