How Does Context Affect Assessments of Facial Emotion? The Role of Culture and Age

Seon-Gyu Ko
University of Southern California

Tae-Ho Lee
Korea Military Academy, Seoul, Korea

Hyea-Young Yoon and Jung-Hye Kwon
Korea University

Mara Mather
University of Southern California

People from Asian cultures are more influenced by context in their visual processing than people from Western cultures. In this study, we examined how these cultural differences in context processing affect how people interpret facial emotions. We found that younger Koreans were more influenced than younger Americans by emotional background pictures when rating the emotion of a central face, especially those younger Koreans with low self-rated stress. In contrast, among older adults, neither Koreans nor Americans showed significant influences of context in their face emotion ratings. These findings suggest that cultural differences in reliance on context to interpret others' emotions depend on perceptual integration processes that decline with age, leading to fewer cultural differences in perception among older adults than among younger adults. Furthermore, when asked to recall the background pictures, younger participants recalled more negative pictures than positive pictures, whereas older participants recalled similar numbers of positive and negative pictures. These age differences in the valence of memory were consistent across culture.

Keywords: Asian vs. Western culture, aging, emotion recognition, context memory

Other people's facial expressions give us important information about what they are feeling. Being able to interpret facial expressions not only facilitates social interactions, but also provides cues about the environment. For instance, seeing a fearful expression on someone else's face can signal the need to pay attention to whatever they are looking at. In everyday life, faces appear in particular contexts. Although most empirical work on facial recognition and perception has focused on isolated faces shown without any background images, a couple of recent studies indicate that context can influence how people interpret facial expressions. For instance, Dutch participants were faster and more accurate at categorizing facial emotions when faces were presented in front of emotionally congruent scenes than when they were presented in front of emotionally discordant scenes (Righart & de Gelder, 2008b). In addition, event-related potential (ERP) recordings reveal that a face-processing component (known as the N170) shows a more negative amplitude when faces are shown in fear-related contexts than in neutral contexts, especially when the face expressed fear (Righart & de Gelder, 2006, 2008a).

Culture and Perception

There may be cultural differences in the effects of context on interpreting facial emotion. Previous visual processing research indicates that East Asians from China, Japan, and Korea tend to attend to the relationship between an object and its context, whereas Westerners from North America or Western Europe tend to process a salient object independently of its context (Chua, Boland, & Nisbett, 2005; Nisbett & Masuda, 2003; Nisbett & Miyamoto, 2005; Nisbett, Peng, Choi, & Norenzayan, 2001).

Nisbett and colleagues have argued that these cultural differences are due to differing intellectual histories, with Western culture strongly influenced by traditions dating from ancient Greece thought that emphasized objects and their characteristics, and East Asian culture (most notably China and the countries it strongly influenced, including Japan and Korea) strongly influenced by the holistic focus of ancient Chinese thought, with its emphasis on the field in which an object was situated (Nisbett et al., 2001).

A recent study tested the possibility that Japanese participants would be more influenced by the social context in interpreting a facial expression than would North American participants (Mas-

uda et al., 2008). In the study, participants saw cartoon images with a central person expressing a clear emotion and a group of people in the background also expressing a clear emotion. The emotions of the central figure and those in the background were either the same or different. Japanese participants' ratings of the emotion of the central character were influenced more by whether the facial expressions of the background characters were consistent or discrepant than were North American participants' ratings.

In our study, we compared the influence of context on face emotion ratings for younger and older Koreans and Americans. Korea is one of the East Asian cultures that Nisbett and colleagues argued promotes more attention to the field or background context (Nisbett et al., 2001). Thus, among the younger adults, we expected to find greater influence of the context among Koreans than among Americans, as seen in Masuda et al.'s study comparing Japanese and Americans. However, as outlined in the next section, we predicted that these cultural differences in the influence of context on interpreting emotion would be less pronounced among older adults because the ability to integrate contextual and central information declines with age.

Age Differences in Context Processing

Older adults show a larger impairment in memory tests of associations between two items or between an item and its contextual details (such as who said it or what color it was) than on tests for the individual items or details (e.g., Chalfonte & Johnson, 1996; Henkel, Johnson, & De Leonardis, 1998; Kessels, Hobbel, & Postma, 2007; Mitchell, Johnson, Raye, Mather, & D'Esposito, 2000; Naveh-Benjamin, 2000; Naveh-Benjamin, Guez, Kilb, & Reedy, 2004). These studies suggest age-related impairments in the ability to bind elements of an event together in memory. In addition, age-related binding deficits extend to initial perception, as visual search studies reveal that older adults show deficits in integrating information perceptually (e.g., Humphrey & Kramer, 1997; Plude & Doussard-Roosevelt, 1989).

Of particular relevance for our research question about the effects of background scenes on ratings of a central face, a recent study compared Singaporean younger and older adults' neural adaptation to central objects and background scenes (Chee et al., 2006). The results suggested that older adults are less likely than younger adults to be able to absorb and integrate new information from a central object and a background scene simultaneously. Thus, based on older adults' impairments in integrating multiple aspects of a scene or event, we predicted that older adults would be less influenced by the emotion conveyed by a background scene when rating the emotion on a central face than would younger adults.

Memory for the Background Images

We also tested recall of the background contexts at the end of our study to see if cultural differences in the influence of the backgrounds were also reflected in cultural differences in memory for them. Based on the hypothesized differences in attention to background context, we expected younger Koreans to have better memory for the background images than younger Americans. To our knowledge, previous research has not directly examined cultural differences in the recall of background context, although studies have examined the effects of changing contexts on recog-

nition of central objects (Evans, Rotello, Li, & Rayner, 2009; Masuda & Nisbett, 2001), source memory for who said particular statements (Chua, Chen, & Park, 2006), and neural adaptation for background contexts (Goh et al., 2007).

By testing recall of the positive, negative and neutral background images in our study, we had the opportunity to investigate another cross-cultural question. Previous studies have found that, compared with younger adults, relatively less of what older adults recall consists of negative material and relatively more consists of positive material, a shift in the ratio of positive to negative memories (for a review see Mather & Carstensen, 2005). This positivity effect in free recall of pictures has been found in American, Canadian, and European samples (e.g., Charles, Mather, & Carstensen, 2003; Langeslag & van Strien, 2009; Mather & Knight, 2005; Tomaszczyk, Fernandes, & MacLeod, 2008; although significant age differences in valence of recall are not seen in all studies with Western samples, for instance see Denburg, Buchanan, Tranel, & Adolphs, 2003; Kensinger, Brierley, Medford, Growdon, & Corkin, 2002).

However, it is not clear whether this positivity effect would be seen in East Asian cultures, as there are a number of cultural differences in how Westerners versus East Asians integrate and value negative and positive valence in their emotional experience (e.g., Noguchi, Gohm, Dalsky, & Sakamoto, 2007; Uchida & Kitayama, 2009; Tsai, Knutson, & Fung, 2006). For instance, the experience of positive and negative emotions are more likely to be negatively correlated in Western cultures than in East Asian cultures (Bagozzi, Wong, & Yi, 1999; Schimmack, Oishi, & Diener, 2002). But a recent study with a Korean sample suggests that the age-related positivity effect in free recall does extend to East Asian culture (Kwon, Scheibe, Samanez-Larkin, & Tsai, 2009). Kwon et al. found age by valence interactions in both recall and recognition of emotional pictures among Koreans that demonstrated a larger ratio of positive to negative memories among older adults than younger adults. Thus, given Kwon et al.'s findings with Korean participants and previous findings with Western samples, we expected to find similar positivity effects among older Koreans and Americans.

Effects of Stress on Background Integration

Emotional arousal or stress can narrow attention to enhance processing of high priority central information at the cost of peripheral information (for a review see Mather, 2007). For instance, when soccer or football players were given a peripheral vision test in which they focused on a central dot and indicated when they detected peripheral visual cues, they did worse when tested an hour before an important game than when tested before a practice workout (Rogers & Landers, 2005; Rogers, Alderman, & Landers, 2003). In the current study, we examined whether self-rated current stress levels moderated the effects of background context on emotion judgments, with the prediction that participants who were more stressed would show less of an influence of the background context on their ratings of the central face. Since younger Koreans were the group who we anticipated would show the largest influence of the background context, we predicted that the attentional narrowing effects of stress would be most evident for this group.

