



## God's categories: The effect of religiosity on children's teleological and essentialist beliefs about categories <sup>☆</sup>

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### ABSTRACT

Creationism implies that God imbued each category with a unique nature and purpose. These implications closely correspond to what some cognitive psychologists define as an essentialistic and teleological stance towards categories. This study assessed to what extent the belief in God as creator of categories is related to the mappings of these stances to categories in different domains. Israeli secular and orthodox Jewish 1st and 5th graders responded to questions assessing these three types of beliefs. The results revealed that secular children did not differ from orthodox children with respect to their essentialist beliefs about the stability of animal category membership, and their teleological construal of artifacts. In turn, secular children did differ from orthodox children with respect to their essentialist beliefs about the stability of social category membership, and their teleological construal of both animal and social categories. These findings intimate that while essentialist beliefs about animals, and teleological beliefs about artifacts do not require cultural input in order to emerge, essentialist beliefs about social categories, and teleological beliefs about both animal and social categories do.

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### 1. Introduction

And out of the ground the LORD God formed every beast of the field, and every fowl of the air; and brought them unto Adam to see what he would call them: and whatsoever Adam called every living creature, that was the name thereof (Genesis 2:19).

The Judeo-Christian orthodox interpretation of the above passage is that in his act of naming all living creatures, Adam captured their individual essences. In fact, Jewish mysticism endorses a version of “nominal realism”, by which the Hebrew names of entities are not arbitrary conventions, but instead are symbols that uniquely represent the core nature of their referents. A further implication of the belief in God as creator is that the world –

and everything in it – exists for a purpose. Given that “God works in mysterious ways”, the exact purpose of every entity might not be clear to people, leading believers to either conjecture possible purposes, or simply invoke God's will as the ultimate purpose.

That religiosity, particularly creationism, entails a belief that every creature has a God-given essence and purpose seems unequivocal. Intriguingly, these two sets of beliefs about the world implied by creationism resonate quite transparently with two sets of beliefs that cognitive scientists argue characterize children and adults' beliefs about various categories, namely, essentialism and teleology. In brief, essentialism is the belief that members of certain categories have inherent and stable properties, which are causally responsible for more superficial properties, and which make members of one category fundamentally distinct from members of other categories (Medin & Ortony, 1989). Teleology is the belief that things exist for a purpose, be it intrinsic to the organism (Atran, 1990), or extrinsic for the benefit of another agent

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(Kelemen, 1999). The goal of the present study is to systematically investigate the relationship between children's belief in God as the creator of the world, and their essentialist and teleological construal of categories in the world.

A number of findings provide pieces of evidence regarding this relationship. For instance, Evans (2000, 2001) demonstrated that 1st to 5th graders from Christian fundamentalist families differ from those in non-fundamentalist families in terms of their beliefs in creationism. While Evans did not directly assess the relationship between creationism, essentialism, and teleology, she agrees that the latter two are implied by creationism. For instance, a belief in God as the creator of animals entails that the categories of animals we find today are eternal and immutable, and were designed so as to serve a specific purpose – often, to serve humans in some way (Evans, 2008). Kelemen (2004) contends that this “artificialist” bias towards nature is indeed what might give rise to what she calls “promiscuous teleology”. Specifically, Kelemen argues that an over attribution of goal-directedness or intentional design may lead to an overextension of extrinsic teleology to entities which would not be typically conceived of in such terms. For instance, a belief in God as the intentional designer of nature would lead believers to extend teleology to nature (see also Evans (2001)). In fact, Kelemen and DiYanni (2005) found such a relationship in American and British 1st and 5th graders' explanations for their teleological beliefs regarding living kinds (cf., Lombrozo, Kelemen, & Zaitchik, 2007, on adults with Alzheimer).

An important caveat to the stated goal of the present study – intimated by Evans' and Kelemen's conclusions – is that from early on in development, children's conceptual beliefs may vary across domains (Gelman & Kalish, 2006; Mandler, 2000). In particular, the extent to which children apply essentialism and teleology to animal, artifact, and social categories may vary. Moreover, there are diverse explanations for such domain specificity, and they have different implications for the potential interaction between creationism and these conceptual beliefs.

A number of studies suggest that essentialism characterizes children's concepts of *animals* (Gelman, 2003). For instance, children believe that animal categories are defined by internal non-obvious properties (Diesendruck, Gelman, & Lebowitz, 1998), are “universally objective” (Kalish, 1998), have rich inductive potential (Gelman & Markman, 1986), and that an animal's category membership is determined by birth (Gelman & Wellman, 1991), and therefore unaltered by superficial transformations (Keil, 1989). In recent years, studies have begun to reveal that children apply essentialist beliefs to a variety of *human kinds* as well. For instance, children believe that racial categories are inherited and stable across development (Hirschfeld, 1996), that ethnic categories are determined by birth and have rich inductive potential (Astuti, Solomon, & Carey, 2004; Diesendruck & haLevi, 2006), and that gender categories have innate potential (Taylor, 1996). Whether full-blown essentialist beliefs apply to other domains as well is a matter of more controversy (cf., Bloom, 2007; Malt & Sloman, 2007, regarding *artifacts*). The question to be examined here is whether the existence of essen-

tialist beliefs in a particular domain is related to children's creationist beliefs about that domain.

Two broad perspectives propose alternative mechanisms to explain potential domain-specific mappings of conceptual beliefs. According to one view – called “mild ontology” by Sloman, Lombrozo, and Malt (2007) – essentialist-like beliefs result from both, the causal structure and the communication practices used to refer to categories in a given domain. In this view, if creationist beliefs are part of either the causal structure of a given domain, or of the manner by which adults describe categories in the domain, then we should find a relationship between creationist and essentialist beliefs.

The second view – which we will call “strong ontology” following Sloman et al. (2007) – differs from mild ontology in its commitment to a priori ontological distinctions among domains. According to this view, there might be a set of innate causal beliefs that while varying in the extent to which they are domain-specific by definition, can nonetheless be extended to other domains (see Atran (1995), Keil (1995), Sperber (1996), Tooby and Cosmides (1989)). Sperber (1996), for instance, distinguishes between two types of causal beliefs. *Intuitive* beliefs are ones that are automatically triggered when people are exposed to the stimulus domain for which the belief was evolutionarily selected for – i.e., its *proper* domain. In turn, *reflective* beliefs are ones that while embedded in an intuitive belief, are extended to different – so-called *actual* – domains, by means of communication practices.

Crucially for the present discussion, according to the strong ontology view, essentialism about animals arguably constitutes an intuitive belief, whereas the status of essentialism about social categories is more controversial. Some of the evidence supporting this claim is that essentialist beliefs about animals seem to develop irrespective of parental input (Gelman, Coley, Rosengren, Hartman, & Pappas, 1998), and uniformly across cultures (Astuti et al., 2004; Atran, 1990; Diesendruck, 2001). In turn, while essentialism about social categories seems to be present across cultures, the particular categories essentialized vary (cf., Astuti et al., 2004; Diesendruck & haLevi, 2006; Mahalingam, 2003), thus eliciting debates about the mechanisms underlying the deployment of essentialism in this domain (cf., Gil-White, 2001; Hirschfeld, 1996; Sperber, 1996). In this view, then, while essentialism about animals may emerge independently of creationism, its extension to particular social categories may be fostered by such a relationship.

As for the status of teleology, various studies suggest that such a stance towards *artifacts* comes naturally to children (Keil, 1995). For instance, even infants seem to interpret objects in terms of functions (Booth & Waxman, 2002), toddlers believe that artifacts have exclusive functions and that they are “for” something (Casler & Kelemen, 2005, 2007), and young children's spontaneous questions about artifacts seem to be directed at function (Greif, Kemer-Nelson, Keil, & Gutierrez, 2006). To what extent teleology is applied to other domains is a matter of considerable controversy. The most comprehensive set of data indicates that not only do children explain *properties of animals* in teleological terms, but they also explain *animal categories*

in similar terms (e.g., “tigers are for going in the Zoo”), and do so even with respect to natural phenomena (e.g., mountains, rain) (Kelemen, 1999). To the best of our knowledge, whether teleology is applied to *human kinds* as well, has not been examined at all.

