

Title: **Can compassion, happiness and sympathetic concern be differentiated on the basis of facial expression?**

Otto Condliffe¹ & Frances A. Maratos^{2*}

1. University of Shanghai for Science and Technology, China

2. University of Derby, UK

* Corresponding Author:

Dr. Frances A. Maratos

College of Life & Natural Sciences

University of Derby

Kedleston Road

DE22 1GB

E-mail: F.maratos@derby.ac.uk

Tel: 01332 593053

Key Words: Affiliation, Kind Compassion, Free Response Ratings, Faces, Contented Compassion, Positive Emotion

Abstract

Recent research has demonstrated the importance of positive emotions, and especially compassion, for well-being. Via two investigations, we set out to determine if facial expressions of happiness, 'kind' compassion and sympathetic concern can be distinguished, given limitations of previous research. In investigation one, prototypes of the three expressions were analysed for similarities and differences using the facial action coding system (FACS) by two certified independent coders. Results established that each expression comprised distinct FACS units. Thus, in investigation 2, a new photographic stimulus set was developed using a gender/racially balanced group of actors to pose these expressions of 'kind' compassion, happiness, sympathetic concern, and the face in a relaxed/neutral pose. 75 participants were then asked to name the FACS generated expressions using not only forced categorical quantitative ratings but, importantly, free response. Results revealed that kind compassionate facial expressions: i) engendered words associated with contented and affiliative emotions (although, interestingly, not the word 'kind'); ii) were labelled as compassionate significantly more often than any of the other emotional expressions; but iii) in common with happiness expressions, engendered happiness word groupings and ratings. Findings have implications for understandings of positive emotions, including specificity of expression and their veridicality.

1. Introduction

The ability to recognize emotions through facial expressions is fundamental to social functioning, contributing to an individual's quality of life (Owen & Maratos, 2016). Whilst a myriad of research has focused on understanding negative emotions (e.g. anger, sadness, fear etc.), and their facial expressions (Elfenbein & Ambady, 2002; Schirmer, 2015), only recently has research into positive emotions focused on differentiation of discrete positive emotional states beyond simple 'happiness' (Sauter, 2017; Shiota et al., 2017). Although a definitive taxonomy of positive emotions has yet to be established (Sauter, 2017), compassion has been suggested as being a discrete positive emotional state distinct from happiness (Keltner, 2009; Goetz & Simon-Thomas, 2017). However, Condon and Barrett (2013) suggest that compassion is more likely to be an emotion category, unrelated to any fixed biological substrata (Barrett, 2017), with instances varying from negative to positive valence. Further, it has been suggested that compassion is best viewed as a complex motivational system, rather than a single emotion (Gilbert, 2015; Gilbert, 2017).

As a discrete emotion (or motivation), compassion is widely defined as a feeling of desiring to help when witnessing another's suffering (Goetz et al., 2010; Strauss et al., 2016; Gilbert, 2017). On this basis, it has been argued that compassion evolved through natural selection via enhancing the survival chances of groups in which it was practiced (Keltner, 2009; Goetz et al., 2010). As such, compassion should have its own signaling methods including a specific facial expression associated with the emotion (Goetz et al., 2010). However, if, as has also been argued, such emotions lack a central biological basis (Barrett, 2017), or if compassion is a complex motivational system (Gilbert, 2015; Gilbert, 2017), it would be unlikely to have a single recognizable attendant expression.

To date, the only potential facial display of compassion to have undergone extensive investigation is an expression related to 'sympathetic concern' involving oblique eyebrows and a forward head posture. This expression is based on compassion conceptualized as distress felt at witnessing the suffering of another (Haidt & Keltner, 1999). Accordingly, studies have shown that this expression is often produced in association with self-reports of sympathy or concern (Eisenberg

et al., 1988; Eisenberg et al., 1988; Eisenberg et al., 1989). However, the expression is not consistently recognized as 'compassion' by the majority of participants when asked to label it from a still photograph (Haidt & Keltner, 1999; Widen et al., 2011; Cordaro, 2013). Indeed, in free-labelling activities, the mode label for this expression is sadness (e.g. Haidt & Keltner, 1999). Consistent with this, in recent research by Falconer et al. (2019) it is argued that two perceptually and functionally distinct facial expressions of compassion might exist, one related to 'kind' compassion and one related to 'empathic' compassion. Here, 'empathic' compassion could be argued to be similar to the 'sympathetic concern' expression identified by Keltner and colleagues.

'Kind' compassion, however, has been hypothesized as a warm, affiliative emotion linked to a positive 'safety and contentment' affect system (Gilbert, 2014; Richardson et al., 2016). Affiliative emotions (including compassion) have been shown to have distinctive patterns of brain activity (Moll et al. 2012; Hu et al., 2017), and language studies reveal that people of diverse languages distinguish between two broad categories of positive emotion – a family of joyous emotions such as amusement and excitement, and a family of affiliative emotions such as trust, compassion and love (Shaver et al., 2001; Kapoor et al., 2013).

Based upon this conceptualization of compassion as a 'warm, affiliative and positive emotion', McEwan and colleagues (2014) identified what Falconer et al. (2019) refer to as a 'kind' compassionate facial expression. In this research an imagery induction technique was used to capture actors posing expressions of kind compassion, criticism and the face in a relaxed pose, after which 70 participants rated the images using forced-choice labels of 'compassion/warmth', 'sadness', 'no emotion', 'excitement/happiness', or 'other emotion'. Results revealed that the kind compassionate facial expressions were rated as significantly higher in compassion than the other posed emotions, including the expression of 'excitement/happiness'. McEwan et al. hence concluded that their expression of kind compassion could be reliably identified and distinguished from the positive emotion of happiness, in accord with arguments of compassion as a distinctive affiliative emotion/motivation (with at least one recognizable facial expression).

A caveat of the above research, as well as that by Falconer et al. (2019) is, however, that forced choice rating methodology was used. Importantly, this technique has been criticized for over-inflating levels of agreement on emotion labels amongst participants (Widen et al. 2011). In addition, to argue for the distinction between 'kind' and 'empathic' compassion, in initial experimentation by Falconer et al., only a two-alternative force-choice task was used when participants were asked to rate expressions of the female (and predominantly Caucasian) computer-generated composite images. Moreover, whilst Falconer et al. (2019, p.1) concluded that '*the empathic-compassion expression was perceived as best depicting the general definition of compassion.*' this definition reflects that used in scientific research, which may differ from how the emotion/motivation is perceived by a general audience. Namely, Condon and Barrett (2013) as well as Sinclair et al., (2017) note that positive conceptualizations of compassion as a warm affiliative emotion may better reflect general societal understandings of this emotion. Thus, to truly establish the extent to which a kind compassionate facial expression exists and is distinctly recognizable as compared to happiness and sympathetic concern (or empathic compassion), research adopting free responses to a gender-balanced, ethnically diverse range of real (vs. computer generated) individuals expressing the emotion is now necessary. Whilst the facial averaging method Falconer et al. used have been employed in a variety of studies, such 'averaging' risks missing certain cues, or misinterpreting the relations between them (Sutherland et al., 2017). Therefore, confirmation using a complementary method, for example, based on detailed analysis of facial muscle physiology, is desirable.

Hence, the purpose of the present investigations was to more stringently investigate whether 'kind' compassion - which may well be the aspect better recognized among the general population - has a distinctive facial expression which conveys a single specific emotion. This was achieved by, in investigation 1, establishing whether there is a prototypical facial expression for 'kind' compassion distinct from that of happiness, and/or sympathetic concern, using the Facial Action Coding System (FACS). Then, in investigation 2b, recruiting 75 lay individuals of various nationalities to name the emotions presented (free response), as well as categorize them using

predetermined labels (forced choice). Importantly, to achieve the latter, we created a new stimulus set of -'kind' compassion, happiness, sympathetic concern and the face in a relaxed 'neutral' pose - expressions. This new stimulus set was created based entirely upon FACS coding, but using real individuals (Investigation 2a). Finally, we chose to utilize still images, as, if 'kind' compassion does have a recognizable facial physiology different from happiness or sympathetic concern, it should be identifiable from muscle configuration alone.

