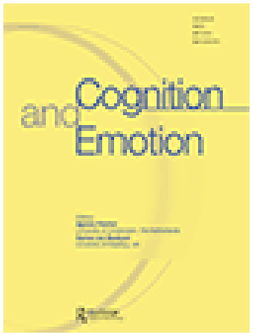

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Every look matters: appraisals of faces follow distinct rules of information integration under arousing versus non-arousing conditions

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ABSTRACT

In this research, we investigated whether appraisals of faces follow distinct rules of information integration under arousing versus non-arousing conditions. Support for this prediction was found in four experiments in which participants observed angry (and fearful) faces that were presented with a direct versus an averted gaze (Experiments 1a, b), on a red versus a grey background (Experiment 2), and after performing a motor exercise versus no exercise (Experiment 3). Under arousing conditions, participants' appraisals of faces reflected *summation* (i.e. extremely negative encounters were strengthened by moderately negative encounters) whereas, under non-arousing conditions, appraisals did not reflect summation (i.e. extremely negative encounters were weakened by moderately negative encounters) and could instead be accounted for by three alternative rules of information integration based on averaging, mere exposure, or the number of strong stimuli.

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Gaze direction; facial expression; emotion; cognitive appraisals; information integration; summation

It is important for people to be able to integrate information contained in faces. Faces communicate a large amount of information, especially the eye region and facial expressions. Research has shown that the direction of eye gaze and the emotional quality of facial expressions affect people's inferences about others' internal states and intentions and people's evaluative judgments of others (e.g. Jones, DeBruine, Little, Conway, & Feinberg, 2006; Mason, Tatkow, & Macrae, 2005). Moreover, observers respond emotionally to faces. For example, observers were found to respond with increased arousal to angry faces that gazed directly at them compared with angry faces that showed an averted eye gaze as indicated by subjective intensity ratings (Sander, Grandjean, Kaiser, Wehrle, & Scherer, 2007), skin conductance responses, heart rate change (Soussignan et al., 2013), and measures of amygdala activity (Adams, Gordon, Baird, Ambady, & Kleck, 2003; Conty & Grèzes, 2012; N'Diaye, Sander, & Vuilleumier, 2009). Yet, one unanswered question is how observers integrate facial information into an evaluative judgment of the person who expressed the emotion and whether information integration is different in arousing as opposed to non-arousing conditions.

Information integration and arousal

Similar to what happens in real life, in most previous research, facial stimuli were presented repeatedly. According to contemporary appraisal theories of emotional reactions, "the nature of the emotional experience changes each time a new appraisal is *added*" (Ellsworth & Scherer, 2003, p. 574). Similarly, the procedure of evaluative conditioning is based on the notion that, in conjunction with other positive or negative stimuli, repeated encounters with a stimulus change the value of a formerly neutral stimulus (De Houwer, Thomas, & Baeyens, 2001). However, it is usually difficult to discern the exact nature of this change. Is an evaluative response to repeated encounters with an emotional stimulus a function of the sum of the encounters, or is it rather a function of the mere number of encounters, the number of strong arguments for either position, or the average encounter? These variables are often interrelated.

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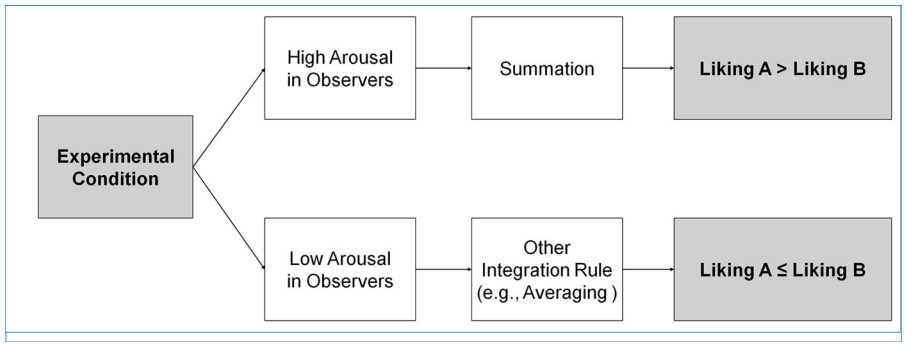

Figure 1. Conceptual model. Grey boxes indicate directly manipulated/assessed variables. White boxes indicate inferred variables.

As there are alternative models of how observers can integrate information (Anderson, 1991), in the present research, we empirically examined whether information integration under arousing (vs. non-arousing) conditions could be specified by a summation model. Specifically, we tested summation against alternative rules based on mere exposure (e.g. Zajonc, 1968), number of strong arguments (e.g. Petty & Cacioppo, 1984), and averaging (see Betsch, Kaufmann, Lindow, Plessner, & Hoffmann, 2006). In the case of summation, moderate encounters would add to and strengthen extreme evaluations. In the case of any of the three alternative rules, moderate encounters would weaken extreme encounters with the object of evaluation.

