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Bodily expression of emotion

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Abstract

The question whether body movements and body postures are indicative of specific emotions is a matter of debate. While some studies have found evidence for specific body movements accompanying specific emotions, others indicate that movement behavior (aside from facial expression) may be only indicative of the quantity (intensity) of emotion, but not of its quality. The study reported here is an attempt to demonstrate that body movements and postures to some degree are specific for certain emotions. A sample of 224 video takes, in which actors and actresses portrayed the emotions of elated joy, happiness, sadness, despair, fear, terror, cold anger, hot anger, disgust, contempt, shame, guilt, pride, and boredom via a scenario approach, was analyzed using coding schemata for the analysis of body movements and postures. Results indicate that some emotion-specific movement and posture characteristics seem to exist, but that for body movements differences between emotions can be partly explained by the dimension of activation. While encoder (actor) differences are rather pronounced with respect to specific movement and posture habits, these differences are largely independent from the emotion-specific differences found. The results are discussed with respect to emotion-specific discrete expression models in contrast to dimensional models of emotion encoding. © *1998 John Wiley & Sons, Ltd.*

BODY MOVEMENT, POSTURE AND EMOTION

Since Darwin's (1872) classic volume on *The expression of the emotions in man and animals* considerable research has been conducted on the expression of emotion within different behavioral modalities. Given our present knowledge, there is conclusive evidence that specific and differential facial expressions exist for a number of fundamental or primary emotions (see Ekman, 1982; Izard, 1977). Similar claims for

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emotion-specific patterns of vocal characteristics (like fundamental frequency or frequency spectra) have been made but not yet substantiated (so far mostly different degrees of non-specific arousal associated with these emotions have been demonstrated (Scherer, 1981, 1986; Banse & Scherer, 1996).

Since Darwin's work the view of the relation between (facial) expression (at least some expressions) as a valid indicator of at least some basic, or fundamental emotions underwent a number of direction changes. In the first part of the twentieth century the view changed, driven by often-cited studies by Landis (1924) or analyses by Klineberg (1938), to a 'culture-relativistic' view basically stating that the relation emotion–facial expression is neither innate nor universal, but to a very large degree culture-dependent. Starting in the 1960s the 'universality' position again gained momentum, this time driven both by theory (Tomkins, 1962, 1963) and by cross-cultural studies (cf. Ekman & Friesen, 1971). Recently, the direction changed again, propelled by research and publications by Russell (1994) and Fridlund (1994), both sharply attacking (but not altogether denying) the 'universalist' position.

Here the question is asked whether body movements, body posture, gestures, or the quantity or quality of movement behavior in general allow us to differentiate between emotions. Table 1 presents citations from Darwin's work concerning emotion-specific nonverbal behaviors within the domain of bodily movement. Darwin was quite specific in ascribing certain movement and posture patterns to specific emotions.

Though these citations indicate rather specific movement and posture patterns for certain emotions, research on this topic is ambiguous. First, most research concerning emotion-specific expression has been conducted on facial expressions, and not on body movements. Second, the '*quantity but not quality*' view seems to dominate the

Table 1. Body movements and postures accompanying specific emotions (citations from Darwin, 1872/1965)

Joy	Various purposeless movements, jumping, dancing for joy, clapping of hands, stamping, while laughing head nods to and fro, during excessive laughter whole body is thrown backwards and shakes or almost convulsed, body held erect and head upright (pp. 76, 196, 197, 200, 206, 210, 214)
Sadness	Motionless, passive, head hangs on contracted chest (p. 176)
Pride	Head and body held erect (p. 263)
Shame	Turning away the whole body, more especially the face, avert, bend down, awkward, nervous movements (pp. 320, 328, 329)
Fear/terror/ horror	Head sinks between shoulders, motionless or crouches down (pp. 280, 290) convulsive movements, hand alternately clenched and opened with twitching movement, arms thrown wildly over the head, whole body often turned away or shrinks, arms violently protruded as if to push away, raising both shoulders with the bent arms pressed closely against sides or chest (pp. 291, 305)
Anger/rage	Whole body trembles, intend to push or strike violently away, inanimate objects struck or dashed to the ground, gestures become purposeless or frantic, pacing up and down, shaking fist, head erect, chest well expanded, feet planted firmly on the ground, one or both elbows squared or arms rigidly suspended by the sides, fists are clenched, shoulders squared (pp. 74, 239, 243, 245, 271, 361)
Disgust	Gestures as if to push away or to guard oneself, spitting, arms pressed close to the sides, shoulders raised as when horror is experienced (pp. 257, 260)
Contempt	Turning away of the whole body, snapping one's fingers (pp. 254, 255, 256)

literature: Ekman and Friesen (1974) have stated that observation of bodily movements does provide information of the quantity (i.e. the intensity) of emotion, but not on the quality or specificity of emotions. This would imply that no specific gestures, body movements, or body postures exist which indicate emotions, but instead that only intensity of the emotion experienced is reflected in, for instance, the total movement activity. On the other hand, there is evidence (see Scherer & Wallbott, 1990) that movements might be influenced by the emotional state of a person. In a study by Camras, Sullivan & Michel (1993), for instance, it was found that body activity accompanying discomfort and anger was judged to be more jerky and active compared to that accompanying sadness. Allport and Vernon (1933)—though not concerned specifically with emotion—in fact addressed the issue that *every* movement may contain both expressive information, as well as purposive information.

