

## Culture and the Sequence of Steps in Theory of Mind Development

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To examine cultural contrasts in the ordered sequence of conceptual developments leading to theory of mind (ToM), we compared 135 3- to 6-year-olds (77 Australians; 58 Iranians) on an established 5-step ToM scale (Wellman & Liu, 2004). There was a cross-cultural difference in the sequencing of ToM steps but not in overall rates of ToM mastery. In line with our predictions, the children from Iran conformed to a distinctive sequence previously observed only in children in China. In contrast to the case with children from Australia (and the United States), knowledge access was understood earlier than opinion diversity in children from Iran, consistent with this collectivist culture's emphasis on filial respect, dispute avoidance, and acquiring knowledge. Having a sibling was linked with faster overall ToM progress in Australia only and was not related to scale sequences in either culture.

*Keywords:* theory of mind, culture, parenting, siblings, preschoolers

With the acquisition of a theory of mind (ToM), children come to understand people's behavior as the product of their internal, subjective mental states including desire, emotion, and belief. For the last 25 years, most of the research on this crucial development has relied on a single marker of ToM: the inferential false belief test (Dennett, 1978). Children pass this test by accurately predicting the actions or thoughts of protagonists with reality-discrepant beliefs that the child does not share. Most typically developing children in all cultures so far examined fail at age 3 years (Wellman, Cross, & Watson, 2001). Yet by age 5 or 6, success on the task is so widespread as to suggest that "understanding of belief and, relatedly, understanding of mind exhibit genuine conceptual change during the preschool period" (Wellman et al., 2001, p. 655). Debate currently surrounds whether this is via the preordained maturational unfolding of a neurobiological mind-reading module (see e.g., Leslie & Thaiss, 1992) or whether the uniquely human social and conversational experiences that all societies provide for their young nurture children's developing understanding (see e.g., Astington, 2001).

Cross-cultural comparisons can help address these contrasting accounts. However, cross-cultural research to date has yielded contradictory evidence. Thus, some studies have suggested uniform ages of false belief acquisition in diverse cultural settings such as between urban middle-class Europe or North America and

(a) a remote bush community in western Africa (Avis & Harris, 1991), (b) an impoverished Peruvian mountain village (Callaghan et al., 2005), or (c) a Polynesian settlement in Samoa (Callaghan et al., 2005). Yet other studies have shown variations of up to 2 years in the average age for passing false belief tests even between highly similar industrialized societies such as Canada versus the United Kingdom (Wellman et al., 2001), Japan versus Korea (Oh & Lewis, 2008), or mainland versus Hong Kong China (Liu, Wellman, Tardif, & Sabbagh, 2008).

This inconsistency may partly reflect "the danger in letting a single task become a marker for complex development" (Astington, 2001, p. 687). ToM conceptually encompasses a range of mental states including emotion, intention, and desire, as well as belief, and recent evidence has suggested that false belief mastery is just one step in a coherent developmental progression of folk psychological insights stretching back though toddlerhood and forward into the school years (see e.g., Pons, Harris & de Rosnay, 2004; Wellman & Liu, 2004). Both to further clarify the timing of ToM mastery and to shed new light on sociocultural influences on the acquisition of psychological understanding, ToM must be examined through a wider lens than just false belief.

Pioneering this approach, Wellman, Fang, Liu, Zhu, and Liu (2006) used a five-step developmental scale of ToM understanding to compare Chinese-speaking preschoolers in Beijing with English-speaking preschoolers in the United States. The ToM scale (Wellman & Liu, 2004) had previously been well validated and shown, via both Guttman and Rasch analyses, to identify a reliable developmental sequence of mental state concepts in which progress to any later scale step was contingent on mastery of all earlier ones. Preschoolers in the United States mastered the steps in the following order: diverse desires (DD), then diverse beliefs (DB), then knowledge access (KA), then false beliefs (FB), and finally hidden emotions (HE). The same sequence has been shown to replicate exactly for English-speaking preschoolers in Australia (Peterson & Wellman, 2009; Peterson, Wellman, & Liu, 2005) and for preschoolers in Germany (Kristen, Thoermer, Hofer, Aschersleben, & Sodian, 2006).

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This article was published Online First May 30, 2011.

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This study received indirect support from a grant by the Australian Research Council to Candida C. Peterson, Virginia Slaughter, and Henry M. Wellman. We are very grateful to all the children who took part and to their teachers and parents.

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Yet in their Chinese sample, Wellman et al. (2006) observed an intriguing cross-cultural difference. Despite passing the same total number of scale steps as did U.S. children at equivalent ages, children in China completed the steps in a different order. Relative to the previously explained order observed for English-speakers, the Beijing preschoolers reversed the DB and KA steps to reveal a scale sequence that, although just as reliably consistent across children as the original U.S. one, placed expertise with KA (people who perceive an event know about it) reliably ahead of DB (different people have different ideas and opinions about the same thing). Longitudinal evidence (Wellman, Fang, & Peterson, in press) supports this cross-cultural contrast by showing that when individual Chinese, U.S., and Australian children are tested repeatedly on the scale as they grow up, their individual orders of progress conform to their own country's specific cross-sectional sequence.

