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Sharing Joy Increases Joy: Group Membership Modulates Emotional Perception of Facial Expressions

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When we judge someone's emotional expressions, we often consider the emotions of other people who are present in the same social context. Using a psychophysical method, we estimated the influence of the emotions of contextual faces on the emotional perception of an individual face. Particularly, we hypothesize that a shift in the perceptual judgment occurs when the target individual and others share a Group Membership. To test this hypothesis, we generated artificial images of two sports teams and asked participants to first judge the outcome of the game (win/loss for Experiment 1; win/loss/draw for Experiment 2) by looking at the facial emotions of four members of a team, and then judge the emotional category of the target face presented amid the contextual faces. The expressions of the target faces were gradually morphed (happy to sad for Experiment 1; happy to angry for Experiment 2). In Experiment 1, the perceptual decision threshold of the emotional categories of the target face shifted toward the emotional context of the same group members. However, such shifts did not occur in the different group condition. Experiment 2 showed that the shifted perceptual decision threshold significantly differed from the neutral condition only in the same group condition, which further replicated the results of Experiment 1. Our results indicate that people consider the emotions of others in the context of estimating an individual's emotion when they are socially attached to each other through Group Membership.

Keywords: facial expressions, emotion perception, Group Membership, social context, decision making

"Shared joy is a double joy; shared sorrow is half a sorrow." This proverb means that sharing emotions with other people may increase or decrease the intensity of the emotional experience rather than experiencing it alone. As social animals, we may strengthen social relationships by sharing emotions with others as an integral part of our social life (Rimé et al., 1992, 1998). Recent psychological research has revealed that sharing positive experiences with other people boosts positive affect, happiness, and life satisfaction (e.g., Lambert et al., 2013). We frequently observe group-level social activities such as team plays at school or the office, sports games, and political rallies. A person participating in group activities easily experiences shared emotions with the same group members, and his or her emotion can be affected by those activities. Then, can we systematically measure the increase or decrease of an individual's emotion when sharing it with others? In other words, when we look at the face of an individual who is a member of the group in a certain emotional state, such as the victory of a sports game, do we perceive his or her emotion as being affected by the group activity? In the present study, we used a psychophysical method to estimate how much the emotional perception of an individual face is influenced by the emotion of the group members in the context.

Recent reviews of research for facial emotion processing indicate that the perception of facial expressions is not processed in an isolated or de-contextualized manner but is instead influenced by many contextual factors in various social situations (for reviews, Barrett et al., 2011; Hassin et al., 2013; Wieser & Brosch, 2012). Particularly, Wieser and Brosch (2012) described that external information from the environment surrounding the face (e.g., emotion labeling, verbal description of social situations, visual scenes, and other faces) was one of the important contextual features influencing emotional face recognition or perception. Because contextual information provides conceptual and situational knowledge to perceivers, it may help to perceive an ambiguous emotional face as a certain category of emotion (e.g., Halberstadt & Niedenthal, 2001; Lee et al., 2012). Among external visual information, other nontarget faces as the context are particularly interesting for the current research because they can convey emotion in themselves as well as additional socially relevant information. For example, the emotion visible on another face in the background may imply social appraisal to the target person (Mumenthaler & Sander, 2012), and multiple emotional faces (i.e., a crowd of emotional faces) can provide us information about the state of the world or affective atmosphere of the group (Elias et al., 2017; Haberman et al., 2015).

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Indeed, we frequently encounter multiple faces at the same time during a social interaction ubiquitously (at a sports game stadium, in public transportation, at school, as well as in the office). Even when we perceive an individual face, we often pick it up among many faces. In that situation, the individual face we have picked up is the target face whose emotion we want to know, while the other faces serve as the context to judge the target face's emotion. For example, when we attend an office meeting, we may look at a particular person's face (e.g., the face of a boss) after providing an opinion on a critical topic. At that time, if the facial emotion of the boss is ambiguous, we can refer to the facial expressions of other people in the meeting for our judgment. This kind of situation occurs very frequently in everyday life because we are involved in a lot of group activities and interact with multiple people simultaneously. Nonetheless, there are few studies that examine the process of judging the emotion on an individual's face (i.e., target face) among other faces in the context (i.e., contextual faces) and the interaction between the target and contextual faces.

There exist several studies that have developed an experimental paradigm to perceive or judge the emotion of an individual face in the presence of other faces (Hess et al., 2016; Ito et al., 2013; Masuda et al., 2008, 2012). Most of them were cross-cultural studies focusing on cultural differences between individualism (Western culture) and collectivism (Asian Culture). For example, Masuda and his colleagues (Masuda et al., 2008) presented a cartoon of multiple faces to Japanese and European American students and asked them to rate the degree of the emotion of a target face presented with other faces. As hypothesized by Masuda et al. (2008) only the Japanese participants' rating was influenced by the emotion of others in the background. Moreover, the eye-tracking data showed that the Japanese students looked at the surrounding people for longer periods than did European American students (Masuda et al., 2008). In a subsequent study, Masuda and his colleagues (Masuda et al., 2012) replaced the cartoon stimuli with real photo stimuli and replicated similar results. Recently, Hess and her colleagues (Hess et al., 2016) explored the influence of the contextual facial emotions on the perception of the target person with two European participant groups whose cultural orientations were different (Greece: interdependent vs. Germany: independent). Here the influence of the contextual facial emotion was not dichotomous, but complex. In both groups, there was a significant influence of the contextual facial emotions on the perception of the target person's emotion, but the influence was differentiated by the cultural decoding rules. Greek participants (i.e., the interdependent culture) rated the sadness of the central person as *less* when surrounded by people within the group versus when the individual was alone. On the contrary, German participants (i.e., the independent culture) rated the happiness and anger of the target person more intensely when the target and the group showed the same emotion.

Probably, cultural background or cultural decoding rules are important factors for the processing of emotional information. However, when grasping a person's emotions, it is not just a cultural matter to consider the facial expressions of others around that person. As described earlier, we perceive an individual face from the array of multiple faces very frequently in daily life. However, we do not always consider the emotions of other faces when we perceive an individual face, such as in the street. Then what is an important factor for determining the influence of contextual facial emotions on the emotional judgment for the target face? In this research, we postulated the social relationship between the target and the others, such as Group Membership, to be a critical factor. Group-based emotions (Smith & Mackie, 2008; Yzerbyt et al., 2006) are the emotions that occur when individuals identify themselves as a specific social group and experience emotions on behalf of the social group (see also collective emotions; Niedenthal & Brauer, 2012). The categorization of social identity (Tajfel & Turner, 1986; Turner et al., 1987) plays a key role in group-based emotions. In line with this notion, Parkinson and colleagues (Parkinson et al., 2005) suggested several reasons why Group Membership can influence emotional convergence within groups: (a) more likely to be exposed to identical emotional events; (b) influencing each other's emotions via interactions; and (c) the sharing of norms and values (Parkinson et al., 2005, p. 87). For example, sports fans can experience happiness after watching their team win in a competitive match, and these group-based emotions can be strengthened by being in a collective or in physical proximity. In summary, many researchers have proposed that we often experience group-level emotions through the social events in which Group Membership plays a key role.

Empirical research on group-based emotions has demonstrated that people experience emotional convergence with other group members (Moons et al., 2009). When participants categorized themselves as a national group, an arbitrary minimal group, and gender groups, people converged toward their identified group's emotions for both positive (happiness) and negative (fear or anger) emotions. Further analysis revealed that high identifiers showed more emotional convergence than low identifiers, indicating that the reported group-based emotions were due to the categorization of social identity. In Weisbuch and Ambady (2008) experiments, participants were asked to judge affective valence (positive or negative) of affective scenes (e.g., IAPS) that were followed by the same-race (in-group) or other-race (out-group) facial expression. The results showed that the emotion of the same group members had a congruent priming effect, demonstrating that in-group member's emotions evoke similar emotions in perceivers. Hirt and colleagues (Hirt et al., 1992) found that people who strongly identified with their team experienced positive moods if they watched their team's success while they experienced negative moods when they watched their team's failure (Hirt et al., 1992). The mood convergence was greater in the high-identity participants and weaker in the low-identity participants. Taken together, previous research on group-based emotions suggested that people can experience emotional convergence with other group members. Based on these previous studies, we hypothesized that participants would perceive group emotions when the target person and contextual people are in the same group (shared Group Membership). Further, those group emotions would influence participants to judge the emotion of the target similar to the emotion of contextual faces.

In this study, we used a psychophysical method to quantitatively estimate the effects of contextual facial emotions on perceptual judgment. This method has been traditionally used in the sensation and perception research field. Recently, the successful application of the psychophysical method has been reported in several emotion studies (Hass et al., 2015; Lee et al., 2012; Lim & Pessoa, 2008). For example, in the experiment of Hass and colleagues (Hass et al., 2015), participants performed a two-alternative forced choice (2-AFC) task in which participants judged young and old facial expressions that were parametrically manipulated from neutral to happy (or angry) by increments

of 20% either "neutral" or "happy" (or "angry"). The results showed that the perceptual threshold for the happy expression was lower and the perceptual threshold for the angry expression was higher in the old face compared with the young face. Like the procedure of the previous study, we used the 2-AFC task in which participants judged the emotional expressions of the target face that were gradually morphed into one of two categories "happy versus sad" (Experiment 1) or "happy versus angry" (Experiment 2). After the experiment, we used a nonlinear psychometric curve-fitting procedure to estimate the perceptual decision threshold for a happy expression. Then, we compared the perceptual decision thresholds for each context condition through repeated-measures analysis of variances (ANOVAs) and *t* tests.