2.1 Investigation 1 – Does the emotion of compassion have unique facial physiology?

To establish if kind compassionate facial expressions have unique facial physiology as compared to further emotions, FACS was used. This is a widely established and validated system for the objective measurement of facial actions (Cohn et al., 2007). In FACS, facial expressions are deconstructed into action units (AU's), which represent the actions of underlying facial muscles.

We used the McEwan Faces set (McEwan et al., 2014) from which to generate FACS coding for kind compassionate facial expressions given images from this set represent a diverse set of real individuals rather than computer-generated composites. We then analyzed these codes in respect to those available for: i) happiness (determined using the Warsaw Facial Stimulus Set, Olszanowski et al., 2015); and ii) those provided by Haidt and Keltner (1999) for their sympathetic concern expression. It was hypothesized that, should kind compassion be represented by a distinctive facial expression, then its physiology in terms of facial muscles involved should differ from that of happiness and sympathetic concern given the different conceptualization of this compassionate expression.

2.2. Methodology

2.2.1. 'Kind' Compassionate Faces Coding

Using standard procedure (Ekman et al., 2002), kind compassionate facial expressions (N=31; McEwan, 2014) were first coded by the lead researcher (O.C.), a certified FACS coder. Based upon this, FACS units established were: AU12, the lip corner puller characteristic of smiling (which

occurred in all expressions); AU6, the cheek-raise (which occurred in 12 expressions); AU25, parting of the lips (which occurred in 3 expressions); AU's 55 and 56, left and right head tilt (which occurred in 9 expressions); and AU7, narrowing of the eyes (which occurred in 3 expressions). All other FACS AU's occurred with very low frequency (total $n \leq 3$). A second certified coder (M.P.), who was unaware of hypotheses, then blindly coded 20% of the photographs (determined at random) to establish inter-rater reliability. Reliability for the presence/absence of AU's was calculated using Cohen's Kappa (Fleiss, Levin & Paik, 2003). Of note, there was perfect agreement between the raters on AU6 (cheek-raise), AU12 (lip corner puller) and AU's 55/56 (head tilt, left or right), $\kappa = 1.00$, (95% CI, 1.00 to 1.00), $p = 0.008$. Kappa statistics for AU25 and AU7 were not calculated as neither AU occurred in the set of photographs randomly selected for inter-rater reliability testing. Additionally, reliability for the ordinal level intensity code data for AU12 was excellent: $\kappa = .78$ (95% CI, .60 to .96), $p < .001$. Thus, the FACS codes established for the kind compassionate expressions were: AU12, AU6, AU25, AU's 55 and 56 (together) and AU 7.

2.2.2. Happiness Face Coding

Photographs representing happiness were taken from the Warsaw set of emotional facial expressions (Olszanowski et al., 2015). The set was selected because, similar to McEwan and colleagues (2014), an emotion induction procedure was utilized, increasing ecological validity. All 30 photographs portraying 'happiness' were selected. Olszanowski and colleagues provide FACS codes for all photographs, suggesting happiness is most often comprised of: AU12, AU6 and AU25/26. This conforms with Ekman's prototype (Ekman et al., 2002).

2.2.3. Sympathetic Concern Face Coding

Haidt and Keltner (1999, p.233) describe this expression as including '*oblique eyebrows, fixed gaze, and head movement forward (AU's 1, 4, 58)*'. They describe the codes as being based upon the earlier research of Eisenberg et al. (1989). A thorough review of literature related to coding for this 'sympathetic concern' expression reveals that although further FACS codes are suggested (e.g. AU24 – lips pressed together, AU 7 – lower eyelid raised), none of these codes are consistently part of the

'sympathetic concern' expression (see Eisenberg, et al., 1988; Eisenberg et al., 1989; Eisenberg et al., 1991; Keltner & Buswell, 1996; Guthrie et al., 1997; Haidt & Keltner, 1999; Goetz et al., 2010; Cordaro, 2013; Keltner & Cordaro, 2016). Therefore, as the only facial actions visible on the one available picture of the 'sympathetic concern' expression (Figure 1c) were AU's 1, 4 and 58, and these are the FACS codes consistently stated, these were the codes we used.

2.3 Analyses and Results

2.3.2 Establishment of FACS Units predicting compassion as compared to happiness

Table 1 displays frequency counts for the occurrence of specific facial actions in the McEwan et al. 2014 kind compassionate expression as compared to the Olszanowski et al., 2015 happiness expression, and the occurrence of high and low intensity smiles as a function of expression.

*****Table 1 about here*****

A Firth logistic regression (Heinze & Schemper, 2002) was performed to ascertain the effects of the identified kind compassion FACS codes (i.e. smile intensity (AU12), head tilt (AU's 55/56 - entered as one predictor), lips parting (AU25), and contraction of the muscles around the eyes (AU6 and AU7)), on the likelihood that faces would be rated as displaying either happiness, or compassion. Tests for collinearity were within acceptable limits. Thus, all cases were retained in the final analysis. Of the five compassionate face predictor variables, only three were statistically significant: presence of smile with low intensity, absence of lips parting and head tilt. Expressions with low intensity smiles were 3.03 times more likely to be judged as compassionate (95% CI, 0.003 - 8.78, $p=0.0498$). Expressions with closed-mouth smiles were 3.61 times more likely to be judged as compassionate (95% CI, 0.83 - 8.48, $p=0.01$). Expressions with head-tilt were 4.83 times more likely to be judged as compassionate (95% CI, 0.77 - 10.61, $p=0.02$).

2.3.3 Establishment of FACS Units predicting kind compassion as compared to sympathetic concern

The only AU's clearly visible on the single photograph of the sympathetic concern expression provided by Haidt and Keltner (1999, p.23) were AU1, AU4 and AU58. This is in complete contrast to

the McEwan et al. (2014) expressions, which logistical regression revealed to consist of AU12 at low intensity, absence of AU25, and AU55 or 56. Thus, whilst further statistical analyses cannot be pursued (given the lack of a sympathetic concern stimulus set), it is evident that there is **no** overlap in FACS AUs associated with the two expressions.

2.4 Investigation 1 Discussion

The purpose of investigation 1 was to establish whether 'kind' compassion has a facial physiology distinct from happiness and sympathetic concern, as determined by FACS. Results demonstrate that the McEwan et al. (2014) kind compassion expression significantly differs from happiness. Here, low smile intensity, absence of lips parting, and head tilt were associated with the expression of kind compassion, whereas high smile intensity, open mouth and cheek raise were associated with the expression of happiness. Additionally, as the kind compassion expression does not involve raising or drawing together of the brow, and the codes identified for the kind compassion expression do not overlap with those identified for the Haidt and Keltner (1999) single sympathetic concern expression (compassion codes = AU12 at low intensity, AU 55 or 56, and absence of AU 25; sympathetic codes = AU's 1, 4 and 58), it is clear that, based on the limited stimulus set available for sympathetic concern, these two facial expressions bear no resemblance. Although further FACS codes for sympathetic concern have been suggested (e.g. AU's 7 and 24), as discussed previously, these do not overlap with the codes for the kind compassion expression either.

Thus, results of investigation one clearly evidence that the facial physiology of kind compassion differs from that of either happiness or sympathetic concern, with kind compassion represented in terms of low smile intensity, absence of lips parting, and left/right head tilt. This is somewhat consistent with the research of Falconer et al. (2019) that two expressions of compassion exist; one representing a more positive emotion of kindness and one, similar to the earlier research of Haidt and Keltner (1999), a more concerned facial expression.

