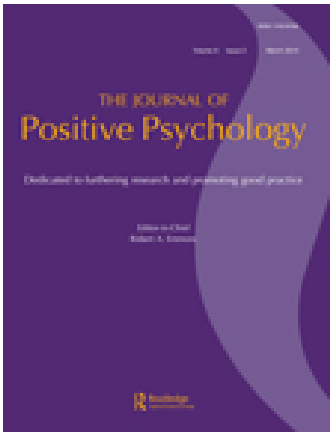

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Enhancing positive affect and divergent thinking abilities: Play some music and dance

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Enhancing positive affect and divergent thinking abilities: Play some music and dance

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This study compares the effect of dance on affect and cognition to music or exercise, in a young, non-clinical population. Participants were asked to complete tests of mood and creativity before and after spending 5 min either listening to music, dancing, cycling or sitting quietly. Both dancing and passively listening to music enhanced positive affect, decreased negative affect and reduced feelings of fatigue. Cycling and sitting quietly had no effect on positive mood or feelings of fatigue. Moreover, dancing and passively listening to music had dissociable effects on different aspects of creativity, with greater change in positive affect being associated with greater enhancement in measures of verbal and non-verbal creativity, respectively. We suggest that these findings support the use of either short duration dancing or passively listening to music as potentially powerful tools in enhancing emotional well-being and different aspects of divergent thinking in non-clinical settings.

Keywords: positive affect; negative affect; dancing; music; divergent thinking; creativity

Introduction

Positive affect has been shown to be important in achieving psychological and physical well-being, and is associated with improved cognitive function and mental health (Fredrickson, 2001; Seligman & Csikszentmihalyi, 2000). There is now a growing body of work demonstrating that positive affect can be induced by activities such as physical exercise and listening to music (Reed & Ones, 2006; Schellenberg, Nakata, Hunter, & Tamoto, 2007). In addition to increases in positive feelings, various forms of aerobic exercise have been shown to decrease negative affect (Daley & Welch, 2004; Reed & Ones, 2006). Equally, music seems to have a similarly profound effect on mood, with tempo and genre of the music having the power to influence affect both positively and negatively (Labbe, Schmidt, Babin, & Pharr, 2007; Thompson, Schellenberg, & Husain, 2001). What is more, listening to music and participating in aerobic activity not only appear to alter mood, they also seem to enhance cognitive function, improving spatial awareness, creativity and memory for up to 2 hr post-activity (Colcombe & Kramer, 2003; Kramer et al., 2003; Kramer, Erickson, & Colcombe, 2006; Schellenberg et al., 2007; Tomporowski, 2003). Yet, while there is much research on the effects of music and exercise on affect and cognition, there is considerably less work on an activity that combines the two: dance; defined as the intentional movement of one's body, often, though not always, to music.

To date, research into the effects of dance on affect and cognitive function has tended to focus on dance movement therapy (DMT) interventions for older people or to use people already enrolled in dance classes. The majority of these studies find that dance can increase positive affect and decrease depressive symptoms (Cruz & Sabers, 1998; Ritter & Low, 1996) as well as help to retain some cognitive function in older people (Alpert et al., 2009; Hagen, Armstrong-Esther, & Sandilands, 2003). However, some of these findings have been questioned as many of the control groups in these studies have not been well matched in terms of age or physical ability (Koch, Morlinghaus, & Fuchs, 2007; Van de Winckel, Feys, De Weerdt, & Dom, 2004). Moreover, it is difficult to compare the effect of dance across these studies, not only due to the variations in measures and population types, but also due to the intensity and type of dance used. For example, in many of the studies examining the effect of dance in older participants, interventions are termed 'musical exercise' or 'movement to music' rather than 'dance', and it is unlikely that these activities are equivalent to those in aerobic dance classes. Thus, it is difficult to know how far the comparison can be extended and what kind of movement to music is sufficient to enhance mood and cognition.