According to the value-account model (Betsch et al., 2006; Betsch, Plessner, Schwieren, & Gütig, 2001) – a dual process account of information integration – summation is more likely to occur when responses are urgent (e.g. when arousal is high or time is scarce), whereas averaging is more likely to occur when responses are not urgent (e.g. when arousal is low or time is abundant). Therefore, we expected summation under conditions of high arousal and an alternative rule (mere exposure, number of strong arguments, or averaging) under conditions of low arousal, see Figure 1.

Measuring the applied rule of information integration

We measured participants' liking of faces after the faces were repeatedly presented. To disentangle summation from the alternative rules of mere exposure, number of strong arguments, and averaging, we presented the faces in either (a) six portrait images (photographs) with an intense expression of anger and two images with a weaker version of that expression (Sample A) or (b) two images with an intense emotional expression and 18 images with a weaker expression (Sample B). The multiple images of a target individual were presented in a randomized order on a single computer screen. As illustrated in Table 1, if participants' appraisals of faces follow a *summation* rule of information integration, participants should indicate more favorable attitudes toward the Sample A individuals than toward the Sample B individuals (Liking A > Liking B). If participants' appraisals can be better explained by another rule such as mere exposure, the number of strong arguments, or averaging, they should instead indicate more favorable attitudes toward the Sample B individuals (Liking A < Liking B).

According to the *mere exposure* effect (Zajonc, 1968), observers tend to prefer stimuli to which they

Table 1. Sample composition and evaluative judgments as a function of different rules of information integration.

	Sample A	Sample B	Diff. score (A–B)
Sample composition			
Intense expression (hypothetical value -2)	6	2	
Weak expression (hypothetical value -1)	2	18	
Evaluative judgment as a function of			
Sum value	−14	−22	> 0 (pos.)
Average value	−1.75	−1.1	< 0 (neg.)
Number of encounters	8	20	< 0 (neg.)
Number of strongly negative encounters	(−)6	(−)2	< 0 (neg.)

have been exposed more frequently. If this account applies to evaluations of negative emotional stimuli (i.e. a negative stimulus is rated less negatively after it has been encountered repeatedly), participants should favor the Sample B over the Sample A individuals because the Sample B individuals are presented more frequently. Alternatively, if participants are influenced by *strong arguments* rather than the mere number of arguments (Petty & Cacioppo, 1984), they should again favor the Sample B over the Sample A individuals because the Sample B individuals are less frequently presented with an intense negative expression.

Finally, the *averaging* rule predicts that extremely negative impressions are diluted by the integration of less intense encounters with the stimulus (Betsch et al., 2006). Consistent with an averaging rule, research on emotional episodes has repeatedly shown that the integration of a less extreme negative encounter with a stimulus leads to a less extreme overall judgment of the stimulus (e.g. Fredrickson & Kahneman, 1993; Kahneman, Fredrickson, Schreiber, & Redelmeier, 1993; Redelmeier & Kahneman, 1996). If participants' judgments are compatible with an averaging model, they should also favor the Sample B over the Sample A individuals because the Sample B individuals are more often presented with a less extreme negative expression.

Overview of the present research

Two cues that have been shown to increase emotional responses to faces are gaze direction (direct vs. averted) and emotional expression (angry or fearful vs. neutral). As reviewed above, especially the combination of direct eye gaze and angry expression has been found to elicit arousal in observers (e.g. N'Diaye et al., 2009). To our knowledge, however, no experiment has reported whether such arousing cues promote a summation rule for information integration.

We conducted four experiments to examine whether eye gaze direction and the emotional quality of faces modulate how people judge how much they like target individuals. In the first two experiments, we tested the hypothesis that participants apply a summation rule when exposed to faces that display anger with a direct (vs. averted) gaze (Experiments 1a, b). If the presumed effects of gaze direction are indeed due to increases in participants' arousal, we expected to obtain similar results (i.e. support for a summation rule) when arousal in observers was increased through alternative methods. Therefore, in two additional experiments, we tested the hypothesis that participants apply a summation rule when arousal is increased by the context in which the faces are presented (Experiment 2: red background; Elliot & Maier, 2012) and by means of engaging in a motor exercise before rating the faces (Experiment 3: squeezing a ball; Thayer, 1978).

Experiment 1a

In the first study, we explored which facial cues induce a switch from an alternative information integration rule (mere exposure, number of strong arguments, averaging) to a summation rule. Participants rated the likability of faces that were repeatedly presented with either a direct or an averted gaze combined with an expression of either anger or fear. Previous research has shown that angry faces with a direct gaze induce significantly more arousal in observers than angry faces with an averted gaze (e.g. Adams et al., 2003; Soussignan et al., 2013). Therefore, we expected appraisals of angry faces with a direct gaze to support a summation rule (Liking A > Liking B) and appraisals of angry faces with an averted gaze to follow an alternative rule (Liking A ≤ Liking B). By comparison, findings from previous research on the effect of gaze direction for fearful faces have been less clear. Whereas some studies have reported effects that were similar to those found for angry faces (e.g. Langton, Watt, & Bruce, 2000), others have suggested that fearful faces induce more arousal in observers when presented with an averted compared with a direct gaze (e.g. Sander et al., 2007; Soussignan et al., 2013). Because the literature has been inconsistent with regard to the combined effect of gaze direction and emotional expression, we were not able to make more precise predictions about whether gaze direction and emotional expression would show additive or interactive effects on the application of appraisal rules (for an overview and further discussion, see Frischen, Bayliss, & Tipper, 2007). Here, the study was purely exploratory.