So far there is not much evidence for differential patterns of bodily activity accompanying different emotions. Darwin (1872, see above) described behavioral observations on dogs and related erectness of posture to dominance and submission (pp. 51, 54). Similar observations have been reported by Eibl-Eibesfeldt (1984). In the *clinical area* there are some speculations (based on the work of Reich, 1970, as well as on the work of his successors, like, for instance, Lowen, 1967, 1971) reporting that specific emotions for certain patients may result in specific muscle tensions, which in turn influence movement behavior and especially habitual postures. Most often gesture activity as well as bodily activity and posture have been studied with depressive patients (for an overview see Ellgring, 1989), often finding reduced movement activity, cf. hand gestures, and non-erect posture.

Laboratory studies on the specificity of body movements and postures accompanying emotions are rare. Some early studies using hypnotic techniques to induce emotional states have indicated that in fact certain emotions (six emotions were induced) are accompanied by specific bodily postures (Gidro-Frank & Bull, 1950; Bull & Gidro-Frank, 1950). In a more recent study (McClenney & Neiss, 1989) it was found that at least sadness and happiness were recognized better (judgements of happiness, sadness, and anger, only these three emotions were induced via post-hypnotic suggestion) from video recordings of the body than the face. Bull (1978) analyzed clinical interviews (interview sections were rated as being either funny, sad, interesting, or boring) with a coding system for body postures and found some categories to be related to emotional state (like 'drops head' during sadness, 'leans face on one hand' during boredom). Additional evidence that body postures might convey information of an emotional state was collected in some early studies. James (1932) presented photographs of different bodily postures encoded by an actor to subjects, whose task it was to judge the emotions conveyed. The results indicated that certain bodily postures (cf. head postures like head-up, down, tilted) determined judgements of emotions to some degree. Carmichael, Roberts and Wessell (1937) found that photographs and cinematic presentations of gestures, presented by an actor whose task it was to encode certain emotions, were recognized correctly far above chance. Other studies did not involve specific emotions, but success and failure experiences. Riskind (1984) was able to demonstrate that specific body postures (slumped versus upright posture) may affect emotional experiences differentially. Weisfeld & Beresford (1982) showed that successful student subjects tended to have an erect posture and that students' posture changed in erectness upon receiving their grade depending on the grade. A study using drawings of body positions showed that

upright positions compared to positions with shoulder and head down were judged more positively (Schouwstra & Hoogstraten, 1995).

The study to be reported here is an attempt to shed some light on the importance of bodily movement and bodily posture in expressing specific emotions. The discussion concerning the relation between emotion and expression has been mentioned. Our attempt will be to test whether different emotions are associated with different body movements and postures. Thus, 'associations' will be tested, and not so much whether movements 'really express' emotions (for convenience the term 'expression' will be used, though). Still, following Darwin we start from the assumption that body movements express not only the quantity of emotions but also their quality. The question to be asked is which specific patterns of bodily movement and posture can be identified for a number of fundamental emotions.

TECHNIQUES FOR THE ANALYSIS OF BODY MOVEMENTS

As different studies used different techniques to analyse movement behavior (i.e. subjective ratings, free descriptions, category systems) a word concerning the observation of body movements and postures seems justified. 'Modality' approaches provide the observer with categorical definitions of types of movements or movement components within one bodily modality, such as certain types of head or trunk movements, usually defined in terms of the three spatial dimensions in which movements are possible. 'Functional' classifications, on the other hand, provide more general categories not focusing on 'objective' movement characteristics, but on the function of a certain movement within the context of interaction or communication processes (see Scherer & Wallbott, 1985; Wallbott, 1988a). Such a functional classification system was for instance developed by Ekman & Friesen (1969, 1972), who distinguished among other categories between 'illustrators' (movements, which accompany, illustrate, or accentuate the verbal content, like speech accompanying gestures), 'manipulators', or 'adapters' (movements, which serve functions of drive reduction or other non-communicative functions, like scratching oneself), and 'emblems' (movements, with a precise, culturally defined meaning, like the eye-wink, gestures signaling the intellectual deficiency of another person or obscene gestures).

Notation systems to describe movement behavior on an anatomical basis were proposed by Birdwhistell (1970), or by Frey & Pool (1976). Both systems define movements of different parts of the body with respect to the three spatial dimensions. Though these movement notations are rather cumbersome to use for an observer, they provide the possibility to transcribe all visually distinctive behaviors in a fine-grained fashion. Mehrabian (1972) has proposed a more simplified system to code body posture and body orientation. Body orientation here is coded with respect to the orientation of the head and the body toward or away from an interaction partner. Body posture is coded in terms of the closeness or openness and the symmetry or asymmetry of the different body limbs.

