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Abstract

The present study investigated the differential effects of a brief compassion meditation compared to a brief mindfulness meditation on felt and facially expressed compassion while viewing images of suffering. Participants (N = 82) were randomly assigned to one of two meditation conditions designed to promote compassion and relaxation, or relaxation alone. Participants then filmed themselves as they watched a two-minute compassion-inducing video that depicted suffering from around the world. These participant videos were later coded using three-distinct facial coding schemes: Complex FACS, Simplified FACS, and intuition rating. Finally, participants responded to a battery of self-report items about the level of compassion and sadness they experienced during the stimulus video, their trait emotional expressivity, and demographic questions including prior experience with meditation. Results found no difference in felt or facially expressed compassion between participants who completed the compassion meditation and those who completed the mindfulness meditation. Complex and Simplified FACS coding schemes were highly correlated, and both only weakly associated with intuition ratings. However, all three facial coding schemes failed to be even moderately associated with self-reported compassion. Intuition was the most vulnerable facial coding method to the influence of individual differences in gender and trait emotional expressivity. The current study found that FACS was unable to measure participant compassion, however, further research should be conducted using FACS in combination with other indicators of compassion.

Facial Action Coding System and Induced Compassion

Compassion is an increasingly valuable social emotion. In a bipartisan political climate that has born a bipartisan social climate, the ability to recognize the experience, emotion, and humanity of a dissimilar other has become even more important. But compassion is not only useful as an instrument for keeping society-wide peace, it also promotes love and intimacy in close relationships. By definition compassion requires noticing, feeling, and responding to another's emotional state (Kanov et al., 2004). This greater attunement to the experience of another and motivation to act altruistically in response, is a transformative feature in personal relationships.

Cultivating compassion has been a long-time goal of Western educational programs — clinicians, criminals, and children alike are taught to increase their compassionate responses to the suffering they witness (or in the case of criminals, cause). But the roots of compassion cultivation are planted in Eastern philosophy and Buddhist practice. One of the primary goals of contemplative practice is to foster the motivational component of compassion that brings a compassionate person to the aid of a suffering other (Desbordes et al., 2012). Within Buddhist literature, meditation develops the *four immesuarbles* – metta (loving kindness), karuna (compassion), mudita (empathetic joy), and upekkha (equanimity). Together these four immesurables are considered the pillars of sustainable positive change (Wallace, 1999; Ekman et al., 2005). Meditative practice that operates on the four immesurables uses breathing and grounding techniques characteristic of traditional mindfulness, in addition to spoken or envisioned well wishing upon others. These compassionate intentions are connected to structured breathing. For instance, one might be prompted to breathe in the love that they have experienced in their life, feel it fill their chest with warmth, and then exhale this loving-kindness, compassion,

and beneficence to a specific other. Throughout the meditation, one begins to send compassionate breath to more physically and socially distant targets. One may begin by sending well-wishes to a loved one or family member, and end with the welfare of all beings, known and unknown, on one's mind (Wallace, 1999).

Compassion meditation is thought to operate on mental and physiological levels. Cognitively, meditators are being primed to feel connection and closeness to others. Increased feelings of closeness in turn promote supportive behavior (Ahn, Le, & Bailenson, 2013). Not only are these feelings of connection hypothesized to directly increase one's motivation to help others, they also are hypothesized to have an overall positive effect on emotional and psychological wellbeing which make supportive behavior more sustainable and less draining for the meditator (Sahdra & Shaver, 2013). Physiologically, compassion meditation practice improves vagal tone, the body's ability to redirect metabolic resources of the autonomic nervous system to parasympathetic activation as opposed to sympathetic activation (Porges, Doussard-Roosevelt, & Maiti, 1994). Increased activity in the parasympathetic nervous system indicates a relaxed state in which resources are redirected toward emotion regulation, appropriately attending to social cues and contexts, and interpersonal functioning (Miller, Kahle, & Hastings, 2017; Porges, 2011). Vagal tone ultimately mediates the quality of emotional and behavioral responses to social stimuli, such that higher vagal tone is associated with quick recovery from physiological stressors and more social attunement. There is an increasing amount of empirical evidence suggesting that compassion meditation improves vagal tone which in turn, makes mediators more capable of recognizing others' suffering and acting compassionately in response (Desbordes et al., 2012; Luberto et al., 2018; Condon et al., 2013).

However, a difficulty arises in empirically measuring compassion because of its social nature and high-value status in society. It is likely that compassion is especially vulnerable to social desirability biases among participants in empirical literature. Because compassion meditations prime participants to think about helping behaviors, separating the true effect of the meditation from participants' sense of obligation to adhere to social expectations or research goals becomes very difficult. Ekman et al. (1980) and Eisenberg et al. (1988) suggest that insight into emotional states based on facial expression can be helpful in attaining an unbiased assessment of emotion. In fact, the same research on vagal tone mentioned above supports the connection between the vagus nerve and the face, further justifying the use of facial expressions as a window into feelings of compassion in an empirical setting (Stellar et al., 2015).

Coding facial expression of emotion is not a novel concept. A multitude of facial coding systems have been developed but the Facial Action Coding System (FACS) is the field standard. Developed by Ekman & Friesen (originally published in 1978), FACS picks out and justifies the existence of 58 unique Action Units, or AUs, each tied to a specific facial muscle movement. The appearance change associated with each AU is described in detail, identified by number, and rated on a 5-point intensity scale (ranging from A = trace, to E = maximum). FACS is an anatomically based system that is used across disciplines; it is not designed specifically to measure emotion, rather it is used as a tool to taxonomize facial movement. However, researchers have found success in identifying specific AUs or combinations of AUs that tend to indicate certain emotions. Among the most well validated and recognized facial emotions accessible with FACS are boredom, fear, anger, shame, and confusion (Cordaro et al., 2019). Basic emotions such as these are well suited for FACS because they are comprised of a specific set of AUs. Other emotions such as pride, lust, and compassion have proven to be relatively

inaccessible with anatomical coding systems because they lack theoretical clarity and universality in non-verbal expression (Cordaro et al., 2019; Goetz, Keltner, & Simon-Thomas, 2010). Despite the lack of reliability in compassion coding found by some researchers, others continue to utilize FACS, or EMFACS – an addition to the basic instructional manual suggesting sets of cooccurring AUs indicative of emotion – to gain insight into participant compassion (Condliffe & Maratos, 2020; Stellar, Anderson, & Gatchpazian, 2020). For example, Rosenberg et al. (2015), using FACS, found that sustained meditation practice increases facial expressions of sympathetic concern for suffering individuals.

