RESEARCH ARTICLES

Smiling and Laughter in Naturally Occurring Dyadic Interactions: Relationship to Conversation, Body Contacts, and Displacement Activities

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Abstract

Although research suggests that different types of smiles have different meaning, and possibly different functions, observational evidence to support that claim is relatively rare. The present study reports ethological observations on the frequency of smiling and laughter during naturally occurring dyadic interactions taking place in bars and cafés. Smiles were classified along two dimensions: spontaneous/deliberate and open/closed. Younger individuals displayed more laughter, spontaneous smiles and open smiles. People tended to smile more to individuals of their own sex and this was particularly salient for closed smiles, which appeared at significantly higher rates in male dyads. Different forms of smiles and laughter also varied with the behavioural context, characterized in this study by conversation time, displacement activities, and body contacts. The present findings also suggest that laughter plays a role in regulating partner's speech. This article supports the assumption that different forms of smiles have different functions in social relationships: Open and spontaneous smiles could be related to affiliation/bonding; whereas closed and deliberate smiles could be related to the regulation of status based social interactions. The relationship between smiling and laughter is also discussed.

Keywords: Smiling, Laughter, Smile Types, Conversation, Displacement Activities, Body Contact, Observational Study

Introduction

Building social relationships generally entails a series of interactions during which people are able to elicit the disclosure of valuable information by others and thereby acquire adaptive social knowledge. In order to achieve such a level of social expertise, people make use of a variety of information conveyed through diverse channels, including verbal exchanges and nonverbal cues (Grammer, Fivola, & Fieder, 1997). These different means of communication are believed to interact with each other to form a coherent system aimed at solving social issues such as mate choice (Grammer, 1989; Moore, 1985), social competition (Cashdan, 1998), or cooperation (Brown, Palameta, & Moore, 2003).

Smiling and laughter are ubiquitous in social interactions over the life time, starting from a very young age (Washburn, 1929; Wolff, 1963) and continuing into adulthood (Mehu & Dunbar, 2008a; Otta, 1998). Previous observations made distinctions between different forms of smiles based on the degree of mouth opening (Brannigan & Humphries, 1972) or the involvement of muscles in the eye region and particular movement dynamics (Duchenne de Boulogne, 1862; Ekman & Friesen, 1982). These different forms of smiles are believed to have different meanings (Ambadar, Cohn, & Reed, 2009; Ekman & Friesen, 1982; Otta, 1996) or functions (Mehu & Dunbar, 2008b). For example, the spontaneous smile, also known as the Duchenne smile (Ekman & Friesen, 1982), is believed to convey positive emotional experience such as joy (Frank, Ekman, & Friesen, 1997) and amusement (Ambadar et al., 2009), but also to

advertise altruistic intentions (Brown et al., 2003; Mehu, Grammer, & Dunbar, 1997). Moreover, the degree of mouth opening in smiling has been associated with increased levels of positive emotion (Ambadar et al., 2009; Messinger, Fogel, & Dickson, 2001; Otta, Abrosio, & Hoshino, 1996). The meaning usually attributed to other forms of smiles revolves around the themes of politeness, embarrassment, and nervosity (Ambadar et al., 2009; Goldenthal, Johnston, & Kraut, 1981; Keltner, 1995). Previous research therefore suggests that smiling may have different motivational bases and possibly different functions.

The role played by different forms of smiles in naturally occurring social interactions has generally been overlooked, as previous research mostly entailed rating studies of posed behaviour or investigations of facial displays recorded in constrained laboratory settings. Previous observational research showed that smiling and laughter could be involved in the formation of cooperative relationships (Mehu & Dunbar, 2008a) via the advertisement of prosocial dispositions (Brown et al., 2003; Mehu et al., 2007; Mehu, Little, & Dunbar, 2007; Tidd & Lockard, 1978). Although smiling and laughter were found to vary with 'demographic' factors such as group size or the age and sex of individuals involved (Adams & Kirkevold, 1978; Chapell, 1997; Mehu & Dunbar, 2008a), previous studies tell us little about the interactive mechanisms through which smiling and laughter could lead to social bonding.

The present study investigates the behavioural and social context of different forms of smiling and laughter as they appear in informal dyadic interactions. If smiling and laughter function to manage cooperative or competitive relationships they should be linked to a series of interpersonal behaviours that have been shown to occur repeatedly during affiliative and agonistic interactions. These behaviours are displacement activities, speaking and listening, and body contacts. Although they have been rarely studied in relation to smiling and laughter, these behavioural categories have been considered, in the psychological and ethological literature, as important regulators of social interactions.

Displacement activities form a class of non-verbal behaviours that is widely observed in human social interactions (Eibl-Eibesfeldt, 1989, p. 337; Ekman & Friesen, 1969; Morris, 1982, p. 277). These actions involve the manipulation of objects, clothes or body parts, auto-grooming, scratching, and self-touching, to name a few. The term displacement activity was first introduced by Tinbergen (1952) to describe behaviour that seemed irrelevant to the context in which it appears (Andrew, 1956; Tinbergen & van Iersel, 1948). For example, pecking movements in birds can be observed before or after a sexual fight, although these actions are relevant to foraging (Tinbergen, 1952). Displacement activities are expected to occur 'when an activated motivation is denied discharge through its own consummatory act(s)' (Tinbergen, 1952, p. 26). Tinbergen described two conditions in which this could happen: when there is a conflict between antagonist motivations, and when stimuli responsible for the release of a behaviour are absent.

Although displacement behaviours may not function as social signals, they are believed to reflect the state of tension or anxiety brought about by the social context (Maestripieri, Schino, Aureli, & Troisi, 1992). Generally speaking, social anxiety represents a condition of emotional arousal associated with the anticipation of danger (American Psychiatric Association, 1987; Watson & Friend, 1969). The ambiguity and uncertainty typical of social encounters is likely to provoke such tension. For example, the tension provoked by the conflicting tendencies to disclose relevant information to potential partners and to avoid

social exploitation by hiding informative cues – a situation also known as the communication paradox (Grammer et al., 1997) – could be the main source of emotional arousal in social encounters. Interestingly, research conducted in non-human primates suggests that self-directed activities could be used as reliable behavioural indicators of emotional state associated with social interactions (Aureli & van Schaik, 1991; Aureli, van Schaik, & van Hooff, 1989).

There are a number of ways through which emotional arousal could be linked to social context. First, social tension could result from the uncertainty about the status relationship with the partner. For instance it has been shown that in macaques, uncertainty about the status might give way to increased rates of self-directed activities (Schino, Maestripieri, Scucchi, & Turillazzi, 1990). Second, the perceived risk of aversive consequences might increase the frequency of displacement activities (Rowell & Hinde, 1963; Schino et al., 1990). Social tension could also result from the uncertainty on how to behave next. For example, high rates of scratching were observed in male baboons during group coordination for movement (Kummer, 1968). In addition, Scucchi and colleagues (1991) observed that in opposite-sex pairs of caged long-tailed macaques, males' displacement activities increased during the periovulatory phase of the female's menstrual cycle. All in all these studies suggest that various aspects of the social context can lead to a generalized increase in individuals' arousal, which in turn is reflected in self-directed, or displacement activities.

The relationship between smiling and self-directed activities might depend on the type of smile considered and on the context in which people interact. In general, smiling could lessen arousal because it reduces the ambiguity associated with the social context. This reduction of ambiguity could probably follow the interpretation made by the perceiver of the social situation, through association of a sender's particular type of smile with some aspect of the context. For example, certain types of smiles could reduce social tension by settling the status relationship between the partners. Interestingly Schino et al. (1990) observed that two unfamiliar macaques caged together showed decreased rates of scratching when formal indicators of status difference – such as the silent bared-teeth display (de Waal & Luttrell, 1985) – were exchanged.