METHODOLOGICAL PROBLEMS

As access to emotional situations in the field and the movement behavior of persons experiencing emotions is difficult and problematic from an ethical point of view (see

Wallbott & Scherer, 1985), expressions of actors were used in this study. Although the problem of *posed versus expressed emotions* is certainly a crucial and difficult one (see Zuckerman, Hall, DeFrank & Rosenthal, 1976), some evidence (Zuckerman *et al.*, 1976; Wallbott, 1990) suggests that posed emotional expressions represent an approximation to really felt emotional expressions. Banse and Scherer (1996) using the same video material as in the present study for the analysis of vocal behavior have extensively discussed this issue. One common argument is that actors tend to produce only stereotypes or exaggerate expressive behaviour (see Wallbott & Scherer, 1986). We will come back to this issue in the discussion section.

Most of the studies on posed expressions of emotion suffer from a number of problems: Often *only one actor or actress* has been used (as in the PONS (Profile of Nonverbal Sensitivity) test by Rosenthal, Hall, DiMatteo, Rogers, & Archer, 1979). Yet, there is considerable evidence that actors differ to a large degree in their ability to encode emotions (see Wallbott & Scherer, 1986).

Often encoders are just given emotion labels to describe the emotional state they are to encode (e.g. 'Read this text as if you were very angry'). The problem is that different encoders may attribute different meanings to such labels and that they might envisage different situations inducing these emotions. Such problems can be partly avoided by using a *scenario approach* (see Williams & Stevens, 1972; Rosenthal *et al.*, 1979; Wallbott & Scherer, 1986). In this approach, actors are provided with situation vignettes or short scenarios describing an emotion eliciting situation. They are instructed to imagine these situations and act out as if they were in such a situation.

Given these problems with existing material, we decided to develop a new set of behavior samples suitable for analysis of emotionally expressive behavior in the vocal (see Banse & Scherer, 1996) and nonvocal domain, while attempting to avoid at least some of the problems referred to above (for a more detailed description of the procedure see Banse & Scherer, 1996).

In most encoding studies *only few emotions* have been analyzed (see above). Thus, for the present purpose it was decided to sample a larger range of emotions. These emotions were selected to account not only for 'fundamental' emotions (see Ekman, 1982; Izard, 1977), but also for 'social' emotions, as well as for major subtypes of discrete emotions (like hot versus cold anger, see Scherer, 1986; Banse & Scherer, 1996, for the rationale for choosing the fourteen emotions used here).

Thus, the main hypothesis of the present approach is that body movements and postures allow reliable distinction between emotions, i.e. that body movements and postures reflect not only the quantity of an emotion but also its quality. To study this a scenario approach to encode emotions was used, employing a variety of emotions as well as a considerable number of encoders.

PROCEDURE

Actors

In order to avoid the single encoder problem, twelve actors (six male, six female) were employed. All were professional actors who regularly participate in theater and television productions. Audio and video recordings were collected in a semi-professional

studio of the Max-Planck-Institute for Psychiatry in Munich, Germany. The actors were paid for their services.

Emotions Encoded

It was decided to elicit behavior samples for the emotions of elated joy, happiness, sadness, despair, fear, terror, cold anger, hot anger, disgust, contempt, shame, guilt, pride, and boredom (see Scherer, 1986).

Elicitation of Behavior Samples

For the present study, most scenarios were not constructed *a priori*, but instead were selected from actual situation descriptions collected in a large-scale cross-cultural study (Scherer, Wallbott, & Summerfield, 1986). For each of the fourteen emotions studied, two scenarios intended to produce intense emotions were selected or constructed in order to obtain situation variation. To account for the situations professional actors might envisage, details of the scenarios were adjusted to this specific group of encoders to result in more realistic descriptions.

Utterances

For various methodological reasons (see also Banse & Scherer, 1996) the 'standard sentence' approach was used. As the present stimulus material was devised to be used also in cross-cultural research, we did not select sentences from any specific language. Instead, 'culturally neutral' sentences were constructed in the following way: from each of six European languages, namely German, English, French, Italian, Spanish, and Danish, two meaningless syllables, typical of the respective languages, were selected by a phonetician. These syllables were randomly arranged into several seven-syllable sentences—each containing at least one syllable from each of the six languages. A number of such artificially constructed 'sentences' were judged by the expert phonetician and a number of lay judges with respect to ease of articulation, language neutrality, and whether they could be considered as 'sentences'. Using this selection process, two 'sentences' were selected: 'Fee gott laish jonkill gosterr' and 'Hat sundig pron you venzy' (see Banse & Scherer, 1996).