Method

Participants

Seventy-eight female university students (age: $M = 21.92$ years, $SD = 2.32$) from the University of Trier completed a study on "person perception." The sample consisted of only female participants

because prior research has suggested that women are more sensitive to emotional facial expressions than men are (e.g. Jones et al., 2006; Mason et al., 2005; Schmitz, Scheel, Rigon, Gross, & Blechert, 2012; Soussignan et al., 2013). A power analysis was conducted prior to data collection using a moderate effect size for the factors of gaze direction and facial expression ($\eta_p^2 = .04$; see Soussignan et al., 2013). The power analysis suggested a total sample size of 78 participants. Consistent with this result, data collection was stopped when this number was reached. Students were offered research participation credit for taking part in the study.

Design

Participants were asked to indicate their liking of target individuals who were repeatedly presented via images of faces with either a direct or an averted gaze showing intense and weak expressions of either anger or fear as described above for Sample A and Sample B (see Table 1). We applied a 2 (Gaze Direction: direct, averted) × 2 (Facial Expression: anger, fear) factorial design with the first factor as a within-subjects factor and the second factor as a between-subjects factor. The dependent variable was a difference score composed of the mean liking ratings of the target individuals from Sample A minus the mean ratings of the target individuals from Sample B. A summation model predicts a positive difference score (i.e. a stronger relative liking of Sample A individuals). The alternative integration rules predict a negative score (i.e. a stronger relative liking of Sample B individuals).

Stimulus material

Images of four Caucasian male adults from the Radboud Faces Database (Langner et al., 2010) were selected for use in the study. A pretest ($N = 32$) of the neutral expressions with direct gaze showed no a priori differences in liking between the four target individuals on a 10-point scale (1 = *dislike*, 10 = *like*; $M = 2.87$, $SD = 0.63$, all single comparisons, $ps > .13$). For each of these individuals, three direct gaze and three averted gaze images were selected from the database, one of which showed anger, one fear, and one a neutral expression. As illustrated in Figure 2, in the present research, the target individuals appeared with an intense facial expression of the emotion as well as with a weak version of the expressed emotion. Weaker versions were created by morphing the full expression with the neutral expression of the same person (using photo-editing software, Adobe Photoshop 5.0) yielding weaker expressions primarily in the mouth region. As a manipulation check, the emotional intensity of the stimuli was rated in a pretest ($N = 60$ for angry faces and $N = 37$ for fearful faces). Participants were asked to indicate how angry (fearful) the faces appeared to them on a 10-point scale (1 = *not at all*; 10 = *extremely*). Ratings of the two emotional expressions were each subjected to a 2 (Image: intense vs. weak) × 2 (Gaze Direction: direct vs. averted) analysis of variance (ANOVA). Results yielded significant main effects of the image for both anger, $F(1, 59) = 54.44$, $MSE = 0.55$, $p < .001$, $\eta_p^2 = .48$, and fear, $F(1, 36) = 74.86$, $MSE = 0.54$, $p < .001$, $\eta_p^2 = .68$. As intended, intensity ratings were significantly higher for images containing the full emotional expressions (anger: $M = 7.43$, $SD = 1.36$; fear: $M = 7.41$, $SD = 1.81$) compared with images containing the morphed, weaker expressions (anger: $M = 6.72$, $SD = 1.32$; fear: $M = 6.37$, $SD = 1.73$). There was no main effect of gaze direction and no interaction between image and gaze direction (all Fs < 1). The results suggest that the original and morphed images of target individuals were indeed perceived as intense and weak versions of the depicted emotion, respectively. It is important to mention that angry faces with a direct (vs. averted) gaze were *not* perceived as depicting a more intense expression of anger. Nevertheless, on the basis of previous research, we expected the direct gaze to induce more arousal in observers.

Procedure

Participants were tested in groups of up to six at the laboratory. Each participant was seated in a separate cubicle equipped with a computer. Participants were told that the study was about "person perception" and that they would be required to indicate their intuitive gut feelings about different individuals on the computer screen. Each participant was presented with four target individuals. Half of the participants were presented with four angry target individuals and the other half with four fearful ones.

As illustrated in Figure 3, the multiple images of each target individual were presented in a randomized order on a single screen. For all participants, two target individuals appeared in six images with an intense expression and in two images with weaker versions of the emotional facial expression (Sample A). The other two appeared in two images with an intense expression and in 18 images with a

Figure 2. Example images of the target individuals with a weaker expression (left) and an intense expression (right) of anger, with an averted gaze (top) and direct gaze (bottom). *Source*: Permission obtained.

weak expression (Sample B). Of these two Sample A and two Sample B individuals, one target individual was presented with a direct gaze and one with an averted gaze. The factors of gaze direction, emotion, and sample were counterbalanced across target individuals. That is, across participants, each target individual was presented (a) with a direct and an averted gaze, (b) with an expression of anger and fear, and (c) as described above for Samples A and B.

