Journal of Personality and Social Psychology
2012, Vol. 102, No. 6, 1118–1135

0022-3514/12/$12.00 DOI: 10.1037/a0026885

Social Appraisal Influences Recognition of Emotions

Christian Mumenthaler and David Sander
University of Geneva

The notion of *social appraisal* emphasizes the importance of a social dimension in appraisal theories of emotion by proposing that the way an individual appraises an event is influenced by the way other individuals appraise and feel about the same event. This study directly tested this proposal by asking participants to recognize dynamic facial expressions of emotion (fear, happiness, or anger in Experiment 1; fear, happiness, anger, or neutral in Experiment 2) in a target face presented at the center of a screen while a contextual face, which appeared simultaneously in the periphery of the screen, expressed an emotion (fear, happiness, anger) or not (neutral) and either looked at the target face or not. We manipulated gaze direction to be able to distinguish between a mere contextual effect (gaze away from both the target face and the participant) and a specific social appraisal effect (gaze toward the target face). Results of both experiments provided evidence for a social appraisal effect in emotion recognition, which differed from the mere effect of contextual information: Whereas facial expressions were identical in both conditions, the direction of the gaze of the contextual face influenced emotion recognition. Social appraisal facilitated the recognition of anger, happiness, and fear when the contextual face expressed the same emotion. This facilitation was stronger than the mere contextual effect. Social appraisal also allowed better recognition of fear when the contextual face expressed anger and better recognition of anger when the contextual face expressed fear.

Keywords: emotion, social appraisal, appraisal theories, context

Appraisal theories of emotions agree that emotions are elicited by the subjective evaluation (appraisals) of events and situations (Roseman & Smith, 2001). Even if the importance of contextual information is considered to arise from the basic principles of these theories (Sander, Grandjean, & Scherer, 2005), appraisal processes have commonly been studied independently of the social context. In laboratory experiments investigating appraisal processes, individuals are typically requested to evaluate a series of events without taking into account the reactions of others to the same events. This approach is an efficient way to address many critical questions concerning the nature and structure of appraisal processes (e.g., the dimensions involved and their interactions; see Grandjean & Scherer, 2008). However, social information about the emotional reaction of others might be integrated at some point into the dynamic appraisal process. Such a fundamental postulate for social psychology is defined, for example, by Allport (1954) as an "attempt to understand and explain how the thought, feeling, and behavior of individuals are influenced by the actual, imagined, or implied presence of others" (p. 3). This notion, however, has received surprisingly little attention in appraisal theories of emotion (see Evers, Fischer, Mosquera, & Manstead, 2005).

In 2001, Manstead and Fischer incorporated and specified this social dimension into the theoretical framework of appraisal theories of emotion by introducing the concept of social appraisal. They proposed that "behaviors, thoughts or feelings of one or more other persons in the emotional situation are appraised in addition to the appraisal of the event per se" (Manstead & Fischer, 2001, p. 222). This proposal implies that the appraisal of an emotional event made by an individual is influenced by the appraisal that other individuals make of the same event. Although there are different ways of addressing social appraisal, the aim of the current study was to directly investigate how social appraisal modulates the perception of facial expressions of emotion.

Previous Research on Social Appraisal

Until now, studies investigating the process of social appraisal, as defined by Manstead and Fischer (2001), principally focused on its role in the expression and the experience of emotions. For instance, Evers et al. (2005) suggested that women were less likely than men to express their anger because they were more likely than men to think that negative social consequences would follow from doing so. Social appraisal, as related to the imagined social implications of the participant's expression, was interpreted to influence the actual expression of anger.

The relationship between social appraisal and emotional experience has been described as the way in which individuals evaluate an emotional event while being affected by the way in which others evaluate and feel about the same event. For example, Fischer, Rotteveel, Evers, and Manstead (2004) investigated the

This article was published Online First January 30, 2012.

Christian Mumenthaler and David Sander, Laboratory for the Study of Emotion Elicitation and Expression (E3Lab), Department of Psychology, and Swiss Center for Affective Sciences, University of Geneva, Geneva, Switzerland.

This work was supported by the National Centre of Competence in Research (NCCR) Affective Sciences, financed by the Swiss National Science Foundation (SNSF, 51NF40-104897), and hosted by the University of Geneva.

Correspondence concerning this article should be addressed to Christian Mumenthaler or David Sander, Department of Psychology, University of Geneva, 40 Bld du Pont d'Arve, 1205 Geneva, Switzerland. E-mail: christian.mumenthaler@unige.ch or david.sander@unige.ch

impact of others' emotional reactions on participants' self-reported emotion. Considering the emotional assimilation hypothesis, these authors suggested that individuals tend to experience and express emotions that are similar to the emotions of people in their social environment, especially when an interdependent self becomes salient in an emotionally ambiguous situation. Their paradigm was a situation in which it was possible to experience and express various negative emotions. After the manipulation of interpersonal orientations (independent vs. interdependent selves), participants were asked to read a vignette in which they imagined receiving a low grade on a long essay. Others' emotions were manipulated by the final two sentences of the vignette: In one condition, the fellow students were depicted as angry, whereas in the other, they were described as sad and disappointed. Because the fellow students also received low marks for their essays, they were exposed to the same emotional stimuli as the participants. Results of the study revealed that, when others expressed anger, participants reported more intense anger, and when others expressed sadness, participants reported more intense sadness. The findings also showed that the extent of this emotional assimilation depended on one's interpersonal orientation and on the extent to which information about others' distinct emotional reaction was recognized and processed (see also Jakobs, Fischer, & Manstead, 1997).

Note that the influence of social appraisal should typically be observed in ambiguous situations (see Fischer et al., 2004) because a person is more influenced by others' appraisals if confronted with an ambiguous emotional event that is difficult to appraise. Such a phenomenon has already been observed in infants and is often discussed in the context of so-called social referencing. Children use another's affective interpretation of a novel situation to formulate their own interpretation and to guide subsequent behavior (see Feinman, Roberts, Hsieh, Sawyer, & Swanson, 1992). Of particular interest for the current study, ambiguous situations can also be observed in the field of emotional perception. Indeed, some studies investigating facial emotion recognition showed impairment in participants' fear recognition. Facial expression of fear is often confused with surprise and has been found to be less well recognized than other so-called basic emotions (see Ekman & Friesen, 1971; Russell, 1994). Rapcsak et al. (2000) observed that in both normal control participants and neurologic patients, the most frequent recognition error involved mistaking fear for surprise. One explanation was that facial expressions of surprise and fear share a number of similar features that make these emotions perceptually difficult to discriminate. In his book *The Expression of the Emotions in Man and Animals,* Charles Darwin (1955) had already observed continuity between these two facial expressions: "I have now endeavored to describe the diversified expressions of fear, in its gradations from mere attention to a start of surprise, into extreme terror and horror" (p. 352). This strong relationship between the facial expressions of fear and surprise and its subsequent ambiguity for the perception of these expressions is relevant for our investigation into the role of social appraisal in emotional perception.

Social Appraisal Versus Contextual Information

Making a distinction between the influence of general contextual information and a more specific effect of the social appraisal process is crucial for understanding how contextual information influences the perception and evaluation of emotional facial expressions. Even if social appraisal is considered as a type of influence provided by contextual information, it is conceptualized as a specific inferential mechanism exerting specific influences on the perception of emotional stimuli, including facial expressions.

Various factors that depend either on the perceiver or on the producer can influence the perception of emotional facial expression. For example, personality traits, such as the attachment style of the perceiver, affect the ability to recognize the displayed expression (see Fraley, Niedenthal, Marks, Brumbaugh, & Vicary, 2006; Vrtička, Andersson, Grandjean, Sander, & Vuilleumier, 2008). The gaze of the producer is also a very important component of the face (see Emery, 2000) that can provide information about mental states and can interact with emotional expression. Several studies have reported that anger expressions are more quickly categorized and are perceived as being more angry when presented with a direct than with an averted gaze, whereas fear expressions are more quickly categorized and are perceived as being more afraid when presented with an averted than with a direct gaze (e.g., Adams & Kleck, 2003, 2005; Cristinzio, N'Diaye, Seeck, Vuilleumier, & Sander, 2010; Sander, Grandjean, Kaiser, Wehrle, & Scherer, 2007).

In addition, numerous lines of research have shown that contextual information can strongly modulate the perception of facial expressions. Studies investigating the role of contextual information in the processing of facial expressions often argue that facial expressions are rarely seen in isolation. Princeps studies that have directly addressed this issue have presented participants with pictures of facial expressions along with vignettes describing an emotional situation (Carroll & Russell, 1996; Nakamura, Buck, & Kenny, 1990). More recently, Meeren, Van Heijnsbergen, and De Gelder (2005) were able to show better categorizations and shorter response times when a body expression was congruent with a facial expression than when it was incongruent. Related work has also demonstrated that an identical facial expression was perceived differently depending on the accompanying body expression (Aviezer et al., 2008). Studies also indicate that contextual effects go beyond the influence of body expression. For example, Righart and De Gelder (2008) showed that facial expressions were categorized more quickly and more accurately if presented together with congruent as compared with incongruent background pictures. The influence of contextual information on the perception of facial expressions has also been revealed in a social context. Indeed, Masuda et al. (2008) presented participants with cartoons depicting a happy, sad, angry, or neutral person surrounded by other persons expressing either the same emotion as the central person or a different emotion. Results revealed that Japanese participants tended to be influenced by contextual information more than Caucasians participants were. The Japanese participants actively incorporated the feelings of the background figures when they were asked to evaluate the central person's facial expressions.

The effects of how another individual appraises a face (but not a facial expression) or an object have been investigated in other theoretical frameworks. For instance, with respect to faces, Jones, DeBruine, Little, Burriss, and Feinberg (2007) showed that the attractiveness of a face was influenced by the emotional expression of a face looking at it. For female participants, observing another woman smiling at a neutral male face, compared with observing the woman not smiling, increased their preference for this male.

With respect to objects, Bayliss, Frischen, Fenske, and Tipper (2007) studied conjointly the effects of gaze direction and emotional facial expression on the affective evaluation of neutral objects (e.g., a mug). Results indicated that when a face was looking at such an object, the emotion expressed by the face modulated how much the object was liked by the participant afterward. Objects were more appreciated when the face looking at them expressed happiness rather than disgust. Of importance for the aim of our study, these authors reported that facial expressions as such were not responsible for this effect: The mere presentation of a facial expression (happiness vs. disgust) did not seem to influence object preference. Indeed, there was no effect of happiness or disgust on objects that were not looked at.

Given these results, one can make a distinction between what we refer to here as a general contextual effect of the facial expression and a more specific social appraisal effect of the facial expression. For instance, in the Bayliss et al. (2007) experiment, a general contextual effect could be observed when a facial expression was present in the context but without the gaze being particularly directed toward the object. In that condition, should a modulation of the attitude toward the object be observed, such a modulation could be due to the mere presence of the happy or disgusted expression in the context and could possibly be explained by priming or congruency effects. On the other hand, the more specific effect of the facial expression of an evaluative kind corresponds to a condition in which a facial expression is indeed present in the context but with the gaze being directed toward the object. The slight physical difference in the stimulus (i.e., a change in gaze direction) can have strong psychological effects, as shown, for instance, by Bayliss and colleagues. In that case, one may infer that the face is evaluating the object. Making a distinction between a general contextual effect and a more specific inferential effect seems therefore useful for understanding how contextual information can influence perception and evaluation.

Bayliss et al. (2007) used neutral objects in their study. However, their paradigm is inspiring for the study of social appraisal. Indeed, a typical social appraisal condition is one in which a facial expression present in the context gazes directly toward an emotional stimulus, with the idea that such a social appraisal modulates the appraisal of the emotional object by the participant. Therefore, in this article, we refer to a social appraisal effect (as opposed to a mere contextual effect) by comparing conditions in which a contextual facial expression gazes toward a target emotional stimulus with conditions in which the same contextual facial expression does not gaze toward the target emotional stimulus. Such an effect is predicted to be more specific than a mere contextual effect, which could be explained by a congruency effect between the two emotional stimuli (i.e., the target stimulus and the contextual one) that modulates categorization processes.