FACS, however, requires a hefty investment of time and money. The training materials suggest that one can become fluent in FACS after 75 to 100 hours of self-study, and the certification exam can take up to 10 hours across multiple sittings. The training and certification materials can be purchased for around 500 dollars but only two copies of the manual are distributed. For these reasons, FACS is a relatively inaccessible coding tool, especially for researchers without consistent funding.

The current study aims to address several questions related to induction and facial coding of compassion. First, the researchers wanted to test whether a brief compassion-cultivating meditation, in comparison to a brief mindfulness meditation, would cause participants to either feel or express more compassion towards images of suffering people. Researchers hypothesized that participants who experienced the compassion meditation would report and express more compassion than those who experienced the mindfulness meditation. Second, researchers wanted to compare three types of facial coding of compassion: Complex FACS (coding according to the official manual), Simplified FACS (maintaining only some features addressed in the manual), and untrained intuition ratings. It was expected that Complex FACS and Simplified FACS would

provide similar information about participant compassion while intuition ratings would differ considerably. Third, given disagreement in the literature, researchers wanted to investigate if facial coding was capable of measuring compassion at all. Of the three facial coding schemes, researchers expected Complex FACS to be most closely associated with participants' self-reports of compassion, while the Simplified FACS and intuition ratings were expected to be only weakly associated with self-reported compassion.

Method

Participants

One hundred and seventy-two college students were recruited from an online research pool at a mid-size public university located in the Pacific Northwest (90 of which were excluded from the final analysis due to procedural error, poor quality audio-visual data, failure to pass attention checks embedded in the survey, and missing data. As expected, given the novel difficulties of synchronous virtual data-collection, the majority of excluded participants were removed because of technical trouble and video-quality issues (73%). The final sample analyzed below was comprised of (N = 82) participants (72.0% female-identifying, 24.4% male-identifying, and 3.7% gender non-binary). Both cis and transgender men and women are included in the reported male and female frequencies respectively. All participants who specified their age were over 18 years old (M = 19.65, SD = 1.88). Participants were also asked to report their racial/ethnic identities (70.1% White, 13.4% Multiracial, 6.1% African American, 3.7 % Latinx, 2.4% Asian, 1.2% Native American/Alaskan Native, and 2.4% did not specify).

Materials

Audio-Guided Meditations

Two audio-guided meditations served as the manipulation in the present study. Both began with the same four-minute script adapted from a meditation written by Dr. Erika Rosenberg. Participants were asked to settle into their chairs and were then guided through a body scan and breathing exercises. See Appendix F for the full baseline, compassion, and mindfulness meditation scripts.

Compassion Condition. The compassion meditation was a continuation of the baseline script; it was inspired by and adapted from a loving-kindness meditation from UCLA Mindfulness Awareness Research Center and the Common Humanity Meditation developed by Dr. Barbara Lehman and Tim Burnett (presented by Willett et al., 2020). The script prompts participants to remember times in which they'd felt love and happiness, and times that they had suffered. The goal was to ground participants in those three core emotions to help them recognize the universality of human experience. From this recognition, the meditation asked participants to breathe in well-wishes for themselves and then exhale well-wishes for others who they care deeply for (e.g., family members, friends, partners, etc.). Through each round of breathing, participants are asked to be present with the suffering of, and exhale well-wishes to, people who are less familiar to them, until eventually they are practicing compassion for an unnamed stranger. The meditation concludes with a final centering in the body and breath.

Mindfulness Condition. The mindfulness meditation was a continuation of the baseline script; it was adapted from a meditation written and presented by Dr. Tara Brach. It asked participants to be aware of their cognitive and emotional experiences coming and going. Clearing the mind and body of persistent thoughts, and grounding participants in bodily sensations were

the primary purposes of the mindfulness meditation. To be consistent with the focus on the heart and chest as the center of well-wishing in the compassion meditation, participants were asked to attend to the way their breath created sensations of filling and emptying the chest cavity. To act as a point of comparison for the compassion meditation, it was of particular importance that the mindfulness meditation maintain focus on the self without reference others.

Stimulus Images

Seven stimulus images, each displayed for 15 seconds, were compiled into a PowerPoint video. On a black screen, participants are prompted to wave for the camera at the beginning and end of the video to provide benchmarks for the coders who later reviewed the videos. The stimulus images depicted people who appeared to be suffering; the images ranged in intensity from a pouting child to an emaciated man. These images were collected from a variety of open-source and creative commons websites and can be viewed in Appendix E (Open Affective Standardized Image Set [OASIS]; creativecommons.org).

Measures

Self-report State Emotions

Inspired by and adapted from a variety of self-report state-emotion scales, participants were asked to indicate the extent to which they felt a variety of emotions while viewing the stimulus images. All emotions were rated on a continuous 7-point scale (1 = none at all, to 7 = a great deal) that allowed respondents to drag a slider bar to any point between the minimum and maximum values. Modeled after the Discrete Emotions Questionnaire (Harmon-Jones, Bastian, & Harmon Jones, 2016), the short form Profile of Mood States Questionnaire (Curran, Andrykowski, & Studts, 1995), and an empathy scale used in Stellar, Anderson, & Gatchpazian (2020). The emotion words presented to participants included positive (e.g., moved, joyful) and

negative (e.g., uncomfortable, guilty, contemptuous) affects. In accordance with Batson et al. (1997), all empathy-related emotion words (tenderness, warmth, empathy, compassion, and sympathy) were be combined into a "compassion" index for the sake of analysis (α = .71).

Berkley Expressivity Questionnaire (BEQ)

The Berkley Expressivity Questionnaire measures an individual's emotional expressivity – that is the degree to which one outwardly displays one's emotions. The measure prompts participants to indicate their level of agreement with 16 statements on a 7-point Likert scale (responses ranged from 1 = strongly disagree to 7 = strongly agree, with a neutral mid-point at 4). The measure can be further divided into three distinct subscales: the 6-item Negative Emotionality Scale (e.g., "Whenever I feel negative emotions, people can easily see exactly that I am feeling"); the 4-item Positive Emotionality scale (e.g., "When I'm happy, my feelings show"); and the 6-item Impulse Strength scale (e.g., "My body reacts very strongly to emotional situations"). The BEQ has been shown to be very reliable with an alpha of .86 for all items (α = .70 for the Negative Emotionality factor, α = .70 for the Positive Emotionality factor, and α = .80 for the Impulse Strength factor; Gross & John, 1997). The BEQ maintained strong internal consistency in the current data set (α = .88 for all items).

