

Chased by Wolves: Effects of a Threat Prime on Working-Memory in Portuguese and Hong Kong Populations

ORIGINAL PAPER

Cultural differences between Western and East Asian populations have been categorized in terms of Individualism versus Collectivism. This study investigates the role of working memory and a threat prime across these cultures. Therefore, 30 participants from Hong Kong and 26 participants from Portugal were compared. Individualism and Collectivism levels were measured using the Auckland Individualism and Collectivism Scale (Shulruf, Hattie & Dixon, 2007). Working memory was tested using the Corsi block-tapping task (Corsi, 1972). Finally, a modified version of the wolfpack task (Gao, McCarthy & Scholl, 2010) was employed to investigate analytic / holistic perception, perceived animacy, and changes in working memory after a threat prime. An interaction between priming condition and culture was found. The performance of the Hong Kong group stayed constant over both conditions, while the performance of the Portuguese group deteriorated after a threat prime. While Hong Kong scored higher on Collectivism, no difference between the two cultures was found for Individualism. In addition, no correlation was found between Collectivism and working memory performance after threat prime. The wolfpack task used here proved insufficient to detect differences in analytic and holistic perception across cultures. This study urges caution when applying the Individualism-Collectivism distinction to these cultures.

Keywords: Working Memory, Collectivism, Individualism, Wolfpack Task

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INTRODUCTION

In his influential 1980 book *Culture's consequences: International differences in work-related values*, Hofstede divided cultures along a collectivistic – individualistic spectrum. He found Western cultures to be individualist, while East Asian cultures were collectivist. Indeed, researchers have found differences between Western and East Asian cultures to be so profound that, according to Nisbett, Peng, Choi, and Norenzayan (2001) “Psychologists who choose not to do cross-cultural psychology may have chosen to be ethnographers instead” (p.307). However, a meta-analysis by Oyserman, Coon and Kimmelmeier (2002) found that differences in individualism and collectivism across cultures were not as extreme as suggested. They found that European Americans fitted the description of an individualist society by scoring both high on individualism and low on collectivism. In contrast, they found that for East Asian populations, Chinese society fitted the classical description of a collectivist society the best by both scoring low on individualism and high on collectivism. While the individualism-collectivism distinction remains influential, they found that other East Asian cultures did not fit this pattern as nicely (Oyserman et al., 2002). Still, whether one grows up in a Western or in an East Asian culture may influence how one thinks about the world (Nisbett & Masuda, 2003; Lim, 2007; Lim & Giles, 2007) and about oneself (Markus & Kitayama, 1991). For example, Westerners perceive the world according to attitudes, beliefs and personality of the individual, while East Asians use in-group norms, context, and history of events to make sense of the environment (Morris & Peng, 1994). Furthermore, Westerners see themselves separate from the social context, and put emphasis on private achievements, expressing oneself and being unique. In contrast, East Asians see themselves as part of the group, and put emphasis on public tasks, fitting in, and being a good member of society (Markus & Kitayama, 1991). Thus, individualists are more independent, while collectivists are more interdependent.

In parallel to the Individualism-Collectivism distinction, differences in world view, cognition, perception and attention across cultures have often been described as analytic for Westerners and holistic for East Asians (e.g. Lim, 2007; Lim & Giles, 2007; Masuda & Nisbett, 2001; Nisbett et al, 2001; Nisbett & Masuda, 2003; Nisbett & Miyamoto, 2005, Miyamoto, Nisbett & Masuda, 2006). The analytic worldview is described as trying to find key elements and relationships in the bigger world, thus breaking it up into smaller parts (Kim, Lim, Dindia & Burrell, 2010). In contrast, the holistic worldview is described as seeing everything as a whole without breaking it into smaller parts (Kim et al., 2010) Similarly, there exist different cognitive strategies to cope with the environment: Westerners tend to make more use of categorical, rule-based thinking and formal logic, compared to East Asians (Nisbett et al, 2001, Nisbett & Masuda, 2003). Conversely, East Asians make more use of dialectical reasoning and causal attributions (Nisbett et al, 2001, Nisbett & Masuda, 2003).

But apart from cognition, basic perceptual and attentional processes were also found to differ. In one classic experiment, Masuda and Nisbett (2001) showed Japanese and American participants animated underwater scenes, which consisted of a salient fish in the foreground, and other fish and marine life in the background. The participants had to remember the scene and then make statements about it. They found that Japanese perceived and remembered objects in relation to their contexts better and paid more attention to interrelations between objects. In contrast, Americans perceived objects relatively independent of their field. These findings supported the analytic-holistic distinction. Westerner's perception is more analytic, meaning they focus more on highly salient single objects and their properties. In contrast, East Asians, who come from collectivist cultures, have a more holistic perception. They take into account various objects, their interrelations, and not so salient background stimuli. Their perception is more focused on the broader picture. (Ji, Peng & Nisbett, 2000; Nisbett & Miyamoto, 2005; Masuda & Nisbett, 2001 Miyamoto et al., 2006) Furthermore, Savani and Markus (2012) have proposed that selective attention may also play a role in this distinction, making it easier for Westerners to discern important from unimportant stimuli due to their analytic attention style.

Interestingly, holistic and analytic perception styles may already be present at an early age. In a recent study, Senzaki, Masuda and Nand (2014) compared landscape paintings and collages of Canadian and Japanese school children from grades one through six. They found that while in grade one the paintings were relatively similar, with increasing age the paintings were increasingly conforming to holistic ideologies for Japanese children, and to analytic ideologies for Canadian children. This supports the notion of analytic and holistic perception emerging from distinct cultural backgrounds.

In summary, East Asian cultures have been characterized as collectivistic, meaning they are more interdependent and put emphasis on belonging to their group (Markus & Kitayama, 1991). They have also been labeled holistic, which means seeing interrelations between different objects, and considering their contexts and the scene as a whole (e.g. Nisbett & Miyamoto, 2005). Conversely, Westerners are thought to be individualistic, being more independent and putting emphasis on personal achievements and uniqueness (Markus & Kitayama, 1991). Additionally, they have been labeled analytic, which means they break up the whole picture into smaller parts, and analyze each object relatively independent of their surroundings (e.g. Nisbett & Miyamoto, 2005).