In Experiment 1, we primarily aimed to test whether the Group Membership (between the target person and contextual people) modulates the effect of contextual facial emotions on perceptual judgments for the target's emotional expressions. Participants were informed that two teams are competing with each other (European team wearing blue uniform vs. African team wearing yellow uniform). In a dual-task paradigm, the participants were asked (a) to judge the win/loss of the game by looking at the players' faces at the top, bottom, right, and left sides of the screen and (b) to decide the emotion category (happy or sad) of a target person who was presented at the center of the group of people. The target person could be a member of the same team in the background or a member of the other team. In Experiment 2, the Emotional Context was manipulated by a win/draw/loss of the game while contextual facial emotions were all happy, neutral, and angry. By including a neutral Emotional Context, we investigate the effects of the happy Emotional Context and the angry Emotional Context separately by comparing them to the neutral context, while replicating the modulation effects of the Group Membership on emotional judgments of Experiment 1.

Experiment 1

Method

Participants

Sixty-two college students were recruited from the Pusan National University. The participants were all Koreans (East Asian). They received $10 or course credits for participating in the experiments. To detect an effect of Cohen's $f = .15$ with 80% power in a one-way within-subjects ANOVA (one group, four levels, $\alpha = .05$), G*Power suggests we would need 62 participants (Faul et al., 2007). Before the experiment, all participants provided informed consent. The mean age of participants was 21.24 years (SD = 2.53 years; 30 females and 32 males).

Materials

The experimental stimuli were constructed as follows. Using FaceGen Modeller software Version 3.5 (www.facegen.com), 30 identities of facial stimuli (15 European male faces and 15 African male faces) were generated, and emotional expressions of each face identity were parametrically manipulated from extremely happy expression (closed mouth) to extremely sad expression (closed mouth) by increments of 20% (six levels: happy 0%/sad 100%, happy 20%/sad 80%, happy 40%/sad 60%, happy 60%/sad 40%, happy 80%/sad 20%, and happy 100%/sad 0%). A total of 180 faces (30 face identities × 6 emotional expression intensities) were generated. Using Photoshop, blue T-shirts were added to the European identities and yellow T-shirts were added to the African identities for easy recognition of the two different teams (see Figure 1A).[1] The size of all individual images was 150 × 150 pixels.

Regarding the target stimuli for the 2 AFC task of emotion category judgment, the emotional expression could be one of the six morphed emotions (from 100% happy to 100% sad in a 20% interval). For contextual stimuli, four 100% happy or four 100% sad faces randomly selected from the same team or different teams were presented at the upper, lower, left, and right sides of the screen. Regarding the game outcome judgment, in case of four 100% happy faces, it could be inferred that the team won (*Win* context), while in case of four 100% sad faces, it could be inferred that the team lost (*Loss* context). The target and others in the context were from the same team (e.g., target-yellow/context-yellow or target-blue/context-blue) for the same Group Membership condition and from different teams (e.g., target-yellow/context-blue or target-blue/context-yellow) for different Group Membership condition. The horizontal and vertical visual angles of the context stimuli were 13.6° and 12.1° and those of the target stimulus were 4.4° and 4.1°, respectively. The semimajor and semiminor axes were 235 pixels and 225 pixels, respectively, so the eccentricity was .29 (Figure 1C).

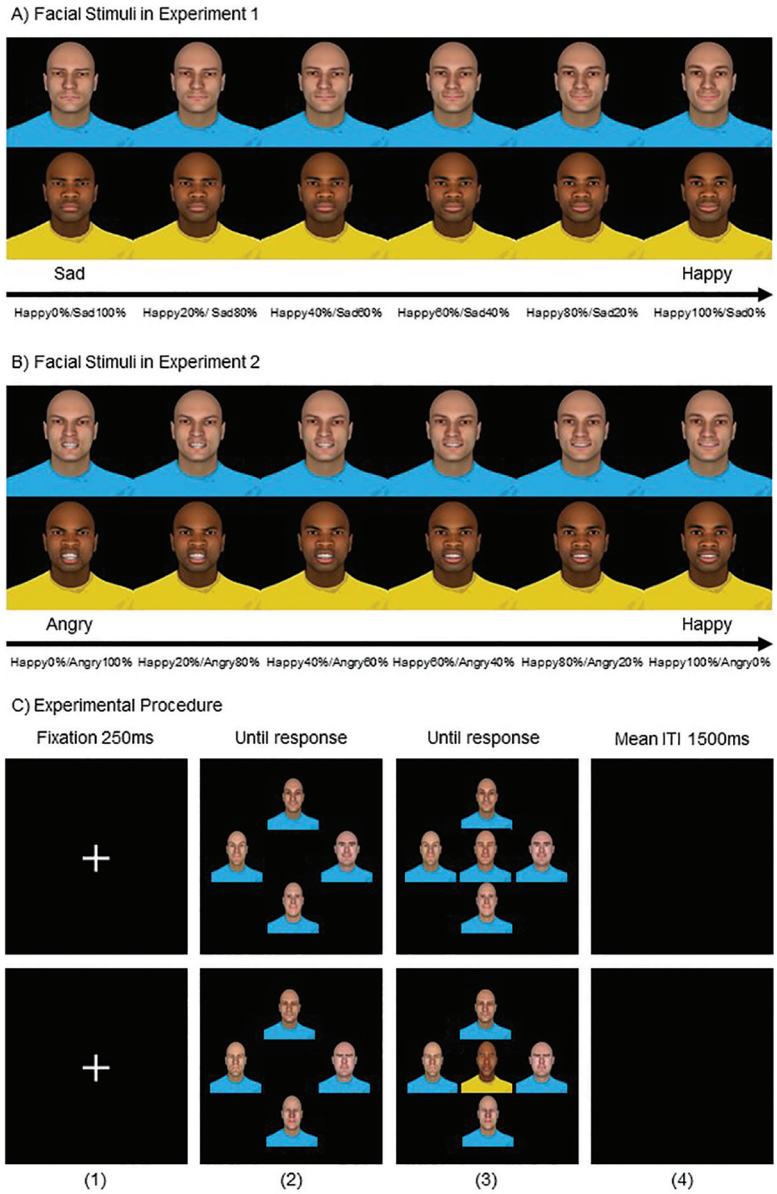
Procedure

The experiment was conducted using a computerized program built by E-prime 2 software. The participants were instructed to make a series of decisions regarding the facial expressions of the two teams of athletes competing with each other (European team wearing a blue uniform vs. African team wearing a yellow uniform). The experimental procedure is illustrated in Figure 1C. After a 250 ms fixation cross that signaled the start of the trial, four happy or four sad faces of a team were presented peripherally at the upper, lower, left, and right sides of the screen. The participants were first asked to make a win/loss judgment for the outcome of the game by looking at the emotion on the players' faces. For example, the participants could judge the game's result as "*Win*" for happy faces and "*Loss*" for sad faces by pressing the buttons "*A*" or "*S*." By doing this, they would consciously notice the emotional expressions of the four faces and infer the Emotional Context of the team. After the participants entered their responses for the first *Win*/*Loss* judgment task, a target face was presented at the center of the screen with four faces visible in the peripheral region of the screen. For the target face, the participants performed a 2-AFC (two-alternative forced choice task) task, judging the emotional category of the face (either happy or sad decisions) by pressing a "K" or "L" button.[2] After responding for the second task, a blank screen was displayed with an average intertrial-interval (ITI) of 1,500 ms.

[1] Because this experiment was conducted with South Korean participants, we used European and African faces as experimental stimuli for two competing sports teams to reduce any uncontrollable effect such as the same race effect if the race of participants is the same as that of stimulus.

[2] We did not explicitly instruct participants to consider or ignore the emotions of contextual people while judging the emotions of the target. The surrounding faces presented as contextual information that was not directly task-relevant.

Figure 1
Facial Stimuli and Procedure of Experiment 1



Note. (A) Facial stimuli in Experiment 1. (B) Facial stimuli in Experiment 2. (C) Experimental procedure with a dual-task paradigm. The participants first performed a win/loss judgment task of judging the outcome of a sports game based on the emotional expressions of the peripherally presented four faces (the second screen). Next, the participants performed an emotional judgment ("happy" or "sad") task for the target face (the third screen). The upper panel shows an example of the same group condition, while the bottom panel shows an example of the different group condition. Face stimuli were generated by FaceGen Modeller software version 3.5. This figure can be used freely without permission for publication. See the online article for the color version of this figure.

