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Intrapersonal Emotional Responses to the Inquiry and Advocacy Modes of Interaction: A Psychophysiological Study

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Abstract
In negotiations and group decision making we can use two characteristically different interaction modes: inquiry and advocacy. Inquiry refers to an interested and explorative interaction mode, and advocacy to an assertive and narrow mode. Although these modes have been studied in organizational behavior literature, the intrapersonal emotional responses to the inquiry and advocacy modes remain yet unexplored. We explored intrapersonal emotions by facial electromyography and skin conductance responses and by emotional empathy self-reports. The subjects were prompted to adopt the two modes in hypothetical encounters with another person. We found that Duchenne smiles were specific to the inquiry mode, that emotional arousal showed specificity to the expressions, and that emotional empathy predicts expressiveness in the inquiry treatment. We discuss the implications of these results to the use of the interaction modes and the related possibilities of influencing group interaction by influencing one's own internal emotional state in group decisions.

Keywords Inquiry · Advocacy · Intrapersonal emotions · Group interaction · Psychophysiological responses

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1 Introduction

Different ways of interacting affect behavior in negotiations. Some ways of interacting may have intended effects that are beneficial for the negotiation, such as generating more insights or trust or persuading group members of certain courses of action, but also unintended effects, such as creating friction, distrust, and disagreement. Much literature has focused on the interpersonal effects of dyadic or group interaction in negotiations and has related these effects on how successful the interaction is in terms of the achieved outcomes. However, equally important is to understand intrapersonal effects – how one's emotional reactions to different ways of interacting affects within oneself (see e.g. Morris and Keltner 2000, for a definition of intrapersonal effects of emotions). Different ways of interacting can give rise to different emotional responses in oneself, which can then be reflected in the person's own facial emotional expressions and in other ways that emotions are manifested. This will again influence the collective emotional landscape in the dyad or group in which one is interacting (Kappas 2013).

Both intrapersonal and interpersonal emotions have been extensively studied in negotiation and group settings; see e.g. van Kleef et al. (2004, 2017). To name a few examples, it is well known that moods are contagious in groups making managerial decisions (Barsade 2002), and that language and emotions play a role in online negotiations and negotiation support systems where there is no direct facial contact (see e.g. Brett et al. 2007; Hine et al. 2009; Broekens et al. 2010; Griessmair et al. 2015). Some evidence of how emotions affect negotiators in an isolated environment may be drawn from studies using online interactions in group decision making and negotiations where communication is possible only via computers. However, the review by Derks et al. (2008) concludes that emotions in online communication play a very similar role as emotions in offline communication.

We study the question whether emotions that naturally arise in certain types of interactions have intrapersonal effects even if the communication does not have an emotional component. By these types of interactions we mean communication modes in which emotions are not mediated nor prompted. Adopting a certain behavioral interaction style or mode in a negotiation or in the group that is making decisions generates emotional effects in the group, which in turn may be advantageous or disadvantageous for attaining a desired outcome. Before these emotional effects become interpersonal, however, they are experienced within oneself and may be manifested as emotional expressions or autonomic responses. With this perspective in mind we set to explore whether different ways of interacting have different intrapersonal emotional effects on oneself, which consequently has an impact on the other participants.

We choose from the literature two interaction modes that are developed for structured interaction, inquiry and advocacy, and arrange a laboratory experiment to study their intrapersonal emotional correlates. These interaction modes, designed to introduce constructive conflict in a group (Schweiger et al. 1986), have been studied a lot in the literature but the mechanisms that they trigger are not well understood. A person with an inquiry mode shows interest in the others' points of views and asks questions and explores different possibilities. A person with an advocacy mode approaches the others with a narrow and assertive way and emphasizes her own points of view. Inquiry is suggested to be related to improved organizational learning (Argyris and

Schön 1978) and to the lowering of inhibitory defensive routines (Schein 2013). Such phenomena are naturally desirable also in group decision and negotiation settings. Evidence from laboratory experiments shows that introducing and balancing inquiry and advocacy in the decision making process improves decisions over a simple process where only expert recommendations are followed and no conflict between the decision makers is present (Schwenk 1990). Inquiry is also an essential component in dialogue (see e.g. Slotte and Hämäläinen 2015). The organizational learning literature also emphasizes the need for the systems perspective in understanding and improving organizational behavior.[1]