In the current study, we built on this work, and compared Portuguese and Hong Kong populations. The cultural differences mentioned above have been most extensively researched between American and Japanese cultures (e.g. Masuda & Nisbett, 2001, Miyamoto et al., 2006) or American and Mainland Chinese cultures (e.g. Ji et al., 2000). The purpose of choosing Portugal and Hong Kong as cultures to be compared was to see if these findings also hold true for less extensively researched Western and East Asian cultures. Therefore, the current experiment was also set up to investigate how easily the individualism/collectivism distinction and the analytic/holistic distinction could be generalized to other Western and East Asian cultures. Most East Asian cultures that were categorized by Hofstede (1980)

to be collectivist, have been found to show holistic cognition and perception (e.g. Nisbett et al., 2001, ; Nisbett & Masuda, 2003; Nisbett & Miyamoto, 2005). Similarly, cultures categorized as individualistic showed analytic cognition and perception (e.g. Nisbett et al., 2001, ; Nisbett & Masuda, 2003; Nisbett & Miyamoto, 2005). The Portuguese and Hong Kong populations in this study were also compared on their levels of individualism and collectivism, as well as their degrees of analytic or holistic perception.

Additionally, cultural differences in working memory were researched. Working memory is defined as a part of short-term memory that is responsible for keeping important things in mind while performing complex tasks (Baddeley, 2010). Compared to perception and attention, little is known about working memory differences across cultures. While the literature on this topic is not very extensive, insight comes from a study by Imbo and LeFevre (2009). They compared Chinese, Belgian and Canadian participants on the effects of working-memory load on math problem solving. They found that Chinese participants were faster than Belgians and Canadians, and also required fewer working memory resources. The Authors attributed these effects to different cultural backgrounds, and different forms of education during childhood. In this study, we compared Portugal and Hong Kong populations on working memory, and investigated the effect of a threat prime on working memory performance. The threat prime was also used to see if this affects how people react to their ingroups or outgroups. Specifically, approach and avoidance behavior to the participant's ingroup and outgroup was measured.

We hypothesized that the two populations would differ significantly on individualism and collectivism. Consistent with prior research, we expected Portugal to score higher in individualism, as it is a western culture. Additionally, we expected Hong Kong to score higher on collectivism, as it is an East Asian culture. Similarly, we hypothesized that Portugal would show higher levels of analytical perception, and that Hong Kong would show higher levels of holistic perception. Furthermore, we expected that the two cultures would show different response patterns in the wolfpack task after being confronted with a threat prime. Considering working memory, building on the findings of Imbo and LeFevre (2009), we predicted that Hong Kong would score higher than Portugal, both in normal tasks, and after a threat prime.

METHODS

Participants

The experiment was approved by the local ethical committees. There were 68 participants in total. 30 of them were local Portuguese students of the University of Lisbon (mean age = 21.8), while the other 38 were local Hong Kong students of the Chinese University of Hong Kong (mean age = 19.8). Out of the 38 participants from Hong Kong, 8 were male and 30 were female. The 30 Portuguese participants consisted of 14 males and 16 females. All students were undergraduate students,

and a pre-experimental screening was performed via a short questionnaire sent by email. Its purpose was to make sure that participants (1) had no vision impairments, (2) had no memory impairments, and (3) were born and raised in Portugal or Hong Kong and spent the greatest part of their life there, to make sure that they were shaped by the respective cultures this experiment claims to compare. For their participation, they received a compensation of 7 Euros or 75 Hong Kong Dollars.

In total, 12 participants had to be excluded from the analysis. 10 exclusions were due to technical difficulties. The program crashed, and as a result not enough trials were obtained to guarantee a proper analysis or counterbalancing. The remaining participant was excluded because contrary to answers on the pre-experimental screening, the participant had not grown up exclusively in an East Asian culture. The last excluded participant was an outlier, and was excluded because the participant's responses indicated a complete disregard of task instructions, pressing the same button 99 percent of the time. All excluded participants were still fully compensated. After these exclusions, there were 30 participants in the Hong Kong group (5 male and 25 female) and 26 in the Portuguese group (13 male and 13 female).

Materials

Auckland Individualism and Collectivism Scale (AICS)

To measure collectivism and individualism of the participants, we employed the Auckland Individualism and Collectivism Scale, short AICS, which was developed by Shulruf, Hattie and Dixon (2007). This questionnaire defines three dimensions of individualism: responsibility, uniqueness and competitiveness, and two dimensions of collectivism: advice and harmony. Participants had to rate 26 statements on the frequency (1= never to 6= always) they behave in the given ways. 15 statements load on the individualism dimensions, while 11 questions load on the collectivism dimensions.

Corsi Block Tapping Task

To measure spatial working memory in a standardized way, a digital version of the Corsi block tapping task was used (Corsi, 1972; Berch, Krikorian & Huha, 1998). The task was run via Millisecond software's Inquisit 4 (2012). In this task, an increasing number of blocks were displayed, and then highlighted in a specific order. The participant had to remember the order of highlighting, and click the blocks in the same sequence (Corsi, 1972,). The task started with two blocks, and gradually increased the number of lit-up blocks to nine. The participant had to complete each number of blocks correctly twice before continuing the task with more blocks. If the participant failed twice in a row, the task ended and the participant's score was provided. This task was needed to see whether differences in the memory task performed afterwards could be explained with working memory capacity, or had alternative explanations.

Wolfpack task with integrated working memory task and approach-avoidance task

To investigate the differences in perception, and in order to provide the threat prime, the so-called “wolfpack effect” (Gao, McCarthy & Scholl, 2010) was used. This effect worked with perceptual animacy, which means that people attribute social interactions and intentions to objects, based on motion cues (Meyerhoff, Huff & Schwan, 2013). Participants saw a video with some darts and a square in it. All the objects were moving around in a completely random manner. In one condition, each dart was always oriented perpendicular to the square, thus not facing it. But in the other condition, the “wolfpack condition”, each dart constantly faced the square. Even though each dart’s movement was completely random, the fact that they were constantly facing the square made it seem as if they were chasing it, like a pack of wolves (see figure 1).

