

## THE RITUALISATION OF LAUGHTER

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#### 1. THE RITUALISATION OF BEHAVIOUR

Huxley (1966) defined ritual biologically as as the adaptive formalization or canalization of emotionally motivated behaviour, under the teleonomic pressure of natural selection, so as:

- a. "to promote better and more signal function, both intra and inter-specifically
- b. to serve as more efficient stimulators or releasers of more efficient patterns of action in other individuals
- c. to reduce intra-specific damage and
- d. to serve as sexual or social bonding mechanisms." (p.250)

According to Huxley, rituals can all be broadly characterized as displays. They are based on motivated intention movement, either singly or in combination, frequently with the addition of displacement and redirected activities.

If we have a closer look at these definitions, one might doubt that these definitions can be brought into empirical testable hypotheses, because their main parts are centered around the determination of function on an ultimate or proximate level.

This flaw of the definition was recognized very soon by other ethologists, who then tried to establish descriptive categories for the analysis of displays and who developed methodological approaches for the evaluation of function. The above definitions were made more

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precise by Morris (1966) and then modified by Eibl-Eibesfeldt (1975). The process by which displays evolve is called ritualisation.

Movement patterns experience changes through ritualisation which enhance the signal function of movement patterns. This is achieved in a variety of ways: *Simplification of the movement patterns, exaggeration of the movement amplitude, rhythmic repetition (not always), typical intensification (not always), but certainly constancy of form.*

The rigidification of the the form of the pattern results in the development of a typical intensity. This process involves the disruption of the usual frequency/intensity relationship: instead of the intensity of the action increasing as its frequency increases, it remains more or less the same regardless of frequency changes.

Another condition for ritualisation is *rhythmic repetition* of patterns. As soon as the *threshold for the performance* of a behaviour is lowered, it will often be repeated in a rhythmic fashion. All other components in ritualisation have to be evaluated by sequential analysis, because in ritualized movements *typical movement configurations* or changes in the sequence of movements should be found.

Finally one condition remains which is the *Loss or modification of orientation* which means, that an action does not have to be aimed directly at a social companion thereby reducing potential variability of patterns.

In addition morphological structures can evolve to emphasize various movement patterns. This way the signal becomes clearly recognizable, simple and unmistakably.

The function of ritualized behaviour can be assessed in two ways: a. the evaluation of context differences and b. the evaluation of consequences. This means that a certain type of behaviour should differ markedly in frequency and quality from one context to another if it has a special function in one of those contexts. A certain type of behaviour should also be connected to repeatedly observable consequences (Hinde, 1975).

The aim of this article will be trying to find out, if the categories for the description of ritualisation and the methods for the evaluation of function can be applied satisfactory in empirical approaches to the description of human behaviour on a micro-level, in other words, do humans use ritualized non-verbal displays, and if yes, what are the

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functions of such displays ?

"Laughter" was selected because it is a clear *cut* behaviour, which can be identified reliably in interactions, and because there are reasonable interspecific comparisons which shed light on the phylogeny of laughter

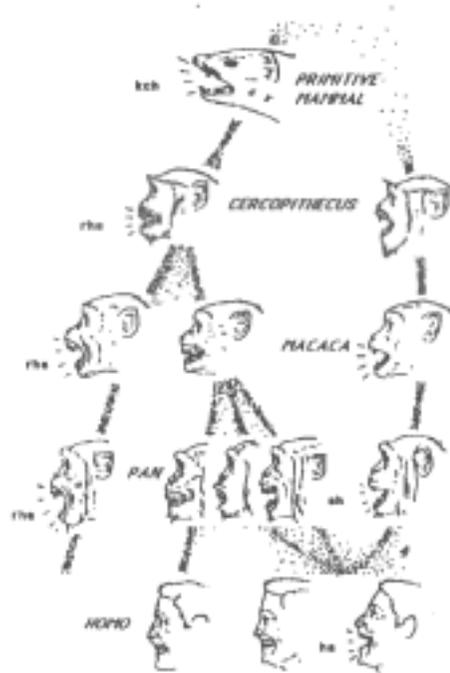


Figure 1: The phylogeny of laughter, (vanHoof, 1972)

Figure 1: The phylogeny of laughter, (vanHoof, 1972)

According to van Hoof (1972) human laughter and human smiles have two different phylogenetic roots. The roots of the smile can be found in the bareed-teeth display, which is present in nearly all primates: lips and mouth corners are retracted, and the mouth is open. Animals show this intense vocalized display when they are subject to some threat or strong aversive stimulation. It is shown for instance in situations of defence. Among higher primates the tendency to flee does not have to be present - it may develop into a signal of frustration and

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general excitement.

In the ascending scales of primates leading to man there is a broadening of the meaning of the element of baring the teeth: originally forming part of a defensive or protective behaviour pattern, this element becomes a signal of submission and non-hostility, finally developing to a friendly signal in some species.

But laughter itself is supposed to have its roots in the "relaxed open mouth display" a common pattern occurring during play among primate infants, which is a metacommunicative signal, designating the behaviour with which it is associated as mock aggression or play.

In humans then both roots are mixed into a continuum between the extreme cases: aversive and friendly laughter to loud and vocalized laughter as an expression of play.