To help participants acclimate to our dual-task experimental paradigm, participants were given a short practice session before the main experiment. In practice trials, participants received feedback on the accuracy and response time of the first win/loss judgment task, but not for the second task because there was no correct answer. Participants completed a total of 720 trials in the dual-task paradigm—2 (Group Membership: same group vs. different group) × 2 (Emotional Context: win vs. loss) × 30 (Face Identities: 15 European faces with blue T-shirts and 15 African faces with yellow T-shirts) × 6 (Emotional Expression Intensity: happy

0%/sad 100%, happy 20%/sad 80%, happy 40%/sad 60%, happy 60%/sad 40%, happy 80%/sad 20%, and happy 100%/sad 0%). To reduce the cognitive burden of participants, the experimental trials were divided into 12 separate blocks (60 trials for each block). The Group Membership was manipulated in a blocked structure. The same group condition was presented in odd blocks (1, 3, 5, 7, 9, and 11) and the different group condition was presented in even blocks (2, 4, 6, 8, 10, and 12). The Emotional Context was fully randomized within each block (50% win context and 50% loss context). The response key button mapping ("A" or "S" key for the win/loss outcome judgment task) was counterbalanced between the first six blocks and the second six blocks. Before moving on to the later six blocks, participants performed the second practice session to learn the new response key allocation. Before the beginning of each block, participants were informed of the Group Membership condition and the response key allocation of each block. After completing all experimental trials, participants were debriefed about the experiment.

Psychometric Curve Fitting

We applied a nonlinear psychometric curve-fitting approach to the proportion data of happy (= 1 − sad proportion) judgments to six levels of emotional expression intensities of the target faces that were presented in the 2 (Group Membership) × 2 (Emotional Context) experimental conditions. The Cumulative Distribution Function (CDF) was fitted by using the Maximum Likelihood (ML) method. For each participant, we estimated the Point of Subjective Equality (PSE) parameters separately for four (2 × 2) experimental conditions. In psychophysics, the PSE is the stimulus intensity at which the response is half-maximal (also called the "perceptual decision threshold"). In this study, we set the *x*-axis as the intensity level of the happy expression of the target face (0 = happy 0%/sad 100%, .2 = happy 20%/sad 80%, .4 = happy 40%/sad 60%, .6 = happy 60%/sad 40%, .8 = happy 80%/sad 20%, and 1 = happy 100%/sad 0%) and the *y*-axis as the response proportion of happy decisions. Therefore, in this study, the estimated PSE is the happy expression intensity of the target face at which the proportion of happy is half-maximal. Note that the curve fitting can be done either with the happy expression proportion or sad expression proportion in our 2-AFC emotional judgment paradigm. The PSE for the sad expression can be easily calculated by 1-PSE for the happy expression. Three participants' data were excluded in our data analysis—one participant made random button responses and the other two participants predominantly pressed one response button throughout experimental trials, which produced nonsigmoid shaped data that prevented psychometric function fitting.

Results

Win/Loss Judgment Task for Emotional Context

The average accuracy of the win/loss judgment task was above 96% in all experimental manipulation conditions (blue team/win context, M = 96.90%, SD = 4.96%; blue team/loss context, M = 97.46%, SD = 3.64%; yellow team/win context, M = 96.54%, SD = 4.60%; yellow team/loss context, M = 96.25%, SD = 6.00%). For subsequent analyses of the PSE and RT data for emotional judgment of the target, we excluded the incorrect trials in the win/loss judgment task to rule out potential attention lapses in the subsequent task.

Emotional Judgment Task for Target Facial Stimuli

First, we performed a 2 (Group Membership) × 2 (Emotional Context) repeated-measures ANOVA on the PSE. Means, standard deviations, and confidence intervals of the PSE_{happy} in Experiment 1 are shown in Table 1. The ANOVA results revealed a significant interaction effect, $F(1, 58) = 14.13$, $p < .001$, $\eta_p^2 = .20$ (see Figure 2). The main effects of Group Membership, $F(1, 58) = 7.09$, $p < .05$, $\eta_p^2 = .11$, and Emotional Context, $F(1, 58) = 21.20$, $p < .001$, $\eta_p^2 = .27$, were significant.

To clarify the interaction effect, we first performed paired *t* tests between Emotional Context conditions in each Group Membership condition. The PSE_{happy} of the same group/win context (M = .34, SE = .015) was significantly lower than the PSE_{happy} of the same group/loss context (M = .43, SE = .017), $t(58) = 5.74$, $p < .001$, d = .75. This indicated that the participants required a relatively less happy expression to make a happy decision for the target face's emotion when the same group members in the background were all happy because they won. In other words, the participants required a relatively happier expression to make a happy decision for the target when the same group members in the context were all sad because they lost. However, the PSE_{happy} of the different group/win context (M = .40, SE = .019) was not significantly different from the PSE_{happy} of the different group/loss context (M = .41, SE = .016), $t(58) = .64$, $p = .53$, d = .08. This indicated that the Emotional Context of the surrounding faces belonging to different group members did not influence the judgment of the target face's emotion.

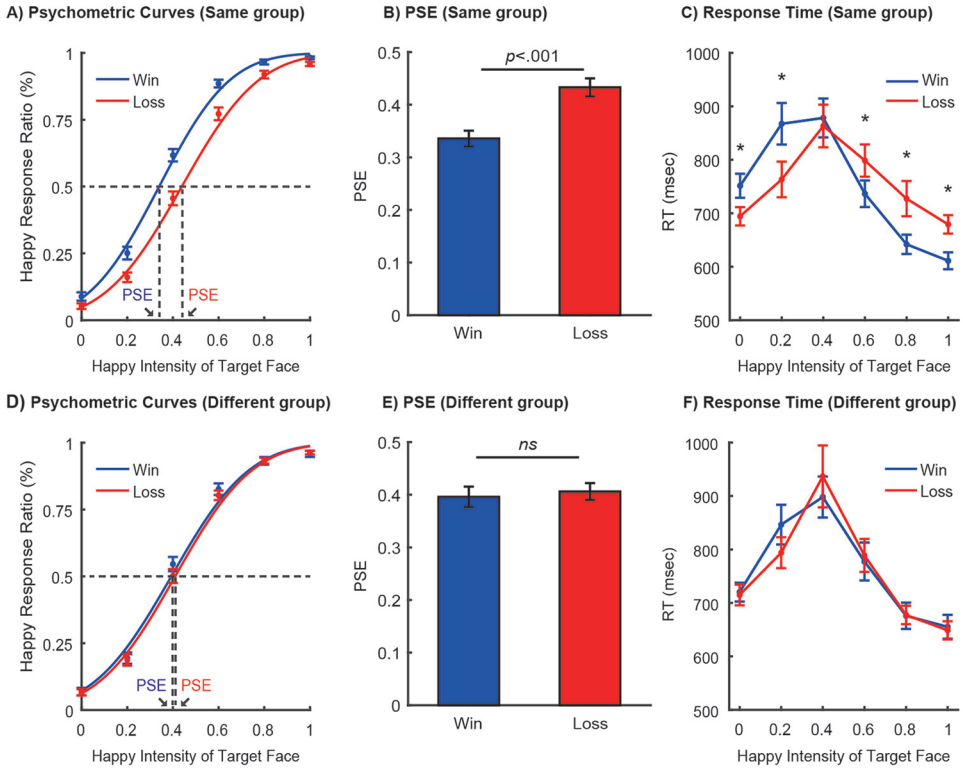
Next, to understand the interaction effect from a different direction, we conducted paired *t* tests between Group Membership conditions in each Emotional Context condition. The results showed that the PSE_{happy} of the same group/win context (M = .34, SE = .015) was significantly less than the PSE_{happy} of the different group/win context (M = .40, SE = .019), $t(58) = 4.15$, $p < .001$, d = .54. Also, the PSE_{happy} of the same group/loss context (M =

Table 1
Means, SDs, and 95% CI of the PSE in Experiment 1

	Same group		Different group	
Descriptive stats	Win	Loss	Win	Loss
M	.336	.433	.396	.406
SD	.116	.131	.149	.123
95% CI	[.306, .366]	[.400, .466]	[.358, .434]	[.375, .437]

Note. *SD* = standard deviation; CI = confidence interval; PSE = point of subjective equality.

Figure 2
Results of Experiment 1



Note. (A) Psychometric curves for the same group condition. (B) The estimated PSE_{happy} parameters for the same group condition. (C) Response times of emotional judgments in the same group condition as functions of Emotional Context and Emotional Expression Intensity of target faces. (D) Psychometric curves for the different group condition. (E) The estimated PSE_{happy} parameters for the different group condition. (F) Response times of emotional judgments in the different group condition as functions of Emotional Context and Emotional Expression Intensity of target faces. The figure legends, blue lines for win and red lines for loss, denote the Emotional Context of people in the background. The bootstrapping method was used to estimate the psychometric curves (5,000 bootstrapping at each target intensity, 30 samples at each bootstrap). Median response time was used for the central tendency index at the subject level. All error bars denote the standard error of the mean. PSE = point of subjective equality; *ns* = nonsignificant. See the online article for the color version of this figure.
* $p < .05$ (Bonferroni corrections).