On the same screen as the composition of images, participants reported their feelings toward the target individuals on open rating bars (ranging from −5.00 = dislike to + 5.00 = like). After participants rated how much they liked the target, they could go to the next screen, which showed a different individual. This procedure was entirely the same for each of the presented target individuals. The presentation of the target individuals was computerized (written in

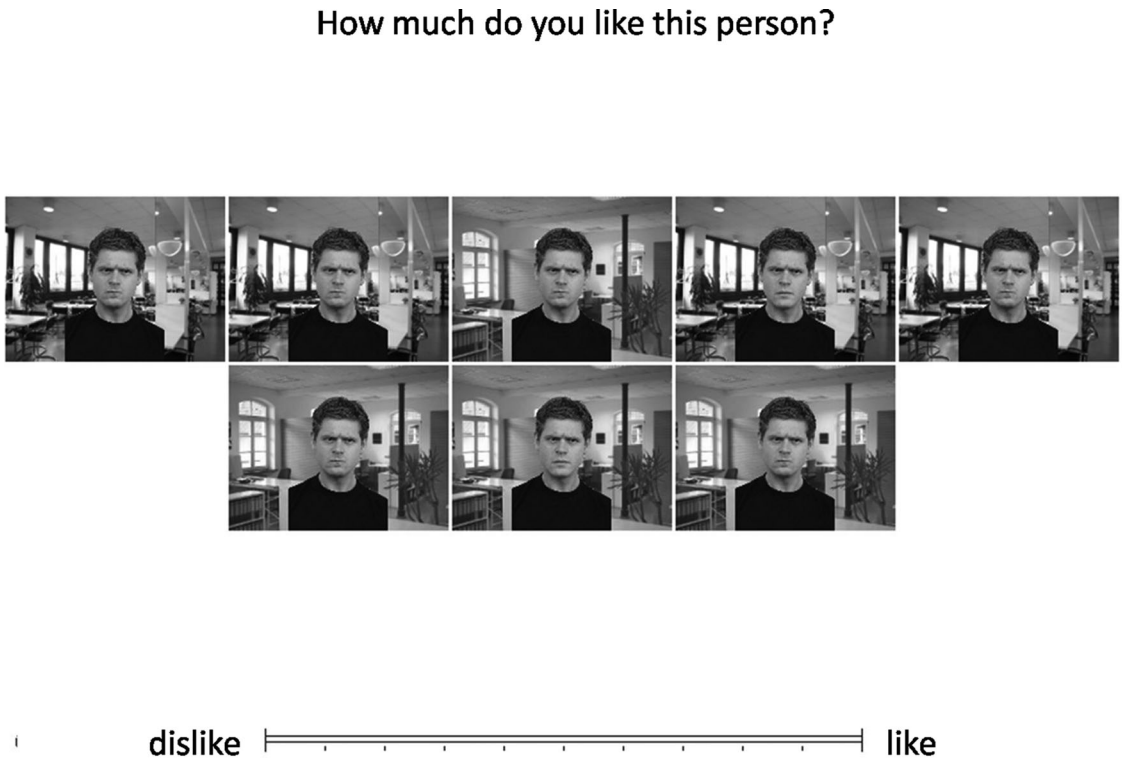

Figure 3 Example of the single screen array (e.g. anger, averted gaze, Sample A). *Source*: Permission obtained.

Microsoft Visual Studio). The order of target individuals as well as the order of images within samples was randomized across participants.

As the dependent variable, we calculated difference scores between the ratings of the Sample A and Sample B individuals (Liking A minus Liking B). Difference scores were calculated separately for each gaze direction condition and each participant.

Results

A 2 (Gaze Direction) × 2 (Facial Expression) ANOVA of the difference scores in liking with gaze direction (averted, direct) as a within-subjects factor and facial expression (fear, anger) as a between-subjects factor yielded a significant main effect of gaze direction, $F(1, 76) = 4.35$, $MSE = 364.63$, $p < .05$, $\eta_p^2 = .05$. As listed in Table 2, when the targets' gaze was direct, participants liked the Sample A individuals more than the Sample B individuals, resulting in a positive difference score ($M = 0.15$), which indicated summation. By contrast, when the targets' gaze was averted, participants liked the Sample B individuals more than the Sample A individuals, resulting in a negative difference score ($M = -0.45$), which indicated an alternative rule (averaging, mere exposure, number of strong arguments). The contrast between participants' ratings of Sample A vs. Sample B individuals

Table 2. Means and standard deviations of participants' (dis)liking of the target individuals: angry and fearful male faces (Experiment 1a) and angry male faces (Experiment 1b)