In our experiment, the subjects were prompted to adopt an inquiry mode, an advocacy mode, and a passive (neutral) viewing mode in simulated encounters with other persons who were represented by facial pictures accompanied by textual statements. We then measured emotions in the alternative modes in a within-subject design. To distinguish genuine positive emotional expressions from non-genuine ones, we measured both the Duchenne and the non-Duchenne smiles.[2] The Duchenne smile is often associated with positively valenced stimuli and it is formed by contracting both the *zygomaticus major* and the *orbicularis oculi* muscles in the face, whereas the non-Duchenne smile involves only the *zygomaticus major* (Ekman et al. 1990; Frank and Ekman 1993). The negative emotional expressions were represented by furrowed eyebrows where the *corrugator supercilii* muscle is contracted. The furrowed brows expression is often associated with negatively valenced stimuli (Larsen et al. 2003). These facial expressions were measured by facial electromyography (EMG). To represent internal emotional states, we measured activation of the sympathetic part of the ANS, or emotional arousal, by the skin conductance response (SCR). To include somatic responsivity as a control variable in the analysis we formed an empathy score for each subject using a 33-item self-report questionnaire.

Earlier studies on inquiry and advocacy have studied their effect on others and the group (see Schwenk 1990). We contribute to this literature by describing the intrapersonal emotional effects of inquiry and advocacy. Our contribution will thus offer an increased understanding of the whole picture of the interaction in negotiations and group decisions. Looked from another perspective, we demonstrate that there is a possibility that one can alter one's influence on the group's behavior by influencing oneself through intrapersonal emotions.

[1] The concept of systems intelligence was introduced as an extension to this literature by Hämäläinen and Saarinen (2004), see also Luoma et al. (2008, 2011). Systems intelligence presents a theory of how we can successfully interact with people in systemic settings such as in groups and in this theory communication in the inquiry mode is seen as an essential tool. The construct of systems intelligence has eight factors some of which relate directly to how people are encountered and are thus directly related to group interaction (Törmänen et al. 2016).

[2] It is important to be able to differentiate genuine from non-genuine positive emotional expressions. This is because it is possible that a nongenuine positive emotional expression is displayed in the advocacy mode, for example, by a negotiator who wants to give a false emotional signal. Yet it is possible that the other person in fact sees that this is not a genuine signal.

2 Theoretical Background

Much of the literature on emotions emphasizes the regulatory nature that emotions play in human interaction. Interpersonal emotions regulate social interaction, and intrapersonal emotions regulate individuals, and all these effects form complex interrelated layers, leading to blending of the concepts of emotion generation and regulation (Kappas 2013). For comprehensive reviews on emotions in negotiations, see e.g. Druckman and Olekalns (2008) and Martinovski (2015a).

In face-to-face negotiations behaviors such as nonverbal signs and speech intonation are often used to express emotion (Martinovski 2015b). Via these behavioral tendencies emotions have interpersonal effects, i.e. emotions affect and are transferred onto others in interaction (Christov-Moore and Iacoboni 2015; Olekalns and Druckman 2015; Griessmair 2017). Specific interpersonal effects of emotions in negotiations include emotional contagion (e.g. Thompson et al. 1999) and conveying behavioral intentions (Fridlund 1994). Through face-to-face interactions, shared or collective emotions may then arise (Von Scheve and Ismer 2013) that may influence how well a whole strategic change in an organization can be managed (see e.g. Sanchez-Burks and Huy 2009).

Various intrapersonal effects of emotions in social interaction are known to exist. For example, the disgust emotion produces avoidance towards moral transgressors (Chapman and Anderson 2013). It has been hypothesized that the anger emotion has evolved to orchestrate behavior in a person that creates incentives in the target of anger to produce concessions (Sell et al. 2009). People also know how to use anger strategically in competitive interactions (Gneezy and Imas 2014). Anger causes more concessions (Sinaceur and Tiedens 2006; Van Kleef et al. 2004) as well as an anger response in the opponent (Friedman et al. 2004), but experienced anger may be counterproductive (Allred et al. 1997). In negotiation and decision making, it is known that humans resort to intrapersonal emotion regulation strategies such as cognitive reappraisals, and these strategies have been shown to reduce decision biases that are believed to be emotional in origin, such as risk aversion (Heilman et al. 2010). Indeed, emotion regulation may have instrumental value in negotiations (Tamir and Ford 2012).

Deception and dishonesty have received interest in the negotiation literature (see e.g. Olekalns and Smith 2007) and it has been argued that groups make people more dishonest (Sutter 2009; Kocher et al. 2017). The link between deception and emotions can be traced to violations of norm perceptions (Schweitzer and Gibson 2008).