Study Overview

To examine the effects of culture and age differences on the influence of contextual information on interpreting facial emotion, we tested younger and older Koreans and Americans on a face-rating task. On each trial of this task, a face was shown in the center of the screen with an emotionally positive, negative or neutral picture (or a scrambled picture) behind it (Figure 1). We expected context to influence emotion ratings more for Korean younger adults than for American younger adults across different types of emotions, and so included both a positive and a negative emotion-rating task to test this.

The experiment involved one block in which participants rated how fearful faces were and another block in which they rated how happy faces were. In the fear-rating block, the faces were morphs displaying varying degrees of a neutral versus a fearful expression. In the happiness-rating block, the morphed faces displayed varying degrees of a neutral versus a happy expression. In both rating blocks, there were four types of background contexts shown with the faces: negative, blank, neutral and positive scenes. After completing both blocks, participants were asked to recall as many of the background pictures as they could.

As already outlined, compared with younger Americans, we expected younger Koreans to show more influence of the background contexts on face intensity ratings and better memory for the background contexts, based on research indicating that East Asians attend more to background context information. We also anticipated that one constraint on this cultural difference would be stress. As stress tends to narrow attention, we expected that stressed younger Koreans would show less of an effect of context on their ratings of the central faces than those who were less stressed. Furthermore, we predicted that cultural differences in the influence of context would be diminished or eliminated among the older group because, when they were attending to the central face, they would not be as likely to be able to integrate context information, even if culturally biased to do so.

In addition to our research questions about the ratings of the faces, we were interested in whether there would be cultural and age differences in how well participants recalled the background pictures and which valence of picture they were most likely to recall. Based on East Asians' greater focus on background context, we predicted that Koreans would recall more background pictures than Americans (at least among younger adults).

In contrast with the predicted cultural differences for the number of pictures recalled, we predicted cultural consistency for the emotional nature of the pictures recalled, with age-related positivity effects in both Korean and American groups, consistent with previous findings (Kwon et al., 2009) and with the hypothesis that older adults' positivity effect are due to a greater focus on emotion regulation goals as people perceive time left in life to be more limited (Carstensen, Mikels, & Mather, 2006). Specifically, we expected younger adults' recall to consist of a relatively higher proportion of negative pictures than that of older adults.

Method

Participants

The North American subject population included University of Southern California students and healthy younger and older adults from the Los Angeles community. The students were recruited from a participant pool and received course credit for their participation. The other participants received monetary compensation for their participation ($15/hour). For the American sample, participants were excluded if they had not grown up in an English-speaking household. Younger Korean subjects were recruited from a pool of psychology classes at Korea University. They received course credit for their participation. The older Korean adults were recruited from the Institute for Continuing Education of Korea University. Each older participant was paid 15,000 won/hour (about $15 US). In both countries, 26 older and 29 younger adults participated in the study. As shown in Table 1, the American and Korean participants did not differ significantly in their average ages, years of education, vocabulary, depression levels, state anxiety, self-rated stress, or self-rated health. However, Korean older adults scored about one point lower on the Mini-Mental Status Exam (MMSE) than American older adults, a significant difference (we did not administer the MMSE to younger participants). All older participants achieved at least a 26 on the test, thus scoring in the cognitively normal range (Folstein, Folstein, & McHugh, 1975).

As can be seen in Table 1, there were several differences among younger and older adults on the measures administered. Older adults had higher levels of education than younger adults, reflecting the fact that younger adults were mostly college students who had not yet completed their educations. In addition, younger adults
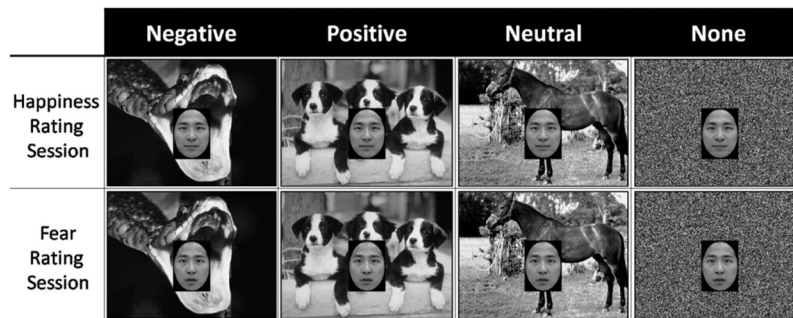

Figure 1. Example face-background composites for a negative, positive, neutral and scrambled ("none") background.

Table 1
Demographic Characteristics and Emotional and Cognitive Measures, With Standard Deviations in Parentheses

	Westerners		East Asians		F values		
	Younger	Older	Younger	Older	Age	Culture	Culture × Age
Male/female N	12/17	12/14	15/14	13/13			
Age range	18–30	65–78	18–27	65–80			
Age in years	21.66 (2.79)	72.27 (3.57)	21.90 (2.47)	70.38 (3.57)			
Years of education	15.10 (1.60)	16.08 (2.28)	14.90 (1.05)	15.31 (2.17)	3.98*		
Vocabulary[a]	15.07 (2.28)	13.62 (2.47)	14.69 (1.61)	12.85 (2.29)	15.75**		
MMSE		29.42 (0.90)		28.54 (1.24)		8.65**	
Depression	12.83 (9.12)	9.76 (8.81)	13.21 (8.13)	14.96 (6.38)			
State Anxiety	37.47 (8.00)	32.92 (9.26)	37.52 (7.91)	35.19 (8.42)	4.57*		
Self-rated stress	4.55 (1.92)	2.96 (2.24)	3.97 (1.68)	3.38 (1.60)	9.23**		
Self-rated health	8.24 (1.22)	8.04 (1.69)	7.66 (1.68)	7.77 (1.29)			

Note. Only significant F values are reported for the main effects of culture and age, and the interaction between age and culture.
[a] WAIS-R t-score.
* $p < .05$. ** $p < .01$.

scored higher on vocabulary, state anxiety and self-rated stress than did older adults. However, there were no age-by-culture interactions on any of the measures.

Materials

Face stimuli were from the Karolinska Directed Emotional Faces (KDEF; Lundqvist, Flykt, & Öhman, 1998) and the Korea University Facial Expression Collection (KUFEC; Lee, Lee, Lee, Choi, & Kim, 2006). The stimuli consisted of three facial expressions for each model (happy, fearful, and neutral faces), with equivalent numbers of male and female faces and Asian and Western faces. All participants saw all the different types of faces.

We wanted participants to decide *how* fearful a face was rather than just whether it was fearful or not. Thus, we parametrically varied emotional expression in order to have faces with a variety of emotional intensity levels. Faces were morphed using Fanta-Morph software 2.5, generating a sequence of 10 faces in 10% increments for each identity. These 10% increments provided a subtle gradation of emotional intensity. Two different morph progressions were created: neutral to fearful, and neutral to happy. Twelve separate people's faces (six Asian and six Western faces) were used to construct the different morph types.

All expressions were posed in full frontal orientation without changes in head orientation either across or within morphs. Between each source and target emotion, eight intermediate expressions with 10% increments were used. The original neutral and emotional faces were not used, as pilot testing established that there was little variability in rating the emotional intensity in these faces. Thus, a total of 192 face images were used in this experiment (six models × two ethnic groups × two emotion morph types × eight morph increments). Each participant saw each face image presented four times, once with each type of background scene.

The emotional scenes presented with face stimuli as the contextual backgrounds were 48 images (16 positive, negative, and neutral images) from the International Affective Pictures System (IAPS; Lang, Bradley, & Cuthbert, 1999). Each facial expression was randomly matched up with one background picture of each type (see Figure 1 for examples and Appendix 1 for the list of 48 images and their average valence and arousal ratings[1]). Across the

happy and fearful sessions, participants were shown each background image 12 times. In addition, in the no-context condition, we used Fourier transformed IAPS images.

The stimuli were displayed on a 21-in LCD monitor. The size of the face and context stimulus corresponded to 3.2° (horizontal) × 4.7° (vertical) and 14.3° × 21.2° of the visual angle, respectively. Face stimuli were embedded on the center of a context stimulus during the task. SuperLab pro 4.0 (Cedrus Corp., San Pedro, CA) software with a response pad (RB-730; Cedrus Corp.) controlled the schedule of the stimulus presentation.