Emotional Contagion Scale (ECS)

The Emotional Contagion Scale is a 15-item index which assesses the extent to which respondents adopt or "catch" (consciously or unconsciously) the emotions of others (Doherty, 1997). The measure prompts respondents to indicate their level of agreement with each statement on a 5-point Likert scale (1 = never true for me, 2 = rarely true for me, 3 = usually true for me, 4 = often true for me, 5 = always true for me). A composite score from the EC index can be interpreted or the measure can be divided into two subscales: positive emotion contagion

consisting of happiness items (e.g., “When someone smiles warmly at m, I smile back and feel warm inside”) and love items (e.g., “When I look into the eyes of the one I love, my mind is filled with thoughts of romance”); and negative emotion contagion consisting of fear items (e.g., “Watching the fearful faces of victims on the news makes me try to imagine how they might be feeling”); anger items (e.g., “I clench my jaws and my shoulders get tight when I see the angry faces on the news”); and sadness items (e.g., “If someone I am talking with begins to cry, I get teary-eyed”). The ECS has demonstrated very high reliability as an entire index (α = .90) as have both subscales with alphas of .82 and .80 for positive emotions and negative emotions, respectively (Doherty, 1997).

Open-ended Experiential Questions

Participants were asked to report whether or not they experienced persistent thoughts, images, or physical reactions while viewing the stimulus images. If participants indicated that they had experienced any of these thoughts or feelings, they were asked to elaborate in writing.

Procedure

Participants were recruited through Sona, an online participant pool associated with the university at which data was collected. One credit hour was offered as compensation for participation. On Zoom, researchers met with participants in groups of up to 10 people. Participants were given details about the study and were invited to give informed consent if they wished to continue on with the study. After being briefed as a group, participants were assigned to private breakout rooms where they completed the bulk of the online survey. First, participants were asked to engage with either the compassion or mindfulness meditation (randomly assigned through Qualtrics survey). Upon completion of the meditation, participants recorded themselves via the Zoom recording feature while watching the short stimulus video. After ending the 2-

minute recording, participants completed the state-based emotion report, the BEQ, the ECS, the open-ended experiential questions, and provided a variety of demographic information, including their past experiences with meditation and related mindfulness-based practices. Participants were debriefed as a group and shown how to upload their recorded videos to Qualtrics.

Facial Coding Schemes

Three facial coding schemes of varying rigor were applied to all 82-participant videos. A 1-minute and 15-second segment was extracted from the middle of each participant video for facial coding. While coders had access to the video taken before and after the coded period and were encouraged to view it for the sake of better recognizing facial change, the pre- and post-video segments were not coded and are not represented in the final analysis. For an abbreviated comparison of the facial coding schemes, see Table 1.

Complex FACS Coding Scheme

The Complex FACS coding scheme was the most intensive of the three schemes. Two undergraduate researchers applied for university funds which were used to purchase FACS training material and certification exams from the Ekman Institute. Both researchers spent over 100 hours learning FACS through included joint meetings, individual studying, and coding practice. The training process culminated in a certification exam, which both researchers passed.

While full FACS coding (Ekman, Friesen, & Hager, 2002) is comprised of 58 unique Action Units, or AUs, the current study utilized only seven AUs which had been closely associated with compassion in previous literature (Cordaro et al., 2019, Goetz, Keltner, & Simon Thomas, 2010; Kanovsky et al., 2020). This choice was made to support the theoretical focus of the current project on facial expressions of compassion, and to prevent superfluous coding efforts. AU 1, the “Inner Brow Raiser”, AU 4 the “Brow Lowerer”, AU 12 the “Lip Corner

Puller", AU 15 the "Lip Corner Depressor", AU 24 the "Lip Presser", and AUs 55/56 the "Head Tilt" (left and right respectively) were all included in the Complex FACS coding scheme. See full descriptions and examples of the seven relevant AUs in Appendix A.

The Complex FACS coders recorded the changing intensities (measured on a 5-point scale with definitions unique to each AU but generally ranging from A = trace, B = slight, C = marked, D = severe, to E = maximum), and the onset and offset times of each AU as they appeared throughout the minute and 15-second coded period. Coders referenced earlier parts of participant videos in order to identify a "neutral" face for the purposes of comparison (which becomes especially important for recognizing A-level AUs). Complex FACS coders tended to watch participant's faces in isolated sections to catch minor muscle movements that might otherwise be lost. For example, AUs 15 and 17 can create a similar visual appearance even though they originate from different muscle groups. So, a coder might have to focus on an independent muscle group for the duration of the facial movement in order to definitively label it an AU 15 as opposed to a 17. Additionally, for AUs that affect the eyebrows, it can be helpful to cover the upper lid region of the face so that blinking doesn't distort one's perception of the brows. Eyelid movement can create the impression of brow movement, again making it important to block out certain muscle groups and focus on specific regions of the face (the glabella in the case of brow movement) for accurate coding. This detail-oriented coding process required between 5 and 10 viewings of the coded portion of the video and took on average 25 minutes to complete per participant. An example of the unprocessed Complex FACS code for an unnamed participant can be found in Appendix B.

Both Complex FACS coders independently coded and then compared scores for (n = 30) participants and obtained an acceptable reliability score of 0.76. The coders then split the

remaining participant videos, each producing the final code for (n = 26) participants. Each coder also "audited" 10 participants coded by the other to confirm acceptable reliability (0.77 for the 20 audited participants).

Simplified FACS Coding Scheme

The simplified FACS coding scheme was designed by the two certified FACS coders (one of whom is the author of this paper). The hope was to distill the most important components of FACS coding that are relevant to inferring emotion into a more time-efficient procedure that could be carried out by researchers without extensive training. It was determined that dividing the 75-second participant videos into smaller sections would allow coders to avoid the time-consuming task of recording onset, offset, and durations for each AU. Instead, Simplified FACS coders were instructed to direct their attention toward AU intensity as the primary indication of strength of emotion displayed. They were encouraged to refer to the neutral-face baseline for each participant to better assess AU intensities. Coders watched and participated in a 2-hour lesson (taught by the certified FACS coders) on the seven compassion-relevant AUs.

Simplified FACS coders were given the coded portion of the participant videos divided into five, 15-second segments. For each segment they were asked to assign a single code informed by a Likert scale raging 0 (indicating absolutely no expression of facial compassion) to 4 (indicating maximal expression of facial compassion). Each Likert-scale value was defined by the intensity ("low intensity" including levels A and B, "mid-intensity" including level C, or "high intensity" including levels D and E) and the duration ("unextended" is less than three seconds and "extended" is greater than three seconds) of the most intense AU that appeared in each segment. For example, if a participant exhibited a ten-second AU 1A, a two-second AU 4B, and a two-second AU 15C in a single video segment, Simplified FACS coders would record the

Likert-score that best fit the two-second AU 15C (which in this case would be 2, a moderate expression of compassion). The full Likert scale used by simplified FACS coders can be found in Appendix C). Both Simplified FACS coders coded all 82 participant videos and corrected discrepancies for the final analyses. An acceptable reliability of 0.74 was calculated based on Likert-score agreement (meaning perfect reliability for a single participant would be congruent scores on all five video segments). On average, these coders spent an average of five minutes per participant video, viewing each 15-second segment no more than three times.

