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BRIEF REPORT

Differential Reliance on the Duchenne Marker During Smile Evaluations and Person Judgments

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Abstract When evaluating the smiles of other people (regarding amusement, authenticity, spontaneity, or intensity), perceivers typically rely on *Orbicularis oculi* activity that causes wrinkles around a target's eyes. But does this so-called *Duchenne marker* also impact more generalized judgments of person characteristics (e.g., regarding a target's attractiveness, intelligence, dominance, and trustworthiness)? To address this issue, the current study asked participants to provide the above smile evaluations and person judgments for a series of Duchenne and non-Duchenne smiles. The results showed that smile evaluations uniformly increased during Duchenne marker presence. The marker's effect on person judgments, in contrast, was judgment dependent. While attractiveness, dominance and intelligence ratings showed the expected enhancement, trustworthiness ratings remained unaffected by the facial cue of interest. The findings suggest that the Duchenne marker's role as a cue of social relevance during target perception depends on the type of person inference under consideration.

Keywords Person perception · Person construal · Social judgement · Trait judgment

Introduction

Hardly any other emotional expression has attracted as much scientific interest concerning its genuine expression than smiling. At first glance, detecting whether another person smiles appears an easy perceptual task. Individuals from many different cultures typically agree when asked to select smiling faces from a series of photographs depicting various facial expressions (e.g., Ekman 1994; Haidt and Keltner 1999; Izard 1971). Decoding a smile's particular meaning, in contrast, is considerably more challenging. Besides signaling happiness or joy, smiles can be flashed out of politeness, for reasons of affiliation, to

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mask negative emotional states (such as sadness or embarrassment) and sometimes even to deceive others (e.g., Ekman and Friesen 1982; Ekman et al. 1988; Keltner 1995; Niedenthal et al. 2010).

Given this diverse range of functionality, a large body of work has focused on the question whether enjoyment smiles that reflect a positive emotional state of some kind (e.g., joy, happiness, elation) can reliably be distinguished from non-enjoyment smiles. Over the last three decades, various morphological markers have been suggested to serve such a purpose, ranging from a smile's symmetry and smoothness to its onset and duration (e.g., Hess and Kleck 1990; Schmidt et al. 2006, 2009; Skinner and Mullen 1991). Most often, however, the role of the so-called Duchenne marker has been discussed in the literature (e.g., Ekman 1990; Krumhuber and Manstead 2009).

The Duchenne marker is a facial action characterized by the narrowing of a person's eye aperture through the raising of the cheeks and the lowering of the eye cover fold accompanied by the appearance of wrinkles ("crow's feet") on the external side of the eyes. This distinctive facial state is caused by a contraction of the external strand of the *Orbicularis oculi* muscle and typically co-occurs with activity of the *Zygomatic major* muscle that pulls the lip corners up into a typical smile (Duchenne de Boulogne 1862; Ekman and Friesen 1982). In line with the idea that the Duchenne marker signals true enjoyment, smiles carrying the marker (i.e., Duchenne smiles) occur particularly often when people experience positive feelings (e.g., Ekman et al. 1990, 1988; Harris and Alvarado 2005; Keltner 1995).

Duchenne smiles can, however, also arise when negative emotions are being concealed (e.g., Ekman et al. 1988; Keltner 1995; Keltner and Bonanno 1997). Furthermore, posed smiles have been found to contain large proportions of Duchenne smiles indicating that *O. oculi* action in a smiling face is not necessarily a marker of genuine enjoyment (e.g., Krumhuber and Manstead 2009; Schmidt et al. 2006, 2009). Nevertheless, people seem to rely on the marker when evaluating whether a smile is real. For instance, smiles perceived as amused rather than polite or nervous are more likely to have the Duchenne marker (Ambadar et al. 2009). In addition, *O. oculi* activity has been found to predict enhanced smile authenticity and amusement ratings (e.g., Frank et al. 1993; Gosselin et al. 2002; Krumhuber and Manstead 2009; Thibault et al. 2009).

