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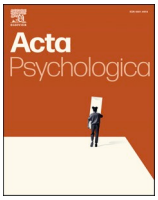

When a smile is still a conflict: Affective conflicts from emotional facial expressions of ingroup or outgroup members occur irrespective of the social interaction context☆

Robert Huber [a,*], Rico Fischer [a], Julia Kozlik [b]

[a] Department of Psychology, University of Greifswald, Greifswald, Germany
[b] University Medicine Greifswald, Greifswald, Germany

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ABSTRACT

Facial expressions play a crucial role in human interactions. Typically, a positive (negative) expression evokes a congruent positive (negative) reaction within the observer. This congruent behavior is inverted, however, when the same positive (negative) expression is displayed by an outgroup member. Two approaches provide an explanation for this phenomenon. The *social intentions account* proposes underlying social messages within the facial display, whereas the *processing conflict account* assumes an affective conflict triggered by incongruent combinations of emotion and the affective connotation of group membership. In three experiments, we aimed at further substantiating the processing conflict account by separating the affective conflict from potential social intentions. For this, we created a new paradigm, in which the participant was an outside observer of a social interaction scene between two faces. Participants were required to respond to the emotional target person that could represent an ingroup or outgroup member. In all three experiments, irrespective of any social intention, responses were consistently affected by the group relation between participant and emotional target, i.e., the affective (in)congruency of the target seen by participants. These results further support the processing conflict account. The implications for the two theoretical accounts are discussed.

1. Introduction

Human interactions deeply depend on emotional facial expressions. Naturally, most seen expressions lead to a congruent reaction within the observer. A positive expression (e.g., happiness) induces positive affect and an approach reaction whereas negative expressions (e.g., fear or anger) elicit negative affect and an avoidance reaction (Elliot et al., 2013; Hatfield et al., 1993; Marsh et al., 2005; Phaf et al., 2014; Shaham et al., 2020; Stins et al., 2011). While these affective reactions are intuitive and rather automatic, they seem to critically depend on the group membership between the interaction partners, that is, whether they share a social or cultural group with one another or not (Craig & Lipp, 2018; Paulus et al., 2019; Paulus & Wentura, 2014; Weisbuch & Ambady, 2008). More precisely, congruent affective reactions only occur in perceivers interacting with an ingroup person. When confronted with an outgroup person, however, these reactions are inverted (Paulus & Wentura, 2014; Weisbuch & Ambady, 2008), with positive emotions triggering negative reactions (e.g., avoidance reaction) within the perceiver and negative emotions triggering a positive reaction (e.g., approach reaction).

The most prominent account for the observed group-induced response divergence to emotional facial expressions – the *social intentions account* – assumes that affective reactions are based on imputed social intentions by the perceiver that result from the combination of the expresser's emotion and group membership (Paulus & Wentura, 2014; Weisbuch & Ambady, 2008). It is assumed that due to a general liking of ingroup members and disliking of outgroup members (i.e., ingroup favoritism, cf. Fazio et al., 1995; Tajfel, 1974), perceivers tend to impute ingroup persons to pursue benevolent intentions and outgroup persons to pursue malevolent intentions. This ingroup favoritism as well as a

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* Corresponding author at: University of Greifswald, Department of Psychology, Franz-Mehring-Str. 47, 17489 Greifswald, Germany.
E-mail address: robert.huber@uni-greifswald.de (R. Huber).

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self-association with the ingroup are seen as unconscious processes which are considered highly automated (Otten & Moskowitz, 2000; Otten & Wentura, 1999; Zinn et al., 2022). Consequently, the perceiver is thought to interpret different social intentions for each combination of emotional expression and group membership. More precisely, depending on the group membership of the expresser, happiness either conveys an affiliation intention (ingroup expresser) or a dominance intention (outgroup expresser). Similarly, fearful expressions are thought to be interpreted either as a warning signal (ingroup expresser) or a submissive signal (outgroup expresser). Thus, affective reactions of the perceiver are expected to systematically vary as a function of these imputed intentions: Affiliation (i.e., happy ingroup faces) and submission signals (i.e., fearful outgroup faces) should trigger positive affective reactions and warning (i.e., fearful ingroup faces) and dominance signals (i.e., happy outgroup faces) should trigger negative affective reactions.

However, recently Kozlik and Fischer (2020) proposed an alternative explanation for the observed group-induced response divergence to emotional facial expressions – the *processing conflict account*. This account assumes that both stimulus features, emotional expression and group status, are processed individually. This process can result in an activation of conflicting stimulus information (i.e., affective processing conflict). Thus, for example, a *positively* evaluated emotion (e.g., happiness) expressed by a *negatively* evaluated person (i.e., outgroup member) – is thought to induce an affective conflict. Therefore, we consider emotional expressions by ingroup/outgroup individuals as a Stroop-like stimulus (Stroop, 1935) where two features of the same stimulus (in the case of a Stroop stimulus: color word and print color) match or mismatch, creating non-conflicting or conflicting cognitive processes, respectively.

Multiple studies in the field of conflict processing have found increased negativity in subsequent judgements when confronted with conflicting stimuli or response conflicts (cf., Dreisbach & Fischer, 2012; Fritz & Dreisbach, 2013; Nohlen et al., 2019), which may explain the observed negative affective reactions (i.e., facilitated avoidance reactions, cf., Paulus & Wentura, 2014) to happy outgroup or fearful ingroup faces since both are incongruent in their affective features. On the other hand, congruent facial displays (i.e., the valence of both stimulus features matches, which would be the case for happy ingroup and fearful outgroup faces) do not trigger an affective conflict within the observer. An important requirement for the assumptions of the processing conflict account is that the affective value of facial expression and group membership are both evaluated automatically. In fact, the literature provides broad evidence for preferences towards ingroup compared to outgroup members, as well as more negative implicit attitudes towards the outgroup and more positive attitudes about the ingroup (Fazio et al., 1995; Greenwald et al., 1998; Hewstone, 1990; Otten & Wentura, 1999). Likewise, there is broad evidence concerning automatic affective evaluation of facial expressions (Murphy & Zajonc, 1993; Palermo & Rhodes, 2007; Rotteveel et al., 2001). Thus, it seems reasonable to consider the processing conflict account as a more parsimonious theoretical explanation than the social intentions account (but see Wentura & Paulus, 2022).

To empirically support the proposed processing conflict account, Kozlik and Fischer (2020) conducted four experiments to demonstrate that affective incongruence between affective stimulus features of a facial display induces conflict as well as typical conflict adaption processes. Participants were presented with pictures of persons with affectively congruent (e.g., happy + ingroup) or incongruent (e.g., happy + outgroup) stimulus features and were required to decide whether the displayed facial expression is positive or negative. Responses to congruent faces were faster and less erroneous than responses to incongruent faces. Furthermore, this congruency effect was consistently reduced following incongruent trials, which has been interpreted as adjustment to conflict (Botvinick et al., 2001; Gratton et al., 1992; see also Braem et al., 2019). Importantly, such conflict adaptation effects occurred not only when the type of conflict signal repeated from one trial to another (e.g., happy + outgroup followed by happy + outgroup), but also when the type of conflict signal switched (e.g., happy + outgroup followed by fear + ingroup). This result supports the processing conflict account, because the source of conflict is identical for both, fear + ingroup and happy + outgroup, as it represents a mismatch between two affective stimulus features. However, the finding of conflict adaptation effects in conflict switch trials is hard to reconcile with the social intentions account, because it assumes distinct social messages underlying fearful ingroup and happy outgroup faces.

To further strengthen the argument for the processing conflict account, Kozlik and Fischer also replicated these findings when reducing potential contributions of social intentions in the stimulus display (Experiment 4). In particular, face stimuli were tilted to the left or right by 45° in order to create the feeling of stimulus faces looking elsewhere. It was argued that potential intentions were not directed towards the participant, which should at least reduce the influence of social intentions. Again, the findings of faster responses to affectively congruent compared to affectively incongruent faces as well as respective conflict adaptation effects speak in favor of the processing conflict account.

