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Developmental changes in reasoning about cross-classified individuals.

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DEVELOPMENTAL CHANGES IN REASONING ABOUT CROSS-CLASSIFIED INDIVIDUALS

By

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DEDICATION

This dissertation is dedicated to my grandparents, Jack and Louise McDermott, Farrokh Najmabadi, and Guity Kashani.

Thank you for all that you made possible.

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ABSTRACT

DEVELOPMENTAL CHANGES IN REASONING ABOUT CROSS-CLASSIFIED INDIVIDUALS

Catherine H. McDermott

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Social categories allow children to make inferences about novel situations, which can then guide their interactions with others. However, this process can be complicated because individuals often belong to many different, sometimes interrelated, social categories. Four experiments examine whether children and adults differ in their willingness to classify a person as holding two social roles (e.g., a mother and a daughter), and how this influences their reasoning. Specifically, this work will examine the influence of cross-classification on inductive inferences, trust in testimony, and knowledge evaluations. The aim of these experiments is to investigate whether children privilege certain roles when reasoning about individuals who hold multiple social roles. Because children rely heavily on their knowledge of individuals' social roles to interact with them appropriately, it is important that children be able to accurately use these social categories to reason about others. Experiments 1 and 2 explore children's willingness to cross-classify individuals into a variety of social roles with varying degrees of hierarchical (vs. non-hierarchical) structure. Experiment 2 further examines what cognitive mechanisms may underlie children's cross-classification behaviors.

Experiments 3 and 4 examine how children make inferences about and evaluate the testimony of cross-classified individuals. Overall, the findings of these four experiments illustrate that there are developmental differences in willingness to cross-classify and reasoning about cross-classified individuals occurring between the preschool, early elementary, and adult years. The results of these experiments suggest that cross-classification may influence the way children make inferences about individuals, but that cross-classification does not influence their trust in the testimony of individuals with multiple social roles. This work contributes to our growing understanding of how children utilize information about social categories to reason about others.

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INTRODUCTION AND REVIEW OF LITERATURE

Children are constantly receiving novel information from their environment and having to make sense of it. One of the ways that children organize this information is through categorization (Markman, 1989). Categorization refers to the process of organizing the environment into cohesive groups of entities, thus allowing these entities to be treated equivalently (Rosch, Mervis, Gray, & Boyes-Braem, 1976). Categories give structure to the environment (Murphy, 2002), allow individuals to reason beyond only the information that is available (Smith & Medin, 1981), and support inferences about both novel situations and individuals (Rhodes, 2013). Because adults have more general knowledge and experience than children, children's concepts differ from those of adults (Carey, 1985). However, categories are ubiquitous across ages (Murphy, 2002), and although children do not display the same broadly defined categories as adults (Rosch, 1973), they do indeed have fairly complex conceptual abilities (Murphy, 2002).

Categorical Organization

Categories can be organized in various ways, at different organizational and structural levels. From a young age, children recognize different kinds of categories. By age three, children are able to make use of script and taxonomic categories (Nguyen & Murphy, 2003). Script categories refer to items that go together in the same sort of event or activity (e.g., pumpkins and costumes on Halloween), whereas taxonomic categories

include items with shared or common attributes (e.g., birds can fly; Lucariello, Kyratzis, & Nelson, 1992). Children are also able to categorize the same entity into both taxonomic and script categories, suggesting that they can use more than one form of categorization (e.g., Nguyen & Murphy, 2003). Knowing what kind of category an item belongs to is essential to being able to make accurate judgments about a given category and its members (Murphy, 2002). Categories can also be organized hierarchically at the subordinate, basic, and superordinate levels. Basic level categories are often the first categories children develop, share the most common features, and have the highest cue validity (i.e., denote the highest likelihood that a cue is associated with a category; Rosch & Mervis, 1975; Rosch et al., 1976). Categories can also be organized at the superordinate, or broadest level of abstraction, and the subordinate, or most specific level of abstraction (Mervis & Crisafi, 1982).

Blewitt (1994) proposed that children's understanding of category hierarchies progresses through four levels, beginning in the preschool years. Level one, which begins around age two, represents a stage during which children do not have any real knowledge of category hierarchies, whereas at level two children have some implicit understanding of hierarchies. In level two, which develops between ages two and four, children may accept that an item can belong to multiple categories, although they are often unable to reason any further about these multiply classified items. Upon reaching levels three and four, children are able to use their knowledge about the relationship between categories to make both quantitative and qualitative inferences. Indeed, children as young as two have been found to form different hierarchical categories and classify the same objects within different categories (Blewitt, 1994).

Social Categorization

The study of concepts and categories has historically focused on labeling entities and objects, however there is another area of study that has only recently been given as much attention. In recent years, research on how children label and subsequently reason about people in different domains and across various social categories has grown. Similar to categorizing objects, children use group labels to split up individuals into different social categories (Macnamara, 1982). Indeed, research has suggested that even infants are able to pick up on information related to social categorization (Shutts, Pemberton, & Spelke, 2013). In order to interact with and navigate their environments successfully, children must be able to determine not only what social group various individuals belong to, but also what membership in a social group implies or communicates about the characteristics or behaviors of group members. Relatedly, children must recognize that the degree to which group members may be similar or dissimilar differs based on the social category in question (Baron, Dunham, Banaji, & Carey, 2014).

Two prominent theories of how children develop and use social categories have been proposed. The first is that social categories are kind referring (Rothbart & Taylor, 1992), and that the category that an individual fits into reflects some internal aspects of that individual which cause its external and observable characteristics and behaviors (e.g., a tiger's DNA causes it look and act like a tiger). This theory posits that children believe social categories denote group membership that is stable over time and predictive of a variety of behaviors. A second, more recent theory is that social categories are markers of social obligations (Rhodes, 2013), in that they are used to understand individuals'

interactions and relations to one another. In support of this theory, studies have found that from age three children use social categories to predict social interactions (Rhodes, 2012). Given these two theories, much of the research investigating children's development of and reasoning about social categories has focused on exploring whether children treat social certain categories as naturally or artificially constructed, and investigating how children use categories to determine how they should interact with others.

One difficulty that children have when categorizing new information is that they often see categories as more homogenous (Rhodes & Brickman, 2010) and permanent (Diesendruck, Goldfein, Rhodes, Gelman, & Neumark, 2013; Gelman & Wellman, 1991) than they may be. Rhodes and Brickman (2010) found that children often fail to recognize that there can be within-category variance, unless the diversity of a sample has been emphasized or made salient. Although adults recognize diverse samples as more representative of a category, children often do not, which can prevent them from understanding the benefits of making inferences based on diverse rather than homogenous samples. Specific to social categorization, children often face the challenge of both recognizing and understanding the different social roles that a person may hold. Because the roles people hold are often nonobvious (Gelman & Wellman, 1991) and cannot be recognized by simple observation of perceptual properties (Gelman & Markman, 1986), social categorization may be difficult for children.

Work in this area suggests that there are developmental and cultural differences in the way children reason about and represent different social categories. In terms of recognizing different social groups, preschoolers can identify various types of people

(Kalish & Lawson, 2008), and distinct social categories, including race (e.g., Roberts & Gelman, 2016) and gender (e.g., Rhodes & Gelman, 2009). Race and gender represent a unique area of study because these categories are often marked by salient physical and social markers that other categories may not have. Rhodes and Gelman (2009) found that younger children (5- and 7-year-olds) typically viewed gender as a naturally constructed category (i.e., categories of objects that occur in nature). In contrast, 10-year-old children viewed gender as more artificially constructed (i.e., categories of objects that are created by humans). Compared to gender, younger children viewed race as more artificially constructed, whereas older children viewed race as naturally constructed. Further, some of the differences in children's reasoning were attributable to their cultural context (e.g., children from rural areas often view race as more naturally constructed than children from urban areas; Rhodes & Gelman, 2009). Researchers have also investigated how people reason about multiracial individuals, or individuals who belong to more than one race, and found that both children and adults exhibit more difficulty when performing categorization tasks about multiracial versus monoracial individuals (Roberts & Gelman, 2015). Both younger and older White children (4- to 13-years-old) were more likely to categorize an individual as 'Black' when their race was ambiguous (or multiracial). Roberts and Gelman (2015) claim that this effect may be a product of overweighing minority perceptual features. Interestingly, this study found no developmental differences in perception, indicating that race is a salient enough cue for even young children to use when making categorization judgments. Unlike adults, preschoolers' reasoning about social categories has been suggested to be primarily based on their observations of perceptual features (Watson, 1984). However, in contrast to social

categories with distinct visual or physical features, many social categories are defined by factors such as occupation, familial role, age, and hobbies.

Although learning to recognize different social categories is an important aspect of social cognitive development, one of the critical functions of social categories is that they denote certain expectations for the members of that social group (Kalish & Lawson, 2008). For example, the social category of 'teacher' allows for certain behavioral (writes on a chalkboard), psychological (is smart), and deontic (can tell you what is allowed in class) predictions. These defined group behaviors often exist in relation to another role, for example the expected behaviors of a student are defined in reference to the expected behaviors of a teacher. Social groups defined by role-based properties have been shown to be particularly salient for children (Kalish & Lawson, 2008). Kalish and Lawson gave children the opportunity to categorize individuals following information about their deontic and psychological properties. They found that both younger and older children viewed deontic (or obligation-related) properties as most central to category membership, with younger children showing the most reliable judgments of this sort, suggesting that children may be less perceptually biased than previously suspected. By four years old, children are also able to use information about an individual's social category to make inferences about shared biological and psychological properties (Shutts et al., 2013). Diesendruck and Eldror (2011) have also found that children are able to use biological and psychological properties to infer category membership, and that children are more concerned with category members sharing the same psychological (rather than biological) properties. Importantly, social categorization also allows children to predict how another

person may behave and what that person may be obligated or not allowed to do (Kalish & Lawson, 2008).

Studying social categories is important because people often treat these categories as if they are inherent, permanent, and predictive of individuals' characteristics (Diesendruck & Eldror, 2011). Understanding social categorization is a necessary step in knowing how to effectively interact with and behave towards others, as well as a foundation of children's developing social competence (Watson, 1984). As adults, we understand that individuals can simultaneously belong to a multitude of social categories; however, the fact that children's representations are still developing may present an obstacle for their understanding that an individual can be a member of various social categories at the same time.

Children's Cross-classification Behaviors

While children readily classify new information into existing categories, one obstacle they may face is classifying entities into multiple categories. Cross-classification is the ability to categorize one item into multiple categories (Murphy & Ross, 1999), a necessary skill as almost every individual is a member of multiple social categories (Murphy & Ross, 1999; Nguyen & Chevalier, 2015; Ross & Murphy, 1999). The ability to cross-classify is not only important to social interactions, but also represents children's developing cognitive flexibility (Nguyen, 2007). Given that most people belong to multiple categories, children need to be able to flexibility shift their reasoning to attend to the appropriate role at the appropriate time in order to effectively interact with others.

Extending work by Ross and Murphy (1999) demonstrating that adults cross-classify foods into multiple categories, Nguyen and Murphy (2003) examined whether 4-year-old children, 7-year-old children, and adults would perform cross-classification within the food domain when presented with taxonomic and script categories. Participants in Nguyen and Murphy's (2003) third experiment were given the opportunity to categorize an item in both a taxonomic and script category on two independent trials. While all age groups showed cross-classification levels that were significantly above chance, 7-year-old children and adults did so significantly more often than 4-year-old children, suggesting that cross-classification abilities improve through the early elementary years.

Nguyen (2007) examined the development of children's cross-classification behaviors within taxonomic and script categories across multiple experiments. In the first experiment, children were given the opportunity to categorize items into both taxonomic and script categories on different trials. Overall, children ages 3-, 4-, and 6-years-old all cross-classified at levels above chance (i.e., were willing to classify the same item as belonging to both a script and a taxonomic category), and this behavior increased over these age groups with 6-year-old children showing no significant differences from adult-like responding. In a second study using largely the same procedure, 2-year-old children also cross-classified items (although they did this at levels only just above chance) and showed no significant differences in responding from the 3-year-old children in the first experiment. In a third experiment, participants were asked if items could simultaneously belong to both a taxonomic and script category (e.g., "Are pajamas bedtime clothes?"). Participants in all age groups endorsed cross-classified

labels at similar rates when these labels were appropriate (e.g., pajamas are bedtime clothing, but a library is not a bedtime building). However, when cross-classified category labels were inappropriate, 3-year-old children's performance was significantly worse than the other age groups. Additionally, 4-year-old children's performance on the inappropriate classification items did not differ from chance. Taken together, these studies indicate that children as young as two are able to able to cross-classify items as belonging to both taxonomic and script categories, and by age four children exhibit some ability to represent these classifications simultaneously. Overall, research examining children's cross-classification performance suggests that children have some rudimentary ability to reason that objects can simultaneously belong to multiple categories and that in certain cases two hierarchically related labels may apply to the same item (Blewitt, 1994).

The Present Studies

Cross-classification is a necessary step in accurately reasoning about the social role intersections present when an individual holds more than one role at the same time (Watson, 1984). Despite the fact that performing cross-classification and navigating the multiple social roles held by others is an important and ubiquitous experience, relatively little research has focused on exploring the emergence and development of young children's cross-classification behaviors in the social domain. Because children rely heavily on their knowledge of social categories to interact with others appropriately, it is important that they develop a mature understanding of these categories (Kalish & Lawson, 2008; Rhodes & Brickman, 2010). The current set of experiments will contribute to our growing understanding of how children use information about the social

roles that individuals hold to make inferences, evaluate testimony, and infer knowledge status.

We are particularly interested in how children reason about individuals in familial and occupational roles, given the hierarchical nature of these social roles and the literature indicating that children exhibit differences in reasoning in these domains at different ages (e.g., Deak & Maratsos, 1998; Jordan, 1980). These experiments answer two questions: 1) How does children's willingness to cross-classify individuals develop, and 2) how does cross-classification influence children's reasoning in different domains? Experiments 1 and 2 will explore children's willingness to cross-classify individuals into a variety of social roles with varying degrees of hierarchical (vs. non-hierarchical) structure. Experiment 2 will further examine whether children's willingness to cross-classify individuals in hierarchical social roles can be improved through a brief training and whether certain cognitive competencies contribute to children's cross-classification behaviors. Experiments 3 and 4 will examine how children reason about individuals who are cross-classified. Specifically, we will be examining how cross-classification influences children's inductive inferences, trust in testimony, and knowledge evaluations, and whether there are developmental differences in reasoning in these domains from the preschool to early elementary years.

Finally, this work will provide insight into how children's reasoning about individuals may be influenced by cross-classification. Investigating whether children believe others can hold multiple social roles and whether this varies by domain, is important to understanding how children may believe they should behave in relation to others. For instance, if a child believes that a woman can be only a mother or a daughter,

but not both, this could have implications for how that child thinks they should interact with her. This work will also have implications for how adults explain or talk to children about the social roles that other's hold. In certain contexts, it may be important to make holding multiple social roles salient to children (e.g., being a teacher and a cook may indicate a wider knowledge base). However, in other contexts, it may be beneficial for children to be focused on a single social role (e.g., if the role of student undermines the role of teacher). Understanding children's beliefs about whether individuals can hold multiple social roles and how this cross-classification influences children's reasoning about and interactions with others will expand our growing understanding of children's social cognition.

CHAPTER II

EXPERIMENT 1 – CHILDREN'S WILLINGNESS TO CROSS-CLASSIFY INDIVIDUALS

Introduction

As adults we understand that people often hold many different social roles at the same time. For instance, a woman can simultaneously be a mother, daughter, teacher, student, voter, and athlete. This kind of social categorization is particularly relevant because expectations about social roles are important in guiding children's inferences (Kalish & Lawson, 2008) and interactions (Watson, 1984). For the purpose of the current experiment, "social roles" refer to labels that reference identities that provide meaningful information about individuals, and that refer to rich social categories. For example, the label "mother" is informative along many dimensions. Further, understanding the social roles that an individual holds provides information about how that person may behave, including what that person may be obligated or allowed to do (Kalish & Lawson, 2008; Watson, 1984). Understanding the many social roles held by individuals is important to being able to appropriately and effectively interact with others.

Attributing multiple social roles to a single individual may be a challenging task for young children. In general, children may exhibit a tendency to seek out the one – and only – label for an entity. Classically, Piaget (1928) demonstrated that children typically resist the notion that an entity can have multiple labels. As highlighted in the literature

on the mutual exclusivity bias (see Woodward & Markman, 1991, but also see Deak & Maratsos, 1998; Mervis, Golinkoff, & Bertrand, 1994), this tendency may be adaptive in some situations (e.g., word learning), but it may interfere with children's ability to perform cross-classification. Further, it has been suggested that even older children and adults will default to a mutual exclusivity type bias when integrating new and old names for a given referent (Merriman & Bowman, 1989). Although some studies have indicated that children as young as two years old are willing to generate more than one term to refer to a single entity (Clark & Svaib, 1997), it is unclear if they will do so when the terms in question are social roles.

Dahlgren (1985) suggested that individual social categories are represented in a similar manner to other entities (e.g., animals, food, etc.). However, it is unclear whether children treat social categories as if they are exclusive (e.g., a student cannot also be a teacher) or inclusive (e.g., a mother can also be a daughter). Thus, the current experiment aims to answer two questions: a) does children's willingness to cross-classify individuals change over the course of development, and b) does the structure of the social roles being probed influence children's cross-classification behaviors? In order to explore these questions in a systematic manner, we elected to probe children's intuitions about cross-classification by presenting them with pairs of social roles that were more or less structured and asking children to determine whether an individual could hold both roles.

In the current experiment we generally investigated children's willingness to attribute two social roles to a single individual. If children apply the same governing principles that they apply to basic level labels to social roles, then they may treat them as mutually exclusive. Alternatively, children may learn to suspend the mutual exclusivity

bias over the course of development. Critically, some social roles are more related, or structured, than others. Thus, it is possible that children may treat some social roles as more exclusive than others.

