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Can Environment be a Motivator for Exercise?

The Effect of Visual Suggestion on Exercise[1]

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Summary. Theories of suggestion and motivation were used to examine if college students exercising in an environment with low or high motivation posters would affect mood, perceived exertion, and exercise workload (i.e., RPM and speed). A total of 134 students (62 males, 72 females) were randomly assigned to one of three conditions while exercising: relaxing posters (i.e., tropical nature), motivational posters (i.e., competitive bikers), or no posters (i.e., control). Participants completed 20 minutes of exercise at their own pace. Measures of mood were taken immediately prior to and following exercise. Exercise workload was recorded throughout. Results indicate that participants in the relaxing condition experienced higher levels of tension than those in the other two conditions. Participants in the motivational condition reported higher levels of relaxation. A consistency bias may have made participants uncomfortable in an exercise environment with relaxing images that are inconsistent with a typical exercise atmosphere.

Researchers have validated the claim that exercise is good for us (Centers for Disease Control and Prevention [CDC], 2011a; 2011b; Fletcher, Balady, Blair, Blumenthal, Caspersen, Chaitman, et al., 1996; Harvard School of Public Health, 2012; United States Department of Health and Human Services, 2011); it provides substantial physical and psychological health benefits including reduced risks for cardiovascular disease, hypertension, diabetes, cancer and obesity, as well as decreased levels of depression, anxiety and stress (CDC, 2011a; CDC, 2011c; Fletcher et al., 1996, Harvard School of Public Health, 2012, United States Department of Health and Human Services, 2011). According to the Center for Disease Control (2011a) the recommended amount of physical exercise includes 150 minutes of moderately intense aerobic activity (i.e., brisk walking) each week as well as strength training two days per week. As suggested by the CDC (2011a), ten minutes of walking three times a day for five days will give one the allotted 150 minutes as well as the significant health benefits associated with being physically active.

Despite the abundance of research that emphasizes the importance of regular exercise, 37 percent of Americans have insufficient amounts of physical activity, and 25 percent of Americans do not exercise at all (CDC, 2011c). There are many barriers that may discourage people from exercising including time and financial constraints, lack of energy, interest, motivation, and enjoyment. According to Kosteva, Salata, Krishnan, Howe, Weber, Rubenfire, et al., (2012), the most common barriers to physical activity include busy work schedules, family commitments, cost, reconditioning from prior experience with exercise, and lack of access to facilities. It is important to be mindful of personal factors that may become potential obstacles

of physical activity in order to encourage exercise behavior and thus improve health and well being.

Clearly, much research has been conducted in the area of physical exercise and its potential benefits. Yet there is a lack of research assessing how the social environment influences one's motivation or drive to participate in physical activity. Utilizing examples from advertising and marketing, unconscious priming based on visual suggestion along with social comparison theory has been demonstrated to be a useful way to evaluate one's motivation for exercise (Bargh, Chen, & Burrows, 1996; Johnson & Stapel, 2007; Moore, 1982; Richins, 1991; Veltkamp, Custers, & Aarts, 2011). According to Bargh et al. (1996), unconscious priming refers to the "incidental activation of knowledge structures, such as trait concepts and stereotypes, by the current situational context" (p. 230). In other words, environmental cues can unknowingly influence one's behavior.

The clearest examples of unconscious priming stem from advertising and marketing campaigns that encourage audiences to purchase products. According to some researchers, participants are presented with visual stimuli that may act as retrieval cues triggering conscious and subconscious cognitive processes. The cognitive processes allow individuals to draw connections and attach meaning to the advertisements that aid the decision whether or not to purchase products; the advertisements themselves do not hold any meaning. It is the active audience that associates the advertisements with personal intuition, constructing specific links that can potentially influence purchasing behavior (Moore, 1982).

The social comparison theory is also considered in advertising and marketing. Festinger's (1954) study states the following about the social comparison theory:

> There exists, in the human organism, a drive to evaluate his opinions and his abilities…to the extent that objective, non-social means are not available, people evaluate their opinions and abilities by comparison respectively with the opinions and abilities of others (p. 117-118).