In our study, we manipulated the expression of contextual faces by using a rationale similar to that used by Bayliss and colleagues (2007). As described below in more detail, we also manipulated the expression of target faces. Because a social appraisal effect should be observed only in the case of a joint appraisal of the target face by both the contextual face and the participant in the study, we changed the gaze direction of the contextual face as a way of manipulating whether or not the target face was appraised by the contextual face (for discussion, see Sander et al., 2007). This means that the appraisals performed by the contextual agent were indirectly manipulated by changing the facial expression that was gazing at the target face.

General Overview of the Present Study

The purpose of this study was to directly test the hypothesis according to which social appraisal modulates emotion recognition. An experimental paradigm was created in which participants had to recognize dynamic facial expressions of emotion in a target face presented at the center of the screen, while another nontarget face, which appeared simultaneously in the periphery of the screen, also expressed an emotion and either gazed toward the target face or not. Our rationale was that an experimental condition in which a peripheral face displays a gaze movement that is never directed toward a target face would be our best baseline condition to be compared with a condition in which a peripheral face dynamically moves its gaze toward the target. Whereas the former condition would allow testing for a mere contextual effect of emotional expression, the latter would allow testing for a more specific social appraisal effect. We thought to manipulate the mere context by varying the emotional expressions of the peripheral face while keeping the gaze averted (i.e., keeping it away from the target but controlling for gaze dynamics that were also present in the social appraisal condition). Therefore, in such an averted gaze condition, one would not expect any evaluative process to be inferred because the gaze would never be directed toward the target. Consequently, the displayed emotional expression could not be attributed to any relation between the target face and the peripheral face. Available empirical evidence seems to support this claim. For instance, as mentioned earlier, Bayliss et al. (2007) showed that when a face expressing an emotion is seen to be looking at a neutral object, the nature of the emotion does indeed modulate affective preference for the object. Critically, in their studies, such an influence of facial expression was not a general effect: There was no effect of expressed happiness or disgust on objects that were not directly looked at. The fact that only ratings of the object of joint attention were subject to modulation in their study suggests that our condition, in which the gaze of a peripheral face remains averted, is a relevant baseline condition to test a specific effect of social appraisal (i.e., when the target face is the object of joint attention of both the peripheral face and the participant).

Three hypotheses were tested. The first hypothesis was that when an emotional facial expression of a target face is presented together with another face expressing the same emotion, the congruency between these two emotions would improve the recognition of the emotion expressed by the target face (mere contextual effect). More critically, the second hypothesis was that such recognition improvement by the presence of a contextual congruent face would be even stronger in the social appraisal condition than in the mere contextual condition. Third, we also predicted an effect of social appraisal on emotion recognition when there was a coherent functional relationship between the two emotional expressions. In particular, in the social appraisal condition, we expected that the recognition of a facial expression of fear, which can be considered as ambiguous because it is often confused with surprise, would be increased when the contextual face expressed anger.

Experiment 1

Experiment 1 was performed to test these hypotheses by asking participants to recognize dynamic facial expressions of fear, happi-

ness, or anger in target faces while contextual faces appearing simultaneously in the periphery of the screen expressed fear, happiness, or anger or remained neutral. The gaze of the contextual face was manipulated to distinguish between a social appraisal effect (gaze directed toward the target face) and a mere contextual effect (gaze directed toward the outside of the screen). Participants were asked to recognize target emotions by using six emotion rating scales (fear, disgust, happiness, surprise, anger, and sadness).

Method

Participants. Forty-six female students from the University of Geneva (Geneva, Switzerland), all native French speakers, participated in the study. It was performed in accordance with the guidelines of the ethical committee of the university. Because of technical problems, data from two participants were not included, reducing the sample to 44 participants with an average age of 24 years ($SD = 4.5$).

Materials.

Stimuli. Synthetic dynamic emotional facial expressions were created by using FACSGen, software developed by the Swiss Center of Affective Sciences (see Roesch et al., 2011). The software was designed to manipulate expressions in three-dimensional faces with exact control of the muscle parameters derived from the Facial Action Coding System (Ekman & Friesen, 1978). This tool allowed us to perform highly controlled manipulations of temporal features for gaze movement and unfolding of dynamic facial expression. The work done on the validation of the stimuli created with FACSGen (Roesch et al., 2011) and in studies conducted with these stimuli (Cristinzio et al., 2010; N'Diaye, Sander, & Vuilleumier, 2009; Roesch, Sander, Mumenthaler, Kerzel, & Scherer, 2010) served as a starting point to elaborate the stimuli used in the current experiment.

In the current study, participants were presented with two faces on screen, a target face and a contextual face. The emotional expressions of both the target face and the contextual face were manipulated, and gaze direction of the contextual face was also manipulated so that the contextual face would either look at the target face or not. More precisely, 40 identities[1] (20 men and 20 women) were selected with four expressions (happiness, fear, anger, and neutral) and with either a straight gaze or an averted gaze to the left or to the right. The angle of the averted gaze was set to 18° for both sides.

Equipment. Participants completed the task on Dell Optiplex 755 computers with 15-in. (381 mm) screens and a resolution of 1280×1024. The experiment was developed by using MATLAB with the Psychophysics Toolbox extensions (Brainard, 1997; Pelli, 1997) and administered through MATLAB Component Runtime.

Procedure. All participants performed the 24 experimental conditions: 2 (context condition: social appraisal and non–social appraisal) $\times$ 3 (target emotion: anger, fear, and happiness) $\times$ 4 (contextual emotion: anger, fear, happiness, and neutral). Each of these conditions consisted of eight trials for a total of 192 trials per participant divided into four blocks of 48 trials. A short break was introduced between the blocks to avoid fatigue.

Participants were told that the objective of this study was to evaluate the recognition of dynamic emotional facial expressions. They sat in front of a computer screen and were asked to sign a consent form and to complete demographic information. Task instructions were given orally and also appeared on the computer screen. Participants were told that two faces would be presented on the screen, one in the center, the other in the periphery, and that their task would be to assess the emotion expressed by the face in the center of the screen by using six emotion scales. Participants were informed that if they did not use a given scale, this would mean that the face displayed in the center of the screen did not express this emotion at all. Participants were asked to respond spontaneously and were notified that there were no right or wrong answers. They were also informed about the duration of the task (four blocks of 10 min each). After reading the instructions, participants had to perform five trials to familiarize themselves with the task.

Each trial consisted of a dynamic sequence[2] starting with a fixation cross in the center of the screen for 500 ms, followed by a neutral face with a straight gaze in the periphery of the screen (i.e., not directed toward the center of the screen). The face remained alone and static for 61 ms. We refer to this face as the contextual face. After this delay, a neutral face appeared in the center of the screen with a straight gaze. We refer to this face as the target face. These two faces remained static for 61 ms. After this delay, the contextual face showed a gaze shift (671 ms) either toward the target face or toward the outside of the screen (i.e., away from both the target face and the participant). We therefore controlled for the presence of a movement in these two conditions. To accentuate the fact that the contextual face was looking toward the target face, the size of the contextual face was always smaller than the target face so that an effect of depth was created in all conditions. This effect increased the impact of gaze direction, which was important because the manipulation of gaze direction was used to specifically operationalize the concept of social appraisal. The rationale was that when the gaze of the contextual face was directed toward the target face, it corresponded specifically to the condition of social appraisal. Following the gaze shift of the contextual face, the target face displayed an emotional expression of anger, happiness, or fear (671 ms). Once the unfolding of this emotional expression was finished, the contextual face displayed an emotional expression of anger, happiness, or fear or remained neutral (671 ms), and both faces remained unchanged for 61 ms. The total duration of the sequence in all conditions was 2.196 s (+ 500 ms for the fixation cross presented at the beginning of each trial; see Figure 1). Then, a response window was presented to the participants. This window was composed of a series of six rating scales (horizontal bars representing a continuous range between a pole on the left labeled *a little* and a pole on the right labeled *a lot*). Participants had to use these emotion scales to indicate the extent to which the six different emotion types were perceived in the face (a similar procedure to that used in Cristinzio et al., 2010; Péron et al., 2010; Sander et al., 2007). Participants were free to answer using

[1] Previously validated on three dimensions (see Roesch et al., 2011): believability (Is this face natural? Would you see it on the street?), intrinsic emotionality (Does this face seem to show a positive, neutral, or negative emotion?), and gender (Is this the face of a male, an androgynous person, or a female?).

[2] Dynamic stimuli were created by superimposing all the static images corresponding to different stages of movement with MATLAB (like a flip book). We proceeded in this way to keep strict control of the temporal sequence.

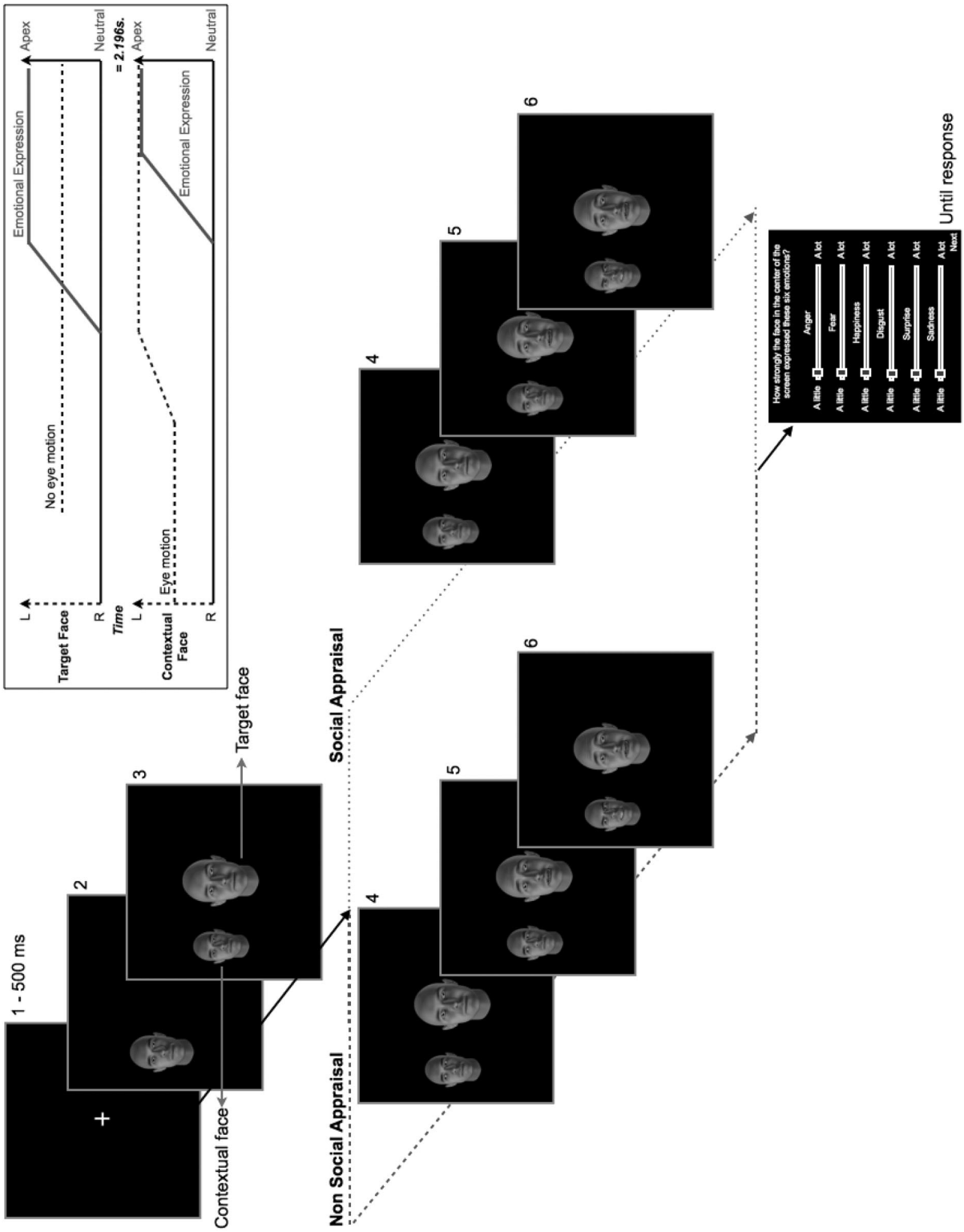

Figure 1. Illustration of an experimental trial for Experiment 1. After the presentation of the fixation cross (1), the contextual face appeared in the periphery of the screen (2), followed by the target face in the center of the screen (3). The gaze of the contextual face shifted (4) toward the outside of the screen (non–social appraisal condition) or toward the target face in the center (social appraisal condition). Following the gaze shift of the contextual face, the target face expressed an emotion (5), and then the contextual face expressed an emotion (6).