In order to manipulate structure, we presented children with social roles that varied on that dimension. Our highly structured stimuli included two kinds of social roles with hierarchical structure, including familial (e.g., mother-daughter), and occupational (e.g., teacher-student) dominant-subordinate pairs of social roles. These hierarchically structured roles were contrasted with non-hierarchical occupations (e.g., cook-runner). Thus, contrast allowed us to determine whether children treat social roles as exclusive because they are basic level labels, or if children treat them in this manner because they are meaningfully structured. One weakness of this design is that children may reasonably infer that all of these social role labels are non-exclusive and doing so may set up a response pattern wherein children simply affirm every item. In order to prevent such a task demand from unduly influencing participants' responses, we also presented children with other labels that were not social roles, including items involving relative social (e.g., nice-mean) and biological (e.g., tall-short) evaluations. If children do tend to cross-classify, then these items will help us to understand whether the nature of the judgment (social versus biological) or the contrast between the labels (relative in this case, rather than absolute) influences children's willingness to cross-classify. Finally, in order to ensure that the children were paying attention to the task, we included check items that children should have been unwilling to cross-classify, as they included basic level labels that they should have treated as exclusive (e.g., person-giraffe). This array of

dimensions allowed us to determine when children were willing to attribute multiple roles to the same individual, and to identify what variables were relevant to their intuitions.

Methods

Participants

Participants in this experiment included a group of younger children, older children, and adults, recruited from urban and suburban areas in and around Louisville, KY. These age groups were selected to represent different levels of cognitive development and formal schooling experience (Carey, 1985; Gelman, 1988). Thirty-three 3- to 5-year-old children (M_{age} = 4.80, *SD* = .813, females = 16), 30 6- to 8-year-old children (M_{age} = 7.65, *SD* = .920, females = 13), and 35 adults participated in this experiment. None of the children who participated in Experiment 1 participated in any of the subsequent experiments. Adults were included in this experiment to represent "mature" reasoning about these concepts. Note that, as a requirement of the IRB approval of this experiment, adult demographic information was not collected. Eighty-four percent of the children in this experiment were Caucasian, 3% were Asian, 2% were African American, and 2% were mixed race (parents of the remaining 9% did not provide a response). An additional 20 3- to 5-year-olds were interviewed, but their data were excluded from analyses for failing to respond correctly to two or more of the check items. Of the participants that were excluded, 35% were age three (*N* = 7), 30% were age four (*N* = 6), and 35% were age five (*N* = 7). All participants included in data analyses passed two or more of the check items. We had no initial estimates of effect size to use in estimating appropriate sample sizes for this experiment. Thus, we elected to recruit

moderately large samples for each age group. Post-hoc power analyses revealed that our method was sufficiently powerful to detect significant effects with a sample size of only 18 participants per group. Thus, we concluded that the above sample sizes were appropriate.

Materials

The materials for this experiment included 24 images of adults (half female and half male) with neutral facial expressions from the Chicago Face Database (Ma, Correll, & Wittenbrink, 2015). The images included faces of Asian, Caucasian, African-American, and ambiguous origin. Participants were shown an image of a face on a laptop, using presentation software. Images were accompanied by a statement and follow-up question.

This cross-classification query included 24 questions made up of 12 different pairs of social roles (see Table 1 and Appendix A). Pairs of social roles were divided into six different categories, two with hierarchical structure (e.g., familial hierarchical, occupation hierarchical), one with no hierarchical structure (e.g., occupation non-hierarchical), two relative pairs (e.g., social relative, biological relative), and one set of check questions to make sure participants were not simply answering 'yes' to every question.

Table 1

Pairs of social roles presented (Experiment 1)

Category	**Pairs**
Familial Hierarchical	Mom – Daughter; Dad – Son
Occupation Hierarchical	Teacher – Student; Doctor – Patient
Occupation Non-hierarchical	Cook – Runner; Artist – Swimmer
Social Relative	Rich – Poor; Mean – Nice
Biological Relative	Tall – Short; Weak – Strong
Check	Person – Dolphin; Person – Giraffe

Adult judgments. To ensure that the pairs of social roles we presented had the structure we intended, we collected preliminary data from an additional 20 adult participants to examine how 'associated' they believed the roles in question to be. In addition to the pairs of social roles presented in Table 1, we included four check items probing unrelated social roles (e.g., daughter-cook). These pairs of social roles were randomly selected across the social categories.

Participants judged how associated they believed two social roles to be on a 7-point Likert scale ranging from 1 (*not at all associated*) to 7 (*extremely associated*). We utilized one-sample *t*-tests to compare mean scores of each item category to the midpoint (midpoint = 3.5; see Figure 1). We found that within the familial hierarchical, occupation hierarchical, biological relative, and social relative item categories, associative judgments were all significantly above chance, p's < .001. In contrast, the associative judgments of the occupation non-hierarchical, check items (animal), and unrelated check items (social roles) were all significantly below chance, p's < .001. Thus, we concluded that the pairs we presented to participants were representative of social roles with varying structure.

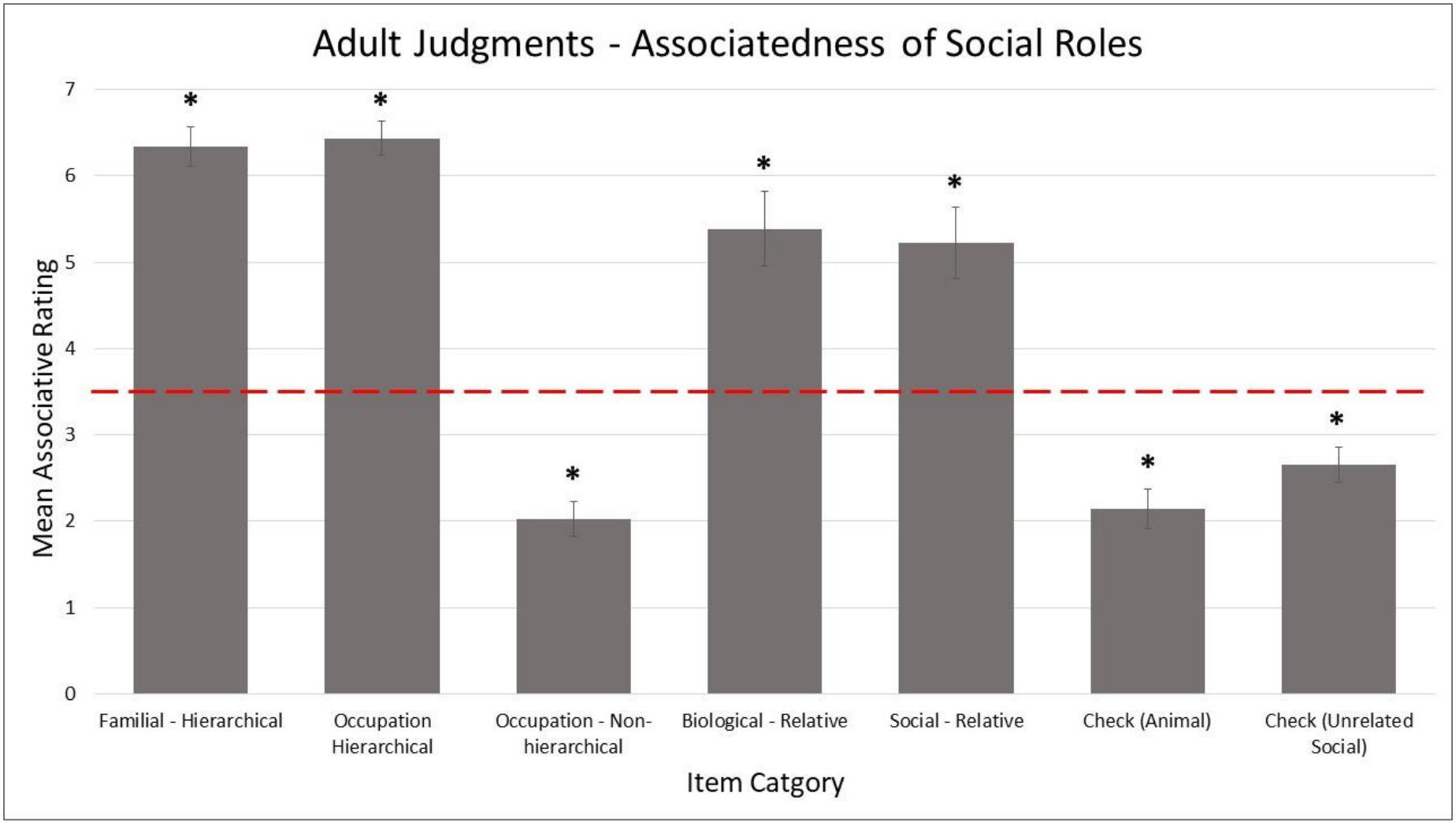

Figure 1. Mean associative ratings by Item Category.

Procedure

The experimenter and the child sat side-by side with a laptop between them. For each test item, the experimenter gave the participant a brief description followed by a question about the specific image presented on the screen. For example, "This person is a daughter. Can this person also be a mom?" The participants then answered with either "yes" or "no." Items were presented in one of two pseudo-random orders, in that no item category had a run of more than two pairs. Each pair of social roles was presented twice so that each role appeared first (e.g., "This person is a teacher. Can this person also be a student?" and "This person is a student. Can this person also be a teacher?"). Participants were either tested in a quiet space at their school or in a university research lab. Each testing session lasted approximately ten minutes.

Results

For each trial, participants were scored a 1 for responding that an individual could hold both social roles and a 0 for saying they could not, resulting in a total composite score that could range from 0-4 for each of the five item categories (check items were used as an inclusion criterion, but were not analyzed).

Preliminary analyses revealed no main effects of order or gender at any age, therefore we collapsed subsequent analyses across these factors. We used a repeated measures ANOVA with Age Group (younger children, older children, and adults) as a between-subjects factor and Item Category (familial hierarchical, occupation hierarchical, occupation non-hierarchical, social relative, and biological relative) as a within-subjects factor. Because the assumption of sphericity was violated, Greenhouse-Geisser estimates

are reported where appropriate. Our analysis revealed a significant main effect of Age Group, $F(2, 95) = 16.69$, $p < .001$, $\eta_p^2 = .26$, and a significant main effect of Item Category, $F(3.30, 313.20) = 18.05$, $p < .001$, $\eta_p^2 = .16$, embedded within a significant interaction between Age Group and Item Category, $F(6.59, 313.20) = 7.31$, $p < .001$, $\eta_p^2 = .13$.

Bonferroni corrected post-hoc tests revealed that younger children showed no differences in responding between any of the item categories. In contrast, older children cross-classified occupation non-hierarchical items significantly more often than familial hierarchical, occupation hierarchical, and biological relative items, *p*s < .001. Adults cross-classified occupation non-hierarchical items significantly more often than social relative items, $p < .05$, and they cross-classified biological relative items at a significantly lower rate than all four of the other item categories, *p*s < .05.

Within the familial hierarchical category, both younger children ($M = 2.21$, $SD = 1.69$) and older children ($M = 2.87$, $SD = 1.48$) had significantly lower scores than adults ($M = 3.97$, $SD = .17$), $p < .01$ (see Figure 2). Within the occupation hierarchical category, younger children ($M = 1.97$, $SD = 1.78$) had significantly lower scores than both older children ($M = 2.93$, $SD = 1.17$) and adults ($M = 3.89$, $SD = .40$), $p < .01$, and older children also had significantly lower scores than adults, $p < .01$. Within the occupation non-hierarchical, category younger children ($M = 2.36$, $SD = 1.85$) had significantly lower scores than both older children ($M = 3.83$, $SD = .59$) and adults ($M = 4.00$, $SD = .00$), $p < .01$. Within the social relative category, younger children ($M = 1.88$, $SD = 1.60$) had significantly lower scores than both older children ($M = 3.33$, $SD = 1.09$)

and adults (M = 3.40, SD = .85), $p < .001$. Within the biological relative category, there were no differences between younger children (M = 2.18, SD = 1.74), older children (M = 2.53, SD = 1.38), and adults (M = 2.66, SD = 1.21).

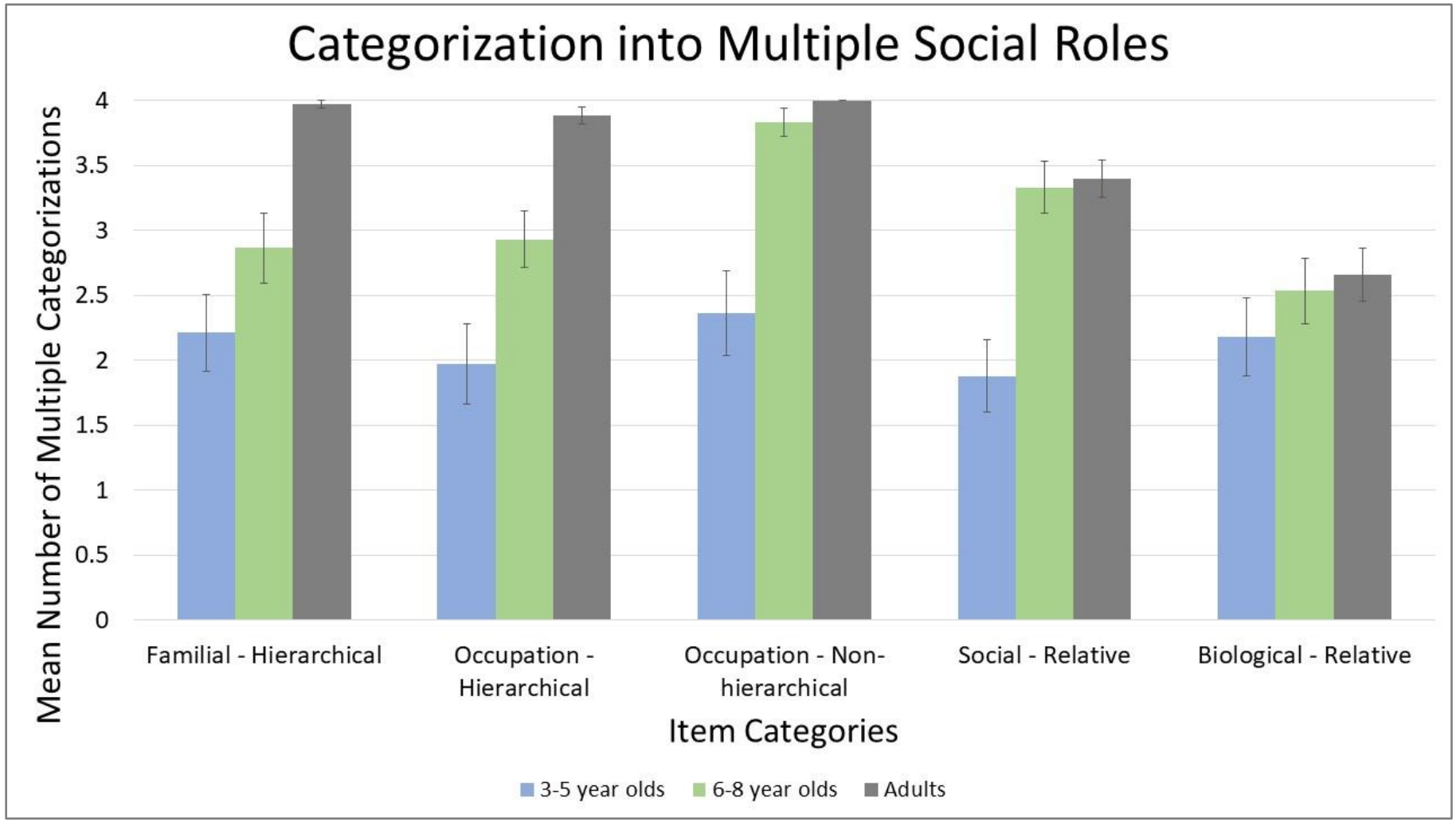

Figure 2. Mean number of cross-classifications for each Item Category by Age Group.

Discussion

The goal of this experiment was to examine developmental differences in willingness to cross-classify individuals into multiple social roles, and whether this willingness was influenced by the structure of the category in question. This experiment was intended to gather a baseline for children's cross-classification behaviors as they pertained to the social roles that an individual may hold. Although previous research has suggested that children are more willing to cross-classify items over the course of development (Nguyen, 2007), they may struggle more broadly with allowing one entity to have multiple labels (Woodward & Markman, 1991), especially at the same basic level. Although studies have investigated both children's cross-classification behaviors (e.g., Nguyen, 2007; 2012; Nguyen & Chevalier, 2015; Nguyen & Murphy, 2003) and their social categorization in general (e.g., Diesendruck & Eldror, 2011; Kalish & Lawson, 2008; Rhodes, 2013), none have directly investigated children's willingness to cross-classify individuals into more than one social role across various social categories. Thus, we believe this to be one of the first studies to specifically investigate children's willingness to cross-classify individuals into multiple social roles at the basic level, and to examine how their willingness to cross-classify individuals varies given the structure of the social roles in question (e.g., hierarchical vs. non-hierarchical).

The first aim of this experiment was to determine whether willingness to cross-classify individuals changes over the course of development. The results revealed that overall younger children cross-classified individuals significantly less often than older children and adults in the majority of the categories being probed (with the

exception of the biological relative category). The older participants in this experiment represented a midpoint between the younger children and adults in that they showed adult-like reasoning in some domains (e.g., occupation non-hierarchical, social relative, biological relative), but not others (e.g., familial hierarchical, occupation hierarchical), suggesting that children become more willing to cross-classify individuals into multiple social roles over the course of development.

The second aim of this experiment was to determine whether the structure of the social role in question influences cross-classification behaviors. Younger children cross-classified at similarly random rates across all of the item categories, suggesting that they may be treating these roles as mutually exclusive, regardless of their structure. Older children were willing to attribute two roles to a single person when the roles in question were unstructured, but when the roles were structured hierarchically, older children were less willing to attribute both to the same person. Because older children were willing to cross-classify non-hierarchical social roles, they appear to be using the structure of the roles, rather than mutual exclusivity alone, to determine whether an individual may hold both roles simultaneously. This interpretation is supported by children's responses to the social relative items as well. These judgments were less straightforward, as indicated by adult performance being below ceiling, but the reported pattern of results suggests that young children treated social relative labels as being more exclusive (i.e., you can't be rich and poor at the same time) than older children and adults, who treated them as less exclusive, perhaps alluding to a better understanding of the relative nature of judgments of variables such as wealth. Finally, we hesitate to further interpret responses to the biological relative judgments. We intended them to represent an opportunity for our

participants to generate "no" responses other than on check items, but adults and children were more mixed in their responses than we anticipated.

