Comprehensive Psychology
Volume 5: 1–9

DOI: 10.1177/2165222816634038
cop.sagepub.com
SAGE

A Preliminary Investigation Into the Use of the Emotional Contagion Effect in the Exercise Environment

Dave Elliott[1] and Lucy Charlton[1]

Abstract

Based upon the theory of Emotional Contagion, the purpose of this investigation was to examine whether the use of positively-charged imagery could create a more positive exercise experience. Participants were randomly allocated into one of three test conditions ('neutral', 'happy' and control) whereupon they performed two step-aerobic sessions; baseline/familiarisation and experimental. Upon completion of the trials various exercise related, psychological measures were taken (Session RPE, FS, Enjoyment and Subjective Exercise Experience). A 3 × 2 Factorial MANOVA was used to assess for main effects and between condition interactions. There was no evidence of any effect for any of the DVs. ES data appeared to support this conclusion. Numerous recommendations are made to direct future research into this area.

Keywords

Emotional Contagion, exercise, mood, enjoyment, effort sense

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 & Strack, 2000; Wild, Erb, & 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 Electromyography (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 were presented to allow an effect size to be calculated. Wild et al. (2001) also used emotionally loaded facial expressions to study the EC effect. In this instance, static images were taken from the Pictures of Facial Affect Compendium (Ekman & Friesen, 1976) and digitally morphed to produce numerous emotions (happy and sad) at varying intensities (75%–150%). Using a 0 to 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

[1]University of Cumbria, Carlisle, UK

Corresponding Author:
Dave Elliott, University of Cumbria, Sport and Physical Activity, Fusehill Street, Carlisle CA1 2HH, UK.
Email: david.elliott@cumbria.ac.uk

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). While 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 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 hypothesized that "follower" affect would be positively related to perceived charismatic leadership qualities, namely, attributed charisma, idealized influence, and inspiration motivation. Correlational analysis provided some support for the author's assertions with both "affect at work" ($r = .34$, $d = 0.72$) and "general" affectivity ($r = .37$, $d = 0.79$) being significantly associated with perceived leadership charisma. While significant, it must be recognized that the correlations were not particularly strong. In this instance, the effect sizes offer better evidence of an EC effect. Analyzing 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 behavior when dealing with customers; this was also subcategorized 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 employees' smiling and customers' affective responses. However, evidence indicated that that the perceived authenticity affected the outcomes. Specifically, when the employees engaged in deep acting, evidence of an EC effect did emerge (partial $\eta^2 = 0.14$, $d = 0.79$).

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 affected other on-field players. More than 300 video clips of penalty kicks were assessed for their (physical) emotional content. Phi correlations revealed a significant association between certain celebratory behavior 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 the penalty competition (ϕ^2 range = 0.16–0.29, $d = 0.32$–0.60). The authors surmised that this was due to emotional convergence. Specifically, because such expressions are synonymous with pride and confidence, a more positive mindset 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 effect of "collective" mood among 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 ($r = .64$, $d = 1.66$); for example, the happier the collective, the happier the individual. Totterdell 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 toward a behavior, thereby increasing the likelihood it will be repeated (Ekkekakis, Parfitt, & Petruzzello, 2011; Godin, 1994; Williams, 2008). 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 program adherence ($\beta = 0.26$). Annesi (2002) 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) 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 and Rejeski (1989) reported that a negative, linear relationship 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% and 9% of mood improvement during exercise. While 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 subscale of the Exercise Induced Feeling Inventory (Gauvin & Rejeski, 1993), Annesi showed that among individuals with low motivation to exercise, perception of effort was negatively associated with program 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 program adherence. To date, no study has attempted to utilize the EC effect in this environment. This investigation examined the effect of positively valenced 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 EC Scale was also utilized to determine whether the participants were susceptible to the EC effect.