A function different from the ones van Hoof postulates, was proposed by Eibl-Eibesfeldt (1986), in which laughter is an action whose function is to correct or to repel deviant or non-conforming individuals - the effect is a binding function on companions who are laughing together - (mobbing effect). Laughter then also might have an educational aggressive function, which brings outsiders in line and which reinforces group solidarity and homogeneity. In this view laughter acts as a conformity pressure.

For the context of laughter we selected same sex and opposite sex encounters between strangers, because this makes it possible to observe differences in frequency and quality, and, as we will see, the possible consequences. Furthermore, in mixed sex encounters the subjects are in a difficult situation: one or both individuals might be attracted to the partner and start courting him or her. His or her actions could be interpreted as courtship actions by the partner - and it would be possible, that the partner would try to stop these actions. According to Goffman (1967) in the initial phases of mixed sex encounters, we find high anxiety of rejection, because "by saying something, the speaker opens himself up to the possibility that the intended recipients will affront him by not listening or will think him foolish, or offensive in what he has said". Thus mixed sex encounter have a high potential risk of face loss and rejection. Males and females thus should develop tactics to meet this risk (Grammer, 1989b). A statement accompanied by laughter which has the metacommunicative function of signalling that

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this statement is a play statement could reduce this possibility. The same holds for the signalling of aversion. Laughter allows the partner to accept actions as a joke, which would in case of refusal then allow to save the face. If we take into account that the more ambiguous and potentially dangerous a situation is, the more ritualized and strictly behaviour should be organised (Eibl-Eibesfeldt, 1975), then we should find marled differences between the potential courtship situations and same sex encounters, as far as degree of the ritualization is concerned. This means the higher the interest in the partner, and the higher the experienced risk of possible rejection, the more ritualized the laughter should be.

Both types of interactions have one aspect in common. This is the establishment of a potential dominance relationship. So in addition to the risk of possible rejection, there is a risk of status loss. According to Eibl-Eibesfeldt (1988) male sexual behaviour has a tendency for dominance, whereas female sexual behaviour is submissive as a part of our archaic heritage: "It still plays a significant role in normal human sexual behaviour, but supplemented and controlled by the phylogenetically newly acquired love or affiliative sexuality "(p.6). Thus females, when they are together with males should show the "higher degree of ritualisation in laughter than males, because showing submissiveness is equal to solicitation when the male has a tendency to dominate the female. When the establishment of dominance relationships plays a role in same-sex dyads, the ritualization of laughter should be more pronounced for male-male dyads than for female-female dyads because males are more dominance oriented than females (Grammer, 1988).

If the function of laughter is signalling 'this is play', then males who are together with males should laugh less. than females who are together with females, because signalling play could be interpreted by the partner as a submissive signal. Thus males should laugh less than females, in both the mixed-sex dyads and in the same sex dyads. If this is the case, laughter would be a submissive signal.

In addition to this, laughing together should have a binding function, which prevails in those mixed sex episodes where mutual interest is developed, - and which allows to signal "this is play, don't take it serious" in a difficult situation, in a non-binding standard which

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prevents face loss but provokes status loss.

### **2. METHODOLOGICAL ISSUES**

The data were gathered in a strangers meet situation. Two unfamiliar subjects were brought together in a room and then left alone for ten minutes and filmed through a one way mirror. The experiment included opposite sex (n=79) and same sex dyads (males n=6 and females n=9; all of mean age 18,5 years). In order to evaluate interest or disinterest in the partner, we gave questionnaire to participants, where they could rate their interest in the partner on scales from one (not interested) to seven (highly interested) by the question: "Would you like to accompany your partner in the experiment to cinema, or give him/her your telephone number". A second question concerned the amount of possible compliance of the partner, i.e. the subjective representation of "risk" of the person in the situation ("Do you think your partner would go out with you to the cinema, or give you his/her telephone number if you asked him/her?"). These variables are used as independent variables in the analysis. The following analysis of the data was done on several levels:

#### a. Description of the types of laughter

An episode of laughter was coded by an occurring Action Unit 12 (contraction of M.Zygomaticus) meeting the minimal criteria specified by Ekman and Friesen (1978) in FACS. This contraction had to be accompanied by an acoustically detectable exhaustion, either vocalized or non-vocalized, of air. A single exhaustion was viewed as a bout of laughter, multiple bouts occurring within a time-span of 3 seconds were designed as an episode of laughter.

#### b. a frequency analysis

#### c. description of body movements related to laughter, with their sequential organisation

The movements have been described in terms of deviances of the body axes for all body parts: heads, trunk, legs arms and hands. For head, shoulders and trunk deviations from the horizontal and vertical room axis were used to form the patterns. This procedure results in seven possible directions of movements or postures: neutral (i.e. identical to room axes), left-right, up-down, and lateral tilt (left-right).

Based on Moore (1985) and Eibl-Eibesfeldt (1975) we added more

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global descriptors, which can not be described in terms of deviation from the room axes: *Hair flip*, *Head nod*, *Trunk flex forward* or *backward* which arches the spine, in contrast to *Trunk forward* or *backward*, and *Move hips*.