Social comparison theory can be exemplified through person-to-person interaction. In the presence of others, individuals often feel the need to directly compare himself/herself to those around. This theory can also be applied to individuals in the presence of two-dimensional representations of individuals including posters and advertisements.

In a study by Johnson et al. (2007) results showed that individuals faced with upward social comparisons and threats to self-regard respond to that threat by increasing their performance. Participants were exposed to different comparison targets that were either extremely or moderately successful such as popular students with many friends. They found that the subjects who were exposed to the extremely successful comparison targets increased their performance on a self-evaluative questionnaire. They found that when participants were presented to less attainable targets, self-evaluations decreased. Thus comparing oneself to others who are better at certain tasks will force one to increase performance in order to protect their self-evaluation.

Past research has also demonstrated that social comparison theory can explain how exercising with another individual can alter exercise exertion, enjoyment, and various psychological and mood outcomes suggesting that the perceived fitness of a stranger exercising nearby can have a significant impact on one's exercise exertion (Plante, Madden, Mann, Lee, Hardesty, Gable, et al., 2010). Exercising in the presence of someone perceived as physically fit resulted in higher exertion and exercising alongside someone perceived as low fit resulted in less

exertion. Exercisers tend to compare themselves to others and mirror the exercise behavior of those around them. In addition, exercise environment has also been proven to affect mood outcomes (Plante, Gustafson, Brecht, Imberi, & Sanchez, 2011). Whether it is indoor or outdoor, with a friend or without, and with or without music, these environmental factors have the ability to change one's energy, enjoyment, tiredness, and calmness levels while exercising.

Richins (1991) used social comparison from the media to examine idealized images in advertising and the effects these images have on consumers. By gathering ads portraying these social ideals, Richins found that visual advertisements generate a sense of social comparison which leads to an increased desire to look or feel more like the people portrayed in the advertisements. The ads acted as forms of visual suggestion purposely motivating viewers to buy their product in order to look like the idealized images portrayed.

The current study seeks to further explore the effects of visual suggestion and priming in one's physical environment and the effects it has on one's motivation to and benefits from exercise measured by physical and psychological outcomes. We hypothesized that those participants exercising in a motivating condition marked by a poster of Lance Armstrong, a professional United States cyclist and heroic cancer survivor, and a female counterpart, would increase one's motivation to exercise. On the other hand, participants in the highly relaxing condition marked by tropical landscape posters would decrease one's motivation to exercise. It is also suspected that level of motivation through visual suggestion would influence the participant's enjoyment, relaxation, and tension levels. Those in the relaxing, less motivating condition are predicted to feel more relaxed, more enjoyment, and less tension in comparison with the highly motivating group. Consistent with social comparison theory, participants would

exercise harder when exercising with a motivating poster of a well known cyclist and report feeling more tense, less relaxed, and lower enjoyment scores when exercising as well.

Method

Participants

The sample consisted of 134 undergraduate students at a private university in California (M = 18.84 years, SD = 1.52 years). Both males and females participated in this study (62 male, 72 female). These participants had enrolled in a general psychology course at the university and were receiving credit for their research participation. The project met university research requirements and was approved by the human subjects committee.

Measures

Activation-Deactivation Adjective Check List (AD-ACL). This frequently used questionnaire is a brief self-report checklist used to measure immediate mood states (i.e., tension, energy, tired, calm) in association with exercise (Kosteva et al., 2012; Thayer, 1978; Thayer, 1986). The AD-ACL has been used in a number of exercise studies, and has adequate test-retest reliability (r = 0.8 or higher).

Multiple Likert scales. Several 10-point Likert scales measured participants' relaxation level (pretest and posttest; 1 = stressed, 10 = relaxed), enjoyment level (posttest only; 1= no enjoyment, 10 = much enjoyment), and perceived physical exertion (posttest only; 1 = no exertion, 10 = much exertion). Participants also answered quantitative questions regarding current fitness and exercise routine, perception of physical fitness, level of stress and coping, and global assessment of the self (all measured in a posttest). A number of different studies have used these scales to assess environment, mood, and exercise (Plante, Coscarelli, & Ford, 2001; Plante et al., 2010; Plante et al., 2011).

