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SHORT COMMUNICATION

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Viewing the outdoors during indoor walking may yield no additional exercise-induced affective benefit

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ABSTRACT

Objective: We examined the experimental effects of two different indoor environmental conditions [blinds up (visible view of the outdoors) or blinds down] during an acute bout of walking on participants' affect.

Methods: Participants (*N* = 30, mean age = 20.5 years) completed a 15 minutes walking bout on two different days—one when participants walked in front of windows with a view of the outdoors (including natural sights such as trees, flowers, etc.) and one when participants walked in front of the same windows with the blinds down and no outside view. We counterbalanced the order of these conditions, and treadmill speed was matched across the two visits.

Results: There were no significant differences in affect change scores (post walk–baseline) between outdoor view and no outdoor view conditions. Both acute bouts of walking demonstrated positive affective changes.

Conclusion: While this slight modification to the environment did not appear to alter exercise-induced hedonic responses during moderate-intensity walking, future research should continue to investigate any effects of other modifications and the extent to which biological, psychological, and/or environmental mechanisms may or may not interact.

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Affect; environment; exercise psychology; physical activity; walking

Introduction

Among various factors that may influence an individual's likelihood of adhering to an exercise program, personal affective/hedonic responses to exercise can be important. In a 2015 review, Rhodes and Kates highlighted the powerful role of exercise-related affect in modulating motivation for future exercise behaviors. Thus, exercise interventions should elicit positive affect.

Notable factors that have been shown to influence the affective experience during a bout of exercise include such direct characteristics of the exercise as intensity [1] and modality [2]. Other factors have included physiological agents such as opioids [3] and endocannabinoids [4], psychological factors such as self-efficacy [5], and such environmental factors as listening to music [6] and location of exercise [7]. Of particular relevance to the current study, previous work has demonstrated differential levels of treadmill exercise enjoyment from exercising indoors *vs*. outdoors, with greater enjoyment, mood enhancing benefit, and fondness for the exercise associated with outdoor environments [7].

A systematic review [8] on outdoor environments and psychological well-being suggests an overall beneficial effect of exercising outdoors in a natural environment, often elevated beyond exercising indoors, but ultimately concluded that there is a lack of high quality evidence and a need for further investigation. Previous work evaluating "restorative natural environments" has shown their ability to reduce stress, for example [9]. Notably, a restorative natural environment may simply be a window with an outdoor view to a garden [10]. The experimental study detailed in this brief report was interested in

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examining the extent to which having an outdoor view during a bout of indoor treadmill-based exercise may modulate affective responses to exercise. We hypothesized that affective responses to exercise would be more favorable during exercise with a view of the outdoor environment.

Methods

Study design and participants

Participant demographic characteristics are contained within Table 1. Thirty participants (mean age = 20.5 years) were recruited via convenience-based sampling methods. Participants were excluded from the study if they: 1) were not within the target age range (18–53 years), 2) exercised within 5 hours of either visit time, consumed caffeine within 3 hours of either visit, ate within 1 hour of coming into the laboratory, or reported greatly disliking walking on a treadmill (i.e., reported a score of 8 or higher in response to the following statement "I dislike walking on a treadmill," with response options ranging from "strongly disagree" [1] to "strongly agree" [10]). During the first visit (Visit 1), after assessing demographic variables (e.g., age, race/ethnicity), participants put on a Polar heart rate monitor and rested for 2 minutes. Participants' resting heart rate and blood pressure (for safety reasons) were assessed. Subsequently, participants provided their baseline affect scores [feeling scale (FS), felt arousal scale (FAS), and affective circumplex]. Upon completion of the aforementioned surveys, participants began their 15 minute walk. Affective valence (FS) and arousal (FAS) were assessed half-way through the walk, as were heart rate and rating of perceived exertion (RPE). Heart rate was measured during the final minute of the walk, and all affect measures were re-assessed following exercise. Participants came back into the lab after approximately 7 days to complete the same walking bout. Participants walked at the same speed as they had walked during the first visit. In order to control for as many confounding factors as possible, participants were also asked to obtain the same amount of sleep the night before the visit, to eat food/drink caffeine about the same amount of time before Visit 2 as they had during Visit 1 (e.g., if they had abstained from caffeine consumption on the day of Visit 1, we asked them to abstain also on the day of Visit 2), and to wear the same/similar clothing as Visit 1 (e.g., long sleeves *vs*. short sleeves, hair up *vs*. hair down). Laboratory temperature was recorded during each visit and was not significantly different between visits (*P* = 0.16). The order of the experimental condition (blinds up or blinds down) was counterbalanced; 15 participants were randomly assigned to exercise with blinds up at Visit 1 and blinds down at Visit 2 (Group 1); similarly, 15 participants were randomly assigned to exercise with blinds down during Visit 1 and blinds up during Visit 2 (Group 2).