Analogously to the discussion about the domain specificity of essentialism, here too mild ontology and strong ontology offer distinct explanations for the mapping of teleology to the different domains, and the potential contribution of creationism to this process. According to mild ontology, teleological beliefs about artifacts develop because of the causal processes believed to explain the categories in that domain – in particular, beliefs about creators’ intent and object function. Children’s overextension of teleology to the domain of living kinds, as found by Kelemen and DiYanni (2005) for instance, may reflect children’s peculiar beliefs about the causal structure of that domain. In an experimental investigation of this conjecture, Lombrozo and Carey (2006) manipulated the causal explanations provided to adults for the existence of various phenomena. They found that adults’ teleological construals of different categories indeed varied as a function of the causal stories they were exposed to. In particular, intentional stories most strongly led to teleological explanations – a finding consistent with the idea that creationism supports teleological reasoning.

From a strong ontology perspective, again the question revolves around what is the proper domain of teleology. Keil (1995) argues that while the proper domain of teleology is artifact kinds, it can be extended to the *properties of living kinds*. Kelemen (2004) agrees that the proper domain of teleology is intentionally created kinds like artifacts, but she adds that children’s over sensitivity to intentionality – and the consequent promiscuity in teleological reasoning – suffices for children to extend this kind of belief to natural phenomena *per se*. In fact, she found that the extension of teleological belief to natural kinds does not necessitate explicit linguistic endorsement (Kelemen, Callanan, Casler, & Perez-Granados, 2005). In this vein, teleology is of an *extrinsic* sort, that is, as often subserving the goals of an agent other than the actual organism. Finally, Atran (1995) argues that teleology is an intuitive construal of natural kinds as well, insofar as the properties of natural kinds are believed to serve the *intrinsic* goals of the organism. In sum, according to strong ontology, while there seems to be agreement about the appropriateness of teleology to the domain of artifacts, its application to animals – and perhaps even more decisively to social categories – may be promoted by the presence of an intentional causal story such as creationism.

The main points to be drawn from the above overview is that there is variability in children’s essentialist and teleological beliefs about categories in different domains, and that there are alternative accounts of this variability. Arguably, the main difference between the alternative accounts is that while mild ontology does not advocate a priori differences in the mapping or extension of these conceptual beliefs to domains, strong ontology does. Consequently, while mild ontology does not stipulate a priori domain specificity in the relationships between creationism and essentialism or teleology, strong ontology does. A theoret-

ical goal of the present investigation of these relationships is to shed light on this debate.

In order to address our goal, we recruited children with qualitatively and quantitatively different exposure to creationist beliefs, namely, secular and orthodox Jewish children living in Israel. The Israeli Jewish society is quite markedly divided into secular and orthodox sectors. The secular sector typically embraces Western-like modern values and lifestyles, whereas the orthodox sector – although quite heterogeneous – endorses values and lifestyles that accord to those prescribed by the Old Testament and its rabbinical interpretations. The Israeli Jewish public school system reflects this population divide, and is administratively and pedagogically separated into a secular and an orthodox branch. One major distinction between the two systems that is particularly relevant for the present study has to do with the teaching of the Old Testament, and within it, the account of creation. In the secular system, the Old Testament is taught as a text recounting the *myths* – e.g., the story of creation – and traditions of ancient Jews. In the orthodox system, the Old Testament is taught as a *veridical* account of the history of the world and the Jewish people, and the traditions are presented as normative rules to be followed presently as well.

Previous studies reported on an equivalent degree of teleological beliefs across children with arguably different levels of religiosity (American vs. British 1st and 5th graders; Kelemen & DiYanni, 2005). It seemed to us, however, that the divide within the Israeli samples used in the present study is, on the one hand, more extreme in terms of religiosity, while on the other hand, more comparable in terms of other demographic variables (e.g., all the children live in the same country, in similar cities, with parents employed in similar jobs and with similar levels of education). A second important addition of the present study is that three different sets of beliefs were assessed – creationism, teleology, and essentialism – with regard to three different category domains – animals, artifacts, and human kinds. Moreover, the present study operationalized the relevant measures in as similar a way as possible in the different domains.

Belief in God as creator of categories was assessed with a task similar to the one used by Evans (2001) and Kelemen and DiYanni (2005). In this task, the experimenter showed children pictures depicting exemplars of a category, and simply asked the children, “How did the very first X appear in the world?” The crucial measure was the number of times children invoked God in their responses. Teleology was assessed with a task developed by Kelemen (1999). In this task, children were again shown pictures of exemplars of various categories, and through a game with dolls, they were asked to decide whether the categories were “for something”, or “not for something”. While this test question was vague as to the possible purpose of the categories, familiarization trials invited an analogy to artifacts, and thus to an extrinsic, intentional purpose. Finally, given that there is no agreed upon single measure of essentialism, this construct was assessed with a battery of questions representative of various implications of essentialism as discussed in the literature. In particular, Gelman (2003, p. 23) listed the following beliefs as implied by essentialism: existence and centrality of non-obvious properties, stability of

category membership over superficial transformation, categories with sharp boundaries, category membership determined by nature as opposed to nurture, existence of causal features, and categories with inductive potential. The present questionnaire attempted to capture the implications that could be easily conveyed via a short and direct question. Importantly, in light of current debates about the coherence of children's essentialist beliefs (e.g., Gelman, Heyman, & Legare, 2007), or even the necessity for postulating such beliefs (e.g., Strevens, 2000), we exercised caution in our analyses and interpretation of this questionnaire.

Our basic hypothesis was that the more children believe a given category was created by God, the more likely they are to believe that the category has a permanent essence, and that it exists for an extrinsic purpose. In other words, we should find differences between secular and orthodox children in terms of their essentialist and teleological tendencies towards categories, and we should find positive correlations between children's beliefs in God as creator of categories, and their essentialist or teleological construals of these categories. In line with our review of domain specificity, this hypothesis seemed especially pertinent to the domain of human kinds, wherein there is either a controversy about the origins of children's beliefs (in the case of essentialism), or there are no studies about the applicability of a belief (in the case of teleology). The presence – or absence – of such a relationship in the domains of animals or artifacts would shed light on the status of essentialism and teleology in these domains – an issue to be extended upon in Section 4.

## 2. Methods

### 2.1. Participants

A total of 64 Jewish Israeli children participated in this study, 34 girls and 30 boys. Half of the children were recruited in a secular public school, and the other half in two orthodox public schools. All three schools catered to neighborhoods of similar socio-economic composition, i.e., mainly middle-class families. Children from two age groups participated: 1st and 5th graders. There were 16 secular children from 1st grade, eight boys and eight girls ( $M = 7$  years 0 months,  $SD = 3$  months,  $range = 6$  years 6 months to 7 years 4 months); 16 secular children from 5th grade, nine boys and seven girls ( $M = 11$  years 1 month,  $SD = 4$  months,  $range = 10$  years 5 months to 11 years 6 months); 16 orthodox children from 1st grade, seven boys and nine girls ( $M = 6$  years 11 months,  $SD = 4$  months,  $range = 6$  years 4 months to 7 years 7 months); and 16 orthodox children from 5th grade, six boys and 10 girls ( $M = 10$  years 11 months,  $SD = 5$  months,  $range = 10$  years 0 months to 11 years 2 months). All children were tested in their schools. Only children with signed parental permission participated. Children received a small gift in gratitude for their participation.

### 2.2. Design

All children completed three tasks in the following order: (1) origins of categories task, (2) teleology task, and

(3) essentialism task. This order of tasks was adopted because our interest was in examining the potential effect of belief in God as creator on the other measures, rather than the other way around. Thus we did not want children to respond to the belief in God question after being primed for teleology and essentialism.

### 2.3. Materials

The stimuli used in the three tasks were 12 color photographs, each depicting a group of entities that were all members of the same category (e.g., a group of different chairs, a group of Jews, a group of women, etc.). The photographs were taken from magazines and newspapers. The photographs depicted groups of category exemplars so as to make it clearer to children that the questions in each of the tasks referred to a category rather than individual exemplars. The 12 photographs represented two categories of animals (elephants and lions), two categories of artifacts (chairs and tables), and eight categories of people, representative of four dimensions of social categories: ethnicity (Arabs and Jews), gender (women and men), race (black people and white people), and social-economic status (rich and poor). We included social categories that have been found to be familiar to Israeli children (Diesendruck & haLevi, 2006). The animal and artifact categories were selected so as to match as closely as possible the social categories used. To this end, we applied the following criteria: (a) the categories needed to be familiar to 1st graders, (b) the typical behaviors or functions of the categories needed to be familiar and distinctive enough, and (c) the categories needed to belong to a superordinate category familiar to 1st graders ("mammals" for animals, and "furniture" for artifacts). The same categories and photographs were used in the three tasks.