	Experiment 1a				Experiment 1b			
	Averted gaze		Direct gaze		Averted gaze		Direct gaze	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
A (6–2)	−1.46	1.87	−1.22	1.79	−0.31	1.29	0.52	1.68
B (2–18)	−1.01	1.82	−1.36	1.77	0.33	1.59	−0.70	1.72
Diff. score (A–B)[a]	−0.45	1.95	0.15	2.10	−0.65	1.72	1.22	1.65

Note: −5 = dislike, +5 = like.
[a]Positive scores indicate summation (i.e. a stronger disliking of Sample B individuals).

within each condition was not significant for the direct gaze condition, $t(77) = 0.62$, $p = .538$, but it was significant for the averted gaze condition, $t(77) = 2.04$, $p = .045$. There was no significant effect of facial expression, $F(1, 76) = 1.80$, $MSE = 447.36$, and no significant interaction between gaze direction and facial expression, $F(1, 76) = 2.01$, $MSE = 364.63$. For exploratory purposes, we calculated the difference score for each emotion condition separately. On a descriptive level, the results for the angry face condition supported the direct gaze effect (direct: $M = 0.64$, $SD = 2.12$ vs. averted: $M = -0.44$, $SD = 2.14$), whereas those for the fearful face condition did not (direct: $M = -0.25$, $SD = 2.03$ vs. averted: $M = -0.46$, $SD = 1.80$).

Discussion

The present findings supported the prediction that gaze direction would have a significant effect on the rule applied for information integration. Although ratings in the direct gaze condition were not significantly different for Sample A versus Sample B individuals, we found a tendency for appraisals of emotional faces to follow the summation rule in this condition. Consistent with the mixed findings in the literature on the effects of a direct gaze in fearful faces, this tendency was found for angry but not for fearful faces. For an averted gaze, by contrast, appraisals of emotional faces followed a different rule (i.e. mere exposure, number of strong arguments, averaging).

On the basis of the empirical evidence in the literature, we assumed that this shift in rules was due to the arousal elicited in observers by a direct gaze. If this assumption is valid, the results should be relatively robust regardless of methodological changes. Studies in which stimuli were presented in a serial manner or judged retrospectively have provided evidence for mere exposure effects (e.g. Zajonc, 1968) and averaging (e.g. Fredrickson & Kahneman, 1993; Kahneman et al., 1993; Redelmeier & Kahneman, 1996), respectively. Accordingly, one may doubt whether the results from Experiment 1a would be robust against such methodological changes. In order to test the robustness of the effect, we conducted a follow-up experiment in which we drastically changed the presentation of the faces and the rating conditions.

Experiment 1b

The purpose of Experiment 1b was to test whether we would obtain similar results if we changed the presentation of faces and the rating conditions. In this experiment, we presented angry faces in a serial manner as task-irrelevant distracting information and tested the effects on ratings of the same target individuals at a later point in time when presented with a neutral facial expression and a direct gaze. We expected to find similar results when the presentation and rating conditions were changed. Specifically, we expected that appraisals of angry faces with a direct gaze would support a summation rule (Liking A > Liking B), whereas appraisals of angry faces with an averted gaze would not (Liking A ≤ Liking B).

Method

Participants and design

Forty university students (29 women, 11 men, age $M = 23.28$ years, $SD = 2.01$) from the University of Trier participated in a study on "person perception." Participants judged angry faces with a direct gaze and an averted gaze under two different task conditions. The study applied a 2 (Gaze Direction: averted, direct) × 2 (Rating Task: first, second) within-subjects design. The sample size was determined prior to data collection via a power analysis. The power analysis was calculated with an intermediate effect of gaze direction ($\eta_p^2 = .05$, see Experiment 1a). The results suggested a sample size of 40 participants. Data collection was stopped when this number was reached. This time, both men and women took part in the study so that we could test for possible gender differences. Students were offered research participation credit for taking part in the study.

Material and procedure

We employed a modified version of the experimental paradigm for the study of information integration as developed by Betsch et al. (2006). In a first phase, participants were instructed to focus on information about stock shares running in a stock ticker at the bottom of a screen. They were told that they would be asked to evaluate the shares at a later point in time. During this task, the faces were presented as distracting information. They flashed one after another in a random order in the center of the screen and remained there for 2.5 s each. We expected that participants would incidentally encode the faces, similar to what occurs in everyday life. There were two sets of distracters, one that had to be rated at a later time and one that was not rated. During the presentation, a total of 95 faces were shown (including the

28 images of the target individuals). The other (not rated) distracters appeared in half of the cases with a direct gaze and equally often with an intense and a weak emotional expression (i.e. 6 intense + 6 weak images). Following the presentation, participants were unexpectedly asked to rate the target individuals (instead of the shares). For the ratings, the faces were again presented serially on separate screens. In contrast to Experiment 1a, the targets were shown in this retrospective test with a neutral facial expression and a direct gaze.

The second phase of this study was a replication of Experiment 1a but with one modification. Participants were given extra instructions to carefully inspect all images before providing their ratings of the target individuals. The order of the target individuals was randomized across participants in each task condition. Participants gave their ratings on open rating bars (ranging from −5.00 = dislike to + 5.00 = like). The difference score (Sample A rating minus Sample B rating) served as the dependent variable and was calculated separately for each task condition, gaze condition, and participant.