Table 1. Demographic characteristics of the analyzed sample (N = 30).

Variable	Visit 1	Visit 2	*P*-value$^{\Psi}$
Age, mean years	20.5 (1.9)	–	–
Gender, % male	20.0	–	–
Race, %			
Mexican American	0	–	–
Other Hispanic	0	–	–
Non-Hispanic White	40.0	–	–
Non-Hispanic Black	60.0	–	–
Other	–	–	–
BMI, mean kg/m^2	26.5 (7.2)	–	–
MVPA, mean minute/week	199.5 (195.8)	–	–
Exercise regularly, %	70.0	–	–
Dislike treadmill exercise, mean	3.9 (2.3)	–	–
Last meal, mean hours	3.6 (3.1)	3.3 (3.0)	0.64
Hunger, mean	2.0 (1.3)	1.8 (1.0)	0.46
Sleep, mean hours	7.0 (1.9)	7.5 (1.6)	0.13
Heart rate, mean			
Resting	89.8 (15.2)	89.3 (17.5)	0.89
7 minutes	121.1 (19.9)	123.2 (21.5)	0.56
14 minutes	128.7 (21.7)	126.0 (19.0)	0.44
Final heart rate	95.5 (20.4)	97.0 (16.7)	0.69
RPE, mean	9.9 (1.9)	9.6 (1.8)	0.38
Speed, mean mph	3.4 (0.3)	3.4 (0.3)	0.33

Ψ = *P*-value calculated based on paired *t*-tests comparing Visit 1 *vs*. Visit 2; BMI = measured body mass index; Dislike treadmill exercise = average score on the statement "I dislike exercising on a treadmill" with response options ranging from 1 (strongly disagree) to 10 (strongly agree); Exercise regularly = percentage of the sample who indicated that they regularly (weekly) engage in exercise; Hunger = response to the question, "How hungry are you right now?" with response options ranging from 1 (not at all) to 5 (extremely); Last meal = number of hours since last food consumption; MVPA = average weekly moderate-to-vigorous physical activity minutes; RPE = rating of perceived exertion; scored on a Borg standard 6–20 scale; and Sleep = average hours of sleep from the night before.

Walking protocol

Participants walked for 15 minutes at a steady pace. Participants were instructed to self-select a brisk pace at or above 3 mph that they would use if they were walking to a class or a meeting and trying to avoid being late. The treadmill is stationed in the corner of the laboratory, approximately two

Table 2. Visit 1 and Visit 2 baseline & post affect measures.

Affect measures	Time points					
	Baseline			Post		
	Visit 1	Visit 2	*P*-value	Visit 1	Visit 2	*P*-value
FS[b]	2.9 (1.7)	2.6 (1.5)	0.58	3.3 (1.6)	3.2 (1.3)	0.85
FAS[a,b]	2.8 (1.1)	2.3 (1.2)	0.07	3.4 (1.3)	3.2 (1.1)	0.51
C Happy	67.6 (22.1)	59.5 (26.4)	0.13	65.2 (26.5)	62.6 (27.0)	0.63
C Excited[a,b]	47.7 (23.7)	47.3 (26.0)	0.93	59.1 (25.2)	55.7 (25.2)	0.44
C Content	72.4 (22.2)	70.3 (23.1)	0.62	68.9 (24.8)	68.0 (23.4)	0.84
C Sad[a]	9.7 (15.9)	8.7 (11.9)	0.72	6.1 (11.9)	5.0 (7.9)	0.57
C Angry	3.9 (9.8)	3.8 (6.7)	0.96	3.9 (9.0)	2.4 (4.2)	0.21
C Anxious[a]	28.6 (31.6)	18.9 (22.7)	0.11	21.6 (27.1)	16.2 (20.9)	0.32
C Tense	23.8 (27.3)	19.9 (22.3)	0.35	20.7 (23.5)	14.2 (21.1)	0.16
C Fatigued	26.4 (29.1)	19.5 (24.4)	0.21	26.3 (22.6)	21.9 (22.5)	0.24