Interestingly, presence of the Duchenne marker not only appears to influence how people evaluate smiles, but also how they judge others more generally (e.g., Krumhuber et al. 2007). For instance, perceivers are more willing to approach (Miles 2009) and to cooperate with individuals displaying Duchenne rather than non-Duchenne smiles (Bernstein et al. 2010; Johnston et al. 2010). In addition, Duchenne targets appear to be rated more positively across various dimensions of social relevance, such as on extraversion, likeability, and trustworthiness (Frank et al. 1993; Johnston et al. 2010). But while some studies observe this effect across different types of person judgments (see Frank et al. 1993; Johnston et al. 2010), others find it to impact only certain assessments (e.g., judgments of extraversion but not trustworthiness, see Mehu et al. 2007).

Unfortunately, an in depth comparison of existing data is limited by the fact that several published reports merely include 'positivity scores' that collapse ratings across numerous social dimensions (see Frank et al. 1993; Johnston et al. 2010). As a result, it remains unclear whether the Duchenne marker tempts perceivers to judge others more positively in a general manner or whether this marker informs a specific subset of person inferences. The former notion is in agreement with theories claiming that emotional expressions function to influence others, with happiness-related cues (such as the Duchenne marker) promoting an unspecified favorable stance towards the cue provider (Owren and

Bachorowski 2003). The latter view, in contrast, supports the idea that perceivers rely more strongly on signals of happiness when judging a target's trustworthiness/likeability than when assessing other dimensions such as dominance or intelligence (see Todorov et al. 2008). Given the lack of unequivocal results, it has been argued that "additional research is needed to identify the trait impressions elicited by the distinctive facial cues that communicate happiness [such as the Duchenne marker]" (Zebrowitz and Montepare 2008, p. 184). To address this empirical lacuna, the current study examines the impact of the Duchenne marker on various types of smile evaluations and person judgments.

Method

Participants

Forty-eight Caucasian undergraduate students of the University of Louvain (average age 20.1 years, age range 18–24 years, 24 females) took part in the experiment for course credit. All participants had normal or corrected-to-normal vision and provided informed consent prior to study participation.

Stimulus Material

Sixty-four color images of full-front faces depicting thirty-two individuals (16 females) without facial hair, earrings, glasses, or visible make-up were presented during the experiment. All individuals displayed direct eye contact. To obtain equal numbers of male and female targets, images were created based on photographs used by Miles and Johnston (2007), by Niedenthal et al. (2010), and based on images extracted from videoclips of smiling people as available on the BBC science website (http://www.bbc.co.uk/science/humanbody/mind/surveys/smiles; as previously used in Bernstein et al. 2008, 2010).

In previous studies, researchers targeting the association between the Duchenne marker and person judgments (see Frank et al. 1993; Johnston et al. 2010; Mehu et al. 2007) typically selected their stimulus material based on the following criteria: After recording smiling individuals across different situations, the obtained images were coded for evidence of *Zygomaticus major* activity (Action Unit 12, AU12) and/or *O. oculi* contraction (Action Unit 6, AU6) according to the Facial Action Coding System (FACS; Ekman et al. 2002). Based on this coding, faces with AU6 and AU12 presence were considered Duchenne smiles, whereas faces with mere AU12 presence counted as non-Duchenne smiles. Though categorizing smiles according to these criteria guaranteed that the Duchenne marker was present in Duchenne relative to non-Duchenne smiles, it did not ensure that the facial action in the *Zygomaticus major* was equally intense across both types of smiles (see Fig. 1a).

Since we were specifically interested in the contribution of the Duchenne marker on smile evaluations and person judgments rather than the impact of other facial cues, we decided to alter the available pictures accordingly. Thus, for each individual, photographs depicting a smile including the Duchenne marker (DM) and a facial expression with an absent (or less pronounced) Duchenne marker (NM) were obtained. Using Adobe Photoshop® these pictures of faces were split in half horizontally above the target's nostrils. In a next step, the bottom halves of DM faces were combined with their original DM top halves, and additionally with their corresponding NM top halves (creating composite faces, see Young et al. 1987). As a result, a stimulus set was obtained that consisted of