The contrast between U.S. and Chinese children suggests that "culturally shaped differences in input are at work" (Wellman et al., 2006, p. 1080) in ToM's progressive development. On this hypothesis, systematic community variations in parenting philosophies, conversation, and socialization practices might draw certain mental state concepts to children's attention before other ones (Astington, 2001).

Any country encompasses multiple cultural communities and varied practices, making global cultural distinctions problematic. Nonetheless, qualified generalizations can be appropriate. Thus, many middle-class samples in the United States (like those in Australia) evidence individualistic, independent views of personhood (Greenfield, Keller, Fuligni, & Maynard, 2003; Nisbett, 2007) according to which children are encouraged to think for themselves, to develop their own ideas, to assert their opinions freely, and to engage in reasoned discussion without privileging the traditional wisdom of elders over the creative new ideas of the young. It is conceivable that this style of child rearing leads many children in the United States and Australia to form initial conceptualizations of mind in terms of differences of opinion, thus explaining their early mastery of the DB task.

Contemporary, middle-class Chinese samples, by contrast, experience collectivist, interdependent cultural practices (Greenfield et al., 2003; Nisbett, 2007) according to which many parents teach filial respect, emphasize the acquisition of well-established knowledge, and encourage children's conformity to the cultural models, rules, and traditions conveyed by their elders rather than self-assertive expression of their own independent points of view. Such an approach to child rearing may redirect ToM development in many Chinese children so that key concepts of mind are initially constructed around the insight that people can be knowledgeable versus ignorant rather than that people are often diverse in their opinions and beliefs.

Underwriting these generalities, research asking parents about their goals and practices has shown that samples of parents in individualistic communities, such as middle-class parents in the United States, often highly value children's self-expression, self-assurance, and independence. Thus, in their beliefs and timetables for their child's development, U.S. mothers of Anglo background (see e.g., Mosier & Rogoff, 2003) and Australian mothers of similar background (see e.g., Goodnow, Cashmore, Cotton, & Knight, 1984) often expect and encourage their children's early independence of mind and self-assertive expression of their opin-

ions. Despite important variability among families within the same culture, systematic comparisons between cultural groups often show significant differences between the parenting values/practices in these countries and those of parents from more collectivist or interdependent cultural backgrounds, who often instead place significantly higher value on young children's obedience, dependency, and respect for elders (see e.g., Harwood, Schoelmerich, Ventura-Cook, Schulze, & Wilson, 1996). Thus, in China parents often discourage children's voicing of their independent views or opinions (Chen, Dong, & Zhou, 1997) and instead strive to facilitate and foster children's early mastery of culturally shared knowledge and practical know-how (see e.g., Johnston & Wong, 2002; Stevenson et al., 1990).

Wellman et al.'s (2006) findings could reflect these variable socialization practices, but other explanations are also conceivable. One illustrative alternative would instead emphasize the normative presence or absence of siblings. A large body of research shows that preschoolers with siblings in Australia, Canada, the United Kingdom, and the United States master ToM concepts of FB significantly ahead of only-children (see e.g., Jenkins & Astington, 1996; McAlister & Peterson, 2007; Perner, Ruffman, & Leekam, 1994; Ruffman, Perner, Naito, Parkin, & Clements, 1998). Possible explanations for these findings include that siblings provide increased opportunities for interaction, for pretend play (Perner et al., 1994), for family discussions of thoughts and feelings (Brown, Donellan-McCall, & Dunn, 1996), and/or for disputes and disagreements (Randell & Peterson, 2009), factors that correlate with enhanced understanding of FB. These same factors seem equally likely to highlight the nature and frequency of differences in belief or belief diversity as assessed by the DB task, although this has been unstudied. From this perspective, when interacting with child siblings at home, preschoolers often gain rich and varied exposure to the diversity of people's opinions and beliefs. Yet these potential stimuli to early mastery of the DB task were unavailable to the Beijing preschoolers who took part in Wellman et al.'s study, owing to their parents' conformance to their nation's one-child-per-family policy.

Less intriguing, but also worthy of consideration, is a methodological divergence between Wellman et al.'s (2006) U. S. versus Chinese DB tasks. The standard U.S. version of the DB task (Wellman & Liu, 2004), and the one used for Wellman et al.'s English-speaking children, involves people's differing opinions about a pet's whereabouts. But in order to cope with their Beijing preschoolers' unfamiliarity with household pets, Wellman et al.'s Chinese children received a modified version involving beliefs about possible locations for an inanimate object (a coat that one person thought was in the cupboard and another believed was under the bed). Conceivably, this version might be harder than the original pet scenario (because inanimate objects do not move independently of human agency and/or because putting coats under beds might seem odd or wrong).

Further cross-cultural research using the ToM scale is therefore needed to examine these possibilities and, more fundamentally, to examine the existence and nature of cultural variation in progressive mastery of interconnected facets of ToM. Furthermore, as others have noted (see e.g., Callaghan et al., 2005; Liu et al., 2008) moving ToM research beyond its traditional concentration on middle-class North American, European, and Australian preschoolers to include children in rarely studied nations and cultures

throughout the world could uncover new insights into the growth of social cognition. The present study addressed these aims.