Borg Ratings of Perceived Exertion. Based on a 14-point scale (6 = no exertion, 20 = maximal exertion), this measurement requires a participant to rate his or her level of exercise exertion after completion of the exercise period. Several studies have assessed the Borg RPE and found it to be reliable, valid, and easy to administer and complete (Borg & Kaijser, 2006; CDC 2011b; Robertson, Goss & Metz, 1998).

Procedures

The researchers randomly assigned participants to one of three categories based on the setting of the exercise environment. In the first condition ("motivating"), participants saw two posters of athletic bikers, one male and one female (see Figure 1). In another condition, ("relaxing") participants viewed two calming nature posters (see Figure 2). In both of these conditions, the research assistant hung the posters on the wall in front of the exercise bike before the participant entered the room. The final condition was a control group in which participants saw no posters. Instead, they faced a blank wall when biking.

[Insert Figures 1 and 2 about here]

Prior to conducting the experiment, the researchers conducted a manipulation check to ensure the posters suggested the desired emotion. For the high motivation posters, assistants asked students to rate how motivating they deemed the pictures (1 = not motivating, 10 = very motivating). For the low motivation posters, assistants asked students to rate how relaxing they deemed the pictures (1 = not relaxing, 10 = very relaxing). The manipulation was successful with significant differences between the two poster sets (p's < .05).

Students viewed the available studies at the university and could choose to participate in this experiment for course credit. When enrolling online, an overview of the experimental procedure informed participants that they would be engaging in brief exercise and should wear

comfortable clothing. The experiment was conducted in a laboratory setting. A research assistant brought the participants into the lab and instructed them to first fill out consent forms, acknowledging that the participants could decline to partake in the experiment if desired. Next, the research assistant administered the pre-exercise questionnaires for the participants to complete. These questions asked for perceived fitness, exercise routine, global self-assessment, and current mood states. Participants also recorded their age, height, and weight. After the participants completed the forms, the assistant gave them a heart rate monitor (a chest strap and watch) and explained how the monitor was to be worn.

Once this preparation was completed, the assistant asked the participants to get on the exercise bike and pedal at a comfortable pace for 20 minutes. For all three conditions, the assistant recorded the participant's heart rate, revolutions per minute (RPM), and speed every five minutes. At the end of the 20 minutes, participants finished their biking and took a short posttest (AD-ACL for mood measures and various Likert scales for relaxation, enjoyment, and exertion). In addition, the participants indicated their perceived level of exertion based on the Borg scale. Participants received a debriefing about the general purpose of the study but were asked to keep the information confidential to avoid interference with later students' participation in the study. Each participant who partook in the experiment received class credit.

Analysis

First, a manipulation check was conducted prior to beginning the experiment to ensure the posters provoked a notion of either high or low motivation. The manipulation was successful with a mean of 7.00 (SD = 1.99) for the high motivation posters in which a score of 10 equaled the most motivating, and with a mean of 7.59 (SD = 1.35) for the low motivation posters in which a score of 10 equaled the most relaxing.

To analyze the data gathered from the experiment, a 2 (Gender) x 3 (Condition) Analysis of Covariance (ANCOVA) was used with the post-test scores as the dependent measure and the pre-test scores as the covariate. The condition effect was followed by comparing each condition with the others using the Tukey HSD test at the .05 level.

A similar Analysis of Covariance was performed on the tension post-test scores, with tension pre-test scores as covariates. The condition effect was followed by comparing each condition with the others using the Tukey HSD test at the .05 level.

Results

Mood scores are summarized in Table 1, and physiological measurements are summarized in Table 2.

[Insert Tables 1 and 2 about here]

Results showed a significant main effect for condition on level of relaxation (F (2, 131) = 5.19, $p < .01$). Participants in the motivating condition had higher relaxation scores than participants in both the relaxing and control conditions.