Positive emotion expressions are known to have various interpersonal and outcome-related effects, such as increasing cooperativeness and reducing conflict and leading to better negotiation outcomes than negative emotions (Barsade 2002; Kopelman et al. 2006; Hine et al. 2009). Positive emotions are also known to carry informational value in decisions despite being seemingly irrelevant (Steffen et al. 2009). However, there is less research on the intrapersonal effects of positive emotions on behavior. Positive emotions are known to broaden attention and increase cognitive flexibility (Fredrickson 2001) and promote in-group identity (Johnson and Fredrickson 2005). However, positive and negative emotions affect differently on cognition. Positive emotions lead to different information processing strategies than negative emotions (Forgas and George 2001). Whereas positive emotions broaden attention, negative emotions narrow attention and bias it against threats (Frijda 1994). Thus, the literature on how emotions affect cognition supports, indirectly, our argument that emotions have intrapersonal effects in group interactions.

Our goal in this article is to contribute into the literature how positive and negative intrapersonal emotions arise in different ways of interacting in groups. This will help the understanding of the functions of these emotions in group interaction. We are interested in the emotional effects of the two interaction modes of inquiry and advocacy and conduct an explorative experimental study. Our main assumption regarding the experimental results is that the valence (i.e. positivity–negativity) of the intrapersonal emotions elicited by the different interaction modes can be traced to the positive–negative domain from facial emotional expressions when each interaction mode is displayed. If this assumption is correct, then we should observe that one interaction mode is "positive" and the other is "negative". The changes in valence are observed in comparisons of the emotional expressions in the interaction mode to the emotional expressions in the passive mode. We are also interested in finding out whether the "positive" mode, if it can be observed, is related to genuine positive emotional expressions. In this analysis the comparisons are made within the respective interaction modes and between the emotional expressions. This analysis is conducted because it is important to be able to differentiate genuine from non-genuine positive emotional expressions. It is possible that a nongenuine positive emotional expression is displayed in an interaction mode by, for example, a negotiator who wants to display false emotional signals.

To find evidence for the argument that intrapersonal emotions are represented as internal emotional states and not just as facial expressions that support the communication of emotions and thus their interpersonal effects, we explore the autonomous nervous system correlates of each interaction mode. However, as emotional arousal does not directly reflect the valence of emotions but only emotional intensity (Larsen et al. 2008), investigation of emotional arousal is not rooted to positivity or negativity of emotions. In this investigation our interest is to learn whether the two interaction modes elicit different levels of emotional arousal, and how arousal correlates with the different emotional expressions within the modes.

Finally, we study individual-level variability in the expression of intrapersonal emotions using an empathy questionnaire. Empathy is known to affect how responsive individuals are to emotions (Mehrabian and Epstein 1972). We assume that subjects who have a higher empathy score are more expressive than subjects who have a lower empathy score, and that this is also reflected in the treatment effects.

3 Experiment

3.1 Procedure

During the experiment, the subjects sat still in a dimly lit room and underwent three treatments: Inquiry, advocacy, and passive. The stimuli were the same in each treatment and consisted of a set of 26 facial photographs with written statements below the photograph. The statements represented the opinion of the person in the photograph on a topic which varied from person to person. Examples of statements included: 'I am terrified of gene manipulated food' and 'Shopping makes me happy'. The subjects were instructed to silently take either an inquiry approach (inquiry treatment) or an advocacy approach (advocacy treatment) to the stimuli, or to observe the stimuli passively (passive treatment). The photographs, statements, and the experimental instructions are available in the Supplemental Material.

Each photograph was shown for 18 s with 5-s breaks. The same set of photographs was shown in each treatment in randomized order. The order of the inquiry and advocacy treatments was randomized between the subjects. To allow the main treatment effects to be compared with the passive treatment, the passive treatment was always presented after the main treatments. A 5-min baseline was measured at the beginning.

3.2 Measurements

The EMG and SCR data were obtained using bipolar Ag/AgCl electrodes. The measurements were conducted with Nexus-4 equipment and recorded with BioTrace+ software (MindMedia B.V., The Netherlands). The EMG data was obtained from the *corrugator supercilii*, *zygomaticus major*, and *orbicularis oculi* facial muscle sites at the left hemisphere of the face. The placements of the EMG electrodes followed the recommendations of Fridlund and Cacioppo (1986). The SCR data was obtained from the non-dominant hand index and middle fingers.