We identified Iran as a nation that, like modern China, is collectivist or interdependent in its overall cultural orientation (see e.g., Ghorbani, 2003; Greenfield et al., 2003; Rudy & Grusec, 2006). Even though Iran's dominant Muslim religious tradition differs in many ways from the Confucian/Buddhist/communist belief system that dominates contemporary China, there are similarities when it comes to normative Iranian and Chinese approaches to child rearing. Many Iranian parents, like Chinese parents (Chen et al., 1997), endorse collectivist child-rearing goals (e.g., by strongly agreeing that children "should consider the needs of his or her family as more important than his or her own"; Rudy & Grusec, 2006, p. 72). In both Iran and China, there is likewise a widely shared cultural emphasis on teaching children to (a) respect their elders, (b) defer their own views and wishes to parental authority, (c) avoid overt disputation with parents and other family members, and (d) curb individual desires when these conflict with family needs (see e.g., Chen et al., 1997; Frank, Plunkett, & Otten, 2010; Sharifzadeh, 2004; Stevenson et al., 1990). Sharifzadeh (2004) noted that many Iranian parents "prefer to see their children grow as interdependent members of the family rather than as independent individuals" (p. 396).

At the same time, middle-class parents in Iran, like Chinese parents, often report placing high value on children's knowledge acquisition, with a willingness to sacrifice their own luxuries to improve their children's education and training (Chao, 1994; Sharifzadeh, 2004). As preschoolers, children in these cultures are often expected to acquire knowledge and academic skills more quickly, but autonomy and social skills more slowly, than in the West (Goodnow et al., 1984; Chen et al., 1997; Rudy & Grusec, 2001). Research shows that many middle-class Iranians place "high emphasis on academic and occupational achievement" (Frank et al., 2010, p. 1), which is consistent with findings for Chinese parents (Stevenson et al., 1990). Thus, although middle-class urban parents in both countries often score highly on measures of warmth, affection, and child-centeredness (Chao, 1994; Rudy & Grusec, 2006), this typically coincides with strong endorsement of a controlling, didactic, and knowledge-oriented approach to their children's development and learning (see e.g., Chao, 1994; Chen et al., 1997; Rudy & Grusec, 2006).

In these ways and others, Iran, like China, evidences interdependent, collectivist familial and educational practices that are firmly rooted in longstanding Eastern philosophical traditions that have evolved and endured in relative isolation from Westernizing influences. If these relate to the developmental sequence of preschoolers' ToM mastery, it is possible that Iranian children will follow the distinctive Chinese sequence.

By contrast with parallels between Iran and China, there are often sharp differences when samples of Iranian parents are compared with matched groups of parents from North America. Again, within in any particular nation or culture, individual differences in parenting are clearly evident (Goodnow & Collins, 1990); however, when normative parenting patterns are considered, Iranian parents are often found to differ in important ways from parents of individualist cultural background in countries such as Canada, the United States, or Australia. For example, even after migrating to Canada, Iranian-born parents are found to score higher in collectivist parenting attitudes and lower in individualism than do

Anglo-Canadians (Rudy & Grusec, 2006). When it comes to monitoring children, setting rules, and applying discipline, Alizadeh and Andries (2002) noted that in Iran "the dominant style is probably authoritarian" (p. 41), and Rudy and Grusec (2006) reported higher authoritarian parenting scores for an Iranian migrant sample of parents in Canada than for a matched group of Anglo-Canadian parents. The reverse was true for these groups' levels of endorsement of authoritative parenting.

More directly related to our research samples, research shows that many Anglo-Australian parents favor an authoritative style of discipline (Leung, Lau, & Lam, 1998; Nicholson, Phillips, Peterson, & Battistutta, 2002) that encourages discussions of family rules and imposes fewer constraints and expectations on children than does the authoritarian style often favored in Asian cultures (Vinden, 2001) as well as by many Muslim families from the Middle East (Rudy & Grusec, 2006). Anglo-Australian parents likewise typically place greater emphasis than Middle Eastern parents do on children's autonomy and self-confidence (see e.g., Goodnow & Collins, 1990; Rudy & Grusec, 2006). In line with a more authoritarian style of parenting (Rudy & Grusec, 2006), many middle-class Iranian parents, like parents in China (Chao, 1994; Chen et al., 1997), have been found to favor their children's suppression of anger and disagreement more strongly than do comparable Anglo-North American parents (Diener & Lucas, 2004).

In total, therefore, middle-class preschoolers growing up in Iran or China may well have less chance than those being reared in Australia or the United States to be exposed to opinion diversity during family conversations or disputes. Nor are they as likely as middle-class Western children to be encouraged by parents and teachers to express personal beliefs that oppose the prevailing adult point of view. Indeed, even after migration exposes them to Westernizing influences, many Iranian young people continue to deem autonomy seeking and the challenging of parental viewpoints to be improper and disrespectful (Frank et al., 2010). Similarly, one comprehensive cross-cultural study of groups of mothers of preschoolers who were either Anglo-Australians or recent migrants to Australia from the Middle East showed, via several converging methodologies, that the latter were significantly less in favor of their children's developing verbal negotiation and self-assertion skills so as to be able to "resolve disputes with peers without fighting," "state own preferences when asked," "explain why he/she thinks so," or "get [his/her] own way by persuading friends" (Goodnow et al., 1984, p. 197).