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

Method

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 years, $SD = 6.8$) and 24 males (M age = 24.6 years, $SD = 2.2$). 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 (deGelder, Snyder, Greve, Gerard, & Hadjikhani, 2004; Hess & Blairy, 2001). 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 utilized in the current investigation. Facial photographs were taken of 10 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 lighthearted and a number of jokes were recited in order to achieve authentic smiles.

Printed in color, the photographs were subsequently presented to a sample of 28 raters (14 male, 14 female). Each photograph was evaluated for emotional tone with participants being asked to "Please state how much you feel these photographs represent either happiness or sadness." Responses were recorded on a 10-point Likert-type 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 images $M = -0.91$ to $M = 0.14$. The photographs were enlarged to a size of 600×850 mm and laminated.

Measures

Session RPE. 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*) to 5 (*hard*) to 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 the following: %VO_2peak $R^2 = .76$, %HRpeak $R^2 = .74$ and %HRreserve $R^2 = .71$ (Herman, Foster, Maher, Mikat, & Porcari, 2006).

Feeling Scale. Developed by Rejeski (1985) to monitor in-task affect, respondents were asked to rate how they currently feel on an 11-point scale ranging from -5 (*feeling very bad*) to 0 (*neutral*) to $+5$ (*feeling very good*). This is a

valid measure of affect during exercise (Hardy & Rejeski, 1989). Van Landuyt, Ekkekakis, Hall, and Petruzzello (2000) reported correlations ranging from .51 to .88 between the Feeling Scale and the Valance scale of the Affect Grid (Russell, Weiss, & Mendelsohn, 1989) and .41 to .59 between the Feeling Scale and Lang's (1980) Self-Assessment Manikin, a pictorial measure of affect. Importantly, for this investigation, the Feeling Scale has been used successfully as a post-exercise measure of affect (Stanley & Cummings, 2010a, 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 ranging from 1 (*not at all*) to 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 or enjoyment subscale of the Ryan's (1982) Intrinsic Motivation Inventory ($r = .82$ to .85) and moderate correlations ($r = -.41$ to $-.49$) 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: Positive Well-Being (Items 1, 4, 7, 10), Psychological Distress (Items 2, 5, 8, 11), and Fatigue (Items 3, 6, 9, 12). All items are scored on a 7-point Likert-type scale ranging from 1 (*not at all*) to 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 Positive Well-Being $r = .71$, Psychological Distress $r = -.47$, and fatigue $r = -.03$. For the negative affect, PANAS subscale revealed the following: Positive Well-Being $r = -.47$, Psychological Distress $r = .61$ and Fatigue $r = -.06$. Correlations between the SESS subscales and the Feeling Scale were as follows: Positive Well-Being $r = .69$, Psychological Distress $r = -.64$, and Fatigue $r = -.28$.

EC Scale. This is a measure of an individual's 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 ranging from 1 (*not at all*) to 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 $r = .22$ and .47 were reported (Doherty, 1997). While these values are not particularly strong, the EC scale has been used by others (e.g., Johnson, 2008; Totterdell, 2000).

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, while 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, while 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 recognize 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, this was the best option that we could think of 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 standardized 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 EC through verbalizations. To overcome this threat, using Garageband '09, 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 EC 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 (1,200 × 1,500 mm) that also included psychology or 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 place the participants were standing. 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 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 behavior 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 or control and an experimental trial that represented one of the three conditions.

Table 1. Descriptive Statistics, Effect Sizes, Mean Difference and Ranges for Each Dimension of the Emotional Contagion Scale.

Subscale	*M*	*SD*	Range
Happiness	5.68	1.28	3.00–8.00
Love	6.87	1.92	3.00–12.00
Fear	8.17	1.93	3.00–12.00
Anger	8.17	2.18	4.00–12.00
Sadness	7.95	1.71	3.00–11.00

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 utilized. 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 on the assumption that a positive relationship should exist, a one-tailed analysis was implemented.