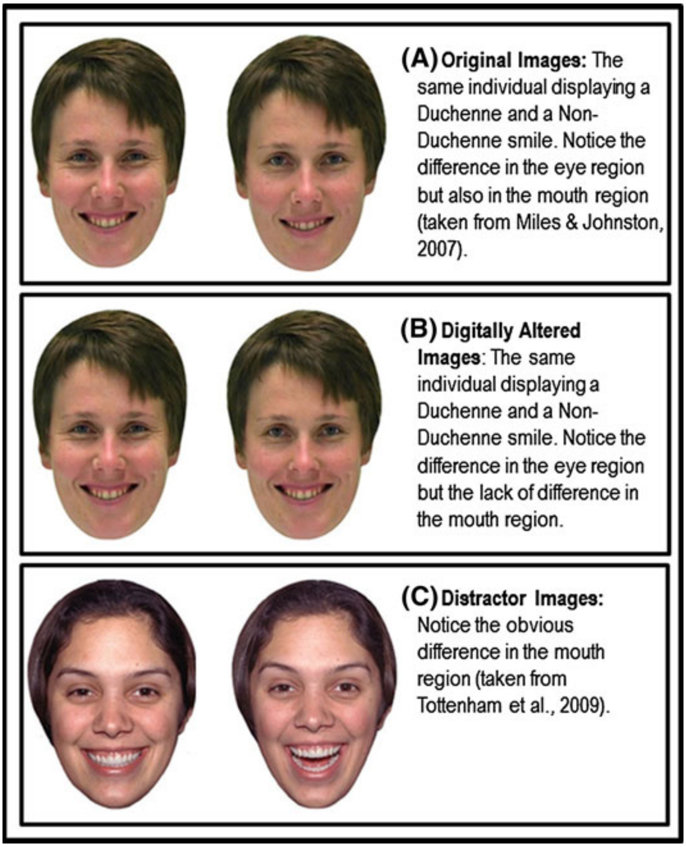

Fig. 1 Comparison of current and previous stimulus material

twenty-four targets (12 females), who all featured in two images that differed systematically in the eye region while having identical lower face halves (see Fig. 1b).

In addition, sixteen filler items were added to the final set of stimuli to distract perceivers from the facial manipulation of interest (see Fig. 1c). Filler items consisted of eight individuals (4 females) taken from the NimStim Set of Facial Expressions (http://www.macbrain.org/resources.html). For each individual, two posed expressions of happiness differing in the mouth region (e.g., one with an opened and one with a closed mouth smile) were included (Tottenham et al. 2009). Therefore, the final set of faces comprised variation across both, upper and lower facial halves, concealing our sole interest in the Duchenne marker. All faces were standardized to a common height of 280 pixels and inserted on a uniform white background of 288 × 288 pixels.

Procedure

Upon arrival at the laboratory, participants were seated at an iMac computer equipped with a 20 inch screen set to a resolution of 1,680 × 1,050 pixels, and asked to pay close attention to a set of directions that informed them about the study. Computerized instructions stated that the study involved viewing a series of photographs of smiling people. Participants were also informed that for each individual they would see two images that had been taken at different times, and that the experimenters were interested in their impressions of these photographs. In line with previous investigations (e.g., Oosterhof and Todorov 2008), participants were encouraged to rely on their “gut feeling” during the task. They were also informed that ratings would be requested in blocks of trials, each of which would be related to one specific dimension of relevance.

To avoid directing perceivers’ attention artificially to the different types of smiles, participants began by providing person judgments. Based on existing work, we asked participants to provide ratings regarding a person’s attractiveness, dominance, intelligence, and trustworthiness (Krumhuber et al. 2007; Oosterhof and Todorov 2008). Subsequently, participants evaluated the same faces regarding how amused a person looked and how authentic, intense, and spontaneous the smile seemed to be (see Hess et al. 1989; Krumhuber and Manstead 2009; Thibault et al. 2009). The order of assessments requested within person judgments and smile evaluations was counterbalanced across participants. For each block of trials, participants received four practice trials to familiarize themselves with the task before encountering the trials proper in a randomized fashion.

On each trial, a centralized target face was presented on a white screen with a question above the photograph (e.g., “How trustworthy is this person?”, “How intense is this smile?”) and a response scale displayed below. The response scale ranged from 1 (*not at all*) to 9 (*extremely*). Each face was visible until the participant responded with a button press. Trials were separated by an interval of 500 ms. Blocks of trials were separated by a short pause during which the experimenter set up the next type of judgment. After task completion, participants were debriefed and thanked for their participation.