Encoding Procedure

The actors encoded each sentence within each scenario twice. Thus, the complete design for the elicitation of behavior samples included 12 actors × two scenarios × 14 emotions × two sentences × two repetitions, resulting in 1344 behavior recordings collected.

Video recordings of the actors during their utterances were taken by employing two black-and-white studio cameras (one focusing in close-up on the actor's face, the other recording a total of the actor from 'head to toe'). The shots of these two

cameras were combined into one split-screen recording depicting the total on the left, and the close-up of the face on the right of the screen. All video recordings were made using the high-band U-matic system.

Selection of Behavior Samples for the Present Study

To select the most appropriate takes from this large corpus for analysis, twelve drama students (considered as being expert coders) were paid to watch all 1344 takes. They were aware of the intended emotion in each take and their task it was to judge the *naturalness* of expression and the *recognizability* of the intended emotion for each take. The final sample, containing the most appropriate items with respect to naturalness and recognizability, was to follow the original design of the study as closely as possible with the factors actor, actor's gender, emotion, sentence, and scenario. The final sample with the most appropriate takes consisted of 224 takes (14 emotions × 2 sentences × 2 scenarios × 2 genders of actors × 2 takes each). These takes were analyzed with respect to nonvocal movement and postural activity for the present study. The takes were edited in random order on a tape so that only the phase when the actors produced the 'utterance' were visible.

Coding of Bodily Movements

For the present purpose it was decided to use an eclectic approach to the coding of body movement and posture, relying mostly on the behaviors really shown by the actors. Thus, trained observers—different from the drama students used in the preselection process—watched all 224 takes (throughout the close-up recording of the face was hidden to them) and recorded all bodily activity visible in a free format. From these recordings a preliminary category system was devised and used by two trained, independent coders who coded all 224 takes. After a reliability check the final category system as listed in Table 2 was used, accounting both for functional and anatomical categories, as they appeared in the recordings (figures behind categories = % agreement between two independent coders; see below).

Movements and postures as well as movement quality judgments were coded for each take, but only during the utterance of the respective 'sentence' (which had a mean duration of about 2 to 3 seconds). Multiple coding was allowed where appropriate. Coders were blind as to the respective emotions encoded in the different takes. During the coding the part of the video screen showing the close-up of the actor's face was masked.

Reliability of Coding System

To determine inter-observer agreement of the coding system two independent coders coded all takes in the corpus ($N = 224$). Inter-observer agreement was determined by computing % agreement between the two coders for each category

Table 2. The final category system used (i.e. only categories with >75% intercoder agreement)

Category	Agreement between two coders across all 224 takes (%)
Upper body	
Away from camera	0.96
Collapsed	0.84
Shoulders	
Up	0.75
Backward	0.94
Forward	0.89
Head	
Downward	0.88
Backward	0.89
Turned sideways	0.84
Bent sideways	0.88
Arms	
Lateralized hand/arm movements	0.87
Stretched out frontal	0.89
Stretched out sideways	0.96
Crossed in front of chest	0.99
Crossed in front of belly	0.95
Before belly	0.95
Stemmed to hips	0.99
Hands	
Fist(s)	0.88
Opening/closing	0.83
Back of hand(s) sideways	0.80
Self-manipulator	0.91
Illustrator	0.92
Emblem	0.98
Pointing (index finger)	0.99
Movement quality judgments (rating scale: 1 = weak/low/small, 2 = medium, 3 = strong/high/large; see Wallbott, 1985, 1988a)	
Movement activity	0.73
Expansiveness/Spatial extension	0.86
Movement dynamics/energy/power	0.80

separately. The agreement proved to be rather high and sufficient, ranging from 38% to 100% with a mean across the 40 original categories of 90%. The judgments of movement quality also proved to be rather reliable (73% agreement for movement activity, 86% for spatial extension, and 80% for movement dynamics). Finally, only categories with an inter-observer agreement >75% or close to 75% were used for further analyses. All reliability coefficients are provided in the final list of categories in Table 2. Given the high reliability of most categories for the statistical analyses to be presented now data from always one coder were chosen at random for each of the $N = 224$ takes.

RESULTS

Differences between the Fourteen Emotions Studied

As a first step to detect possible differences in movements and postural activity between the fourteen emotions each single category was subjected to one-way ANOVAs. Because of the number of cases no attempt was made to include gender of encoder, or scenario into analyses, only main effects for emotion were of interest. All results are summarized in Table 3, indicating the means for the respective categories which reached significance between emotions, as well as Newman–Keuls' *post-hoc* comparisons between the emotions. The ANOVA approach was used only for categories reaching at least 5% frequency of occurrence in the total sample of 224 takes.