The 2048-Hz EMG data was band pass filtered between 90 and 200 Hz, smoothed, rectified and logarithmized. The EMG scores were obtained with a similar procedure as used by Johnson et al. (2010). This procedure was conducted to ensure that the emotional expressions were mutually exclusive. The signal during each 18-s stimuli was averaged into 3-s bins, the mean from the 60-s baseline signal was subtracted from each bin, and each bin was coded active for a positive remainder. Therefore, the baseline signal was considered as the muscle activation threshold during each stimuli. Then, the facial expressions were coded as follows. A Duchenne smile was registered if both the *zygomaticus major* and the *orbicularis oculi* were active but the *corrugator supercilii* inactive. A non-Duchenne smile was registered if only the *zygomaticus major* was active. In this way, the Duchenne and non-Duchenne smiles are mutually exclusive. A furrowed brow was registered if only the *corrugator supercilii* was active. Each EMG score therefore has a count value 0–6, and this is referred to as EMG bin count of the respective muscle area. The 128-Hz SCR data was deconvoluted into an integrated SCR (ISCR) score (Benedek and Kaernbach 2010) and logarithmized. The ISCR score has unit μSs.

Before the measurement began the subjects filled a 33-item questionnaire measuring empathy (Mehrabian and Epstein 1972, p. 528). An empathy score 0–100 was calculated from the responses.

3.3 Participants

A total of 40 healthy subjects participated. After the experiment, the subjects reported in writing what they had thought during the inquiry and advocacy treatments. The reports were used to decide which subjects did not understand the task and should be excluded from further analysis. We defined understanding the task as reporting different thoughts in the inquiry and advocacy modes that roughly corresponded to the task instruction. To ensure objectivity in the decision to exclude subjects, we used a panel of three outside observers. The observers, who were research assistants and did not know the goals of the experiment, were asked to read the reports and evaluate subjects' understanding of the task. The panel then discussed which subjects should be excluded and came to an unanimous decision. As a result, seven subjects were excluded. The remaining number of subjects was 33 ($M_{\text{age}} = 34.6$ years, age range: 22–61 years, 17 women).

All subjects gave their written consent on participating in the experiment. The experiment was approved by the ethics committee of Aalto University and conducted in accordance with the Declaration of Helsinki.

4 Results

The results were analyzed using linear mixed models (LMMs) where the subjects were treated as random effects. This takes the between-subject heterogeneity in the psychophysiological measurements into account. The degrees of freedom were calculated by Satterthwaite approximations. We report the *SD* of random effects as σ_0 (residual) and σ_1 (slope). To account for the possibility of habituation, time (indicating the stimulus number) is included as an independent variable in the main analyses. For six subjects, the SCR signal failed to appear at all or failed to appear at some point during the experiment. These subjects are treated as missing values in the analyses on emotional arousal.

Figure 1 shows the main results. We see that the Duchenne smiles are exclusively related to the inquiry treatment. In that treatment the number of Duchenne smiles is significantly higher than in the passive treatment, while in the advocacy treatment the number of Duchenne smiles is not significantly different from the Duchenne smile numbers in the passive treatment. We also find that there were more both Duchenne and non-Duchenne smiles in the inquiry treatment than in the passive treatment. Thus, the inquiry treatment generated both genuine and non-genuine positive emotional expressions. In the advocacy treatment the number of non-Duchenne smiles was higher than in the passive treatment. Thus, the genuine positive emotional expressions were above the passive treatment numbers only in the inquiry treatment, whereas the non-genuine positive emotional expressions were above the passive treatment numbers in both the inquiry and the advocacy treatments. These results imply that only the inquiry mode generates genuine positive emotional expressions whereas the advocacy mode generates also nongenuine positive emotional expressions.

We do not find a higher number of furrowed brows in the advocacy treatment than in the passive treatment. However, there are a lower number of furrowed brows in the inquiry treatment than in the passive treatment (Fig. 1). In other words, the furrowed brows expression is inhibited in the inquiry treatment. This suggests that there is an inverse relationship between furrowed brows and the Duchenne smiles that is specific to the inquiry treatment but not observed in the advocacy treatment. We can also explore this inverse relationship a bit more, namely the relationship between the bin