Results

A 2 (Gaze Direction) × 2 (Task) repeated-measures ANOVA was computed on the difference scores. It showed a significant main effect of gaze direction, $F(1, 39) = 19.68$, $MSE = 7.07$, $p < .001$, $\eta_p^2 = .34$. As in Experiment 1a, in the direct gaze condition, there was a positive difference score, thus supporting a summation rule ($M = 1.22$). In the averted gaze condition, by contrast, there was a negative difference score, thus indicating the use of another integration rule ($M = -0.65$, see Table 2). In both conditions, the contrast of participants' ratings of Sample A vs. Sample B individuals was significant (direct gaze: $t(39) = 4.68$, $p < .001$; averted gaze: $t(39) = 2.37$, $p = .037$).

In addition, there was a marginally significant main effect of task, $F(1, 39) = 3.74$, $MSE = 6.10$, $p = .060$, $\eta_p^2 = .09$, and a marginally significant Gaze Direction × Task interaction, $F(1, 39) = 3.88$, $MSE = 4.43$, $p = .056$, $\eta_p^2 = .09$, indicating a somewhat stronger preference reversal effect evoked by gaze direction (direct vs. averted) when the faces were presented as distracters (first phase) rather than explicitly evaluated (second phase).

When participants' gender was inserted as an additional factor into a 2 × 2 × 2 (Gaze Direction × Task × Gender) ANOVA on the difference scores, the main effect of gaze direction remained significant, $F(1, 38) = 13.31$, $MSE = 7.18$, $p < .001$, $\eta_p^2 = .26$. There were no significant main or interaction effects of gender (Gaze Direction × Gender, $F(1, 38) = 0.40$, $MSE = 7.18$; Task × Gender, $F(1, 38) = 0.54$, $MSE = 6.18$; Gaze Direction × Task × Gender, $F(1, 38) = 0.30$, $MSE = 4.51$).

Discussion

Replicating the results of Experiment 1a, participants' appraisals in this experiment supported a summation rule when the angry faces were presented with a direct gaze as opposed to an averted gaze. In line with our assumption that it is the arousal elicited by the direct gaze that changes the applied appraisal rule, the results remained consistent across different presentation formats and rating conditions as well as across observers' gender. In order to more thoroughly examine whether the appraisal rule varies as a function of the arousal presumably elicited in observers by the facial stimuli, we conducted two further experiments. In these experiments, we tested whether we would obtain similar results when we increased arousal with methods other than targets' gaze direction. We increased participants' arousal through the context in which we presented the faces (Experiment 2) or by having participants engage in a motor exercise before they observed the facial cues (Experiment 3).

Experiment 2

In this experiment, we tested whether angry faces with an averted gaze would produce effects similar to angry faces with a direct gaze when the averted-gaze faces were presented in an arousing context. There is evidence that the context can alter the perception of emotional faces (Aviezer et al., 2008; Righart & de Gelder, 2008; Wieser & Brosch, 2012). Furthermore, presenting stimuli in the context of the color red can induce arousal in observers (for a review, see Elliot & Maier, 2012). Accordingly, we expected to find similar results for faces with an averted gaze when presenting them in the context of the color red. Specifically, we expected appraisals of angry, averted-gaze faces to support a summation rule (Liking A > Liking B) when presented on a red background but an alternative rule when presented on a grey background.

Method

Participants and design

Fifty-five female university students (age $M = 22.93$ years, $SD = 3.19$) from the University of Trier participated in exchange for research participation credit in a study on "person perception." Participants judged angry male faces with an averted gaze presented in two different display conditions: in front of a neutral grey computer screen or in front of a red screen. The sample size was determined prior to data collection via a power analysis. The power analysis was calculated with a small preference reversal effect of the color factor (of at least $\eta_p^2 = .02$; see Elliot, Maier, Moller, Friedman, & Meinhardt, 2007). Data collection was not stopped until the suggested sample size was reached (resulting in a total of 55 participants, with $n \geq 24$ in each condition).

Material and procedure

The procedure was similar to Experiment 1a but with the following modification. We presented angry faces with an averted gaze for half of the participants on a neutral grey screen (see Experiment 1a) and for the other half on a red screen.

Results

For the difference score, the contrast between the two background conditions was not significant, $F(1, 53) = 3.25$, $MSE = 3.29$, $p = .077$, $\eta^2 = .06$. Nevertheless, as expected, the red background condition produced a large positive difference score (Sample A minus Sample B: $M = 1.11$, see Table 3). The contrast between participants' ratings of Sample A vs. Sample B individuals was significant in the red background condition, $t(23) = 2.53$, $p = .019$, but not in the grey background condition, $t(30) = 0.82$, $p = .420$.

Discussion

By showing that similar results could be obtained with averted-gaze faces that were presented in the context of the color red, the present study provides further support for the notion that when faces are presented in a manner that is presumed to induce arousal in observers, they promote the use of a distinct appraisal rule in observers (i.e. summation). In Experiment 3, we tested whether the same results would emerge if we induced arousal in our participants before exposing them to the facial stimuli.