.43, SE = .017) was significantly higher than the PSE_{happy} of the different group/loss context (M = .41, SE = .016), $t(58) = 2.29$, $p < .05$, $d = .30$. This showed that the participants required a relatively low happy expression intensity of the parametrically morphed target facial stimuli to make happy decisions in the same group/win context than in the different group/win context. Also, the participants required a relatively high happy expression intensity of the parametrically morphed target facial stimuli to make happy decisions in the same group/loss context than in the different group/loss context. Overall, our results show that the effect of the Emotional Context of the surrounding facial stimuli that reduced the perceptual decision threshold of the target-context congruent emotions occurred when the target and surrounding facial identities belonged to the same group, but not when the target and surrounding facial identities belonged to the different group. Even in identical Emotional Contexts, people judged the target emotion to be happier when the same team members won and sadder when the same team members lost.

Second, we performed a 2 (Group Membership) × 2 (Emotional Context) × 6 (Emotional Expression Intensity) repeated-measures ANOVA on response time (RT) data. The ANOVA results revealed a significant three-way interaction effect, $F(5, 290) = 5.86$, $p < .001$, $\eta_p^2 = .09$ (see Figure 2). The two-way interaction effect of Group Membership × Emotional Context was not significant, $F(1, 58) = .94$, $p = .34$, $\eta_p^2 = .02$, while the two-way interaction effects of Group Membership × Emotional Expression Intensity, $F(5, 290) = 3.15$, $p < .01$, $\eta_p^2 = .05$, and Emotional Context × Emotional Expression Intensity, $F(5, 290) = 8.59$, $p < .001$, $\eta_p^2 = .13$, were significant. The main effects of Group Membership, $F(1, 58) = 1.93$, $p = .17$, $\eta_p^2 = .03$, and Emotional Context, $F(1, 58) = .19$, $p = .67$, $\eta_p^2 = .003$, were not significant, while the main effect of Emotional Expression Intensity was significant, $F(5, 290) = 34.95$, $p < .001$, $\eta_p^2 = .38$. To clarify the three-way interaction effect, we subsequently performed a 2 (Emotional Context) × 6 (Emotional Expression Intensity) repeated-measures

ANOVA for each level of Group Membership. In the same group condition, there was a significant interaction effect, $F(5, 290) = 13.65$, $p < .001$, $\eta_p^2 = .19$. The main effect of Emotional Context was not significant, $F(1, 58) = .86$, $p = .36$, $\eta_p^2 = .02$, while the main effect of Emotional Expression Intensity was significant, $F(5, 290) = 29.07$, $p < .001$, $\eta_p^2 = .33$. In the different group condition, however, the interaction was not significant, $F(5, 290) = 1.83$, $p = .11$, $\eta_p^2 = .03$. The main effect of Emotional Context was not significant, $F(1, 58) = .11$, $p = .74$, $\eta_p^2 = .002$, while the main effect of Emotional Expression Intensity was significant, $F(5, 290) = 33.08$, $p < .001$, $\eta_p^2 = .36$. To further clarify the two-way interaction effect of the same group condition, we performed subsequent comparisons of Emotional Context for each level of Emotional Expression Intensity with Bonferroni corrections. When the happy expression intensities of the target face were 0% and 20%, the response times for emotional judgment of the target face were faster in the loss context than in the win context, $t(58) = 3.76$, $p < .05$, $d = .49$; $t(58) = 4.86$, $p < .05$, $d = .63$. When the happy expression intensity of the target face was 40%, the response time was not significantly different, $t(58) = .68$, $p > .05$, $d = .09$. When the happy expression intensities of the target face were 60%, 80%, and 100%, the response times for emotional judgment of the target face were faster in the win context than in the loss context, $t(58) = 3.17$, $p < .05$, $d = .41$; $t(58) = 3.15$, $p < .05$, $d = .41$; $t(58) = 5.06$, $p < .05$, $d = .66$. Our results show that in the same group condition, participants made emotional judgments more quickly for the target faces with relatively lower intensities of happy expression (= relatively higher intensities of sad expression) in the loss context than in the win context. On the other hand, they made emotional judgments more quickly for the target faces with a relatively higher happy expression (= relatively lower intensities of sad expression) in the win context than in the loss context. Similar comparisons in the different group conditions did not show any significant results.

Discussion

In Experiment 1, the results analyzed within Group Membership conditions show that the perceptual decision thresholds of the happy–sad emotional judgment of the target face were systematically shifted toward the social emotional context only when the surrounding face identities were the same group members. This means that when the target and surroundings face identities were the same group members that shared the same social identity, participants required relatively low levels of happy expression intensity of the target emotion to make happy decisions in the win context and relatively low levels of sad expression intensity of the target emotion to make sad decisions in the loss context. On the contrary, the perceptual decision thresholds did not differ for the different group condition. This means that when the target and surrounding face identities were different group members that did not share the same social identity, the Emotional Context represented by the emotion of the surrounding faces did not influence the judgment of the target emotion. The results analyzed across Group Membership conditions also showed that the perceptual thresholds of the target happy emotion were relatively low in the same group/win context than in the different group/win context and were relatively high in the same group/loss context than in the different group/loss context. This means that the identical emotional expressions of the target face in the identical Emotional Contexts were judged differently according to the Group Membership. Overall, our results emphasize that the effect of the Emotional Context on emotional judgment is systematically modulated by Group Membership. Also, the response time data convergently supported the results of the PSE data. For the same group condition, the response times of happy decisions for the target faces with higher levels of the happy expression were faster in the win context than in the loss context, whereas the response times of sad decisions for the target faces with higher levels of the sad expression were faster in the loss context than in the win context. Identical to the PSE data, the response time for the target face was not different for the different group condition. The results of Experiment 1 suggest that when people judge the emotions of the target person, they consider the social relationships between the target person and other persons, and the contextual effects of others' emotions on the judgment of the target emotion are modulated by the nature of social relationships.

However, while we could find the existence of the modulation effect of the social context on emotional judgments, it is still uncertain whether the observed relative differences were due to the effect of the win context, the loss context, or both, and whether this modulation effect can be generalized to other emotional expression domains beyond the happy–sad dimension. To answer these remaining questions, in Experiment 2, we additionally manipulated the draw context consisting of four neutral face identities and the loss context consisting of four angry faces (instead of the sad faces). Finally, in Experiment 2, we aimed to investigate the effects of the win context and loss context separately by comparing them to the draw context, while replicating the modulation effects of the social context on the emotional judgments of Experiment 1.

Experiment 2

Materials and Method

Participants

Fifty-nine college students were recruited from the Pusan National University. The participants were all Koreans (East-Asian). They received $10 for participating in the experiments. To compare the results between Experiment 1 and Experiment 2, we recruited a similar size of participants like Experiment 1. Before the experiment, all participants provided informed consent. The mean age of participants was 22.34 years (SD = 3.01 years; 31 females and 28 males).

Materials

Experimental manipulations of face identities and the color of uniforms were identical to those in Experiment 1. However, in Experiment 2, 30 identities of facial stimuli were parametrically manipulated from extremely happy face (opened mouth) to extremely angry face (opened mouth) by increments of 20% (six levels; happy 0%/angry 100%, happy 20%/angry 80%, happy 40%/angry 60%, happy 60%/angry 40%, happy 80%/angry 20%,

and happy 100%/angry 0%) by using the morph function of the FaceGen Modeller software (see Figure 1B).

The target face for emotional judgment (happy vs. angry) was presented in 2 (Group Membership: same group vs. different group) × 3 (Emotional Context: win vs. draw vs. loss) experimental conditions, which were systematically manipulated by the color of the uniforms and the emotional expressions of the surrounding four facial stimuli. The manipulation of Group Membership was identical to Experiment 1. For Emotional Context, four 100% happy faces, four 100% neutral faces, or four 100% angry faces were peripherally presented above, below, left, and right of the target face. The size of face stimuli, distance from the monitor, the resolution and size of the monitor, the horizontal and vertical visual angles of the stimuli, and the eccentricity were all identical to those in Experiment 1.

Procedure

The procedure of Experiment 2 was similar to that of Experiment 1. After a 250 ms fixation cross that alerted the start of a dual-task trial, four happy, four neutral, or four angry faces were presented peripherally. The uniform color was randomly selected (either yellow or blue). Based on the emotional expressions of the four contextual faces presented at the periphery, participants were asked to make win/draw/loss outcome judgments about their competitive sports game. For example, participants judged the outcome of a sports game as win for happy faces, as draw for neutral faces, and as loss for angry faces via an "A," "S," or "D" button press. After participants entered their responses for the first win/draw/loss judgment task, a target face was presented at the center of the screen. Then, participants performed the second 2-AFC task of judging the emotional expression (either happy or angry decisions) of the target face. In Experiment 2, to rule out potential attentional lapses in the dual-task trials, the second 2-AFC trials were presented only after participants made correct responses for the first outcome judgment task. If the participants' answers were incorrect, the trial was repeated. Thus, all win/draw/loss outcomes of the recorded dual-task trials were always 100% correct. The emotional expressions of the target face were randomly selected from the face sets that were parametrically varied from happy 0%/angry 100% to happy 100%/angry 0% in 20% intervals. After responding, a blank screen was displayed with an average ITI of 1,500 ms.

