

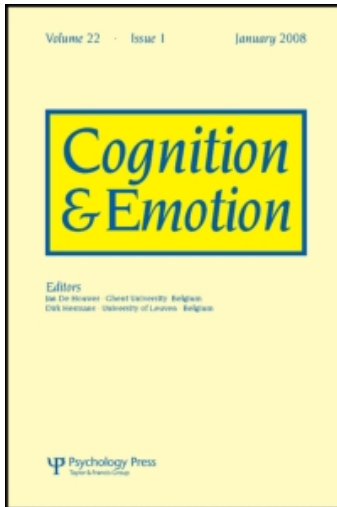
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The Karolinska Directed Emotional Faces: A validation study

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The Karolinska Directed Emotional Faces: A validation study

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Although affective facial pictures are widely used in emotion research, standardised affective stimuli sets are rather scarce, and the existing sets have several limitations. We therefore conducted a validation study of 490 pictures of human facial expressions from the Karolinska Directed Emotional Faces database (KDEF). Pictures were evaluated on emotional content and were rated on an intensity and arousal scale. Results indicate that the database contains a valid set of affective facial pictures. Hit rates, intensity, and arousal of the 20 best KDEF pictures for each basic emotion are provided in an appendix.

Since the 1990s, affectively valenced stimuli have increasingly been used in emotion research. However, the current variety in methodology may account for the often divergent research findings in emotion research. Although several problematic methodological issues can be identified (Bradley, 2000), one of the most important problems concerns the affective stimuli used in emotion research. Because the experimental study of emotion requires stimuli that reliably evoke psychological and physiological reactions that vary systematically over the range of expressed emotions, the development and use of standardised sets of affective stimuli are of crucial importance.

Lang and colleagues (Bradley & Lang, 1999a, 1999b; Lang, Bradley, & Cuthbert, 1997a) developed affective norms for different sets of experimental stimuli in different modalities (pictures, words, and sounds) by asking groups of subjects to rate the pleasantness, arousal, and dominance dimension. Other researchers have also reported affective ratings for sets of affectively charged stimuli for words (e.g., Anderson, 1968; Hermans & De Houwer,

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1994; Messina, Morais, & Cantraine, 1989), film clips (e.g., Hewig et al., 2005), and facial expressions (e.g., Beaupré, Cheung, & Hess, 2000; Ekman & Friesen, 1976; Matsumoto & Ekman, 1988). Pictorial stimuli are particularly interesting. The processing of words and pictures differs as a function of access to the semantic network in which the affective information is stored. Whereas words tend to be controlled by the lexical executive system, pictures have privileged access to the semantic system (Glaser & Glaser, 1989). Film clips also have privileged access to this system, but they are less easily applicable to certain avenues of research. In information processing research, for example, the time needed to evoke and measure different processing aspects is often limited, making the use of film clips problematic.

Pictorial emotional facial expressions are often used in emotion research. In addition to the fact that the facial expression of an emotion has a clear social dimension, facial expression is considered a core element of the perception and experience of emotions (Ekman, 1993; Izard, 1990). The recognition and interpretation of the emotional expression of faces plays a crucial role with regard to our environmental adaptation capacities and, furthermore, facilitates personal interaction. The use of emotional facial expressions has also increased exponentially in the field of neuroscience research. However, it has often been highlighted that the choice of affective stimuli may not always have been optimal. This may explain the inconsistent results reported in the brain-imaging literature (see Zald, 2003). Researchers often use schematic faces (e.g., Fox, Russo, Bowles, & Dutton, 2001) or computerised faces (e.g., Schultz et al., 2000) of which the ecological validity may be questioned. Another often used alternative is ad hoc composed facial stimuli sets (e.g., Pourtois, Schwartz, Seghier, Lazeyras, & Vuilleumier, 2005). Although these sets might offer an instant solution, questions may be raised regarding standardisation and validity. The existing validated sets of affective facial pictures are rather limited. The most important and frequently used facial picture sets were developed by Ekman and colleagues. The set produced by Ekman and Friesen (1976) includes 60 black and white pictures of faces. These pictures are nowadays rather old-fashioned, limiting their ecological validity. Another well-validated facial picture set is the Japanese and Caucasian Facial Expressions of Emotion (JACFEE) and Neutral Faces (JACNeuf) set up by Matsumoto and Ekman (1988; see also Biehl et al., 1997). This set contains a more contemporary-looking collection of colour pictures and takes into account cultural differences by including different ethnic groups. An important limitation of this set, however, is the small number of pictures ($n = 56$). Another—more extensive—standardised set of affective facial pictures is the Montreal Set of Facial Displays of Emotion (MSFDE; Beaupré et al., 2000), which consists of 144 facial stimuli

expressed by three cultural groups. However, the use of this set is still relatively restricted by the small number of pictures available.

The present validation study provides affective ratings for 490 colour pictures of the Karolinska Directed Emotional Faces database (KDEF) designed by Lundqvist, Flykt, and Öhman (1998). The original KDEF-database consists of a total of 490 JPEG pictures (72×72 dots per inch) showing 70 individuals (35 women and 35 men) displaying 7 different emotional expressions (Angry, Fearful, Disgusted, Sad, Happy, Surprised, and Neutral). Each expression is viewed from 5 different angles and was recorded twice (the A and B series). All the individuals were trained amateur actors between 20 and 30 years of age. For participation in the photo session, beards, moustaches, earrings, eyeglasses, and visible make-up were exclusion criteria. All the participants were instructed to try to evoke the emotion that was to be expressed and to make the expression strong and clear.

The pictures selected for this validation study are frontal view pictures of the A series ($n = 490$). In order to minimise fashion issues, we removed the hairline of all pictures, which might be an important advantage in comparison with the existing stimuli sets. In addition, in contrast to certain other picture series, all the pictures are in colour, which is an important asset with regard to ecological validity. Furthermore, and most importantly, many studies require several different stimuli to avoid habituation. In this regard, our validation study offers many more stimuli ($n = 490$) than the original Ekman and Friesen series (1976; $n = 60$), the Matsumoto and Ekman JACFEE faces (1988; $n = 56$), and the Montreal Set of Facial Displays of Emotion (MSFDE; Beaupré et al., 2000; $n = 144$).

The primary aim of this study was to obtain emotion and intensity ratings. Since from a motivational point of view arousal is a fundamental dimension of emotion, arousal ratings were also included (Lang, Greenwald, Bradley, & Hamm, 1993). It was expected that, compared with expressions of emotions, neutral facial expressions would be rated lowest on the arousal dimension. The Self-Assessment Manikin (SAM; Lang, 1980) was chosen as forced judging rating instrument. The SAM was also used in the assessment of the IAPS picture set (Lang et al., 1997a).

METHOD

Participants

A total of 272 female students from Ghent University volunteered to take part in the rating procedure. The mean age was 21.1 years ($SD = 2.1$; range 18–37 years). Participants were asked to take part in the study only if they

were able and willing to comply with all the instructions given in the accompanying manual.

Stimulus material and rating scales

The picture set comprised colour pictures of human facial expressions with no hairline from the A series of the Karolinska Emotional Directed Faces database. This set of 490 pictures includes 70 selected individuals (35 women and 35 men), each displaying six basic emotions (Angry, Fearful, Disgusted, Happy, Sad, and Surprised) and a neutral facial expression (Lundqvist et al., 1998). Each expression is photographed from the front. See Figure 1 for an example of each emotional expression.