For the description of arm movements we took a number of existing movement categories described by Ekman and Friesen (1972): *Illustrators* (movements which illustrate speech) and *Adaptors*, open and closed arm postures, and crossing and uncrossing as the respective movement patterns.

Hand movements are often coupled to arm movements. We divided hand movements into all categories of 'self-touching' behaviour defined by the body part which was touched: for instance: *Touch legs*, *Touch body*, *Hair strike*, *Primp* (e.g. Moore, 1985) and so on. The coding of legs was mainly done by contrasting open and closed postures and the respective movements of *Open legs* and *Close legs* in different combinations with *Legs crossed*. In this analysis we will refer to all codings globally as movements, or to some selected movements, because the discussion of all movements would go beyond the scope of this paper.

### 3. DETERMINANTS OF RITUALISATION OF LAUGHTER

#### 3.1 Frequency and Quality of Laughter

The hypotheses suggest that as soon as a potential target of the other sex is spotted, frequencies and quality of behaviour should change, and ritualisation should occur, as compared to same sex dyads. In both types of dyads dominance rituals should be present, where males should laugh less and females should show signs of submission. Changes in quality of laughter can be assessed by comparing the amount of vocalizations, and repetition, i.e. The number of bouts which are produced in an episode of laughter.

Furthermore, if the function of laughter in mixed sex episodes differs for the sexes, sex-differences should appear in mixed-sex dyads which are not present in same-sex dyads. Then, by the comparison of frequencies and quality of laughter with the data from the questionnaire, we are able to analyze whether frequency and quality of laughter can predict interest for either males or females. If this is the case we can demonstrate a specific function of laughter and ritualisation

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in same and mixed sex episodes.

**3.1.1. Frequencies of Laughter: *the threshold of performance***

Males and females laugh equally often in same-sex experiments (mean=19.8 for females; mean=17.8 for males, Table 1). Table 2 gives the results of a one-way analysis of variance (variable by experiment type by sex, all tests two-tailed) and the respective single comparisons between experiment types and sex-differences in mixed-sex and same-sex encounters (see Table 2).

Table 1: Frequencies and Quality of Laughter

	Laughs			Non-vocalized laughs			Vocalized laughs		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Same-Sex									
Female	18	19.8	9.4	18	6.2	4.4	18	9.8	8.3
Male	12	17.8	7.2	12	10.0	5.5	12	4.4	4.1
Mixed-Sex									
Female	79	15.1	7.9	79	5.6	4.9	79	6.8	4.6
Male	79	12.4	7.9	79	7.7	5.4	79	3.9	5.0
	Bouts			Laughing together			Start synchronized		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Same-Sex									
Female	18	37.7	17.5	18	9.7	5.7	18	2.2	2.7
Male	12	31.8	15.6	12	8.2	5.5	12	2.7	2.6
Mixed-Sex									
Female	79	31.6	18.4	79	5.5	4.0	79	1.7	2.0
Male	79	23.3	17.5	79	5.5	4.0	79	1.5	1.5

By comparing the means we can suspect that there are no overall sex-difference in the sense that females would laugh more often than males. Although both sexes laugh significantly less in mixed-sex experiments, a sex-difference becomes evident as soon as females are together with males: females laugh more often than males (mean=15.1, StdDev=7.9) in this situation (mean=12.4; StdDev=7.9). This shows that laughter is significantly suppressed in mixed-sex experiments for both sexes, and that this effect is more Pronounced for males

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The '*threshold of performance*' for laughter in mixed sex-episodes seems not to be lowered - in contrast to our hypotheses this seems to be the case for same sex dyads.

Table 2: Differences in Laughter between same-sex and mixed-sex dyads and between the sexes

Laughs	Non-vocalized		Vocalized		
Laughs	Laughs		Laughs		
One way Analysis of variance	5.14	0.002	3.65	0.0137.85	<.000
	F	p	F	p	p
Females (mixed-sex)	14.09	0.046	0.26	n.s.	4.17 0.044
Males (mixed-sex)	4.49	0.037	1.85	n.s.	0.13 n.s.
Sex-differences experiment	0.36	n.s.	4.32	0.0474.33	0.047
Sex-differences controls	4.29	0.040	5.78	0.018 13.07	<.000

Bouts	Laughing		Start		
Bouts	Together		synchronized		
One way Analysis of variance	4.38	0.0056.03	<.000	1.49	n.s.
	F	p	F	p	F
Females (mixed-sex)	1.62	n.s.	13.54	<.000	1.14 n.s.
Males (mixed-sex)	2.51	n.s.	3.51	n.s.	4.56 0.036
Sex-differences experiment	0.86	n.s.	2.48	n.s.	0.25 n.s.
Sex-differences controls	7.32	0.008-	-	0.09	n.s.

(For the analysis of variance following contrasts were used: sex within type of experiment; type of experiment within sex, all tests two-tailed)

### 3.1.2. The quality of laughter

#### 3.1.2.1. *Rhythmic repetition and typical intensity*'

The markers used for the intensity of laughter surely are its loudness, the number of single bouts and the amount of vocalization which is present. Because we did not measure loudness, we only will compare the number of bouts and the amount of vocalisation.

