STRANGERS MEET: LAUGHTER AND NONVERBAL SIGNS OF INTEREST IN OPPOSITE-SEX ENCOUNTERS

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ABSTRACT: When strangers of the opposite-sex meet for the first time, both sexes are in a difficult situation. In this high risk situation, neither person knows the intention of the other, and consequently non-verbal signalling becomes the major channel for communication. Because of their higher biological risk, females should prefer less obvious tactics in order to communicate interest in a potential partner than males. The tactical task of signalling clearly, but at the same time subtly, is solved by the use of multifunctional or metacommunicative signals. In this study we propose that there is not one single meaning for any given signal. In laughing loudly we find a signal which consists of acoustical, mimical and postural information. In this way either laughter can send a "this is play" message or its meaning can be modified by other signals. Thus laughter, together with its accompanying body postures and movements, conveys messages that range from sexual solicitation to aversion, depending on which and how many different signals are present. Males seem to communicate interest for the female during laughter with only a few signals, such as body orientation and dominance signals. In contrast, females communicate interest via numerous signals which function as signals of bodily self-presentation and submission. In both sexes, a lack of interest is communicated through closed postures.

When two people of the opposite sex who are potential partners in courtship meet for the very first time, both interactants will find themselves in a difficult and ambiguous situation. One of them might develop an interest in the other, without knowing whether he or she shares this interest. Uncertainty exists concerning the use of signals to find out if the partner will accept the advances and initiates courting. According to Duck and Miell (1983), courtship is a process in which information about possible mating partners is exchanged. When a person of the opposite sex is spotted

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who appears to have "optimal mating qualities", signals are emitted which convey interest in this person. Thus, courtship is the communication of interest in a potential partner. This can be done either by sending signals that indicate interest or withholding signals that convey avoidance.

In an encounter between opposite-sex strangers, we should expect courtship behavior as soon as one person develops interest in the other person. But as courtship behavior may be influenced strongly by reproductive behavior, evolutionary constraints might become visible as strict "biological" necessities. If traits which are associated with better reproduction in a species are not distributed equally, competition for optimal mates would be expected. In most species this intrasexual competition will be greater within the sex that puts lower investment in the offspring, i.e., the males (Trivers, 1972). Thus males should tend toward overt advertisement under the pressure of male-male competition. Females have different problems. Due to prolonged pregnancy and high dependency of the young child, the female puts higher overall investment in the offspring. However, she can lower her investment through eliciting greater paternal care and therefore should be interested in obtaining a stable pair bond. In other words, she should be choosy (Darwin, 1871; Bateman, 1948; Trivers, 1972). Thus we should expect different behavioral tendencies for males and females. These differences are amplified by male and female mate-selection criteria. In a study of 36 cultures, Buss (1989) showed that these criteria are culturally independent: specifically, males prefer females they rate as physically attractive, whereas females use different selection criteria, as for instance the male's social status.

These theoretical considerations propose gender-specific and interest-dependent signalling in interactions between strangers of the opposite sex. First of all, high risk of possible rejection should equally influence both sexes in their choice of signalling tactics. According to Goffman (1977), verbalization in the opening phase of courtship may trigger "social jeopardy". In contrast to verbal behavior, non-verbal behavior can control and trigger behavior without being too obvious. According to Cook (1981), it is the very feature of vagueness which is of great advantage in courtship. The problem with direct verbal invitations is that they tend to require direct verbal responses, which either commit the speaker or offend the person addressed. Invitations given non-verbally or in symbolic form are not binding and can be withdrawn, refused or denied, without causing affront or loss of self-esteem (Symonds, 1972). The use of non-verbal behavior or verbal indirectness in courtship creates "detours" to the mating goal. "Detours" are constructed in such a way that, when risk of possible rejection is high, they pave an indirect way to a goal. That is, they avoid obstacles the

partner might put in the way (Grammer, 1985). In addition, indirect approaches allow for a wide range of responses from the partner. They let the actor modify his approach according to the partner's desires, so that compromise and compatibility can be achieved.

Non-obvious and non-binding tactics can only be used by females on a regular basis. Under the pressure of possible competition with other males, males are forced into more immediate and fast action and so they should tend towards overt self-presentation (Grammer, 1989). Overt self-presentation of males is strengthened by the fact that females select male partners according to their status, which can be difficult to signal non-verbally. Males often solve this dilemma between pressure for direct signalling and possible rejection by approaching only those females who signalled interest to the male (Grammer, in press).

The situation for the female is ambiguous. On one hand, she has to signal interest in order to invite the male for self-presentation according to her partner-selection criteria, but on the other hand, if she signals availability directly she will attract only those males who are interested in a short-term relationship. If she is interested in a long-term relationship, signalling should not be done too obviously, for direct signalling in females is not prudent. Direct signalling might indicate general availability and males who are interested in a long-term relationship might be repelled by any indications of a tendency toward infidelity. If females want to avoid making this impression, they should use subtle signs to convey interest. So, at the beginning of a courtship interaction, both male and female signalling is forced to a clear but subtle equilibrium, as neither knows what the other is seeking. Females should signal more discreetly than males, but because of the high risk situation they should signal clearly, so that their signals are perceived and accurately decoded. Moreover, if the female is interested in the male, she can enhance her chances by signalling according to male partner selection criteria: physical attractiveness can best be signalled non-verbally. This tactic also avoids being too obvious, because if the female tries to demonstrate her physical attractiveness non-verbally, the male can choose not to interpret this a "come on signal".