Consequently, here the effect of dance on affect and cognitive function, specifically creativity, in a young non-clinical population is examined. The focus on creativity is based on work showing that positive mood

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can help broaden people's thought-action repertoires (Fredrickson, 2001, 2004). The Broaden-and-Build Hypothesis proposes that these repertoires then serve to build enduring personal resources, which can fall within physical, social and psychological realms. This study tests whether engagement in activities that previous studies suggest should induce positive mood would also be associated with an enhanced ability to think creatively. Notably, the concept of creativity is multifaceted (Isen & Daubman, 1984) and it is beyond the scope of this paper to consider all of its aspects. For this reason, here it is defined as divergent thinking, a process that allows an individual to make links between items that are otherwise unconnected and the ability to be fluent, elaborate and original, though relevant, in thought (Baas, De Dreu, & Nijstad, 2008). Indeed in support of the Broaden-and-Build Hypothesis, it has been shown that people experiencing positive emotions are better at divergent thinking, more flexible when categorising items, more unusual in the organisation of their ideas and more creative in their problem-solving (Estrada, Isen, & Young, 1997; Isen, Daubman, & Nowicki, 1987; Isen, Rosenzweig, & Young, 1991; Kahn & Isen, 1993).

This study also aims to examine whether mood and divergent thinking processes could be altered even after very short durations of engagement in activity. Most studies examining the effect of music or physical activity on mood and cognition use long durations and sustained engagement, which may not be practical if one wanted to use these approaches in more clinical settings, or to provide a simple way to enhance mood and psychological function in a normal working day. To that end, this study has been designed to examine the impact of engaging in 5 min of dancing, in comparison to listening to music and exercise, on mood and creativity. There were four experimental conditions: dance ('free' movement with music), cycling (specific movement with music), music (no movement, just music) and quiet (no movement, no music). The quiet condition was included as a control for any non-specific practice effects, and to examine whether any 'time out' intervention could alter mood and cognition. Participants were randomly assigned to one of these four conditions, and were asked to complete tests of mood and creativity before and after engaging with their assigned activity, which they performed alone in a room, eliminating social interaction as a possible confound. Heart rate was measured before and after engagement with assigned activity to control for the possible confounding effect of different levels of physical exertion between the experimental conditions.

In line with previous research it was predicted that after participating in the active conditions (dancing, cycling, listening to music), but not the quiet condition, participants' feelings of well-being would increase as measured by an increase in positive affect and a decrease in negative affect. In addition, engagement in these active conditions would also be associated with an enhancement in measures of creativity. Furthermore, we postulated that, due to the interaction between exercise and music in the dance condition, the participants in this group would show greater improvements across all outcome measures of well-being and creativity.

Methods

Participants

Sixty participants were recruited to take part in the study (51 female, 9 male; Age Range = 18–23; Mean age ± SD = 20.4 ± 1.31) from the student population at the University of York, using social networking sites and word of mouth. All participants gave written informed consent.

Design

The experiment used a mixed/split-plot design. The independent variable, activity condition, had four levels (dancing, cycling, music, quiet) and participants were randomly assigned to one of these four conditions. If participants expresses high levels of distress in response to their allocated condition, they were allowed to opt out and were randomly re-assigned to one of the remaining three conditions; this occurred in only 4 (3 of which were female) out of 60 participants tested, all of whom objected to being in the dance condition. These participants were excluded from the data analysis as they wanted to be reassigned to another experimental condition, hence the final number of participants included in data analysis was 56 (47 female, 9 male; Age Range = 18–23; Mean age ± SD = 20.4 ± 1.34), and final group numbers were: Dancing = 15, Cycling = 14, Music = 14, Quiet = 13.

In addition, to ensure that our participants were matched in terms of day-to-day engagement with dancing, listening to music and cycling, they were asked to fill in a questionnaire on how much time they spent in an average week dancing, cycling and listening to music. Indeed, participants did not differ significantly between groups in the number of hours they engaged with each one of these activities per week (Kruskal–Wallis test; Dancing privately for pleasure, Range 0–6 h; $\chi^2(3) = 5.277$ $p = 0.153$; Listening to music, Range 2–7 h, $\chi^2(3) = 1.648$, $p = 0.649$; Cycling, Range 1–4 h, $\chi^2(3) = 2.114$, $p = 0.549$).

The dependent variables were measures of well-being (positive affect, negative affect and fatigue) and creativity (verbal fluency, nonverbal fluency (NVF), nonverbal originality (NVO) and nonverbal elaboration (NVE)). Participants completed measures of mood and creativity both before and after their allocated activity and the changes in these were compared between groups.

