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Does a Male Nurse Know about Football? American and Egyptian Children's Understanding of Gender and Expertise

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Abstract
Three experiments explore how American (n=102) and Egyptian (n=73) preschoolers' inferences about expertise are affected by an expert's gender and occupation. Children viewed a nurse and a car mechanic in a gender stereotypical (female nurse, male mechanic) or counterstereotypical (female mechanic, male nurse) presentation and indicated who would know more about profession-related information and gender-stereotypical activities. American children inferred expert knowledge primarily based on the expert's profession, regardless of gender. Egyptian children also made correct attributions about professional expertise, but they were more likely to be influenced by an expert's gender than their American counterparts. Additionally, both American and Egyptian children were less likely to attribute stereotypical male knowledge to a male in a counterstereotypical profession. These results suggest that culturally mediated stereotypes affect preschool children's social cognitive judgments. Implications for the development of gender stereotypes are discussed.

Keywords
Gender development, gender stereotypes, conceptual development, expertise, cultural comparisons, Middle Eastern children

Introduction

Understanding that different individuals know different things is essential for both learning about the world and navigating social situations, and the emergence of this ability during early childhood is an important milestone. Children as young as age 3 are able to assign questions appropriately to familiar experts when the questions are directly related to the expert's professional knowledge or more distantly related to the expert's domain of expertise (Lutz and Keil, 2002). Thus, preschoolers demonstrate an understanding of the division of cognitive labor by recognizing that different experts have divergent

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knowledge, and by age 5, they understand that an expert's knowledge extends to more than just their immediate topic of specialization.

In Lutz and Keil's (2002) study and subsequent research on children's understanding of expertise (Danovitch and Keil, 2004; Keil et al., 2008; Koenig and Jaswal, 2011; Aguiar et al., 2012), the expert characters presented to children are always male, allowing the researchers to focus on other attributes that may influence children's judgments. However, gender is typically a salient characteristic of a potential information source and it may play an important role in children's decisions about whom to consult for answers, as shown by a recent study where children differentially trusted information provided by a male or female informant about novel toys based on the match between the informant's gender and a gendered toy color (Ma and Woolley, 2013). Here, we explore the role of gender in children's judgments of expertise by examining (1) how an expert's gender influences children's reasoning about the division of cognitive labor, particularly when faced with a gender atypical presentation (e.g., a female mechanic) and (2) how children's assessments of expert knowledge are influenced by their own gender and culture. To address these questions, we rely on a theoretical framework that describes the development of stereotypes in any domain: developmental intergroup theory (DIT; Bigler and Liben, 2006, 2007).

According to DIT (Bigler and Liben, 2006), four core processes are involved in the creation of social stereotypes: establishing psychological salience, categorizing individuals, developing stereotypes, and applying stereotype filters. For the development of gender stereotypes, DIT postulates that children must first establish that gender is an important characteristic of people. This occurs by observing perceptual distinctions between males and females (e.g., on average, men are taller, women have longer hair), explicit labels that reference gender (e.g., "that boy"), and implicit signals that imply these two categories (e.g., forming separate queues for boys and girls). Accordingly, children start to categorize individuals that they encounter as male or female. They become better at this categorization task as their classification skills improve and as they are exposed to more exemplars from each category.

After establishing that gender is a salient category and learning to categorize individuals by gender, children start to form beliefs (stereotypes) about men and women based on the exemplars they encounter (Bigler and Liben, 2006). This motivation to form stereotypes, according to DIT, may be driven by essentialist thinking, meaning that humans are intrinsically motivated to conclude that members of a category have inherent shared qualities (see Gelman, 2003). In addition, people's tendency to form in-group biases (e.g., Bigler et al., 1997) contributes to stereotype formation with respect to gender, especially

because children are able to identify themselves as belonging to either the male or female category early in life (e.g., Thompson, 1975). Indeed, exposure to explicit messages about gender roles (e.g., adults saying "boys play rough" or "girls are sweet") and implicit information about males and females (e.g., the prevalence of female teachers in preschools) is posited to aid the process of stereotype formation (Bigler and Liben, 2006).

According to DIT, children's stereotypes are strengthened when they are applied to people who fit their developing stereotype. Alternatively, if a person does not meet the stereotype (e.g., a girl who plays football), children start applying a "stereotype filter" – creating a subtype containing the counterstereotypical individual. Research has shown that children tend to distort counterstereotypical information to fit their stereotype schemas (e.g., Liben et al., 2001). Therefore, children are more likely to distort information about or forget individuals who do not conform to stereotypes. How children handle these exemplars also depends on their multiple classification skills: once children recognize that one person may belong to two different categories (e.g., a woman and a football player), they are more likely to create such subgroups (as in Bigler and Liben, 1992; see Bigler and Liben, 2006 for further details).

Prior research suggests that young children are already sensitive to gender stereotypes and their violation. For example, 2-year-olds are surprised by pictures showing individuals engaged in counterstereotypical activities (such as a man putting on make-up; Serbi et al., 2002). Although little research has examined young children's occupational stereotypes, there is some evidence that children as young as 30 months show occupational gender stereotypes (Gettys and Cann, 1981). Furthermore, by age 5, children attribute better job performance to individuals who are presented in gender-stereotypical occupations (e.g., nurse, secretary, police officer, truck driver; Gettys and Cann, 1981). Similarly, preschoolers and first graders attribute more competence to a person of their own sex when the person is engaged in a gender-stereotypical occupation and they express more positive affective reactions when asked to imagine growing up to have a gender-stereotypical occupation (Levy et al., 2000). These results suggest that by the time they begin elementary school, children have acquired gender norms and apply them to judgments of a person's occupational knowledge and competence, as well as their own preferences and future aspirations.

In addition, children over age 3 judge individuals (particularly males) who engage in counterstereotypical activities more negatively (Blakemore, 2003) and 5- and 6-year-olds are more likely to misremember or distort information about individuals with counterstereotypical pairings of gender and occupation (Cordua et al., 1979; Wilbourn and Kee, 2010). However, it is unknown

how younger children evaluate the expertise of characters engaged in gender-counterstereotypical activities, and how these evaluations may relate to a child's own gender, age, and culture. Thus, the current study focuses on how an expert's profession and gender influence children's choices when seeking information. Specifically, how does an expert's gender influence children's judgments about expert knowledge? In order to address these questions, we compared children's inferences about profession-related and gender-stereotypical knowledge when evaluating experts in gender-stereotypical occupations (male mechanic, female nurse) and experts in gender counterstereotypical occupations (female mechanic, male nurse).