Emotion, intensity, and arousal ratings were obtained for each picture. The three rating scales per picture were presented on a single page for each facial expression. For emotion rating, participants were asked to circle the word that best matched the emotional expression of each face. In addition to the possibility of choosing one of the six basic emotions, the options “neutral” and “?” (indistinct) were offered as alternatives. The intensity assessment of the chosen emotion was measured using a 9-point Likert scale, ranging from “1” (*not at all*) to “9” (*completely*). The arousal assessment was based on a pencil-and-paper version of the Self-Assessment Manikin (SAM; Lang, 1980). The SAM rating scale consisted of graphic figure representations providing an easy understandable depiction of the arousal dimension ranging from feeling completely relaxed, unstimulated, and calm



Figure 1. Example of each emotion (Angry, Fearful, Disgusted, Happy, Sad, Surprised, and Neutral) of the KDEF stimulus set.

at the one extreme (represented by a face with eyes closed) to awake, stimulated, and excited at the other extreme (represented by a face with eyes wide open). Pictures could be rated by placing an “X” on any of the five faces or between any two faces, yielding a 9-point scale ranging from “1” (*calm*) to “9” (*aroused*).

Procedure

Participants were seated in rows in front of a screen on which slides were projected. They had been told that they were to take part in a validation study of emotional pictures of human faces for experimental research. All the participants received a manual that contained one page with instructions and a test page for each slide. The meaning of the three different emotional dimensions was explained by the experimenter. It was stressed that the participants had to work autonomously. For the emotion dimension, the participants were asked to indicate which emotion was expressed. For the intensity dimension, they were instructed to indicate the intensity of the chosen emotion. For the arousal dimension, the meaning of the SAM figure was given. For this latter judgement, the participants were instructed to concentrate on how they actually felt when looking at a picture, with feelings ranging from completely relaxed, unstimulated, and calm at the one extreme to awake, stimulated, and excited at the other extreme.

Before showing a picture, a warning slide was shown for 5 seconds with the instruction “Get ready to rate the next picture”. Immediately after this slide, a picture was shown for 5 seconds. The next slide was then presented for 5 seconds with the instruction to rate the picture. This procedure was repeated for each picture. In order to simplify the rating procedure and to avoid overloading the participants, the 490 pictures were randomly divided into 12 slide shows. Eleven slide shows contained 41 pictures, and the remaining one had 39 pictures. Each of the KDEF pictures was rated by 64 participants. After deleting missing values and invalid answers (0.2%), each of the 490 KDEF pictures was rated by a minimum of 60 and a maximum of 64 participants ($M = 63.89$; $SD = 0.39$) on emotion, intensity, and arousal.

RESULTS

Hit rate

Analyses were performed in several steps. First, for each picture, the idiosyncratic hit rate was calculated, which is an index of the percentage of participants who correctly identified the KDEF target emotion. The mean success index was 71.87% ($SD = 25.78$), ranging over the different emotions from 43.03% to 92.65% (see Table 1).

TABLE 1
 Mean scores (*M*) and standard deviations (*SD*) for biased hit rate percentage, unbiased hit rate (values range from 0 to a perfect score of 1), and intensity and arousal measures as a function of emotion

	<i>Emotion</i>						
	<i>Angry</i>	<i>Fearful</i>	<i>Disgusted</i>	<i>Happy</i>	<i>Sad</i>	<i>Surprised</i>	<i>Neutral</i>
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
Biased hit rate (%)	78.81 (22.89)	43.03 (24.18)	72.17 (27.76)	92.65 (14.70)	76.70 (19.26)	77.09 (14.51)	62.64 (23.77)
Unbiased hit rate	0.59 (0.15)	0.29 (0.16)	0.54 (0.16)	0.89 (0.09)	0.47 (0.13)	0.59 (0.15)	0.54 (0.21)
Intensity	5.59 (0.93)	5.39 (0.80)	6.23 (0.81)	6.10 (0.86)	5.28 (0.84)	5.89 (0.93)	4.75 (0.50)
Arousal	3.58 (0.53)	3.58 (0.39)	3.71 (0.47)	3.72 (0.44)	3.37 (0.44)	3.51 (0.50)	2.67 (0.32)

Of all the picture ratings, "Sad" was the most frequently reported emotion (19.1%), while the lowest rated emotion was "Fearful" (8.6%). Two pictures were indicated as indistinct by the majority of participants (pictures "M33AN" and "M33SU").

To compare the percentage hit rate between emotions, a 7-level between-subjects analysis of variance (ANOVA) was performed with Emotion (Angry, Fearful, Disgusted, Happy, Sad, Surprised, and Neutral) as independent variable and Percentage Hit Rate across all judges per photo as dependent variable. Results revealed a main effect of emotion, $F(6, 483) = 36.47$, $p < .0001$. Bonferroni-corrected post hoc comparisons revealed that the percentage hit rate for happy pictures ($M = 92.65$; $SD = 14.7$) was significantly higher than all the other emotions, whereas the percentage hit rate for "Fearful" was significantly lower ($M = 43.03$; $SD = 24.18$) than all other emotions, $ps < .05$.

Although the proportion of correctly identified target stimuli is one of the most frequently used measures of accuracy, this method confounds recognition accuracy with the frequency of usage of each response category. Wagner (1993) developed a procedure that takes this problem into account. This procedure is based on the computation of an unbiased hit rate which involves "the joint probability that a stimulus is correctly identified (given that it is presented) and that a response is correctly used (given that it is used). This is done by multiplying together the two conditional probabilities, each of which is the cell entry in a frequency matrix divided by the appropriate marginal total" (p. 16). The unbiased hit rates per emotion ranged from .29 to .89 ($M = 0.56$; $SD = 0.15$; see Table 1). Because this unbiased hit rate is a proportion, it has to be arcsine transformed before statistical analyses can be performed. Values range from a minimum of 0 to a perfect score of 1.57, which is the arcsine of 1 and indicates that a stimulus is always correctly identified and that the corresponding response category is always correctly applied.

We first computed the arcsine transformed unbiased hit rate accuracy scores per judge for each emotion separately. A within-subjects ANOVA (multivariate solution) was conducted with Emotion Category (Angry, Fearful, Disgusted, Happy, Sad, Surprised, and Neutral) as within-subject variable and the Unbiased Hit Rate Score per judge as dependent variable. Results revealed a main effect of Emotion, $F(6, 266) = 505.86$, $p < .0001$. Pairwise comparison with Bonferroni correction revealed a data pattern similar to the biased hit rate analysis. The arcsine transformed unbiased hit rate for happy pictures ($M = 1.15$, $SD = 0.23$) was significantly higher than all other emotions, $ps < .05$, while the unbiased hit rate for "Fearful" ($M = 0.30$, $SD = 0.18$) was lower than all other emotions, $ps < .05$. In contrast to the biased hit rate comparisons, the unbiased hit rate for "Sad" ($M = 0.50$, $SD = 0.17$) was significantly lower than all emotions, $ps < .05$, except "Fearful".

To check that the participants selected the intended emotion at a rate far higher than chance, chance proportion scores were calculated per judge for each emotion separately, in line with the unbiased hit rates. Chance scores were obtained by multiplying together the independent probabilities of the co-occurrence by chance of a stimulus and response of a corresponding category for each judge (see Wagner, 1993). Paired *t*-tests (two-tailed) were conducted between arcsine transformed unbiased hit rate scores and chance scores for each emotion separately. All analyses were significant at the $p < .0001$ level, indicating that selecting the intended emotion was far above chance level.