Table 1
Means and Standard Errors of the Mean for Each Target Emotion When the Contextual Emotion Was Neutral and Was Not Gazing Toward the Target Face (Non–Social Appraisal Condition)

Emotional scale	Target emotion							
	Anger		Fear		Happiness		Neutral	
	Experiment 1	Experiment 2	Experiment 1	Experiment 2	Experiment 1	Experiment 2	Experiment 1	Experiment 2
Anger	6.83 (0.75)	7.65 (1.29)	0.08 (0.13)	0 (0.01)	0.06 (0.10)	0 (0)	—	0.12 (0.18)
Fear	0.07 (0.12)	0 (0)	3.84 (1.90)	5.00 (2.56)	0.17 (0.27)	0.02 (0.04)	—	0.01 (0.01)
Surprise	0.15 (0.23)	0.07 (0.12)	4.66 (1.97)	4.30 (2.22)	0.37 (0.48)	0.24 (0.39)	—	0.10 (0.14)
Happiness	0.03 (0.06)	0 (0)	0.06 (0.11)	0 (0)	6.10 (1.93)	5.62 (1.73)	—	0.10 (0.13)
Sadness	0.03 (0.04)	0.07 (0.12)	1.35 (1.31)	0.70 (0.84)	0.13 (0.21)	0.02 (0.03)	—	0.28 (0.36)
Disgust	0.51 (0.66)	0.16 (0.25)	0.29 (0.40)	0.10 (0.12)	0.06 (0.10)	0.04 (0.08)	—	0 (0.01)
Other	—	0.01 (0.02)	—	0 (0.03)	—	0.16 (0.27)	—	0.74 (1.03)

Note. Dashes are used in the cells of results for Experiment 1 where no "other emotion" scale was used and no neutral target emotion was presented.

none, one, or all of the emotion scales. The emotion labels used for these scales were the French terms for fear, anger, disgust, happiness, surprise, and sadness. Ratings on each emotion scale were the main dependent variables. The order of emotion category scales on the screen was kept constant for a given participant, but randomized across participants. Using such continuous scales allowed us to compute analyses of variance on the data, and the values ranging from 0 (left pole of the scales) to 10 (right pole of the scales) were used for statistical analyses and for display purposes.

The effect of facial identities was controlled for by randomly assigning the 40 avatars selected for this study as either target faces (32 of them, including 16 females) or contextual faces (eight of them, including four females). Each target face expressed the emotions of fear, anger, and happiness and was presented under the two modalities of the context condition variable (social appraisal and non–social appraisal—mere contextual effect). Moreover, the contextual faces were also presented under these two modalities and expressed the same emotions plus a neutral expression. We ensured that all possible combinations of gender between the target and the contextual faces occurred the same number of times. The order in which each avatar was presented to express an emotion, the combination of the emotions expressed by each target and contextual avatar, and the order of the emotion scales were counterbalanced across participants.

Results

In our control condition, where the contextual face was not expressing any emotion and was not gazing toward the target face (non–social appraisal condition), all the target emotions were accurately recognized with the exception of the fear expression (see Table 1). This result pointed out the ambiguity of the facial expression of fear and replicated several findings showing that fear is often confused with surprise (see Ekman & Friesen, 1971; Rapcsak et al., 2000; Russell, 1994).

Additionally, to better characterize the response of the participants, we computed two standard indices of emotion recognition to test our hypotheses (see Cristinzio et al., 2010; Shaw et al., 2004). First, the congruence index was simply defined as the mean rating on the correct emotion scale. Second, the discrimination index was defined as the difference between the rating on the correct emotion scale and the mean of the ratings on the other five incorrect emotion scales. These indices were particularly useful for studying emotion recognition accuracy for the target emotions of happiness and anger (see Table 2). The recognition accuracy of the target emotion of fear, which was mainly confused with an expression of surprise, was analyzed by directly comparing the scores on the emotion scales of fear and surprise. In addition, we also computed the discrimination index for this target emotion (see Table 3).

Mere contextual effect. In our study, we predicted that when the target emotional facial expression was presented together with another face expressing the same emotion, the congruency between these two emotions would improve the recognition of the emotion expressed by the target face (mere contextual effect) in comparison to our control condition (i.e., when the contextual face was not expressing any emotion and was presented in the non–social appraisal condition—when the gaze of the contextual face was not directed toward the target face).

Target emotion of anger. Contrast analyses revealed a mere contextual effect on the congruence index and on the discrimination index for a target emotion of anger. Therefore, in the non–social appraisal condition, the scores for the congruence index, $F(1, 43) = 18.89$, $p < .01$, $\eta_p^2 = .305$ (see Figure 2), and the discrimination index, $F(1, 43) = 16.63$, $p < .01$, $\eta_p^2 = .279$, were significantly higher when the contextual emotion was anger than when it was neutral. Consequently, anger was better recognized when the contextual face expressed the same emotion than it was when the contextual face was neutral. To test whether the mere contextual effect was specific to the congruency between the target and contextual emotion, we also compared the influence of the other contextual emotions (fear and happiness) on the scores of these indices. The contextual emotion of fear also allowed better recognition of the target emotion of anger, as indicated by an increase of the congruence index when the contextual emotion was fear compared with when it was neutral, $F(1, 43) = 6.03$, $p < .01$, $\eta_p^2 = .123$. However, no significant difference was observed on the discrimination index when the contextual emotion was fear as compared with when it was neutral ($p > .10$). On the other hand, when the contextual emotion was happiness, we observed a decline in the recognition of the target emotion of anger, as revealed by the fact that the scores on both indices were significantly lower than

Table 2
Means and Standard Errors of Both Indices (Congruence and Discrimination) for the Target Emotions of Anger and Happiness When the Contextual Face Was Gazing Toward the Target Face or Not and for Each Contextual Emotion

		Target emotion: anger				Target emotion: happiness			
		Experiment 1		Experiment 2		Experiment 1		Experiment 2	
Contextual emotion	Context condition	Congruence index	Discrimination index	Congruence index	Discrimination index	Congruence index	Discrimination index	Congruence index	Discrimination index
Anger	SA	8.30 (0.45)	7.91 (0.70)	8.65 (1.09)	8.60 (1.08)	5.36 (1.66)	5.17 (1.60)	5.40 (1.71)	5.34 (1.72)
	NSA	7.53 (1.04)	7.34 (1.08)	8.10 (1.24)	8.07 (1.23)	5.59 (1.88)	5.38 (1.86)	5.48 (1.77)	5.44 (1.77)
Fear	SA	8.51 (0.38)	8.18 (0.51)	8.31 (1.32)	8.27 (1.31)	5.40 (1.54)	5.15 (1.51)	5.38 (1.79)	5.31 (1.84)
	NSA	7.26 (1.31)	6.99 (1.39)	7.97 (1.47)	7.94 (1.46)	5.57 (1.90)	5.36 (1.86)	5.47 (1.75)	5.38 (1.78)
Happiness	SA	6.63 (0.97)	6.31 (1.14)	7.64 (1.19)	7.57 (1.18)	7.19 (1.13)	6.99 (1.09)	6.45 (1.64)	6.38 (1.69)
	NSA	6.54 (0.90)	6.20 (1.04)	7.68 (1.24)	7.65 (1.22)	6.88 (1.05)	6.66 (1.04)	6.06 (1.76)	5.97 (1.80)
Neutral	SA	6.89 (0.95)	6.58 (1.08)	7.67 (1.25)	7.61 (1.24)	6.37 (1.33)	6.15 (1.27)	5.51 (1.71)	5.43 (1.76)
	NSA	6.83 (0.75)	6.68 (0.80)	7.65 (1.29)	7.59 (1.28)	6.10 (1.93)	5.95 (1.89)	5.62 (1.73)	5.54 (1.77)

Note. SA = social appraisal condition; NSA = non–social appraisal condition.

they were when the contextual emotion was neutral, $F(1, 43) = 6.01$, $p < .05$, $\eta_p^2 = .123$, for the congruence index; $F(1, 43) = 11.13$, $p < .01$, $\eta_p^2 = .206$, for the discrimination index.

Target emotion of happiness. Contrast analyses revealed that happiness was better recognized when the contextual face also expressed happiness than when it was neutral. Therefore, in the non–social appraisal condition, the scores on the congruence index, $F(1, 43) = 12.82$, $p < .01$, $\eta_p^2 = .230$ (see Figure 2), and on the discrimination index, $F(1, 43) = 10.36$, $p < .01$, $\eta_p^2 = .194$, were significantly higher when the contextual emotion was happiness than when it was neutral. Results also revealed that the contextual emotions of fear and anger obstructed the recognition of the target emotion of happiness. Thus, in the non–social appraisal condition, the scores on both the congruence and discrimination indices were significantly lower when the contextual emotion was fear—$F(1, 43) = 12.74$, $p < .01$, $\eta_p^2 = .229$, congruence index; $F(1, 43) = 14.83$, $p < .01$, $\eta_p^2 = .256$, discrimination index—or anger—$F(1, 43) = 7.41$, $p < .01$, $\eta_p^2 = .147$, congruence index; $F(1, 43) = 8.09$, $p < .01$, $\eta_p^2 = .158$, discrimination index—than when it was neutral.

Target emotion of fear. In view of the well-replicated confusion between fear and surprise, the emotion recognition accuracy of the target emotion of fear was tested by analyzing the scores on the emotion scales of fear and surprise. As depicted in Figure 3, recognition of the target emotion of fear was not improved with mere contextual effect. Even if, in the non–social appraisal condition, the scores on the emotion scale of fear were significantly higher when the contextual emotion was fear than when it was neutral, $F(1, 43) = 6.17$, $p < .05$, $\eta_p^2 = .126$, there was no significant difference between the scores on the emotion scales of fear and surprise when the contextual emotion was fear ($p > .10$). Moreover, the scores on the emotion scale of surprise did not differ significantly when the contextual emotion was fear than when it was neutral ($p > .10$). Consequently, the perception of an ambiguous emotional expression of fear was not disambiguated when the contextual emotion was fear. Furthermore, the target expression of fear was still confused with surprise when the contextual emotion was anger or happiness. Therefore, in the non–social appraisal condition, the scores on each of the emotion scales of fear and surprise did not change significantly when the contextual emotion

Table 3
Means and Standard Errors of the Discrimination Index and of the Emotion Scale of Fear and Surprise for the Target Emotion of Fear When the Contextual Face Was Gazing Toward the Target Face or Not and for Each Contextual Emotion

		Target emotion: fear					
		Experiment 1			Experiment 2		
Contextual emotion	Context condition	Fear scale	Surprise scale	Discrimination index	Fear scale	Surprise scale	Discrimination index
Anger	SA	6.40 (1.72)	3.42 (1.87)	5.56 (1.65)	6.26 (1.94)	1.60 (1.38)	5.89 (1.91)
	NSA	4.12 (1.90)	4.37 (1.96)	2.86 (1.98)	5.35 (1.87)	2.42 (1.52)	4.84 (1.83)
Fear	SA	5.60 (1.08)	3.47 (2.21)	4.62 (1.45)	5.83 (2.27)	2.86 (2.09)	5.26 (2.29)
	NSA	4.50 (1.28)	4.51 (2.31)	3.38 (1.57)	5.10 (2.19)	2.93 (1.81)	4.50 (2.22)
Happiness	SA	3.70 (1.70)	4.96 (1.96)	2.42 (1.67)	4.86 (2.38)	2.88 (1.73)	4.25 (2.43)
	NSA	3.78 (2.27)	4.84 (1.85)	2.54 (2.25)	5.02 (2.30)	2.85 (2.06)	4.39 (2.41)
Neutral	SA	4.10 (1.91)	4.55 (2.21)	2.90 (1.93)	4.98 (2.52)	4.09 (2.00)	4.16 (2.50)
	NSA	3.84 (1.90)	4.66 (1.97)	2.55 (1.84)	4.99 (2.56)	4.34 (2.22)	4.13 (2.55)

Note. SA = social appraisal condition; NSA = non–social appraisal condition.