In addition, results indicated a main effect for condition on level of tension [F (2, 131) = 4.39, $p < .05$], as well as a main effect for gender on level of tension, [F (1, 132) = 4.39, $p < .05$ (see Table 3b)]. These results demonstrated that participants in the relaxing and control condition reported higher levels of tension than those in the motivating condition; females reported higher levels of tension than males in all conditions. No main effects or interaction effects were found when analyzing the remaining mood conditions by the same methods (all *p's* > .05). These included energy level, calmness, tiredness, and enjoyment [F (2, 131) = 1.00, *ns*, F (2, 131) = 1.26, *ns*, F (2, 131) = 0.96, *ns*, F (2, 131) = 0.95, *ns*].

For the physiological data, the measurements were analyzed using baseline measures as a covariate by gender and condition for each of the four assessment time points (five, ten, fifteen, and twenty minutes). Regardless of condition and at all recorded time points, males experienced higher bike speed levels and higher rotations per minute (RPM) than females, with all p's < .05. Similarly, females experienced higher heart rates than males (p's < .05) at all time points regardless of condition. No condition or interaction effects were found for this physiological data, suggesting the significant main effects were due to natural biological differences between males and females.

Lastly, zero-order correlations were used to analyze associations among the various mood measures. Significant results were found for tired level at baseline correlating with enjoyment level, (r = -0.18, p < .05), indicating that participants with higher tired scores before exercising enjoyed the exercise experience less. Additionally, results obtained for exercise exertion correlated with enjoyment level (r = 0.20, p < .05) indicating that participants who had higher exercise exertion scores also reported greater enjoyment of the experience.

Discussion

The purpose of the present study was to examine how social comparison theory and priming effects could influence mood and exertion when exercising with visually suggesting posters of relaxation, motivation, or without any suggestive posters. The study also assessed whether gender moderated any differences when biking with the different motivational posters. Overall, our results indicated that mood after exercise was influenced by the presence of the type of poster presented during the experiment yet in directions we did not expect to find.

Inconsistent with previous research suggesting that exercise exertion and mood may be driven by the motivation to be compared with idealized images in the environment (Johnson &

Stapel, 2007; Richins, 1991; Veltkamp, Custers, & Aarts, 2011), the current study found that both males and females reported the most relaxation after they exercised with highly motivating posters such as Lance Armstrong and reported the most tension while exercising in the presence of tropical landscapes that suggest calming effects. Prior studies suggested that comparing one's self to unrealistic or socially desirable target images lead to self-doubt, self-evaluation dissatisfaction, and increased tension, but our current findings contradict this notion found in previous research. Participants reported more tension and less relaxation in the relaxing condition viewing tropical landscapes.

It was initially hypothesized that comparisons to Lance Armstrong would increase tension because of social comparison as well as increase exercise exertion because Lance Armstrong is a motivating figure and successful athlete. Also research has found that when working out with others, people tend to compare themselves to others and increase or decrease their performance in order to imitate their comparison target (Plante et al., 2010). In the case of Lance Armstrong, it was expected that participants would increase their exercise exertion in the highly motivating condition to match his high level of performance.

Surprisingly, the current study found no differences in exertion based experimental conditions, which is inconsistent with prior research (Veltkamp, Custers, & Aarts, 2011). Their research suggests that primed goals like Lance Armstrong's physique and strength have the potential to affect motivation unconsciously because these goals are thought of as desirable. If this was the case, it was expected that those participants exercising in this condition would report greater exercise exertion ratings than the relaxing and control conditions. Yet there were no differences found between these three conditions in our study.

This may indicate that in this setting, social comparison theory is an intrinsic comparison that does not directly impact external behavior. It could also indicate that the priming medium (posters) and visual suggestion were not strong enough to alter behavior. Thus, changes in physiological exertion may be due to other mechanisms rather than social comparison and priming. Another explanation for the results could be the influence of habit formation of exercise. According to Aarts, Paulussen, and Schaalma (1997), habits are formed and behaviors become automatized based on the situational cues presented. In terms of exercise, many participants may have reflected on their past exercise behavior to decide when, why, and how hard to exercise. Only in those cases in which one has little or no previous experience with a particular behavior will he/she look to external cues for additional information to aid the individual to making a decision to exercise and how hard the exertion should be.

