Cross-Cultural Differences in Adult Theory of Mind Abilities: A Comparison of Native-English Speakers and Native-Chinese Speakers on the Self/Other Differentiation Task

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ABSTRACT

Theory of Mind (ToM) refers to the ability to compute and attribute mental states to ourselves and other people. It is currently unclear whether ToM abilities are universal or whether they can be culturally influenced. To address this question, this research explored potential differences in engagement of ToM processes between two different cultures, Western (individualist) and Chinese (collectivist), using a sample of healthy adults. Participants completed a computerized false-belief task, in which they attributed beliefs to either themselves or another person, in a matched design, allowing direct comparison between 'Self' and 'Other' oriented conditions. Results revealed that both native-English speakers and native-Chinese individuals responded significantly faster to self-oriented than other-oriented questions. Results also showed that when a trial required a 'perspective-shift', participants from both cultures were slower to shift from Self-to-Other than from Other-to-Self. Results indicate that, despite differences in collectivism scores, culture does not influence task-performance, with similar results found for both Western and non-Western participants, suggesting core and potentially universal similarities in the ToM mechanism across these two cultures.

Key Words: Theory of Mind; Cross-Cultural; Perspective-Taking; False-Belief; Social Cognition

1.0 Introduction

A fundamental part of our day-to-day lives is our ability to understand, compute, and attribute mental states to both ourselves and other-people (Wimmer & Perner, 1983; McCleery, Surtees, Graham, Richards, & Apperly, 2011; Baron-Cohen, Leslie, & Frith, 1985). This ability is often referred to as possession of a 'Theory of Mind' (ToM), and plays an essential role in everyday communication, allowing us to understand what other people may believe, know, see, or think at any given time, and thus allowing efficient and successful interactions to occur (Premack & Woodruff, 1978; Apperly, 2013). Despite the key role of ToM, the nature and structure of the ToM mechanism, particularly in adults, currently remains unclear (Apperly, 2013; Apperly, Samson & Humphreys, 2005; Saxe, 2006). For instance, it is currently unclear whether ToM reflects universal processes, engaged and expressed in the same way regardless of cultural background, or whether ToM is subject to social influences, developing differently as a result of an individual's cultural experience (Shahaeian et al., 2014; Callaghan et al., 2005; Kobayashi, Glover, & Temple, 2006). The term 'culture' refers to key differences in social experiences, including, for example, styles of relating, social practices and values, geographical location, religious values, language, and diet (Chiao & Ambady, 2007; Markus, Kitayama, & Heiman, 1996; Adams et al., 2009). A number of prior studies have shown that clear cultural differences can be found across a wide variety of traits, including values, personality traits, visual perception, and spatial reasoning (Henrich et al., 2010; Hofstede, 2001; Arnett, 2008; Schwartz & Bilsky, 1990; McCrae & Terracciano, 2005; Nisbett et al., 2001). However, there is limited research that has examined cross-cultural differences in ToM processes in adults. By exploring the potential presence – or absence – of cross-cultural differences in adult ToM, we will be able to gain more insight into the structure of the ToM mechanism, such as the extent to which ToM processes may be considered universal versus culturally-influenced (e.g. Shahaeian, Nielsen, Peterson, & Slaughter, 2014; Rozin, 2003; Barrett et al., 2013; Sabbagh, Xu, Carlson, Moses & Lee, 2006).

Of the studies that have examined cross-cultural differences in ToM, a majority have focused on the *development* of ToM abilities (e.g. Shahaeian et al., 2014; Barrett et al., 2013; Sabbagh, Xu, Carlson, Moses & Lee, 2006; Callaghan et al., 2005; Liu, Wellman, Tardif, & Sabbagh, 2008; Wang et al., 2016). Results have revealed similar developmental trajectories of ToM abilities across a variety of cultures, suggesting that mentalistic reasoning (e.g., false-belief understanding) emerges at the same age, around 5-years-old, across different cultures (e.g. Callaghan et al., 2005; Avis & Harris, 1991; Sabbagh et al., 2006). However, despite this evidence of developmental synchrony in false-belief understanding, there is also evidence that suggests that certain aspects of ToM abilities (e.g.,

understanding of sarcasm) can be differentially enhanced across cultures, suggesting that cultural background can influence the *sequence* in which ToM abilities emerge, whilst developing more global mentalistic reasoning abilities (e.g. Vinden, 1996; Lecce & Hughes, 2010; Liu et al., 2008; Oh & Lewis, 2008; Shahaeian, Peterson, Slaughter, & Wellman, 2011; Wellman et al., 2006; Mayer & Trauble, 2013). For instance, Peterson et al. (2006) conducted a study with Australian and Iranian children, aged 3-6-years old, examining separable ToM components, including understanding of diverse beliefs (i.e., different people can hold different beliefs about the same thing) and knowledge access (i.e., awareness that an individual may be ignorant or knowledgeable about a situation). Results revealed no significant difference in overall ToM performance (i.e., scores taken as an overall indicator of performance, across the tasks), but found that Australian children developed diverse belief understanding *before* developing knowledge/ignorance understanding, whilst Iranian children developed knowledge/ignorance understanding before diverse belief understanding, suggesting cultural differences in the sequence of ToM emergence across these two populations (Peterson et al., 2006). Further supporting this, Peterson and Siegal (1997) note that social experiences during an individuals' development could greatly impact their ability to reason about others' minds; for instance, it has been suggested that growing up with siblings may be associated with enhanced false-belief understanding in young children (Perner, Ruffman, & Leekam, 1994; Liu et al., 2008). Chinese children are more likely to be an only child than their American counterparts, and ToM development and experiences may therefore greatly differ between Chinese and Western children based not only on culture, but also on the social experiences that are a result of the cultural experience. Whilst these studies with children have indicated the presence of at least some cultural variation in ToM abilities, there is limited research that has directly compared fully-developed, mature ToM capacities of adults across cultures.

