A preliminary investigation into the use of the Emotional Contagion Effect in the exercise environment

The term Emotional Contagion (EC) refers to the tendency for humans to mimic the emotions of others; this can occur either consciously or importantly for this investigation, unconsciously (Hsee, Hatfield, Carlson & Chemtob, 1990; Neumann and Strack, 2000; Wild, Erb and Bartels, 2001). The EC effect has been shown to manifest in many situations and in response to a variety of transfer sources. Using speech as the emotional transfer medium, Neumann and Strack (2000) asked participants to listen to either a ‘neutral’ or emotionally charged (‘happy’ or ‘sad’) reading of a philosophical text. Upon hearing the text, participants were first asked to rate their present mood state (‘how do you feel right now?’). After this they were presented with a list of emotional adjectives (e.g. happy, cheerful, sad) and asked to rate how strongly they were feeling each. All responses were recorded on a 10-point Likert scale. Although there was no change in the specific, adjective-based feeling states, the emotional tone of the reading did induce the congruent mood state in the listeners. Facial expression provides a particularly potent form of emotional transfer (Dimberg & Ohman, 1996; Hess & Blairy, 2001). Applying this medium, Hess and Blairy (2001) presented participants with short video clips of persons displaying various emotional expressions (anger, sadness, disgust, and happiness). Facial EMG activity and self-reported ratings of subjective affect were assessed. Even when relatively weak emotional expressions were used, the EMG recordings showed differentiated patterns of facial muscle activity in response to the stimuli and these activation differences were found to correspond to the emotion being presented. Affective state was also found to correspond to the emotional stimuli. Unfortunately, insufficient data was presented to allow ES to be calculated. Wild et al. (2001) also used emotionally loaded facial expression to study the EC effect. In this instance, static images were taken from the Pictures of Facial Affect Compendium (Ekman and Friesen, 1976) and digitally morphed to produce numerous emotions (happy and sad) at varying intensities (75-150%). Using a 0-100 linear scale, the pictures were rated on how much they evoked associated feeling states. The tone of the photographs did have a significant effect on participants. For example, it was found that the ‘happy’ and ‘sad’ pictures provoked the corresponding feeling state. It was also shown that emotions were transferred relatively quickly and the stronger the expression, the stronger the effect. Again, effect sizes were incalculable from the data presented. The inducement of EC through pictures of static facial images has also been observed by others; for example Dimberg and Thunberg (1998) and Dimberg, Thunberg and Elmehed (2000). Whilst the preceding examples offer support for the contagious nature of emotions, evidence from outside controlled laboratory settings would be more indicative of any potential practical application.

Some researchers have indeed studied the effect in what might be termed ‘real-world’ environments. Johnson (2008) examined EC and leader-follower (employee) relationships in the education profession. A sample of teachers was asked to complete various measures of affect as well as a charismatic leadership questionnaire. It was hypothesised that ‘follower’ affect would be positively related to levels of perceived charismatic leadership qualities; namely attributed charisma, idealised influence and inspiration motivation. Correlational analysis provided some support for the author's assertions with both ‘affect at work’ (r = .34, d = .72) and ‘general’ affectivity (r = .37, d = .79) being significantly associated with perceived leadership charisma. Whilst significant, it must be recognised that the correlations were not particularly strong. In this instance, the ESs offer better evidence of an EC effect. Analysing the role of EC in customer relations, Hennig-Thurau, Groth, Paul and Gremler (2006) contrived a situation to assess the role of smiling on interpersonal interactions between employees and customers. Actor ‘employees’ were asked to display either ‘high’ or ‘low’ smiling behaviour when dealing with customers; this was also sub-categorised into ‘high’ or ‘low’ authenticity. Customer affect was measured via a number of 7-point Likert items prior to, and after encountering the employee. Overall, there was no statistical relationship between level of employee smiling and customer affective responses. However, evidence indicated that that the degree of perceived authenticity impacted upon the outcomes. Specifically, when the employees engaged in deep acting, evidence of an EC effect did emerge (partial $\eta 2$ = .139, d = .79).

