Brief Report

Implicit need for affiliation is associated with increased corrugator activity in a non-positive, but not in a positive social interaction

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ABSTRACT

Affective changes in response to motive-relevant stimuli are a defining feature of implicit motives. We therefore expected to find an effect of individual differences in the implicit need for affiliation (nAff) on corrugator supercilii activity, an indicator of affect, when participants were confronted with nonverbal indicators of a conversational partner's withdrawal. Participants' nAff was assessed with a Picture Story Exercise (PSE). They were then involved in an interaction with a smiling or a neutral experimenter while their corrugator activity was measured with electromyography (EMG). As expected, we found higher corrugator activity for people high in nAff compared to people low in nAff when the experimenter kept a neutral facial expression throughout the interaction but not when he/she was smiling.

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1. Introduction

Implicit motives are dispositional capacities to experience positive or negative affect upon contact with specific classes of incentives or disincentives. They operate outside of conscious awareness, respond to nonverbal incentive cues, and influence nondeclarative behavioral outcomes (Atkinson, 1957; McClelland, Koestner, & Weinberger, 1989; Schultheiss, 2008). In line with this general definition, the implicit affiliation motive (need for Affiliation, or nAff) is thought to determine the amount of pleasure that people derive from close, harmonious contact with others as well as the amount of displeasure they experience when rejected – the stronger the motive, the stronger the affect when being in an affiliative situation (Schultheiss, 2008). However, the moderating role of nAff on affect is not well documented for objective measures of affect. The present research therefore addresses this issue by examining the role of changes in affect measured with facial EMG in individuals with varying nAff in response to facial expressions displayed by an interaction partner.

In the context of nAff, nonverbal signals by an interaction partner should have incentive value (Stanton, Hall, & Schultheiss, 2010) because they are a source of information on whether the goal of establishing harmonious relationships has been achieved or not. Smiling faces are generally judged to be more positively valenced than neutral faces (e.g., Johnsen, Thayer, & Hugdahl, 1995; Rösch,

Stanton, MacInnes, & Schultheiss, submitted for publication). But that does not imply that neutral faces have neutral valence: Lee, Kang, Park, Kim, and An (2008) reported that perceivers judge neutral faces as negatively valenced. And Rösch et al. (submitted for publication) found that nAff is associated with lower valence ratings for neutral faces only, but does not correlate with valence ratings of smiling faces. In line with these results, Schultheiss, Pang, Torges, Wirth, and Treynor (2005a) reported that people high in nAff, compared to people low in nAff, show impaired learning when being reinforced with a picture of a neutral face but not enhanced learning when being reinforced with a smiling face. The authors argued that a neutral face signals a lack of involvement in the social interaction and is therefore more aversive for people higher on nAff. These observations support the earlier conclusion by Winter (1996) who characterized individuals high in nAff as "'prickly' and defensive" (p. 148) in response to even slight signals of rejection. Thus, individuals high in nAff experience interpersonal situations as problematic or even hostile that individuals low in nAff would deem to be neutral and not offensive. So, nAff is thought to be a rejection-sensitive motive (see also Boyatzis, 1973).

The dependent measure we use, namely facial EMG, is sensitive enough to capture even minute muscle movements (Schandry, 1998; Stern, Ray, & Quigley, 2001) and has been found to be an objective and valid indicator of affective responses to (dis)incentive contact (e.g., Cacioppo, Petty, Losch, & Kim, 1986; see also Berridge, 2000). Specifically, muscle activity of the corrugator supercilii, the muscle between the eyebrows, has been shown to closely track responses to affective stimuli, increasing when negative affect is elicited and decreasing when positive affect is prevalent (Bradley,