One exception is a study conducted by Kobayashi, Glover, and Temple (2006), in which adult participants (American English-speaking monolinguals and Japanese-English bilinguals) completed a task whilst undergoing fMRI scanning. The task involved either ToM reasoning (i.e., attribution of a belief), non-ToM reasoning (e.g., physical causal situations, such as identifying what a person can see or hear), or reading of unlinked sentences (acting as a baseline condition). Results revealed that both American and Japanese participants showed significant and comparable activation in the medial pre-frontal cortex and anterior cingulate cortex when engaging in ToM processing, supporting prior research findings (e.g. Ochsner et al., 2004; Mitchell, Banaji, & MacRae, 2005; Amodio & Frith, 2006). Interestingly, however, Japanese participants showed significantly less temporo-parietal junction activity than American participants when engaging in ToM tasks, despite no significant

differences in behavioural performance between the two nationalities. Kobayashi et al. suggest that these results may reflect potential cultural differences in the underlying neural bases of ToM, with a reduced sense of Self/Other distinction present in the Japanese participants compared to American participants, due to a larger emphasis on 'collectivist' traits compared to 'individualist' traits when engaging in social contexts for the Japanese participants (Kobayashi & Temple, 2009; Kobayashi et al., 2006; Perner & Aichhorn, 2008).

Supporting Kobayashi et al.'s (2006) conclusion, it has been argued that Western cultures (e.g. United States, Canada, United Kingdom, and Australia) emphasize individuality and independence, whereas non-Western cultures (e.g. Asian cultures) place more emphasis on interdependence and sharing of group values (Nisbett, 2003; Nisbett & Masuda, 2003; Shahaeian et al., 2014; Nisbett, Peng, Choi, & Norenzayan, 2001). Thus, if ToM is culturally-influenced, perhaps in non-Western cultures, where interdependence is emphasized, there may be a reduced sense of the 'Self'/'Other' distinction, whereas in Western cultures, where 'uniqueness' and individuality are encouraged, a more distinct 'Self'/'Other' differentiation may be present (Kobayashi & Temple, 2009; Adams et al., 2009; Naito, 2007; Naito & Koyama, 2006; Werner & Kaplan, 1963). A further study by Wu and Keysar (2007) compared perspective-taking abilities of Chinese and American individuals, using a communication game; their results revealed that Chinese participants were more efficient at taking their communication partners' perspective than their American counterparts, suggesting that Chinese individuals are more effective at considering the perspective of another person than American individuals. However, it is noted that the participants in both Kobayashi et al.'s (2006) and Wu and Keysar's (2007) study were all living in the United States, and the Chinese and Japanese participants were bilingual, speaking fluent English; it is therefore unclear to what extent their results may have been influenced by cultural experiences, as opposed to other outside influences.

To allow a direct measure of cultural differences, the study reported in this paper sought to explore the extent to which Western (native-English speakers from the United Kingdom, United States, and Canada, all tested in the U.K.) and non-Western participants (native Chinese individuals, tested in China) differed on cultural dimensions of individualism and collectivism, and whether this influenced performance on a ToM task, specifically selected to assess the Self/Other distinction. These two cultures were selected as there is evidence to suggest a distinct differentiation between the two, with China considered a more collectivist culture and Western cultures considered to be more individualist (Morris & Peng, 1994; Chen, 2000; Oyserman, Coon, & Kemmelmeier, 2002). To ensure results were reflective of two different cultures – that is, whether those in the participant sample

truly did differ in tendencies towards individualism and/or collectivism – a self-report questionnaire, the Auckland Individualism and Collectivism Scale (AICS; Shulruf, Hattie & Dixon, 2007) was utilized, directly assessing individualism and collectivism traits of participants. To assess ToM abilities, participants completed a computerized false-belief task, the Self/Other Differentiation task, suitable for use with adults (Bradford, Jentzsch, & Gomez, 2015). The Self/Other Differentiation task allows direct comparison of self-oriented and other-oriented belief-attribution processes, as well as the role of 'perspective-shifting' in ToM.

The Self/Other Differentiation task has previously been used with Western samples, with results demonstrating that in these samples, self-oriented processing is much more efficient (faster and more accurate) than other-oriented processing (Bradford et al., 2015). Results have also shown a key role of 'perspective-shifting' in ToM processing. Within the Self/Other Differentiation task, participants are asked to solve dilemmas from either their own or another person's perspective, in a false-belief task scenario. Within a trial, participants may maintain a perspective (e.g., the 'self' perspective: 'Where would you look?' → 'What did you think?') or switch perspectives within a trial (e.g., shifting from the 'other' perspective to the 'self' perspective: 'Where would John look?' → 'What did you think?'). Results from Western participants have demonstrated that the inclusion of a perspective-shift within a trial (Self-to-Other or Other-to-Self) significantly influences responses (taking longer and with more errors) than trials in which no perspective-shift is required (Self-to-Self or Other-to-Other). Results have also shown that participants find it harder to shift from the 'Self' perspective to the 'Other' perspective within a trial ('Where would you look?' → 'What did John think?') than they do to shift from the Other perspective to the Self perspective ('Where would John look?' → 'What did you think?'), suggesting that it is not only the need to shift perspectives that influences response efficiency, but also the *type* of perspective-shift required (Bradford et al., 2015). It is currently unclear whether these results – a differentiation between 'Self' and 'Other', and a key role of perspective-shifting – are due to cultural influences on ToM abilities, perhaps reflecting an individualist cultural background in which the 'other' is only considered when explicitly required, or whether this reflects a universal component of the ToM mechanism, in which the 'self' acts as the stem for understanding the 'other' perspective.

