Social Cognitive and Affective Neuroscience Advance Access published July 10, 2014

doi:10.1093/scan/nsu088

Perceiving emotions in neutral faces: expression processing is biased by affective person knowledge

Franziska Suess, Milena Rabovsky, and Rasha Abdel Rahman
Department of Psychology, Humboldt-Universität zu Berlin, 12489 Berlin, Germany

According to a widely held view, basic emotions such as happiness or anger are reflected in facial expressions that are invariant and uniquely defined by specific facial muscle movements. Accordingly, expression perception should not be vulnerable to influences outside the face. Here, we test this assumption by manipulating the emotional valence of biographical knowledge associated with individual persons. Faces of well-known and initially unfamiliar persons displaying neutral expressions were associated with socially relevant negative, positive or comparatively neutral biographical information. The expressions of faces associated with negative information were classified as more negative than faces associated with neutral information. Event-related brain potential modulations in the early posterior negativity, a component taken to reflect early sensory processing of affective stimuli such as emotional facial expressions, suggest that negative affective knowledge can bias the perception of faces with neutral expressions toward subjectively displaying negative emotions.

Keywords: facial expressions; affective knowledge; emotion; ERPs

INTRODUCTION

Person-related knowledge, acquired via direct personal interactions or verbal descriptions of traits and behaviors of personally unfamiliar individuals, is an important factor determining how we evaluate other persons, and even more so when this knowledge contains affective and socially relevant information (Singer *et al.*, 2004; Croft *et al.*, 2010; Todorov, 2011). However, while effects on person evaluation and moral judgments are well-established (Bliss-Moreau *et al.*, 2008), far less is known about the influence of affective knowledge on other aspects of person recognition, in particular those preceding higher level evaluations, such as the perception of facial features and emotional expressions (Abdel Rahman, 2011). The present study was designed to investigate such affective knowledge effects on perceptual aspects of face processing. Specifically, we ask whether long established or recently acquired affective and socially relevant person knowledge has the potential to bias the perception of objectively neutral faces toward subjectively conveying emotional expressions that are congruent with the valence of the associated biographical knowledge. Such an influence of knowledge on expression perception, may this knowledge be correct or based for false information or gossip, should have considerable consequences for how we evaluate the mental states of other persons, and should thus strongly influence our social interactions.

According to a widely held view on the expression and perception of facial emotions (Ekman and Friesen, 1976; Ekman, 1993, 2003), basic expressions such as those of anger or happiness are invariant manifestations of specific emotional states that are universally shared and uniquely defined by specific facial muscle movements (Ekman and Friesen, 1976; Ekman, 1993, 2003, but see Barrett, 2006). Thus, expression perception should be stable and unaffected by visually opaque affective information about the person's biography.

Yet, cumulating evidence on visual context effects suggests that expression perception can be subject to influences from meaningful information outside the face at least when the source of the context information is visual, stemming from, for instance, body postures and gestures (Meeren *et al.*, 2005; De Gelder *et al.*, 2006; Van den Stock *et al.*, 2007; Aviezer *et al.*, 2008). Thus, Aviezer *et al.* (2008) have reported remarkable shifts in the categorization and perception of basic expressions induced by body contexts, demonstrating a marked vulnerability of expression perception to influences from outside the face (see also Aviezer *et al.*, 2011; for a review, see Hassin *et al.*, 2013).

Comparable evidence for non-visual conceptual effects on expression perception is scant. Some research suggests that general face processing mechanisms such as person evaluations are influenced even when the available person knowledge is based on seemingly sparse behavioral information, e.g. that the person hit a small child (Bliss-Moreau *et al.*, 2008). Furthermore, affective knowledge is reflected in spontaneous activations of neural regions associated with social cognition and emotion (Todorov *et al.*, 2007), and personality information may even influence how we imagine or classify facial features (Hassin and Trope, 2000). Crucially, some evidence suggests that affective knowledge may modulate early sensory processing of the faces of well-known persons (Abdel Rahman, 2011) and, in the case of negative social information associated with initially unfamiliar faces, even alter the potency of faces to gain access to and maintain conscious perception (Anderson *et al.*, 2011). Furthermore, an observer's knowledge about the situation in which an expression is presented may modulate its classification (Carroll and Russell, 1996, but see Nakamura *et al.*, 1990), and the perception of ambiguous facial expressions is influenced by verbal emotion concepts (e.g. 'happy'; Halberstadt *et al.*, 2009). In line with theoretical views of person recognition incorporating interactions between perceptual and semantic processing components (Haxby *et al.*, 2000), these findings suggest that not only late evaluative but also early perceptual aspects of face recognition are shaped by affective person knowledge.

The present study focuses on investigating emotional knowledge effects specifically on the perception of facial expressions: can objectively neutral faces be perceived in an unbiased way irrespective of what we know about the person's character and good or evil deeds or are expressions perceived in light of our knowledge associated with the person as more positive or negative, depending on the valence of the associated knowledge? We build on a previous study by Abdel Rahman

Received 12 December 2013; Revised 20 March 2014; Accepted 13 June 2014

The authors thank Julia Baum, Johannes Rost and Philipp Glage for creative contributions to stimulus materials and assistance with data acquisition. This work was funded by German Research Foundation grant AB 277-5 and 6 to Rasha Abdel Rahman.

