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Individual Differences in Emotional Mimicry: Underlying Traits and Social Consequences

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Abstract: Mimicry, the imitation of the nonverbal behaviour of others, serves to establish affiliation and to smoothen social interactions. The present research aimed to disentangle rapid facial reactions (RFRs) to affiliative emotions from RFRs to nonaffiliative emotions from a trait perspective. In line with the Mimicry in Social Context Model by Hess and Fischer, we expected that only the former are mimicry responses indicative of underlying social relating competence and predictive of social satisfaction, whereas the latter superficially resemble mimicry responses and are driven by social relating incompetence and have opposite effects on social satisfaction. Further, we assumed that social relating competence would moderate the relationship between stable individuals' tendencies to show (mal) adaptive RFRs and social satisfaction. To test these hypotheses, 108 participants first completed scales measuring social relating competence, then participated in a mimicry laboratory task and finally evaluated their naturally occurring social interactions for 10 days. Affiliative RFRs to sadness were related to proximal indices of social relating competence and predicted positive social interactions, whereas nonaffiliative RFRs to disgust were related to social relating incompetence and predicted negative social interactions. By contrast, neither affiliative RFRs to happiness nor nonaffiliative RFRs to anger were linked to proximal indices of social relating competence, and both RFRs were only (dys)functional for interaction quality in less social relating-competent individuals. Copyright © 2015 European Association of Personality Psychology

Key words: facial mimicry; emotional mimicry; rapid facial reactions; social interactions; social relating competence; diary study

Mimicry, the imitation of the nonverbal behaviours of others, is a means for establishing rapport in human interactions (Chartrand & Bargh, 1999; Hess & Fischer, 2013). Mimicry has positive consequences for both the mimicker (i.e. the person who mimics) and the mimickee (i.e. the person who is being mimicked; Stel & Vonk, 2010). To the extent to which people imitate others, they feel closer to their interaction partners (Stel & Vonk, 2010), and their interaction partners perceive them as more trustworthy (Maddux, Mullen, & Galinsky, 2008), likable (Chartrand & Bargh, 1999) and accepting (Yabar & Hess, 2007). Thus, mimicry as an act of reciprocating affiliation entrains social interactions that are more pleasant and harmonious.

Yet, evidence regarding this notion mostly stems from *behavioural* mimicry, the imitation of neutral behaviours, such as face touching or foot tapping (for a recent exception including some facial expressive elements as well, see Kurzius & Borkenau, 2015). This type of mimicry has to be distinguished from *emotional* mimicry, the imitation of emotional displays, which are intrinsically meaningful within the relationship with another individual. Emotional displays are quintessentially social messages and tell the other to withdraw, to approach, to stay, to comfort, to play or to back off (see also Fridlund, 1991). Thus, emotional mimicry—in order to function as a social facilitator—should involve only emotional displays that communicate affiliative intent (see the *Mimicry in Social Context Model*, Hess & Fischer, 2013). Congruent facial reactions in response to emotional displays that lack affiliative intent hardly function as a social glue that fosters affiliation and smoothens interactions like genuine mimicry does (Chartrand & Bargh, 1999; Lakin, Jefferis, Cheng, & Chartrand, 2003); hence, they should not be considered 'mimicry', as they are not an imitation of but rather part of an emotional reaction to the emotions of others (Hess & Fischer, 2014). Based on this perspective, our primary goal was to disentangle genuine emotional mimicry from other types of congruent facial responses with regard to their social consequences. Specifically, whereas social interactions should benefit from congruent facial reactions to affiliative emotions (emotional mimicry), congruent facial reactions to nonaffiliative emotions should have detrimental effects. To avoid confusions, in the following, we will use the conceptually neutral term *rapid facial reactions* (RFRs) to refer to both types of congruent responses (Moody, McIntosh, Mann, & Weisser, 2007).

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Further, previous studies only investigated the immediate effect of mimicry on interaction satisfaction. Yet, the occurrence and strength of RFRs do not depend only on *situational* characteristics but also on *personality* characteristics (Kurzius & Borkenau, 2015; Sonnby-Borgström, 2002; Sonnby-Borgström, Jönsson, & Svensson, 2003). As such, RFRs could be dynamic state manifestations of underlying personality traits that drive individuals' communicative behaviour across different situations. From this perspective, socially competent individuals should show more affiliative and fewer nonaffiliative RFRs. On the other hand, it is plausible that RFRs are not equally (dys) functional for everyone. Even if the RFRs to affiliative expressions have a positive impact on social interactions, they may not have an added benefit for those who are already highly skilled at creating harmonious interactions. Similarly, RFRs to nonaffiliative emotions may disturb socially competent individuals' interactions less. Thus, personality may influence not only the overall tendency for RFRs but also their social consequences when shown. Accordingly, a further goal of our study was to examine *social relating competences* that help to explain the following: (i) the variations in adaptive and maladaptive RFRs between individuals and (ii) the effects of RFRs for certain individuals on social situations. Figure 1 shows a general model of the relationship between individual differences in social relating competence, RFRs and social interaction quality. In this model, social relating competence predicts individual differences in the tendency to show affiliative and nonaffiliative RFRs and moderates the impact of both kinds of RFRs on social outcomes.

Indicators of social relating competence

Pleasant interpersonal interactions require socially effective actions (i.e. friendly behaviours that foster mutual understanding and affiliation between interaction partners such as engaging in affiliative RFRs, cf. Floyd, 1999). Interestingly, there is limited research on the concept of social relating competence, that is, on personality factors that predict the harmonious tone of a person's everyday interactions across different types of relationships. Thus, for the sake of completeness, we base our assumptions also on research on narrower social outcomes such as satisfaction with peer or marital relationships and interactions with strangers. In the following, we will review socially adept behaviours, cognitions and emotions underlying specific established traits that promote positive social outcomes. Figure 2 depicts whether a high level of a trait indicates either social relating competence (localized at the high end of the dimension, labelled 'friendly') or social relating incompetence (localized at the low end of the dimension, labelled 'hostile') and whether the trait is a more proximal or more distal index of social relating competence.

Proximal indicators of social relating competence

Research on higher-order personality traits (Costa & McCrae, 1992) points to three factors along the affiliation dimension in the interpersonal circumplex (Wiggins, 1979) of highest relevance for social relating competence: *Agreeableness*, *extraversion* and *neuroticism* explain substantial variance in the feelings and perceptions of social interactions (Barrett & Pietromonaco, 1997; Côté & Moskowitz, 1998; Cuperman & Ickes, 2009; Wilson, Harris, & Vazire, 2015). The overall usefulness of the Big Five as predictors of mimicry was also underlined by the findings of Kurzius and Borkenau (2015), but as these authors did not assess emotional mimicry *per se*, no specific assumptions can be deduced.

Agreeableness. Individuals high in agreeableness are more empathic (e.g. Graziano, Habashi, Sheese, & Tobin, 2007), are less prone to prejudice (Graziano, Bruce, Sheese, & Tobin, 2007) and perceive others generally more positively (e.g. Swami, Buchanan, Furnham, & Tovée, 2008). Agreeableness in turn predicts variation in individuals' behavioural tendencies to resolve conflicts constructively (Graziano, Jensen-Campbell, & Hair, 1996; Jensen-Campbell & Graziano, 2001), to cooperate with others (Graziano, Hair, & Finch, 1997) and to offer help to others (Graziano et al., 2007). Thus, as agreeableness is associated with acting in a modest, altruistic, kind and trusting manner (Costa & McCrae, 1992), it is the most proximal index of social relating competence.

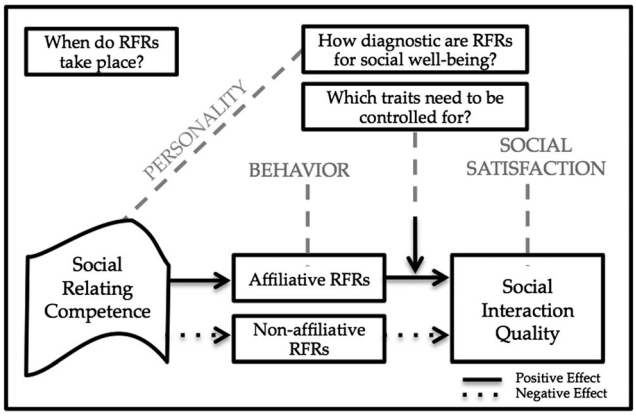

Figure 1. A model of facial reactions in interactions. RFR, rapid facial reaction.

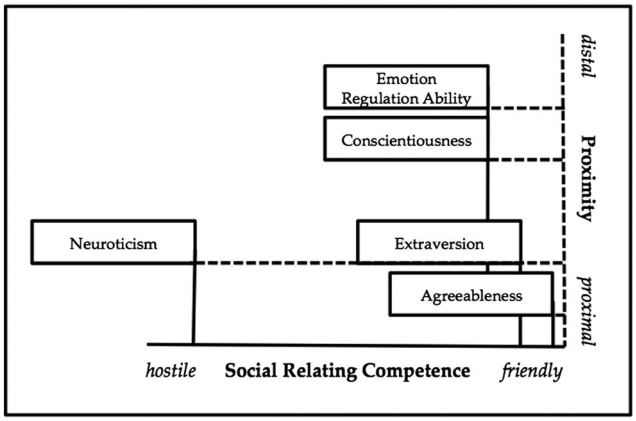

Figure 2. Indicators of social relating competence.