Procedure

When participants arrived, they read an information sheet about the study and decided whether to consent to participate in the study. After giving consent, they completed a demographic information sheet that included ratings of health ("How would you describe your overall health, on a scale from 1 to 10 (1 = very poor health, 10 = excellent health)?" and stress ("What do you feel your stress level is today on a scale from 1 to 9 [1 = very low, 5 = moderate, 9 = very high]?"). They also completed the Center for Epidemiological Studies Depression Scale (CES-D) and the State-Trait Anxiety Inventory-State (STAI-S). Before the experiment, the participants completed a practice session with faces that were not included in the main set. All questionnaires and task instructions were administered in English for the American participants (see Radloff, 1977; Spielberger & Gorsuch, 1983) and in Korean for the Korean participants (see Cho, 1989; Cho & Kim, 1998; Cho, Nam, & Suh, 1998). In order not to bias performance, participants were not given any advice about whether to attend to or ignore the background images.

The experiment was divided into two blocks (one for happiness ratings and one for fear ratings) of 384 randomly ordered trials in each section (i.e., six identities × two race types × eight intensities × four backgrounds). The questionnaire interval between

---

[1] Thirteen negative, thirteen positive, and three neutral pictures included people in the photograph; the others had no people.

blocks took about 15 minutes. Which block was completed first was counterbalanced across participants.

The main experimental task was to look at each version of the morphed faces and rate the intensity of the emotional expression. In the happiness-rating block, neutral-happy morphed faces appeared and participants rated them on a scale of 1 = "neutral" to 7 = "happy." In the fear-rating block, the neutral-fearful morphed faces appeared and participants rated them on a scale of 1 = "neutral" to 7 = "fearful."

Stimuli were presented one at a time and participants were asked to respond as quickly and accurately as possible. Each trial consisted of a fixation for 400 ms followed by an individual face-context stimulus presented with the response rating scale (Figure 2). This screen was displayed until the participant made a response; the response was followed by a 1000-ms inter-stimulus interval. There was no time limit for responding.

In the questionnaire interval phase between the two blocks, participants were tested on several standard measures of general cognitive functioning. The Mini Mental Status Exam (MMSE; Folstein et al., 1975) was used as a screening tool for dementia. The Vocabulary test subset of the Wechsler Adult Intelligence Scale–revised provided estimates of intelligence (WAIS–R; Wechsler, 1981). Each of these cognitive instruments also has a Korean version that was used for the Korean sample (Kang, 2006; Yum, Park, Oh, & Lee, 1992).

Immediately after the second face-rating block, participants were asked to recall as many of the background pictures seen during the face-rating blocks as they could. They were asked to write down brief descriptions of all the background pictures they could remember.

At the end of the experiment, we asked participants to rate how much they ignored or paid attention to the background images on a scale of 1–5 (1 = "I almost always paid attention to the background images," 5 = "I almost always ignored the background images").

Results

In this section, we start by reporting the effects of context on emotion ratings for the faces and then examine how participant stress levels modulated the cultural differences seen in the influence of context. In initial analyses, we found that the ethnicity of the displayed face did not interact with any of the effects described below and so we collapsed across face ethnicity in the subsequent analyses. In addition, to simplify the analyses we averaged across face morph level, which was not a factor of interest in our study.[2] After reporting the face rating results, we examine group differences in the number and valence of the background pictures recalled. Finally, we report on the post-experiment ratings of attention to the background pictures.

Context Affected Fear Ratings Most for Younger Koreans

We examined participants' ratings of fear intensity using a 2 (age group) × 2 (culture) × 4 (background type) analysis of variance (ANOVA). As listed in Table 2, there were significant effects of age and background type and significant two-way interactions with background type and the other factors. These effects

were qualified by the predicted three-way interaction of age, culture, and background type. As shown in Figure 3, younger Korean participants increased their fear ratings more in fear contexts than other participants did.

Context Affected Happiness Ratings Most for Younger Koreans

We examined participants' ratings of happiness in the morphed neutral-happy faces using the same ANOVA as in the fear-rating block. As in the fear-rating block, there were some significant main effects and two-way interactions that were qualified by the predicted significant three-way interaction of age, culture, and background type (see Table 2 for statistics). As can be seen in Figure 4, younger Korean participants were the group most influenced by background contexts in their face happiness ratings.

Of the Participant Characteristics Differing Among Groups, Only Self-Rated Stress Shows an Influence

There were several participant characteristics that revealed overall age differences, and so we ran separate ANOVAs for the fear and happiness ratings with each of these as a covariate.[3] Education, vocabulary and anxiety did not interact significantly with background type and including each of these scores as a covariate did not eliminate any of the significant culture by background type interactions. However, rerunning the fear rating ANOVA with self-rated stress as a covariate revealed a significant interaction of background type and stress rating, $F(3, 315) = 5.63$, $p < .01$, $\eta_p^2 = .05$. Furthermore, the 3-way age by culture by background became only marginally significant when self-rated stress was included as a covariate, $F(3, 315) = 2.46$, $p = .06$, $\eta_p^2 = .02$. For the happiness rating data, there were no significant interactions with stress and the 3-way age by culture by background interaction remained significant.

Relationship Between Self-Rated Stress and Influence of Context

To examine how stress modulated the culture by background effects, we first computed composite scores of the impact of the

---

[2] All the effects we report remain significant when morph level is included as a within-subjects factor. Furthermore, as expected, subjects were sensitive to morph level; for instance, they rated intensity of fear as higher for faces with a higher percentage of the fear face than for faces with a higher percentage of the neutral face.

[3] One concern we had was whether the interactions of age, culture and background type might be related to the higher MMSE scores among older American than Korean participants. We could not include MMSE as a covariate in the overall analysis as younger adults did not have MMSE scores. Instead, as a test of the robustness of our effects to differences in MMSE, we reran the analyses with a subset of our older adults that were selected to be those Americans with lower than their group median MMSE scores and those Koreans with higher than their group median MMSE scores. Within this subgroup, the Americans had lower MMSE scores than the Koreans. The interactions of culture, background type and age remained significant for both the fear and the happiness rating sessions. Thus, it is clear that the age by culture by background type interactions in the overall dataset cannot be accounted for by older Americans having higher MMSE scores than older Koreans.
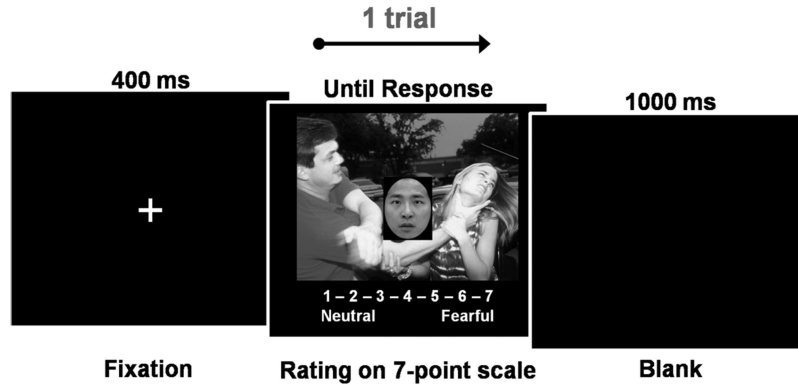
Figure 2. Timing and sequence for one trial.

background context on fear ratings by subtracting each participant's average fear rating for faces seen in a negative context from their average fear rating for faces seen in a positive context. This measure was negatively correlated with stress ratings for both younger ($r = -.44$, $p < .05$) and older Koreans ($r = -.45$, $p < .05$) but not for younger ($r = .13$) or older Americans ($r = -.10$). Thus, for Koreans, higher stress levels predicted less influence of a negative context in rating the level of fear in a face. Using the reverse score for the happiness data (average happiness rating for faces seen in a positive context minus average happiness rating for faces seen in a negative context) revealed a marginally significant negative correlation with stress for younger Koreans ($r = -.31$, $p = .10$) and no significant correlations for the older Koreans ($r = .07$), younger Americans ($r = .09$), or older Americans ($r = -.17$).