Materials

The music used in the study was 'Do Your Thing' by Basement Jaxx (2001), which was edited to last 5 min and was played on computer speakers, at 74 dB. In addition, in the cycling condition, a stationary bicycle was set to a moderate resistance setting and the height was adjustable to accommodate all participants. This same piece of music was used in the dancing, cycling and music conditions. After taking part, participants in the conditions that involved listening to the same music clip (dancing, cycling and music conditions) reported that they liked the song, and they were very familiar with the piece of music chosen; no significant differences in these rating measures were found between the groups (Likert scale, with 1 not at all and 7 extremely; liking song mean score, 4.66 ± 2.76, $\chi^2(2) = 0.568$, $p = 0.753$; familiarity score, 4.64 ± 2.96, $\chi^2(2) = 0.062$, $p = 0.970$).

Measures

Mood

Participants completed the Subjective Exercise Experiences Scale (SEES; McAuley & Courneya, 1994) 10 min before and 1 min after their respective activities. Participants rated the extent to which 12 adjectives suited the way they felt at that moment on a Likert scale from 1 ('not at all') to 7 ('very much so'). This gave composite scores of positive affect, negative affect and fatigue; each composite had possible scores ranging from 4–28, derived from four adjectives. Despite the ongoing debate surrounding the types of feelings and emotions produced by exercise and whether they warrant separate measures to those of other emotions (Ekkekakis & Petruzzello, 2001; Gauvin & Rejeski, 2001), this measure has been validated and used in other studies considering similar effects (Cox, Thomas, & Davis, 2001; Daley & Welch, 2004). It was, therefore, chosen in preference over other measures to allow comparison across studies.

Verbal creativity

The alternate uses subtest of the Torrance Tests for Creative Thinking (TTCT; Torrance, 1966) was adapted for this experiment. Although participants are usually given 10 min to list as many uses as possible for a common object (brick/can), the present study only allowed 4 min to keep testing time short and to avoid boredom effects. Responses were scored on fluency, with one point being awarded for each relevant and plausible response. Responses that were impossible or irrelevant (e.g. a brick being used as a hairbrush) received a score of 0. Repetitive lists of common uses were also curbed to three (e.g. a brick can be used to build a wall, a house, a shop, a hospital, a building and a bridge would receive a score of 3).

Nonverbal creativity

The circles/lines subtest of the TTCT was used to assess nonverbal creativity; in this task, participants were presented with 18 circles or sets of parallel lines and given 4 min to create as many different images in which the stimulus is central, being as elaborate and original as possible. Points were awarded for fluency (one per valid item), originality (one point per original item) and elaboration (one point for each additional detail) as described in the manual (Ball & Torrance, 1984). Items were discarded if the stimulus was not central to the piece (e.g. drawing a garden in a circle), if there was repetition or if the picture was indecipherable. This test has been found reliable and valid and has been used across a variety of experiments regarding creativity (Kim, 2006).

Experience

Participants completed questions regarding their history with each of the activities (dancing, cycling, and music) and how often they engage with each one in an average week. After the activity participants answered questions regarding the extent to which they enjoyed and engaged with the activity.

Heart rate

Before and after their individual activity, participants measured their own heart rate, counting the number of pulse beats per minute.

Procedure

Participants were assigned randomly to one of four groups (dancing, music, cycling, quiet). They were then asked whether they had a preference for or against participating in any of the four conditions. Participants were then left to complete a questionnaire about their history and current participation in each of the experimental conditions (dancing, listening to music, cycling) and the SEES questionnaire. Following this, they completed the verbal and then non-verbal creativity tasks. Ball and Torrance (1984) advise that these tasks should be given in a fun and game-like manner so they were referred to as 'tasks', not 'tests', and participants were told not to worry about them too much as they were supposed to be enjoyable. The experimenter then left the room and gave them 4 min to complete each task, instructing participants to move on to the next task over an intercom system from a separate room in order to avoid experimenter interference.

After completing these tasks, participants were asked to take a measure of their heart rate, counting their pulse over 1 min. They were then left to engage in their assigned activity (dancing, cycling, listening to music or sitting quietly) for 5 min, after which they took their pulse and completed the SEES again as well as a questionnaire assessing their engagement with the activity. Participants then completed the second set of forms of the creativity subtests. In each experimental condition, participants were asked to engage with the activity as freely and actively as possible. Dancers were asked to dance to the music, listening to it and moving with it. Cyclists were reassured they were not being measured on speed or distance, they were asked just to keep cycling for the duration of the song with no need to keep in time. In the music condition, participants were asked to listen to the music and think about it, engaging as much as possible, and the participants with no stimulus were asked to sit quietly.