As discussed above, it has been suggested that in collectivist societies, consideration of the 'other' perspective may be regarded as equally important, if not more important, than consideration of the 'self' perspective (Naito, 2007; Naito & Koyama, 2006; Wener & Kaplan, 1963; Oyserman et al., 2002; Morris & Peng, 1994). If this is the case, and if ToM develops and is utilized differently as a

function of cultural-experience, it could be argued that there would be less of a differentiation between 'Self' and 'Other' for individuals from collectivist cultures, as the collectivist social experience may have reduced the differentiation between 'Self' and 'Other' in mentalizing processing, compared to individuals from individualist cultures (Shulruf et al., 2007; Adams et al., 2009; Kobayashi & Temple, 2009; Chen et al., 1998; Oyserman et al., 2002). Results from the Self/Other Differentiation task should, therefore, show no significant differences in behavioural responses (response times, error rates) to 'Self' versus 'Other' oriented belief-attribution questions, and no effect of perspective-shifting in efficiency of responses, for participants from collectivist cultures. However, if ToM abilities reflect universal traits, regardless of cultural experience, it would be expected that participants from both individualist and collectivist cultural backgrounds will show the same pattern of responses, with more efficient responses following 'Self' oriented belief-attribution (faster and more accurate) compared to 'Other' oriented belief-attribution questions, and a significant role of perspective-shifting (with trials requiring a perspective-shift taking longer, and being more error-prone, than trials that do not require a perspective-shift), as previously established in Western samples (Bradford et al., 2015).

2.0 Method

2.1 Participants

Fifty-five native-English speakers were recruited from St Andrews University, Scotland (34 females, 21 males; *M* = 21.4 years, range 17-34 years; participants all identified themselves as native-English speakers, from either the U.K., USA, or Canada). Fifty-four native-Chinese individuals were recruited from Peking University, China (35 females, 19 males; *M* = 22.6 years, range 18-28 years). A minimum sample size of 66 total participants was determined a-priori using G*Power software (Faul, Erdfelder, Lang, & Buchner, 2007); alpha was set at 0.05, and power at 90%, with an anticipated medium effect size (*f* = .25; Cohen, 1988). All participants were reimbursed for their time, at the standard rate for each institution (£5 per hour for St Andrews University; 25 Chinese Yuan or course credits at Peking University). Participants did not have any learning or reading disabilities. All participants gave informed consent and this study was approved for use in human subjects in accordance with the University of St Andrews Research Ethics committee.

2.2. Stimuli and Procedure

The tasks reported here were part of a battery of tasks completed in a single session, lasting no more than 60 minutes. All tasks were separated by a break in the session. The AICS questionnaire was always completed at the end of the testing session; the order of the computerised tasks was

randomized across participants. The task was presented on a 12-inch Laptop, with all participants completing the tasks using the same apparatus.

2.2.1 Auckland Individualism and Collectivism Scale (AICS)

The AICS questionnaire, developed by Shulruf, Hattie, and Dixon (2007; see also Shulruf et al., 2011) consisted of thirty questions measuring three dimensions of individualism, and two dimensions of collectivism. For individualism, the dimensions measured referred to: responsibility (acknowledging responsibility for one's actions; e.g., '*Being able to take care of myself is a primary concern for me*'), uniqueness (distinction of the self from the other; e.g., '*I enjoy being unique and different from others*'), and competitiveness (prime interest in striving for one's own goals; e.g., '*Competition is the law of nature*'). For collectivism, the dimensions referred to: advice (seeking advice from people before making decisions; e.g., '*I discuss job or study related problems with my parents*') and harmony (avoidance of conflict; e.g., '*I sacrifice my self-interest for the benefit of the group*'). Each of these dimensions was measured by responses to four questions; ten filler questions were also included in the questionnaire, to reduce emphasis of the focus on collectivism/individualism dimensions.

Participants were provided with a paper version of the AICS questionnaire in their native language, and were asked to read each statement carefully, rating how strongly they felt each statement described themselves on a Likert-type scale of 1 (Never/Almost Never) to 5 (Always). There was a maximum possible score of 60 for individualism traits, and a maximum possible score of 40 for collectivist traits. The AICS questionnaire has been used across a number of different cultures, including the U.K., China, Romania, Italy, and Portugal, and the reliability across cultures, and between the specific factors of the questionnaire and their relationship to individualism and collectivism, has been found to be high (e.g., Fu et al., 2010; Shulruf et al., 2007; Shulruf et al., 2011). Individualism and collectivism were assessed using these two dimensions to explore differences between Western and Chinese participants on each of these components separately; prior research has demonstrated that individuals can show varying traits of both individualist and collectivist tendencies (i.e., that individuals may be individualist and collectivist concurrently, such as self-reliant non-competitors or interdependent competitors), rather than necessarily being either individualist or collectivist (e.g., Green, Deschamps, & Páez, 2005; Shulruf et al., 2011; Tamis-LeMonda et al., 2008). Thus, this study sought to assess the extent to which participants from the two target cultures independently differed on measures of both individualist and collectivist traits.

2.2.2 Self/Other Differentiation Task

The Self/Other Differentiation Task (Bradford, Jentzsch, & Gomez, 2015) was programmed using E-Prime software. The task consisted of 8 practice trials, and 120 test trials (Table 1 details the number of trials in each test condition). All trials followed the same format, with each trial consisting of three stages: Dilemma Stage → Contents Revelation Stage → Probe Stage. Only test trials required belief-attribution, with practice trials always referring to reality states. There were two language versions of the task – English and Chinese. Native-English speakers all completed the English version of the task, and native-Chinese individuals all completed the Chinese version of the task.