EC has also been studied within authentic sport environments. For example, Moll, Jordet and Pepping (2010) investigated how the penalty goal celebrations of International footballers impacted other on-field players. More than three hundred video clips of penalty kicks were assessed for their (physical) emotional content. Phi-correlations revealed a significant association between certain celebratory behaviour and competition outcomes. It was found that the team whose members displayed triumphal gestures (e.g. expanded chest and raised arms) after a successful attempt, were more likely to win (ϕ^2 range = .164 - .290, d = .32 - .60) the penalty competition. The authors surmised that this was due to emotional convergence. Specifically, because such expressions are synonymous with pride and confidence, a more positive mind set was induced in team members. Conversely, the opposing teams' players were believed to have perceived such actions as dominating and as such, negative emotions were experienced. Totterdell (2000) assessed the impact of 'collective' mood amongst professional cricketers. Players from four teams were supplied with pocket computers and asked to record their own moods and the perceived mood of the team as a whole. Pooled time-series regression analysis revealed significant, and positive correlations between the mood of the team and that of the individual players (r = .64, d = 1.66); e.g. the happier the collective, the happier the individual. Totterdell (2000) attributed the outcomes to what he termed mood linkage; in other words, EC.

The preceding examples support the notion that emotions can be transferred to individuals via emotionally charged stimuli. With its potential for mood enhancement, it is possible that the EC effect could offer benefits to exercise participants. Affective state is considered to be an important determinant of exercise adherence (Williams, 2008). The suggestion is that positive experiences engender positive feelings towards a behaviour, thereby increasing the likelihood it will be repeated (Godin, 1994; Williams, 2008; Ekkekakis, Parfitt & Petruzzello, 2011). In essence, positive feelings act as reinforcements (Annesi, 2002). There is empirical support for this view. For example, using Structural Modelling Analysis McAuley, Jerome, Marquez, Elavsky and Blissmer (2003) found that for older adults, affect experienced during exercise had a direct effect on self-efficacy and ultimately programme adherence (β = .26). Annesi (2002) has also showed post-exercise feeling states to be correlated with adherence. In this case however, the association was only applicable to individuals identified as possessing low self-motivation (r =.48. d =1.09). Positive affect is also thought to be related to what some consider to be one of the most important determinants of exercise adherence; namely enjoyment (Raedeke, 2007; Hagberg, Lindahl, Nyberg & Hellenius, 2009). Miller, Bartholomew and Springer (2005) suggest that affective state might be fully mediated by this construct.

Another potential determinant of the exercise experience is effort sense; commonly referred to as rate of perceived exertion (RPE). For example, Annesi (2002) has reported an interaction between effort sense and enjoyment for individuals classified as possessing a low motivation to exercise. Specifically, as perceived physical exhaustion increased, a decrease in positive engagement, a construct that relates to feelings of enthusiasm and happiness, was observed. Perception of effort also appears to be related to affective state. Hardy & Rejeski (1989) have reported that a negative, linear relationship between exists between these two constructs (r = -.56, d = 1.35). Additionally, O'Halloran, Murphey and Webster (2005) found that reductions in in-task RPE accounted for between 7%-9% of mood improvements during exercise. Whilst these examples provide evidence of a link between RPE and affect, it is currently unclear as to whether the relationship is reciprocal. That is, whether improvements in affect lead to reductions in effort sense. It is possible given that psychological factors such as self-efficacy (Rudolph & McAuley, 1996), social desirability (Coquart, Dufour, Groslambert, Matran & Garcin, 2012), anxiety and depression (Watt & Grove, 1993) have been shown to mediate RPE. Ultimately, an ability to manipulate effort sense might influence adherence. Utilizing the ‘Physical Exhaustion’ sub-scale of the Exercise Induced Feeling Inventory (Gauvin & Rejeski, 1993), Annesi (2002) provide evidence showing that for individuals with low motivation to exercise at least, perception of effort is negatively associated with programme adherence (r =.62, d = 1.58).