In addition, the unbiased hit rate scores per expressor (the actor who expressed the emotion) was calculated for each emotion separately. This accuracy score computation involves the probability that an emotion is expressed as intended by a specific expressor and can thus be seen as a quality index of a particular emotional expression as a function of expressor. An overview of these accuracy rates per expressor is given in Appendix 2.

Intensity and arousal

In our subsequent analyses, we treated the highest-rated emotion as the valid emotion for every picture. Mean intensity and arousal measures were determined for every emotion separately (see Table 1).

To check whether the mean ratings for intensity and arousal were significantly different between rated emotions, a 7-level between-subjects ANOVA was conducted with mean intensity and mean arousal scores across all judges per photo as dependent variable. For both emotional dimensions, a significant main effect was found, $F(6, 483) = 27.69$, $p < .0001$ and $F(6, 483) = 46.76$, $p < .0001$, respectively. For the intensity dimension, Bonferroni corrected post hoc comparisons show that the emotions “Happy” and “Surprised” did not differ significantly from “Disgusted”, which had the highest intensity, $ps > .05$. The other emotions (including “Neutral”) had significantly lower intensity ratings than “Disgusted”. Furthermore, post hoc results for the arousal dimension indicate that neutral pictures were rated significantly lower than all the other emotion pictures, $ps < .0001$.

Test-retest reliability

Furthermore, a test-retest reliability analysis was performed by computing the percentage similarity of emotion type ratings and by calculating the correlations for the intensity and arousal measures. Two groups of 21 female students (Group 1: mean age = 20.7; $SD = 1.9$; range: 18–24; Group 2: mean age = 20.1; $SD = 1.5$; range: 18–23) rated each half of the KDEF picture set at Time 1 and at Time 2 (one week later). The same rating procedure as in the first part of the study was conducted, but this time each group rated 6 randomly selected slide shows. The slide shows were presented twice in the same order. Results indicate

that 87.96% ($SD = 15.67$) of the emotion ratings of the pictures were the same at Time 1 and Time 2. With regard to the intensity and arousal measures, a mean correlation across all pictures of .75 ($SD = 0.28$) and .78 ($SD = 0.24$) respectively was found. For the two “indistinct” pictures (“M33AN” and “M33SU”), mean intensity and arousal correlations were 100%. These pictures might therefore be interesting for specific research questions. Table 2 gives an overview of the similarity indices per emotion.

DISCUSSION

In this study, 490 pictures of human facial expressions from the Karolinska Directed Emotional Faces database (KDEF; Lundqvist et al., 1998) were validated. The pictures were evaluated on emotional content, intensity of the chosen emotion, and arousal. The mean biased hit rate of 72% is comparable with other validation studies (e.g., Biehl et al., 1997; Elfenbein, Mandal, Ambady, Harizuka, & Kumar, 2004). Moreover, the mean unbiased hit rate of .56 is comparable to or even better than that of other studies (e.g., Elfenbein et al., 2004). Based on these idiosyncratic hit rates in combination with the good test–retest results, it might be concluded that the KDEF facial picture database offers a valid set of affective stimuli that can make a significant contribution to emotion research. Depending on the research question, researchers can freely select pictures as a function of (a combination of) several parameters: sex of the expressor, quality of the emotional expression per expressor, hit rate, intensity, and/or arousal. See Appendix 1 for an overview of the 20 best pictures per emotion, selected on the basis of the percentage biased hit rate and the mean intensity score. For a comprehensive overview of the ratings of all pictures, the authors can be contacted. The picture set can be ordered via www.facialstimuli.com.

In addition to the different possible parameters for picture selection, this database has several other strengths. It should be reiterated that strict criteria were applied for the selection of the actors and for the picture-taking procedure (Lundqvist et al., 1998). Additionally, we removed the hairline from the faces. We believe that this made the facial emotional expression clearer, making the actual emotion even more distinctive. This aspect may give this set an important comparative advantage over the other facial picture sets (Beaupré et al., 2000; Ekman & Friesen, 1976; Matsumoto & Ekman, 1988). Cultural diversity, on the other hand, was not included as a parameter. Only Caucasian subjects were portrayed. Therefore, application to cultural comparison studies is restricted.

Several limitations of our study should be acknowledged. First, the limited choice of rating options may have led to answer tendencies. Participants could choose from only the six basic emotions, and “neutral” or “indistinct” as

TABLE 2
 Mean scores (*M*) and standard deviations (*SD*) for the percentage similarity of emotion type and the correlations for the intensity and arousal measures as a function of emotion in the test–retest reliability analysis

	<i>Emotion</i>						
	<i>Angry</i>	<i>Fearful</i>	<i>Disgusted</i>	<i>Happy</i>	<i>Sad</i>	<i>Surprised</i>	<i>Neutral</i>
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
Similarity percentage	89.35 (16.58)	78.33 (20.39)	88.51 (13.87)	97.00 (5.97)	89.32 (14.22)	88.30 (15.25)	84.88 (13.98)
Intensity correlation	.73 (.28)	.71 (.30)	.69 (.33)	.81 (.23)	.76 (.28)	.79 (.26)	.80 (.22)
Arousal correlation	.74 (.28)	.78 (.22)	.78 (.24)	.82 (.22)	.80 (.25)	.82 (.24)	.76 (.26)

alternatives, whereas other validation studies have included more possibilities such as contentment, embarrassment, interest, etc. (e.g., Rottenberg, Ray, & Gross, 2007). Our methodology, however, was in line with the original KDEF picture set, and was based on the assumption of the universality of basic emotions. Furthermore, an important advantage of this simple rating method is that the instruction is straightforward and this may help the participants to focus exclusively on the specific emotion they have selected for their intensity and arousal ratings. An alternative method, the Facial Action Coding System (FACS; Ekman, Friesen, & Hager, 2002), for example, which is a well-validated method that is based on the activated muscles and the intensity to which they are activated, has the disadvantage that it involves a time-consuming learning process that precedes the assessment. Second, all participants were female. Females may be more accurate than males in recognising emotions (Gross & Levenson, 1995). Therefore, the hit rate percentage in this study may be inflated by gender. In addition, Schaefer, Nils, Sanchez, and Philippot (2005) demonstrated that women reported significantly higher intensity scores for several, specific emotions, for example "sad". Therefore, our validation cannot be extrapolated to a male population. However, it is important to note that in recent decades many experimental studies have used only females as research subjects (Stinson, 2003).

Apart from the quality of the KDEF set, several other observations emerge from this study. "Happy" was the most easily distinguishable emotion, whereas a fearful facial expression appears to be the most difficult to recognise. Similar findings were obtained when accuracy scores were calculated according to the Wagner method (1993). These findings are in line with previous emotion research (e.g., Gross & Levenson, 1995). Biehl et al. (1997) offered several explanations for this. First, experience of emotions in daily life may influence accuracy in making emotional judgements. It may simply be that in everyday life people are confronted more often with happy expressions than with fearful expressions. Second, emotions may differ in degree of complexity in terms of the number of muscles involved. From this angle, happiness can be described as a simple emotion, whereas fear is one of the most complex emotions. These first two explanations may also help explain why "sad" obtained the highest rating (unbiased hit rates). Third, there may be more overlap between certain response categories for certain emotions. For example, Biehl and colleagues stated that fear may have an element of surprise. Our data support this reasoning, as "surprised" was the most rated non-target emotion for the fearful expressions. For the arousal dimension, the neutral expression was rated significantly lower than all the other emotions, which confirms the assumption that arousal is an important dimension of emotions (e.g., Lang, Bradley, & Cuthbert, 1997b).