Experiment 3

In this final experiment, we aimed to test whether arousal stemming from an irrelevant and unrelated external source would produce results similar to those obtained by the gaze and color manipulations. Therefore, we induced arousal in our participants through an ostensibly unrelated task and then examined the carryover effect of this arousal manipulation on participants' evaluations of emotional faces. In previous research, simple motor exercises increased ratings on the deactivation-activation dimension (Thayer, 1978) and induced a shift in appraisal processes (e.g. Sanbonmatsu & Kardes, 1988). Accordingly, half of the participants in the current research performed a simple motor exercise (i.e. squeezing a softball for one minute) before viewing the emotional faces. For the purpose of the present experiment, we presented angry female faces. Our previous results suggested that angry male faces induce too much

Table 3. Means and standard deviations of participants' (dis)liking of the target individuals (Experiment 2: males with averted gaze; Experiment 3: females with direct gaze) as a function of arousal in the context (Experiment 2) or in the observer (Experiment 3).

	Experiment 2				Experiment 3			
	Grey color		Red color		No exercise		Motor exercise	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Anger								
A (6–2)	−2.21	1.81	−1.63	2.25	−1.78	1.86	−1.13	1.92
B (2–18)	−2.43	1.66	−2.74	1.78	−1.30	1.63	−2.04	1.50
Diff. score (A–B)[a]	0.22	1.50	1.11	2.15	−0.48	1.43	0.91	1.80
Fear								
A (6–2)					−0.91	1.73	−0.63	1.82
B (2–18)					−0.74	1.87	−0.41	1.44
Diff. score (A–B)[a]					−0.17	1.77	−0.22	1.22

Note: −5 = dislike, +5 = like.
[a]Positive scores indicate summation (i.e. a stronger disliking of Sample B individuals).

arousal in participants for an alternative integration rule to still be possible. By contrast, faces with averted gaze induce too little arousal for summation. To test our prediction, we therefore presented angry female faces instead of angry male faces (see Williams & Mattingley, 2006). In addition, we presented fearful female faces to follow up on the nonsignificant effects of emotional expression in Study 1.

Method

Participants and design

Sixty-three female university students (age $M = 23.14$ years, $SD = 4.50$) from the University of Trier participated in exchange for research participation credit in a study on "person perception." The study was a 2 (Arousal Condition: motor exercise, no exercise) × 2 (Facial Expression: anger, fear) design with the first factor as a between-subjects factor and the second factor as a within-subjects factor. The sample size was determined prior to data collection via a power analysis. The power analysis was calculated with a moderate effect size for the factors of arousal manipulation and facial expression, respectively ($\eta_p^2 = .04$; see Soussignan et al., 2013). The results suggested a total sample size of 63 participants. Data collection was stopped when this number was reached.

Material and procedure

The procedure was similar to Experiment 1a with the following changes. Participants were randomly assigned to either an arousal priming group or a control group (no arousal priming) and were presented with faces of women displaying either anger or fear with a direct gaze. The faces were selected from the Radboud Faces Database, and moderate expressions were created using photo-editing software (Adobe Photoshop 5.0). Participants in the arousal priming group squeezed a softball for 1 min in the right or left hand before the facial stimuli were presented. Prior to the experiment, each participant filled out a handedness questionnaire (Oldfield, 1971), and hand use was counterbalanced between participants.

Results

Because the results did not change when the left-handed participants ($N = 7$) were excluded, the data from these participants were included in the analyses. A 2 × 2 (Arousal Condition × Facial Expression) mixed-factorial ANOVA on the difference scores (i.e. Sample A minus Sample B) yielded a significant main effect of arousal condition, $F(1, 61) = 4.90$, $MSE = 2.54$, $p < .05$, $\eta_p^2 = .07$. There was no significant main effect of facial expression, $F(1, 61) = 2.03$, $MSE = 2.34$, but there was a significant Arousal Condition × Facial Expression interaction, $F(1, 61) = 6.14$, $MSE = 2.34$, $p < .05$, $\eta_p^2 = .09$. As shown in Table 3, when participants observed anger after squeezing a softball, the difference score was positive, thus supporting a summation rule ($M = 0.91$), whereas in all other conditions, the difference score was negative, thus indicating the use of another integration rule (e.g. averaging; M ranged from −0.17 to −0.48). In the condition in which participants observed anger after squeezing the ball, the contrast between participants' ratings of Sample A vs. Sample B individuals was significant, $t(41) = 3.27$, $p = .002$. In all other conditions, the contrast between participants' ratings of Sample A vs. Sample B individuals was not significant, all $ts \leq 1.53$, all $ps \geq 143$.