In sum, the current body of cross-cultural evidence on parental values and cultural models and practices combines to suggest that, on average, a middle-class preschooler growing up in Iran or China may gain less exposure than does a middle-class Anglo-Australian or Anglo-North American peer to people's overt disagreements and differences of opinion (i.e., the theme of the DB task on the ToM scale) and may gain richer and more varied exposure to experiences likely to promote an understanding of how knowledge is accessed, acquired, and distinguished from ignorance (i.e., the themes of the KA task).

We therefore hypothesized that (a) Farsi-speaking preschoolers native to Iran would follow the developmental sequence of ToM task mastery (KA ahead of DB) that had previously been noted only among Chinese preschoolers in Beijing (Wellman et al., 2006) and (b) these Iranian children would differ in sequence from

a matched sample of Anglo-Australian preschoolers, who were predicted to conform to the developmental sequence (DB before KA) that has been observed in much previous research both in Australia (see e.g., Peterson et al., 2005) and in the United States (see e.g., Wellman & Liu, 2004). If confirmed, this finding would help bolster arguments that cultural variations in parental attitudes and socialization practices exert an influence on the sequence of steps in children's acquisition of ToM. Moreover, our sample of Iranian children could potentially provide strong evidence for such a conclusion, or force revision of it, because unlike the Chinese preschoolers studied by Wellman et al. (2006), many were raised with siblings in the home.

For our research, we used exactly the same ToM tasks in Iran and Australia (see Table 1), presented in the same way in the children's native language (Farsi in Iran and English in Australia). Our complete matching of procedures included retaining Wellman and Liu's (2004) original (pet) scenario for the DB task. In addition, we directly explored the viability of the sibling-based interpretation of Wellman et al.'s (2006) Chinese findings. Indeed, we were able to make comparisons within and between cultures of ToM performance in relation to sibling status and family size, a variable that has not previously been examined in relation to ToM scale progressions.

## Method

### Participants

The sample of 135 preschoolers included 58 Farsi-speaking Iranians (24 boys, 34 girls; mean age = 4.79 years; range =

3.33–6.50) in Shiraz, Iran, plus 77 English-speaking Australians (36 boys, 41 girls; mean age = 4.55 years; range = 3.00–6.42) in Brisbane, Queensland, Australia. Thirty-one of the Iranian preschoolers were only-children (53%), whereas the rest (47%) had one child sibling ( $n = 21$ ) or had two child siblings or more ( $n = 6$ ). Sibling information was available for only 49 (64%) of the Australians. Of these, 8 (16%) were only-children, 27 (55%) had one child sibling, and 14 (29%) had two or more.

The Iranian children were all born in Iran and spoke the local language (Farsi) as their sole or primary language. Similarly, the Australian children we tested were all born in Australia and spoke English as their sole or primary language. We had no information on parents' birthplaces, but it is safe to assume that the vast majority of the Iranian parents were also born in Iran, because migrants to Iran from foreign countries constitute only 0.04% of Iran's total adult census population (Statistical Center of Iran, 2006).

To maintain a strong contrast between our two sample groups, we excluded any Australian child whose teacher reported that he or she might have a parent or grandparent of Asian or Middle Eastern descent. Although only 74% of the Brisbane adult population is Australian-born (Australian Bureau of Statistics, 2008), the previously mentioned exclusion criterion made it unlikely that any of our particular Australian participants had migrant parents from non-English-speaking countries because, according to recent census figures, once migrants from Asia are excluded, 90% of Brisbane adults are of Anglo-Celtic background, having been born either in Australia or in a similar English-speaking country (e.g., the United Kingdom, New Zealand, or Ireland) with a predomi-

Table 1  
*Theory of Mind (ToM) Scale Tasks and Numbers (and Percentages) of Iranian and Australian Preschoolers Who Passed*

Task	Iran ( $n = 58$ )	Australia ( $n = 77$ )	ToM concept tested/task scenario
Diverse desires <sup>a</sup>	50 (86)	73 (95)	Different people like and want different things/After choosing his/her own preferred food (cake or carrot), child must predict the snack choice of someone else with opposite preferences.
Diverse beliefs	27 (47)	59 (77)	Different people can hold different beliefs about the same thing when both opinions are potentially true/The child states his/her belief that a pet is hiding in the garage and must predict the search behavior of someone who believes the pet is hiding in the bushes.
Knowledge access	51 (88)	52 (68)	Seeing leads to knowing, and not seeing leads to ignorance/The child, having seen a toy in a nondescript container, must judge (yes/no) if someone who has not looked inside will know what is in the closed container.
False beliefs <sup>b</sup>	9 (16)	28 (36)	People can have invalid beliefs/The child is shown that a distinctively marked candy box actually contains a toy and then must predict the belief of someone who has not seen inside the closed box.
Hidden emotions <sup>c</sup>	10 (17)	12 (16)	People may choose to hide what they really feel inside by altering their facial expressions and/or behavior/A boy being teased does not want his friends to call him a cry baby: the child must point to an emotion face picture and/or say how the boy really feels (sad) and how he makes his face look (happy or OK).
Mean total ToM tasks passed (out of 5)	2.53	2.90	