Statistical analysis

Data were analysed using PASW version 20.0. Data were first examined for outliers; scores three standard deviations from the mean were removed from the data analysis (Dance group: one data point post-negative affect score; Music group, one data point pre-negative affect score; Cycling group, one data point post non-verbal elaboration score; Quiet group, one data point pre-heart rate score). The data were then tested and failed the test for normality using the Shapiro-Wilk procedure, and hence analysed using non-parametric statistics. To examine any group differences in measures of well-being and creativity before participants engaged in their respective activities, a Kruskal–Wallis test was performed. Differences in measures of well-being and creativity were analysed using the Wilcoxon signed-rank test for each group separately comparing pre- and post-engagement scores. Correlation between positive mood scores and measures of creativity was conducted using Spearman's r. Differences between groups in the degree of engagement, enjoyment, awkwardness and how freely they engaged with their task, were tested with Kruskal–Wallis test. Follow on *post hoc* tests were performed using the Mann–Whitney U test. A Bonferroni correction for multiple comparisons was used when appropriate.

Results

Effects on well-being, psychological distress and fatigue

Positive affect, negative affect and fatigue scores were calculated from SEES, which participants completed before and after engaging in their respective activities. Figure 1 illustrates the percentage change in mood and fatigue, as well as associated changes in heart rate. Statistical analysis was done on the pre and post scores (Supplementary Table 1). No significant differences between the experimental groups were found in any of the measures of well-being pre-engagement in their respective activities (Kruskal–Wallis test; Positive affect, $\chi^2(3) = 1.257$, $p = 0.739$; Negative affect, $\chi^2(3) = 3.432$, $p = 0.330$; Fatigue, $\chi^2(3) = 2.567$, $p = 0.463$.

Wilcoxon test was then used to examine possible changes in positive affect, negative affect and fatigue before and after engaging in the tasks. A Bonferroni correction for multiple comparisons was performed, and accordingly the level of significance was set at 0.0125. Dancing and listening to music significantly increased measures of positive affect (Figure 1(A); Dancing, $T = 6$, $Z = -3.085$, $p = 0.002$; Music, $T = 4$, $Z = -2.936$, $p = 0.003$), but cycling and sitting quietly had no effect on positive mood (Cycling, $T = 34.5$, $Z = -0.780$, $p = 0.436$; Quiet, $T = 16.0$, $Z = -0.787$, $p = 0.431$). There were also significant effects on negative mood ratings, where dancing and listening to music significantly decreased negative affect (Dancing, $T = 2.5$, $Z = -2.736$, $p = 0.006$; Music, $T = 0.00$, $Z = -2.555$, $p = 0.011$). There was a trend for a similar reduction in negative affect in the cycling condition ($T = 9.5$, $Z = -1.860$, $p = 0.063$) and the sitting quietly condition ($T = 11$, $Z = -1.723$, $p = 0.085$), but these did not reach statistical significance.

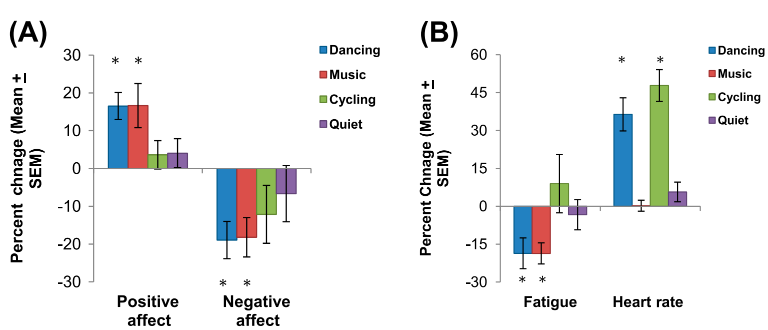

Figure 1. Dancing and passively listening to music enhance emotional well-being. (A) Mean percent change in positive and negative affect, as well as (B) Feelings of fatigue and heart rate changes after engagement in one of the four experimental conditions. Error bars represent standard error of the mean.

Furthermore, only participants in the dancing and listening to music conditions had significantly reduced feelings of fatigue (Figure 1(B); Dancing, $T = 13$, $Z = -2.678$, $p = 0.007$; Music, $T = 0.00$, $Z = -2.952$, $p = 0.003$), an effect that was not observed in the other two experimental conditions (Cycling, $T = 40.5$, $Z = -0.351$, $p = 0.726$; Quiet, $T = 27$, $Z = -0.953$, $p = 0.341$).