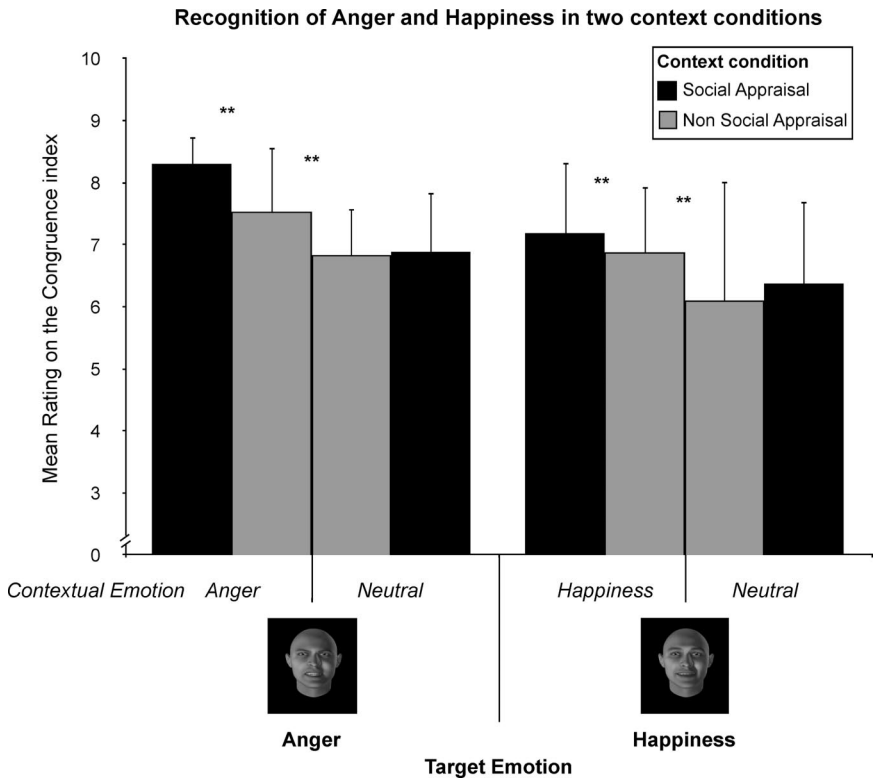

Figure 2. Mean rating on the congruence index in Experiment 1 for the target emotions of anger and happiness when the contextual emotion was either expressing the same emotion or was neutral, and as a function of when the gaze of the contextual face was directed toward the target face (social appraisal condition) or not (non–social appraisal condition—mere contextual effect). Error bars represent standard errors of the mean. $^{**}p < .01$.

was anger or happiness as compared with when it was neutral ($p > .10$). We observed a tendency of the scores on the emotion scale of surprise to be higher than those on the emotion scale of fear only when the contextual emotion was happiness, $F(1, 43) = 4.06$, $p = .0503$, $\eta_p^2 = .086$. When the contextual emotion was anger, no such effect or trend was found ($p > .10$).

We also investigated how the mere contextual effect influenced all five incorrect emotion scales by performing contrast analyses on the discrimination index. Results revealed that, in the non–social appraisal condition, the scores on the discrimination index were significantly higher when the contextual emotion was fear than when it was neutral, $F(1, 43) = 8.02$, $p < .01$, $\eta_p^2 = .157$. No significant difference on the score of this index was observed when the contextual emotion was anger or happiness from that observed when it was neutral ($p > .10$).

Social appraisal effect. The main goal of this study was to test whether a specific social appraisal effect can be observed on emotion recognition. We expected that participants would better recognize a target expression when the contextual face expressed a particular emotion with the gaze being directed toward the target face than when the contextual face expressed the same emotion but with the gaze being directed away from the target face.

Target emotion of anger. As predicted, social appraisal allowed better recognition of the target emotion of anger than did the mere presence of a contextual facial expression of anger. Indeed, when both the target and the contextual faces displayed an anger expression, the scores on the congruence index, $F(1, 43) = 13.85$, $p < .01$, $\eta_p^2 = .244$ (see Figure 2), and on the discrimination index, $F(1, 43) = 6.64$, $p < .05$, $\eta_p^2 = .134$, were significantly higher when the gaze of the contextual face was directed toward the target face (social appraisal condition) than when it was directed away from the target face (non–social appraisal condition). We also tested whether a social appraisal effect for a target emotion of anger was observed when the contextual emotion was fear or happiness. Results revealed better recognition of the target emotion of anger when the contextual emotion was fear, as indicated by the fact that scores on both indices were significantly higher in the social appraisal than in the non–social appraisal condition, $F(1, 43) = 28.44$, $p < .01$, $\eta_p^2 = .398$, congruence index; $F(1, 43) = 20.96$, $p < .01$, $\eta_p^2 = .328$, discrimination index. However, no difference was found when the contextual emotion was happiness ($p > .10$). Analyses suggested that this effect of social appraisal was not driven by a mere attentional shift produced by the gaze of the contextual face. Indeed, when the contextual emotion was neutral, no significant effect of social appraisal was observed on the scores of these indices ($p > .10$).

Target emotion of happiness. Contrast analyses revealed that when both the target and the contextual faces displayed an expression of happiness, the scores on the congruence index, $F(1, 43) = 12.88$, $p < .01$, $\eta_p^2 = .231$(see Figure 2), and on the discrimination index, $F(1, 43) = 11.15$, $p < .01$, $\eta_p^2 = .206$, were significantly higher in the condition of social appraisal than in the condition of non–social

appraisal. No significant difference was found on the congruence and discrimination indices for a target expression of happiness between a social appraisal and a non–social appraisal condition when the contextual emotion was anger, fear, or neutral ($p > .10$).

Target emotion of fear. As depicted in Figure 3, analyses of the scores on the emotion scales of fear and surprise revealed that when both the target and the contextual faces displayed an expression of fear, the score on the emotion scale of fear was significantly higher in the condition of social appraisal than in the condition of non–social appraisal, $F(1, 43) = 39.31$, $p < .01$, $\eta_p^2 = .478$. Inversely, the score on the emotion scale of surprise was significantly lower in the condition of social appraisal than in the condition of non–social appraisal, $F(1, 43) = 28.12$, $p < .01$, $\eta_p^2 = .395$. Moreover, when the contextual emotion was fear, results revealed an interaction between the scores on the emotion scales of fear and surprise, depending on whether the contextual face gazed at the target face (social appraisal condition) or not (non–social appraisal condition), $F(1, 43) = 49.37$, $p < .01$, $\eta_p^2 = .534$. In the social appraisal condition, when the contextual emotion was fear, the scores on the emotion scale of fear were significantly higher than the scores on the emotion scale of surprise, $F(1, 43) = 20.50$, $p < .01$, $\eta_p^2 = .323$.

In addition, considering that the social appraisal condition should make the functional relationship between the expressions of anger and fear particularly salient, we expected in particular that the recognition of a facial expression of fear would be facilitated in a social appraisal condition with the contextual face expressing anger. As expected, when the contextual emotion was anger, we observed that the scores on the emotion scale of fear were significantly higher in the social appraisal condition than in the non–social appraisal condition, $F(1, 43) = 49.24$, $p < .01$, $\eta_p^2 = .534$. Consistently for the same comparison, the scores on the scale of surprise were significantly lower, $F(1, 43) = 15.11$, $p < .01$, $\eta_p^2 = .260$. The interaction between these two emotion scales and the social appraisal variable was indeed significant when the contextual emotion was anger, $F(1, 43) = 42.78$, $p < .01$, $\eta_p^2 = .499$. Moreover, in the social appraisal condition and when the contextual emotion was anger, the scores on the emotion scale of fear were significantly higher than the scores on the emotion scale of surprise, $F(1, 43) = 57.6$, $p < .01$, $\eta_p^2 = .572$. The effect of social appraisal for the target emotion of fear was specific to the contextual emotions of fear and anger because we did not observe any difference between a social appraisal and a non–social appraisal condition on ratings for the emotion scale of fear or surprise ($p > .10$) when the contextual emotion was neutral or happiness.

Analysis on the discrimination index revealed that, for a target emotion of fear, the scores on this index were significantly higher in the social appraisal condition than in the non–social appraisal condition when the contextual emotion was fear, $F(1, 43) = 40.96$, $p < .01$, $\eta_p^2 = .488$, or anger, $F(1, 43) = 52.37$, $p < .01$, $\eta_p^2 = .549$, but not when it was neutral or happiness ($p > .10$).

Discussion

Consistent with our hypothesis, the results of Experiment 1 revealed a mere contextual effect for the emotions of anger and happiness. As expected, even when the contextual face was not

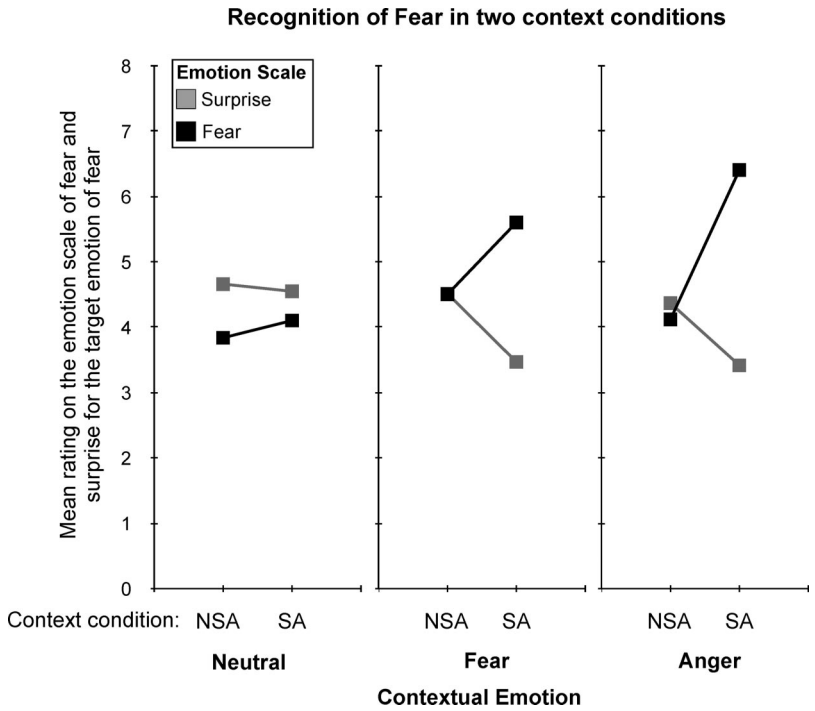

Figure 3. Mean rating on the emotion scales of fear and surprise in Experiment 1 for the target emotion of fear when the contextual face was neutral or was expressing fear or anger, and as a function of when the gaze of the contextual face was directed toward the target face (SA = social appraisal condition) or not (NSA = non–social appraisal condition—mere contextual effect).

gazing at the target face, presenting a target emotional facial expression of anger or happiness together with another face expressing the same emotion improved the recognition of the emotion expressed by the target face. This improvement in recognition was manifested by an increase in the scores on both the congruence and the discrimination indices.

The effects of contextual information on the recognition of target expressions were not restricted to cases of expression congruency (i.e., with the two faces expressing the same emotion). Indeed, recognition of anger was also improved when the contextual face expressed fear (although this effect was significant only for the congruence index). Inversely, as shown by the diminution of both the discrimination and the congruence indices, for the target emotion of anger when the contextual emotion was happiness, we were able to show that contextual information can also decrease the recognition of an emotion. Additionally, we found a decrease in the recognition of happiness when the contextual emotion was either anger or fear. These effects are consistent with a mere contextual effect being driven by congruency (in the case of a fear–anger pair) or incongruency (in the cases of happiness–fear or happiness–anger pairs) effects of valence between the two expressions. Of note is that no social appraisal effect was observed for the pairs anger–happiness and fear–happiness. This suggests that gaze direction toward the target emotions in these cases did not add any relevant evaluative information to that already provided by the noncongruency of the expressions. This is consistent with the social appraisal framework, as we would not have predicted any social appraisal effect for these pairs. Indeed, neither fear nor anger is a typical reaction to an expression of happiness (although it is a possible reaction, depending on the meaning of the smile). Reciprocally, happiness is not a typical reaction to an expression of fear or anger.