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Codispoti, Cuthbert, & Lang, 2001; Larsen, Norris, & Cacioppo, 2003). Fodor and Wick (2009) used corrugator EMG to investigate the affect-moderating role of the dispositional need for power (nPow), that is, the capacity to derive pleasure from having impact over others. They demonstrated that high-nPow people, compared to low-nPow people, respond more negatively and show more corrugator activity when they give a speech in front of an unappreciative audience which frustrates their desire to impress and thereby influence others (see also Fodor, Wick, & Hartsen, 2006). Likewise, Kordik and Schultheiss (in preparation) revealed with EMG that people high compared to people low in need for achievement (nAch), the capacity to derive pleasure from the autonomous mastery of challenging tasks, show a distinct pattern of corrugator activity changes when being confronted with negative performance feedback. While Fodor and colleagues work on nPow focused on incentives related to dominance and submission and our own work on nAch on incentives related to success and failure, in the present research we examine the role of incentives related to friendliness versus rejection on individuals differing in nAff. The studies mentioned above demonstrate that EMG is a valid indicator to describe the affective qualities of implicit motives and that it can be used to investigate a potential common driving force and defining feature of implicit motives, namely affect (see also Cabanac, 1992).

The goal of our present study is to investigate the moderating role of nAff on participants' corrugator EMG responses as an indicator of the presence versus absence of negative affect in response to an experimenter's nonverbal signals of neutral indifference versus friendliness, respectively. Based on the definitions and findings outlined above, we expect that for a high-nAff person, signals of indifference (e.g., a neutral expression) should be more aversive than for a low-nAff person. We therefore expect that interacting with an indifferent experimenter blocks the fulfillment of high-nAff individuals' need for a harmonious relationship, which in turn makes them feel bad. Because previous studies (e.g., Schultheiss et al., 2005a; Schultheiss et al., 2005b) found that gender can play a role in motive-driven reactions to facial expressions, half of the participants were interacting with a male and the other half with a female experimenter.

The study constitutes a specific contribution to existing literatue in two ways: First, it uses a direct measure of affective responses. More specifically, nonverbal expressions of affect in the form of facial expressions are considered a prime indicator of the hedonic impact of goal attainment (Berridge, 2000). Although McAdams, Jackson, and Kirshnit (1984) found that a strong need for intimacy is associated with naturally occurring smiles, our study is the first to use facial EMG in combination with experimentally manipulated incentives to measure affect as an outcome in the context of nAff. Furthermore, although self-reports of emotional well-being are associated with satisfaction and frustration of nAff in field studies (Brunstein, Schultheiss, & Grässmann, 1998), self-reported affective responses to situational manipulation in the laboratory typically do not reflect people's implicit motive levels (Brunstein & Schmitt, 2004; Schultheiss et al., 2005b). In line with these results, Berridge and Robinson (2003) argue that implicit and explicit levels of affect and motivation need to be distinguished and that observable behavioral indicators should be preferred over self-report data (Berridge, 2003). Thus, corrugator activity measured with EMG was the indicator of our choice when dealing with the affective components of nAff, given the validity of corrugator measurements in the assessment of both negative and positive affect (Bradley et al., 2001; Larsen et al., 2003).

Moreover, although the physiological measurements required the study to be conducted as a laboratory experiment, it provides a high degree of external validity since participants thought they were involved in a regular social interaction with the experimenter, ostensibly after the actual study was over.

2. Method

2.1. Sample

Data was collected from 145 students enrolled at Friedrich-Alexander University in Erlangen, Germany. Psychology students and students that had participated in previous studies of the laboratory were not admitted. Eight participants were excluded due to technical difficulties during recording and additional three whose stories on the PSE were below the minimum number of words required (see Smith, Feld, & Franz, 1992). Two participants produced extreme EMG values (with the criterion for the cutoff being studentized residuals > |4.0|) and were therefore excluded as well. The remaining 132 participants (81 women and 51 men), had an average age of 22.68 years ($SD = 4.20$).

2.2. Design

The study used a nAff × Experimenter Behavior × Experimenter Gender design, with nAff being a quantitative measured predictor variable and experimenter behavior and experimenter gender being two experimentally varied between-subject factors. Participants were randomly assigned to the four resulting experimental conditions. The dependent measure was corrugator EMG activity during the interaction with the experimenter.