<sup>a</sup> To ensure local familiarity, a cake (rather than a cookie) was used in both Australia and Iran. <sup>b</sup> To ensure local familiarity, a candy box was substituted for the original Band-Aid box in both Australia and Iran. <sup>c</sup> As in Peterson et al. (2005), we added a more stringent comprehension control question. When children pointed at the neutral face on Wellman and Liu's (2004) sad-neutral-happy facial expression scale, they were asked to justify their response. Correct answers indicated that the protagonist tried to hide his true feelings or wanted others not to know them; incorrect answers reiterated that he looked like he felt (sad or angry). Two raters, each separately coding 100% of the justifications, reached 97% agreement for the Iranian sample and 94% for the Australian sample (see the text).

nantly Anglo-Celtic cultural heritage (Australian Bureau of Statistics, 2008). Although not specifically excluded, no indigenous Aboriginal Australian children happened to be included in this study's sample.

As cities, Shiraz and Brisbane share similarities. Shiraz has a population of 1.2 million (Statistical Center of Iran, 2006) and is the sixth largest city in Iran, capital of the Fars province. Brisbane has a population of 1.7 million (Australian Bureau of Statistics, 2008) and is the third largest city in Australia, capital of the state of Queensland. Both cities offer a range of high-quality educational options to preschoolers, and many middle-class families in each city avail themselves of these, even though compulsory education begins after preschool in both countries.

In both Iran and Australia, we recruited children from a similar set of public (fully government-funded) and private (fully or partially fee-paying) preschools and education-focused child-care centers that were all located in predominantly middle-class urban and suburban neighborhoods in each city. Precise information on family incomes was not available to us in either country owing to confidentiality constraints. However, indirect evidence based on population figures for each family's neighborhood of residence (e.g., the median rental cost and home purchase price in that neighborhood) suggests that the vast majority of participants in both cultural groups in our sample were likely to be of middle-class socioeconomic status.

Parents in both samples were also likely to be highly educated. We had precise parental education information for 30 of our Iranian children (52%), whose parents reported to us the highest level of education that had been completed by the mother and by the father. Most (93%) of these Iranian parents were high school graduates (i.e., completed the 12th grade), all had done some high school, and 65% had studied at university. In total, 30% of these Iranian parents (33% of mothers; 27% of fathers) had earned a bachelor's degree, and 18% (13% of mothers; 27% of fathers) had earned a master's or PhD. The 30 children with parental information were a haphazard sample based simply on test scheduling from each of the preschools, genders, and age groups that we tested in Shiraz. Thus, their parents' educational levels were likely to approximate those for our Iranian group as a whole.

We had no direct data on parental education for our Australian sample; however, we have access to full maternal education data for an earlier cohort of children recruited 2 years previously from exactly the same set of preschools. This is likely to approximate maternal education for the present Australian group, especially because the preschools' catchment areas were so stable that a number of the children we tested were the earlier cohort's younger siblings. As reported by Randell and Peterson (2009), 98% of the 54 mothers in the earlier cohort had completed high school (12th grade), all had done some high school, and 55% had completed university degrees. There was no significant difference in the proportion of mothers with, versus without, university education in the present Iranian sample (47% vs. 53%) versus this earlier Australian cohort (44% vs. 55%),  $\chi^2(1) < 1$ ,  $N = 84$ ,  $p > .50$ .

In terms of ethnicity (a variable that can be defined as the conjunction of religious affiliation with native language and country of birth; Australian Bureau of Statistics, 1995), the Iranian children were, as noted earlier, Farsi speakers from Farsi-speaking Persian families. We did not, for ethical reasons, ask parents in either culture to state their religion. Nevertheless, for the vast

majority of our Iranian group, family religious background was almost certainly Muslim. Not only is Islam the state religion of Iran but Muslims constitute 98% of Iran's census population (Statistical Center of Iran, 2006), and parents of preschoolers belonging to the 2% non-Muslim minority typically elect to send their children to special denominational (e.g., Christian, Jewish) preschools that we did not recruit from. Population statistics provide less guidance as to the likely religious background of our Australian group, but it is unlikely that any of them were Muslim. Thirty-one percent of the Queensland adult population reports no religious affiliation at all, whereas 66% identify with various Christian faiths (Australian Bureau of Statistics, 2008).

Families were recruited in both countries via an invitational letter to parents, distributed by the children's preschool teacher and seeking volunteers. No monetary or other tangible incentive was offered or given to participating families. All children who took part had written parental informed consent and gave their own willing verbal assent. The study had ethical approval from all relevant university and school institutional review bodies.

### Procedure, Tasks, and Scoring

Each child was tested individually at the preschool by an experienced local graduate research assistant who was a native speaker of the child's language (Farsi or English) but was unfamiliar with the child prior to the onset of testing. Table 1 includes brief descriptions of the five ToM tasks we used. All tasks, stimuli, questions, and procedures were constructed identically in both cultures. They were administered in the same manner in both Iran and Australia: in a single testing session lasting 15–20 min. Apart from three small changes, the tasks were the same as their original versions described by Wellman and Liu (2004; see Appendix on pp. 538–539 for complete details). Our three changes included the following: (a) we reduced children's memory burdens by substituting "the girl" or "the boy" for all proper names (e.g., "Linda," "Matt"), (b) we ensured local familiarity in both Iran and Australia by using a cake instead of a cookie for the DD task and a candy box rather than a Band-Aid box for the FB task, and (c) we added a control question to the HE task, as described later. (To reiterate, we did not change the DB task; Wellman and Liu's original pet version was used in both Iran and Australia.)