Results

Cross-Dimensional Correlations

To explore how the different smile evaluations and person judgments related to each other, the average rating of each face for each dimension of assessment was computed across all participants. These average ratings were then correlated across dimensions, separately for Duchenne and non-Duchenne smiles, allowing us to investigate cross-dimensional correlations for both types of smiles. Comparable correlation patterns were obtained across smile types (see Table 1). For Duchenne as well as non-Duchenne smiles, smile evaluations were highly correlated among each other [all $rs(22) > .51$]. The same was true for person judgments [all $rs(22) > .57$], with the exception of the dimensions trustworthiness and dominance that failed to correlate (an effect repeatedly reported in the trait judgment literature, for a review see Todorov et al. 2008). Importantly, smile evaluations and person judgments were largely uncorrelated. The only significant correlations to emerge indicated that the more authentic and spontaneous a smile was considered to be (regardless of the presence of the Duchenne marker), the more trustworthy a target appeared [all $rs(22) > .51$].

Multivariate Analyses of Variance

In a next step, the influence of the Duchenne marker on smile evaluations and person judgments was assessed. To do so, the average rating across all twenty-four faces belonging to the same smile type was computed for each participant and each dimension of

Table 1 Cross-dimensional correlation patterns according to smile type for Duchenne smiles (above the matrix diagonal) and non-Duchenne smiles (below the matrix diagonal)

	Amu	Aut	Inten	Spo	Att	Dom	Intel	Tru
Amusement (Amu)	1	.73*	.92*	.74*	.06	−.38	−.24	.03
Authenticity (Aut)	.74*	1	.59*	.97*	.25	−.33	.09	.56*
Intensity (Inten)	.86*	.51*	1	.55*	.12	−.28	−.14	.01
Spontaneity (Spo)	.77*	.97*	.54*	1	.17	−.34	.04	.51*
Attractiveness (Att)	.09	.32	.18	.29	1	.67*	.84*	.61*
Dominance (Dom)	−.37	−.20	−.21	−.24	.66*	1	.73*	.16
Intelligence (Intel)	−.19	.22	−.10	.14	.81*	.77*	1	.72*
Trustworthiness (Tru)	.14	.65*	.06	.57*	.57*	.15	.65*	1

* $p \leq .01$

assessment. The obtained scores were submitted to two mixed measures Multivariate Analyses of Variance (MANOVA), depending on whether the scores represented smile evaluations or person judgments respectively. Thus, scores related to smile evaluations were submitted to a 2 (smile type: Duchenne vs. non-Duchenne) $\times$ 4 (evaluation type: amusement, authenticity, intensity, spontaneity) MANOVA. Along similar lines, scores related to person judgments were submitted to a 2 (smile type: Duchenne vs. non-Duchenne) $\times$ 4 (judgment type: attractiveness, dominance, intelligence, trustworthiness) MANOVA. In both cases, participants' sex was specified as a between subject factor but did not reveal any significant main or interaction effects.

For smile evaluation scores main effects of smile type [$F(1,46) = 77.37$, $p < .05$, *partial* $\eta^2 = .63$] and evaluation type [$F(3,44) = 3.02$, $p < .05$, *partial* $\eta^2 = .17$] were revealed. Follow-up paired t tests demonstrated that the main effect of smile type was driven by systematic differences in ratings across all four dimensions of interest (see Table 2A). Specifically, Duchenne smiles were rated as more authentic, intense, spontaneous, and as expressing more amusement than non-Duchenne smiles. For person judgments, again main effects of smile type [$F(1,46) = 12.89$, $p < .05$, *partial* $\eta^2 = .22$] and judgment type [$F(3,44) = 22.27$, $p < .05$, *partial* $\eta^2 = .60$] were found. This time, follow-up paired t-tests revealed that the main effect of smile type was driven by systematic differences in ratings for three of the four types of judgments (see Table 2B). Specifically, faces displaying a Duchenne smile were rated as more attractive, intelligent, and marginally so as more dominant than faces with a non-Duchenne smile. For ratings of trustworthiness, however, no significant difference emerged.