Table 1: Number of trials in each condition of the Cross-Cultural Self/Other Differentiation task

	Self Dilemma			**Other Dilemma**			
	Self Probe	**Other Probe**	**Distracter**	**Self Probe**	**Other Probe**	**Distracter**	*Total*
Expected Contents	10	10	10	10	10	10	*60*
Unexpected Contents	10	10	10	10	10	10	*60*
	20	*20*	*20*	*20*	*20*	*20*	*120*

Dilemma Stage – this stage was used to establish a belief-state. A sentence was shown on the screen asking participants to identify where either they (self-oriented) or someone else (other-oriented) would look for a specific object. Three images were presented in a horizontal line, one of which was the correct answer. Participants indicated their selection by pressing one of the arrow keys on the laptop keyboard, corresponding to the location of the object (left side image ←, central image ↓, or right side image →). Dilemma questions were shown alone for 1500 ms, before the image answer options were also displayed, for a maximum of 5000 ms. If an incorrect selection was made, or there was no response within this time limit, an 'X' was displayed for 1500 ms before the Dilemma reset until the participant correctly passed the trial.

Contents Revelation Stage – this stage was used to create a true- or false-belief state for participants. Contents of the selected container was revealed, and could be either expected (true-belief) or unexpected (false-belief). Contents were shown for 2000 ms and no response was required. Following Self or Other oriented dilemmas, half of each were followed by expected contents, and half by unexpected contents.

Probe Stage – this stage was used to assess belief-attribution abilities. A sentence appeared on screen asking participants to identify what either they themselves or another person believed to have been in a container, before they saw inside. Answers were indicated by selection of one image from three presented in a horizontal line, as in the Dilemma stage. The probe question was displayed for 1500 ms before the three answer options were revealed. Image answer options were displayed until response, or for a maximum of 8000 ms if no response was recorded. Distracter

questions were also included at the probe stage (e.g. '*What colour was the egg box?*') to reduce participant's ability to anticipate the correct answer until after the probe question was presented.

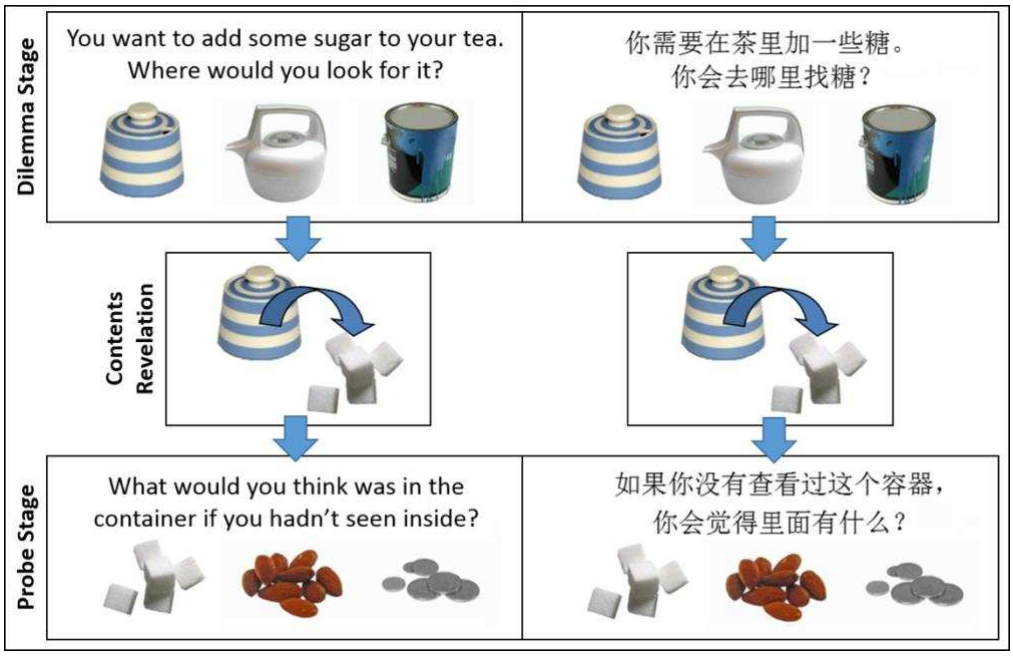

Figure 1: an illustration of a single trial (Self-Expected-Self) as it would have been seen in the English and Chinese versions of the task. All trials were translated from English to Chinese, so all participants were presented with the same dilemma and probe questions, to ensure comparability across the two different participant samples.

The questions used in the English and Chinese version of the Self/Other Differentiation task referred to the same Dilemmas/Probes (i.e. seeking the same objects). For the English version of the task, sentences were matched across conditions in terms of length, structure and syntax so that each 'Self'-oriented sentence had a matched 'Other'-oriented sentence (e.g. '*What would [you/Jane] think was in the container, if [you/Jane] hadn't seen inside?*'). It is noted that sentences were not matched in this way for the Chinese version of the task, as the nature of differences in language style and structure meant this was not possible. However, given that the questions made the same referrals as the English questions (e.g. looking for specific objects/self and other perspectives), the manipulations in self/other orientation remained consistent, and therefore this was not anticipated to significantly influence the responses of Chinese participants. Figure 1 illustrates a single trial as it would have been seen in the English versus Chinese language versions of the task. Sentence translations for this task were completed by a bi-lingual Chinese native, who was living in the UK, but had spent at least 20 years living in China. To ensure accuracy of translations, a random cross-section of sentences were back-translated, confirming the reliability of translations.

3.0 Results

To ensure the homogeneity of the samples, one participant (English, female, 34 years old) was removed from all analysis, as they were over three standard deviations from the mean age of the sample. This resulted in a final sample for analysis of 54 Chinese individuals (35 females, 19 males; mean age 22.6 years, range 18-28 years) and 54 English individuals (33 females, 21 males; mean age 21.13 years, range 17 – 30 years).

3.1 Auckland Individualism and Collectivism Scale

For the AICS questionnaire, questions were divided into those regarding 'Individualism' (responsibility, uniqueness, and competitiveness) and those regarding 'Collectivism' (advice and harmony). For analysis, an overall individualism score (out of 60) and an overall collectivism score (out of 40) was calculated, by adding together the sum of responses in each condition; i.e. each question was answered on a scale of 1-5, thus providing a number value for each question answered. These scores were then compared between Chinese and Western participant samples, to assess for any differences between the two groups. One participant (English, male) was not included in analysis, due to a failure to complete the AICS in its entirety.