In developing the procedural protocols prior to testing, we used back-translation from Farsi to English to ensure that task narratives and questions were comparable to one another and had the same focus in both cultures. In their initial scale development, Wellman and Liu (2004) had carefully matched and counterbalanced all procedures, stimuli, and formats across tasks to reduce the likelihood that any differential executive, memory, or linguistic demands could plausibly account for observed differences in the relative difficulty of individual scale tasks. Each task had a focal ToM test question and comprehension control question, and we required accuracy on both of these before counting a child as having passed that task. A total ToM score (ranging from 0 to 5) summed these passes.

Following procedures established in Peterson et al. (2005), the comprehension control question for the HE task asked children to explain their test question responses (e.g., "Why did the boy make his face look sad?"). Transcripts of these "Why" justifications from all children in each sample were independently scored by

pairs of coders as either correct or incorrect. Initial agreement was 97% for the Iranian sample and 94% for the Australian sample, indicating that the scoring scheme was a reliable one for both cultures.

## Results

Table 1 shows the numbers and percentages Iranian and Australian children who passed each ToM scale task. There were no significant differences between cultural groups in age,  $t(133) = 1.52, p > .10$ , or gender ( $\chi^2 < 1$ ), nor in performance on the DD task,  $\chi^2(1) = 2.05, N = 135, p > .10$ , or the HE task,  $\chi^2(1) < 1, N = 135, p > .50$ . As predicted, however, the Iranians found the KA task significantly easier than the Australians did,  $\chi^2(1) = 6.52, N = 135, p < .02$ , and the opposite held for DB,  $\chi^2(1) = 11.67, N = 135, p < .01$ . Australians also passed FB more often than did Iranians,  $\chi^2(1) = 6.22, N = 135, p < .02$ . However, importantly, there was no significant cultural difference in the mean total of scale steps passed (see Table 1),  $t(133) = 1.81, p > .07$ , consistent with previous evidence of similar rates of development in these two countries using FB as the sole ToM index (Yazdi, German, Defeyter, & Siegal, 2006).

To test our main predictions that the scale sequences for the Iranian preschoolers would evidence understanding KA before DB, whereas the Australian preschoolers' sequences would reverse these steps, we selected all the children who passed either KA or DB but not both. Of the 28 such Iranian children, 26 (93%) passed KA only, whereas 18 of the 23 Australians (78%) passed DB only, statistically confirming the predicted crossover pattern,  $\chi^2(1) = 16.64, N = 51, p < .001$ . (Comparatively, in Wellman et al.'s, 2006, sample, 18 of 28 (64%) Chinese children passed KA only, and 15 of 22 (68%) Americans passed DB only).

As a further test, we examined the Iranian and Australian children's five-step Guttman scale sequences. Guttman scaling techniques (Green, 1956) are strict, requiring an exact match between observed data and a perfectly ordered scale pattern in which no task is passed after the first one in the sequence is failed. We tested our Iranian group's conformity to the China sequence, namely (easiest to hardest): DD > KA > DB > FB > HE. Forty-three of the 58 children (74%) matched this sequence perfectly across all five steps (compared with 68% in China; Wellman et al., 2006). Conversely, 62 of 77 Australians (81%) matched the original U.S. scale sequence (DD > DB > KA > FB > HE), in line with previous Australian data (e.g., 87% of a previous Australian preschool sample; Peterson & Wellman, 2009). There was no significant difference between proportions of Iranian and Australian children conforming perfectly to their country's sequence,  $\chi^2(1) < 1, N = 135, p > .35$ .

Green's (1956) coefficient of replicability (Rep) assesses observed data's goodness of fit to a predicted Guttman sequence and achieves statistical significance at Rep = .90. The Iranian sample's Rep was a significant .94, similar to the earlier Chinese Rep of .93 for the same distinctive sequence. The present Australian group had a Rep of .95 that was equally highly significant, despite matching the original U.S. children's task ordering rather than the Iranian children's. In short, on the basis of Green's primary<sup>1</sup> statistical scale index, both Iranian and Australian sequences were significantly scalable as well as different from one another in exactly the manner we had predicted. That is, the vast majority of

children in each culture progressed through all five steps of the ToM scale in the sequence that we had predicted on the basis of our cross-cultural contrast hypothesis. Furthermore, the close match of the Iranian preschoolers' patterns to the ToM sequence observed for the Chinese children (Wellman et al., 2006), together with the clear contrast we found between our Iranian group's pattern and that for our Anglo-Australian preschoolers, was confirmed by scaling statistics as well as by the individual task comparisons reported earlier.