Correspondence should be addressed to Franziska Suess, Department of Psychology, Humboldt-Universität zu Berlin, Rudower Chaussee 18, 12489 Berlin, Germany. E-mail: franziska.suess@hu-berlin.de.

© The Author (2014). Published by Oxford University Press. For Permissions, please email: journals.permissions@oup.com

Downloaded from http://scan.oxfordjournals.org/ at Humboldt-Universitaet zu Berlin on July 15, 2014

(2011) that investigated the influence of affective knowledge on the perception of well-known and initially unfamiliar faces. In this study, early event-related brain potential (ERP) modulations induced by emotional knowledge were found only for well-known faces. Here, to assess the effects of newly acquired information about initially unfamiliar faces more directly, we employed a similar learning paradigm but additionally increased the credibility of the newly acquired information with several measures (see below). Furthermore, here, we included a facial expression rating before and after learning to investigate the consequences of this information on the perception of the person's facial expression.

Based on the evidence discussed above, we expected a bias in expression judgments according to the valence of the affective knowledge associated with the person. Additionally, ERPs were used to localize the effects on early perceptual processing stages. In particular, perceptual effects should be reflected in modulations of the early posterior negativity (EPN), an ERP component associated with early reflexive emotion effects, reflecting attention to and enhanced perceptual processing of affective stimuli such as objects and scenes (Junghöfer *et al.*, 2001; Schupp *et al.*, 2003), words (Kissler *et al.*, 2007; Schacht and Sommer, 2009) and even symbolic hand gestures (Flaisch *et al.*, 2011). Crucially, the EPN has been shown to be sensitive to facial expression perception (Schupp, *et al.*, 2004; Schacht and Sommer, 2009), and therefore, any affective knowledge effects influencing expression perception should be reflected in modulations of this component.

METHOD

Participants

Twenty-four participants (17 female; mean age = 23.67 years, range 19–29) with normal or corrected-to-normal vision took part in the experiment for monetary compensation or for course credits. Informed consent was obtained from all participants before the experiment started. The study was approved by the local ethics committee of the Psychology department at Humboldt-Universität zu Berlin.

Materials

Picture stimuli consisted of gray-scale photographs of 18 very well-known, 18 less well-known and 36 initially unfamiliar male and female faces displaying neutral facial expressions (see Supplementary Material I). All photographs were frontal headshots, scaled to 2.7 cm × 3.5 cm at a viewing distance of about 90 cm. To increase believability of the fictitious stories associated with initially unfamiliar faces, we included not only very well-known persons (e.g. Adolf Hitler) but also somewhat less well-known persons (e.g. Sarah Palin) as filler items that were not included in further analyses because, across participants, they could not reliably be assigned to known and initially unfamiliar faces. The selection was based on prior familiarity ratings of face/name pairs with a different group of participants. Participants were informed that some of the faces might be unfamiliar to them because some persons were not very well-known in general or only well-known in their country. Because participants were able to verify that some faces were less well-known than others, they were presumably more likely to believe that all stories were associated with real persons even in those cases when they could not recognize the person.

Spoken stories were recorded that contained emotionally negative, positive or neutral biographical information (see Supplementary Material II). Each fictitious story was constructed in analogy to one of the real stories to further increase credibility of the information, and the faces of the initially unfamiliar and well-known persons were matched accordingly for age, gender and race. All stories were presented auditorily with a mean duration of ~26 s.

Procedure

The experiment consisted of a learning and a test session, separated by 1 or 2 days. Before learning, participants were told that all persons presented really existed but that some would be more familiar than others. The learning session began and ended with a sympathy rating and a rating of facial expressions ranging from negative (−2) to positive (2), on a 5-point scale, analogous to the Self-Assessment Manikin (Bradley and Lang, 1994). Between these ratings, a familiarity classification task (1: unfamiliar, 2: familiar) was administered, which confirmed the status of faces as unfamiliar (initially unfamiliar faces mean: 1.06) and familiar (well-known faces mean: 1.98). Subsequently, participants learned the person's nationality. This later task-relevant information was acquired before the affective information was presented to avoid any effects of emotion on initial familiarization and learning. Crucially, the task could be completed entirely independent of the affective or neutral biographical information acquired later. Successful learning was tested in a semantic task in which all 72 faces were presented in random order once for 500 ms. Participants were instructed to classify via button press whether the person was European or not.

In addition, participants executed a spatial attention task in which the faces were presented in a cueing paradigm (Posner, 1980) and participants indicated via button press on which side the target was presented. The purpose of the attention task was to further illuminate the underlying mechanisms of the early visual effects using a different task. The results of the attention task would exceed the scope of the present article and are not discussed any further.

