Culture, Control and Perception of Relationships in the Environment

Li-Jun Ji

University of Michigan

Kaiping Peng

University of California, Berkeley

Richard E. Nisbett

University of Michigan

Author Note:

Correspondence concerning this article should be addressed to Li-Jun Ji, Department of Psychology, University of Michigan, Ann Arbor, MI 48109-1109 (email: lijunji@umich.edu), or Kaiping Peng, Department of Psychology, University of California, Berkeley, CA 94720 (email: kppeng@socrates.berkeley.edu), or Richard E. Nisbett, Department of Psychology, University of Michigan, Ann Arbor, MI 48109-1109 (email: nisbett@umich.edu).

The research was supported by NSF grant SBR 9729103. We thank Michael Morris, Piotr Winkielman, and Miguel Wong for their advice and assistance.

Abstract

East Asian cognition has been held to be relatively “holistic”, that is, attention is paid to the field as a whole. Western cognition, in contrast, has been held to be object-focused and control-oriented. We compared East Asians (mostly Chinese) and Americans on detection of covariation and field dependence. The results showed that (1) Chinese participants reported stronger association between events, were more responsive to differences in covariation, and were more confident about their covariation judgments; (2) These cultural differences disappeared when participants believed they had some control over the covariation judgment task; (3) American participants made fewer mistakes on the Rod-and-Frame test, indicating that they were less field dependent; (4) American performance and confidence, but not that of Asians, increased when participants were given manual control of the test. Possible origins of the perceptual differences are discussed.

Characters (with spaces): 958

Scholars in many disciplines have maintained that people in Asian cultures, especially the East Asian cultures of China, Korea and Japan, have a relatively holistic cognitive orientation, emphasizing relationships and connectedness. The traditional Chinese view, from ancient times forward, is that "the world is a collection of overlapping and interpenetrating stuffs or substances…" (Hansen, 1983, p. 30). Since the Chinese saw the world as interpenetrating and continuous, their attempts to understand it caused them to be oriented toward the complexities of the perceptual or conceptual field taken as a whole (Moore, 1968, p. 3). For the Chinese, the individual object was "not a primary conceptual starting point" (Moser, 1996, p. 169) "[T]he background scheme [of Chinese thought was] that of mass substances rather than that of objects and properties" (Hansen, 1983, p. 31).

The Chinese stance contrasts with the analytic Western world view, again tracing far back in time to the ancient Greeks, who saw the world as composed of "objects which are understood as individuals or particulars which instantiate or 'have' properties…" (Hansen, 1983, p. 30). Whereas the Chinese focused on relationships among objects in the field, the Greeks were prone to focus more exclusively on the object, searching for those attributes of the object that would help to explain and control its behavior (Moser, 1996, p. 116; Nakamura, 1964/1985, p. 185-186).

The profound differences in ontology or folk science had many consequences. A concern with the attributes of the object was helpful in allowing the Greeks to discover many important scientific laws (Nakamura, 1964/1985). But the neglect of the field led to the failure of the Greeks to understand the fundamental nature of causality in the physical domain. Aristotle explained a stone's falling through the air by reference to the stone

having the property of "gravity" and explained a piece of wood's floating on the surface of water as being due to the wood having the property of "levity." The Chinese, in contrast, understood that causation is always the result of interaction between the object and the field and recognized the principle of "action at a distance" 2,000 years before Galileo. The Chinese understood acoustic resonance and magnetism, and knew the correct explanation for the behavior of the tides (Needham, 1962).

Following the views of scholars in several fields (e.g., Abel & Hsu, 1949; Chiu, 1972; Cromer, 1993; Hsu, 1981; Liu, 1974; Nakamura, 1964/1985), Nisbett and Peng and their colleagues (Nisbett, 1998; Nisbett, Peng, Choi, & Norenzayan, 1999; Peng & Nisbett, 1999) have proposed that the holistic cognition characteristic of ancient Chinese has its counterpart in the reasoning and perception of contemporary peoples influenced by ancient China, including Koreans and Japanese. Similarly, the more analytic cognition of the ancient Greeks, with its attempts to isolate the object from the field and categorize it with respect to its properties, has its counterpart in the reasoning and perception of contemporary Western peoples. Several recent findings in cultural psychology are consistent with the proposed differences.

Causal Perception: Attention to the Field or to the Object

One of the best demonstrated phenomena in social psychology is the so-called "correspondence bias" (Jones, 1979) or "fundamental attribution error" (Ross, 1977). People tend to attribute behavior to the object rather than to the field, even when it is obvious (to the psychologist at least) that the behavior is produced, or at least heavily influenced by some contextual or situational factor. But Asians have been shown repeatedly to be more likely than Americans to explain behavior in terms of situational or

contextual factors, including social roles and obligations (Choi & Nisbett, 1998; Hong, Chiu, & Kung, 1996; Kitayama & Masuda, 1997; Lee, Hallahan, & Herzog, 1996; Miller, 1984; Morris & Peng, 1994; Peng & Nisbett, in press).

Part of the reason for the cultural differences probably lies in causal theories. When people are asked to indicate whether they think human behavior is normally trait-caused, normally situation-caused, or normally the result of some combination of the person and the situation, East Asians endorse the two alternatives ascribing weight to the situation more than do Americans (Norenzayan, Choi, & Nisbett, 1999). This is what we would expect of people with holistic thinking.