In addition, the effects observed on measures of well-being were not dependent on physical exertion, as measured by increase in heart rate after engagement with each activity (Figure 1(B)). There was no difference in heart rate between participants in the different conditions before engagement in their respective activities ($\chi^2(3) = 3.492$, $p = 0.322$). However, as would be expected, significant increases in heart rate were found in the physically active conditions – dancing and cycling (Figure 1(B) and Supplementary Table 1; Wilcoxon test; Dancing, $T = 0$, $Z = -3.408$, $p = 0.001$; Cycling, $T = 0$, $Z = -3.181$, $p = 0.001$), but not while either passively listening to music or sitting in a quiet room for 5 min (Music, $T = 31.0$, $Z = -0.178$, $p = 0.859$; Quiet, $T = 15.0$, $Z = -1.278$, $p = 0.201$).

Effects on measures of creativity

Pre- and post-mean scores of both verbal and non-verbal creativity are presented in Table 1. Non-verbal creativity was examined using three different measures, NVF, NVO and NVE. No significant differences between the experimental groups were found in any of the measures of creativity pre-engagement in their respective activities (Kruskal–Wallis test; Verbal, $\chi^2(3) = 1.519$, $p = 0.678$; NVF, $\chi^2(3) = 3.698$, $p = 0.296$); NVO, $\chi^2(3) = 1.556$, $p = 0.669$; NVE, $\chi^2(3) = 2.715$, $p = 0.438$.

Wilcoxon tests were then performed to examine pre and post differences in these measures of creativity in each group. A Bonferroni correction for multiple comparisons was performed; so for all effects reported, the level of significance was set at 0.0125. There was only a trend for a significant increase in NVO after listening to music, and no significant differences in non-verbal originality in the other conditions (Music, $T = 17$, $Z = -2.017$, $p = 0.044$; Dancing, $T = 37.5$, $Z = -0.958$, $p = 0.338$; Cycling, $T = 17$, $Z = -0.654$, $p = 0.513$; Quiet, $T = 20$, $Z = -1.163$, $p = 0.245$). In contrast, listening to music resulted in a significant increase in NVF ($T = 7$, $Z = -2.546$, $p = 0.011$). There was a trend for a similar enhancement in the other conditions but this did not reach statistical significance (Figure 2(B), Cycling, $T = 10$, $Z = -2.291$ $p = 0.022$; Quiet, $T = 1.5$, $Z = -2.319$, $p = 0.020$; Dancing, $T = 10.5$, $Z = -1.743$, $p = 0.081$). No significant effects on verbal measures of creativity or non-verbal elaboration were found after engagement in any of the experimental conditions ($p > 0.05$).

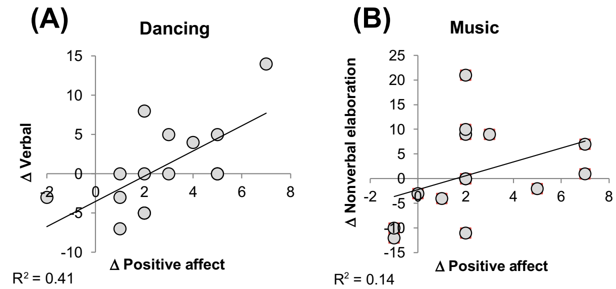

Figure 2. Positive mood induction by dancing and passively listening to music has dissociable effects on different aspects of divergent thinking, with a greater change in positive affect being associated with greater enhancement in measures of verbal (A) and non-verbal (B) creativity after dancing and listening to music, respectively. Error bars represent standard error of the mean.

The Broaden-and-Build Hypothesis (Fredrickson, 2001, 2004) predicts a correlation between change in positive mood and creativity. Hence, we next examined whether there was a relationship between changes in mood and changes in verbal and non-verbal divergent thinking measures in each condition (Difference score, Spearman's r, 2-tailed). We found that greater change in positive affect in the dance condition was associated with greater change in verbal creativity ($r = 0.637$, $p = 0.011$, Figure 2(A)), this correlation remained significant even with removal of the outlier in that data-set (Spearman's rho $r = 0.550$, $p = 0.042$, $n = 14$). There was also a correlation between change in positive affect in participants in the music condition and change in non-verbal elaboration ($r = 0.555$, $p = 0.039$, Figure 2(B)). In contrast, no significant correlations were found between changes in positive affect and divergent thinking measures in either the cycling condition or in the quiet condition ($p > 0.05$). In addition, we also looked whether there was any relationship between change in negative affect and measures of creativity. The only significant association found was a positive correlation between the degree of change in negative affect and verbal creativity scores in the cycling condition ($r = 0.606$, $p = 0.022$). However, this effect was found to be driven by one outlier in the data (see Supplementary Figure 1). No significant associations were found between verbal and non-verbal measures of creativity and the other experimental conditions ($p > 0.05$).