In order to guarantee a smooth experiment, the remaining tasks for chase perception, working memory and approach-avoidance behavior were aggregated into one continuous task. The video stimuli and the code for this task were custom-made by the researchers, and were run using the free open-source software Psychopy (Pierce, 2007).

In this task, participants first saw a video of a square and ten dart-shaped objects moving around. At the end of the video, the scene froze for two seconds so participants could remember it. The darts were either arranged perpendicular, thus facing away from the square, or they were constantly facing the square. This latter condition was the wolfpack condition that created a perception of animacy.

After seeing the video of either the perpendicular or the wolfpack condition, people had to indicate whether or not they thought the darts were chasing the square. They did so by clicking the left or right mouse button, respectively. As the perception of a chase depends on the interaction of many moving objects, this effect should give an indication of the participant’s degree of analytic or holistic perception.

Afterwards, they saw a picture which was either an exact screen shot of the end of the video they just saw, or a slightly manipulated picture. They had to indicate if it was the same or a different picture by pressing the left or right mouse button again. This served as a working memory test with a threat prime, to see if items would be encoded into memory more easily in threatening conditions. This reasoning follows findings by Gao et al. (2010), who successfully used the wolfpack task as a social cue. The proportion of same and different pictures the participants saw was 50/50. In the screenshots or manipulated pictures that the participants saw, the position of the “sheep” and the facing direction of the “wolves” were controlled for, so participants had to memorize the position of up to 10 wolves in order to judge if a picture was the same or different.

Finally, the participants received an instruction for the approach-avoidance task, and saw a picture of their ingroup or their outgroup afterward. The instruction either stated to move the mouse forward if the picture was turned clockwise and backward if the picture was turned counterclockwise, or the instruction was the other way around. This way, they would be focusing on which way the picture was turned, and not if their ingroup or outgroup was on the picture. The video they saw before functioned either as a threat prime (wolfpack condition), or as a control

(perpendicular condition), which should influence their movement of the mouse. The results of this approach-avoidance task are not discussed here, as this paper's focus is on working memory.

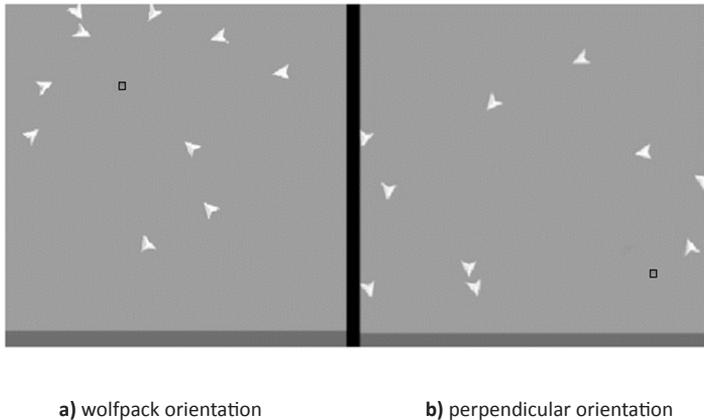


Figure 1. An example of the stimuli used in the experiment. In the wolfpack condition (a) the darts were constantly facing the square, while their movement was completely random. This induced a perception of animacy. In the control condition (b), the darts were constantly oriented perpendicular to the square, while their movement was also random. For a video of moving stimuli similar to those used in this experiment, visit: <http://perception.research.yale.edu/Animacy-Wolfpack/Animacy-Wolfpack-Search-Wolfpack-NoCheating.mov> for the wolfpack condition and <http://perception.research.yale.edu/Animacy-Wolfpack/Animacy-Wolfpack-Search-Perpen-NoCheating.mov> for the perpendicular condition (Scholl, n.d.).

Procedure

The design of this study was a quasi-experimental split-plot design. The procedure was identical for Portuguese and Hong Kong students. The experiment started with a brief description, and participants filled out an informed consent form. They were also told that they may stop participating in the study at any point, should they feel uncomfortable.

After their written consent had been given, participants filled out the AICS questionnaire. Afterwards, they completed the Corsi Block Tapping task on a computer screen. Then they moved on to the Wolfpack task. This task had a 2x2 design. The wolfpack task had two conditions (wolfpack and perpendicular), and the approach-avoidance task had two conditions (approach/avoid). The working memory task embedded in this task did not add any additional conditions. Even though people could see an identical or a different picture, only the percentage of correct responses was measured. All four possible conditions were counterbalanced, and each participant completed 40 trials of each condition, so 160 trials in total (see figure 2). Furthermore, the design of this study was a mixed design. It had a between-subject factor, namely the Portuguese and Hong Kong group of participants. It also had several within-subject factors, as every subject ran through all conditions of the wolfpack/working memory/approach-avoidance task.

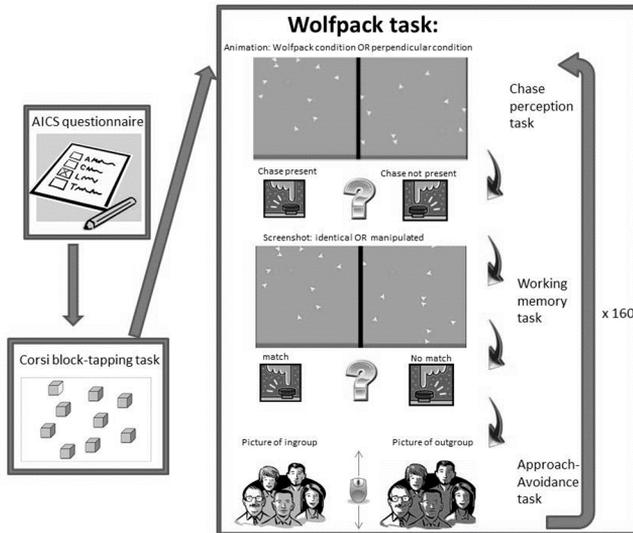


Figure 2. The procedure of this experiment. First, participants filled out the Auckland Individualism and Collectivism Scale. Afterwards, they completed the Corsi block-tapping task. Then, they moved on to the wolfpack task: Participants saw an animation in which objects were either in the wolfpack orientation (this provided the threat prime), or in the perpendicular orientation (this provided the neutral prime). The animation froze for two seconds at the end, so that participants could remember the configuration of objects. They then had to indicate via button press if a chase was present or not. Afterwards they saw a picture, which was either a screen shot, or a modified version, of the last two seconds of the video. Participants had to indicate via button press whether the picture was identical. Finally a picture of either their ingroup or their outgroup was presented. This picture was slightly rotated clockwise or anticlockwise, and instructions were given to move the computer mouse forward or backward, depending on the rotation of the picture. The whole wolfpack task was run 160 times, 80 times with a threat prime and 80 times with a neutral prime.