Thus females would be expected to use signals which are not too direct. The use of nonverbal tactics should be more pronounced for females because (1) males prefer females who are physically attractive and (2) females put greater investment in reproduction and thus should more carefully investigate the qualities of the mate. Accordingly, females should use the non-binding standard of non-verbal behavior in order to control male approaches and to test out the male's tendencies for investment. Non-verbal behavior of the female thus is a means of manipulating the

male's perception of the female. The types of signals people send in such situations then would depend on the cognitive assessment of the situation, which in the case of opposite-sex interactions is interest in the other person.

Previous studies by Givens (1978), Scheflen (1965), and Moore (1985) on non-verbal behavior in courtship illustrate that the function of non-verbal communication is to show interest and availability and to enhance attractiveness. But both studies use a "one signal one effect" approach, which seems to be inadequate in opposite sex encounters, in which signalling has to occur obviously and unobtrusively at the same time. These multiple functions of non-verbal behavior in courtship raise two difficult questions: (1) How to ascribe a specific meaning or intention to any given behavior pattern, and (2) how to classify any behavior as a courtship behavior with a particular function.

The tactical task of signalling obviously but subtly at the same time can be solved either by the use of composite signals in which signals of avoidance and solicitation are mixed together, as in a coy-smile (Eibl-Eibesfeldt, 1984), or by the use of metacommunicative signals, which change the original signal value. A possible candidate for such an approach is laughing out loud, because it is reliably observable and it seems to serve a quite different range of functions. In addition, Grammer and Eibl-Eibesfeldt (1990) have shown that laughing loudly in same-sex and in opposite-sex interactions is a ritualized signal. Moreover, the degree of ritualization, which becomes visible in form-constancy and typical intensity, increases with female interest in the male. Thus laughter has a "signal frame" which makes it detectable as a discrete signal. This eventually forces the receiver of the signal to try to decode its meaning (Hofstadter, 1979).

The different meanings attributed to laughter range from a signal of aggressive intention (Bollwig, 1964) to a signal of sexual excitement (Freud, 1912). Laughter has been described as courtship-signal (Moore, 1985) and as a signal of sexual-interest (Duncan & Fiske, 1977). In a quite different approach laughing loudly has been characterized as a metacommunicative signal. The metacommunicative function of laughter is that it changes the messages of accompanying signals (or actions) into a "playful mode" (van Hoof, 1972).

In this metacommunicative approach, either laughter could change the message of other non-verbal signals (van Hoof, 1972) or different non-verbal signals could act as a set of "triggers" which, in turn, determine the meaning of laughter (Hofstadter, 1979). This would imply that the meaning of laughter is intricately linked with other non-verbal signals occurring at the same time.

If this is the case, laughter is a safe signal which can be used tactically to mask aversive or friendly signals or to cover up signals of rejection or solicitation. This possibility makes laughter the ideal candidate for a low risk move by both sexes because it creates an obvious, but at the same time a discreet, playful message of either aversion or excitement. Thus we should expect that laughter is accompanied by specific signals of high interest or by signals of aversion. In this study behavior will be defined as courtship behavior if it arouses interest in the partner or if it is performed by a person who is highly interested in his/her partner. Since interest can be assessed independently by questionnaires, it can be used as a dependent variable.

Method

Subjects and Situation

The data were recorded in a situation in which two people met for the first time. The subjects were male and female undergraduate students who did not known each other. (Males: $N=79$ Mean age: 18.6 years, $SD=0.1$; Females: $N=79$, Mean age: 18.0 years, $SD=.35$). The subjects were paired randomly and told that they would take part in an experiment. While they were waiting for the experimenter to return from an "urgent phone-call", they were videotaped for ten minutes through a one way mirror. In order to control for effects of social class, participants were matched according to their social background.

Definitions

Laughter was defined by an occurrence of Action Unit 12 (contraction of M.Zygomaticus), meeting the minimal criteria specified by Ekman and Friesen (1978) in their Facial Actions Coding System (FACS). This contraction had to be accompanied by an acoustically detectible vocalized or non-vocalized exhaustion of air. A single exhaustion was designated as an instance of laughter and instances occurring within a time-span of three seconds were designated as a bout of laughter.

An episode of laughter was defined as beginning two seconds prior to the onset of laughter, extending throughout the duration of laughter, and ending in a pause of movement after laughter, when the person assumed a new sitting posture. This movement pause usually occurred within three to four seconds of the termination of laughter and was accompanied by, or followed, a change in posture.

We did not code all episodes of laughter, but chose four episodes of

laughter per subject through random sampling. Random sampling was done by giving consecutive numbers to each episode of laughter each subject performed and then selecting four episodes with random numbers. Thus the data can, with some reservations, be viewed as independent. For analysis, we divided behavior patterns into postures and movements. Both posture and movement patterns were described according to the body parts involved: (1) head, (2) shoulders, (3) trunk, (4) arms, (5) hands, and (6) legs.