When each expert was presented in a gender-stereotypical profession, we expected children to attribute expert knowledge to the corresponding expert and gender-stereotypical knowledge to the corresponding gender. We also expected this attribution pattern to grow stronger with age, as children's understanding of the division of cognitive labor improves (Lutz and Keil, 2002) and they become more aware of gender stereotypes (Blakemore, 2003). On the other hand, there were three possible outcomes for the counterstereotypical presentation. First, children could rely on gender as the primary indicator of knowledge for all questions, including profession-related questions. For example, children might attribute both mechanical knowledge and male stereotypical knowledge to the male nurse. This would suggest that gender is more salient to children than a person's profession, perhaps reflecting the influence of essentialist thinking (Gelman, 2003; Bigler and Liben, 2006). Second, children could use profession as a stronger indicator of knowledge about profession-related activities and assign gender-stereotypical knowledge to experts based on professional interests as well. This result would suggest that gender is not a rigid construct, but rather that children categorize people primarily based on gendered interests instead of biological attributes. If this is the case, children should indicate that the male nurse knows more about nursing-related facts and stereotypically female activities than the female mechanic and vice versa. Finally, children could treat profession and gender as two distinct indicators of expertise and decide which one to apply based on the question at hand. Such results would suggest that children base their attributions about profession-related expert knowledge on each expert's profession and attributions about gender-stereotypical knowledge on gender, such that a male nurse would know both about human biology and about stereotypically male activities and a female mechanic would know about machines and stereotypically female activities. Bigler and Liben's (2006) proposal that flexibility in children's judgments is driven by the acquisition of multiple classification skills also suggests

that there may be developmental shifts towards disambiguating gender-related and profession-specific knowledge during the preschool years.

We were also interested in examining how children's choices are influenced by their own gender and how this may change with age. Previous research has shown that young girls' evaluations of other people's competence are influenced less by gender stereotypes than boys' evaluations (e.g., Miller and Budd, 1999), thus we expected boys' judgments about expertise to be influenced more by the expert's gender than girls' judgments.

Our final goal was to investigate the role of culture in the development of children's gender stereotypes and judgments about expertise by comparing children in two countries with different levels of gender equality: the United States and Egypt. While gender stereotypes and discrepancies still persist in the United States, American society has a history of breaking gender norms and promoting a more egalitarian workplace. Almost half of the American labor force are women (International Labor Organization (ILO), 2010), and women have attained high-ranking positions in business and government. In contrast, many developing countries continue to struggle with gender equality on multiple levels. In Egypt, women represent barely over one fifth of the labour force (ILO, 2010), and illiteracy is still a major problem, particularly among women (40% of women versus 17% of men are illiterate; Central Intelligence Agency (CIA), 2011). Also, anecdotally, Egyptian adults adhere more closely to gender norms than American adults. For example, although American men are responsible for about a third of time spent by a couple on housework every week (Killewald and Gough, 2010), Egyptian men rarely help their wives with housework or care for children, even when women are employed. It is revealing that even though a survey of Egyptian female undergraduates found that 97% believed in equality in education, only 55% believed that household chores should be equally divided among men and women and many women indicated that they would leave the decision of whether or not they should work outside the home to their husbands (Zayed et al., 2002). Because Egyptian children are less likely to be exposed to women in the workforce and egalitarian models in the home, we expected them to show stronger gender stereotypes and to make decisions about an expert's knowledge based on the expert's gender more often than American children.

In the following three experiments, we adapt Lutz and Keil's (Experiment 1, 2002) design (substituting a nurse for the doctor in order to include a typically female profession) to examine how children's knowledge attributions are influenced by manipulations of gender and profession. In order to observe cultural differences, Experiments 1 and 2 were conducted with English-speaking

American children and Experiment 3 was conducted with Arabic-speaking Egyptian children.

Experiment 1

Method

Participants. Seventy-four American children participated in this experiment. Children were divided into three age groups: three-year-olds (n=24, M_{age}=3.59 years, SD=0.28, 12 girls), four-year-olds (n=26, M_{age}=4.46 years, SD=0.26, 13 girls), and five-year-olds (n=24, M_{age}=5.17 years, SD=0.22, 12 girls). Children were recruited from two mid-sized Midwestern cities through local preschools and a laboratory database. Most children were identified by parents as Caucasian (74%), with 11% Asian, 7% African-American, and the rest unidentified. All children spoke English fluently, and 22% spoke a second language (only one child spoke Arabic).

Pretesting with Adults and Children. To develop the list of questions pertaining to gender-stereotypical activities (see Table 1), six American undergraduate students collaboratively generated a list of 20 gender-stereotypical activities associated with males or females. These activities were then rated by a different group of 20 undergraduates at a Midwestern university (M_{age}=19.75, 10 female) and 20 university students in Cairo, Egypt (M_{age}=20.25, 11 female). The Egyptian students were all fluent in English and completed the identical web-based survey as the American students. Adults rated the activities in terms of whether they were more well understood by only men, mostly men, both men and women, mostly women, or only women. These responses were converted to a 5-point numerical scale and a final list of eight gender stereotypical activities – those rated "only" or "mostly" for one gender in both cultures – were selected, such that there were four activities for each gender, and activities were similarly rated by both samples. Only activities that would be familiar to children in both cultures were included (e.g., shovelling snow was omitted, since there is no snow in Egypt).