Next, we categorized each participant as being above or below their group median stress score and reran our overall fear-rating ANOVA separately for those in the low stress group and those in the high stress group. Among those with low stress levels, there were significant interactions of background type and culture, $F(3, 156) = 10.86$, $p < .001$, $\eta_p^2 = .17$, and background type, culture, and age (see Figure 5A), $F(3, 156) = 2.93$, $p < .05$, $\eta_p^2 = .05$, as in the overall analysis. In contrast, the same ANOVA run with those with high stress yielded no significant interactions of back-

ground type and culture ($Fs < 1$; see Figure 5B). The same pattern occurred for the happiness rating data, with the low stress group showing a marginally significant interaction of background type and culture, $F(3, 156) = 2.46$, $p = .06$, $\eta_p^2 = .05$ and a significant interaction of background type, culture and age (Figure 5C), $F(3, 156) = 2.75$, $p < .05$, $\eta_p^2 = .05$, and the high stress group showing no significant interactions of background type and culture ($Fs < 1$; Figure 5D). As can be seen in Figures 5B and 5D, younger Koreans experiencing high stress levels did not show the culturally predicted increased influence of the background context in their ratings.

There Were Culture and Age Differences in the Number of Background Pictures Recalled

Participants' recalled descriptions of the background images (e.g., "snake with open mouth," "mushrooms," "three puppies") were coded by two coders (separate coders for the Korean and American data) to indicate which of the 48 background pictures they corresponded with and which valence category the picture was from. For the specific picture match, the American coders agreed for 90% of the recalled items; Korean coders agreed for 94% of the recalled items. In both sets of data, the coders had 99%

Table 2

Statistics Corresponding With Significant Effects of Age, Culture, and Background Type for Fear and Happiness Ratings

Fear ratings	
Age[*]	$F(1, 106) = 10.12$, $p < .01$, $\eta_p^2 = .09$
Culture	$F(1, 106) = .03$, $p > .8$, $\eta_p^2 < .01$
Age × culture	$F(1, 106) = .03$, $p > .8$, $\eta_p^2 < .01$
Background type[*]	$F(3, 318) = 27.40$, $p < .001$, $\eta_p^2 = .21$
Background type × age[*]	$F(3, 318) = 3.22$, $p < .05$, $\eta_p^2 = .03$
Background type × culture[*]	$F(3, 318) = 5.64$, $p < .01$, $\eta_p^2 = .05$
Background type × age × culture[*]	$F(3, 318) = 3.48$, $p < .05$, $\eta_p^2 = .03$
Happiness ratings	
Age[*]	$F(1, 106) = 8.45$, $p < .01$, $\eta_p^2 = .07$
Culture	$F(1, 106) = .23$, $p > .6$, $\eta_p^2 < .01$
Age × culture	$F(1, 106) = .78$, $p > .3$, $\eta_p^2 < .01$
Background type[*]	$F(3, 318) = 14.85$, $p < .001$, $\eta_p^2 = .12$
Background type × age	$F(3, 318) = 1.81$, $p < .15$, $\eta_p^2 = .02$
Background type × culture[*]	$F(3, 318) = 2.64$, $p < .05$, $\eta_p^2 = .02$
Background type × age × culture[*]	$F(3, 318) = 3.72$, $p < .05$, $\eta_p^2 = .03$

agreement for the valence categories of the recalled pictures. Coder disagreements were resolved by one of the coauthors.

We examined the total number of background images recalled with a 2 (age group) $\times$ 2 (culture) ANOVA. As expected, younger adults recalled more pictures ($M = 13.79 \pm 1.17$[4]) than older adults did ($M = 5.14 \pm 1.24$), $F(1, 106) = 101.11$, $p < .001$, $\eta_p^2 = .49$. There was no main effect of culture, but there was a significant interaction of culture and age, $F(1, 106) = 20.19$, $p < .001$, $\eta_p^2 = .16$. Consistent with expected cultural differences in attention to context, younger Koreans recalled more background images ($M = 15.76 \pm 1.66$) than did younger Americans ($M = 11.83 \pm 1.66$). In contrast, older Koreans recalled fewer background images ($M = 3.23 \pm 1.75$) than did older Americans ($M = 7.04 \pm 1.75$). It is interesting that the Asian advantage for memory for background material did not just disappear among the older group but instead reversed; this may indicate that focusing on a central face is a more demanding task for those with a lifetime habit of attending to context.

In Both Cultures, Younger Adults Showed a Greater Negativity Advantage in Memory for the Background Contexts Than Did Older Adults

We next examined the nature of what was recalled with a 3 (emotion type) $\times$ 2 (age group) $\times$ 2 (culture) ANOVA. On average, participants were most likely to recall the negative pictures ($M = 4.11 \pm .35$), followed by the positive pictures ($M = 3.14 \pm .36$) and then the neutral pictures ($M = 2.21 \pm .36$), $F(2, 212) = 49.91$, $p < .001$, $\eta_p^2 = .32$.

However, an emotion type by age interaction, $F(2, 212) = 17.17$, $p < .001$, $\eta_p^2 = .14$, revealed that this negativity advantage was greater among younger adults ($M_{\text{negative}} = 6.19 \pm .49$, $M_{\text{positive}} = 4.38 \pm .49$, $M_{\text{neutral}} = 3.22 \pm .50$) than among older adults ($M_{\text{negative}} = 2.04 \pm .52$, $M_{\text{positive}} = 1.90 \pm .52$, $M_{\text{neutral}} = 1.19 \pm .53$). The interaction of emotion type, age and culture was not significant, $F(2, 212) = .30$, $p > .7$, $\eta_p^2 < .01$, indicating that the increased negativity of younger adults' memories was consistent across culture (Figure 6). The interaction of age and valence remained significant at the $p < .001$ level when the ANOVA was rerun
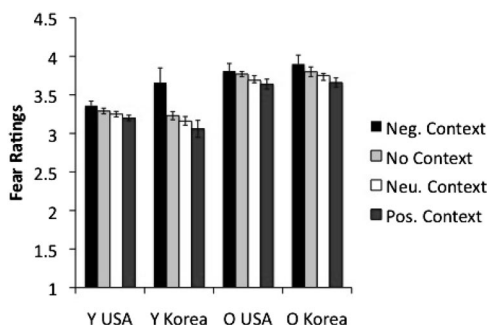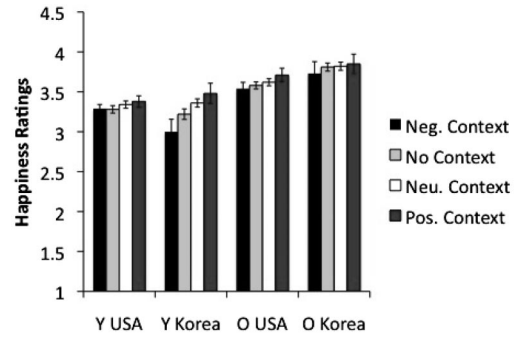
Figure 4. Average happiness intensity ratings for younger Americans, younger Koreans, older Americans, and older Koreans for faces shown with each background type (negative, none, neutral, or positive). Younger Koreans showed the largest influence of background on their face ratings. Error bars represent within-subject 95% confidence intervals. Between-subjects confidence intervals for older adults = $\pm.30$; for younger adults = $\pm.28$.

separately with each of the covariates where there were overall age differences (education, vocabulary, anxiety, and stress).[5,6]

Self-Rated Attention to Background Pictures Also Showed an Age by Culture Interaction

A culture by age group ANOVA on the post-experiment ratings of how much participants attended to the background pictures revealed a main effect of age, $F(1, 106) = 20.01$, $p < .001$, $\eta_p^2 = .16$. Lower scores indicate more attention to the backgrounds and higher more ignoring of the backgrounds; older adults reported more ignoring ($M = 3.96 \pm .30$) than younger adults ($M = 3.05 \pm .28$). However, this was qualified by a significant interaction of age and culture, $F(1, 106) = 3.96$, $p < .05$, $\eta_p^2 = .04$. Younger

Figure 3. Average fear intensity ratings for younger Americans, younger Koreans, older Americans, and older Koreans for faces shown with each background type (negative, none, neutral, or positive). Younger Koreans showed the largest influence of background on their face ratings. Error bars represent within-subject 95% confidence intervals (Loftus & Masson, 1994). Between-subjects confidence intervals for older adults = $\pm.31$; for younger adults = $\pm.30$.

---

[4] Confidence intervals reported in the results section are 95% confidence intervals and factor in between-subjects variance and so are appropriate for between-groups comparisons.