Coding of Postures and Movements

To define postures and movements, a simplified version of the coding procedure developed by Golani (1969) was used. This coding procedure describes head, shoulders and trunk movements or postures as deviations from a zero position which is identical to the room axes. A person would assume a zero-posture when he/she is sitting upright and the longitudinal and/or horizontal axes of the body parts are aligned with the room axes. The minimal criterion for movement or posture coding was a deviation of at least 15 degrees from the room axes. This gives basically eight possible directions of posture: left-right, forward-backward, up-down, and left-right tilt. In order to describe the orientation of the postures and movements left-right and tilt left-right were replaced by "away from" and "toward" partner. If the axes of the respective body parts were identical to the room axes, "neutral" was coded (see Table 1).

Coding of postures and movements was done according to the following procedure. Two seconds before laughter occurred, a still frame was coded in order to score initial body postures. Coding of movements started from the posture still frame and was done frame by frame until laughter and throughout laughter to end with the first movement pause after laughter.

Because definition of postures and movement by deviation from the room axes does not cover all possible postures or movements, we had to add specific categories for the description of arm, hand and leg movements, and postures (see Table 1). From our observations we found it necessary to add the following categories: if the angle between body and arm was greater than 45° and the hands were folded in the neck region we scored "head akimbo".

The coding of hand postures and movements was problematical as hand movements are often linked to arm movements. We divided "self-touching" behavior into categories defined by the body part which was touched: for instance: "touch legs", "touch body", "hair strike", "primp"

TABLE 1

Definitions of Postures and Movements

Involved body part	Deviation from the room axes	Orientation to partner	P	M	Other
Head	none (neutral)	toward or away	+	−	
	turned horizontally	toward or away	+	+	
	forward or backward		+	+	
	tilted vertically	toward or away	+	+	
	up or down		+	+	
			−	+	head no; head yes: repeated left-right or up-down movement of head.
			−	+	hair flip: Moore (1985)
Trunk	upright (neutral)	toward or away	+	−	
	turned horizontally	toward or away	+	+	
	tilted vertically	toward or away	+	+	
	forward or backward		+	+	
			−	+	trunk flex: repeated forward backward movement with arched spine
			−	+	move lower body
Shoulder	neutral		+	−	
	up or down		+	+	
	forward or backward		+	+	
			−	+	shoulder flex: repeated simultaneous forward-backward movement of both shoulders
			−	+	shoulders sway: alternating forward backward movement of both shoulders
Arms	crossed-open		+	+	
			+	+	head akimbo: see text Scheflen (1972)
			−	+	illustrator; adaptor: Ekman and Friesen (1972)
Hands			+	+	touch: body; head or face; hands; arms
			−	+	primp: Moore (1985)
			+	+	palm: both hands are turned so that palms face upward Scheflen (1965)
			−	+	hairstrike: Moore (1985)
Legs			+	+	open: visible gap between thighs
			+	+	crossed closed: one thigh placed on the other
			+	+	crossed open: one foot on one thigh, or crossing at ankles, with visible gap

P = coded as posture; M = coded as movements

(see Moore, 1985) and so on. Because of possible asymmetry in coding of arm and hand postures, we applied a special coding rule: crossing of one arm took precedence over an open arm. For the other arm codings, only symmetrical ones were left in the analysis. For touching and other hand categories we also combined symmetrical ones for analysis: if one hand was laid on the hips and the other hand touched the abdomen "touch body" was coded. The coding of legs was mainly done by contrasting open and closed postures and the respective movements of "opening legs" and "closing legs".

In a preliminary study of the videos, a catalogue of 98 categories was constructed which covered more than 97% of all observed postures and movements. The categories then were combined into 26 more generalized categories for postures and 37 categories for movements. This reduction of categories reduced the number of coded postures from $N=3504$ to $N=1282$ coded postures for females and from $N=3406$ to $N=1141$ for males.

Inter-rater reliability was assessed by recoding ten randomly sampled episodes of laughter using an independent observer. The reliability then was calculated as percentage of agreement between original observation and the recoded observation. The codings of backward-forward and up-down head positions and shoulder postures were omitted because of poor reliability. Inter-rater reliability was 84% for an episode of laughter, 79% for the rest of the head codes, 72% for shoulder movements, 81% for arm codes, 77% for hand codes, and 87% for leg codes.

The Questionnaire

At the end of the ten minutes we gave each subject a questionnaire to fill out, covering three main topics: (1) estimation of probability of acceptance by the respective partner, (2) the interest in having further contact with the partner, and (3) ratings on attractiveness. In this analysis we will only refer to the ratings of interest evaluated by the following question: "If your partner in the experiment asked you (a) out for cinema (b) for your telephone number, how likely would you be to agree to (a) and (b)?". The subjects had to answer the questions on a scale from 1-7 ranging from unlikely to very likely. Two other questions rated the possibility of a negative answer ("how likely would you be not to agree"). These mirror-questions were presented later in the questionaire in order to control the reliability of the answers. Thus we received four questions which assessed subjective "interest". For the overall rating of interest, we then summed the scores from the four questions and thus got an interest-scale extending from 4 (lowest) to 28 (highest) interest.