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Extraversion. Individuals high in extraversion generally feel more positively across a variety of situations (Lucas & Fujita, 2000). They are more humorous, interesting, involved and enthusiastic as well as less critical, insecure and reserved (Funder, Furr, & Colvin, 2000), which renders them likable interaction partners (see Eaton & Funder, 2003, for the finding that an individual's level of trait extraversion relates to their interaction partners' degree of interest and engagement during a social interaction). Thus, extraversion is an additional index of social relating competence.

Neuroticism. Individuals high in neuroticism are generally more vulnerable and hence experience minor frustrations as distressing (Costa & McCrae, 1992). Further, they lack social skills such as conveying empathy (Argyle & Lu, 1990). Thus, they often act hostile and aggressive (Costa & McCrae, 1992; Egan & Lewis, 2011), which leads to maladaptive social outcomes (e.g. conflicts within relationships and dissolution of relationships; Ozer & Benet-Martínez, 2006). Consequently, as social maladjustment is defined as 'neuroticism manifested in social behavior' (Schneider, Ackerman, & Kanfer, 1996, p. 474), neuroticism represents a facet of social relating incompetence.

Distal indicators of social relating competence

Another line of research indicates two additional constructs relevant for social relating competence: Self-control capacities such as *conscientiousness* (Eisenberg, Duckworth, Spinrad, & Valiente, 2014) and *emotion regulation abilities* (Tice & Bratslavsky, 2000) relate to interpersonal functioning across life domains (Duckworth, Weir, Tsukayama, & Kwok, 2012; Eisenberg, Fabes, Guthrie, & Reiser, 2000; Tangney, Baumeister, & Boone, 2004; Vohs & Ciarocco, 2004). In contrast to the aforementioned factors, better self-regulatory skills influence social interactions more indirectly, by helping people to adhere to society's norms and rules and hence to inhibit undesirable impulsive thoughts, feelings and behaviours for the sake of integrity and interpersonal harmony (Baumeister & Exline, 1999; Roberts, Jackson, Fayard, Edmonds, & Meints, 2009). Thus, self-control represents a distal indicator of social relating competence, as it is a better predictor of low intense but consistent communal responses over time (e.g. keeping promises, forgiving others and inhibiting destructive reactions during stressful or upsetting situations) than of immediate kindness and understanding during everyday conversations (Fabes et al., 1999; Finkel & Campbell, 2001; Kammrath & Peetz, 2011; Karremans & van der Wal, 2013; Peetz & Kammrath, 2011). This would explain why self-control seems to be more important for overall relationship satisfaction and peer popularity (Dyrenforth, Kashy, Donnellan, & Lucas, 2010; Heller, Watson, & Hies, 2004; Jensen-Campbell & Malcolm, 2007; Lopes, Salovey, Coté, & Beers, 2005; Malouff, Thorsteinsson, Schutte, Bhullar, & Rooke, 2010; Schaffhuser, Allemand, & Martin, 2014) than for feelings during everyday social encounters with interactants across various acquaintance levels (e.g. Barrett & Pietromonaco, 1997).

Different forms of rapid facial reactions and their relationship to social relating competence and social interaction quality

Data from a 24-month follow-up (Hess et al., 2015) with a subset of 40 individuals from the present study provide a first clue regarding differences in quality between RFRs to affiliative and nonaffiliative emotions: intraclass correlations (ICCs) were relatively high for RFRs to the two prototypical *affiliative* emotions happiness (ICC = 0.658) and sadness (ICC = 0.637), whereas they were intermediate to relatively low for RFRs to the two prototypical *nonaffiliative* emotions anger (ICC = 0.475) and disgust (ICC = 0.273). In all, these data are suggestive of considerable stability over time especially for RFRs to affiliative emotions like sadness and happiness.

In the following, we will speculate on the likely impact of personality factors on RFRs. Given the dearth of research on the antecedents and functions of RFRs in the personality domain, this discussion has to be considered preliminary. However, learning more about the meaning of RFRs is pertinent for understanding the social regulation function of RFRs.

Affiliative rapid facial reactions

Between the two RFRs to affiliative facial expressions of sadness and happiness, RFRs to sadness expressions can be considered as most clearly linked to individuals' proximal social relating competences. This is because facial expression of sadness are elicitors of emotional support and serve to create empathy (Eisenberg, Fabes, Schaller, & Miller, 1989; Miller & Eisenberg, 1988) and thus directly function to utilize or restore communal bonds (cf. Averill, 1968; Fischer & Manstead, 2008; Lazarus, 1991; Roseman, Wiest, & Swartz, 1994).

In contrast to RFRs to sadness, RFRs to happiness may often emerge because smiling is the default stance to comply with the politeness conventions of society. Specifically, in order to behave in congruence with social standards (e.g. Adalı & Golbeck, 2014) that demand smiles in social encounters (Hess, Beaupré, & Cheung, 2002), individuals return smiles when smiled to without inherently wishing for intimate relations to interaction partners. An example for this is the greeting smile. Hence, RFRs to happiness may be linked to self-control capacities (i.e. distal social relating competences) that drive such norm-compliant efforts (Baumeister & Exline, 1999; DeBono, Shmueli, & Muraven, 2011; Roccas, Sagiv, Schwartz, & Knafo, 2002; Rothbart, Ahadi, Hershey, & Fisher, 2001). Therefore, RFRs to happiness may be not as predictive for positive social interactions compared with RFRs to sadness. RFRs to happiness may only have diagnostic value for social satisfaction in individuals less likely to show those socially learned smiles.

Nonaffiliative rapid facial reactions

Between the two RFRs to nonaffiliative facial expressions of anger and disgust, only RFRs to disgust should be clearly related to social relating incompetence. Disgust displays mainly signal rejection, as this emotion expression is, when shown in response to people's behaviour rather than sensory

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stimuli, linked to social censure (cf., Haidt, Rozin, Mccauley, & Imada, 1997; Rozin, Haidt, & McCauley, 2008). Disaffiliating from someone whom one feels rejected by may function as a defence strategy to protect oneself from hurt and despair resulting from social exclusion (Griffin & Bartholomew, 1994); thus, RFRs to disgust may be a means to distance oneself from rejection. However, hostility under the slightest threat of rejection is a maladaptive strategy that destroys intimacy and reduces relationship satisfaction (Ayduk, Gyurak, & Luerssen, 2008; Kelly, 2001). RFRs to disgust as a protective barrier to refute rejection may be particularly destructive if paired with high neuroticism (Breines & Ayduk, 2015; Downey & Feldman, 1996; Engeser & Langens, 2010).

Conversely, anger displays mainly represent strength, competence and control (Fischhoff, Gonzalez, Lerner, & Small, 2005; Hess, Blairy, & Kleck, 2000; Lerner, Gonzalez, Small, & Fischhoff, 2003; Lerner & Keltner, 2001; Lerner & Tiedens, 2006; Sinaceur & Tiedens, 2006). Reacting dominantly towards someone who tries to intimidate (Clark, Pataki, & Carver, 1996) may signal the will to defend oneself instead of backing down from the potential problematic situation; thus, RFRs to anger may be a means to express dominance (cf. Stanton, Hall, & Schultheiss, 2010), which serves neither to affiliate with nor to disaffiliate from others but to influence others (Leary, 1957; Wiggins, 1979). Hence, RFRs to anger may not necessarily be linked to individuals' social relating incompetence. Instead, RFRs to anger may characterize individuals who generally feel active, strong and approach motivated (Carver & Harmon-Jones, 2009; Harmon-Jones, Harmon-Jones, Abramson, & Peterson, 2009; Hess, 2014) as well as confident and optimistic about themselves (Barkow, 1975; Brown & Zeigler-Hill, 2004; Hess, 2014; Lerner & Tiedens, 2006). Therefore, RFRs to anger may be less diagnostic for negative social interactions than RFRs to disgust, as they represent a conceptually different phenomenon than RFRs to disgust. RFRs to anger as an expression of one's social influence and dominance may only have diagnostic value in individuals unable to control their impulses.

Depending on an individual's self-control capacities, RFRs to anger may be either detrimental (when used in an aggressive impulsive manner) or beneficial (when used with skill in a confident and reflected manner) for social interaction quality (e.g. Magee & Langner, 2008). Whereas the former triggers resistance and mutual dislike, which impair social interaction quality (Tiedens & Fragale, 2003), the latter may trigger respect and admiration and therefore should benefit social interactions (Hess, 2014). Thus, the ability to regulate and express oneself appropriately likely moderates the effects of RFRs to anger on social interaction quality.