Even though the aforementioned results initially support the processing conflict account, one cannot exclude the possibility that simply looking at an emotional expression of a facial target display creates the illusion of an interaction, which might come along with automatic evaluation of social intentions. Although there are several empirical indices in favor of the processing conflict account, it is still conceivable that the effects reported in Kozlik and Fischer (2020) do not result from a conflict between affective features of the face but from social intention processing. The response divergence between affectively congruent and incongruent stimuli could also be explained by expected outcomes for the perceiver linked to the different social intentions, even when the face is not directed to the participant (e.g., E4 in Kozlik & Fischer, 2020). For example, the social intentions account considers ingroup happiness to reflect an affiliation intention, which is representative for “safety” and, thus, comes along with positive outcomes for the perceiver. Likewise, outgroup fear, which is supposed to represent a submission intention, also promises safety for the perceiver. The other two combinations (i.e., outgroup happiness and ingroup fear), however, assumingly represent dominance and warning signals, which are both interpreted as “danger” and, thus, come along with negative outcomes for the perceiver. Considering that outcome expectancies like these have shown to result in response accelerating effects (Eder et al., 2015), the congruency effects (i.e., performance benefit for affectively congruent targets) observed by Kozlik and Fischer (2020) could alternatively be explained by outcome expectancies elicited by specific social intentions. Therefore, the present study was designed to further reduce the social interaction context between participant and target face with the aim to disengage the participant from any social intentions, potentially conveyed by the facial expression of the target.

For this, we developed a new experimental paradigm, in which a participant looked at a social interaction scene between two persons. The face of a target person with an emotional facial expression was presented together with a neutral face of another person (i.e., a distracter). Both, target and distracter face were either ingroup or outgroup to each other. As done previously, we used pictures of White Caucasian and Middle-Eastern men to represent ingroup and outgroup members (cf., Kozlik & Fischer, 2020; Paulus & Wentura, 2014). Most importantly, both faces were directed towards each other to create a social interaction scene (see Fig. 1). As a consequence, potential social intentions of the expresser (i.e., target) were directed to the interaction partner – the receiver (i.e., distracter) whereas the participant itself becomes an outside observer of the interaction scene. The advantage of this approach is clear: All social messages that are sent from the emotional target person should be directed towards the newly introduced distracter person instead of the participant. Thus, this experimental setup allows to more clearly assess the contribution of affective

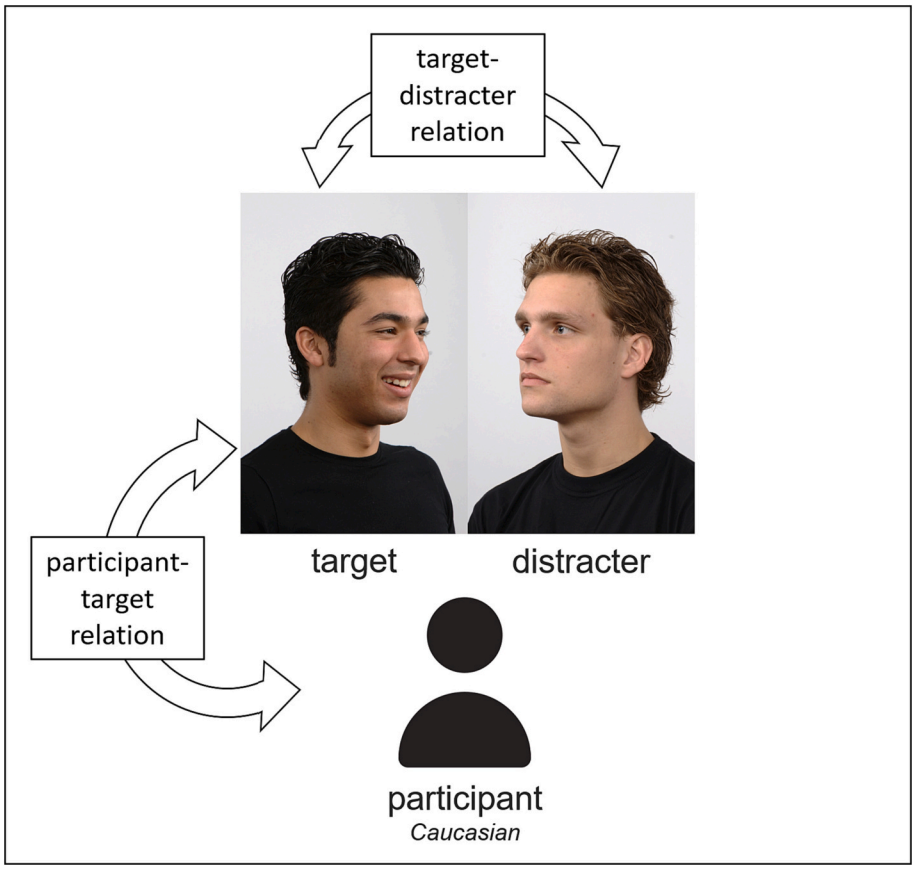


Fig. 1. Schematic illustration of the experimental paradigm. The participant-target relation describes the group membership (ingroup vs. outgroup relation) between target and participant (exclusively White-Caucasian), the target-distracter relation describes the group membership between target and distracter (ingroup vs. outgroup relation). The target is characterized by an emotional expression (happiness vs. fear), the distracter is characterized by a neutral facial expression.

conflict processing.

Affective processing conflicts were induced as in Kozlik and Fischer (2020). The observing participants were exclusively members of one specific group (i.e., White Caucasians) and formed an ingroup or outgroup relationship with the emotional target person, which was orthogonally varied to the ingroup/outgroup relation of target and distracter. Therefore, specific combinations of the target's emotional facial expression and the participant-target group membership relation are associated with affective (in)congruence. Accordingly, if the effects reported in Kozlik and Fischer (2020) are a result of the proposed processing conflict we should observe a performance decline on participant-target combinations that are associated with affective incongruency. More precisely, ingroup targets displaying negative expressions and outgroup targets displaying positive expressions should yield slower and more erroneous responses than combinations of affective congruency, i.e., when ingroup targets display positive expressions and outgroup targets displaying negative expressions. Because potential social intentions are orthogonally varied by the group status of target and distracter, such findings would substantially strengthen the case for the processing account.

1.1. Overview of experiments

The goal of the present study was to test whether conflict-like effects would even occur when potential influences of social intentions are eliminated as far as possible. For this, we conducted three experiments with happy vs. angry (Experiment 1) or happy vs. fearful (Experiments 2 + 3) facial expressions of targets that (a) form an ingroup vs. outgroup to the participant and (b) form an ingroup vs. outgroup to the distracter. In Experiments 1 and 2 participants task was to identify the emotional expression of the target as being positive or negative. Thus, viewed from the perspective of the Stroop-analogy, the emotional expression was the task-relevant stimulus feature, whereas the group status between target and participant was task-irrelevant. If the processing conflict account is correct, one would expect Stroop-like conflict effects regardless of the characteristics of the distracter, i.e., processing interference should occur when negative ingroup and positive outgroup targets are perceived.

Because incompatibility between the irrelevant stimulus information and features of the required response has been shown to contribute to the Stroop effect, affective conflict effects in Experiments 1 and 2 could in principle stem from the task demands. It could be argued that the task requirement of responding to one of the critical stimulus features (here: emotional expression) might evoke conflict effects due to the perceived incompatibility between the required response and the irrelevant, to-be-ignored stimulus dimension (here: group membership). However, the applicability of the processing conflict account does not hinge on response conflicts. Instead, based on the finding that Stroop conflicts also arise without any requirement to respond to the color (Damen et al., 2018; Tae et al., 2021), we assumed that emotional expression and group membership are processed automatically and irrespective of the task requirements. Thus, incongruent stimulus configurations should result in a processing conflict due to the perceived evaluative incongruency. Thus, to strengthen the argument for the processing conflict account it is important to demonstrate an impact of evaluative incongruency in an unrelated task. Therefore, in Experiment 3, participants' task was to localize the target on the screen (i.e., left vs. right position), which made both the emotional expression and the group status of the target task-irrelevant. Again, we expected performance decrements to negative ingroup and positive outgroup targets compared to positive

ingroup and negative outgroup targets irrespective of the characteristics of the distracter.

Because social intentions were orthogonally varied via manipulation of the group status of the target to the distracter, it could be interesting to explore the contribution of potential social intentions. The presented interaction scene between target and distracter might represent social intentions sent from one to the other. Because the social intentions account postulates that emotional expression and group membership are processed and integrated forming specific social messages, if anything, the social intentions account would postulate influences on participants' reactions by the emotional expression and the group membership between target and distracter (i.e., the receiver). However, it is important to mention that several auxiliary assumptions need to be made to assume an impact of social intentions on participants' responses in this newly developed paradigm. For example, one needs to assume that participants are able to process and relate the emotional expression of the target, the ethnicity of the target, and the ethnicity of the distracter to one another in a rather short period of time. Furthermore, it must be assumed that an outside observer of a social interaction scene processes social intentions sent from one interacting individual to another. Although recent evidence suggests an ability to understand social intentions sent between other persons from an observer position, which is accompanied by higher activation in brain areas connected to social attention and communicative signals (Böckler et al., 2016), one should be cautious with reference to drawing implications for the social intentions.