Results

Frequency of Laughter

Frequencies of laughter were quite high in the ten minutes of the experiment. The number of laughs ranged between 0 to 75 times per ten minute interval. Males laughed an average of 12.4 ($SD=7.9$) per ten minutes interval, and females laughed significantly more frequently (15.1; $SD=7.8$; $t(74)=2.47$, $p=0.016$). The absence of significant correlations between frequency of laughter and interest (females: $r=0.13$; males: $r=0.12$) indicates that laughter was not a sign of interest in the partner. Furthermore, neither males nor females were more interested in a person of the other sex who laughed more often (females $r=0.12$; males: $r=0.09$). This result suggests that the laughter itself might not be a courtship signal, and that there indeed must be trigger-signals which change the function of laughter.

Postures

Frequencies of postures. For the analysis of postures, we used the following methodological procedure: at first we calculated the mean interest expressed by individuals exhibiting each posture by summing the interest scores of the subjects performing the posture and dividing the sum by the number of times the posture was observed. In order to find a baseline for further comparison of body postures we then constructed "mean body postures" for each sex. Figure 1 represents for males and females the combination (total body posture) of the postures of the different body parts which were assumed most frequently by males and females (see also Table 2).

Table 2 shows that the percentage of the most frequent body-postures was almost identical in both sexes, with the exception of the legs. The results for leg postures show significant sex-differences, $\chi^2(3)=314$, $p<0.0001$. Females had their legs less frequently opened, and more frequently crossed at the ankles with a visible gap between the thighs than males. Sex differences are also present in the following categories: females more often have their arms lifted, with their hands behind their necks ("Head-Akimbo") than males who cross their arms in front of their bodies more often than do females, $\chi^2(2)=7.71$, $p<0.03$.

Total body postures and interest level. It was not very useful to test whether the single categories of postures differed in their bearer's interest, because postures may occur in many different combinations. We thus restructured body postures associated with low and high interest to create total body postures (head-trunk-arms-hands-legs).

FIGURE 1 Sex-differences in postures.

These pictures (Fig. 1 to Fig. 5) have been reconstructed in the following way: a male and a female who were unfamiliar with the theory and with the coding procedure, were told to assume the postures with verbal commands like: "tilt head right", "turn trunk left" and so on. These figures show that the coding procedure can reproduce valid results. The photo on this page shows the "mean body postures", i.e. those postures which were assumed most often by males and females. The photos shown in Figs. 2 to 5 show the deviations from these postures which occur under different conditions of male and female interest.

TABLE 2

Most Frequent Total Body Postures

	Gender			
	Females		Males	
Postures	n	%[a]	n	%[a]
Look at partner-head neutral	108	40.0	112	46.3
Trunk lean back-neutral	113	44.0	103	44.4
Arms open	209	81.6	180	82.2
Touch hands	129	54.4	119	56.9
Legs open[b]	107	41.0	139	58.2
Legs crossed-closed[b]	115	44.1	61	25.5

[a]percentage of all head-, trunk-, arm-, hand-and leg postures for each sex
[b]frequency of leg postures differs significantly (see text)

A total body posture indicating high or low interest was created in the following way: The postures of head, trunk, arms, hands and legs which were selected to create a complete high or low interest body posture were those associated with an average interest that was either the highest or lowest for all possible postures of that body part. Thus by recombining postures we got one complete high interest and one complete low interest total body posture.

This procedure resulted in a low interest and a high interest posture for each sex. But signals only can work if the partner is watching. Thus we divided between low and high interest postures where the partner was watching and low and high interest postures where the partner was not watching. Thus we registered four postures for each sex associated with high and low interest ratings. The following section will describe deviations from the mean body posture under different conditions of interest.

Interested male and interested female (Pair 1). When the female looked away, males were likely to assume the following total body posture associated with high interest: the head is turned toward the partner and titled away (see Table 3). He leans forward and has his trunk turned toward the female. He has his elbows lifted so that his arms are in at an angle of approximately 90° to his trunk and his hands folded behind his neck. At the same time, his arms either held by the wrist or the palm, supported by his head or other hand. His hands touch his arms and his legs are crossed