φ =*P*-value calculated based on paired *t*-tests comparing baseline Visit 1 *vs*. Visit 2; ϕ = *P*-value calculated based on paired *t*-tests comparing post-walk Visit 1 *vs*. Visit 2; a = significant differences baseline *vs*. post during Visit 1 ($P < 0.05$); b = significant differences baseline *vs*. post during Visit 2 ($P < 0.05$); and C = circumplex.

feet from a large window that takes up the majority of the wall that the treadmill is facing. During the blinds up protocol, participants had a view of a natural environment outside, including grass, trees, flowers, etc. During the blinds down protocol, all blinds on the windows were lowered completely and angled, so that there was no (or very limited) visibility possible for participants to see out the window. Additionally, we evaluated weather conditions (sunny, partly cloudy, cloudy, and rainy).

Assessment of affect

As implemented elsewhere [11], the hedonic valence component of affect was assessed via an affective circumplex scale. Participants were asked to rate how much they feel each of nine emotions (e.g., content, sad, and angry), in the present moment, on a 1–100 rating scale. The FS [12] is an 11-point bipolar scale of pleasure and displeasure that ranges from −5 to 5. Anchor values are present at 0 = "neutral" as well as odd integers, ranging from −5 = "very bad" to 5 = "very good." The FAS, part of the Telic State Measure [13], is a six-point single-item rating scale ranging from 1 to 6, with anchors at 1 = "low arousal" and 6 = "high arousal."

Statistical analysis

Analysis was computed using Stata software (version 12.1). Paired *t*-tests were completed to assess differences in affect from baseline to post walk within each visit, differences in baseline affect for the two visits, differences in post-walk affect for the two visits, and affect change scores (post walk–baseline) between visits. Similar results were obtained when employing a 2 (pre/post) × 2 (condition; blinds up vs. blinds down) ANOVA. Statistical significance was set at $\alpha = 0.05$.

Results

Sample characteristics

Descriptive characteristics of the study sample are displayed in Table 1. Briefly, the mean (standard deviation) age of the group was 20.5 years (1.9), males constituted 20% of the sample, the race/ethnicity profile of the sample was 40% Non-Hispanic white and 60% Non-Hispanic black, the mean body mass index (BMI) was 26.5 kg/m^2 (7.2), and the mean moderate-to-vigorous physical activity minutes/week was 199.5 (195.8). There were no differences in Visit 1 *vs*. Visit 2 levels of desire to eat, hunger, and hours of sleep from the previous night. Though not shown in Table 1, there were no observed differences in weather conditions between Visit 1 and Visit 2 ($P = 0.13$), or time of day ($P = 0.09$). The mean number of days between Visit 1 and Visit 2 was 6.8 (1.0).

Main outcomes

A comparison of baseline and post-walk measurements during Visit 1 and Visit 2 is located in Table 2. There were no significant differences between baseline affect during Visit 1 and baseline affect during Visit 2. Similarly, there were no significant differences between post-walk affect during Visit 1 or post-walk affect during Visit 2. When evaluating the change of baseline *vs*. post-walk affect for Visit 1, significant differences were observed for FAS ($P = 0.03$), circumplex excited ($P = 0.002$), circumplex sadness ($P = 0.03$), and circumplex anxiousness

(P = 0.01); specifically, arousal (FAS) and excitement elevated, whereas sadness and anxiousness decreased. For Visit 2, arousal (P < 0.001), feelings of pleasantness (FS; P < 0.001), and circumplex excitement (P = 0.007) were all significantly different (favorable change) between baseline and post walk; notably, all three increased from baseline to post walk. As shown in Table 3, there were no significant differences in affect change scores (post walk–baseline) between the Visit 1 and Visit 2 when considering any of the affect measures. When examining the post walk minus baseline change scores for Visits 1 and 2, separated by group, results were unchanged. We additionally examined whether affect change scores calculated between baseline and mid-walk yielded any significant effects; the findings remained unchanged (results are not shown).