Intuition Rating Scheme

The intuition rating scheme is the simplest of the three facial coding options. It was included as a point of comparison for both FACS-based schemes after researchers realized that detail-oriented anatomical coding often neglected to assess the face as a whole. The intuition rating scheme was intended to rely on the untrained capacities that we as humans have in perceiving compassion. Consequently, very few instructions were given to the intuition raters so as not to cloud their natural perceptions. These raters were asked to assign a single Likert-score to each (undivided) 75-second participant video indicating the level of compassion they perceived from the participants (the intuition Likert scale also ranged from 0 = absolutely no expression of facial compassion to 4 = maximal expression of facial compassion; it can be read in full in Appendix C). Again, raters were encouraged to refer to the neutral-face baseline for each participant if needed. While the intuition rating scale was not intended to be a scientific measure with high reliability and construct validity, researchers hoped it would provide an important comparison for the anatomical coding schemes. As expected, the three intuition raters achieved a low reliability of 0.45 and the mean intuition score for each participant was used in final analyses. The intuition raters took on average two-minutes to code each participant video.

Results

Complex FACS codes were translated into a total of 14 variables: the duration and frequency of each of the seven AUs. Frequency represented the number of times each AU was displayed during the coded section of a participant's video (extended AUs were arbitrarily split into 10-second units such that an AU held for 43 seconds would receive a frequency score of 4). AU duration represented the total number of seconds each AU was displayed on the participant's face (summed across all occurrences of each individual AU). Exact onset and offset times were not recorded for a small percent of unextended AUs, so the average duration of recorded unextended AUs (2.5 seconds) was generalized to those without clear timestamps. These 14 variables were then standardized.

Principal Components Analysis

To reduce the number of dependent variables and identify possible latent constructs, a principal components analysis (PCA) was conducted on the 14 Complex FACS variables (duration and frequency for each of the seven AUs). All participants (N = 82) were included in the PCA.

Initially all 14 variables were entered into a correlation matrix and the principal components extraction method was applied. An oblique rotation via promax was used to allow for correlations between components. A statistically significant model ($\chi 2$ (31) = 581.97, $p <$ .001) emerged with five components that together accounted for 83.7% of the variability in the original fourteen variables. However, several items cross-loaded on multiple components or had high uniqueness. To obtain a simple solution, a second model was tested excluding the duration and frequency variables associated with AUs 55/56, or head tilts, because of inconsistency in coding and lack of theoretical clarity. This second and final model ($\chi 2$ (24) = 472.19, $p <$ .001)

better fit the data. Four components were supported by parallel analysis and together explained 80.6% of the variability in the 12 included variables. The issues of cross loading were resolved, and each variable maintained low uniqueness and high loading values.

Component 1 (labelled the "Upper Face" component), which uniquely explained 32% of the variability in the 12 included variables, was comprised of the duration and frequency scores for AUs 1 and 4, which both affect the appearance of the eyebrows. Component 2 (labelled the "Lower Face" component) included the duration and frequency scores for AUs 15 and 17 and uniquely explained 20% of the overall variability. Both AUs 15 and 17 affect the chin and mouth region of the face. Component 3 (the "Smile" component) included the duration and frequency scores for AU 12 and uniquely explained 15% of the overall variability. Finally, Component 4 (the "Lip Presser" component) included the duration and frequency scores of AU 24, and it uniquely explained 14% of the overall variability. Descriptive statistics, loadings, and component reliability can be found in Table 2.

Facial Coding Scheme Comparison

To compare the Complex FACS code to the Simplified FACS code and intuition ratings, all 14 duration and frequency variables were combined into a single scale which displayed satisfactory internal consistency ($\alpha = .81$). For the sake of comparison, head tilts (AUs 55/56) were included in the overall Complex FACS score. The five Likert scores assigned to each participant by the Simplified FACS coders were averaged into a single final Simplified FACS score. Finally, the three intuition raters' scores were averaged for each participant, producing a single final intuition score. A bivariate correlation matrix found that Complex FACS and Simplified FACS were strongly associated ($r = .78$, $p < .01$), Complex FACS and intuition

ratings were moderately associated ($r = .52$, $p < .01$), and intuition ratings and Simplified FACS were moderately associated ($r = .66$, $p < .01$).

A hierarchical linear regression was then used to predict the Complex FACS scores from the Simplified FACS scores and intuition ratings. Intuition was entered as the first step of the analysis and Simplified FACS was entered as the second step. Model 1, which included only intuition ratings, explained 27.5% of the variability in the Complex FACS scores. Model 2, which assessed the added effect of simplified FACS, explained an additional 5.8% of the variability in the Complex FACS scores. While it initially appeared that both Simplified FACS and intuition ratings significantly predicted Complex FACS scores, their beta weights suggested that only Simplified FACS statistically significantly predicted Complex FACS scores ($\beta = 0.77$, $p < .001$), while intuition ratings did not ($\beta = 0.02$, $p = .85$). This indicates that there was an issue of multicollinearity between the predictors such that the *shared* effect of intuition ratings and Simplified FACS accounted for the vast majority of R^2 added in Model 1 and that the *unique* predictive power of intuition ratings was negligible. See Table 3 for more detail.

Facial Coding and Compassion

Self-reported compassion and self-report sadness was entered into a bivariate correlation with the three facial coding schemes. Self-reported compassion was only weakly associated with the three facial coding schemes (Complex FACS $r = 0.15$, $p = .18$; Simplified FACS $r = 0.16$, $p = .17$; intuition ratings $r = 0.15$, $p = .17$). On the other hand, self-reported sadness was weakly, but statistically significantly, associated with all three facial coding schemes (Complex FACS $r = 0.24$, $p < .05$; Simplified FACS $r = 0.27$, $p < .05$; intuition ratings $r = 0.26$, $p < .05$). See Table 4 for a full correlation matrix.

Three hierarchical linear regressions were run to assess the extent to which self-reported compassion and emotional expressivity (overall BEQ score) predicted the three facial coding schemes. For all three regressions, self-reported compassion was entered as the first step and emotional expressivity was entered as the second step. Neither self-reported compassion nor expressivity significantly predicted Complex FACS scores or Simplified FACS scores (together the predictors explained only about 2% of the variability in Complex FACS and 4% of the variability in Simplified FACS). And while self-reported compassion failed to predict intuition ratings, emotional expressivity statistically significantly predicted about 10% of variability in intuition ratings ($\beta = 0.30$, $p = .01$).