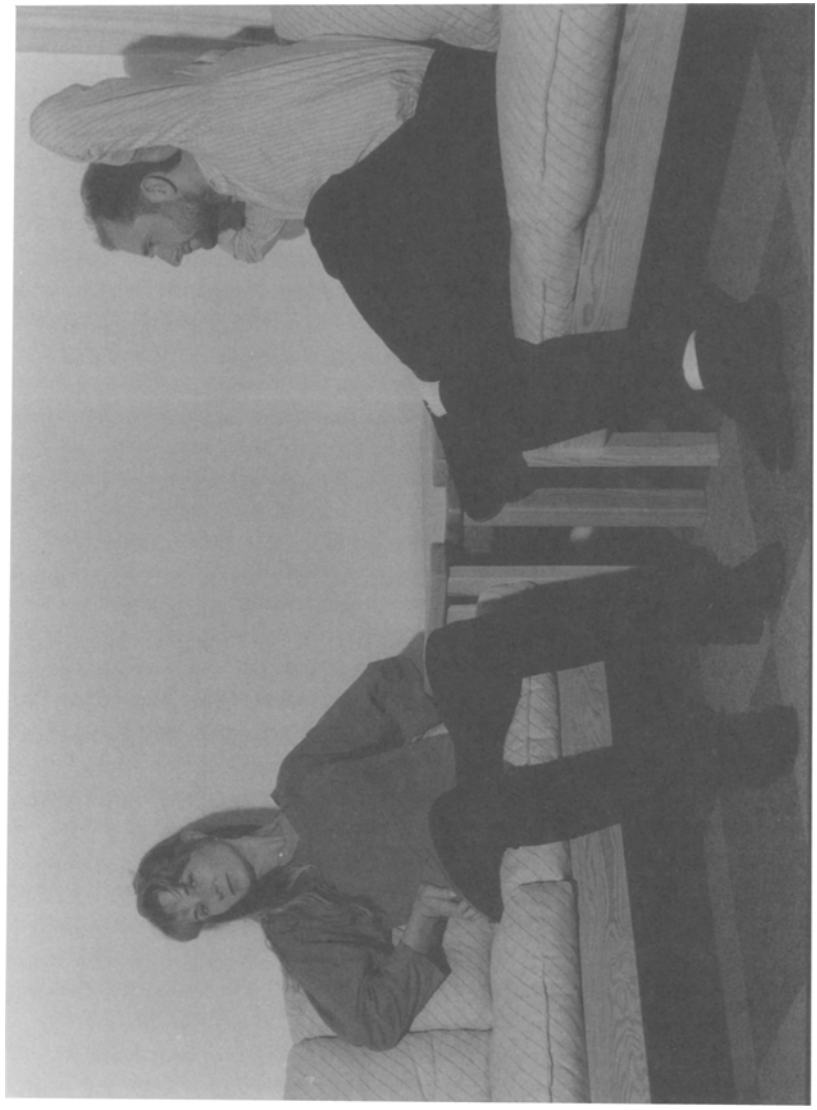

FIGURE 2

Female high interest—male high interest.

TABLE 3

Total Body Postures and Interest: Interested Female and Uninterested Male (Pair 1)

	Males				Females			
Bodypart	Posture	n	M_I[a]	SD	Posture	n	M_I[a]	SD
Head	turned toward-tilted away	5	20.5	1.9	turned away-tilted away	10	23.0	4.8
Arms	head akimbo	8	22.5	3.7	open	112	15.8	6.7
Hands	touch arms	22	20.7	7.1	touch body	20	15.8	7.7
Trunk	leans forward-turned toward	7	23.4	2.5	leans back-turned away	9	19.8	5.3
Legs	crossed-open	13	21.8	5.1	open	61	15.3	7.1

[a]mean interest for posture

but open. This gives an associated average interest of $M_I = 21.75$. A female with high interest, being watched by the male, typically turned and tilted her head away from the male. She leaned back and had her trunk turned away from the male. Both arms were open, i.e., there was a visible angle between arms and body, and her hands touched her body, usually in the region between hips and chin. Her legs were open to a visible angle. This posture gave an overall average interest of $M_I = 17.89$ (see Figure 2 and Table 4).

Uninterested female and interested male (Pair 2). If the male showed high interest and an uninterested female looked at him, he had his head turned toward the female and no tilt occurred. His trunk leaned back and was turned toward the female. The male performed a head akimbo, or axillar presentation, with his hands touching his head or the face. His legs were open. This resulted in an average interest score for this posture of $M_I = 20.19$. The uninterested female watched the male and had her head tilted toward him. She leaned back and turned her trunk toward the male. Her arms were crossed in front of her body. There was no visible angle between body side and arm. At least one of her hands touched her head or face. Her legs were closed. The average interest score of this posture was $M_I = 11.81$ (see Figure 3 and Table 5.

Interested female and uninterested male (Pair 3). When a male showed no interest in the female, but she was interested and was watching him, he turned his head away and tilted it toward the female. He leaned back and turned his trunk away. His arms were crossed. He touched his arms and his legs were closed and crossed. This male posture had an overall average of $M_I = 17.83$. The interested female looked at the male who avoided eye-contact, and she had her head tilted toward the male. Her trunk was leaned back and turned away. In contrast to an interested female while a male was watching her, she had both her arms crossed. Her hands touched, and her legs were crossed but open with a visible gap. This female posture resulted in a total mean associated interest of $M_I = 15.68$ (see Figure 4 and Table 6).

Uninterested female and uninterested male (Pair 4). When both partners were uninterested, they tended to avoid eye contact. The male turned and tilted his head away from the female. He leaned forward, but his trunk was neither turned toward nor turned away from her. His arms were both open and his hands touched his head or face. His legs were open. The average interest score associated with this posture was $M_I = 15.62$. The uninterested female also looked away but had her head tilted toward the male. She leaned back and her trunk was not turned. She assumed a head akimbo and touched her arms. Her legs were crossed but closed. This posture was associated with an average interest score of $M_I = 11.38$ (see Figure 5 and Table 7).

FIGURE 3

Female low interest—male high interest.