Results also revealed that the facial expression of fear was mainly confused with the expression of surprise. Even when the contextual face was expressing fear, anger, or happiness, participants still confused the target expression of fear. These results suggest that a mere contextual effect might not be sufficient to disambiguate the emotion of fear.

The main question addressed in this study concerned the specific effect of social appraisal. As expected, for each target emotion, when the target emotional facial expression was presented together with another face expressing the same emotion, recognition of the target face was better when the contextual face gazed toward rather than away from the target face. Of importance, this effect of gaze direction was not observed for any target emotion when the contextual face was neutral. Consequently, it seems that the effect of social appraisal was not driven by a mere attentional shift produced by the gaze of the contextual face. Moreover, as predicted, using gaze direction to specify the target of the appraisal of the contextual face seems to have created for the participants a functional relationship between the expressions of anger and fear. Indeed, when the contextual face expressed anger and gazed toward the target face, we observed a better disambiguation of the target expression of fear as compared with when the gaze of the contextual angry face was directed away from the target. We also observed the effect of social appraisal on the recognition of the target expression of anger when the contextual emotion was fear. In contrast, social appraisal did not have any effect on the recognition of the target emotion of happiness when the contextual emotion was either fear or anger.

Given these results, we decided to adapt Experiment 1 to conduct a second experiment aimed at replicating the major results, with (a) a sequence of interacting faces that would be even better adapted to the specific study of the effect of social appraisal for pairs that are particularly functionally related (i.e., anger–fear pairs), (b) the inclusion of neutral faces as a new type of target face that could be considered ambiguous and therefore particularly sensitive to social appraisal, and (c) the inclusion of another rating scale in the response window that would allow the participants more choice in their answers.

Experiment 2

In Experiment 2, we particularly focused on a new sequence for the presentation of the stimuli that accentuated the causality between the contextual and the central events. Another modification was the inclusion of the neutral emotional expression as a target face because this expression could be considered particularly ambiguous and could consequently be influenced by social appraisal manipulation. Moreover, in Experiment 1, participants used six different emotion scales (labeled as fear, anger, disgust, happiness, surprise, and sadness) to indicate the extent to which these emotions were perceived in each target face. Even when they had the possibility of answering by using several emotion scales simultaneously, participants were still presented with a limited list of emotion labels. Such a response screen already provides the participant with much more flexibility than what is possible with a forced-choice task between labels, which does not allow reporting of blends between emotions. However, as suggested by several studies, allowing the possibility of reporting various emotions in parallel is still a limitation, as the use of emotional words as such seems to influence the perception of emotion (see Barrett, 2006; Barrett, Lindquist, & Gendron, 2007; Lindquist, Barrett, Bliss-Moreau, & Russell, 2006). In our study, the use of emotional words as labels for the rating scales could therefore have constrained the participants' answers. Therefore, in Experiment 2, we incorporated a new dependent variable, a rating scale labeled *none of the above but another emotion,* to allow participants to consider emotions that were not listed in our scales.

Method

Participants. Thirty-eight female subjects with an average age of 21 years ($SD = 2.3$) participated in the study. Participants were not involved in Experiment 1. They were all students from the University of Geneva and native French speakers. The study was performed in accordance with the guidelines of the ethical committee of the university.

Materials.

Stimuli. In Experiment 2, we used the same stimuli as in Experiment 1.

Equipment. As in Experiment 1, participants completed the task on Dell Optiplex 755 computers with 15-in. (381 mm) screens and a resolution of 1280×1024. This second experiment was also developed by using MATLAB with the Psychophysics Toolbox extensions (Brainard, 1997; Pelli, 1997) and administered through MATLAB Component Runtime.

Procedure. All participants performed the 32 experimental conditions: 2 (context condition: social appraisal and non–social appraisal—mere contextual effect) × 4 (target emotion: anger, fear, happiness, and neutral) × 4 (contextual emotion: anger, fear, happiness, and neutral). Each of these conditions consisted of eight trials for a total of 256 trials per participant divided into four blocks of 64 trials. A short break was introduced between the blocks to avoid fatigue.

As in Experiment 1, participants were told that the objective of this study was to evaluate the recognition of dynamic emotional facial expressions. They sat in front of a computer screen and were asked to sign a consent form and to complete demographic information. The task instructions were given orally and also appeared on the computer screen.

For the most part, the procedure was identical to that used in Experiment 1 with the exception that a new sequence of presentation for the stimuli that accentuated the functional relationship between the contextual and the central events was used in Experiment 2. The new sequence is identical to that issued in Experiment 1 (see Figure 1) except for the order in which each face expressed an emotion. In Experiment 2, the sequence consisted of a dynamic sequence that started by showing a fixation cross in the center of the screen for 500 ms followed by a neutral face that also appeared in the center of the screen with a straight gaze. The face remained alone and static for 61 ms. After this delay, a neutral face appeared in the periphery of the screen with a straight gaze. These two faces remained static for 61 ms, after which the contextual face showed a gaze shift (671 ms) either toward the target face in the center or toward the outside of the screen (i.e., away both from the target face and from the participant). Following the gaze shift, the contextual face displayed an emotional expression of anger, happiness, or fear or remained neutral (671 ms). Once the unfolding of this emotional expression was finished, the target face displayed an emotional expression of anger, happiness, fear, or neutral (671 ms), and both faces remained unchanged for 61 ms. The total duration of the sequence in all conditions was 2.196 s (+ 500 ms for the fixation cross presented at the beginning of each trial). In Experiment 2, participants were asked to assess the emotion expressed by the face in the center of the screen by using seven, rather than six, emotion scales. The emotion labels used for these scales were the French terms for fear, anger, disgust, happiness, surprise, and sadness, with an additional scale labeled *none of the above but another emotion.* As in Experiment 1, participants were free to answer using none, one, or all of the emotion scales. The order of emotion category scales on the screen was kept constant for a given participant, but randomized across participants. We also informed the participants about the duration of the task (four blocks of 15 min each in Experiment 2).

Results

As in Experiment 1, when the contextual face was not expressing any emotion and was not gazing toward the target face (non–social appraisal condition), all the target emotions were recognized accurately with the exception of the expression of fear, which was, as expected, confused with surprise (see Table 1).

Mere contextual effect.

Target emotion of anger. Contrast analyses revealed that anger was better recognized when the contextual face expressed anger or fear than when it was neutral. In the non–social appraisal condition, the scores on the congruence and discrimination indices were significantly higher when the contextual emotion was anger—$F(1, 37) = 51.52$, $p < .01$, $\eta_p^2 = 0.582$, congruence index (see Figure 4); $F(1, 37) = 51.80$, $p < .01$, $\eta_p^2 = .583$, discrimination index—or fear—$F(1, 37) = 14.57$, $p < .01$, $\eta_p^2 = .283$, congruence index; $F(1, 37) = 14.32$, $p < .01$, $\eta_p^2 = .279$, discrimination index—than when it was neutral. On the other hand, the contextual emotion of happiness did not have any significant influence on the recognition of the target emotion of anger. Indeed, in the non–social appraisal condition, the scores on these indices did not differ significantly when the contextual emotion was happiness from when it was neutral ($p > .10$).

Target emotion of happiness. Contrast analyses revealed a mere contextual effect on happiness recognition. Indeed, in the non–social appraisal condition, the scores on the congruence index, $F(1, 37) = 65.37$, $p < .01$, $\eta_p^2 = .639$ (see Figure 4), and on the discrimination index, $F(1, 37) = 56.20$, $p < .01$, $\eta_p^2 = .603$, were significantly higher when the contextual emotion was happiness than when it was neutral. Results did not reveal that the contextual emotions of fear or anger had any significant influence on recognition of the target emotion of happiness as, in the non–social appraisal condition, the scores on these indices did not differ significantly when the contextual emotion was fear or anger from when it was neutral ($p > .10$).

Target emotion of fear. As in Experiment 1, emotion recognition accuracy was analyzed for the target emotion of fear by using the scores on the emotion scales of fear and surprise. As illustrated in Figure 5, in the non–social appraisal condition, results revealed that fear was better recognized when the contextual emotion was fear, anger, or happiness than when it remained neutral. Indeed, even if there was no difference between the scores on the emotion scale of fear for each of these contextual emotions in comparison to when the contextual emotion was neutral ($p > .10$), scores on the emotion scale of surprise were significantly lower when the contextual emotion was fear, $F(1, 37) = 22.04$, $p < .01$, $\eta_p^2 = .373$; anger, $F(1, 37) = 34.41$, $p < .01$, $\eta_p^2 = .482$; or happiness, $F(1, 37) = 25.58$, $p < .01$, $\eta_p^2 = .409$, than when it was neutral. Moreover, in the non–social appraisal condition, the scores on the emotion scale of fear were significantly higher than those on the scale of surprise when the contextual emotion was fear, $F(1, 37) = 14.65$, $p < .01$, $\eta_p^2 = .283$; anger, $F(1, 37) = 62.93$, $p < .01$, $\eta_p^2 = .630$; or happiness, $F(1, 37) = 13.21$, $p < .01$, $\eta_p^2 = .263$. Results also revealed interactions between these two emotion scales, depending on whether the contextual emotion was fear, anger, or happiness, in comparison to when the contextual emotion was neutral, $F(1, 37) = 15.85$, $p < .01$, $\eta_p^2 = .300$, for fear; $F(1, 37) = 28.26$, $p < .01$, $\eta_p^2 = .433$, for anger; $F(1, 37) = 17.52$, $p < .01$, $\eta_p^2 = .321$, for happiness.

Contrast analyses on the discrimination index revealed that, in the non–social appraisal condition, the scores on this index were significantly higher when the contextual emotion was anger than when it was neutral, $F(1, 43) = 8.54$, $p < .01$, $\eta_p^2 = .180$. However, no significant differences on the scores of this index were observed when the contextual emotion was fear or happiness as compared with when it was neutral ($p > .10$).

Neutral target emotion. Concerning the neutral target emotion, we compared whether the contextual facial expression of fear, anger, or happiness influenced the scores on each emotion

scale differently from when the contextual facial expression was neutral. Results revealed that, in the non–social appraisal condition, the scores on each emotion scale did not differ significantly when the contextual emotion was fear, anger, or happiness from when the contextual emotion was neutral (all ps $> .10$).

Social appraisal effect.

Target emotion of anger. As expected, results revealed a social appraisal effect in the recognition of the target emotion of anger when the contextual emotions were anger or fear. Scores on the congruence and discrimination indices were significantly higher in the condition of social appraisal than in the condition of non–social appraisal when the contextual emotion was anger—$F(1, 37) = 93.88$, $p < .01$, $\eta_p^2 = .711$, congruence index (see Figure 4); $F(1, 37) = 80.26$, $p < .01$, $\eta_p^2 = .684$, discrimination index—or fear—$F(1, 37) = 33.04$, $p < .01$, $\eta_p^2 = .472$, congruence index; $F(1, 37) = 29.50$, $p < .01$, $\eta_p^2 = .444$, discrimination index. When the contextual emotion was happiness or neutral, scores on these indices did not differ significantly between the social appraisal and the non–social appraisal conditions ($p > .10$).

Target emotion of happiness. Results revealed that when the contextual emotion was happiness, social appraisal facilitated happiness recognition. Indeed, when both the target and the contextual faces displayed happiness, scores on the congruence index, $F(1, 37) = 27.62$, $p < .01$, $\eta_p^2 = .427$ (see Figure 4), and on the discrimination index, $F(1, 37) = 28.39$, $p < .01$, $\eta_p^2 = .434$, were significantly higher in the social appraisal condition than in the non–social appraisal condition. Moreover, scores on these indices were significantly lower between a social appraisal and a non–social appraisal condition when the contextual face was neutral, $F(1, 37) = 5.83$, $p < .05$, $\eta_p^2 = .136$, congruence index; $F(1, 37) = 5.55$, $p < .05$, $\eta_p^2 = .130$, discrimination index. No significant social appraisal effect was found either on the congruence or on the discrimination index when the contextual emotion was anger or fear ($p > .10$).