### 2.4. Procedure

Children were seen individually, during regular school hours, by a female experimenter in a quiet room of their school that was prepared in advance with all the experimental materials. Prior to the actual testing, the experimenter spent some time in children's classrooms getting acquainted with the children so that they would feel comfortable leaving the classroom with her. The entire procedure was conducted in Hebrew, and took approximately 45 min. The procedure started with the experimenter explaining to children that she was going to show them some pictures and would then ask questions about the pictures. The experimenter emphasized to children that for many of the questions, no one really knew what was right or wrong, and that therefore children should feel comfortable just guessing and saying what they thought was the right answer. The experimenter then started with the three tasks, in the order described above.

*Origins task.* The goal of this task was to assess children's beliefs about the origins of categories. The procedure in this task followed closely the one developed by Kelemen and DiYanni (2005). The experimenter started by showing children one of the 12 photographs of the cat-

egories, and asking children if they knew what were the entities portrayed in the photograph. If children did not answer or gave an incomplete answer (e.g., for a photograph of a group of Jews children said, “these are people”), the experimenter provided the target category label (e.g., the experimenter said, “these are Jews”). Next the experimenter asked the Origins question, namely, “How did the very first [category label] appear in the world?” If children did not answer, or said that they did not understand the question, the experimenter rephrased the question, asking, “Did something or someone cause the first [category label] to appear, or did it just happen?” If children replied that something or someone caused it to appear, then the experimenter asked children, “What or who caused it to appear?” The experimenter wrote down children’s responses for later coding. She then took the photograph away, and pulled out another photograph.

The order of presentation of the photographs was quasi-random. Given that our main focus was on children’s beliefs about social categories, the first two photographs children saw were of an animal and an artifact category (for half of the children, first an animal, for the other half, first an artifact). Children then saw four photographs, one from each of the four social categories. A second “block” then started, again with photographs of an animal and an artifact (in the opposite order of the one provided in the first block), and finally the complementary photographs of the four social categories were shown. The rationale for starting with animals and artifacts was to provide children with the two polar kinds of categories first, so that subsequently – when responding to social categories – they would feel comfortable providing a range of explanations (e.g., from “created by God” – which presumably would be more typical for animals, to “created by people” – which presumably would be more typical for artifacts). The order of presentation of the social categories was randomized across children.

Children’s responses were coded by a single coder into seven different and mutually exclusive types, expanding on Kelemen and DiYanni’s (2005) coding scheme. The explanation types were: (1) God, (2) human agent, (3) anthropomorphic agent, (4) natural mechanism, (5) social mechanism, (6) internal mechanism, and (7) do not know. Table 1 provides examples of these explanation types. For the statistical analyses, we simply counted the number of responses of each type that children provided for each category. In the origins task, as well as in the other two tasks, we combined the scores for the two categories of animals and for the two categories of artifacts, such that in all tasks, children had a combined score for animals, a combined score for artifacts, and separate scores for each of the four social categories. Given that there were two instances of each category (i.e., two animals, two artifacts, two ethnicities, two genders, two social–economic statuses, and two races), the number of explanations of each type for each category that children could make varied from 0 to 2.

When children concluded responding to all 12 photographs, the experimenter told children that they had finished the first part, and that they would now move on to the second part, in which she would be asking them different questions.

**Table 1**

Examples of children’s responses in the origins task.

Explanation type	Example
God	“God created the elephant” “God gave a lot of money to some men, and that’s how they became rich”
Human agent	“People had to sit, so they made chairs” “Prehistoric men made the first table in the world out of wood”
Anthropomorphic agent	“Nature created the first lion” “Nature has all the time created new things”
Natural mechanism	“There was development, and a small animal became the lion” “Black people appeared by a genetic change so they would be adaptive to Africa”
Social mechanism	“Poor people got like that because others didn’t give them enough money” “There was a split of cultures, and that’s how Arabs appeared”
Internal mechanism	“People worked very hard and so they became rich” “The first Arab decided not to be Jewish but instead Muslim”

*Teleology task.* The goal of this task was to assess children’s beliefs about whether or not categories exist for a purpose. This task was based on Kelemen’s (1999) task. The stimuli for this task were the same 12 photographs used in the origins task.

The task started with some practice trials, in which the experimenter illustrated to children the difference between something existing for a purpose versus something existing for no purpose even if it can have some function. For this illustration, the experimenter used a pencil and a pencil sharpener. The experimenter showed children the pencil and told them that the pencil exists for a purpose, namely, writing. She then sharpened the pencil thus creating shavings. The experimenter pointed to the pencil shavings and said that they were created for no specific purpose, even though they can be used for various things, such as for decoration. The experimenter then gave another example verbally, noting that a glass was made for a specific purpose, namely drinking, but pieces of glass were not made for a specific purpose even though they can be used for different things. It could be said that these practice trials reinforced an extrinsic notion of teleology.

The experimenter then moved on to the experimental trials. Based on the results of some pilot testing, the experimental trials were slightly different for the 1st and 5th graders. For the 5th graders, the trials followed closely the procedure used by Kelemen (1999) in which dolls were used as props. For the 1st graders, we noticed that the dolls were somewhat distracting, so children were simply directly questioned about which of two propositions was correct. As will be evident later on in Section 3, this slight difference in procedure did not seem to contribute to potential age differences in responding.

For the 5th graders, the experimenter introduced two Playmobil™ dolls named “Danny” and “Yossi”. She explained that although Danny and Yossi are good friends, they often argue. Children were instructed to listen carefully to what each one said, and then decide which one is right. The experimenter spoke for the two dolls by using

distinctive tones of voice. The first two trials referred to the examples of the pencil and the pencil shavings. For instance, Danny said that pencils were “for something, for some purpose”, while Yossi said that “pencils can do many things, but they are not for something, for a purpose”. Children were then asked which doll they thought was right. The term used in Hebrew instead of “for” was “bishvil”, which also has a clear connotation of purposefulness, and a similar range of applicable semantic contexts. The second practice example was identical except the questions were about pencil shavings, and importantly, the dolls switched statuses. That is, in the second example, the doll that said that the pencils were for something (i.e., was “right”), now said that the pencil shavings were for something (i.e., was “wrong”). The experimenter emphasized this switch in statuses by explicitly saying to children that sometimes Danny is right, but sometimes Yossi is right. Following the two examples, the experimenter started showing children the photographs of the target categories, one at a time, about which Danny and Yossi expressed their opposite beliefs, with the same exact phrasing as the ones used in the examples (e.g., “Danny says that rich people exist for a purpose. Yossi says that rich people exist for no purpose, they just exist”). After the dolls expressed their views, children were asked which of the two was right.

For the 1st graders, instead of having dolls express opinions, the experimenter simply stated the two opposing views. For instance, she explained that, “some people think that pencils are for something, while others think they are not for something. What do you think?” She used the same kind of phrasing to question children about the 12 target categories.

A number of counterbalancing cautions were undertaken in this task. First, the order of presentation of the 12 categories followed the same kinds of constraints as in the origins task. Namely, children first responded to an animal and an artifact category, and then to social categories. Second, the order of presentation of the propositions, i.e., whether the “for a purpose” or the “for no purpose” proposition was presented first, also varied within subjects across the categories, and between subjects within each category type. Third, for the 5th graders, the particular opinion of the dolls, i.e., which one stated the “for a purpose” proposition, was also counterbalanced within subjects across categories, so that children could not develop a “preference” for a doll.

Children’s responses were simply coded in terms of the number of times children selected the “for a purpose” and the “for no purpose” options, or “don’t know”. For the statistical analyses, children’s “for a purpose” responses were counted as 1. Thus, for each of the 6 categories (i.e., animals, artifacts, ethnicity, gender, social–economic status, and race), we computed a teleology score that ranged from 0 (answering that the two instances of the category existed for no purpose) to 2 (answering that the two instances of the category existed for a purpose).

*Essentialism task.* The essentialism task consisted of a questionnaire adapted to children, including a number of questions associated with different implications of essentialism. Most of the questions in the questionnaire were

applied to all three kinds of categories (animals, artifacts, and social categories). Others were slightly modified, or dropped, depending on their appropriateness for the different domains.