In summary, EC has been shown to manifest in many situations and via numerous emotional transfer mechanisms. The fact that emotions can be induced through this phenomenon might have practical application for those involved in exercise. There is evidence to suggest that factors such as affect, enjoyment and effort sense mediate the exercise experience. Therefore, if the EC effect can induce a more positive exercise experience, then it could have implications for programme adherence. To date, no study has attempted to utilise the EC effect in this environment. This investigation examined the impact of positively-charged facial imagery upon ratings of affect, enjoyment, REP and perceived exercise experience. Participants performed two aerobic exercise sessions; one without any EC stimuli (baseline) and another under one of three conditions (control, ‘neutral’ or ‘happy’). The Emotional Contagion Scale was also utilised to determine whether the participants were susceptible to the EC effect.

Hypothesis. Positively-charged facial imagery will invoke increases in ratings of affect, enjoyment, subjective exercise experience, and lower session RPE.

Method

Experimental Participants

The experimental sample consisted of staff and students from a University situated in the North of the UK. There were 30 female participants (M age = 28.7 yr., SD = 6.8) and 24 males (M age = 24.6, yr., SD = 2.2). The participants were randomly allocated into one of three conditions: ‘happy’ (n = 19), ‘neutral’ (n = 19) or control (n = 16). All participants were involved in regular aerobic exercise. Ethical approval was granted by the relevant institutional ethics committee.

Experimental (EC) Stimuli

Facial expressions are considered to be a particularly potent means of emotional transfer (Hess & Blairy, 2001; deGelder et al., 2004). Numerous studies (e.g. Dimberg & Thunberg, 1998; Dimberg et al., 2000; Wild et al., 2001) have shown that static images can be used to induce the effect. It is this transfer medium that will be utilised in the current investigation. Facial photographs were taken of ten volunteers asked to exhibit 'happy' and 'neutral' expressions; for ethical reasons we did not consider 'sad' expressions as it is possible that doing so would induce negative mood states in raters and experimental participants. The photography session was kept light-hearted and a number of jokes were recited in order to achieve authentic smiles. Printed in colour the photographs were subsequently presented to a sample of 28 raters (14 male and 14 female). Each photograph was evaluated for emotional tone with participants being asked to respond to the following 'please state how much you feel these photographs represent either happiness or sadness'. Responses were recorded on a 10-point Likert scale (-5 = 'very unhappy', 0 = 'neutral' and +5 = 'very happy'). To maintain consistency, the photographs for each condition were of the same individuals. Eight photographs of four volunteers were selected; four for each condition. For the 'happy' images average ratings ranged from $M = 3.51$ to $M = 4.50$ and for the 'neutral' $M = -0.91$ to $M = 0.14$. The photographs were enlarged to a size of 600 × 850 mm and laminated.

Measures

Session RPE Scale. Created by Foster et al. (2001), the 10-point category-interval scale is used to assess global ratings of effort sense. The perceived intensity of an exercise session is rated in response to the following statement: 'How was your workout?' (0 = rest, 5 = Hard, 10 = maximal). The scale has been found to be a valid predictor of session exercise intensity, for example, regression analysis between Session RPE and other measures of exercise intensity were found to be: %VO_2peak R^2 =.76, %HRpeak R^2 =.74 and %HRreserve R^2 = 0.71 (Herman, Foster, Maher, Mikat & Porcari, 2006).

Feelings Scale (FS). Developed by Rejeski (1985) to monitor in-task affect, respondents are asked to rate how they currently feel on an 11-point scale (-5 = feeling very bad, 0 = neutral and +5 = feeling very good). This is a valid measure of affect during exercise (Hardy & Rejeski, 1989). Van Landuyt, Ekkekakis, Hall and Petruzzello (2000) have reported correlations ranging from .51 - .88 between the FS and the Valance scale of the Affect Grid (Russell, Weiss, & Mendelsohn, 1989) and .41 - .59 between the FS scale and Lang's (1980) Self-Assessment Manikin; a pictorial measure of affect. Importantly, for this investigation, the FS has been used successfully as a post-exercise measure of affect (Stanley & Cummings, 2010a and Stanley & Cummings, 2010b).

