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DUCHENNE SMILES AND THE PERCEPTION OF GENEROSITY AND SOCIABILITY IN FACES

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Abstract: Although Duchenne smiles have been shown to have a social signal value, there is limited evidence as to whether this effect generalises to most positive attributes, or whether it is restricted to a particular social domain. As opposed to non-Duchenne smiles, Duchenne smiles involve the activity of facial muscles in the eye region (*orbicularis oculi*). The hypothesis that Duchenne and non-Duchenne smiles produce different responses in receivers was tested in a face perception experiment. People were asked to rate neutral and smiling faces on ten attributes: attractiveness, generosity, trustworthiness, competitiveness, health, agreeableness, conscientiousness, extroversion, neuroticism, and openness to experience. Results showed that the type of smile had a stronger impact on the ratings of generosity and extroversion. The difference between neutral and smiling was larger when faces showed a Duchenne than a non-Duchenne smile, though the effect of smile type on attributions of generosity appeared to be restricted to male faces. Therefore the Duchenne marker shows some specificity to judgements of altruism and sociability.

Keywords: facial expression, duchenne smile, generosity, extroversion, evolution

1. INTRODUCTION

The idea that smiles can be categorised in different types can be traced back to the physiological studies conducted by the anatomist DUCHENNE de BOULOGNE. DUCHENNE (1862) noticed that emotionally motivated smiles often involve facial activity in the eye region, *orbicularis oculi*, whereas deliberate smiles include the sole

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activation of the *zygomaticus major*. The latter pulls the lip corner obliquely up and back, and deepens the furrow running from the nostril to the lip corner. The former lifts the cheek upwards and pushes the skin toward the eye, thereby narrowing the eye opening sometimes causing crow's feet wrinkles to appear at the outer corner of the eye (EKMAN and FRIESEN 1982). These careful observations led to the adoption of *orbicularis oculi*'s activity as one of the main features used to differentiate between spontaneous and deliberate smiles (EKMAN and FRIESEN 1982; FRANK, EKMAN and FRIESEN 1993), and the former took the appellation 'Duchenne smile' to honour the early work of the French anatomist.

Interestingly, the observable variations between Duchenne and non-Duchenne smiles were shown to produce different effects in perceivers, with Duchenne smiles having a more positive impact on social judgements than non-Duchenne smiles. For example researchers found associations between Duchenne smiles and positive attributions by observers (O'SULLIVAN et al. 1992 cited by FRANK et al. 1993). It is unclear, however, what these positive attributions were about. In another study, people showing enjoyment smiles (i.e. Duchenne smiles) were judged as being more expressive, natural, outgoing, sociable, relaxed, and were deemed to feel and act more pleasant than when they showed non-enjoyment smiles (FRANK et al. 1993). LAFRANCE and HECHT (1995) also found evidence that a person showing a Duchenne smile can be judged as more likeable and diplomatic. Although these studies suggest that the Duchenne smile has a signal value, an emphasis on emotional expression has regularly been preferred to investigations of social function (maybe with the exception of LAFRANCE and HECHT 1995). Furthermore these studies often failed to specify particular areas in which the Duchenne smile could be functional (e.g. mate choice, cooperation, etc.). Overall there appears to be very limited data concerning the effect of Duchenne and non-Duchenne smiles on person perception.

No matter what smiling is meant to express, the mere suggestion that it expresses something beneficial to the sender makes the possibility of social manipulation an appealing option for nature to select for (BROWN and MOORE 2002). The degree of control that individuals gained over their face (SHERWOOD et al. 2004; SHERWOOD et al. 2005) and the effect of smiling on trait perception (LAI 1982; OTTA, ABROSIO and HOSHINO 1996; MEHU 2006) set forward the obvious problem that people could smile purposefully and claim specific traits whenever a relevant situation presents itself. This might have created a selection pressure for individuals who were particularly sensitive to smiling, as they became increasingly vulnerable to exploitation by socially skilled individuals. Consequently, the evolution of cognitive structures responsible for the control of facial behaviour might also have led to cognitive counter strategies based on a better discrimination between the various forms smiles appeared to take. Social responses to faces should therefore be expected to vary with the type of smile shown by these faces.