If East Asians endorse holistic theories of behavior, then we might also expect them to be more likely to attend to events in the environment in the first place. Thus they might be more capable than Americans of detecting relationships in the environment. Since people tend to be confident about things that they are good at, East Asians might therefore be more confident about relationship detection. In the research reported here, we examined covariation detection by showing participants one of two arbitrary stimuli on the left of a computer screen and one of two other arbitrary stimuli on the right of the screen. The anticipation was that East Asians would be more capable of accurate covariation detection than Americans, would be more confident about their covariation judgments, and would be less likely to rely on a dubious heuristic for inferring covariation, namely the primacy effect in which early-seen pairings have a disproportionate effect on ultimate covariation judgments (Yates & Curley, 1996).

On the other hand, if Americans have an analytic cognitive style, being inclined to separate the object from its environment, then they might be expected to be less “field

dependent" (Witkin et al., 1954) than East Asians. Relatively field dependent people are more likely to be influenced by frames of reference provided by physical or social surroundings than are relatively field independent people.

In order to test whether East Asians are more field dependent than Americans, we presented participants with the Rod and Frame Test developed by Witkin and his colleagues. The anticipation was that Americans would be less influenced by the position of the frame and hence would make fewer errors on the test and would be more confident about their performance.

Perception of Control

Perceived personal control might be expected to affect the performance of Americans and East Asians in perceptual tasks in different ways. Since the actor is seen as the main cause of behavior in the West, it would seem to follow that a sense of personal control is more important in the West than in the East. As Hsu (1981, p. 13) put it, "the Chinese tends to mobilize his thought and action for the purpose of conforming to the reality, while the American tends to do so for the purpose of making the reality conform to him". Control is so important to Westerners that they often fail to distinguish between objectively controllable and uncontrollable events, tend to perceive more control than they actually have, and report mistakenly high levels of predictability of events (see Presson & Benassi, 1996 for review). This tendency toward an "illusion of control" was defined by Langer (1975, p. 313) as expectancy of personal success higher than the objective probability would warrant. The illusion of personal control seems to affect many cognitive functions of Americans. For example, performance on routine tasks is improved when people believe they can control the occurrence of a loud noise, even

though they do not actually exercise any control over the noise (Glass & Singer, 1973).

Cross-cultural research suggests that a sense of perceived personal control is not as important for East Asians as for Americans. Perceived control over external events, or "primary control" as defined by Rothbaum, Weisz and Snyder (1982), is stronger for European Americans than for East Asian and Hispanic Americans or for Asians (Weisz, Rothbaum, & Blackburn, 1984; Morling & Fiske, 1998; Sastry & Ross, 1998). "Secondary control" (Weisz, et al, 1984) or accommodation to existing reality including group needs, is more characteristic of the latter groups. Though the perceived sense of controlling external events has been shown to be positively related to adaptation and mental health for Americans (Taylor & Brown, 1988; Langer, 1983), this may not be the case for East Asians (Kitayama, Palm, Masuda & Carroll, 1998; Sastry & Ross, 1998). In a study by Sethi and Lepper (1998), American children showed high levels of motivation to solve anagrams when they had been given free choice regarding which type to solve. In contrast, Chinese and Japanese children performed best on anagrams their mothers chose for them. Research conducted by Yamagushi, Gelfand, Mizuno and Zemba (1997) showed that American males were more optimistic in a condition in which they had an illusion of personal control over outcomes, whereas Japanese, as well as American females, were more optimistic in a group condition in which they had an illusion of collective control of the environment.

The evidence thus implies that Americans and East Asians respond differently to being given control. That is, Americans, perhaps especially American males, can be expected to improve their task performance when given personal control, even if the control is illusory. A similar effect of control would not be expected for East Asians.

Hypotheses

The above considerations lead to several expectations. (1) East Asians should be better at detecting covariation in the environment than Americans, and be more confident about their covariation judgments. (2) On the other hand, East Asians should be more field dependent than Americans, that is, they should make more errors on the Rod-and-Frame test. (3) Americans and East Asians should respond differently to being given control over perceptual tasks. Americans should benefit more from believing that they have control, even when the control is illusory. We expected that when given the illusion of control over the covariation task, Americans would be better calibrated with respect to actual covariation and more confident about their covariation judgments. Similarly, a control manipulation should lead Americans to have even better performance on the Rod-and-Frame test and to have more confidence about their performance. All of these effects of control should be weaker or nonexistent for East Asians.

Study 1a: Covariation Detection

Method

Participants

Fifty-four Caucasian American undergraduate students (27 males and 27 females) and 41 Taiwanese Chinese undergraduate students (19 males and 22 females) at the University of Michigan participated in Study 1a. American participants came from the Psychology Department subject pool and received course credit for their participation. All Chinese students had graduated from high schools in Taiwan and were recruited from the Taiwanese Chinese Student Association. They were paid $10 for participating in the study.

Materials

Twelve figures were adapted from the Macintosh II Clip Art Program. All the figures were common in both cultures and included such objects as a light bulb, a medal, a pointing finger, and a coin. All the figures were schematic to ensure that there was little culture-specific symbolic meaning. On a bifurcated computer screen pairs of figures were shown to participants. On the left side of the screen was shown one of the two arbitrary figures – for example, a schematic medal or a schematic light bulb. Immediately following that, on the right of the screen, one of another two figures – for example, either a pointing finger or a schematic coin – was displayed. At each level of covariation, there were in total four figures, two of which appeared only on the left of the screen and two of which appeared only on the right of the screen.

The actual covariation between figures on the left and on the right was set at one of three levels: One level was a zero degree of association, meaning that the probability of the figures appearing on the right was not related to which figure appeared on the left. The other two levels of association corresponded to Pearson correlation coefficients of about .40 and .60, representing a moderate covariation and a relatively strong covariation respectively (see note 1).