The Exercise Enjoyment Scale (EES). Enjoyment was assessed using the single-item measure of Stanley, Williams and Cumming (2009). Participants respond to the statement 'Indicate how much you enjoyed this exercise session' via a 7-point Likert item (1 = Not at all, 7 = Extremely). The ESS has been found to be a valid measure on exercise enjoyment with Stanley et al. (2009) finding high correlations between the EES and the interested/enjoyment sub-scale of the Ryan's (1982) Intrinsic Motivation Inventory (r = .82 - .85) and moderate correlations (r = -.41 - .49) between the EES and the Feeling Scale (Hardy & Rejeski, 1989) .

Subjective Exercise Experience Scale (SEES). The SESS was created by McAuley and Courneya (1994) as a global measure of psychological responses to exercise. The 12-item scale incorporates three factors: PWB - Positive Well-Being (items 1, 4, 7, 10), PD - Psychological Distress (items 2, 5, 8, 11) and Fatigue (items 3, 6, 9, 12). All items are scored on a 7-point Likert Scale (1 = not at all, 7 = very much so). Items are summed to create a summary score for each of the three factors. McAuley and Courneya (1994) have found the SESS to be a valid measure of psychological responses to exercise. Correlational analysis between the SEES subscales and the Positive and Negative Affect Schedule subscales (Watson, Clark & Tellegen, 1988) revealed the following: positive affect and PWB, $r = .71$, PD $r= -.47$ and fatigue, $r = -.03$. For the negative affect PANAS subscale: PWB r = -.47, PD r = .61 and Fatigue r = -06. Correlations between the SESS and the FS were PWB r = .69, PD r = -.64 and Fatigue r = -.28.

Emotional Contagion Scale (EC scale): This is a measure of an individuals susceptibility to EC. Developed by Doherty (1997) the 15-item scale includes five sections: Love (items 6, 9, 12), happiness (items 2, 3, 11), fear (items 8, 13, 15) anger (items 5, 7, 10) and sadness (items 1, 4, 14) that are scored on a 7-point Likert Scale (1 = not at all, 7 = very much so). According to Doherty (1997), the scale is a valid measure of emotional reactivity. When assessed against theoretically related constructs (e.g. Reactivity, emotionality, sensitivity to others and empathy) correlations between r = .22 - .47 were reported (Doherty, 1997). Whilst these values are not particularly strong, the EC scale has been used by others (e.g. Totterdell, 200; Johnson, 2008;

Exercise Task

Given that this is the first attempt to examine EC within an exercise environment, details of the study design process are provided. It is hoped that such information will aid any future research into this area. A number of exercise options were considered, but most were deemed unsuitable. For example, using a naturalistic gym setting, whilst increasing ecological validity, would have required informed consent from all who entered the location; this would have implications if any gym user refused to take part. Treadmill running and cycle ergometry were rejected because it was felt that the only way to display the stimuli would have been directly in front of the exercising participant. This could make the demand characteristics explicit. Circuit training was dismissed on the basis that we envisaged difficulties in ensuring that the EC stimuli were noticed without specifically instructing participants; an act that again could potentially threaten internal validity. Therefore a forward-facing task was selected that would allow stimuli to be displayed in a subtle manner whilst increasing the likelihood that the pictures would be easily seen. As to intensity, according to Rejeski (1985), individuals are more likely to acknowledge external cues when performing at low-medium exercise intensities. As such, a low intensity task (to be verified via session RPE values) was selected. A relatively simple and repetitive task was chosen to reduce the prospect of participants becoming overly focused on the activity itself or the exercise leader. Based on these considerations, an instructor led, low intensity, step-aerobic routine was therefore chosen. We do recognise that this task does lack some ecological validity as in such circumstances it would likely be the exercise leader and not additional external stimuli that would provoke any EC response. However, we do feel that this is the best option to make an initial enquiry into this phenomenon within the exercise environment.

Audio Accompaniment

As is typical in such activities, the step-routine was performed in time to music. This procedure also allowed exercise intensity to be standardised for all the trials. Six tracks were selected from FitMix Pro, an application that allows songs to be mixed in a continuous manner. All tracks were 100 beats per minute. Because step-aerobics is an instructor-led exercise form, there was a possibility that the instructor could induce emotional contagion through verbalisations. To overcome this threat, using Garageband ’09 (Apple Inc. 2009), in-task instructions were recorded and overlaid onto the music mix; this action also ensured verbal consistency between the trials. The final mix was recorded onto CD-R.