To collect baseline data from our target age group, we presented 31 American children (M_{age}=4.90, 15 female) with a male and female puppet and asked them which of the two puppets would perform each activity. Children chose the male character 73% of the time for male activities and the female character 71% of the time for female activities, rates well above chance, $t(30)=-5.330$, $p<0.001$ and $t(30)=4.998$, $p<0.001$, respectively. These data suggest that children

Table 1
Percentage of Children Choosing the Corresponding Gender for Each Gender-stereotypical Knowledge Question by Country and Condition

	USA (Experiment 1)		Egypt (Experiment 3)	
	Stereotypical condition (n=38)	Counterstereo. Condition (n=36)	Stereotypical condition (n=34)	Counterstereo. Condition (n=39)
Female-stereotypical knowledge				
Why dark colours should not be washed with light colours	50%	58%	50%	56%
How to clean the kitchen	58%	53%	71%	67%
How to braid hair	66%	36%	65%	59%
How to sew clothes	55%	56%	59%	51%
Total	57%	51%	61%	58%
Male-stereotypical knowledge				
How to set-up a new TV	87%	31%	82%	33%
How to kill bugs	66%	69%	62%	56%
How to play football	84%	39%	71%	44%
Which computer game is more difficult	74%	25%	71%	41%
Total	78%	41%	71%	44%

shared the adults' views of these activities as gender stereotypical. Independent samples t-tests demonstrated no differences between responses among boys and girls, t values ≤0.17, p values ≥0.86, nor were any effects of age observed.

Design, Materials and Procedure. A between-subjects design was used where each child was assigned to either the stereotypical or the counterstereotypical condition, with approximately equal numbers of boys and girls of each age group in each condition. A set of two similar puppets, a male and female, was used for each condition. In the stereotypical condition, the male puppet was

dressed in a mechanic's outfit, and the female puppet was dressed in a nurse's outfit. In the counterstereotypical condition, the outfits were reversed. The puppets' gender was easily distinguishable: the male puppets had short hair and a moustache, while the female puppets had long hair.

Children were tested individually by a female experimenter in a session lasting approximately 10 minutes. The experimenter introduced children to the two puppets by telling them the puppets' gender and describing their profession (e.g., "This man is a nurse. A nurse is a person who helps doctors. A nurse helps people when they are sick or hurt and makes sure that people are healthy.") Then, children answered 24 questions where they were asked who would know more about a certain activity, were reminded of the choices ("this nurse or this mechanic?") and chose one of the puppets by pointing or saying the puppet's gender or profession. Eight questions involved gender-stereotypical activities (see Table 1) and 16 questions involved expertise related to the puppets' professions. These questions were drawn verbatim from Lutz and Keil's stereotypical role and normal functioning categories (Experiment 1, 2002), including eight mechanic-related questions and eight nurse-related questions. For clarity, we refer to Lutz and Keil's stereotypical role category as "standard professional knowledge" here. These questions directly related to professional skills (e.g., "who would know more about how to fix a flat tire?", "who would know more about how to take your temperature?"). The normal functioning category involved understanding the normal functions of humans and machines (e.g., "who would know more about how elevators work?", "who would know more about why you should eat your vegetables?"). These questions were expected to be more challenging for younger children as they require the child to infer that each expert's knowledge extends to the broader domains of biology and physics.

The expert knowledge and gender-stereotypical knowledge questions were intermixed and presented to children in one of two random orders and the order in which the puppets were presented was also counterbalanced across subjects. Finally, children were asked whether they would prefer to be a nurse or a mechanic when they grow up.

Results and Discussion

Scoring and Data Analysis. Children's answers were scored such that each choice of the appropriate expert puppet, regardless of gender, for the 8 standard professional knowledge and 8 normal functioning questions counted as 1 point. For the 8 gender stereotypical activities questions, each choice of the appropriate gender expert, regardless of profession, also counted as 1 point.

Because they require distinct ways of reasoning, profession-related questions and gender-stereotypical knowledge questions were analysed separately.

Expert Knowledge. In order to analyse children's responses on the expert knowledge (profession-related) questions, we divided the analyses into two parts. The first part examined children's understanding of knowledge associated with each profession (nurse vs. mechanic), and the second examined the type of question (standard professional vs. normal functioning knowledge) collapsed across the two professions. Two repeated-measures ANOVAs were used. The first ANOVA design was 2 (Condition: stereotypical, counterstereotypical) by 2 (Child's Gender: male, female) by 3 (Age Group: 3 years, 4 years, 5 years) by 2 (Question Type: mechanic vs. nurse questions). This ANOVA revealed no main effect of the profession associated with the questions (nurse or mechanic), $F(1, 62)=2.18$, $p=0.15$, $\eta_p^2=0.03$ (see Table 2), and no main effect of Condition, $F(1, 62)=0.174$, $p=0.678$, $\eta_p^2=0.003$. However, there was a significant main effect of Age Group, $F(2, 62)=6.19$, $p=0.004$, $\eta_p^2=0.17$. Bonferroni post-hoc analyses revealed a significant difference between 3-year-olds and 5-year-olds ($p=0.003$), but not between 3-year-olds and 4-year-olds ($p=0.088$), or 4-year-olds and 5-year-olds ($p=0.576$). In addition to showing improvement with age, scores for all age groups were significantly higher than chance (4 points) on mechanic questions (t values ≥3.30, p values ≤0.003) as well as nurse questions

Table 2
Children's Mean Scores by Country and Question Type

Question type	USA (Experiment 1)		Egypt (Experiment 3)	
	Stereotypical condition (M (SD))	Counterstereo. Condition (M (SD))	Stereotypical condition (M (SD))	Counterstereo. Condition (M (SD))
Profession-related questions (maximum score=8)				
Mechanic	6.16 (2.06)**	6.22 (1.81)**	6.79 (1.57)**	5.38 (2.15)**
Nurse	5.76 (1.68)**	5.94 (1.74)**	5.21 (2.19)**	5.03 (1.81)**
Gender-stereotypical questions (maximum score=4)				
Male-stereotypical	3.11 (0.92)**	1.64 (1.22)	2.85 (0.89)**	1.74 (1.23)
Female-stereotypical	2.29 (1.18)	2.03 (1.23)	2.44 (1.28)	2.33 (1.13)

** Values significantly different from chance at the $p<0.01$ level.

(t values ≥3.36, p values ≤0.003). There was also a significant Question Type × Gender interaction, $F(1, 62)=5.37$, $p=0.024$, $\eta_p^2=0.08$. Boys on average performed better than girls on the mechanic questions (boys' $M=6.73$, SD=1.92; girls' $M=5.65$, SD=1.80; $t(72)=2.50$, $p=0.015$) but they had similar scores on nurse questions (boys' $M=5.81$, SD=1.73; girls' $M=5.89$, SD=1.70, $t(72)=-0.20$, $p=0.84$). Within each gender, boys scored significantly higher on mechanic questions than on nurse questions, $F(1, 31)=5.75$, $p=0.023$, $\eta_p^2=0.16$, but girls' performance did not differ on both categories, $F(1, 31)=0.47$, $p=0.498$, $\eta_p^2=0.06$. There was also a significant Question Type × Age Group × Condition interaction, $F(2, 62)=3.68$, $p=0.031$, $\eta_p^2=0.11$; however, breaking down the interaction did not yield any significant two-way interactions. There were no other significant interactions (all F values ≤2.29, all p values ≥0.11). These results suggest that children's scores improve with age and that boys are more adept at identifying questions that a mechanic would be better at answering, regardless of whether the mechanic is male or female.