The PsyScope program (version 1.0) was used to present the stimuli and to record participants' responses.

Procedure

Participants came to the laboratory individually. They sat in front of a Macintosh II computer and watched the presentation of the figures on the screen. After ten pairings at each level of covariation, a figure appeared on the left of the screen and a question

mark appeared on the right. The participants were first asked to predict "What will appear on the right", then asked "How strong is the association between what appears on the left and what appears on the right". Their judgments were marked on a scale from 0 (no association at all) to 100 (perfect association). Finally they were asked to indicate "How confident are you about your judgment" along a scale ranging from 50% (no idea) to 100% (extremely confident). All the scales were printed on an answer sheet, and the participants could choose either an English version or a Chinese version of the sheet.

Results

The anticipations were that Chinese participants, as compared to Americans, would 1) show better calibration of covariation judgments with actual covariation, 2) be more confident about their covariation judgments, and 3) show better calibration of confidence judgments with actual covariation. Previous research has found that Americans show large primacy effects in covariation-detection tasks, judging the nature of the association to be the same as that seen on the very first few trials (Shaklee & Mims, 1982; Yates & Curley, 1986). We anticipated that, because of their greater sensitivity to covariation, 4) Chinese participants would show less primacy bias in their predictions about which stimulus would be observed on the right side of the screen in the final pairing.

Covariation Judgments

Participants' estimated covariations were submitted to a 2 (culture) X 3 (level of covariation) ANOVA (see note 2). It may be seen in Figure 1 that there was a strong main effect of Level of Covariation, indicating that participants' estimated covariations followed the actual covariation changes, F (2, 92) = 15.79, $p < .001$ (see note 3). There

was also a main effect of Culture, F (1, 93) = 5.82, p < .02, such that Chinese participants estimated higher degrees of covariation than Americans did. Though not anticipated, it is not surprising that Chinese would perceive more covariation overall than Americans. Though Chinese tended to be better calibrated in their covariation judgments, seeing relatively stronger associations than Americans as covariation increased, the interaction between Culture and Level of Covariation was not significant, F < 1.

Confidence judgments

Participants' confidence judgments were also submitted to a 2 (Culture) X 3 (Level of Covariation) ANOVA. It may be seen in Figure 2 that there were a strong main effect of Level of Covariation, F (2, 92) = 17.39, p < .001, and a significant main effect of Culture such that Chinese participants were more confident in their judgments than were Americans, F (1, 93) = 14.15, p < .001. Simple effect tests on the between-subject variable (Culture) revealed higher confidence for Chinese than for Americans at all three levels of covariation (see note 4). These results thus support our predictions that Chinese would be more confident in their covariation judgments than Americans.

There was an interaction of Culture with Level of Covariation, F (2, 92) = 2.84, p = .06, indicating that Chinese increased their confidence judgments with actual covariation increase more than did Americans. Specified contrast analyses of interaction were conducted. The cultural difference at the .60 covariation level was significantly greater than at the zero level, t (94) = 2.17, p < .05. The contrasts between .60 and .40 and between .40 and zero were not significant. The confidence of Chinese participants was more affected by the extremes of the covariation levels than that of American participants and therefore Chinese confidence judgments were more closely calibrated

with actual covariation than those of Americans.

Prediction Accuracy

The final measure of attentiveness to covariation was the degree to which participants based their predictions about which object would appear on the final trial on the degree of covariation actually presented or on some other heuristic. In order to see to what extent participants relied on covariation or on a "first-pair-seen" heuristic to make predictions, we designed two conditions at the .60 covariation level – the level at which information should be most reliably detected. One was the Consistent Condition, in which the first pairing information was consistent with the covariation information, such that a “coin” was first paired with a “dart-board” and the two also appeared together more frequently during the presentations. The other was the Inconsistent Condition, in which the first pairing information and the covariation information were inconsistent and thus might lead to different predictions.

We anticipated that Americans might rely more on the “first-pair-seen” heuristic and Chinese would rely more on the covariation information in their predictions. It may be seen in Table 1 that in the Consistent Condition, where covariation information and first-pair-seen information led to the same prediction, an almost equal number of Americans (67%) and Chinese (66%) made the correct prediction given the covariation information. However, in the Inconsistent Condition, many more Chinese made the correct prediction based on the covariation information than Americans: 73% versus 35%. ($\chi 2$ (1, N=94) = 14.10, $p < .001$). Thus American responses were based on the first pairing information rather than on the covariation information presented.

Discussion

Chinese participants saw more covariation at all three levels of covariation. In addition, Chinese participants were more confident about their covariation judgments than were Americans, albeit rather overconfident. For instance, at the zero covariation level, confidence judgments might be expected to be 50%, but both the Chinese and Americans reported higher confidence (69% for Chinese and 63% for Americans and the former was significantly higher than the latter). Such a cultural difference in overconfidence is consistent with the results of other cross-cultural studies on confidence judgments (e.g., Wright et al,1978; Yates**,** Lee & Bush, 1997).

The Chinese confidence judgments also corresponded more to the actual covariation differences than did the Americans', as indicated by the fact that differential confidence was particularly marked at the highest level of covariation. Even more indicative of covariation sensitivity, Chinese were more likely to use covariation information in their predictions about particular pairings whereas Americans were more likely to rely on a primacy heuristic.

Study 1b: Covariation Detection and Control

In Study 1b, we attempted to manipulate participants' sense of control during the covariation detection task used in Study 1a. We anticipated that the introduction of control might increase Americans' attention to the stimuli they were "controlling" and hence the degree of covariation they saw and their confidence in it.