Results

EC ratings ranged from 3 to 12 for each subscale. The median value for each subscale was 7.50 (low scores were indicative of high EC susceptibility). The values (Table 1) suggested that for the most important emotion "happiness," the participants were prone to EC.

The mean Session RPE data confirmed that the exercise intensity was low–moderate (American College of Sports Medicine, 2006).

For the factorial MANOVA, Box's Test of Equality was significant ($p = .02$), so Wilks' Lambda was used for the analysis. There was no significant main effect between Trial 1 and Trial 2, $F(7, 38) = 2.01$, $p = .08$. For condition interactions, Wilks' Lambda revealed no significant interactions for any of the variables, $F(14, 78) = 1.10$, $p = .37$. There were no significant interactions with condition: Session RPE, $F(2, 44) = 1.02$, $p = .36$; Feeling Scale, $F(2, 44) = 2.27$, $p = .11$; Enjoyment, $F(2, 44) = .64$, $p = .53$; Positive Well-Being, $F(2, 44) = .01$, $p = .99$; Psychological Distress, $F(2, 44) = 1.63$, $p = .20$; and Fatigue, $F(2, 44) = .21$, $p = .80$ (Table 2).

The correlation between the "happiness" dimension of the EC scale and the Positive Well-Being subscale of the SEES was significant, $r = -.24$, $p = .04$. None of the remaining correlations with EC were significant: Session RPE, $r = .12$, $p = .19$; Feeling Scale, $r = -.14$,

Table 2. Descriptive Statistics, Effect Sizes, Mean Difference and 90% Confidence Intervals for Each Condition.

	Trial 1		Trial 2				
Condition and scale	*M*	*SD*	*M*	*SD*	Cohen's *d*[a]	*M* Diff.	90% CI
Happy							
Session RPE	2.43	1.09	2.06	0.77	−0.56	0.37	0.05, 0.69
Session FS	1.68	1.53	2.25	1.29	0.47	0.57	.001, 1.13
Enjoyment	4.50	1.71	3.93	1.28	−0.61	0.57	0.11, 1.01
PWB	16.37	3.82	15.56	2.47	−0.20	0.81	0.79, 2.24
PD	5.93	2.31	5.56	2.47	−0.11	0.37	−0.69, 1.44
Fatigue	8.43	5.92	7.12	3.72	−0.21	1.31	−1.01, 3.64
Neutral							
Session RPE	2.84	0.68	2.94	1.17	0.06	0.10	10.58, 0.37
Session FS	2.47	1.57	1.88	1.99	−0.32	0.59	−0.22, 1.37
Enjoyment	5.05	1.12	4.78	1.08	−0.29	0.27	−0.13, 0.65
PWB	19.05	4.57	18.21	4.77	−0.28	0.84	−0.67, 2.31
PD	5.25	1.66	6.52	4.77	0.31	1.27	−2.92, 0.39
Fatigue	8.26	4.53	7.57	4.45	−0.14	0.69	−0.12, 2.58
Control							
Session RPE	2.50	1.24	2.16	0.71	−0.27	0.34	−0.34, 1.00
Session FS	2.91	1.31	2.66	1.37	−0.20	0.25	−0.33, 0.84
Enjoyment	5.25	1.35	5.03	1.44	−0.20	0.22	−0.31, 0.65
PWB	19.08	5.24	18.33	6.61	−0.24	0.75	−0.81, 2.32
PD	4.75	1.76	4.33	1.15	−0.36	0.42	−0.18, 1.02
Fatigue	5.56	2.57	5.50	2.02	−0.01	0.06	−1.45, 1.78

Note. RPE = ratings of perceived exertion; FS = Feeling Scale; PWB = positive well-being; PD = psychological distress.
[a]The negative sign (−) denotes the direction of the changes from Trial 1 to Trial 2.

$p = .14$; Enjoyment, $r = -.10$, $p = .23$; Psychological Distress, $r = -.15$, $p = .14$; and Fatigue, $r = .00$, $p = .48$.

