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Can Two People Process Different Things Based on Differences in Cultural Identity?

Emily Nam Cho
Asia Pacific International School, South Korea
emilycho6125@gmail.com

Abstract

Can cultural differences influence how people perceive and subsequently recall visual stimuli? East Asians tend to holistically process visual stimuli by attending to relationship, whereas Westerners tend to analytically process by attending to focal features. Previous aging studies suggest that older adults relative to younger adults bind target and distractor items despite attempts to inhibit distractors, which benefits subsequent explicit learning. Through implicit exposure to word-picture pairs in a 1-back task, we investigated whether there were cultural differences between East Asians and Westerners on an explicit learning task using similar stimuli. East Asians are likely to process visual stimuli holistically (e.g., Lao et al., 2013), so we predicted that they would bind the target picture and distractor word together, facilitating explicit learning. Conversely, we predicted Westerners to analytically process words and pictures separately, with successful inhibition of the distractor word, resulting in no facilitation on the explicit learning task. We found differences that suggest Easter Asians are engaging in binding. This may suggest that bottom-up perceptual processes occur concurrently to top-down attentional inhibition, interacting to influence memory recall dependent on cultural identity.

Keywords: culture, visual processing, attention, inhibition

Cultural Differences in Visual Processing

Given the same picture, could two people see different things based on differences in cultural identity? Jenkins and colleagues (2010) investigated cultural differences in visual processing in a functional magnetic resonance imaging study that involved presenting participants with objects against congruent or incongruent backgrounds. They found that East Asians showed greater neural activity when focal objects mismatched the background context when compared to Westerners, suggesting that East Asians holistically processed these visual stimuli by focusing on the relation between foreground objects and background context. Conversely, Westerners engaged in analytic processing by independently processing focal features and background context. Furthermore, Chua and colleagues (2005) tracked eye movements when East Asian and Westerner participants viewed scenes. They found that East Asians more often looked at the background whereas Westerners spent more time looking at focal features. This indicates that there are cultural differences in overt attention paid to visual stimuli. Taken together, these studies show that East Asians and Westerners do exhibit differences in visual processing of scenes, owing to differences in where overt attention is directed.

These cultural differences in visual processing between East Asians and Westerners apply to object processing as well. Kitayama and

colleagues (2003) first presented participants with a diagram of a rod that was surrounded by a frame and had participants either reproduce the exact length of the rod or an equivalent proportion of the rod given differently sized frames. Westerner participants were more accurate at reproducing the exact length of the rod independent of the frame given to them, supporting the view that they analytically process each feature independent others. Conversely, East Asians were more accurate at reproducing lengths of rods in proportion to the provided frame size, suggesting that they initially holistically processed the rod in relation to the surrounding frame. Supporting this cultural difference in object perception, Lao and colleagues (2013) found cultural differences in a task that asked participants to classify Navon figures, basic shapes that are constructed from smaller shapes. Westerners were quicker to classify analytically similar figures (e.g., a square made of circles and a triangle made of circles are similar based on the features that make up the whole). Conversely, East Asians showed repetition suppression in an attentional component of electroencephalogram measurements (i.e., P1) for holistically similar figures (e.g., a circle made of squares and a circle made of triangles are similar based on the bigger picture formed from the smaller shapes). That is, East Asians showed more neural efficiency when processing objects holistically rather than analytically. These two studies show that there are cultural differences between East Asians and Westerners in object perception based in attention, similar to scene perception.

A previous study investigating attentional inhibition on subsequent explicit learning found differences in performance by age, rather than culture (Campbell et al, 2010). Older and younger adults were asked attend to specific features of visual stimuli (i.e., pictures) and inhibit distracting features (i.e., superimposed words). Older adults were found to less successfully inhibit the distractor and instead bind words and pictures together, which benefitted them in a later explicit learning task. Given that East Asians holistically process visual stimuli based on the attention they give to relationships between features, we wondered if they would exhibit similar binding patterns between word and picture that could subsequently benefit them in an explicit learning task. We investigate this idea by implicitly exposing both East Asian and Westerner younger adults with word-picture visual stimuli during an attentional inhibition task and subsequently testing recall on an explicit learning task. Given that East Asians holistically process visual items, we expect binding to occur between word and picture in the initial implicit exposure, resulting in better explicit learning of word-picture pairs that were previously exposed. Conversely, we predict that Westerners will analytically process target pictures independently of distractor words, resulting in no benefit in a subsequent explicit learning task.