Method

Participants

The participants from Study 1a participated in Study 1b. There was a 15 minute

break between Study 1a and Study 1b.

Materials

We used two numbers and four pictures of people from the Clip Art Program on a Macintosh II computer as event stimuli. Numbers – 1 and 3 – were the figures presented on the left of the screen. On the right of the screen, one of two arbitrary figures appeared in random sequence. All stimuli were presented on a Macintosh II computer screen by the PsyScope Program (Version 1.0).

Procedure

Study 1b had a 2 (Culture) X 2 (Operation Mode) factorial design. The Operation Mode (Control vs. Non-Control) was a within-subject factor. The covariation between numbers and pictures was randomly determined by the computer, and the number of trials was determined by the participants. The average degree of covariation was pre-set to be zero, but the actual degree of covariation was idiosyncratic for each participant and was in general greater than zero, probably because participants were more likely to experience some consistency during an accidental period of association and tended to stop when they did experience such consistency.

In the Non-Control mode, either the number 1 or the number 3 appeared on the left of the screen first. Immediately following, one of two arbitrary stimuli appeared on the right of the screen. Both the number and the picture stayed on the screen for a duration of 10 seconds before the next pairing started. In the Control Mode, the number 1 or 3 appeared on the left according to the participants' action. The participants could press either key in any order and a given pairing remained on the screen until participants pressed a key again. However, the picture that appeared on the right was randomly

controlled by the computer. Therefore, the nature of the relationships in these two conditions – Control and Non-Control – was exactly the same: participants had no influence over the covariation between the numbers and the pictures.

Before the experiment, all participants were told, "If you figure out the association between the numbers and the pictures, please click the mouse to stop the trial (or tell the experimenter to stop it)." After they decided to stop, participants were asked, "Which picture is each of the numbers associated with?" Then they were asked, "How strong is the association between the numbers and the pictures?" Their judgments were made on a scale from 0 (no relationship at all) to 100 (perfect relationship). Finally, they were asked to indicate their confidence about their judgments along a scale ranging from 50% (no idea) to 100% (extremely confident).

Results

Covariation Judgments

Participants' judgments of covariation can be seen in Figure 3. These were submitted to a 2 (Culture) X 2 (Operation Mode) ANOVA, which revealed a main effect of Culture such that overall Chinese judged the covariation to be higher than the Americans did, F (1, 93) = 4.94, $p < .05$. The main effect of Operation Mode was not significant, $F < 1$. However, there was a significant Culture by Operation Mode interaction, F (1, 93) = 3.80, $p = .05$, indicating that participants from the two cultures reacted differently to the difference in Operation Mode. Simple effect tests revealed that in the Non-Control Mode, Chinese participants estimated significantly higher covariation than American participants, F (1,93) = 8.88, $p < .01$. However, in the Control Mode, the cultural difference was trivial, $F < 1$.

Confidence Judgments

Participants' confidence judgments can be seen in Figure 4. A main effect of Culture was found, F (1,93) = 4.12, p <.05, such that Chinese were more confident in their judgments overall. There was no main effect of Operation Mode. However, the Culture by Operation Mode interaction was significant, F (1, 93) = 4.20, p < .05. The simple effect tests showed that in the Non-Control Mode, Chinese participants were more confident than Americans (77% for Chinese and 68% for Americans), F (1, 93) = 8.22, p < .01. But in the Control Mode, the cultural difference disappeared (74% for Chinese and 73% for Americans), F < 1. Within Culture simple effect tests on the within subject variable (Operation Mode) were also conducted. For Americans, the difference between the Control Mode and the Non-Control Mode was marginally significant, F (1, 93) = 3.02, p = .09; for Chinese, the difference was not significant, F (1, 93) = 1.45, ns .

Correlation between actual covariation and estimated covariation

We found that participants were sensitive to the degree of covariation they saw. We calculated the correlation between each participant's estimated covariation and the actual observed covariation. Americans were sensitive in both the Non-Control and Control Modes (r = .37, p < .01 and r = .41, p < .01, respectively). However, matters were different for Chinese participants. In the Non-Control Mode, the average correlation between their estimated covariation and the actual observed covariation was r = .47, p < .01. But the correlation was much lower in the Control Mode (r = - .18, ns), indicating that their calibration actually got worse when they had to control the stimuli (see note 5).

Discussion

We found cultural differences in the Non-Control Mode that were similar to those

we found in Study 1a. Chinese perceived more covariation and were more confident than Americans in their covariation judgments. We also found that, as anticipated, Americans and Chinese responded differently to the control manipulation. When Americans believed that they had control over the process, their estimated covariation and their confidence tended to increase whereas Chinese judgments trivially decreased. Moreover, the calibration of Chinese covariation judgments was actually impaired by the control manipulation. A possible explanation for this latter finding is that the cognitive load was heavier under the Control Mode than under the Non-Control Mode. Participants not only needed to figure out the covariation but also needed to be revising hypotheses in order to decide which key to press. This additional burden might have made the task more difficult for Chinese, who did not have the off-setting advantage of the experience of control that Americans had.

The Chinese participants, unlike the American participants, were paid, and thus one might suspect a greater motivation to perform the task on the part of the Chinese. While this might explain greater accuracy in Study 1a (though payment does not normally affect people's behavior in judgment experiments; see Colin, 1995), it could not explain why control has different effects on the judgments of Americans and Chinese.