Although the results potentially reflected children's exposure to culturally distinctive parenting, it was important to rule out possible alternative explanations. As outlined earlier, one of these was sibling status. In fact, there were more Iranian than Australian only-children (53% vs. 16%). Nevertheless, when we compared the proportions of scale-consistent versus scale-inconsistent only-children in Iran with the proportions of those in Australia, no significant difference emerged,  $\chi^2(1) = 3.32, N = 39, p > .06$ , and the same was true for sibling children,  $\chi^2(1) = 2.17, N = 68, p > .10$ . Nor were Iranian only-children more likely than Iranians with siblings to pass KA while failing DB instead of the converse,  $\chi^2(1) = 1.17, N = 28, p > .20$ . Thus, the Iranian children's match to the predicted sequence previously observed only in China (Wellman et al., 2006) could not plausibly be explained by disproportionate numbers of only-children in this non-Western sample.

As a subsidiary comparison, we used a 2 (cultural sample)  $\times$  2 (sibling/only-child) analysis of covariance (with age covaried) to see whether sibling status influenced total ToM steps passed. The age covariate was significant,  $F(1, 102) = 40.05, p < .001, \eta^2 = .28$ . Neither the main effect for cultural sample,  $F(1, 102) = 3.73, p > .05, \eta^2 = .03$ , nor the main effect for sibling status,  $F(1, 102) = 1.54, p > .20, \eta^2 = .02$ , was statistically significant. However, sibling status interacted significantly with cultural sample,  $F(1, 102) = 5.62, p < .025, \eta^2 = .05$ . In the Iranian group, only-children ( $M = 2.45$ ) equaled those with siblings ( $M = 2.63$ ) in scale progress, but in the Australian group, only-children ( $M = 2.38$ ) lagged significantly behind those who with siblings ( $M = 3.24$ ) in total numbers of scale steps passed. This latter finding extends to the five-step ToM scale a result that had been found previously for the FB task alone among English-speaking preschoolers in Western cultures such as Canada (see e.g., Jenkins & Astington, 1996), the United Kingdom (see e.g., Perner et al., 1994), and Australia (see e.g., McAlister & Peterson, 2007).

<sup>1</sup> Green (1956) also offered a computational formula for an additional "optional" (p. 81) scale statistic,  $I$ , indexing the match of observed data to patterns arising, for any given set of marginal totals (i.e., success rates), purely by chance. This highly conservative measure (Festinger, 1947) can prove unduly strict when a broadly developmental scale is given to a homogenous age group, because their expected uniformity in (a) failing "too hard" items (aimed at older ages) and (b) passing "too easy" items (aimed at younger children) will distort marginal estimation of chance probabilities. Nevertheless, the present Iranian group's  $I = .25$  ( $ns$ ) was identical to Wellman et al.'s (2006)  $I = .25$  for their Chinese sample. Furthermore, Wellman et al. showed separately, using probabilistic Rasch analysis, that this reflected significantly above-chance scale consistency. Our Australian sample's  $I = .45$  was also closely similar to the results of previous studies (see e.g., Peterson & Wellman, 2009).

Our data also effectively rule out concerns about the formats of the DB task. Had Wellman et al.'s (2006) use of an inanimate object (coat) with their Chinese group accounted for that group's task sequencing, our Iranian group (exposed to the original pet version) should have conformed to the U.S./Australian pattern instead. But this was clearly not the case. Thus, our predicted result, based on inferences about differences in culturally based child-rearing practices, held up robustly against each of these non-culture-related alternatives.

### Discussion

The present study documented a reliable cross-cultural difference in the sequential development of ToM in children. We found that 3- to 6-year-old Farsi-speaking Iranian children in Shiraz, Iran, understood KA (people can be knowledgeable or ignorant) before they understood DB (different people can have different opinions). By contrast, the present sample of English-speaking Australian preschoolers in Brisbane, Australia (who resembled the Iranian group in terms of age, gender, type of preschool attended, parental education level, and neighborhood socioeconomic status), mastered these two core cognitive concepts in the reverse order, replicating the same developmental sequence of ToM performance observed in previous samples of U.S. (Wellman & Liu, 2004) and Anglo-Australian (Peterson & Wellman, 2009; Peterson et al., 2005) preschoolers. The developmental sequences that emerged in Iran and Australia were each robust and reliable: Most children in each country conformed perfectly to their country's sequence across all five of the scale's steps.

Importantly, there was no significant difference between these Iranian and Australian children in their overall rates of ToM development, as indexed by both groups' having passed the same mean total number of scale steps. Thus, the key difference between Iranian and Australian children's scale sequences emerged against a background of their overall equivalent rates of ToM progress. This pattern of findings enables a more nuanced and complete picture of group developmental similarities and differences in ToM growth than would have been possible using FB tasks alone. FB is either understood or not. Thus, only one of two broad conclusions is usually possible from this kind of cross-cultural comparison: Either one cultural group is more advanced than the other or the two groups do not differ.

Yet neither of these situations accurately depicts our results. We obtained an important cultural group difference, even though these Iranian and Australian children were developing just as rapidly as one another in their progress through all five ToM scale tasks. Cross-cultural difference in this case reflected not rates or extent of ToM mastery but rather the fact that the Iranian children were taking a different developmental route than the Australian children did toward eventual mastery of all these tasks. Thus, our data are consistent with theoretical models proposing that important cross-cultural variations exist within broadly culturally consistent, if not universal, patterns (see e.g., Wellman, in press).