At the beginning of the questionnaire, the experimenter showed children photographs of the two sets of category exemplars (e.g., photographs of lions and elephants, Jews and Arabs, etc.), and told children she was going to ask them questions about these entities. The initial questions had to do with how different members of the category were. These questions addressed the essentialist implications of sharpness of boundaries and the existence of non-obvious differences between members of different categories, as described by Gelman (2003). These questions all had the same syntactic structure, and varied only in terms of the dimension of similarity/difference targeted. Specifically, the questions were of the form: “To what extent do Xs (e.g., lions) and Ys (e.g., elephants) differ in [property] P (e.g., what they like)?” Regarding animals, there were four such questions, targeting the properties: “what they like”, “how they behave”, “how they look”, and “what they have inside their body”. Regarding artifacts, there were three such questions, targeting: “their uses”, “what they are made of”, and “how they look”. Finally, regarding social categories, there were five such questions: the same four used with animals, plus a question on “what they think”. Children were provided with a scale for their responses, with the values: “1 = not at all”, “2 = a little”, “3 = a lot”, and “4 = completely different”. Given this coding scheme, high scores represented responses consistent with the belief in substantial differences.

The next question had to do with the possibility of changing category membership. Specifically, the question asked: “It is possible for an X to become a Y?” This question was identical in all three domains. Children were given three options to respond: “possible”, “may be possible”, “impossible”. In order to make this scale comparable to the scale on “difference” described above, these responses were also converted into a 1–4 scale, such that a response of “may be possible” was coded as 2.5.

The last two questions asked about the extent to which category membership was determined by original conception. These questions were identical with regard to animals and social categories (except gender, for which this question was inapplicable). Specifically, one of the questions asked: “Is it possible that a couple of Xs will give birth to a baby Y?” The second question asked, “If a baby is born to, and raised by, an X family, is it possible that it will be a Y when it grows up?” While there is no exact translation of a “birth” question regarding biological kinds to the domain of artifacts, we phrased the artifact question so as to emphasize the implied category membership of the creator of the artifact. Namely, we asked children: “Is it possible that a builder of Xs will build a Y?” As a number of researchers have noted, children grant much value to artifact creators in determining the category membership of objects (e.g., Bloom, 2007; Jaswal, 2006). Children responded to these questions using the same “possible” to “impossible” scale described above.

Once children finished responding to the questions regarding one of the categories, the experimenter took

away the photographs pertinent to that category, and brought out a new pair of categories explaining that she would now ask questions about these entities. The order of presentation of the categories was randomized across children, but all children first answered questions about animals and artifacts (counterbalanced between subjects).

At the end of this task, children were thanked for their participation, given a small gift in gratitude (e.g., a sticker or an eraser), and returned to their classrooms.

### 3. Results

Our main hypotheses were that: (a) there would be differences between secular and orthodox children in all the dimensions assessed and (b) there would be correlations between children's beliefs in God as the creator of categories, and children's teleological and essentialist construal of the categories. Importantly, we further hypothesized that both (a) and (b) would be qualified by the particular categories children were asked about. In order to evaluate these hypotheses, we first conducted analyses on each task separately. We then analyzed the relationships among the measures.

#### 3.1. Origins task

Our main interest regarding the origins task had to do with potential differences between secular and orthodox children in the *absolute* frequency with which they mentioned God as the creator of the various categories. A secondary question had to do with potential differences between secular and orthodox children in the *relative* frequency with which they provided different explanations for the origins of categories. For the sake of clarity, we conducted systematic analyses in order to address the first question, and provide more descriptive data on the alternative explanations children provided.

*God as creator.* The main dependent measure for this analysis was children's Belief in God score, which could vary from 0 (a child who said that God did not create the category in response to both exemplars of the category, e.g., Jews and Arabs) to 2 (a child who said that God created the category in response to both exemplars of the category). Preliminary analyses revealed no effect of gender on this measure ( $p > .4$ ), and thus gender was excluded from all other analyses.

Our first analysis was a repeated-measures ANOVA in which participants' age group (1st, 5th graders) and religiosity (secular, orthodox) were entered as between-subjects factors, and category type (animals, artifacts, gender, ethnicity, social status, and race) was entered as a within-subjects factor. Fig. 1 displays the means for this measure broken down by religiosity group. The ANOVA revealed a significant effect of category type,  $F(5,56) = 65.13$ ,  $p < .001$ ,  $\eta^2 = .85$ . Post-hoc within subjects contrasts (at  $p < .05$ ) revealed that across all children, the rank ordering of the categories on this measure was: gender > animals > (race = ethnicity) > SES > artifacts. The ANOVA also revealed a significant effect of religiosity,  $F(1,60) = 73.50$ ,  $p < .001$ ,  $\eta^2 = .56$ , with orthodox children being overall

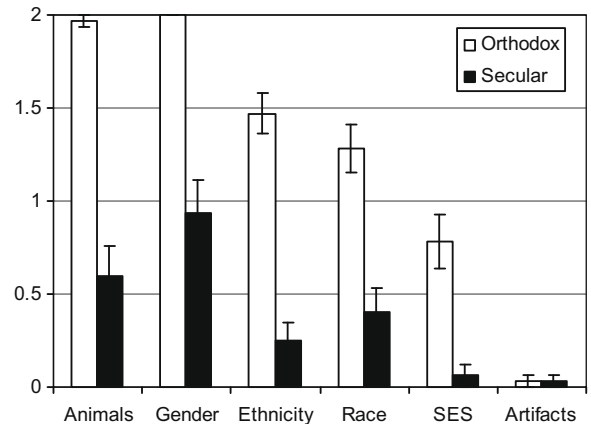


Fig. 1. Mean number of responses (SE) that God created different categories, across religiosity groups.

more likely than secular children to endorse a belief in God as creator of categories. Moreover, there were significant two-way interactions between category type and religiosity,  $F(5,56) = 24.42$ ,  $p < .001$ ,  $\eta^2 = .69$ , and between category type and age,  $F(5,56) = 7.39$ ,  $p < .001$ ,  $\eta^2 = .40$ , and a three-way interaction among category type, religiosity, and age,  $F(5,56) = 4.99$ ,  $p < .005$ ,  $\eta^2 = .31$ . None of the other effects were significant.

Given the significant interactions with category type noted above, we next conducted a MANOVA with age group and religiosity as between-subjects factors, using the belief in God score for each category as the dependent measures. The omnibus MANOVA revealed significant effects of religiosity,  $F(6,55) = 20.03$ ,  $p < .001$ ,  $\eta^2 = .69$ , and age group,  $F(6,55) = 6.24$ ,  $p < .001$ ,  $\eta^2 = .41$ , and a significant interaction between these two factors,  $F(6,55) = 4.20$ ,  $p < .005$ ,  $\eta^2 = .31$  (see description below). The individual ANOVAs on each category type separately, revealed that the significant effect of religiosity held for all category types except artifacts: for animals,  $F(1,60) = 70.14$ ,  $p < .001$ ,  $\eta^2 = .54$ ; for gender,  $F(1,60) = 35.24$ ,  $p < .001$ ,  $\eta^2 = .37$ ; for SES,  $F(1,60) = 30.64$ ,  $p < .001$ ,  $\eta^2 = .34$ ; for ethnicity,  $F(1,60) = 78.95$ ,  $p < .001$ ,  $\eta^2 = .57$ ; and for race,  $F(1,60) = 24.00$ ,  $p < .001$ ,  $\eta^2 = .29$ .

The ANOVAs further revealed that the effect of age group was significant only for the categories SES,  $F(1,60) = 20.91$ ,  $p < .001$ ,  $\eta^2 = .26$ , and ethnicity,  $F(1,60) = 4.20$ ,  $p < .05$ ,  $\eta^2 = .07$ , which were also the only two categories for which the interaction between age group and religiosity was significant: for SES,  $F(1,60) = 13.03$ ,  $p < .005$ ,  $\eta^2 = .18$ ; for ethnicity:  $F(1,60) = 8.77$ ,  $p < .005$ ,  $\eta^2 = .13$ . To follow up on these interactions, we conducted ANOVAs on each religiosity group separately. These ANOVAs revealed that among secular children, there were no differences between 1st and 5th graders in their belief that God created either SES or ethnic categories ( $ps > .3$ ). In contrast, among orthodox children, there were significant differences between age groups for both categories. In particular, 1st grade orthodox children ( $M = 1.31$ ,  $SD = .70$ ) were more likely than 5th grade orthodox chil-

dren ( $M = .25$ ,  $SD = .58$ ) to believe that God created SES categories,  $F(1,30) = 21.78$ ,  $p < .001$ . Similarly, 1st grade orthodox children ( $M = 1.81$ ,  $SD = .40$ ) were more likely than 5th grade orthodox children ( $M = 1.13$ ,  $SD = .62$ ) to believe that God created ethnic categories,  $F(1,30) = 13.86$ ,  $p < .005$ .