Study 2: Field Dependence and Control

In Study 2, we applied a different paradigm to examine attention to the field. Two classic tests were used by Witkin and his colleagues to measure field dependence, or ability to differentiate an object from the field. These are the Rod-and-Frame Test (RFT) and the Embedded Figure Test (EFT). In the EFT, the task is to find a simple figure in a more complex one. Some researchers (e.g., Bagley, 1995) have pointed out that this task

is not unlike seeing the radical in a Chinese pictograph. A small number of studies have shown that Chinese and other East Asians do as well as Americans, if not better, on EFT (e.g., Bagley, 1995; see De Vos (1980) for related findings with Japanese on Kohs Blocks Test, another field independence test). Since EFT performance may reflect to some degree experience with Chinese writing, we focused on RFT in our study (see note 6). We anticipated that East Asians would be more field dependent than Americans on RFT. Given the findings of previous research on RFT, we expected that females would be more field dependent than males. We also examined the effects of control, with the expectation that Americans would benefit more from having control than would East Asians.

Method

Participants

Fifty-six European American (27 males and 29 females) and 42 East Asian (19 males and 23 females) undergraduate students at the University of Michigan were recruited from the Psychology Department subject pool. The East Asian participants were mainly from China, Korea, and Japan. The average amount of time they had stayed in the US was less than 2.5 years. All participants received course credit for their participation. We matched participants from the two cultures on SAT math scores. There were no differences in scores among the four groups, that is, American males and females, and Asian males and females. One male Asian subject's data was excluded from the data analysis because he refused to perform the RFT task after the first 2 trials.

Materials

The classic Rod and Frame machine was used. In this test, a frame about 16 in. square is rotated independently of a rod that sits inside it. Both the rod (the black line at

the end of the box) and the frame (the box) can be turned independently. The task is to judge when the rod appears to be vertical, or "straight up and down" (regardless of the position of the frame). People are field dependent to the extent that they are influenced by the position of the frame when making their judgments.

Procedure

The study had a 2 (Culture) X 2 (Gender) X 2 (Control Mode vs. Non-Control Mode) design, with the last variable a within-subject factor. Each participant took the Rod and Frame test under two modes. In the Non-Control Mode, the experimenter adjusted the rod and the participant did not have manual control. The participants were to tell the experimenter to stop turning the rod when they thought the rod was straight up and down. In the Control Mode, the participants adjusted the rod themselves and stopped when they felt the rod was straight up and down. The order of Control and Non-Control Modes was counterbalanced among subjects within each culture (see note 7).

The dependent variables were: 1) the errors participants made in each trial, defined as the degrees of arc of the final rod position's deviation from the vertical position, and 2) confidence judgments provided by participants at the end of testing in each mode, when they were asked to estimate their performance on a twelve point scale indicating how close their judgments were to a true vertical position.

Results

The anticipations for the RFT were that: 1) Asians would show more field dependence than Americans; 2) Americans would benefit more from being given control over the task, and that 3) control would make Americans think they were being more accurate, and this would be less true for East Asians.

Field Dependence

A 2 (Culture) x 2 (Gender) x 2 (Control) Repeated Measurement ANOVA was conducted on the mean errors on RFT for all 16 trials (see note 5). It may be seen in Figure 5 that European Americans made fewer mistakes on the RFT than East Asians, $F(1,93) = 4.16$, $p < .05$. Consistent with previous research, males made fewer mistakes than females, $F(1,93) = 3.84$, $p = .05$. It is important to note that the credibility of both the cultural difference and the gender difference is enhanced by the fact that participants were matched on a related ability, namely mathematics.

We also measured the time participants spent on completing each trial of RFT in the Control Mode, in which participants had manual control of the rod and could choose how long to spend on each trial. There is no suggestion in these data that East Asians were engaging in any kind of speed-accuracy tradeoff. On the contrary, Asian males actually took longer than American males in addition to making more errors, $p = .01$. Asian females did not differ from American females.

Reactions to Control

The effects of control can be examined by comparing the participants' errors in Control vs. Non-Control Modes, and by comparing the confidence judgments in the two modes.

Effect of control on errors. The 2 (Culture) x 2 (Gender) x 2 (Control vs. Non-Control) ANOVA revealed a significant 3-way interaction effect, $F(1,93) = 4.40$, $p < .05$ (see Table 2). We had anticipated that Americans would be less field dependent when given control, whereas this would be less true for East Asians. This was the case for males (interaction $F(1,43) = 4.51$, $p = .04$). Indeed East Asian males tended to do worse

when given control. Control had no differential effect on performance of American and East Asian females (F (1,50) < 1). None of the four simple effect comparisons between Control and Non-Control Modes was significant.

Effect of control on confidence. At the end of testing for each mode, we asked participants to indicate how close they thought their judgments were to true vertical on average. The results can be seen in Figure 6, where higher numbers mean participants thought their performance was closer to the exact vertical position. As anticipated, the simple effects tests showed that Americans believed that they had done better with control, F (1,95) = 7.39, p < .01. In contrast, East Asians did not feel their performance had been influenced by having control or not, F (1,95) < 1. Thus, Americans became more confident with control, whereas control had no such impact on East Asians' confidence. The interaction effect of culture and control was marginally significant, F (1,95) = 2.68, p =.105 (see note 9).

Discussion

Americans' performance on the Rod and Frame Test indicates that they are less field dependent than East Asians. They made fewer mistakes and American males spent less time on the task. The field independence of Americans is consistent with the notion that they are more attentive to the object and its relation to the self than to the field. Asian participants' greater field dependence is consistent with the notion that they are more attentive to the field and to the relationship between the object and the field.