[5] They also remained significant when we tested whether MMSE differences could account for the findings by rerunning the ANOVA excluding Korean older adults who scored below their group MMSE median and American older adults who scored above their group MMSE median. Thus, regardless of whether we had groups in which the older Americans or the older Koreans had higher MMSE scores, the two older groups consistently showed less of a negativity advantage in memory than did younger adults.

[6] The negative pictures were on average more arousing than the positive pictures, which may have led to the overall advantage in memory for negative pictures. To test whether the age difference in which valence is most memorable would hold up if arousal were equivalent across positive and negative pictures, we compared recall for the eight positive pictures with the highest arousal ratings ($M = 5.6$, $SD = .29$) with the eight negative pictures with the lowest arousal ratings ($M = 5.6$, $SD = .55$). Even with just this subset of pictures, there was a significant interaction of age and valence, $F(2,106) = 5.49$, $p < .05$, $\eta_p^2 = .05$. Older adults recalled similar numbers of negative pictures ($M = .90 \pm .31$) as positive pictures ($M = 1.00 \pm .37$) whereas younger adults recalled more negative pictures ($M = 2.86 \pm .30$) than positive pictures ($M = 2.24 \pm .35$). As in the analysis with all the pictures, the interaction of valence, age and culture was not significant, $F(2,106) = .01$, $p = .95$, $\eta_p^2 = .00$, indicating that the age difference in valence of recall was consistent across culture.
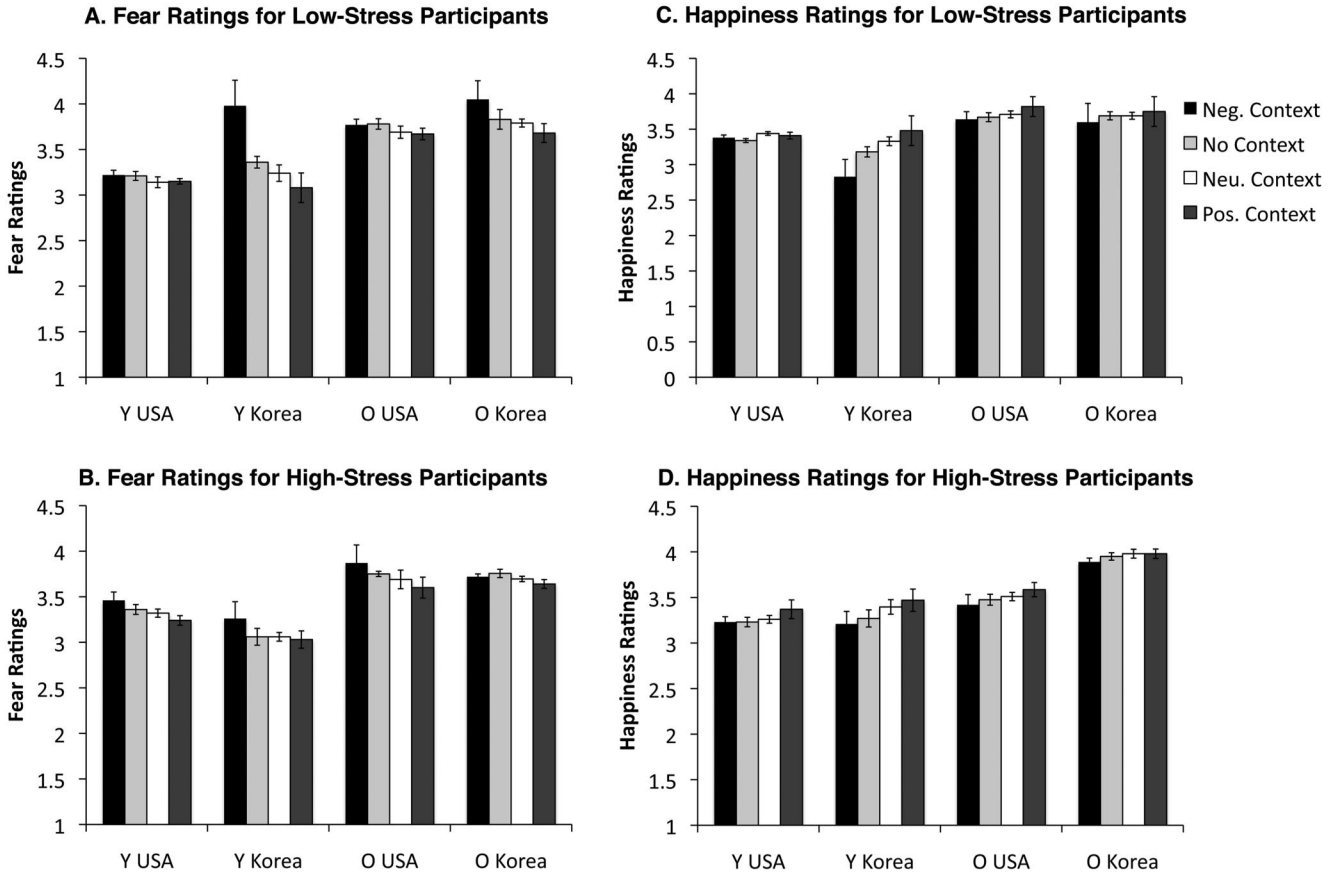
Figure 5. A–D. Emotion intensity ratings separately for participants with low and high self-rated stress levels. Younger Koreans only showed a greater effect of context than other participants when they had low stress levels. Error bars represent within-subject 95% confidence intervals. Between-subjects confidence intervals range from ±.41 to ±.50.

Koreans reported less ignoring of the background pictures ($M = 2.72 \pm .40$) than did younger Americans ($M = 3.38 \pm .39$), whereas older Koreans ($M = 4.04 \pm .41$) and older Americans ($M = 3.89 \pm .40$) reported similar levels. Thus, consistent with the face emotion rating results and the background picture recall results, younger Koreans were the group who were most likely to say they attended to the background images.

Discussion

Culture and Age Interactions in Context Integration

This study revealed a number of interesting findings. First, as predicted, Korean younger adults' ratings of emotional faces were more influenced by emotional contexts than were American younger adults' ratings. This finding is consistent with the general idea that Westerners tend to focus on focal objects whereas East Asians attend to a broader perceptual field (Nisbett & Masuda, 2003) and adds support to a recent study revealing cultural differences between Japanese and Americans in the effects of background context on face emotion ratings (Masuda et al., 2008).

In contrast, this cultural difference was not seen among older adults. Neither American nor Korean older adults were signifi-

cantly influenced by the emotional nature of background contexts when rating face emotion. If considered purely from the perspective of culture, the fact that we found cultural differences among the younger cohorts but not the older cohorts is surprising. Older

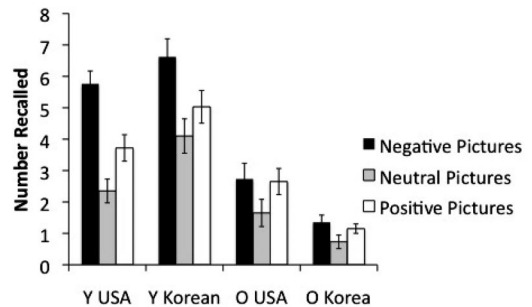*Figure 6.* Average number of background pictures recalled for each group of participants. Both younger Americans and younger Koreans recalled more negative than positive pictures whereas older adults did not show this negativity bias. Error bars represent within-subject 95% confidence intervals. Older adults' between-subjects confidence interval = ±1.82; younger adults' between-subjects confidence interval = ±1.71.

cohorts grew up when Asian and Western cultures were more distinct from each other than they are today. In addition, older adults have had more years of experience within their culture than younger adults, which should increase cultural influence over perceptual processing.

One possible account of our findings is that older Koreans were better than younger Koreans at inhibiting the irrelevant background information when rating the central faces. However, this would contradict much research indicating that older adults are worse than younger adults at inhibiting irrelevant information (for a review see Hasher, Lustig, & Zacks, 2007) and therefore seems unlikely. Another possibility is that the ability to integrate background information while attending to a central item declines with age, constraining the degree to which cultural differences in attention to the background can emerge among older adults. This possibility would be consistent with previous findings of age-related impairments in the simultaneous processing of objects and backgrounds (Chee et al., 2006). In addition to their well-documented deficits in context and associative memory (Old & Naveh-Benjamin, 2008; Spencer & Raz, 1995), older adults appear to have more difficulty than younger adults in perceptually integrating information from multiple sources (Humphrey & Kramer, 1997; Plude & Doussard-Roosevelt, 1989; Sekuler, Bennett, & Mamelak, 2000). Our findings that younger Koreans were influenced by background context in interpreting facial emotion whereas older Koreans were not suggest that age-related declines in the ability to integrate multiple sources of information during perceptual processing constrain the expression of cultural differences in perception.