**Alternative explanations.** A secondary question regarding the origins task had to do with differences in the relative frequency of explanations children provided for the origins of the various categories. Given that this was not the main focus of the present study, we decided not to include here systematic analyses of differences between children in these regards. Table 2 provides the frequency with which the different groups of children provided these explanations for the different categories.

There was practically no variation in explanation type with regard to artifact categories so these were not included in the table. Except for three children (two secular and one orthodox), all children said that people created artifacts. With regard to animals, gender, and race, the two major explanation types were “God” and “natural mechanism”, and while orthodox children were more likely to refer to God than to natural mechanisms as explanations for the origin of these categories, secular children did the opposite. The response patterns for the remaining two categories – i.e., social status and ethnicity – were a bit more complex. Regarding social status, three kinds of explanations seemed common: “God”, “social mechanism”, and “internal mechanism”. In fact, it appears that despite differences between the groups in the frequency of referring to God as an explanation, both groups were quite likely to explain the origins of social-status categories in terms of internal mechanisms. Finally, children referred to all of the four mechanisms mentioned above when explaining the origins of ethnic categories. Here too, there were substantial differences between secular and orthodox children’s reference to God as an explanation, but interestingly, both secular and orthodox children were quite likely to refer to internal mechanisms to explain the origins of ethnic categories.

**Table 2**  
Mean number (SDs) of explanations of each type per category, across religiosity groups.

Explanation type	Category type	Religiosity group	
		Secular	Orthodox
God	Animals	.59 (.92)	1.97 (.18)
	Gender	.94 (1.01)	2.00 (.00)
	Race	.41 (.71)	1.28 (.73)
	SES	.78 (.83)	
	Ethnicity	.25 (.57)	1.47 (.62)
Natural	Animals	1.25 (.95)	
	Gender	.91 (.96)	
	Race	1.44 (.80)	.53 (.72)
Social	Ethnicity	.41 (.76)	.16 (.37)
	SES	.41 (.67)	.22 (.42)
	Ethnicity	.19 (.54)	
Internal	SES	1.44 (.72)	.97 (.78)
	Ethnicity	.97 (.93)	.38 (.55)

Note: Empty cells, or unmentioned categories for a given explanation type, indicate frequency of responses below 0.1.

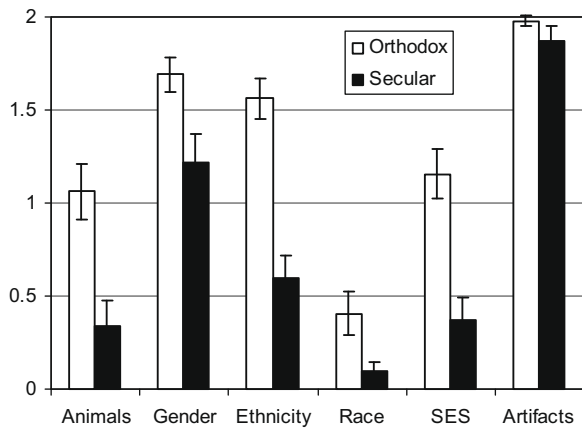
### 3.2. Teleology task

The main dependent measure for this analysis was children’s teleology scores for the different categories, which could vary from 0 (none of the category exemplars exist for a purpose) to 2 (both category exemplars exist for a purpose). Again, preliminary analysis revealed no effect of gender on these measures ( $p > .05$ ), and gender was thus excluded from all subsequent analyses.

Our first analysis was a repeated-measures ANOVA in which participants’ age group (1st, 5th graders) and religiosity (secular, orthodox) were entered as between-subjects factors, and category type (animals, artifacts, gender, ethnicity, social status, and race) was entered as a within-subjects factor. The omnibus ANOVA revealed a significant effect of category type,  $F(5,56) = 95.82$ ,  $p < .001$ ,  $\eta^2 = .90$ . Post-hoc within subjects contrasts (at  $p < .05$ ) revealed that across all children, the rank ordering of the categories on this measure was: artifacts > gender > ethnicity > (SES = animals) > race. The ANOVA also revealed a significant effect of religiosity,  $F(1,60) = 32.25$ ,  $p < .001$ ,  $\eta^2 = .35$ , and a significant interaction between category type and religiosity,  $F(5,56) = 6.09$ ,  $p < .001$ ,  $\eta^2 = .35$ . None of the other effects were significant, including ones involving participants’ age group.

Given the significant interaction between category type and religiosity, we next conducted a MANOVA with religiosity as a between-subjects factor, using the teleology score for each category as the dependent measures. The omnibus MANOVA revealed a significant effect of religiosity,  $F(6,57) = 6.57$ ,  $p < .001$ ,  $\eta^2 = .41$ . The individual ANOVAs on each category type separately, revealed that the effect of religiosity was significant on all category types except artifacts: for animals,  $F(1,62) = 13.11$ ,  $p < .005$ ,  $\eta^2 = .18$ ; for gender,  $F(1,62) = 6.74$ ,  $p < .05$ ,  $\eta^2 = .10$ ; for SES,  $F(1,62) = 19.09$ ,  $p < .001$ ,  $\eta^2 = .24$ ; for ethnicity,  $F(1,62) = 33.74$ ,  $p < .001$ ,  $\eta^2 = .35$ ; and for race,  $F(1,62) = 5.89$ ,  $p < .05$ ,  $\eta^2 = .09$ . As can be seen in Fig. 2, for all these categories, orthodox children were more likely than secular children to believe that the categories existed for a purpose.

Last but not least, given that in the teleology measure, children’s answers varied on a scale from not believing any of the category exemplars had a purpose (i.e., a teleology score of 0) to believing both exemplars of the category had a purpose (i.e., a score of 2), a middle-point (i.e., a score of 1) could be taken to reflect chance performance. We thus decided first to evaluate whether children had an overall tendency towards a teleological construal of categories. For this purpose, we simply compared children’s overall teleology score to chance. This analysis revealed that the overall average teleology score ( $M = 1.03$ ,  $SD = 0.48$ ) was not significantly different from chance,  $t(63) = .48$ ,  $p > .6$ . Next, we compared children’s teleology scores in each category against chance, separately for secular and orthodox children (see Fig. 2). Among secular children, teleology scores for artifacts were significantly above chance,  $t(31) = 11.75$ ,  $p < .001$ . In turn, teleology scores for animals,  $t(31) = -4.98$ ,  $p < .001$ , SES,  $t(31) = -5.36$ ,  $p < .001$ , ethnicity,  $t(31) = -3.23$ ,  $p < .005$ , and race,  $t(31) = -17.31$ ,  $p < .001$ , were all significantly below chance. Teleology



**Fig. 2.** Mean number of responses (SE) that categories were created for a purpose, across religiosity groups.

scores for gender were not significantly different from chance. Among orthodox children, not only were teleology scores for artifacts significantly above chance,  $t(31) = 31.00$ ,  $p < .001$ , but so were the scores for gender,  $t(31) = 7.27$ ,  $p < .001$ , and ethnicity,  $t(31) = 5.14$ ,  $p < .001$ . The only scores significantly below chance were for race,  $t(31) = -5.05$ ,  $p < .001$ . Among orthodox children, teleology scores for animals and SES were not significantly different from chance. These analyses against chance indicate that religiosity seems to push children towards teleological construals of certain categories, and secularism, in turn, pushes children away from such a construal.

### 3.3. Essentialism

Given the diversity of the questions in the essentialism questionnaire, we entered children's responses to all questions into a factor analysis. The factor analysis, with varimax rotation, yielded two factors with eigenvalues above 1, which accounted for 62% of the variance (see Table 3). The first factor, labeled distinctive properties, consisted of children's responses to the first three questions (eigenvalue = 3.01, 37.6% of the variance accounted for, factor loadings above 0.85). The second factor, labeled stable membership according to the highest factor loadings, consisted of children's responses to the remaining questions (eigenvalue = 1.96, 24.4% of the variance accounted for, factor loadings above 0.54).

For all subsequent analyses, children's responses to the pertinent questions were averaged in order to compose two scores representative of the two factors for each category: a distinctive properties score, and a stable membership score. Both of these scores could vary from 1 (least consistent with essentialism) to 4 (most consistent with essentialism). Preliminary analysis revealed no effect of gender on these measures ( $p > .3$ ), and thus gender was not included in any of the subsequent analyses.