The present study

In the present research, we chose an approach that combined questionnaires and tests with laboratory assessments and reports of naturally occurring social interactions (Reis & Gosling, 2010). Specifically, we conducted a three-phase study. In the first phase, we used self-report measures of social relating competence in an online survey. In the second phase, we measured individuals' level of RFRs in the laboratory. For this, we used electromyography (facial EMG) to measure the facial response to facial expressions of sadness, happiness, disgust and anger. Facial EMG is a valid measure of emotional facial expressions (see Girard, Tassinary, Kappas, Gosselin, & Bontempo, 1997, for the finding that behavioural and EMG measures of emotions on faces converge). Because of its high spatial resolution (Tassinary, Cacioppo, & Vanman, 2007), even subtle facial reactions can be assessed with facial EMG.

In the third phase, we asked participants to report on the quality of their naturally occurring social interactions for 10 days using a standard event-sampling methodology. In comparison with traditional questionnaires, which suffer from different kinds of retrospective biases (Reis & Gosling, 2010) and which do not capture contextual fluctuations, an event-sampling approach provides more accurate descriptions of social interactions across a broad range of naturally occurring situations (Bolger, Davis, & Rafaeli, 2003; Reis & Gosling, 2010) and is hence more ecologically valid. We then related the individuals' tendency to show RFRs in response to these four emotions as measured in the laboratory to the quality of their reported interactions as measured in the field, taking into account social relating competences as antecedents of RFRs and moderators of RFRs' social effects (see Dufner, Arslan, Hagemeyer, Schönbrodt, & Denissen, in press, for a similar method that supports the claim that facial reactions measured in the laboratory can indeed represent underlying personality traits and have the potential to predict positive social experiences in real life).

Spontaneous versus posed facial expressions

Research on emotion perception accuracy traditionally relies on standardized sets of emotional facial expressions (i.e. the Japanese and Caucasian Brief Affect Recognition Test, Matsumoto et al., 2000; and the NimStim set of facial expressions, Tottenham et al., 2009), and these have also been used for research in the field of RFRs. These sets have the advantage that they present highly standardized prototypical facial expressions that are recognized at high rates. However, these expressions are not typical for everyday emotion expressions where people are likely to exhibit subtle nonprototypical expressions that can be open to different interpretations (Ekman, 2003; Motley & Camden, 1988). As people imitate those less prototypical facial expressions as well (Hess & Blairy, 2001; Hühnel, Fölster, Werheid, & Hess, 2014), we used an ecologically more valid set of spontaneous facial expressions to assess RFRs.

METHOD

Participants

Given the disproportionate influence of Level 2 variables in power determination (Bolger, Stadler, & Laurenceau, 2011), we used the more conservative approach for a

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multiple regression model to calculate sample size. This analysis revealed that, to detect a small to medium effect ($f^2 = 0.15$), an $N = 87$ with alpha = .05 and one Level 2 predictor would yield a power of 0.95. We initially recruited 162 participants (113 women) via the participant database at the Humboldt-Universität zu Berlin (PESA) to compensate for potential loss due to a typical drop out of 20% in diary studies (Ohly, Sonnentag, Niessen, & Zapf, 2010) and due to difficulties in the acquisition of RFR data. As the laboratory data were collected during the winter season where more individuals suffer from colds, data from 15 participants (9.3%) needed to be excluded from analysis because of excessive EMG artefacts due to coughing and sneezing. Data from eight participants (5%) were lost because of equipment malfunction. Finally, data from 31 participants (19.1%) were excluded because they did not return their diaries or returned them incompletely. Thus, data of 108 participants (82 women) with a mean age of 25.6 years ($SD = 5.1$ years) were included in the analysis. Participants were all students or recent students (42 psychology students). The percentage of men was higher in the dropouts (41%) compared with the completers (24%), and the mean age was higher in dropouts (27.6 years) than in completers (25.6 years). Dropouts did not differ from completers with respect to any other sociodemographic or individual difference variables.

The study was carried out in accordance with the guidelines of the Declaration of Helsinki and was approved by the institutional ethics committee. Participants were aware that they had the right to discontinue participation at any time and that their responses were confidential. They participated individually and received either course credit (the 42 psychology students) or an 8-GB USB stick and another small gift such as a book, a wellness product or chocolates of a value equivalent to €10.

Stimulus material

For the RFRs task, we used the *Assessment of Contextualized Emotions-faces* (ACE-faces; Hess, Kafetsios, Mauersberger, Blaison, & Kessler, 2014), which consists of a series of photos showing four emotional expressions (sadness, happiness, disgust and anger) either by one person or by a central person surrounded by two others. In order to provide a more ecologically valid test of emotion recognition, we created a set of spontaneous facial expressions similar to those that occur during social encounters. For this, groups of three same-sex individuals who identified themselves as close friends were invited to a recording studio at the Campus of the Humboldt-Universität zu Berlin. To elicit the required emotions, the relived emotion task, which has been shown to be an effective technique to elicit emotional expressions (e.g. Levenson, Carstensen, & Ekman, 1991; Tsai, Chentsova-Dutton, Freire-Bebeau, & Przymus, 2002), was used. The three people were arranged in an open semicircle, and the central person in this group was instructed to remember a time when they, as a group, had felt happiness, sadness, disgust and anger and to then recount the events as vividly as possible to the other two. A total of 18 male and female triads were filmed. Triads with members who had obscuring beards or wore visible tattoos or piercings or unusual haircuts or colours or were otherwise visually conspicuous were excluded. In a second screening, triads in which one or more members did not show any discernable reaction during the narrative were excluded, leaving a final sample of six male and six female triads. In a third screening, the apex period of expressiveness for each group was identified. This was used as the congruent emotion stimulus. For each group, we then used digital image manipulation, to create an image with an emotional central figure while the two friends showed a neutral expression. Finally, a version that showed only the central figure was created. Hence, the central figure's emotional expression was always the same.[1] During a pilot study, this set of 144 stimuli was shown in randomized order to 14 women and 12 men with a mean age of 26.2 ($SD = 6.7$) years who did not take part in the main study. They rated each picture on eight 7-point scales anchored with *not at all* and *very much* with regard to the degree to which the central figure expressed calmness, happiness, sadness, anger, surprise, fear, disgust and other (any other emotions apart from the seven labelled emotions). Frequency distributions of the number of responses on the scale with the highest rating were computed for each photo. The photo was considered to be representative of the target emotion if at least 50% (chance accuracy = 12.5%) of the raters rated the expression highest on the target scale. All of our final stimuli passed that criterion. Figure 3 shows an example for male anger.

A Latin square design was used to create 12 parallel orders of 48 stimuli including six congruent, noncongruent and individual male stimuli as well as six congruent, noncongruent and individual female stimuli for each emotion.[2] Hence, for each emotion, the central figure from each of the six male and six female groups was always shown in either of the following ways: (i) with their two friends expressing the same emotion or (ii) with their two friends showing a neutral face or (iii) alone.

Procedure

Prior to the laboratory session, participants received a link for an online questionnaire with the individual differences relevant to social relating competence (see below). Participants completed the measures at least 24 hours before the laboratory task.

In the laboratory session, after providing informed consent, participants reclined in a comfortable chair while physiological sensors were attached. The experimenter then left

[1]The three different formats were chosen to assess whether RFRs of one person are affected by the presence of others, as this would have been relevant for the conclusions we wanted to draw about the impact of RFRs in social situations, which often comprise more than one interaction partner. However, analyses based on all 133 participants for whom EMG data were available showed no difference. The main effects of presentation type, $F(2, 131) = 0.26$, $p = .768$, $\eta_p^2 = 0.00$, and the Emotion × Presentation Type interaction, $F(6, 127) = 1.75$, $p = .116$, $\eta_p^2 = 0.08$, were both nonsignificant. We therefore collapsed the data over presentation type.

[2]Each presentation was interrupted 12 times with a short emotion contagion questionnaire. These were presented in an equal-probability manner for every order. These data will not be discussed in the present context.

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Figure 3. Example for a male triad showing anger.

the room, monitored the experiment via a video camera and explained the task via microphone. Following this, a 3.5-minute baseline period for the EMG measures was taken while participants watched a relaxing video showing water lapping at a beach in the sunset. Then participants completed the emotion perception task, while facial EMG was recorded to assess RFRs. At the end of the laboratory task, the experimenter instructed participants in the use of the diary (see below) and encouraged them to call or write if any questions arose. Participants received an SMS reminder twice a day. One day after the last day of the diary task, they received another link for an online questionnaire, which consisted of the second part of the questionnaires package (see below) and were asked to return the diary to the laboratory. On that occasion, they were fully debriefed, and all outstanding questions were answered by the experimenter.