In order to examine children's responses to standard professional knowledge versus normal functioning questions, we collapsed across professions and repeated our earlier ANOVA with these question types as the last within-subjects variable. There was a significant effect of Question Type, $F(1, 62)=30.73$, $p<0.001$, $\eta_p^2=0.33$, where children made more correct attributions on standard professional knowledge questions than on normal functioning questions. However, there were no significant interactions, F values ≤0.58, p values ≥0.51. Although 4- and 5-year-olds' scores were significantly above chance (4 points) on both the standard professional knowledge (t values ≥4.3, p values ≤0.001) and normal functioning questions (t values ≥5.63, p values ≤0.001), 3-year-olds' responses were significantly above chance on professional knowledge questions, $t(23)=4.3$, $p<0.001$, but were only marginally significant on normal functioning questions, $t(23)=1.9$, $p=0.07$. Similar to Lutz and Keil's (2002) participants, children in our study assigned professional knowledge and normal functioning questions to the correct expert more often with age, regardless of whether or not the expert's gender conformed to stereotypes. Taken together, the absence of a significant effect of condition in both analyses of the expert knowledge questions indicates that the gender typicality of an expert's profession did not powerfully influence children's attributions about expert knowledge.

Gender-Stereotypical Knowledge. To analyse judgments about the gender-stereotypical activity questions, we examined children's responses to male activities and female activities separately using a 2 (Condition) by 2 (Child's Gender) by 3 (Age Group) ANOVA. For questions about male-stereotypical activities,

there was a main effect of Condition $F(1, 62)=37.24$, $p<0.001$, $\eta_p^2=0.375$, indicating that children chose the male puppet more often to answer the questions about male activities in the stereotypical condition than in the counterstereotypical condition (see Table 1). There were no significant main effects of Age Group nor the Child's Gender (F values ≤1.64, p values ≥0.20). These results suggest that children were influenced by a person's profession when attributing knowledge about stereotypical male activities. Children in the stereotypical condition consistently indicated that the male mechanic would know more about male-stereotypical activities at levels above chance, $t(37)=7.38$, $p<0.001$ (see Table 2). This effect was much smaller in the counterstereotypical condition, $t(35)=-1.77$, $p=0.085$. In sum, children did not consistently attribute stereotypically male knowledge to either gender in the counterstereotypical condition, suggesting that their judgments about stereotypically male knowledge were influenced by each character's gender atypical profession.

With regard to stereotypically female activities, the univariate ANOVA revealed no significant effects of any of the variables, F values ≤0.84, p values ≥0.55. In fact, children's scores on the female activities questions did not differ from chance in either condition (see Table 2). Thus, children do not seem to hold strong gender stereotypes about these activities, despite the fact that both adults and children rated these items as highly associated with females in the absence of information about profession. One potential explanation for this discrepancy is that children were asked who would know more about each activity, rather than who engages in those activities (as in the pre-test group) and perhaps children viewed the knowledge associated with the female activities as less specialised and more accessible to both genders.

Future Aspirations. When asked if they would rather be a nurse or a mechanic when they grow up, more boys chose mechanic when they were in the stereotypical condition (72%) than in the counterstereotypical condition (65%); however, this difference was not significant, $\chi^2(1, 35)=0.229$, $p=0.63$. In fact, boys' results were only marginally different from chance in the stereotypical condition, $\chi^2(1)=3.56$, $p=0.059$, and no different from chance in the counterstereotypical condition ($\chi^2(1)=1.47$, $p=0.23$). On the other hand, significantly more girls (89%) chose nurse in the stereotypical condition than in the counterstereotypical condition (53%, $p=0.027$, Fisher's Exact Test). This suggests that children held stereotypes of mechanics as typically male and nurses as typically female, and tried to conform to these stereotypes. However, when they were presented with an example that did not conform to the stereotype, girls were less likely to choose the occupation that matched the familiar stereotype.

In-Group Favoritism. To analyse whether children preferred the character of their own gender, we counted the total number of times children chose the male character (out of 24 questions). A 2 (Condition) by 2 (Child's Gender) by 3 (Age Group) ANOVA was conducted with number of times the male character was chosen as the dependent variable. There was a significant main effect of Condition, $F(1, 62)=7.61$, $p=0.008$, $\eta_p^2=0.11$, such that children were more likely to choose the male character in the stereotypical condition ($M=13.21$, SD=3.75) than in the counterstereotypical condition ($M=11.33$, SD=2.66). There was also a main effect of Age Group, $F(1, 62)=4.29$, $p=0.018$, $\eta_p^2=0.12$. Bonferroni post-hoc analyses revealed that this effect was driven by 4-year-olds ($M=10.33$, SD=2.39) being significantly less likely to choose the male character than 5-year-olds ($M=12.42$, SD=2.43; $p=0.019$). There was no significant main effect of Child's Gender, $F(1, 62)=1.47$, $p=0.23$, $\eta_p^2=0.02$; however, there was a marginally significant Gender × Condition interaction, $F(1, 62)=3.96$, $p=0.051$, $\eta_p^2=0.06$. Breaking down the interaction by gender revealed that boys were significantly less likely to choose the male character in the counterstereotypical condition, $F(1, 31)=8.58$, $p=0.006$, $\eta_p^2=0.22$, but girls did not show any significant effect of Condition, $F(1, 31)=0.43$, $p=0.52$, $\eta_p^2=0.01$. Overall, neither boys nor girls chose the male character significantly more or less often than chance, t values ≤1.18, p values ≥0.25. However, boys in the stereotypical condition chose the male character significantly more often than chance, $t(18)=2.40$, $p=0.028$. These results suggest that children are more likely to choose the male expert when he is presented in a stereotypical occupation, yet, overall, children chose the male and female characters at approximately equal rates.