Stress May Constrain Cultural Differences

Our findings of a cultural difference in contextual influences in face perception among younger adults support the idea that Westerners tend to focus on a salient object independently of its context, whereas Asians tend to engage in more holistic perceptual processes. However, we found that the more holistic approach of younger Asians was not seen among those with high self-rated stress, suggesting that Koreans' culturally learned perceptual habit of integrating contextual information with central information is disrupted among those experiencing greater stress. This reduction of the impact of the context on face ratings among Koreans with higher stress ratings is consistent with findings that emotional arousal or stress can lead to a narrowing of attention that benefits high priority central information at the cost of peripheral information (for a review see Mather, 2007). More research is needed, however, to see if these effects based on self-rated stress are due to stable individual differences in typical levels of stress or to daily variation in stress levels.

There Was a Culture by Age Interaction in the Number of Background Pictures Recalled

Previous studies revealed mixed findings regarding whether there are cultural differences in context memory, with some finding no effect (Chua et al., 2006; Evans et al., 2009) and others finding indications of better context memory among East Asians (Goh et al., 2007; Masuda & Nisbett, 2001). However, none of these studies tested free recall of background context. In our study, we found the predicted effect that younger Koreans recalled more background context images than younger Americans. We expected a reduced Korean advantage in background image recall among older adults, but

instead found a reversal, such that older Koreans recalled fewer background images than older Americans. It is not clear why memory for backgrounds would decrease more from younger to older adults in the Korean group than in the American group, but one possibility is that it has to do with the experimental task being a culturally nonpreferred task. Focusing on a central target may be a less habitual and therefore more demanding task for older Koreans than for older Americans, which may have reduced older Koreans' capacity to process the background images as deeply.

The Positivity Effect Was Consistent Across Cultures

Even though there were cultural differences in how many background pictures were recalled, the two cultures showed the same age-related biases in terms of what type of pictures they were most likely to recall. Among both American and Korean participants, younger adults had a negativity bias in memory for the background pictures, whereas older adults did not, extending previous findings of age by valence interactions that reveal a negative-to-positive shift with age in what is most likely to be recalled (for a review see Mather & Carstensen, 2005) to a Korean sample. Our findings are consistent with recent findings showing an age-related positivity effect among Koreans (Kwon et al., 2009).[7]

Limitations

One limitation of our study is that participants rated the emotional intensity of expressions only of younger faces. Analogous to the own-race bias, in which people are better at remembering faces

---

[7] In addition to the positivity effect seen in memory, studies have found that American older adults have a greater bias against attending to negative faces and towards attending to positive faces than do American younger adults (Isaacowitz, Wadlinger, Goren, & Wilson, 2006b, 2006a; Knight et al., 2007; Mather & Carstensen, 2003). In contrast, older Asians compared with younger Asians do not show a positivity effect in emotional attention to faces (Fung et al., 2008; Ko, Kang, & Lee, 2009). What might lead memory for emotional scenes in our study to show similar age differences across East Asian and Western cultures whereas attention to emotional faces in previous studies shows cultural differences? One possibility is that attention to faces is more strongly influenced by cultural differences in ideal affect. Asian and Western cultures differ in what affective states people value, and the most striking difference is that whereas high arousal positive states such as excitement are sought after in Western cultures, they are undesirable in Asian cultures (Tsai et al., 2006). In particular, whereas for Westerners, broader smiles convey more happiness than more muted smiles, bigger smiles are not necessarily a sign of greater happiness for East Asians (Tsai, Louie, Chen, & Uchida, 2007) and may even be less preferred than more moderate smiles (Hess, Beaupre, & Cheun, 2002) or considered inappropriate (Matsumoto, 1990). East Asians may also be more likely than Westerners to use a smile to mask embarrassment or to express frustration or nervousness (Argyle, 1975; Gao, Ting-Toomey, & Gudykunst, 1996). Furthermore, there is some indication that the display rules for smiling were different when older cohorts were young, such that smiling in public was inappropriate (Hess et al., 2002). Thus, the display of full intensity smiles with teeth may be seen as embarrassing and inappropriate among East Asian participants, especially the older participants. In any case, further work is needed to clarify why there are similar age-related positivity effects across cultures in memory for pictures as found in the current study whereas the Fung et al. and Ko et al. studies suggest cultural differences in the positivity effect for attention to faces.

of their own race than of other races (for a review see Meissner & Brigham, 2001), there is also evidence of an own-age memory bias, in which people are better at remembering neutral faces near their own age than those in an older or younger cohort (Anastasi & Rhodes, 2005; Bäckman, 1991; Bartlett & Leslie, 1986; Lamont, Stewart-Williams, & Podd, 2005; Wiese, Schweinberger, & Hansen, 2008). Thus, a relevant question for future research is whether there might be participant age by target face age interactions if participants rated both younger and older faces.

Several previous findings suggest that it is unlikely that we would find participant age by target face age interactions for the effect of background context on emotion intensity ratings. First, the context effects found in our study did not interact with target face race, suggesting that the in-group or out-group status of the target face does not increase or decrease how much the emotional context influences the intensity of the perceived emotion. Second, a recent study found no own-age memory bias for emotional faces, in contrast with the own-age biases seen in earlier studies for neutral faces, suggesting that in-group biases are less pronounced for emotional stimuli (Ebner & Johnson, 2009). Third, and more relevant to our study than the own-age memory effects, Ebner and Johnson found that both younger and older adults were better at identifying the correct emotional facial expression for younger target faces than for older target faces, but there were no participant age by target face interactions.

Our experimental design had some other factors as well that may have influenced the results. We used background contexts that were not integrated with the foreground faces, which may have reduced overall levels of integrating context with the face expressions. Also, we repeated faces and contexts, which might have led to habituation, also potentially decreasing the impact of the stimuli.

Another issue that needs to be considered when interpreting our results is the possibility that some other difference (other than culture) led to the group differences among younger adults. Although our Korean and American groups did not significantly differ on average education, vocabulary, state anxiety, depression, self-rated stress, or self-rated health, there may be other factors that we did not assess that contribute more than culture to the group differences in the effects of context. One factor that did reveal differences across cultures was the MMSE, for which the older Americans had higher scores than the older Koreans. However, follow-up analyses in which we excluded those Koreans with the lowest MMSE scores and those Americans with the highest MMSE scores yielded the same culture by context interactions as the analyses with the full data set, indicating that this group difference could not account for our findings of cultural differences in the influence of background context.

Conclusions

Interpreting others' emotions is an important social skill. Previous work suggests that East Asians are more likely than Westerners to integrate contextual information when processing foreground central information. Does this mean that Asians will be more likely than Westerners to be influenced by the context when interpreting facial emotion? Our study indicates that the answer is yes, but that whether this cultural difference is expressed is subject to constraints of both age and stress levels. It was only among the younger cohort that Koreans were more influenced than the Americans by the background

contexts in their ratings of the central face emotion. Also, younger Koreans recalled more background images than younger Americans but this memory advantage for background images was not seen among older Koreans. Decreased capacity to integrate different perceptual sources of information may constrain perceptual processing more among older adults than among younger adults, leading to a decrease in the impact that culture has in determining attentional processing style. Furthermore, increased consideration of context among young Asians was only seen for those who were not stressed, suggesting that stress narrows perceptual focus such that background context has less influence.

References

Anastasi, J. S., & Rhodes, M. G. (2005). An own-age bias in face recognition for children and older adults. *Psychonomic Bulletin & Review, 12,* 1043–1047.

Argyle, M. (1975). *Bodily communication* (2nd ed.). New York, NY: Methuen and Co.

Bäckman, L. (1991). Recognition memory across the adult life span: The role of prior knowledge. *Memory & Cognition, 19,* 63–71.