It is also important to note that the validity of a stimulus may not be appropriate for every study (Schaefer et al., 2005). Although in this study a

valid set of pictorial affective faces was acquired, no stimuli set can be suited to all types of emotion studies. Within this context, Schaefer and colleagues (2005) seek to define as many parameters as possible to have an *à la carte* approach that allows the researcher to select the stimulus or group of stimuli best suited to a specific study. Therefore, in this study both intensity and arousal were chosen as emotional dimensions. Furthermore, gender was also included as a stimulus parameter, since half of the pictures were female faces and the other half male faces. However, in addition to the large number of pictures available, an important advantage of the KDEF picture set concerns the description of the unbiased hit rate scores as a function of expressor. Thanks to this feature of the set, perceptibly comparable stimuli can be selected for each emotion based on the best expressor.

In summary, despite the limitation in use with regard to cross-cultural studies and gender specificity, the good percentage idiosyncratic hit rate leads us to conclude that the KDEF pictorial database is an extensive, valid, and readily applicable stimuli set of human affective facial pictures.

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APPENDIX 1

Mean scores and standard deviations (*SD*) for the intensity and arousal dimension on a 9-point scale and the mean percentage biased idiosyncratic hit rate for the 20 most valid KDEF pictures per emotion category. Selection is based on two criteria: first, on the emotion with the highest hit rate and, second, on the mean intensity score. For each emotion, the stimuli are presented in descending order according to the percentage highest-rated emotion. In addition, the (percentage) most rated non-target emotion is indicated. The first letter of the KDEF code indicates gender (F = female; M = male). *N* indicates the number of judgements

<i>KDEF code</i>	<i>N</i>	<i>Most rated emotion</i>	<i>Hit rate (%)</i>	<i>Mean intensity</i>	<i>SD intensity</i>	<i>Mean arousal</i>	<i>SD arousal</i>	<i>Most rated non-target emotion</i>	<i>Most rated non-target emotion (%)</i>
M11AF	64	Fearful	84.38	5.63	1.43	3.67	1.48	Sad	6.25
M25AF	63	Fearful	84.13	5.44	1.65	3.54	1.85	Disgusted	7.94
M14AF	64	Fearful	79.69	6.48	1.46	4.31	1.96	Surprised	18.75
M19AF	64	Fearful	78.13	7.55	1.41	4.62	2.11	Surprised	14.06
M17AF	64	Fearful	78.13	6.67	1.40	4.14	1.88	Angry	14.06
M31AF	64	Fearful	78.13	4.95	1.71	3.88	1.71	Indistinct	12.50
F16AF	64	Fearful	76.56	6.45	1.39	4.21	1.94	Sad	15.63
M22AF	64	Fearful	75.00	5.83	1.69	3.89	2.07	Surprised	15.63
F14AF	64	Fearful	71.88	5.75	1.70	3.61	1.96	Surprised	25.00
F22AF	64	Fearful	71.88	5.14	1.78	3.42	1.73	Surprised	18.75
F33AF	64	Fearful	70.31	5.72	1.63	4.08	1.95	Disgusted	20.31
F28AF	64	Fearful	68.75	7.16	1.31	4.25	1.99	Disgusted	29.69
F30AF	64	Fearful	68.75	5.80	1.70	3.67	1.84	Surprised	18.75
M10AF	64	Fearful	67.19	6.05	1.46	3.30	1.74	Disgusted	21.88
M35AF	64	Fearful	67.19	5.64	1.70	3.29	1.62	Surprised	21.88
M16AF	64	Fearful	65.63	6.56	1.60	3.53	1.95	Surprised	32.81
M04AF	64	Fearful	65.63	5.66	1.76	3.50	2.02	Disgusted	12.50
F09AF	64	Fearful	65.63	5.31	1.81	3.53	1.95	Sad	23.44
M24AF	64	Fearful	64.06	5.97	1.53	3.41	1.76	Sad	17.19
F31AF	64	Fearful	62.50	6.09	1.35	3.88	1.70	Surprised	28.13

APPENDIX 1 (Continued)

<i>KDEF code</i>	<i>N</i>	<i>Most rated emotion</i>	<i>Hit rate (%)</i>	<i>Mean intensity</i>	<i>SD intensity</i>	<i>Mean arousal</i>	<i>SD arousal</i>	<i>Most rated non-target emotion</i>	<i>Most rated non-target emotion (%)</i>
M10AN	63	Angry	100	7.59	1.64	4.48	1.97	n/a	—
M05AN	64	Angry	100	6.31	1.87	3.83	2.19	n/a	—
F14AN	64	Angry	100	6.14	1.74	3.50	2.08	n/a	—
M11AN	64	Angry	100	5.70	1.86	2.98	1.67	n/a	—
M17AN	64	Angry	98.44	7.92	1.46	5.28	2.17	Happy	1.56
M09AN	64	Angry	98.44	7.00	1.49	4.51	1.68	Sad	1.56
F23AN	64	Angry	98.44	6.58	1.69	4.19	2.12	Indistinct	1.56
M30AN	64	Angry	98.44	5.76	1.76	3.55	1.74	Indistinct	1.56
F22AN	64	Angry	98.44	5.39	1.71	3.22	1.68	Disgusted	1.56
M29AN	63	Angry	98.41	7.63	1.42	4.70	2.48	Fearful	1.59
F20AN	63	Angry	98.41	6.70	1.68	3.40	1.80	Disgusted	1.59
F31AN	64	Angry	96.88	7.08	1.66	4.78	2.31	Fearful/Disgusted	1.56
F21AN	64	Angry	96.88	6.36	1.77	3.48	1.77	Disgusted/Indistinct	1.56
F25AN	64	Angry	96.88	6.34	1.90	3.73	1.90	Disgusted	3.13
F16AN	64	Angry	96.88	6.22	1.70	3.39	1.84	Surprised/Indistinct	1.56
M24AN	64	Angry	96.88	6.14	1.45	3.28	1.79	Disgusted/Indistinct	1.56
M22AN	64	Angry	96.88	6.03	1.86	3.55	1.87	Fearful	3.13
F29AN	64	Angry	96.88	5.94	1.74	3.67	2.00	Disgusted	3.13
F01AN	64	Angry	96.88	5.92	1.84	3.89	1.78	Fearful/Surprised	1.56
F35AN	64	Angry	96.88	5.84	1.44	3.38	1.78	Disgusted/Indistinct	1.56
M31DI	64	Disgusted	100	7.36	1.48	4.33	1.93	n/a	—
F21DI	64	Disgusted	100	6.75	1.26	4.00	1.97	n/a	—
F12DI	64	Disgusted	98.44	7.36	1.26	4.02	2.04	Sad	1.56
F09DI	64	Disgusted	98.44	6.88	1.39	3.86	2.04	Fearful	1.56
M24DI	64	Disgusted	98.44	6.56	1.42	3.23	1.70	Fearful	1.56
F13DI	64	Disgusted	96.88	7.22	1.47	3.78	1.86	Fearful/Sad	1.56
M12DI	64	Disgusted	96.88	6.88	1.56	3.68	1.97	Sad/Indistinct	1.56