TABLE 4

Total Body Postures and Interest: Uninterested Female and Interested Male (Pair 2)

	Males				Females			
Bodypart	Posture	n	M_I[a]	SD	Posture	n	M_I[a]	SD
Head	turned toward-neutral	72	19.2	5.2	turned toward-tilted toward	19	12.9	8.3
Arms	head akimbo	8	20.3	3.2	crossed	9	9.4	6.4
Hands	touch head	13	21.4	3.6	touch face	22	14.3	7.3
Trunk	leans back-turned toward	18	21.3	4.2	leans back-turned toward	15	12.6	8.3
Legs	open	72	19.0	5.6	closed	8	9.7	5.3

[a]mean interest for posture

FIGURE 4

Female high interest—male low interest.

TABLE 5

Total Body Postures and Interest: Interested Female and Uninterested Male (Pair 3)

	Males				Females			
Bodypart	Posture	n	M_I[a]	SD	Posture	n	M_I[a]	SD
Head	turned away-tilted toward	8	17.6	5.2	turned toward-tilted toward	8	17.4	7.7
Arms	crossed	22	18.8	4.8	crossed	12	14.1	8.7
Hands	touch arms	22	16.7	7.1	hands	62	14.8	7.1
Trunk	leans back-turned away	11	14.4	6.2	leans back-turned away	9	15.2	5.4
Legs	crossed-closed	36	17.5	7.5	crossed-open	10	16.3	5.5

[a]mean interest for posture

FIGURE 5

Female low interest—male low interest.

TABLE 6

Total Body Postures and Interest: Uninterested Female and Uninterested Male (Pair 4)

	Males				Females			
Bodypart	Posture	n	M_I[a]	SD	Posture	n	M_I[a]	SD
Head	turned away-tilted away	6	13.0	2.1	turned away-tilted toward	9	9.54	5.5
Arms	open	86	18.1	6.5	head akimbo	8	10.4	8.3
Hands	touch head or face	9	14.0	5.2	touch arms	14	10.6	7.2
Trunk	leans forward-neutral	24	15.1	6.8	leans back-neutral	53	13.8	7.9
Legs	open	67	17.9	6.5	crossed-closed	58	12.4	8.6

[a]mean interest for posture

Additive Effects of Postures

We saw in the first analysis that the frequency of certain postures was quite different. Thus it could be possible that a posture of one body part was associated with high interest because it occurred in combination with a "real" high interest posture. Consequently, we have to see if our model of total body-postures corresponds to the total body-postures which actually occur. The more similar an actual body posture is to the model body posture, the higher (or respectively lower) the corresponding interest should be. We analyzed the various combination of postures with an ANOVA (interest by number of the respective postures in combination within a total high or low interest total body posture). The results revealed that there were indeed additive effects on interest for some of the body postures, when more than one constituent member of the total body posture was present.

Table 7 shows the results of the analysis. We see that in all cases, there were significant effects for postures associated with high interest. Thus, in the case of high male or female interest there was an additive effect of single postures which are combined in total body postures. If there is no interest, additive effects occur only for males in the presence of a uninterested female. The conclusion is that we are indeed dealing with an additive effect of postures, where each body part contributes to the total communicative information that is transmitted by the total body posture.

Open vs. closed postures. The above results give the impression that interest was signalled via open postures ("Arms Open", "Legs Open"), whereas disinterest could be signalled via closed postures ("Arms Crossed", "Legs Crossed"). Female open postures indeed showed augmented female interest in an additive way, but only as long as the male watched the female, (F (2,142) = 3.51, p = 0.032). For males watched by females there was no such linear additive effect, although the differences were significant. A male's interest was highest when he assumed no open postures (M_I = 21.63, SD = 4.63), low if he assumed one open posture (M_I = 16.60, SD = 5.86); and higher again with two postures (M_I = 19.13, SD = 5.69, F(2,134) = 6.32, p = 0.002).

Movements

Males move less than females during episodes of laughter, and these differences were significant. On average females made five to six movements per sequence (M = 5.64, SD = 2.79), whereas males made only four

TABLE 7

Additive Effects of Postures on Associated Interest: The Number of Postures in a Total Body Posture

		Males			Females		
	Posture[a]	n	M_I	SD	n	M_I	SD
Pair 1:		*male high interest***			*female high interest***		
	0	65	16.7	6.7	15	10.3	6.7
	1	19	21.4	4.2	56	12.8	6.0
	>=2	15	22.0	5.0	57	16.3	6.9
	>=3	—	—	—	8	18.3	6.6
Pair 2:		*male high interest**			*female low interest*		
	0	22	15.8	7.0	84	15.4	6.6
	1	54	18.2	5.6	44	12.4	6.9
	>=2	38	19.5	5.4	8	13.7	8.3
Pair 3:		*male low interest*			*female high interest***		
	0	63	19.3	5.6	47	10.4	8.1
	1	44	18.1	5.6	63	14.3	7.1
	>=2	22	16.8	6.8	11	17.1	7.7
Pair 4:		*male low interest***			*female low interest*		
	0	10	22.7	3.3	38	13.4	7.6
	1	25	20.1	6.5	38	13.5	7.7
	2	43	19.3	5.9	29	14.1	8.0
	>=3	21	15.0	6.7	16	9.1	8.5

[a]Number of postures classified as high or low interest postures which are present in one total body posture

*ANOVA (interest by number of single postures in one total body posture) significant $p>0.05$

**ANOVA (interest by number of single postures in one total body posture) significant $p>0.01$

movements per sequence ($M=3.95$, $SD=2.10$; Median test: $\chi^2(2,513)=43.4$, $p<0.0001$). If we assume that movements are signals, then females signalled more often than males in this situation.