There are a few possible explanations for children's reluctance to cross-classify individuals into multiple social roles. The first, and most straightforward explanation is that children broadly have difficulty with cross-classification; however, this does not completely explain the reluctance that children exhibited in the current experiment. Given that older children showed adult-like cross-classification in some categories but not in others, specifically those with hierarchical structure, it is possible that these differences may reflect the development of cognitive processes, such as executive function or cognitive flexibility. There may also be more domain-specific differences that account for some of the results seen in the current experiment. For example, children may have difficulties understanding the present-future continuity of some of these roles (Jordan, 1980). Although previous studies have investigated present-future continuity in terms of kinship roles specifically, the occupation hierarchical roles in the current experiment have a similar structure in that these roles may represent a present-future transformation (e.g., student-teacher), but can also be held simultaneously. Our findings suggest that although younger children exhibit the lowest levels of cross-classification behaviors in general, children are still developing the ability to cross-classify individuals into roles with hierarchical structure through the early school years.

Limitations and Future Directions

Although the current experiment establishes a baseline for children's cross-classification behaviors in terms of social roles, it is unclear what underlies the

developmental differences that were observed. It is possible that there are developmental differences in general cognitive abilities (e.g., cognitive flexibility, non-verbal reasoning, executive functioning) that could account for some of the differences in children's cross-classification behaviors. Future studies should include measures of cognitive abilities as a possible mechanism for explaining developmental differences in reasoning about the cross-classification of individuals.

In future work, it will also be important to investigate how children use the information about a given individual's social roles to reason within other domains. One area of interest is how children make inferences about cross-classified individuals. Previous research has indicated that when making inductive inferences, children may rely more on social categories than other available information (Diesendruck & HaLevi, 2006; Heyman & Gelman, 1998; Nguyen, 2012). However, based on children's reluctance to cross-classify individuals into hierarchical roles in the current experiment, it could be the case that when making inferences about cross-classified individuals, children defer to one role instead of accounting for all of an individual's social roles. Exploring how social roles contribute to children's reasoning about others' testimony is another area of considerable importance. Children's lack of direct access to information (Harris, 2012) results in much of their knowledge being acquired through information received from others (Csibra & Gergely, 2009). Research has suggested that individuals may rely on group membership to make inferences about informants by extending information about a social category to all of its members (Landrum, Eaves, & Shafto, 2015). In future work, it will be crucial to determine how children's reasoning about cross-classified individuals influences their reasoning in other domains of social cognition.

Conclusions

Understanding how children reason about the social roles that others hold is an important step in more broadly understanding children's social cognitive development (Watson, 1984). When children do not, or cannot, account for the multiple social roles that individuals hold, this can limit their interactions to be in relation to one selected social role rather than a given individual's full identity. It is also important that we, as adults, understand where children may be lacking in their overall understanding of social categorization.

Based on these preliminary findings, the subsequent studies reported here will focus on social roles that have a hierarchical structure, specifically familial and occupational roles. Focusing on these social roles will allow us to determine how these difficulties in cross-classification impact children's reasoning about individuals in various domains, and specifically how children make inferences, evaluate testimony, and make judgments about expertise.

CHAPTER III

EXPERIMENT 2 – TEACHING CHILDREN TO CROSS-CLASSIFY INDIVIDUALS

Introduction

In Experiment 1, young children exhibited a general reluctance to classify individuals as simultaneously holding two social roles, and older children showed this same pattern of responding for social roles that had a hierarchical structure. However, it is unknown why children exhibited this reluctance to cross-classify individuals. Given that previous research has demonstrated that young children are able to cross-classify entities outside of a social role domain (Nguyen, 2007; Nguyen & Murphy, 2003), it seems unlikely that children's reluctance in Experiment 1 came from a broader difficulty with cross-classification tasks. Similarly, the breadth of work indicating that children will accept multiple labels for a referent at young ages (Clark & Svaib, 1997; Deak & Maratsos, 1998; Waxman & Hatch, 1992), suggests that it is unlikely that children's reluctance was due primarily to a mutual exclusivity bias. Thus, it is possible that there is a more general cognitive limitation, such as cognitive load, contributing to children's reluctance to classify individuals as simultaneously holding multiple social roles.

Cognitive load theory suggests that learning and performance are hindered when processing demands are too high (Mayer & Moreno, 2003). According to cognitive load theory, when children are learning or dealing with new information, their working memory capacity is limited and their performance often degrades (Paas, Renkl, &

Sweller, 2004). Various strategies have been proposed to improve performance by decreasing cognitive load, including receiving training prior to learning (Mayer & Moreno, 2003) and practicing new skills (Paas et al., 2004). In Experiment 1, it could have been the case that children did not have the processing capabilities to simultaneously hold multiple representations for the same individual (Flavell et al., 1986). Mayer and Moreno (2003) suggest that when there are limitations on cognitive load caused by representational complexity, presenting some sort of animation paired with narration can reduce the need to hold multiple representations in memory. Similarly, scaffolding, or assisting a child with elements of a task that exceed their learning capacity can improve their performance on tasks that may otherwise be too difficult for them (Wood, Bruner, & Ross, 1976).

Thus, in Experiment 2, we investigated whether reducing children's cognitive load would lead to an increased willingness to cross-classify individuals. In order to lighten children's cognitive load, we presented them with scaffolding in the form of a short narrative explaining the hierarchical family structure accompanied by a 'family tree' schematic. If children's willingness to cross-classify individuals is influenced by their cognitive load, then this intervention should increase children's rates of cross-classification. If the intervention does lead to any increase in children's rates of cross-classification, this could indicate that the willingness to perform cross-classification is not limited by children's cognitive competencies, but perhaps by the maturity of their conceptual representations. It could also be the case that children tested in Experiment 1 were more reluctant to cross-classify individuals, because they were not familiar with the occupational hierarchical social roles we probed. To explore this explanation, we

included a matching task in Experiment 2, designed to ensure that children were familiar with the social roles we presented.

In addition to examining whether cross-classification behaviors can be increased by reducing cognitive load, we also explored two cognitive competencies as possible explanations for any developmental differences we may find in Experiment 2. Based on the systematic differences that emerged in children's cross-classification behaviors in Experiment 1, it is possible that there were improvements in specific cognitive competencies that may have predicted these differences in responding. One possibility is that developmental differences in cognitive flexibility predict children's cross-classification behaviors. Cognitive flexibility, or the ability to categorize the same item differently based on specific contexts (Ionescu, 2012), develops over the course of childhood. It may be that children's willingness to classify an individual as simultaneously holding multiple social roles depends on their ability to flexibly switch their cognitive representation of that individual (e.g., from daughter to mom). It could also be that general relational or non-verbal reasoning explains some of the variance in children's willingness to cross-classify individuals. Relational reasoning, or the ability to find meaningful relationships between entities (Jablansky, Alexander, Dumas, & Compton, 2015), develops throughout childhood and is fundamental to later abstract thought (Kotovsky & Gentner, 1996; Richland, Morrison, & Holyoak, 2006). Although young children have some ability to perform relational reasoning, this skill improves over the early and later elementary school years (Jablansky et al., 2015). Given that there are improvements in cognitive flexibility and nonverbal reasoning that occur in early childhood, we included measures of these two cognitive competencies to examine

whether or not they predict children's cross-classification behaviors. In the current experiment, children will be presented with the same cross-classification task that was used in Experiment 1, however this task will be preceded by a training task designed to provide children with scaffolding for performing cross-classification. The central task of Experiment 2 differs from Experiment 1 in that only familial hierarchical, occupation hierarchical, and occupation non-hierarchical items were presented. Following the cross-classification task, children completed the Dimensional Change Card Sort - border version (DCCS; Zelazo, 2006) as a measure of cognitive flexibility and the KBIT-2 Non-verbal Reasoning Subscale (Kaufman & Kaufman, 2004).

Methods

Participants

Based on an a priori power analysis using effect sizes from Experiment 1, we determined that a sample size of 18 children per age group would be sufficient to detect significant effects. Age groups in this experiment and all subsequent experiments will be narrower than those in Experiment 1 for a few reasons. First, the large number of three-year-old children that failed to pass the check questions in Experiment 1, led us to believe that tasks of this nature may be too difficult for this age group. Second, there seemed to be a shift between preschool and school-aged children in the understanding of kinship terms (Watson, 1984), for this reason we did not be include six-year-old children, as they may represent a transition in kinship understanding. Thus, participants in this experiment included a group of younger children and older children, recruited from urban and suburban areas in and around Louisville, KY. Eighteen 4- to 5-year-old children (M_{age} = 5.02, *SD* = .66, females = 9) and 17 7- to 8-year-old children (M_{age} = 7.91, *SD* = .59,

females = 9) participated in this experiment. None of the children who participated in Experiment 2 participated in any of the subsequent experiments. Seventy-four percent of the children in this experiment were Caucasian, 9% were African American, 3% were Asian, and 11% were mixed race (parents of the remaining 3% did not provide a response). An additional 2 children were interviewed, but their data were excluded from analyses due to experimenter error in the administration of the KBIT-2.

Materials

The training materials for this experiment included a 'family tree' schematic. The family tree was presented on plain white 8.5 x 11 in. paper in black and white ink and depicted 3 generations of family members (see Figure 3). The 'family tree' schematic was gender matched so that male participants saw and heard about a family tree including three generations of males, and female participants saw and heard about three generations of females.

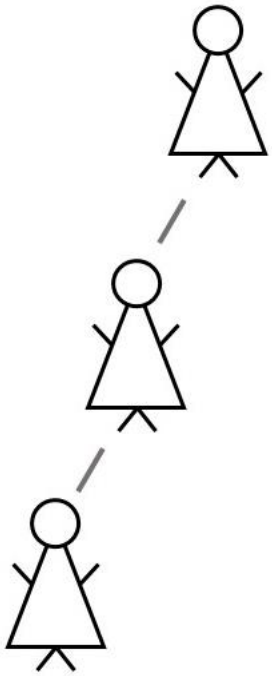

Figure 3. Example of 'family tree' schematic shown to participants in Experiment 2.

Family members were shown as line drawings to control for any perceptual features that children may have been relying on to make their judgments. The cross-classification items were identical to those used in Experiment 1 and were similarly presented. The cross-classification items for this experiment included 6 different pairs of social roles (see Table 2) divided into three different categories: two with hierarchical structure (e.g., family hierarchical, occupation hierarchical) and one without such structure (e.g., occupation non-hierarchical).

Table 2

Pairs of social roles presented (Experiment 2)

Category	**Pairs**
Familial Hierarchical	Mom – Daughter; Dad – Son
Occupation Hierarchical	Teacher – Student; Doctor – Patient
Occupation Non-hierarchical	Cook – Runner; Artist – Swimmer

Participants also completed a matching task where they were instructed to identify 4 images of different social roles (teacher, student, doctor, patient) from an array of 5 photos. For each item, participants were asked to point to a certain social role (ex: "Can you point to the teacher;" see Figure 5 for example of stimuli). A fifth social role (chef) was included as a lure to ensure that children's correct identifications were not simply a product of eliminating all other response options. After the matching task, cognitive flexibility was measured using the Dimensional Change Card Sort – border version (Frye, Zelazo, & Palfai, 1995; Zelazo, 2006). Non-verbal reasoning abilities were measured using the KBIT-2 Non-verbal reasoning subsection (Kaufman & Kaufman, 2004). See Appendix B for example protocol (excluding KBIT-2 section).

Procedure

To begin the experiment, the experimenter introduced the child to the family tree. The experimenter started at the bottom of the family tree and gave the following instructions: "First, I want to tell you about this picture. This person is her/his daughter/son. This person is her/his mom/dad. She/he is also this person's daughter/son. This person is her/his mom/dad." As the narrative progressed, the experimenter indicated the individuals they were referencing, so that children were able to keep track of which referent the experimenter was talking about. After this training, participants completed the cross-classification task as in Experiment 1. Following the cross-classification task, participants completed a matching task in which they were instructed to identify images of four different social roles (e.g., "Can you point to the picture of a teacher?"). Participants then completed the DCCS – border version, followed by the KBIT-2 Non-verbal reasoning subsection.

Results

Matching Task

To ensure that children were familiar with the social roles that we presented, we included a matching task where participants were instructed to identify the four occupation hierarchical social roles included in this experiment. For the matching task, participants were scored a 1 for responses that correctly matched a given social role label with the appropriate image, and a 0 for incorrect responses.

We used one-sample *t*-tests to compare participants responding on each matching task item to chance (chance = 20%). Younger children correctly identified the student (M = .83, SD = .38), teacher (M = .89, SD = .23), patient (M = .56, SD = .51), and doctor (M = .89, SD = .32) at levels significantly above chance, p's < .01. Older children correctly identified the all social roles on 100% of the trials, so *t*-tests were not calculated.

Social Role Cross-Classification Data

For each cross-classification trial, participants were scored a 1 for responding that an individual could hold both social roles and a 0 for saying they could not, resulting in a total composite cross-classification score that could range from 0-4 for each of the three item categories. Preliminary analyses revealed no main effects of order or gender, therefore we did not include these factors in subsequent analyses. We used a repeated measures ANOVA with Age Group (younger children and older children) as a between-subjects factor and Item Category (familial hierarchical, occupation hierarchical, and occupation non-hierarchical) as a within-subjects factor. Our analysis revealed no significant main effect of Age Group, $F(1, 33) = .02$, $p = .888$, $\eta_p^2 = .001$, or Item

Category, $F(2, 66) = 1.75$, $p = .182$, $\eta_p^2 = .05$. However, there was a significant interaction between Age Group and Item Category, $F(2, 66) = 5.02$, $p < .05$, $\eta_p^2 = .13$.

Bonferroni-corrected post-hoc tests revealed that younger children showed no differences in responses between the occupation hierarchical items ($M = 3.17$, $SD = 1.38$), occupation non-hierarchical items ($M = 2.94$, $SD = 1.39$), and familial hierarchical items ($M = 3.00$, $SD = 1.60$; see Figure 4). In contrast, older children cross-classified occupation non-hierarchical items ($M = 3.29$, $SD = 1.36$) and familial hierarchical items ($M = 3.18$, $SD = 1.13$) significantly more often than occupation hierarchical items ($M = 2.47$, $SD = .94$), *p's* $< .05$.

We also conducted one-sample *t*-tests to compare children's scores in each item category to chance (chance = 2). Younger children's scores were significantly greater than chance on the occupation hierarchical, $t(17) = 3.58$, $p < .01$, occupation non-hierarchical, $t(17) = 2.88$, $p < .01$, and familial hierarchical items, $t(17) = 2.64$, $p < .05$. Older children's scores were also significantly greater than chance on the occupation hierarchical, $t(16) = 2.06$, $p = .05$, occupation non-hierarchical, $t(16) = 3.93$, $p = .001$, and familial hierarchical items, $t(16) = 4.29$, $p = .001$.

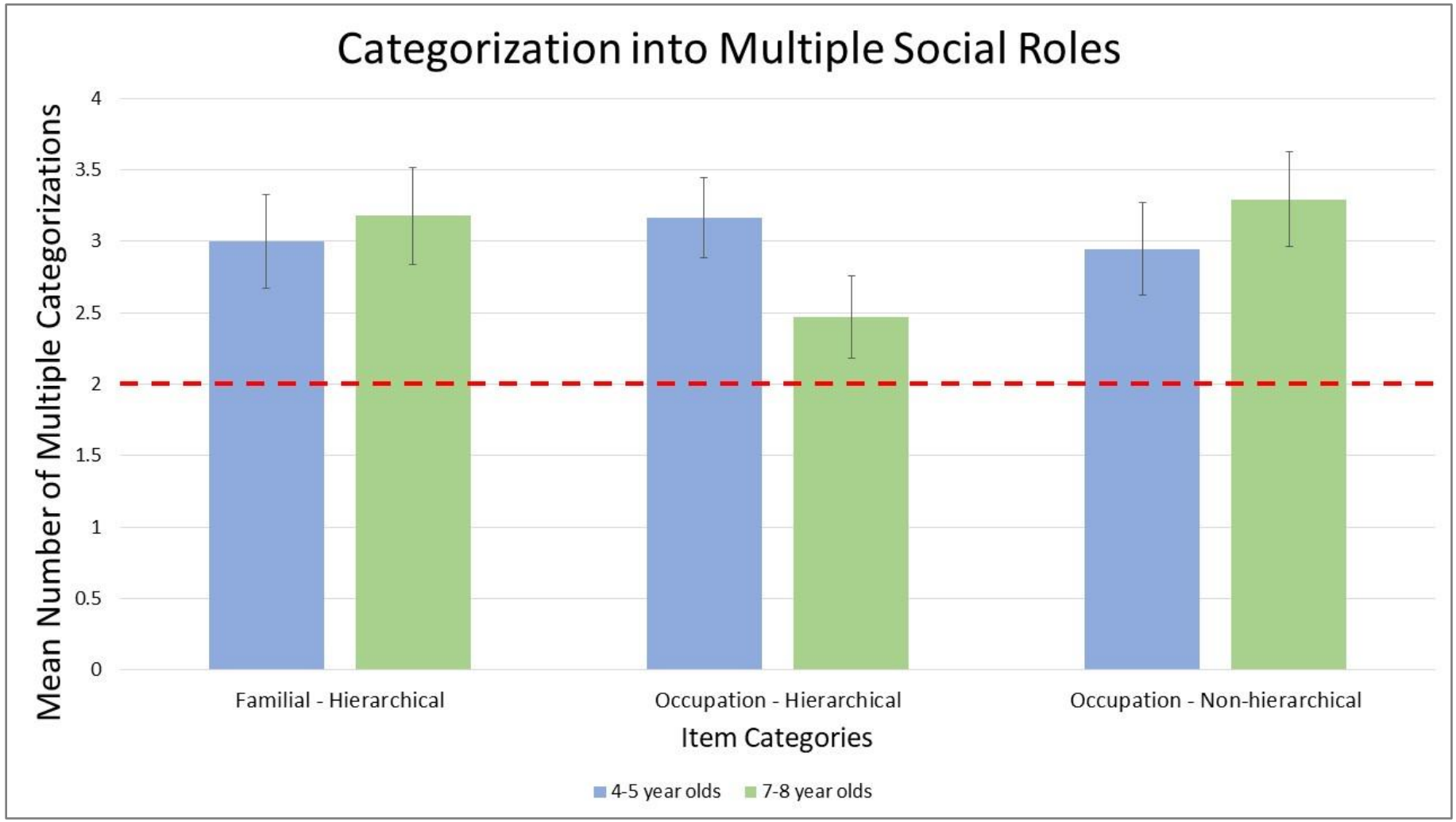

Figure 4. Mean number of cross-classifications for each Item Category by Age Group.