Questionnaires

Participants completed a series of online questionnaires assessing social relating competence as well as other traits theoretically relevant to RFRs.[3] Specifically, participants completed the 10-item version of the *Big Five Inventory* (Rammstedt & John, 2007) measuring extraversion, conscientiousness, neuroticism, openness and agreeableness with a 5-point Likert-type scale (1 = *strongly disagree*, 5 = *strongly agree*); a short version of the *Situational Test of Emotion Management* with multiple choices for the judgment of effective behaviours to manage emotions in interpersonal situations (MacCann & Roberts, 2008). In addition, participants completed *The Positive and Negative Affect Scale* (Watson, Clark, & Tellegen, 1988) and the *Rosenberg Self-esteem Scale* (e.g. Rosenberg, 1979) both on a 5-point Likert-type scale (1 = *strongly disagree*, 5 = *strongly agree*).

[3]As the current study focused on traits relevant to social relating competence, data for additional questionnaires will not be presented. The descriptives (mean and standard deviation) of all assessed personality variables (including those not covered in the present manuscript) and their relations between both mimicry and indicators of social interaction quality can be found in Tables S1 and S2 in the supporting information (available from http://www. […]).

Table 1. Mean, standard deviation (*SD*) and Cronbach's alpha (α) for the questionnaires completed prior to the laboratory task

	Mean	*SD*	α
Extraversion	3.17	0.96	.75
Conscientiousness	3.38	0.86	.42
Neuroticism	3.29	0.95	.55
Openness	3.75	0.90	.48
Agreeableness	3.19	0.78	.13
Emotion management	6.99	1.73	.55
Positive affectivity	3.36	0.71	.87
Negative affectivity	2.16	0.64	.83
Self-esteem	3.53	0.61	.74

Table 1 shows the means, standard deviations and the alphas for each scale.[4]

Emotion perception task

The participants' task consisted of rating the central person's emotion expressions on each of the following 7-point scales anchored with *not at all* and *very much*: sadness, happiness, disgust, anger, calmness, fear and surprise while facial EMG was measured (see below). Expressions were presented for 6 seconds before the rating scales appeared. Responses were considered as accurate if the rating on the target emotion scale (i.e. anger for a person showing an angry expression) was higher than the ratings on the remaining scales. Accurate ratings were coded as 1 and inaccurate ones as 0.

Facial electromyography

Rapid facial reactions were assessed using facial EMG at the *corrugator supercilii* (frown), *orbicularis oculi* (wrinkles around the eyes), *levator labii alaeque nasi* (lifting the upper lip in disgust) and *zygomaticus major* (lifting the corners of the mouth in a smile) sites on the left side of the face using bipolar placements of EasyCAP GmbH Ag/AgCl miniature surface electrodes filled with Signa gel by Parker Laboratories Inc. (Fairfield, NJ). The skin was cleansed with lemon prep peeling and 70% alcohol. Raw EMG data were sampled using a MindWare bioamplifier (Gahanna, OH) with a 50-Hz notch filter at 1000 Hz. The signals were band pass filtered between 30 and 300 Hz.

Artefact control and data preparation

The EMG data were offline rectified and smoothed. The video records for all participants were inspected for movements such as yawning, coughing or sneezing that could disrupt the EMG measures. Periods corresponding to such movements were set missing and excluded from further analyses. To control for the individuals' muscle tension as well as their general expressiveness (their general level of facial activity), we computed within-subject z-transformed difference scores for each participant, each muscle and each trial. That means that for each participant, each muscle and each trial we did the following: (i) first subtracted the

[4]If not otherwise specified, we used Statistical Package for the Social Sciences (version 20.0; SPSS Inc., Chicago, IL) for all statistical analyses.

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muscle baseline from the trial score; (ii) then subtracted the mean muscle activity across all 48 trials; and (iii) finally divided by the standard deviation muscle activity across all 48 trials.

Event-sampling (diary) task

Following the laboratory RFRs task, participants were instructed in the use of the event-sampling form. They were told to report every social interaction they had that lasted 10 minutes or longer for 10 days using a set of questions adapted from Wheeler and Nezlek (1977). Participants could choose either a paper-and-pencil or Web-based version of the event-sampling form; they were instructed to complete the forms as soon as possible after each interaction. An interaction was defined as any encounter in which the participant and their interaction partner attended to one another and adjusted their behaviour in response to one another. Consequently, telephone or Internet conversations were excluded except for social interactions involving face-to-face communication via Web cam. The event-sampling form had three subsections, described in the following.

Description of the interaction

For each social interaction, participants reported the length of the interaction, the sex of the other person and their relationship status with the interaction partner. Participants also rated on a 7-point Likert scale ranging from 1 = *distant* to 7 = *intimate* the level of intimacy as well as on a 7-point Likert scale ranging from 1 = *task focused* to 7 = *relationship orientated* the content of the social interaction. In total, participants described 3001 interactions with acquaintances (24.3%), friends (17.9%), good friends (17.1%), best friends (7.1%) and partners (17.8%) as well as family members (15.8%) ($M = 2.75$, $SD = 2.08$ per day; 95% confidence interval (CI) [2.62, 2.87]). The median length of the interactions was 40 minutes. On average, interactions were reported to be somewhat more relationship oriented ($M = 4.28$, $SD = 1.87$; 95% CI [4.22, 4.35]) and somewhat more intimate ($M = 4.79$, $SD = 1.54$; 95% CI [4.74, 4.85]) than the midpoint of the scale (4).

The participant's own emotional reactions

Participants described on 7-point Likert scales ranging from 1 = *not at all* to 7 = *very much* their general satisfaction with the interaction and rated the degree to which they felt understood, accepted, supported and comfortable expressing their emotions. As these variables were substantially intercorrelated, they were combined into one variable 'satisfaction' ($\alpha = .92$). Further, participants reported on the same 7-point Likert scales their own negative and positive feelings during the interaction. Inspection of the means suggests that overall, and in line with previous research (Nezlek, Kafetsios, & Smith, 2008), participants reported high levels of satisfaction with the interaction as well as experiencing positive emotions rather than negative emotions during the interactions (Table 2).

Table 2. Multilevel summary statistics

	Mean	Between-persons variance	Within-persons variance	ICC1 (%)
Satisfaction	5.33	0.72	1.21	37
Positive feelings	4.88	0.54	1.81	23
Negative feelings	2.49	0.74	1.76	30
Positive perception of others	5.18	0.45	0.84	35
Negative perception of others	2.81	0.63	2.03	24

Note: $N = 108$ participants at Level 2 and 2958 social interaction reports at Level 1.ICC, intraclass correlation.

The interaction partner's reactions

Participants described on 7-point Likert scales ranging from 1 = *not at all* to 7 = *very much* their perception of the degree to which their interaction partner showed negative and positive emotions and the extent to which they perceived the other person as expressive and well intentioned. As the latter three variables were substantially intercorrelated, they were combined into one variable 'positive perception of others' ($\alpha = .71$). The first variable was called 'negative perception of others'. Generally, social interaction partners were perceived as positive rather than negative (Table 2).

RESULTS

Decoding accuracy

The overall decoding accuracy hit rate (i.e. the proportion of accurate responses for the target emotion) was 53% with hit rates highest for happiness (73%; 95% CI [68%, 76%]) and lowest for sadness (33%; 95% CI [29%, 36%]), and higher for disgust (56%; 95% CI [55%, 64%]) compared to anger (48%; 95% CI [45%, 53%]). As such, all emotions were recognized at better than chance levels (14.3%). Overall, these accuracy rates compare well with accuracy rates found in other studies assessing RFRs to spontaneous emotion expressions (Hess & Blairy, 2001; Hühnel et al., 2014).

Rapid facial reactions

To verify whether participants showed RFRs at the group level, we analysed whether a distinct pattern of facial muscle activity in response to our stimuli was shown (Dimberg, 1982; Hess & Blairy, 2001). For this, we conducted a series of one-way analyses of variance on the mean within-subject z-transformed muscle activity for each emotion condition (sadness, happiness, disgust and anger stimuli). RFRs to happiness expressions were defined as a muscle activity pattern with lower corrugator activity compared with the mean activity of orbicularis and zygomaticus. RFRs to sadness and anger were defined by the reverse pattern. To test for those activation patterns, we used a planned Helmert contrast to compare the level of activity of the corrugator muscle with the mean levels of orbicularis and zygomaticus activity.

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RFRs to disgust were defined as a muscle activity pattern of higher levator labii alaeque nasi activity compared with zygomaticus activity. Significant or marginally significant planned contrasts emerged for RFRs to sadness, $F(1,107) = 21.76$, $p < .001$, $\eta_p^2 = 0.169$; happiness, $F(1,107) = 64.71$, $p < .001$, $\eta_p^2 = 0.377$; anger, $F(1,107) = 39.84$, $p < .001$, $\eta_p^2 = 0.271$; and disgust expressions, $F(1,107) = 3.45$, $p = .066$, $\eta_p^2 = 0.031$ (displayed in Figure 4). We then calculated a facial expression index that corresponds to the aforementioned contrasts. For example, for the sadness index, we calculated the difference between corrugator activity and the mean of orbicularis and zygomaticus.