Our first analysis was a repeated-measures ANOVA in which participants' age group (1st, 5th graders) and religiosity (secular, orthodox) were entered as between-subjects factors, and category type (animals, artifacts, gender, eth-

**Table 3**  
Factor loading of essentialism questionnaire.

Question	Factor	
	Distinctive properties	Stable membership
What they think	.86	-.09
What they like	.87	.10
How they behave/are used	.87	-.03
How they look	.27	.57
Have inside body/made of	.09	.62
Possibility of category change	-.43	.78
Give birth to/build out of category exemplar	.01	.54
Category change from conception to growth	-.42	.80

Note: In questions with two options, the latter one refers to artifacts. Refer to the text for a full description of the questions applied to the different domains.

nicity, social status, and race) and aspect (distinctive properties, stable membership) were entered as within-subjects factors. The ANOVA revealed significant main effects only of category type,  $F(5,56) = 81.64$ ,  $p < .001$ ,  $\eta^2 = .88$ , and religiosity,  $F(1,60) = 5.03$ ,  $p < .05$ ,  $\eta^2 = .08$ . There were significant two-way interactions between aspect and age group,  $F(1,60) = 16.09$ ,  $p < .001$ ,  $\eta^2 = .21$ , and aspect and category type,  $F(5,56) = 78.22$ ,  $p < .001$ ,  $\eta^2 = .88$ . There was also a three-way interaction among category type, aspect, and age group,  $F(5,56) = 2.90$ ,  $p < .05$ ,  $\eta^2 = .21$ , and a four-way interaction among category type, aspect, age group, and religiosity,  $F(5,56) = 2.49$ ,  $p < .05$ ,  $\eta^2 = .18$ . There were no other significant main effects or interactions. Given the above interactions, we next conducted MANOVAs for each aspect and within each age group separately, entering religiosity as a between-subjects factor, and the distinctive properties scores and stable membership scores for each category as the dependent measures.

*Distinctive properties analyses.* The MANOVA on 1st graders' distinctive properties scores revealed no overall effect of religiosity ( $p > .3$ ). In turn, the MANOVA on 5th graders' scores did reveal an overall significant effect of religiosity,  $F(6,25) = 2.90$ ,  $p < .05$ ,  $\eta^2 = .41$ . The individual ANOVAs on each category type separately revealed that the effect of religiosity was significant only with respect to ethnicity,  $F(1,30) = 15.08$ ,  $p < .005$ ,  $\eta^2 = .34$ . As can be seen in Fig. 3, orthodox children were more likely than secular children to believe Jews and Arabs differ on a number of psychological properties.

Post-hoc within-subjects contrasts ( $p < .05$ ) comparing the distinctive properties scores across categories revealed the following rank ordering of the categories: (animals = ethnicity = gender = SES) > artifacts > race.

*Stable membership analyses.* Differently from the results on the distinctive properties aspect of essentialism, the analyses on the stable membership aspect of essentialism revealed significant effects of religiosity in both age groups. Among 1st graders, the omnibus effect of religiosity was significant,  $F(6,25) = 3.42$ ,  $p < .05$ ,  $\eta^2 = .45$ , and the ANOVAs on each category type revealed that this was particularly the case for gender,  $F(1,30) = 7.34$ ,  $p < .05$ ,  $\eta^2 = .20$ , and race,  $F(1,30) = 8.67$ ,  $p < .01$ ,  $\eta^2 = .22$ . Similarly,

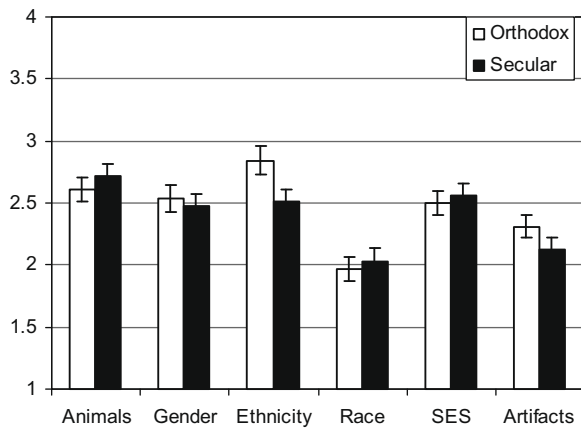


Fig. 3. Mean distinctive properties scores (SE) for the different categories, across religiosity groups.

among 5th graders, the omnibus effect of religiosity was significant,  $F(6,25) = 3.50$ ,  $p < .05$ ,  $\eta^2 = .46$ , though the ANOVAs on each category type did not single out any category as significant. Overall, as can be seen in Fig. 4, orthodox children were more likely than secular children to treat membership in gender and racial categories as stable. Notice that these group differences were nonetheless smaller than the ones found regarding teleology.

Post-hoc within-subjects contrasts ( $p < .05$ ) comparing the stable membership scores across categories revealed the following rank ordering of the categories: animals > race > gender > ethnicity > (SES = artifacts).

In our final analyses on essentialism, we assessed the extent to which children's distinctive properties and stable membership scores tended towards either ends of the essentialism scale. For this purpose, we first computed an overall essentialism score, across children, aspects, and categories, and compared it to the mid-point of the scale, i.e., 2.5. We found that children's overall essentialism score was significantly below the mid-point ( $M = 2.42$ ,  $SD = .22$ ),  $t(63) = -3.04$ ,  $p < .005$ . Next, we compared the distinctive properties and stable membership scores on each category

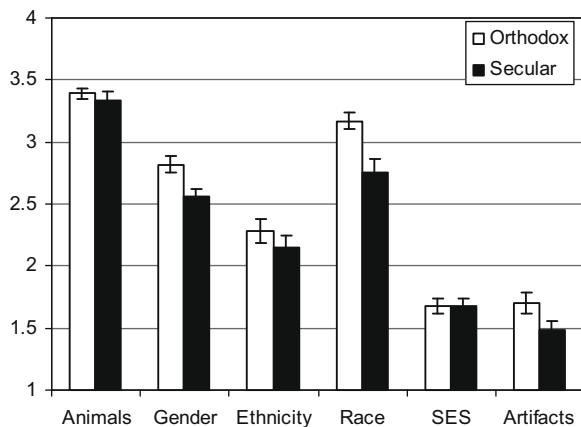


Fig. 4. Mean stable membership scores (SE) for the different categories, across religiosity groups.

to this mid-point, separately for secular and orthodox children.

Among secular children, both the distinctive properties score and stable membership score for *animals* were significantly above the mid-point ( $t(31) = 2.44$ ,  $p < .05$ , and  $t(31) = 12.01$ ,  $p < .001$ , respectively). In turn, both the distinctive properties score and stable membership score for *artifacts* were significantly below the mid-point ( $t(31) = -4.31$ ,  $p < .001$ , and  $t(31) = -14.60$ ,  $p < .001$ , respectively). For both *ethnicity* and *SES*, only the stable membership scores were significantly below the mid-point ( $t(31) = -3.52$ ,  $p < .005$ , and  $t(31) = -14.48$ ,  $p < .001$ , respectively). Intriguingly, for *race*, the distinctive properties score was significantly below the mid-point, but the stable membership score was significantly above the mid-point ( $t(31) = -4.17$ ,  $p < .001$ , and  $t(31) = 2.41$ ,  $p < .05$ , respectively). No other score, including the two for *gender*, deviated significantly from the mid-point.

Among orthodox children, the patterns were somewhat different. Regarding *animals*, only the stable membership score was significantly above the mid-point,  $t(31) = 20.87$ ,  $p < .001$ . For *artifacts*, as well as for *SES*, the stable membership scores were significantly below the mid-point ( $t(31) = -9.80$ ,  $p < .001$ ,  $t(31) = -13.21$ ,  $p < .001$ , respectively). Regarding *ethnicity*, the distinctive properties score was significantly above the mid-point, but the stable membership score was significantly below the mid-point ( $t(31) = 2.92$ ,  $p < .01$ , and  $t(31) = -2.19$ ,  $p < .05$ , respectively). The pattern for *race* was exactly the opposite, matching that of secular children. Namely, the distinctive properties score was significantly below the mid-point, but the stable membership score was significantly above the mid-point ( $t(31) = -5.39$ ,  $p < .001$ , and  $t(31) = 10.47$ ,  $p < .001$ , respectively). Finally, for *gender*, the stable membership score was significantly above the mid-point,  $t(31) = 4.56$ ,  $p < .001$ .