An independent samples *t*-test showed no significant difference between English and Chinese participants' ratings of individualism, t (105) = 0.83, p = .41, with similar scores of individualism in the Western (M = 45.9; *S.D.* = 5.79) and Chinese (M = 46.8; *S.D.* = 5.04) responses; this may reflect that Chinese participants in this sample were recruited from an urban rather than a rural population. An independent samples *t*-test did, however, show a significant difference in ratings of collectivism between Western and Chinese participants, t (105) = 3.99, $p < .001$, d = .87, with higher agreement with statements reflecting collectivist traits in Chinese participants (M = 30.9; *S.D.* = 3.89) than in Western participants (M = 27.7; *S.D.* = 4.29). Figure 2 illustrates the relationship between scores in the individualism and collectivism scales, for both Chinese and Western participants.

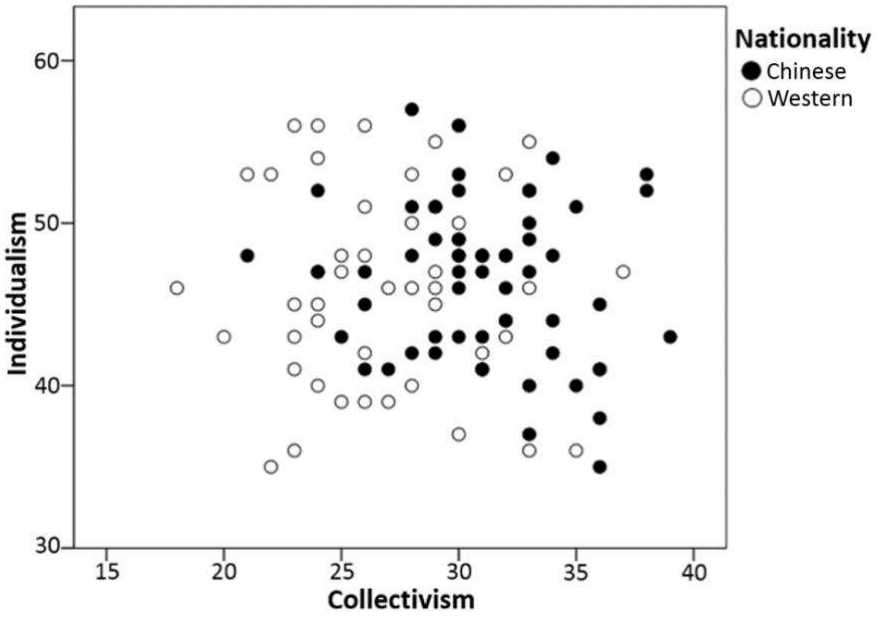

Figure 2: Scatterplot demonstrating the relationship between ratings on the individualism and collectivism traits in the AICS questionnaire, for Chinese and Western (native English speakers) participants.

3.2 Self/Other Differentiation Task

In the Self/Other Differentiation task, participants had up to 8,000 ms to respond to probe questions after potential answer options were presented. Due to the presence of outliers in the data, trials in which RTs were higher than 3,000 ms were excluded from analysis, to ensure comparability of results across nationalities. This resulted in removal of an average of 1.60 % of test trials for Chinese participants, and 1.50 % trials for English participants. After these trials were removed from the raw data, an average RT for each test condition of the Self/Other Differentiation task was calculated for each participant.

Nine participants (six Chinese, three English) were removed from analysis as they made at least 50 % errors in one or more test condition, suggesting a failure to engage with the task. This resulted in a final sample size for analysis of 48 native Chinese participants (32 females, 16 males; *M* = 22.45 years, range 18 – 28 years), and 51 English participants (32 females, 19 males; *M* = 21.29 years, range 17 – 30 years).

3.2.1 Dilemma Stage

A Repeated-Measures ANOVA with Dilemma Type (Self vs. Other) as a within-subject factor, and Nationality (Chinese vs. English) as a between-subjects factor, revealed a significant main effect of

Dilemma Type ('*Where would [you/John] look for the sugar?*') for RT, F (1, 97) = 13.39, p < .001, η_p^2 = .12, with faster responses to self-oriented dilemmas (M = 1262 ms, *S.D.* = 303 ms) than other-oriented dilemmas (M = 1312 ms, *S.D.* = 317 ms). For Error rates, there was a significant effect of Dilemma Type, F (1, 97) = 16.63, p < .001, η_p^2 = .15, with more errors made in self-oriented dilemmas (M = 2.40 % errors, *S.D.* = 2.26%) than other-oriented dilemmas (M = 1.60 % errors, *S.D*. = 1.65%).

There was a significant interaction between Dilemma Type and Nationality for Error Rates, F (1, 97) = 22.86, p < .001, η_p^2 = .19, and a trend towards significance for RT, F (1, 97) = 3.19, p = .08, η_p^2 = .03. Post-hoc analysis using paired-samples t-tests with Bonferroni corrections revealed that this was because, for Chinese participants, there was no significant difference in RT to Self versus Other-Oriented Dilemma questions, t (47) = -1.14, p = .26, but there was a significant difference in Error Rates, t (47) = 4.97, p < .001, d = .82, with more errors following the Self-Oriented Dilemma questions (M = 3.83 % errors, *S.D.* = 2.30%) than the Other-Oriented Dilemma questions (M = 2.10 % errors, *S.D.* = 1.89%). The opposite was true for English participants, with paired-sample t-tests revealing a significant difference in RT to Dilemma Questions, t (50) = -4.63, p < .001, d = .32, with faster responses to Self-Oriented Dilemmas (M = 1146 ms, *S.D.* = 213 ms) than Other-Oriented Dilemmas (M = 1221 ms, *S.D.* = 241 ms), but no significant difference in error rates between Self and Other-Oriented Dilemma questions, t (50) = -.72, p = .94.