The RFR indices are a measure of the mean magnitude of RFRs for each person across all 12 anger, disgust, happiness and sadness trials. We additionally assessed on a categorical level whether a person had shown anger, disgust, happiness or sadness RFRs or not for each of the 12 trials and averaged these values across the 12 trials for each person. In contrast to the magnitude measure, the resulting percentage is a frequency measure. As the two showed moderate to high correlations for each of the four emotions [sadness: $r(108) = .73$, $p < .001$, happiness: $r(108) = .73$, disgust: $r(108) = .53$, anger: $r(108) = .56$], we refrained from using both measures simultaneously to avoid potential multicollinearity problems. For the purpose of the following analyses, we thus used the more powerful RFR magnitude indices that provide information not only about the frequency but also about the intensity of the RFRs.

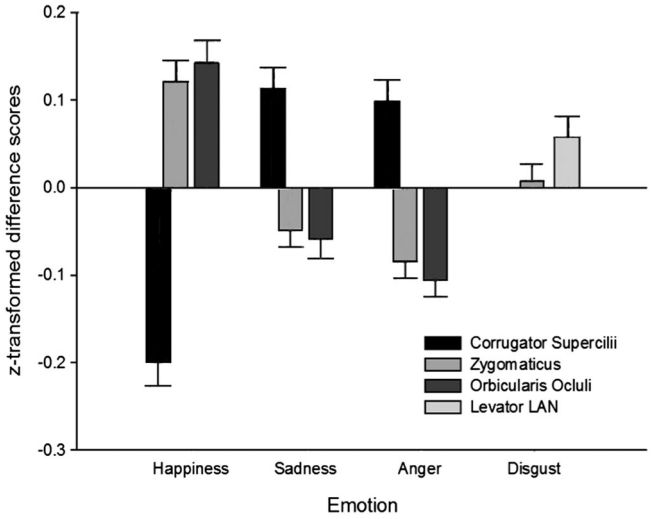

Figure 4. Muscle activity pattern as a function of target emotion expression. Error bars represent standard errors. LAN, *labii alaeque nasi*.

Rapid facial reactions and social interaction quality

As the data comprise two levels (the between-person-level RFRs and social relating competence data and the within-person-level social interaction quality data; see Table 2 for ICCs for each social interaction index), we used multilevel modelling to allow varying intercepts between participants. We conducted a *two-level* regression analysis with MPLUS 5.2 (Muthén & Muthén, 1998–2008) using a full-information maximum-likelihood procedure with robust standard errors. Each social satisfaction index (satisfaction, own positive and own negative feelings as well as positive and negative perceptions of interaction partners during a range of social interactions) was regressed on each RFR. We controlled for emotion-decoding accuracy, because accuracy varied between emotions (see above). All predictor variables were grand-mean centred. Figure 5 summarizes the significant standardized parameter estimates. Complete results for the multilevel effects of each RFR on interaction quality (with and without controlling for accuracy) can be found in Tables S3 and S4 in the supporting information (available from http://www. […]).

Except for the negative influence of RFRs to happiness on the negative perception of interaction partners, RFRs to happiness were not significantly related to the quality of social interactions. In contrast, RFRs to sadness were related to all indicators of social interaction quality. To the degree

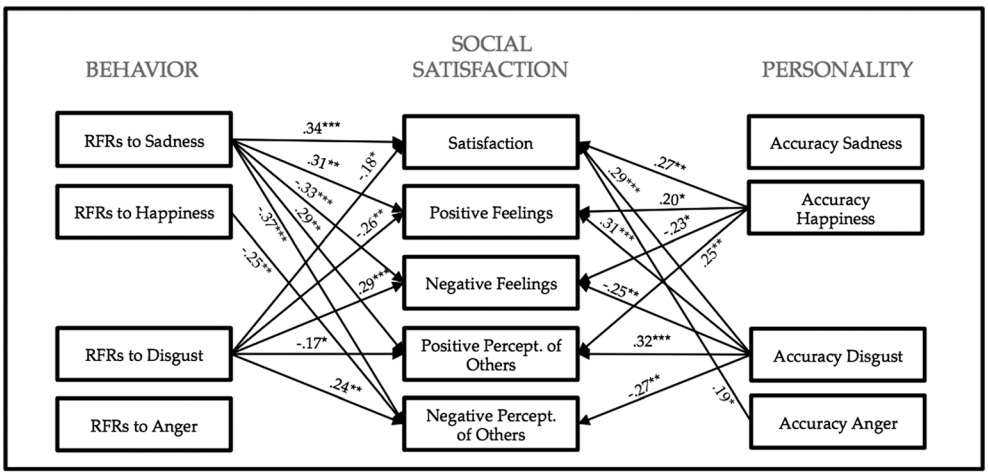

Figure 5. Multilevel regression investigating the social consequences of RFRs to sadness, happiness, disgust and anger, controlled for accuracy. Numbers represent standardized coefficients. Only significant coefficients are represented (even though all displayed variables were included in the analyses). $*p < .05$. $**p < .01$. Percept., perception; RFR, rapid facial reaction.

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that participants engaged in RFRs to sadness in the laboratory task, they perceived the interaction as more satisfying, they reported feeling more positive and less negative affect during the interaction and they perceived the interaction partner as more positive and as showing less negative affect. The exact opposite pattern emerged for RFRs to disgust. That is, individuals who showed RFRs to disgust to a larger extent in a laboratory task reported overall more negative social interactions. In contrast, RFRs to anger expressions were not predictive of social interaction quality.

Personality, rapid facial reactions and social interaction quality

In a second step, we assessed whether personality had the expected effect on RFRs. For this, we calculated correlations between the social relating competence (agreeableness, extraversion and low neuroticism, conscientiousness, and emotion management), positive affectivity and self-esteem and all RFRs. As expected, proximal indicators of social relating competence were only significantly associated with RFRs to sadness (agreeableness: $r = .27$, $p < .01$, extraversion: $r = .20$, $p < .05$) and RFRs to disgust (agreeableness: $r = -.25$, $p < .01$, neuroticism: $r = .27$, $p < .01$), but not with RFRs to happiness or with RFRs to anger. Instead, RFRs to happiness were significantly related to distal indicators of social relating competence (conscientiousness: $r = .28$, $p < .01$, emotion management: $r = .26$, $p < .01$) and RFRs to anger to positive affectivity ($r = .25$, $p < .01$) and self-esteem ($r = .21$, $p < .05$).

Rapid facial reactions as mediators between personality and social interaction quality

Then, we tested for meditational effects between proximal social relating competences with predictors, sadness and disgust RFRs as mediators and all social satisfaction indices as outcomes (here again controlling for accuracy). For this, we first conducted several two-level path analyses with MPLUS 5.2 (Muthén & Muthén, 1998–2008) using a full-information maximum-likelihood procedure with robust standard errors, following the process described by Baron and Kenny (1986). If all conditions for a mediation were satisfied (for a detailed description of all requirements, see the explanatory text in the supporting information Tables S5A and S5B, available from http://www. […]), we then used Monte Carlo simulation (Selig & Preacher, 2008) to calculate 95% CI for the indirect paths.

Rapid facial reactions to sadness significantly mediated both the positive effect of agreeableness and the positive effect of extraversion on social interaction quality for all interaction outcomes except for positive perception of others. Further, RFRs to disgust significantly mediated both the positive effect of agreeableness and the negative effect of neuroticism on more positive and less negative feelings during social interactions as well as on reduced perceived negative reactions of the interaction partner (a detailed presentation of all analyses can be found in Tables S5A and S5B in the supporting information, available from http://www. […]). This means that individuals high in social relating competence partially experience more positive social interactions, because they engage in more RFRs to sadness and less RFRs to disgust during their everyday social interactions.

Personality as moderators of the relationship between rapid facial reactions and social interaction quality

Finally, we examined the influence of each personality trait on RFRs as well as on the relationship between RFRs and social interaction quality to better understand the meaning and diagnostic value of RFRs for social satisfaction. Thus, for each type of RFR, we conducted a two-level path analysis with MPLUS 5.2 (Muthén & Muthén, 1998–2008) using a full-information maximum-likelihood procedure with robust standard errors. Figure 6 depicts the general procedure. Paths were estimated *from* (i) RFRs associating social relating competences (positive affectivity and self-esteem for anger RFRs) *to* RFRs (a1) and *to* each social satisfaction index (a2) as well as *from* (ii) RFRs and *from* (iii) interactions of RFRs and social relating competence *to* each social satisfaction index (b2 and c2). For the sake of consistency, we again controlled for accuracy in all analyses.

We examined the potential moderating impact of agreeableness and extraversion for RFRs to sadness, of conscientiousness and emotion management for RFRs to happiness, of neuroticism and agreeableness for RFRs to disgust and of conscientiousness and emotion management for RFRs to anger. All predictor variables were grand-mean centred. Given that this procedure produced fully saturated models, an examination of model fits was irrelevant. Figures 7 and 8 summarize the results (i.e. the standardized parameter estimates for all significant paths). Complete results for the multilevel path analyses investigating the correlates and social consequences of RFRs can be found in Tables S6–S9 in the supporting information (available from http://www. […]). Additional analyses including attachment (a very well-established predictor of social interaction quality; Kafetsios & Nezlek, 2002) as control variable can be found in Tables S10–S13 in the supporting information (available from http://www. […]).