APPENDIX 1 (Continued)

<i>KDEF code</i>	<i>N</i>	<i>Most rated emotion</i>	<i>Hit rate (%)</i>	<i>Mean intensity</i>	<i>SD intensity</i>	<i>Mean arousal</i>	<i>SD arousal</i>	<i>Most rated non-target emotion</i>	<i>Most rated non-target emotion (%)</i>
M27DI	64	Disgusted	96.88	6.44	1.62	4.03	1.95	Angry	3.13
F17DI	64	Disgusted	95.31	7.08	1.36	3.75	1.86	Sad	3.13
M18DI	64	Disgusted	95.31	6.81	1.64	4.11	1.92	Sad	3.13
M16DI	64	Disgusted	95.31	6.64	1.51	4.34	1.79	Angry	4.69
M25DI	64	Disgusted	95.31	6.63	1.33	4.08	2.08	Angry	3.13
F27DI	64	Disgusted	95.31	6.02	1.25	3.30	1.41	Angry	3.13
F03DI	63	Disgusted	95.24	5.68	1.40	3.33	1.48	Angry/Sad/ Indistinct	1.59
M35DI	64	Disgusted	93.75	7.03	1.63	3.89	1.95	Angry	4.69
F10DI	64	Disgusted	93.75	7.00	1.53	3.63	1.85	Fearful	3.13
M29DI	64	Disgusted	93.75	6.69	1.58	3.24	1.47	Angry	6.25
M14DI	64	Disgusted	93.75	6.27	1.68	3.48	1.99	Angry	6.25
F16DI	64	Disgusted	92.19	7.25	1.50	4.72	2.26	Angry	6.25
M02DI	64	Disgusted	92.19	6.16	2.03	3.98	1.99	Indistinct	4.69
F33HA	64	Happy	100	7.47	1.54	4.49	2.19	n/a	—
M07HA	64	Happy	100	7.42	1.55	4.70	2.08	n/a	—
F21HA	64	Happy	100	7.33	1.57	4.14	1.98	n/a	—
F06HA	64	Happy	100	6.92	1.55	3.66	1.87	n/a	—
M25HA	64	Happy	100	6.92	1.62	3.80	2.11	n/a	—
F11HA	64	Happy	100	6.81	1.54	3.94	2.15	n/a	—
F22HA	64	Happy	100	6.77	1.35	3.56	1.99	n/a	—
F34HA	64	Happy	100	6.69	1.33	3.72	1.99	n/a	—
M26HA	64	Happy	100	6.64	1.55	4.37	1.93	n/a	—
M32HA	64	Happy	100	6.48	1.75	4.33	2.08	n/a	—
M17HA	64	Happy	100	6.00	1.73	3.31	1.97	n/a	—
F20HA	64	Happy	100	5.81	1.74	3.84	2.19	n/a	—
M22HA	64	Happy	98.44	7.23	1.51	3.98	2.02	Sad	1.56

APPENDIX 1 (Continued)

<i>KDEF code</i>	<i>N</i>	<i>Most rated emotion</i>	<i>Hit rate (%)</i>	<i>Mean intensity</i>	<i>SD intensity</i>	<i>Mean arousal</i>	<i>SD arousal</i>	<i>Most rated non-target emotion</i>	<i>Most rated non-target emotion (%)</i>
M23HA	64	Happy	98.44	7.00	1.61	4.30	2.12	Sad	1.56
M05HA	64	Happy	98.44	6.94	1.49	4.22	2.06	Angry	1.56
M12HA	64	Happy	98.44	6.72	1.58	3.98	2.13	Sad	1.56
F26HA	64	Happy	98.44	6.67	1.54	4.08	2.13	Neutral	1.56
F25HA	64	Happy	98.44	6.63	1.39	4.08	2.33	Fearful	1.56
M20HA	64	Happy	98.44	6.61	1.43	3.72	1.71	Surprised	1.56
F07HA	64	Happy	98.44	6.59	1.39	3.97	2.34	Sad	1.56
M11NE	64	Neutral	96.88	6.06	2.20	2.11	1.40	Angry/Indistinct	1.56
F06NE	64	Neutral	96.88	5.60	2.04	2.20	1.35	Angry/Sad	1.56
F13NE	64	Neutral	93.75	5.67	2.24	2.40	1.43	Happy	4.69
F19NE	64	Neutral	92.19	5.48	2.09	2.52	1.37	Sad	4.69
F29NE	64	Neutral	90.63	5.28	2.02	2.44	1.39	Angry	3.13
M31NE	64	Neutral	89.06	5.73	2.15	2.47	1.46	Angry	4.69
M13NE	64	Neutral	89.06	5.66	2.39	2.53	1.44	Happy	7.81
M10NE	64	Neutral	89.06	5.41	2.42	2.31	1.49	Angry/Happy	3.13
F05NE	64	Neutral	89.06	5.33	2.44	2.48	1.64	Happy	4.69
F07NE	64	Neutral	87.50	5.36	2.04	2.44	1.35	Sad	6.25
M01NE	64	Neutral	87.50	4.69	1.98	2.20	1.34	Sad	4.69
F01NE	64	Neutral	85.94	5.20	2.33	2.51	1.53	Angry	6.25
M07NE	64	Neutral	85.94	5.11	1.89	2.55	1.33	Angry	9.38
F26NE	63	Neutral	85.71	4.98	2.08	2.49	1.53	Angry	7.94
F34NE	64	Neutral	84.38	5.06	2.16	2.68	1.57	Sad	7.81
M06NE	64	Neutral	84.38	4.94	2.17	2.25	1.37	Angry/Sad	6.25
M08NE	64	Neutral	84.38	4.89	2.15	2.78	1.65	Sad	9.38
M09NE	63	Neutral	84.13	4.64	2.13	2.37	1.63	Sad	11.11
M25NE	64	Neutral	82.81	5.30	2.11	2.97	2.10	Sad	7.81
F03NE	64	Neutral	81.25	5.19	2.07	2.47	2.47	Angry	7.81

APPENDIX 1 (Continued)