Discussion

Replicating previous work (e.g., Krumhuber and Manstead 2009; Thibault et al. 2009), the current study demonstrates that perceivers rely on the Duchenne marker when evaluating the amusement, authenticity, intensity, and spontaneity of other people's smiles. In addition, the study shows that perceivers utilize the marker when making person judgments (see Frank et al. 1993; Johnston et al. 2010)—albeit less extensively so than during smile evaluations as signaled by the reduction in effect sizes for the latter relative to the former analyses. Importantly, while the Duchenne marker systematically enhanced attractiveness and intelligence ratings, findings with regard to dominance and trustworthiness were

Table 2 Smile evaluations and person judgments: average ratings (and SD) for each smile type

	Duchenne smiles	Non-Duchenne smiles	t value ($df = 47$)	p value	Cohen's d
(A) Smile evaluations					
Amusement	5.43 (.71)	4.98 (.79)	8.06	<.001	1.16
Authenticity	5.39 (.68)	4.94 (.69)	7.03	<.001	1.01
Intensity	5.28 (.71)	4.96 (.79)	5.51	<.001	0.79
Spontaneity	5.17 (.73)	4.77 (.77)	5.06	<.001	0.73
(B) Person judgments					
Attractiveness	4.17 (1.0)	4.07 (1.0)	2.43	.02	0.35
Dominance	4.61 (.79)	4.53 (.71)	1.81	.08	0.26
Intelligence	5.04 (.60)	4.92 (.71)	2.35	.02	0.34
Trustworthiness	5.18 (.89)	5.14 (.86)	.64	.52	0.09

ambivalent, indicating that the impact of the Duchenne marker on person judgments differed depending on the type of person judgment made.

The obtained results are noteworthy since they fit neither of the proposed theories. In conflict with the idea that Duchenne smiles may put the perceiver in a generally favorable stance toward the target, presence of the marker did not elicit more positive ratings across all personality dimensions probed. At the same time, the obtained data also challenge the idea that perceivers rely particularly strongly on signals of happiness when judging trustworthiness. The lack of modulation of trustworthiness ratings based on the presence/absence of the Duchenne marker has previously been reported in the literature (Mehu et al. 2007). Such a finding appears unexpected given that a more positive (i.e., authentic and spontaneous) smile should sway a perceiver to find the smile-bearer more trustworthy. Indeed, our correlational analyses revealed that the more authentic and spontaneous a target's smile was rated, the more trustworthy a person was considered to be (or vice versa!)—but this pattern was observed regardless whether smiles carried the Duchenne marker or not. This finding may suggest that an individual's facial physiognomy (including *Zygomaticus major* activity) provides such a rich information basis for trustworthiness judgments that a single additional cue such as the Duchenne marker fails to be potent enough to amend these judgments.

Interestingly, previous work has shown that various person judgments tend to be correlated among each other and that adopting statistical techniques to reduce data dimensionality reveals two orthogonal factors—valence/trustworthiness and power/dominance—that can account for a majority of the variance in person ratings (Hassin and Trope 2000; Oosterhof and Todorov 2008). The current data suggest that the Duchenne marker may unfold its impact particularly for judgments that are best represented as a linear combination of the two fundamental dimensions (see Todorov et al. 2008). Put differently, ratings that simultaneously correlated with both dominance and trustworthiness judgments such as attractiveness and intelligence were found to be more affected by the presence of the Duchenne marker than the two fundamental dimensions themselves. Further research will need to show whether this pattern of results replicates reliably across different stimuli and with various kinds of observers.

In summary, the current data suggest that perceivers consider the Duchenne marker as a facial cue of social relevance not only when trying to decipher someone's affective state but also when judging enjoyment-unrelated social attributes such as a person's attractiveness and intelligence. Additionally, the data signal that reliance on the Duchenne marker during person judgments depends on the exact person inference under consideration. Future research will need to clarify why such differential reliance on the Duchenne marker during smile evaluations and person judgments occurs.

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Conflict of interest The authors declare that they have no conflict of interest.

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