Bagozzi, R. P., Wong, N., & Yi, Y. J. (1999). The role of culture and gender in the relationship between positive and negative affect. *Cognition & Emotion, 13,* 641–672. doi: 10.1080/026999399379023

Bartlett, J. C., & Leslie, J. E. (1986). Aging and memory for faces versus single views of faces. *Memory & Cognition, 14,* 371–381.

Carstensen, L. L., Mikels, J. A., & Mather, M. (2006). Aging and the intersection of cognition, motivation and emotion. In J. E. Birren & K. W. Schaie (Eds.), *Handbook of the psychology of aging* (Sixth ed., pp. 343–362). San Diego: Academic Press. doi: 10.1016/B978-012101264-9/50018-5

Chalfonte, B. L., & Johnson, M. K. (1996). Feature memory and binding in young and older adults. *Memory and Cognition, 24,* 403–416.

Charles, S. T., Mather, M., & Carstensen, L. L. (2003). Aging and emotional memory: The forgettable nature of negative images for older adults. *Journal of Experimental Psychology: General, 132,* 310–324. doi: 10.1037/0096-3445.132.2.310

Chee, M. W. L., Goh, J. O. S., Venkatraman, V., Tan, J. C., Gutchess, A., Sutton, B., . . . Park, D. (2006). Age-related changes in object processing and contextual binding revealed using fMR adaptation. *Journal of Cognitive Neuroscience, 18,* 495–507. doi: 10.1162/jocn.2006.18.4.495

Cho, M. J., & Kim, K. H. (1998). Use of the Center for Epidemiologic Studies Depression (CES-D) scale in Korea. *Journal of Nervous and Mental Disease, 186,* 304–310. doi: 10.1097/00005053-199805000-00007

Cho, M. J., Nam, J. J., & Suh, G. H. (1998). Prevalence of symptoms of depression in a nationwide sample of Korean adults. *Psychiatry Research, 81,* 341–352. doi: 10.1016/S0165-1781(98)00122-X

Cho, S. C. (1989). Assessment of test anxiety. *Journal of Korean Neuropsychiatry, 28,* 668–677.

Chua, H. F., Boland, J. E., & Nisbett, R. E. (2005). Cultural variation in eye movements during scene perception. *Proceedings of the National Academy of Sciences of the United States of America, 102,* 12629–12633. doi: 10.1073/pnas.0506162102

Chua, H. F., Chen, W. F., & Park, D. C. (2006). Source memory, aging and culture. *Gerontology, 52,* 306–313. doi: 10.1159/000094612

Denburg, N. L., Buchanan, D., Tranel, D., & Adolphs, R. (2003). Evidence for preserved emotional memory in normal elderly persons. *Emotion, 3,* 239–253. doi: 10.1037/1528-3542.3.3.239

Ebner, N. C., & Johnson, M. K. (2009). Young and older emotional faces: Are there age-group differences in expression identification and memory? *Emotion, 9,* 329–339. doi: 10.1037/a0015179

Evans, K., Rotello, C. M., Li, X. S., & Rayner, K. (2009). Scene perception and memory revealed by eye movements and receiver-operating characteristic analyses: Does a cultural difference truly exist? *Quarterly*

Journal of Experimental Psychology, 62, 276–285. doi: 10.1080/ 17470210802373720

Folstein, M., Folstein, S., & McHugh, P. R. (1975). Mini-Mental State: A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research, 12,* 189–198. doi: 10.1016/ 0022-3956(75)90026-6

Fung, H. H., Isaacowitz, D. M., Lu, A. Y., Wadlinger, H. A., Goren, D., & Wilson, H. R. (2008). Age-related positivity enhancement is not universal: Older Chinese look away from positive stimuli. *Psychology and Aging, 23,* 440–446. doi: 10.1037/0882-7974.23.2.440

Gao, G., Ting-Toomey, S., & Gudykunst, W. B. (1996). Chinese communication processes. In M. H. Bond (Ed.), *The handbook of Chinese psychology* (pp. 280–293). Hong Kong: Oxford.

Goh, J. O., Chee, M. W., Tan, J. C., Venkatraman, V., Hebrank, A., Leshikar, E. D., . . . Park, D. C. (2007). Age and culture modulate object processing and object-scene binding in the ventral visual area. *Cognitive Affective & Behavioral Neuroscience, 7,* 44–52. doi: 10.3758/ CABN.7.1.44

Hasher, L., Lustig, C., & Zacks, R. T. (2007). Inhibitory mechanisms and the control of attention. In A. Conway, M. Jarrold, A. Kane, A. Miyake, & J. Towse (Eds.), *Variation in working memory* (pp. 227–249). New York: Oxford University Press.

Henkel, L. A., Johnson, M. K., & De Leonardis, D. M. (1998). Aging and source monitoring: Cognitive processes and neuropsychological correlates. *Journal of Experimental Psychology: General, 127,* 1–18. doi: 10.1037/0096-3445.127.3.251

Hess, U., Beaupre, M. G., & Cheun, N. (2002). Who to whom and why–Cultural differences and similarities in the function of smiles. In M. H. Abel (Ed.), *An empirical reflection on the smile* (pp. 187–216). Lewiston, NY: Edwin Mellon Press.

Humphrey, D. G., & Kramer, A. F. (1997). Age differences in visual search for feature, conjunction, and triple-conjunction targets. *Psychology and Aging, 12,* 704–717. doi: 10.1037/0882-7974.12.4.704

Isaacowitz, D. M., Wadlinger, H. A., Goren, D., & Wilson, H. R. (2006a). Is there an age-related positivity effect in visual attention? A comparison of two methodologies. *Emotion, 6,* 511–516. doi: 10.1037/1528-3542.6.3.511

Isaacowitz, D. M., Wadlinger, H. A., Goren, D., & Wilson, H. R. (2006b). Selective preference in visual fixation away from negative images in old age? An eye tracking study. *Psychology and Aging, 21,* 40–48. doi: 10.1037/0882-7974.21.1.40

Kang, Y. (2006). A normative study of the Korean Mini Mental State Examination (K-MMSE) in the elderly. *Korean Journal of Psychology, 25,* 1–12.

Kensinger, E. A., Brierley, B., Medford, N., Growdon, J. H., & Corkin, S. (2002). Effects of normal aging and Alzheimer's disease on emotional memory. *Emotion, 2,* 118–134. doi: 10.1037/1528-3542.2.2.118

Kessels, R. P. C., Hobbel, D., & Postma, A. (2007). Aging, context memory and binding: A comparison of "what, where and when" in young and older adults. *International Journal of Neuroscience, 117,* 795–810. doi: 10.1080/00207450600910218

Knight, M., Seymour, T. L., Gaunt, J., Baker, C., Nesmith, K., & Mather, M. (2007). Aging and goal-directed emotional attention: Distraction reverses emotional biases. *Emotion, 7,* 705–714. doi: 10.1037/1528-3542.7.4.705

Ko, S. G., Kang, H. S., & Lee, T. H. (2009). The selective attention for emotional faces in older adults. *Korean Journal of Clinical Psychology, 28,* 81–96.

Kwon, Y., Scheibe, S., Samanez-Larkin, G. R., & Tsai, J. L. (2009). Replicating the positivity effect in picture memory in Koreans: Evidence for cross-cultural generalizability. *Psychology and Aging, 24,* 748–754. doi: 10.1037/a0016054

Lamont, A. C., Stewart-Williams, S., & Podd, J. (2005). Face recognition and aging: Effects of target age and memory load. *Memory & Cognition, 33,* 1017–1024.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1999). *The international affective picture system (IAPS): Technical manual and affective ratings.* Gainesville, FL: University of Florida, The Center for Research in Psychophysiology.

Langeslag, S. J. E., & van Strien, J. W. (2009). Aging and emotional memory: The co-occurence of neurophysiological and behavioral positivity effects. *Emotion, 9,* 369–377. doi: 10.1037/a0015356

Lee, T.-H., Lee, K., Lee, K.-Y., Choi, J.-S., & Kim, H.-T. (2006). *Korea University Facial Expression Collection: KUEFC.* [Unpublished stimuli]. Lab of Behavioral Neuroscience, Department of Psychology, Korea University.

Loftus, G. R., & Masson, M. E. (1994). Using confidence intervals in within-subject designs. *Psychonomic Bulletin and Review, 1,* 476–490.