<i>KDEF code</i>	<i>N</i>	<i>Most rated emotion</i>	<i>Hit rate (%)</i>	<i>Mean intensity</i>	<i>SD intensity</i>	<i>Mean arousal</i>	<i>SD arousal</i>	<i>Most rated non-target emotion</i>	<i>Most rated non-target emotion (%)</i>
M05SA	64	Sad	100	6.16	1.56	3.25	1.18	n/a	—
F13SA	64	Sad	98.44	5.98	1.79	3.33	1.54	Fearful	1.56
M16SA	64	Sad	98.44	5.31	1.64	3.16	2.01	Neutral	1.56
M32SA	64	Sad	96.88	7.19	1.65	3.94	1.84	Angry/Surprised	1.56
F32SA	64	Sad	96.88	5.50	1.75	3.45	1.90	Surprised/Indistinct	1.56
M19SA	64	Sad	95.31	6.66	1.73	3.94	2.07	Fearful/Surprised/ Indistinct	1.56
M11SA	64	Sad	95.31	6.50	1.50	3.67	1.90	Surprised	3.13
M31SA	64	Sad	95.31	5.38	2.07	3.06	1.61	Indistinct	3.13
F05SA	64	Sad	95.31	5.00	1.73	3.22	1.79	Angry/Surprised/ Indistinct	1.56
F20SA	64	Sad	93.75	6.13	1.64	3.76	1.69	Disgusted	3.13
F09SA	64	Sad	93.75	5.88	1.77	3.84	1.53	Fearful	4.69
F10SA	64	Sad	92.19	5.92	1.52	3.14	1.84	Fearful	3.13
F14SA	64	Sad	92.19	5.73	1.65	3.48	1.75	Fearful/Surprised	3.13
M33SA	64	Sad	92.19	5.16	1.78	2.94	1.81	Angry	3.13
M13SA	64	Sad	92.19	4.50	1.85	2.78	1.43	Neutral	3.13
M25SA	64	Sad	90.63	6.89	1.59	4.21	1.93	Surprised	7.81
F19SA	64	Sad	90.63	5.35	1.83	3.08	1.66	Fearful/Indistinct	3.13
F02SA	64	Sad	90.63	5.34	1.87	2.84	1.64	Neutral	4.69
F11SA	64	Sad	90.63	4.98	2.03	3.50	1.61	Surprised	3.13
F23SA	64	Sad	90.63	4.67	1.86	3.28	1.80	Fearful/Neutral	3.13
M35SU	64	Surprised	98.44	6.44	1.73	3.75	1.65	Sad	1.56
F24SU	64	Surprised	96.88	5.70	1.69	3.22	1.70	Happy/Neutral	1.56
F22SU	64	Surprised	95.31	7.48	1.67	4.23	2.06	Fearful	4.69
M11SU	64	Surprised	95.31	6.56	1.88	3.41	1.99	Fearful	4.69

APPENDIX 1 (Continued)

<i>KDEF code</i>	<i>N</i>	<i>Most rated emotion</i>	<i>Hit rate (%)</i>	<i>Mean intensity</i>	<i>SD intensity</i>	<i>Mean arousal</i>	<i>SD arousal</i>	<i>Most rated non-target emotion</i>	<i>Most rated non-target emotion (%)</i>
F32SU	64	Surprised	95.31	5.56	1.74	3.30	1.70	Sad/Neutral/ Indistinct	1.56
F01SU	64	Surprised	95.31	5.02	1.57	2.97	1.63	Indistinct	4.69
F35SU	63	Surprised	95.24	5.51	1.62	3.67	1.69	Happy	3.17
F13SU	64	Surprised	93.75	7.00	1.69	4.09	2.22	Happy	6.25
F34SU	64	Surprised	93.75	6.47	1.51	3.61	1.71	Fearful/Disgusted/ Sad/Neutr.	1.56
F05SU	64	Surprised	93.75	5.57	1.60	3.48	1.63	Indistinct	4.69
M16SU	64	Surprised	92.19	6.41	1.70	3.56	1.83	Fearful	7.81
M28SU	64	Surprised	92.19	4.91	1.62	2.59	1.48	Fearful	4.69
F16SU	64	Surprised	90.63	6.81	1.55	3.76	1.81	Fearful	6.25
F20SU	64	Surprised	90.63	6.64	1.43	3.81	1.82	Fearful	6.25
M09SU	64	Surprised	90.63	6.58	1.55	3.77	1.97	Fearful	6.25
F09SU	64	Surprised	90.63	5.13	1.58	2.70	1.41	Fearful	7.81
F12SU	63	Surprised	90.48	6.08	1.72	3.44	1.99	Sad	4.76
F17SU	64	Surprised	89.06	7.67	1.19	4.78	2.52	Happy	7.81
M01SU	63	Surprised	88.89	6.13	1.55	3.18	1.48	Fearful	4.76
M13SU	64	Surprised	87.50	4.94	1.41	3.14	1.44	Fearful	7.81

APPENDIX 2

The unbiased hit rate accuracy scores (Hu) per expressor calculated for each emotion separately. Values are between 0 (never correctly identified) and 1 (always correctly identified). The mean unbiased hit rate per expressor is also shown. The first letter of the expressor code indicates gender (F = female; M = male). *N* indicates the total number of judgements per expressor

<i>N</i>	<i>Expressor code</i>	<i>Expressed emotion</i>	<i>Hu</i>	<i>Mean Hu</i>	<i>N</i>	<i>Expressor code</i>	<i>Expressed emotion</i>	<i>Hu</i>	<i>Mean Hu</i>
447	F01	Fearful	0.45	0.68	447	M01	Fearful	0.20	0.56
	F01	Angry	0.76			M01	Angry	0.68	
	F01	Disgusted	0.46			M01	Disgusted	0.27	
	F01	Happy	0.94			M01	Happy	0.97	
	F01	Neutral	0.84			M01	Neutral	0.75	
	F01	Sad	0.58			M01	Sad	0.37	
	F01	Surprised	0.72			M01	Surprised	0.65	
447	F02	Fearful	0.33	0.57	448	M02	Fearful	0.09	0.49
	F02	Angry	0.51			M02	Angry	0.49	
	F02	Disgusted	0.60			M02	Disgusted	0.67	
	F02	Happy	0.95			M02	Happy	0.95	
	F02	Neutral	0.54			M02	Neutral	0.53	
	F02	Sad	0.50			M02	Sad	0.10	
	F02	Surprised	0.54			M02	Surprised	0.62	
447	F03	Fearful	0.36	0.61	447	M03	Fearful	0.29	0.40
	F03	Angry	0.40			M03	Angry	0.14	
	F03	Disgusted	0.71			M03	Disgusted	0.38	
	F03	Happy	0.86			M03	Happy	0.47	
	F03	Neutral	0.74			M03	Neutral	0.38	
	F03	Sad	0.46			M03	Sad	0.73	
	F03	Surprised	0.77			M03	Surprised	0.44	
448	F04	Fearful	0.06	0.56	448	M04	Fearful	0.38	0.47
	F04	Angry	0.50			M04	Angry	0.00	
	F04	Disgusted	0.71			M04	Disgusted	0.23	
	F04	Happy	0.91			M04	Happy	0.98	
	F04	Neutral	0.58			M04	Neutral	0.64	
	F04	Sad	0.38			M04	Sad	0.40	
	F04	Surprised	0.77			M04	Surprised	0.65	
447	F05	Fearful	0.08	0.65	448	M05	Fearful	0.37	0.67
	F05	Angry	0.46			M05	Angry	0.65	
	F05	Disgusted	0.81			M05	Disgusted	0.48	
	F05	Happy	0.91			M05	Happy	0.97	
	F05	Neutral	0.82			M05	Neutral	0.64	
	F05	Sad	0.77			M05	Sad	0.76	
	F05	Surprised	0.69			M05	Surprised	0.80	
448	F06	Fearful	0.24	0.68	444	M06	Fearful	0.34	0.56
	F06	Angry	0.80			M06	Angry	0.79	
	F06	Disgusted	0.57			M06	Disgusted	0.18	
	F06	Happy	0.96			M06	Happy	0.91	
	F06	Neutral	0.92			M06	Neutral	0.83	

APPENDIX 2 (Continued)