Discussion

Research has shown that emotions can be transferred to individuals through a process known as EC. It was argued that if the EC effect could be used to influence emotional valence positively and reduce the sense of effort, then the phenomena could provide a simple means of enhancing the exercise experience and ultimately program adherence (e.g., Annesi, 2002; Godin, 1994; Raedeke, 2007; Williams 2008). Despite the EC effect being well documented in other situations, there was little evidence of it in this investigation, despite the fact that participants were susceptible to the Happy dimension of emotional transfer. The primary statistical analysis (factorial MANOVA) revealed no significant effects for any of the dependent variables. The supplementary analyses (effect size, mean difference, and 90% CI) did offer some evidence of EC. In the Happy condition, there were moderate effect sizes for Session RPE and affect and the 90% CIs were in the hypothesized direction. Importantly, the effect size for affect ($d = 0.57$) was 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.

The outcomes need to be interpreted with caution, as there was also a moderate negative effect for Enjoyment ($d = -0.61$). Given the supposed interaction between these variables, a corresponding increase in Enjoyment might have been expected. The apparent effect for RPE and affect had no corresponding affect upon subjective exercise experience. It is, therefore, difficult to accept the effect sizes as being indicative of a "real," practical effect. As an additional measure, correlational analysis was conducted between the Happy dimension of the EC scale and dependent variables. These data provide some indication as to whether emotional susceptibility was an influencing factor. A significant, yet weak, correlation existed between Happy ratings and Personal Well-Being; however, no other associations were evident. So, despite some encouraging effect sizes for two of the variables, it must be concluded that the data do not support the use of positive emotional imagery within the

exercise environment. With these outcomes in mind, we will explore some reasons why the EC effect was not observed. It is hoped that this will aid future research in this area.

One possible explanation for lack of an EC effect is that the participants did not actually see the stimuli. In 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 thus 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. Therefore, the authors consider this explanation unlikely. The EC effect has been shown to manifest within seconds (Hess & Blairy, 2001; Wild et al., 2001) and so even cursory glances should have been sufficient to alter psychological state of the exercisers. Also, according to Bayle, Henoff, and Korak-Salmon (2009), stimuli, including facial expressions, are readily processed via the peripheral vision system. Nevertheless, perhaps researchers need to make concerted efforts to direct participants' attention toward any stimuli, or use an exercise mode (e.g., treadmill running) in which stimuli can be placed in the central visual field. As has been argued, implementing such strategies could compromise both internal (demand characteristics) and external (ecological) validity.

Another aspect that requires consideration is temporality. It is unclear how long changes generated by EC persist. If transient in nature, then it might be that the stimuli were observed and emotional state did change but was modulated throughout the exercise session. Retrospective measures like those used in this investigation might lack the sensitivity to discover such momentary changes. Future research might consider utilizing in-task measures at regular intervals throughout an exercise session; this could be performed in conjunction with any attempts to direct participants' attention toward 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 effect upon exercise adherence.

Before any efforts are made to implement modified procedures, the research of Wild et al. (2001) and Hennig-Thurau et al. (2006) should be considered. 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 analyzing 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, while the use of static facial images has been shown to be a valid transfer medium, dynamic representations could prove to be more powerful (Hatfield, Bensman, Thorton, & Rapson, 2014). For example, Hess and Blairy (2001) used dynamic images and observed the EC effect even when the emotional displays were relatively weak. Unfortunately, adopting this approach could compromise external validity. For example, gymnasia would have to invest in equipment that allowed dynamic images to be displayed. This would not be worthwhile unless the EC effect was quite strong.

This study differs in a major respect to those that have shown EC in real-world sport situations. In Totterdell (2000) and Moll et al. (2010), active participants would have had multiple sources of emotional transfer; for example, verbal and body gestures as well as facial expressions. Under the conditions of the current study, a single EC source may not have been 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 utilizing EC in this environment.