Subsequently the biographical knowledge was learned. Each face was presented on the screen while participants listened to a story describing real or fictitious biographical details. For initially unfamiliar faces, the assignment of faces to positive, negative or neutral stories was counterbalanced across participants. All faces and the respective stories were presented twice in random order. The semantic and attention task were administered again after learning.

The test session with electroencephalogram (EEG) recordings consisted of both tasks (semantic and attention task). The semantic task was conducted as described above. All faces were presented eight times in random order. Here, we focus on the sympathy and facial expression rating and ERPs from the semantic task.

EEG data recording and analysis

The EEG was recorded with Ag/AgCl electrodes from 62 sites according to the extended 10–20 system, referenced to the left mastoid, at a sampling rate of 500 Hz. The horizontal and vertical electrooculograms were measured with external electrodes attached to the left and right canthi of both eyes and beneath and above the left eye. Electrode impedance was kept below 5 kΩ. A short calibration procedure was used to obtain prototypical eye movements to correct for eye movement artifacts. Offline, the continuous EEG was transformed to average reference and low-pass filtered at 30 Hz. Eye movement artifacts were removed with a spatiotemporal dipole modeling procedure using BESA (Berg & Scherg, 1991); remaining artifacts were eliminated with a semiautomatic artifact rejection procedure (amplitudes over ± 200 μV, changing >50 μV between samples or >200 μV within single epochs, or containing baseline drifts). Error- and artifact-free EEG data were segmented into epochs of 2 s with a 100 ms pre-stimulus baseline.

Amplitude differences were assessed with repeated-measures analyses of variance (ANOVAs) with the factor Emotion (negative, positive, neutral) separately for very well-known and newly learned faces. Huyhn–Feldt corrections were applied when appropriate. Analyses focused on a region of interest (PO7, PO8, PO9, PO10, TP9, TP10),

Downloaded from http://scan.oxfordjournals.org/ at Humboldt-Universitaet zu Berlin on July 15, 2014

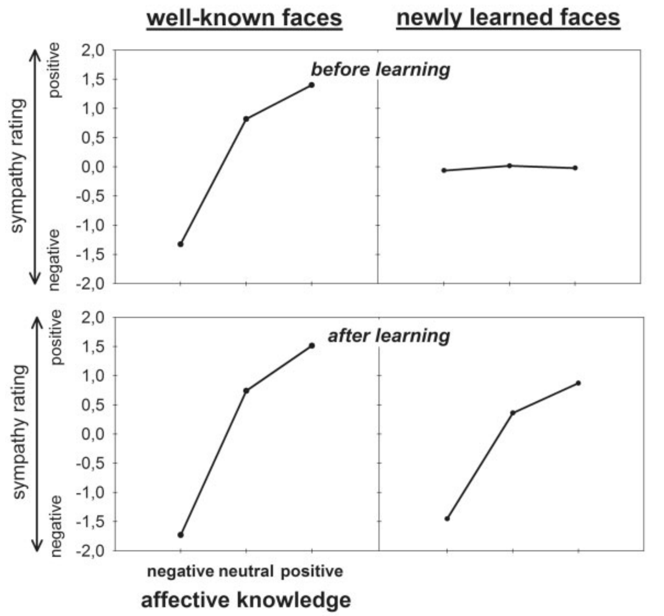

Fig. 1 Mean sympathy ratings before (top) and after presentation of biographical information (bottom) for well-known faces (left) and newly learned faces (right).

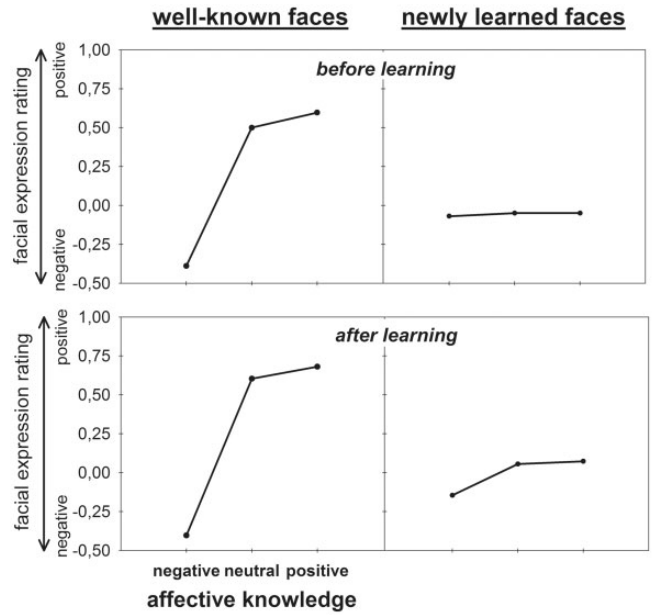

Fig. 2 Mean facial expression ratings before (top) and after presentation of biographical information (bottom) for well-known faces (left) and newly learned faces (right).

chosen based on previous findings of early emotion effects in the EPN (Abdel Rahman, 2011).