Discussion

Exercise environment has been shown to alter the enjoyment of exercise [7], which is of important consideration because the affective response to exercise plays a key role shaping exercise behaviors [14–16]. Additionally, exercise environment may influence psychological outcomes associated with an exercise bout. For example, there is some evidence to suggest that walking outdoors may enhance mood to a greater extent than walking indoors [17]. There is also evidence that simply viewing a natural outdoor environment may attenuate stress levels [9]. No previous study, to our knowledge, has investigated whether affective response to indoor treadmill walking may be altered by having a view of an outdoor natural environment. The present study aimed to investigate this important inquiry, as this could have important implications for gyms, for example (described below). Contrary to our initial hypothesis, we did not observe any differences in affect when comparing the two environmental conditions/exercise bouts.

The implications for this study may provide beneficial for exercise psychologists. When studying a perception-based psychological outcome, researchers are tasked with trying to control as many factors as possible that may, in any way, influence the participants' mood, affect, etc. The findings of this study suggest that having a natural outdoor environment view does not alter the affective response to a brisk walk. These findings may mitigate concerns of this factor potentially confounding study results (e.g., a study utilizing multiple lab spaces, one with a window and one without a window). More relevant to the general population, it is commonplace to see cardio training equipment facing a window in recreation facilities, perhaps in part due to the thought (by gym staff responsible for equipment/floor layout) that placement may enhance enjoyment of cardio exercise. The current findings would suggest, however, that treadmill placement may not matter substantively.

This study was conducted among relatively active, young adults. As such, the findings may not generalize to other age groups or individuals who are less active. Additional limitations include the relatively small sample size and only assessing the exercise-related affective response to each condition once. This study is strengthened by utilizing multiple assessments of affect (i.e., dimensional and distinct) and a within-subject study design, allowing participants to serve as their own control. While biological, psychological, and environmental factors may all impact the hedonic responses to exercise,

Table 3. Visit 1 and Visit 2 change scores: overall and separated by group.

Affect measures	Change score								
	Post—Baseline			Group 1 Post—Baseline			Group 2 Post—Baseline		
	Visit 1	Visit 2	*P*-value	Visit 1 (blinds up)	Visit 2 (blinds down)	*P*-value	Visit 1 (blinds down)	Visit 2 (blinds up)	*P*-value
FS	0.4 (1.2)	0.6 (0.8)	0.55	0.1 (1.0)	0.4 (0.9)	0.47	0.6 (1.4)	0.7 (0.8)	0.88
FAS	0.6 (1.5)	0.9 (1.1)	0.31	0.8 (1.4)	0.9 (1.3)	0.88	0.4 (1.5)	0.9 (1.0)	0.18
C Happy	−2.4 (19.4)	3.1 (10.1)	0.18	−5.6 (26.1)	5.2 (11.9)	0.20	0.4 (10.8)	1.3 (8.2)	0.74
C Excited	11.5 (18.9)	8.4 (16.0)	0.38	9.8 (16.2)	7.6 (15.3)	0.64	12.9 (21.4)	9.1 (17.0)	0.48
C Content	−3.6 (16.2)	−2.3 (13.9)	0.70	−4.0 (10.0)	−3.6 (17.2)	0.90	−3.2 (20.5)	−1.3 (9.3)	0.71
C Sad	−3.5 (8.3)	−3.6 (10.3)	0.96	−1.1 (3.5)	−2.1 (8.4)	0.68	−5.7 (10.6)	−5.0 (11.8)	0.80
C Angry	0.0 (2.4)	−1.4 (4.7)	0.06	0.1 (0.5)	−0.4 (2.5)	0.36	−0.1 (3.3)	−2.2 (5.9)	0.11
C Anxious	−7.0 (13.9)	−2.7 (10.8)	0.21	−6.1 (8.8)	−2.1 (14.8)	0.41	−7.8 (17.0)	−3.25 (5.9)	0.37
C Tense	−3.1 (19.5)	−5.7 (18.2)	0.51	−5.1 (11.9)	0.5 (13.4)	0.23	−1.3 (24.6)	11.2 (20.3)	0.11
C Fatigued	−0.1 (17.5)	2.4 (13.9)	0.49	4.2 (15.6)	5.1 (19.2)	0.88	−3.9 (18.6)	0.0 (6.4)	0.43