Experiment 2

Experiment 1 revealed that children base judgments about an expert's knowledge primarily on the expert's profession, regardless of whether they conform to gender stereotypes of nurses as women and mechanics as men. One potential explanation for children's reliance on profession over gender when attributing knowledge about gender-stereotypical activities is that the puppets' professions may have been emphasized more than their gender due to the wording of the questions (i.e., "Who would know more about. . . .? This *nurse* or this *mechanic*?"). Thus, in Experiment 2, we modified the terms used to emphasize each puppet's gender instead and compared children's responses to Experiment 1 in order to determine whether the language used affected their choices.

Method

Participants. Twenty-eight children ages three to five participated (M_{age}=4.37, SD=0.52, 14 girls). Children were recruited from the same populations as Experiment 1 and had similar demographic characteristics. No child had participated in Experiment 1. All children spoke English fluently, and 14% spoke a second language (none were Arabic speakers).

Procedure. The procedure was identical to the counterstereotypical condition in Experiment 1, except that after each question, instead of reiterating the puppets' professions, the experimenter asked "this man or this woman?"

Results and Discussion

The same scoring procedures were used as in Experiment 1. To analyse the data, we compared children's scores in the counterstereotypical condition in Experiment 1 with scores in Experiment 2 for each type of question. *T*-tests revealed no significant differences between children's responses in this experiment and children's responses in the counterstereotypical condition of Experiment 1, all t values <1.50, all p values >0.14. This suggests that the use of vocabulary emphasizing gender or profession did not have a strong influence on children's choices about expert knowledge.

Experiment 3

Experiments 1 and 2 demonstrate that an expert's gender does not have a strong influence on children's judgments about professional expertise. The children in Experiments 1 and 2 lived in university cities in the Midwestern United States, where women are well-represented in the workforce and egalitarian attitudes about daily activities (such as dividing housework among partners) are common at home and in educational settings. However, it is unclear whether these cultural and environmental factors influenced children's attitudes toward information sources relative gender. In order to address this question, we administered the same task to children growing up in Egypt, a culture where traditional gender roles are more prevalent and women are less visible in the workforce.

Because of cultural differences in attitudes towards gender roles, we expected Egyptian children to show stronger gender stereotypes and for their decisions about an expert's professional knowledge to be more influenced by the expert's gender than American children. While the DIT does not include

a core process or contributing factor dedicated to influence of culture, it is an interactionist theory, meaning that it encompasses both what the child brings to the environment and also what the environment offers to the child. Thus, it allows for a persistent effect of culture on the child's cognition, supporting our hypothesis that even young Egyptian children might exhibit stronger gender stereotypes than American children and that their judgments about professional expertise may be influenced as well.

Method

Participants. Seventy-three Egyptian children participated (M_{age}=4.46, SD=0.90, 36 girls). Children were divided into three age groups: 3-year-olds (n=24, M_{age}=3.53, SD=0.37, 12 girls), 4-year-olds (n=26, M_{age}=4.36, SD=0.24, 13 girls), and 5-year-olds (n=23, M_{age}=5.53, SD=0.51, 11 girls). Children were from upper-middle class families and were recruited from seven preschools located in different areas of Cairo. Arabic was the primary language spoken by all participants.

Design, Materials and Procedure. The script from Experiment 1 was translated into Arabic (Egyptian dialect) by the first author and a native Arabic speaker unaware of the hypotheses of the experiment back-translated the script into English. Otherwise, the exact same materials and procedure were employed as in Experiment 1.

Results and Discussion

Expert Knowledge. The scoring strategy and data analyses were identical to Experiment 1. A repeated-measures ANOVA analysing mechanic and nurse questions (collapsed across professional knowledge and normal functioning questions) revealed a significant main effect of Question Type, $F(1, 61)=15.75$, $p<0.001$, $\eta_p^2=0.21$, such that children had higher scores on mechanic questions than on nurse questions (see Table 2). There was also a main effect of Condition, $F(1, 61)=8.07$, $p=0.006$, $\eta_p^2=0.117$ and a main effect of Age Group, $F(2, 61)=9.06$, $p<0.001$, $\eta_p^2=0.23$, but no significant effect of Child's Gender, $F(1, 61)=1.67$, $p=0.202$, $\eta_p^2=0.027$. Bonferroni post-hoc analyses showed that overall performance improved with age, where 3-year-olds' responses were significantly different from 4-year-olds ($p=0.038$) and 5-year-olds ($p=0.001$), while the latter two groups had similar scores ($p=0.479$). These effects were qualified by a significant Age Group × Condition interaction, $F(2, 61)=3.44$, $p=0.039$, $\eta_p^2=0.10$, where there was a significant difference between age groups only in the stereotypical condition, $F(2, 28)=19.11$, $p<0.001$, $\eta_p^2=0.58$, and not in the counterstereotypical condition, $F(2, 33)=0.924$, $p=0.41$, $\eta_p^{2=0}.05$. Bonferroni

post-hoc analyses revealed that children's knowledge attributions improved in a stepwise manner in the stereotypical condition with increasing age (p values ≤0.040), but age did not relate to knowledge attributions in the counterstereotypical condition (p values ≥0.637). In particular, the Egyptian 5-year-olds' relatively weak performance compared to the younger children in the counterstereotypical condition suggests that they may have struggled to reconcile their understanding of expertise with gender stereotypes (see Figure 1).

In addition, there was a significant Question Type × Condition interaction, $F(2, 61)=3.94$, $p=0.016$, $\eta_p^2=0.09$. Further analyses revealed that there was a significant effect of Question Type in the stereotypical condition, $F(1, 33)=17.20$, $p<0.001$, $\eta_p^2=0.38$, with higher scores for mechanic questions than nurse questions, but there was no significant effect in the counterstereotypical condition, $F(1, 33)=1.34$, $p=0.26$, $\eta_p^2=0.04$ (see Table 2). This suggests that Egyptian children were better at attributing mechanical knowledge to the mechanic than biological knowledge to the nurse when the experts' professions conformed to gender stereotypes.