Participants completed a total of 1,080 trials in the dual-task paradigm—2 (Group Membership: same group vs. different group) × 3 (Emotional Context: win vs. draw vs. loss) × 30 (Face Identities: 15 European faces with blue T-shirts and 15 African faces with yellow T-shirts) × 6 (Emotional Expression Intensity: happy 0%/angry 100%, happy 20%/angry 80%, happy 40%/angry 60%, happy 60%/angry 40%, happy 80%/angry 20%, and happy 100%/angry 0%). To reduce the cognitive burden of participants, the experimental trials were divided into 18 separate blocks (60 trials for each block). The Group Membership was manipulated in a blocked structure. The same group condition was presented in odd blocks (1, 3, 5, 7, 9, 11, 13, 15, and 17) and the different group condition was presented in even blocks (2, 4, 6, 8, 10, 12, 14, 16, and 18). The Emotional Context was fully randomized within each block (1/3 win context, 1/3 draw context, and 1/3 loss context). The response key button mapping ("K" or "L" key for the emotional judgment task) was counterbalanced across participants. This modification was implemented to minimize potential behavior errors due to the new button mapping learning within subjects. Before the beginning of each block, participants were informed of the Group Membership context and the response key allocation of each block. After completing all experimental trials, participants were debriefed about the experiment.

Psychometric Curve Fitting

We applied a nonlinear psychometric curve-fitting approach to the proportion data of happy (= 1 − angry proportion) judgments to six levels of emotional expression intensities of the target faces that were presented in the 2 (Group Membership) × 3 (Emotional Context) experimental conditions. The CDF was fitted by using the ML method. For each participant, we estimated the PSE parameters separately for six (2 × 3) experimental conditions. In this study, we set the *x*-axis as the intensity level of happy expression intensity of the target face (0 = happy 0%/angry 100%, .2 = happy 20%/angry 80%, .4 = happy 40%/angry 60%, .6 = happy 60%/angry 40%, .8 = happy 80%/angry 20%, and 1 = happy 100%/angry 0%) and the *y*-axis as the response proportion of happy decisions. Note that the curve fitting can be done either with the happy expression proportion or the angry expression proportion in our 2-AFC emotional judgment paradigm. The PSE for the angry expression can be easily calculated by 1 - PSE for the happy expression. Four participants' data were excluded in our data analysis; one participant's data had a technical problem with data collection and the other three participants predominantly pressed one response button throughout the experimental trials, which produced nonsigmoid shaped data that prevent psychometric function fitting.

Results

Emotional Judgment Task for Target Facial Stimuli

First, we performed a 2 (Group Membership) × 3 (Emotional Context) repeated-measures ANOVA on the PSE. Means, standard deviations, and confidence intervals of the PSE in Experiment 2 are shown in Table 2. The ANOVA results revealed a significant interaction effect, $F(2, 108) = 5.44$, $p < .01$, $\eta_p^2 = .09$ (see Figure 3). The main effects of Group Membership, $F(1, 54) = 5.65$, $p < .05$, $\eta_p^2 = .10$, and Emotional Context, $F(2, 108) = 5.71$, $p < .01$, $\eta_p^2 = .10$, were significant.

To clarify the interaction effect, we first performed paired *t* tests between Emotional Context conditions in each Group Membership condition. The PSE_{happy} of the same group/win context ($M = .39$, $SE = .018$) was significantly lower than the PSE_{happy} of the same group/draw context ($M = .42$, $SE = .017$), $t(54) = 2.49$, $p < .05$, $d = .34$. Further, the PSE_{happy} of the same group/loss context ($M = .46$, $SE = .019$) was significantly higher than the PSE_{happy} of the same group/draw context ($M = .42$, $SE = .017$), $t(54) = 2.40$, $p < .05$, $d = .32$. This indicated that the participants required relatively low happy expression intensity and relatively high angry expression intensity of the parametrically morphed target facial stimuli to make happy decisions and angry decisions, respectively, in the win context compared with the draw context in the same group condition. Similarly, the participants required relatively high

Table 2
Means, SDs, and 95% CI of the PSE in Experiment 2

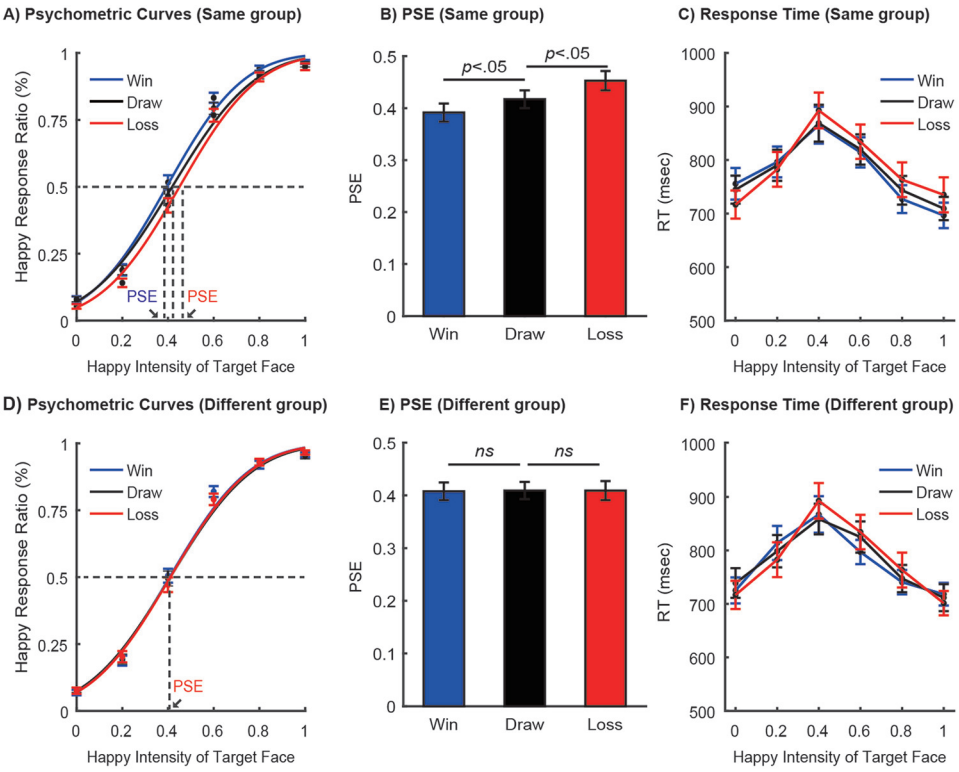
	Same group			Different group		
Descriptive stats	Win	Draw	Loss	Win	Draw	Loss
M	.393	.418	.455	.409	.411	.409
SD	.130	.129	.140	.126	.123	.136
95% CI	[.359, .427]	[.384, .452]	[.418, .492]	[.376, .442]	[.378, .444]	[.373, .445]

Note. *SD* = standard deviation; CI = confidence interval; PSE = point of subjective equality.

happy expression intensity and relatively low angry expression intensity of the parametrically morphed target facial stimuli to make happy decisions and angry decisions, respectively, in the loss context compared with the draw context in the same group condition. However, there was no significant PSE_{happy} difference between the different group/win context (M = .41, SE = .017) and the different group/draw context (M = .41, SE = .017), $t(54)$ = .17, p = .87, d = .02 as well as between the different group/loss context (M = .41, SE = .018) and the different group/draw context (M = .41, SE = .017), $t(54)$ = .17, p = .87, d = .02. This shows that the Emotional Context of the surrounding faces did not influence the perceptual decision threshold in the different group condition.

Second, to understand the interaction effect from a different direction, we conducted paired t tests between Group Membership conditions in each Emotional Context condition. Because there was a slight difference between the average mean of the PSE_{happy} of the same group/draw context and the PSE_{happy} of the different group/draw context, we computed difference scores. We computed

Figure 3
Results of Experiment 2



Note. (A) Psychometric curves for the same group condition. (B) The estimated PSE_{happy} parameters for the same group condition. (C) Response times of emotional judgments in the same group condition as functions of Emotional Context and Emotional Expression Intensity of target faces. (D) Psychometric curves for the different group condition. (E) The estimated PSE_{happy} parameters for the different group condition. (F) Response times of emotional judgments in the different group condition as functions of Emotional Context and Emotional Expression Intensity of target faces. The figure legends, blue lines for win and red lines for loss, denote the Emotional Context of people in the background. The bootstrapping method was used to estimate psychometric curves (5,000 bootstrapping at each target intensity, 30 samples at each bootstrap). Median response time was used for the central tendency index at the subject level. All error bars denote the standard error of the mean. PSE = point of subjective equality; *ns* = nonsignificant. See the online article for the color version of this figure.

the PSE_{happy} of SW-SD score and the PSE_{happy} of SL-SD score by subtracting the PSE_{happy} of the same group/draw context from the PSE_{happy} of the same group/win context and the PSE_{happy} of the same group/draw context from the PSE_{happy} of the same group/loss context, respectively. Similarly, DW-DD score and DL-DD score were computed by subtracting the PSE_{happy} of the different group/draw context from the PSE_{happy} of the different group/win context and subtracting the PSE_{happy} of the different group/draw context from the PSE_{happy} of the different group/loss context, respectively. The results showed that there was a difference between the PSE_{happy} of SW-SD ($M = -.026$, $SE = .010$) and the PSE_{happy} of DW-DD ($M = -.001$, $SE = .009$), $t(54) = 1.88$, $p = .065$, $d = .25$. Also, the difference between the PSE_{happy} of SL-SD ($M = .037$, $SE = .015$) and the PSE_{happy} of DL-DD ($M = -.001$, $SE = .008$) was significant, $t(54) = 2.27$, $p < .05$, $d = .31$. These showed that participants required a relatively low happy expression intensity of the parametrically morphed target facial stimuli to make happy decisions in the same group/win context than in the different group/win context. Also, they required a relatively high happy expression intensity of the parametrically morphed target facial stimuli to make happy decisions in the same group/loss context than in the different group/loss context. Overall, our results show that compared with the neural context, the target-context congruent emotions of the surrounding facial stimuli systematically reduced the perceptual decision threshold only when the target and surrounding facial identities belonged to the same group, but not to a different group. Even in identical Emotional Contexts, people judged the target emotion to be happy when the same team members won and angry when the same team members lost.