It is also possible that the EC effect did occur and was not detected. Although efforts were made to justify selection of dependent variables, there are problems with using RPE and enjoyment measures. Addressing effort sense, while 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 whether this association is reciprocal. The assumption the RPE would be influenced by affective change might be misguided. Enjoyment was included because of the hypothesized relationship with affect (e.g., Miller et al., 2005). While 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 (Kimiecik & 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 ($r = .39$, $d = 0.84$). It is also worth noting that Enjoyment decreased from Trial 1 to Trial 2, regardless of condition. Perhaps, exposure to the first trial induced a novelty effect that inflated the initial enjoyment ratings (Kimiecik & Harris, 1996; Onwuegbuzie, 2003). 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 (Hatfield et al., 2014; Howard & Gengler, 2001). Unfortunately, no assessment of facial mimicry was made, so there is no way of knowing if it occurred. This is a major limitation. Other researchers (e.g., Hess & 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 analyzed for emotional reactions. However, while determining whether mimicry has occurred is important, adopting this procedure might be problematic, particularly in the exercise environment. The introduction of such equipment in the exercise setting could provoke evaluation apprehension (performance anxiety; Elliott, Polman, & Taylor, 2012). It must also be recognized that while numerous studies do support the mimicry hypothesis (Hatfield et al., 2014), Hess and Blairy (2001) induced the EC effect without facial mimicry. Despite such concerns, future research into this area needs to make efforts to determine whether the mimicry response occurs.

In summary, this is the first attempt to induce the EC effect in the exercise environment. Had the hypothesized results been forthcoming, the simple act of displaying positive images in gymnasia might have offered a simple means of enhancing the exercise experience and ultimately adherence. Unfortunately, the effect was not observed. The authors felt that the design utilized was appropriate, as it had reasonably high internal and external validity. However, it is possible that methodological issues affected outcomes so 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 it seemed most appropriate to make an initial enquiry into the application of EC in the exercise environment. While alternative approaches might help uncover an effect in exercising participants, any efforts to induce the effect must be weighed against threats to validity. Many of the recommendations made at this stage are mere conjecture. Overall, these results could suggest that the either (a) the EC effect does not manifest in this setting, (b) if present, provides no benefit to exercise-related psychological states, or (c) methodological issues hampered efforts to observe the phenomenon. Despite its failings, this investigation initiates research on the potential of EC within the exercise environment.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

American College of Sports Medicine. (2006). *ACSM's resource manual for guidelines for exercise testing and prescription*. Philadelphia, PA: Lippincott, Williams and Williams.

Annesi, J. J. (2002). Relationship between changes in acute exercise-induced states, self-motivation, and adults' adherence to moderate aerobic exercise. *Perceptual and Motor Skills*, *94*, 425–439.

Bayle, D. J., Henaff, M.-A., & Krolak-Salmon, P. (2009). Unconsciously perceived fear in peripheral vision alerts the limbic system: A MEG Study. *PLoS ONE*, *4*(12), e8207.

Coquart, J., Dufour, Y., Groslambert, A., Matran, R., & Garcin, M. (2012). Relationships between psychological factors, RPE and time limit estimated by teleoanticipation. *The Sport Psychologist*, *26*(3), 359–374.

deGelder, B., Snyder, J., Greve, D., Gerard, G., & Hadjikhani, N. (2004). Fear fosters flight: A mechanism for fear contagion when perceiving emotion expressed by a whole body. *Proceedings of the National Academy of Sciences*, *101*(47), 16701–16706.

Dimberg, U., & Ohman, A. (1996). Behold the wrath: Psychological responses to facial stimuli. *Motivation and Emotion*, *20*(2), 149–182.

Dimberg, U., & Thunberg, M. (1998). Rapid facial reactions to different emotionally relevant stimuli. *Scandinavian Journal of Psychology*, *39*, 39–45.