Compassion Meditation

Four independent sample t-tests were run to compare the effects of the compassion meditation compared to the mindfulness meditation on self-reports of compassion and each of the three facial coding schemes. All four t-tests indicated that participants who engaged with the compassion meditation and those who engaged with the mindfulness meditation did not significantly differ in the amount of compassion they reported experiencing nor did they have statistically significant differences in their facial expression of compassion according to the three facial coding systems. These tests were re-run controlling for individual differences in expressivity, gender, and prior meditation experience, but still failed to indicate the presence of statistically significant differences between meditation types.

Discussion

The purpose of this study was twofold. First, the researchers wanted to assess the short-term efficacy of a brief compassion meditation in causing participants to feel and express more compassion in response to images of suffering compared to their counterparts who experienced a

brief mindfulness meditation. Analyses indicate that participants from the two meditation groups neither felt nor outwardly expressed differing amounts of compassion, even when gender, emotional expressivity, and prior meditation experience were statistically controlled for. Second, the researchers wanted to determine whether FACS could be used to reliably infer compassion from facial expression alone, and, if it could, were there other more time- and cost-efficient facial coding schemes that could capture the same compassion-relevant information as FACS. Analyses indicate that while intuition ratings and especially Simplified FACS coding demonstrated a large amount of overlap with Complex FACS coding, none of the three facial coding systems seemed to be measuring the same construct as self-reported compassion. On the other hand, all three facial coding systems were significantly associated with participants' self-reports of sadness suggesting that facial coding was an effective tool for measuring expression of other emotions.

While it was disappointing that the brief compassion meditation was unable to promote expressions of compassion above and beyond the mindfulness meditation, it was not surprising. Previous research that provides evidence for the prosocial effects of meditation have utilized routine meditative practice. For instance, Rosenberg et al. (2015) observed increased sympathy and empathetic concern in response to suffering among participants of a three-month meditation retreat. Countless other papers demonstrate that regular practice is the key to effective meditation (Luberto et al., 2018; Desbordes et al., 2012; Trautwein, Muradas, & Schmidt, 2014). Not only was the current meditation structured as a single-sitting practice, it also lasted only about nine minutes. In the documented literature, one of the primary mechanisms underlying increased compassion following meditation is physiological arousal in the parasympathetic nervous

system. Such physiological changes require time to occur in the body, and it was likely the case that nine minutes failed to provide sufficient time for this change.

The compassion meditation may have also failed to increase felt and expressed compassion among participants because it was compared to a mindfulness meditation rather than a control group that lacked meditation altogether. Researchers decided to include the mindfulness meditation as a comparison point for several reasons, but primarily because they were concerned about the difference in mindset participants would have approaching the stimulus if some were seated calmly for 10-minutes before, while others transitioned directly from potentially hectic environments. While the mindfulness meditation comparison condition solved some of these concerns, it produced a larger one — perhaps the mindfulness and compassion meditations had similar effects on expression of compassion, such that even if an effect were present, it would be too small to discover given the relatively small sample size. Whatever the reason, the null meditation findings from the current study suggest that future research intended to investigate the efficacy of compassion meditation would benefit from a more robust experimental design including a variety of control and comparison groups alongside the meditation of interest, and from investigating a habitual or intensive meditative practice rather than a brief intervention.

Regarding the implementation of FACS as a tool to measure compassion, several helpful results emerged. First and foremost, it became clear that FACS, both the complex and simplified coding schemes, failed to measure compassion within the context of this study. FACS is an anatomically based system that relies on nuanced muscle movements and slight appearance changes. Its proponents do not claim that FACS measures emotion, rather it is intended as a tool that, in combination with others, allows researchers to infer emotion from objective movement.

This became apparent to coders throughout the training process. Researchers were encouraged to cover sections of the face to focus on very specific muscle groups. While improving coders accuracy, this intense focus on musculature prevented observation of emotion which is often interpreted from the face as a whole. Both researchers noted throughout the coding process that after a thorough session of FACS coding, they would only *barely* be in a better position than a blindfolded person to label the emotion the participant was displaying. This coding experience is reflected in the lack of even a moderate association between the Complex FACS coding scheme and self-reported compassion. This is not to say that FACS fails to provide insight into emotion; FACS importantly was able to predict participant's self-reported sadness. Instead, the current findings suggest that FACS is not well suited to measuring compassion specifically – possibly because compassion is expressed through a combination of facial expression, tone, proximity, posture, and touch (Goetz et al., 2010), or possibly because the participants were empathetically sharing the emotional state of the subjects depicted in the stimulus images as opposed to experiencing compassion or an urgency to provide support. However, because the intuition raters also failed to predict self-reported compassion, it seems likely that a failure to examine other non-verbal forms of communication may have been the primary culprit in the inability of facial coding to pick up compassion.

The power of the Complex FACS coding could have been compromised in the data analysis phase as well. Translating a very detailed and somewhat haphazard coding scheme into analyzable data proved to be a rather significant challenge. Previous research involving FACS data incorporated Poisson regression models and secondary binary logistic components to account for the positive skewness of AU count data. The current researchers did not incorporate these statistical adjustments. But this small difficulty is representative of a larger issue with

FACS, more generally. FACS is, for lack of a better term, very closely gatekept. Access to FACS material is so limited that its purpose, potential, and procedure remain mysterious until one purchases the material. This limited access creates an environment that is very difficult to enter. FACS researchers largely publish to each other rather than a more general audience and charge hefty fees for consultations. While one can invest in the training materials to become certified in the coding process, the manual does not teach one how to design studies that lend themselves to FACS analyses or how to interpret FACS codes into consumable statistically relevant data. These larger frustrations further justified the inclusion of the Simplified FACS and intuition rating coding schemes as alternatives to full FACS.

The Simplified FACS coding scheme was created by the two FACS-certified primary investigators. The goal was to demonstrate that less extensive training on the same set of AUs and less detailed coding would preserve the emotion relevant information of full FACS codes and do away with extraneous information that demanded extra time to collect. The researchers believed that a focus on the facial area with the highest displayed intensity of pre-selected compassion relevant AUs would indicate the amount of compassion expressed. As results indicate, there was a strong association between Simplified FACS and Complex FACS suggesting that Simplified FACS did an adequate job of preserving emotion-relevant information from the Complex FACS code. However, neither reliably measured compassion. So, while the simplified coding scheme succeeded in representing FACS, neither is well suited to compassion research. The Simplified and Complex FACS schemes had very similar inter-rater reliability (0.74 and 0.76), but they differed drastically in the time spent coding. Simplified FACS coders took on average four-and-a-half minutes to code 75-seconds worth of data, while Complex FACS coders spent an average of 20 minutes on the same amount of data.