2.3. Procedure

After participants had completed the PSE assessment of nAff, electrodes were attached to their forehead to collect corrugator EMG data. Participants then listened via headphones to instructions of a progressive muscle relaxation task (Bernstein, 2002) during which a baseline measure of corrugator activity was taken. Next, participants were working on a picture perception experiment (reported elsewhere) that served as a cover story for the present study. When that task was finished and the experiment was supposedly over, a second experimenter, whose behavior and gender were varied, measured participants' blood pressure with a wrist monitor, allegedly to see if the experiment stressed the participant. During this interaction, corrugator activity was recorded. Prior to this interaction, the experimenter who was performing the manipulation had been sitting behind a computer in the laboratory and made sure he/she did not have any contact with the participant. The interaction with the second experimenter was scripted and both the female and the male experimenter enacting the conditions took part in several training sessions. During these training sessions the procedures were practiced and the experimenters learned to vary only their nonverbal behavior, that is, to make a neutral or a smiling facial expression while keeping wording and pitch of verbal messages constant. The following script was used by the experimenters:

Alright, [*a marker was manually inserted into the EMG recording by pressing the escape key to mark the beginning of the interaction*] I just need to check the EMG file to see if everything has been recorded properly [*smile vs. neutral expression*]. I will remove the electrodes in just a second – right when I'm finished measuring your blood pressure which will tell me whether the experiment stressed you [*smile vs. neutral expression*]. I need your right arm for this [*smile vs. neutral expression* while the blood pressure monitor was placed on the wrist and the start button was pressed]. Alright…that's going to take a minute [*smile vs. neutral expression*]. That was it…[*smile vs. neutral expression* while removing the blood pressure monitor]. Everything is fine [*smile vs. neutral expression*]. I will now remove

the electrodes [*smile vs. neutral expression* while putting the second marker into the EMG recording to mark the end of the interaction].

If participants tried to engage the experimenter in a conversation the experimenter said (in a standardized way) "we will have a chance to discuss this in a moment [*smile vs. neutral expression*]". The interaction always lasted at least 2 min and the timing was controlled with a clock visible to the experimenter. After the interaction the electrodes were removed and participants were debriefed about the purpose of the study.

2.4. Measures

PSE The PSE is a standard story-writing measure of motivational needs that are not accessible through introspection or self-report (Schultheiss & Pang, 2007). We used Pang and Schultheiss's (2005) computer-based version, with the pictures *boxer, trapeze artist, women in laboratory, ship captain, nightclub scene* and *couple by river*. During the administration, participants viewed each picture for 10 s and then had 4 min to write an imaginative story about the picture. The content of the stories was later coded for nAff imagery according to Winter's (1994) *Manual for Scoring Motive Imagery in Running Text* by a trained scorer who had exceeded 85% of interscorer agreement on expert-scored calibration material. nAff can be scored whenever a character expresses positive, intimate feelings towards others, shows sadness about a separation, engages in companionate activities, or acts in a nurturant manner. Interrater reliability for nAff was $r = .92$, determined by correlating imagery coded by the first coder with imagery independently scored by a second coder. We calculated the overall nAff score for each participant by computing the sum over all stories ($M = 6.65, SD = 2.70$). We then performed a square root transformation on raw scores to achieve a normal distribution. Since PSE total word count ($M = 589, SD = 174$) was significantly correlated with transformed nAff ($r = .58; p < .01$), we corrected for the influence of protocol length on the transformed nAff by regression and converted the residuals to z-scores.

EMG Participants' skin was cleaned by the first experimenter with water and an abrasive paste to lower the impedance between skin and electrodes. After drying the skin, two Ag/AgCl surface electrodes were attached to the forehead with an adhesive collar along the muscle fiber of the corrugator supercilii on the left side of the face according to the standards for EMG measurement (Fridlund & Cacioppo, 1986). A clip electrode was placed on the left ear as a reference electrode. The electrodes were connected to a Biopac MP 150 amplifier. The signal was sampled at 1000 Hz by the software AcqKnowledge 4.0 running on a personal computer. The EMG raw signal was rectified and integrated for further analysis. We extracted the mean corrugator activity from the 2-min-interaction with the experimenter. The muscle relaxation task lasted approximately 8 min in total. The baseline was the mean corrugator activity of the six minutes toward the end phase of the relaxation task. Then, in order to achieve a normal distribution for corrugator activity measurements, we performed a log-transformation with each measure.