Dimberg, U., Thunberg, M., & Elmehed, K. (2000). Unconscious facial reactions to emotional facial expressions. *Psychological Science*, *11*, 86–89.

Doherty, R. W. (1997). The emotional contagion scale: A measure of individual differences. *Journal of Nonverbal Behavior*, *21*, 131–154.

Ekkekakis, P., Parfitt, G., & Petruzzello, S. J. (2011). The pleasure and displeasure people feel when they exercise at different intensities: Decennial update and progress towards a tripartite rationale for exercise intensity prescription. *Sports Medicine*, *41*(8), 641–671.

Ekman, P., & Friesen, W. V. (1976). *Pictures of facial affect*. Palo Alto, CA: Consulting Psychologists Press.

Elliott, D., Polman, R., & Taylor, J. (2012). The effects of relaxing music for anxiety control on competitive sport anxiety. *European Journal of Sport Science*, *14*(S1), S296–S301.

Foster, C., Florhaug, J. A., Franklin, J., Gottschall, L., Hrovatin, L. A., Parker, S., . . . ,Dodge, C. (2001). A new approach to monitoring exercise testing. *Journal of Strength and Conditioning Research*, *15*(1), 109–115.

Gauvin, L., & Rejeski, W. J. (1993). The Exercise-Induced Feeling Inventory: Development and initial validation. *Journal of Sport and Exercise Psychology*, *15*, 403–423.

Godin, G. (1994). Social cognitive models. In R. K. Dishman (Ed.), *Advances in exercise adherence* (pp. 113–137). Champaign, IL: Human Kinetics.

Hagberg, L. A., Lindahl, B., Nyberg, L., & Hellenius, M. L. (2009). Importance of enjoyment when promoting physical exercise. *Scandinavian Journal of Medicine and Science in Sport*, *19*(5), 740–747.

Hardy, C. J., & Rejeski, J. (1989). Not what but how one feels: The measurement of affect during exercise. *Journal of Sport and Exercise Psychology*, *11*, 304–317.

Hatfield, E., Bensman, L., Thornton, P. D., & Rapson, R. L. (2014). New perspectives on emotional contagion: A review of classic and recent research on facial mimicry and contagion. *Interpersona: An International Journal of Personal Relationships*, *8*, 159–179.

Hennig-Thurau, T., Groth, M., Paul, M., & Gremler, D. D. (2006). Are all smiles created equal? How employee-customer emotional contagion and emotional labor affect service relationships. *Journal of Marketing*, *70*, 58–73.

Herman, L., Foster, C., Maher, M. A., Mikat, R. P., & Porcari, J. P. (2006). Validity and reliability of the session RPE method of monitoring exercise training intensity. *South African Journal of Sports Medicine*, *18*(1), 14–17.

Hess, U., & Blairy, S. (2001). Facial mimicry and emotional contagion to dynamic emotional facial expressions and their influence on decoding accuracy. *International Journal of Psychophysiology*, *40*, 129–141.

Howard, D. J., & Gengler, C. (2001). Emotional contagion effects on product attitudes. *Journal of Consumer Research*, *28*(2), 189–201.

Hsee, C. K., Hatfield, E., Carlson, J., & Chemtob, C. (1990). The effect of power on susceptibility to emotional contagion. *Cognition and Emotion*, *4*, 327–340.

Johnson, S. K. (2008). I second that emotion: Effects of emotional contagion and affect at work on leader and follower outcomes. *The Leadership Quarterly*, *19*(1), 1–19.

Kimiecik, J. C., & Harris, A. T. (1996). What is enjoyment? A conceptual/definitional analysis with implications for sport and exercise psychology. *Journal of Sport and Exercise Psychology*, *18*, 247–263.

McAuley, E., & Courneya, K. S. (1994). The Subjective Exercise Experiences Scale (SEES): Development and preliminary validation. *Journal of Sport and Exercise Psychology*, *16*, 163–177.