For the quality of laughter we find sex-differences which already present in same-sex experiments and which are still at hand in mixed sex experiments. In same-sex experiments, males laugh more often non-vocalized (mean=10; StdDev=5.5, females: mean=6.2, StdDev=4.4), females laugh more often vocalized (mean=9.8; StdDev=8.3; males:

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mean=4.4, StdDev=4.1, Table 1). In mixed-sex encounters again frequency of female vocalization is significantly lower than in same-sex experiments.

The number of bouts per episode does not differ between sexes or between experiment types, with the exception that females in mixed sex encounters laugh with significantly less bouts than their male partners (Table 2).

### INTENSITY OF LAUGHTER: VOCALIZATION AND NUMBER OF BOUTS

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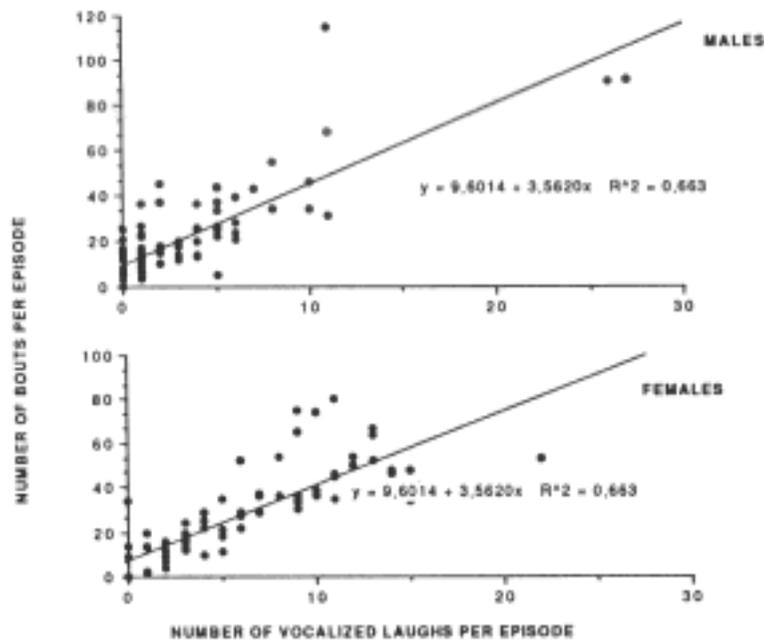


Figure 2: The intensity of laughter: Bouts and Vocalisation

Bout rate, i.e. the number of bouts per episodes is comparably high for all sexes in the different contexts. For females we find 2.16 (Std=0.37) bouts per laughter in mixed sex, and 2.0 under same sex conditions (Std=0.65). Comparable results present for males with 1.7 (std=0.4) in the same sex condition and 1.8 (std=0.7S) in the mixed

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sex condition. This shows that the degree of *rhythmical repetition* is not context dependent.

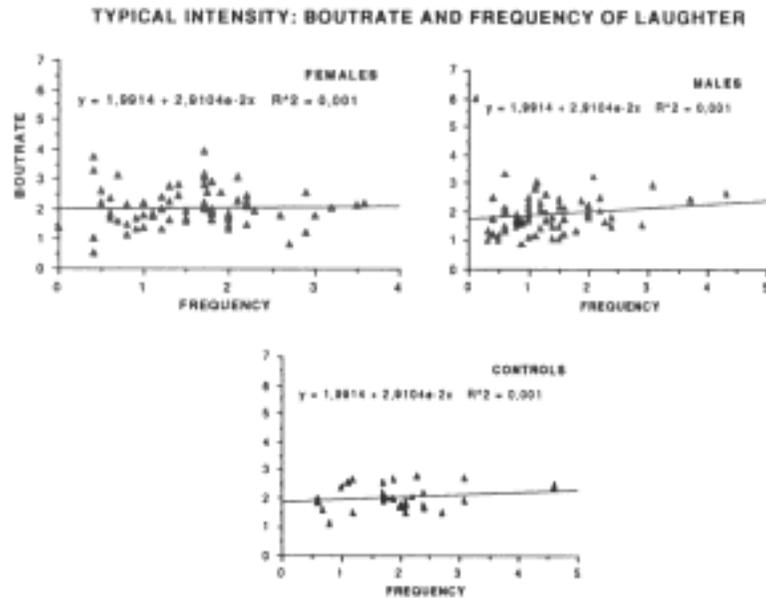


Figure 3: Typical intensity of laughter

The number of laugh bouts is bound directly to vocalization. Laughter with more bouts tends to be vocalized in both sexes (Chi-square=19.4 for females, 42.3 for males;  $df=2$ ,  $p<0.0000$ ). Thus duration and vocalization of laughter can be interpreted as signs of intensity of laughter.

Now if *typical intensity* would be present for laughter - the bout rate should not change with the frequency of laughter.

The results are shown in Figure 3, which shows nearly flat regression lines with a small standard deviation in every context. This means, that the bout rate does not change with increase in frequency of laughter.

The first conclusion we can draw is that laughter is rhythmically repeated, and has a typical, stereotyped intensity, but the threshold of

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performance is not lowered in the context where it should be expected, if situations of potential danger enforce ritualisation.