2. Experiment 1

Because the intended introduction of a second person (i.e., the distracter) into the experimental paradigm is a rather substantial change compared to previous studies that only presented one target person, the aim of Experiment 1 was to test whether we find the expected markers of conflict processing. In the study of Kozlik and Fischer (2020) the presentation of happiness versus anger as emotional expressions resulted in the strongest conflict effects. Therefore, we chose happiness versus anger for Experiment 1 and expected to reproduce critical markers of conflict processing, i.e., an interaction of participant-target relation and target emotion, which is representative for the affective (in)congruency, proposed by the processing conflict account.

To test this hypothesis, participants in Experiment 1 were confronted with pictures of two persons who are supposed to be interacting with each other – a target person with an emotional expression and a distracter person with a neutral expression. The task was to find the emotional target person and decide as quickly and accurately as possible whether the target displays a positive (happiness) or negative (anger) facial expression. Similar to previous comparable experiments we used ethnicity as a manipulation of group membership (Kozlik & Fischer, 2020; Paulus & Wentura, 2014; Weisbuch & Ambady, 2008).

If the findings of Kozlik and Fischer (2020) stem from conflict processing, we should observe an interaction between participant-target relation and emotion of the target on participant's performance, irrespective of the characteristics of the distracter. More precisely, when participant-target group membership and emotional facial expression of the target form an incongruent combination (i.e., outgroup-happy or ingroup-angry) responses should be slower and more erroneous compared to congruent combinations of participant-target group membership and target emotion (i.e., ingroup-happy or outgroup-angry). If, however, the findings of Kozlik and Fischer (2020) stem from outcome expectancies elicited by social intentions, we should fail to observe an interaction between participant-target relation and target emotion.

If social intentions do play a role in this stimulus configuration, one might rather expect an influence of the target-distracter relation because in our modified experimental setup social messages should be communicated between target and distracter. From the viewpoint of the social intentions account, a happy target in an ingroup relation to the distracter represents a positive intention (i.e., affiliation) whereas a happy target in an outgroup relation to the distracter represents a negative intention (i.e., dominance). Since, at least in some experimental paradigms, responses to negative stimuli are slowed down (cf., Emotional Stroop paradigm, Frings et al., 2010; McKenna & Sharma, 1995) one might expect that responses to negative intentions are slower than responses to positive intentions. Because angry expressions are considered to represent an aggression signal irrespective of the group status (Horstmann, 2003), the assumed response benefit for happy targets in an ingroup relation to the distracter statistically equates to an interaction between target emotion and target-distracter relation. The fact that participants are required to respond to the positivity/negativity of the target's expression should even boost this expected interaction effect because the categorization of a happy face as positive should be even further hampered in case of an outgroup relation between target and distracter because happy outgroup faces represent a negative stimulus.

2.1. Method

2.1.1. Participants

A total of 39 undergraduate students (27 female) from the University of Greifswald were tested. Participants received course credits as compensation for their participation. All participants were between 18 and 38 years old ($M = 21.2$ years; $SD = 4.7$ years). The data sets of two participants were not further considered because they indicated to have a migration background which led us to exclude them from further analyses.

2.1.2. Stimuli

Pictures of 8 White and 8 Middle-Eastern men from the Radboud Faces Database (Langner et al., 2010) were selected as stimuli to display the happy or angry facial expressions of target persons. Furthermore, pictures of different 8 White and 8 Middle-Eastern men were used as stimuli for the neutral distracter persons within the interaction scenes.

2.1.3. Procedure

The task consisted of a valence categorization task with pictures of White and Middle Eastern men displaying facial expressions as stimuli. All depicted faces were in a 45° or 135° orientation to create an interaction scene with two persons who are seemingly interacting with each other. Each interaction scene displayed one emotional person (i.e., happiness or anger) and one person with a neutral facial expression. Participants were instructed that the face stimulus depicting an emotional facial expression serves as target stimulus. The face stimulus depicting a neutral facial expression represented the distracter stimulus and could be ignored. Participants' task was to decide as quickly and accurately as possible whether the emotional target person is depicting a positive (happy) or negative (angry) facial expression. They were required to respond with their left (“X” key) and right (“M” key) index finger and the assignment of the response keys was counterbalanced across the sample. Both target and distracter person could either be White or Middle-Eastern men which resulted in two different relation categories (target-distracter relation, ingroup vs. outgroup). Moreover, because participants were exclusively White there were also two different relation categories with reference to the target (participant-target relation, ingroup vs. outgroup).

The experimental session started with a practice block of 8 trials followed by 256 experimental trials divided into two blocks with a brief break in between blocks. During the practice block we used pictures of 4 different White and 4 different Middle-Eastern men to avoid stimulus repetitions during the experiment trials. Each of the White and Middle-Eastern target persons were equally often presented with a happy and angry facial expression. In addition, the target persons were equally often presented on the right or left side of the interaction scene. The sequence of stimuli was completely randomized.

Each individual trial started with a fixation cross depicted for 1000 ms followed by the interaction scene until a response was given (i.e., no response deadline applied). Afterwards a blank screen appeared for 1500 ms as an intertrial interval. During the practice trials an additional feedback screen was presented for 1500 ms immediately after response was given. No feedback was given during the experimental trials.

2.1.4. Data analysis

We analyzed reaction times (RT) and error percentages (PE) as dependent variables. RT's were preprocessed by excluding erroneous trials (2.3 %). Furthermore, we excluded all trials with RT below 200 ms and above 1500 ms (3.1 %).

Mean RT's and PE's were submitted to a repeated measures analyses of variances (rmANOVA) with the factors: participant-target relation (ingroup vs. outgroup), target-distracter relation (ingroup vs. outgroup), and target emotion (happiness vs. anger). Results are presented in Table 1.

2.2. Results

The repeated measures analysis of variance (rmANOVA) over mean RT's revealed a significant main effect for participant-target relation, with faster responses when categorizing the facial expression of an ingroup member ($M = 689$ ms, $SEM = 21$) compared to that of an outgroup member ($M = 702$ ms, $SEM = 21$), $F(1, 36) = 10.10$, $p = .003$, $\eta_p^2 = 0.22$. A further significant main effect was obtained for the factor target emotion. Responses were faster for happy ($M = 679$ ms, $SEM = 21$) than for angry ($M = 712$ ms, $SEM = 21$) facial expressions, $F(1, 36) = 12.20$, $p < .001$, $\eta_p^2 = 0.25$. The target-distracter relation revealed no significant main effect, $F < 1$.

The critical interaction between participant-target relation and target emotion was only close to statistical significance, $F(1, 36) = 3.12$, $p = .086$, $\eta_p^2 = 0.08$. Comparing affectively congruent trial types (i.e., happy ingroup and angry outgroup targets) with affectively incongruent trial types (i.e., happy outgroup and angry ingroup targets), revealed a benefit for responding to affectively congruent targets ($M = 692$ ms, $SEM = 20$) than to affectively incongruent targets ($M = 699$ ms, $SEM = 20$) as predicted by the processing conflict account.

The interaction of target-distracter relation and target emotion, which may be representative for the social intentions account, was not significant, $F(1, 36) = 1.02$, $p = .319$, $\eta_p^2 = 0.03$. None of the other RT-related effects reached significance (all p's $> .215$).

The same rmANOVA over PE's revealed a significant main effect for participant-target relation, with less errors when categorizing the facial expressions of ingroup ($M = 1.9$ %, $SEM = 0.3$) compared to outgroup ($M = 2.7$ %, $SEM = 0.4$) members, $F(1, 36) = 5.47$, $p = .025$, $\eta_p^2 = 0.13$. Furthermore, a significant main effect was revealed for target emotion, with higher error rates for happy facial expressions ($M = 3.6$ %, $SEM = 0.4$) compared to angry facial expressions ($M = 1.1$, $SEM = 0.2$ %), $F(1, 36) = 35.94$, $p < .001$, $\eta_p^2 = 0.50$. Like in the RT's the target-distracter relation revealed no significant main effect, $F < 1$.

Most importantly, in error rates the critical interaction of participant-target relation and target emotion was significant, $F(1, 36) = 5.17$, $p = .029$, $\eta_p^2 = 0.13$. Again, performance in affectively congruent trials ($M = 1.9$ %, $SEM = 0.3$) was more efficient than performance in affectively incongruent trials ($M = 2.8$ %, $SEM = 0.4$. The interaction between target-distracter relation and target emotion was not statistically significant (*ns*), $F < 1$.