3. Investigation 2 - Can individuals distinguish kind compassionate facial expressions from further (positive) facial emotions?

The purpose of investigation 2 was to explore whether individuals can distinguish 'kind' compassion from further (positive) emotions such as happiness and sympathetic concern. As, if 'kind' compassion does have distinct recognizable facial physiology different from happiness or sympathetic concern, it should be recognisable from muscle configuration alone (i.e. still images). Additionally, whilst Falconer et al., (2019) suggest this to be true, computer-generated images and/or forced choice methodologies could be argued to provide contrived research evidence (e.g. Russell, 1994). Therefore, in investigation 2, a new fully FACS-coded photographic set of ethnically diverse and gender-balanced individuals expressing happiness, kind compassion, sympathetic concern, and neutral facial expressions was created, before participants were recruited to code these emotional displays using both free response and categorical ratings. Of note, a new stimulus set was created to control for actor variation and to allow for the investigation of each expression as a function of 'typical' FACS muscle movements (which may be useful for future research). Each expression was posed according to its FACS coding: with codes for the happy facial expression taken from Ekman et al. (2002; see also Olszanowski et al., 2015); codes for the sympathetic concern facial expression taken from Haidt and Keltner (1999); and codes for the 'kind' compassion expression according to those established in investigation 1. In analyzing the free response data, four possible aspects of positive emotion in participants' descriptions of the photographs were investigated: happiness, affiliation, contentment and interest. These four aspects were chosen based on theories of emotion (Izard & Buechler, 1980; Plutchik, 1991; Panksepp, 1998; Gilbert, 2014) and cluster analyses of emotion terms (e.g. Shaver et al., 2001; Kapoor et al., 2013).

We predicted that: i) the 'kind' compassionate expressions would be rated as significantly higher in compassion than the other emotions when using a categorical methodology (similar McEwan et al., 2014); and ii) when using free response, participants would use more words related to affiliative social emotions to describe the 'kind' compassionate expression as compared to the

happiness or sympathetic concern expression (see also McEwan et al., 2013; Campos et al., 2013). Additionally, we further predicted that, iii) when using free response, the words and phrases used to describe facial expressions of kind compassion, happiness and sympathetic concern would differ in terms of arousal and valence. Here, we expected words suggested for the kind compassionate expressions to be of lower arousal than those used to describe the happy expressions (consistent with Condon & Barrett 2013 and McEwan et al. 2014), but of higher valence than words used to describe the sympathetic concern expression.

3.2 Methods

3.2.1 Design

We employed a repeated measures design, with all participants taking part in both a 'free response' and 'categorical rating' task of the four expression types (i.e. happiness, kind compassion, sympathetic concern and the face in a 'neutral' pose). For the free response task, logistic regression using generalised estimating equations (GEE) was employed. Sample size was calculated based upon the free response task, with a minimum of 50 participants required for the specific GEE analysis (McNeish et al., 2017).

3.2.1. Ethics Declaration

Ethical approval was received from the local Research Ethics Committee, and all participants provided written informed consent.

3.2.2 Participants

75 participants completed the categorical and free response tasks. Of these 18 (24%) were male (mean age = 29.67, $SD=8.90$) and 57 were female (mean age = 29.26, $SD=11.54$). 33 (44%) declared their nationality as American, 27 (36%) were British, 8 (11%) were from other European countries and remaining participants were from countries within Africa (4%), Asia (3%), Australia (1%) or South America (1%). All participants declared that they were at least advanced speakers of English, with the majority (63; 84%) declaring that they had native levels of fluency in the language.

52 (69%) of participants were white, with 8 (11%) black, 2 Asian, 1 Arabic. The remaining participants either stated other (11; 15%) or chose not to declare this (1%).

3.2.3. Stimulus Set Development

Actors for the photographs were an opportunity sample of 8 staff members and undergraduate students at the Sino-British College, Shanghai. These were 4 males and 4 females (comprising 4 Asians and 4 Caucasians), aged from 20 to 43 (mean age= 32.5, $SD=8.75$). A standardized set of instructions for posing the four facial expressions (happy, kind compassionate, sympathetic concern and neutral) was created, with example photographs of all four expressions, and explanations of muscular movements provided. Briefly, the individuals were asked to read through instructions for posing the four different expressions, as well as shown examples, before being shown how to pose the four expressions by the FACS trained researcher (OC). Each individual practiced the expressions using mirrors until they and the researcher felt confident in their ability. Photographs were then taken using a Canon EOS Rebel T3 camera with standard 18-55mm EFS kit lens, mounted on a tripod. For the neutral expression, participants were simply asked to relax and look at the camera. Example stimuli produced, as compared to those from which the FACS codes were generated, are presented in Figure 1.

For the kind compassion expressions, to ensure correct expressions had been posed, an independent rater (blind to the hypotheses of the study) then provided FACS codes and inter-rater agreement checked against that of OC. Both raters agreed in all cases that the smiles were of low intensity, and head tilt was present. Indeed, using Cohen's Kappa for presence of AU's and weighted Cohen's kappa for intensity (Fleiss et al., 2003), there was perfect agreement between the raters on the presence of all three 'kind' compassion action units in each photograph (AU12 (lip corner puller), absence of AU25 (lips parting) and AU's 55/56 (head tilt, left or right), $\kappa=1.00$, (95% CI, 1.00 to 1.00), $p=.005$ for all AU's). There was also excellent agreement between the raters regarding judgements of AU12 intensity ($\kappa = .77$ (95% CI, .33 to 1.20), $p = .002$).

*****Figure 1 about here*****

3.2.4 Expression Recognition Tasks

3.2.4.1. Free Response Task. The 32 photographs of the eight actors posing each of the four expressions were presented to participants one by one, with order of presentation randomized. Beneath each photograph was a blank text box into which the participant could enter a brief descriptive word or phrase to represent the depicted emotional expression. The specific instruction given was *'write the emotion in the box'*.

3.2.4.2. Categorical Rating Task. The 32 photographs of the eight actors posing each of the four expressions were presented to participants one by one, with order of presentation randomized. Participants were instructed to rate each photograph from 0-10 using a numerical scale for perceived strength of: compassion, sadness, no emotion, happiness and/or 'other emotion'. Participants could choose any combination of ratings they felt to be most appropriate for each photograph.

3.2.5 Procedure

Investigation two was hosted on Qualtrics (an online research platform). Following informed consent, participants first completed the free response task before completing the categorical rating task. Demographic information was then collected, before debrief information was presented. The entire study took participants approximately 20 minutes to complete.

3.3. Results

3.3.1: Free Response Items and Label Assignment

A list of words as a function of word category and facial expression is presented in Table 2. Responses were coded as '1' if they belonged to a word category, '0' if they did not, and separate GEE models fitted for each word category using binary logistic regression where data points sufficed.

3.3.1.1 Happiness Word Choices

The happiness category included most words which could be considered as synonyms of 'happiness' (e.g. Shaver et al., 2001; Kapoor et al., 2013), except 'pleased' and related word forms,

which were excluded from the count, as previous cluster analyses have provided differing results as to whether this word should belong to the 'happiness' or the 'contentment' category (e.g. Storm & Storm, 1987 vs. Alvarado, 1998). Happiness words and synonyms were used 480 times to describe the happiness photographs, 196 times for the kind compassion photographs, 0 for the sympathetic concern and 4 for the neutral photographs. The GEE model indicated a significant effect of emotional expression (Wald $\chi^2 = 194.19$, $p < .001$). The odds ratio for choosing 'happiness' or related synonyms when looking at the kind compassionate expression as compared to the happiness expression was 0.12.