It would be unreasonable to question the role of language in the development of social relationships. However the importance of verbal exchange might be dependent on its link to behaviour, as talking, laughing and smiling are often performed together as parts of a given social episode (Provine & Fischer, 1989). Considering the dynamic flow of social interactions, it has been suggested that laughter regulates conversational behaviour (Dunbar, 1996, p. 191; Seepersand, 1999). For example Provine (1993) showed that the amount of laughter and the relative contribution of speaker and audience laughter depended on the sex composition of a group. For example, in most types of dyads that he surveyed, speakers were laughing more than listeners (see also Vettin & Todt, 2004). Interestingly, that pattern was reversed when the speaker was a man and the audience was composed of women. Overall, male speakers were more efficient at eliciting audience laughter than female speakers (Provine, 1993). Women were also found to laugh more than men when interacting with opposite-sex individuals (Grammer & Eibl-Eibesfeldt, 1990; Mehu & Dunbar, 2008a). We should then expect a relationship between laughter and talking time, and this relationship should depend on the sex of individuals involved.

The relationship between smiling, laughter, listening, and talking could inform about the function of the former two behaviours in social

interactions. For instance smiling and laughter could act as backchannels to send nonverbal feedback to a speaker (Brunner, 1979), in which case they should be positively related to listening time. On the other hand smiling and laughter could be used to emphasize speech, i.e. to draw attention to what is said, or to place positive valence on utterances. In this case we should expect a positive relationship between smiling, laughter and talking time. In addition, the relationship between smiling, laughter and conversation could depend on the type of smiles and laughs considered. Some smile/laugh types could function as backchannels while other types could function as speech emphasizers.

In addition to self-directed activities and conversational behaviour, body contacts are included in the present study in order to provide a measure of intimacy between participants. Physical proximity has been related to smiling and laughter (Chapman, 1975; McAdams, Jackson, & Kirshnit, 1984). If smiling and laughing are involved in the process of bonding between people, they could have a particular relationship to linking behaviours such as non-aggressive body contacts. Frequent and long body contacts observed in informal conversations are believed to reflect closeness between two persons (Argyle, 1988, p. 214; Morris, 1982, p. 140), and such a degree of closeness could be attained with the use of visual or auditory signals sent from a distance. Particular forms of smiling and laughter could therefore play a role in reducing physical space between interacting partners.

The main objective of this article is to investigate the social and behavioural context of different types of smiles and laughs. More specifically, this study investigates how smiling and laughing varies with age and sex of individuals involved in informal, naturally occurring, social interactions; and how these behaviours relate to conversation, body contacts, and displacement activities.

Method

Subjects

Most subjects were white Caucasians, and due to restriction imposed by anonymity, no systematic examination was made of background variables. Eighty four individuals, 41 men and 43 women, were covertly observed in naturally occurring social interactions in four different bars and cafés. Participants were classified into sex and age classes. Four age classes were defined on the basis of external appearance and approximately corresponded to the following life stages: late teenage (15-25), young adult (25-35), mature adult (35-45), old adult (45 and older). In order to eliminate variation due to group size (Mehu & Dunbar, 2008a), people were observed interacting in dyads. The sex and age of the interacting partner were also recorded.

Behaviours

The behaviours recorded in the present study are described in Table 1. Smiles and laughs were classified in different categories. Smiles were classified along two dimensions: spontaneity and mouth opening. The first dimension included two smile types: spontaneous and deliberate. The spontaneous smile was similar to the Duchenne smile described by Ekman and Friesen (1982), i.e. it had to be symmetric and to entail facial activity in the eye region. The deliberate smile category included all other types of smiles, for example "false" or "miserable" smiles (Ekman & Friesen, 1982), and the smiles on which an obvious voluntary control was imposed. The voluntary nature of smiles was inferred using two criteria: symmetry and timing. Asymmetric smiles and smiles with abrupt onsets and offsets were considered as deliberate smiles. The second dimension, mouth opening, also included two categories: open smile and closed smile. The open smile is a smile during teeth

can be observed as a result of mouth opening. It corresponds to Brannigan and Humphries' (1972) upper smile and broad smile. The closed smile, also called the simple smile (Brannigan & Humphries, 1972) is a smile performed with a closed mouth.

Table 1. *Behavioural Variables*

Behaviour	*Description*
Open Smile	Spontaneous smile open mouth
Closed Smile	Spontaneous smile closed mouth
Deliberate Open Smile	Deliberate smile open mouth
Deliberate Closed Smile	Deliberate smile closed mouth
Low Laughter	Low intensity spontaneous laugh
Medium Laughter	Medium intensity spontaneous laugh
High Laughter	High intensity spontaneous laugh
Deliberate Laughter	Deliberate laugh
Talk	Talking to the partner
Listen	Listening to the partner
Out	Attention directed outside the dyad
Yawn	Yawning
Nod	Head-nod
Touch	Brief contact with the partner
Contact	Long contact with the partner
Kiss Lip	Kissing partner's lips
Kiss Head	Kissing partner's head
Kiss Body	Kissing partner's body
Auto-Face	Fiddling or self-grooming in the face area
Auto-Hair	Fiddling or self-grooming one's hair
Auto-Hand	Fiddling or self-grooming one's hands
Object	Fiddling with an object or with clothes
Adjust	Adjust one's hair or clothes

Laughter was categorized according to three levels of intensity: low, medium, and high. The intensity was assessed by the inclusion of four components typical of laughter (Ruch & Ekman, 2001): staccato breathing, vocalization, open-mouth, and body movement (mainly head, shoulders and trunk). The presence or absence of these factors determined the intensity of laughter as follows:

- Low intensity: brief exhalations with limited vocalization (up to three notes), mouth slightly open or closed, rhythmic shoulder movements, and the trunk slightly tilted forward or backward.
- Medium intensity: prolonged vocalization (more than three notes), open-mouth, same body movement as low intensity but rhythmically more pronounced.
- High intensity: loud and prolonged vocalization, open-mouth, head and trunk goes abruptly backward (sometimes forward).

Procedure

People were observed from a distance of 5–20m. Individuals were selected if their face was accessible to the observer and if they were interacting in a stable pair, i.e. if no third party came to be involved in the interaction. Interactions with passers-by were not recorded. All occurrences of the behaviours described below were sampled during focal observations performed on one individual at a time (Altmann, 1974). Sampling duration varied from 10 to 30 minutes depending on the availability of individuals (M = 15.5, SD = 4.35). Data covered a total of 21.7 hours of observation and were collected everyday of the week between 1 and 9 pm, with most observations being made between 4 and 7 pm[1]. Behaviours were encoded in a Psion Workabout 3.1 and then transferred to the

[1] Smiling and laughter rates varied neither with the day of week nor with the time of day that the observations were made.

Observer 5.0 for storage and labelling. The duration of the following behaviours was recorded using the state function of the Observer 5.0: talk, listen, out, and contact. All the other behaviours were described as events.

Data analysis

All event behaviours were transformed into a rate per minute by dividing the total frequency by total observation time whereas state behaviours such as talking and listening were converted into percentages of the total observation time. All displacement activities were added together to form a single index (also expressed in rate per minute) representing the general arousal brought about by the social context. Due to the small observed frequency of body contacts between participants, people were classified in two groups according to their involvement in body contacts: contact or no contact.

The effect of age and sex of individuals was assessed using univariate analyses of variance performed separately on each smile type and laughter. Because different forms of smiles could be affected in a different way, each dimension of smiling was the object of a separate analysis. It is important to note that smile dimensions are not exclusive of each other. Therefore the analysis of one category of a dimension involves both categories of the other dimension.

Correlation and regression analyses further investigated the relationships between the different behavioural and contextual variables: the sex and age of the focal individual, the sex and age of the interacting partner, head-nods (rate per min.), self-directed behaviours (rate per min.), laughter (rate per min.), talking and listening time (percentage of the observation period spent talking/listening).