Experimental Procedure

To conceal the true nature of the investigation and so reduce the demand characteristics, participants were led to believe that the investigation was aimed at assessing the effects of repeated exercise bouts on various psychological constructs. If there were enquires about the emotional contagion stimulus, participants were informed that they were part of a psychology conference that was to held later that day; a number of signs were placed in the gymnasia foyer advertising this fictitious psychology conference. The experimental stimuli were placed upon display boards (1200 × 1500mm) which also included psychology/evolution themed pictures (diversionary stimulus), none of which had any emotional content.

Upon arrival to the experimental sessions, informed consent was obtained (first trial only) and the relevant instructions were given (e.g., anchoring procedures for the RPE and Feeling Scale). Importantly, because it was possible that a group setting could lead to emotional contamination, participants were instructed to refrain from communication with others during the tasks. The participants were then led to the 4-inch steps; these were placed in an arc around the instructor, who was situated no more than 3 m away. When the participants were ready, the exercise task began. The music and instructional mix was played via a Sony CDF-W57L CD system. Sound intensity was set at 90 decibels at the point of the participants. A qualified exercise instructor led the routine. The exercise session lasted 22 minutes in total. This protocol was implemented for all of the trials. In in the experimental conditions however, the appropriate stimulus was added; for the control condition, only the ‘diversionary’ stimulus was presented. The display boards were located directly in front of the group. Upon completion of the exercise task, the participants were provided with the relevant measurement scales. During all trials the instructor refrained from any behaviour that could influence the outcomes.

Research Design

This investigation adopted a factorial design. Participants were allocated into one of three conditions; ‘happy’, ‘neutral’ or control. All participants undertook two trials; baseline/control and an experimental trial which represented one of the three conditions.

Analysis

A 3 (condition) × 2 (trials) Factorial Multivariate Analysis of Variance (MANOVA) with Bonferroni correction factor applied, was used to assess for main effects and condition interactions. To uncover any condition × trial effects, dependent t tests with p set at .016, were to be utilised. Effect size, mean differences and 90% Confidence Intervals (CI) were also calculated (Table 1). Correlational analysis was used to assess for relationships between level of emotional susceptibility and experimental DVs. Based upon the assumption that a positive relationship should exist, a 1-tailed analysis was implemented.

Results

Emotional Susceptibility (EC Scale): Emotional Contagion ratings range from 3 to 12 for each subscale. The Median value for each is 7.50 and low scores are indicative of high EC susceptibility. The values (see Table 1) suggest that for the most important emotion ‘happiness’, the participants were prone to emotional transfer.

Exercise Intensity: The mean Session RPE data confirms that the exercise intensity was low-moderate (American College of Sports Medicine, 2006).

Factorial MANOVA: Box’s Test of Equality was significant, $p = .28$, as such Wilks Lambda was used for the analysis. There was no significant main effect between trial 1 and trial 2, (F (7, 38) = 2.01, $p = .079$). For condition interactions, Wilks Lambda revealed no sig interactions for any of the variables, (F (14, 78) = 1.10, $p = .371$). Condition interaction values were: Session RPE (F (2, 44) = .1.02, $p = .36$), FS (F (2, 44) = 2.27, p =.11), Enjoyment (F (2, 44) = .64, $p = .53$), PWB (F (2, 44) = .01, $p = .99$), PD (F (2, 44) = 1.63, $p = .20$) and Fatigue (F (2, 44) = .21, $p = .80$). See Table 2 for descriptive data.

Correlations: The correlation between the ‘happiness’ dimension of the EC scale and the PWB sub-scale of the SEES was found to be significant at $p < .05$; PWB, $r = -.24$, $p = .04$. None of the remaining correlations were significant; Session RPE $r = .12$, $p = .19$, FS $r = -.14$, $p = .14$, Enjoyment $r = -.10$, $p = .23$, PD $r = -.15$, p =.14 and Fatigue $r = .00$, $p = .48$.