Relationship between Cognitive Competencies and Social Role Cross-Classification

There was a positive correlation between children's age and their DCCS score, r = .52, $p < .01$, as should be expected given children's increasing cognitive flexibility over the preschool and early elementary years (see Table 3). Using multiple regression, we tested a model that assumed all three of our variables of interest – age (in years), cognitive flexibility (DCCS), and non-verbal reasoning (KBIT-2) – predict children's overall performance on cross-classification trials. Note that the Variance Inflation Factor (VIF) and Tolerance values for this model indicated that multicollinearity was not a problem for interpreting these data. This "full" model did not produce a significant regression equation, $R^2 = .03$, $F(3, 31) = .30$, $p = .83$ (see Table 4). Further, none of our variables of interest contributed significantly to the model. Note that a larger sample size may have increased our ability to detect significant relationships between variables. However, the reported model does not approach significance and a feature of our manipulation is that it reduced variability. Thus, we concluded that these factors did not meaningfully predict variability in children's cross-classification behaviors.

Table 3

Mean DCCS and Non-verbal Ability Scores by Age Group

	4- to 5-year-olds *M, SD*	7- to 8-year-olds *M, SD*
Dimensional Change Card Sort – Border Version (DCCS)	14.28, 5.99	18.72, 5.06
KBIT-2 Standardized Score	101.67, 11.41	101.20, 15.81

Table 4

Summary of Regression Analysis for Variables Predicting Cross-classification Behaviors

	B	*SEB*	*β*	*t*	*p*
Exact Age	.02	.44	.01	.05	.960
DCCS Score	.05	.13	.09	.41	.682
KBIT-2 Standardized Score	.03	.05	.12	.65	.519

$R^2 = .03$, $F(3, 34) = .30$, $p = .825$

Comparison of Results across Experiments 1 and 2

To more directly examine the effects that the scaffolding in Experiment 2 had on children's cross-classification behaviors, we compared children's scores on the cross-classification task across Experiments 1 and 2. We used a repeated measures ANOVA with Age Group (younger children and older children) and Experiment (Experiment 1 and Experiment 2) as between-subjects factors and Item Category (familial hierarchical, occupation hierarchical, and occupation non-hierarchical) as a within-subjects factor. Because the assumption of sphericity was violated, Greenhouse-Geisser estimates are reported where appropriate. Our analysis revealed no significant main effect of Experiment, $F(1, 94) = 1.29$, $p = .26$, a marginally significant main effect of Age Group, $F(1, 94) = 3.12$, $p = .08$, $\eta_p^2 = .05$, and a significant main effect of Item Category, $F(1.832, 172.230) = 8.90$, $p < .001$, $\eta_p^2 = .09$. Significant interactions between Age Group and Item Category, $F(1.832, 172.230) = 6.00$, $p < .01$, $\eta_p^2 = .06$, and Age Group and Experiment, $F(1, 94) = 3.89$, $p = .05$, $\eta_p^2 = .04$, were also detected, all embedded within a significant three-way interaction between Item Category, Age Group, and Experiment, $F(1.832, 172.230) = 3.40$, $p < .05$, $\eta_p^2 = .04$ (see Figure 5).

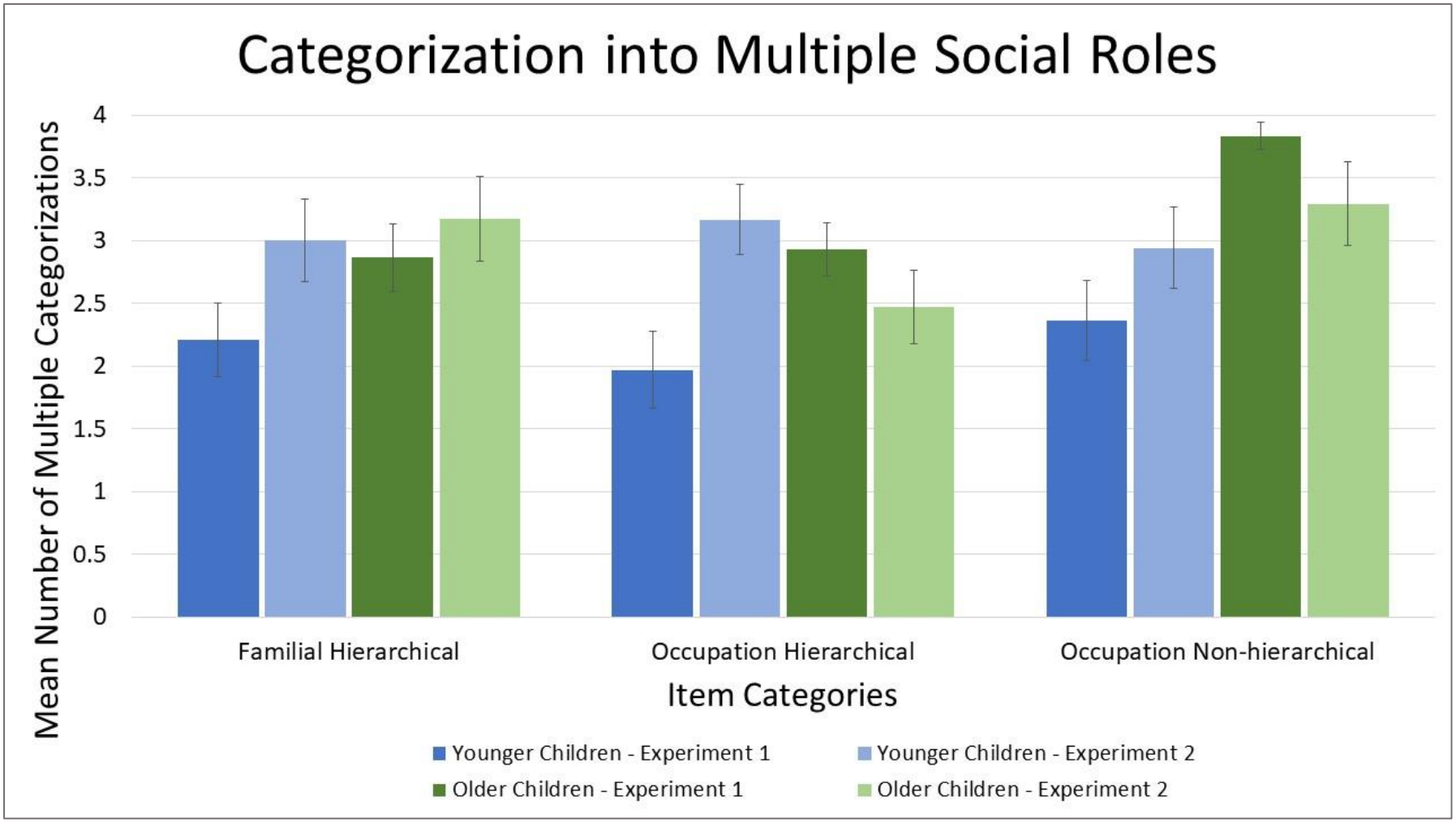

Figure 5. Mean number of cross-classifications for each Item Category by Age Group and Experiment.

Bonferroni-corrected planned comparisons comparing each age group's performance between experiments revealed that there were no significant differences in older children's responding across item categories in Experiment 1 and Experiment 2. However, younger children had significantly higher scores on the occupation hierarchical items in Experiment 2 than in Experiment 1, $p < .01$, $d = .75$. Younger children's scores on the familial hierarchical items were also trending towards being significantly higher in Experiment 2 than Experiment 1, $p = .08$, $d = .61$. Younger children's scores on the occupation non-hierarchical items did not differ between Experiment 1 and Experiment 2.

Discussion

Social role cross-classification. The first goal of this experiment was to determine whether a training session aimed at reducing cognitive load by highlighting hierarchical family structure would influence children's willingness to cross-classify individuals in social roles with such structure. Overall, there were no significant differences in younger and older children's willingness to classify individuals as holding multiple social roles. However, for the older children in this experiment, there were differences in responding based on the structure of the social role in question. Older children cross-classified occupation non-hierarchical and familial hierarchical items significantly more often than occupation hierarchical items. When participants were provided with this scaffolding, there were no longer differences between age groups (as seen in Experiment 1) and responding in both age groups was above chance for all items.

Taken together, the results of the cross-classification task in this experiment suggest that the scaffolding that the family tree schematic and training provided may have reduced the cognitive load on children, thus increasing their cross-classifications in

the familial hierarchical category. Although the younger children seemed to show domain general increases in cross-classification behaviors (i.e., their cross-classifications did not differ across item types), the training seemed to provide only domain specific improvements for the older children. For the older children, scaffolding increased cross-classification rates for the familial hierarchical items to be similar to the rates for the occupational non-hierarchical items. However, this was not the case for the occupation hierarchical items, indicating that this training did not extend to hierarchical relationships in general.

Relationship between cognitive competencies and social role cross-classification. The second aim of this experiment was to examine the relationship between children's cognitive competencies and their cross-classification behaviors in a social domain. The results indicate that neither cognitive flexibility nor non-verbal reasoning predicted children's cross-classification behaviors in a social domain. Although the results also suggest that age, cognitive flexibility, and non-verbal reasoning did not predict cross-classification behaviors, we believe these results should be interpreted cautiously. Because we attempted to scaffold children in this experiment to perform cross-classifications at higher rates, it could be the case that our manipulation removed some of the individual differences in cross-classification behaviors between age groups. The results of the current study suggest that holding multiple representations in their heads may decrease children's willingness to cross-classify individuals.

Cross-experiment comparison. To more directly examine the effect that the scaffolding in Experiment 2 had on children's cross-classification behaviors, we compared cross-classification data between Experiments 1 and 2. Note that this

comparison is somewhat imperfect due to the differences between the two experiments; however, for exploratory purposes we believe this analysis to be particularly valuable. Our results indicated that older children's scores were not affected by the scaffolding in Experiment 2, but younger children's scores were affected. The younger children cross-classified individuals in the occupation hierarchical category significantly more often in Experiment 2 than in Experiment 1, suggesting that the scaffolding provided offset some of the children's cognitive load limitations and led to an increase in the cross-classifications made for these items. Although the scaffolding children received was in a familial domain, on the familial hierarchical items, younger children were only trending towards cross-classifying significantly more often in Experiment 2 versus Experiment 1. It could be that case that since younger children already had a higher number of cross-classifications on the familial hierarchical as compared to the occupation hierarchical items in Experiment 1, there was less room for them to improve in Experiment 2. Given that there were no differences in older children's cross-classification rates between Experiments 1 and 2 and that responses were significantly higher than chance rates across item categories in Experiment 2, it seems that older children's willingness to cross-classify individuals was not limited by cognitive load. However, cross-experiment comparisons suggest that younger children's willingness to cross-classify individuals may be increased by providing them with scaffolding that offsets some of the representational work they would otherwise have to do from memory.

Limitations and Future Directions

In this experiment, we were interested in how reducing cognitive load would influence children's subsequent cross-classification behaviors. We were also interested

in whether cognitive flexibility and nonverbal reasoning abilities predicted children's willingness to classify individuals as holding multiple social roles. A general limitation of this experiment is that since we provided a training aimed at increasing children's cross-classification scores, we may have inadvertently eliminated some of the natural variance in these behaviors. So, although we found no relationship between the cognitive competencies we tested and children's willingness to classify individuals as holding multiple social roles, it is possible that this relationship exists when children are not given training prior to completing this cross-classification task. In future studies, it will be important to test these cognitive competencies without any sort of training in order to gather a baseline for how these underlying mechanisms may relate to children's more naturalistic cross-classification behaviors.

In our exploration of possible cognitive competencies that may predict children's cross-classification behaviors, we chose to include cognitive flexibility and non-verbal reasoning as measures of individual differences. Although neither of these cognitive competencies predicted children's willingness to cross-classify individuals, there could be other mechanisms at play that predict children's cross-classification behaviors. In future studies, it will be important to examine additional cognitive competencies (e.g., theory of mind, inhibitory control, executive function), to better understand what cognitive mechanisms may underlie children's development of adult-like cross-classification behaviors.

CHAPTER IV

EXPERIMENT 3 – CHILDREN'S INFERENCES ABOUT CROSS-CLASSIFIED INDIVIDUALS

Introduction

Categorization allows people to divide the world into meaningful units and is essential to making sense of the environment. Induction allows people to use category information to make educated guesses about new or unfamiliar entities (Markman, 1989; Rips, 1975). Inductive inferences rely on the use of known categories and allow an individual to hypothesize beyond the information that is currently available (Gelman, 1988). For example, if children know that birds can fly, they may assume that a new, unfamiliar bird they encounter would be able to do the same (Gelman & Markman, 1986). Children are able to use categories to make inferences (Gelman & Markman, 1986) and have shown some ability to cross-classify entities (e.g., Nguyen, 2007; 2012; Nguyen & Murphy, 2003). However, when making inferences about items that belong to multiple categories, they face the added obstacle of deciding which category they should employ to make these inferences. Category-based induction allows individuals to make inferences about unfamiliar situations (Gelman, 1988), including what to expect and how to behave in different social situations (Rhodes, 2013). Induction serves critical functions in development, both in guiding social interactions (Nguyen & Chevalier, 2015), and in reasoning about others (Shutts et al., 2013).

Although adults understand that people and objects belong to many different categories, when reasoning about individuals who are members of multiple social categories, adults often use only one of the known categories to make inferences about that individual. Studies have suggested that in order to simplify thinking, adults often focus on the most 'distinctive' social role held by an individual when making inferences (e.g., 'skydiver' may be more distinctive than 'tennis player;' Macrae, Bodenhausen, & Milne, 1995; Nelson & Miller, 1995). Although some studies have shown that adults will consider multiple categories when making inferences about cross-classified entities, this seems only to be the case when the context of the questions they are being asked refers to both categories (Murphy & Ross, 1999). Indeed, without such context, adults tend to use inductive selectivity, and base their inferences off one category, rather than taking all category memberships into account. Inductive selectivity refers to the ability to make inferences using individual category memberships of cross-classified entities (Nguyen & Girgis, 2014).

In a study examining children's induction regarding cross-classified entities, Nguyen and Murphy (2003) investigated children's use of taxonomic, script, and evaluative categories when making inferences in a food domain. In their fourth experiment, they explored what categories 4-year-olds, 7-year-olds, and adults used when making biochemical (e.g., chemical make-up of food) versus situational (e.g., what setting food is eaten in) inferences. They found that while adults exhibited inductive selectivity, using taxonomic and evaluative categories to make biochemical inferences and script categories to make situational inferences, children made similar numbers of biochemical and situational inferences across all three category types. In a follow-up

experiment examining only taxonomic and script categories, 7-year-old children exhibited the adult-like inductive selectivity demonstrated in the previous experiment. Although 4-year-olds showed significant differences in their use of taxonomic categories to make biochemical inferences and script categories to make situational inferences, they did not use taxonomic categories to make biochemical inferences at levels above chance, indicating that their use of inductive selectivity is still developing. Although children as young as age four have been found to make some use of inductive selectivity when making inferences, this skill is still developing over the early elementary years (Kalish & Gelman, 1992; Nguyen, 2012; Nguyen & Murphy, 2003).

Social categorization may be particularly important for induction, because the ability to organize individuals into different social categories, or distinct social groups (Diesendruck & Eldror, 2011), allows individuals to make inferences about novel situations and to predict outcomes (Rhodes, 2013). Previous research suggested that when reasoning about social categories, children focus on physical and behavioral properties (Aboud, 1984; Watson, 1984). Kalish and Lawson (2008) asked participants to make category membership judgments based on either frequency (e.g., how often someone does something), psychological (e.g., what someone likes to do), or deontic (e.g., what someone must do) information. They found that younger children (4- to 5-years-old), older children (7- to 8-years-old), and adults used deontic properties most often when making social categorizations in non-personality categories, with younger children showing the most reliable use of deontic properties. However, older children also relied on deontic properties to make categorizations in personality categories (or those with central psychological properties).

In a follow-up experiment, Kalish and Lawson (2008) examined whether participants would make inferences about behaviors based on deontic or psychological properties, and found that younger children, older children, and adults viewed deontic properties as the most reliable information to use when making inferences about behavior. In a third experiment, Kalish and Lawson (2008) investigated whether participants believed individuals who had the same deontic properties or preferences would be members of the same social categories. Similar to their first two experiments, they found that young children saw deontic properties as more reliable than preferences when making inferences about category membership. However, older children showed more mixed responding, inferring category membership similarly from deontic properties and preferences. In contrast to previous claims (Aboud, 1984; Watson; 1984), the results from this set of studies suggest that young children make use of deontic properties when reasoning about category membership.