3.2.1 Probe Stage

Analysis of the probe question (e.g., '*What did [you/John] think was inside the container, before seeing inside?*') considered whether there was a shift in perspective between Dilemma Type and Probe Type. For trials in which there was no perspective shift, trials would either address the self (Self-Self) or other (Other-Other) at both the Dilemma and Probe stages. In perspective shift trials, trials could either shift from Self-to-Other, or from Other-to-Self, across the Dilemma to Probe stages. A 2 (Perspective Shift: No Shift vs. Shift) x 2 (Contents: Expected vs. Unexpected) x 2 (Probe: Self vs. Other) Repeated-Measures ANOVA was conducted on RT and Error Rates, with Nationality (Chinese vs. English-Speakers) as a between-subjects factor.

Results revealed a significant main effect of Probe Type for RT, F (1, 97) = 51.59, p < .001, η_p^2 = .35, and Error Rates, F (1, 97) = 24.33, p < .001, η_p^2 = .20, with faster and more accurate responses following self-oriented probes (M = 794 ms, *S.D.* = 182 ms; 5.48 % errors, *S.D.* = 5.02%) than other-oriented probes (M = 860 ms, *S.D.* = 204 ms; 8.43% errors, *S.D.* = 5.40 %). There was a significant

effect of Contents Type on RT, F (1, 97) = 11.09, p= .001, η_p^2 = .10, and Error Rates, F (1, 97) = 84.99, p < .001, η_p^2 = .47, with faster and more accurate responses following expected contents (M = 808 ms, *S.D.*= 199 ms; 3.89% errors, *S.D.* = 4.14%) than unexpected contents (M = 845 ms, *S.D.* = 193 ms); 10.03% errors, *S.D.* = 6.47%).

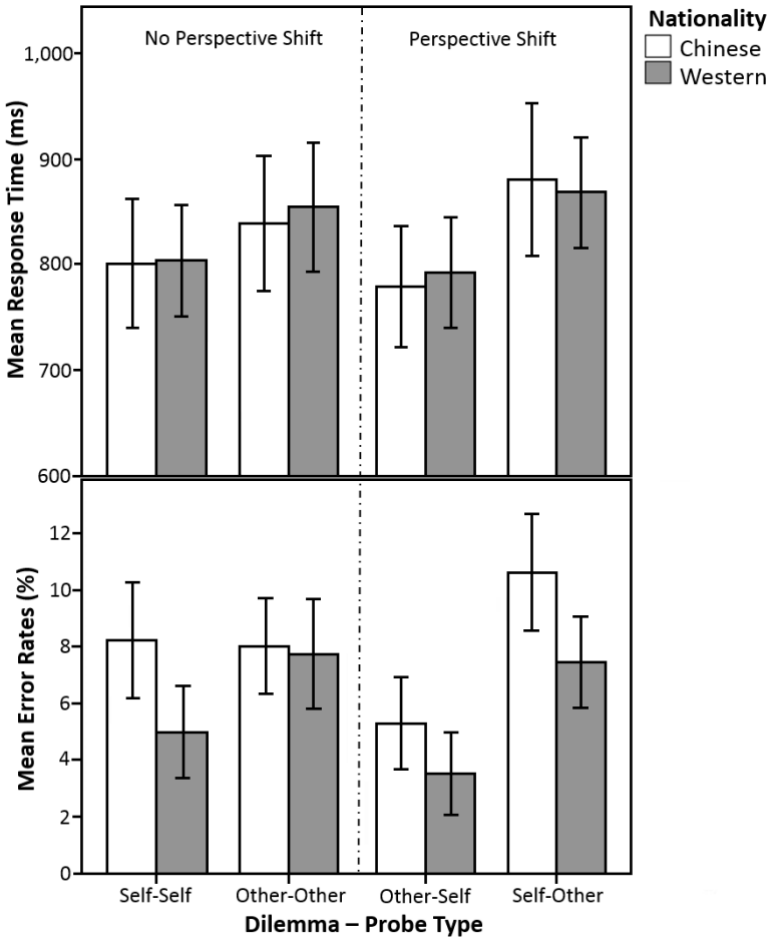

Figure 3: The upper graphs illustrate mean response times (in ms), and the lower graphs present accuracy data (percentage of errors), for each test condition of the Self/Other Differentiation task. Mean responses are illustrated in the white bars for the Chinese participants, and the grey bars for the Western (native-English speakers) participants. Errors bars represent 95% confidence intervals.

Critically, there was also a significant interaction between Perspective Shifting and Probe Type for RT, F (1, 97) = 4.26, p = .04, η_p^2 = .04, and Error Rates, F (1, 97) = 11.28, p = .001, η_p^2 = .10. This was due to a larger Probe Type effect (Other Oriented Probes minus Self Oriented Probes) in perspective shift trials (89 ms; 4.62% errors) than in no-perspective shift trials (44 ms; 1.27% errors). Post-hoc analysis, with Bonferroni corrections, revealed that there was a significant difference between probe types for RT in both perspective-shift conditions, t (98) = -5.97, p <.001, d = .21, and in no-perspective shift conditions, t (98) = -3.28, p = .002, d = .43. For Error Rates, there was a significant difference in responses to Probe Questions in perspective-shift conditions, t (98) = -6.32, p < .001, d = .77, but not in the no perspective-shift conditions, t (98) = -1.58, p = .24. For response times, this

interaction was not modulated by nationality, F (1, 97) = .76, p = .39, η_p^2 = .008, suggesting similar effects across both Chinese and Western participants. For error rates, there was a significant three-way interaction between Perspective Shifting, Probe Type, and Nationality, F (1,97) = 4.74, p = .03, η_p^2 = .05. Post-hoc analysis demonstrated that this was due to the interaction between Perspective Shifting and Probe Type only being present in the error rates for the Chinese participants, F (1, 47) = 13.45, p = .001, η_p^2 = .22, and not for the Western participants, F (1, 50) = .80, p = .38, η_p^2 = .02. Figure 3 illustrates these findings.