Finally, there was an interaction between participant-target relation and target-distracter relation $F(1, 36) = 12.96$, $p = .001$, $\eta_p^2 = 0.27$. Irrespective of the valence of the facial expression, responses to ingroup targets ($M = 1.6$ %, $SEM = 0.3$) were less erroneous than responses to outgroup targets ($M = 3.3$ %, $SEM = 0.4$) when the target faced an outgroup interaction partner, $t(36) = 3.52$, $p = .001$, $d = 0.58$ (two-tailed). But there were no significant differences in participants' responses to ingroup ($M = 2.3$ %, $SEM = 0.3$) and outgroup ($M = 2.1$ %, $SEM = 0.3$) targets when the target faced an ingroup interaction partner, $t < 1$, *ns*. None of the other effects reached significance (all p's $> .163$).

Table 1
Mean response times in ms (standard error) and error rates in percentage (standard error) for Experiment 1. Data are depicted as a function of expressed facial emotion by the target (happiness vs. anger), participant-target relation (ingroup vs. outgroup), and target-distracter relation (ingroup vs. outgroup).

	Participant-target relation		Target-distracter relation	
	Ingroup	Outgroup	Ingroup	Outgroup
Response times				
Happiness	669 (20)	688 (21)	679 (20)	678 (21)
Anger	709 (22)	714 (21)	708 (21)	714 (21)
Error rates				
Happiness	2.7 (0.4)	4.4 (0.6)	3.6 (0.4)	3.3 (0.5)
Anger	1.2 (0.3)	1.2 (0.3)	1.2 (0.2)	1.1 (0.2)

2.3. Discussion

Experiment 1 demonstrated that participants' responses to emotional facial expressions of the target person were affected by the (mis)match between group membership and emotion. More errors were committed for affectively incongruent target faces (i.e., angry ingroup and happy outgroup faces) compared to affectively congruent target faces (i.e., happy ingroup and angry outgroup faces). The same effect was also observed in RT's, which, however, missed statistical significance. Importantly, the interaction between emotional facial expression and group membership in the target-participant relation occurred although elicited social intentions by the target person were directed to the interaction partner (distracter) and not to the observer of the interaction scene (participant). Thus, this result pattern further supports and extends the conclusion of Kozlik and Fischer (2020) and further substantiates the processing conflict account.

An unpredicted finding was the interaction between participant-target relation and target-distracter relation in the error rates. Responses to ingroup targets were less erroneous than responses to outgroup targets when the target interacted with an outgroup distracter. This difference between ingroup and outgroup targets did not occur when the target interacted with an ingroup distracter. A possible explanation for this finding is that the target's group membership might be more salient when the distracter is of opposing group membership to the target which is in line with findings of more pronounced ingroup biases with increased group saliency (e.g., Mullen et al., 1992).

With reference to the social intentions account, the social interaction scene between target and distracter seemingly did not affect performance in a way that the social intentions account would have assumed. However, in Experiment 1 we used anger as a negative expression because this emotion produced the largest conflict effects in the Kozlik and Fischer study. Viewed from the perspective of the social intentions account, anger is special in the sense that it is thought to be interpreted as an aggression signal irrespective of the group membership of the expresser (Horstmann, 2003). Because the social message of an anger expression does not vary as a function of group membership, we exchanged anger for fear expressions, which from the viewpoint of the social intentions account are differentially interpreted depending on the group membership of the expresser.

3. Experiment 2

Experiment 2 applied the same experimental setup as in Experiment 1 with the only difference that the target emotion presented were happiness vs. fear instead of happiness vs. anger. The task was to indicate whether the target displays a positive (happy) or negative (fear) facial expression. Because the participant is not an active part of the

social interaction and is thus not the receiver of the social intention, we expect to replicate the result pattern of Experiment 1. To reiterate, in line with the processing conflict account, we expect an interaction between participant-target relation and target emotion: Responses should be slower and more erroneous in affectively incongruent combinations (i.e., fearful ingroup and happy outgroup targets) compared to affectively congruent combinations (i.e., happy ingroup and fearful outgroup targets). If, however, social intentions were responsible for the effects observed in the Kozlik and Fischer (2020) study, we should fail to find the respective interaction.

With regard to the social intentions account, again, based on the assumption that responses to negative stimuli are slowed down, one might expect an interaction between target-distracter relation and target emotion, because the group membership between target and distracter should determine which social intention is attributed to the facial expression. This interaction should be demonstrated by faster and less erroneous reactions to interaction scenes representing positive intentions (i.e., happy target – ingroup relation with distracter [affiliation intention], or fearful target – outgroup relation with distracter [submission intention]) compared to interaction scenes representing negative intentions (i.e., happy target – outgroup relation with distracter [dominance intention] or fearful target – ingroup relation with distracter [warning intention]). Moreover, the required response (i.e., to categorize the valence of the facial expression) could result in an additional hampering of specific combinations: As described in the introduction, emotional expressions elicit compatible affective reactions in ingroup receivers and incompatible reactions in outgroup receivers. Therefore, categorizing the emotion according to its affective value should be facilitated for ingroup relations between target and distracter, because the required response matches to the affective value of the attributed social message (positive expression = positive affiliation intention and negative expression = negative warning intention). However, in outgroup relations the categorization of happiness as positive and fear as negative may be hampered because the respective attributed social message (i.e., dominance and submission) do not match with the categorization that needs to be taken. This pattern should equate to a main effect of target-distracter relation.

3.1. Method

3.1.1. Participants

A total of 48 participants (38 female, 1 non-binary) signed up and participated. The sample consisted of 45 students of the University of Greifswald, 2 professionals and 1 pupil. 44 Participants stated to be right-handed, the other 4 participants stated to be left-handed. Participants received course credits as compensation for their participation. All participants were between 18 and 35 years old (M = 21.9 years; SD = 3.3 years). One participant was excluded from further analyses, because this participant indicated a migration background, which counteracts the ingroup and outgroup manipulation of participant-target relation.

3.1.2. Materials

Pictures of 9 White and 9 Middle-Eastern men from the Radboud Faces Database (Langner et al., 2010) were selected as target stimuli. The pictures of each person were relative to the height of the participants screen, picture width was 30 % of screen height and picture height was 45 % of the screen's height. All 18 faces displayed either a happy or a fearful facial expression. For the distracter persons, faces of different 9 White and 9 Middle-Eastern men with neutral facial expressions were selected for the interaction scenes.

3.1.3. Procedure

The study was programmed in PsychoPy (Peirce et al., 2019) and conducted online (Bridges et al., 2020). The experimental setup was virtually identical to Experiment 1. Participants' task was to decide as quickly and accurately as possible whether the emotional target person displays a positive (happy) or negative (fearful) facial expression. They were required to respond with their left ("X" key) and right ("M" key) index finger and the assignment of the response keys was counterbalanced across the sample. Both target and distracter person could either be White or Middle-Eastern men. This resulted in an ingroup or outgroup relation not only between target and distracter (target-distracter relation), but also between target and participant (participant-target relation), because all participants were White Caucasians.

Because the experiment was conducted online, practice was extended to 16 trials. In the experimental block 18 faces with happy expressions (9 White and 9 Middle-Eastern) and 18 faces with fearful expressions (9 White and 9 Middle-Eastern) were presented 4 times in total, amounting to 144 trials. The target persons were again equally often paired with ingroup vs. outgroup faces displaying neutral emotional expressions. In addition, target faces were equally often presented on the left or right side of the interaction scene. The sequence of stimuli was completely randomized for each participant.

Each trial started with a fixation cross depicted for 500 ms, followed by the interaction scene, presented for a maximum of 2000 ms or until a response was given. Afterwards a blank screen appeared for 1000 ms as an intertrial interval. During the practice trials feedback for erroneous or missing responses and a blank screen for correct responses was provided for 700 ms. No feedback was given during the experimental trials.

3.1.4. Data analysis

Data of three participants were excluded due to unusual high error rates (> 2.5 SD of the average error rate). For the remaining 44 data sets RT's and PE's were analyzed. RT's were preprocessed by excluding erroneous trials (4.4 %), trials without a reaction (0.7 %, also excluded from PE analysis), and trials with a reaction below 200 ms and above 1500 ms (1.7 %). Mean RT's and PE's were submitted to repeated measures analyses of variances (rmANOVA) with the factors: participant-target relation (ingroup vs. outgroup), target-distracter relation (ingroup vs. outgroup), and target emotion (happiness vs. fear). Results are presented in Table 2.

3.2. Results

The rmANOVA over mean RT's revealed a significant main effect for target emotion. Participants responded faster when the target depicted a happy expression (M = 776 ms, SEM = 17) compared to a fearful expression (M = 807 ms, SEM = 18), $F(1, 43) = 23.77$, $p < .001$, $\eta_p^2 = 0.36$. Moreover, there was a main effect for participant-target relation, with faster responses to ingroup targets (M = 783 ms, SEM = 18) compared to outgroup targets (M = 801 ms, SEM = 18), $F(1, 43) = 14.71$, $p < .001$, $\eta_p^2 = 0.26$.