Results

Effect of Sex and Age on Smiling and Laughter

Smiling

The impact of sex composition and age composition of dyads on the different types of smiles was assessed using Student t tests. Sex composition of dyads affected the frequency of closed smile rates, $t(82) = 2.35$, $p < .02$. Dyads of the same sex ($M = 0.73$, $SD = 0.54$, $N = 43$) tended to show higher rates of closed smiles than mixed sex dyads ($M = 0.49$, $SD = 0.39$, $N = 41$). Other smile types were not influenced by sex composition of dyads. The age composition of dyads had a marginally significant impact on the frequency of open smiles, $t(82) = 1.92$, $p < .06$, as individuals tended to show more open smiles when interacting with people of their own age ($M = 0.83$, $SD = 0.73$, $N = 62$) than with people of a different age class ($M = 0.51$, $SD = 0.47$, $N = 22$). Other smile types were not affected by the age composition of dyads.

The effects of sex and age on the different types of smiles were further investigated in 2 (sex of focal individual) × 2 (age of focal individual) × 2 (sex of interacting partner) × 2 (age of interacting partner) univariate analyses of variance. A separate analysis was conducted for each type of smile. There was a main effect of age on spontaneous smile rates $F(1, 83) = 5.34$, $p = .02$ and on open smile rates $F(1, 83) = 5.07$, $p = .03$. Individuals younger than 35 years old displayed higher rates of spontaneous smiles and open smiles than older individuals (Table 2).

There was no main effect of age or sex on deliberate smiles. However there was a significant interaction effect between sex and age of interacting partner, $F(1, 83) = 5.19$, $p = .03$, suggesting that the partner's sex has an influence depending on his/her age. On average, mature men received significantly more deliberate smiles ($M = 0.22$, $SD = 0.20$, $N = 12$) than mature women ($M = 0.11$, $SD = 0.12$, N

= 14), $F(1, 26) = 5.26$, $p = .03$, whereas young men and women received equal amounts of deliberate smiles, $F(1, 49) = 0.72$, $p = .40$ (Figure 1). The interaction effect also pointed out that when the interacting partner was a man, mature individuals appeared to received more deliberate smiles ($M = 0.22$, $SD = 0.20$, $N = 11$) than younger ones ($M = 0.14$, $SD = 0.15$, $N = 32$), $F(1, 35) = 3.73$, $p = .06$, whereas this effect was non-significant when the partner was a woman, $F(1, 31) = 1.64$, $p = .21$ (Figure 1).

Univariate analyses also revealed that the frequency of closed smiles was affected by the sex of focal individual, $F(1, 83) = 3.98$, $p = .05$, men displayed significantly higher rates of closed smiles than women (Table 3). There was also a significant interaction effect between sex of focal and sex of interacting partner on closed smiles, $F(1, 83) = 10.29$, $p = .002$, indicating that the sex difference was mediated by the sex of the interacting partner. When interacting with other men, men showed significantly higher rates of closed smiles than women, $F(1, 35) = 12.21$, $p = .001$, whereas this sex difference was absent when the partner was a woman, $F(1, 31) = 1.32$, $p = .26$. On the other hand, women gave more closed smiles to other women than to men, $F(1, 34) = 24.48$, $p < .001$. All in all these results indicate that people tend to display more closed smiles to individuals of their own sex (Figure 2).

Laughter

Laughter of the high intensity category were too rare to be considered for statistical analysis. They were therefore grouped with laughter of medium intensity and treated as a single category of moderate to high intensity laughter. Low intensity laughter constituted a class of its own. The age composition of dyads had a significant impact on the frequency of laughter of high intensities $t(79) = 2.90$, $p < .005$. Laughs of high intensities were more frequent in same age ($M = 0.19$, $SD = 0.29$, $N = 62$) than in mixed age dyads ($M = 0.07$, $SD = 0.08$, $N = 22$). Although low intensity laughter was not affected by the age composition nor the sex composition of dyads, younger individuals displayed more of these laughs than older individuals, $F(1, 83) = 4.76$, $p = .03$ (Table 2). There was no effect of sex or age (of either of the protagonists) on laughter rates.

Table 2. *Frequencies of Smiling by Age Categories*

Age Of Focal Individual		*Young* *N = 57*	*Mature* *N = 27*	*Total* *N = 84*
Spontaneous Smiles	Mean	1.37	0.86	1.21
	SD	0.77	0.73	0.79
Deliberate Smiles	Mean	0.15	0.14	0.15
	SD	0.16	0.13	0.15
Open Smiles	Mean	0.90	0.41	0.74
	SD	0.74	0.42	0.69
Closed Smiles	Mean	0.62	0.59	0.61
	SD	0.49	0.48	0.49
Low Intensity Laughter	Mean	0.37	0.18	0.31
	SD	0.28	0.25	0.28
High Intensities Laughter	Mean	0.18	0.12	0.16
	SD	0.28	0.21	0.26

Note. Young adults <35 years, mature adults > 35 years

Table 3. *Mean Frequencies (Rate per Minute) and Standard Deviations for Smiling and Laughter Rates According to the Sex Composition of Dyads*

Sex Of Focal		*Male*			*Female*		
Sex Of Friend		*Male* N = 22	*Female* N = 19	*Total* N = 41	*Male* N = 22	*Female* N = 21	*Total* N = 43
spontaneous smiles	Mean	1.38	1.19	1.29	1.00	1.27	1.13
	SD	0.80	1.00	0.89	0.68	0.68	0.68
deliberate smiles	Mean	0.16	0.14	0.15	0.16	0.14	0.15
	SD	0.13	0.13	0.13	0.20	0.15	0.18
open smiles	Mean	0.66	0.67	0.67	0.82	0.82	0.82
	SD	0.51	0.93	0.72	0.71	0.61	0.66
closed smiles	Mean	0.87	0.66	0.77	0.34	0.58	0.46
	SD	0.62	0.44	0.55	0.27	0.41	0.36
low intensity laughter	Mean	0.35	0.25	0.30	0.28	0.35	0.31
	SD	0.30	0.21	0.26	0.30	0.32	0.31
high intensities laughter	Mean	0.18	0.10	0.14	0.20	0.16	0.18
	SD	0.29	0.15	0.24	0.34	0.21	0.28

Figure 1. *Effect of sex and age of interacting partner on deliberate smiles (young<35years, mature>35years)*

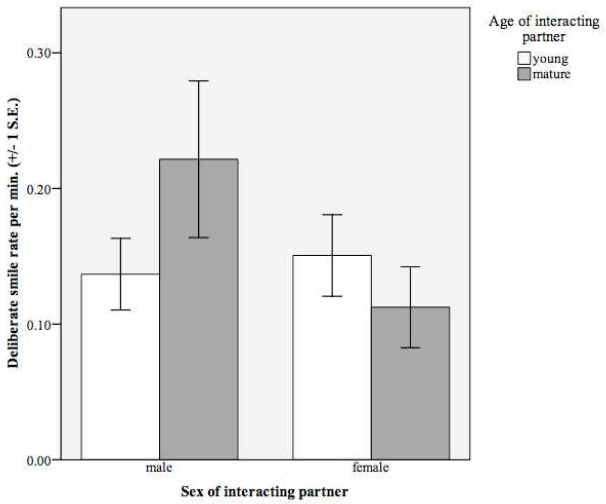
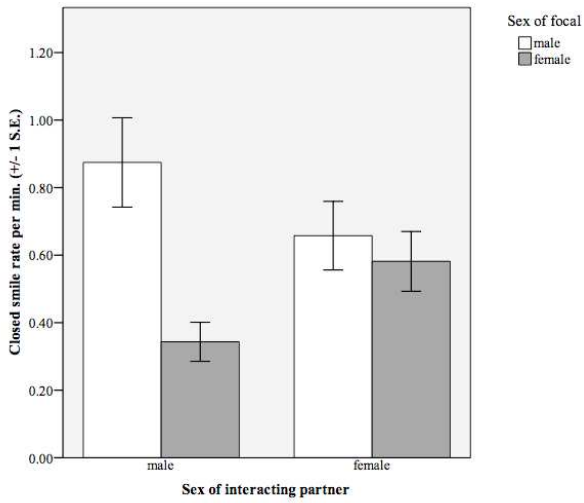


Figure 2. *Effect of Sex Composition of Dyads on Closed Smiles*



Behavioural Context of Smiling and Laughter

Correlation analysis was performed to assess the relationships between the behavioural variables under study (Table 4). Spontaneous smiling was positively associated with open smiles, closed smiles, laughter, and talking time; whereas deliberate smiling was positively related to closed smiles, head nods, listening time, and negatively related to displacement activities. Open and closed smiles were positively associated with laughter rate and

with spontaneous smiles. Due to the small frequencies of body contacts, their relation with smiling and laughter is treated in a separate analysis.