3.3.1.2 Affiliation Word Choices

The 'affiliation' word category was based on Pennebaker, Boyd, Jordan and Blackburn (2015), with the addition of lemmatized forms of the words 'accepting' and 'affinity', which were also considered to convey the core idea of positive interpersonal feeling. Affiliation-related words were used 24 times to describe the kind compassion photographs, but only 3, 2 and 0 times to describe the happiness, sympathetic concern and neutral photographs, respectively. The GEE model indicated a significant effect of emotional expression (Wald $\chi^2 = 11.88$, $p = .001$). The odds ratio for choosing 'affiliation' or related synonyms when looking at the kind compassionate expression as compared to the happiness expression was 8.29.

3.3.1.3 Contentment Word Choices

The 'contentment' word category was based on research by Gilbert (2014; see also Richardson et al., 2016) as well as previous cluster analyses of emotion terms demonstrating that people differentiate joyous emotions (e.g. hedonic pleasure) from contented emotions on some level of clustering (e.g. Storm & Storm, 1987; Kapoor et al., 2013). Of note, 'satisfied' was included in this category as an acceptable close synonym (e.g. Merriam-Webster.com). 'Contentment'-related words were used 71 times to describe the kind compassion photographs, but only 18 and 9 times for the happiness and neutral photographs, respectively. Importantly, contentment words were not used in any instance to describe the sympathetic concern photographs. The GEE model indicated a

significant effect of emotional expression (Wald $\chi^2 = 22.62$, $p < .001$). The odds ratio for choosing 'contentment' or related synonyms when looking at the kind compassionate expression as compared to the happiness expression was 4.34.

3.3.2.4 Interest Word Choices

On initial viewing of the data, it was clear that a number of words related to interest or attention had been used to describe the expressions. As there is some theoretical basis that the kind compassion expression head tilt (AU's 55 & 56) may also form part of expressions of interest (Reeve, 1993), descriptions indicating interest or attention were also investigated. 'Interest'-related words were used 35 times to describe the kind compassion photographs, but 0 times for the happiness photographs, 7 times for sympathetic concern, and 7 times for the neutral photograph.

3.3.2.5 "Other" Word Choices

A full list of 'other' words/clusters can be found in the supplementary table. However, of note, for the neutral pictures, the majority of descriptions (375 i.e., over 62%) mapped onto synonyms associated with 'no emotion'. For sympathetic concern the modal response was 'sadness' or close synonyms (151 words i.e., over 25%), whereas 'sad' was used only 4 times for kind compassionate photographs, 20 times for neutral photographs, and 2 times for the happy photographs. Additionally, in describing this expression, forms of the word 'concern' were used 27 times, whereas 'concern' was used only once each for descriptions of the kind compassionate and neutral expressions, and no times when describing the happy expressions.

3.3.2.6 Supplementary Analyses

It should be noted that, with the exception of happiness, the modal word category for each facial expression was 'other'. In addition, for the kind compassionate facial expressions, happiness word categorisations were returned 196 times, whereas compassion related word categorisations (i.e. affiliated, contented, interested) were returned 126 times. Thus, participants were actually significantly more likely to use happiness words as compared with compassion words to describe the kind compassionate expressions ($\chi^2 = 15.22$, $df = 1$, $p < .0001$).

*****Table 2 about here*****

3.4.2 Free Response - Analysis of arousal and valence ratings

Arousal and valence ratings of the words chosen by participants to describe the displayed emotions were rated according to the validated affective norms for English words (Warriner, Kuperman and Brysbaert, 2013). For each emotional expression viewed, means, medians and interquartile ranges for arousal and valence ratings are presented in Table 3. Median data are provided, given the assumption of normality was violated.

For the arousal data, Friedman's test revealed significant differences in the ratings of arousal ($\chi^2(3) = 524.34, p < 0.001$) as a function of facial expression (neutral, happy, kind compassion or sympathetic concern). Bonferroni corrected comparisons demonstrated that this reflected happiness expression words being rated as significantly more arousing than all other expressions ($p < .001$ for all comparisons); kind compassionate expression words being rated as significantly more arousing than neutral expression words ($p < .001$); and sympathetic concern expression words being rated as significantly more arousing than neutral expression words ($p < .001$). However, there was no difference in arousal ratings between the kind compassion and sympathetic concern expression words ($p = .46$).

For the valence data, there was again a significant difference ($\chi^2(3) = 1102.74, p < 0.001$) as a function of facial expression. Bonferroni corrected comparisons demonstrated this reflected happiness expression words being rated as significantly more positive than all other expressions ($p < .001$ for all comparisons); kind compassion expression words being rated as significantly more positive than neutral and sympathetic concern expression words ($p < .001$); and sympathetic concern expression words rated as significantly less positive than all other expression words ($p < .001$ for all comparisons).

*****Table 3 about here*****

3.4.2 Analysis of categorical rating data

The overall mean rating scores for the four expression types are presented in Table 4, with highest mean ratings for each expression in bold. An ANOVA of rating scores with facial expression (4 levels) and perceived rating (5 levels), revealed significant main effects of facial expression [$F(3, 2.810) = 5.321, p < .001, \eta_p^2 = .06$] and rating [$F(4, 2.776) = 12.558, p < .001, \eta_p^2 = .145$], and a significant interaction between the two [$F(12, 5.697) = 236.897, p < .001, \eta_p^2 = .762$]¹. To clarify the interaction, similar to McEwan et al., (2014), a one-way Bonferroni-corrected ANOVA of perceived rating (i.e. compassion, sadness, no emotion, happiness and/or 'other emotion') as the independent variable, was undertaken separately for each facial expression. These analyses revealed a main effect of rating for each facial expression: neutral [$F(4, 1.902) = 138.756; p < 0.001, \eta_p^2 = .652$], happiness [$F(4, 2.853) = 292.080; p < 0.001, \eta_p^2 = .798$], 'kind' compassion [$F(4, 3.016) = 48.606; p < 0.001, \eta_p^2 = .396$], and sympathetic concern [$F(4, 2.787) = 128.193; p < 0.001, \eta_p^2 = .634$].

To establish the cause of these differences, four pair-wise Bonferroni corrected comparisons were undertaken for each facial expression. For the happy expressions, these planned simple effects analyses revealed that participants were significantly more likely to rate this face as happy as compared to compassionate, sad, neutral or other ($p < 0.001$ in all cases). For the kind compassion expressions, these analyses revealed that participants were significantly more likely to rate this face as compassionate than sad, neutral, or other ($p < .001$ for all), although they were as likely to rate this face as compassionate as they were happy ($p = 0.473$). For the sympathetic concern expressions, analyses revealed participants were significantly more likely to rate this face as compassionate than happy or other ($p < .001$ in both cases), but they were equally likely to rate it as compassionate as they were neutral ($p = 0.475$) and, most importantly, they were significantly *more* likely to rate it as sad than compassionate ($p < 0.001$). Finally, for the neutral expressions, analyses revealed that participants were significantly more likely to rate this face as neutral compared to compassionate, sad, happy or other ($p < 0.001$ in all cases).

¹ Note that reports of degrees of freedom have been corrected using Greenhouse-Geisser, given 'perceived rating' violated Mauchly's test of Sphericity.