Most importantly for the present hypothesis regarding the processing conflict account, there was a marginally significant participant-target relation and target emotion interaction, $F(1, 43) = 3.38$, $p = .073$, $\eta_p^2 = 0.07$. Comparing affectively congruent and incongruent trials,

Table 2
Mean response times in ms (standard error) and error rates in percentage (standard error) for Experiment 2. Data are depicted as a function of expressed facial emotion by the target (happiness vs. fear), participant-target relation (ingroup vs. outgroup), and target-distracter relation (ingroup vs. outgroup).

	Participant-target relation		Target-distracter relation	
	Ingroup	Outgroup	Ingroup	Outgroup
Response times				
Happiness	762 (18)	790 (18)	782 (18)	770 (18)
Fear	804 (19)	811 (18)	803 (18)	812 (18)
Error rates				
Happiness	5.2 (1.2)	5.1 (0.9)	5.6 (1.2)	4.7 (0.9)
Fear	3.9 (0.9)	3.6 (0.7)	3.9 (0.8)	3.5 (0.7)

revealed faster responses in trials with an affectively congruent (M = 787 ms, SEM = 18) compared to trials with an affectively incongruent target person (M = 797 ms, SEM = 18).

In addition to that, the main effect of target-distracter relation that might be indicative of the assumptions of the social intentions account was insignificant, $F(1, 43) = 0.12$, $p = .728$, $\eta_p^2 = 0.00$. However, the interaction of target emotion and target-distracter relation did reach significance, $F(1, 43) = 4.23$, $p = .046$, $\eta_p^2 = 0.09$. To interpret this interaction, we combined the two interaction scenes reflecting positive social intentions (i.e., happy target with an ingroup distracter [affiliation intention] and fearful target with an outgroup distracter [submission intention]) and compared them to the interaction scenes reflecting negative social intentions [i.e., happy target with an outgroup distracter (dominance intention) and fearful target with an ingroup distracter (warning intention)]. Participants' responses to interaction scenes representing positive interactions were slower (M = 797 ms, SEM = 18) compared to responses to interaction scenes representing negative intentions (M = 787 ms, SEM = 18). Thus, the direction of the interaction was opposite to what would have been predicted by the social intentions account.

Finally, participant-target relation interacted with target-distracter relation, $F(1, 43) = 4.55$, $p = .039$, $\eta_p^2 = 0.10$. The difference in reaction time between ingroup targets to the participant (M = 777 ms, SEM = 18) and outgroup targets to the participant (M = 805 ms, SEM = 19) only occurred when the target interacted with an outgroup distracter, $t(43) = 4.64$, $p = .001$, $d = 0.7$ (two-tailed). In contrast, responses to ingroup targets to the participants (M = 789 ms, SEM = 19) did not differ from responses to outgroup targets to the participants when the target is facing an ingroup distracter (M = 796 ms, SEM = 18), $t(43) = 0.82$, $p = .418$, $d = 0.1$.

The RT analysis revealed no other significant effects (all p's $> .441$). The same rmANOVA over mean PE revealed no significant effects (all p's $> .181$).

3.2.1. Combined analysis of Experiment 1 and Experiment 2

Because the important interaction between participant-target relation and target emotion in support of the processing conflict account was only close to statistical significance, we performed a post hoc power analysis via MorePower (Campbell & Thompson, 2012), which revealed that the power to detect the interaction effect (participant-target relation x target emotion, $\eta_p^2 = 0.07$) with N = 44 in Experiment 2 was indeed very low (1-beta = 0.60). The structure of both experiments is virtually identical, except for number of trials and the negative expression, i.e., anger in Experiment 1 and fear in Experiment 2. The type of negative emotion, however, should make no difference with regard to the processing conflict account. Importantly, the results of the combined analysis, with the between-subjects factor Experiment, largely mirrored the results of Experiments 1 and 2. Importantly, the interaction of participant-target relation and target emotion was now significant in RTs, $F(1, 79) = 5.87$, $p = .018$, $\eta_p^2 = 0.07$, and was not further modulated by the factor Experiment, $F < 1$ (for the complete results, see Appendix A).

3.3. Discussion

Experiment 2 generally confirmed the findings of Experiment 1. Participants' categorizations of emotional facial expressions of the target person were affected by the affective (mis)match between group membership and emotional facial expression. While responses to affectively incongruent targets resulted in significantly increased RT's compared to responses to affectively congruent targets, as predicted by the processing conflict account, the respective interaction between participant-target relation and target emotion, however, just missed the statistical level of significance. The interaction was shown, however, with increased statistical power in a combined analysis of Experiments 1 and 2.

Moreover, we obtained an interaction between participant-target and target-distracter relation as in Experiment 1, only this time in RT's. Again, the target's group membership seems to be more salient when the distracter is of opposing group membership to the target and further highlights the importance of group saliency for ingroup biases to occur (cf. Mullen et al., 1992).

In contrast to Experiment 1, however, there was a significant interaction between target-distracter relation and target emotion which may be representative of social intention processing. Based on the assumption that responses to negative stimuli are slowed down, one might have expected responses to positive intentions to be faster compared to responses to negative intentions. The results of Experiment 2, however, pointed to the opposite direction. Here, reactions were faster when negative social intentions were communicated within the interaction scenes (i.e., dominance intention: happy + outgroup and warning intention: fear + ingroup) compared to when positive social intentions (i.e., affiliation intention: happy + ingroup and submission intention: fear + outgroup) were communicated within the interaction scenes. Although unexpected, these findings at least suggest that the characteristics of the social interaction between target and distracter were indeed processed and affected participants' responses. We will get back to this in the General Discussion section.

Together, Experiment 2 largely replicated the findings of Experiment 1 when using fear instead of anger as negative facial expression and may be taken as further support for the assumption of an affective (mis) match between the stimulus dimensions of the facial display (i.e., group membership and emotional facial expression). However, in both experiments, participants were required to respond to one of the critical affective stimulus features (i.e., emotional expression), which reasonably creates response conflict. However, because the processing conflict account assumes that negative ingroup and positive outgroup faces create a processing conflict due to the perceived evaluative incongruency irrespective of the task requirements, participants in Experiment 3 were no longer required to respond to the emotional expression, but rather to categorize the left vs. right localization of the target face (i.e., unrelated task).

4. Experiment 3

Experiment 3 was designed to replicate and extend the result patterns of the previous experiments. So far, one of the affective features in the facial target display was task-relevant. That is, participants responded to the emotional facial expression by indicating its positive or negative valence. Because in this task setup the positivity or negativity associated with the perceived group status can form a conflict with the required positive or negative response, it could be argued that the observed conflict effects are exclusively a result of response conflicts. However, the processing conflict account assumes conflict effects irrespective of the task requirements. Thus, it is important to investigate conflict effects under different task environments.

Furthermore, the applied response labeling in Experiments 1 and 2 (i.e., to indicate the positive or negative valence of the facial expression) may have contradicted certain combinations of target emotion and participant target relation. While, the labeling fits the presented facial expression alone (i.e., happy = positive and fearful = negative), the addition of the participant-target relation resolves the fit between affective response label and the affective stimuli. Because the affectively incongruent combinations of target emotion and participant-target relation (i.e., outgroup – happy or ingroup – fear) were not as exclusively positive or negative as the affective response labels suggested. Thus, it is conceivable that these affective response labels exerted an additional influence on responses (Eder & Rothermund, 2008) which might have hampered the affective conflict effects.

To (a) test conflict effects under different task requirements and (b) exclude potential response label effects, in Experiment 3, the target face was still defined by an emotional facial expression, but participants were now asked to simply localize the target and indicate the position within

the interaction scene (i.e., left or right). Thus, the task was unrelated to the critical stimulus features and the response alternatives were no longer labeled as positive or negative.

With regard to the social intentions account, one might again expect an interaction between target emotion and target-distracter relation. However, because the task changed in Experiment 3, one should not expect an additional main effect of target-distracter relation.

4.1. Methods

4.1.1. Participants

A total of 49 participants (36 females, 1 non-binary) signed up and participated. The sample consisted of 45 students of the University of Greifswald and 4 employed participants. 41 participants indicated to be right-handed, 7 to be left-handed, and 1 participant indicated to be ambidextrous. Participants received course credits as compensation for taking part in the study. All participants were between 18 and 38 years of age (M = 22.4 years; SD = 3.7 years). Three participants were excluded from further analysis due to migration background.