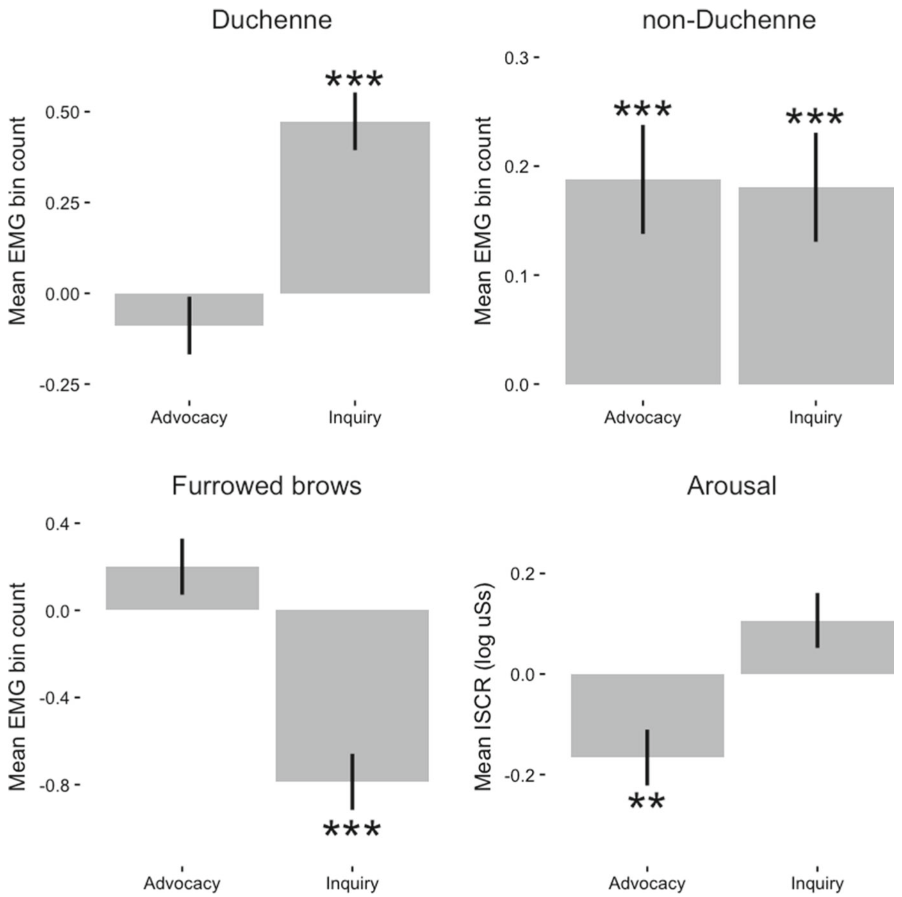

Fig. 1 LMM estimates of mean bin counts of EMG for the three facial expressions and ISCR for arousal. *Note*: The number of observations is 2496 in models with EMG bin counts and 2106 in the model with ISCR. The reference treatment, passive, is moved to zero, i.e. the bar heights represent deviations from the passive treatment level. The mean levels of EMG bin counts in the passive treatment are 0.26 ($SD = 0.95$) for Duchenne smiles, 0.13 ($SD = 0.68$) for non-Duchennes, and 2.17 ($SD = 2.47$) for furrowed brows. The mean ISCR score in the passive treatment is 0.46 (SD = 0.51) μSs. Time is included as an independent variable. The error bars represent standard errors of the coefficients estimated by the LMMs. The random effect standard deviations are: $\sigma_0 = 1.0$, $\sigma_1 = 0.62$ (Duchenne), $\sigma_0 = 0.65$, $\sigma_1 = 0.62$ (non-Duchenne), $\sigma_0 = 1.7$, $\sigma_1 = 1.6$ (Furrowed brows), $\sigma_0 = 0.66$, $\sigma_1 = 0.40$ (Arousal). Asterisks represent significance levels: $^{**}p < 0.01$, $^{***}p < 0.001$. Significance is calculated with respect to the zero level (passive treatment)

counts of the furrowed brows expressions and the Duchenne and non-Duchenne smiles. This reveals that the furrowed brows bin count at each stimulus is indeed inversely related to the bin counts of the two smiles (LMM, Duchenne coefficient -0.27, $t = -8.2$, 2488.6 df, $p < 0.001$, non-Duchenne coefficient -0.31, $t = -5.9$, 2495.1 df, $p < 0.001$, $\sigma_0 = 1.7$ and $\sigma_1 = 1.5$).

Based on observations shown in Fig. 1, our main assumption about the valence of the modes is partially supported, in the sense that the inquiry mode is "positive" because it elicits the positive emotional expressions but not the negative one. The advocacy mode only elicits the non-genuine Duchenne smiles and therefore has an inconclusive relationship to the facial expressions, i.e. we cannot confirm whether it is "positive" or "negative" in nature.