Significant differences between emotions were obtained for seventeen categories (while comparing data of twenty-six categories). This means that 66% of the movement and posture categories distinguished significantly between emotions or subclasses of the emotions studied. At this point briefly some of the results found will be mentioned (see Table 3). An erect body posture is very rare when experiencing the emotions of shame, sadness, or boredom. During these emotional states actors much more often chose a collapsed body posture. Lifting the shoulders, on the other hand, is typical for elated joy and hot anger, but rather infrequent for all other emotions. Moving the shoulders forward is frequent for disgust, as well as for despair and fear, compared to the other emotions. For different types of head movements and head postures also significant differences arose between emotions. Orientation of the head directly toward the camera is least frequent during boredom experiences. On the other hand, moving the head downward is most typical of disgust. Moving the head backwards, i.e. raising the chin, can be observed rather frequently during boredom, but also during pride and during elated joy, compared to the other emotions.

Most significant differences between emotions arose for different types of hand and arm postures and movements. Lateralized hand/arm movements are most frequent during hot anger, cold anger, and interest, i.e. rather 'active' emotions. Arms stretched out to the front indicate the same three emotions and, in addition, elated joy in comparison to the other emotions. Arms stretched sideways is especially typical for terror, while less often used for all other emotions. Crossing the arms in front of the body is rather frequent during pride experiences, as well as during disgust. Opening and closing of the hands is again typical for some 'active' emotions, like hot anger and elated joy, but also for despair and fear.

The functional categories of self-manipulators and illustrators (see Ekman & Friesen, 1972) distinguish between the emotions studied in a rather meaningful way. Self-manipulators are most frequent during shame experiences and during fear experiences compared to the other emotions. Illustrators, on the other hand, dominate during hot anger, elated joy, and interest, again 'active' emotions.

For the three qualitative aspects of movement behavior as judged on scales from 1 to 3, considerable significance for the differences between emotions was obtained. The judged amount of movement activity resulted in a rather clear-cut succession of emotions. Most movement activity is judged for elated joy, followed by hot anger, followed by terror, then somewhat less movement activity during despair, interest, shame, and cold anger and still less movement activity for fear, pride, disgust, and

Table 3. Significant differences between emotions (one-way ANOVAs with df = 13 (emotions)/210 (within groups; only movement categories with total frequency > 0.05 considered)

Category	Means for emotions 1	2	3	4	5	6	7	8	9	10	11	12	13	14	*F*	*p*
Upper body collapsed			0.08		0.38[a]	0.13	0.56[a]	0.06	0.06	0.06	0.63[a]			0.38[a]	7.91	0.001
Shoulders up	0.32	0.60[a]	0.63[a]	0.19	0.13	0.25		0.19	0.25	0.38	0.25	0.31	0.31		2.96	0.001
Shoulders forward		0.07	0.25		0.44[a]			0.38[b]	0.38[b]	0.19	0.06	0.06	0.13		3.94	0.001
Head downward	0.13	0.07			0.31[a]		0.13	0.13		0.06	0.25[b]		0.06	0.06	2.03	0.020
Head backward	0.06		0.25[b]		0.06					0.06		0.06	0.31[a]	0.38[a]	3.97	0.001
Head bent sideways	0.25	0.07			0.06		0.06		0.06		0.19	0.06	0.13	0.25	1.81	0.043
Lateral hand/arm movements	0.44[b]	0.67[a]	0.19	0.06	0.13		0.06			0.06	0.06	0.44[b]		0.06	6.99	0.001
Arms stretched out frontal	0.44[b]	0.67[a]	0.38[c]	0.06	0.06			0.31	0.13	0.13	0.06	0.38[c]			5.86	0.001
Arms stretched out sideways	0.13	0.33	0.25			0.06		0.25	0.13	0.50[a]	0.13	0.06	0.13		3.25	0.001
Arms crossed in front of chest			0.06	0.06	0.25[b]						0.06		0.31[a]	0.19	3.17	0.001
Hands opening/closing	0.25	0.67[a]	0.56[b]	0.13	0.13	0.06		0.50[c]	0.50[c]	0.38	0.38	0.25	0.19		4.31	0.001
Back of hands sideways	0.75	0.93	0.75	0.50	0.50	0.69	0.31	0.63	0.50	0.56	0.69	0.75	0.31	0.25	2.78	0.002
Illustrator	0.31	0.73[a]	0.50[b]	0.06	0.06			0.25	0.19	0.13	0.19	0.44[c]	0.13		5.56	0.001
Self-manipulator				0.06	0.25		0.13	0.25	0.38[b]	0.06	0.50[a]	0.06			4.76	0.001
Movement activity	169[d]	200[b]	219[a]	150[e]	156[e]	106	125	181[d]	163[e]	194[c]	175[d]	175[d]	156[e]	144	4.60	0.001
Expansiveness/Spatial extension	144[c]	200[a]	194[a]	106	100	106	106	150[b]	113	138[d]	106	125	125	100	7.64	0.001
Movement dynamics/energy/power	169[e]	273[a]	213[b]	119	125	131	100	188[c]	169[e]	200[c]	138[f]	175[d]	150[f]	119	14.10	0.001