RESULTS

Sympathy ratings

The results of the sympathy rating are presented in Figure 1. A 2 (Learning: pre- *vs* post-learning) x 2 (Familiarity: well-known *vs* newly learned faces) × 3 (Emotion: negative, positive and neutral) repeated-measures ANOVA yielded main effects of Learning, $F(1,23) = 11.3$, $P < 0.01$, $\eta^2 = .330$, Familiarity, $F(1,23) = 74.1$, $P < 0.001$, $\eta^2 = 0.763$, and Emotion, $F(2,46) = 252.8$, $P < 0.001$, $\eta^2 = 0.917$, and interactions of Learning and Emotion, $F(2,46) = 159.3$, $P < 0.001$, $\eta^2 = 0.874$, Familiarity and Emotion, $F(2,46) = 158.9$, $P < 0.001$, $\eta^2 = 0.874$, and a three-way interaction of Learning, Familiarity and Emotion, $F(2,46) = 47.3$, $P < 0.001$, $\eta^2 = 0.673$.

A separate analysis for well-known faces revealed main effects of Learning, $F(1,23) = 19.5$, $P < 0.001$, $\eta^2 = 0.459$, and Emotion, $F(2,46) = 257.8$, $P < 0.001$, $\eta^2 = 0.918$, and an interaction of Learning and Emotion, $F(2,46) = 11.7$, $P < 0.001$, $\eta^2 = 0.338$. Faces associated with negative biographical information were rated as more dislikeable than those associated with relatively neutral knowledge, before learning, $F(1,23) = 158.1$, $P < 0.001$, $\eta^2 = 0.873$, as well as after learning, $F(1,23) = 366.6$, $P < 0.001$, $\eta^2 = 0.941$. Likewise, faces associated with positive information were rated as more likeable both before, $F(1,23) = 28.9$, $P < 0.001$, $\eta^2 = 0.557$, and after learning, $F(1,23) = 54.8$, $P < 0.001$, $\eta^2 = 0.704$.

For newly learned faces, there was a main effect of Emotion, $F(2,46) = 141.4$, $P < 0.001$, $\eta^2 = 0.860$, and an interaction of Learning and Emotion, $F(2,46) = 141.3$, $P < 0.001$, $\eta^2 = 0.860$. Before learning, sympathy ratings did not differ between emotion conditions, $F(1,23) = 3.9$, $P > 0.05$, $\eta^2 = 0.146$ (negative *vs* neutral knowledge condition), and $F(1,23) = 0.66$, $P > 0.1$, $\eta^2 = 0.028$ (positive *vs* neutral knowledge condition), whereas after learning faces associated with negative information were rated as more dislikeable, $F(1,23) = 158.0$, $P < 0.001$, $\eta^2 = 0.873$, and faces associated with positive information were rated as more likeable, $F(1,23) = 57.1$, $P < 0.001$, $\eta^2 = 0.713$, than those associated with relatively neutral biographical information. As expected, these findings confirm that affective knowledge has a strong influence on person evaluation. Furthermore, they demonstrate successful learning of the affective information associated with initially unfamiliar faces.

Facial expression ratings

The ANOVA on mean expression ratings (see Figure 2) yielded main effects of Familiarity, $F(1,23) = 147.8$, $P < 0.001$, $\eta^2 = 0.865$, and Emotion, $F(2,46) = 119.9$, $P < 0.001$, $\eta^2 = 0.839$, and interactions of Learning and Emotion, $F(2,46) = 5.0$, $P < 0.01$, $\eta^2 = 0.180$, and Familiarity and Emotion, $F(2,46) = 86.1$, $P < 0.001$, $\eta^2 = 0.789$.

For well-known faces, there was a main effect of Emotion, $F(2,46) = 149.3$, $P < 0.001$, $\eta^2 = 0.867$, whereas neither the effect of Learning, $F(1,23) = 3.9$, $P = 0.06$, $\eta^2 = 0.145$, nor the interaction of Learning and Emotion, $F(1,23) = 1.3$, $P > 0.1$, $\eta^2 = 0.053$, reached significance. As expected, independent of learning participants perceived the expressions of well-known faces related to negative biographical information as more negative than faces associated with relatively neutral information, $F(1,23) = 209.1$, $P < 0.001$, $\eta^2 = 0.901$. No difference was found between the positive and neutral condition, $F(1,23) = 2.2$, $P > 0.1$, $\eta^2 = 0.087$.

For newly learned faces, a main effect of Emotion, $F(2,46) = 4.5$, $P < 0.05$, $\eta^2 = 0.163$, and an interaction of Learning and Emotion, $F(2,46) = 3.5$, $P < 0.01$, $\eta^2 = 0.219$, was found. Before learning, there were no differences between the negative, $F(1,23) = 0.18$, $P > 0.1$, $\eta^2 = 0.008$, or positive, $F(1,23) = 0.00$, $P > 0.1$, $\eta^2 = 0.000$, relative to the neutral knowledge condition. In contrast, after learning participants rated the expressions of persons newly associated with negative information as more negative than faces paired with neutral information, $F(1,23) = 7.8$, $P < 0.01$, $\eta^2 = 0.253$. No difference was found between the positive and neutral condition, $F(1,23) = 0.1$, $P > 0.1$, $\eta^2 = 0.005$.