McAuley, E., Jerome, G., Elavsky, S., Marquez, D. X., & Ramsey, S. N. (2003). Predicting long-term maintenance of physical activity in older adults. *Preventive Medicine*, *37*, 110–118.

Miller, B. M., Bartholomew, J. B., & Springer, B. A. (2005). Post-exercise affect: The effect of mode preference. *Journal of Applied Sport Psychology*, *17*(4), 263–272.

Moll, T., Jordet, G., & Pepping, G. J. (2010). Emotional contagion in soccer penalty shootouts: Celebration of individual success is associated with ultimate team success. *Journal of Sports Sciences*, *28*(9), 983–992.

Neumann, R., & Strack, F. (2000). Mood contagion: The automatic transfer of mood between persons. *Journal of Personality and Social Psychology*, *79*(2), 211–223.

O'Halloran, P., Murphy, G. C., & Webster, K. E. (2005). Moderators of mood during a 60-minute treadmill run. *International Journal of Sport Psychology*, *36*, 241–250.

Onwuegbuzie, A. J. (2003). Expanding the framework of internal and external validity in quantitative research. *Research in the Schools*, *10*(1), 71–90.

Raedeke, T. D. (2007). The relationship between enjoyment and affective responses to exercise. *Journal of Applied Sport Psychology*, *19*, 105–115.

Rejeski, W. J. (1985). Perceived exertion: An active or passive process? *Journal of Sport Psychology*, *7*, 371–378.

Rudolph, D. L., & McAuley, E. (1996). Self-efficacy and perceptions of effort: A reciprocal relationship. *Journal of Sport and Exercise Psychology*, *18*, 216–223.

Russell, J. A., Weiss, A., & Mendelsohn, G. A. (1989). Affect grid: A single-item scale of pleasure and arousal. *Journal of Personality and Social Psychology*, *57*(3), 493–502.

Ryan, R. M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology*, *42*, 450–461.

Stanley, D. M., & Cumming, J. (2010a). Are we having fun yet? Testing the effects of imagery use on the affective and enjoyment responses to acute moderate exercise. *Psychology of Sport and Exercise*, *11*, 582–590.

Stanley, D. M., & Cumming, J. (2010b). Not just how one feels, but what one images? The effects of imagery use on affective responses to moderate exercise. *International Journal of Sport and Exercise Psychology*, *8*, 343–359.

Stanley, D. M., Williams, S. E., & Cumming, J. (2009). Preliminary validation of a single-item measure of exercise enjoyment: The Exercise Enjoyment Scale. *Journal of Sport and Exercise Psychology*, *31*, S138–S139.

Totterdell, P. (2000). Catching moods and hitting runs: Mood linkage and subjective performance in professional sport teams. *Journal of Applied Psychology*, *85*(6), 848–859.

Van Landuyt, L. M., Ekkekakis, P., Hall, E. E., & Petruzzello, S. J. (2000). Throwing themountains into the lakes: On the perils of nomothetic conceptions of the exercise affect relationship. *Journal of Sport and Exercise Psychology*, *22*, 208e234.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*(6), 1063–1070.

Watt, B., & Grove, R. (1993). Perceived exertion: Antecedents and applications. *Sports Medicine*, *15*(4), 225–241.

Wild, B., Erb, M., & Bartels, M. (2001). Are emotions contagious? Evoked emotions while viewing emotionally expressive faces: Quality, quantity, time course and gender differences. *Psychiatry Research*, *102*, 109–124.

Williams, D. M. (2008). Exercise, affect and adherence: An integrated model and a case for self-paced exercise. *Journal of Sport and Exercise Psychology*, *30*, 471–496.

Author Biographies

Dave Elliott is a Senior Lecturer in Sport and Exercise Science.

Lucy Charlton is a graduate of the University of Cumbria. She is a qualified 'Exercise to Music' Instructor and currently works as a Physical Education teacher.