The intuition ratings were included in the present study to represent the ways that one naturally interprets facial compassion in daily life. The intuition raters took on average, two minutes to code 75-seconds worth of data but reported extremely low inter-rater reliability (0.45). This, however, was expected; the intuition rating system was not a scientifically sound scheme by any means. Still, understanding the average amount of compassion intuited from each participant provided helpful insight into whether *any* kind of facial coding is associated with self-reported compassion. Researchers found that, like the FACS coding schemes, intuition ratings of compassion were not associated with self-reported compassion. This suggests that facial expression may not be directly linked to felt compassion as was hypothesized. Additionally, researchers found that the intuition rating scores were significantly more vulnerable to participants' trait-based level of emotional expressivity. Participants who reported being more expressive were generally perceived as being more compassionate by intuition coders but not by either type of FACS coder. It appears, then, that FACS coding is more robust against potential confounds such as differences in facial expression between genders and trait-features like emotional expressivity overall.

In the researchers' opinion, the time- and cost-effectiveness of the Simplified FACS coding scheme outweighed lost detail in final codes, especially given the inability of either Complex FACS or Simplified FACS to measure compassion. However, it is possible that in other research contexts, the detail lost in a less intensive coding scheme could become a more important issue. On the other hand, the researchers acknowledge the benefit of having been fully trained and certified in FACS coding. This experience benefited the Complex FACS coders immensely and allowed them to develop the Simplified coding system. In fact, FACS-certified

researchers could continue to create and test other FACS-inspired coding schemes that solve the difficulties with full FACS coding.

Future projects related to the current study would benefit from measuring compassion through facial coding in addition to other methods. Allowing participants to discuss their feelings out loud might produce greater opportunity for compassion expression. Additionally, if a suffering confederate had been used to illicit compassion, participants may have been more likely to externalize their compassionate feelings for the sake of the confederate. Finally, it is suggested that a future study is conducted to replicate the procedure used here. With more time and money, five Complex FACS coders could be trained which would alleviate the strain and fatigue associated with coding, and a larger sample could be utilized. The intuition rating scheme should also be reworked to establish higher reliability among raters. Perhaps with these modifications, the procedure from the present study could be re-tested and more reliable results could be produced.

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Tables

Table 1.

Comparison of Facial Coding Schemes

Coding Scheme	Training	Procedure	Inter-rater Reliability	Coding Time per Participant
Complex FACS	100 hours of self-study and certification exam	Through a continuous 75-second participant video, each individual AU frequency, duration, and intensity is recorded	0.76	20 minutes
Simplified FACS	2-hour training taught by certified FACS coders	In each of five 15-second segments, a single Likert score (0-4) is assigned to indicate the intensity of the strongest present AU (duration is simplified to greater or less than 3 seconds)	0.74	4.5 minutes
Intuition Rating	30-minute orientation to study and data — no FACS training	A single Likert score (0-4) is assigned to the entire 75-second participant video to indicate how much compassion the rater intuits from the participants' faces	0.45	2 minutes

Note. Complex FACS reliability was calculated according to an equation provided by the manual. Reliability for Simplified FACS and intuition rating was based on agreement in Likert score.

Table 2.

Component Loadings and Descriptive Statistics for Principal Components Analysis of Complex FACS

Component/Action Unit	Mean	SD	Loadings	α
Component 1: Upper Face				*0.85*
Duration AU 1	6.98	16.84	0.86	
Frequency AU 1	0.96	1.81	0.82	
Duration AU 4	15.82	25.65	0.83	
Frequency AU 4	1.88	2.64	0.82	
Component 2: Lower Face				*0.84*
Duration AU 15	1.79	7.94	0.80	
Frequency AU 15	0.37	1.12	0.79	
Duration AU 17	7.59	15.14	0.90	
Frequency AU 17	1.57	2.17	0.79	
Component 3: Lip Corner Puller				*0.86*
Duration AU 12	4.43	8.39	0.93	
Frequency AU 12	0.92	1.28	0.95	
Component 3: Lip Corner Puller				*0.99*
Duration AU 24	1.31	2.52	1.00	
Frequency AU 24	0.54	1.02	1.03	

Note. Means and standard deviations are based on unstandardized frequency and duration variables (duration can be interpreted in seconds and frequency can be interpreted as count data). Internal consistency for each component is based on standardized frequency and duration variables.

Table 3.

Hierarchical Linear Regression Predicting Complex FACS from Simplified FACS and Intuition

Predictor	Pearson's r	B	R^2 added	Standardized Beta
Constant	--	-0.42	--	--
Intuition Rating	0.52**	0.01	0.28**	0.02
Simplified FACS	0.78**	0.62**	0.33**	0.77**

Note. Total R^2 = .608. ** indicates $p < .01$.

Table 4.

Correlation Matrix Between Self-Reported Emotion and Three Facial Coding Schemes

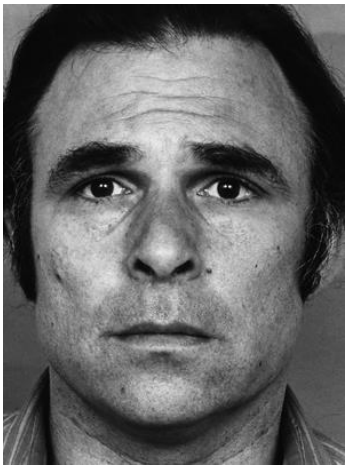
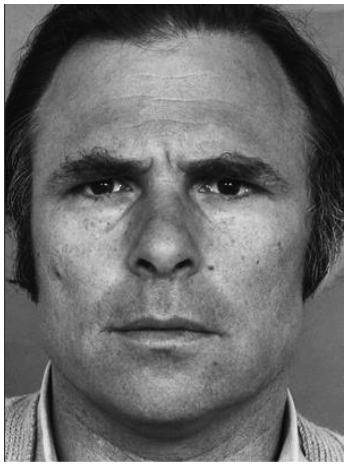
	Complex FACS	Simplified FACS	Intuition Rating	Self-Report Compassion	Self-Report Sadness	Trait Expressivity
Complex FACS	1.00	-	-	-	-	-
Simplified FACS	0.78***	1.00	-	-	-	-
Intuition Rating	0.52***	0.66***	1.00	-	-	-
Self-Report Compassion	0.15	0.16	0.16	1.00	-	-
Self-Report Sadness	0.24*	0.27*	0.26*	0.47***	1.00	-
Trait Expressivity	0.06	0.16	0.32**	0.36**	0.32**	1.00

Note. Pearson's correlations are reported here. * indicates $p < .05$; ** indicates $p < .01$; ** indicates $p < .001$.

