CYBER PARTNERS: HARNESSING GROUP DYNAMICS TO BOOST MOTIVATION FOR MORE EFFICIENT EXERCISE

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PURPOSE

The purpose of the current project is to use principles of group dynamics to improve the motivation of astronauts to exercise at higher intensities through the use of an exercise video game (exergame). Exercise at high intensities is necessary to minimize losses in bone density, muscle mass, and cardiovascular function during space missions. Exercising with a partner or in a group setting can lead to more adherence than working alone [1], but group exercise settings are not feasible during a space mission. However, motivation gains in persistence at exercise tasks have been documented through the use of virtually-present partners in exergames [2]. Based on principles of group dynamics, such as social comparison and indispensability, individuals may be motivated to work harder when they are working together toward a shared goal with a slightly-better virtual partner. Thus, the aims of our project are to (1) create a software-generated (SG) exercise partner that can be interfaced for use with exercise equipment on a space shuttle flight (cycle ergometer for this project); (2) test features of the SG partner to determine what is most effective for motivation to exercise, enjoyment, confidence, and social connectedness; and (3) test whether exercising with an SG partner over a 24-week time period, compared to exercising alone, leads to better aerobic capacity and muscle strength, adherence to the exercise regimen, and enhanced enjoyment in the activity, self-efficacy, and social connectedness.

METHODS

First, the SG partner and game design will be developed and refined with input from astronaut focus groups, and pilot tested with a convenience sample of undergraduate students. The game design will then be tested through two experiments: one short-term and one long-term. For Experiment 1, participants will include 200 male and female competitive master's-level athletes or consistent fitness club users, ages 35-60 yrs., with a minimum VO_2 max of 35 ml/kg/min and health status to engage in vigorous physical activity. Participants will be assigned to one of four conditions: (a) individual control condition, (b) co-acting partner (e.g., exercising/competing with the SG partner), (c) teammate with conjunctive demands (e.g., working towards a team score dependent on the weaker member), and (d) choice of either a co-acting partner or conjunctive teammate. In the three experimental conditions, the SG partner is programmed to ride slightly faster on a cycle ergometer than each participant. Day 1 will include continuous cycling for 30 minutes at a workload that is at or above 75% of each participant's VO_2 max. Day 2 will include a warm-up, followed by an interval workout (i.e., 8x30 seconds of maximal exercise). Participants will alternate workouts for one week.

Experiment 2 will take place over 24 weeks and include 60 participants (at least 20% will be female) and will meet the same criteria as in Experiment 1. Participants will be randomly assigned to one of three conditions: (a) individual control, (b) working collaboratively with SG partner, and (c) catch-up to SG. The catch-up condition will allow the participant to catch-up to the moderately better SG partner and will advance to working out with a new partner. Participants will perform aerobic exercises 6 days per week, alternating days of continuous cycling (as in Experiment 1) or interval training. Interval days will include alternating days of (a) 8x30 second maximal sprints, (b) 6x2 minute intervals varying levels of effort, and (c) 4x4 minute intervals at 90% effort.

HYPOTHESES

We hypothesize that exercising with an SG partner over the 24-wek time period, compared to exercising alone, will lead to greater effort, adherence, enjoyment, and sense of social connectedness during the experimental sessions, as well as better post-experimental outcomes of aerobic capacity, ventilatory threshold, and muscle strength. To test these hypotheses, RPM, average heart rate, average power output, and distance cycled will be recorded during each session, along with ratings of self-efficacy, perceived exertion, perceived autonomy, task enjoyment, and interest in continuing the game in the future. Pre-experiment, 12-week, and post-experiment VO_2 max tests will be used to assess changes in aerobic capacity and ventilatory threshold. Muscle performance will also be assessed using isokinetic measures of thigh muscles at 12 weeks and post-experiment. Baseline performance measures will be used to control for pre-experimental fitness levels.

REFERENCES

[1] Burke S.M. et al (2006) *Sport Exerc Psychol Rev* 2, 13-29. [2] Feltz D.L. et al (2011). *J Sport Exerc Psychol* 33, 506-26.