There was a significant interaction between Perspective Shifting and Contents Type for RT, F (1, 97) = 19.73, p < .001, η_p^2 = .17, and error rates, F (1, 97) = 5.84, p = .02, η_p^2 = .06, due to a larger difference between Expected and Unexpected contents conditions in no-perspective shift trials (M = 76 ms; 7.39% errors) compared to perspective-shift trials (M = 3 ms; 4.93% errors). Finally, there was a significant interaction between Contents Type and Probe Type for RT, F (1,97) = 20.66, p < .001, η_p^2 = .18, and for error rates, F (1, 97) = 24.81, p < .001, η_p^2 = .20, due to a larger difference between 'Self' and 'Other' probes following unexpected contents (M = 102 ms; 5.41% errors) compared to expected contents (M = 31 ms; 0.48% errors). No other effects were significant.

4.0 Discussion

The aim of this study was to examine potential cross-cultural differences in ToM processing by utilizing the Self/Other Differentiation task to explore whether performance of Western participants (native English speakers) differed from that of Chinese participants, in terms of the extent of differentiation between 'Self' and 'Other' and the ease in which an individual is able to shift between perspectives of the 'Self' and 'Other'. Results revealed that for both Western and non-Western individuals, self-oriented belief attribution (i.e., the Probe stage) was significantly faster and more accurate than other-oriented belief-attribution. Importantly, results also demonstrated a significant interaction between Perspective Shifting and Probe Type present across both the Western and Chinese samples, suggesting a resilient presence of this effect; this interaction reflects that, regardless of culture, participants found it harder (i.e., were slower) to complete trials in which a perspective-shift was required across the Dilemma to Probe stage (Self-to-Other or Other-to-Self), compared to trials in which no perspective-shift was required. Critically, the *type* of perspective shift that was required influenced responses, with slower responses to trials in which the perspective required a shift from Self-to-Other, as opposed to trials requiring a shift from Other-to-Self. Results indicate a robust finding of the differential processing of the 'Self' and 'Other' and a key role of perspective-shifting in ToM expression across two different cultures, Western and Chinese.

In the current study, we compared the responses of Chinese native individuals and a representative Western sample, who were all native-English speakers. These two cultures were selected as representative of vastly different cultural backgrounds, and in particular with predictions that these two cultures would reflect differences in individualist and collectivist traits. A key strength of this study is that, unlike prior studies that have started to explore cross-cultural differences in ToM processes, a questionnaire that explicitly assessed individualistic/collectivist traits participants associated as being relevant to themselves was included, to allow assessment of whether the two samples really did differ in these traits. Results revealed no significant difference in the Chinese or Western participants' ratings of individualist traits. However, results did reveal a significant difference between Chinese and Western participants' ratings of collectivist traits; as expected, Chinese participants scored more highly on these traits than Western participants, supporting prior research suggestions that Chinese culture involves a more collectivist approach in day-to-day living (e.g., Morris & Peng, 1994; Chen, 2000; Oyserman, Coon, & Kemmelmeier, 2002). The result of no significant difference in individualistic traits may reflect where the samples were recruited from; participants were all recruited through university samples, at either the University of St Andrews, Scotland, or Peking University, China. It may be that the individuals attending Peking University have been exposed to more Western culture, and thus may have different motivations and experiences than if participants had been recruited from a non-university population; future research may further explore this, assessing the influence of exposure to Western cultures (e.g., time spent abroad) compared to individuals with no exposure to Western cultures, and differences between university versus non-university populations. However, the differences found in collectivist tendencies in the current study suggest that the AICS questionnaire was able to tap into certain traits that are more strongly promoted in non-Western cultures, supporting collectivist tendencies such as interdependence and sharing of group values, when compared to Western cultures. Given these findings, it appears that this study provides a good basis for direct comparison of cultural differences in false-belief task performance.

As previously discussed, it is currently unclear whether the underlying features of ToM reflect a universal capacity which would be seen to be utilized and expressed similarly across different cultures, or whether ToM develops differently as a result of cultural influences, with adaptations to the ToM capacity as a result of social experiences (e.g. Kobayashi & Temple, 2009; Adams et al., 2009; Barrett et al., 2013; Shahaeian et al., 2014; Callaghan et al., 2005; Liu et al, 2008). Despite finding evidence to support the notion that Chinese participants associated with more collectivist

tendencies than Western participants, performance of both cultures was similar on the Self/Other Differentiation task. Both Chinese and Western participants were faster and more accurate when attributing beliefs to the 'Self' compared to the 'Other' at the probe stage of the Self/Other Differentiation task (i.e., where understanding of a belief-state was required), and both groups of participants found it harder to shift from Self-to-Other than from Other-to-Self. The finding that in both the Western and non-Western samples the 'Self' perspective is processed more efficiently when attributing beliefs – faster and more accurately – than the 'Other' perspective supports the suggestion that the 'self' may act as a stem for understanding of the 'other', indicating an egocentric bias in processing of ToM, that may be a core, universal component of the ToM mechanism (Bradford et al., 2015; Kinderman, Dunbar, & Bentall, 2011; Keysars & Gazzola, 2007; Bodden et al., 2010; Decety & Sommerville, 2003; Harari et al., 2010).