### 3.1.2.2. *Form constancy*

*Form constancy* of laughter is expressed in the number of bouts which form an episode of laughter. Several episodes of laughter performed by the same person can be labeled as constant in form, if the number of bouts which constitute it does not vary. In order to analyze this, we calculated a variability coefficient for bout length for those subjects who performed more than 10 episodes of laughter. The variability coefficient  $V$  was calculated by the following formula:  $V=100 \times \text{Standard Deviation} / \text{mean}$  (Haselhoff and Hoffman, 1970).

According to our hypotheses laughter in mixed-sex episodes should be much more invariant in its performance than in same-sex episodes, this is the case only for females (Kruskal-Wallis-One-WayAnova,  $p=0.0056$ ) but not for males ( $p=0.70$ ).

In both sexes and in the controls vocalized laughter shows higher form constancy than unvocalized laughter (Wilcoxon-test: Females mixed sex  $p<0.000$ ; female controls  $p=0.01$ ; male mixed sex  $p=0.001$ ; male controls  $p=0.04$ ). This means that higher intensity laughter shows higher form constancy.

In addition we find that the higher the females self-report they are interested in the male, and the higher the female evaluated the risk of rejection, the lower is the variability in her episodes of laughter ( $r=0.33$ ,  $p=0.01$  for interest,  $r=-0.56$ ,  $p<0.000$  for risk,  $n=42$ ) this again is not so for males ( $r=0.00$  for interest,  $r=0.01$  for risk,  $n=33$ ).

### 3.1.3. **Laughing together**

For the number of episodes of laughter, where one of the partners joins the other in laughing we do not find a difference between the sexes in same-sex experiments, but again, as soon as females are together with males, they laugh significantly less synchronized than with females (mean=9.7; StdDev=5.7 versus mean=5.5, StdDev=4.0). For starting an episode of synchronization the suppression effect is on the males' side: they start significantly less episodes of synchronization when they are together with females than they do when they are together with males (tmean=2.7. StdDev=2.6 versus mean=1.5, StdDev=1.5).

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Now we can extend our conclusions: with the exception of vocalization / non-vocalization we did not find sex-differences in same-sex encounters. Sex-differences only become obvious in mixed-sex encounters: females then laugh more than males, and with more bouts than males. In addition we find a suppression of laughter and synchronization in both sexes when they are together with a partner of the opposite sex.

Thus frequency and quality are changed significantly in mixed sex encounters compared to same sex encounters, so we have to analyze whether frequency and quality of laughter are able to predict interest in both sexes.

### **3.2. Consequential evidence: Frequencies of laughter and interest**

In order to find out in how far laughter could predict interest we applied a step wise regression approach to the laughter data with interest as the dependent variable. Table 3 shows the results. The number of times the female laughs, the number of vocalized laughs, and the number of times the couple laughs together are able to predict male interest significantly. The partial correlation coefficient between interest and frequency of laughter is the highest for the number of times the female laughs, but it is negative. This means that the more the female laughs alone, the lower is the males' interest to join the female. Laughing together shows the second highest partial correlation, followed by the number of vocalized laughs the female performs. These two aspects thus have a high predictive value for interest. Both variables correlate positively with male interest: the more the couple laughs together, and the more the female vocalizes, the higher is the males' interest.

As we will see, laughing together seems to be a prominent point in the analysis: it is the only variable which predicts male interest when compared to the predictive value of female laughter, although the regression model does not reach the significance level.

The synchronization of laughter (laughing together) predicts female interest: the more often she joins the male in laughing together, the higher is her interest to join the male. For female laughter only the number of laughs she performs shows a tendency to correlate positively

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vely with interest, and the number of non-vocalized laughs correlates negatively with interest: the more non-vocalized laughs she shows, the lower is the female's interest.

Again, the controls should show either the opposite or no effects of laughter in respect to interest, if laughter signals interest in mixed sex dyads. For male controls, we do not find a correlation between frequency of laughter and interest, whereas for female controls the opposite turns out: the less another female laughs, the higher is her partner's interest (to join her for cinema). The opposite is true for nonvocalized laughs.

So far we can draw the following picture: the more the female laughs, the less the male is ready to join her. But the more often the female laughs vocalized, and the more often she laughs jointly with the male, the higher male interest will be. The female's interest can be predicted by the number of times she joins the male laughing. This is not so for the controls.

As a result laughter might indeed signal interest or common ground. Frequencies and types of laughter are bound to interest in the partner. Females seem to use this signal more often, thus signalling interest non-verbally. Laughter, seems to signal interest if it is vocalized, or declination if it is non-vocalized. Thus qualitative changes of a single signal might change the meaning of the signal completely, even in opposite directions.

This analysis also shows, although that the overall *'threshold of performance'* is higher in mixed sex episodes, it becomes lowered as soon as interest is developed.

### 3.3. Sequential organisation of behaviour in episodes of laughter

#### 3.3.1. Frequency of body movements during laughter: *'threshold of performance'*

These movement codings show a marked increase in the number of movements, as soon as laughter occurs. Movement analysis was carried out only for mixed-sex episodes, because there was a reasonable number of dyads present, which are necessary for reliable analysis.