Engagement with task

On completing their assigned activity, participants were asked to rate on a scale of 1 (not at all) – 7 (very much so) the extent to which they enjoyed, engaged with, felt awkward during and free to participate in the activity (Figure 3). Kruskal–Wallis test revealed a significant

Table 1. Mean scores of verbal and non-verbal measures of creativity in each group before and after engagement in their respective activities (standard deviations in brackets).

	Verbal		Non-verbal fluency		Non-verbal originality		Non-verbal elaboration	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Dancing	11.60 (4.44)	12.47 (7.07)	4.53 (1.41)	5.73 (2.71)	2.47 (1.64)	2.93 (1.22)	12.07 (10.71)	14.87 (9.06)
Music	12.43 (2.62)	13.07 (3.32)	5.36 (2.21)	7.21 (2.67)	2.71 (0.99)	4.00 (2.35)	16.21 (8.17)	17.29 (6.70)
Cycling	11.21 (3.19)	11.36 (3.10)	6.43 (2.85)	8.07 (2.30)	4.29 (3.54)	4.86 (2.82)	15.50 (10.86)	12.92 (7.53
Quiet	11.85 (5.06)	12.38 (4.29)	5.69 (2.32)	7.54 (2.47)	2.85 (1.99)	3.77 (1.54)	13.00 (9.87)	17.38 (13.21)

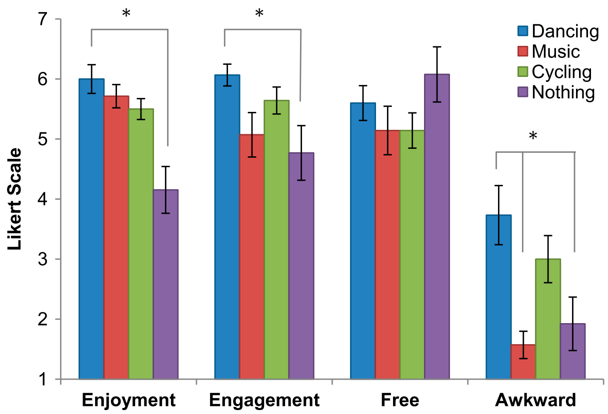

Figure 3. Participants in the dance conditions felt more awkward engaging in this activity in comparison with participants in the music condition. Errors bars represent standard error of the mean.

difference in participants being able to engage freely with the task in the different conditions ($\chi^2(3) = 7.867$, $p = 0.049$). There were also significant differences in how much they enjoyed, engaged or felt awkward in taking part during each of their respective activities (Enjoyment, $\chi^2(3) = 17.545$, $p = 0.001$; Engagement, $\chi^2(3) = 8.181$, $p = 0.042$; Awkward, $\chi^2(3) = 16.985$, $p = 0.001$).

Mann–Whitney tests were used to follow up these findings; comparisons were constrained to examine differences between the dance group and the other three experimental conditions in line with our experimental hypothesis focused on the effects of dance in comparison to the other conditions. A Bonferroni correction for multiple comparisons was applied; so all effects are reported at a 0.0167 level of significance. There was no significant difference between the dance and cycling condition ($U = 73.5$, $Z = -1.488$, $p = 0.137$) or the dance and music groups ($U = 88.5$, $Z = -0.765$, $p = 0.444$) in how much they enjoyed the task. However, greater enjoyment was reported by participants in the dance condition in comparison to participants in the quiet condition ($U = 24.0$ $Z = -3.488$, $p = 0.001$). Similar patterns of results were found in the degree of engagement with the task, with participants in the dance condition reporting greater levels of engagement in the task more than participants in the quiet condition ($U = 46.0$ $Z = -2.462$, $p = 0.014$). But, no significant differences were found in the reported degree of engagement by participants in the dance condition in comparison to the other experimental conditions (dance vs. cycling, $U = 75.5$, $Z = -1.389$, $p = 0.201$; dance vs. music, $U = 59.5$, $Z = -2.124$, $p = 0.046$). However, participants in the dance condition found engaging with this activity to be more awkward than participants taking part in the music condition ($U = 29.5$, $Z = -3.423$, $p = 0.001$). There was a significant difference in reported feelings of awkwardness between participants in the dance and quiet condition ($U = 36$, $Z = -2.930$, $p = 0.003$), but no significant differences in reported feelings of awkwardness in participants taking part in the dance vs. the cycling condition ($U = 74.0$, $Z = -1.109$, $p = 0.267$).