Understanding the social roles that a given person may hold is a necessary prerequisite to interacting appropriately with, and accurately anticipating the behavior of, others (Rhodes & Gelman, 2008). However, it may be difficult for children to make inferences about individuals who hold multiple social roles (i.e., cross-classified individuals), because they need to mentally represent two roles simultaneously. Further, Experiments 1 and 2 of the current set of studies indicated that children may have difficulty reasoning about cross-classified individuals when they hold roles that are embedded within a hierarchical social role. Because children rely heavily on categorization to understand and respond appropriately to an individual's roles (Rhodes & Brickman, 2010; Kalish & Lawson, 2008), it is important that children are able to

accurately use these social categories to make inferences. The current experiment is intended to determine how cross-classification influences children's inferences. Specifically, do children privilege certain social roles when making inferences about the deontic properties of a person that holds multiple, sometimes conflicting, social roles?

Methods

Participants

Participants in this experiment included 35 4- to 5-year-old children (M_{age} = 4.93, *SD* = .50, females = 17) and 35 7- to 8-year-old children (M_{age} = 8.06, *SD* = .54, females = 19). Ninety-one percent of the children in this experiment were Caucasian, 2% were Asian, and 3% were mixed race (parents of the remaining 4% did not provide a response). An additional 10 children were interviewed, but their data were excluded from analyses due to experimenter error (*N* = 3), parental interference (*N* = 2), computer malfunction (*N* = 2), and inability to follow task instructions (*N* = 1). Thirty-four of the participants from Experiment 3 also participated in Experiment 4.

Materials

The materials for this experiment were made up of two sets of three identical line drawings (see Figure 6). Identical line drawings were used to control for any differences that may be assumed based on the appearance of the stimuli. These line drawings were intentionally schematic and lacking detail so that children could not use perceptual features irrelevant to the task to guide their responses during testing. The gender of the line drawings was matched to the item type (e.g., female for mom and daughter, male for dad and son). All images were presented on a laptop, using presentation software.

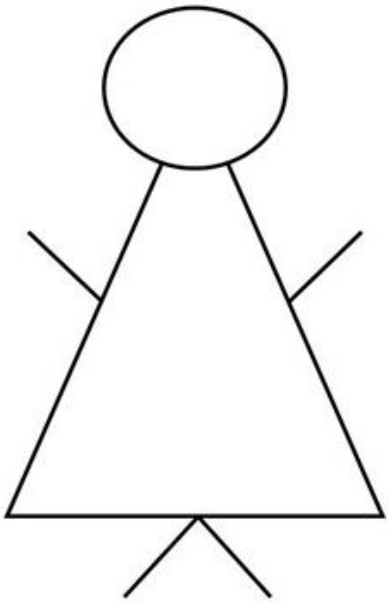

Figure 6. Example of stimuli shown to participants in Experiment 3.

Participants were asked to make inferences for two pairs of social roles, mom vs. daughter and dad vs. son, for a total of 6 items (see Appendix C). For both pairs of social roles, each social role was presented singly and cross-classified (e.g., mom, daughter, mom-daughter). Inferences about deontic properties were examined by asking about whether people "have to listen" to a given individual. Trials were blocked so that participants always made their inferences about both singly classified individuals in a pair before making inferences about the cross-classified individual. The order of the blocking was counterbalanced across participants.

Procedure

The experimenter and the child sat side-by-side at a table with a laptop in front of them. Participants heard the following directions; "Today I am going to ask you some

different questions. You can tell me, in your own words, what you think the answer is." For the test items, participants were shown an image and given social role information about the individual presented on the screen. While the experimenter gave the participant information, she pointed to the image of the person being referenced. For example, items were presented as follows; "This person is a mom (experimenter pointed to line drawing on screen). Do people have to listen to her?" This procedure was the same for both pairs of social roles, except that the pronoun matched the role of the line drawing in the image. Participants then responded verbally. Participant responses were recorded, transcribed, and then coded by two independent coders.

Results

Two independent coders coded children's responses and any disagreement was solved by a third independent coder. Coders agreed on 414/420 responses, $\kappa = .97$, 95% CI (0.52, 1.42). Participants' responses to the question of whether they had to listen to a given individual were coded into three primary categories: (a) yes responses, (b) no responses, and (c) unsure responses (e.g., 'I don't know,' 'maybe,' 'sometimes;' see Table 5).

Table 5

Percentage of Responses by Age Group

Item Type	Age Group	Yes	No	Unsure
Mom	Younger Children	97.1	2.9	0.0
	Older Children	91.4	2.9	5.7
Dad	Younger Children	88.6	11.4	0.0
	Older Children	85.7	5.7	8.6
Daughter	Younger Children	40.0	51.4	8.6
	Older Children	2.9	82.9	14.3
Son	Younger Children	45.7	51.4	2.9
	Older Children	2.9	82.9	14.3
Mom-Daughter	Younger Children	80.0	11.4	8.6
	Older Children	62.9	5.7	31.4
Dad-Son	Younger Children	80.0	11.4	8.6
	Older Children	62.9	2.9	34.3

Fisher's exact tests indicated that participants responses on the daughter, $\chi^2(2, N = 70) = 15.27$, $p < .05$, mom-daughter, $\chi^2(2, N = 70) = 5.89$, $p = .05$, son, $\chi^2(2, N = 70) = 19.65$, $p < .05$, and dad-son $\chi^2(2, N = 70) = 7.76$, $p < .05$, items were significantly related to age group (see Figure 7). There was no significant relationship between responses and age group for the mom, $\chi^2(2, N = 70) = 1.93$, $p = .743$, and dad, $\chi^2(2, N = 70) = 3.28$, $p = .242$, items.

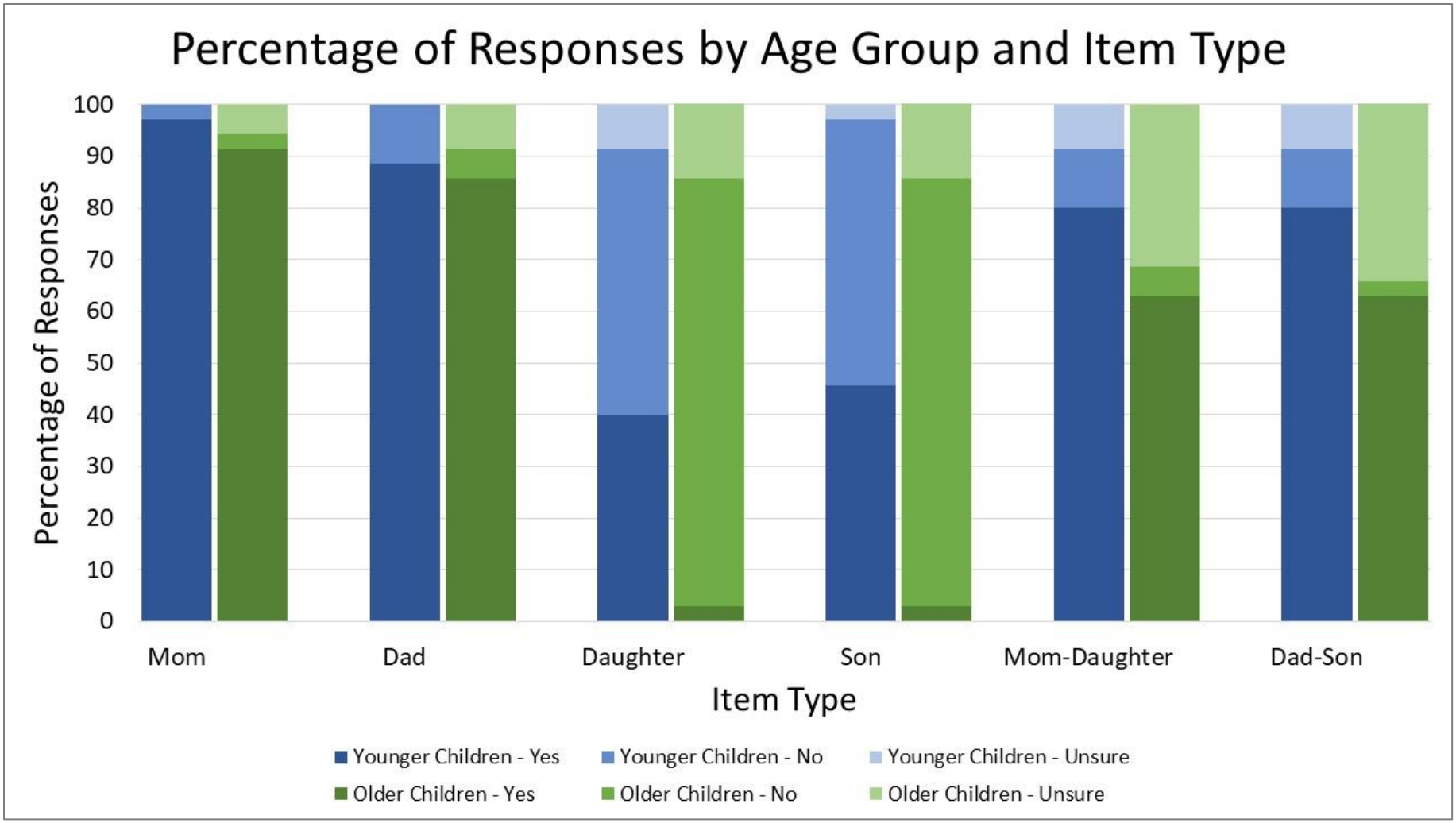

Figure 7. Percentage of responses by Age Group and Item Type.

Discussion

The goal of this experiment was to examine which social roles children make use of when making inferences about deontic properties. Specifically, we were interested in which social roles children would use to make inferences when social roles crossed hierarchical boundaries. Based on children's reluctance to cross-classify individuals in Experiment 1, it seemed likely that the subordinate hierarchical role (e.g., son) would undermine the inductive potential of the dominant role (e.g., dad). Indeed, in the current experiment we found that there were different response patterns between age groups for the different social roles being probed.

Children's responses to the mom and dad items were the most straightforward, indicating that across both age groups, the majority of both younger and older children believed that people had to listen to these individuals. However, children's responses to both the subordinate and cross-classified individuals was more varied. While the majority of older children indicated that people did not have to listen to a daughter or son, younger children's responses were almost equally distributed between 'yes' and 'no' responses. Interestingly, on the mom-daughter and dad-son items, the majority of younger children indicated that people do have to listen to these individuals, while older children's responses were distributed between 'yes' and 'unsure' responses (see Figure 9).

Taken together, these findings suggest a shift in children's reasoning about the deontic properties that hierarchical social roles indicate. Indeed, when presented with cross-classified items (e.g., mom-daughter and dad-son), the majority of younger children (80%) indicated that people had to listen to these individuals, suggesting that the

subordinate role in the pair (e.g., daughter or son) did not dilute to relevant deontic properties of the dominant role in the pair (e.g., mom or dad). The only items where younger children showed mixed patterns of responding were on the subordinate social role items (e.g., daughter or son), where about half of the children indicated that people had to listen to these individuals (40% and 45.7% respectively) and about half of the children indicated that people did not need to listen to these individuals (51.4%). The majority of older children indicated that people did not need to listen individuals who only held a subordinate role (82.9%). When presented with cross-classified items, older children also showed a different pattern of responding than the younger children. On both the mom-daughter and dad-son items, 62.9% of the older children indicated that people did need to listen to these individuals, and about 30% gave responses indicating that they were unsure about whether people needed to listen to these individuals. In contrast, 80% of the younger children indicated that people did need to listen to these individuals.

These results suggest that there is a shift in the way children make inferences about cross-classified individuals. Although more younger children were inclined to believe that people had to listen to any individual who held a dominant role (even if they also held a subordinate role), they showed more mixed responding to those who held only subordinate social roles. In contrast, older children showed a clear pattern of responding when asked about subordinate roles, indicating that people did not have to listen to these individuals. Thus, older children's mix of yes and unsure responses on the cross-classified items may indicate that the relative deontic properties of an individual who

holds a dominant role can be diluted by simultaneously holding a subordinate role within the familial hierarchical domain.

Limitations and Future Directions

One limitation of the current experiment is that due to the exploratory nature of this experiment, our questions were necessarily broad. To gather a baseline for how children reasoned about the deontic properties of cross-classified individuals, we elected to present them with a general question about whether they had to listen to a given individual. It is likely the case that children reason differently about whether people have to listen to certain individuals depending on the situation. It could be the case that children show more or less inclination to listen to individuals with certain social roles when the nature of what they are listening to is important (e.g., following directions about how to play a game versus following directions about how to use household appliances). In future studies, it will be important to examine how children's reasoning differs when making inferences in specific contexts.

Another limitation of the current experiment is that we only included social roles within a familial hierarchical domain. For the purposes of this exploratory experiment, we wanted to use social roles that we felt sure the young children in our sample would have been familiar with. Although there were differences in response patterns between age groups within familial hierarchical social roles, it would be interesting to see if this pattern of responses extended to occupational hierarchical social roles and how children's responses to such items might differ. Examining how children make inferences about individuals holding social roles in different domains would be an informative area of future study.

CHAPTER V

EXPERIMENT 4 – CHILDREN'S REASONING ABOUT THE TESTIMONY OF CROSS-CLASSIFIED INDIVIDUALS

Introduction

One area in which understanding of social categories may influence children's reasoning is in their trust of informants. Children's lack of direct access to information (Harris, 2012) results in much of their knowledge being received from others (Csibra & Gergely, 2009). When evaluating information from other sources, children consider various factors. Jaswal and Neely (2006) found that in the absence of any conflicting information, both 3- and 4-year-olds preferred object labels provided by an adult over those provided by a child, indicating that preschoolers believe adults are better sources of information about the names of objects. Children also make use of informant accuracy and reliability when deciding whom to trust (e.g., Koenig & Harris, 2005; Pasquini, Corriveau, Koenig, & Harris, 2007). In the current experiment, we will employ methodologies from the selective trust literature to provide converging evidence about the development of cross-classification in children and how children reason about the testimony of cross-classified individuals. Specifically, we were interested in whether presenting a cross-classified individual within a hierarchical category enhances, dilutes, or has no effect on children's reasoning about that individual's knowledge status.

Koenig and Harris (2005) found that when children were presented with

individuals who were knowledgeable versus ignorant about the names of various objects, both 3- and 4-year-old children were able to distinguish between the two types of informants. Further, 4-year-olds endorsed the claims of knowledgeable informants rather than ignorant informants. In a subsequent study, Koenig and Harris (2005) found that both 3- and 4-year-old children extended their preferences for knowledgeable informants beyond the domain that that person had previously given accurate information in. Similarly, Pasquini and colleagues (2007) also found that 3- and 4-year-old children were able to identify inaccurate informants and use that information when deciding who to trust, suggesting that children consider the relative accuracy of an informant when making decisions about who is a trustworthy source of information. More generally, Lane, Wellman, and Gelman (2013) found that children as young as 3-years-old endorse the testimony of informants they believe are smart over those they believe are not smart.

Similar research has also found that children are sensitive to an informant's area of expertise when evaluating claims (e.g., Danovitch & Keil, 2004; Lane, Wellman, & Gelman, 2013; Lutz & Keil, 2002). Lutz and Keil (2002) presented 3-, 4-, and 5-year-olds with informants that had differing areas of expertise (e.g., a doctor and a mechanic) and asked children which informant they believed would have more information on varying topics. They found that children of all ages were able to correctly attribute relevant knowledge to familiar occupations (e.g., a doctor knows more about how to fix broken bones than a mechanic), suggesting that they recognize that certain individuals have areas of expertise. Studies have also found that while children may recognize that informants have different areas of expertise, it may be difficult for them to use this information when evaluating testimony. Landrum, Mills, and Johnston (2013) examined

whether children endorse novel object names based on an informant's expertise and found that both 4- and 5-year-old children used expertise to choose which informant's testimony was accurate. However, children were generally more accurate at attributing knowledge to an individual than using knowledge evaluations when endorsing an expert's claim.

Given that children take into account relevant information, such as expertise and knowledge (e.g., Lutz & Keil, 2002), accuracy (e.g., Koenig & Harris, 2005), and age (Jaswal & Neely, 2006) when choosing who to trust, we were interested in how children reason about the testimony of individuals who hold multiple social roles. Experiment 4 examines how children reason about the testimony of four pairs of informants: a teacher vs. a student, a teacher-student vs. a teacher, a teacher-cook vs. a teacher, and a teacher-student vs. a teacher-cook. For each pair of informants, children heard each informant name an unknown object inside a box, and then they were asked which informant they believe named the object correctly. Children were also asked which informant in each pair was a better teacher as a measure of relative knowledge status.

There are several different effects that cross-classification might have on children's selective trust. First, it could be the case that children's reluctance to classify an individual as holding multiple social roles within categories with hierarchical structure may lead them to trust cross-classified informants less than singly classified informants. In this case, the subordinate role (e.g., student) may dilute the dominant role (e.g., teacher). The items that compare the two cross-classified individuals (teacher-cook vs. teacher-student), provide us with a measure of relative dilution. Since both the informants in these items hold multiple social roles, participants responses will indicate

which role dilutes the role of teacher more, the one within the same domain (e.g., student) or the one within a different domain (e.g., cook). It seems likely that holding a role subordinate to teacher (e.g., student) would undermine the role of teacher more than holding an additional unrelated social role (e.g., cook), and thus make the former informant's testimony less trustworthy. A second outcome is that having any two social roles may indicate a wider knowledge base and enhance the role of teacher, thus making the cross-classified informant's testimony more trustworthy. However, it is also possible that this enhancement will only occur when the two social roles are in unrelated domains (e.g., teacher-cook). A third option is that holding two social roles does not enhance or dilute the role of teacher either. Children's reluctance to cross-classify individuals into hierarchical social roles may make it difficult for them to reason about these individuals, resulting in random responding.

Methods

Participants

Participants in this experiment included 35 4- to 5-year-old children (M_{age} = 5.03, *SD* = .50, females = 17) and 35 7- to 8-year-old children (M_{age} = 8.06, *SD* = .54, females = 19) experiment. Ninety percent of the children in this experiment were Caucasian, 1% were African American, and 3% were mixed race (parents of the remaining 6% did not provide a response). An additional 6 children were interviewed, but their data were excluded from analyses due to computer malfunction (*N* = 2), and inability to follow task instructions (*N* = 4). Thirty-four of the participants from Experiment 4 also participated in Experiment 3.