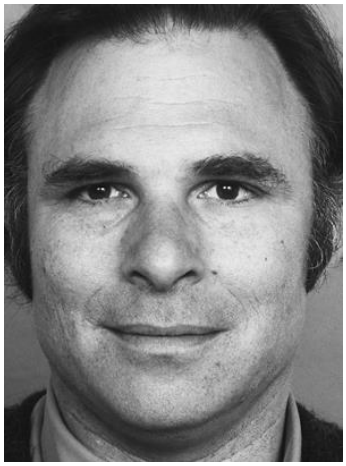
Appendix A

Action Units Considered Relevant to Compassion

Seven action units were comprehensively coded by the Full FACS coders. These seven were also taught to the Simplified FACS coders, though they were not coded comprehensively in the simplified scheme. The following images are taken from the official Facial Action Coding System Manual and should not be distributed.

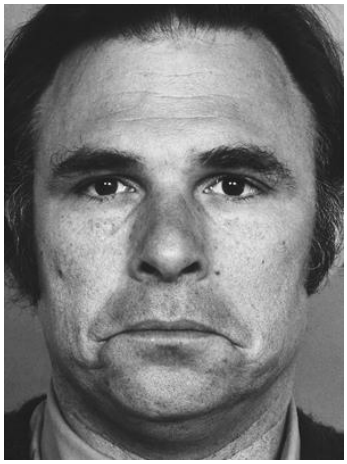
Action Unit	Example	Characteristics
1 Inner-Brow Raiser		• Inner eyebrows are pulled upwards producing an oblique brow shape (like the slanted toward each other). • Horizontal wrinkles appear only in the center of the forehead. • Some movement in the outer brow may occur, but it should move inward rather than upward.
4 Brow Lowerer		• Lowering of inner (and at high intensity center) of the brows. • Brows appear to move closer together creating vertical wrinkles on the glabella (wrinkles can vary between 45–90-degree angle). • Lowering of brows will narrow the eye appear. • Muscle bulges may appear across the lower forehead.

12
Lip Corner Puller



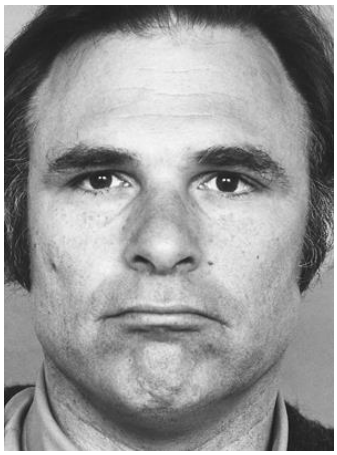
- Lip corners move up and back creating an oblique angle.
- Infraorbital triangle may appear lifted and the center of the nasolabial furrow, deepened.
- Strong action will produce extensive changes across the face, but these are irrelevant to the current project.

15
Lip Corner Depressor



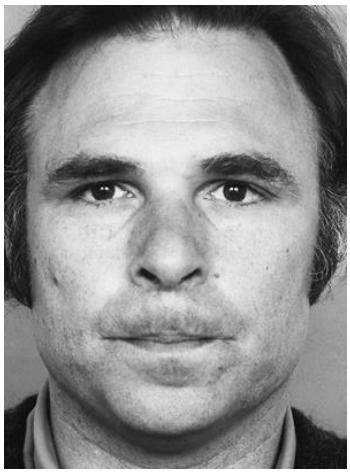
- Lip corners angle down creating an overall appearance of change in mouth shape.
- Pouching and horizontal wrinkles appear under the corners of the lips.
- Flattening of the lower lip and chin boss may occur with strong action.
- Lower nasolabial furrow deepens

17
Chin Raiser



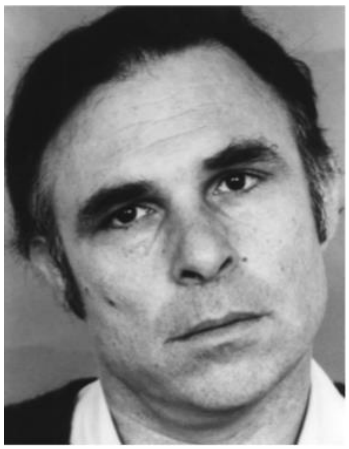
- Chin boss appears as though it is being lifted upward in the center (the lower lip will be pushed upward and outward as a result).
- Stippled wrinkles appear on the center of the chin boss.
- The overall mouth shape may also appear downturned as a result of the lifted chin.

24
Lip Presser



- Lips are pressed together and outward *without* lifting or wrinkling in the chin boss.
- Lips will appear tightened, narrowed, and possibly de-elongated.
- Bulging above the top lip and below the bottom lip is common.

55/56
Head Tilt
(Left/Right)



- Head is cocked to either the left or right.
- The head must be tilted at least at a 30-degree angle from a central vertical line in order to be considered codable.

Appendix B

Sample of Full FACS Coding

Raw data from a minute and 15-second participant video:

Translation from raw data into analyzable data:

Freq tilt	Freq 1	Freq 4	Freq 12	Freq 15	Freq 17	Freq 24	Time tilt	Time 1	Time 4	Time 12	Time 15	Time 17	Time 24
7	6	7	1	7	7	3	66	61	63.6	2.5	67	67	7.5

Note. Frequency variables are count data and time variables are measured in seconds. Unextended AUs are averaged to 2.5 seconds unless otherwise specified in raw code.

Appendix C

Likert Scales for Intuition Raters and Simplified FACS Coders

Intuition Rating Scale:

Value	Description
0	No expression of facial compassion
1	Minimal expression of facial compassion
2	Moderate expression of facial compassion
3	High expression of facial compassion
4	Maximal expression of facial compassion

Simplified FACS Scale:

Value	Description
0	Absolutely no indication of compassion
1	LOW compassion • Low intensity (a-b) AUs, any duration
2	MEDIUM compassion • Mid-intensity (c) AUs, short duration (< 3 sec)
3	HIGH compassion • Mid-intensity (c) AUs, extended duration (> 3 sec) • High intensity (d-e) AUs, short duration (< 3 sec)
4	MAXIMAL compassion • High intensity (d-e) AUs, extended duration (> 3 sec)

*When two AUs are present of different intensities, code highest present intensity
** Pay no attention to frequency of AUs within one segment
*** Applies to following AUs: 1, 4, 12, 15, 17, 24, tilts

Appendix D

Berkley Expressivity Questionnaire

For each statement below, please indicate your agreement or disagreement. Do so by filling in the blank in front of each item with the appropriate number from the following rating scale:

1	**2**	**3**	**4**	**5**	**6**	**7**
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