Discussion

This study examined whether dancing for a short period of time could enhance positive affect and improve divergent thinking abilities. In accordance with our predictions, participants who engaged in 5 min of dance showed significant improvements in emotional well-being, as measured by an increase in positive affect and a decrease in negative affect. In addition, taking part in the dance condition significantly reduced reported levels of fatigue. This is noteworthy, given that heart rate measures were equally elevated in both dance and cycling conditions, yet cycling did not significantly affect mood and increased feelings of fatigue. Notably, there were very similar improvements in measures of well-being in participants in the music condition. In addition, dancing and passively listening to music had dissociable effects on different aspects of creativity, with greater change in positive affect being associated with greater enhancement in measures of verbal and non-verbal creativity, respectively.

The majority of previous studies investigating the effects of dance on non-clinical participants are field experiments, which tend to use individuals already enrolled in dance classes (Bartholomew & Miller, 2002; Gondola, 1987; Lox & Rudolph, 1994; McInman & Berger, 1993). This study is one of few laboratory-based experiments to use a non-clinical sample. Thus, although participants in this study may present some self-selecting bias, this is likely to be less acute than in field experiments, further extending the evidence for the positive effects of dance on well-being. What is more, measuring both positive and negative affect in the study offers a wider perspective on how mood can be altered than previous research, which had tended to focus solely on changes in negative affect (Castillo-Perez, Gomez-Perez, Velasco, Perez-Campos, & Mayoral, 2010; Koch et al., 2007; Reed & Ones, 2006; Ritter & Low, 1996; Steinberg et al., 1997). Moreover, previous research has tended to focus on physical activity lasting 30 min, while the present study demonstrates that even 5 min of either dancing or listening to music is effective in enhancing emotional well-being.

The second objective of this study was to examine the relationship between the enhancement of emotional well-being and divergent thinking processes. Previous research into creativity and positive emotions has repeatedly found that people in a positive mood produce more creative responses than people in neutral or negative emotional states (Baas et al., 2008; Rowe, Hirsh, & Anderson, 2007; Subramaniam, Kounios, Parrish, & Jung-Beeman, 2009). Here, it seems that different activities can influence measures of creativity in a dissociable manner. That is, at the group level, none of the experimental conditions had any effect on verbal measures of creativity. However, non-verbal fluency significantly increased in the music condition, but not in the other conditions. Furthermore, individual differences were observed in the degree to which dancing and listening to music increased positive mood and this was positively correlated with a dissociable increase in verbal and non-verbal measures of creativity, respectively. The variation in how and which elements of creativity are affected in each condition argues against a simple practice effect explanation for these findings, since that would result in a non-specific increase in verbal and non-verbal measures of creativity across all conditions.

These findings do not fully support the Broaden-and-Build Hypothesis (Fredrickson, 2004), which suggests that any increase in positive affect will lead to broadened cognitive functioning. This discrepancy could be due to a number of reasons. Inconsistent definitions of emotion in the literature may explain some of the ambiguity surrounding the interaction between affect and creativity, as different forms of mood induction could lead to similar surface emotions with diverse underlying processes (Davis, 2010; Etnier et al., 1997; Tomporowski, 2003). For example, Steinberg et al. (1997) found that exercise improves creativity independently of its improvement on affect. Indeed, arousal regulatory focus and meta-emotions all play important roles in determining the effect of affect on cognitive processes and these are often neglected in research (Baas et al., 2008; Meinhardt & Pekrun, 2003; Pekrun, Goetz, Titz, & Perry, 2002). Thus, it may be that not all positive emotional states increase creativity, but rather that this is facilitated by specific sub-types of positive emotions. This is particularly notable as increases in positive affect in the dance and music condition were correlated with improvements in different aspects of creativity.

Additionally, it is also possible that the measures used in this study were not sensitive enough to evaluate the effect of short bursts of activity on creativity. Though other studies have used individual subtests of the Torrance Tests of Creative Thinking with exercise, reporting them to be effective and reliable measures of creativity (Kim, 2006), this study adapted these measures from 10 to 4 min in order to reduce the chance of fatigue/boredom by the participants. This may have compromised the sensitivity of the measures.