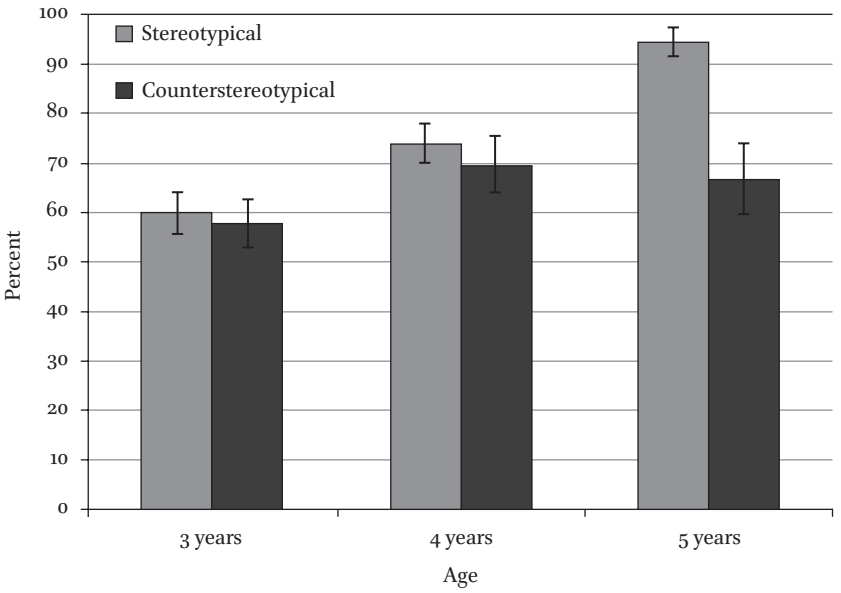

Figure 1. Egyptian children's responses to expert knowledge questions. Percentages represent percent of correct responses (attributing expert knowledge to corresponding expert, regardless of gender). Error bars denote standard error of the mean.

There was also a significant Question Type × Age Group interaction, $F(2, 61)=3.94$, $p=0.025$, $\eta_p^2=0.11$. Breaking down the interaction revealed that there was a significant effect of Question Type for 3-year-olds, $F(1, 20)=10.76$, $p=0.004$, $\eta_p^2=0.35$, and 4-year-olds, $F(1, 22)=10.32$, $p=0.004$, $\eta_p^2=0.31$, but not for 5-year-olds, $F(1, 19)=0.001$, $p=0.97$, $\eta_p^2<0.001$, where 3- and 4-year-olds had significantly higher scores on mechanic questions than on nurse questions, and 5-year-olds performed similarly on both categories. Finally, there was a significant three-way Question Type × Gender × Condition interaction, $F(1, 61)=4.11$, $p=0.01$, $\eta_p^2=0.10$. Further analyses revealed a significant Question Type × Gender interaction in the stereotypical condition, $F(1, 28)=5.19$, $p=0.031$, $\eta_p^2<0.156$, but not in the counterstereotypical condition, $F(1, 33)=1.94$, $p=0.17$, $\eta_p^2=0.055$. Examining the Question Type × Gender interaction revealed that, in the stereotypical condition, there was a significant effect of question type for boys, $F(1, 14)=20.88$, $p<0.001$, $\eta_p^2=0.599$, but not for girls, $F(1, 14)=1.73$, $p=0.21$, $\eta_p^2=0.11$. Post-hoc *t*-tests revealed that boys had lower scores on nurse questions than mechanic questions in the stereotypical condition, $t(16)= 4.34$, $p=0.001$.

The repeated-measures ANOVA analysing standard professional knowledge and normal functioning questions (collapsed across both professions) showed no significant effect of Question Type, $F(1, 61)=1.17$, $p=0.29$, $\eta_p^2=0.02$; however, there was a significant Question Type × Gender interaction, $F(1, 61)=6.80$, $p=0.011$, $\eta_p^2=0.10$, where boys scored significantly lower on normal functioning questions, $F(1, 30)=7.44$, $p=0.011$, $\eta_p^2=0.199$, while girls performed similarly on both categories, $F(1, 31)=1.08$, $p=0.31$, $\eta_p^2=0.034$.

Overall, Egyptian children scored higher on mechanic questions than on nurse questions (especially younger children), but their scores on mechanic questions were lower in the counterstereotypical condition. This suggests that although Egyptian children understood which expert was more likely to know about each domain, the counterstereotypical presentation influenced their decisions.

Gender-Stereotypical Knowledge. Using the same scoring procedure and analyses as Experiment 1, the univariate ANOVA for questions about male activities revealed a significant main effect of Condition, $F(1, 61)=17.64$, $p<0.001$, $\eta_p^2=0.224$, where children chose the male puppet more often in the stereotypical condition. There were no main effects of Age Group or Child's Gender, *F* values ≤1.78, *p* values ≥0.18. Children's scores were significantly above chance (4 points) in the stereotypical condition, $t(33)=5.58$, $p<0.001$ (see Table 1). In the counterstereotypical condition, children showed a slight preference for the female mechanic, although this preference was not significantly different from chance, $t(38)=-1.30$, $p=0.201$. Thus, Egyptian children indicated that the

male puppet would know more about stereotypically male activities in the stereotypical condition, while they did not show a preference for either puppet in the counterstereotypical condition. This suggests that, similar to American children, Egyptian children's inferences about stereotypically male knowledge were impacted when the male puppet was engaged in a counterstereotypical profession.

For female activities, the univariate ANOVA indicated no significant effect of Condition, $F(1, 61)=0.36$, $p=0.55$, $\eta_p^2=0.006$. However, there was a main effect of Age Group, $F(2, 61)=4.88$, $p=0.011$, $\eta_p^2=0.138$, such that older children were more likely to correctly attribute expertise about stereotypically female activities to the female character than younger children. Bonferroni post-hoc analyses showed that 3-year-olds were significantly different from 5-year-olds ($p=0.014$), but not significantly different from 4-year-olds ($p=0.817$), while 4- and 5-year-olds were not significantly different ($p=0.187$). In addition, there was a significant main effect of the Child's Gender, $F(1, 61)=4.69$, $p=0.034$, $\eta_p^2=0.071$, with girls more likely to choose the female expert than boys. Although boys' scores were not significantly different from chance in either condition, t values ≤ 0.50, p values ≥ 0.63, girls' scores were significantly higher than chance in both conditions, t values ≥ 2.56, p values ≤ 0.019. In sum, Egyptian boys did not indicate that a female expert would know more about activities that adults in their culture judge as stereotypically female activities, but Egyptian girls did, and this remained true even when the female expert was engaged in a counterstereotypical profession.