Decimal points omitted for the last three variables for space reasons; (a-e significant differences between means according to Newman–Keuls *post-hoc* comparisons).
Categories with frequencies <0.05, but discriminating emotions (not tested via ANOVA):
Arms upwards indicative of emotion 3 (0.19)
Pointing (index finger) emotion 2 (0.27)
Shoulders backward emotion 5 (0.18)
Emotions: 1 = cold anger, 2 = hot anger, 3 = elated joy, 4 = happiness, 5 = disgust, 6 = contempt, 7 = sadness, 8 = despair, 9 = fear, 10 = terror, 11 = shame, 12 = interest, 13 = pride, 14 = boredom.

happiness, finally followed by the remaining emotions of contempt, sadness, and boredom with least movement activity. This succession again indicates that the activity factor accounts for some amount of variance of the differences between the emotions. The data for the use of space in terms of judged expansiveness or spatial extension of movements are somewhat similar. Highest expansiveness was again found for the active emotions of hot anger and elated joy, followed by despair, cold anger, terror, and then all other, more 'passive' emotions. The largest differences were obtained for the judgments of 'dynamics/energy/power' of movements. Highest again are hot anger, followed by elated joy and terror, then despair, interest, cold anger and fear, then pride and shame, and with lower values all the other emotions.

It was mentioned earlier that ANOVAs were computed only for categories with a frequency of at least 5% in the total sample. Still, when looking at the remaining categories with less than 5% of occurrence some interesting findings can be obtained in a descriptive fashion. Three of these categories seem to be typical for just one emotion: arm movements upward, for instance, for the emotion of elated joy, pointing movements (especially with the index finger) for hot anger, and finally shoulders backward for the emotion of disgust (see also Table 3).

This considerable number of significant results indicates that movement activity and postures in fact seem to be differently shaped for at least some of the emotions studied. In order to get a general idea how good the movement categories would be able to distinguish between the fourteen emotions, a discriminant analysis (method = direct, tolerance = 0.001, minimal partial F-value = 1.00, Varimax rotation) was computed by which it was tested whether the categories (again excluding all categories with frequencies < 5%) would be able to predict group membership with respect to the fourteen emotions. The results are presented in Table 4.

Four discriminant functions reached significance (see Table 4) which altogether accounted for about 70% of the total variance, the first function being the most important with an eigenvalue = 1.29. It is interesting to look at the classification matrix showing the relationship between actual group membership in terms of the emotions encoded and predicted group membership from the coding data. The percentage of correct classifications across emotions is 54%, which is highly significant considering a chance expectancy of agreement of about 7%. The classification matrix furthermore indicates that the number of correct classifications for the different emotions is significant for all the fourteen emotions. The emotion classified most often correctly with respect to the movement data is shame with 81% correct classifications. The classification for the two active emotions of elated joy (69%), and hot anger (67%) is also very good. On the other hand, emotions classified worst according to the movement coding are despair, terror, and pride (38% each). It is interesting to note that, for instance, terror is very often confused with happiness by the discriminant analysis, although these two seem to be rather distinctive emotional states. On the other hand, pride is also very often confused with happiness, in this case similarities between both states are much more evident.

Some basic dimensions may at least partly underlie the distinction between the emotions. An interpretation of the first two discriminant functions indicates two underlying dimensions, one being the dimension of activity versus passivity with hot anger and elated joy at the one extreme and boredom at the other, crossed by a second dimension of approach versus avoidance, characterized by the poles of interest at the one extreme and shame at the other. Inspection of the other two dimensions did not

Table 4. Results of discriminant analysis (criterion: emotion)

Significant discrim. functions	Eigen-value	% of variance explained	*df*	*p*
1	1.29	26.93	324	0.001
2	0.97	20.25	286	0.001
3	0.65	13.61	250	0.001
4	0.47	9.81	216	0.036

Classification matrix (total percentage of correct classifications = 0.54)

Actual group (emotion) membership	Predicted group (emotion) membership													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	*0.50*	0.13	0.06			0.13				0.06		0.13		
2		*0.67*		0.07		0.07		0.07				0.13		
3		0.13	*0.69*					0.06				0.13		
4				*0.50*		0.31			0.06			0.06	0.06	
5	0.06				*0.56*		0.06		0.06		0.13		0.13	
6				0.13		*0.63*	0.06			0.06	0.06	0.06		
7				0.06		0.19	*0.63*	0.06			0.06			
8			0.13	0.13	0.06	0.06		*0.38*	0.13	0.13				
9				0.19	0.06	0.06	0.06	0.13	*0.44*	0.06				
10			0.13	0.25	0.06			0.06	0.06	*0.38*	0.06			
11	0.06						0.06			0.06	*0.81*			
12	0.06	0.25		0.06		0.13						*0.44*	0.06	
13				0.25	0.06	0.06				0.13			*0.38*	0.13
14	0.06			0.06		0.06	0.06					0.06	0.06	*0.63*

Emotions: see Table 3.

reveal any clear-cut possibility of interpretation. There is no need to stress that the first two dimensions strongly remind of circumplex models of emotion (see, for instance, Russell, 1980) or of dimensional theories (cf. Rosenthal *et al.*, 1979).

