

Original Article

Relationships of Smiling and Flirtation to Aggression and 2D:4D, a Prenatal Androgen Index

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Abstract: Smiling has been reported to be a signal of submission/lower status, or a sign of cooperation. In the present study, use of smiling and flirtation to “make people receptive to my ideas” was conceptualized as mild aggression, since it is mildly manipulative of the perception of others as to one’s internal emotional status. For 91 participants (55 female, 36 male), use of smiling and flirtation to make others receptive to one’s ideas were associated with relational aggression and a more male-typical (smaller) right 2D:4D finger length ratio. The only significant relationship in the male sample alone was the relationship between smiling and relational aggression. In the female sample alone, use of smiling and flirtation to “make people receptive to my ideas” was associated with a more male-typical 2D:4D finger length ratio pattern, and there was a trend for flirtation to be associated with greater physical aggression. Both 2D:4D and physical aggression have been associated with higher prenatal androgen level. It is concluded that deliberate smiling and flirtation are mild forms of relational aggression, and are related to prenatal androgenic activity in a manner similar to physical aggression. These findings are discussed in terms of the different evolutionary strategies of men and women to control their social environments.

Keywords: Sex, hormones, androgen, aggression, flirtation, smiling, finger length ratios (2D:4D)

Introduction

Smiling has been reported to be a signal of submission/lower status (Keating et al., 1981), or as a sign of cooperation (Mehu and Dunbar, 2008; Mehu, Grammer, and Dunbar, 2007; Waller and Dunbar, 2005). In the present study, use of smiling and flirtation to manipulate others was conceptualized as mild aggression. The purpose of the present study was to evaluate sex differences in the use of smiling and flirtation to influence the behavior of others, and to evaluate relationships of smiling and flirtation to other variables that have shown sex differences, such as aggression and a measure of prenatal androgenic influence, finger length ratios.

Smiling and flirtation

There is a great deal of human and non-human primate literature indicating that smiling is a submissive signal. The non-human primate analogue to a human smile is thought to be the silent bared teeth display and is seen in contexts of appeasement and reconciliation (de Waal and Luttrell, 1985; Kummer, 1957; Thierry, Demaria, Preuschott, and Desportes, 1989; van Hooff, 1972). Other data indicate that smiling signals cooperation. For example, Mehu et al. (2007) reported that spontaneous (Duchenne) smiles were displayed at higher rates in a sharing situation compared to a control condition, and non-Duchenne smiles did not vary between control and sharing situations. The authors concluded that a spontaneous, honest (Duchenne) smile would reliably indicate altruistic intention, and thus be important in forming cooperative relationships. In another study, smiling faces elicited trust and cooperation responses among strangers in a one-shot interaction (Scharleman, Eckel, Kacelnik, and Wilson, 2001).

Numerous studies report that women smile more than men (see Hall, 1984, 2006; LaFrance, Hecht and Paluck, 2003), raising questions of biological/hormonal mechanisms. Dabbs (1997) reported smaller smiles and less use of eye muscles (orbicularis oculi) while smiling in high testosterone men compared to low testosterone men, with only weak relationships in the female participants. The lack of use of eye muscles is significant, because that is a component of spontaneous (Duchenne) smiles. Thus, the lower use of eye muscles in high testosterone men suggests greater use of non-spontaneous smiles, which could be a means of interpersonal control.

Other studies have reported lower frequency of smiling in high (vs low) testosterone men (Dabbs, Hargrove and Heusel, 1996) and less frequent smiling in high (vs. low) testosterone women (Cashdan, 1995). Ellis (2006) has suggested that less frequent male than female smiling overall may be due to the idea that smiling would interfere with the ability to intimidate a rival in mate-competition. It is important to note that smiling may have a different function in men and women for navigating their specific within-sex and between-sex contexts.

In some contexts, smiling may be a form of flirtation. Kray and Locke (2008) evaluated the use of flirtation by women to gain power in professional contexts. They found that female negotiators that used flirtation were judged to be less authentic but more likeable than the female negotiators that did not. Using attraction to gain power is a useful strategy, as physical attractiveness has been shown to increase perceptions of intelligence

and success (see Zebrowitz, 1997), and smiling has significant effects on attractiveness (Lau, 1982).