Taken together, these findings reveal that: (a) children from both groups conceived of animal categories in an essentialist fashion, (b) children from both groups did not conceive of artifact or social-status categories in an essentialist fashion, and (c) children from these groups disagreed on the essentialist status of gender, race, and ethnic categories.

### 3.4. Relationships among measures

Our last set of analyses aimed at assessing the relationships among the different measures: belief in God as creator of categories, teleology, distinctive properties (essentialism task), and stable membership (essentialism task). Given that our main hypotheses had to do with domain-specific relationships, we conducted Pearson correlations among these measures across all participants, within each type of category. In other words, we asked whether the extent to which a particular participant endorsed one of the beliefs with regard to a specific category, was related to the participant's endorsement level of another one of the beliefs with respect to that same category. Table 4 summarizes the findings of these analyses.

There are a number of important findings to notice in Table 4. First, there were significant correlations between

**Table 4**

Correlations among measures across all participants.

Correlation between	Race	Ethnicity	SES	Gender	Animals	Artifacts
God as creator and teleology	.27*	.47**	.46**	.36**	.43**	NS
God as creator and distinctive properties	NS	NS	NS	NS	NS	NS
God as creator and stable membership	.38**	.33*	NS	.29*	NS	NS
Teleology and distinctive properties	NS	NS	NS	NS	NS	NS
Teleology and stable membership	NS	NS	NS	NS	NS	NS

NS, not significant at  $p = .05$ .\*  $p < .05$ .\*\*  $p < .005$ .

the belief in God as creator of a category and children's teleological construal of the category, for all categories except artifacts. Second, there were significant correlations between the belief in God as creator of a category and children's beliefs in the stable membership of a category for three of the six category types: race, ethnicity, and gender – all social categories. Third, there were no significant correlations with the distinctive properties measure of essentialism. Fourth and finally, there were no significant correlations between teleology and either measure of essentialism for any of the categories.

In addition, we also conducted the complementary set of correlations, namely, looking at the relationships among the tasks across all categories. These correlations would reveal whether across all participants, the level of endorsement of a given belief with regard to a specific category, was related to the level of endorsement of another belief with regard to that same category. These analyses revealed only one significant correlation, namely, between belief in God as creator of a category and the belief in the stable membership of the category,  $r(6) = .82$ ,  $p < .05$ . In other words, across all participants, the more a category was believed to have been created by God, the more the category's membership was believed to be permanent.

#### 4. Discussion

The goal of the present study was to uncover to what extent children's essentialist and teleological construals of various categories is related to a belief in God as creator of categories. For this purpose, we tested secular and orthodox Jewish children in tasks assessing their belief in God as creator of categories from various domains, and their essentialist and teleological construal of these categories. We reasoned that if a given conceptual belief (e.g., essentialism) about a given category (e.g., animals) is autonomous of creationism, then we should find the following pattern of findings: (a) high endorsement of that belief across children, (b) no difference between secular and orthodox children regarding their level of endorsement of that belief, and (c) no correlation between children's belief in God as creator of that category and their level of endorsement of that belief. In contrast, we reasoned that if creationism promotes the development of a conceptual belief about a given category, then we should find the following complementary pattern of findings: (a) no unitary level of endorsement of that belief across children, (b) a difference between secular and orthodox chil-

dren regarding their level of endorsement of that belief, and (c) a positive correlation between children's belief in God as creator of that category and their level of endorsement of that belief. Overall, the findings revealed a domain-specific pattern of mappings between conceptual beliefs and categories.

The findings regarding essentialism showed first and foremost that not all aspects of essentialism cohere (see also Gelman et al. (2007)). In particular, questions assessing the degree of psychological differences between category members did not capture substantial group differences, nor were they related to the other two sets of beliefs assessed. In contrast, questions assessing the stability of category membership and the existence of internal physical distinctions between categories, did reveal consistent group differences and relationships with the other measures. While this lack of coherence in the construct may be interpreted as supportive of alternative construals of categories (e.g., Strevens' (2000) *k*-laws, or Sloutsky and Fisher's (2004) similarity models), we cannot envision how these alternatives can account for the full pattern of findings described here. In turn, the findings on the domain specificity of the interaction between creationism and category stability, is fully consistent with an essentialist construal of categories (see for instance, Ahn et al. (2001)). A second general finding about essentialism is that it seemed to be less influenced by the religiosity status of the respondents than was teleology. It would be interesting to examine whether this relative robustness of essentialism to variations in religious beliefs is also found with respect to other dimensions of cultural variation.

These general points notwithstanding, we found that essentialism – but especially its aspect regarding stable category membership – about animals, matched the pattern of findings exposed above as illustrative of a belief autonomous from creationism. First, the stable membership essentialism score for animals was the highest of all categories assessed. That is, consistent with a vast literature, children responded that animal category membership is innately determined and stable (see Gelman (2003) for a review). Second, despite substantial differences between secular and orthodox children in their belief in God as creator of animal categories – consistent with Evans' (2000, 2001) findings – there were no differences between these groups of children in either one of their essentialism scores regarding animals. Third and finally, there were also no correlations between the degree to which children believed God was the creator of animal categories, and either

of their essentialism scores regarding animals. In sum, essentialism about animals seems to be what Sperber defines as an intuitive belief, such that animals constitute essentialism's proper domain. This conclusion is consistent with both the cross-cultural prevalence of essentialism about animals (Astuti et al., 2004; Atran, 1990; Diesendruck, 2001), and the lack of evidence for a substantial effect of linguistic input on children's essentialization of animals (Gelman et al., 1998). Whether this intuitive status of essentialism about animals is due to it being an innate habit of the mind shaped by humans' evolutionary history (Atran, 1990), the confluence of multiple cognitive predispositions (Gelman, 2003), or the observable causal structure of the domain (Sloman et al., 2007), is still debatable.

The status of essentialism vis-à-vis social categories seems to be different. In fact, the pattern of findings in this regard closely matched the pattern indicated above as consistent with a "derived" belief. First, on either measure, there was no unitary level of endorsement of essentialism, neither across social categories, nor across groups of children. For instance, in comparison to the mid-point in our essentialism scale, orthodox children treated certain social categories (gender and race) as having stable category membership, but secular children treated other categories (ethnicity and SES) as not having stable category membership. Second and related, across the two measures of essentialism, there were indeed differences between secular and orthodox children in their level of endorsement of essentialism regarding three of the four social categories: gender, race, and ethnicity. The only social category about which there was no difference between the two groups of children – SES – turned out to be the one with the lowest level of endorsement of stable category membership by both groups. Finally, children's level of endorsement of the stability of category membership regarding the former three social categories was positively correlated with the extent to which children believed that God created these social categories.

The conclusion that essentialism about specific social categories is facilitated by a particular cultural belief – creationism – sheds new light on debates about the origins of such a belief in this domain. On the one hand, this conclusion is consistent with findings of cross-cultural differences in terms of the particular social categories essentialized in different cultures (e.g., Gil-White, 2001; Mahalingam, 2003). On the other hand, the conclusion seems to counter the sheer robustness and early emergence of essentialism about social categories (e.g., Astuti et al., 2004; Diesendruck & haLevi, 2006). A possible resolution to this apparent conflict is offered by Hirschfeld (1996). Namely, that while children might be intuitively disposed to essentialize human kinds, the *specific* kinds in their social environment onto whom they eventually deploy this essentialist disposition is determined by cultural input. Whether cultural input is crucial for generating social essentialism – as suggested by Carey (1995) and Sperber (1996) – or simply for maintaining social essentialism – as argued by Hirschfeld (1996) and Diesendruck and haLevi (2006) – remains an open question. Up till now, the only cultural factor examined in this respect had been language (Cimpian, Arce, Markman, & Dweck, 2007; Gel-

man & Heyman, 1999). The present findings are the first to systematically reveal how a different cultural variable can exert such an effect.

Finally, the findings regarding artifacts indicate that, on the measures of essentialism used here, children from neither group essentialized artifacts, and there were no differences between groups on either of the essentialism measures. While as pointed out in Section 2, there is no obvious translation for some of the questions regarding essentialism to the domain of artifacts, this is the first study to use almost identical measures to assess children's essentialist beliefs about a variety of categories. In this respect, the rank ordering of categories revealed in Figs. 3 and 4 is quite unique. For instance, it is interesting to compare between social categories that differ in their degree of salience in the Israeli society, such as race and ethnicity. Specifically, while Israeli children responded that there are more psychological differences between members of ethnic categories than between members of racial categories, they responded that category membership is more stable in racial than in ethnic categories. This pattern again illustrates the lack of coherence of essentialist beliefs, particularly with regard to social categories (see also Haslam, Rothschild, and Ernst (2000) for a similar claim).