Methods

Participants

Participants were a convenience sample of 22 younger adults (ages 18 to 25 years, M = 18.64, SD = 1.64; 9 males, 13 females). They were undergraduate students at the University of Illinois Springfield Seoul Campus and received partial course credit for their participation. A total of 25 participants were recruited, though data from three participants were not analyzed because they did not follow instructions, their cultural identity did not match that of the experimenter, or they were not tested at their chronotype peak. Of these remaining 22 participants, 11 were East Asian participants and 11 were Western participants. East Asians were recruited to be of 'East Asian descent, i.e., Korean, Chinese etc.', whereas Westerners were recruited to be of 'European descent, Caucasian'. All participants were required to be native English speakers because English words appear as stimuli within this study.

Procedure

East Asian and Western participants were matched with an experimenter of the same cultural identity to make cultural identity more salient. After we obtained informed consent, participants proceeded with a 1-back task, some filler tasks, an explicit learning task, and a working memory task. In the 1-back computer task, participants saw stimuli constructed from a black English word superimposed over a red line drawing (see Figure 1) presented sequentially on a computer. screen. Participants were instructed to attend to the picture as the target and ignore the superimposed word, responding by pressing the spacebar whenever the target picture occurred twice in a row. Following this, participants completed two visuospatial filler tasks, the flanker task and the hidden patterns task, for a total of ten minutes. In the flanker task, participants responded to left or right arrow symbols (e.g., '>' or '<') that appeared at the center of a letter string by one of two buttons representing left and right. The hidden patterns task was a paper task, where participants searched within a series of line figures and indicated whether a model line structure can be traced within them. Participants responded with an 'x' in the presence of the model line structure, and 'o' in absence. Next, participants completed an explicit learning task using similar word-picture stimuli used in the initial 1-back task, without reference to this first task. They first studied sixteen of each word-picture pair for two seconds each, and subsequently verbally recalled the English word when given the picture as a cue. There were two conditions for these word-picture pairs. Eight 'maintained' pairs were the exact word-picture combination that participants saw in the 1-back task, and Eight 'disrupted' pairs were constructed from previously seen picture and words but in a novel combination. The study test procedure was repeated three times. To ensure that participants were not aware that the stimuli in the explicit learning task were previously implicitly shown in the 1-back task, we questioned participants for any similarities they found between tasks. At the end of the study, participants were given the operation span task. In the operation task, participants were instructed to read the equation aloud, verify its accuracy by saying "yes" or "no," and then read the target word aloud. Immediately after finishing reading the target word, the experimenter advanced the program to the next equation/word pair. Once all of the equation/word pairs for a trial had been shown, they were asked to recall all of the target words from that trial by saying them aloud in the same order in which they were presented. Scores were calculated by summing the number of words correctly recalled in any order. Finally, we interviewed each participant for demographic information on cultural background. Participants were also given a package of questionnaires to complete at the very end of the experiment.

Figure 1. Prototypical word-picture pair that was shown to participants to illustrate the idea of superimposition before a practice trial.

Measures

Participants filled out several questionnaires after the experiment, including the Morningness-Eveningness Questionnaire (MEQ; Horne and Östberg, 1976), Shipley Institute of Living-2 Vocabulary Subscale (Shipley, 1940), and the Asian Suinn-Lew Questionnaire (Suinn et al., 1987). Younger adults peak in performance during the afternoons (e.g., Goldstein et al., 2007), so the MEQ was administered to verify that participants were not morning-type, because the experiment was only run in the afternoon (between noon and 5pm). The Shipley-2 is a measure of English fluency and was used to exclude any participants with scores under 20,

because English words were used as stimuli. Finally, only East Asian participants filled out the Asian Suinn-Lew questionnaire, which measured the level of acculturation to Western culture. This measure was not administered to Westerners because many questions could not be answered if the participant was not of East Asian descent.

Design

This study had a 2 (culture) x 3 (trial) x 2 (pair-type) mixed design. Cultural identity is a between-subjects variable, whereas trial and pair-type are both within-subjects variables. Performance on the explicit learning task was analyzed across the three different study-test trials and two word-picture pair-types (preserved, disrupted).

Results

Accuracy on the 1-back task was calculated as the percentage of hits minus false alarms. Overall, Westerners (M = 92%, SD = 13 %) and East Asians (M = 91%, SD = 13%) did not differ in detecting repetitions, t(50) = 0.28, p > .7, d = .028.

Number of words recalled was submitted to a mixed analysis of variance (ANOVA) with culture as a between-subjects factor and Pair type as a within-subjects factor. The significance level for all statistical tests was p <.05. The improvement in trial showed that by the second and third trial, participants were performing at ceiling, recalling a mean of more than 7.5 out of eight pairs correctly. Given this, we focused on exploring data within the first trial. There was a reliable main effect of pair type, F(1, 51) = 5.64, p = .021, ηp2= .101, and culture, F(1, 51) = 5.36, p =.025, ηp2 = .097. The two-way interaction of culture and pair type was not significant, F(1,51) = .130, p = .720, ηp2=.003. To further examine the effect of cultural group, we ran separate analyses for each cultural group. Overall, East Asians recalled more preserved pairs than did Westerners, t(26) = 2.49, p = .01, d = 7.33 (see Figure 2). However, memory recall of disrupted pairs did not differ between Westerners and East Asians, t(26) = 1.44, p = .16, d = 4.97.