Discussion

Research has shown that emotions can be transferred to individuals through a process known as Emotional Contagion (EC). It was argued that if the EC effect could be used to positively influence emotional valence and reduce effort sense, then the phenomena could provide a simple means of enhancing the exercise experience and ultimately programme adherence (e.g. Godin, 1994; Annesi, 2002; Raedeke, 2007; Williams 2008). Despite the EC effect being well documented in other situations, there was little evidence of its manifestation in this investigation; this despite the fact that participants were susceptible to the ‘happiness’ dimension of emotional transfer. The primary statistical analysis (factorial MANOVA) revealed no significant effects for any of the DVs. The supplementary analysis (ES, mean difference and 90% CI) did appear to offer some evidence of EC. In the 'happy' condition there were moderate ESs for Session RPE and affect and the 90% CIs were in the hypothesised direction. Importantly, the ES for affect (*d* = .57) is comparable to those presented by Hennig-Thurau et al (2006) and Johnson (2008). Furthermore, it was only in this condition that a positive change in these variables was observed. However, these outcomes need to be interpreted with caution as there was also moderate negative effect for enjoyment (*d* = .61). Given the supposed interaction between these variables, a corresponding increase in enjoyment levels might have been expected; a point that will be discussed in further detail later. Furthermore, the apparent effect for RPE and affect had no corresponding impact upon subjective exercise experience. It is therefore difficult to accept the ESs as being indicative of a 'real', practical effect. As an additional measure, correlational analysis was conducted between the 'happiness' dimension of the EC scale and experimental trial DVs. This data provided some indication as to whether emotional susceptibility was an influencing factor. A significant, yet weak, correlation existed between 'happiness' and personal well-being (PWB), however, no other associations were evident. As such, despite some encouraging ESs for two of the variables, it must be concluded that this data does not support the use of positive emotional imagery within the exercise environment. With these outcomes in mind, the remainder of the discussion will attempt to determine why the EC effect was not forthcoming. It is hoped that the information presented will aid any future research into this area.

One possible explanation is that the participants did not actually see the stimuli. In those studies that have also used facial expressions (e.g. Hess & Blairy, 2001; Wild et al., 2001), participants were instructed to look directly at the images. In this investigation the authors went to great lengths to conceal the nature of the experiment and as such, did not take this course of action. It was assumed, because of the exercise mode and the fact that the images were sizeable and placed directly in front of the exercise group, that the stimuli would be readily observed. Whilst feasible, the authors consider this explanation unlikely. The EC effect has been shown to manifest in seconds (Hess & Blairy, 2001; Wild et al., 2001) and so even cursory glances should have been sufficient to alter psychological state Furthermore, according to Bayle, Henoff and Korak-Salmon (2009), stimuli, including facial expressions, are readily processed unconsciously via the peripheral vision system. As such, it is probable the stimuli were processed, at the least, subconsciously. Nevertheless, perhaps researchers need to make concerted efforts to direct participants' attention towards any stimuli, or use an exercise mode (e.g. treadmill running) in which they can be placed in the central visual field. However, as has been argued, implementing these strategies could compromise both internal (demand characteristics) and external (ecological) validity. Another factor that requires consideration is temporality. It is unclear how long EC generated emotional changes persist. If transient in nature, then it might be that the stimuli were observed and emotional state did change, but modulated throughout the exercise session. If so, retrospective measures like those use in this investigation, might lack the sensitivity to uncover any such momentary changes. Future research might consider utilising in-task measures at regular intervals throughout an exercise session; this could be performed in conjunction with any attempts to direct participants' attention towards the stimuli. However, even if this did provide evidence of EC, it could be argued that without any post-task change, any in-task effect would have minimal impact upon exercise adherence. Before any efforts are made to implement the above procedures, the research of Wild et al. (2001) and Hennig-Thurau et al. (2006) requires consideration. They found that emotional reactivity to facial stimuli tended to diminish in response to repeated exposure. As such, the very act of ensuring multiple viewings might actually be counterproductive. This might offer another explanation for the current outcomes. Perhaps the EC effect was apparent in the early stages of the task and waned, due to repeated viewings, as the experimental trial progressed. To assess the veracity of this explanation, any subsequent research could consider analysing the EC effect over the time-course of an exercise task. If the assertion holds, then emotional stimuli might only provide benefits if introduced in the latter states of an exercise session.