Further analysis was conducted to assess the relative contribution of social and behavioural variables on smiling and laughter. Each type of smile and laugh was treated as a dependent variable in a regression analysis. The different analyses yielded significant models, but the number and type of predictors emerging as significant varied with the type of smile and laugh considered (see Table 5 and 6, respectively).

Spontaneous smile rate was significantly associated with laughter rate, age of focal individual, and talking time. Laughter rate and talking time had a positive relationship to spontaneous smile rate whereas the age of focal was negatively related to spontaneous smiles, indicating that smile rate tended to decrease as age increased. The rate of deliberate smile was positively related to listening time (Figure 3) but not talking time. On the other hand there was a negative relationship between the rate of deliberate smile and the frequency of displacement activities (Figure 4). Open and closed smiles were both significantly and positively related to laughter rate. However these two forms of smiling were affected in a different way by the sex and age of individuals (see above).

The analysis of laughter showed that spontaneous smiling was the most significant predictor and was positively associated with all types of laughter, regardless of intensity (Table 6). In addition, low intensity laughter was positively related to listening time but negatively related to head-nod.

Smiling, Laughter, and Body Contact

The overall rate of body contacts did not have the properties needed to perform parametric statistical tests. People were therefore classified in two groups according to their involvement in body contacts (contact or no contact). A Student t-test was conducted to estimate whether these two groups differed with respect to smiling and laughter rates. Men and women were analysed separately.

Analysis showed that the association between smiling and body contacts depended on the type of smile considered and the sex of the individuals involved. There was a significant difference in open smile rates between contact and no-contact individuals in women, $t(42) = 2.18$, $p = .03$, but not in men, $t(40) = 0.19$, $p = .85$, indicating that women who had at least one body contact during the interaction exhibited higher rates of open smiles ($M = 1.16$, $SD = 0.61$, $N = 12$) than women who showed no contact ($M = 0.69$, $SD = 0.64$, $N = 31$). The sex difference within the 'contact' category was also significant, $t(20) = 2.19$, $p = .04$, indicating that women showed higher rates of open smiles ($M = 1.16$, $SD = 0.61$, $N = 12$) than men ($M = 0.71$, $SD = 0.31$, $N = 9$) when they had at least one physical contact with their friend (Figure 5).

Laughter rates were related to body contacts in a similar way than open smiles were. Women who had at least one physical contact with their friend displayed significantly higher rates of laughter (of any type) ($M = 0.61$, $SD = 0.4$, $N = 12$) than women who had no contact ($M = 0.45$, $SD = 0.51$, $N = 31$), $t(42) = 2.83$, $p = .007$. However, this was not the case for men $t(40) = 0.80$, $p = .43$. The sex difference within the contact category was marginally significant $t(20) = 2.02$, $p = .058$, suggesting that women who had physical contacts with their friends laughed at higher frequencies ($M = 0.61$, $SD = 0.4$, $N = 12$) than men did ($M = 0.33$, $SD = 0.19$, $N = 9$) (Figure 6). Men were inclined to laugh more when they had no body contact with their friends than when they had some. This difference, however, was statistically significant for high intensity laughs only, $t(40) = 2.45$, $p = .02$.

Table 4. *Correlations between spontaneous smile (sps), deliberate smile (ds), open smile (os), closed smile (cs), laughter (lau), headnods (hn), talking (talk), listening (list), and displacement activities (displ). All variables are expressed in rate per min., except talking and listening time that represented percentage of total observation time spent talking/listening.* $^{*}p < .05$, $^{**}p < .01$

	sps	*ds*	*os*	*cs*	*lau*	*hn*	*talk*	*list*	*displ*
sps		.02	.80**	.49**	.58**	-.08	.22*	.05	.07
ds			.08	.23*	-.01	.22*	-.07	.38**	-.25*
os				-.09	.47**	-.09	.14	.06	.09
cs					.28*	.07	.13	.11	-.09
lau						-.04	.09	.17	.07
hn							-.17	.57**	-.19
talk								-.48**	.05
list									-.05

Table 5. *Summary of Stepwise Regression Analyses Performed On the Different Types of Smiles (Rates per Minute)*

Smile type	*F*	R^2_{adj}	*Predictors*	*B*	*SE B*	*β*	*t*
Spontaneous	19.02**	.39	(constant)	1.80	0.33		5.41**
			laughter	0.27	0.45	.52	5.93**
			age foc	-0.20	0.08	-.22	-2.55**
			talking	0.01	0.01	.18	2.05*
Deliberate	9.85**	.18	(constant)	0.09	0.05		1.89
			listening	0.01	0.01	.37	3.69**
			displ.act.	-0.4	0.02	-.23	-2.27*
Open	17.72**	.29	(constant)	1.76	0.24		7.23**
			laughter	0.18	0.43	.41	4.28**
			age foc	-0.24	0.75	-.30	-3.13**
Closed	9.28**	.17	(constant)	0.91	0.08		10.84**
			sex foc	-0.32	0.10	-.33	-3.30**
			laughter	0.09	0.03	.28	2.83**

Notes. Predictors are: sex of focal (sex foc), age of focal (age foc), sex and age of interacting partner, head-nod (rate per min.), laughter (rate per min.), displacement activities (displ. act., rate per min.), talking and listening time (proportion of total observation time). $^{*}p < .05$, $^{**}p < .01$, $N = 84$

Table 6. *Summary of Stepwise Regression Analyses on Different Types of Laughter (Rate per Minute)*

Laughter type	*F*	R^2_{adj}	*Predictors*	*B*	*SE B*	*β*	*t*
Low Intensity	17.46**	.39	(constant)	-0.11	0.08		-1.33
			spont. smile	0.18	0.03	.50	5.67**
			head-nod	-0.08	0.02	-.39	-3.71**
			listening	0.004	0.00	.23	2.13*
Medium+High Intensities	16.14**	.15	(constant)	-0.002	0.05		-0.04
			spont. smile	0.13	0.03	.40	4.02**

Notes. Predictors are: sex and age of focal individual, sex and age of interacting partner, spontaneous smiles (spont. smile, rate per min.), deliberate smiles (rate per min.), head-nod (rate per min.), displacement activities (rate per min.), talking and listening time (proportion of total observation time). $^{*}p < .05$, $^{**}p < .01$, $N = 84$