In addition, the study indicates that having control makes more difference for Americans' confidence judgments than for that of East Asians. American participants' confidence was significantly increased when they were given control, and this was not

the case for East Asian participants. In addition, American males actually made fewer errors on the task when given control. The results support the idea that perceived control is more important for Americans than for East Asians.

General Discussion

The findings support our view that East Asians are more attentive to relationships in the environment than Americans. This leads them to see covariation with greater accuracy and confidence. On the other hand, Americans are more accustomed to analysis of a focal object in the environment and to orienting the self in relation to the object. Hence they made fewer errors on the Rod-and-Frame task. In addition, the two groups responded very differently to being given control. We believe that these differences are due to habitual differences in the way Easterners and Westerners attend to their environments, rather than to any social, economic, or ability level confounds. In Study 1 participants from both cultural groups were all undergraduate students at the same university. Thus socio-economic and ability differences would not likely have been very great. Study 2 was intended to speak directly to the sampling issue. Study 2 included participants from different East Asian countries, including China, Japan, and Korea. Moreover, we matched American participants and East Asian participants on their SAT math scores to make the two samples comparable. Perhaps most importantly, we find compatible results with a number of other variables and with a wide variety of other populations. East Asians are more holistic than Westerners on a variety of variables, whether we look at Chinese, Koreans or Japanese, and whether we look at people studying in the US or studying in their home countries, and whether we test them in English or in their native languages.

The interpretation of results in terms of attention gains credence from a recent study by Masuda and Nisbett (1999) requiring participants to watch underwater scenes in which a focal fish moved across a field of less salient fish and animals and static seascape features such as rocks and coral. When asked to describe what they had seen, Japanese participants reported more observations about the background and more relationships between the focal fish and the background than did American participants. The results support our contention that East Asians orient themselves to the environment as a whole and to relationships among objects within it.

Social and Economic Origins of the Perceptual Differences?

Following scholars in several disciplines including history, ethnography and philosophy of science, we believe that the sorts of cognitive and perceptual differences between East Asians and Europeans that we find are due to social structure differences (Cromer, 1993; Lloyd, 1990, p. 131; Nakamura, 1964/1985, p. 413; Witkin & Berry, 1975). East Asian societies such as China's were until quite recently based on agricultural economies in which cooperation is crucial and hierarchical political organization requires obedience. The social environment is highly complex and constraining and attention to it is essential for effective action. In contrast, European economies were based on hunting and herding to a much later period, and, uniquely among the great ancient civilizations, that of Greece was not based on agriculture but on animal husbandry, fishing, and trade.

Cross-cultural research indicates that hunting and herding peoples, as well as people who live in the relative freedom of modern wage economies, emphasize autonomous functioning in child rearing and have a relatively loose social structure (Barry, Child, & Bacon, 1959; Whiting & Child, 1953). In contrast, sedentary agricultural

groups stress interpersonal orientation and conformity in child-rearing and they have a tight social structure, in which group members need to accommodate each other and strive to regulate one another's behavior.

Work by Witkin and his colleagues (e.g., Witkin & Goodenough, 1977) within U.S. culture gives added credence to the notion that the cognitive differences between cultures are related to the social differences between cultures. Relatively field dependent people are more likely to take account of the frames of reference provided by the social surroundings in defining such attributes of self as attitudes, sentiments, feelings and self-view (Rudin & Stagner, 1958) and to be selectively attentive to social cues (Eagle, Goldberger & Breitman, 1969). Field dependent people have an interpersonal orientation, show strong interest in others, and prefer to have people around them and even physically close to them, whereas field independent people have an impersonal orientation, show relatively little interest in others, and prefer more solitary and nonsocial situations (Greene, 1973; Witkin & Goodenough, 1977).

Thus the work of Witkin and his colleagues indicates that the differences in attention to the perceptual field are due to differences in requirements to pay attention to the social environment. Berry (1976; Berry & Annis, 1974) has maintained that the differences found within societies have a parallel across societies. Farmers, who are required to attend to the social environment, are more field dependent than either hunters or industrialized peoples. The latter are relatively free to focus on their own goals in relation to an object rather than having to coordinate their actions in relation to a complex social world.

Attention to Social Stimuli

The above account strongly implies that East Asians are more attentive to their social environments than are Americans. We have some evidence that this is the case. Ji, Schwarz and Nisbett (in press) found evidence that Chinese college students were more knowledgeable about the observable behaviors of their peers than were American students. Hedden, Park, Ji, Nisbett, Jing & Jiao (1999) presented words to Chinese and American participants that were either on social backgrounds (pictures of people), nonsocial backgrounds, or no background and then asked the participants to recall the words. Chinese recall of words was superior when the word had appeared on a social background whereas this was not true for Americans.

Social Environment and Control

It is plausible that the same social factors that lie behind the cultural differences in attention to the environment also affect the meaning and importance of control. Agricultural societies with relatively "tight" social structures require the individual to accommodate to social requirements. Hunting, herding, and wage economy societies encourage the individual to exert control over the environment. Hui and Triandis (1986) argue that Western cultures encourage individuals to pursue personal goals and to develop personal autonomy ("primary control"), whereas Asian cultures encourage individuals to accommodate personal needs to the overall goals of the family and to adhere to social norms ("secondary control"). Thus, it seems to us that East Asian sensitivity to the environment and American sensitivity to being given control both reflect important differences in cultural realities, and that they are results of adapting to quite different social environments.

The differential sensitivity of East Asians and Americans to relationships in the environment and to being given control may have implications for many domains. For instance, in education, teachers may want to emphasize different things when dealing with Asian students than when dealing with American students since the focus of attention of the two groups may be different. Asian students may need more help in differentiation and analysis of focal objects, whereas American students may need more help in seeing relationships between objects, including the self and the field.