Regarding the actual stimuli, whilst the use of static facial images has been shown to be a valid transfer medium, dynamic representations could prove to be more powerful (Hatfiled et al., 2014). For example, using dynamic images Hess and Blairy (2001) found the EC effect to be forthcoming even when the emotional displays were relatively weak. It is therefore possible that the use of dynamic stimuli might invoke the desired response. Although this might be the case, adopting this approach could well compromise external validity. For example, gymnasia would have to invest in equipment that allowed dynamic images to be displayed. It could actually be that none of the preceding recommendations would be sufficient. This study differs in a major respect to those that have shown EC to manifest in authentic sport situations. In the studies of Totterdell (2000) and Moll et al. (2010) active participants would have had multiple sources of emotional transfer; e.g. verbal, body gestures as well as facial expressions. Maybe under the conditions applied to this study, a single EC source is simply not strong enough to induce the effect. EC can occur via a number of transfer mechanisms (e.g. speech, facial expression, body gestures), so perhaps a multifaceted approach is required. Again, efforts to increase the strength of the stimuli could actually reduce the practicality of utilising EC in this environment. It is also possible that the EC effect did occur and was not detected. Although we made efforts to justify DV selection, there are issues surrounding the inclusion of RPE and enjoyment. Addressing effort sense, whilst a negative linear relationship between affect and RPE has been suggested, the assumption appears to be that reductions in RPE improve affect (Hardy & Rejeski, 1989). It is currently unclear as to whether this association is reciprocal. As such, the assumption the RPE would be influenced by affective change might be misguided. As to enjoyment, this measure was again included because of the hypothesised relationship with affect (e.g. Miller et al., 2005). Whilst many theorists assert that these two constructs are linked, others claim that enjoyment is a complex, multifaceted construct that is not necessarily synonymous with affect (Kiniecik & Harris, 1996). In retrospect, an increase in enjoyment should not necessarily have been expected. That said, Raedeke (2007) did find that enjoyment was significantly related to post-task affect; as measured via the vigor subscale of POMS (r=.39, d =, d =.84). It is also worth noting that enjoyment levels reduced from trial one to trial two, regardless of condition. Perhaps exposure to the first trial induced a novelty effect that simply inflated the initial enjoyment ratings (Kiniecik & Harris, 1996; Onwuegbuzie, 2000). These arguments aside, given the importance of such variables to the exercise experience, the fact the stimuli failed to influence them would imply that the EC effect would be of little value to the exerciser.

The final discussion point relates to one of the central tenets of EC theory; namely mimicry. Many believe that facial mimicry must occur if an emotion is to be ‘felt’, and it is the afferent feedback from the facial muscles that produces the corresponding emotional experience (Howard & Gengler, 2001; Hatfield, Bensman, Thorton & Rapson, 2014). Unfortunately, we did not include an assessment of facial mimicry and as such, have no way of knowing if this actually occurred. The current authors acknowledge that this could be a major limitation. Had this been assessed, then a much more focused discussion could have been presented. Other researchers (e.g. Hess and Blairy, 2001) have addressed this issue through the use of video equipment. This has allowed the facial expressions of the ‘receiver’ to be recorded and analysed for emotional reactions. However, whilst we recognise the importance of determining whether mimicry has occurred, we also believe that adopting this procedure might be problematic; particularly in this environment. It is possible the introduction of such equipment in the exercise setting could provoke evaluation apprehension; in other words, performance anxiety (Elliott, Polman & Taylor, 2012). It must also be recognised that whilst numerous studies do support the mimicry hypothesis (Hatfield et al., 2014), Hess and Blairy (2001) did manage to induce the EC effect without facial mimicry. Despite such concerns, future research into this area needs to make efforts to determine whether the mimicry response is evident.