Finger length ratios

The present study used finger length ratios as an index of prenatal androgenic activity, given the well-known relationships between androgens and aggression, and the current focus on smiling as an aggressive behavior. Finger length ratios have been shown to differ for male and female subjects from age two and older, such that a smaller ratio of the second to fourth finger (relatively larger fourth than second finger) is found in men compared to women (Burton, Henninger, and Hafetz, 2005; Ecker, 1875; George, 1930; Phelps, 1952; see Manning, 2002 for a review). Consistent sex differences in digit length ratios have also been found in mice, baboons, gorillas, and chimps (Brown, Finn, and Breedlove, 2001; McFadden and Bracht, 2000a,b).

Sex differences in finger length ratios are thought to reflect prenatal organizational effects (Manning, 2002), because hand patterns are set prenatally (see Manning, 2002; Garn, Burdi, Babler, and Stinson, 1975) and the ratio difference has been reported at such a young age. McIntyre, Ellison, Lieberman, Demerath, and Towne (2005) have reported longitudinal data using radiographs indicating that sex differences arise before puberty and finger lengths in infancy and childhood are highly correlated with adult lengths. Homosexual men and women show finger ratio patterns in between that of heterosexual men and women (McFadden and Shubel, 2002). Further, female subjects with congenital adrenal hyperplasia (CAH) show a finger length pattern in the direction of the male pattern (Brown, Hines, Fane, and Breedlove, 2002).

A study by Burton, Henninger, Hafetz, and Cofer (2009) evaluated an independent sample of 134 participants with the Aggression Questionnaire of Buss and Perry (1992) and a Gender-Typical Play Behavior Questionnaire constructed for that study. Sex differences in physical aggression and in the finger length ratios were found, in the directions reported in the literature, and for the male participants, a more male-typical finger length ratio was associated with a higher physical aggression score. Correlations between greater current report of physical aggression and play style more typical of boys during childhood were found in both the male and female samples, supporting the idea that physical aggression, childhood play style, and finger length ratios may reflect prenatal androgenic influence.

The present study

In the present study, using smiling and flirtation to make others receptive to one's ideas was evaluated. The relationships of these variables to measures of relational aggression, physical aggression, and finger length ratios as a measure of prenatal androgenic activity were also evaluated.

Materials and Methods

Participants

There were 91 participants (55 female and 36 male) from the university community in the present study (male average age of 19.5 years, SD of 1.0; female average of 19.8, SD

of 3.1); these participants have been described in Burton et al. (2010). Participants came from the population of students taking Introduction to Psychology classes, who participated in partial fulfillment of a research requirement. Thus, the inclusion/exclusion criteria of being able to read sufficiently well to take a college course was fulfilled. Although students were able to stop participation at any time or not participate at all, none chose these options.

Measures

Smiling and flirtation questions. Participants were asked to rate themselves on a scale of 1 (*Never*) to 5 (*Always*) in response to two questions:

1. I'm good at using a smile to make people receptive to my ideas.
2. I'm successful at using flirtation to make people receptive to my ideas.

These two simple and straight-forward questions have good face validity, since both flirtation and smiling are well-understood terms in the vernacular.

Physical aggression questionnaire. The Physical Aggression Questionnaire of Buss and Perry (1992) was used with slight modifications, including changing the Likert scale wording (*never* = 1, *sometimes* = 2, *frequently* = 3, *very frequently* = 4, *always* = 5), and changing the direction of rating to be consistently the same. The nine physical aggression items queried being unable to control the urge to strike someone, hitting with provocation, hitting back, getting into fights more than average, resorting to violence to protect rights, coming to blows if pushed too far, having good reasons for hitting, threatening others, and breaking things in anger. A physical aggression total score was calculated by adding the item values. Scores could range from nine to 45, with high scores indicating high aggression. The Physical Aggression scale and other scales were constructed by Buss and Perry from replicated factor analyses on items assessing physical aggression, verbal aggression, anger and hostility in a sample of 1,253 college students. Evaluation of the internal consistency for the Physical Aggression scale yielded an alpha coefficient of .85, and the test-retest reliability correlation was .80.

Relational aggression questionnaire. The Relational Aggression items consisted of the seven items suggested by Werner and Crick (1999) with slight modification, such as changing the Likert scale categories (*never* = 1, *sometimes* = 2, *frequently* = 3, *very frequently* = 4, *always* = 5), and altering the wording to allow self vs. peer rating. Behaviors evaluated included use of the "silent treatment", damaging reputation with gossip, excluding and ignoring others, threatening to share private information, and attempting to steal a dating partner. Each item involved a self-rating on the 5 point Likert scale, with the direction such that a higher number was associated with higher aggression. Total scores can range from seven to 35. Werner and Crick evaluated 225 college students, and reported good reliability, with a Cronbach's alpha of .87.