Nevertheless, the measures did identify significant changes in mood and creativity, and hence these findings could offer encouragement for people who are unaccustomed to or have little time for exercise. Starting small could be less intimidating than the recommended 30 min of exercise for psychological and physical health benefits (Berger & Motl, 2000), and could result in significant positive changes, which may encourage longer-term participation. What is more, the finding that cycling has no effect on fatigue while dancing decreases it is striking, and though this needs to be replicated, it could offer valuable insight into the types of activity that could be most effective with non-clinical and clinical populations.

Furthermore, the finding that listening to an upbeat song for 5 min can be so efficacious bodes well for using this procedure for positive mood induction and enhancement of divergent thinking abilities. Dancing is not for everyone, it is both physically challenging and it is an activity that may make some people feel anxious and less confident about taking part, especially as they get older (Lovatt, 2011). This is supported in this study by the fact that, in comparison to the music and quiet conditions, participants in the dance condition felt much more awkward dancing for 5 min in a room by themselves. Interestingly, this was also the case for the cycling condition. However, in contrast to the cycling condition, it is worth noting that in spite of these feelings of awkwardness, engaging in dancing still significantly increased their feelings of emotional well-being.

In future work, it would be valuable to compare the effects of 5 min of dance to the more usual 15 or 30 min (Berger & Motl, 2000). Daley and Welch (2004) compared 15 min of aerobic exercise to 30 min and found no significant difference in effect sizes. In addition to varying the duration of the activity used to enhance mood and cognition, it would be pertinent to investigate how long these effects can last. There is some research that suggests they last up to 2.5 h for longer durations of exercise (Blanchette, Ramocki, O'del, & Casey, 2005). However, no research to date has examined if and when these effects diminish (2.5 h is the longest duration tested), hence more investigation is needed to understand the full temporal extent of these findings.

In addition, though this study focuses on non-clinical participants, the possible implications of these findings for clinical populations are important. The findings presented here could offer support to DMT, since they suggest that as little as 5 min of dance can offer at least momentary elevations in mood and lessen fatigue. Such effects could offer a window of symptom alleviation in which therapeutic techniques may be better learned and received. In addition, the increase in creativity/divergent thinking found after listening to music may also create a break in ruminative thinking and allow clients to think more broadly, again offering a period of receptiveness to other forms of therapy (Teasdale, Segal, & Williams, 1995). It must be noted that this study did not follow any DMT or music therapy instruction and it would be advantageous to investigate whether particular types of dance, has different effects as well as varying the genre, style and tempo of the music.

Furthermore, as this is a preliminary investigation, the results are offered tentatively to highlight areas for further exploration and the findings must be considered within their limitations. First, the sample was predominantly young and female and it is quite possible that a different and larger cohort may have yielded different results. What is more, though there were no differences in physiological arousal between the dance and cycling conditions, the quality of the movement in these activities is notably different. That is, dance allows freedom to move and uses the whole body while cycling is much more restrictive. Moreover, dancing marries music and movement while cyclists were asked to cycle independently of the music. It is possible, then, that this instruction could have impacted the results and could offer an alternative explanation as to why such different effects were found between the dance, music and cycling conditions. Nevertheless, as people tend to implicitly follow the beat of the music they are listening to when exercising (Waterhouse, Hudson, & Edwards, 2010), it is highly likely that they also did so in this study, although, this needs to be empirically investigated. In addition, in future work, it would be important to isolate the effects of physical movement and music by including conditions where participants dance and cycle or engage in other physical activities without music.

In conclusion, this study has, for the first time, examined the effect of short duration engagement in dance on affect and divergent thinking abilities, in comparison to exposure to either music or exercise, in a young non-clinical population. Dancing significantly increased positive affect and decreased negative affect and feelings of fatigue. Similarly to dancing, listening to music was also very effective in increasing emotional well-being and divergent thinking abilities. Notably, while both dancing and listening to music increased emotional well-being, they had dissociable effects on different aspects of divergent thinking, with greater change in positive affect being associated with greater enhancement in measures of verbal and non-verbal creativity, respectively. Together, these findings highlight an area for further research into the potential use of two different types of approaches, dancing as well as listening to music, in helping to enhance positive affect, decrease negative affect and reduce fatigue in both clinical and non-clinical settings.

Supplemental data

Supplemental data for this article can be accessed here: http://dx.doi.10.1080/17439760.2013.848376.

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