<i>N</i>	<i>Expressor code</i>	<i>Expressed emotion</i>	<i>Hu</i>	<i>Mean Hu</i>	<i>N</i>	<i>Expressor code</i>	<i>Expressed emotion</i>	<i>Hu</i>	<i>Mean Hu</i>
	F06	Sad	0.49			M06	Sad	0.31	
	F06	Surprised	0.76			M06	Surprised	0.60	
448	F07	Fearful	0.44	0.72	448	M07	Fearful	0.00	0.56
	F07	Angry	0.92			M07	Angry	0.70	
	F07	Disgusted	0.62			M07	Disgusted	0.39	
	F07	Happy	0.82			M07	Happy	0.98	
	F07	Neutral	0.86			M07	Neutral	0.72	
	F07	Sad	0.74			M07	Sad	0.58	
	F07	Surprised	0.66			M07	Surprised	0.53	
448	F08	Fearful	0.14	0.39	448	M08	Fearful	0.40	0.67
	F08	Angry	0.38			M08	Angry	0.71	
	F08	Disgusted	0.05			M08	Disgusted	0.54	
	F08	Happy	0.92			M08	Happy	0.97	
	F08	Neutral	0.61			M08	Neutral	0.81	
	F08	Sad	0.29			M08	Sad	0.67	
	F08	Surprised	0.37			M08	Surprised	0.59	
447	F09	Fearful	0.50	0.74	445	M09	Fearful	0.26	0.56
	F09	Angry	0.75			M09	Angry	0.86	
	F09	Disgusted	0.95			M09	Disgusted	0.69	
	F09	Happy	0.98			M09	Happy	0.95	
	F09	Neutral	0.55			M09	Neutral	0.61	
	F09	Sad	0.60			M09	Sad	0.05	
	F09	Surprised	0.85			M09	Surprised	0.52	
448	F10	Fearful	0.06	0.49	447	M10	Fearful	0.57	0.71
	F10	Angry	0.30			M10	Angry	0.82	
	F10	Disgusted	0.71			M10	Disgusted	0.45	
	F10	Happy	0.94			M10	Happy	0.92	
	F10	Neutral	0.41			M10	Neutral	0.86	
	F10	Sad	0.59			M10	Sad	0.60	
	F10	Surprised	0.45			M10	Surprised	0.76	
448	F11	Fearful	0.28	0.44	448	M11	Fearful	0.75	0.79
	F11	Angry	0.25			M11	Angry	0.98	
	F11	Disgusted	0.00			M11	Disgusted	0.40	
	F11	Happy	0.97			M11	Happy	0.95	
	F11	Neutral	0.29			M11	Neutral	0.95	
	F11	Sad	0.77			M11	Sad	0.61	
	F11	Surprised	0.53			M11	Surprised	0.91	
447	F12	Fearful	0.02	0.45	447	M12	Fearful	0.10	0.62
	F12	Angry	0.28			M12	Angry	0.87	
	F12	Disgusted	0.97			M12	Disgusted	0.63	
	F12	Happy	0.73			M12	Happy	0.98	
	F12	Neutral	0.27			M12	Neutral	0.65	
	F12	Sad	0.17			M12	Sad	0.45	
	F12	Surprised	0.72			M12	Surprised	0.63	
448	F13	Fearful	0.27	0.69	447	M13	Fearful	0.32	0.73
	F13	Angry	0.55			M13	Angry	0.86	
	F13	Disgusted	0.79			M13	Disgusted	0.69	

APPENDIX 2 (Continued)

<i>N</i>	<i>Expressor code</i>	<i>Expressed emotion</i>	<i>Mean Hu</i>	<i>Mean Hu</i>	<i>N</i>	<i>Expressor code</i>	<i>Expressed emotion</i>	<i>Mean Hu</i>	<i>Mean Hu</i>
	F13	Happy	0.80			M13	Happy	0.91	
	F13	Neutral	0.91			M13	Neutral	0.83	
	F13	Sad	0.90			M13	Sad	0.66	
	F13	Surprised	0.59			M13	Surprised	0.84	
448	F14	Fearful	0.47	0.58	448	M14	Fearful	0.56	0.74
	F14	Angry	0.68			M14	Angry	0.70	
	F14	Disgusted	0.77			M14	Disgusted	0.92	
	F14	Happy	0.83			M14	Happy	0.89	
	F14	Neutral	0.27			M14	Neutral	0.73	
	F14	Sad	0.66			M14	Sad	0.81	
	F14	Surprised	0.38			M14	Surprised	0.59	
448	F15	Fearful	0.04	0.37	448	M15	Fearful	0.27	0.47
	F15	Angry	0.51			M15	Angry	0.52	
	F15	Disgusted	0.38			M15	Disgusted	0.25	
	F15	Happy	0.84			M15	Happy	0.92	
	F15	Neutral	0.18			M15	Neutral	0.41	
	F15	Sad	0.41			M15	Sad	0.32	
	F15	Surprised	0.25			M15	Surprised	0.59	
447	F16	Fearful	0.52	0.70	448	M16	Fearful	0.56	0.76
	F16	Angry	0.77			M16	Angry	0.76	
	F16	Disgusted	0.77			M16	Disgusted	0.92	
	F16	Happy	0.91			M16	Happy	0.98	
	F16	Neutral	0.77			M16	Neutral	0.64	
	F16	Sad	0.35			M16	Sad	0.77	
	F16	Surprised	0.83			M16	Surprised	0.66	
447	F17	Fearful	0.04	0.57	448	M17	Fearful	0.62	0.74
	F17	Angry	0.52			M17	Angry	0.73	
	F17	Disgusted	0.66			M17	Disgusted	0.76	
	F17	Happy	0.80			M17	Happy	0.98	
	F17	Neutral	0.64			M17	Neutral	0.64	
	F17	Sad	0.47			M17	Sad	0.71	
	F17	Surprised	0.88			M17	Surprised	0.75	
447	F18	Fearful	0.26	0.43	448	M18	Fearful	0.30	0.59
	F18	Angry	0.31			M18	Angry	0.83	
	F18	Disgusted	0.15			M18	Disgusted	0.65	
	F18	Happy	0.88			M18	Happy	0.75	
	F18	Neutral	0.63			M18	Neutral	0.73	
	F18	Sad	0.27			M18	Sad	0.38	
	F18	Surprised	0.50			M18	Surprised	0.44	
447	F19	Fearful	0.06	0.63	443	M19	Fearful	0.54	0.71
	F19	Angry	0.75			M19	Angry	0.76	
	F19	Disgusted	0.69			M19	Disgusted	0.79	
	F19	Happy	0.95			M19	Happy	0.75	
	F19	Neutral	0.89			M19	Neutral	0.71	
	F19	Sad	0.67			M19	Sad	0.87	
	F19	Surprised	0.40			M19	Surprised	0.54	
447	F20	Fearful	0.35	0.61	448	M20	Fearful	0.02	0.39

APPENDIX 2 (Continued)