Rapid facial reactions to sadness. Even though agreeableness moderated the effect of RFRs to sadness on one or the other interaction quality index, RFRs to sadness remained a significant predictor for the quality of social interactions. An examination of the interaction effect with an online simple slopes calculator (Preacher, Curran, & Bauer, 2006; Table 3) revealed that RFRs to sadness enhanced social interaction quality for mean and low agreeable individuals (1 *SD* below the mean) but not consistently for highly agreeable individuals (1 *SD* above the mean). Specifically, for highly agreeable individuals, RFRs to sadness were a significant predictor of neither satisfaction and positive feelings during social interactions nor perceived positive reactions of the

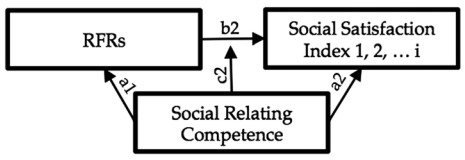

Figure 6. Path coefficients in the multilevel path analysis.

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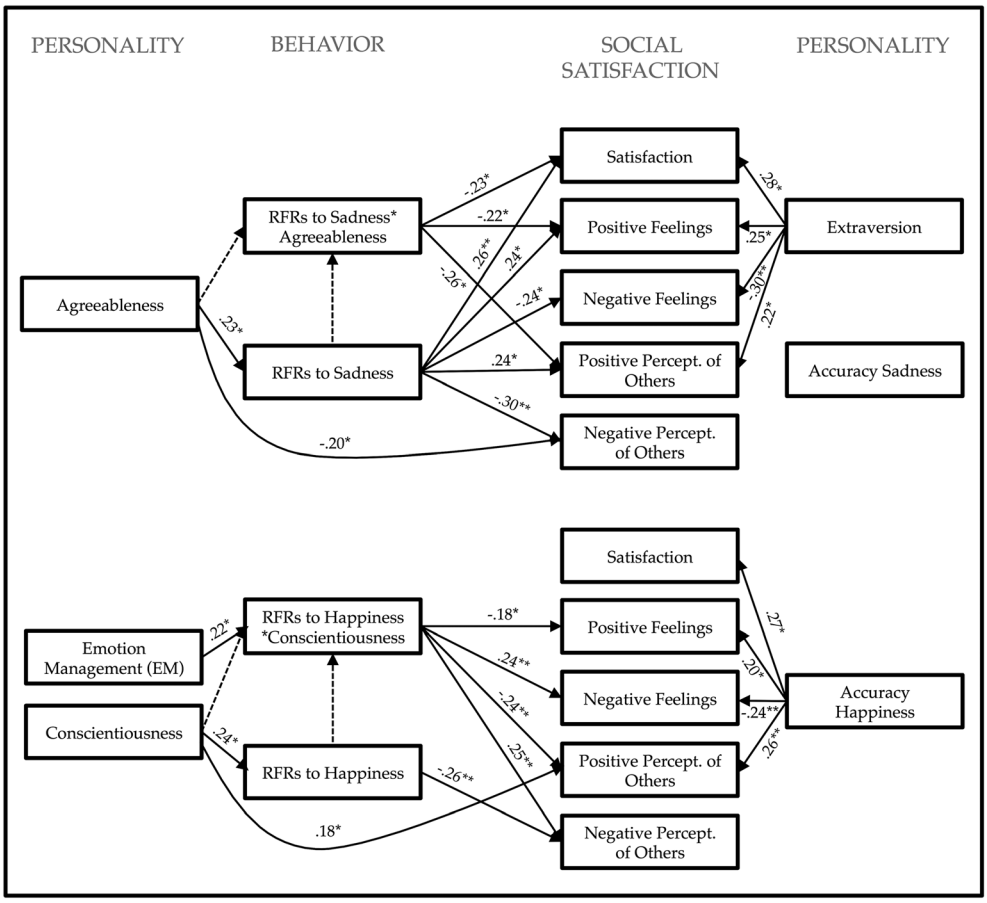

Figure 7. Multilevel path analyses investigating the social relating competence correlates and social consequences of rapid facial reactions (RFRs) to sadness moderated by agreeableness and of RFRs to happiness moderated by conscientiousness, controlled for accuracy. Numbers represent standardized coefficients. Only significant paths are represented (even though all displayed variables were included in the analyses). $*p < .05$. $**p < .01$. $***p < .001$. Percept., perception.

interaction partner. Yet, for all other individuals, engaging in RFRs to sadness entrained positive outcomes, and even highly agreeable individuals experienced less negative feelings and less negative reactions from interaction partners owing to RFRs to sadness.

Rapid facial reactions to happiness. Conscientiousness moderated the effect of RFRs to happiness on social interaction quality in expected ways. An examination of the interaction effect with an online simple slopes calculator (Preacher, Curran, & Bauer, 2006; Table 3) revealed that RFRs to happiness only enhanced social interaction quality for low conscientious individuals (1 *SD* below the mean) but not for highly conscientious individuals (1 *SD* above the mean). Specifically, for low conscientious individuals, RFRs to happiness were significant predictors of more positive and less negative feelings as well as more perceived positive and less perceived negative reactions of the interaction partner. By contrast, conscientiousness did not moderate the effect of RFRs to happiness on overall satisfaction with the interaction.

Rapid facial reactions to disgust. Neuroticism moderated the effect of RFRs to disgust on social interaction quality in expected ways. Simple slopes analyses (Preacher, Curran, & Bauer, 2006; Table 3) confirmed that RFRs to disgust only impaired social interaction quality for individuals high in neuroticism (1 *SD* above the mean) but not for those low in neuroticism (1 *SD* below the mean). For the former, RFRs to disgust were significant predictors of less positive and more negative feelings, of less perceived positive and more perceived negative reactions by the interaction partner and of less satisfaction with the interaction.

Rapid facial reactions to anger. Conscientiousness and emotion management ability moderated the effect of RFRs to anger on social interaction quality. Simple slopes analyses (Preacher, Curran, & Bauer, 2006; Table 3) revealed that the ability to control impulses influenced the direction of the relationship between RFRs to anger and social interaction quality. Whereas for individuals high in self-control (1 *SD* above the mean) RFRs to anger positively predicted social interaction quality, for individuals scoring low in self-control (1 *SD* below the mean), RFRs to anger were negatively related to social interaction quality.

With regard to conscientiousness, this effect was significant for self-reported satisfaction and positive feelings during the interaction and for perceived positive reactions by the interaction partner. Specifically, individuals low in conscientiousness reported less satisfaction and perceived less positive reactions from interaction partners the more they showed RFRs to anger. Further, individuals high in conscientiousness reported more positive feelings during their social interactions and perceived more positive reactions from

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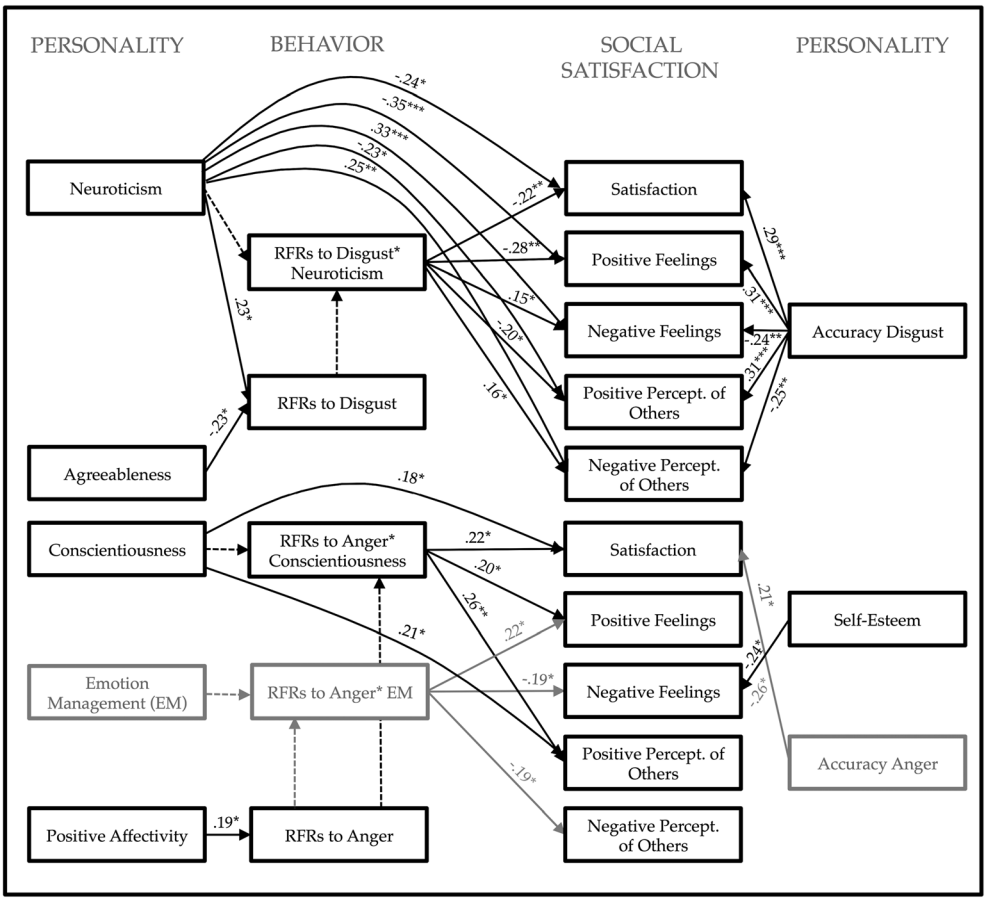