Future Aspirations. When Egyptian children were asked if they would rather be a nurse or a mechanic when they grow up, boys in the stereotypical condition chose mechanic (92%) significantly more often than boys in the counterstereotypical condition (46%, $p=0.023$, Fisher's Exact Test). Similarly, girls chose nurse significantly more often in the stereotypical condition (93%) than in the counterstereotypical condition (47%; $p=0.021$, Fisher's Exact Test). These results suggest that Egyptian children hold stereotypes for these two professions and they try to conform to these roles. However, when they are presented with a counterstereotypical portrayal of characters, both boys and girls become less likely to conform to gender norms.

In-Group Favoritism. We utilized the same analysis as in Experiment 1 to measure whether children preferred the character of their own gender. The ANOVA revealed a significant main effect of Condition, $F(1, 61)=18.56$, $p<0.001$, $\eta_p^2=0.23$, such that children were more likely to choose the male character in the stereotypical condition. There was also a main effect of Child's Gender, $F(1, 61)=10.24$,

p=0.002, η_p^2=0.14, such that boys were more likely to choose the male character (M=13.52, SD=3.54) than girls (M=11.32, SD=2.77). There was no significant effect of Age Group, $F(1, 61)$=1.42, p=0.25, η_p^2=0.05, but there was a significant Age Group × Condition interaction, $F(1, 61)$=3.85, p=0.027, η_p^2=0.11. Breaking down the interaction by condition revealed a significant main effect of Age Group in the stereotypical condition, $F(1, 28)$=5.29, p=0.011, η_p^2=0.27, but not in the counterstereotypical condition, $F(1, 33)$=0.70, p=0.50, η_p^2=0.04. Bonferroni post-hoc analyses for the stereotypical condition revealed that 5-year-olds were significantly less likely to choose the male expert compared to 3-year-olds (p=0.010) but not compared to 4-year-olds (p=0.116), but 3- and 4-year-olds' responses were not significantly different from each other (p=0.28). These results suggest that Egyptian children's in-group preferences were influenced by each character's profession, although this influence was somewhat weaker among the oldest children.

Cross-Cultural Comparisons. In order to evaluate potential cross-cultural differences between the Egyptian and American samples, we used a series of 2 (Country: USA, Egypt) by 2 (Condition: stereotypical, counterstereotypical) ANOVAs to analyze children's responses for each Question Type. For the mechanic questions, there was a significant main effect of Condition, $F(1, 143)$= 4.49, p=0.036, η_p^2=0.03, such that children on average chose the mechanic more often in the stereotypical condition than in the counterstereotypical condition. While there was no significant main effect of Country, $F(1, 123)$=0.10, p=0.75, η_p^2=0.001, there was a significant Country × Condition interaction, $F(1, 123)$ =5.39, p=0.022, η_p^2=0.036. Breaking down the interaction by Country revealed that although there was no effect of condition for American children, $t(72)$=−0.14, p=0.89, Egyptian children showed a significant effect of Condition, $t(69)$=3.16, p=0.002 (Levene's test indicated unequal variances, $F(1, 71)$=6.93, p=0.01, so degrees of freedom were adjusted from 71 to 69.04), such that they correctly attributed expertise to the mechanic more often in the stereotypical condition than in the counterstereotypical condition. Thus, for questions related to a mechanic's knowledge, the presentation of counterstereotypically gendered experts influenced Egyptian children's judgments, in contrast to their American counterparts who did not seem to be influenced by the expert's gender.

For the nurse questions, we found a significant main effect of Country, $F(1, 123)$=5.79, p=0.017, η_p^2=0.039, where American children were more likely to make correct attributions for nurse questions than Egyptian children. This may be due in part to increased familiarity with the nursing profession among American children because, for example, nurses are much more ubiquitous in

pediatrician's offices in the United States than in Egypt. There was no significant main effect of Condition, $F(1, 123)<0.001$, $p=0.999$, $\eta_p^2<0.001$.

The ANOVA exploring scores for the questions about stereotypically male activities revealed a significant main effect of Condition, $F(1, 123)=51.87$, $p<0.001$, $\eta_p^2=0.27$, such that children in both countries were more likely to choose the male puppet in the stereotypical condition. However, there was no significant effect of Country, $F(1, 123)=0.17$, $p=0.68$, $\eta_p^2=0.001$, suggesting that American and Egyptian children had similar responses. For questions about female activities, there was neither a significant effect of Country, $F(1, 123)=1.32$, $p=0.25$, $\eta_p^2=0.009$, nor a significant effect of Condition, $F(1, 123)=0.86$, $p=0.36$, $\eta_p^2=0.006$. Overall, these results suggest that while Egyptian children had more difficulty attributing profession-related knowledge to counterstereotypically gendered experts, children in both populations drew similar inferences when attributing knowledge about activities that are typically associated with one gender.

General Discussion

We examined children's attributions of expertise based on information about an expert's profession and gender, and how gender, age, and culture influence children's knowledge attributions. Overall, our results replicate Lutz and Keil's (2002) finding that children as young as age 3 understand that different domains of knowledge are associated with professional expertise. These experiments also demonstrate that preschoolers' understanding of the division of cognitive labour is robust across two different cultures. Both American and Egyptian preschoolers correctly inferred domains of expertise and generalized professional knowledge to broader knowledge about machines and people, although these skills showed improvement between ages 3 and 5.

Weighing Profession versus Gender

Our results suggest that American children rely on a person's profession as a stronger indication of profession-related knowledge than their gender. For Egyptian children, however, the results were less straightforward. Children in the counterstereotypical condition were less likely to attribute knowledge to the appropriate expert (especially mechanical knowledge), suggesting that gender plays a stronger role in Egyptian children's judgments about professional expertise, but not to the extent that children attribute knowledge solely based on gender.