The case of movements during laughter was comparable to the case of the postures. If movements during laughter were signals, we then should find differences in interest between different movements. But again, movements did not occur as single behavioral units; they came together with

other movements. Thus, we used a hierarchical cluster analysis (Norusis, 1986) in order to determine if there were movement clusters of high or low interest. The agglomeration method employed was the average linkage between groups using squared euclidian measures. For this analysis we only used movements which occurred at least ten times. The average interest scores were calculated for the clusters of movements. The clusters were then ordered according to the size of the interest scores. Proceeding this way we found 20 different clusters of movements which occurred with comparable interest scores.

As a next step we tried to determine if single movements in a cluster contributed equally to the signalling of interest, and thus if their effects were additive. Therefore, if movements communicate interest, the cluster members would be expected to contribute to the signalling of interest in an additive way. In order to test this hypothesis we simply calculated the partial correlations between interest and the numbers of movements present in a sequence from one cluster. Only four out of 20 clusters reached the significance level.

The entire population of all clusters for female movements had an average associated interest score of $M_I = 13.65$ ($SD = 1.87$, $n = 23$). The components of the high interest cluster ($M_I = 17.02$, $SD = 0.11$, $n = 3$) contributed to the signaling of interest in a linear additive way and consisted of three movements: (1) "Head Akimbo", (2) "Head No" and (3) "Shoulders Flex". The presence of more components of this cluster in one movement chain was correlated with high female interest ($r = 0.33$; $p = 0.005$). A second cluster produced by females showed somewhat lower interest, although the mean interest was still higher than that of the whole population ($M_I = 15.02$; $SD = 0.57$, $n = 4$). The component movements were "Head Yes" and the "Shoulders Back" and "Shoulders Up" movements. "Move Lower Body" was the last member of this cluster. This cluster was also additive ($r = 0.31$; $p = 0.009$). The low interest cluster ($M_I = 9.44$) had only one member ("shoulders sway"), and showed only a small negative relationship with interest ($r = 0.21$; $p = 0.07$).

For males we only found one cluster which showed a significant relationship with interest. "Head tilt" and "Trunk lean forward" showed a mean interest of $M_I = 18.93$. Increasing occurrences in one movement chain correlated positively with interest ($r = 0.25$; $p = 0.03$).

Discussion

In this study female interest and female non-verbal behavior correlated to a significant degree: females laughed more often than males and moved more often than males during instances of laughter. But laughter itself was

not the signal which communicated interest or lack of interest in the partner, because the frequency of laughter showed no correlation with interest. During instances of laughter, interest or aversion can be communicated. Females used this unobtrusive communicative "tool" much more often than males. In contrast to verbal communication, non-verbal communication allows to use an indirect standard of communication which does not offend neither the sender nor the receiver of a signal. This result underlines the theoretical assumption that females experience higher risk in a potential courtship situation and thus rely on less obvious tactics than males.

The amount of interest in the partner associated with different postures and movements was clearly different between the sexes, suggesting that we can indeed talk of gender-specific signals. This view was strengthened by the fact that certain postures and movements showed additive effects with increasing interest. The more postures indicating interest were present in one total body posture, the higher was the interest. Thus the interest associated with one single postures adds up to a total interest of the total body-posture. This allows "fine-tuning" in signalling interest, because high interest postures can be combined with low interest postures. The results suggested that laughter might be accompanied by quite a number of different nonverbal signals which have a different communicative function. Thus laughter could either be a metacommunicative signal, or that the function of laughter itself is mediated by trigger-signals. In this case the function of laughter could reach from signalling aversion to signalling sexual enticement depending from the postures and movements which are sent parallel to laughter.

The baseline for non-verbal behavior in this situation are neutral positions, which occurred between 40% and 80% of all observed cases. We found that head and trunk assumed a neutral position, one of sitting upright and looking straight ahead. Although this "freeze effect" can be interpreted as a sign of social anxiety (Givens, 1978), it also can be seen as providing a neutral base position from which all movements and deviations stand out. "Freezing" thus is the background against which signal production and signal detection can work, and not necessarily the result of immobilization due to stress.

The Signal-Value of Movements and Postures

Now, if the above interpretation that movements and postures during laughter are signals is correct, then being watched and not being watched should have a high impact on the presentation of signals. A highly interested male in the presence of a female with comparable interest (Pair 1) had open postures and turned toward and watched her. The female

avoided eye contact. She looked away from the male, tilting her posture away from him and she presented her body profile from the side. Here again cant positions are present. For females the head was tilted identical to Moore's (1985) "neck presentation" and presentation of the breasts is obvious to any observer. Additionally the highly interested female opened her extremities. As more of these single postures were present, the higher are the interest scores in both sexes. All of these postures have aspects of bodily self-presentation and thus they can be designated as solicitation postures.