Performance on the operation span task was also analyzed. Number of words correctly recalled did not differ between Westerners (M = 71%, SD = 9.9%) and East Asians (M = 75%, SD = 12%), t(26) = 4.76, p = 6.30, d = 13.63, demonstrating that they do not have fundamentally different working memory limits.

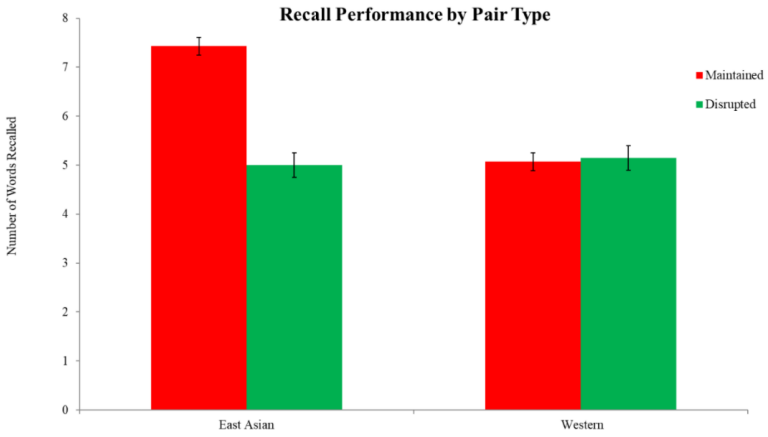

FIGURE 2. Mean number of words correctly recalled in trial 1of paired-associates task. Error bars represent one standard error of the mean. In the experiment, there were eight preserved and eight disrupted picture-word pairs.

Discussions

To recap, through implicit exposure to word-picture pairs in a 1-back task, we investigated whether there were cultural differences between East Asians and Westerners on an explicit learning task using similar stimuli. East Asians are likely to process visual stimuli holistically (e.g., Lao et al., 2013), so we expected that they would bind the target picture and distractor word together, facilitating explicit learning. Conversely, we expected Westerners to analytically process words and pictures separately, with successful inhibition of the distractor word, resulting in no facilitation on the explicit learning task.

Both of our repeated measures ANOVAs, across all data or just trial one showed significant effects

of practice across trials and differences in learning across pair-types. More importantly, significant cultural differences were found between East Asians and Westerners. Post-hoc analyses revealed differences between cultures in their pattern of recall across pair-types. Whereas Westerners performed similarly regardless of pair-type, East Asians were impaired on recalling disrupted pairs when compared with maintained pairs. This suggests that East Asians do engage in some binding between words and pictures in the initial 1-back task. This in turn facilitates their explicit learning when these pairs remain intact in maintained pairs or impairs explicit learning when these pairs are reshuffled. This could be suggestion that East Asians bind pictures and words due to holistic processing. East Asians may be attending to the relation between the word and picture rather than the independent features themselves, consistent with previous scene and object perception studies (Jenkins et al., 2010; Lao et al., 2013).

Adaptations to the current design may address some of the concerns that have been raised. Given that younger adults are performing similarly regardless of culture, but also at ceiling by second and third trials of the explicit learning task, increasing the difficulty of the task may help further parse apart any culture difference in younger adults. This can be done by reducing the length of time that younger adults view the word-picture pairs at study phase of the explicit learning task or increasing the total number of word-picture pairs to greater tax memory load. To investigate whether the differences in culture may be due to initial perceptual binding, we can adapt the explicit learning task to no longer require the segregation of features. Instead, we could have a recognition task where participants recall have to match the entirety of the word-picture pair, thus matching the hypothesized holistic processing at both prior exposure and explicit learning recall phase. Finally, we had recruited East Asian participants on the basis of being native English speakers, a control measure that was included because English words were used as stimuli. East Asian, who are native English speakers, would have likely grown up under the influence of Western culture. This is reflected in the Asian Suinn-Lew Questionnaire scores, with East Asian participants scoring on average 3.02 out of five, indicating that our East Asian participants more likely identified as bicultural rather than purely East Asian. To emphasize the difference in cultures, we could alternatively recruit international students fluent in reading in their native language and adapt our stimuli to match the language of these participants.

Overall, we found subtle differences between East Asians and Westerners in attentional inhibition and subsequent explicit learning, possibly accounted for by differences in initial perceptual binding. This may suggest that bottom-up perceptual processes occur concurrently to top-down attentional inhibition, interacting to influence memory recall dependent on cultural identity.

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