Turning now to the teleological construal of categories, especially the extrinsic kind of teleology implied by the present measure, we see that its status too varies across domains. The domain in which children's responses regarding teleology matched the pattern predicted for an autonomous belief was artifacts. First, artifact categories were the ones most likely to be conceived by children as existing for a purpose, suggesting that artifacts are the proper domain of teleology in Sperber's (1996) terms (Keil, 1995; Kelemen, 1999). Second, there were no differences between secular and orthodox children in their teleological construal of artifact categories. This is consistent with the claim that an understanding of artifacts as having specific functions emerges early in development (Casler & Kelemen, 2007), and seems stable across cultures (Kelemen, 2003).

The extension of extrinsic teleology to other domains, however, was facilitated by creationist beliefs. Specifically, regarding animals, children's overall tendency was not strongly teleological, there were differences between secular and orthodox children in their endorsement of teleology, and there was a positive correlation between children's belief in God as creator of animal categories and their teleological construal of these categories. This pattern of findings is consistent with Keil's (1995) argument that while children might hold a teleological construal of the properties of living kinds, such a construal is not intuitively applied to categories of living kinds.

The same basic pattern of findings found in relation to animals, was also true for social categories. For instance, while secular children did not view any of the social categories as existing for a purpose, orthodox children conceived of both gender and ethnicity as existing for a purpose. In their spontaneous explanations, orthodox children often referred to divine reasons for the existence of these categories. For instance, that Jews exist so as to obey the laws of the Old Testament, and men exist to perform

certain orthodox rituals. This original demonstration of an extension of teleology to social categories – arguably mediated by a belief in an intentional agent – illustrates the flexibility and power of this reasoning bias.

Kelemen (1999) has argued that early on in development, children may be susceptible to a promiscuous teleology, such that they treat the existence of a variety of phenomena as existing for a purpose. Kelemen (2004) further suggests that this notion of teleology may be linked to children's beliefs in the existence of a designer. Consistent with this argument, Kelemen and DiYanni (2005) reported on connections between children's tendency to provide teleological explanations of various natural phenomena and the frequency with which they mentioned God as the source of the phenomena. In contraposition to this argument, Lombrozo et al. (2007) found no systematic relationship between the degree to which Alzheimer patients endorsed teleological explanations and their creationist beliefs. One possible reconciliation between our – and Kelemen and DiYanni's – findings, and those of Lombrozo et al. has to do with the age of the participants. In particular, as argued by Kelemen (2004), it is possible that for children, a teleological construal is indeed closely tied to concepts of design and intentionality, making an association with the concept of God particularly feasible. In contrast, for adults, teleology involves not only intentional processes, but non-intentional ones as well (e.g., evolution), making the concept of God a more distant association.

A related possible implication of this disparity in findings is that while teleology does not necessarily invoke creationism, the opposite direction of causality might indeed be the case. Thus, one could speculate that while with regards to artifacts, children might come naturally to a belief in a designer – i.e., humans – that is not the case with regards to animal and social categories. In these latter domains, it is culture that provides children with a plausible designer – e.g., God – thus licensing the application of teleology to these domains. Evidently, the correlational nature of the present findings prevents us from resolving these questions about causality, but nonetheless point out plausible directions for future work.

In this light, it is unclear whether the belief in God as creator of categories pushes children towards conceiving of certain categories in teleological terms, or whether the absence of this factor pulls children away from an intuitive teleological construal. It is interesting in this regard that with slightly different tasks, Kelemen and DiYanni (2005) found endorsement of teleology for animals at around 45% of the time across ages. We found for orthodox children rates of slightly above 50%, but for secular children around 15%. In other words, it would seem that it is our group of secular children who are the exception.

An additional finding consistent with this latter conclusion has to do with the sheer endorsement of God as the creator of categories. Evans (2001) found that North-American Fundamentalist Christian children, both young (6.5 year olds) and old (11.5 year olds), endorsed creationist explanations of the origins of animals from around 80% to above 90% of the time, respectively. Non-fundamentalists from both age groups did so 50% of the time. Kelemen

and DiYanni (2005) found overall among British children of similar ages – an arguably more secular cultural group than even North-American non-fundamentalists – a rate of about 50% endorsement of God as creator of categories. We found among orthodox children endorsement of God as creator of animal categories at above 95% of the time at both ages. Among secular children, however, it was around 30% of the time. In other words, while the orthodox Jewish children in our sample responded similarly to how the fundamentalist Christian children in Evans' sample did, the secular Jewish children in our sample were less creationist with regards to animal kinds than either North-American or British secular children. This is consistent with the idea that in an integrated society, in which notions of religiosity are salient and openly discussed, the belief systems of the different constituent groups may in fact get polarized. It is interesting to note in this regard, moreover, that these different cultural discourses might have their strongest effect on young children. For instance, we found that with development, secular and orthodox children's explanations for the origins of different categories tended to converge – especially in regard to social categories. Thus, while orthodox 1st graders tended to believe God created ethnic and social-status categories, by 5th grade, orthodox children started endorsing social or internal mechanisms as possible sources for these categories.

Last but not least, the correlational findings also speak to a controversy about the relationship between teleology and essentialism (cf., Atran, 1995; Keil, 1995). Specifically, the finding of no correlation between teleology and either measure of essentialism with regards to animals seems to counter Atran's (1995) claim about an intuitive teleo-essentialist construal of living kinds. A possible reconciliation is that while children might have an essentialist construal of animal *kinds*, they hold a teleological construal only of animal *properties*. A second important point to note is that the measure of teleology used in the present study emphasized extrinsic purposes. It is possible that if we had used a measure of intrinsic purpose – which is more closely related to how Atran discusses teleology – we might have found tighter relationships between it and essentialism. These reconciliations notwithstanding, the general finding of no significant correlations between teleology and essentialism in any of the domains is consistent with Keil's (1995) arguments about the existence of two separate modes of construal, a teleological and an essentialist one, early on in development.

While our discussion so far has been mostly in terms of the domain specificity of essentialism and teleology, it is important to point out that the present studies do not provide direct evidence as to the status of the domains. In particular, as we noted in the Introduction, there are at least two broad accounts of the development of causal beliefs that are consistent with domain specificity. The account most closely associated with the present discussion is what we have termed strong ontology, which advocates some degree of a priori ontological distinctions. From that perspective, the present findings of the differential effect of creationism on children's beliefs about various categories can be interpreted in terms of a priori default beliefs, and the fine-tuning of the mappings between beliefs and do-

mains. For instance, the present findings could be taken to support the claim that essentialism about animals is a default bias (Atran, 1990), but its extension to social categories necessitates cultural mediation (Sperber, 1996). One of the main challenges the present findings pose to such an account is to provide *direct* and *uniform* assessments of the status of the various conceptual beliefs in the different domains.

A second account consistent with domain specificity is what Sloman et al. (2007) define as mild ontology, which argues that ontological distinctions vis-à-vis causal beliefs emerge out of the particular causal structures observable in the different domains. From that perspective, the present findings of differential interactions among beliefs can be interpreted as illustrative of how unique cultural stories or communicative practices shape children's ultimate causal beliefs about a given domain. It seems to us that one of the challenges the present findings pose to this account is to explain the differential effect of creationism in the different domains.

In general, in order to decide between these broad alternative accounts, we need to have better definitions of the mechanisms by which default beliefs emerge, and how cultural factors can affect such default biases. In this regard, the present findings provide an initial map of some of the domain-specific conceptual distinctions that need to be explained.

To conclude, applying similar assessment tools across domains for investigating children's beliefs about God as the creator of categories, essentialist beliefs about categories, and teleological construals of categories, we found systematic patterns of differences across domains regarding the relationships among these beliefs. Employing Sperber's (1996) typology of beliefs, our findings indicate that children's essentialist beliefs about animals, and their teleological construal of artifacts, come to them intuitively and independently of creationism. In turn, children's extension of essentialism to particular social categories, and teleology to both social categories and animals, are reflective, and result from the communication of a culturally constituted belief system – i.e., creationism. As Keil (1995) notes, one of the main tasks children face in conceptual development is to figure out to which domains their various modes of construals apply. The present study reveals that cultural beliefs channel this learning process.

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