Cooperation between unrelated individuals is a sphere in which exploitation by free-riders could be particularly detrimental (DUNBAR 1999). Indeed, consistent failures from the partner to retaliate favours could quickly eliminate the benefits

expected from a cooperative relationship. ROBERT TRIVERS (1971) suggested that the possibility to identify individuals likely to reciprocate in the future would be an important solution to the issue of commitment between unrelated individuals. In that respect, prospective altruist-detection would be particularly adaptive because it would help avoid interactions with cheaters *before* exploitation could occur (BROWN and MOORE 2000). In support to that claim, computer simulations showed that a partner preference is ecologically reasonable and allows for the evolution of cooperation (COOPER and WALLACE 1998).

Recent research also suggests that smiling could act as a signal that facilitates the identification of cooperative partners (SCHARLEMANN et al. 2001; BROWN and MOORE 2002; BROWN, PALAMETA and MOORE 2003). This follows an earlier emphasis by some authors on the role of pro-social emotions in the resolution of commitment problems (TRIVERS 1971; HIRSHLEIFER 1987; FRANK 1988). According to these models, the non-verbal cues related to positive emotions are seen as honest signals of altruistic dispositions because, as a result of their contingency with physiological processes, they are not easy to fake (HIRSHLEIFER 1987; ZAHAVI 1987; FRANK 1988; GRAFEN 1990; ZAHAVI and ZAHAVI 1997). The findings that some forms of smiles, but not others, are consistently associated with positive emotions (EKMAN, FRIESEN and O'SULLIVAN 1988; EKMAN, DAVIDSON and FRIESEN 1990; SURAKKA and HIETANEN 1997) suggest that the Duchenne smile is a good candidate for the advertisement of altruistic intentions and dispositions (BROWN and MOORE 2002; BROWN et al. 2003).

In addition to traits that are directly relevant to cooperation, the Duchenne smile could advertise general dimensions of human personality such as agreeableness, conscientiousness, extroversion, neuroticism, and openness to experience. According to evolutionary theory, basic personality traits would represent the social background to which people have to adapt (BUSS 1991). These traits could therefore provide crucial information to answer adaptive questions such as whom to rely on, whom to mate with, or whom to include in social alliances (*ibid.*). Given that personality traits could represent information adaptive to receivers, one should expect the judgement of such traits to depend on the presence of subtle behavioural cues. Interestingly, extrovert individuals have been shown to display higher frequencies of Duchenne smiles in response to humorous stimuli than introverts (RUCH 1993), indicating that this behaviour could signal sociability.

Only a few studies reported associations between personality attributions and smiling. For example, the frequency of smiling displayed by targets while reading a standard text was significantly correlated with ratings of extroversion, agreeableness, emotional stability (the opposite of neuroticism), and openness to experience (BORKENAU and LIEBLER 1995). This suggests that people who smile a lot are rated more positively on most personality dimensions (with the exception of conscientiousness). In addition, OTTA and colleagues (1994) showed that smiling faces received higher ratings on extroversion. Unfortunately these studies did not show whether personality judgements are affected by Duchenne smiles. The present

study investigates whether a link can be drawn between Duchenne smiling and the five major personality dimensions. Moreover, the potential role of smiling in courtship (MOORE 1985; GRAMMER 1989) leads to the question of whether Duchenne smiles have an impact at all on attractiveness and health judgements.