STATISTICAL ANALYSIS

To investigate the differences in collectivism and individualism across cultures, independent samples t-tests were performed for collectivism score and individualism score, and on each sub-category of individualism and collectivism. Significance tests were one-tailed. However, Shulruf, et al. (2011) suggested that a cluster analysis is more informative than the mean. Therefore, a k-cluster analysis was also performed. This made it possible to get an understanding of within-group variation on individualism and collectivism. Within each culture, participants were divided into four clusters, based on their scores. These clusters were: Mid Individualism- High Collectivism (MI-HC), High Individualism- Mid Collectivism (HI-MC), High Individualism- High Collectivism (HI-HC), and Mid Individualism-

Mid Collectivism (MI-MC). The cultural differences in the Corsi block-tapping task were also measured with a one-tailed independent samples t-test.

In order to investigate chase perception, we performed a split-plot ANOVA (General Linear Model). Culture served as a Between-Subject factor. The Within-subject factor was provided by the measure of chase detection. More precisely, we used the participant's score on how often they correctly identified that a chase was happening, in the perpendicular condition and in the wolfpack condition, respectively. This analysis was then repeated with the scores on individualism, collectivism, and the Corsi block-tapping task added as co-variables.

In order to investigate working memory capacity after a threat prime, we performed another split-plot ANOVA (General Linear Model). Culture served as the between-subject factor again. The within-subject factor consisted of a working memory measure after a threat prime (wolfpack condition) or after a neutral prime (perpendicular condition). Specifically, after watching either an animation of the wolfpack condition or of the perpendicular condition, participants saw either a screenshot of the animation they just saw, or a slightly different picture. They had to indicate if the picture was identical to what they had just seen during the animation. The Corsi block tapping task was included as a co-variable, as it measures working memory. Furthermore, the scores on correct identification of chase in the wolfpack and perpendicular conditions were also added as co-variables, since these provided the threat primes or neutral primes.

Finally, the Corsi block-tapping task, individualism, and collectivism scores were correlated to the different conditions of the chase perception task and the wolfpack memory task.

RESULTS

Auckland Individualism and Collectivism Scale

We found significant differences between the Hong Kong and Portuguese groups for Collectivism with $t(54) = 3.49, p < 0.001$. As expected, the Hong Kong group scored higher on collectivism ($M = 4.04, SD = 0.58$) than the Portuguese group ($M = 3.56, SD = 0.44$). The two groups did not differ significantly on individualism, $t(54) = -1.17, p = 0.124$ (see figure 3a). An analysis of the different sub-categories of the AICS showed that scores differed on only one sub-item. This was "harmony" ($t(54) = 3.52, p < 0.001$), which loads on collectivism (see table 1). Cluster analysis showed that the largest cluster of Hong Kong participants (40%) had midlevel individualism scores and high collectivism scores. The second largest cluster of Hong Kong participants (30%) had high individualism scores and midlevel collectivism scores. The greatest part of the remaining participants (27%) scored high on both individualism and collectivism. In the Portuguese group, there were no participants that had midlevel score on individualism and a high score on collectivism. Instead, the biggest cluster (65%) scored high on individualism and medium on collectivism. This cluster was almost as big as the two biggest clusters from the Hong Kong group combined.

Unlike the Hong Kong participants, the largest part of the remaining Portuguese participants (31%) had midlevel scores in both individualism and collectivism (see figure 3b).

Corsi Block-Tapping Task

The Corsi block-tapping task showed a marginally significant effect between cultures ($t(54) = 1.611, p = 0.057$), with the Hong Kong group scoring higher than the Portuguese group ($M = 73,33; SD = 24,21$ for the Hong Kong group and $M = 62,77; SD = 24,77$ for the Portuguese group).