4.1.2. Materials and procedure

Procedure, trial sequence, and stimulus material were identical to Experiment 2. Instead of judging the valence of the emotion expressed by the target person, participants now responded to the location of the face displaying an emotional expression. Left versus right responses were given with the "X" or "M" keys on their keyboards. A spatially compatible response assignment (e.g., left response key to indicate left side) was used for all participants.

4.1.3. Data analysis

For all remaining data sets (excluding the participants who indicated a migration background) we analyzed error rates and RT's. RT's were preprocessed by excluding erroneous trials (2.2 %) and trials without any response (0.1 %, also excluded from PE analysis) and trials with RT's below 200 ms and above 1500 ms (additional 0.2 %). Mean RT's and PE's were submitted to repeated measures analyses of variances (rmANOVA) with the factors: participant-target relation (ingroup vs. outgroup), target-distracter relation (ingroup vs. outgroup), and target emotion (happiness vs. fear). Results are presented in Table 3.

4.2. Results

The rmANOVA on mean RT's revealed a significant main effect for target emotion, with faster reactions towards targets displaying happy facial expressions (M = 546 ms, SEM = 14) than targets displaying fearful expressions (M = 600 ms, SEM = 15), $F(1, 45) = 67.28$, $p < .001$, $\eta_p^2 = 0.60$. Neither participant-target relation, $F(1, 45) = 0.85$, $p = .362$, $\eta_p^2 = 0.02$, nor target distracter relation, $F(1, 45) = 1.93$, $p = .172$, $\eta_p^2 = 0.04$, revealed significant main effects.

Importantly, the critical interaction for the processing conflict account, participant-target relation x target emotion, was significant, $F(1, 45) = 23.19$, $p < .001$, $\eta_p^2 = 0.34$. As expected, responses to affectively congruent targets (M = 565 ms, SEM = 13) were significantly faster than responses to affectively incongruent targets (M = 581 ms, SEM = 15). The interaction that might represent the assumptions of the social intentions account, target-distracter relation and target emotion on the other hand, was not significant, $F(1, 45) = 1.29$, $p = .262$, $\eta_p^2 = 0.03$. To further inspect the data with reference to the two theoretical accounts, we conducted additional post hoc analyses (see Appendix B).

Finally, the participant-target relation x target-distracter relation interaction was marginally significant, $F(1, 45) = 3.38$, $p = .073$, $\eta_p^2 = 0.07$. Whereas responses to ingroup targets facing an outgroup distracter (M = 570 ms, SEM = 14) and outgroup targets facing an outgroup distracter (M = 572 ms, SEM = 15) did not differ, $t(45) = 0.44$, $p = .660$, $d = 0.07$, responses to ingroup targets facing an ingroup distracter were slightly slower (M = 580 ms, SEM = 14) than to outgroup targets facing an ingroup distracter (M = 570 ms, SEM = 14), $t(45) = -1.86$, $p = .070$, $d = -0.27$ (two-tailed). No other RT related effects reached significance (all p's > .141).

The rmANOVA on PE's revealed a significant main effect for target emotion, with less errors when the target displayed a happy facial expression (M = 1.1 %, SEM = 0.2) rather than a fearful expression (M = 3.3 %, SEM = 0.4), $F(1, 45) = 26.14$, $p < .001$, $\eta_p^2 = 0.37$. Like in RT's, neither participant-target relation, $F(1, 45) = 2.40$, $p = .129$, $\eta_p^2 = 0.05$, nor target distracter relation, $F(1, 45) = 0.69$, $p = .410$, $\eta_p^2 = 0.02$, revealed significant main effects.

Furthermore, there was a participant-target relation x target emotion interaction mirroring RT results, $F(1, 45) = 5.37$, $p = .025$, $\eta_p^2 = 0.11$. Participants committed more errors responding to affectively incongruent targets (M = 2.6 %, SEM = 0.3) compared to affectively congruent targets (M = 1.8 %, SEM = 0.4).

In contrast, the interaction of target-distracter relation x target emotion, representing the social intentions account was not significant, $F(1, 45) = 1.50$, $p = .227$, $\eta_p^2 = 0.03$. None of the other effects reached significance (all p's > .129).

Table 3
Mean response times in ms (standard error) and error rates in percentage (standard error) for Experiment 3. Data are depicted as a function of type of emotion expressed by the target (happiness vs. fear), participant-target relation (ingroup vs. outgroup), and target-distracter relation (ingroup vs. outgroup).

	Participant-target relation		Target-distracter relation	
	Ingroup	Outgroup	Ingroup	Outgroup
Response times				
Happiness	540 (13)	553 (15)	547 (14)	546 (14)
Fear	610 (16)	589 (15)	604 (15)	596 (15)
Error rates				
Happiness	0.9 (0.3)	1.1 (0.3)	0.7 (0.2)	1.4 (0.3)
Fear	4.0 (0.7)	2.5 (0.4)	3.4 (0.5)	3.2 (0.5)

4.3. Discussion

The results of Experiment 3 were again in line with the processing conflict account. As predicted, the important interaction between participant-target relation and target emotion was observed in both dependent measures, RT's and PE's. Thus, in line with Kozlik and Fischer (2020, Experiments 2 and 4), we observed conflict effects even in an unrelated task paradigm. This observation complements studies demonstrating that Stroop conflicts also arise without any requirement to respond to the color (Damen et al., 2018; Tae et al., 2021) and further supports the notion that processing conflicts from emotional ingroup-outgroup faces do not hinge on stimulus-response incompatibility.

Moreover, because participants were no longer required to categorize the targets' facial expression as positive or negative, but instead were asked to respond to the localization of the target, affective response labels could no longer exert an influence on responses. Consistent with this assumption, the effect size in the analysis of response times was substantially larger ($\eta_p^2 = 0.34$) than in Experiments 1 and 2. Thus, with this optimization of the experimental setup the assumptions of the processing conflict account could be further substantiated.

Furthermore, there was again an at least marginally significant interaction between participant-target relation and target-distracter relation. In contrast to Experiments 1 and 2, however, responses to ingroup and outgroup targets tended to differ especially when the target faced an ingroup instead of an outgroup distracter. This finding is hard to interpret in terms of increased group saliency. Instead, it seems much more plausible to consider this finding as a byproduct of the critical adaptation of the task from emotional categorization to localization. In trials where the distracter is a member of the same group as the target, participants seem to have less difficulties in localizing an outgroup

compared to an ingroup target. In other words, localizing an emotional face among two outgroup members seems to be easier than localizing an emotional face among two ingroup members. Further research is needed to investigate this finding.

Inspecting the results of Experiment 3 from the viewpoint of the social intentions account, the interaction between target-distracter relation and target emotion, which we assumed to be representative for the predictions of the social intentions account, was not found. Potential implications for the social intentions account are discussed in the General Discussion section.

5. General discussion

The current research was designed to further substantiate the previously proposed processing conflict account (Kozlik & Fischer, 2020) that was formulated as an alternative and potentially more parsimonious explanation to the widespread social intentions account (Paulus & Wentura, 2014; Weisbuch & Ambady, 2008) to account for the often-observed response divergence to emotional ingroup/outgroup faces. For this, we tested the assumptions of the processing conflict account under conditions where social intentions are not directed to the participant. To achieve this, we designed a new experimental setup that introduced a distracter person, who functioned as an interaction partner to the emotional target person. Thus, contrary to previous studies, the participant was not the recipient of any social message sent by the emotional target person. Instead the participant became an outside observer of an interaction between two persons. This redirection of social messages allowed us to examine whether the reactions to emotional expressions of ingroup and outgroup persons are still present when the participant is not part of the interaction scene. Across three experiments, we found a largely consistent pattern for a negative impact of affective incongruency between the features of facial displays, namely, group membership and emotional expression on participants' responses. Slower responses and higher error rates to affectively incongruent as compared to affectively congruent faces in the target-participant relation indicated a processing conflict between affective group membership between target and participant and emotional expression of the target. This pattern was obtained when participants categorized happy vs. anger facial expressions (Experiment 1) and happy vs. fear facial expressions (Experiments 2 and 3). Furthermore, this pattern occurred when one stimulus feature was task-relevant (Experiments 1 and 2) as well as when participants executed an unrelated task (Experiment 3). Therefore, with the new experimental paradigm that allowed to assess influences of conflict processing independent from potential social intentions, we obtained virtually consistent effects across the three experiments supporting the processing conflict account.