Differences Due to Idiosyncrasies of Actors/actresses

Casual observation of the video recordings had indicated that at least some of the actors exhibited rather idiosyncratic movement styles irrespective of the emotions they were to encode. In order to test the effect of such actor differences on differences between emotions, two-way ANOVAs were computed with the factors of emotion and of actor, whereby only actors with at least twelve takes in the final sample were used. This implies that finally eight actors entered the analysis on the 'actor' factor using a total $N = 205$ takes. Due to the small number of actors no attempt was made to include gender of actors as a factor, which would have been an interesting additional research question.

The data for the judgements of movement quality on all three scales (movement activity, expansiveness, dynamics) indicate that the differences due to actors are of nearly the same size as the differences due to emotions, but that in general (with the exception of movement activity) interactions between both factors are non-significant.

The additional results for movement and posture categories indicate a number of main effects for the factor 'actor', for instance, for the categories of 'body collapsed', 'shoulders backward', 'arms before belly', 'back of hands sideways', or the number of 'illustrators'. On the other hand, interactions between the two factors of emotion and actor rarely reach significance.

This means that idiosyncratic strategies of actors or actresses to encode emotions in general are to a rather large degree independent of the type of emotion encoded. Similar to the discriminant analysis reported above for differences between emotions, a discriminant analysis to predict the actor or actress was computed with the movement and posture categories as dependent variables. Again, this discriminant analysis is highly significant. Four discriminant functions explain about 80% of the variance. The accuracy of classification of the eight actors and actresses employed in the statistical analysis on average reaches 65.8%, with a range from 45.8% to 91.7% for the different actors and actresses. This again indicates that actors and actresses differ to a large degree in their stereotypicity of encoding emotions. While some actors can be classified almost unambiguously, which implies that these actors produced rather stereotyped movements and postures irrespective of the emotion to be encoded, the classification results for other actors (though still far above chance level which in this case is 12.5%) is not very impressive. But these should be the 'good' actors encoding different movement patterns for the different emotions.

DISCUSSION

The most important point to note is that a considerable number of categories distinguished significantly between emotions and that via the discriminant analysis it was possible to classify the emotions correctly far above chance. This implies that in fact there seem to be distinctive patterns of movement and postural behavior associated with at least some of the emotions studied. Or if there are not patterns, there should at least be distinctive features which allow reliable distinction between the emotion categories. Some of these distinctive features seem to be typical of certain emotions, such as 'arms crossed in front of chest' for the emotion of pride, or the number of 'self-manipulators' for shame. Thus, movement and postural behavior when encoding different emotions (at least as captured with the categories used here) is to some degree specific to at least some emotions. A general factor of activity/passivity (and probably a second factor of approach-avoidance as indicated in the discriminant analysis), on the other hand, might account for some similarities found. It is evident from the data that a number of movement and posture categories merely distinguish between 'active' emotions like hot anger or elated joy, on the one hand, and more 'passive' emotions, on the other. We may conclude that both a dimensional approach to emotions and an approach favoring distinctive features do account for some of the results found.

In general, our results indicate that movement and postural behavior is certainly indicative of the quantity (intensity) of different emotions, a finding which is especially evident when looking at the movement quality scales, which to a large degree distinguish between active and passive emotions. On the other hand, certain distinctive features in movement and postural behavior seem to exist which allow us to

identify quality, i.e. specific emotions. In order to demonstrate both findings, all differences between emotions for all categories are summarized in Table 5 in a descriptive fashion. The reader might refer to Table 1 for Darwin's predictions and to Table 3 for the respective frequencies for movement and posture profiles for the respective emotions.

One additional finding has to be discussed. As in this study a considerable number of different actors were involved, it was possible to compare movement encoding styles of these actors with respect to the different emotions. The results indicate that actors and actresses differ to a large degree in their 'ability' to encode the emotions in movement and posture, as well as in their idiosyncrasies of encoding style. While some actors seem to be very 'good' in producing different movement and posture patterns for the different emotions, other actors seem to use rather stereotyped movements and postures even when encoding different emotions. This finding is in line with other results (based on stereotypy of facial expression for professional actors; see Wallbott, 1988b; Wallbott, 1991). Thus, finally one is confronted with three possible sources of variance: the type of emotion encoded, the specific ability of the encoder, and specific, discriminative movement indicators for certain emotions versus indicators of the general intensity of the emotional experience. This, in turn, indicates that a more 'differential' view of the indicative function of movement and postural behavior for emotions is mandatory, with respect not only to the emotions studied but also to the encoders used and to the indicators measured. The fact that actors or actresses differ to a large degree in their specific general encoding styles nowadays is well established (see Wallbott & Scherer, 1986). But it seems worth noting that such idiosyncratic styles here are largely independent of the type of emotion encoded, given the neglectable low number of significant interactions compared to the number of main effects found. This finding highlights the fact that the differences between emotions as reported above seem to be rather stable phenomena, which reach significant results—irrespective of the large differences between the actors and actresses employed in the study.