Target emotion of fear. Analyses of scores on the emotion scales of fear and surprise revealed that fear recognition was better in the social appraisal condition that in the non–social appraisal condition. As depicted in Figure 5, results showed that when both the target and the contextual faces displayed an expression of fear, the score on the emotion scale of fear was significantly higher in the condition of social appraisal than in the condition of non–social appraisal, $F(1, 37) = 21.73$, $p < .01$, $\eta_p^2 = .370$. Moreover, when the contextual emotion was fear, even if the scores on the emotion scale of surprise were not significantly different between these conditions ($p > .10$), we observed an interaction between the scores on the emotion scales of fear and surprise and the gaze direction of the contextual face, $F(1, 37) = 9.44$, $p < .01$, $\eta_p^2 =$

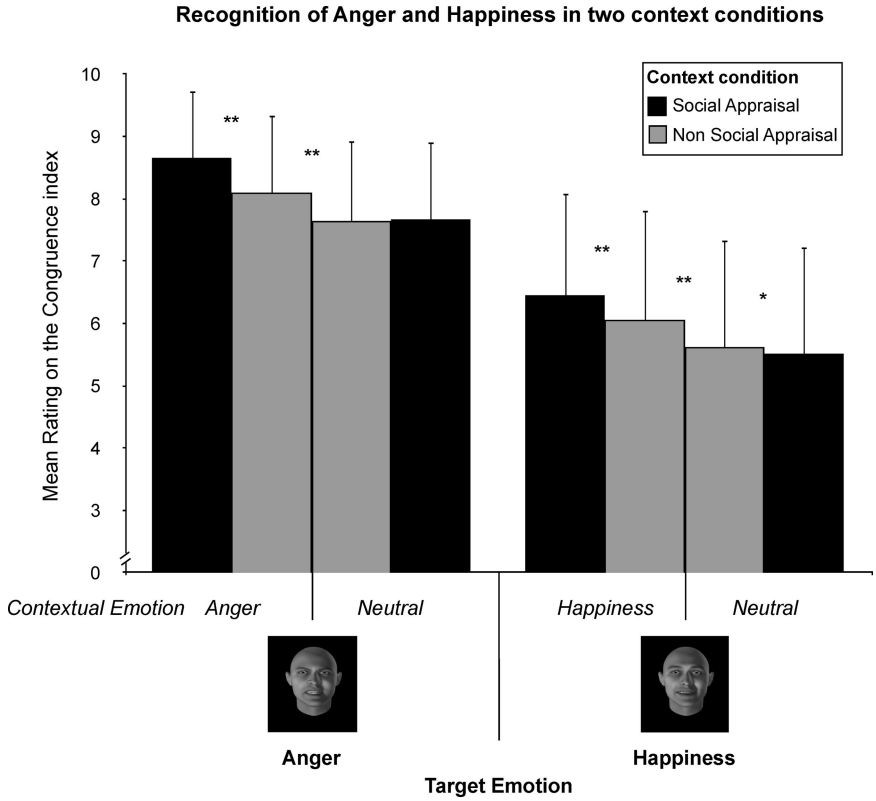

Figure 4. Mean rating on the congruence index in Experiment 2 for the target emotions of anger and happiness when the contextual emotion was either expressing the same emotion or was neutral, and as a function of when the gaze of the contextual face was directed toward the target face (social appraisal condition) or not (non–social appraisal condition—mere contextual effect). Error bars represent standard errors of the mean. * $p < .05$. ** $p < .01$.

.203. In addition, we observed that in the social appraisal condition, the scores on the emotion scale of fear were significantly higher than the scores on the emotion scale of surprise, $F(1, 37) = 22.40$, $p < .01$, $\eta_p^2 = .388$.

As expected, we also observed a social appraisal effect for the target emotion of fear when the contextual emotion was anger. Indeed, when the contextual emotion was anger, scores on the emotion scale of fear were significantly higher in the condition of social appraisal than in the condition of non–social appraisal, $F(1, 37) = 23.48$, $p < .01$, $\eta_p^2 = .388$. Inversely, scores on the scale of surprise were significantly lower, $F(1, 37) = 48.07$, $p < .01$, $\eta_p^2 = .565$. The interaction between these two emotion scales and the gaze direction of the contextual face was also significant when the contextual emotion was anger, $F(1, 37) = 58.15$, $p < .01$, $\eta_p^2 = .611$. Moreover, in the condition of social appraisal, the scores on the emotion scale of fear were significantly higher than the scores on the emotion scale of surprise, $F(1, 37) = 142.57$, $p < .01$, $\eta_p^2 = .794$, when the contextual emotion was anger. When the contextual emotion was happiness or when the contextual face remained neutral, no difference between a social appraisal and a non–social appraisal condition was observed for the emotion scales of fear or surprise ($p > .10$).

Scores on the discrimination index were significantly higher in the condition of social appraisal than in the condition of non–social appraisal when the contextual emotion was fear, $F(1, 39) = 19.64$, $p < .01$, $\eta_p^2 = .335$, or anger, $F(1, 39) = 28.71$, $p < .01$, $\eta_p^2 = .424$. No significant difference was found on the discrimination index between a social appraisal and a non–social appraisal condition when the contextual emotion was happiness or neutral ($p > .10$).

Neutral target emotion. We also tested for any social appraisal effect on the neutral target faces when the peripheral faces expressed fear, anger, or happiness. Results indicated that for each contextual emotion, scores on each emotion scale did not differ significantly between a social appraisal and a non–social appraisal condition (all ps $> .10$).

Discussion

Key findings obtained in Experiment 1 were replicated in Experiment 2. In particular, with respect to the mere contextual effect, results indicated that both anger recognition and happiness recognition were increased by the presence of congruent contextual emotions. Indeed, as revealed by the increases in the congruence and discrimination indices, when the gaze of the contextual face was not directed toward the target face, anger recognition and happiness recognition were both improved when the contextual face was expressing the same emotion. Moreover, the recognition of anger was also improved when the contextual emotion was fear. Contrary to results obtained in Experiment 1, the recognition of happiness was not significantly influenced by contextual emotions of anger or fear, and the target emotion of anger was not significantly affected by the contextual emotion of happiness. Consequently, in Experiment 2, the effect of the contextual information was restricted either to a pure congruency effect (i.e., with the two faces expressing the same emotion) or to a case of a functional

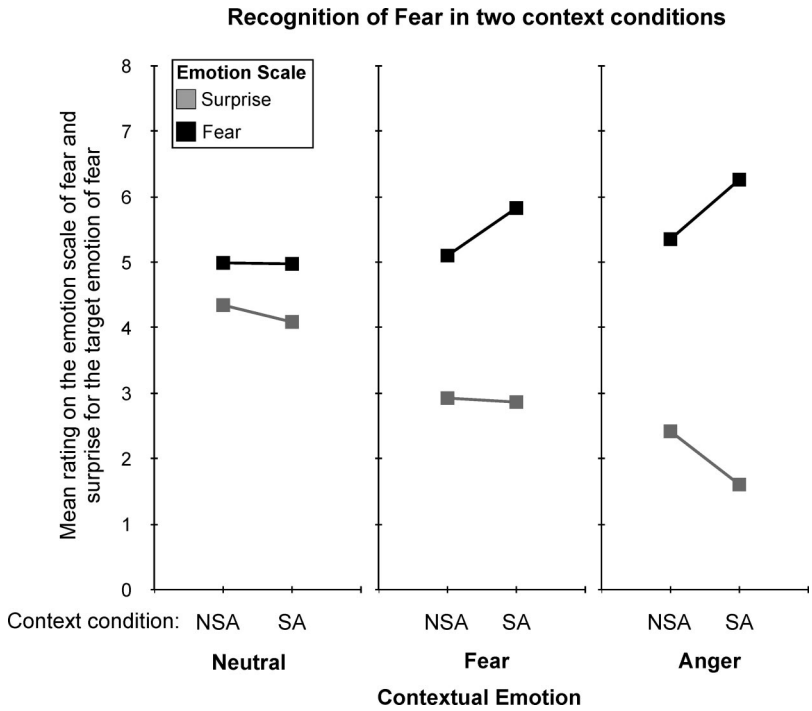

Figure 5. Mean rating on the emotion scales of fear and surprise in Experiment 2 for the target emotion of fear when the contextual face was neutral or was expressing fear or anger, and as a function of when the gaze of the contextual face was directed toward the target face (SA = social appraisal condition) or not (NSA = non–social appraisal condition—mere contextual effect).

relationship between these two expressions (i.e., the fear–anger pair).

Results again highlighted the fact that the facial expression of fear was confused with surprise. We found that, contrary to the results of Experiment 1, in the condition when the gaze of the contextual face was not directed toward the target face, fear recognition was improved when the contextual face expressed any emotion (fear, anger, or happiness) as compared with when the contextual face remained neutral. Such a contextual effect on fear recognition was therefore not specific to a particular emotion in the periphery, and we have not interpreted this general effect observed in Experiment 2 but not in Experiment 1.

With respect to social appraisal, results were again consistent with our hypotheses. Indeed, in replicating the results of Experiment 1, we found that, for each target emotion, when the target face and the contextual face expressed the same emotion, the recognition of this emotion was better when the contextual face gazed toward the target face than when the gaze was not directed toward it. Moreover, the results highlighted the importance of the functional relationship between the emotions of fear and anger. Indeed, social appraisal facilitated the disambiguation of the target emotion of fear when the contextual emotion was anger. Reciprocally, a target expression of anger was better recognized when the contextual face displayed fear and gazed at the target face than when the expression of fear was displayed but with the gaze not directed toward the target face. As predicted and as already found in Experiment 1, no effect of social appraisal was observed for any target emotion when the contextual face was neutral.

In Experiment 2, we included a neutral expression as the target emotion because this expression could be considered ambiguous and could therefore be influenced by a social appraisal effect. Results indicated that this neutral expression was considered as expressing an emotion other than those that were presented in the emotion scales (but with very low scores). However, no mere contextual or social appraisal effect was found to significantly modulate the perception of the target neutral expression. We speculate that social appraisal did not have any effect on the neutral expression because, in strong contrast with the other dynamic target emotions, it was static. Consequently, participants could have used the absence of movement of this neutral target face as an indicator of an absence of changes in the emotion expressed. Thus, the responses of the participants may have been so strongly influenced by the fact that the expression of the face was static that there was no room for contextual or social appraisal modulation. Future studies could explore the idea that ambiguous expressions are particularly sensitive to social appraisal by validating dynamic expressions that are still typically recognized as neutral when presented without any context. To the best of our knowledge, no such set of stimuli exists in the literature.

As already mentioned, the use of emotional words may influence the perception of emotion (see Barrett, 2006; Barrett et al., 2007; Lindquist et al., 2006). In our study, the use of emotional words as labels for the rating scales could have constrained the participants' answers. Consequently, in Experiment 2, we included a new rating scale labeled *none of the above but another emotion.* Ratings on this scale were used together with ratings on the other five incorrect emotion scales to compute the discrimination index. Because the behavior of this index was mostly consistent between the two experiments, the inclusion of this scale does not seem to have strongly influenced the participants' responses.

General Discussion

The aim of these experiments was to directly test a fundamental hypothesis of the recent social appraisal account of theories of emotion, namely, that the way we appraise an emotional stimulus is modulated by the way that other individuals appraise, or feel about, the same stimulus. We focused here on the case in which the appraised emotional stimulus is a facial expression, which allowed us to compare explicit ratings of emotion recognition in experimental conditions that varied as a function of social appraisal.

Generally speaking, our research highlights the importance of considering the social dimension when investigating the processing of facial expressions of emotion. In everyday situations, facial expressions are rarely seen in isolation, and indeed, our results indicate that the nature of social information presented together with a to-be-recognized target face makes a difference.

In particular, consistent with our hypotheses, both experiments revealed that the influence of social contextual information on emotion recognition can be separated into two different effects: the mere effect of contextual information versus the social appraisal effect. The difference between a mere contextual condition and the social appraisal condition was perceptually subtle, but we believe that it clearly operationalized the concept of social appraisal. Indeed, the only difference between these two conditions was the gaze direction of the contextual face, which gazed either toward the target face (social appraisal) or toward the outside of the screen (mere context).