Table 4 about here

4.3 Investigation 2 discussion

The purpose of investigation 2 was to establish if individuals could distinguish 'kind' compassionate facial expressions from those of happiness and sympathetic concern. To achieve this, we used both free response and rating task methodology. Importantly, analysis of the free response data revealed five main results. Firstly, participants were more likely to use words related to interest, contentment and affiliation to describe the kind compassion expression, than other word categories. Secondly, participants were more likely to use happiness words/synonyms to describe the happy expression than other word categories, including those linked to compassion. Thirdly, there was minimal overlap between words used to describe the kind compassionate expression, compared with that of sympathetic concern. Fourthly, words used to describe the kind compassion expressions were rated as lower than happiness in terms of both valence and arousal; but higher in valence than words used for sympathetic concern expressions. Although, fifthly, participants were more likely to ascribe happiness words to the compassionate faces than compassionate words. Thus, whilst participants were able to observe the compassionate nature of the kind compassionate face (demonstrated through affiliative, contented and interested word choices), as well as clearly differentiate this expression from sympathetic concern, for some participants differentiating this expression from happiness was problematic.

Consistent with this, analyses of the forced-choice rating task data revealed that the kind compassion faces were equally likely to be rated as compassionate as they were happy. Although, happy faces were much more likely to be rated as happy, as compared to any further expression; and participants could clearly differentiate between sympathetic concern and kind compassion. A fuller discussion of all results is expanded upon in the general discussion.

5. General discussion

The purpose of the present investigations was two-fold. Firstly, to investigate if 'kind' compassion has distinctive facial physiology as compared to happiness and sympathetic concern,

and, secondly, if individuals could distinguish kind compassionate facial expressions from further facial emotions, especially in light of recent research suggesting the multi-faceted nature of compassion. In relation to these two main aims, findings from Investigation 1 revealed that a kind facial expression of compassion does have distinct facial musculature from happiness and, and based on the limited data available, also from sympathetic concern. Findings related to investigation 2, however, were more complex. That is, whilst both the free response and forced choice data revealed individuals to be able to differentiate 'kind' compassion expressions from those of sympathetic concern, the same was not always true for kind compassion as compared to happiness. Here, whilst both the free response and categorical rating data revealed expressions of happiness to be quite clearly described and rated as happy; for kind compassionate expressions, free recall engendered words associated with affiliation, interest and contentment categories but, significantly more often, happiness synonyms (e.g. happy, joyous etc.). This is somewhat consistent with the forced labelling task, where kind compassionate faces were as likely to be rated as happy as they were compassionate. These results will be discussed in turn.

The results of investigation one revealed that the McEwan kind compassion expression (McEwan et al., 2014) is characterised by a low-intensity smile, absence of lips parting, and left or right head tilt. This relates to FACS coding AU12 (low intensity), AU55 or 56, and absence of AU25. These coding units are significantly different to: i) prototypical codings for the emotional expression of happiness (being either FACS AU12 at a higher level of intensity or AU12 and AU6 in combination, and the potential involvement of AU25/26 (Ekman et al. 2002)) and; ii) sympathetic concern (FACS AU1, AU4 and AU58, as described by Haidt & Keltner, 1999). Thus, our data demonstrate that 'kind' compassion has a distinctive facial physiology from that of either happiness or sympathetic concern. This is consistent with arguments that compassion has its own signaling methods (Goetz et al., 2010), as well as arguments that it may be multifaceted in nature (Falconer et al., 2019; Strauss et al., 2016).

Turning next to Investigation two, and the free recall results, it was observed that participants were: i) more likely to use happiness words/synonyms to describe the happy expression than other word categories, including compassion; ii) more likely to use words related to interest, contentment and affiliation to describe the kind compassion expression, than other word categories; and iii) use different words to describe the kind compassion expression compared with the sympathetic concern expression. These latter findings are consistent with the research of Falconer et al. (2019) suggesting that at least two perceptually and functionally distinct facial expressions of compassion exist, one related to compassion as 'kindness' and one related to compassion as 'empathy'. Indeed, consistent with this, the valence and arousal ratings of the words used to describe the respective faces revealed that, whilst words associated with the kind compassion expression were positively valenced (as were those associated with happiness), those associated with the sympathetic concern expressions were negatively valenced. Additionally, whilst words used to describe the kind compassion and sympathetic concern expressions were matched in terms of arousal intensity, this arousal intensity was significantly less than that associated with words used to describe happiness.

The above findings accord well with theory that 'kind' compassion may form part of a distinct group of emotions *within* an overall group of positive emotions. Specifically, a group of emotions associated with lower arousal safety, soothing and affiliative emotions, as compared to higher arousal drive/joyous emotions (Gilbert, 2014; 2015; Kapoor et al; 2013; Richardson et al., 2016; Shaver et al; 2001). Added to this, the free response data are also consistent with previous language studies (e.g. Shaver et al., 2001; Kapoor et al. 2013). Here, it has been observed that individuals distinguish between joyous emotions such as amusement and excitement, and affiliative emotions such as trust, compassion and love; with associated words qualitatively different in terms of arousal and valence (see also Condon and Barrett, 2013).

However, the above results must be tempered in observation of the findings that: (i) individuals also used significantly more forms of the word 'happiness' to describe the 'kind'

compassion expressions than 'compassion' words; and (ii) in the forced choice rating task, whilst happiness expressions were consistently rated as happy (as compared to all other choices), individuals were as likely to rate 'kind' compassion faces as compassionate as frequently as they were to rate them as happy. Thus, whilst our expression of compassion may: i) have distinctive musculature properties as compared to happiness and sympathetic concern; and ii) be associated with some unique descriptors, we would tentatively argue that the expression belongs to a broad affiliative (and calming/soothing) emotion 'family' category (consistent with Barrett, 2017).

A further result worthy of discussion is that in the free response task when describing our kind compassion expressions, no individual used the word 'kind'. This result is extremely important as it demonstrates that conceptualizations researchers use, as well as their methodologies, may confound the very topic of their interest (see Barrett, 2017; Haidt & Keltner, 1999; Widen, Christy, Hewett & Russell, 2011). Thus, whilst at least two expressions of compassion may exist (Falconer et al., 2019), 'kind' compassion may not reflect lay recognition or understanding of this expression. Indeed, in using free response, the expression of kind compassion was recognized by individuals as 'contented'. Interestingly, this finding is consistent with the original conception of this emotion (or motivation) as being aligned with a '*contented*, affiliated and soothing affect system' (Gilbert, 2014).

Moreover, the free response task also revealed words associated with interest to be used when describing the kind compassionate expression. Of note our 'contented' expression of compassion involved a head tilt. As head tilting can be associated with the emotion of interest (Reeve, 1993), this suggests that the expression of compassion we used, may involve a motivation or drive to act. This fits with the idea that compassion can also be understood as a motivation focused on the 'sensitivity to distress in self and others', with a commitment (i.e. drive) to do our best to alleviate and prevent it (Gilbert 2017; Maratos et al., 2019).

Finally, it should be noted that Barrett and colleagues (2019) have suggested that how individuals express emotion varies considerably. Notably, they opine caution when arguing prototypical emotional facial expressions exist. Here, we agree and also caution the 1:1 transposition

of findings to AI models etc. This stated, our participants were very much able recognise happiness from a single static instance and qualitatively differentiate 'contented' compassion from sympathetic concern, across our ethnically diverse and mixed gender stimulus set. Indeed, this ability to make quick heuristic stereotyped decisions has served humans well, enabling rapid efficient responding when necessary. However, as suggested by both Barrett and colleagues (2019) and Maratos & Pessoa (2019), the next stages of emotion research require multi-faceted approaches and, as a minimum, the broadening of investigations to include context and relevance of a stimulus to an individual.

Conclusions:

The results of the two investigations reveal that the facial expression of kind compassion, as utilized by McEwan et al., (2014), comprises distinct facial FACS physiology as compared to the emotional expressions of happiness and sympathetic concern. This is consistent with recent research suggesting that compassion may have its own distinctive signaling methodology (Goetz, 2010) as well as potentially two different facial expressions (Falconer et al., 2019). This stated, whilst our kind compassion expressions were labelled and/or associated with word groupings representing affiliation and contentment (i.e. compassion) more often than any of our further expressions, they also engendered happiness word groupings and the happiness label. This suggests that whilst the facial musculature of '**contented**' compassion is distinct, its psychological conception forms part of a broader positive emotional categorization linked to an affiliative emotional system or family. Finally, our research demonstrates methods to circumvent fallibilities of facial emotion research. Most notably, using free recall, and real actors (of balanced gender and ethnicity), we can have confidence in our finding that individuals can reliably distinguish 'contented' (cf. kind) compassion from sympathetic concern and, to some extent, happiness in static instances.