As more and more commercial activity occurs involving different cultures, it may be helpful to business people to know that East Asians and Americans respond differently to being given control. East Asians may appreciate control less than Americans would tend to assume and Americans may resent lack of control more than Asians would guess. Asian visitors to the U. S. are often stunned when their hosts nonchalantly ask them to "help themselves", and Americans may feel equally uncomfortable when they are "deprived" of freedom by their hospitable Asian hosts, who believe they are taking good care of their guests by presenting their guests with what they themselves think is best. Cultural misunderstandings may sometimes derive from superficial differences in customs, but the work presented here suggests that they may sometimes be produced by rather deep and fundamental differences in orientations toward the world.

Notes

1. Previous work with arbitrary stimuli indicates that .60 represents a level of covariation that can be reliably detected with arbitrary stimuli (Jennings, Amabile & Ross, 1980).

2. When gender was included in the analysis, there was no significant effect of gender nor interaction effect involving gender.

3. All p levels are based on two-tailed tests.

4. At the zero level, F (1, 93) = 6.68, $p < .02$; at the .40 level, F (1, 93) = 4.87, $p < .05$; and at the .60 level, F (1, 93) = 18.59, $p < .001$.

5. The difference between .47 and -.18 is significant at .01 level.

6. We included the EFT as an exploratory measure, though we had no predictions about cultural difference. We found no significant cultural difference on this task.

7. The manipulation of order had no effect.

8. Each participant provided 16 RFT error data points. Data points identified by boxplots as extremes --more than 3 box lengths (the interquartile range) from the upper or lower edge of the box -- were excluded from the analysis. On average, 1.2 data points were excluded for each participant.

9. We didn't anticipate any effect of gender, therefore we didn't include gender in our analysis. However, we did perform an analysis including gender as a factor. When gender was considered, the simple effect tests still held. Indeed, both American males and American females believed their performance was improved when given control than not, both ps <=.06. Control had no such impact on either Asian males or females, both ps >.25.

References

Abel, T. M., & Hsu, F. I. (1949). Some aspects of personality of Chinese as revealed by the Rorschach Test. Journal of Projective Techniques, 13, 285-301.

Bagley, Christopher (1995). Field independence in children group-oriented cultures: comparisons from China, Japan and North America. The Journal of Social Psychology, 135(4), 523-525.

Barry, H., Child, I., & Bacon, M. (1959). Relation of child training to subsistence economy. American Anthropologist, 61, 51-63.

Berry, J. W. (1976). Human ecology and cognitive style: Comparative studies in cultural and psychological adaptation. New York: Sage/Halsted.

Berry, J. W., & Annis, R. C. (1974). Ecology, culture and differentiation. International Journal of Psychology, 9, 173-193.

Chiu, L.-H. (1972). A cross-cultural comparison of cognitive styles in Chinese and American children. International Journal of Psychology, 8, 235-242.

Choi, I., & Nisbett, R. E. (1998). Situational salience and cultural differences in the correspondence bias and in the actor-observer bias. Personality and Social Psychology Bulletin, 24, 949-960.

Colin, C. (1995). Individual decision making. In J. H. Kagel and A. E. Roth (Eds.), The handbook of experimental economics (pp.587-703). Princeton University Press, Princeton.

Cromer, A. (1993). Uncommon sense: The heretical nature of science. New York: Oxford University Press.

De Vos, G.A. (1980). Ethnic adaptation and minority status. Journal of Cross

Cultural Psychology, 11, 101-124.

Eagle, M., Goldberger, L., & Breitman, M. (1969). Field dependence and memory for social vs neutral and relevant vs irrelevant incidental stimuli. Perceptual and Motor Skills, 29, 903-910.

Glass, D.C. & Singer, J.E. (1973). Experimental studies of uncontrollable and unpredictable noise. Representative Research in Social Psychology, 4(1), 165-183.

Greene, L.R. (1973). Effects of field independence, physical proximity and evaluative feedback, affective reactions & compliance in a dyadic interaction. Dissertation Abstracts International, 34(5-B), 2284-2285.

Hansen, C. (1983). Language and logic in ancient China. Ann Arbor: University of Michigan Press.

Hedden, T., Park, D., Ji, L., Nisbett, R.E., Jing, Q., & Jiao, S. (1999). Cultural predispositions when encoding associations: Consequences for memory and aging. Unpublished manuscript, University of Michigan, Ann Arbor.

Hong, Y., Chiu, C., & Kung, T. (1996). Bringing culture out in front: Effects of cultural meaning system activation on social cognition, University of Hong Kong.

Hsu, F.L.K. (1981) Americans and Chinese: Passage to differences (third edition). Honolulu: University of Hawaii Press.

Hui, H. C. & Triandis, H. (1986). Individualism-collectivism: a study of cross-cultural research. Journal of Cross-Cultural Psychology, 17, 225 –248.

Ji, L., Schwarz, N., & Nisbett, R. E. (In press). Culture, autobiographical memory, and social comparison: Measurement issues in cross-cultural studies. Personality and Social Psychology Bulletin.

Jones, E. E. (1979). The rocky road from acts to dispositions. American Psychologist, 34, 107-117.

Kitayama, S. & Masuda, T. (1997). Cultural psychology of social inference: The correspondence bias largely vanishes in Japan. Unpublished manuscript, Kyoto University.