There are in total 646 Duchenne smiles in the inquiry treatment, versus 174 non-Duchenne smiles in that treatment. An LMM comparing the difference in the smiles within the inquiry treatment confirms that there are significantly more Duchennes than non-Duchennes at the subject level (dependent variable bin count, independent variable EMG dummy that has value 0 for Duchenne and 1 for non-Duchenne, coefficient -0.56, $t = -10.73$, 1632 df, $p < 0.001$, $\sigma_0 = 1.08$ and $\sigma_1 = 0.80$). In the advocacy treatment, the total number of Duchenne smiles is 178, and the total number of non-Duchenne smiles is 180, and this difference is not significant in a similar LMM as above (dependent variable bin count, independent variable EMG dummy that has value 0 for Duchenne and 1 for non-Duchenne, coefficient 0.0024, $t = 0.063$, 1632 df, $p = 0.95$, $\sigma_0 = 0.78$ and $\sigma_1 = 0.52$). Thus, the number of genuine smiles is clearly highest in the inquiry treatment compared to the advocacy treatment and compared to the non-genuine smiles.

We find that the negative emotional expression, the furrowed brows, is inhibited in the inquiry mode with respect to passive viewing. Although this inhibition may seem surprising, previous research concerning the neurophysiology of the *corrugator supercilii* has reported that its activation can be reciprocal to negative and positive valence and antagonistic to the *zygomaticus major* (Dimberg and Lundquist 1990) or otherwise restricted in specific positive emotion stimuli (Heckmann et al. 2003). The inhibition of furrowed brows and activation of the Duchenne and the non-Duchenne smiles during the same stimuli implies that the inquiry mode did not only include the use of the smiles but also expressions where control of the brow musculature played a role. Particularly notable is that the *corrugator supercilii* activity was significantly lower in the inquiry treatment than in the passive treatment, which may indicate that subjects volitionally inhibit the furrowed brows expression when instructed to adopt the inquiry interaction mode (see also Kappas et al. 2000).

Figure 1 shows that there is less emotional arousal in the advocacy treatment than in the passive treatment, and that the level of arousal in the inquiry treatment is not different from its level in the passive treatment. However, if we run the LMM again without the inquiry treatment, we do not find a significant difference in arousal level between the advocacy and passive treatments (coefficient 0.012, $t = 0.28$, 1392 df, $p = 0.78$, $\sigma_0 = 0.37$, $\sigma_1 = 0.36$). Therefore, the relationship between arousal and the interaction modes remains unconfirmed.

To see the relationships between arousal and the expressions, we next study how the expressions explain the arousal level in each treatment. Table 1 shows results from an LMM where emotional arousal is the dependent variable and the emotional expressions are the independent variables and the treatments are included as interaction effects. Only the non-Duchenne smiles are differently related to emotional arousal in the inquiry and advocacy treatments. This treatment interaction effect is positive in the inquiry treatment and negative in the advocacy treatment. In other words, arousal increases in the bin count of non-Duchenne smiles in the inquiry treatment, but in the advocacy treatment arousal decreases in the bin count of non-Duchenne smiles. There are no significant relationships between emotional arousal and the Duchenne smile

Table 1 How the emotional expressions are related to emotional arousal, LMM estimates

Independent variable	Estimate (*SEM*) × 1000
(Intercept)	848.3 (104.0)***
Duchenne	44.8 (29.9)
Non-Duchenne	490.9 (36.5)***
Furrowed brows	– 15.8 (13.7)
Duchenne × advocacy	56.3 (40.1)
Duchenne × inquiry	– 34.5 (37.8)
Non-Duchenne × advocacy	– 986.5 (61.7)***
Non-Duchenne × inquiry	– 188.4 (53.4)***
Furrowed brows × advocacy	14.1 (20.7)
Furrowed brows × inquiry	13.9 (21.2)
Time	– 5.2 (0.62)***

The number of observations is 2106. The dependent variable is the ISCR score. The EMG bin counts are centered on subject means. The main treatment effects are omitted from the regression. The random effect standard deviations are: $\sigma_0 = 0.62$, $\sigma_1 = 0.52$. Asterisks represent significance levels: ***$p < 0.001$

nor between emotional arousal and the furrowed brows expression. These results confirm that the level of arousal is different in the inquiry and advocacy modes and the correlation between arousal and the non-Duchenne smile is different in the treatments.