Figure 3. *Relationship between Deliberate Smiles and Listening Time*

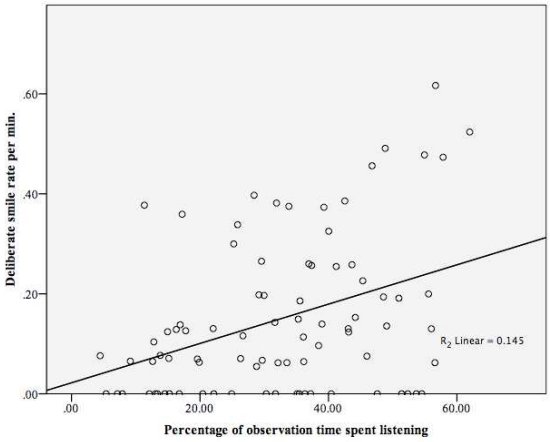


Figure 4. *Relationship between Deliberate Smiles and Displacement Activities*

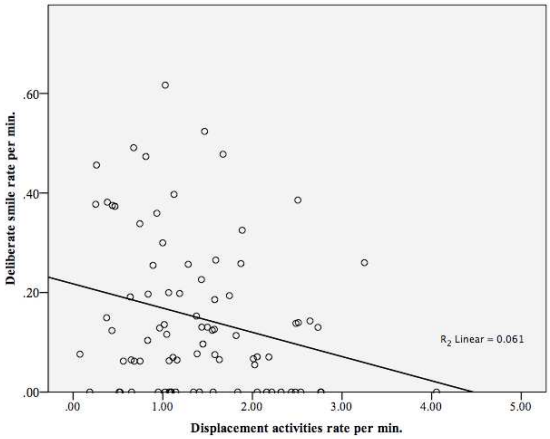


Figure 5. *Body Contact and Open Smiles in Men and Women*

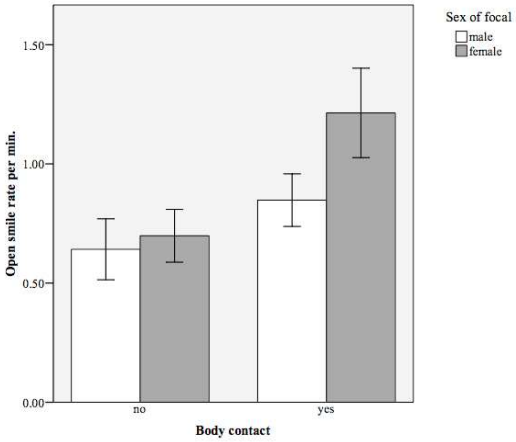


Figure 6. *Body Contact and Laughter in Men and Women*

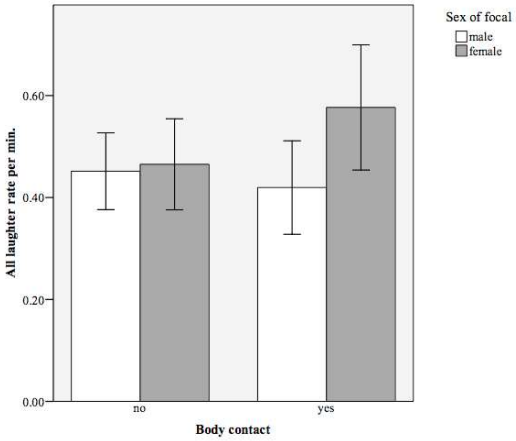


Table 7. *Logistic Regression Coefficients after Non-Significant Predictors Were Removed from the Model*

	Predictors	*B*	*SE*	*Wald* χ^2	*p*	*EXP (B)*
Males	Sex Part	3.49	1.44	5.87	0.01	32.73
N = 41	Open Smiles	1.45	0.91	2.55	0.11	4.25
	High Laughs	-11.09	6.06	3.35	0.07	0.00
	Displ. Act.	0.25	0.88	0.08	0.77	1.29
	Forced Smiles	4.11	4.19	0.96	0.33	60.96
	(Constant)	-4.69	2.33	4.07	0.04	0.01
Females	Sex Part	-4.13	1.63	6.43	0.01	0.02
N = 43	Open Smiles	4.38	1.78	6.07	0.01	79.93
	High Laughs	-0.50	2.27	0.05	0.83	0.61
	Displ. Act.	-1.88	0.97	3.77	0.05	0.15
	Forced Smiles	-11.64	4.83	5.80	0.02	0.00
	(Constant)	0.92	1.32	0.49	0.49	2.52

Notes. The dependent variable is the presence or absence of body contact. Predictors are: age of focal individual, age and sex of interacting partner (sex part), talking and listening time (% of total observation time), and open smiles, deliberate smiles, low and high intensity laughter, and displacement activities (displ. act.), as rates per minute.

Finally, a logistic regression was performed in order to estimate the impact of social context and behavioural variables on the probability to observe at least one physical contact during the interaction. Data were analysed separately for each sex. The model was significant (men: χ^2 = 15.21, p = .01; women: χ^2 = 22.82, p < .001; df = 5), and accounted for between 31% and 48.6% of the variance in men, and between 41.2% and 59.3% of the variance in women. Overall, the accuracy of predictions was 87.8% for males and 81.4% for females. The sex of the partner reliably predicted body contacts in men and women, with a higher probability of having physical contacts when interacting with opposite-sex individuals (Table 7). In addition, open smile rates did reliably predict body contacts in women but not in men. There was also a marginally significant trend suggesting that the amount of moderate to high intensity laughter in men could be negatively associated with the odds of having physical contacts. This was not the case for women's laughter. Finally, deliberate smiles and displacement activities did predict body contacts in a negative direction in women only, indicating that high rates of deliberate smiles and self-directed behaviours would decrease the probability of having physical contact.

Discussion

Functional analyses of behaviour depend on the study of the context in which it occurs and on its consequences for the individuals that display it. The main objective of this article was to investigate the social and behavioural context of smiling and laughter as they naturally occur during dyadic conversations. The present study showed that smiling and laughter rates vary with the age and sex of individuals involved and are connected to conversation, body contact, and displacement activities. These relationships varied with the type of smile and laugh, but also with the social context. The discussion will make sense of these data in terms of how smiling and laughter could contribute to the development of social relationships and lead to social bonding.

Smiling

Spontaneous smiling was the only smile type that was invariably associated with laughter rate. The overlap between spontaneous smile and laughter suggests that this form of smile (and to some extent open smile) shares the same motivational basis with laughter. This finding supports previous studies reporting associations between spontaneous smiles and laughter (Mehu & Dunbar, 2008b; Ruch, 1994) and also provides additional evidence that these behaviours frequently co-occur in naturally ongoing interactions. This result also complements a recent perceptual study showing that smiles that are perceived as "amused" more often involve mouth opening, *orbicularis oculi* activity (cheek raise), and a longer duration (Ambadar et al., 2009). Although these findings seem to contradict the proposal that smiling and laughter have different motivational roots (van Hooff, 1972; Lockard, Fahrenbruch, Smith, & Morgan, 1977), not all smile types were positively associated with laughter (for example deliberate smiles). This indicates that spontaneous and open smiles may have the same motivational basis than laughter whereas deliberate smiles may not.

The reason for the overlap between certain forms of smiling and laughter probably lies behind characteristics of the social context of the interaction (Mehu & Dunbar, 2008b; Preuschoft & van Hooff, 1997). The observation that mature men received considerably more deliberate smiles than young men and mature women implies that deliberate smiles could signal a submissive position, assuming that older men usually enjoy higher social status in modern western societies. In that sense, the deliberate smile may have conserved the

similar appeasing function as the silent bared-teeth display in some macaque species (de Waal & Luttrell, 1985), and the underlying motivation may be quite different from the playful attitude manifested in laughter. This also supports the finding that men displaying non-Duchenne smiles in dyadic interaction are perceived as being more fearful (Merten, 1997). More generally, deliberate smiles could be involved in the communication of friendly, polite, and formal agreement. The association between deliberate smiles and deference is also supported by the observation that this smile type is positively related to listening time. Previous research indeed suggest that the act of speaking is positively related to dominance (Islam & Zyphur, 2005; Mullen, Salas, & Driskell, 1989; Rosa & Mazur, 1979; Schmid-Mast, 2002), indicating that increased rates of deliberate smiles while listening may reflect deference to more assertive and dominant individuals.

Frequencies of deliberate smiles were also negatively correlated with displacement activities, as individuals who displayed high rates of deliberate smiles exhibited fewer self-directed behaviours. This may seem at odds with the proposition that deliberate smiles mostly function in hierarchical contexts, as we would expect these contexts to generate social tension, hence more displacement behaviours. An alternative is that deliberate smiles precisely function to attenuate the social tension induced by hierarchical contexts through the establishment of social status within dyads. This explanation is corroborated by previous research on non-human primates that reported decreased rates of scratching in caged macaques after the display of formal signs of status (Schino et al., 1990). Deliberate smiles could therefore lessen the social tension present in social relationships through a reduction of the ambiguity or uncertainty associated with social status. Previous research showed that smiling is indeed associated with embarrassment and could function as an appeasement display (Goldenthal et al., 1981; Keltner, 1995).