This notion is further supported by the interaction seen between perspective-shifting and probe type, across the two cultural samples. This interaction reflects that participants, regardless of cultural background, found it harder to complete trials in which there was a perspective-shift compared to trials in which there was no perspective-shift and, critically, that participants found it harder to shift from Self-to-Other than from Other-to-Self. It appears that, in trials in which the 'Self' perspective was primed at the Dilemma Stage, no additional cognitive effort is exerted to consider the 'Other' perspective until explicitly prompted to do so, at the Probe Stage; in contrast, in trials in which the 'Other' perspective was primed at the Dilemma stage, participants were able to efficiently process the 'Self' perspective when prompted at the Probe stage, suggesting the 'Self' may have been considered and processed as a means of understanding the 'Other' perspective. This finding is resilient to cultural experiences; despite being a member of a collectivist society, and indeed reflecting this experience in assessment of association with collectivist traits in the current study, Chinese participants did not show a reduced differentiation between 'Self' and 'Other' at a behavioural level, suggesting this differentiation may be a core component of the ToM mechanism, utilized in similar ways across different cultures.

It is noted that in the prior research that has explored cross-cultural ToM, there is evidence to suggest that, whilst overall explicit measures of ToM abilities appear to reflect similar levels of success in ToM engagement across different cultures, closer inspection of factors such as the emergence of ToM abilities in children and the neural correlates of ToM expression in adults have revealed key differences in cross-cultural samples (e.g. Kobayashi et al., 2006; Perner & Aichhorn, 2008). It is therefore possible that, whilst results in the current study show similar patterns of

behavioural outcomes, different strategies may be being utilized by individuals from different cultures to achieve the same goals, in terms of attribution of beliefs to either the 'Self' or 'Other'. The results of the current study provide preliminary evidence that association with either individualist or collectivist cultural backgrounds does not influence basic aspects of ToM abilities; even in a more collectivist, inter-group focused culture, there appears to remain a distinct differentiation between the 'Self' and 'Other' perspectives, and switching between these two perspectives carries behavioural consequences, differing dependent on the direction of the perspective-shift required.

These results provide some of the first opportunities to directly compare ToM abilities across two different cultures, Western and Chinese, using behavioural measures, whilst assessing the extent to which the two cultures truly do differ in their sense of individualist/collectivist traits. One potential issue with utilizing the Self/Other Differentiation task cross-culturally was that, in translating the sentences, there was a chance that some of the meaning would be lost, and additionally, sentence structure was not able to be matched in terms of length and syntax. However, analysis of the error rates at the probe stage suggest that Chinese participants performed equally as well as Western participants on the task, indicating that translation of sentences did not lead to less understanding of the task. Further, error rates were overall very low, again suggesting the task was not harder for the Chinese participants than the Western participants. However, it is noted that at the Dilemma Stage of the Self/Other Differentiation task, there was a significant interaction between Dilemma Type and Nationality for error rates, which may reflect that some of the scenarios presented at the Dilemma stage were less familiar to the Chinese participants compared to the Western participants; results showed that at this stage of the task, Chinese participants made more errors when responding from the 'Self' perspective compared to the 'Other' perspective, although there was no significant difference in the speed in which 'Self' and 'Other' dilemmas were answered. In contrast, Western participants were faster at responding to 'Self' dilemmas compared to 'Other' dilemmas, but showed no significant difference in error rates between these two conditions.

The role of the Dilemma stage in the Self/Other Differentiation task is to prompt participants to adopt the perspective of another person, or to consider their own perspective; the Probe stage of the task requires explicit consideration of *what* the mental states (i.e., belief-states) of either the self or another person are, following a true- or false-belief scenario. The results in this study indicate that when first adopting a particular perspective, either self or other (i.e., dilemma stage), cultural experience can modulate the ease at which a perspective is adopted. However, once this

perspective has been ascertained and a trial commences, cultural background no longer influences responses, suggesting that it is only when first adopting the perspective of another person (or considering one's own mental states) that this cultural influence is seen. This is illustrated in the dilemma stage results, where Chinese participants made more errors following self-oriented versus other-oriented dilemma questions, although showed no significant difference in response times between these trial types. We suggest that this is due to higher levels of association with collectivist traits amongst the Chinese participants, and that this is highlighted when originally engaging in consideration of another person's perspective, i.e., at the dilemma stage of a trial when adoption of a perspective (self or other) is required. At the probe stage of the task, when explicit consideration of another person's belief state is required, Chinese and Western participants perform in similar ways; that is to say, whist association with collectivist traits may aid Chinese participants in considering the 'other' perspective at the Dilemma stage, once a perspective is primed at the dilemma stage, Chinese participants do not then demonstrate an advantage compared to Western participants in switching between the perspective of 'Self' and 'Other' at the probe stage, indicating that this is not a general advantage of the collectivist experience.

4.1 Conclusion

The aim of this study was to directly compare ToM abilities between two different cultures: Western (native English-speakers) and non-Western (native-Chinese). To ensure representative samples of these two cultures, the AICS questionnaire was used, finding no significant difference in individualism levels between participants, but finding Chinese participants to be significantly more in agreement with collectivism traits than Western participants. Results from the Self/Other Differentiation task, assessing belief-attribution abilities, revealed similar results found for both Western and Chinese participants. Both cultures showed a distinct differentiation between 'Self' and 'Other', with trials in which the self-perspective was required promoting faster and more accurate responses than trials in which the other-perspective was required. Critically, the interaction between Perspective-Shifting and Probe Type was also present across Western and Chinese cultures, suggesting a resilient effect of this requirement; participants all found it harder to shift perspectives from Self-to-Other than from Other-to-Self, supporting the suggestion of the 'Self' acting as a stem for understanding of the 'Other'. Considerations of potential cross-cultural differences are important in psychological research, to assess the extent to which findings may relate to more universal traits, or more specific traits influenced by social and cultural surroundings. The results of this study support the idea of core similarities in the ToM mechanism across the two cultures studied. Further research to explore the neural signatures underlying these behavioural results, and whether

different strategies for ToM expression are utilized across cultures, would help build an even more informed understanding of how the ToM mechanism develops, functions, and is utilized in everyday life.

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