fig. 3a

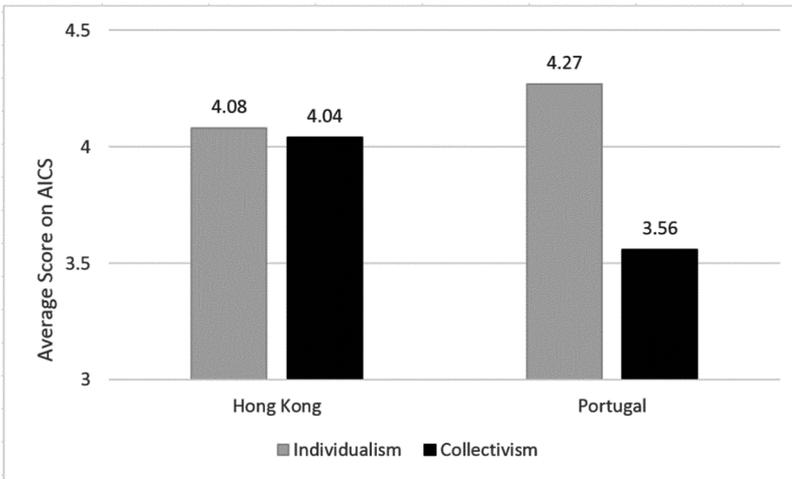


fig. 3b

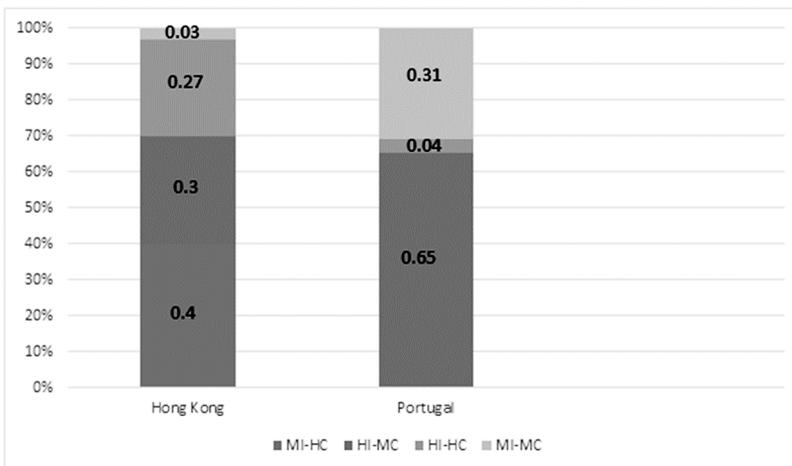


Figure 3. Individualism and Collectivism scores by culture. a) mean individualism and collectivism scores, b) cluster analysis showing percentage of people belonging to one of the following clusters: Mid Individualism-High Collectivism (MI-HC), High Individualism- Mid Collectivism (HI-MC), High Individualism- High Collectivism (HI-HC), and Mid Individualism- Mid Collectivism (MI-MC)

Table 1. Means and standard deviations on Individualism, Collectivism, and its subcategories by culture.

		Hong Kong			Portugal		
		M	SD	N	M	SD	N
Individualism	Total	4,08	0,64	30	4,27	0,5	26
	Responsibility	4,58	0,67	30	4,70	0,37	26
	Uniqueness	4,23	0,97	30	4,59	0,89	26
	Competence	3,72	0,71	30	3,51	0,87	26
Collectivism	Total	4,04	0,58	30	3,56	0,44	26
	Advice	4,19	0,73	30	3,92	0,68	26
	Harmony	3,78	0,64	30	3,17	0,65	26

Wolfpack task

Measuring perceived animacy through chase detection

In the chase detection task, we found no significant difference between cultures ($F_{1, 54} = 0.001, p = 0.976$), meaning that both Hong Kong and Portuguese populations perform equal on detecting whether a chase was present in the wolfpack task. However, we found a significant difference between conditions, with $F_{1, 54} = 7.292$ and $p = 0.009$. Responses were measured in a percentage score. In the perpendicular condition, the correct answer to whether a chase was present was always no, and in the wolfpack condition the correct answer was always yes. Of course, participants were unaware of this, as they did not know about the two different experimental conditions. Thus, people are better at identifying that no chase is present in the perpendicular trials ($M = 0.9, SD = 0.13$ for Hong Kong and $M = 0.85, SD = 0.16$ for Portugal) than at identifying that a chase is present in the wolfpack trials ($M = 0.79, SD = 0.20$ for Hong Kong and $M = 0.84, SD = 0.18$ for Portugal). Additionally, we found a marginally significant interaction between conditions of the wolfpack task, and culture; $F_{1, 54} = 3.0828, p = 0.056$.

When repeating the analysis with the added covariables, the within-subject effect that compared the wolfpack condition to the perpendicular condition disappeared ($F_{1, 51} < 0.001, p = 0.998$). The interaction also disappeared ($F_{1, 51} = 1.56, p = 0.217$). Furthermore, there was no significant interaction with the co-variables, neither between task conditions and Individualism score ($F_{1, 51} = 0.198, p = 0.279$), nor between task conditions and Collectivism score ($F_{1, 51} = 0.023, p = 0.881$), or task conditions and score on the Corsi block tapping task ($F_{1, 51} = 1.580, p = 0.214$). Furthermore, there was still no between-subject effect for culture. ($F_{1, 51} = 0.942,$

$p = 0.336$). While we found no between-subject effects for the Corsi block-tapping task ($F_{1, 51} = 0.158, p = 0.692$) or for Collectivism score ($F_{1, 51} = 1.921, p = 0.172$), we did find a between-subject effect for Individualism score ($F_{1, 51} = 6.041, p = 0.017$). We then ran the analysis once more, but included only Individualism score as a co-variable, since this was the only significant one. There was still no within-subject effect for task condition ($F_{1, 53} = 1.843, p = 0.180$), task condition * Individualism score ($F_{1, 53} = 1.004, p = 0.321$) or task condition * culture ($F_{1, 53} = 3.149, p = 0.082$), although the interaction showed a trend (see figure 4). While the between-subject effect of culture was still insignificant ($F_{1, 53} = 0.132, p = 0.718$), the between-subject effect of Individualism score remained significant ($F_{1, 53} = 6.295, p = 0.015$).

Then the co-variables were correlated to the chase perception task. No significant correlations were found in the Hong Kong group. In the Portuguese group, individualism correlated with both the perpendicular trials and the wolfpack trials of the chase perception task (see table 2).

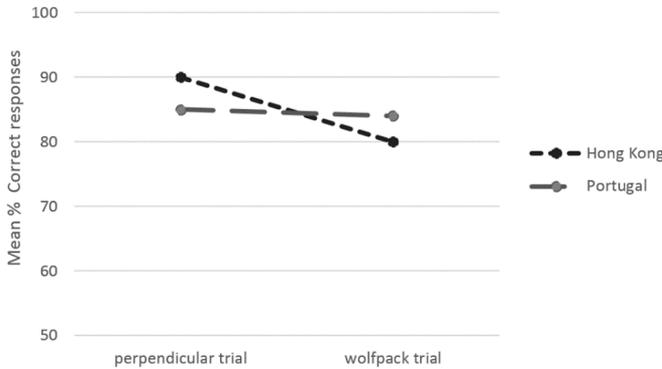


Figure 4. Mean percentage of correct identification on the chase perception task. A test for interaction was not significant ($F_{1, 53} = 3.149, p = 0.082$.)

Measuring working memory after threat prime

No main effect for the match/no match task was found; $F_{1, 51} = 0.084, p = 0.773$. Moreover, no significant interaction was found between the match/no match task and either the Corsi block-tapping task ($F_{1, 51} = 1.687, p = 0.2$), the chase detection in the wolfpack condition ($F_{1, 51} = 0.011, p = 0.916$), or chase detection in the perpendicular condition ($F_{1, 51} = 0.524, p = 0.472$).