Kitayama S., Palm, R., Masuda, T., & Carroll, J. (1998). Interdependent and independent modes of cultural participation: Coping with earthquake risks in Japan and the United States. Unpublished manuscripts, Kyoto University, Kyoto, Japan.

Langer, E. (1975). The illusion of control, Journal of Personality and Social Psychology, 32, 311-328.

Langer E. J. (1983) The psychology of control. Beverly Hills, CA: Sage.

Lee, F., Hallahan, M., & Herzog, T. (1996). Explaining real life events: How culture and domain shape attributions. Personality and Social Psychology Bulletin, 22, 732-741.

Liu, S. H. (1974). The use of analogy and symbolism in traditional Chinese philosophy. Journal of Chinese Philosophy, 1, 313-338.

Lloyd, G.E.R. (1990). Demystifying mentalities. New York: Cambridge University Press.

Masuda, T. & Nisbett, R.E. (1999). Culture and attention to object vs. field. Ann Arbor: University of Michigan.

Miller, J. (1984). Culture and the development of everyday social explanation. Journal of Personality and Social Psychology, 46, 961-978.

Moore, C. A. (Ed.). (1968). The Chinese mind: Essentials of Chinese philosophy

and culture. Honolulu: University of Hawaii Press.

Morling, B., & Fisker, S.T. (1998) Defining and measuring self-directed (secondary) control. Manuscript submitted for publication.

Morris, M.W. & Peng, K. (1994). Culture and cause: American and Chinese attribution of physical and social events. Journal of Personality and Social Psychology, 67, 949-971.

Moser, D. J. (1996). Abstract thinking and thought in ancient Chinese and early Greek: Ph.D. Dissertation, University of Michigan, Ann Arbor.

Nakamura, H. (1964/1985). Ways of thinking of eastern peoples (P.P. Wiener, Ed.). Honolulu: University of Hawaii Press.

Needham, J. (1962). Science and civilisation in China. (Vol. IV). Cambridge: Cambridge University Press.

Nisbett, R. E. (1998). Essence and accident. In J. Cooper & J. Darley (Eds.), Attribution processes, person perception, and social interaction: The legacy of Ned Jones. Washington, D. C.: American Psychological Association.

Nisbett, R. E., Peng, K., Choi, I., & Norenzayan, A. (1999). Culture and systems of thought: Holistic vs. analytic cognition. Unpublished manuscript, University of Michigan.

Norenzayan, A., Choi, I., & Nisbett, R. E. (1999). Folk psychology and the prediction of behavior . Ann Arbor, MI: University of Michigan.

Peng, K., & Nisbett, R. E. (In press). Culture, dialectics, and reasoning about contradiction. American Psychologist.

Peng, K.P. & Nisbett, R.E. (In press). Cross-cultural similarities and differences

in the understanding of physical causality. In M. Shield (Ed.), Proceedings of conference on culture and science. Frankfort: Kentucky State University Press.

Presson, Paul K. & Benassi, Victor A. (1996). Illusion of control: A meta-analytic review. Journal of Social Behavior and Personality, 11, 493-510.

Ross, L. (1977). The intuitive psychologist and his shortcomings. In L. Berkowitz (Ed.), Advances in experimental social psychology (Vol. 10, pp.174-220). New York: Academic Press.

Rothbaum, F., Weisz, J.R., & Snyder, S.S. (1982). Changing the world and changing the self: A two-process model of perceived control. Journal of Personality and Social Psychology, 42, 5-37.

Sastry, J., & Ross, C.E. (1998). Asian ethnicity and the sense of personal control, Social Psychology Quarterly, 61, 101-120.

Sethi, S. & Lepper, M. R. (1998). Rethinking the role of choice in intrinsic motivation: A cultural perspective. Unpublished manuscript, Stanford University, Stanford, CA.

Taylor, S. E., & Brown, J. D. (1988). Illusion and well-being: A social psychological perspective on mental health. Psychological Bulletin, 103, 193-210.

Weisz, J.R., Rothbaum, F.M., & Blackburn, T.C. (1984). Standing out and standing in: The psychology of control in America and Japan. American Psychologist, 39, 955-969.

Whiting, J. W. M., & Child, I. L. (1953). Child training and personality: A cross-cultural study. New Haven: Yale University Press.

Witkin, H. A., & Berry, J. W. (1975). Psychological differentiation in cross-

cultural perspective. Journal of Cross Cultural Psychology, 6, 4-87.

Witkin, H.A. & Goodenough, D.R. (1977). Field dependence and interpersonal behavior. Psychological Bulletin, 84, 661-689.

Witkin, H.A., Lewis, H.B., Hertzman, M., Machover, K., Meissner, P.B., & Karp, S.A. (1954). Personality through perception. New York: Harper.

Wright, G. N., Phillips, L.D., Whalley, P.C., Choo, G.T., Ng, K.O., Tan, I., & Wisudha, A. (1978) Cultural differences in probabilistic thinking. Journal of Cross-Cultural Psychology, 9, 285-299.

Yamagushi, S., Gelfand, M., Mizuno, M., & Zemba, Y. (1997). Illusion of collective control or illusion of personal control: Biased judgment about a chance event in Japan and the U. S. Paper given at the Second Conference of the Asian Association of Social Psychology, Kyoto, Japan.

Yates, J.F. & Curley, S.P. (1986). Contingency judgment: Primacy effects and attention decrement. Acta Psychologica, 62, 293-302.

Yates, J.F., Lee, J.-W., & Bush, J.G. (1997). General knowledge overconfidence: Cross-national variations, response style, and "reality". Organizational Behavior and Human Decision Processes, 70, 87-94.