The results can possibly be explained by schematization and the consistency bias as well. A schema comprises of one's preexisting notions of objects, people, locations, and so forth based on prior experience (Matlin, 2009). The consistency bias refers to the tendency to exaggerate the consistency between past and present attitudes, beliefs, and feelings (Schacter, 1999). This bias can potentially lead to memory recall usually in favor of current one's current beliefs (Conway & Pleydell-Pearce, 2000).

For the current study, the students participating were generally regular exercisers. Only ten out of the 134 participants reported that they did not work out on a regular basis. They could have easily developed a particular exercise schema or base of knowledge around exercise environment which may be comprised of motivational posters to increase the intensity of one's workout. For those presented with the calming, nature posters, they may have felt somewhat confused because those posters did not fit into their current schema of exercise environment.

One would expect there to be tension when the workout environment is not consistent with one's current schema.

Significant correlations were found between enjoyment, exercise exertion, and mood. Being relaxed was associated with decreased exercise exertion scores. The correlation also suggests that exercise exertion was related to enjoyment. The harder one works out, the more likely they enjoyed it.

Implications of this research suggest that the exercise environment can impact one's mood and inevitably the psychological benefits of exercise. Consistent with the cognitive concept of schematization and consistency bias, individuals perhaps view their workout environment as unchanging. Certain changes in the environment may lead to maladaptive mood changes leading to a suboptimal workout routine. Individuals then may feel more relaxed and less threatened in those conditions that are unchanging and therefore are able to focus on their own exercise behavior. These environmental factors should be considered when shaping an individual's preferred exercise regimen. Thus individuals should be more aware of their personal preference for exercise environment while engaging in aerobic fitness.

There are several important limitations of this study. The participant sample consisted of a generally homogenous population of healthy undergraduate students of a similar age at a private university. The sample was relatively small (n = 134) as well. Furthermore, this experiment was conducted in a laboratory setting, thus the experimental environment may impact participant's mood and exertion.

Future research should further investigate the difference between exercising in a laboratory versus in a more natural environment, such as a gym or outdoors. The context in which individuals exercise may have important implications for adhering to exercise regimens

and maximizing psychological benefits. In addition, alternative exercise behaviors could be explored, such as running, group cardio classes, and weight lifting. Future research should also seek to sample a larger and more heterogeneous population, particularly one with a greater variability in fitness level.

Various types of suggestive media should also be studied as well. For example, people may react differently to more interactive and realistic videos or virtual suggestion. Certain types of media may have the potential to be more influential than others. Instead of using one Lance Armstrong poster, multiple posters could be used for a greater chance of motivating exercise behavior. It would also be interesting to determine if the effect of suggestion would be stronger for those who are sedentary and have little to no previous exercise experience because no former habits or perceptions of exercise have been developed.

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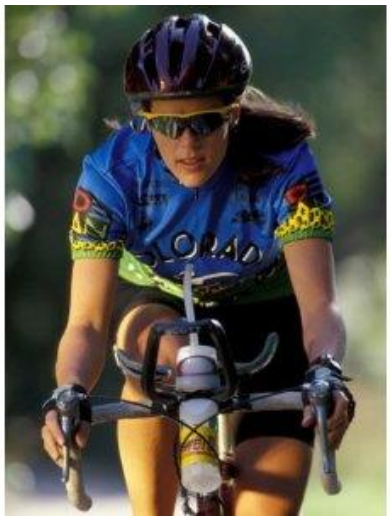
Figure 1: The two motivating posters used in the study.