Acknowledgements

With particular thanks to Marcello Passarelli (the second FACS coder), and also the staff/students at the Sino-British College, USST, who allowed their photographs to be used as part of Investigation 2.

Without all of their various contributions this research would not have been possible.

End note

The 'Shanghai Emotional Facial Expressions' (SEFE) set developed as part of this research is available

on request. For access to the SEFE set please email f.maratos@derby.ac.uk and/or

ottocondliffe@gmail.com

References

- Alvarado, N. (1998). A reconsideration of the structure of the emotion lexicon. *Motivation and emotion*, 22(4), 329-344.
- Ambadar Z., Cohn J. F., Reed L. I. (2009). All smiles are not created equal: Morphology and timing of smiles perceived as amused, polite, and embarrassed/nervous. *Journal of Nonverbal Behavior*, 33(1), 17–34.
- Barrett, L.F. (2017). *How emotions are made: The secret life of the brain*. Boston: Houghton Mifflin Harcourt.
- Barrett, L. F., Adolphs, R., Marsella, S., Martinez, A. M., & Pollak, S. D. (2019). Emotional expressions reconsidered: challenges to inferring emotion from human facial movements. *Psychological Science in the Public Interest*, 20(1), 1-68.
- Campos, B., Shiota, M. N., Keltner, D., Gonzaga, G. C., & Goetz, J. L. (2013). What is shared, what is different? Core relational themes and expressive displays of eight positive emotions. *Cognition & emotion*, 27(1), 37-52.
- Cohn, J. F., Ambadar, Z., & Ekman, P. (2007). Observer-based measurement of facial expression with the Facial Action Coding System. *The handbook of emotion elicitation and assessment*, 203-221.
- Condon, P., & Barrett, L.F. (2013). Conceptualizing and experiencing compassion. *Emotion*, 13(5), 817-821.
- Depue, R. A., & Morrone-Strupinsky, J. V. (2005). A neurobehavioral model of affiliative bonding: Implications for conceptualizing a human trait of affiliation. *Behavioral and Brain Sciences*, 28(3), 313-349.
- Eisenberg, N., Fabes, R. A., Miller, P. A., Fultz, J., Shell, R., Mathy, R. M., & Reno, R. R. (1989). Relation of sympathy and personal distress to prosocial behavior: a multimethod study. *Journal of personality and social psychology*, 57(1), 55-66.
- Eisenberg, N., McCreath, H., & Ahn, R. (1988). Vicarious emotional responsiveness and prosocial behavior: Their interrelations in young children. *Personality and Social Psychology Bulletin*, 14(2), 298-311.
- Ekman, P., Friesen, W., & Hager, J.C. (2002). *Facial Action Coding System: Investigator's Guide*. [CD ROM]. Salt Lake City: A Human Face.

- Elfenbein, H. A., & Ambady, N. (2002). On the universality and cultural specificity of emotion recognition: a meta-analysis. *Psychological bulletin*, 128(2), 203-235.
- Falconer, C. J., Lobmaier, J. S., Christoforou, M., Kamboj, S. K., King, J. A., Gilbert, P., & Brewin, C. R. (2019). Compassionate faces: Evidence for distinctive facial expressions associated with specific prosocial motivations. *PloS one*, 14(1), e0210283.
- Fleiss, J. L., Levin, B., & Paik, M. C. (2013). *Statistical methods for rates and proportions*. Hoboken, NJ: Wiley.
- Gilbert, P. (2014). The origins and nature of compassion focused therapy. *British Journal of Clinical Psychology*, 53(1), 6-41.
- Gilbert, P. (2015). The evolution and social dynamics of compassion. *Social and personality psychology compass*, 9(6), 239-254.
- Gilbert, P. (2017). Compassion: Definitions and controversies. In, P. Gilbert (Ed.), *Compassion: Concepts, Research and Applications* (pp. 3–15). London: Routledge.
- Goetz, J.L., Keltner, D. and Simon-Thomas, E. (2010). Compassion: An Evolutionary Analysis and Empirical Review. *Psychological Bulletin*, 136(3), 351-374.
- Goetz, J.L. and Simon-Thomas, E. (2017). The landscape of compassion: Definitions and scientific approaches. In Seppälä, E.M., Simon-Thomas, E., Brown, S.L., Worline, M.C., Cameron, C.D. and Doty, J. R. (Eds.), *The Oxford Handbook of Compassion Science* (pp. 1-24). New York: Oxford University Press.
- Haidt, J., & Keltner, D. (1999). Culture and facial expression: Open-ended methods find more expressions and a gradient of recognition. *Cognition & Emotion*, 13(3), 225-266.
- Heinze, G., & Schemper, M. (2002). A solution to the problem of separation in logistic regression. *Statistics in medicine*, 21(16), 2409-2419.
- Hu, X., Yu, J., Song, M., Yu, C., Wang, F., Sun, P., ... & Zhang, D. (2017). EEG correlates of ten positive emotions. *Frontiers in human neuroscience*, 11, 26
- Izard, C. E. and Buechler, S. (1980) Aspects of consciousness and personality in terms of differential emotions theory. In Plutchik R. and Kellerman H. (eds.). *Emotion: Theory, Research and Experience*, Vol. I. Academic Press, New York.

- Kapoor, A., Czerwinski, M., MacLean, D.L., Zolotovitski, A. (2013) On Recovering the Structure of Affect. Humaine Association conference on affective computing and intelligent interaction. IEEE.
- Keltner, D. (2009). *Born to be good: The science of a meaningful life*. New York: Norton.
- Maratos, F.A., Gilbert T & Gilbert. P (2019). Improving well-being in Higher Education: Adopting a compassionate approach. In S. Gibbs, Editor (Eds) *Values in Higher Education*. Springer
- Maratos, F. A., & Pessoa, L. (2019). What drives prioritized visual processing? A motivational relevance account. *Progress in brain research*, 247, 111-148.
- McEwan, K., Gilbert, P., Dandeneau, S., Lipka, S., Maratos, F., Paterson, K. B., & Baldwin, M. (2014). Facial expressions depicting compassionate and critical emotions: the development and validation of a new emotional face stimulus set. *PloS one*, 9(2), e88783.
- Moll, J., Bado, P., de Oliveira-Souza, R., Bramati, I. E., Lima, D. O., Paiva, F. F., ... & Zahn, R. (2012). A neural signature of affiliative emotion in the human septohypothalamic area. *Journal of neuroscience*, 32(36), 12499-12505.
- McNeish, D., Stapleton, L. M., & Silverman, R. D. (2017). On the unnecessary ubiquity of hierarchical linear modeling. *Psychological methods*, 22(1), 114-140.
- Olszanowski, M., Pochwatko, G., Kuklinski, K., Scibor-Rylski, M., Lewinski, P., & Ohme, R. K. (2015). Warsaw set of emotional facial expression pictures: a validation study of facial display photographs. *Frontiers in psychology*, 5, 1516.
- Owen, S., and Maratos, F. A.* (2016) Recognition of subtle and universal facial expressions in a community-based sample of adults classified with intellectual disability. *Journal of Intellectual Disability Research*, 60: 344–354.
- Panksepp, J. (1998). *Affective neuroscience: The foundations of human and animal emotions*. Oxford: Oxford University Press.
- Pennebaker, J.W., Boyd, R.L., Jordan, K., & Blackburn, K. (2015). *The development and psychometric properties of LIWC2015*. Austin, TX: University of Texas at Austin.
- Plutchik, R. (1991). *The Emotions*. Lanham: University Press of America.