The mean empathy score is 43.4 ($SD = 23.7$). Table 2 shows results from LMMs where each emotional expression and emotional arousal are in turn the dependent variables and the empathy score is the independent variable and the treatments are included as interaction effects. Empathy correlates with all the EMG bin counts as well as with the arousal score in the inquiry treatment, but in the advocacy treatment empathy correlates only with the non-Duchenne smile. With the Duchenne and non-Duchenne smiles this treatment effect is increasing, i.e. in the inquiry treatment subjects with a higher empathy score express a higher number of positive emotional expressions than subjects with a lower empathy score. With the furrowed brows expression, this treatment effect is decreasing, i.e. in the inquiry treatment subjects with a higher empathy score express a smaller number of negative emotional expressions than subjects with a lower empathy score. With arousal, the treatment effect is increasing but again only in the inquiry treatment.

5 Discussion

Our results show that positive emotional expressions are only observed in the inquiry mode. It is likely that people express both Duchenne and non-Duchenne smiles in interactions with other people. For this reason, we used a method that distinguished the Duchenne smiles from the non-Duchenne smiles, and this method of counting the smiles in 3-s bins ensures that the detection of these smiles is mutually exclusive. In other words, whenever a Duchenne smile is detected, our method rules out the

Table 2 How empathy moderates the treatment effects of each emotional measure, LMM estimates

Independent variable	Duchenne	Non-Duchenne	Furrowed brows	Arousal
Intercept	29.7 (14.6)*	−4.10 (12.6)	214.1 (33.0)***	85.7 (10.6)***
Empathy	0.49 (0.44)	0.12 (0.45)	−0.86 (1.2)	0.14 (0.33)
Advocacy	−6.7 (7.7)	19.1 (4.9)***	17.9 (12.8)	−13.1 (5.5)*
Inquiry	51.1 (7.7)***	18.2 (4.9)***	−82.3 (12.8)***	14.6 (5.46)**
Empathy × advocacy	−0.26 (0.21)	0.91 (0.13)***	−0.02 (0.34)	0.058 (0.15)
Empathy × inquiry	2.14 (0.21)***	0.64 (0.13)***	−2.2 (0.34)***	0.94 (0.15)***
Time	−0.054 (0.15)	0.27 (0.099)**	0.028 (0.25)	−0.61 (0.11)
σ_0	1.0	0.64	1.65	0.65
σ_1	0.56	0.60	1.58	0.39

The number of observations is 2496 in models with EMG bin counts (reported in the duchenne, non-Duchenne, and furrowed brows columns) and 2106 in the model with ISCR (reported in the arousal column). Each psychophysiological score is in turn the dependent variable. Each cell shows the estimate (*SEM*) × 100. The empathy score is centered on its mean. Asterisks represent significance levels: *$p<0.05$, **$p<0.01$, ***$p<0.001$

simultaneous expression of a non-Duchenne smile, and vice versa. The non-genuine smiles are more likely to be related to masked or feigned emotions than the genuine smiles. Previous literature has also found that the non-genuine smiles are expressed when experiencing negative emotions or in situations of deception (e.g. Ekman et al. 1988; Ekman 2003). In our experiment, the Duchenne smiles are only present in the inquiry mode whereas the non-Duchenne smiles are present in both inquiry and advocacy modes. These results on the specificity of facially expressed emotions are consistent with other experiments reporting the differential activation of genuine and non-genuine smiles on positively and negatively valenced stimuli (Ekman et al. 1990; Johnson et al. 2010; for opposing evidence see also Krumhuber and Manstead 2009). Related findings in the literature include the use of Duchenne smiles in persuasion (Gunnery and Hall 2014), as social reinforcers (Shore and Heerey 2011), and as honest signals of cooperation in a Prisoner's Dilemma game (Reed et al. 2012).

We were also interested to know how well the different emotional expressions in different treatments correlate with the internal emotional states. As we do not find a treatment effect for arousal, our initial assumption that arousal alone represents intrapersonal emotions within the treatments cannot be confirmed. However, we do find that the correlation between arousal and the non-Duchenne smiles is different in the inquiry and advocacy treatments. The levels of non-Duchenne smiles increase in the level of arousal in the inquiry treatment and decrease in the level of arousal in the advocacy treatment. ANS activity as measured by SCR is known to increase in facial expressivity (Adelmann and Zajonc 1989) and be specific to many discrete emotions (Kreibig 2010). Thus, one possible way to interpret this finding would be such that the non-Duchenne smile does not correspond to an actual intrapersonal emotion as its linear relationship to emotional arousal is different between the different treatments. This interpretation is in line with the monotonicity hypothesis (McIntosh

1996; Soussignan 2002) that argues that autonomic arousal increases monotonously with the intensity of the facial expression. The monotonicity hypothesis would thus indicate that the non-Duchenne smile does not correlate with an internal emotional state. (It should be noted that the term 'intensity' in our experiment does not refer to the amplitude of the EMG signal but rather to intensity in the time domain, the count of 3-s bins within each 18-s stimuli where the expression was active.)