Furthermore, a main effect for culture was found; $F_{1, 51} = 5.722, p = 0.020$. The Corsi block-tapping task showed no significant between-subject effect ($F_{1, 51} = 0.4081, p = 0.777$), and neither did chase perception in the wolfpack condition ($F_{1, 51} = 0.430, p = 0.515$). Yet chase perception in the perpendicular condition showed a significant between-subject effect ($F_{1, 51} = 6.527, p = 0.014$). Additionally, an interaction between the match/no match task and culture was found; $F_{1, 51} = 5.092, p = 0.028$ (see figure 5).

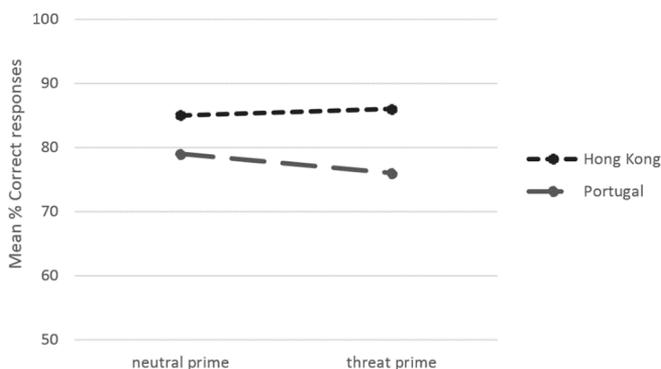


Figure 5. Mean percentage of correct answers on the match / no match task after threat prime and neutral prime per culture. A test for interaction was significant ($F(1, 51) = 5.092, p = 0.028$).

A post-hoc analysis of simple effects showed that cultures differed significantly in the perpendicular condition of the match / no match task ($t(54) = 2.111, p = 0.039, M = 0.86; SD = 0.13$ for the Hong Kong group and $M = 0.79; SD = 0.12$ for the Portuguese group). Cultures also differed significantly in the wolfpack condition of this task ($t(54) = 3.197, p = 0.002, M = 0.86; SD = 0.12$ for the Hong Kong group and $M = 0.76; SD = 0.12$ for the Portuguese group).

Furthermore, within the Hong Kong population there was no significant difference between the wolfpack condition and the perpendicular condition of the match/no match task; $t(29) = -0.729, p = 0.472, M = 0.86; SD = 0.13$ for the perpendicular condition and $M = 0.86; SD = 0.12$ in the wolfpack condition. In contrast, the Portuguese population showed a significant difference between the two conditions of this task; $t(25) = 2.468, p = 0.021$. The Portuguese group performed worse in the wolfpack condition, where they saw a threat prime ($M = 0.76; SD = 0.12$) than in the perpendicular condition, where they saw a neutral prime ($M = 0.79; SD = 0.12$).

Correlating the different tasks

In the Hong Kong population, we found no correlations between either collectivism, individualism, or the Corsi block-tapping task and the match/ no match task. However, in the Portuguese population, we found a marginally significant correlation between individualism and the wolfpack condition of the match / no match task (see table 2). Furthermore, a trend could be discerned for correlations between individualism and the perpendicular condition of this task, as well as for individualism and the Corsi block-tapping task (see table 2).

Hong Kong				Portugal			
	Corsi block-tapping task	AICS: Individualism	AICS: Collectivism		Corsi block-tapping task	AICS: Individualism	AICS: Collectivism
Chase: perpendicular	r=-0,035 p=0,854	r=0,005 p=0,981	r=-0,161 p=0,394	Chase: perpendicular	r=-0,181 p=0,377	r=0,538** p=0,005	r=-0,214 p=0,294
Chase: wolfpack	r=-0,049 p=0,798	r=0,254 p=0,176	r=-0,158 p=0,405	Chase: wolfpack	r=-0,136 p=0,506	r=0,407* p=0,039	r=-0,168 p=0,412
Chase: Overall	r=-0,049 p=0,796	r=0,179 p=0,345	r=-0,183 p=0,332	Chase: Overall	r=-0,020 p=0,925	r=0,538** p=0,005	r=-0,220 p=0,280
Match: perpendicular	r=0,049 p=0,798	r=-0,106 p=0,579	r=-0,031 p=0,870	Match: perpendicular	r=0,156 p=0,445	r=0,331 p=0,098	r=-0,176 p=0,391
Match: wolfpack	r=-0,020 p=0,917	r=-0,150 p=0,430	r=-0,122 p=0,520	Match: wolfpack	r=-0,052 p=0,802	r=0,380 p=0,056	r=0,032 p=0,878
Match: Overall	r=0,015 p=0,936	r=-0,123 p=0,518	r=-0,068 p=0,722	Match: Overall	r=0,074 p=0,719	r=-0,312 p=0,121	r=-0,036 p=0,861

Table 2. Correlations between the different wolfpack tasks and the Corsi block-tapping task, Individualism and Collectivism. *: significant, with $p < 0.05$; **: significant, with $p < 0.01$.

DISCUSSION

In accordance with our hypothesis, we found that the Hong Kong group scored higher in the working memory tasks. We also found cultural differences in working memory after threat prime, in accordance with our hypothesis. However, no cultural difference in holistic or analytic perception, as measured by perceived animacy, was found.

Furthermore, we hypothesized that Hong Kong would score higher on collectivism, and Portugal would score higher on Individualism. While we found that Hong Kong scored higher on collectivism than Portugal, but we found no difference for Individualism. Moreover, the only subcategory of the AICS that showed a significant difference across cultures was “Harmony”, which loads on collectivism. This suggests that the higher collectivism of the Hong Kong population, compared to the Portuguese population, is mainly due to increased levels of harmony, which is a measure of avoiding conflict (Shulruf et al., 2007). Cluster analysis showed that for the Hong Kong population there were three main groups: the first scored high on collectivism and medium on individualism. For the second group, the reverse was the case. Finally, the last group scored high on both dimensions. This nicely explains how Hong Kong scored high on both individualism and collectivism. In contrast, the Portuguese population was lacking a group that scored high on collectivism and medium on individualism. But the group that scored high on individualism and medium on collectivism made up almost two thirds of the population. Unlike in the Hong Kong group, the remaining participants did not score high on both dimensions, but had midlevel scores. This explains why Portugal scored high on individualism but medium on collectivism. Our findings differ from those of Shulruf et al. (2011), who found that the largest group of Portuguese participants scored high

on collectivism and low in individualism.