Figure 8. Multilevel path analyses investigating the social relating competence/personality correlates and social consequences of rapid facial reactions (RFRs) to disgust moderated by neuroticism and of RFRs to anger moderated by conscientiousness (numbers and paths coloured black) and by emotion management (numbers and paths coloured grey), controlled for accuracy. Numbers represent standardized coefficients. Only significant paths are represented (even though all displayed variables were included in the analyses). $*p < .05$. $**p < .01$. $***p < .001$. Percept., perception.

interaction partners the more they showed RFRs to anger. Even though simple slopes were not significant, individuals low in conscientiousness also experienced less positive feelings, whereas individuals high in conscientiousness also reported more overall satisfaction during their social interactions.

Similar effects could be found for emotion management: That is, individuals high in emotion management abilities reported feeling more positive and perceiving less negative reactions from interaction partners the more they showed RFRs to anger. Even though simple slopes were not significant, this effect was reversed for individuals low in emotion management abilities. Further, despite nonsignificant simple slopes, the effect of RFRs to anger on negative feelings significantly differed between individuals high and low in emotion management abilities; in the former, RFRs to anger enhanced, and in the latter, RFRs to anger decreased reported negative emotions during social interactions.

DISCUSSION

The present research aimed to assess the antecedents and social consequences of individual differences in emotional mimicry or RFRs. Specifically, we assumed that stable individual differences in the tendency to show affiliative and nonaffiliative RFRs assessed in a laboratory task relate to social satisfaction assessed in an event-sampling study in opposite directions: Whereas the former should be predictors of positive social interactions, as they are closely related to the concept of *emotional mimicry* (imitating the emotional expression of others as a reciprocal affiliative stance), the latter should predict negative social interactions, as they constitute affectively congruent reactions to an unpleasant facial display that may preclude mutual affiliation (Hess & Fischer, 2014). To further understand the meaning of each RFR, we undertook an explorative investigation of the influence of social relating competence assessed via questionnaires on RFRs and on the relationship between RFRs and social satisfaction. Given the exploratory nature of our approach and the number of analyses run, our findings, especially those involving moderators, need to be interpreted with certain care, and our reasoning should only be considered speculative pending direct replication.

Affiliative rapid facial reactions

Sadness rapid facial reactions and their impact on social interaction quality

As expected, sadness RFRs predicted positive social interaction outcomes and related positively to proximal indices

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Table 3. Results for simple slopes analyses for moderators (significant models only)

		Low	High
		Agreeableness	
RFRs to sadness	Satisfaction	1.05 (0.38)**	0.12 (0.24)
	Positive feelings	0.85 (0.34)*	0.07 (0.29)
	Negative feelings	—	—
	Positive perception of others	0.83 (0.33)*	−0.0001 (0.22)
	Negative perception of others	—	—
		Conscientiousness	
RFRs to happiness	Satisfaction	—	—
	Positive feelings	0.52 (0.25)*	−0.03 (0.19)
	Negative feelings	−0.68 (0.25)**	0.16 (0.22)
	Positive perception of others	0.48 (0.23)*	−0.15 (0.16)
	Negative perception of others	−0.87 (0.27)**	−0.08 (0.19)
		Neuroticism	
RFRs to disgust	Satisfaction	0.46 (0.37)	−0.73 (0.33)*
	Positive feelings	0.40 (0.40)	−0.91 (0.27)***
	Negative feelings	−0.01 (0.38)	0.84 (0.27)**
	Positive perception of others	0.30 (0.35)	−0.56 (0.24)*
	Negative perception of others	−0.13 (0.36)	0.66 (0.25)**
		Conscientiousness	
RFRs to anger	Satisfaction	−0.82 (0.36)*	0.34 (0.23)
	Positive feelings	−0.43 (0.35)	0.51 (0.22)*
	Negative feelings	—	—
	Positive perception of others	−0.61 (0.30)*	0.48 (0.18)**
	Negative perception of others	—	—
		Emotion management	
RFRs to anger	Satisfaction	—	—
	Positive feelings	−0.54 (0.38)	0.56 (0.27)*
	Negative feelings	0.70 (0.41)	−0.42 (0.27)
	Positive perception of others	—	—
	Negative perception of others	0.46 (0.42)	−0.54 (0.25)*

Note: RFRs, rapid facial reactions.
*$p < .05$;**$p < .01$;***$p < .001$.

of social relating competence. Further, RFRs to sadness mediated the effect of social relating competence on social interaction quality. This is in line with the notion that RFRs to sadness unambiguously meet the criteria of emotional mimicry (Hess & Fischer, 2014). The imitation of sadness is an empathic act (Eisenberg, 1989; Miller & Eisenberg, 1988); it signals to others the will to approach the suffering person and engage in soothing-related behaviours (Eisenberg & Miller, 1987), which unites people (Weber, Johnson, & Corrigan, 2004) and thus leads to affiliation between individuals. Yet, empathy with another's sad feelings is not intrinsically desirable as it entails personal and social costs (Duan, 2000). It is therefore plausible that individuals who are willing to invest their energy in empathy with sad interactants have a stronger desire for affiliation and thus also make more likeable interaction partners. Therefore, RFRs to sadness may smoothen social interactions and strengthen relationships because they signal a tendency towards altruistic behaviours, boosting mimickers' likability. This effect, however, was reduced in highly agreeable individuals. Highly agreeable individuals also have other positive qualities such as honesty, generosity or humbleness (Costa & McCrae, 1992) that make them admirable (Hareli & Weiner, 2000); this fact may render sadness RFRs less diagnostic for social interaction quality in overall kind and compassionate individuals.

Happiness rapid facial reactions and their impact on social interaction quality

Rapid facial reactions to happiness did not relate to social satisfaction and were only associated with distal indices of social relating competence. This is in line with our assumption that an RFR to happiness is a ubiquitous phenomenon that does not necessarily reveal mimickers' willingness to affiliate with others. Rather, RFRs to happiness might be a means to comply with the cultural norm of friendliness that demands people to return smiles in social encounters (Hess et al., 2002). In fact, whereas affiliative RFRs generally do not emerge in nonaffiliative contexts (Hess & Bourgeois, 2010; van der Schalk et al., 2011), RFRs to happiness always emerge, except in situations of definite dislike (e.g. Likowski, Mühlberger, Seibt, Pauli, & Weyers, 2008) or clear competition (Lanzetta & Englis, 1989). The positive relationship of RFRs to happiness with self-control capacities (with both conscientiousness and emotion regulation ability) in our study also fits this notion (DeBono et al., 2011; see Uziel, 2010, for the suggestion that social desirability simply reflects an individuals' self-control tendencies).

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However, RFRs to happiness predicted higher social interaction quality for low conscientious[5] individuals. That is, only for these individuals who tend to be overall less likely to conform to the social norms for smiling was a tendency to show RFRs to happiness in the laboratory task predictive of more positive interaction outcomes. In this sense, RFRs to happiness may represent socially learned smiles with correspondingly little diagnostic value unless shown by someone who is less likely to engage in socially desirable behaviours.

Nonaffiliative rapid facial reactions

Disgust rapid facial reactions and their impact on social interaction quality

Rapid facial reactions to disgust were related to less positive interaction outcomes and proximal measures of social relating incompetence. Further, RFRs to disgust mediated the effect of social relating incompetence on social interaction quality. Thus, RFRs to disgust seem to be protective but socially maladaptive reactions to avoid rejection driven by uncertainty, distress (high neuroticism) and distrust in humanity (low agreeableness). Indeed, people sensitive to social rejection score above average in neuroticism and below average in agreeableness (Breines & Ayduk, 2015; Downey & Feldman, 1996; Engeser & Langens, 2010) and act hostile under threat of rejection (Ayduk et al., 2008; Kelly, 2001), for instance, by expressing dislike for others during social interactions (Strachman & Gable, 2006), rendering them less likable interaction partners (Mehrabian & Ksionzky, 1974; Russell & Mehrabian, 1978).