2. METHOD

Twenty-five males and 25 females were photographed and their pictures were used as stimuli in a face perception experiment. Faces were from a Caucasian sample and had no extreme distinctive feature such as jewellery, dyed hair, or severe skin or teeth condition. Two pictures were taken for each individual: a picture showing a neutral face and a picture showing a smiling face. Each of the smiling face was coded using the most recent version of the Facial Action Coding System (EKMAN, FRIESEN and HAGER 2002), by two certified coders blind to the ratings given to faces (reliability 0.75). Smiles were classified into Duchenne and non-Duchenne with respect to the criterion used by EKMAN and FRIESEN (1982), i.e. the co-occurrence of 'AU 6' (*orbicularis oculi*) and 'AU 12' (*zygomaticus major*) indicated the presence of the Duchenne type.

Neutral and smiling faces were then rated by independent judges on separate Likert scales ('1': not at all, '4': neutral, '7': very much) for ten different attributes: attractiveness, generosity, trustworthiness, competitiveness, health, agreeableness, conscientiousness, extroversion, neuroticism, and openness to experience. These attributes were presented to participants in a random order, and the 50 stimulus faces within each category were also arranged in a random order. Because the meaning of the Big Five personality traits might not be evident to lay people, adjectives related to each dimension were used to clarify their meaning. For example, it was explained that a person who would be highly neurotic would be nervous, worrying, and highly strung; whereas someone who would not be neurotic at all would be calm, at ease, and relaxed.

The panel of judges consisted of 58 people (29 males, 29 females) ranging in age from 19 to 35 year old ($M = 27.8$, $SD = 3.6$). Judges were all Caucasian and had no connection to the people depicted on the pictures. Participants were asked to rate the 50 stimulus faces on the ten dimensions mentioned above. Each judge was randomly assigned to either the control or the experimental condition, respectively neutral or smiling, and each condition included an equal representation of men and women. Judges rated the ten dimensions in a single block of trials.

A score representing the change in perception was computed for each stimulus face by subtracting the score given to the neutral version from the score given to the smiling version of the face. The score difference between the two conditions was therefore considered as an indicator of the effect of smiling. The effect of Duchenne smiles on ratings of personal attributes was analysed in a 2 × 2 × 2 repeated measure ANOVA, with sex of faces and type of smile as between-subject factors, and sex of

judges as a within-subject factor. The score differences between neutral and smiling for each type of judgements (10) were entered in the analysis as separate dependent variables. Effect sizes were calculated with the Effect Size Generator for Windows version 2.3 (DEVILLY 2004).

3. RESULTS

Overall, the model showed that the impact of smiling on social judgements was affected by 'smile type', $F(10, 37) = 4.05$, $p = 0.001$, and by 'sex of judges' $F(10, 37) = 6.29$, $p < 0.001$. The impact of smiling on the judgements of attractiveness, generosity, competitiveness, agreeableness, conscientiousness, and neuroticism was greater for male than for female raters. Overall, the sex of faces did not affect the change between ratings of neutral and smiling faces, $F(10, 37) = 1.31$, $p = 0.26$. Multivariate tests did not reveal significant interactions between variables: 'smile type' × 'sex of faces', $F(10, 37) = 1.64$, $p = 0.13$; 'smile type' × 'sex of judges', $F(10, 37) = 1.32$, $p = 0.32$; 'smile type' × 'sex of faces' × 'sex of judges', $F(10, 37) = 0.86$, $p = 0.57$.

Univariate tests showed that the effect of smile type was not generalised to the judgements of all dimensions. There was a main effect of smile type on the degree of change in ratings of generosity and extroversion, indicating that the difference between neutral and smiling was significantly larger when the face showed a Duchenne rather than a non-Duchenne smile (*Fig. 1*). Note that when Bonferroni correction was applied and the level of significance reduced to 0.005 (0.05 divided by 10 univariate tests), all *F*-values became non-significant. Means, standard deviations, and effect sizes are presented in *Table 1*.