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Table 3: Regression Analysis of Laughter and Interest

Interest: Males						
(Female Laughter)		(Male Laughter)				
Regression model:	R'	F	Sig.F	R	F	Sig.F
	0.43	4.98	0.003	0.22	3.56	0.063
Variables	p'	F	Sig.F	p	F	Sig.F
Laughter	-0.37	10.66	0.001-	-0.01	0.02	0.882
Vocalized Laughs	0.26	8.42	0.005-	-0.05	0.21	0.644
Unvocalized Laughs	0.02	0.05	0.818	-0.03	0.08	0.771
Laughing together	0.33	5.02	0.005-	0.22	3.56	0.063
Starting synchronized	0.02	0.03	0.852	-1.13	1.28	0.260

Interest:Females						
(Male Laughter)		(Female Laughter)				
Regression model:	R	F	Sig.F	R	F	Sig.F
	0.24	4.42	0.039	0.23	1.94	0.151
Variables	p	F	Sig.F	p	F	Sig.F
Laughter	-0.06	0.30	0.580	0.20	2.98	0.088
Vocalized Laughs	0.00	0.00	0.987	-0.06	0.31	0.573
Unvocalized Laughs	-0.10	0.71	0.400	-0.29	3.44	0.067
Laughing together	-0.07	0.33	0.560	0.06	0.27	0.598
Starling synchronized	0.25	4.42	0.039-	-0.04	0.18	0.743

Interest:Male Controls		Female Controls				
(Self)		(Self)				
Regression model:	R	F	Sig.F	R	F	Sig.F
	0.00	0.00	n.s.	0.572	2.250	0.126
Variables	p	F	Sig.F	p	F	Sig.F
Laughter	0.08	0.06	0.801	-0.53	5.50	0.034
Vocalized Laughs	0.05	0.03	0.860	-0.46	3.82	0.070
Unvocalized Laughs	-0.07	0.05	0.824	0.49	4.51	0.051
Laughing together	-0.12	0.15	0.698	-0.01	0.00	0.955
Starting synchronized	0.08	0.08	0.783	0.18	0.440	0.516

('Multiple Regression regression equation) Coefficient / 'Partial Correl align/ Variable in the regression equation)

The changes in the number of movements affect the whole body in females: head (frequency/per episode of 0.21 before, 0.40 after laughter), trunk (0.042 to 0.14), hands (0.017 to 0.040), shoulders (0.007 to 0.067), arms (0.032 to 0.043) and legs (0.0013 to 0.012) start to move, when laughter bursts out. These changes in female movements are dramatic for movements of trunk, shoulders and legs. The changes are not so pronounced among males: head movements aug

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meat in frequency from 0.25 to 0.45, hands from 0.01 to 0.03, shoulders from 0.004 to 0.016, from 0.046 to 0.049, and legs from 0.0075 to 0.0064. Thus the sign value for females, which becomes evident in the movement changes, might be more pronounced for females.

The *threshold of performance* for the accompanying body-movements thus seems to be lowered among females as compared to males.

For the analysis of sequences different methods are available - with typical methodological flaws of each method. Cross-leg analysis (Sackett, 1978, 1979) is an exception, because this method does not make any assumption on the underlying distributions of behaviour. The basic idea is the event or time lag. One behaviour, the "criterion behaviour" is defined as a fixed point. In our case laughter, which is the point "zero". Then the distributions of all following behaviours are calculated for the following onset (lag 1), the next onset (lag2) and so on

The same procedure can be applied to the behaviour proceeding laughter - in this case the lags are called lag -1, lag-2 and so on. Now, if a behaviour would occur at random in respect to laughter in these chains, laughter should be distributed according to the "unconditional probability" calculated from total number of instances where the behaviour unit occurred, divided by the total number of all units. These scores then are transformed into Z-Scores, and the "lag-conditional" probabilities (the number of times a behaviour unit occurred on a lag divided by the total number of all units) are calculated. The graphical representations of these distributions are called "lag-profiles". Finally the size of the z-scores then allows to decide if a behaviour unit occurs significantly more often on certain lags.

Figures 4 and 5 show the lag profiles for head and arm movements. In this figures the point 0 is the occurrence of the criterion behaviour "laughter". The profiles suggest for female arm movements an illustrating arm movement followed by an adaptor before laughing, which is followed by five other movements until laughter occurs. After laughter, illustrating arm movements are insignificant. When an adapting arm and hand movement occurs, this movement occurs at three steps

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before laughter. If we look at the males arm movements, the distributions seem to be nearly identical. Thus arm movements in both sexes, always seem to occur at specific sequential points relative to laughter, which can be interpreted as a sign of *typical movement sequences*.

The analysis of vertical head movements shows comparable results. The lag profile suggest the following sequence for females:

*Head up - Laughter- Head up - Head down -Head up -Head down.*

Females thus perform an oscillating up and down movement starting with the head up. Males show the sequence:

*Head up - Head down - Head up -Laughter- Head up - Head down- Head up - Head down - Head up.*

Thus males perform the same oscillating movement sequence, but this sequences is extended by an additional oscillation before and after laughter. The basic sequence in respect to laughter is the same.