2D:4D finger length ratios. Photocopies of both hands with fingers together and rings removed were obtained. The length in millimeters was measured from the proximal crease at the base of the digit to the tip of the finger. The ratios of the length of the second to fourth finger (2D:4D) of the right and left hands were calculated. As discussed, smaller ratios are found in men compared to women.

Results

Sex differences in 2D:4D and physical aggression were found, consistent with other reports (Table 1). The male participants reported higher physical aggression and both right and left 2D:4D were lower in the male than the female participants, as in the literature reviewed. There was a trend for greater use of flirtation by the female than male participants.

Table 1. Means (*SD*) for male and female participants

	Male	Female	<i>t</i>	<i>p</i>
Smiling	2.7 (.8)	2.9 (.9)	1.27	.104
Flirtation	2.3 (.7)	2.6 (1.0)	1.52	.065
Physical aggression	18.1 (6.6)	13.2 (3.4)	4.63	.000
Relational aggression	10.3 (2.1)	10.2 (2.0)	.175	.430
Right 2D:4D	.956 (.042)	.975 (.035)	2.34	.011
Left 2D:4D	.947 (.041)	.969 (.030)	2.97	.002

Note: significant differences, and those approaching significance, are in bold.

Separate regressions were done with smiling and flirtation as the criterion variables, and sex, relational aggression, physical aggression and right and left 2D:4D as the predictor variables. Significant models emerged for both smiling ($F(5,85) = 3.79$; $p = .004$, adjusted R -square = .134) and flirtation ($F(5,85) = 2.63$; $p = .029$, adjusted R square = .083) (Tables 2). Greater smiling was associated with greater relational aggression and a more male-typical right 2D:4D ratio; a trend was seen for greater smiling in the female than male participants. Greater flirtation was similarly associated with greater relational aggression and with a more male-typical right 2D:4D ratio, with a trend for an opposite pattern in the left 2D:4D ratio. There was also a trend for greater use of flirtation in the female than male participants.

Given the current focus on sex differences, separate regressions were done for the male and female participants with smiling and flirtation as criterion variables and relational aggression, physical aggression and right and left 2D:4D as the predictor variables. For smiling, a significant model emerged for the male participants ($F(4,31) = 3.08$; $p = .030$, adjusted R -square = .192), and emerged at a trend level for the female participants ($F(4,50) = 2.37$, $p = .065$, adjusted R -square = .092). Greater smiling was associated with greater relational aggression in both the male and female participants, and greater smiling was associated with a more male-typical pattern in the right 2D:4D ratio for the female participants.

For flirtation, the model was significant for the female participants ($F(4,50) = 3.96$, $p = .007$; adjusted R -square = .180), and insignificant for the male participants ($F(4,31) = 1.12$, $p = .366$; adjusted R -square = .012). For the female participants, greater flirtation was associated with a more male-typical pattern in the right 2D:4D ratio, and there was a trend for greater flirtation to be associated with greater physical aggression.

Table 2. Beta values and significance levels of predictors for separate regression analyses, both combined and sex specific, on smiling and flirtation variables

Predictor variable	Criterion variable			
	Smiling		Flirtation	
	β	p	β	p
<i>Sex combined</i>				
Relational aggression	.328	.002	.232	.029
Physical aggression	.129	.256	.135	.250
Right 2D:4D	-.285	.045	-.307	.036
Left 2D:4D	.151	.292	.250	.092
Sex	.220	.059	.221	.064
<i>Males only</i>				
Relational aggression	.470	.005	.286	.104
Physical aggression	.190	.247	-.099	.580
Right 2D:4D	-.099	.658	.103	.674
Left 2D:4D	.008	.971	.161	.503
<i>Females only</i>				
Relational aggression	.288	.045	.171	.205
Physical aggression	-.006	.967	.252	.061
Right 2D:4D	-.409	.024	-.454	.009
Left 2D:4D	.235	.193	.230	.179

Note: significant differences, and those approaching significance, are in bold.

Discussion

In the present study, men reported more physical aggression than women, and had lower 2D:4D finger length ratios than women, consistent with the literature reviewed. Additionally, there was a trend for greater use of flirtation by women compared to men. Use of smiling and flirtation to make others receptive to one's ideas was related to relational aggression and a more male-typical 2D:4D finger length ratio in the combined sex sample.