Semantic task

Behavioral results

ANOVAs on mean reaction times (RTs) yielded main effects of Familiarity, $F(1,23) = 30.2$, $P < 0.001$, $\eta^2 = 0.568$, and Emotion,

Downloaded from http://scan.oxfordjournals.org/ at Humboldt-Universitaet zu Berlin on July 15, 2014

$F(1,23) = 4.8$, $P < 0.05$, $\eta^2 = 0.174$, and a significant interaction of both factors, $F(2,46) = 5.4$, $P < 0.01$, $\eta^2 = 0.191$. Separate analyses revealed a main effect of Emotion, $F(2,46) = 7.9$, $P = 0.001$, $\eta^2 = 0.256$, for well-known faces, with slower RTs both in the negative (649.93 ms), $F(1,23) = 14.3$, $P = 0.001$, $\eta^2 = 0.384$, and positive (633.13 ms), $F(1,23) = 4.7$, $P < 0.05$, $\eta^2 = 0.170$, relative to the neutral condition (617.54 ms). For newly learned faces, reaction times did not differ between emotion conditions, $F(2,46) = 0.6$, $P > 0.1$, $\eta^2 = 0.025$ (negative: 670.91 ms; positive: 672.74 ms; neutral: 677.37 ms).

A similar pattern was found in the error rates with a main effect of Familiarity, $F(1,23) = 41.2$, $P < 0.001$, $\eta^2 = 0.642$, and an interaction of Familiarity and Emotion, $F(1,23) = 5.6$, $P < 0.05$, $\eta^2 = 0.195$. For well-known faces, higher error rates were found in the negative (4.43%) relative to the neutral condition (2.17%), $F(1,23) = 12.5$, $P < 0.01$, $\eta^2 = 0.352$, but no difference between the positive (2.26%) and neutral condition, $F(1,23) = 0.01$, $P > 0.1$, $\eta^2 = 0.001$. Error rates did not differ significantly between emotion conditions (negative: 6.90%; positive: 8.94%; neutral: 10.07%), $F(2,46) = 2.3$, $P > 0.1$, $\eta^2 = 0.089$, for newly learned faces.

ERP results

ERPs and scalp distributions are presented in Figure 3. After an ANOVA including all electrodes of 10 consecutive 50 ms time windows from 0 to 500 ms, significant emotion effects were observed in the time windows 200–350 ms and 300–350 ms for very well-known and newly learned faces, respectively.

For well-known faces, the negative and neutral condition, and the positive and neutral condition differed in the EPN time window between 200 and 350 ms and the EPN ROI, $F(1,23) = 11.2$, $P < 0.01$, $\eta^2 = 0.327$, and $F(1,23) = 40.2$, $P < 0.001$, $\eta^2 = 0.636$, respectively.

For newly learned faces, a similar posterior negativity was found for the comparison between the negative and neutral condition, with a slightly later onset between 300–350 ms, $F(1,23) = 5.5$, $P < 0.05$, $\eta^2 = 0.192$, and a somewhat different distribution (most pronounced at posterior electrode sites PO7, PO8, PO9, PO10, P7, P8). To determine the onset of the effect more precisely, we conducted *t*-tests for each time point (2 ms) and each electrode of the region of interest (significance criterion: $P < 0.05$). The onset was determined when at least 20 successive time points (40 ms) reached the significance criterion at all six electrodes. The negative and neutral condition started to diverge at 270 ms, 70 ms after the onset of the knowledge effects for well-known faces. No effect was found for the comparison between the positive and neutral condition $F(1,23) = 0.9$, $P > 0.1$, $\eta^2 = 0.040$.

DISCUSSION

In this study, we investigated the effects of long-established and newly acquired socially relevant affective person knowledge on the processing of facial expressions. Specifically, we asked whether affective knowledge has the potential to bias the perception of neutral facial expressions toward subjectively conveying emotions that are determined by the valence of the biographical information.

We demonstrated that judgments of facial expressions are indeed biased by affective knowledge. While for positive information this effect was absent, it was strong and robust in the case of negative information associated with both well-known and initially unfamiliar faces. That is, when negative person-related information was long established or recently acquired, the expression of the person's face was classified as more negative than the expression of a person associated with relatively neutral biographical information.

One might argue that the observed expression rating effects for well-known faces might be due to subtle uncontrolled differences in facial expressions or other physical attributes, rather than induced by the affective knowledge. Although care was taken to avoid expressions in the faces, this is a potential confound that cannot entirely be excluded. However, the same knowledge effects were found for faces that were initially unknown to the participants. Because these faces were equally assigned to the different knowledge conditions across participants, physical differences cannot explain the effects found for initially unfamiliar faces, and the similar pattern observed for well-known faces is likely caused by the same mechanism, namely, modulated expression perception.