An additional possibility to look at the relative importance of the factors emotion and actor is to compare the *etas* for the two factors across movement and posture categories. The average *eta* for the 26 categories for emotion amounts to 0.40, while the average *eta* for the factor of actor is 0.31. Thus, the amount of variance which can be explained by emotion is larger than that due to the actors and actresses employed in the study. On the other hand, this finding highlights that studies using only one or very few actors or very few indicators of emotion in terms of movement behavior may be misleading in that some variance of the findings is due to the different actors, while for some indicators (movement or posture categories) the variance due to actors may be higher than the variance due to emotion, such as for the categories of 'head turns sideways' or 'arms hanging down' or 'arms before belly'. To sum up, this indicates that actors' idiosyncrasies in encoding different emotions via body movements and postures cannot be neglected, but in fact have to be taken into account. On the other hand, our findings indicate that emotion still is the predominant factor in determining movement and postural behavior of the actors.

The present results differ from existing studies with respect to the fact that a much broader selection of emotions was used. Other studies often only have used few emotions, or only success/failure as emotional states (see Introduction). Thus, the present results can be seen as being of some interest. Still, a study like the one

Table 5. An overview of discriminative body movements and postures based on *post-hoc* comparisons reported in Table 3

Emotion	Body Parts: Upper body	Shoulders	Head	Arms	Hands	Movement quality
	Differences from 'standard' movement and posture pattern observed, the 'standard' pattern being:					
	Erect	Hanging	Toward camera	Hanging	No specific activities	No extreme judgments
Cold anger				Stretched out frontal	Lateralized movements	
Hot anger		Up		Stretched out frontal	Lateralized movements, pointing, opening/closing, back of hands sideways, many illustrators	High movement activity, expansive movements, high movement dynamics
Elated joy		Up	Backward	Stretched out frontal or upward	Opening/closing, many illustrators	High movement activity, expansive movement, high movement dynamics
Happiness						Low movement dynamics
Disgust	Collapsed	Backward or forward	Downward	Crossed in front of chest		Inexpansive movements
Contempt						Low movement activity, low movement dynamics
Sadness	Collapsed					
Despair		Forward			Opening/closing	Expansive movements
Fear					Opening/closing, many self-manipulators	
Terror				Stretched out sideways		High movement activity
Shame	Collapsed		Downward		Many self-manipulators	
Interest				Stretched out frontal	Lateralized movements	
Pride			Backward	Crossed in front of chest		
Boredom	Collapsed		Backward			Low movement activity, inexpansive movements, low movement dynamics

presented is likely to be confronted with some points of criticism raised also against many similar studies. The problem of the relation between emotion and expression has been mentioned and cannot be resolved here. The present results and other results (see for instance the work on success/failure) indicate that some movement characteristics are associated with some emotions. Whether body movements are an integral part of the emotion process is another question not to be resolved here.

The second criticism concerns the posed expressions used. It should be mentioned that the actors were not aware that body movements were part of their encoding task. They focused attention on the meaningless sentences (see above) they had to utter. Of course, they were aware of the camera, but it seems plausible to argue that not too much attention was paid to deliberately producing specific body movements or postures. Third, only German actors were used. Of course, a cross-cultural replication would be of interest. But this point of criticism holds for many studies, not only in this area of psychology.

Next, the takes were preselected, thus they represent 'good' examples of emotional expressions, which might lead to an overestimation of differences between emotions. But they were not preselected solely with body movement as the criterion, but instead a close-up of the facial expression and the voice were available to the drama students used during the preselection process. It is likely that these judges paid more attention to this salient information than to body movement and postures. No judgement study was conducted because the focus of interest here was on encoding, and not on decoding. But judgement data on a subset ($N = 56$) of the 224 takes analyzed were reported by Wallbott (1992). The decoding accuracy found there amounted to 57% across emotions, which is very close to the mean percentage of correct classifications (54%) found in the present study. This high accuracy also partly invalidates the 'only general arousal' argument. Thus, emotions can be decoded to a considerable and about equal degree by using both behaviour observation and subjective judgements. There is valid information distinguishing emotions in body movements and postures, available both to coding procedures and to naive judges.

Finally, the data presented here are frequencies, and no attempt was made to analyze the temporal structure or sequence of movements and movement changes. The takes were too short to attempt such an analysis. On the other hand, one might expect especially sequence data to provide important information on the emotion process, an argument which recently also became of importance in research on facial expression, where it was argued within the context of appraisal theories of emotion that sequence data would allow elaborated analyses of appraisals or evaluation checks (cf. Scherer, 1986, 1993).

Further studies using other methods (cf. more fine-grained observation techniques, a cross-cultural approach) and especially other material (preferably spontaneous expression) should attempt to replicate or to refine the present results.

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