With respect to gender-stereotypical knowledge, children in both cultures demonstrated gender stereotypes primarily for male activities. This supports previous research showing that young children already hold gender stereotypes (e.g., Serbin et al., 2001; Poulin-Dubois et al., 2002; Blakemore, 2003), as well as the DIT (Bigler and Liben, 2006), which postulates that children establish stereotypes early and categorize people according to those stereotypes. However, one can also interpret the current results as showing that preschoolers take a person's profession – and thus their expert interests – into account when attributing gender-stereotypical knowledge. Children in both cultures consistently attributed knowledge about stereotypically male activities to the mechanic, regardless of gender (although their responses were not significantly different from chance in the counterstereotypical condition). This was true for questions that could arguably be seen as related to mechanical knowledge (e.g., setting up a new TV), but even more so for activities unrelated to a mechanic's knowledge base (e.g., playing football, see Table 1). Perhaps children's experience with males as mechanics is so salient that children automatically associate this profession with other stereotypically male interests unrelated to cars or machines. Alternatively, perhaps children think that if a person is a mechanic, they probably have a personal interest in cars, and therefore must enjoy other male interests, such as football.

Although American children and Egyptian boys stereotyped male activities, they did not attribute knowledge about stereotypically female activities to the female character. This finding is somewhat surprising given that both the adults and children in our pretest groups associated these activities with women. It is possible that this discrepancy resulted from a shift in the focus of the questions between pretest and test items. In particular, the pretest focused on who completes activities (e.g., who cleans the kitchen?) and our main experiments focused on knowledge about a given activity (e.g., who knows more about how to clean the kitchen?).

Across both cultures, we also found that boys were typically better than girls at attributing mechanical knowledge to the mechanic. These gender differences raise the possibility that boys and girls in both cultures are socialized differently and consequently pay attention to different information. For example, boys may be exposed to more mechanic-related activities through toys and media targeting boys, such as the popular Bob the Builder and Handy Manny television shows. This finding also supports the possibility that boys are more likely than girls to adhere to gender boundaries (see Leaper, 2000 for a review). Similarly, Egyptian girls may be more attentive to female-stereotypical activities because they are being socialized to assume a typical female role.

However, additional research is necessary to determine to what degree these effects are driven by socialization rather than children's personal preferences and interests in different types of activities.

The Influence of Culture and Language

There are several potential explanations as to why the expert's gender played a stronger role in Egyptian children's judgments of professional expertise than it did among American children. One explanation is that these results reflect a stronger emphasis on acquired skills among American children. Even though American children held gender-related occupational stereotypes, they may have believed that acquired knowledge overshadows gender. This possibility is supported by other work showing that young children believe that experience influences a person's behaviour more than gender (e.g., Taylor et al., 2009). Thus, perhaps the difference between American and Egyptian children's responses to the expert knowledge questions (particularly mechanic questions) results from different cultural attitudes about learning and knowledge.

In addition, children in the Egyptian sample, particularly boys, exhibited an overall bias in favor of males. As discussed above, women in Egypt are more likely to be illiterate than men, are underrepresented in the workforce and in political life, and are often believed to be inferior to men (Tadros, 2010). Our findings suggest that these cultural factors may influence children's judgments about women's capabilities and knowledge as early as preschool. Since Egyptian children are less likely to see women in professional roles, let alone counterstereotypical ones, they may not be as likely as American children to acknowledge that a woman can be skilled at a counterstereotypical profession. Conversely, Egyptian girls chose the female character more often in the counterstereotypical condition, suggesting that they may attribute exceptional expertise to a female character engaged in a male-stereotypical profession.

Besides differences in exposure to women in professional roles, Egyptian children's choices may also have been affected by the nature of the Arabic language and the use of grammatical gender. In English, nouns identifying an individual's profession, such as doctor, teacher, and pilot, can be gender-neutral (even if they sometimes have a gendered connotation). In Arabic, on the other hand, every word describing a person's profession also indicates whether the person is male or female. For example, nurse in Arabic is "*mumaredha*" if the nurse is a woman, and "*mumaredh*" if the nurse is a man. Because gender is inseparable from profession (as well as from any noun or adjective) in Arabic, gender may be more salient to Arabic-speaking children than it

is to English-speaking children. As several recent studies have shown (e.g., Boroditsky et al., 2003; Wasserman and Weseley, 2009), even subtle linguistic differences with respect to an object's grammatical gender can affect adolescents' and adults' cognitive judgments. Thus, the effects observed in the Egyptian sample may reflect a combination of cultural and linguistic influences. However, the results of Experiment 2 demonstrate that American children's choices were not influenced by an emphasis on gender in the verbal presentation of the questions and therefore language alone does not appear to drive children's judgments. By extension, it seems unlikely that the results of Experiment 3 with the Egyptian children are primarily a function of the gendered words used to describe the experts in the Arabic language. It is more likely that they are a function of a cultural emphasis on gender that happens to also be reflected in the Arabic language.

Children's Aspirations

When asked about their future aspirations, American girls and Egyptian boys and girls chose the gender-typical profession significantly less often when they had just been exposed to puppets engaged in counterstereotypical occupations. These results suggest that exposure to counterstereotypical examples in the course of this relatively brief experiment influenced children's attitudes, in contrast to earlier research demonstrating that children's interests and future aspirations are not influenced by short term interventions (Bigler and Liben, 1990; Liben et al., 2001). However, children in the earlier studies were older than the children in our samples, raising the possibility that interventions earlier in life may have stronger effects, at least in the short term. Further research is needed to assess when and how brief exposures to counterstereotypical exemplars influence preschoolers' attitudes and, if so, how long such effects last.

In conclusion, our findings suggest that preschool children's understanding of expert knowledge is robust across cultures, and that it is largely independent of an expert's gender. This is true despite evidence that preschool children are already aware of gender stereotypes and that they show an explicit in-group bias in favour of their own gender. It is also important to remember that gender is just one of many factors that may influence children's assessment of another person's expertise, and how much children weigh any individual characteristic may vary based on the circumstances. Nevertheless, the current research provides a promising basis for understanding how children evaluate information sources and for developing more effective methods of counteracting the negative effects of gender stereotypes on children's goals and aspirations.

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