Furthermore, it could be argued that participants did not genuinely rate facial expressions but instead, rated how much they liked or disliked the person, in which case we would have captured comparatively late evaluative processing of the 'person behind the face', rather than expression perception. Likewise, the expression classification might have been biased by the recall of the associations between the faces and the affective information, in which case the rating may reflect this recall rather than a genuine change in perception. However, the observation that the sympathy ratings show a markedly different pattern speaks against these alternative explanations. The sympathy ratings were influenced by both positive and negative information, whereas expression ratings were selectively influenced by negative knowledge. Furthermore, the magnitude of the knowledge effects in sympathy ratings was considerably higher than in the expression ratings. Therefore, it seems unlikely that the expression ratings are based on post-perceptual character or sympathy judgments. Furthermore, any effects of recalling the association between the faces and learned information should affect the sympathy ratings in a similar way as the expression ratings, which is clearly not the case. Thus, although we cannot entirely exclude this possibility, it seems rather unlikely that the expression ratings reflect the recall of the associated information. One way to approach this issue in future research could be to investigate potential consequences of changes in expression perception and/or to use tasks that provide more direct tests of perceptual changes such as, for instance, expression matching tasks (Halberstadt *et al.*, 2009). Crucially, the time course of the ERP effects in the present study provides additional evidence for an early locus of affective knowledge effects and against post-perceptual origins, as discussed below.

Affective biographical knowledge elicited an early posterior negativity with an occipito-temporal topographical distribution, starting at about 200 ms for well-known faces and about 70 ms later for initially unknown faces. As discussed in the introduction, comparable EPN modulations have been interpreted to reflect sensory processing of emotional facial expressions in the visual cortex (Schupp *et al.*, 2004). Thus, our findings suggest that abstract affective person knowledge has an influence on how we perceive a person's facial expression.

Mirroring the pattern of results found in the expression ratings, the EPN was most pronounced for negative information, with robust effects for both well-known and initially unfamiliar faces. Stronger effects of stimuli with negative compared to positive valence have often been reported (Abdel Rahman, 2011; Anderson *et al.*, 2011), and may relate to the enhanced processing of potentially threatening stimuli. A person with a negative biography, e.g. a murderer, could pose a potential threat, and to be aware of such danger might secure survival.

Although the EPN modulations were present in both familiarity conditions, affective knowledge effects for well-known and initially unfamiliar faces differed slightly in their time course and topographical distributions. These differences may be attributed to different levels of associative strength of the person-related information with the face and/or a different quality of the emotional responses. While for well-known faces of persons that were familiar already prior to the experiment, biographical knowledge is well established in long-term memory, the traces of the newly acquired information associated

Downloaded from http://scan.oxfordjournals.org/ at Humboldt-Universitaet zu Berlin on July 15, 2014