____ 1. Whenever I feel positive emotions, people can easily see exactly what I am feeling.

____ 2. I sometimes cry during sad movies.

____ 3. People often do not know what I am feeling.

____ 4. I laugh out loud when someone tells me a joke that I think is funny.

____ 5. It is difficult for me to hide my fear.

____ 6. When I'm happy, my feelings show.

____ 7. My body reacts very strongly to emotional situations.

____ 8. I've learned it is better to suppress my anger than to show it.

____ 9. No matter how nervous or upset I am, I tend to keep a calm exterior.

____10. I am an emotionally expressive person.

____11. I have strong emotions.

____12. I am sometimes unable to hide my feelings, even though I would like to.

____13. Whenever I feel negative emotions, people can easily see exactly what I am feeling.

____14. There have been times when I have not been able to stop crying even though I tried to stop.

____15. I experience my emotions very strongly.

____16. What I'm feeling is written all over my face.

Items 3, 8, and 9 are reverse scored.
Items 3, 5, 8, 9, 13, 16 make up the Negative Emotionality facet Items 1, 4, 6, 10 make up the Positive Emotionality facet
Items 2, 7, 11, 12, 14, 15 make up the Impulse Strength facet.

Appendix E

Compassion-Inducing Stimulus Images

Appendix F

Baseline, Compassion, and Mindfulness Meditation Scripts

Baseline Script – used in both conditions (~4:30)

Hello. Welcome to this meditation. We'll begin by becoming comfortable on your chair or cushion, wherever you might be, perhaps loosening any tight clothing…removing your glasses or watch, if you'd like to. Settling in with a relaxed but upright posture; straight, but relaxed… Shoulders relaxed…noticing your sit bones on the chair or cushion, if that's possible. Finding a balance between your sit bones…equal pressure. Centered…and balanced. Settling in here now…Relaxing… Perhaps moving your upper body slightly forward … then slightly back to find that balanced place in the middle…With no stress on your lower back from being too far forward…and no tension in your abdomen from leaning too far back. Finding that centered…balanced…natural… posture. And, allowing your arms and hands to rest comfortably in your lap. Gently closing your eyes now, or if you prefer, casting your gaze downward to the floor or a bit ahead of you…not really looking at anything…, rather, partially closing your eyelids and looking gently with a soft gaze…neutral…relaxed. Allowing your body to become still now, as you focus your attention inward. Your shoulders, chest, and stomach all relaxing. Bringing your awareness now to the breath. Not controlling or manipulating the breath in any way, but noticing your breath as it enters through your nose and moves all the way down to your belly…and back out again. One breath following the other…the in breath…and the outbreath following. Noticing how each breath follows one after the other, in a never-ending cycle and flow. Letting everything else move into the background…allowing the breath to be the focus of your awareness. No need to think about how the air moves in and out…just being with the breath…allowing the breath to breathe itself. Now, allowing your awareness to rest on the path of the breath that is most natural and comfortable for you. It might be at the tip of the nose…noticing that the air is cooler on the in breath and warmer on the outbreath. It might be in the throat area, as you feel the breath move through this channel to support your entire body. Or it might be at the belly, where you notice the wave-like movements of the belly as it rises on the in breath and relaxes on the outbreath. Allowing your attention to rest on the path of the breath that is most comfortable for you now…and resting here…in this moment of silence. (Long Pause) You may notice that the mind wanders away from the breath…perhaps into thoughts…emotions…sounds…body sensations. No problem…this is to be expected. This is what minds do. Whenever you notice that your mind has wandered off…gently, but intentionally bring your attention back to the breath, back to the present moment. (long pause)

Compassion Meditation Script (~4:00)

And knowing that you've experienced love and happiness. Noticing how this feels in your heart… Perhaps you feel warmth, tenderness, or openness. And knowing too that you've experienced suffering. Perhaps you can connect with a moment of difficulty or pain, or you can work with yourself as you are now. Let's practice being present with suffering and pain, with care and attention. We can set the intention to turn toward our pain and respond with care. With this intention of being present for your pain, you can offer yourself phrases of compassion, silently in your head, connecting with your intention to respond with compassion to the difficulties of life. With each breath, you can imagine yourself breathing out heartfelt wishes for yourself: "May I find joy and happiness" "May I be free from suffering." "May I be present for my pain." "I care for my suffering." You can offer these phrases silently in your head, connecting with your warm intention to respond with compassion to difficulties. (long pause) You can now bring to mind a loved one, a friend, a teacher or mentor, or maybe a pet. You can connect with your natural desire to see this person free from pain. Of course, you can't keep them from experiencing any discomfort, but you can cultivate a mind and heart that care for the discomfort. In an effort to cultivate this intent, you can imagine that you're sending them care and breathing out heartfelt wishes. "May you find joy and happiness" "May you be free from suffering." "May I be present with your pain." "I care about your suffering." (long pause) You can let this person go from your mind and bring to mind a neutral person. This is someone you see, maybe regularly, or not, but don't know very well. They may be a neighbor or a bus driver, or someone you've passed by on the street. Although you don't know them, you can know this person experiences pain and difficulties. Again, we can set the intention to care for their pain by offering some phrases of compassion and breathing out heartfelt wishes: "May you find joy and happiness" "May you be free from suffering." "May I be present with your pain." "I care about your suffering." And as you let this person go from your mind, we can notice how universal these emotions are. Let's end with a wish for all other beings', for their suffering to be relieved. Just as I wish to have peace, happiness, and to be free from suffering, so do all beings. (long pause) Let yourself feel this open-hearted wish to ease the suffering of all people and feel the warmth of your heart at this very moment. Sitting gently with the body and the mind. And this closes our practice. Thank you.

Mindfulness Meditation Script (~3:00)

You may find yourself experiencing an emotion--a sense of anxiety…sadness…impatience… patience… or peace. Just allowing your emotional experience to be what it is…simply observing with curiosity. Notice how the feeling may shift and change, and when you are ready, returning your awareness to the breath…and this present moment. (Long Pause) You may notice physical sensations. An itch or tickle…a sense of numbness…tingling…perhaps restlessness. Simply notice this, and maybe

becoming aware that sensations change from moment to moment…coming and going…appearing and disappearing as we observe them in this way. And, once again, returning your attention to the breath (Long Pause) Simply be patient with yourself and with your body. The whole body is filled with awareness. Noticing your breath fill up the chest. Let there be an openness to the chest. Let the awareness fill the heart area. Feeling the heart from the inside out. And noticing the experience of the busy mind, of emotional ups and downs…of boredom…of sounds or physical sensations. Then letting go of whatever tries to capture your attention…again…and again. Just bring your attention back to the breath, and rest here…in this moment…fully awake and alive… Sitting gently with the body and the mind. And this closes our practice. Thank you.