Materials

The materials for this experiment included twelve video clips of women naming a hidden object. Participants were initially shown a still image of an opaque box and told that they would be guessing what was inside the box. In each trial, videos of two women were shown side-by-side with the image of an opaque box in between them (see Figure 8). Four different pairs of informants appeared in the videos, each appearing in three trials. The four different pairs of informants included a person who was a teacher-student vs. a teacher, a teacher-cook vs. a teacher, a teacher-student vs. a teacher-cook, and a teacher vs. a student. Each video depicted two females introducing themselves and then looking into a box and providing a novel name for the hidden object inside. Novel names were selected from the Novel Object and Unusual Name Database 2nd Edition (Horst & Hout, 2014) to ensure that familiarity with labels did not influence children's responses. The positioning of informants was counterbalanced across participants so that, for each pair of informants, both women were shown equally often on either side of the box. Social roles were also counterbalanced across participants so that each informant introduced themselves as a one informant in the pair for half the participants and the other informant in the pair for the other half of the participants to ensure that participants were not just favoring one of the informants or one of the labels.

Figure 8. Still image of a test trial presented to children in Experiment 4.

Procedure

The twelve video clips were presented in blocks of three and each block included three items probing the same pair of social roles. For each test item, participants watched a video and then answered follow-up questions. In each video clip, participants watched two informants introduce themselves (e.g., "Hi, I'm a teacher and a student"). For the first test item in each block participants were asked to identify which person held which social role (e.g., "Can you point to the person who is both a teacher and a student?").

These questions were included as a check to make sure that participants remembered which informant held which social role(s). Participants then began the test trials for each block. Each test trial included a video of two informants naming the item inside the box. For example, one of the women in the video said, "There's a flurp in the box," and the other woman said, "There's a naze in the box." Participants were then asked to point to the person who got it right. The procedure was the same for all twelve test items, with the first item in each block including check questions about which informant held which social role. At the end of each block, participants were asked, "Is one of these people a better teacher or are they the same?" If participants responded that one of the informants was a better teacher there was a follow-up question probing whether they believed that individual was a little bit better or a lot better. See Appendix D for example protocol.

Results

Testimony Data

Scores on the testimony trials were calculated as a function of dilution. For the six items that included one cross-classified informant and one singly classified informant (e.g., teacher-student vs. teacher; teacher-cook vs. teacher), participants were scored a 1 for responses based on the informant who held only one social role, and a 0 for responses based on the informant who held two social roles. Higher scores on these items would reflect endorsing the testimony of the singly classified teacher and lower scores would reflect endorsing the testimony of the teacher-student or teacher-cook. For the three items that included both cross-classified informants (e.g., teacher-student vs. teacher-cook), participants were scored a 1 for responses based on the informant who held unrelated social roles (e.g., teacher-cook), and a 0 for responses based on the informant

who held related social roles (e.g., teacher-student). On these items, higher scores would indicate endorsing the testimony of the teacher-cook informant and lower scores would indicate endorsing the testimony of the teacher-student informant. For the three items that included only singly classified informants (e.g., teacher vs. student), participants were scored a 1 for responses based on the informant who held a dominant role (e.g., teacher) and a 0 for responses based on the informant who held a subordinate role (e.g., student), so that higher scores would indicate endorsing the teacher's testimony and lower scores would indicate endorsing the student's testimony. Each of the four pairs of informants yielded a total composite score that could range from 0 to 3.

High composite scores on these items reflect a tendency for children to trust individuals with a single dominant role over individuals with either a subordinate role or a cross-classification, and to trust individuals cross-classified with non-hierarchical social roles over those holding roles that are hierarchically related. Thus, high scores on the composite generally indicate that cross-classification dilutes trust, especially when the two roles are hierarchically related. Low scores would indicate that cross-classification enhances trust, and intermediate scores would indicate that cross-classification does not strongly influence children's selective trust in informants (see Table 6).

Table 6

Mean Scores on Testimony Trials by Informant Pair and Age Group

	4- to 5-year-olds *M, SD*	7- to 8-year-olds *M, SD*
Teacher vs. Student	1.43, .98	1.77, .88
Teacher vs. Teacher-Student	1.54, .92	1.49, .82
Teacher vs. Teacher-Cook	1.43, .85	1.60, .85
Teacher-Student vs. Teacher-Cook	1.40, .98	1.40, .85

Preliminary analyses revealed no significant main effects of order or gender, so subsequent analyses collapsed across these factors. We used a repeated measures ANOVA with Age Group (younger children and older children) as a between-subjects factor and Informant Pair (teacher-student vs. teacher, teacher-cook vs. teacher, teacher-student vs. teacher-cook, teacher vs. student) as a within-subjects factor. We found no significant main effect of Age Group, $F(1, 68) = .71$, $p = .401$, $\eta_p^2 = .01$, or Informant Pair, $F(3, 204) = .75$, $p = .526$, $\eta_p^2 = .01$, nor a significant interaction between Age Group and Informant Pair, $F(3, 204) = .91$, $p < .44$, $\eta_p^2 = .01$ (see Figure 9).

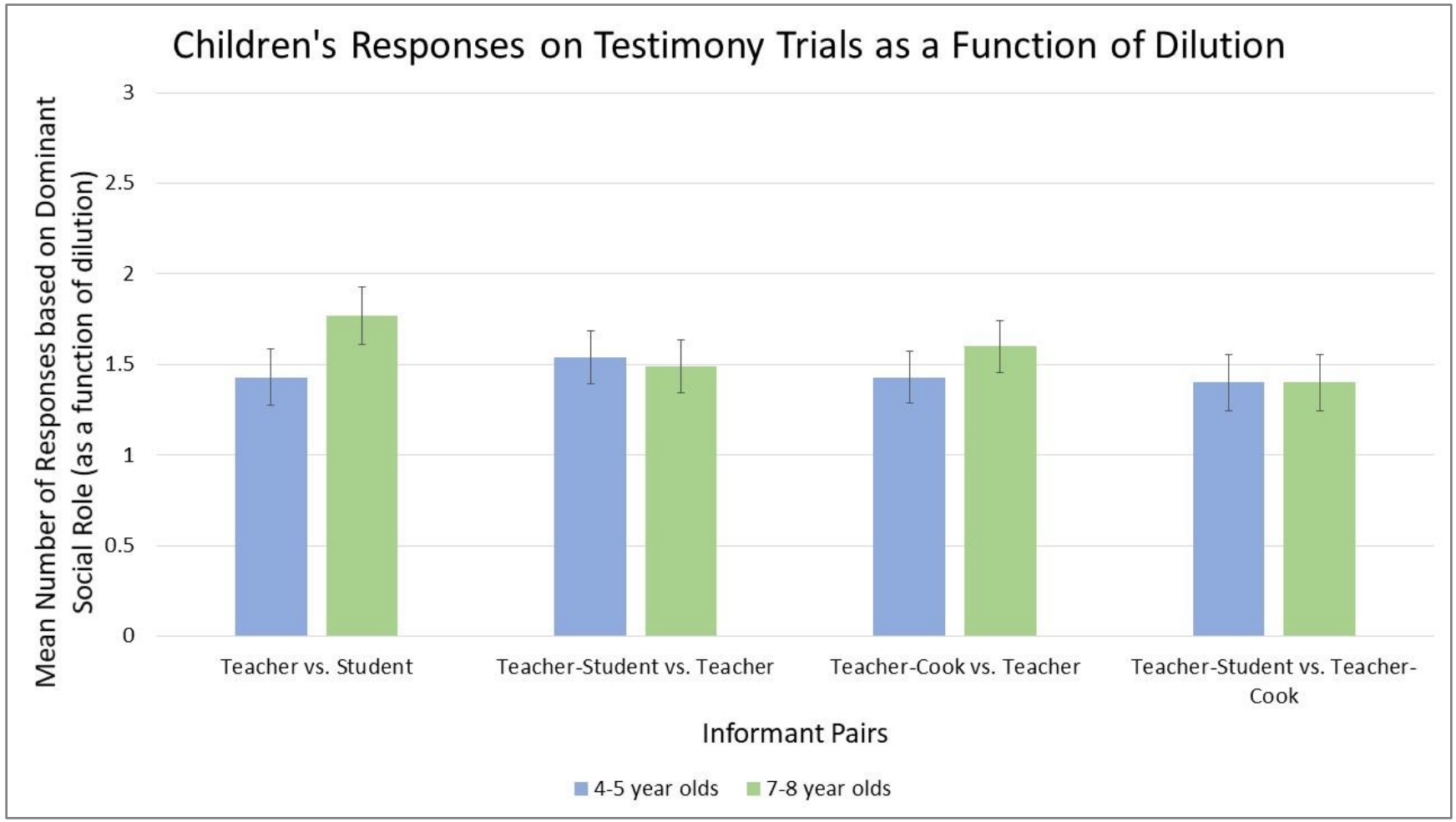

Figure 9. Mean number of responses by Age Group and Informant Pair.

Knowledge Attribution Data

Across all informant pairs, responses indicating that neither informant was a better teacher (i.e., they were the same) were scored a 0. If participants indicated that one informant was a better teacher, they were then asked a follow-up question probing whether they believed that informant was 'a little bit better' or 'a lot better.' Responses indicating informants holding the roles teacher (as compared to student, teacher-student, and teacher-cook) and teacher and cook (as compared to teacher-student) were better teachers, received positive scores. For example, responses indicating that these informants were 'a little bit better' were scored a 1 and responses indicating that these informants were 'a lot better' were scored a 2. Conversely, responses indicating that the student, teacher-student, or teacher-cook was a better teacher (as compared to the teacher) or that the teacher-student was a better teacher (as compared to the teacher-cook), were scored as negative numbers. So, responses indicating that these informants were 'a little bit better' were scored a -1 and responses indicating that these informants were 'a lot better' were scored a -2.

We conducted planned one-sample *t*-tests comparing children's scores for each informant pair to chance (chance = 0; see Table 7). Within the younger age group, participants scores were significantly greater than chance on the teacher vs. student trials, $t(34) = 2.98$, $p < .01$, and the teacher-cook vs. teacher trials, $t(34) = 2.68$, $p < .05$, but did not differ from chance on the teacher-student vs. teacher trials, $t(34) = 0.0$, $p = 1.00$, or the teacher-student vs. teacher-cook trials, $t(34) = -.18$, $p = .856$ (see Figure 10). Within the younger age group, on the teacher vs. student trials, 6% of children indicated that the student was 'a lot better' of a teacher, 6% indicated that the student was 'a little better,'

46% indicated that the teacher and the student were ‘the same,’ 8% indicated that the teacher was ‘a little better,’ and 34% indicated that the teacher was ‘a lot better.’ On the teacher-student vs. teacher trials, 11% of children indicated that the teacher-student was ‘a lot better’ of a teacher, 6% indicated that the teacher-student was ‘a little better,’ 66% indicated that the teacher-student and the teacher were ‘the same,’ 6% indicated that the teacher was ‘a little better,’ and 11% indicated that the teacher was ‘a lot better.’ On the teacher-cook vs. teacher trials, 8% of children indicated that the teacher-cook was ‘a lot better’ of a teacher, 3% indicated that the teacher-cook was ‘a little better,’ 43% indicated that the teacher-cook and the teacher were ‘the same,’ 17% indicated that the teacher was ‘a little better,’ and 29% indicated that the teacher was ‘a lot better.’ On the teacher-student vs. teacher-cook trials, 11% of children indicated that the teacher-student was ‘a lot better’ of a teacher, 77% indicated that the teacher-student and the teacher-cook were ‘the same,’ 3% indicated that the teacher-cook was ‘a little better,’ and 9% indicated that the teacher-cook was ‘a lot better.’

Within the older age group, participants’ scores were significantly greater than chance on the teacher vs. student trials, $t(34) = 5.25$, $p < .001$, but did not differ from chance on the teacher-student vs. teacher trials, $t(34) = 1.68$, $p = .102$, teacher-cook vs. teacher, $t(34) = 1.43$, $p = .163$, or teacher-student vs. teacher-cook trials, $t(34) = -.725$, $p = .473$. Within the older age group, on the teacher vs. student trials, 3% of children indicated that the student was ‘a little better’ of a teacher, 43% indicated that the teacher and the student were ‘the same,’ 26% indicated that the teacher was ‘a little better,’ and 28% indicated that the teacher was ‘a lot better.’ On the teacher-student vs. teacher trials, 6% of children indicated that the teacher-student was ‘a lot better’ of a teacher, 11%

indicated that the teacher-student was ‘a little better,’ 49% indicated that the teacher-student and the teacher were ‘the same,’ 14% indicated that the teacher was ‘a little better,’ and 20% indicated that the teacher was ‘a lot better.’ On the teacher-cook vs. teacher trials, 9% of children indicated that the teacher-cook was ‘a lot better’ of a teacher, 3% indicated that the teacher-cook was ‘a little better,’ 60% indicated that the teacher-cook and the teacher were ‘the same,’ 11% indicated that the teacher was ‘a little better,’ and 17% indicated that the teacher was ‘a lot better.’ On the teacher-student vs. teacher-cook trials, 11% of children indicated that the teacher-student was ‘a lot better’ of a teacher, 9% indicated that the teacher-student was ‘a little better,’ 66% indicated that the teacher-student and the teacher-cook were ‘the same,’ 9% indicated that the teacher-cook was ‘a little better,’ and 5% indicated that the teacher-cook was ‘a lot better.’

Table 7

Mean Ratings on Knowledge Attribution Trials by Informant Pair and Age Group

	4- to 5-year-olds *M, SD*	7- to 8-year-olds *M, SD*
Teacher vs. Student	.60, 1.19	.80, .90
Teacher vs. Teacher-Student	.00, 1.03	.31, 1.11
Teacher vs. Teacher-Cook	.54, 1.20	.26, 1.07
Teacher-Student vs. Teacher-Cook	-.03, .92	-.11, .92

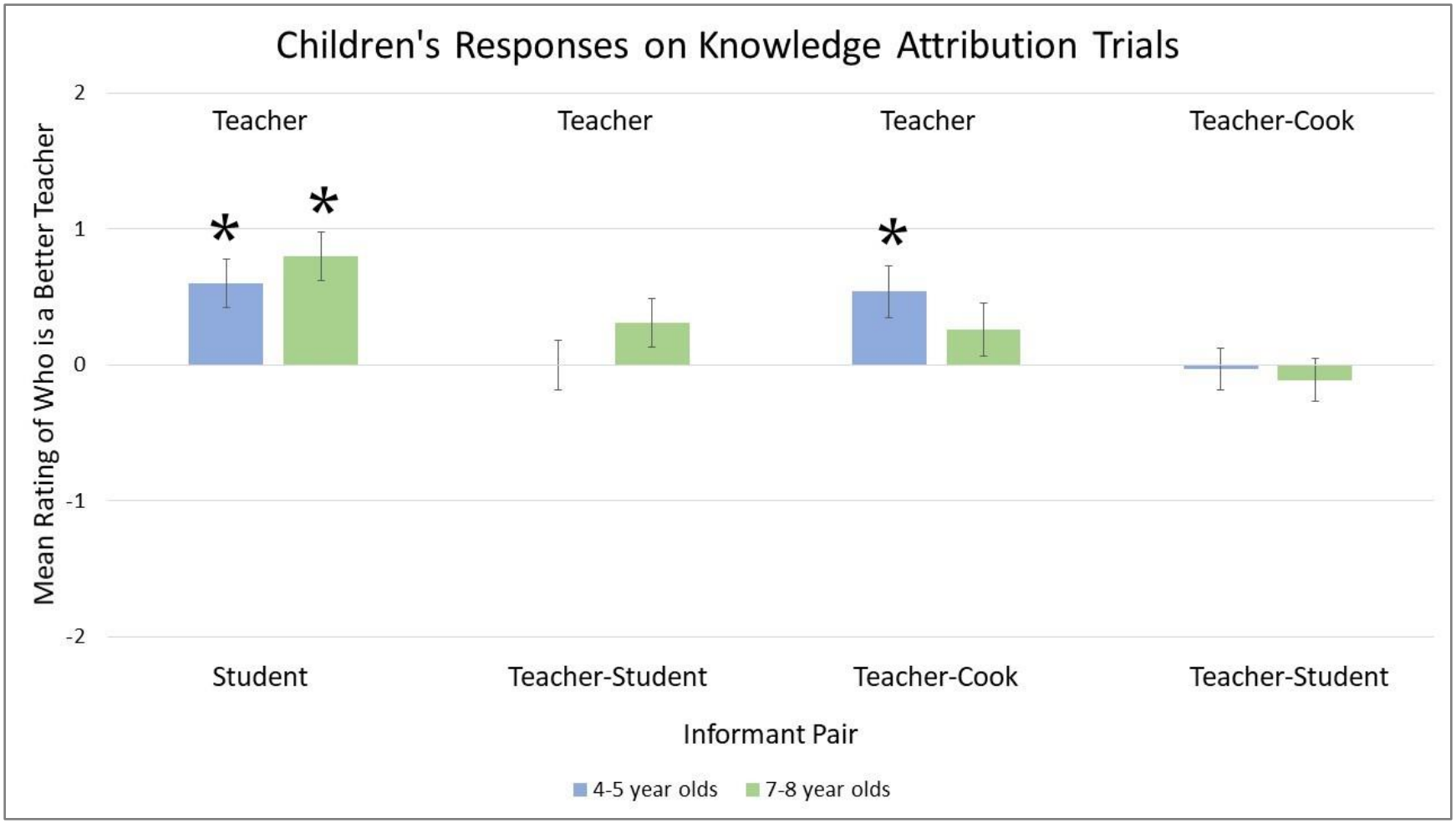

Figure 10. Mean knowledge attribution ratings by Age Group and Informant Pair.