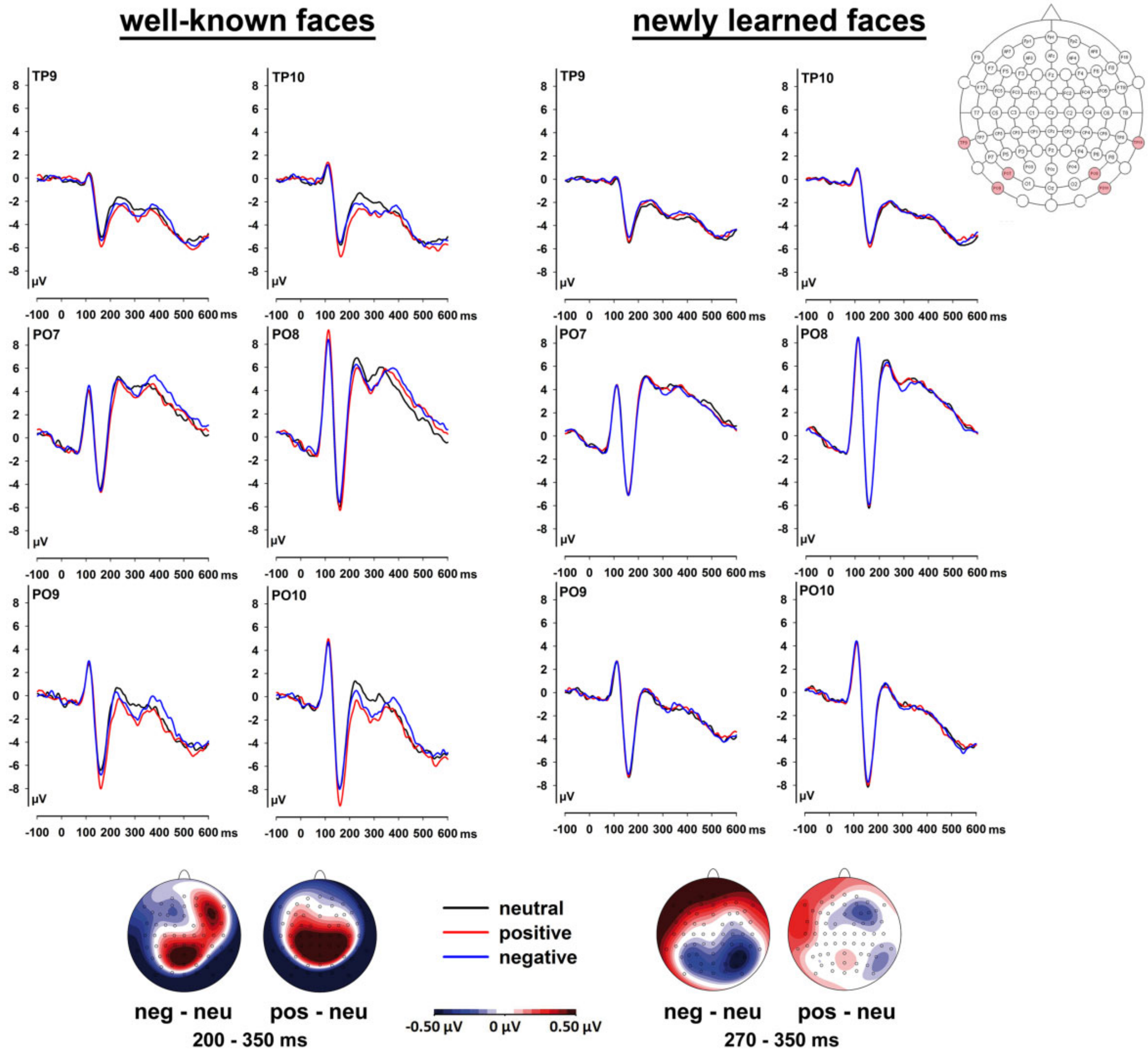

Fig. 3 Top. Grand average event-related brain potentials show the time course of affective knowledge effects on the processing of well-known faces (left) and newly learned faces (right) at six electrodes that were included in the ROI analysis. Affective knowledge had an effect on the EPN component for both well-known (200–350 ms) and newly learned faces (270–350 ms). Bottom. Scalp distributions of the differences between the negative and neutral and positive and neutral affective knowledge conditions in the respective time windows.

with initially unfamiliar faces may be much weaker. As a consequence, the sensory responses reflected in the EPN may not yet be as strong as for well-known faces. Moreover, the factors familiarity and emotion in person recognition and face processing might be closely entangled, and repeated encounters with a person, each associated with affective responses, may form the basis for affective knowledge effects as the ones observed here (cf. Barrett and Bar, 2009; Abdel Rahman, 2011). From this perspective, prior experiences with a person, including verbal descriptions of the person's past behavior, can shape how we perceive emotional expressions of that person's face in the future.

To summarize, we present direct evidence from facial expression ratings and more indirect evidence from ERP responses to faces associated with socially relevant affective biographies suggesting that, literally, facial expressions cannot be viewed independent of the affective knowledge associated with the person. This holds in particular for negative information. Such effects of negatively valenced knowledge on how we perceive a person's facial expression, may the available information be based on proper facts, rumors or gossip, should have a massive influence on social interactions. Specifically, the tendency to perceive the facial expression of another person as more negative may (negatively) influence our interpretations of the mental state and intentions of that person, which may in turn modulate our own behavior toward that person, potentially resulting in a self-fulfilling prophecy.

To conclude, the observed influences of knowledge on expression perception add to the cumulating evidence on context effects in this field and suggest that not only visual contexts (Aviezer *et al.*, 2008) but also semantic contexts can shape expression perception, in contrast to the widely held view (Ekman, 1993) that basic emotions are immune to such influences.

SUPPLEMENTARY DATA

Supplementary data are available at *SCAN* online.

Downloaded from http://scan.oxfordjournals.org/ at Humboldt-Universitaet zu Berlin on July 15, 2014

Conflict of Interest

None declared.

REFERENCES

Abdel Rahman, R. (2011). Facing good and evil: early brain signatures of affective biographical knowledge in face recognition. *Emotion*, *11*(6), 1397–405.

Anderson, E., Siegel, E.H., Bliss-Moreau, E., Barrett, L.F. (2011). The visual impact of gossip. *Science*, *332*, 1446–8.

Aviezer, H., Bentin, S., Dudarev, V., Hassin, R. (2011). The automaticity of emotional face-context integration. *Emotion*, *11*, 1406–14.

Aviezer, H., Hassin, R., Ryan, J., et al. (2008). Angry, disgusted, or afraid? Studies on the malleability of emotion perception. *Psychological Science*, *19*, 724–32.

Barrett, L.F. (2006). Solving the emotion paradox: categorization and the experience of emotion. *Personality and Social Psychology Review*, *10*, 20–46.

Barrett, L.F., Bar, M. (2009). See it with feeling: affective predictions in the human brain. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*, 1325–34.

Bliss-Moreau, E., Barrett, L.F., Wright, C.I. (2008). Individual differences in learning the affective value of others under minimal conditions. *Emotion*, *8*, 479–93.