Introducing a distracter person who served as an outlet for potential social messages sent by the target person, we consistently observed evidence for conflict processing even though the participant is not part of the social interaction. The addition of the distracter person as the recipient of social messages poses difficulties for intention-related positive outcome expectancies as an alternative explanation for the observed response benefit to positive ingroup and negative outgroup faces over positive outgroup and negative ingroup faces reported by Kozlik and Fischer (2020). However, we should address if there is another explanation for these response benefits. In Emotional Stroop tasks (Frings et al., 2010; McKenna & Sharma, 1995) participants name the ink color of words with neutral and negative valence. Usually, reactions to words with negative compared to neutral words are slowed down, even though the word valence is completely task irrelevant. It is conceivable that a similar mechanism is responsible for the findings reported by Kozlik and Fischer (2020). According to both accounts, happy outgroup targets and fearful ingroup targets are seen as negative. On the one hand the social intentions account presumes different social messages, on the other the processing conflict account proposes an affective conflict between stimulus features within the target's face as a reason for this negativity. Thus, the observed response benefit to positive ingroup and negative outgroup faces over positive outgroup and negative ingroup faces could ultimately stem from negativity provoked by certain social intentions instead of negativity provoked by affective incongruency. However, even when we do consider the logic of the Emotional Stroop task, the manipulation realized through our new paradigm would speak in favor of affective incongruency (i.e., processing conflict account) as a reason for this negativity, because the participant is not the recipient of social messages. Furthermore, social messages between target and distracter (i.e., interaction of target emotion and target-distracter relation) revealed no influence on participants responses. Thus, it is at least less likely for social messages to be the factor which resulted in these Emotional Stroop-like effects.

With regard to the social intentions account, we did not find the pattern that might have been representative of the respective assumptions. However, as mentioned earlier (2. Overview of Experiments), the introduction of the distracter person into the stimulus configuration forces us to make auxiliary assumptions in order to expect intention-like effects to occur. For example, we need to assume that participants are able to process and relate the emotional expression of the target, the ethnicity of the target, and the ethnicity of the distracter in a rather complex way. Moreover, it needs to be assumed that the predictions of the social intentions account extend to situations, where the participant is only an outside observer of an interaction scene. This might cause difficulties for intention-like effects to show up. It could possibly be that the distracter is fully ignored and not processed by the participant at all. If this was the case our new experimental paradigm wouldn't allow a fair test of the assumptions of the social intentions account. However, in all three experiments participants' responses were influenced by the target-distracter relation (i.e., interaction of participant-target relation and target-distracter relation). Thus, the critical features of the social interaction are sufficiently processed. Whether this also corresponds to a potential comprehension of social messages sent from the target to the distracter needs to be clarified in future studies, though. Recent research suggests that observed eye contact between two interaction partners facilitates the understanding of subsequent actions between the interaction partners (Böckler et al., 2011, 2014) and even activates brain regions within the observer which overlap with brain regions that are activated when being an active part of a social interaction (Böckler et al., 2016). This suggests that an extraction of social messages between target and distracter within the interaction scene could be possible. Nonetheless, observed eye contact between others does not hold the same communicative signal, as when oneself is the addressee of someone's attention (Csibra & Gergely, 2009). This, on the one hand, may explain why the interaction scenes which we proposed to represent the assumptions of the social intentions account mostly did not reveal the influence on participants' reactions as we would have expected from a social intention account point of view. On the other hand, it emphasizes that the introduction of the distracter person made it less likely that participants would see themselves as recipients of social messages, which also contradicts that the effects observed by Kozlik and Fischer (2020) are a result of imputed social intentions.

Although we did not consistently observe the pattern that could have been representative of the assumptions of the social intentions account, the data of Experiment 2 are special in the sense that we did observe an interaction between target emotion and target-distracter relation. From the viewpoint of the social intentions account and based on the assumption that responses to negative stimuli are slowed down, one would have expected that responses to positive social intentions (i.e., affiliation or submission intention) are faster compared to responses to negative social intentions (i.e., dominance or warning intention). Interestingly, though, the effect in Experiment 2 pointed towards the opposing direction. More precisely, participants' responses to target-distracter interactions with negative consequences for the distracter (i.e., dominance or warning intention) tended to be faster compared to responses to target-distracter interactions with positive consequences

for the distracter (i.e., affiliation or submission intention). First, this is an important finding as it indicates at least some influence of social intentions that are directed towards another person on participants' reactions. Second, this finding could be interpreted as a contrast effect. It is conceivable that a target person that shows an affiliation intention towards the distracter negatively affects participants' responses because the target *does not* show affiliation towards the participant. Similarly, a target person that shows a dominance intention towards the distracter positively affects participants' responses because the target *does not* show dominance towards the participant. In this interpretation, participants seemingly process social intentions that are not directed towards themselves, but towards another person. This pattern, however, seems to be rather unstable, since it only occurred in Experiment 2. Therefore, further research is necessary to test the replicability of such a finding and thus, to assess the boundary conditions of the impact of social intentions on participants' responses.

Although, we found consistent evidence for the assumption that (non-affective) responses to emotional ingroup and outgroup faces are affected by conflict processing (and not social intentions) we cannot conclude that this also applies to affective responses (like approach-avoidance responses, cf., Paulus & Wentura, 2014). Whereas we consider the processing conflict account as a more parsimonious explanation for the finding that typical affective responses to emotional expressions are reversed when confronted with an outgroup member (e.g., Paulus & Wentura, 2014; Weisbuch & Ambady, 2008), a recent study by Wentura and Paulus (2022) challenged this assumption. In this study, frontal emotional faces of young (= positive valence) vs. old persons (= negative valence) as an ingroup and outgroup manipulation were presented in an approach-avoidance task. Importantly, this setup did not reveal the pattern that would have been expected from the viewpoint of the processing conflict account. From this, the authors concluded that the finding of reversed affective responses to emotional expressions of outgroup members is not related to underlying conflicts but rather a consequence of imputed social intentions. Whereas this is an interesting finding, it would be interesting to see whether this also applies to our new experimental design since it allows to more clearly separate processing conflicts from social intentions. Thus, further research is needed to clarify whether or not processing conflicts are a valid and more parsimonious explanation for this group-induced modulation of affective responses to emotional facial expressions.

While the present set of studies provide further evidence for the processing conflict account, we still need to address some limitations of our experiments. One possible limitation is, that we implemented a single ethnic ingroup-outgroup manipulation. However, if conflict processing is a suitable explanation for the different reactions towards emotions of ingroup and outgroup persons, the present result pattern should also be obtained for other group constellations. Yet, a recent study by Wentura and Paulus (2022) challenged this assumption at least with respect to an ingroup-outgroup paradigm consisting of young and old individuals, in which the assumptions of the processing conflict account were not supported. A second limitation is the rather low statistical power in Experiment 2. While the important interaction between participant-target relation and target emotion just missed the level of significance in Experiment 2, it was confirmed, however, in a combined analysis of Experiments 1 and 2. Third, we need to emphasize that the presented results do not necessarily imply that the role of social intentions can be entirely disregarded. Due to the specifications of our new paradigm (i.e., redirection of social messages away from the observer), null findings with respect to predictions by the social intentions account do not necessarily contradict the social intentions account. Because our paradigm aimed to reduce influences of potential social intentions on the observers' responses, it is not surprising that potential influences may be hard to detect.

All in all, it seems plausible to conclude that conflict processing plays a major role in the reaction to emotional ingroup and outgroup persons. First evidence for this assumption can be found in Kozlik and Fischer (2020), where different emotions of the same affective valence, as well as different markers of conflict processing were analyzed. In the present study, we expanded this research by introducing a new experimental paradigm meant to assess influences of conflict processing independent from potential social intentions. With this paradigm we observed virtually consistent effects supporting the processing conflict account. Yet, future research is certainly needed that addresses the generalizability of the present findings and identifies possible limiting factors or variables that influence the assumptions of both accounts in highly powered studies.

Declaration of competing interest

None.

Data availability

The data that support the findings of this study are openly available in [PsychArchives] at https://doi.org/10.23668/psycharchives.12215.