Next, we performed a 2 (Group Membership) × 3 (Emotional Context) × 6 (Emotional Expression Intensity) repeated-measures ANOVA on RT data. The ANOVA results revealed a significant three-way interaction effect, $F(10, 540) = 2.62$, $p < .01$, $\eta_p^2 = .05$ (see Figure 2). The two-way interaction effects of Group Membership × Emotional Context, $F(2, 108) = 2.87$, $p = .06$, $\eta_p^2 = .05$, and Emotional Context × Emotional Expression Intensity were not significant, $F(10, 540) = .71$, $p = .71$, $\eta_p^2 = .01$. The two-way interaction effect of Group Membership × Emotional Expression Intensity was significant, $F(5, 270) = 3.34$, $p < .01$, $\eta_p^2 = .06$. The main effects of Group Membership, $F(1, 54) = 1.13$, $p = .29$, $\eta_p^2 = .02$, and Emotional Context, $F(2, 108) = .14$, $p = .87$, $\eta_p^2 = .002$, were not significant. The main effect of Emotional Expression Intensity was significant, $F(5, 270) = 40.66$, $p < .001$, $\eta_p^2 = .43$. To clarify this three-way interaction effect, we subsequently performed a 3 (Emotional Context) × 6 (Emotional Expression Intensity) repeated-measures ANOVAs for each level of Group Membership. In the same group condition, the ANOVA results revealed a marginal interaction effect, $F(10, 540) = 1.82$, $p = .054$, $\eta_p^2 = .03$. The main effect of the Emotional Context was not significant, $F(2, 108) = .90$, $p = .41$, $\eta_p^2 = .02$, while the main effect of the Emotional Expression Intensity was significant, $F(5, 270) = 39.36$, $p < .001$, $\eta_p^2 = .42$. In the different group condition, there was no significant interaction effect, $F(10, 540) = 1.43$, $p = .17$, $\eta_p^2 = .03$. The main effect of the Emotional Context was not significant, $F(2, 108) = 1.02$, $p = .37$, $\eta_p^2 = .02$, while main effect of the Emotional Expression Intensity was significant, $F(5, 270) = 31.28$, $p < .001$, $\eta_p^2 = .37$. To check the marginal interaction effect of the same group condition, we performed subsequent comparisons of the Emotional Context (win vs. draw, loss vs. draw) for each level of Emotional Expression Intensity with Bonferroni corrections. The results showed that there was no significant difference across all intensities of the target face, all $p > .05$.

Discussion

The results of Experiment 2 successfully replicate the findings of Experiment 1 and convergently demonstrate that the perceptual decision thresholds of the happy–angry emotional judgment of the target face were systematically shifted toward the social emotional context only when the surrounding face identities were the same group members. This means that when the target and surroundings face identities were the same group members that share the same social identity, participants required relatively low levels of happy expression intensity of the target emotion to make happy decisions in the win context compared with the draw context, and relatively high levels of happy expression intensity of the target emotion to make happy decisions in the loss context compared with the draw context. On the contrary, the perceptual decision thresholds of emotional judgments did not differ for the different group condition. This means that when the target and surrounding face identities were different group members that did not share the same social identity, the Emotional Context represented by the emotion of the surrounding faces did not influence the judgment of the target emotion. Also, the results analyzed across Group Membership conditions showed that the perceptual thresholds of the target's happy emotion were relatively low in the same group/win context than in the different group/win context. Further, the perceptual thresholds of the target's happy emotion were relatively high in the same group/loss context than in the different group/loss context. This means that the identical emotional expressions of the target face in the identical Emotional Contexts were judged differently according to the Group Membership. Similar to Experiment 1, the results of Experiment 2 suggest that when people judge the emotions of the target person, they consider the social relationships between the target person and other persons, and the contextual effects of others' emotions on the judgment of the target emotion are modulated by the nature of social relationships. Additionally, the results of Experiment 2 confirm that the effects of the win context and angry context were significant separately while replicating the modulation effects of the social context on emotional judgments of Experiment 1.

The RT data of Experiment 2 generally showed similar patterns as the RT data of Experiment 1. Group Membership modulated the interaction effect of Emotional Context by Emotional Expression Intensity for the same group condition, but it did not modulate the interaction effect for the different group condition. However, there were no significant differences between the Emotional Contexts (win vs. draw, loss vs. draw). In Experiment 2, we modified an experimental procedure to rule out potential attention lapses in the dual-task trials; the second 2-AFC trials were presented only after the participants provided correct responses for the first outcome judgment task. This experimental modification might encourage participants to respond more accurately than faster. Further research needs to examine the effects of Group Membership on the response time of the judgment of the target face's

emotion. Overall, our results of the PSE and the RT data emphasize that the effect of Emotional Context on emotional judgment is systematically modulated by Group Membership.

General Discussion

In the present study, we explored the influence of other emotional faces in the background on the emotional judgment for the target face using a psychophysical method. Particularly, we were interested in the Group Membership between others in the background and the target person. We hypothesized that the emotion of contextual faces influences the emotional judgment of the target face only when the contextual people and the target person were the same group members. To test this hypothesis, the Group Membership of the target person and others in the context was visually manipulated by the uniform color and the ethnicity of the group. And, the Emotional Context was manipulated by the win/loss (in Experiment 1) or win/draw/loss (in Experiment 2). Results of Experiments 1 and 2 supported our hypothesis. That is, the emotional judgment for the target face was not significantly influenced by the emotion of others in the context when the target and others in the background were different team members, but significantly modulated when the other people in the background were the same team members.

In Experiment 1, the decision threshold for the emotion of the target face moved toward a less happy face when other members in the context were all happy because they won. When other members in the context were all sad because they lost, the decision threshold for the emotion of the target in the same team moved toward a less sad face. This means participants require relatively low levels of happy expression intensity of the target emotion to make happy decisions in the win context and relatively low levels of sad expression intensity of the target emotion to make sad decisions in the loss context when the target and surroundings face identities were the same group members that shared the same social identity. In Experiment 2, participants required relatively low levels of happy expression intensity of the target emotion to make happy decisions in the win context compared with the draw context and relatively high levels of happy expression intensity of the target emotion to make happy decisions in the loss context compared with the draw context when the target and surroundings face identities were the same group members. On the contrary, the perceptual decision thresholds of emotional judgments did not differ for the different group conditions in both Experiments 1 and 2. Experiments 1 and 2 convergently showed that the identical emotional expressions of the target face in the identical Emotional Contexts were judged differently according to the Group Membership. For happy decisions, people required relatively low levels of happy expression intensity in the same group/win context than in the different group/win context and relatively high levels of happy expression intensity in the same group/loss context than in the different group/loss context. Overall, our results clearly demonstrate the modulation effect of Group Membership and Emotional Context on the judgment of the target person's emotion.

In addition to the PSE results, our RT data also showed a similar modulation effect of Group Membership and Emotional Context on the emotional face processing. In case of both Experiments 1 and 2, the RT data in the same group condition showed that Group Membership modulated the interaction effect of Emotional Context by Emotional Expression Intensity, but this modulation effect was not observed in the different group condition. In Experiment 1, the participants judged the target faces' emotions more quickly with relatively higher intensities of happy expression (= relatively lower intensities of sad expression) in the win context than in the loss context. On the other hand, they judged the target faces' emotion more quickly with relatively lower intensities of happy expression (= relatively higher intensities of sad expression) in the loss context than in the win context. On the contrary, similar comparisons in the different group conditions did not show any significant results. The RT data of Experiment 2 generally showed similar patterns as the RT data of Experiment 1, but there were no significant differences between the Emotional Contexts (win vs. draw, loss vs. draw). Overall, our RT data showed congruency effects, meaning that people judged the emotions of the target face more quickly when they were similar to the emotions of contextual faces, and the RT data convergently supported the modulation effects of Group Membership on emotional perception of facial expressions with our PSE data.

The present research supports the arguments that facial emotion perception is not processed in an isolated or de-contextualized manner, but is influenced by many contextual factors (Barrett et al., 2011; Hassin et al., 2013; Wieser & Brosch, 2012). Moreover, neuroimaging research has shown that the visual processing of emotional faces is influenced by top-down control mechanisms (Amting et al., 2009; Pessoa et al., 2002; Sussman et al., 2017). For example, Amting et al. (2009) reported neuronal and behavioral modulation effects on emotional face processing by the congruency between the target facial emotion and the peripheral contextual facial emotion. Recently, Sussman et al. (2017) reported that prior threat-related cues enhanced the sensitivity and speed of subsequent threat-related perceptual decision-making. The prior cue-related late positive potential (LPP) and superior temporal sulcus (STS) activity predicted subsequent improved perceptual decisions for threatening faces. Based on these reported neuronal mechanisms, the contextual modulation effect in the same group condition in the present results might be interpreted as the enhancement of the neural activation of subsequent target facial emotions through top-down attentional networks by contextual facial emotions from the same group (i.e., target-context congruent condition), and further shifting of the perceptual decision threshold of the target emotions.