Bradley, M.M., Lang, P.J. (1994). Measuring emotion: the self assessment manikin and the semantic differential. *Journal of Behavior, Therapy and Experimental Psychiatry*, *25*, 49–59.

Carroll, J.M., Russell, J.A. (1996). Do facial expressions signal specific emotions? Judging emotion from the face in context. *Journal of Personality and Social Psychology*, *70*, 205–18.

Croft, K.E., Duff, M.C., Kovach, C.K., Anderson, S.W., Adolphs, R., Tranel, D. (2010). Detestable or marvelous? Neuroanatomical correlates of character judgments. *Neuropsychologia*, *48*, 789–801.

De Gelder, B., Meeren, H.K.M., Righart, R., van den Stock, J., van de Riet, W.A.C., Tamietto, M. (2006). Beyond the face. Exploring rapid influences of context on face processing. *Progress in Brain Research*, *155*, 37–48.

Ekman, P. (1993). Facial expression of emotion. *American Psychologist*, *48*, 384–92.

Ekman, P. (2003). Darwin, deception, and facial expression. In: Ekman, P., Campos, J.J., Davidson, R.J., de Waal, F.B.M., editors. *Emotions Inside Out: 130 Years After Darwin's the Expression of the Emotions in Man and Animals*. New York: New York Academy of Sciences, pp. 205–21.

Ekman, P., Friesen, W.V. (1976). *Pictures of Facial Affect*. Palo Alto, CA: Consulting Psychologists Press.

Flaisch, T., Hacker, F., Renner, B., Schupp, H.T. (2011). Emotion and the processing of symbolic gestures: an event-related brain potential study. *Social Cognitive and Affective Neuroscience*, *6*, 109–18.

Halberstadt, J., Winkielman, P., Niedenthal, P.M., Dalle, N. (2009). Emotional conception: how embodied emotion concepts guide perception and facial action. *Psychological Science*, *20*, 1254–61.

Hassin, R., Trope, Y. (2000). Facing faces: studies on the cognitive aspects of physiognomy. *Journal of Personality and Social Psychology*, *78*, 837–52.

Hassin, R., Aviezer, H., Bentin, S. (2013). Inherently ambiguous: facial expressions of emotions, in context. *Emotion Review*, *5*, 60–5.

Haxby, J.V., Hoffman, E.A., Gobbini, M.I. (2000). The distributed human neural system for face perception. *Trends in Cognitive Sciences*, *4*, 223–33.

Junghöfer, M., Bradley, M.M., Elbert, T.R., Lang, P.J. (2001). Fleeting images: a new look at early emotion discrimination. *Psychophysiology*, *38*, 175–8.

Kissler, J., Herbert, C., Peyk, P., Junghöfer, M. (2007). Buzzwords: early cortical responses to emotional words during reading. *Psychological Science*, *18*, 475–80.

Meeren, H.K.M., van Heijnsbergen, C.C.R.J., de Gelder, B. (2005). Rapid perceptual integration of facial expression and emotional body language. *Proceedings of the National Academy of Sciences of the United States of America*, *102*, 16518–23.

Nakamura, M., Buck, R., Kenny, D.A. (1990). Relative contributions of expressive behavior and contextual information to the judgment of the emotional state of another. *Journal of Personality and Social Psychology*, *59*, 1032–9.

Posner, M. (1980). Orienting of attention. *Quarterly Journal of Experimental Psychology*, *32*, 3–25.

Schacht, A., Sommer, W. (2009). Emotions in word and face processing: early and late cortical responses. *Brain and Cognition*, *69*, 538–50.

Schupp, H.T., Junghöfer, M., Weike, A.I., Hamm, A.O. (2003). Emotional facilitation of sensory processing in the visual cortex. *Psychological Science*, *14*, 7–13.

Schupp, H.T., Öhman, A., Junghöfer, M., Weike, A.I., Stockburger, J., Hamm, A.O. (2004). The facilitated processing of threatening faces: an ERP analysis. *Emotion*, *4*, 189–200.

Singer, T., Kiebel, S.J., Winston, J.S., Dolan, R.J., Frith, C.D. (2004). Brain responses to the acquired moral status of faces. *Neuron*, *41*, 653–62.

Todorov, A. (2011). Evaluating faces on social dimensions. In: Todorov, A., Fiske, S.T., Prentice, D., editors. *Social Neuroscience: Toward Understanding the Underpinnings of the Social Mind*. New York: Oxford University Press, pp. 54–77.

Todorov, A., Gobbini, M.I., Evans, K.K., Haxby, J.V. (2007). Spontaneous retrieval of affective person knowledge in face perception. *Neuropsychologia*, *45*, 163–73.

Van den Stock, J., Righart, R., de Gelder, B. (2007). Body expressions influence recognition of emotions in the face and voice. *Emotion*, *7*, 487–94.

Downloaded from http://scan.oxfordjournals.org/ at Humboldt-Universitaet zu Berlin on July 15, 2014