- Reeve, J. (1993). The face of interest. *Motivation and Emotion*, 17(4), 353-375.
- Richardson, M., McEwan, K., Maratos, F., & Sheffield, D. (2016). Joy and calm: how an evolutionary functional model of affect regulation informs positive emotions in nature. *Evolutionary Psychological Science*, 2(4), 308-320.
- Russell, J. A. (1994). Is there universal recognition of emotion from facial expression? A review of the cross-cultural studies. *Psychological bulletin*, 115(1), 102-141.
- Sauter, D. A. (2017). The nonverbal communication of positive emotions: An emotion family approach. *Emotion Review*, 9(3), 223-234.
- Schirmer, A. (2015). *Emotion*. Thousand Oaks, CA: Sage Publications.
- Shaver, P. R., Murdaya, U., & Fraley, R. C. (2001). Structure of the Indonesian emotion lexicon. *Asian journal of social psychology*, 4(3), 201-224.
- Shiota, M. N., Campos, B., Oveis, C., Hertenstein, M. J., Simon-Thomas, E., & Keltner, D. (2017). Beyond happiness: Building a science of discrete positive emotions. *American Psychologist*, 72(7), 617-643.
- Storm, C., & Storm, T. (1987). A taxonomic study of the vocabulary of emotions. *Journal of personality and social psychology*, 53(4), 805-816.
- Strauss, C., Taylor, B. L., Gu, J., Kuyken, W., Baer, R., Jones, F., & Cavanagh, K. (2016). What is compassion and how can we measure it? A review of definitions and measures. *Clinical psychology review*, 47, 15-27.
- Sutherland, C. A., Rhodes, G., & Young, A. W. (2017). Facial image manipulation: A tool for investigating social perception. *Social Psychological and Personality Science*, 8(5), 538-551.
- Tottenham, N., Tanaka, J. W., Leon, A. C., McCarry, T., Nurse, M., Hare, T. A., ... & Nelson, C. (2009). The NimStim set of facial expressions: judgments from untrained research participants. *Psychiatry Research*, 168(3), 242-249.
- Warriner, A. B., Kuperman, V., & Brysbaert, M. (2013). Norms of valence, arousal, and dominance for 13,915 English lemmas. *Behavior research methods*, 45(4), 1191-1207.

Widen, S. C., Christy, A. M., Hewett, K., & Russell, J. A. (2011). Do proposed facial expressions of contempt, shame, embarrassment, and compassion communicate the predicted emotion? *Cognition & Emotion*, 25(5), 898-906.

Figure1 *Left Panel:* Compassion facial expression from the McEwan et al. (2014) facial stimulus set and one generated from FACS coding as part of investigation 2, respectively. *Right Panel:* The single sympathetic concern expression available from Haidt and Keltner (1999) and one generated from FACS coding as part of investigation 2, respectively.



Table 1: *Frequency Counts for the Occurrence of Specific Facial Actions*

FACS code	Description	Happiness (total/30)	Kind Compassion (total/31)	Total occurrences (/61)
AU 12 ('A' to 'B' level of intensity)	Low intensity smile	0	27	27
AU 12 ('C', 'D' or 'E' level of intensity)	High intensity smile	30	4	34
AU6	cheek raise	29	12	41
AU25	lips parting	29	3	32
AU's 55, 56	left or right head tilt	0	9	9
AU7	eyelids tight	5	3	8
AU14	dimpler	0	2	2
AU1	inner brow raise	1	0	1
AU2	outer brow raise	1	0	1
AU16	lower lip depress	1	0	1
AU17	chin raiser	0	1	1

Table 2: *Positive Emotion Words Used to Describe the Facial Expressions*

Category	Words in category	Total for neutral expressions	Total for happiness expressions	Total for kind compassion expressions	Total for sympathetic concern expressions
Happiness	happy, amused, gleeful, cheerful, joyous, delighted, playfulness	4	480	196	0
Affiliation	compassion, love, loving, ‘acceptive’ (sic), accepted, empathic, empathy, welcoming, affinity, flirtatious, flirty, friendly, sympathy, sympathetic	0	3	24	2
Contentment	Content, satisfied	9	18	71	0
Interest	attentive, interest, intrigued, curiosity, engaged	7	0	31	7
Other		580	99	278	591

Table note: *Categorised words include grammatical forms, for example ‘happiness’ was accepted as well as ‘happy’. ‘Acceptive’ (sic), ‘accepted’ and ‘affinity’ were added to Pennebaker and colleagues (2015) original list of words related to affiliation as they were judged to be very close in meaning.*

Table 3: *Mean (SD) & Median (IQR) of Expressions for Arousal and Valence*

Expression	Arousal		Valence	
	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)
Happiness	5.70 (.13)	6.05 (.00)	6.97 (1.0)	8.47 (.00)
Kind Compassion	4.19 (1.6)	4.55 (2.60)	5.67 (2.8)	6.83 (3.00)
Sympathetic Concern	4.61 (.44)	4.46 (2.32)	3.34 (1.8)	2.82 (1.46)
Neutral	4.10 (.64)	3.45 (.21)	4.85 (1.8)	5.50 (1.29)

Table 4: Mean (SD) Statistics for the Ratings of Different Types of Facial Expressions

Expression	Emotion label									
	Compassion		Happiness		Sadness		Neutral		Other	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Happiness	3.24	0.11	7.48	0.13	1.46	0.05	1.94	0.10	2.49	0.10
Kind Compassion	4.47	0.12	4.66	0.11	1.80	0.06	2.08	0.09	3.45	0.12
Sympathetic Concern	2.28	0.09	1.21	0.04	5.83	0.13	2.13	0.09	5.05	0.14
Neutral	1.57	0.53	1.35	0.43	2.76	0.93	6.87	0.15	3.15	0.13

Supplementary Table 1: Other words used to describe the emotion expressions

Description words	Neutral Expression	Happiness Expression	Kind Compassion Expression	Sympathetic Concern Expression
non-answer (blank, punctuation mark, non-word e.g. asdf etc.)	8	3	11	5
about to speak	0	1	0	0
admiration	0	0	1	0
afraid, fear, scared	5	0	0	28
aggravated	1	0	0	0
agitated	1	0	1	0
agreement	0	1	0	0
anger, angry, cross	22	0	0	31
angry -upset	0	0	0	1
annoyance	0	0	1	2
annoyed	22	0	8	5
anxiety	0	0	0	1
anxious	0	0	0	2
apathetic	0	0	1	0
apathy	1	0	0	0
appreciative	0	0	1	0
apprehensive	1	1	0	0
ashamed	0	0	0	1
astonished	0	0	0	1
attentive and happy	0	0	1	0
attracted	0	0	1	0
aware	0	0	1	0
awkward	0	1	0	0
awkwardness	0	1	0	0
back off	1	0	0	0
bewildered	0	0	1	0
bitch face	1	0	0	0
blank	1	0	0	0
bored	13	1	1	6
bored/tired	0	0	0	1
boredom	1	0	0	0
bothered	0	0	1	1
broken hearted	0	0	0	1
bummed	0	0	0	2
calm	0	1	2	0
calming	0	0	1	0
cautious	0	0	5	0
cautious smile	0	0	1	0
cheeky	0	1	1	0
cheerful	0	4	1	0