Univariate tests also revealed a three-way interaction effect between 'smile type', 'sex of judge', and 'sex of face', on the difference between neutral and smiling for generosity scores $F(1, 49) = 4.53$, $p = 0.04$, indicating that the effect of smile type on generosity ratings could depend on the sex of the face and judge. As shown in *Fig. 2*, male *faces* were rated by men as being significantly more generous when showing a Duchenne smile ($M = 0.91$, $SD = 0.53$) than when showing a non-Duchenne smile ($M = 0.17$, $SD = 0.62$), $t(23) = 3.19$, $p = 0.004$, $d = 1.27$. Ratings of generosity given by female *judges* to male smiling faces were marginally affected by smile type, $t(23) = 1.84$, $p = 0.08$, $d = 0.74$. Finally, the effect of smile type on generosity ratings seemed to be restricted to male *faces* and was non-significant for female *faces*, $t(23) = 1$, $p = 0.33$.

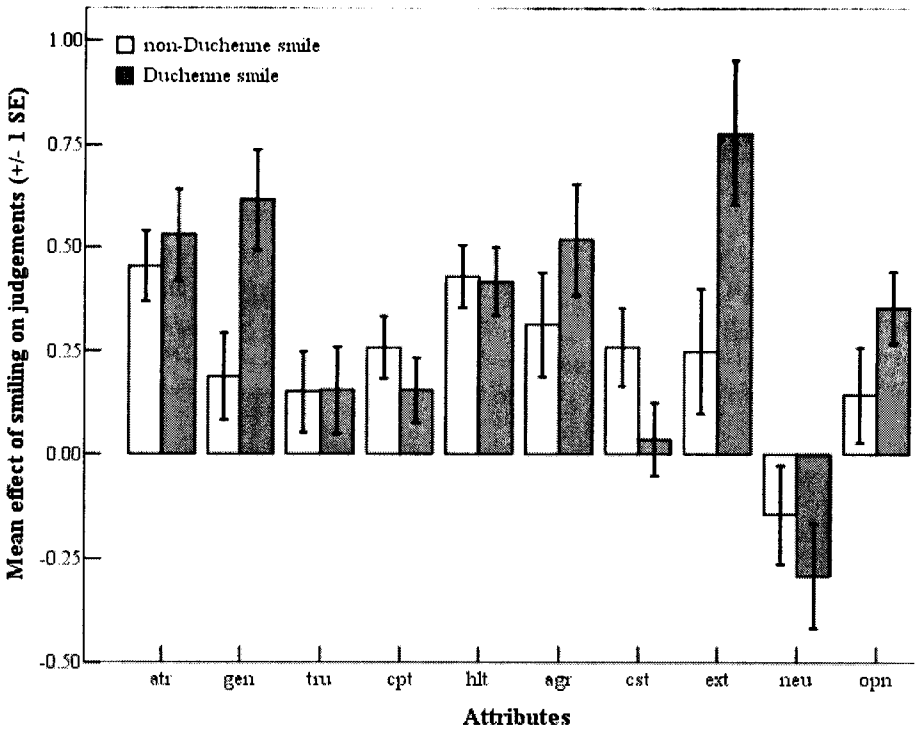

Figure 1. Average differences in judgements between neutral and smiling faces in relation to the type of smile. atr: attractiveness, gen: generosity, tru: trustworthiness, cpt: competitiveness, hlt: health, agr: agreeableness, cst: conscientiousness, ext: extroversion, neu: neuroticism, opn: openness to experience

Table 1. Average increases due to smiling in relation to smile type (non-Duchenne vs. Duchenne) Standard deviations are in brackets. $^{(*)}p < 0.05$, $^{(**)}p = 0.01$. When Bonferroni correction is applied and the significance level divided by the number of tests (i.e. $p < 0.005$), F-values are all non-significant