C = circumplex.

it is difficult to disentangle these influences. This should be a priority, because knowing which factors may contribute to the greatest extent could guide exercise prescription aimed at maximizing positive affective state. This study contributes valuable insights regarding the role of exercise environment, suggesting that having a visible natural outdoor environment may not be a significant driving factor of hedonic experience. Future studies could focus on observing affective responses between altering environmental aspects or altering psychological aspects related to exercise (e.g., implementing four conditions: exercising outdoors, exercising indoors, exercising indoors with researchers targeting self-efficacy awareness/improvements, and exercising indoors without researchers targeting self-efficacy improvements). Similarly, future work could study the influences of hypothesized biological mechanisms in relation to experimental manipulations of the environmental/psychological mechanisms. Lastly, work in this area would benefit by exploring other durations of exercise and whether, for example, demographic characteristics may moderate the exercise environment-affect relationship.

Disclosure of potential conflicts of interest

We declare no conflicts of interest and no funding was used to prepare this manuscript.

Research involving human participants

All study procedures were approved by the authors' institutional review board.

Informed consent

All participants provided written informed consent.

References

[1] Parfitt G, Hughes S. The exercise intensity-affect relationship: evidence and implications for exercise behavior. J Exerc Sci Fit 2009; 7(2):S34–41.

[2] Parfitt G, Gledhill C. The effect of choice of exercise mode on psychological responses. Psychol Sport Exerc 2004; 5(2):111–7.

[3] Dishman RK, O'Connor PJ. Lessions in neurobiology: the case of endorphins. Mental Health Phys Act 2009; 2:4–9.

[4] Dietrich A, McDaniel WF. Endocannabinoids and exercise. Br J Sports Med 2004; 38(5):536–41.

[5] McAuley E, Blissmer B. Self-efficacy determinants and consequences of physical activity. Exerc Sport Sci Rev 2000; 28(2):85–8.

[6] Calik-Kutukcu E, Saglam M, Vardar-Yagli N, Cakmak A, Inal-Ince D, Bozdemir-Ozel C, et al. Listening to motivational music while walking elicits more positive affective response in patients with cystic fibrosis. Complement Ther Clin Pract 2016; 23:52–8.

[7] Plante TG, Gores C, Brecht C, Carrow J, Imbs A, Willemsen E. Does exercise environment enhance the psychological benefits of exercise for women? Int J Stress Manage 2007; 14(1):88–98.

[8] Coon JT, Boddy K, Stein K, Whear R, Barton J, Depledge MH. Does participating in physical activity in outdoor natural environments have a greater efefct on physical and mental wellbeing than physical activity indoors? A systematic review. Environ Sci Technol 2011; 45:1761–72.

[9] Kaplan R. The nature of the view from home. J Environ Behav 2001; 33:507–42.

[10] Depledge MH, Stone RJ, Bird WJ. Can natural and virtual environments be used to promote improved human health and wellbeing? Environ Sci Technol 2011; 45(11):4660–5.

[11] Bernstein EE, McNally RJ. Acute aerobic exercise helps overcome emotion regulation deficits. Cogn Emot. 2017; 31(4):834–43.

[12] Hardy CJ, Rejeski WJ. Not what, but how one feels: The measurement of affect during exercise. J Sport Exerc Psychol 1989; 11:304–17.

[13] Svebak S, Murgatroyd S. Metamotivational dominance: a multimethod validation of reversal theory constructs. J Pers Soc Psychol 1985; 48:107–16.

[14] Edwards MK, Addoh O, Herod SM, Rhodes RE, Loprinzi PD. A conceptual neurocognitive affect-related model for the promotion of exercise among obese adults. Curr Obes Rep 2017; 6(1):86–92.

[15] Rhodes RE, Kates A. Can the affective response to exercise predict future motives and physical activity behavior? A systematic review of published evidence. Ann Behav Med 2015; 49(5):715–31.

[16] Rhodes RE, Quinlan A. Predictors of physical activity change among adults using observational designs. Sports Med 2015; 45(3):423–41.

[17] Harte JL, Eifert GH. The effects of running, environment, and attentional focus on athletes' catecholamine and cortisol levels and mood. Psychophysiology 1995; 32(1):49–54.