cocky	0	0	1	0
comprehensive	0	0	1	0
concentrate	0	0	0	1
concentrating	0	0	1	1
concentration	1	0	0	2
concern	0	0	1	8
concern (mild)	0	0	0	1
concerned	1	0	0	18
confidence	0	0	1	0
confident	0	1	4	0
confuse	0	0	0	1
confused	1	1	10	30
confused/disgusted	0	0	0	1
confusion	0	0	2	6
contempt	3	0	12	0
creepy	0	1	0	0
dazed	1	0	0	0
defeated	0	0	1	0
dejected	0	0	1	0
depressed	4	0	0	1
depression	0	0	1	1
determined	1	0	0	0
disappointed	2	0	5	9
disappointment	0	0	0	5
disappointment-sadness	0	0	0	1
disapproval	4	0	0	0
disbelief	1	0	0	4
disbelieving	0	0	0	2
discernment	0	0	1	0
discontented	1	0	0	0
disenchanted	0	0	1	0
disgruntled	0	0	0	2
disgust	2	0	0	6
disgusted	0	0	0	2
dismissive	0	0	1	0
displeased	1	0	0	3
displeasure	1	0	0	0
dissatisfied	0	0	0	1
distraught	0	0	0	2
distress	0	0	0	1
distressed	0	0	0	1
distrust	0	0	0	1
distrusting	0	1	2	0
don't know	0	0	0	1
doubt	0	0	0	1
doubtful	0	0	1	3

embarrassed	0	1	0	0
engaged, but uncertain	0	0	1	0
excited	0	4	0	0
extremely bored-disappointment	0	0	0	1
fake happy	0	3	0	0
fake joy	0	1	0	0
fake joy, embarrassed	0	1	0	0
fake smile	0	3	0	0
fatigued	0	0	0	1
fed up	3	0	0	1
feeling awkward	0	0	1	0
feeling bored	0	0	1	0
feigned happiness	0	2	0	0
feigned lack of emotion	1	0	0	0
flustered	0	0	0	2
focused	1	0	0	1
forced	0	1	1	0
forced happiness	0	4	0	0
forced happy	0	1	0	0
friendliness or mild amusement	0	1	0	0
frightened	0	0	0	2
frown	0	0	0	1
frustrated	0	0	2	2
frustration	0	0	2	4
glad	0	2	1	0
gloomy	0	0	0	1
grimace	0	1	0	0
grouchy	0	0	0	1
grumpy	2	0	0	4
happily relaxed	0	0	1	0
happily shocked	0	1	0	0
happily surprised	0	1	0	0
happy (but faking it)	0	1	0	0
happy and calm	0	1	0	0
happy and peaceful	0	0	1	0
happy and satisfied	0	0	1	0
happy smiling	0	1	0	0
happy/content	0	0	1	0
he tries to seem angry	0	0	0	1
hopeful	0	0	0	1
hopelessness	0	0	0	1
humiliated	0	0	0	1
hurt	0	0	0	3
i still can't remember where i know you from	0	0	1	0

I'm trying to remember where i				
know you from	0	1	0	0
impatient	0	0	2	0
indifferent	4	0	1	0
ingratiating	0	1	0	0
inquisitive	0	0	1	0
insincere happy	0	1	0	0
intimidation	1	0	0	0
intriguing	0	0	1	0
irritated	3	1	2	2
irritation	0	0	1	0
jovial	0	1	0	0
joy, love (as 1 entry)	0	0	1	0
judgemental	0	0	1	0
judging	0	0	1	0
keeping distance-personal space	1	0	0	0
kind	1	0	0	0
listening	0	0	1	1
listening -watching something nice	0	0	1	0
loneliness	0	0	0	1
lustful	0	0	1	0
mad	9	0	0	7
mildly amused	0	0	1	0
mischievous	0	1	1	0
mistrust	0	0	0	1
nervous	2	2	0	1
nervousness	0	0	0	1
neutral or no emotion	375	4	57	31
nice	0	0	1	0
no emotion - polite smile	0	1	0	0
nonplussed	0	0	0	1
normal	1	0	0	0
nostalgic	0	0	1	0
not amused	1	0	0	0
not bothered	1	0	0	0
not happy with what was said	0	0	0	1
numb	1	0	0	0
ok	0	0	1	0
ok not too happy but not sad	0	0	1	0
ok smiling a little	0	0	1	0
okay	0	0	1	0
pain	0	0	0	1
pained happiness	0	1	0	0
paranoid	0	0	1	0
peaceful	1	0	0	0
perplexed	0	0	1	3

pleading	0	0	0	1
pleased	0	5	22	0
pleased/neutral	0	0	1	0
pleasure	0	1	0	0
polite disagreement/scepticism	0	0	1	0
polite smile	0	1	0	0
positive	0	0	1	0
pouty	0	0	0	1
preoccupation/mild worry	0	0	0	1
professional, strict	1	0	0	0
proud	0	1	1	0
puzzled	0	0	1	0
puzzlement requiring thought	0	0	0	1
questionable face	0	0	1	0
questioned	0	0	1	0
questioning	0	0	1	3
questioning something	0	0	1	0
quizzical	0	0	1	0
really	0	0	1	0
received bad news	1	0	0	0
relieved	0	2	2	0
resigned	0	0	1	0
rye	0	0	1	0
sad, unhappy	20	2	4	151
sad but happy	0	0	1	0
sad shocked	0	0	0	1
sarcastic	0	1	0	0
sarcastic laughing	0	1	0	0
satisfied and happy	0	0	1	0
scattered	1	0	0	0
sceptical	3	1	1	1
scepticism	0	1	5	1
scepticism but not taking it very				
seriously	0	0	1	0
semi happy	0	0	1	0
serious	4	0	0	3
serious or angry	1	0	0	0
serious or upset	1	0	0	0
serious/angry	1	0	0	0
seriousness (mild)	1	0	0	0
shame	0	0	0	1
shock	1	0	1	2
shocked	1	0	0	11
shocked sad	0	0	0	1
shy	0	1	9	0
sincere	0	0	1	0

slightly shocked	1	0	0	0
sly	0	0	1	0
smile	0	1	0	0
smiley	0	1	0	0
smiling	0	3	1	0
smirk	0	0	1	0
smug	0	0	2	0
snobbish	1	0	0	0
startled	1	0	0	0
stern	1	0	0	2
stoked	0	1	0	0
stoned	0	1	0	0
stress	0	0	0	1
stressed	0	0	0	2
stunned	1	0	0	0
subdued	0	0	1	0
sulking	0	0	0	1
sultry	1	0	0	0
superior	0	0	1	0
surprise	2	1	2	4
surprise / polite smile	0	1	0	0
surprised	3	1	0	17
suspicion	0	0	1	0
suspicious	3	0	3	6
this is awkward	0	1	0	0
thoughtful	0	0	6	0
thoughtful/thinking	1	0	0	0
thoughtfulness	2	0	0	0
thoughtfulness (did this guy do the photos with a hangover?)	0	0	0	1
tired	4	2	2	4
tired but happy	0	1	0	0
trying to understand	0	0	0	1
unbelieving	0	0	0	1
uncertain	0	0	1	2
uncertainty	1	0	1	0
uncomfortable	0	3	2	1
undecided	0	0	1	0
unimpressed	3	0	0	0
unsatisfied	0	0	0	1
unsure	0	1	3	0
upset	6	0	1	26
wary	0	0	0	1
watching-listening something nice	0	0	1	0
weary	0	0	1	0
wondering	0	0	0	1

worried	2	0	0	41
worried and fear	1	0	0	0
worried and sad	0	0	0	1
worried or no emotion	0	0	0	1
worried/sad	0	0	0	1
worry	0	0	0	11
worry / fear	0	0	0	1
you're naive, but I'll indulge you and listen anyway	0	0	1	0
you're still talking. this is getting tedious. I'm going to leave now.	0	1	0	0
you've got to be kidding me	0	0	0	1
Total	580	99	278	591