The only significant relationship in the male sample alone was the relationship between smiling and relational aggression. In the female sample alone, use of smiling and flirtation to "make people receptive to my ideas" was associated with a more male-typical 2D:4D finger length ratio pattern, and there was a trend for flirtation to be associated with greater physical aggression. As discussed, both 2D:4D and physical aggression have been associated with higher prenatal androgen level.

The use of smiling and flirtation to "make others receptive to my ideas" implies a less than sincere display of facial expression and behavior as a means to an end. An attempt to influence others with less than honest behavior is manipulative, and can possibly be seen as a form of mild aggression. Certainly the strong relationships in the current dataset found between smiling and flirtation and relational aggression suggest this.

Thus, these data suggest that use of smiling and flirtation can be more than a signal of submission/lower status or cooperation. Deceptively signaling cooperation or

submission may at times be an effective means of controlling a situation. Smiling has been shown to greatly influence outcomes. For example, LaFrance and Hecht (1995) showed that smiling resulted in lesser sentences for court convictions, and Mullen et al. (1986) reported that newscasters' smiles influenced candidate choice.

When behavior occurs with opposite-sexed pairs, smiling may at times be part of flirtation. Grammer, Kruck, Juette, and Fink (2000) presented data indicating that women initiate and control outcomes of interactions with male strangers by using flirtation ("solicitation" or courtship-like behavior) that is not strongly related to professed interest in the man in the initial stages. Tidd and Lochard (1978) reported that men gave bigger tips than women to a smiling waitress. Thus, smiling in general, and flirtation may be very effective means to very significant ends.

Mehu and Dunbar (2008) evaluated the Power Asymmetry Hypothesis of Preuschoft and van Hooff (1995), which suggests that the type of social organization determines the meaning of displays, and thus predicts that appeasement and affiliation signals sent and received depend on status differentiation. Mehu and Dunbar (2008) evaluated smiling in people, and found that younger and presumably lower status men showed more deliberate (vs. spontaneous) smiles when interacting with older and presumably higher status men. The authors interpreted this as reflecting that "deliberate smiles could play a role in the regulation of hierarchical relationships." This interpretation is very similar to the interpretation of the present dataset that less than sincere smiles can be at least mildly manipulative.

Sincere smiling may certainly indicate submission or affiliation, as the numerous studies reviewed earlier have demonstrated, but insincere or deceptive use of smiling and flirtation to "make others receptive to my ideas" may be very different. Manipulative smiling and flirtation were both related to a more male-typical 2D:4D pattern, suggesting prenatal androgen activity as an underlying correlate. The trend for a relationship in the female participants between a more male-typical 2D:4D pattern and physical aggression is also suggestive of an underlying prenatal androgenic correlate, as the relationship between physical aggression and androgens has been well-documented.

It should be noted that although the questions assessing use of smiling and flirtation were quite literal and appeared to have good face validity, some participants may have just responded to the "smiling" or "flirtation" or "make people receptive" parts of the questions. Thus, it is possible that a participant focused on the smiling concept and responded that he or she smiles a lot, or similarly, focused more on the manipulation or flirtation concepts. The fact that similar relationships were found between both smiling and flirtation and the other variables lends support to the idea that they did interpret the question as intended, since the commonality between the two questions was the concept of making others receptive to one's ideas.

In sum, it is concluded that deliberate smiling and flirtation to make others receptive to one's ideas are forms of mild relational aggression, and are related to prenatal androgenic activity in a manner similar to physical aggression. The present data suggest that women use deliberate smiling and flirtation more than men, and this may reflect the different resources that men and women have available. An obvious resource men have more available to them than women is larger physical size; perhaps evolutionary pressures

resulted in an elaboration of this variable into the greater physical aggression seen in men compared to women. Analogously, a resource women have more available to them than men is better understanding of facial emotion and social/emotional interpersonal understanding in general (Bar-On, 1997; Burton, Hafetz, and Henninger, 2007; Burton, Rabin, Wyatt, Frohlich, Vardy, and Dimitri, 2005), and perhaps selection pressures resulted in an elaboration of these variables into the generally higher level of relational aggression (Crick and Grotpeter, 1995) and use of deliberate smiling seen women compared to men. The present study suggests that deliberate smiling and flirtation can be considered effective mildly aggressive behaviors for controlling and influencing social situations.

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