The most interesting finding in the present study is that the Group Membership's information process produced completely different results. When the Group Membership of the target and the contextual people was the same team, people actively used the emotions of contextual faces to judge the target emotion. On the contrary, when the Group Membership was different, the target emotion was judged without considering the emotions of contextual faces. In other words, people can flexibly alter the emotional relevance between the target person and contextual people according to the Group Membership. As introduced, when judging the emotions of the boss at an office meeting, the emotions of coworkers can be used as useful contextual information. However, when judging the emotions of a friend we met on the street, we do not use the emotions of an unknown person walking on the road as contextual information. Our results suggest that the emotions of contextual faces presented around the target person do not always become the context of the judgments of the target emotions. Group

Membership, which is a strong cue to the social relationship between the target person and contextual people, can alter the meaning of the emotions of contextual faces; thus, it can lead to different judgments for the identical emotional expression of the target person. The present study is consistent with previous studies on group-based emotions in which people who share Group Membership can experience similar emotions (Niedenthal & Brauer, 2012; Parkinson et al., 2005).

The present study differs from previous studies of group-based emotions because we did not manipulate participants' Group Membership, but instead manipulated the Group Membership between the target person and contextual people. As described above, group-based emotions are defined as emotions that occur when individuals categorize themselves as a specific social group and experience emotions on behalf of the social group (Smith & Mackie, 2008; Yzerbyt et al., 2006). Moons et al. (2009) and Hirt et al. (1992) reported that when participants categorize themselves into a specific group, they can converge with the emotions of the identified group. Also, Weisbuch and Ambady (2008) reported that the participants' emotional responses to the in-group members and those in the out-group members were different. This implies that the majority of previous studies on group-based emotions focused on the self-categorization of the participants. However, we hypothesized that the effects of Group Membership on emotional processes are not restricted to the identity of the participant and that emotional convergence between people with the same Group Membership can also be applied to emotion perception. This study suggests that the membership of a group of people who are completely unrelated to an individual can be used as an important cue in emotion perception, similar to our own Group Membership. In future research, it is necessary to investigate the differences between self-categorization, in which individuals categorize themselves into a specific group, and the use of Group Membership information of others who are not related to the individual.

Our results are not the first demonstration of the influence of contextual facial emotions on the perception of the target facial emotion. As previously introduced, several cross-cultural studies already showed the influence of other faces on the perception or judgment for the target face emotion (Hess et al., 2016; Ito et al., 2013; Masuda et al., 2008, 2012). Masuda and his colleagues showed that people of interdependent cultures, such as the Japanese, considered the emotion of other people in the background but people of independent cultures, such as Americans, did not. Hess and her colleagues (Hess et al., 2016) expanded such independent-interdependent cultural comparison with Europeans populations (German vs. Greek). The results were quite different from those of previous studies that compared European American and the Japanese. The results of Hess et al. (2016) were not dichotomous, and did not show a difference in the degree of consideration of emotion of other people in the context. That is, Greek people (interdependent culture) did not always consider the emotion of others in the context more than German (independent culture), yet, the German group did consider the emotion of contextual faces in some situations. The important factors included the social situation, and the cultural display rules of emotion according to the situation. Greek participants rated the sadness of the target person less when the other persons were sad together. On the contrary, German participants rated the happiness and the anger of the target person more when the other persons showed the same emotion. Thus, Hess and her colleagues argued that the interpretation of one's facial emotion depends on the knowledge of social situations, which may be culturally differentiated (Hess & Hareli, 2015; Hess et al., 2016).

Moreover, there is one important difference between Hess and her colleagues (Hess et al., 2016) and Masuda and his colleagues' studies in terms of experimental materials. In Masuda and his colleague's studies, they collaged several individual cartoons (Masuda et al., 2008) or photos (Masuda et al., 2012) to make a whole picture with the target person and contextual people. For these pictures, they did not manipulate any social relationship between the target person and contextual people and did not mention at all the relationship between them. On the contrary, in Hess et al.'s study, the experimental material was assumed as a picture of three friends sitting together and then manipulated the facial expressions of the center and others. Thus, participants might easily infer a sociodynamic emotional process among socially related people, which can be also different across cultures. Therefore, the differential experimental manipulation of materials between Hess et al. (2016) and Masuda et al. (2008, 2012) might cause the different results from those studies. Compared with those studies, we experimentally manipulated the social relationships between the target person and contextual people in the materials and revealed the effect of the social relationship on the judgment of the emotion of the target among contextual faces.

The current study was conducted with Korean participants in South Korea, whose culture has been traditionally categorized as East-Asian collectivism. Thus, the collective cultural background of participants might have resulted in the observed strong influence of emotion of the contextual faces on the judgment of the emotion of the target when they were the same team. Nonetheless, when the target person and contextual people were different teams (actually, a competitive relationship), the contextual influence was not observed, even though participants were Korean, with an inferred collective culture. These results were different from those of Masuda and his colleague's studies that did not manipulate the social relationship between the target person and contextual people (Masuda et al., 2008, 2012). Therefore, we argue that the social relationship between the target person and contextual people is an important factor for the judgment or inference of one's emotion among people, even though the influence of the social relationship can be culturally differentiated. The cultural difference in the influence of the social relationship should be investigated in a future study.

Although there were no contextual modulation effects in the different group condition, one might expect a similar opposite effect (compared with the same group condition) because the win/loss of one team is related to the loss/win of the other team. There were several possible reasons why no modulation effect was found in the different group condition in this study. First, according to previous studies on Group Membership and emotions, the effects of Group Membership on emotions are modulated by one's levels of social identity. For example, Hirt et al. (1992) reported that people who had high fanship with their team experienced positive moods when they watched their team's success and negative moods when they watched their team's failure. But, importantly, people with low fanship did not show such Group Membership effects. It implies that we are not significantly affected by information that is not closely related to our identity, whereas we are strongly

influenced by information that is highly related to our identity. Therefore, if the target-context membership is more important to the participants' social identity (e.g., English fans in England vs. Brazil match), we might expect an opposite effect in the different group conditions. Our experimental Group Membership manipulation (i.e., target-context relationships do not relate to participants' social identity or ethnicity) might not have been strong enough to provide an opposite effect. Second, the two teams had competitive relationships, not antagonistic relationships. Generally speaking, in sports, the victory of one team is equivalent to the defeat of the other team. But, occasionally we can celebrate our opponent's win (e.g., good sportsmanship or not-critical personal relevance). It means that in a competitive relationship, the emotional responses for two sports teams might not necessarily be opposite. On the other hand, if the two teams are antagonistic to each other, the win of one team is directly related to the sadness/anger of the other team. This means that the emotional responses between different group members can vary depending on the type of relationship. In future research, it is necessary to examine the differences between competitive and antagonistic relationships.

There are several limitations in the current study. Because we manipulated the Group Membership by two visual features of the stimuli (i.e., the color of the uniform and the ethnicity of the face), the difference in Group Membership conditions was inevitably accompanied by visual information differences between conditions; that is, the same group condition consisted of the target face and contextual faces from the same ethnic group wearing the same uniform, but the uniform color and ethnicity of the target was different from that of contextual faces in the different group conditions. Therefore, the same group condition was visually homogeneous, but the different group conditions were heterogeneous. As it was not the main interest of this study, we cannot determine the influence of individual visual feature differences on the current results. Future studies are needed to clarify the effects of visual information. Another limitation of this study is that the facial stimuli have not been formally validated by the Korean population. We created happy, sad, and angry faces with a default option of the Facegen software (www.facegen.com). Similar facial stimuli created by the same software were used without problems with Asian participants in other published studies (e.g., Mei et al., 2019; Wang et al., 2016). Although our participants did not report any problem in recognizing the emotional categories of the current stimuli, a validation procedure is needed in a future study.

We used a perceptual decision-making procedure to measure perceptual changes in emotional stimuli using the contextual information. Participants' perceptual judgments could be made by the inference based on the sensory (visual) information. Therefore, the perceptual decision-making process includes a top-down inference process on the bottom-up sensory information. Indeed, this theoretical position is consistent with the theory of constructed emotion for emotional perception as well as other fields (Barrett, 2017; O'Callaghan et al., 2017). Therefore, our results can be understood as a product of the perceptual decision-making process based on the target sensory information and the contextual information.

Social relationships can shape our emotional lives (Parkinson et al., 2005; van Kleef & Fischer, 2016). Although the importance of the social aspects of emotions is prominent, little is known about the underlying psychological mechanisms between emotion and social relationships. The present study suggests that social Group Membership is a critical social cue that constructs the perception of emotional convergence and divergence. Sharing joy increases joy in the same group members, but not when individuals are considered different group members. Overall, the findings of the present study shed a new light on emotion perception in a social context and suggest that the Group Membership of target person and contextual people is one of the underlying mechanisms that influence the effect of contextual facial emotions on the emotional judgment of the target face.