If we look at the horizontal head movements - looking at the partner or not - we find slightly different sequences for the sexes. Females show

*Look away - Look at- Look away - Look at- Laugh - Look away -Look at.*

Males show the following sequence:

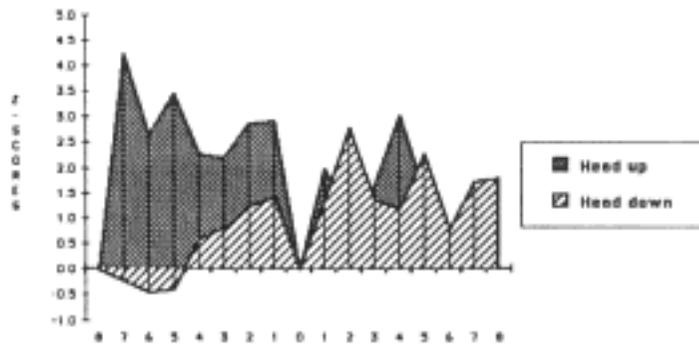
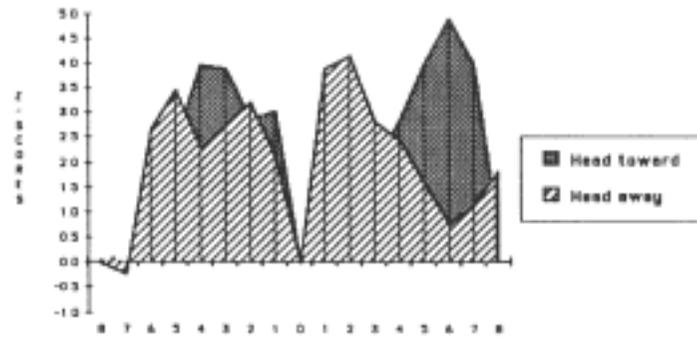
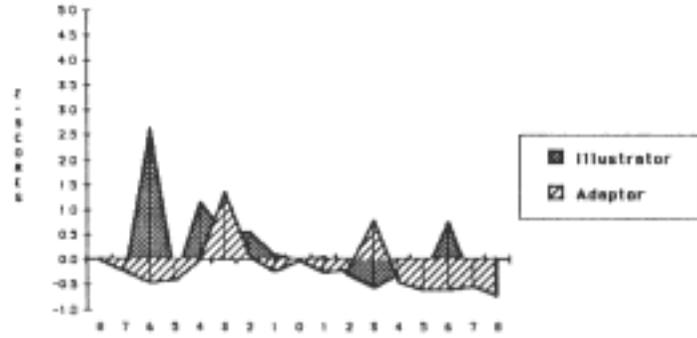
*Look at- Look away -look at- Look away - Laugh - Look awayLook at- Look away - Look at.*

We see that in both sexes the person who is laughing avoids eye-contact with his partner, and when laughter is finished, the person makes eye contact again.

We see that females, in contrast to males, look at their partner, laugh, and then look away, whereas males look away already before they laugh. This oscillation of looking at and looking away from the partner could express ambivalence (Eibl-Eibesfeldt, 1986). This inter

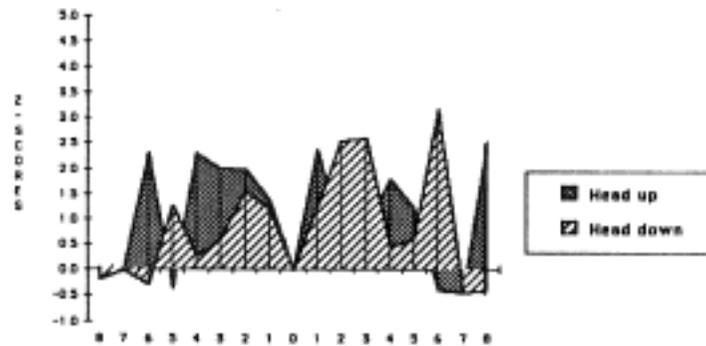
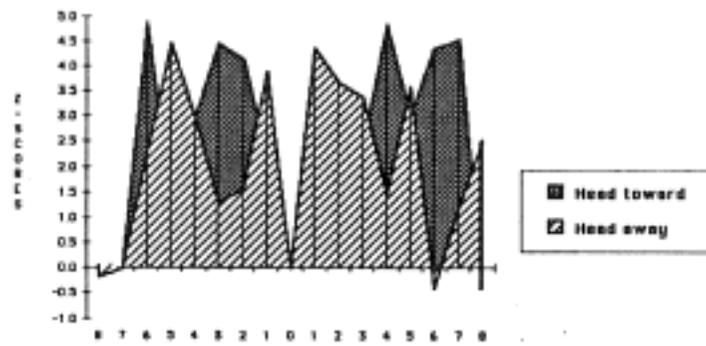
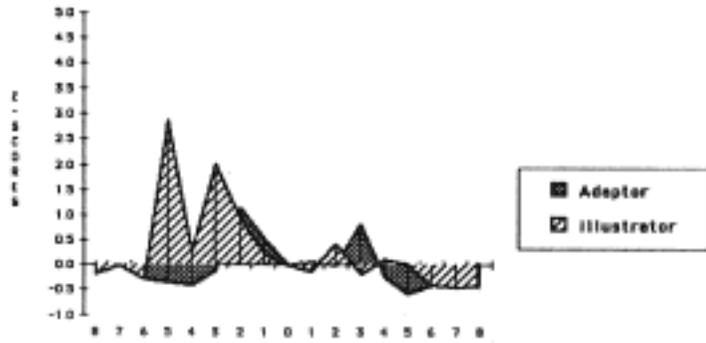
*THE RITUALISATION OF LAUGHTER*  
 SEQUENCING IN FEMALE MOVEMENTS DURING LAUGHTER