Discussion

These results once again demonstrate that angry faces with a direct gaze promoted summation (i.e. a positive difference score) in observers. It is important to mention that, consistent with our arousal hypothesis, angry female faces promoted summation only when observers squeezed a softball before they were exposed to the facial stimuli. The arousal manipulation did not induce a shift in the applied rule of information integration when they appraised fearful female faces. This finding is consistent with the mixed effects found for fearful faces with a direct gaze on observers' arousal. Taken together, the arousal manipulation developed in this experiment (i.e. squeezing a ball) specifically changed participants' appraisals of angry female faces toward summation.

It is important to note that in previous research, squeezing a ball in the right versus left hand has been successfully used to activate left- vs right-hemispheric processes, thereby separating the effects of analytical, controlled, explicit processes from parallel, holistic, implicit processes (e.g. Baumann, Kuhl, & Kazen, 2005; Beckmann, Gröpel, & Ehrenspiel, 2013). Because left-hemispheric processes are associated with controlled processes, one might expect that squeezing a ball with the right hand would promote an alternative rule of information integration instead of summation. We did not find such a lateralization

effect. The results did not change when we considered whether participants used the right or left hand to squeeze the ball. In line with our hypothesis, we assume that this is due to participants' arousal. Specifically, we assume that observing an angry face after squeezing the ball created such an arousing condition that participants relied on summation. To our knowledge, no previous study has reported that the alternative rules (e.g. averaging, mere exposure, and number of strong arguments) have occurred under arousing conditions. In fact, empirical evidence for the alternative rules is limited to non-arousing conditions (see Betsch et al., 2006). Moreover, the previous three experiments consistently showed that exposure to arousing stimuli (e.g. angry faces with a direct gaze) led participants to use summation even when the task itself allowed for alternative rules of information integration.

General discussion

Previous research has shown that people see more threat in angry faces when such faces are presented with a direct gaze than when they are presented with an averted gaze (e.g. Sander et al., 2007). Extending this work, the present results suggest that different appraisal rules underlie the evaluation of angry faces with a direct versus averted gaze. To the best of our knowledge, with these studies, we are the first to investigate whether facial cues and other contextual variables that have previously been shown to affect observers' arousal can promote different rules of information integration. The results of four experiments suggest that, under arousing conditions, participants' appraisals of faces can be best described by a summation rule (with weak encounters adding to intense encounters) whereas, under non-arousing conditions, participants' appraisals can be accounted for by a different rule of information integration (with weak encounters attenuating intense encounters).

Specifically, we found that participants' appraisals were in accordance with summation when targets with expressions of anger looked toward them (vs. to the side; Experiments 1a, b) and when targets were instead observed on a red (vs. grey) background (Experiment 2) or after the participants had engaged in a motor exercise (vs. no motor exercise; Experiment 3). In other words, we found summation following experimental inductions of arousal at the levels of (a) the stimulus: a direct (vs. averted) gaze of angry target individuals (Experiments 1a, b), (b) the context: a red (vs. grey) background color (Experiment 2), and (c) the observer: pre-experimental motor exercise (Experiment 3). Further increasing our confidence in our interpretation of the results, we found that summation characterizes appraisals in arousing conditions across observers' gender (women: Experiments 1a, b, 2, 3; men: Experiment 2), targets' gender (angry men: Experiments 1a, 1b, 2; angry women: Experiment 3), and task conditions (explicit: Experiments 1a, b, 2, 3; implicit: Experiment 2).

But why do appraisals follow distinct rules of information integration under arousing and non-arousing conditions? One possible explanation is that arousal might reduce cognitive capacity. According to the value-account model (Betsch et al., 2001, 2006), cognitive capacity determines which rule will be applied for information integration. For example, Betsch et al. (2006) repeatedly presented returns of different shares to their participants. In an incidental coding condition (low cognitive capacity), participants preferred shares that produced the highest sum of returns. In an explicit condition (high cognitive capacity), by contrast, participants preferred shares that produced the highest average increase. Thus, summation occurred under low and averaging occurred under high cognitive capacity (Betsch et al., 2006). Similarly, studies in which participants form insightful and controlled evaluations have frequently supported rules of information integration such as averaging (Anderson, 1971, 1991; Fredrickson & Kahneman, 1993; Kahneman et al., 1993; Redelmeier & Kahneman, 1996; for a review, see Betsch et al., 2006).

Consistent with the dual process account, we found support for a summation model when participants' cognitive capacity was experimentally reduced (i.e. when we presented faces as distracters rather than as targets). However, we similarly found support for summation when participants rated faces with a direct gaze, on a red background, and following a brief motor exercise. Until now, little has been known about whether and to what extent a direct gaze, a red background color, and a brief motor exercise can reduce cognitive capacity. Yet, studies have consistently shown that all of these variables do induce arousal. Nevertheless, one major limitation of the present research is that we did not directly assess arousal in our participants. Future research should further validate our current interpretation with measures of arousal.

Overall, the present findings are in harmony with the assumption of contemporary appraisal theories

of emotion that "the nature of the emotional experience changes each time a new appraisal is added" (Ellsworth & Scherer, 2003, p. 574). Our findings elaborate on the exact nature of this change. People's affective reactions to another person's facial expressions reflect summation under arousing conditions but a different rule of information integration (e.g. averaging) under non-arousing conditions.

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