While the individualism-collectivism distinction showed an effect between cultures, the distinction between holistic and analytic perception did not. We hypothesized that the Hong Kong group would show more holistic perception and the Portuguese group would show more analytic perception, which could not be confirmed. That no cultural difference in the perception of the wolfpack effect was found may be in part explained by the fact that these cultures' differences in individualism and collectivism were not as profound as expected. Similarly, their level of holistic and analytic perception may also not differ as much. However, there was a main effect for the wolfpack and perpendicular condition. Participants from both cultures found it easier to identify that no chase was present in the perpendicular trials, than to identify that a chase was present in the wolfpack trials. Yet when we added individualism score as a co-variable, this effect disappeared. Furthermore, individualism score in the Portuguese group correlated stronger with chase perception in the perpendicular condition than in the wolfpack condition. This could mean that individualism, but not collectivism, is linked to the perception of this effect. It is intriguing that individualism correlated with chase perception in the Portuguese group only, and not in the Hong Kong group, even though differences in individualism across cultures were not significant. This may be related to the fact that almost two thirds of Portuguese participants scored high in individualism and medium in collectivism, while the Hong Kong group did not have a single large group with such striking differences in score. Ultimately, whether individualism is linked to perceived animacy is beyond the scope of this research. The low number of participants in each cluster also restricts interpretation of these effects. Further research with a larger sample would be needed to investigate this.

While cultures did not differ on the perception of the threat prime, the high percentage of correct responses indicates that participants did indeed perceive the wolfpack effect. One of our hypotheses was that working memory performances would differ across cultures in response to a threat prime. This seemed to be the case. The performance of the Hong Kong group stayed constant after a threat prime, compared to a neutral prime. In contrast, the performance of the Portuguese group declined after a threat prime. Thus the Hong Kong group showed better working memory performance after threat prime. The Hong Kong group also performed better than the Portuguese group over both conditions of this task. Similarly, the Hong Kong group was better at the Corsi block-tapping task, although this effect was only marginally significant. The findings on the working memory tasks are ultimately not strong enough to confirm out hypothesis that the Hong Kong group scores higher than the Portuguese group in working memory tasks.

Overall, these findings show that the differences between Hong Kong and Portugal are not as straightforward as assumed. Hong Kong's high level of Individualism prevents a categorization that puts the East Asian population at one end and the Western population at the other end of the Collectivism – Individualism spectrum. Rather, Hong Kong scores high on both individualism and collectivism, while Portugal scores high on only individualism. Other studies have found similar results that did not fit the individualism-collectivism distinction. For example, Kim et al. (2010) found that Koreans and Americans were equally collectivistic and

equally individualistic. In a different study, Oishi, et al. (2005) found that Americans and Japanese did not differ on Individualism, and Americans scored higher on collectivism than Japanese. These findings reinforce the notion of Oyserman et al. (2002) that an individualism-collectivism distinction should not be applied by default to all Western and East Asian cultures. More recently, other fields of research have also challenged the validity of the individualism – collectivism distinction (e.g. Brewer & Venaik, 2011). Considering the distinction between analytic and holistic perception, we may have been unable to discern effects across cultures because the chase perception task showed a ceiling effect (see figure 4). This task may have been too easy to meaningfully identify differences across cultures. It may be the case that everyone, regardless of their degree of analytic or holistic perception, scores high on this task due to a lack of difficulty. In retrospect, a direct measure of holistic and analytic thinking and perception would have been useful, such as the Analysis-Holism Scale developed by Choi, Koo and Choi (2007). Furthermore, the link between high holistic thinking and a high perception of animacy, while plausible, has not been empirically investigated in this experiment. Future research should try to validate the proposed differences in holistic and analytic perception between Hong Kong and Portugal, as well as the connection between holism and perceived animacy in the wolfpack task.

Therefore, in this study we do not know how analytic or holistic perception comes to bear on the effect a threat prime has on working memory. Whether Individualism or Collectivism has an effect on this also remains disputable. Both groups scored high on Individualism, but only Hong Kong scored high on Collectivism. This makes it tempting to suggest that collectivism is somehow involved in performing well after a threat prime. However, we found no correlation between collectivism score and chase perception in either condition, or between collectivism and performance on the match / no match task. This opposes such an interpretation. Future research on this subject may be warranted in order to see whether collectivism scores influence working memory performance in threatening situations. Similarly, whether individualism is linked to chase perception remains elusive and further research may prove insightful.

Strangely, the match / no match task did not correlate with the Corsi block-tapping task. This could mean that these tasks measured different aspects of working memory. Indeed, the Corsi block-tapping task is sequential, consisting of a slowly increasing number of blocks that have to be remembered. In contrast, the match / no match task used here requires one to attend to the whole picture at once, without gradually building up working memory load. In order to tell if a picture is the same as the one just seen during the wolfpack animation, one needs to attend to the whole screen and remember the position of several wolves at once. A replication of this study with more closely related working memory tasks might provide insight into cultural differences in working memory.

Conclusion

In summary, the Hong Kong group showed better working memory performance than the Portuguese group. Contrary to our hypothesis, working memory performance did not increase after threat prime. Instead, the Hong Kong group's performance

stayed constant, while the Portuguese group's performance dropped after threat prime. Although this experiment proved unable to show differences in analytic or holistic perception across cultures, differences were found in collectivism, with Hong Kong scoring higher than Portugal. However, no differences in individualism were found. This study shows that caution is advised when categorizing Western societies as individualistic and East Asian societies as collectivist. Furthermore, this study adds to existing knowledge by showing that working memory is differently affected by threat primes in these cultures.

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This paper focused on working memory issues. In order to get a full understanding of all the different facets of this experiment, the reader is advised to also read Sachistal & Van der Lugt (In preparation), which focuses on the social psychological issues measured by the approach-avoidance task.