Appendix A. Combined analysis of Experiments 1 and 2

For the combined analysis we ran a post hoc sensitivity analysis for the important interaction effect (participant-target relation x emotion, $\eta_p^2 = 0.07$) with $N = 81$, which resulted in 1-beta = 0.79 (one-tailed). The rmANOVA on mean RT's (Experiment 1 and Experiment 2) with Experiment as a between-subject factor, confirmed the predicted result pattern. The main effect for Target emotion indicated faster responses to targets displaying happiness ($M = 727$ ms, $SEM = 13$) compared to targets displaying fear or anger ($M = 760$ ms, $SEM = 14$), $F(1, 79) = 33.32$, $p < .001$, $\eta_p^2 = 0.30$. Furthermore, there was a significant main effect for Participant-target relation, with faster responses to ingroup targets ($M = 736$ ms, $SEM = 14$) compared to outgroup targets ($M = 751$ ms, $SEM = 14$), $F(1, 79) = 23.69$, $p < .001$, $\eta_p^2 = 0.23$. The factor Experiment revealed a significant main effect $F(1, 79) = 12.87$, $p < .001$, $\eta_p^2 = 0.14$, with overall faster responses in Experiment 1 ($M = 695$ ms, SEM = 20) compared to Experiment 2 ($M = 792$, $SEM = 18$). Importantly for the processing conflict account, a significant interaction between Participant-target relation and Target emotion was found, $F(1, 79) = 5.87$, $p = .018$, $\eta_p^2 = 0.07$. The exact means of the interaction (participant-target relation and target emotion) are presented in Table A1.

The main effect of target-distracter relation was not significant, $F(1, 79) = 0.06$, $p = .809$, $\eta_p^2 = 0.00$. However, the interaction of target-distracter relation and target emotion revealed a significant interaction effect, $F(1, 79) = 4.74$, $p = .032$, $\eta_p^2 = 0.06$, which indicates faster responses to ingroup interaction scenes (target and distracter share their group membership) with targets displaying negative expressions (M = 756 ms, SEM = 14), than outgroup interactions scenes (target and distracter are in different groups) with targets displaying a negative expression ($M = 763$ ms, $SEM = 14$), $t(80) = -2.00$, $p = .025$, $d = -0.22$ (one-tailed). For positive targets, responses were only numerically faster when target and distracter were in an outgroup relation ($M = 725$ ms, $SEM = 14$) than when both were in the same group ($M = 731$ ms, $SEM = 13$), $t(80) = 1.47$, $p = .072$, $d = 0.16$ (one-tailed). This result mirrors the pattern observed in Experiment 2. The exact means of the interaction (target-distracter relation and target emotion) are presented in Table A1.

The same rmANOVA on PE revealed a main effect of emotion $F(1, 79) = 10.41$, $p = .002$, $\eta_p^2 = 0.12$, with less errors when the target depicted anger

or fear ($M = 2.4$ %, $SEM = 0.4$) than targets displaying happiness ($M = 4.4$ %, $SEM = 0.6$). Furthermore, a main effect of Experiment was found, $F(1, 79) = 6.18$, $p = .015$, $\eta_p^2 = 0.07$, with overall less errors in Experiment 1 ($M = 2.4$ %, $SEM = 0.6$) compared to Experiment 2 ($M = 4.4$ %, $SEM = 0.6$). The factors Participant-target relation and Target emotion did not interact in the combined data set, $F(1, 79) = 2.28$, $p = .135$, $\eta_p^2 = 0.03$. Finally, a significant interaction effect of Participant-target relation, Target distracter relation and Experiment was found, $F(1, 79) = 6.85$, $p = .011$, $\eta_p^2 = 0.08$, indicating an interaction of Participant-target relation and Target-distracter relation in Experiment 1 but not in Experiment 2. None of the other effects reached significance (all p's $> .108$).

Table A1
Mean response times in ms (standard error) and error rates in percentage (standard error) for the combined analysis of Experiments 1 and 2. Data are depicted as a function of type of emotion expressed by the target (happiness vs. fear), participant-target relation (ingroup vs. outgroup), and target-distracter relation (ingroup vs. outgroup).

	Participant-target relation		Target-distracter relation	
	Ingroup	Outgroup	Ingroup	Outgroup
Response times				
Happiness	716 (13)	739 (14)	731 (13)	725 (14)
Anger/Fear	757 (15)	763 (14)	756 (14)	763 (14)
Error rates				
Happiness	4.0 (0.7)	4.8 (0.6)	4.5 (0.7)	4.2 (0.6)
Anger/Fear	2.5 (0.5)	2.5 (0.4)	2.5 (0.5)	2.4 (0.4)

Appendix B. Post hoc analysis of Experiment 3

In order to complement the data analysis of Experiment 3 and further strengthen the argument for the processing conflict account, we conducted additional post hoc analyses for the RT data. As emphasized in the introduction section the advantage of the current experimental paradigm is the orthogonal variation of processing conflicts and social intentions. Therefore, it allows to test the assumptions of the processing conflict account when social intentions are held constant. For this, we systematically compared responses in conditions with constant social intentions and different conflict status (cf. Fig. B1: #1 vs. #2, #3 vs. #4, #5 vs. #6, and #7 vs. #8). For reasons of completeness, we also compared responses in conditions with constant conflict status and different social intentions, which could be indicative of an impact of social intentions (cf. Fig. B1: #1 vs. #3, #2 vs. #4, #5 vs. #7, and #6 vs. #8).

Thus, we conducted a series of eight paired one-tailed t-tests, comparing p-values with a Bonferroni adjusted α of $0.05/8 = 0.00625$. Table B1 summarizes the test statistics for these t-tests. Tests 1 to 4 test the assumptions of the processing conflict account since the only difference between the compared conditions was the conflict status of the target (e.g., #1 affectively congruent + affiliation intention; #2 affectively incongruent + affiliation intention). Test 5 to 8 test the assumptions of the social intentions account since the only difference between the compared conditions was the social message sent from the target to the distracter (e.g., #1 affectively congruent + affiliation intention; #3 affectively congruent + dominance intention).

The tests for the assumptions of the processing conflict account revealed in three out of four cases significant differences with responses to affectively congruent conditions being faster than responses to affectively incongruent conditions. Thus, although social intentions were held constant, participants' responses were systematically influenced by the conflict status of the target, which indicates that conflict processing had an impact on participants responses. The non-significant comparisons for the assumptions of the social intentions, when the conflict status of the target was held constant, do not allow for strong conclusions, because of the above-mentioned auxiliary assumptions (see 2. Overview of Experiments) that are specific to the present experimental setup.

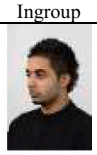
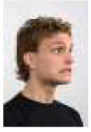
Nr.	Participant-Target Relation	Target-Distracter Relation	Processing Conflict Account	Social Intentions Account
Positive facial expression (Happiness)				
#1	 Ingroup + Happiness	 Ingroup	Target = affectively congruent	Affiliation Intention
#2	 Outgroup + Happiness	 Ingroup	Target = affectively incongruent	Affiliation Intention
#3	 Ingroup + Happiness	 Outgroup	Target = affectively congruent	Dominance Intention
#4	 Outgroup + Happiness	 Outgroup	Target = affectively incongruent	Dominance Intention
Negative facial expression (Fear)				
#5	 Outgroup + Fear	 Ingroup	Target = affectively congruent	Warning Intention
#6	 Ingroup + Fear	 Ingroup	Target = affectively incongruent	Warning Intention
#7	 Outgroup +Fear	 Outgroup	Target = affectively congruent	Submission Intention
#8	 Ingroup + Fear	 Outgroup	Target = affectively incongruent	Submission Intention

Fig. B1. Illustration of interaction conditions. Participants responded to the target and ignored the neutral distracter face. Each interaction scene is described in the framing of the social intentions account and the processing conflict account. Participant-Target relation describes the group membership between target (White-Caucasian vs. Middle-eastern) and participant (which were exclusively White-Caucasian), Target-Distracter relation describes the group membership between target (White-Caucasian vs. Middle-eastern) and distracter (White-Caucasian vs. Middle-eastern).

Table B1
Mean response times for each interaction scene in Fig. B1. Results of Bonferroni corrected paired one-tailed t-tests for each comparison between social intentions and affective (in)congruency.

Compared interaction scenes	M in ms	t	df	*p* (one-tailed) Bonferroni corrected	d
Comparison of conditions with different conflict status and constant social intentions					
#1 vs. #2	545 vs. 549	−0.58	45	.283	−0.09
#3 vs. #4	535 vs. 559	−3.11	45	.002*	−0.46
#5 vs. #6	592 vs. 613	−2.77	45	.004*	−0.41
#7 vs. #8	583 vs. 606	−3.34	45	<.001*	−0.49

(*continued on next page*)

Table B1 (*continued*)

Compared interaction scenes	M in ms	t	df	*p* (one-tailed) Bonferroni corrected	d
Comparison of conditions with different social intentions and constant conflict status					
#1 vs. #3	545 vs. 535	1.71	45	.047	0.25
#2 vs. #4	549 vs. 559	−1.60	45	.058	−0.24
#5 vs. #7	592 vs. 583	1.58	45	.060	0.23
#6 vs. #8	613 vs. 606	1.02	45	.157	0.15

Note. Significant *p*-values ($p < .00625$) are marked with an asterisk.

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