Discussion

The goal of this experiment was to examine whether children's reliance on different informants' testimony differed as a function of the social roles that informants held. Specifically, we were interested in whether children trusted the testimony of a cross-classified individual more or less than that of a singly classified individual, and how children's testimony evaluations differed based on the structure of the roles the cross-classified individual held. Many studies have investigated how children evaluate testimony, and what factors they consider when choosing whose testimony to trust; however, none have directly investigated whether children privilege certain roles when evaluating the testimony of individuals who hold multiple social roles. In their daily lives, children encounter individuals with a range of social roles, many of whom hold multiple roles within the same domain. Thus, to gather baseline data on how children evaluate the testimony of cross-classified individuals, we used a selective trust paradigm. In addition to understanding how children evaluate the testimony of cross-classified individuals, we were also interested in children's judgments of these individuals' knowledge in a given domain.

The results of the current experiment revealed that overall, children did not seem to privilege certain social roles when evaluating informant's testimony about an unknown object. This pattern of results held for both age groups, indicating that age did not play a role in children's testimony judgments in the current experiment. However, it seems unlikely that children would not trust the testimony of a teacher more than that of a student. Indeed, studies have found that children trust the testimony of informants who have expertise in a given area (e.g., Danovitch & Keil, 2004; Lane, Wellman, & Gelman,

2013; Lutz & Keil, 2002). Thus, it may be the case that for novel object naming in particular, the social roles individuals hold do not influence children's reasoning.

When children's evaluations of which informant was a better teacher were compared to chance, both age group's scores were significantly greater than chance on the teacher vs. student items, indicating that they recognized that a teacher has more relevant expertise in a teaching domain than a student. Additionally, the younger group of children had scores that were significantly greater than chance on the teacher-cook vs. teacher items, indicating that they believed a singly classified teacher had more expertise than a teacher that held multiple roles in different domains (e.g., cook). These results suggest that the subordinate role of student did not enhance or dilute the dominant role of teacher, and thus did not negatively affect children's knowledge judgements. Similar to previous findings, it may be the case that while children are able to attribute knowledge to an individual, they exhibit more difficulty with using knowledge attributions when evaluating testimony (Landrum et al., 2013).

Limitations and Future Directions

In the current experiment, we aimed to examine how children reasoned about the testimony of cross-classified individuals. As a first step, we chose to use a novel object naming paradigm to see if any differences appeared in the absence of other contextual factors. One limitation of the current experiment may be that this paradigm did not reflect children's real-world interactions. It could be the case that children do in fact evaluate the testimony of cross-classified individuals differently, but only in certain situations. For example, being a teacher and a student may not indicate that you know what is inside a box, but being a teacher and a student may indicate that you know more

or less about classroom rules. In future studies, it will be beneficial to see how children reason about testimony from cross-classified individuals across a variety of contexts.

Additionally, in the current experiment we elected to use only occupation hierarchical roles. However, Experiment 1 indicated that both younger and older children are less willing to cross-classify individuals as holding multiple social roles in a familial hierarchical domain. Similarly, in Experiment 3, children showed different response patterns across age groups in their reasoning about whether or not people had to listen to cross-classified individuals within a familial hierarchical domain. Thus, in future studies it will be important to investigate how children reason about the testimony of individuals who hold multiple roles in a familial hierarchical domain and how this may differ from their reasoning about individuals in an occupation hierarchical domain.

CHAPTER VII

GENERAL DISCUSSION & CONCLUSION

The goal of these four experiments was to examine the development of children's willingness to cross-classify individuals across different social categories, and to investigate how children reason about cross-classified individuals. Cross-classification is an important aspect of social cognition as almost everyone a child interacts with holds multiple social roles. Thus, to interact with others both appropriately and effectively, children must be able to consider the many social roles that individuals hold. These experiments answered two broad questions: 1) how does children's willingness to cross-classify individuals develop?, and 2) how does cross-classification influence children's reasoning in different domains?

Children's Cross-classification Behaviors

In terms of how children's willingness to cross-classify individuals develops, Experiments 1 and 2 illustrated that children become more willing to cross-classify individuals over time. Experiment 1 indicated that there are developmental differences in children's willingness to cross-classify individuals, and that these differences vary based on the structure of the social category in question. Although the younger children in Experiment 1 were the least willing to cross-classify individuals across social categories, older children were only unwilling to do so when presented with social roles with hierarchical structure (e.g., teacher-student, mom-daughter). Although there was a

developmental shift in younger and older children's willingness to cross-classify individuals, older children still did not exhibit adult-like cross-classification across all social categories. The older children in Experiment 1 seemed to represent a developmental midpoint between younger children and adults, demonstrating some willingness to classify individuals as holding multiple social roles, but only when these roles did not have a hierarchical structure.

Experiment 2 demonstrated that when provided with scaffolding in the form of a verbal and visual reminder of hierarchical family structure, younger children showed no differences in willingness to cross-classify individuals across hierarchical versus non-hierarchical social roles. The older children tested in this experiment showed an increased willingness to cross-classify individuals in the familial hierarchical and occupation non-hierarchical roles as compared to the occupation hierarchical roles. Additionally, both age groups cross-classified at levels significantly above chance for all social categories. Experiment 2 also indicated that children's cross-classification behaviors were not predicted by cognitive flexibility, nonverbal reasoning, or age. However, it is also possible that the variables we investigated in Experiment 2 do account for some of the differences in children's cross-classification behaviors, but because the scaffolding we provided resulted in younger children cross-classifying at similar rates to older children (thus reducing the overall amount of variability in their data), these differences were no longer measurable.

Although studies have found that young children are able to cross-classify entities such as objects and food (e.g., Nguyen, 2007; Nguyen & Murphy, 2003), the results of Experiments 1 and 2 suggest that cross-classification may be more difficult within the

social domain. However, providing young children with scaffolding increased their willingness to cross-classify individuals within familial hierarchical social roles. Thus, it may be the case that while reasoning that individuals hold multiple social roles is too representationally complex for young children, reducing their cognitive load can address this complexity and increase the rate at which they are willing to cross-classify individuals.

However, there could also be more specific cognitive limitations that account for children's difficulties with cross-classification within a social domain. Children's reluctance to cross-classify individuals may stem from a mutual exclusivity bias (Markman, 1989; Merriman & Bowman, 1989; Woodward & Markman, 1991). Although this bias may be adaptive for word learning, it may also negatively impact children's ability to perform cross-classification. However, the literature on the mutual exclusivity bias is conflicting, with some studies suggesting that children as young as two will accept multiple labels for the same objects (e.g., Clark & Svaib, 1997; Deak & Maratsos, 1998; Mervis, Golinkoff, & Bertrand, 1994). Although studies have indicated that children will cross-classify objects, children may be more stringent when cross-classifying people because the roles people hold determine how children should behave or interact with them (Kalish & Lawson, 2008; Rhodes, 2013). It could be the case that children are more conservative about cross-classifying individuals at a young age because they believe social categories are more mutually exclusive than non-social categories.

It is also possible that there are other cognitive mechanisms that underlie children's cross-classification of individuals. One possibility is that there is a relationship between children's theory of mind and their willingness to cross-classify

individuals. It could be the case that to classify an individual as holding multiple social roles, children need to be able to shift their view from one perspective of an individual (e.g., teacher) to another perspective (e.g., student). Another possibility is that there is a relation between inhibitory control and children's beliefs that individuals can be cross-classified. It is possible that once children accept a label for an individual (e.g., 'This person is a teacher'), they are unable to inhibit that response when asked to accept a second label for the same individual. Experiment 1 suggests that accepting multiple roles may be even more difficult for children when they are reasoning about hierarchically structured social roles. The results of these two experiments suggest that willingness to cross-classify individuals is still developing over the preschool and early elementary years. In future studies it will be important to explore these other cognitive competencies to discover what variables predict the development of children's cross-classification behaviors in a social domain.

Finally, in these exploratory experiments, we chose to include eight-year-old children because we felt this older age group would allow us to capture changes in reasoning between younger children and adults. Although we discovered clear developmental differences between younger participants and adults in Experiment 1, the older children in this experiment did not exhibit adult-like reasoning when presented with hierarchically structured categories. In future studies of this nature, it would be beneficial to include even older children to determine when adult-like reasoning about hierarchically structured social roles occurs.

Children's Reasoning about Cross-classified Individuals

The second question these experiments answered was how cross-classification influences children's reasoning in different domains. In these experiments we were specifically interested in how children made inferences about and evaluated the testimony of cross-classified individuals. Experiment 3 demonstrated that there are different developmental patterns in the children's inferences about the deontic properties of singly versus cross-classified individuals. Most of the younger and older children indicated that they believed people did need to listen to individuals who hold only a dominant social role (e.g., a mom or a dad). Children showed different patterns of responding for individuals who held only a subordinate role (e.g., a daughter or a son), with the majority of older children indicating that it is not necessary to listen to these individuals, and younger children showing a more distributed pattern of responses between needing versus not needing to listen to these individuals. However, the opposite pattern emerged for the cross-classified items (e.g., a mom-daughter or a dad-son), in that the majority of younger children indicated that you do need to listen to these individuals, while older children's responses were more mixed, sometimes indicating that people did need to listen to these individuals and sometimes indicating that they were unsure about whether people needed to listen to these individuals.

These results suggest that younger children may make more use of inductive selectivity (i.e., using individual category membership to make inferences about cross-classified items; Nguyen & Girgis, 2014) than older children when reasoning about cross-classified individuals, as evidenced by their inclination to believe that people should listen to individuals who hold dominant roles (even if they also hold subordinate roles).

In contrast, the distribution of older children's responses when reasoning about whether people needed to listen to cross-classified individuals implies that they were not simply using one known social role (e.g., mom *or* daughter) to make inferences about deontic properties but that some children may have tried to account for both social roles (e.g., mom *and* daughter) when making these inferences. Although research has found that adults tend to rely on the most distinctive social role when making inferences about multiply classified individuals (Macrae et al., 1995; Nelson & Miller, 1995), children may not do so in the early elementary years. The results of Experiment 3, in addition to previous research with adults (Nelson & Miller, 1995; Macrae et al., 1995; Murphy & Ross, 1999), suggest that the use of inductive selectivity when making inferences about cross-classified individuals may follow a U-shaped developmental curve. Although preschool age children and adults tend to base their inferences off one distinctive social role, older children may attempt to make use of both social roles when making inferences about cross-classified individuals. Although studies have found that children as young as four demonstrate inductive selectivity when making inferences about objects and food (Kalish & Gelman, 1992; Nguyen, 2012; Nguyen & Murphy, 2003), the responses of older children in Experiment 3 suggest that their intuitions may still be developing in the social domain. However, it could be that children, like adults (Murphy & Ross, 1999), will demonstrate inductive selectivity when making inferences if one social role is made contextually salient. In future studies it will be important to investigate how context influences children's inferences about cross-classified individuals.

Experiment 4 indicated that overall children were not privileging certain social roles when evaluating cross-classified individuals' testimony about the name of a hidden

object. However, Experiment 4 did demonstrate that having a subordinate role (e.g., student) within the same domain as a dominate role (e.g., teacher) did not enhance or dilute the knowledge status (in this case, who was a better teacher) of these individuals. Additionally, both younger and older children in this study indicated that they believed a singly classified teacher was a better teacher than a singly classified student. Younger children also indicated that they believed a singly classified teacher had greater expertise than a cross-classified teacher-cook, suggesting that when a second social role is held in an unrelated domain, it may dilute the perceived knowledge of the relevant or dominant role. The overall results of Experiment 4 indicated that children may be better at attributing knowledge to an individual than using this information to evaluate their testimony (e.g., as in Landrum et al., 2013).

Given that this experiment was the first step in investigating children's trust in cross-classified informants, we were interested in how testimony was evaluated based solely on the social roles that an informant held. Thus, we elected to employ an object naming selective trust paradigm, to remove any contextual factors that children may have used to make testimony evaluations. Although we found that children did not privilege certain social roles (e.g., teacher) when evaluating informant's testimony, it seems unlikely that this is the case in children's real-world behaviors. Indeed, teachers are often a source of knowledge for children. Additionally, previous research suggests that children prefer informants who are accurate and reliable over those that are not (Koenig & Harris, 2005; Pasquini et al., 2007). It could be the case that children do in fact rely on a given individual's social roles when evaluating their testimony, but that doing so depends on the context of that testimony. For example, teachers may know more than

students about classroom rules or what to do during a fire drill, but this may not be the case for knowing the name of an object. In future studies it will be important to examine how children make use of social roles when evaluating testimony in different contexts.

Conclusions

Overall, the findings of these four experiments illustrate that there are developmental differences in willingness to cross-classify individuals and reasoning about cross-classified individuals, between the preschool, early elementary, and adult years. Social roles provide information about the traits and behaviors of others (Baron et al., 2014), what people may be obligated or not allowed to do (Kalish & Lawson, 2008), and how others should behave in relation to certain individuals (Watson, 1984). The results of these experiments suggest that cross-classification may influence the way children make inferences about individuals, but that cross-classification does not influence testimony evaluations when social roles are not contextually salient. Although these experiments indicate that children are reluctant to cross-classify individuals within hierarchical domains, they also highlight the importance of examining the influence this reluctance may have in more real-world scenarios. Because social roles represent such a great deal of information relevant to social interactions, it could be the case that it takes more time and experience for children to develop adult-like cross-classification and reasoning in the social domain than it does in non-social domains. Future research should continue to explore the development of children's cross-classification behaviors in a social domain, as well as investigate how children's intuitions about cross-classification influences their interactions with and reasoning about others.

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Appendix A

Today I'm going to show you pictures of people and tell you different things about them. I want you to listen very carefully because I am going to ask you questions about these people, okay?

12.This person is nice. Can this person also be mean?
Yes No
15.This person is a runner. Can this person also be a cook?
Yes No
14.This person is a student. Can this person also be a teacher?
Yes No
9.This person is a son. Can this person also be a dad?
Yes No
19.This is a person. Can this person also be a kangaroo?
Yes **No**
5.This person is strong. Can this person also be weak?
Yes No
10.This person is a swimmer. Can this person also be an artist?
Yes No
16.This person is a dad. Can this person also be a son?
Yes No
18.This person is poor. Can this person also be rich?
Yes No
24.This person is mean. Can this person also be nice?
Yes No
8.This person is a patient. Can this person also be a doctor?
Yes No
1.This is a person. Can this person also be a giraffe?
Yes **No**
4.This person is a mom. Can this person also be a daughter?
Yes No
3.This person is a cook. Can this person also be a runner?
Yes No
7.This is a person. Can this person also be a dolphin?
Yes **No**
11.This person is short. Can this person also be tall?
Yes No
21.This person is a daughter. Can this person also be a mom?
Yes No
6.This person is rich. Can this person also be poor?
Yes No
2.This person is a teacher. Can this person also be a student?
Yes No
17.This person is weak. Can this person also be strong?
Yes No
13.This is a person. Can this person also be a horse?
Yes **No**
20.This person is a doctor. Can this person also be a patient?
Yes No
22.This person is an artist. Can this person also be a swimmer?
Yes No
23.This person is tall. Can this person also be short?
Yes No

Appendix B

(Family tree schematic on table) First I want to tell you about this picture. (*Put circle on daughter/son*) This person is her/his daughter/son (*point to mom/dad*). (*Put circle on mom/dad*) This person is her/his (*point to daughter/son)* mom/dad. She/he (*keep circle on mom/dad*) is also this persons (*point to grandma/grandpa*) daughter/son. (*Put circle on grandma/grandpa*) This person is her/his (*point to mom/dad*) mom/dad.

Now I'm going to show you pictures of people and tell you different things about them. I want you to listen very carefully because I am going to ask you questions about these people, okay?

1.This person is a runner. Can this person also be a cook?
Yes No
5.This person is a dad. Can this person also be a son?
Yes No
7.This person is a mom. Can this person also be a daughter?
Yes No
2.This person is a student. Can this person also be a teacher?
Yes No
9.This person is a daughter. Can this person also be a mom?
Yes No
6.This person is a patient. Can this person also be a doctor?
Yes No
4.This person is a swimmer. Can this person also be an artist?
Yes No
3.This person is a son. Can this person also be a dad?
Yes No
10.This person is a teacher. Can this person also be a student?
Yes No
8.This person is a cook. Can this person also be a runner?
Yes No
11.This person is a doctor. Can this person also be a patient?
Yes No
12.This person is an artist. Can this person also be a swimmer?
Yes No

TOTAL: _____/12

Now I need your help matching some words with pictures.

Student. Can you point to the picture of a student?

Teacher **Student** Doctor Patient Chef

Doctor. Can you point to the picture of a doctor?

Teacher Student **Doctor** Patient Chef

Patient. Can you point to the picture of a patient?

Teacher Student Doctor **Patient** Chef

Teacher. Can you point to the picture of a teacher?

Teacher Student Doctor Patient Chef

<u>Card Sort Task</u>

Place the two sorting trays side by side in front of the subject within reaching distance (i.e., blue rabbit in the tray to the child's left and red boat in the tray to the child's right).

1. **Demonstration Phase**

SAY, *"Here's a blue rabbit and here's a red boat. Now, we're going to play a card game. This is the color game. In the color game, all the blue ones go here* **[pointing to the tray on the left]**, *and all the red ones go* there **[pointing to the tray on the right]**.*"*

Take first Demo Card and SAY, *"See, here's a blue one. So it goes here* **[place it face down in the correct tray].***"*

REPEAT, "*If it's blue it goes here, but if it's red it goes there."* **Show children the other Demo Card and SAY**, *"Now here's a red one. Where does this one go?"*

> ****If the child takes the card and sorts it correctly or simply indicates the correct tray by pointing, say,** *"Very good. You know how to play the color game."* **If they point, say,** *"Can you help me put this red one down?"* **Ensure that the card is placed face-down in the appropriate tray, turning the card over if necessary.**
>
> ****If the child sorts incorrectly**, **say**, *"No, this one's red, so it has to go over here in the color game. Can you help me put this red one down?"* E**nsure that the card is placed face-down in the appropriate tray.**

2. **Pre-Switch Phase**

Proceed immediately to the pre-switch phase. On the first pre-switch trial, SAY, *"Now it's your turn. So remember, if it's blue it goes here, but if it's red it goes there."*

Select the first test card, the blue boat with #1 labeled on the back. SAY, *"This one is (*color of card), where does it go?"* **The child may take the card and place it in a tray or simply point to one of the trays, in which case, you may sort the card for them. Always ensure that the card is placed face down in the appropriate tray. Whether or not children sort correctly, SAY**, *"Let's do another one, this card is (*color of card), where does it go?"*

Pre-Switch/Color Trial			
Item	Card	Answer	Correct=1; Incorrect=0
1	Blue Boat	Blue (Tray 1)	
2	Red Rabbit	Red (Tray 2)	
3	Red Rabbit	Red (Tray 2)	
4	Blue Boat	Blue (Tray 1)	
5	Red Rabbit	Red (Tray 2)	
6	Blue Boat	Blue (Tray 1)	

3. **Post-Switch Phase**

After six pre-switch trials, SAY, *"Now we're going to play a new game. We're not going to play the color game anymore. We're going to play the shape game. In the shape game, all the rabbits go here* **[pointing to the tray on the left],** *and all the boats go there* **[pointing to the tray on the right].** *Remember, if it's a rabbit, put it here, but if it's a boat put it there. Okay?"*

Do not remove the target cards or the cards that were sorted during the pre-switch phase, and do not pause between pre- and postswitch phases.