<i>N</i>	<i>Expressor code</i>	<i>Expressed emotion</i>	<i>Mean Hu</i>	<i>Mean Hu</i>	<i>N</i>	<i>Expressor code</i>	<i>Expressed emotion</i>	<i>Mean Hu</i>	<i>Mean Hu</i>
	F20	Angry	0.54			M20	Angry	0.40	
	F20	Disgusted	0.73			M20	Disgusted	0.69	
	F20	Happy	0.98			M20	Happy	0.97	
	F20	Neutral	0.21			M20	Neutral	0.06	
	F20	Sad	0.80			M20	Sad	0.13	
	F20	Surprised	0.67			M20	Surprised	0.48	
447	F21	Fearful	0.20	0.51	448	M21	Fearful	0.00	0.45
	F21	Angry	0.58			M21	Angry	0.63	
	F21	Disgusted	0.96			M21	Disgusted	0.76	
	F21	Happy	0.98			M21	Happy	0.83	
	F21	Neutral	0.27			M21	Neutral	0.16	
	F21	Sad	0.35			M21	Sad	0.13	
	F21	Surprised	0.26			M21	Surprised	0.64	
448	F22	Fearful	0.55	0.71	448	M22	Fearful	0.54	0.66
	F22	Angry	0.77			M22	Angry	0.81	
	F22	Disgusted	0.70			M22	Disgusted	0.86	
	F22	Happy	1.00			M22	Happy	0.98	
	F22	Neutral	0.47			M22	Neutral	0.32	
	F22	Sad	0.68			M22	Sad	0.53	
	F22	Surprised	0.77			M22	Surprised	0.61	
447	F23	Fearful	0.01	0.62	448	M23	Fearful	0.24	0.54
	F23	Angry	0.83			M23	Angry	0.83	
	F23	Disgusted	0.84			M23	Disgusted	0.75	
	F23	Happy	0.97			M23	Happy	0.98	
	F23	Neutral	0.66			M23	Neutral	0.25	
	F23	Sad	0.42			M23	Sad	0.42	
	F23	Surprised	0.59			M23	Surprised	0.29	
448	F24	Fearful	0.22	0.52	448	M24	Fearful	0.44	0.68
	F24	Angry	0.20			M24	Angry	0.87	
	F24	Disgusted	0.47			M24	Disgusted	0.95	
	F24	Happy	0.94			M24	Happy	0.91	
	F24	Neutral	0.77			M24	Neutral	0.50	
	F24	Sad	0.45			M24	Sad	0.51	
	F24	Surprised	0.58			M24	Surprised	0.60	
448	F25	Fearful	0.17	0.36	446	M25	Fearful	0.81	0.69
	F25	Angry	0.54			M25	Angry	0.59	
	F25	Disgusted	0.04			M25	Disgusted	0.84	
	F25	Happy	0.97			M25	Happy	0.79	
	F25	Neutral	0.24			M25	Neutral	0.71	
	F25	Sad	0.12			M25	Sad	0.73	
	F25	Surprised	0.44			M25	Surprised	0.34	
445	F26	Fearful	0.12	0.60	447	M26	Fearful	0.06	0.42
	F26	Angry	0.48			M26	Angry	0.73	
	F26	Disgusted	0.58			M26	Disgusted	0.19	
	F26	Happy	0.94			M26	Happy	0.82	
	F26	Neutral	0.77			M26	Neutral	0.43	
	F26	Sad	0.74			M26	Sad	0.15	

APPENDIX 2 (Continued)

<i>N</i>	<i>Expressor code</i>	<i>Expressed emotion</i>	<i>Mean</i>		<i>N</i>	<i>Expressor code</i>	<i>Expressed emotion</i>	<i>Mean</i>	
			<i>Hu</i>	<i>Hu</i>				<i>Hu</i>	<i>Hu</i>
445	F26	Surprised	0.55	0.59	448	M26	Surprised	0.53	0.39
	F27	Fearful	0.14			M27	Fearful	0.24	
	F27	Angry	0.79			M27	Angry	0.41	
	F27	Disgusted	0.88			M27	Disgusted	0.50	
	F27	Happy	0.89			M27	Happy	0.89	
	F27	Neutral	0.45			M27	Neutral	0.18	
	F27	Sad	0.35			M27	Sad	0.14	
445	F27	Surprised	0.60	0.59	447	M27	Surprised	0.35	0.62
	F28	Fearful	0.44			M28	Fearful	0.14	
	F28	Angry	0.41			M28	Angry	0.83	
	F28	Disgusted	0.49			M28	Disgusted	0.62	
	F28	Happy	0.95			M28	Happy	0.94	
	F28	Neutral	0.61			M28	Neutral	0.60	
	F28	Sad	0.57			M28	Sad	0.34	
447	F28	Surprised	0.63	0.61	447	M28	Surprised	0.88	0.59
	F29	Fearful	0.23			M29	Fearful	0.30	
	F29	Angry	0.80			M29	Angry	0.66	
	F29	Disgusted	0.65			M29	Disgusted	0.85	
	F29	Happy	0.81			M29	Happy	0.95	
	F29	Neutral	0.82			M29	Neutral	0.26	
	F29	Sad	0.46			M29	Sad	0.54	
448	F29	Surprised	0.49	0.41	447	M29	Surprised	0.60	0.52
	F30	Fearful	0.40			M30	Fearful	0.27	
	F30	Angry	0.44			M30	Angry	0.90	
	F30	Disgusted	0.09			M30	Disgusted	0.54	
	F30	Happy	0.88			M30	Happy	0.91	
	F30	Neutral	0.00			M30	Neutral	0.41	
	F30	Sad	0.42			M30	Sad	0.37	
448	F30	Surprised	0.62	0.50	448	M30	Surprised	0.25	0.86
	F31	Fearful	0.39			M31	Fearful	0.67	
	F31	Angry	0.46			M31	Angry	0.85	
	F31	Disgusted	0.05			M31	Disgusted	0.97	
	F31	Happy	0.91			M31	Happy	0.95	
	F31	Neutral	0.60			M31	Neutral	0.86	
	F31	Sad	0.62			M31	Sad	0.86	
447	F31	Surprised	0.50	0.59	446	M31	Surprised	0.83	0.47
	F32	Fearful	0.58			M32	Fearful	0.01	
	F32	Angry	0.51			M32	Angry	0.55	
	F32	Disgusted	0.22			M32	Disgusted	0.57	
	F32	Happy	0.92			M32	Happy	0.98	
	F32	Neutral	0.53			M32	Neutral	0.05	
	F32	Sad	0.68			M32	Sad	0.45	
448	F32	Surprised	0.69	0.48	448	M32	Surprised	0.68	0.21
	F33	Fearful	0.30			M33	Fearful	0.01	
	F33	Angry	0.47			M33	Angry	0.04	
	F33	Disgusted	0.20			M33	Disgusted	0.07	
	F33	Happy	0.98			M33	Happy	0.48	

APPENDIX 2 (Continued)

<i>N</i>	<i>Expressor code</i>	<i>Expressed emotion</i>	<i>Hu</i>	<i>Mean Hu</i>	<i>N</i>	<i>Expressor code</i>	<i>Expressed emotion</i>	<i>Hu</i>	<i>Mean Hu</i>
	F33	Neutral	0.42			M33	Neutral	0.22	
	F33	Sad	0.61			M33	Sad	0.30	
	F33	Surprised	0.40			M33	Surprised	0.37	
448	F34	Fearful	0.16	0.58	447	M34	Fearful	0.19	0.26
	F34	Angry	0.41			M34	Angry	0.39	
	F34	Disgusted	0.53			M34	Disgusted	0.02	
	F34	Happy	0.97			M34	Happy	0.00	
	F34	Neutral	0.68			M34	Neutral	0.60	
	F34	Sad	0.47			M34	Sad	0.35	
	F34	Surprised	0.83			M34	Surprised	0.27	
445	F35	Fearful	0.04	0.58	447	M35	Fearful	0.64	0.76
	F35	Angry	0.82			M35	Angry	0.73	
	F35	Disgusted	0.63			M35	Disgusted	0.79	
	F35	Happy	0.89			M35	Happy	0.91	
	F35	Neutral	0.58			M35	Neutral	0.77	
	F35	Sad	0.53			M35	Sad	0.77	
	F35	Surprised	0.54			M35	Surprised	0.75	