Attributes	Non-Duchenne, $N = 26$	Duchenne, $N = 24$	$F(1,49)$	d
Attractiveness	0.45 (0.43)	0.53 (0.53)	0.60	0.16
Generosity	0.19 (0.53)	0.62 (0.60)	$7.10^{(**)}$	0.75
Trustworthiness	0.15 (0.50)	0.15 (0.52)	0.41	0.01
Competitiveness	0.26 (0.39)	0.16 (0.39)	0.63	0.27
Health	0.43 (0.38)	0.42 (0.40)	0.01	0.03
Agreeableness	0.31 (0.65)	0.52 (0.66)	1.36	0.31
Conscientiousness	0.26 (0.48)	0.03 (0.43)	2.62	0.49
Extroversion	0.25 (0.77)	0.78 (0.86)	$5.17^{(*)}$	0.68
Neuroticism	0.14 (0.60)	0.29 (0.61)	0.64	0.24
Openness	0.14 (0.58)	0.35 (0.42)	2.09	0.42

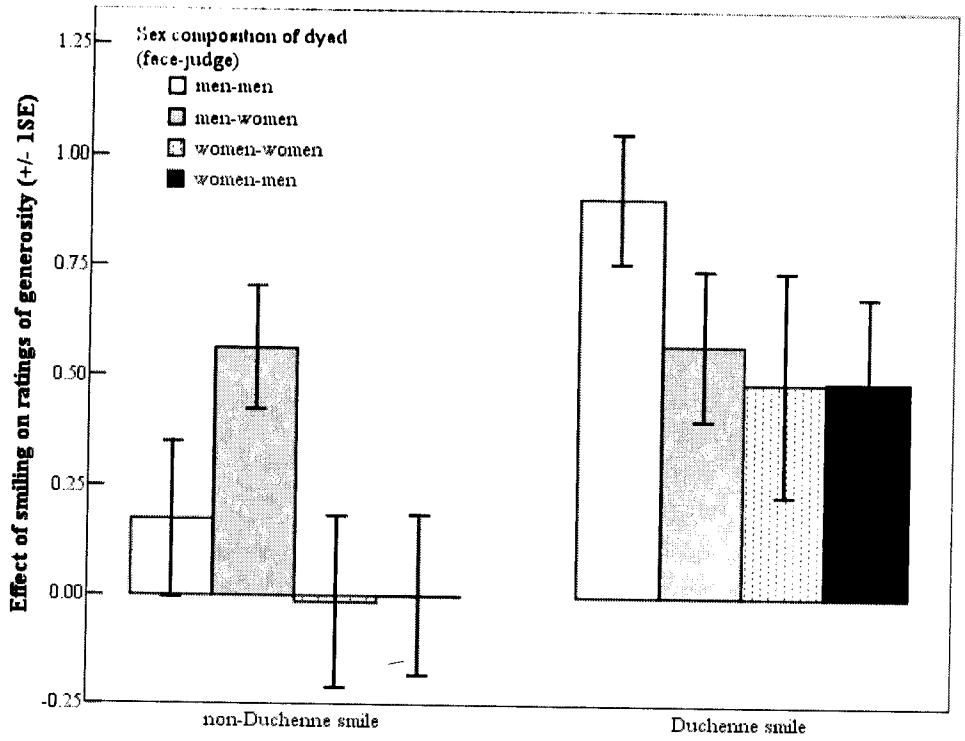

Figure 2. Impact of smile type on the difference between neutral and smiling for judgements of generosity in relation to the sex composition of the dyad (face-judge)

Table 1 shows that several effects are of small to moderate size, suggesting that the impact of Duchenne smile on social judgements could reflect a halo effect. Indeed, it should not be excluded that the relationship between judgements led to comparable increases in ratings of faces showing Duchenne smiles. This possibility was tested using Principal Component Analysis, as it allows the extraction of components that could lie behind the relationship between social judgements.

Two components were extracted that explained 69.8% of the variance (*Table 2*). Variables that showed loading values equal to or higher than 0.5 were retained for subsequent analysis. Two dimensions representing both components were created by averaging the absolute values of the individual variables. The effect of the Duchenne smile on these two dimensions was investigated using Student t-test. There was no effect of Duchenne smile on any of the components, component 1: $t(48) = 1.17$, $p = 0.25$; component 2: $t(48) = 1.47$, $p = 0.15$.