The particular cultural contrast we observed between these Iranian and Australian preschoolers was consistent with our hypothesis as to the likely relevance of collectivist versus individualistic cultural environments (Greenfield et al., 2003) for ToM development. The sequence of ToM performance that these Iranian preschoolers displayed was the same one that Wellman et al.

(2006) had observed for preschoolers in Beijing, China. Both Iran and China are often characterized as collectivist, or interdependent, in overall cultural orientation (see e.g., Greenfield et al., 2003). Furthermore, as described in detail in the introduction, there are numerous studies empirically documenting key similarities, on average, between these two countries in terms of parental attitudes and child-rearing patterns. Notwithstanding the existence, in any culture, of important variability between any one individual family and the next (Goodnow & Collins, 1990), in both China and Iran, many parents emphasize intellectual apprenticeship and family harmony over children's self-confident assertion of divergent opinions or use of reasoned debate to resolve disputes.

Thus, the proposal we favor for these data is that middle-class urban children in both China and Iran may be socialized quite early to strongly value becoming knowledgeable rather than ignorant. Furthermore their understanding of how people acquire knowledge may well profit from exposure to the distinctively training-oriented, warm, yet authority-directed child-rearing styles that Chinese parents (Chao, 1994) and Iranian parents (Rudy & Grusec, 2006) are frequently seen to employ. Hence, we propose that in both these groups, their dominant culture's collectivist orientation in general, along with particular child-rearing practices that China and Iran appear to share, creates a climate especially favorable to children's early understanding of knowledge (as reflected in success on the KA scale task). At the same time, these preschoolers in Iran or China likely gain less exposure than do their counterparts growing up in Anglo-Australian or Anglo-North American settings to other kinds of early experiences more characteristic of cultures with an individualist, independent orientation (Greenfield et al., 2003). As one example, noted earlier, Anglo-Australian and Anglo-North American parents are found, in general, to be more encouraging of their children's asserting themselves and learning the skills of reasoned argument (see e.g., Goodnow et al., 1984). These approaches, by exposing children to the diversity of people's beliefs, might conceivably favor early mastery the DB task. To be clear, we did not directly measure the parental attitudes and child-rearing styles of these children's parents, or their subscription to their culture's collectivist versus individualist orientations, or the nature and extent of their children's actual exposure to others' varied opinions. It will be important for future research to directly examine such links, but our findings provide ample justification and direction for such future research.

In our Australian sample, children who had at least one sibling outperformed only-children in their overall rates of progress through the five-step ToM scale, in line with results of other studies cited earlier from Australia and other Western countries that used FB as their sole ToM criterion. We add to such prior findings both by documenting that the Australian children with siblings proceeded through exactly the same scale sequence as did their singleton peers and by showing that their rate of ToM progress through the scale was significantly faster.

In comparison, no sibling effect of any kind was observed in our Iranian sample. A possible explanation for this pattern, consistent with our general argument, is that even when they have siblings, Iranian children may not gain as much conversational exposure as Australians with siblings do to clashes between different people's points of view or differences of opinion with siblings or between siblings and parents. If so, then the presence of siblings for an Iranian child would not necessarily provide the rich conversational

access to diverse perspectives that may benefit ToM growth (Harris, 2005; Perner et al., 1994) in more individualist cultures such as Australia (where parents frequently expect siblings to voice and attend to one another's varied mental perspectives and to resolve rather than avoid sibling conflict; Foote & Holmes-Lonergan, 2003; Randell & Peterson, 2009). According to this hypothesis, having a sibling at home may make a difference to ToM development only in particular cultures and (within these) particular families in which children are actively encouraged to think for themselves, stand up for their beliefs and opinions, and speak their own minds. Another possibility is that only-children in Iran, unlike their Australian counterparts, might interact so frequently with cousins (other child kin) as to compensate for the lack of a sibling, similar to Lewis, Freeman, Kyriakidou, Marradaki-Kassotaki, & Berridge's (1996) findings in Greece. Although both are concordant with our data, each of these suggestions is speculative. Future research could usefully examine them directly, both via observing sibling-sibling and child-kin interaction in Iran and Australia and via interviewing parents in the two cultures about how they deal with the disagreements their children have with their siblings and kin.

In total, our results illuminate crucial cultural differences in ToM development, as well as variability within each culture in how advanced individual children are in their sequential progressions of ToM development. But, importantly, the differences we observed took place against a background of commonality and consistency across cultures. In these Iranian and Australian groups, as well as those in China and the United States (Wellman et al., 2006; Wellman et al., in press), preschoolers make dramatic progress in discovering a set of key ToM insights, and they do so at an overall rate that is effectively identical in all four cultural groups. This research, stemming from detailed examination of sequences of ToM acquisition, emphasizes both cross-cultural differences in some aspects of the development of ToM and wide cultural uniformity (at least among cultural groups so far studied) in other aspects of the acquisition of social-cognitive understanding during childhood (Wellman, in press). Examining developmental sequences in ToM achievement reveals an intriguing, and specifiable, interplay between these forces.

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Received July 24, 2010

Revision received January 6, 2011

Accepted March 3, 2011 ■