Spontaneous smiling was significantly related to age, with a tendency for younger individuals (< 35 years old) to smile more than older ones. This result replicates the finding of a similar effect of age on spontaneous smiling in group interactions (Adams & Kirkevold, 1978; Mehu & Dunbar, 2008a) and could be explained by a variety of factors. First, younger individuals may have greater needs for cooperative relationships as they have had fewer opportunities than older adults to secure long term resources. The idea that the advertisement of cooperative dispositions could be achieved through spontaneous smiling has received support in other studies (Brown et al., 2003; Mehu et al., 2007), and spontaneous (Duchenne) smiling displayed during an interview has been related to better social integration (Papa & Bonanno, 2008).

Alternatively, younger individuals may smile more because they are, on average, of lower status than older individuals. This explanation, however, can be ruled out because we did not observe any effect of age of interacting partner (a proxy for social status) on spontaneous smiles. Finally, emotional expressivity is known to decrease as people grow older (Carstensen, Gottman, & Levenson, 1995; Gross et al., 1997), and this may also play a role, as a proximal factor, in the negative relationship we observed between age and smiling. The present data should encourage further investigations on the socio-emotional factors involved in the display of smiling across the lifespan.

The sex of individuals also had an impact on smiling. Men showed higher rates of closed smile than women, and this effect was particularly strong when men were conversing with other men. This suggests that closed smiles are crucial to male's intra-sexual relationships, either in the regulation of status related tensions or in the establishment of male

alliances. Closed smiles usually represent smiles of low intensity or smiles that involve attempts to control or dampen the display. Less expressive smiles are seen in expressions of pride (Mortillaro, Mehu, & Scherer, 2011; Tracy & Robins, 2004), some form of which is motivated by the achievement of social status (Cheng, Tracy, & Henrich, 2010), an aspect is particularly relevant to all-male interactions (Eibl-Eibesfeldt, 1989). Alternatively, lip pressing is often used in smile control and is common in expressions of embarrassment that are also viewed as displays of appeasement (Keltner, 1995). Smiles that are perceived as polite also tend to involve a closed mouth (Ambadar et al., 2009). All in all it is likely that the high rates of closed smiles observed in interactions between men function as regulators of status relationships; either as a way to convey dominance or as a way to appease the partner.

Beside differences in morphological and dynamical aspects, spontaneous and deliberate smiles are believed to differ in meaning, the former being considered as an indicator of positive emotion and the latter as a "social lubricant" (Ekman & Friesen, 1982; Woodzicka & Lafrance 2005, p.140). Deliberate smiles are often called "social smiles" as they are believed to mislead perceivers into thinking that the signaler feels positive when he or she actually intends to mask negative feelings. Although this paper somewhat corroborates the view that different types of smiles have different meanings, the present data suggest that the spontaneous smile is not necessarily less "social" that the deliberate smile, as it may simply have a different social function, possibly bonding through emotional commitment (for a discussion of the role of emotion in social relationships see also Frank, 1988). In so far as possible, future ethological research should include a combination of measures that address both social factors and emotional experience.

Laughter

On the whole, laughter was poorly associated with the social variables under study. Age appeared to be the only factor associated with laughter rates, as younger individuals showed increased rates of laughter than older individuals. This was mostly the case for low intensity laughs. It is not excluded that the negative effect of age on low intensity laughter reflects high rates of nervous laughter in younger individuals. Nonetheless, given the positive association between spontaneous smiles and laughter rates the effect of age on laughter could be described by similar factors (see above). In particular, the idea that laughter and smiling could be involved in bonding or cooperative signalling (Mehu & Dunbar, 2008a, 2008b) was corroborated by the observation that laughter of high intensities mostly occurred between individuals of the same age. The combination of these two findings suggests that laughter could function to cement coalitions (Eibl-Eibesfeldt, 1989, p. 315).

The finding that laughter was not linked to talking gives little support to Provine (1993) who had found that speakers usually laugh more than listeners. On the other hand, laughter of low intensity was positively predicted by listening time, indicating that it could exercise positive feedback on the partner's speech. A similar relationship between laughter and conversation had already been found in a field study showing that pairs of friends continued talking about a given topic for a longer period of time after one of them had laughed than if neither had laughed (Seepersand, 1999). The present data and Seepersand's study both support the idea that laughter acts as a reward that keeps the speaker engaged in verbal interactions (Dunbar, 1996, p. 191; Weisfeld, 1993). Finally, recent research showed that attempts at humour and responses to it work as indicators of interest in the initiation and maintenance of social relationships (Li, Griskevicius, Durante,

Jonason, Pasisz, & Aumer, 2009). Although the present study did not report the verbal content of conversations, it is not excluded that portions of the laughter observed were reactions to humorous comments. Since laughter is also known to occur in response to "unfunny" comments (Provine, 1993), laughter could generally be used by individuals to probe the interaction partner to disclose more information through the verbal channel.

One could argue that the relationship between laughter and listening time can be compared to the association previously observer between deliberate smiles and listening (see above) and that was interpreted as reflecting a possible role of this type of smile in submissive or formal agreement. This interpretation was corroborated by the finding that deliberate smiles were positively associated with head nods. Interestingly, low intensity laughter was positively related to listening but negatively related to head nod (and unrelated to deliberate smiles), indicating that the type of feedback it provides on the partner's talking activity is of a different nature than that provided by deliberate smiles. The interpretation of the relationship between deliberate smiles/laughter and listening time depends on the meaning attributed to head nods. Nodding is typically used as a backchannel in conversations (Brunner, 1979), in particular when people want to ingratiate themselves with the interlocutor, as opposed to when they want to appear competent (Bergsieker, Shelton, & Richeson, 2010; Godfrey, Jones, & Lord, 1986). This suggests that head nods and deliberate smiles are used in the context of deference rather than in self-assertion. Nevertheless, a limitation of this study is that the proportion of deliberate, or "fake", laughter (Ruch & Ekman, 2001) was difficult to assess. It is not excluded that this type of laughter could play a similar role than the deliberate smile in appeasement or deference during tense social situations. Further research should therefore integrate different types of laughter.

Physical intimacy between partners, as reflected by the presence of body contacts, appeared to be strongly related to women's, but not men's, open smiling and laughter. Women who had at least one body contact with their friend exhibited higher rates of laughter and open smiles than females who showed no contact. Furthermore, among individuals who had body contacts, women showed higher rates of laughter and open smiles than men. In fact, open smiles appeared to positively influence the likelihood of having body contacts in women but not in men. Open smiling and laughter might therefore be more important in female's intimate relationships than in males', and could, in the former, reflect emotional closeness. The finding that high intensity laughter in men seemed to decrease the odds of having physical contacts with their friend indicate that laughter could have a different function in men and women. Finally, the sex of interacting partner appeared to influence body contacts, as it was more likely to observe such contacts when people interacted with opposite sex individuals. Open smiles and laughter may therefore play a role in female, but not necessarily male, courtship strategies.

A limitation of this study is that it was not possible to evaluate the actual relationship between the members of the dyads. The natural context in which these interactions occurred made it difficult to obtain independent indicators of the nature of social situations. In the absence of such measures, the conclusions made on the role of smiling and laughter in cooperative or hierarchical interactions must be taken cautiously. Another limitation is the lack of information concerning the behaviour of the other individual in the dyad. Behavioural data on both individuals would have allowed for a more precise analysis of the social antecedents and elicitors of smiling and laughter. Such a level of detail is, however, difficult to achieve

in natural settings because of the cognitive load placed on the observer during live observation, and because the seating arrangements in public places rarely allow an equivalent access to facial expressions of both members of a dyad. Finally, the present results mostly apply to individuals who frequently visit public places such as bars and cafés, and may not necessarily generalize to the entire range of human social interactions. Nevertheless, the present sample covers a larger variety of individuals than is typically considered in psychological research, which mostly involves populations of undergraduate students.