SEQUENCING IN FEMALE MOVEMENTS DURING LAUGHTER



*THE RITUALISATION OF LAUGHTER*  
 SEQUENCING IN MALE MOVEMENTS DURING LAUGHTER

SEQUENCING IN MALE MOVEMENTS DURING LAUGHTER



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pretation then would mean that males show a higher degree of ambivalence than females. Moreover, the fact, that just before and after laughter eye-contact is avoided by both sexes is a hint on the *loss of orientation or the redirection of movements*.

The logical extension of this analysis under different interest different interest scores is not possible, because we have not enough data to meet the minimum requirements of lag-sequential analysis. Nevertheless we can conclude that laughter is indeed embedded in stereotypic movement configurations, which show constant organisation of their order of occurrence.

### 4. THE FUNCTION OF LAUGHTER

These results indicate that laughter could well be a ritualized metacommunicative signal, which communicates "this is play" in the ambiguous situation where two strangers of the other sex meet for the first time:

The fact that rhythmical repetition is present in both contexts is obvious for each observer. On the other hand we found that rhythmical repetition is not influenced by the context nor by interest. Besides this typical intensity is present in both contexts. This means that laughter shows a frequency independent intensity level.

Typical movement configurations occur. These movement configurations, also show that redirection of the signal takes place - when people laugh, they do not look at each other. We could interpret these rigid accompanying movements as a complete behavioral pattern, where laughter forms only a part of it (Grammer, 1989a in prep.)

Form constancy is higher in mixed-sex episodes for females as compared to males and increases with increasing interest. Form constancy indeed seems to be an indicator for ritualization, because the form becomes more rigid, the higher the intensity of laughter.

Thus laughter can be labeled as a ritualized display. The open question still is if the function we assume also is the function in our contexts. In contradiction to our hypotheses the threshold for the performance is higher in mixed sex episodes, but it is lowered with increasing female interest.

The analysis of differences in frequencies between the two contexts shows two main points: in mixed-sex encounters, sex

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differences occur which are not present in same-sex encounters, and these differences are mainly a suppression in frequency of laughter, whereas the overall quality of laughter stays the same. In mixed-sex 'encounters sex-differences appear: Females laugh more often than , males, with far more bouts.

This finding - although we find a significant difference in frequency - is not congruent to the supposition that 'higher frequency of a behaviour' could be a factor for the decision that laughter can be labeled as typical courtship behaviour with a specific function in mixed sex encounters. The overall threshold for laughing in mixed-sex episodes is higher - but as soon as interest comes up the threshold is lowered. Thus laughter is an indicator of interest, specifically in mixed sex encounters, and, because it is more suppressed for females, it might be equivalent to female solicitation.

This view is supported by the analysis of interest which shows a connection between interest and the frequency of laughter. The more the female laughs, the less the male is ready to join her. But the more vocalized the female laughs and the more often the male and the female laugh together can predict male readiness. At the same time female readiness can be predicted by the number of times she joins the male in laughing, and by the overall number of instances she laughs. Non-vocalized laughing correlates negatively with female readiness. This shows that vocalization and number of laughs could signal animation of the female (and thus readiness).

This is not so for the controls. In same sex-dyads the frequencies are much higher, but there are no sex differences. Thus melees together with males do not show less signs of submission as predicted. But as soon as they are together with males, females show more laughter than males and thus the interpretation of laughter as a submissive signal could be reasonable. As soon as males are dominance oriented towards females - female solicitation could use signs of submissiveness. The fact that laughter indeed might signal female readiness is strengthened by the finding that females laugh more often in presence of a male rated as attractive by independent other females. Thus laughter signals females' readiness for males.

The initial phase of mixed-sex encounters should be marked by signalling and signalling back: creating communality is the basis for the

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establishment of mutual courtship. Frequency of laughing together correlates highly with readiness in both sexes. Joining one another in laughing could indicate that a common basis has been established. The fact that females' joining the male in laughter can predict female readiness gives the basis for an obvious speculation: laughter could have a tactical function in mixed-sex encounters. If it is suppressed (among the females) and then occurs following a male's laugh it becomes a clear signal for the male. For the complete assessment of function the verbal context also plays a role: males laugh about self presentation statements. Possibly marking them as "play". (Grammer ( 1989d).

If we look back to Huxley's definition of rituals, laughter indeed promotes better and unambiguous signal function - but not in a direct way. Laughter allows to communicate signals which otherwise could offend the receiver- one of the metacommunicative functions of laughter is the prevention of face-loss in a difficult situation, thus it reduces intra-specific damage. Furthermore laughter is a ritualized sign of submission, which communicates female interest in the male. Finally laughing together has a social bonding function, which emerges in mixed-sex encounters as soon as courtship, i.e. the signalling of interest in the partner takes place.

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