References

Amting, J. M., Miller, J. E., Chow, M., & Mitchell, D. G. (2009). Getting mixed messages: The impact of conflicting social signals on the brain's target emotional response. *NeuroImage*, *47*(4), 1950–1959. https://doi.org/10.1016/j.neuroimage.2009.05.011

Barrett, L. F. (2017). The theory of constructed emotion: An active inference account of interoception and categorization. *Social Cognitive and Affective Neuroscience*, *12*(1), 1–23. https://doi.org/10.1093/scan/nsx060

Barrett, L. F., Mesquita, B., & Gendron, M. (2011). Context in emotion perception. *Current Directions in Psychological Science*, *20*(5), 286–290. https://doi.org/10.1177/0963721411422522

Elias, E., Dyer, M., & Sweeny, T. D. (2017). Ensemble perception of dynamic emotional groups. *Psychological Science*, *28*(2), 193–203. https://doi.org/10.1177/0956797616678188

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191. https://doi.org/10.3758/BF03193146

Haberman, J., Lee, P., & Whitney, D. (2015). Mixed emotions: Sensitivity to facial variance in a crowd of faces. *Journal of Vision*, *15*(4), 16. https://doi.org/10.1167/15.4.16

Halberstadt, J. B., & Niedenthal, P. M. (2001). Effects of emotion concepts on perceptual memory for emotional expressions. *Journal of Personality and Social Psychology*, *81*(4), 587–598. https://doi.org/10.1037/0022-3514.81.4.587

Hass, N. C., Schneider, E. J., & Lim, S. L. (2015). Emotional expressions of old faces are perceived as more positive and less negative than young faces in young adults. *Frontiers in Psychology*, *6*, 1276. https://doi.org/10.3389/fpsyg.2015.01276

Hassin, R. R., Aviezer, H., & Bentin, S. (2013). Inherently ambiguous: Facial expressions of emotions, in context. *Emotion Review*, *5*(1), 60–65. https://doi.org/10.1177/1754073912451331

Hess, U., Blaison, C., & Kafetsios, K. (2016). Judging facial emotion expressions in context: The influence of culture and self-construal orientation. *Journal of Nonverbal Behavior*, *40*(1), 55–64. https://doi.org/10.1007/s10919-015-0223-7

Hess, U., & Hareli, S. (2015). The role of social context for the interpretation of emotional facial expressions. In M. K. Mandal & A. Awasthi (Eds.), *Understanding Facial Expressions in Communication* (pp. 119–141). Springer. https://doi.org/10.1007/978-81-322-1934-7_7

Hirt, E. R., Zillmann, D., Erickson, G. A., & Kennedy, C. (1992). Costs and benefits of allegiance: Changes in fans' self-ascribed competencies after team victory versus defeat. *Journal of Personality and Social Psychology*, *63*(5), 724–738. https://doi.org/10.1037/0022-3514.63.5.724

Ito, K., Masuda, T., & Li, L. M. (2013). Agency and facial emotion judgment in context. *Personality and Social Psychology Bulletin*, *39*(6), 763–776. https://doi.org/10.1177/0146167213481387

Lambert, N. M., Gwinn, A. M., Baumeister, R. F., Strachman, A., Washburn, I. J., Gable, S. L., & Fincham, F. D. (2013). A boost of positive affect: The perks of sharing positive experiences. *Journal of Social*

and Personal Relationships, *30*(1), 24–43. https://doi.org/10.1177/0265407512449400

Lee, T. H., Choi, J. S., & Cho, Y. S. (2012). Context modulation of facial emotion perception differed by individual difference. *PLoS ONE*, *7*(3), e32987. https://doi.org/10.1371/journal.pone.0032987

Lim, S. L., & Pessoa, L. (2008). Affective learning increases sensitivity to graded emotional faces. *Emotion*, *8*(1), 96–103. https://doi.org/10.1037/1528-3542.8.1.96

Masuda, T., Ellsworth, P. C., Mesquita, B., Leu, J., Tanida, S., & Van de Veerdonk, E. (2008). Placing the face in context: Cultural differences in the perception of facial emotion. *Journal of Personality and Social Psychology*, *94*(3), 365–381. https://doi.org/10.1037/0022-3514.94.3.365

Masuda, T., Wang, H., Ishii, K., & Ito, K. (2012). Do surrounding figures' emotions affect judgment of the target figure's emotion? Comparing the eye-movement patterns of European Canadians, Asian Canadians, Asian international students, and Japanese. *Frontiers in Integrative Neuroscience*, *6*, 72. https://doi.org/10.3389/fnint.2012.00072

Mei, G., Chen, S., & Dong, B. (2019). Working memory maintenance modulates serial dependence effects of perceived emotional expression. *Frontiers in Psychology*, *10*, 1610. https://doi.org/10.3389/fpsyg.2019.01610

Moons, W. G., Leonard, D. J., Mackie, D. M., & Smith, E. R. (2009). I feel our pain: Antecedents and consequences of emotional self-stereotyping. *Journal of Experimental Social Psychology*, *45*(4), 760–769. https://doi.org/10.1016/j.jesp.2009.04.016

Mumenthaler, C., & Sander, D. (2012). Social appraisal influences recognition of emotions. *Journal of Personality and Social Psychology*, *102*(6), 1118–1135. https://doi.org/10.1037/a0026885

Niedenthal, P. M., & Brauer, M. (2012). Social functionality of human emotion. *Annual Review of Psychology*, *63*, 259–285. https://doi.org/10.1146/annurev.psych.121208.131605

O'Callaghan, C., Kveraga, K., Shine, J. M., Adams, R. B., Jr., & Bar, M. (2017). Predictions penetrate perception: Converging insights from brain, behaviour and disorder. *Consciousness and Cognition*, *47*, 63–74. https://doi.org/10.1016/j.concog.2016.05.003

Parkinson, B., Fischer, A., & Manstead, A. S. (2005). *Emotion in social relations: Cultural, group, and interpersonal processes*. Psychology Press. https://doi.org/10.4324/9780203644966

Pessoa, L., McKenna, M., Gutierrez, E., & Ungerleider, L. G. (2002). Neural processing of emotional faces requires attention. *Proceedings of the National Academy of Sciences of the United States of America*, *99*(17), 11458–11463. https://doi.org/10.1073/pnas.172403899

Rimé, B., Finkenauer, C., Luminet, O., Zech, E., & Philippot, P. (1998). Social sharing of emotion: New evidence and new questions. *European Review of Social Psychology*, *9*(1), 145–189. https://doi.org/10.1080/14792779843000072

Rimé, B., Philippot, P., Boca, S., & Mesquita, B. (1992). Long-lasting cognitive and social consequences of emotion: Social sharing and rumination. *European Review of Social Psychology*, *3*(1), 225–258. https://doi.org/10.1080/14792779243000078

Smith, E. R., & Mackie, D. M. (2008). Intergroup emotions. In M. Lewis, J. M. Haviland-Jones, & L. Feldman Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 428–439). Guilford Press.

Sussman, T. J., Weinberg, A., Szekely, A., Hajcak, G., & Mohanty, A. (2017). Here comes trouble: Prestimulus brain activity predicts enhanced perception of threat. *Cerebral Cortex*, *27*(4), 2695–2707. https://doi.org/10.1093/cercor/bhw104

Tajfel, H., & Turner, J. C. (1986). The social identity theory of intergroup behavior. In S. Worchel & W. G. Austin (Eds.), *Psychology of intergroup relations* (pp. 7–24). Nelson-Hall.

Turner, J. C., Hogg, M. A., Oakes, P. J., Reicher, S., & Wetherell, M. S. (1987). *Rediscovering the social group: A self-categorization theory*. Basil Blackwell.

van Kleef, G. A., & Fischer, A. H. (2016). Emotional collectives: How groups shape emotions and emotions shape groups. *Cognition and Emotion*, *30*(1), 3–19. https://doi.org/10.1080/02699931.2015.1081349

Wang, X., Qian, M., Yu, H., Sun, Y., Li, S., Yang, P., Lin, M., Yao, N., & Zhang, X. (2016). Social anxiety and interpretation bias: Effect of positive priming. *Psychological Reports*, *119*(2), 539–556. https://doi.org/10.1177/0033294116658605

Weisbuch, M., & Ambady, N. (2008). Affective divergence: Automatic responses to others' emotions depend on group membership. *Journal of Personality and Social Psychology*, *95*(5), 1063–1079. https://doi.org/10.1037/a0011993

Wieser, M. J., & Brosch, T. (2012). Faces in context: A review and systematization of contextual influences on affective face processing. *Frontiers in Psychology*, *3*, 471. https://doi.org/10.3389/fpsyg.2012.00471

Yzerbyt, V. Y., Dumont, M., Mathieu, B., Gordijn, E., & Wigboldus, D. (2006). Social comparison and group-based emotions. In S. Guimond (Ed.), *Social comparison processes and levels of analysis: Understanding cognition, intergroup relations, and culture* (pp. 174–205). Cambridge University Press.

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