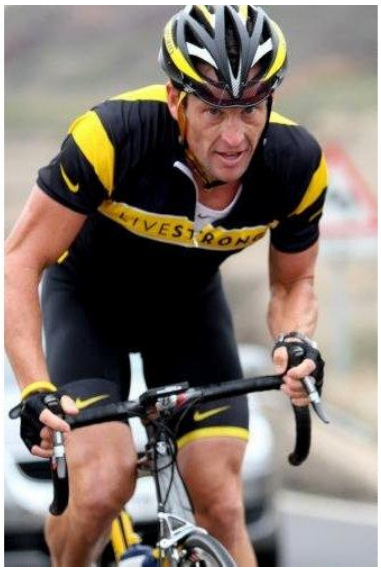
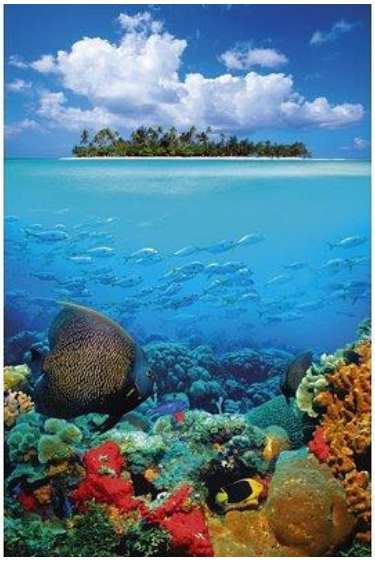


Figure 2: The two relaxing posters used in the study.



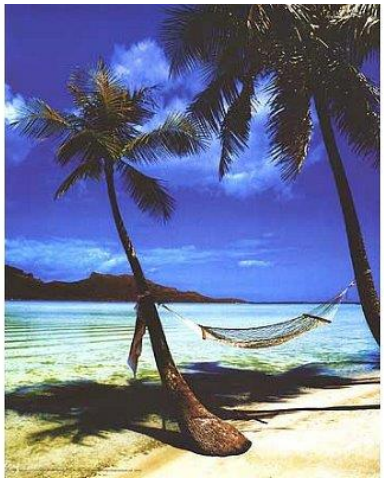


Table 1

Mood Scores

		Motivating		Relaxing		Control	
	Mood	M	SD	M	SD	M	SD
Males	Tense*	8.23	2.47	8.85	2.28	8.80	1.58
	Relax**	7.45	1.47	6.15	1.81	6.80	1.44
	Energy	14.91	3.69	16.00	2.36	13.70	2.75
	Tired	7.41	2.97	6.89	2.04	9.05	3.32
	Calmness	9.95	3.86	8.76	3.31	9.75	2.73
	Enjoyment	6.98	1.71	7.40	1.47	6.60	1.85
Females	Tense*	8.39	2.54	10.32	2.85	9.21	2.48
	Relax**	6.83	1.85	5.60	2.10	6.04	1.81
	Energy	15.39	3.52	14.68	3.30	14.90	2.51
	Tired	8.59	3.33	8.68	2.04	9.08	3.91
	Calmness	8.85	2.83	8.20	2.69	8.83	3.23
	Enjoyment	6.48	2.11	6.76	2.28	6.48	1.58

Note. * $p < .05$, ** $p <. 01$

Table 2

Physiological Output

		Motivating		Relaxing		Control	
	Measure	M	SD	M	SD	M	SD
Males	RPM	65.82	13.73	68.04	11.20	65.14	19.03
	Speed	28.59	5.94	34.19	26.29	36.93	19.02
	Exercise Exertion	6.05	1.43	5.88	1.97	5.93	1.78
	Heart Rate	135.75	19.34	132.57	20.48	137.95	23.48
	Borg Scale	12.45	2.42	13.15	1.46	12.80	1.96
Females	RPM	57.75	10.91	10.32	2.85	56.07	10.25
	Speed	24.29	4.33	24.26	4.10	23.84	4.62
	Exercise Exertion	6.39	1.87	5.92	1.84	6.39	1.87
	Heart Rate	141.31	23.61	147.04	23.13	146.41	19.08
	Borg Scale	12.97	2.18	12.24	2.24	12.96	1.27