This study provides observational evidence to substantiate earlier claims that different forms of smiles have different "meanings" (Ambadar et al., 2009; Ekman & Friesen, 1982; Keltner, 1995). Observational studies of this sort are helpful because they show the extent to which different forms of smiles are used in everyday interactions. Future research should involve more precise behavioural recording of social interactions taking place in minimally constraining environments, for example by using video recording and automatic image analysis.

All in all, the present study showed that the displays of smiling and laughter vary with the social and behavioural context of interactions. More importantly, the different smile types were not influenced in the same way by context, suggesting that they have different motivational bases and possibly different functions. While spontaneous and open smiles, and to some extent laughter, could function to foster coalitions and intimate bonds between individuals; deliberate and closed smiles may function to regulate more formal aspects of social interactions. These two facets of smiling have in common the inhibition of hostile inclinations in the partner and are comparable to the function(s) of the silent bared-teeth display in other primate species (Preuschoft & van Hooff, 1997; Waller & Dunbar, 2005). The evolution of smiling may therefore reflect a diversification of behavioural strategies that evolved to accommodate the different shades of affiliation that can be expected in complex social groups.

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References

Adams, R. M., & Kirkevold, B. (1978). Looking, smiling, laughing, and moving in restaurants: sex and age differences. *Environmental Psychology and Nonverbal Behavior*, *3*(2), 117-121.

Altmann, J. (1974). Observational study of behaviour: sampling methods. *Behaviour*, *44*, 227-267.

Ambadar, Z., Cohn, J. F., & Reed, L. I. (2009). All smiles are not created equal: Morphology and timing of smiles perceived as amused, polite, and embarrassed/nervous. *Journal of Nonverbal Behavior*, *33*(1), 17–34.

American Psychiatric Association. (1987). *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed.). Washington DC: Author.

Andrew, R. J. (1956). Normal and irrelevant toilet behaviour in Emberiza spp. *British Journal of Animal Behaviour*, *4*, 85–91.

Argyle, M. (1988). *Bodily communication*. London: Routledge.

Aureli, F., & van Schaik, C. P. (1991). Post-conflict behaviour in long-tailed macaques: II. Coping with the uncertainty. *Ethology*, *89*, 101–114.

Aureli, F., van Schaik, C. P., & van Hooff, J. A. (1989). Functional aspects of reconciliation among captive long-tailed macaques (Macaca fascicularis). *American Journal of Primatology*, *19*, 39–51.

Bergsieker, H. B., Shelton, J. N., & Richeson, J. A. (2010). To be liked versus respected: Divergent goals in interracial interactions. *Journal of personality and social psychology*, *99*(2), 248–264.

Brannigan, C. R., & Humphries, D. A. (1972). Human non-verbal behaviour, a means of communication. In N. G. Blurton-Jones (Ed.), *Ethological studies of child behaviour* (pp. 37–64). Cambridge, UK: Cambridge University Press.

Brown, W. M., Palameta, B., & Moore, C. (2003). Are there nonverbal cues to commitment? An exploratory study using the zero-acquaintance video presentation paradigm. *Evolutionary Psychology*, *1*, 42–69.

Brunner, L. J. (1979). Smiles can be back channels. *Journal of Personality and Social Psychology*, *37*(5), 728–734.

Carstensen, L. L., Gottman, J. M., & Levenson, R. W. (1995). Emotional behavior in long-term marriage. *Psychology and Aging*, *10*, 140–140.

Cashdan, E. (1998). Smiles, speech, and body posture: how women and men display sociometric status and power. *Journal of Nonverbal Behavior*, *22*(4), 209–228.

Chapell, M. S. (1997). Frequency of public smiling across the life span. *Perceptual and Motor Skills*, *85(3)*, 1326.

Chapman, A. J. (1975). Eye contact, physical proximity and laughter: A re-examination of the equilibrium model of social intimacy. *Social Behavior and Personality: an international journal*, *3*(2), 143–155.

Cheng, J. T., Tracy, J. L., & Henrich, J. (2010). Pride, personality, and the evolutionary foundations of human social status. *Evolution and Human Behavior*, *31*(5), 334–347.

Duchenne de Boulogne, G. B. (1862). *The mechanism of human facial expression* (R. A. Cuthbertson, Trans.). New York: Cambridge University Press.

Dunbar, R. I. M. (1996). *Grooming, gossip, and the evolution of language*. London: Faber & Faber.

Eibl-Eibesfeldt, I. (1989). *Human ethology*. New York: Aldine De Gruyter.

Ekman, P., & Friesen, W. V. (1969). Nonverbal Leakage and Clues to Deception. *Psychiatry, 32*(1), 88–106.

Ekman, P., & Friesen, W. V. (1982). Felt, false, and miserable smiles. *Journal of Nonverbal Behavior*, *6*(4), 238–252.

Frank, R. H. (1988). *Passions within reason: the strategic role of the emotions*. New York: Norton.

Frank, M. G., Ekman, P., & Friesen, W. V. (1997). Behavioral markers and recognizability of the smile of enjoyment. *Journal of Personality and Social Psychology, 64(1)*, 83–93.

Godfrey, D. K., Jones, E. E., & Lord, C. G. (1986). Self-Promotion Is Not Ingratiating. *Journal of Personality and Social Psychology*, *50*(1), 106–115.

Goldenthal, P., Johnston, R., & Kraut, R. (1981). Smiling, appeasement, and the silent bared-teeth display. *Ethology and Sociobiology*, *2*, 127–133.

Grammer, K. (1989). Human courtship behaviour: biological basis and cognitive processing. In A. E. Rasa, C. Vogel, & E. Voland (Eds.), *The sociobiology of sexual and reproductive strategies* (pp. 147–169). London: Chapman & Hall.

Grammer, K., & Eibl-Eibesfeldt, I. (1990). The ritualisation of laughter. In W. A. Koch (Ed.), *Natürlichkeit der Sprache und der Kultur: acta colloquii,* Bochumer Beiträge zur Semiotik, 18 (pp. 192–214). Bochum: Brockmeyer.

Grammer, K., Fivola, V., & Fieder, M. (1997). The communication paradox and possible solutions: towards a radical empiricism. In A. Schmitt, K. Atzwanger, K. Grammer, & K. Schäfer (Eds.), *New aspects of human ethology* (pp. 91–120). London: Plenum Press.

Gross, J. J., Carstensen, L. L., Pasupathi, M., Tsai, J., Skorpen, C. G., & Hsu, A. Y. (1997). Emotion and aging: Experience, expression, and control. *Psychology and Aging*, *12*, 590–599.

van Hooff, J. A. (1972). A comparative approach to the phylogeny of laughter and smiling. In R. A. Hinde (Ed.), *Nonverbal communication* (pp. 209–241). Cambridge, UK: Cambridge University Press.

Islam, G., & Zyphur, M. J. (2005). Power, Voice, and Hierarchy: Exploring the Antecedents of Speaking Up in Groups. *Group Dynamics: Theory, Research, and Practice*, *9*(2), 93–103.

Keltner, D. (1995). Signs of appeasement: Evidence for the distinct displays of embarrassment, amusement, and shame. *Journal of Personality and Social Psychology*, *68*(3), 441–454.

Kummer, H. (1968). *Social organization of Hamadryas baboon*. Basel: Karger.

Li, N. P., Griskevicius, V., Durante, K. M., Jonason, P. K., Pasisz, D. J., & Aumer, K. (2009). An Evolutionary Perspective on Humor: Sexual Selection or Interest Indication? *Personality and Social Psychology Bulletin, 35(7)*, 923–936.