In summary, this is the first attempt to induce the EC effect in the exercise environment. Had the hypothesised results been forthcoming, the simple act of displaying ‘happy’ images in gymnasia might have offered a simple means of enhancing the exercise experience and ultimately adherence. Unfortunately, the effect was not forthcoming. The authors felt that the design utilised was appropriate as it offered reasonably high levels of both internal and external validity. However, it is possible that methodological issues had a bearing on the outcomes and as such, a number of recommendations have been made to help direct any future research. It is worth restating that the authors never intended to apply any positive results to this particular group-exercise setting. During such tasks, any emotional transference would most probably come from other group members or the task leader. Rather, the exercise task was selected because we felt it most appropriate to make an initial enquiry into the application of EC in the exercise environment. Whilst alternative approaches might help uncover an effect in exercising participants, any efforts to induce the effect must be weighed against threats to validity. We also acknowledge that many of the recommendations made at this stage are mere conjecture. More research is needed to determine the veracity of our suggestions. Overall, these results could suggest that the either (1) the EC effect does not manifest in this setting, (2) if present, provides no benefit to exercise-related psychological states or (3) methodological issues hampered efforts to uncover the phenomenon. Despite its failings, we believe that this investigation creates a debate on the potential of EC within the exercise environment.

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Table 1 shows the means, SDs and range values for each dimension of the EC Scale.

	Mean/SD	Minimum	Maximum	Range
Happiness	M = 5.68, SD = 1.28	3.00	8.00	5.00
Love	M = 6.87, SD = 1.92	3.00	12.00	9.00
Fear	M = 8.17, SD = 1.93	3.00	12.00	9.00
Anger	M = 8.17. SD = 2.18	4.00	12.00	8.00
Sadness	M = 7.95, SD = 1.71	3.00	11.00	8.00

Table 2 shows the means, SDs, Effect Sizes, mean-difference and 90% confidence intervals for each condition.

	Session 1	Session 2	Cohen's d	Mean Diff	90% CI
HAPPY					
Session RPE	M = 2.43 SD = 1.09	M = 2.06 SD = 0.77	0.56	0.37	0.05 - 0.69
Session FS	M = 1.68 SD = 1.53	M = 2.25 SD = 1.29	0.47	0.57	0.01 - 1.13
Enjoyment	M = 4.50 SD = 1.71	M = 3.93 SD = 1.28	0.61	0.56	0.11 - 1.01
PWB	M = 16.37 SD = 3.82	15.56 SD = 3.44	0.20	0.81	-0.79 - 2.24
PD	M = 5.93 SD = 2.31	M = 5.56 SD = 2.47	0.11	0.37	-0.69 - 1.44
Fatigue	M = 8.43 SD = 5.92	M = 7.12 SD = 3.72	0.21	1.31	-1.01 - 3.64
NEUTRAL					
Session RPE	M = 2.84 SD = 0.68	M = 2.94 SD = 1.17	0.06	-0.10	-058 - 0.37
Session FS	M = 2.47 SD = 1.57	M = 1.88 SD = 1.99	0.32	0.57	-0.22 - 1.37
Enjoyment	M = 5.05 SD = 1.12	M = 4.78 SD = 1.08	0.29	0.26	-0.13 - 0.65
PWB	M = 19.05 SD = 4.57	M = 18.21 SD = 4.77	0.28	0.84	-0.67 - 2.31
PD	M = 5.25 SD = 1.66	M = 6.52 SD = 4.80	0.31	1.26	-2.92 - 0.39
Fatigue	M = 8.26 SD = 4.53	M = 7.57 SD = 4.45	0.14	0.68	-.12 - 2.58
CONTROL					
Session RPE	M = 2.50 SD = 1.24	M = 2.16 SD = 0.71	0.27	0.33	-0.34 - 1.00
Session FS	M = 2.91 SD = 1.31	M = 2.66 SD = 1.37	0.20	0.25	-0.34 - 0.84
Enjoyment	M = 5.25 SD = 1.35	M = 5.03 SD = 1.44	0.20	0.16	-0.31- 0.65
PWB	M = 19.08 SD = 5.24	M = 18.33 SD 6.61	0.24	0.75	-0.81 - 2.31
PD	M = 4.75 SD = 1.76	M = 4.33 SD =1.15	0.36	0.41	-0.18 - 1.02
Fatigue	M = 5.56 SD = 2.57	M = 5.50 SD = 2.02	0.01	0.16	-1.45 - 1.78