Confirming and extending previous findings showing that congruent contextual information facilitates emotion perception (e.g., Aviezer et al., 2008; Meeren et al., 2005; Righart & De Gelder, 2008), our results revealed that an expression presented in context increases the recognition of a target face that displays the same expression of happiness or anger. In terms of interpretation, given our paradigm, any modulation of the recognition of, for instance, target anger in the context of an angry face can be both the result of affective priming and of an inference process (i.e., social appraisal). We reasoned that if the only process that explains the facilitation of anger recognition when a contextual face is angry is an affective priming process, then one would expect to observe a mere contextual effect but no effect of gaze direction on anger recognition. On the other hand, if anger recognition is also facilitated by a social appraisal process, then recognition should be even better in a social appraisal condition. We observed two effects that seem to work additively. First, contrast analyses revealed that, in the non–social appraisal condition, target anger was better recognized when the contextual emotion was anger than when it was neutral. Second, a social appraisal effect was observed in addition to this mere contextual effect. Indeed, we showed that angry target faces that were gazed at by contextual angry faces were better recognized than when the same contextual faces did not gaze at the target face. These two results suggest that both an affective priming effect and a more inferential social appraisal effect could facilitate emotion recognition in an additive way. We also found in both experiments that the recognition of the target expression of anger was increased when the contextual face expressed fear without the gaze being directed toward the target. This

effect could also be explained by an affective priming effect, typically demonstrating that the processing of a target is facilitated if a prime of the same valence is presented, compared with a neutral prime or a prime of another valence (see Moors & De Houwer, 2001). Alternatively, this effect could be explained by the particular functional relationship that exists between these two facial expressions. Further studies could test these alternatives by including other negative expressions that are less functionally related (e.g., sadness and disgust). Moreover, results also revealed that anger recognition was improved when an angry target face was gazed at by a fear face. This finding reveals that the effect of social appraisal, when there is a functional relationship between the emotions (i.e., fear and anger), is not restricted to the perception of an ambiguous facial expression (i.e., fear) but extends to the perception of a much less ambiguous expression (i.e., anger).

The difference between mere context and social appraisal was also evident when we focused specifically on the functional relationship between the emotions anger and fear. We expected that the expression of fear, which is typically confused with surprise when processed in isolation (Ekman & Friesen, 1971; Rapcsak et al., 2000; Russell, 1994), would indeed be relatively confused with surprise in our paradigm when the contextual face was neutral and possibly when it expressed anger, but not in the social appraisal condition; we reasoned that the gaze of the angry face would be directed toward the fearful face, indicating that the fearful face is the object of the angry face. Such a pattern was indeed observed, with fear being confused with surprise when the contextual face was neutral (either with a direct or an averted gaze) or angry (when the gaze was averted but not directed to the target face), but with a clear disambiguation observed in both experiments when a target face of fear was gazed at by an angry face. This effect was therefore specific to the social appraisal condition.

Although the critical results supporting our hypotheses were consistent and replicated across experiments, a key difference in the design of the two experiments was the presentation order of the target and contextual faces. The differences in order between the sequences used in the two experiments make some combinations more likely than others, especially for the emotion pairs that are particularly functionally related (i.e., the anger–fear pairs). If one maps the sequence of Experiment 1 onto a social interaction, because the contextual expression always appeared after the target expression, it would be natural to perceive that the contextual face in the periphery was reacting to the target's emotion in the center. Thus, one may infer that the face in the periphery may express either the same emotion as the target face (e.g., through a process of emotional contagion) or a functionally related emotion such as fear in reaction to anger expressed by the target face. We indeed observed in Experiment 1 that recognition of anger expressed by the target face was facilitated when the contextual face looked at the target face and expressed fear. However, the opposite relation seems less possible: Why should a person become angry because he or she is looking at someone else who is already fearful? Although this causal relation seems less possible, we clearly observed in Experiment 1 that recognition of fear expressed by the target face was facilitated when the contextual face looked at the fearful target face and expressed anger. Critically, this result was also observed in Experiment 2 when a new sequence was introduced, with the expression of the contextual face now possibly being considered as the cause of the emotional reaction of the target face. Therefore, our results suggest that, independently of the sequence, the presence of an angry contextual face looking at the target face facilitates the recognition of fear expressed by this target face.

Such a sequence independency in the facilitation of fear recognition is puzzling if one considers the temporal dimension of causality. Our interpretation is that the social affective dimension of the interaction between the two faces is so powerful that the temporal dimension of the interaction becomes less meaningful. In other words, participants may integrate the information that the contextual agent is angry and is looking at a target agent who is afraid and infer that the target agent is afraid of the contextual agent even if the target is afraid before he or she is looked at by the agent with an angry expression (as in Experiment 1). Such interpretation remains to be further tested but seems to extend the notion of illusory causation in social situations. Indeed, it has been suggested that, in the social domain, there is a bias that consists of attributing causes to the most salient source of information (Taylor & Fiske, 1975), referred to as the illusory causation phenomenon (see Lassiter, Geers, Munhall, Ploutz-Snyder, & Breitenbecher, 2002). We suggest that the sequence should matter in facilitating the effect but that the social affective relationship between fear and anger is so salient that a congruent temporal relationship is not necessary for the subjective causation to be inferred. This could be considered as a case of illusory causation in which the temporal relation between the two agents (i.e., being the first vs. being the second to express fear) is overcome by the functionality of the social affective relation between the two agents (i.e., one is angry while the other is afraid). Such an interpretation is consistent with the fact that our key social appraisal results are indeed robust to subtle differences in timing and order and suggests that, in our paradigm, the emotional information presented in the periphery and in the center of the screen was integrated by what could be referred to as a social affective binding mechanism. As outlined earlier, in our case, this process seems to be more important than the real temporal and physical causality of the events presented on the screen (for discussion, see Choi & Scholl, 2006; Schlottmann, Ray, Mitchell, & Demetriou, 2006). Such social affective binding would be responsible for integrating the contextual and the target emotions together with their functional relation, therefore representing a global inference concerning the social interaction, possibly subserving illusory causations. By manipulating the time and the sequence in which the information is presented, further studies should be able to investigate temporal integration and subjective causality in affective social situations.

The difference observed in the results of Experiment 1 and Experiment 2 concerned mainly the mere contextual effect and how the contextual emotions may decrease recognition of the target emotion. In Experiment 1, recognition of anger decreased when the contextual emotion was happiness, and recognition of happiness decreased when the contextual emotion was anger or fear. One possible explanation for the fact that the contextual effects involving happiness were observed in Experiment 1 but not in Experiment 2 is that, in Experiment 1, the expression of the target face started just before that of the contextual face, whereas it started just after that of the contextual face in Experiment 2. Therefore, it is possible that the interference effect of a happy face on the recognition of fear and anger, as well as the interference effect of anger and fear on the recognition of happiness, takes

place at a relatively late stage of integration. Further studies could test this hypothesis by systematically varying the timing of co-occurrence of happiness and fear or anger expressions.

Although the specificity of the effects observed in both experiments is interpreted here in terms of an effect of social appraisal, possible alternative explanations should also be explored. Could these effects be explained by differences in the allocation of attention toward the target face? Using an adaptation of Posner's cuing paradigm, several studies (see Frischen, Bayliss, & Tipper, 2007) have shown that gaze direction of a face can be used as a cue to direct attention. For that reason, the possibility arises that our results can be explained by the fact that, in the condition of social appraisal—in which the gaze of the contextual face is directed toward the target face—attention allocation to this face is increased, therefore leading to enhanced recognition accuracy. However, our results are not consistent with such an explanation. Indeed, recognition of the target facial expression was not only dependent on the gaze direction of the contextual face but was, in fact, affected by the interaction between the gaze and the emotional expression of the contextual face. This means that the effect was specific to the predicted conditions and was not due to a general increase of attention toward the target face.

Given that our mere context condition consisted of a peripheral face displaying an averted gaze, one could wonder whether the observed effects should not be considered as gaze aversion effects rather than as mere contextual effects. For instance, moving away from a target could signal disapproval or dislike of the target. However, we do not favor such an interpretation for two reasons. First, in the non–social appraisal condition, the gaze remained averted and was never directed toward the target, which limits the possibility of inferring that the peripheral face appraised the target face as eliciting disapproval or dislike. Second, we do not feel that a dislike–disapproval interpretation corresponds to our findings, which are otherwise typically consistent with a general contextual effect. For instance, it does not seem that a dislike–disapproval hypothesis would predict that a contextual angry face (as compared with a neutral face) with an averted gaze would increase recognition of a target angry face. However, further studies could dynamically manipulate the averted gaze (i.e., moving from the target to another place) of peripheral faces (e.g., using expressions of disgust) to directly test the effects of signals of dislike or disapproval on target facial expressions.

The utilization of emotional scales to measure the recognition of emotions allows us to consider more information in the response of participants than the utilization of a forced choice procedure. For example, the interaction observed between the scales of fear and surprise for the target emotion of fear revealed how recognition of this ambiguous expression was influenced by social appraisal. However, for the target emotions of happiness and anger, where participants mainly responded on the appropriate scale, it remains to be understood whether participants better categorized these target expressions or whether they perceived them as being more intense. Sander et al. (2007) provided the first elements to tackle this question with a similar design. As in our study, the authors evaluated the categorization of facial expressions by using different scales labeled with emotional words, but they provided, in addition, a general intensity scale. Their results indicated that an increase on an emotional scale was typically accompanied by an increase on this general intensity scale. This is consistent with the notion that, for a participant, reporting "seeing more of an emotion" corresponds to "seeing the corresponding emotion as more intense." Of note, expression intensity is the variable that is indeed typically manipulated with morphed stimuli in studies investigating categorical perception of emotional expressions (e.g., Calder, Young, Perrett, Etcoff, & Rowland, 1996).

Considering the fact that we recruited only female participants in both experiments, we cannot be sure that the observed effects would also be observed in male participants. Although it has been suggested that there is a slight female advantage in nonverbal sensitivity (e.g., Hall, Murphy, & Schmid Mast, 2006) and emotion recognition (e.g., Hoffmann, Kessler, Eppel, Rukavina, & Traue, 2010), we are not aware of any theoretical prediction according to which a gender effect would be specifically observed in social appraisal processes.

The main findings of this study suggest that the way we process a facial expression of emotion is shaped by the way other people appraise or feel about the same face. Until now, the literature has provided evidence that social appraisal plays a significant role in the experience (Jakobs et al., 1997) and in the expression (Evers et al., 2005) of emotions. Our study provides new perspectives by showing that the process of social appraisal can also have an impact on the recognition of emotional facial expressions.

The concept of social appraisal, as defined by Manstead and Fischer (2001), is relatively general and certainly implemented by a variety of distinct processes that may occur at different levels and stages of the emotional process. The notion that the social dimension is integrated into the appraisal process is often acknowledged by appraisal theorists (see Scherer, Schorr, & Johnstone, 2001); however, when explicitly taken into account, this dimension can be considered as having a relatively late influence on the appraisal process, such as in the normative significance evaluation criteria proposed in the component process model (see Scherer, 2001), or having an influence after a first series of appraisals has been performed, namely, during reappraisal (for a discussion, see Evers et al., 2005). Therefore, making a distinction between the general concept of social appraisal and a series of processes that implement social appraisal is important from theoretical and methodological points of view.

From the perspective of appraisal theories of emotion, social appraisal can act at different stages of the emotion elicitation process. According to these theories (see Scherer, 2001), an event will elicit an emotion only if it is appraised as relevant (see Sander, Grafman, & Zalla, 2003; Sander et al., 2005). Our results are not informative with respect to the stage at which the social appraisal takes place. For instance, early relevance detection processes could be socially shaped in addition to slower appraisals (e.g., the normative significance appraisal). Recent evidence indicates that contextual effects on emotion recognition may be automatic (Aviezer, Bentin, Dudareva, & Hassin, 2011). Indeed, on the basis of experiments in which instructions or attentional resources are manipulated, Aviezer et al. (2011) suggested that facial expressions and their body contexts are automatically integrated. Further work could investigate whether social appraisal influences the way in which an event is appraised as relevant and therefore influences emotion elicitation at such an early stage. Testing whether social appraisal can have such an early effect, one that could even be automatic (see Aviezer et al., 2011; Moors & De Houwer, 2001,

2006), would improve our understanding of how social information shapes emotional processes.