The empathy score is related to the emotional expressions and emotional arousal, a finding in line with research linking empathy to somatic responsivity (Nummenmaa et al. 2008; Sonnby-Borgström 2002). However, this effect is observed across all the emotional measures only in the inquiry treatment, and the main effect of empathy score is absent from all emotion measures. Although the advocacy treatment generates non-Duchenne smiles, furrowed brows and emotional arousal, only the non-Duchenne activity is related to the empathy score in that treatment. In other words, the higher the empathy score, the more there are non-Duchenne smiles, but not other expressions, across treatments. Taken together with the finding (reported in Table 1) that the ANS is not monotonously activated alongside the non-Duchenne smile this may implicate volitional initiation of non-genuine smiles when thinking about the statements in a way that reflects the subject's empathy.

Autonomic emotional arousal accompanies the emotional expressions in a way that is specific to the expressions. This finding is in line with facial feedback theories (Adelmann and Zajonc 1989) positing that afferent feedback from the facial muscles generates internal emotional states. Facial feedback is also relevant in explaining how emotions are transferred via facial mimicry (Hatfield et al. 1994) and how attribution of emotional states from emotional expressions explains mindreading processes (Goldman and Sripada 2005). It is hypothesized in the literature that empathy moderates, via the insula, the ability to read emotions from facial expressions by modulating emotional content (Carr et al. 2003; Hennenlotter et al. 2009). One future research direction would indeed be to study how emotion transfer relates to the experienced emotions in the inquiry and advocacy modes and the mediating role of empathy.

The passive treatment was always the last treatment that the subject went through, and the inquiry and advocacy treatments were presented in random order before the passive treatment. It is also possible that, as we compare changes in the psychophysiological variables between the main treatments and the passive treatment, our results are partly due to inactivity in the facial musculature or in the autonomous nervous system resulting from habituation to the stimuli. However, this is true in any psychophysiological study where activation levels are compared to baselines. Furthermore, it should be noted that no emotional cues were given to the subjects in any of the treatments, and that the subjects were neither instructed to pose the expressions nor experience the specific emotions. Therefore, we think it is unlikely that the passive treatment would have generated different activation levels if habituation effects were better controlled.

6 Conclusions

Our study brings to focus an important way through which interaction modes can influence group behavior: through one's intrapersonal emotional responses that are triggered by the modes one is adopting. The way a person interacts can change her own internal emotional state and her facial emotional expressions. Emotions are signaled by facial expressions and they affect the interaction in groups. As the main finding our study demonstrates that the inquiry mode can generate genuine positive emotional expressions that are not generated in the advocacy mode.

Our main conclusion for the negotiation context is that it is not enough to only pay attention to one's intended emotional signal in group interaction. One should also be aware of the possibility that the interaction mode one chooses can have an unintended effect on one's own emotional state and the signal generated by it. This insight offers new behavioral possibilities. The inquiry mode is known to lower defenses on the other (Schein 2013) but one can also intentionally use the mode to guarantee one's own positive facial expression. As we discussed in the Introduction, positivity is known to have a favorable impact on negotiations. Whether the positive emotional impact of the inquiry mode generates improved negotiation outcomes remains an interesting research direction in the future.

Over the past decade we have seen an enormous growth in the neuroeconomics literature (see e.g. Glimcher and Fehr 2013; Leppänen and Hämäläinen 2017) which studies individual decision making and social behavior. Recently also operational researchers have started to pay attention to behavioural effects in modeling as well as modelling behaviour (Hämäläinen et al. 2013; Franco and Hämäläinen 2016a, b). Research on group decisions making is increasingly interested in emotions (Olekalns and Druckman 2015; Martinovski 2015a). These developments are reflected in our second methodological conclusion: because emotions do play a key role in negotiations the use of psychophysiological measurements as well as brain imaging methods is likely to increase in group research and yield insights to the field. It is also important to recall that it is also possible to measure neural correlates of two-person social interactions (see e.g. Hari and Kujala 2009). We suggest that group decision researchers should increasingly use these new tools to help understand how people's emotional responses are related to group decisions. The resulting insights can then be used to find improved ways of supporting group decision processes.

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