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REFERENCES

- Baddeley, A. (2010). Working memory. *Current Biology*, 20(4), 136-140.
- Berch, D.B., Krikorian, R., Huha, E.M. (1998). The Corsi Block-Tapping Task: Methodological and Theoretical Considerations. *Brain and Cognition*, 38(3), 317-338.
- Brewer, P., & Venaik, S. (2011). Individualism-collectivism in Hofstede and GLOBE. *Journal of International Business Studies*, 42(3), 436-445
- Choi, I., Koo, M., Choi, J.A. (2007). Individual Differences in Analytic Versus Holistic Thinking. *Personality and Social Psychology Bulletin*, 33(5), 691-705.
- Corsi, P. M. (1972). Human memory and the medial temporal region of the brain. *Dissertation Abstracts International*, 34, 819B.
- Gao, T., McCarthy, G., Scholl, B. J. (2010). The wolfpack effect: Perception of animacy irresistibly influences interactive behavior. *Psychological Science*, 21(12), 1845-1853.
- Hofstede, G. H. (1980). *Culture's consequences: International differences in work-related values*. Newbury Park, CA: Sage.
- Imbo, I., LeFevre, J. (2009). Cultural Differences in Complex Addition: Efficient Chinese Versus Adaptive Belgians and Canadians. *Journal of Experimental Psychology*, 35(6), 1465-1476.
- Inquisit 4.0 [Computer software]. (2012). Seattle, WA: Millisecond Software.
- Ji, L., Peng, K., Nisbett, R.E. (2000). Culture, Control, and Perception of Relationships in the Environment. *Journal of Personal and Social Psychology*, 78(5), 943-955.
- Kim, L., Lim, T., Dindia, K., Burrell, N. (2010). Reframing the Cultural Differences between the East and the West. *Communication Studies*, 61(5), 543-566.

- Lim, T., Allen, M., Burrell, N., & Kim, S. (2007). The relativity and salience of identity across cultures. *Speech and Communication*, 8, 178–202.
- Lim, T., & Giles, H. (2007). Differences in American and Korean college students' evaluations of one-year age differences. *Journal of Multilingual & Multicultural Development*, 28, 349–364.
- Morris, M.W., Peng, K. (1994). Culture and Cause: American and Chinese Attributions for Social and Physical Events. *Journal of Personal and Social Psychology*, 67(6), 941-971.
- Markus, H. R., Kitayama, S. (1991). Culture and the Self: Implications for Cognition, Emotion and Motivation. *Psychological Review*, 98(2), 224-253.
- Masuda, T., & Nisbett, R. E. (2001). Attending holistically versus analytically: Comparing the context sensitivity of Japanese and Americans. *Journal Of Personality And Social Psychology*, 81(5), 922-934.
- Meyerhoff, H.S., Huff, M., Schwan, S. (2013). Linking Perceptual Animacy to Attention: Evidence from the Chasing Detection Paradigm. *Journal of Experimental Psychology*, 39(4), 1003-1015.
- Myamoto, Y., Nisbett, R.E., Masuda, Y. (2006). Culture and the Physical Environment. Holistic Versus Analytic Perceptual Affordances. *Psychological Science*, 17(2), 113-119.
- Nisbett, R.E., Masuda, T. (2003). Culture and point of view. *Proceedings of the National Academy of Sciences of the United States of America*, 100(19), 11163-11170.
- Nisbett, R.E., Miyamoto, Y. (2005). The influence of culture: Holistic vs. Analytic perception. *Trends in Cognitive Science*, 10(9), 467-473.
- Nisbett, R.E., Peng, K., Choi, I., Norenzayan, A. (2001). Culture and Systems of Thought: Holistic versus Analytic Cognition. *Psychological Review*, 18(2), 291-310.
- Oishi, S., Hahn, J., Schimmack, U., Radhakrishnan, P., Dzokoto, V., Ahadi, S. (2005). The measurement of values across cultures: A pairwise comparison approach. *Journal of Research in Personality*, 39(2), 299–305.
- Oyserman, D., Coon, H.M., Kimmelmeier, M. (2002). Rethinking individualism and collectivism: Evaluation of theoretical assumptions and meta-analyses. *Psychological Bulletin*, 128(1), 3–72.
- Paladino, M. P., & Castelli, L. (2008). On the immediate Consequences of Intergroup Categorization: Activation of Approach and Avoidance Motor behavior toward ingroup and outgroup members. *Personality and Social Psychology Bulletin*, 34(6), 755-768.
- Peirce, J.W. (2007). PsychoPy - Psychophysics software in Python. *Journal of Neuroscience Methods*, 162(1-2), 8-13.
- Sachistal, M. S., Van der Lugt, A. (In preparation). Chased by Wolves: Effects of a Threat Prime on Intergroup Bias in different Cultures. *Unpublished empirical undergraduate thesis*.
- Savani, K., Markus, H. R. (2012). A processing Advantage Associated with Analytic Perceptual Tendencies: European Americans Outperform Asians on Multiple Object Tracking. *Journal of Experimental Social Psychology*, 48(3), 766-769.
- Scholl, B. J. (n.d.) The Wolfpack Effect: Perception of Animacy Irresistibly Influences Interactive Behavior. *Yale Perception & Cognition Laboratory*. Retrieved from: <http://www.yale.edu/perception/Brian/demos/animacy-Wolfpack.html>
- Senzaki, S., Masuda, T., & Nand, K. (2014). Holistic Versus Analytic Expressions in Artworks: Cross-Cultural Differences and Similarities in Drawings and Collages by Canadian and Japanese School-Age Children. *Journal of Cross-Cultural Psychology*, 45(8), 1297-1316.
- Shulruf, B., Alesi, M., Ciochina, L., Faria, L., Hattie, J., Hong, F., Pepi, A., Watkins, D. (2011). Measuring Collectivism and Individualism in the Third Millennium. *Social Behavior and Personality*, 39(2), 173-188.
- Shulruf, B., Hattie, J., Dixon, R. (2007). Development of a New Measurement Tool for Individualism and Collectivism. *Journal of Psychoeducational Assessment*, 25(4), 385-401.