References

Adams, R. B., Jr., & Kleck, R. E. (2003). Perceived gaze direction and the processing of facial displays of emotion. *Psychological Science, 14,* 644–647. doi:10.1046/j.0956-7976.2003.psci_1479.x

Adams, R. B., Jr., & Kleck, R. E. (2005). Effects of direct and averted gaze on the perception of facial communicated emotion. *Emotion, 5,* 3–11. doi:10.1037/1528-3542.5.1.3

Allport, G. W. (1954). The historical background of modern social psychology. In G. Lindzey & E. Aronson (Eds.), *The handbook of social psychology* (2nd ed., Vol. 1, pp. 1–80). Reading, MA: Addison-Wesley.

Aviezer, H., Bentin, S., Dudareva, V., & Hassin, R. R. (2011). The automaticity of emotional face-context integration. *Emotion, 11,* 1406–1414. doi:10.1037/a0023578

Aviezer, H., Hassin, R., Ryan, J., Grady, C., Susskind, J., Anderson, A., . . . Bentin, S. (2008). Angry, disgusted, or afraid? Studies on the malleability of emotion perception. *Psychological Science, 19,* 724–732. doi:10.1111/j.1467-9280.2008.02148.x

Barrett, L. F. (2006). Solving the emotion paradox: Categorization and the experience of emotion. *Personality and Social Psychology Review, 10,* 20–46. doi:10.1207/s15327957pspr1001_2

Barrett, L. F., Lindquist, K. A., & Gendron, M. (2007). Language as context for the perception of emotion. *Trends in Cognitive Sciences, 11,* 327–332. doi:10.1016/j.tics.2007.06.003

Bayliss, A. P., Frischen, A., Fenske, M. J., & Tipper, S. P. (2007). Affective evaluations of objects are influenced by observed gaze direction and emotional expression. *Cognition, 104,* 644–653. doi:10.1016/j.cognition.2006.07.012

Brainard, D. H. (1997). The Psychophysics Toolbox. *Spatial Vision, 10,* 433–436. doi:10.1163/156856897X00357

Calder, A. J., Young, A. W., Perrett, D. I., Etcoff, N. L., & Rowland, D. (1996). Categorical perception of morphed facial expressions. *Visual Cognition, 3,* 81–118. doi:10.1080/713756735

Carroll, J. M., & Russell, J. A. (1996). Do facial expressions signal specific emotions? Judging emotion from the face in context. *Journal of Personality and Social Psychology, 70,* 205–218. doi:10.1037/0022-3514.70.2.205

Choi, H., & Scholl, B. J. (2006). Perceiving causality after the fact: Postdiction in the temporal dynamics of causal perception. *Perception, 35,* 385–399. doi:10.1068/p5462

Cristinzio, C., N'Diaye, K., Seeck, M., Vuilleumier, P., & Sander, D. (2010). Integration of gaze direction and facial expression in patients with unilateral amygdala damage. *Brain, 133,* 248–261. doi:10.1093/brain/awp255

Darwin, C. (1955). *The expression of the emotions in man and animals.* New York, NY: Philosophical Library.

Ekman, P., & Friesen, W. V. (1971). Constants across cultures in the face and emotion. *Journal of Personality and Social Psychology, 17,* 124–129. doi:10.1037/h0030377

Ekman, P., & Friesen, W. V. (1978). *The Facial Action Coding System: A technique for the measurement of facial movement.* Palo Alto, CA: Consulting Psychologists Press.

Emery, N. J. (2000). The eyes have it: The neuroethology, function and evolution of social gaze. *Neuroscience and Biobehavioral Reviews, 24,* 581–604. doi:10.1016/S0149-7634(00)00025-7

Evers, C., Fischer, A., Mosquera, P., & Manstead, A. (2005). Anger and social appraisal: A "spicy" sex difference? *Emotion, 5,* 258–266. doi:10.1037/1528-3542.5.3.258

Feinman, S., Roberts, D., Hsieh, K. F., Sawyer, D., & Swanson, K. (1992). A critical review of social referencing in infancy. In S. Feinman (Ed.), *Social referencing and the social construction of reality in infancy* (pp. 15–54). New York, NY: Plenum Press.

Fischer, A. H., Rotteveel, M., Evers, C., & Manstead, A. S. R. (2004). Emotional assimilation: How we are influenced by others' emotions. *Cahiers de Psychologie Cognitive/Current Psychology of Cognition, 22,* 223–245.

Fraley, R. C., Niedenthal, P. M., Marks, M., Brumbaugh, C., & Vicary, A. (2006). Adult attachment and the perception of emotional expressions: Probing the hyperactivating strategies underlying anxious attachment. *Journal of Personality, 74,* 1163–1190. doi:10.1111/j.1467-6494.2006.00406.x

Frischen, A., Bayliss, A. P., & Tipper, P. T. (2007). Gaze cueing of attention: Visual attention, social cognition, and individual differences. *Psychological Bulletin, 133,* 694–724. doi:10.1037/0033-2909.133.4.694

Grandjean, D., & Scherer, K. R. (2008). Unpacking the cognitive architecture of emotion processes. *Emotion, 8,* 341–351. doi:10.1037/1528-3542.8.3.341

Hall, J. A., Murphy, N. A., & Schmid Mast, M. (2006). Recall of nonverbal cues: Exploring a new definition of interpersonal sensitivity. *Journal of Nonverbal Behavior, 30,* 141–155. doi:10.1007/s10919-006-0013-3

Hoffmann, H., Kessler, K., Eppel, T., Rukavina, S., & Traue, H. C. (2010). Expression intensity, gender and facial emotion recognition: Women recognize only subtle facial emotions better than men. *Acta Psychologica, 135,* 278–283. doi:10.1016/j.actpsy.2010.07.012

Jakobs, E., Fischer, A. H., & Manstead, A. S. R. (1997). Emotional experience as a function of social context: The role of the other. *Journal of Nonverbal Behavior, 21,* 103–130. doi:10.1023/A:1024904019590

Jones, B. C., DeBruine, L. M., Little, A. C., Burriss, R. P., & Feinberg, D. R. (2007). Social transmission of face preferences among humans. *Proceedings of the Royal Society of London B: Biological Sciences, 274,* 899–903. doi:10.1098/rspb.2006.0205

Lassiter, G. D., Geers, A. L., Munhall, P. J., Ploutz-Snyder, R. J., & Breitenbecher, D. L. (2002). Illusory causation: Why it occurs. *Psychological Science, 13,* 299–305. doi:10.1111/j.0956-7976.2002..x

Lindquist, K. A., Barrett, L. F., Bliss-Moreau, E., & Russell, J. A. (2006). Language and the perception of emotion. *Emotion, 6,* 125–138. doi:10.1037/1528-3542.6.1.125

Manstead, A. S. R., & Fischer, A. H. (2001). Social appraisal: The social world as object of and influence on appraisal processes. In K. R. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal processes in emotion: Theory, method, research* (pp. 221–232). New York, NY: Oxford University Press.

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

Meeren, H. K. M., Van Heijnsbergen, C. C. R. J., & De Gelder, B. (2005). Rapid perceptual integration of facial expression and emotional body language. *Proceedings of the National Academy of Sciences of the United States of America, 102,* 16518–16523. doi:10.1073/pnas.0507650102

Moors, A., & De Houwer, J. (2001). Automatic appraisal of motivational valence: Motivational affective priming and Simon effects. *Cognition & Emotion, 15,* 749–766. doi:10.1080/02699930143000293

Moors, A., & De Houwer, J. (2006). Automaticity: A theoretical and conceptual analysis. *Psychological Bulletin, 132,* 297–326. doi:10.1037/0033-2909.132.2.297

Nakamura, M., Buck, R., & Kenny, D. (1990). Relative contributions of expressive behavior and contextual information to the judgment of the emotional state of another. *Journal of Personality and Social Psychology, 59,* 1032–1039. doi:10.1037/0022-3514.59.5.1032

N'Diaye, K., Sander, D., & Vuilleumier, P. (2009). Self-relevance processing in the human amygdala: Gaze direction, facial expression, and emotion intensity. *Emotion, 9,* 798–806. doi:10.1037/a0017845

Pelli, D. G. (1997). The VideoToolbox software for visual psychophysics:

Transforming numbers into movies. *Spatial Vision, 10,* 437–442. doi:10.1163/156856897X00366

Péron, J., Grandjean, D., Le Jeune, F., Sauleau, P., Haegelen, C., & Drapier, D. (2010). Recognition of emotional prosody is altered after subthalamic nucleus deep brain stimulation in Parkinson's disease. *Neuropsychologia, 48,* 1053–1062. doi:10.1016/j.neuropsychologia.2009.12.003

Rapcsak, S. Z., Galper, S. R., Comer, J. F., Reminger, S. L., Nielsen, L., Kaszniak, A. W., . . . Cohen, R. A. (2000). Fear recognition deficits after focal brain damage: A cautionary note. *Neurology, 54,* 575–581.

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

Roesch, E. B., Sander, D., Mumenthaler, C., Kerzel, D., & Scherer, K. R. (2010). Psychophysics of emotion: The QUEST for emotion perception. *Journal of Vision, 10*(3), Article 4. doi:10.1167/10.3.4

Roesch, E. B., Tamarit, L., Reveret, L., Grandjean, D., Sander, D., & Scherer, K. R. (2011). FACSGen: A tool to synthesize realistic, static and dynamic emotional facial expressions based on facial action units. *Journal of Nonverbal Behavior, 35,* 1–16. doi:10.1007/s10919-010-0095-9

Roseman, I. J., & Smith, C. A. (2001). Appraisal theory: Overview, assumptions, varieties, controversies. In K. R. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal processes in emotion: Theory, method, research* (pp. 3–19). New York, NY: Oxford University Press.

Russell, J. A. (1994). Is there universal recognition of emotion from facial expressions? A review of the cross-cultural studies. *Psychological Bulletin, 115,* 102–141. doi:10.1037/0033-2909.115.1.102

Sander, D., Grafman, J., & Zalla, T. (2003). The human amygdala: An evolved system for relevance detection. *Reviews in the Neurosciences, 14,* 303–316. doi:10.1515/REVNEURO.2003.14.4.303

Sander, D., Grandjean, D., Kaiser, S., Wehrle, T., & Scherer, K. R. (2007). Interaction effects of perceived gaze direction and dynamic facial expression: Evidence for appraisal theories of emotion. *European Journal of Cognitive Psychology, 19,* 470–480. doi:10.1080/09541440600757426

Sander, D., Grandjean, D., & Scherer, K. R. (2005). A systems approach to appraisal mechanisms in emotion. *Neural Networks, 18,* 317–352. doi:10.1016/j.neunet.2005.03.001

Scherer, K. R. (2001). Appraisal considered as a process of multilevel sequential checking. In K. R. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal processes in emotion: Theory, method, research* (pp. 92–120). New York, NY: Oxford University Press.

Scherer, K. R., Schorr, A., & Johnstone, T. (Eds.). (2001). *Appraisal processes in emotion: Theory, methods, research.* New York, NY: Oxford University Press.

Schlottmann, A., Ray, E., Mitchell, A., & Demetriou, N. (2006). Perceived physical and social causality in animated motions: Spontaneous reports and ratings. *Acta Psychologica, 123,* 112–143. doi:10.1016/j.actpsy.2006.05.006

Shaw, P., Lawrence, E. J., Radbourne, C., Bramham, J., Polkey, C. E., & David, A. S. (2004). The impact of early and late damage to the human amygdala on "theory of mind" reasoning. *Brain, 127,* 1535–1548. doi:10.1093/brain/awh168

Taylor, S. E., & Fiske, S. T. (1975). Point of view and perceptions of causality. *Journal of Personality and Social Psychology, 32,* 439–445. doi:10.1037/h0077095

Vrtička, P., Andersson, F., Grandjean, D., Sander, D., & Vuilleumier, P. (2008). Individual attachment style modulates human amygdala and striatum activation during social appraisal. *PLOS One, 3*(8), Article e2868. doi:10.1371/journal.pone.0002868

Received July 3, 2011
Revision received November 18, 2011
Accepted November 21, 2011 ■