3. Results

3.1. Corrugator activity

We entered corrugator activity during the interaction as the dependent variable into a repeated-measures regression analysis which was realized with Systat's general linear model (GLM). The predictors were quantitative nAff scores and experimenter-behavior (coded neutral face = 1 and smile = 2). Because baseline corru-

gator activity was correlated with corrugator activity during the interaction ($r = .41, p < .01; M_{overall\ conditions} = -3.70, SD = 0.14; M_{baseline} = -3.68, SD = 0.21$), we controlled for baseline corrugator activity in all analyses. Corrugator baseline activity was not significantly correlated with nAff, neither across conditions ($r = .11, p > .05$) nor within each condition ($r_{neutral\ condition} = .15, p > .05; r_{smile\ condition} = .10, p > .05$).

As illustrated in Fig. 1, the experimenter behavior x nAff interaction ($B = -0.05; SE = 0.02; sr = .17; p < .05$) had a significant effect on corrugator activity. The main effect of experimenter behavior was not significant ($B = 0.00; SE = 0.02; sr = .00; p > .05$). Follow-up analyses for each experimental condition revealed a significant effect of large magnitude of nAff on corrugator activity in the neutral-experimenter condition ($B = 0.03; SE = 0.01; sr = .53; p < .05$) but not in the smiling-experimenter condition ($B = -0.01; SE = 0.01; sr = -.35; p > .05$).[1] Thus, participants with high nAff, relative to those low in nAff, responded with increased corrugator activity to a neutral experimenter, but did not differ significantly from their low-nAff counterparts when responding to a smiling experimenter. Descriptive statistics for corrugator activity for people 1 SD above and below mean nAff is given in Table 1.

3.2. Gender

When we added experimenter gender as an additional factor to the analyses reported above, neither experimenter gender ($B = 0.00; SE = 0.07; sr = .00; p > .05$) nor the experimenter gender × nAff interaction ($B = 0.11; SE = 0.08; sr = .10; p > .05$), or the experimenter gender × nAff × experimenter behavior interaction ($B = -0.06; SE = 0.05; sr = .10; p > .05$) had a significant effect on corrugator activity.

When adding participant gender as an additional factor to these analyses, none of the main or interaction effects involving this variable reached statistical significance ($ps > .05$).

4. Discussion

Based on the notion that motives influence affective responses, we expected individual differences in nAff, the need to have warm, friendly relationships with others, to predict corrugator supercilii activity, depending on whether participants encountered an experimenter displaying a neutral facial expression (a signal of the non-attainment of a friendly relationship) or a smiling expression (a signal of a friendly relationship). This hypothesis could be confirmed: when participants were interacting with a neutral-face experimenter, those high in nAff showed stronger corrugator activity than those low in nAff. When interacting with a smiling experimenter, however, there was no reliable difference in corrugator activity between high- and low-nAff participants. Participant or experimenter gender did not play a moderating role.

These results support the notion that nAff moderates affective responses, indexed here by corrugator activity, to affiliative (dis)incentives. However, because we measured individual differences in nAff, we cannot make strong inferences about the causality of nAff or the potential involvement of other variables.[2] Future studies should therefore experimentally manipulate the need to affiliate (e.g., by showing motivationally arousing movies; see Schul-

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[1] *Note*: When splitting nAff at the median and selecting people above the median, the difference between the neutral and the smile condition of the residualized corrugator activity was marginally significant ($M_{neutral\ condition} = 0.040, SD = 0.129, M_{smile\ condition} = -0.018, SD = 0.141; t(63.39) = 1.78; d = 0.22; p = .07$).