As it is obvious in Pair 2, when the female was uninterested and in Pair 3, when the males did not watch, high interest postures disappeared. When a male watched a highly interested female (Pair 1), she looked away and tilted her head away from him. If he did not watch, her postures reverse; she looked at him and tilted her head toward him (Pair 3). Her arms, which were open now are closed, and her legs, which were open while being watched, are crossed and closed when not watched. This change in postures indicates that the above mentioned interpretation of solicitation signals has validity, because these postures appear only when the male watches the female. If the male did not watch, no signalling was necessary. If the male and the female were both uninterested (Pair 4) they tended to avoid eye-contact. While both were not watching each other, we found a mixture of postures associated with interest and disinterest in other model total body-postures, independent of the interest of the subject.

These results show that females seem to be much more sensitive to non-verbal cues, as it was predicted by biological theories, that is, their postures correspond to attention of the partner. Thus female non-verbal behavior is a tactical means used for in mate-selection. In other words, the female tells the male non-verbally what he wants to hear.

Signal Functions in Opposite Sex-Encounters

We found that both sexes communicate high or low interest differently, although there are basic signalling tendencies which are present in both sexes. Interest and no interest are signalled, as hypothesized by Scheflen and Scheflen (1972), through opening and closing of arms and legs in both sexes. Thus "bodily openness" also signals openness for communication. In other dimensions we find differences between the sexes. Head tossing, stretching, protruding chest, avert gaze downward, hair flip, and neck-presentation are all mentioned in the courtship literature as demonstrating female availability (Scheflen, 1966, Givens 1978, Moore 1985). In our study, only hair flip, avert gaze downward, and head tossing were associated with demonstrating interest.

For shoulder movements, we found differences between the sexes similar to those mentioned above. Interest-dependent shoulder movements were only shown by females. These movements mainly consisted of shrugging movements or, in the case of "Shoulders Back", they appeared as chest protrusion. "Shrugging movements" are discussed in the literature as signs of insecurity which are performed in ambiguous situations (Givens, 1978). In contrast, chest protrusion can be viewed as a solicitation signal (Moore, 1985). Nevertheless, shrugging movements like "Shoulders up" and "Shoulders flex" and "Shoulders back" are movements related to high interest in females. These patterns are movements which present the female body to the male. The female shoulders thus are the "body action spots" for movements, and for postures. Female animation also finds its expression in "Move Lower Body".

For male movements during laughter, only "Head tilt" and "Trunk lean forward" reached significance level for high interest. Tilting the head is a movement which could signal submissiveness, whereas leaning the trunk toward the female could be interpreted as a sign of interest in the female (Givens, 1972). Although tilting movements of the head could reduce the "staring" effect of direct eye-contact without breaking eye-contact, these movements can signal interest or disinterest, depending on the direction of the tilt. This is a situation which is comparable to that for "Head Akimbo" where context (i.e., relation to other movements and postures) determines function.

High interest in males was accompanied by the posture "Head Akimbo". However, this pattern is difficult to interpret. Among females this is a posture associated with low interest, but a movement pattern associated with high interest. The literature provides two possible explanations for the pattern. Scheflen and Scheflen (1972) describe the pattern as a kinesic signal of dominance when performed by a male. Goffman (1976) shows a picture of this posture as a sign "readable as conveying a sense of one's body being a delicate and precious thing" (p.41) when assumed by females. If the dominance interpretation holds, why then should a highly interested male try to dominate both a highly interested and an uninterested female? In Pair (1) in which both sexes show high interest in the partner, the dominance interpretation for males would make sense, because the female assumes "cant positions", primarily tilting of the head, and can be interpreted as signalling general submission (Goffman, 1976). Cant positions and movements introduce an angle between the axes of the head, the body, and the legs. The effect is that the upright and direct bodily confrontation to the interaction partner disappears. This is a signal principle which was already recognized by Darwin (1872).

The female behavior shows that there are indeed two possible functions of axillar presentation. She would signal dominance to a male she does not like and she would signal availability to a male she likes. But how then can the male distinguish between the two meanings? Clearly the context of female "Head Akimbo" needs to be investigated. For example, if it is present before laughter it could signal dominance, and when it comes up as a movement during laughter, it could be described as body presentation. This example shows the difficulties involved in functional explanations of non-verbal behavior, that is, the same signal can have sex-specific meaning in one context and quite a different one in another.

Conclusions

The critical locations for body movement and postures indicative of interest in an opposite sex-partner are different for males and females. Male action spots are: head, hand and arm positions and movements which indicate interest in the partner in combination with a submissive signal. Body-action-spots of the female are shoulders and leg positions or movements, which could be interpreted as signals of solicitation. Ambivalence is also present in females' movements, but in this case, such movements can also have the function of female body presentation.

Solicitation in females thus can be expressed by submissive signals or signals which enhance female physical attractiveness, such as signals of bodily presentation. This finding supports other results showing that perceived effectiveness in mate attraction strongly correlates with male display of status and female's display of physical attractiveness (Buss, 1988).

Laughter indeed allows the female to signal without committing herself to male. Against this background a limited number of signals, serve to indicate interest or lack of interest. Thus a key question remains open for further research: Is laughter a metacommunicative signal, with the message that the postures and movements have a "playful character" (van Hoof, 1972), or is the meaning of laughter changed by trigger-signals which allow for the receiver to decode the message? In either case, it seems clear that episodes of laughter, together with other signals, can communicate a wide range of messages with different meanings, ranging from aggression and aversion to sexual enticement.

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