Lundqvist, D., Flykt, A., & Ohman, A. (1998). *The Karolinska Directed Emotional Faces - KDEF.* [Unpublished stimuli]. Department of Clinical Neuroscience, Psychology section, Karolinska Institutet.

Masuda, T., Ellsworth, P. C., Mesquita, B., Leu, J., Tanida, S., & De Veerdonk, E. V. (2008). Placing the face in context: Cultural differences in the perception of facial emotion. *Journal of Personality and Social Psychology, 94,* 365–381. doi: 10.1037/0022-3514.94.3.365

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,* 922–934. doi: 10.1037/0022-3514.81.5.922

Mather, M. (2007). Emotional arousal and memory binding: An object-based framework. *Perspectives on Psychological Science, 2,* 33–52. doi: 10.1111/j.1745-6916.2007.00028.x

Mather, M., & Carstensen, L. L. (2003). Aging and attentional biases for emotional faces. *Psychological Science, 14,* 409–415. doi: 10.1111/ 1467-9280.01455

Mather, M., & Carstensen, L. L. (2005). Aging and motivated cognition: The positivity effect in attention and memory. *Trends in Cognitive Sciences, 9,* 496–502. doi: 10.1016/j.tics.2005.08.005

Mather, M., & Knight, M. (2005). Goal-directed memory: The role of cognitive control in older adults' emotional memory. *Psychology and Aging, 20,* 554–570. doi: 10.1037/0882-7974.20.4.554

Matsumoto, D. (1990). Cultural similarities and differences in display rules. *Motivation and Emotion, 14,* 195–214. doi: 10.1007/BF00995569

Meissner, C. A., & Brigham, J. C. (2001). Thirty years of investigating the own-race bias in memory for faces. *Psychology, Public Policy, and Law, 7,* 3–35. doi: 10.1037/1076-8971.7.1.3

Mitchell, K. J., Johnson, M. K., Raye, C. L., Mather, M., & D'Esposito, M. (2000). Aging and reflective processes of working memory: Binding and test load deficits. *Psychology and Aging, 15,* 527–541. doi: 10.1037/ 0882-7974.15.3.527

Naveh-Benjamin, M. (2000). Adult age differences in memory performance: Tests of an associative deficit hypothesis. *Journal of Experimental Psychology: Learning, Memory and Cognition, 26,* 1170–1187. doi: 10.1037/0278-7393.26.5.1170

Naveh-Benjamin, M., Guez, J., Kilb, A., & Reedy, S. (2004). The associative memory deficit of older adults: Further support using face-name associations. *Psychology and Aging, 19,* 541–546. doi: 10.1037/0882-7974.19.3.541

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,* 11163–11170. doi: 10.1073/pnas.1934527100

Nisbett, R. E., & Miyamoto, Y. (2005). The influence of culture: Holistic versus analytic perception. *Trends in Cognitive Sciences, 9,* 467–473. doi: 10.1016/j.tics.2005.08.004

Nisbett, R. E., Peng, K. P., Choi, I., & Norenzayan, A. (2001). Culture and systems of thought: Holistic versus analytic cognition. *Psychological Review, 108,* 291–310. doi: 10.1037/0033-295X.108.2.291

Noguchi, K., Gohm, C. L., Dalsky, D. J., & Sakamoto, S. (2007). Cultural differences related to positive and negative valence. *Asian Journal of Social Psychology, 10,* 68–76. doi: 10.1111/j.1467-839X.2007.00213.x

Old, S. R., & Naveh-Benjamin, M. (2008). Differential effects of age on

item and associative measures of memory: A meta-analysis. *Psychology and Aging, 23,* 104–118. doi: 10.1037/0882-7974.23.1.104

Plude, D. J., & Doussard-Roosevelt, J. A. (1989). Aging, selective attention, and feature integration. *Psychology and Aging, 4,* 98–105. doi: 10.1037/0882-7974.4.1.98

Radloff, L. S. (1977). The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1,* 385–401. doi: 10.1177/014662167700100306

Righart, R., & de Gelder, B. (2006). Context influences early perceptual analysis of faces - An electrophysiological study. *Cerebral Cortex, 16,* 1249–1257. doi: 10.1093/cercor/bhj066

Righart, R., & de Gelder, B. (2008a). Rapid influence of emotional scenes on encoding of facial expressions: An ERP study. *Social Cognitive and Affective Neuroscience, 3,* 270–278. doi: 10.1093/scan/nsn021

Righart, R., & de Gelder, B. (2008b). Recognition of facial expressions is influenced by emotional scene gist. *Cognitive Affective & Behavioral Neuroscience, 8,* 264–272. doi: 10.3758/CABN.8.3.264

Rogers, T. J., Alderman, B. L., & Landers, D. M. (2003). Effects of life-event stress and hardiness on peripheral vision in a real-life stress situation. *Behavioral Medicine, 29,* 21–26. doi: 10.1080/08964280309596171

Rogers, T. J., & Landers, D. M. (2005). Mediating effects of peripheral vision in the life event stress/athletic injury relationship. *Journal of Sport & Exercise Psychology, 27,* 271–288.

Schimmack, U., Oishi, S., & Diener, E. (2002). Cultural influences on the relation between pleasant emotions and unpleasant emotions: Asian dialectic philosophies or individualism-collectivism? *Cognition & Emotion, 16,* 705–719. doi: 10.1080/02699930143000590

Sekuler, A. B., Bennett, P. J., & Mamelak, M. (2000). Effects of aging on the useful field of view. *Experimental Aging Research, 26,* 103–120. doi: 10.1080/036107300243588

Spencer, W. D., & Raz, N. (1995). Differential effects of aging on memory for content and context: A meta-analysis. *Psychology and Aging, 10,* 527–539. doi: 10.1037/0882-7974.10.4.527

Spielberger, C. D., & Gorsuch, R. L. (1983). *Manual for the State-Trait Anxiety Inventory (Form Y) ("Self-Evaluation Questionnaire")* Palo Alto, CA: Consulting Psychologists Press.

Tomaszczyk, J. C., Fernandes, M. A., & MacLeod, C. M. (2008). Personal relevance modulates the positivity bias in recall of emotional pictures in older adults. *Psychonomic Bulletin & Review, 15,* 191–196. doi: 10.3758/PBR.15.1.191

Tsai, J. L., Knutson, B., & Fung, H. H. (2006). Cultural variation in affect valuation. *Journal of Personality and Social Psychology, 90,* 288–307. doi: 10.1037/0022-3514.90.2.288

Tsai, J. L., Louie, J. Y., Chen, E. E., & Uchida, Y. (2007). Learning what feelings to desire: Socialization of ideal affect through children's storybooks. *Personality and Social Psychology Bulletin, 33,* 17–30. doi: 10.1177/0146167206292749

Uchida, Y., & Kitayama, S. (2009). Happiness and unhappiness in East and West: Themes and variations. *Emotion, 9,* 441–456. doi: 10.1037/a0015634

Wechsler, D. (1981). *Manual for the Wechsler Adult Intelligence Scale – Revised.* New York: Psychological Corporation.

Wiese, H., Schweinberger, S. R., & Hansen, K. (2008). The age of the beholder: ERP evidence of an own-age bias in face memory. *Neuropsychologia, 46,* 2973–2985. doi: 10.1016/j.neuropsychologia.2008.06.007

Yum, T. H., Park, Y. B., Oh, K. J., & Lee, Y. H. (1992). *The manual of Korean-Wechsler adult intelligence scale.* Seoul: Korean Guidance Press.

Appendix

Picture Stimuli

Average Normative Valence and Arousal (Standard Deviations in Parentheses) and Picture Identification Numbers from the International Affective Picture System for the Negative, Positive, and Neutral Pictures Used

Negative	Positive	Neutral
Valence = 2.37 (.72)	Valence = 7.52 (.49)	Valence = 5.79 (1.18)
Arousal = 6.19 (.72)	Arousal = 5.11 (.58)	Arousal = 3.59 (.78)
1120	1340	1590
1300	1440	1600
3120	1710	1620
3181	1999	1670
3550	2091	2191
6313	2208	2514
6315	2340	2579
9040	2345	2590
9250	2530	2595
9253	2550	5500
9400	4598	5750
9410	4599	7170
9433	4626	7175
9440	8350	7200
9910	8461	7233
9921	8470	7510