Select the seventh test card, the red rabbit with #7 labeled on the back. Say, *"Where does it go?"* **Whether or not the child sorts correctly, SAY**, *"Let's do another one, where does this one go?"*

Post-Switch/Shape Trial			
Item	Card	Answer	Correct=1; Incorrect=0
7	Red Rabbit	Rabbit (Tray 1)	
8	Blue Boat	Boat (Tray 2)	
9	Red Rabbit	Rabbit (Tray 1)	
10	Red Rabbit	Rabbit (Tray 1)	
11	Blue Boat	Boat (Tray 2)	
12	Blue Boat	Boat (Tray 2)	

Pre/Post Combined Total Correct: _____

**** Children must get at least 5 correct on Post-Switch Trial to proceed to Border Version**

4. Border Phase

If the child gets at least 5 out of the 6 post-switch trials correct they can move on to the border phase. However, if the child gets less than 5 correct on the post-switch trial they are done with the Card Sort Task and do not qualify for the border trial.

If the child qualifies for the border trials, say, *"Okay, you played really well. Now I have a more difficult game for you to play. In this game, you sometimes get cards that have a black border around it like this one* **[showing a red rabbit with a border]**. *If you see cards with a black border, you have to play the color game. In the color game, red ones go here and blue ones go there* **[pointing to the appropriate trays]**.

Take a red rabbit with a border demo card and say, "*This card's red, so I'm going to put it right there* **[placing it face down in the appropriate tray].** *But if the cards have no black border, like this one* **[show them the red rabbit without a border demo card]**, *you have to play the shape game. In the shape game, if it's a rabbit, we put it here, but if it's a boat, we put it there* **[pointing to the appropriate trays]**.*This one's a rabbit, so I'm going to put it right here* **[placing it face down in the appropriate tray]**. *Okay? Now it's your turn."*

Say *"Remember, if there is a black border then you play the color game. If there is no black border then you play the shape game."* **Select the first border trial card, blue boat with a border that is labeled #13 on the back.** *"This one has (or doesn't have) a border. Where does it go?"*

For remaining cards, say, *"This one has (or doesn't have) a border. Where does it go?"*

Border Trial			
Item	Card	Answer	Correct=1; Incorrect=0
13	Blue Boat w/ Border	Blue (Tray 1)	
14	Red Rabbit	Rabbit (Tray 1)	
15	Red Rabbit w/ Border	Red (Tray 2)	
16	Blue Boat	Boat (Tray 2)	
17	Red Rabbit	Rabbit (Tray 1)	
18	Blue Boat w/ Border	Blue (Tray 1)	
19	Red Rabbit w/ Border	Red (Tray 2)	
20	Blue Boat	Boat (Tray 2)	

21	Blue Boat w/ Border	Blue (Tray 1)	
22	Red Rabbit	Rabbit (Tray 1)	
23	Blue Boat	Boat (Tray 2)	
24	Red Rabbit w/ Border	Red (Tray 2)	

Border Version Total Correct: _____

GRAND TOTAL CORRECT: _____

(Note: Add total correct from Color, Shape, and Border trials)

Appendix C

Today I am going to ask you some different questions. You can tell me in your own words what you think the answer is.

1. **This person is a mom. Do people have to listen to her?**

2. **This person is a daughter. Do people have to listen to her?**

3. **This person is a mom and a daughter. Do people have to listen to her?**

4. **This person is a dad. Do people have to listen to him?**

5. **This person is a son. Do people have to listen to him?**

6. **This person is a dad and a son. Do people have to listen to him?**

Appendix D

(Start on slide 1 with image of only the box) Today I need your help answering some questions. I want to find out what is in this box *(point to box on screen),* so I asked some people I know. They made videos to tell me what they think is in the box. It is your job to tell me who got it right.

TeacherStudent vs. TeacherCook

TSvsTC1. [Slide 2, play video]

> *TSvsTC1check1.* Can you point to which person is both a Teacher and a Cook? (*If child answers incorrectly, correct them by pointing to accurate person and saying,* "Actually this person is both a teacher and a cook" *and repeat the original question)*
>
> TeacherCook TeacherStudent # of times repeated for accurate answer _____
>
> *TSvsTC1check2.* Can you point to which person is both a Teacher and a Student? (*If child answers incorrectly, correct them by pointing to accurate person and saying,* "Actually this person is both a teacher and a student" *and repeat the original question)*
>
> TeacherCook TeacherStudent # of times repeated for accurate answer _____

TSvsTC3. [Slide 2] Remember the person who is a Teacher and a Cook *(point to TeacherCook)* said there is a 'vab' in the box and the person who is a Teacher and a Student *(point to TeacherStudent)* said there is a 'dax' in the box. Can you point to the person who got it right?

TeacherCook TeacherStudent

TSvsTC2. [Slide 3, play video] Remember the person who is a Teacher and a Student *(point to TeacherStudent)* said there is a 'stid' in the box and the person who is a Teacher and Cook *(point to TeacherCook)* said there is a 'gaz' in the box. Can you point to the person who got it right?

TeacherStudent TeacherCook

TSvsTC1. [Slide 4, play video] Remember the person who is a Teacher and a Cook *(point to TeacherCook)* said there is a 'kiv' in the box and the person who is a Teacher and a Student *(point to TeacherStudent)* said there is a 'hux' in the box. Can you point to the person who got it right?

TeacherCook TeacherStudent

TSvsTCcomparison. [Stay on Slide 4 screen] Is one of these people a better teacher or are they the same? *(if they say one of them is better, circle answer and move on to follow-up)*

TeacherCook Same TeacherStudent

TSvsTCfollow-up. Are they a little bit better or a lot better?

Little bit better A lot better

TeacherCook vs. Teacher

TCvsT1. [Slide 5, play video]

TCvsT1check1. Can you point to which person is only a Teacher? (*If child answers incorrectly, correct them by pointing to accurate person and saying,* "Actually this person is only a teacher" *and repeat the original question)*

Teacher TeacherCook # of times repeated for accurate answer _____

TCvsT1check2. Can you point to which person is both a Teacher and a Cook? (*If child answers incorrectly, correct them by pointing to accurate person and saying,* "Actually this person is both a teacher and a cook" *and repeat the original question)*

Teacher TeacherCook # of times repeated for accurate answer _____

TCvsT3. [Slide 5] Remember the person who is a Teacher *(point to Teacher)* said there is a 'kark' in the box and the person who is a Teacher and a Cook *(point to TeacherCook)* said there is a 'lep' in the box. Can you point to the person who got it right?

Teacher TeacherCook

TCvsT2. [Slide 6, play video] Remember the person who is a Teacher and a Cook *(point to TeacherCook)* said there is a 'lorp' in the box and the person who is a Teacher *(point to Teacher)* said there is a 'wost' in the box. Can you point to the person who got it right?

TeacherCook Teacher

TCvsT1. [Slide 7, play video] Remember the person who is a Teacher *(point to Teacher)* said there is a 'zog' in the box and the person who is a Teacher and a Cook *(point to TeacherCook)* said there is a 'goeb' in the box. Can you point to the person who got it right?

Teacher TeacherCook

TCvsTcomparison. [Stay on Slide 7 screen] Is one of these people a better teacher or are they the same? *(if they say one of them is better, circle answer and move on to follow-up)*

Teacher Same TeacherCook

TCvsTfollow-up. Are they a little bit better or a lot better?

Little bit better A lot better

TeacherStudent vs. Teacher

TSvsT1. [Slide 8, play video]

TSvsT1check1. Can you point to which person is both a Teacher and a Student? (*If child answers incorrectly, correct them by pointing to accurate person and saying,* "Actually this person is both a teacher and a student" *and repeat the original question)*

TeacherStudent Teacher # of times repeated for accurate answer _____

TSvsT1check2. Can you point to which person is only a Teacher? (*If child answers incorrectly, correct them by pointing to accurate person and saying,* "Actually this person is only a teacher" *and repeat the original question)*

TeacherStudent Teacher # of times repeated for accurate answer _____

TSvsT3. [Slide 8] Remember the person who is a Teacher and a Student *(point to TeacherStudent)* said there is a 'zorb' in the box and the person who is a Teacher *(point to Teacher)* said there is a 'husp' in the box. Can you point to the person who got it right?

TeacherStudent Teacher

TSvsT2. [Slide 9, play video] Remember the person who is a Teacher *(point to Teacher)* said there is a 'naze' in the box and the person who is a Teacher and a Student *(point to TeacherStudent)* said there is a 'flurp' in the box. Can you point to the person who got it right?

Teacher TeacherStudent

TSvsT1. [Slide 10, play video] Remember the person who is a Teacher and a Student *(point to TeacherStudent)* said there is a 'roak' in the box and the person who is a Teacher *(point to Teacher)* said there is a 'jate' in the box. Can you point to the person who got it right?

TeacherStudent Teacher

TSvsTcomparison. [Stay on Slide 10 screen] Is one of these people a better teacher or are they the same? *(if they say one of them is better, circle answer and move on to follow-up)*

TeacherStudent Same Teacher

TSvsTfollow-up. Are they a little bit better or a lot better?

Little bit better A lot better

Teacher vs. Student

TvsS1. [Slide 11, play videos]

TvsS1check1. Can you point to which person is a Teacher? (*If child answers incorrectly, correct them by pointing to accurate person and saying,* "Actually this person is a Teacher" *and repeat the original question)*

Teacher Student # of times repeated for accurate answer _____

TvsS1check2. Can you point to which person is a Student? (*If child answers incorrectly, correct them by pointing to accurate person and saying,* "Actually this person is a Student" *and repeat the original question)*

Teacher Student # of times repeated for accurate answer _____

TvsS3. [Slide 11] Remember the person who is a Teacher *(point to Teacher)* said there is a 'rel' in the box and the person who is a Student *(point to Student)* said there is a 'tust' in the box. Can you point to the person who got it right?

Teacher Student

TvsS2. [Slide 12, play video] Remember the person who is a Student *(point to Student)* said there is a 'wilp' in the box and the person who is a Teacher *(point to Teacher)* said there is a 'deld' in the box. Can you point to the person who got it right?

Student Teacher

TvsS1. [Slide 13, play video] Remember the person who is a Teacher *(point to Teacher)* said there is a 'cheem' in the box and the person who is a Student *(point to Student)* said there is a 'sarl' in the box. Can you point to the person who got it right?

Teacher Student

TvsScomparison. [Stay on Slide 13 screen] Is one of these people a better teacher or are they the same? *(if they say one of them is better, circle answer and move on to follow-up)*

Teacher Same Student

TvsSfollow-up. Are they a little bit better or a lot better?

Little bit better A lot better

We're all done, thanks for helping me today!

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EDUCATION

Ph.D.	Experimental Psychology, Development and Cognition University of Louisville, 2019
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B.A.	Psychology (summa cum laude & Honors) University of North Carolina Wilmington, 2015

PUBLICATIONS

McDermott, C. H., & Noles, N. S. (2018). The role of age, theory of mind, and linguistic ability in children's understanding of ownership. *PLoS ONE, 13*(10).

McDermott, C. H., & Nguyen, S. P. (in prep.). Hope and happiness in children with visual impairment.

McDermott, C. H., Noles, N. S., & Nguyen, S. P. (in prep.). Developmental changes in cross-classifying individuals into multiple social roles.

CONFERENCE PRESENTATIONS

McDermott, C., Noles, N., Nguyen, S. (2017, October). *Developmental Changes in Categorizing Others into Multiple Social Roles.* Poster presented at the Cognitive Development Society, Portland, OR.

Noles, N., **McDermott, C.** (2017, October). *Can Ownership Rules Be Suspended?* Poster presented at the Cognitive Development Society, Portland, OR.

McDermott, C., Noles, N. (2017, May). *The Role of Age, Theory of Mind, and Linguistic Ability in Children's Understanding of Ownership.* Poster presented at the Association for Psychological Science, Boston, MA.

Noles, N., **McDermott, C.** (2017, May). *Do Children Judge Ownership Transgressions to be Conventional or Moral Violations?* Poster presented at the Association for Psychological Science, Boston, MA.

McDermott, C., Nguyen, S. (2017, April). *Visually impaired children's hope and happiness.* Poster presented at the Society for Research on Child Development, Austin, TX.

Noles, N., **McDermott, C.** (2017, April). *Children's evaluations of ownership transgressions.* Paper symposium presented at the Society for Research on Child Development, Austin, TX.

Noles, N., **McDermott, C.** (2017, April). *Children's reasoning about different kinds of property transfers.* Poster presented at the Society for Research on Child Development, Austin, TX.

McDermott, C., Noles, N. (2016, April). *Learning about economic systems: Developing Concepts of Fungibility.* Poster presented at the University of Louisville Graduate Student Regional Research Conference, Louisville, KY.

McDermott, C. (2014, October). *Visually impaired children's hope and happiness.* Poster presented at the University of North Carolina Wilmington Undergraduate Research Showcase, Wilmington, NC.

Abraham, C., White, B., **McDermott, C.**, Griffith, A., Everhart, K., Parham, A., Vandenbrink, T., & Nguyen, S. P. (2014, April). *Yoga's effects on preschool children's well-being*. Paper presented at the Carolinas Psychology Conference, Raleigh, NC.

McDermott, C., Everhart, K., White, B., Abraham, C., Griffin, A., Parham, A., Vandenbrink, T., & Nguyen, S. P. (2014, April). *Visually impaired children's hope and happiness vs. parent's perceptions of their child's hope and happiness.* Paper presented at the Carolinas Psychology Conference, Raleigh, NC.

Parham, A., Griffin, A., Abraham, C., White, B., **McDermott, C.**, Everhart, K., Vandenbrink, T., & Nguyen, S. P. (2014, April). The effects of mindfulness meditation on children's well-being. Paper presented at the Carolinas Psychology Conference, Raleigh, NC.

Vandenbrink, T., **McDermott, C.**, Everhart, K., Upperman, J., & Nguyen, S. P. (2014, April). *The effects of yoga and meditation on children's well-being & cognition in North Carolina.* Poster presented at the UNCW Showcase of Student Research & Creativity.

Vandenbrink, T., **McDermott, C**., Everhart, K., Upperman, J., Nguyen, S. P., & Gordon, C. (2013, November). *Children's reactions to untrustworthy sources of information in different domains.* Poster presented at the Sigma Xi Student Research Conference, Research Triangle Park, NC.

Vandenbrink, T., **McDermott, C.**, Upperman, J., Everhart, K., & Nguyen, S. P. (2013, November). *Happiness and hope in children with visual impairments*. Poster presented at the Sigma Xi Student Research Conference, Research Triangle Park, NC.

TEACHING EXPERIENCE

Primary Instructor
Great Ideas in Psychology: The Grawemeyer Awards (Writing Seminar)
Lifespan Development
Research Methods (Lab Section)

Teaching Assistant
Child Development
Making Sense of Data

REVIEWING EXPERIENCE

2018 Reviewer, National Conference for Undergraduate Research

2016 Student Reviewer, Society for Research in Child Development

THESES MENTORED

2018-2019 Tanya Nagpal
"Children's Reasoning about the Testimony of Cross-Classified Individuals"
Department of Psychological and Brain Sciences, University of Louisville

2017-2018 Haleh Jortani
"Developmental Changes in the Understanding of Social Roles"
Department of Psychological and Brain Sciences, University of Louisville

PROFESSIONAL EXPERIENCE

2019-Present *Inclusive Teaching Circle*
University of Louisville

2018-Present *Graduate Student Ambassador*
School of Interdisciplinary and Graduate Studies
University of Louisville

2018-Present *Developing Scientists Program*
Experimental Psychology Department, Department of Psychological and Brain Sciences, University of Louisville
Co-founder (with Nonah Olesen)

2018-Present *Diversity Recruitment and Retention Committee*
Department of Psychological and Brain Sciences, University of Louisville

2015-Present *Adult Academic Tutor*
Down Syndrome of Louisville, Inc.

Supervisor: Susan Teaford

2017-2018 *Certification in Community Engagement*
School of Interdisciplinary and Graduate Studies, University of Louisville
Supervisor: Dr. Michelle Rodems

2014-2015 *Substitute Teacher*
Easter Seals United Cerebral Palsy Services

2013-2015 *Certified Master Tutor*
University Learning Center, University of North Carolina Wilmington
Supervisor: Mike Ruwe

2011-2013 *Assistant Teacher*
Chesterbrook Academy

AWARDS & HONORS

2018 Excellence in Service, University of Louisville Graduate Experimental Award

2017 Graduate Network in Arts and Sciences Research Fund

2016 University of Louisville Graduate Student Research Grant

2015 University of Louisville School of Interdisciplinary and Graduate Studies University Fellowship

2015 UNCW Distinguished Engagement Award – awarded for service and leadership within the community

2014 UNCW Michael J. Bradley Psychology Department Undergraduate Research Award – awarded to one senior per year for "exceptional work in psychological research"

2014 UNCW Center for Support of Undergraduate Research and Fellowships Travel Award – $1,000 to support conference travel

2014 UNCW Student Undergraduate Research and Creativity Award – $1,400 to support summer research activities

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