Interestingly, in investigating social relating (in)competence as moderators, RFRs to disgust only remained an index of negative interaction quality for individuals high in neuroticism. Individuals who incessantly strive for unquestioned acceptance may easily feel overwhelmed by the slightest signs of rejection, especially if they generally experience more insecurity, anxiousness and vulnerability (i.e. score higher on neuroticism). In contrast, emotionally stable (i.e. lowly neurotic) rejection-sensitive individuals may be better able to avoid the spiral of hostility, as they do not become stressed easily and hence their social interactions are less negatively affected. Thus, social relating competence buffers the negative effects of RFRs to disgust.

[5]Surprisingly, emotion management did not moderate the relationship between RFRs to happiness and social interaction quality. This may be explained by the two different methods used to assess emotion management and conscientiousness. Whereas we measured the former with an ability test (asking for the most effective way to deal with an emotional situation), we measured the latter with a personality test (asking for a description of the way one typically tends to behave). The crucial difference is that the relationship between a self-control ability measure and social adaptive responding should be always linear (the higher the score, the more adaptive the response), whereas the relationship between a self-control personality measure and social adaptive responding may be sometimes quadratic (above a certain score, a further increase of the score reduces the functionality of the trait; Samuel & Gore, 2012). Hence, lower emotion management unambiguously represents higher impulsive undercontrol, but lower conscientiousness could mean lower rigid overcontrol besides higher impulsive undercontrol (Eisenberg, Eggum, Sallquist, & Edwards, 2010) and hence may be more adaptive for social functioning than lower emotion management.

Anger rapid facial reactions and their impact on social interaction quality

Overall, RFRs to anger neither predicted negative interaction quality nor were related to social relating incompetence. Rather, they were positively associated with positive affectivity and self-esteem. This supports the assumption that RFRs to anger are approach-motivated reactions driven by feelings of strength, confidence and activeness (Barkow, 1975; Brown & Zeigler-Hill, 2004; Carver & Harmon-Jones, 2009; Harmon-Jones et al., 2009; Hess, 2014; Lerner & Tiedens, 2006). RFRs to anger represent a struggle for social influence and dominance (e.g. Knutson, 1996; Tiedens, 2001). This power struggle can escalate into aggression or lead to constructive conflict management (*personalized or socialized power*; Magee & Langner, 2008). Each route has different social consequences, which explains why the association between RFRs to anger and social interaction quality was moderated by self-regulation abilities: Individuals high in self-control are more likely to react to conflicts or threats in a cautious-reflective manner rather than in a rude-aggressive manner (Finkel & Campbell, 2001; Murphy & Eisenberg, 1997). In this case, RFRs to anger represent a component of socially adaptive responding (see De Wied, Van Boxtel, Zaalberg, Goudena, & Matthys, 2006, reporting that socially competent individuals show more intense RFRs to anger). Congruent with this assumption, in our study, RFRs to anger predicted more positive social interactions for individuals high in self-control. Our results support Fischer and Roseman's (2007) suggestion that appropriately displayed anger expressions have long-term benefits. Further, it fits with the notion that people who are more willing to express annoyance in a competent manner have a larger social network and report greater intimacy in their social relationships (Graham, Huang, Clark, & Helgeson, 2008). Showing anger can have positive social effects for the expresser, as it signals a good character (Hess, 2014): Anger displays the intention as well as the capability to correct perceived injustice and to cope with difficult interpersonal situations. By contrast, the direction of the relationship between RFRs to anger and social interaction quality was reversed for individuals low in self-regulation ability. Individuals low in conscientiousness reported less positive social interactions (less satisfaction and less reduced perceived positive reactions from interaction partners), probably due to their inappropriate reactions to angry others (Denson, Pedersen, Friese, Hahm, & Roberts, 2011; Finkel & Campbell, 2001; Murphy & Eisenberg, 1997). As a consequence of these opposing tendencies as a function of self-control capacities, no main effect of RFRs to anger emerged.

Social relating competence as explanation for social effects of rapid facial reactions

In sum, the present findings suggest that, in line with our theoretical argument, affiliative and nonaffiliative RFRs differ in meanings and consequences—but even more than that: RFRs to affiliative emotions (i.e. emotional mimicry), like behavioural mimicry, may promote social satisfaction (Lakin et al., 2003), but only when the 'right' type of

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affiliative emotion, is mimicked—that is, only when affiliative RFRs are proximal indices of social relating competence such as sadness RFRs. Similarly, RFRs to nonaffiliative emotions (i.e. congruent reactive emotional responses) may hinder social satisfaction, but only when the 'wrong' type of nonaffiliative congruent expression is shown—only when nonaffiliative RFRs are reactions to a rejecting expression driven by social relating incompetence such as RFRs to disgust.

Furthermore, individual differences in social relating competence moderated the effects of RFRs on social interaction quality. This finding reflects the fact that social interaction quality is multidetermined. On the one hand, social relating competence buffered the negative effects of RFRs to disgust and weakened the positive effects of RFRs to sadness. On the other hand, social relating competence qualifies the link between both RFRs to happiness and RFRs to anger and social outcomes: In line with the notion that 'norm-congruent behaviors are both unremarkable and unlikely to be remarked on' (Miller & Prentice, 1996, p. 808), the more ubiquitous RFRs to happy expressions were indeed only diagnostic when shown by individuals for whom such norm-congruent behaviour is less expected, as only for these does it seem related to the motive to affiliate and a consequent effort at keeping interactions pleasant. Moreover, the socially informative value of RFRs to anger, which were driven by approaching tendencies and feelings of strength and activeness, increased in individuals (un)able to regulate emotions and inhibit impulses in a socially appropriate manner. That means that only impulsive individuals' social interactions may suffer from RFRs to anger, whereas self-regulated individuals' social interactions may indeed benefit from RFRs to anger. Yet, as our study is the first to assess the impact of personality on RFRs and on their social consequences, our results need to be interpreted with caution. Future research is needed to replicate these findings.

The same divergence of RFR effects as a function of the social relating competence signalled by the behaviour *per se* would not typically be observed for behavioural mimicry as most behaviours considered in this context, most often face touching and foot tapping, do not carry an interpersonal message on the affiliation—antagonism or the dominance dimension. However, it is imaginable that congruent reactions to antagonistic nonverbal behaviours would also have negative consequences. For example, crossing one's arms in front of one's chest is often considered a sign of keeping the other out. Imitating such behaviours might therefore similarly negatively affect interaction quality. The recent findings by Kurzius and Borkenau (2015), while complex, can be interpreted in this sense.

Limitations

Rapid facial reactions are a proxy for how individuals typically react in social interactions. That is, to the degree that RFRs are relative stable traits, we can assume that individuals who show RFRs in the laboratory will also imitate their social interaction partner in real life. As simulated social scenes, however, clearly differ from natural social situations, this kind of measurement may limit the ecological validity of the RFRs. Yet, one has to take into account that a natural setting prevents an appropriate measurement of RFRs, as a result of the following: (ii) the use of EMG in such a setting is challenging and (ii) it is difficult to hold the source of potential RFRs (the emotional expressions) constant across participants. Future studies should address the question of how RFRs could be assessed precisely within a social interaction (see Hess & Bourgeois, 2010, for methodological challenges in this domain).

Another limitation of the present research is that interaction quality was only assessed as perceived by the participants. Yet, by definition, an interaction involves more than one person, and the perception of the event by the interaction partner might not have been the same. In fact, it is even plausible that certain participants systematically misperceive the emotions and reactions of their interaction partners and that such a tendency to misperception would also correlate with their tendency to mimic. Even though a design where data are collected from both sides of the interaction for everyday interactions is difficult to conceive of, it is imaginable to conduct a laboratory study in which participants interact with others and reports of interaction quality are collected from all participants. Yet as reasonably more than one interaction partner should be included, such a design would be hard to realize. If, however, this were carried out, it would provide valuable information on the role of RFRs in social interactions.

A third limitation lies in the assessment of social relating competence. Because of the complexity of our design and the consequent time constraints, we chose very short measures—which, however, are limited in validity and reliability. Yet, the applied short personality scale retains an essential portion of its original validity and reliability (Rammstedt & John, 2007). Still, future studies are needed to replicate our results with a full-scale personality questionnaire.

Conclusion

The present research was the first to assess the role of RFRs in social interactions: (i) by considering the social effects of stable individual differences in RFRs and (ii) by differentiating between social effects of affiliative and nonaffiliative forms of RFRs, which are not equivalent in functionality but, in line with the *Mimicry in Social Context Model* by Hess and Fischer (2013), depend on the communicative intentions of the imitated emotion. Hess and Fischer (2013) describe RFRs as social regulators, and this social regulation is closely dependent on what is mimicked, by whom and in what context. Hence, whether RFRs will foster social interactions depends on both the characteristics of the displayed emotions by the mimickee and the individual characteristics of the mimickers. In this sense—just like there are different glues for wood and metal and one does not work in the place of the other—the RFR of each emotion in each individual has distinct nonexchangeable effects.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article at the publisher's web-site.

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