[2] *Note*: when we explored whether the explicit affiliation motive, as assessed with the Personality Research Form (Jackson, 1997), had an effect on corrugator activity, neither the main effect nor the explicit motive x condition interaction were significant ($ps > .05$).
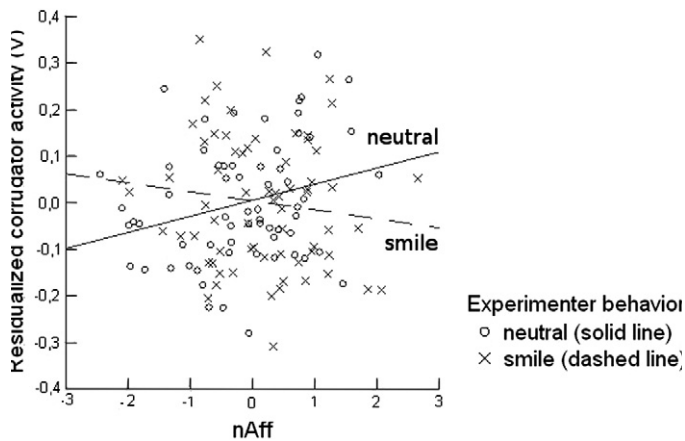
Fig. 1. EMG corrugator activity, residualized for baseline activity, as a function of nAff and experimental condition.

Table 1
Estimated means for EMG corrugator activity (residualized for corrugator baseline activity) in the neutral and the smile condition for people 1 SD above (high) and 1 SD below (low) the mean of nAff.

	EMG neutral condition	EMG smile condition
nAff high	.0390	−.0160
nAff low	−.0409	.0227

theiss, Wirth, & Stanton, 2004) to ascertain a causal role of nAff on affective responses.

We used corrugator EMG, a nondeclarative indicator of affect, because implicit motives, by definition, operate outside of people's conscious awareness and are rarely predictive of declarative measures, like self-reported affect (Schultheiss, 2008). Still, can we be sure that EMG-measured corrugator activity represents affective responses that are associated with nAff? Besides the results of previous studies outlined in the introduction concerning the validation of corrugator activity as a measure of affect (Bradley et al., 2001; Larsen et al., 2003), it is important to note that the measure has been taken in a motive-relevant situation (a social interaction) and therefore the situation is charged with affiliation-related incentives. This limits the possibility that alternative constructs could have been captured by our physiological measure. It is also noteworthy that, at a descriptive level, people high in nAff showed lower corrugator activity than people low in nAff in the smile condition and that the difference between the smile and the neutral condition was marginally significant in high-affiliation individuals (see Footnote 1). Given the findings concerning the bipolar nature of the corrugator, this trend in the smile condition, even though not significant, points towards a bi-directional moderation function of nAff. More precisely, it may be that people high in nAff experienced more positive affect in the smile condition than people low in nAff. Nevertheless, since the corrugator was the only indicator of affect used, one needs to be cautious when interpreting this result. In order to replicate the above-mentioned trend and finding, future studies could include other indicators of affect as well, such as hormonal markers (see Schultheiss et al., 2004).

Our findings also have implications for the issue of experimenter-induced artifacts in psychological research. Investigating the consequences of the experimenter's demeanor is essential since the behaviors of the experimenter can influence the outcome of the study (e.g., Rosnow & Rosenthal, 1997). These effects are often mediated by nonverbal behaviors such as the experimenter's proneness to smiling (Page, 1971). Our results suggest that experimenters' efforts to remain neutral while conducting an experi-

ment can backfire when dealing with affiliation-motivated participants, who need the reassurance of a friendly face. It will be critical to investigate whether differences in affective reactions to a neutral face will also lead to differences in performance on a subsequent experimental task. If this turns out to be the case, then uncontrolled variations in experimenter behavior can give rise to inconsistent results in research on nAff. It would therefore be recommendable to minimize the contact between the participant and the experimenter whenever possible and rely on computer-based procedures in this type of research (see Schultheiss & Pang, 2007).

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