Lockard, J. S., Fahrenbruch, C. E., Smith, J. L., & Morgan, C. J. (1977). Smiling and laughter:

different phyletic origins? *Bulletin of the Psychonomic Society*, *10*(3), 183–186.

Maestripieri, D., Schino, G., Aureli, F., & Troisi, A. (1992). A modest proposal: displacement activities as an indicator of emotions in primates. *Animal Behaviour*, *44*(5), 967–979.

McAdams, D. P., Jackson, R. J., & Kirshnit, C. (1984). Looking, laughing, and smiling in dyads as a function of intimacy motivation and reciprocity. *Journal of Personality*, *52*(3), 261–273.

Mehu, M., & Dunbar, R. I. M. (2008a). Naturalistic observations of smiling and laughter in human group interactions. *Behaviour*, *145*, 1747–1780.

Mehu, M., & Dunbar, R. I. M. (2008b). Relationship between smiling and laughter in humans (Homo sapiens): testing the power asymmetry hypothesis. *Folia Primatologica*, *79*(5), 269–280.

Mehu, M., Grammer, K., & Dunbar, R. I. M. (2007). Smiles when sharing. *Evolution and Human Behavior*, *28*(6), 415–422.

Mehu, M., Little, A. C., & Dunbar, R. I. M. (2007). Duchenne smiles and the perception of generosity and sociability in faces. *Journal of Evolutionary Psychology*, *5*(1–4), 133–146.

Merten, J. (1997). Facial-affective behavior, mutual gaze, and emotional experience in dyadic interactions. *Journal of Nonverbal Behavior*, *21*(3), 179–201.

Messinger, D. S., Fogel, A., & Dickson, K. L. (2001). All smiles are positive, but some smiles are more positive than others. *Developmental Psychology, 37(5)*, 642–653.

Moore, M. M. (1985). Nonverbal courtship patterns in women: Context and consequences. *Ethology and Sociobiology*, *6*(4), 237–247.

Morris, D. (1982). *The pocket guide to manwatching*. London: Triad Grafton Books.

Mortillaro, M., Mehu, M., & Scherer, K. R. (2011). Subtly different positive emotions can be distinguished by their facial expressions. *Social Psychological and Personality Science*. doi: 10.1177/1948550610389080.

Mullen, B., Salas, E., & Driskell, J. (1989). Salience, motivation, and artifact as contributions to the relation between participation rate and leadership. *Journal of Experimental Social Psychology*, *25*, 545–559.

Otta, E. (1998). Sex differences over age groups in self-posed smiling in photographs. *Psychological Reports, 83(3)*, 907–913.

Otta, E., Abrosio, F. F. E., & Hoshino, R. L. (1996). Reading a smiling face: messages conveyed by various forms of smiling. *Perceptual and Motor Skills, 82*, 1111–1121.

Papa, A., & Bonanno, G. A. (2008). Smiling in the face of adversity: the interpersonal and intrapersonal functions of smiling. *Emotion*, *8*(1), 1–12.

Preuschoft, S., & van Hooff, J. A. (1997). The social function of "smile" and "laughter": variations across primate species and societies. In U. Segerstrale & P. Molnàr (Eds.), *Non-verbal communication: where nature meets culture* (pp. 171–189). Mahwah, New Jersey: Erlbaum.

Provine, R. R. (1993). Laughter punctuates speech: Linguistic, social and gender contexts of laughter. *Ethology*, *95*(4), 291–298.

Provine, R. R., & Fischer, K. R. (1989). Laughing, Smiling, and Talking: Relation to Sleeping and Social Context in Humans. *Ethology*, *83*(4), 295–305.

Rosa, E., & Mazur, A. (1979). Incipient status in small groups. *Social Forces*, *58*(1), 18–37.

Rowell, T., & Hinde, R. A. (1963). Responses of rhesus monkeys to mildly stressful situations. *Animal Behaviour*, *11*(2–3), 235–243.

Ruch, W. (1994). Extraversion, alcohol, and enjoyment. *Personality and Individual Differences*, *16*(1), 89–102.

Ruch, W., & Ekman, P. (2001). The expressive pattern of laughter. In A. W. Kaszniak (Ed.), *Emotions, qualia, and consciousness* (pp. 426–443). Napoli, Italy: World Scientific.

Schino, G., Maestripieri, D., Scucchi, S., & Turillazzi, P. G. (1990). Social Tension in Familiar and Unfamiliar Pairs of Long-Tailed Macaques. *Behaviour*, *113*(3–4), 264–272.

Schmid-Mast, M. (2002). Dominance as expressed and inferred through speaking time. *Human Communication Research*, *28*(3), 420–450.

Scucchi, S., Maestripieri, D., & Schino, G. (1991). Conflict, displacement activities, and menstrual cycle in long-tailed macaques. *Primates*, *32*(1), 115–118.

Seepersand, F. (1999). *Laughter and language evolution: Does the topic of conversation eliciting the most laughter last longer?* University of Liverpool.

Tidd, K. L., & Lockard, J. S. (1978). Monetary significance of the affiliative smile: a case for reciprocal altruism. *Bulletin of the Psychonomic Society*, *11*(6), 344–346.

Tinbergen, N. (1952). Derived activities: their

causation, biological significance, origin, and emancipation during evolution. *The Quarterly Review of Biology*, *27*(1), 1–32.

Tinbergen, N., & van Iersel, J. (1948). "Displacement reactions" in the three-spined stickleback. *Behaviour*, *1*, 56–63.

Tracy, J. L., & Robins, R. W. (2004). Show your pride: evidence for discrete emotion expression. *Psychological Science*, *15*(3), 194–197.

Vettin, J., & Todt, D. (2004). Laughter in conversation: features of occurrence and acoustic structure. *Journal of Nonverbal Behavior*, *28*(2), 93–115.

de Waal, F. B. M., & Luttrell, L. M. (1985). The formal hierarchy of rhesus macaques: An investigation of the bared-teeth display. *American Journal of Primatology*, *9*(2), 73–85.

Waller, B. M., & Dunbar, R. I. (2005). Differential behavioural effects of silent bared teeth display and relaxed open mouth display in chimpanzee (Pan troglodytes). *Ethology*, *111*, 129–142.

Washburn, R. W. (1929). A study of the smiling and laughing of infants in the first year of life. *Genetic Psychology Monographs, 6,* 403–537.

Watson, D., & Friend, R. (1969). Measurement of social-evaluative anxiety. *Journal of Consulting and Clinical Psychology*, *33*(4), 448–457.

Weisfeld, G. E. (1993). The adaptive value of humor and laughter. *Ethology and Sociobiology*, *14*, 141–169.

Wolff, P. H. (1963). Observations on the early development of smiling. In B. M. Foss (Ed.), *Determinants of infant behavior* (pp. 113–138). London: Methuen.

Woodzicka, J. A. & LaFrance, M. (2005). Working on a smile: responding to sexual provocation in the workplace. In R. E. Riggio & R. S. Feldman (Eds.), *Applications of nonverbal communication* (pp. 139–156). Mahwah, New Jersey: Lawrence Erlbaum Associates.

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TARGET ARTICLES

Graduate Interdisciplinary Programs for Training Students in Human Behavior, Evolution, and Development

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Introduction

While the traditional ethological study of human behavior has long championed analyses of both proximate and ultimate causes of behavior, recent advances in the sciences relevant to these levels of analysis provide fresh ground for interdisciplinary research collaboration, and a need for graduate student training in a new integrative approach to human behavior. Indeed, we believe that we are witnessing a transformation in our conceptual understanding of the interplay between proximate and ultimate factors in the generation of behavior that more and more will require novel thinking about and design of new research strategies concerning the causes of behavior. In this article, we will explore the idea of creating a graduate interdisciplinary program (GIDP) that trains students in the rapidly emerging conceptual advances and methods pertinent to the study of human behavior. We begin by describing what is new about such a GIDP, address why it is needed now, outline its key components, and explore its pros and cons. Finally, we invite your comments on the proposed program. We