Imagery, Progressive Muscle Relaxation and Restricted Environmental Stimulation:

Enhancing Mental Training and Rowing Ergometer Performance through Flotation REST

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Abstract:
The purpose of this paper is to assess the utility of flotation REST for enhancing imagery and rowing ergometer performance among male university rowers. Two studies, a preliminary and a principal study, were conducted during consecutive years with groups of male varsity and novice rowers. Subjects in Study 1 (n=21) and Study 2 (n=26) were matched based on previous ergometer scores, and other pertinent variables, and randomly assigned to either a flotation REST condition or a relaxation/PMR control condition. All groups were exposed to several administrations of one condition and were pre- and post-tested on a 2000meter rowing ergometer trial. The results from both studies indicated a significant pre- to posttest improvement in rowing ergometer performance ($p<.05$) for the REST group compared to the relaxation/control group, who did not improve significantly. The results are discussed in terms of how rowers might benefit from flotation REST and why the environment could make a difference in mental training. Imagery, Progressive Muscle Relaxation and Restricted Environmental Stimulation: Enhancing Mental Training and Rowing Ergometer Performance through Flotation REST An intervention that has received some attention in the athletic performance enhancement literature and that warrants further research is a technique called Restricted Environmental Stimulation Technique (REST; Suedfeld, 1980). REST is a term that describes a procedure during which participants experience a reduced stimulus environment void of most sensory and perceptual inputs. There are two different versions of REST, chamber and flotation tank; REST research in sport has focused on flotation. In flotation REST, participants lie supine in a lightproof, sound-attenuated tank containing a solution of Epsom salts and skin-temperature water (Suedfeld, Collier, & Hartnett, 1993). Flotation REST tanks can be found at various universities, commercial spas, float centres, and national sport centres around the world. The scientific research on the use of flotation REST for improving athletic performance has yielded positive results. Lee and Hewitt (1987) found that female gymnasts exposed to 40 minutes of flotation REST with a visualization script, once a week for six weeks, performed significantly better and reported significantly reduced negative physical symptoms compared to visualization-only and no-treatment control groups. Suedfeld and Bruno (1990) found that a REST plus guided imagery treatment group significantly

improved from pre- to post-test of 20 consecutive free throws compared to groups of relaxation/imagery and imagery only, who showed no significant improvement. Wagaman, Barabasz & Barabasz (1990, 1991) found that, of 22 male expert collegiate basketball players, those exposed to REST plus guided imagery for six sessions over five weeks performed significantly better than the imagery-only participants, as measured by standardized game performance statistics. In a study on tennis performance, McAleney, Barabasz, & Barabasz (1990) found that participants exposed to flotation REST plus guided imagery scored significantly more first service points than a relaxation/imagery group. Several more recent studies (Barabasz, Barabasz, & Bauman, 1993; Suedfeld et al., 1993) found that REST alone, without guided imagery, can be a powerful tool for improving sport performance. Suedfeld et al. (1993) found that REST-only and REST plus guided imagery groups improved significantly from baseline on dart throwing performance; while, no significant difference was found between baseline and post-session results for the guided imagery-only and control treatments. Barabasz et al. (1993) reported a significant difference in marksmanship scores for a collegiate rifle marksmanship training class following a period of dry-flotation REST, compared with those of a control group from the same class who experienced hypnotically induced relaxation. The results of these studies suggest that REST can be effective for improving athletic training and performance. Nonetheless, the two most recent studies illustrate the potential use of REST-only for sports involving fine motor performance; no study to date has demonstrated the effect of REST-only on gross motor skills or sports that emphasize speed, power and/or endurance (Suedfeld et al., 1993). Suedfeld et al. (1993) suggest that "skills most likely to benefit from flotation are those that require relatively low arousal and a full measure of control over a complex coordinated movement" (p.153). The current paper looks at the effects of REST-only on rowing ergometer ("erg") performance, predominantly a gross motor activity that requires all of the above elements, endurance, power, and speed. In an examination of case studies, Barabasz (1992) reported that a rower of Olympic potential substantially improved rowing performance after four sessions of flotation REST and guided imagery. The current paper is interested in isolating the effect of flotation REST on rowing ergometry and establishing possible explanations for why it may act as a performance enhancement tool in rowing. Flotation REST has provided an interesting perspective on performance enhancement, both as an instrument for inducing profound states of relaxation and as a mediator in mental skills training. Barabasz and Barabasz (1996), state that "there is consistent agreement about the facilitation of both imagery and the reduction of arousal" in REST (p.3). In relation to general relaxation, REST has been shown to decrease arousal and stress and increase alert relaxation, illustrated by psychophysiological and biochemical indices such as decreased heart rate, blood pressure, muscle tension (Francis & Stanley, 1985; Jacobs, Heilbronner, & Stanley, 1985; O'Leary & Heilbronner, 1985; Turner, Fine, McGrady, & Higgins, 1987), plasma cortisol, ACTH, plasma B-endorphin (Turner, Bayless, & Fine, 1989; Turner & Fine, 1983) and increased EEG theta wave activity (Barabasz, 1990; Fine, Mills, & Turner, 1993). Furthermore, anecdotal self-reports, observer reports and verbal indices of mood and cognitive processes indicate that flotation REST is associated with lowered stress, anxiety, fatigue and depression combined with higher appraisals of calmness, alertness, and vigour (Suedfeld et al., 1993, p.152). In relation to imagery and mental training, REST has been associated with increases in imaginative involvement, absorption, vivid fantasizing, imagery, concentrated thought and creative thinking over that experienced in the normal environment (Barabasz, 1982, 1984; Barabasz & Barabasz, 1996; Barabasz, Barabasz, Dyer & Rather, 1993; Barabasz, Barabasz, & Mullin, 1983; Budzynski, 1976; Lilly, 1977, Suedfeld, 1979, 1980; Suedfeld, Metcalfe & Bluck, 1987). Looking at REST as an instrument of relaxation, it is possible that flotation REST teaches athletes sensitivity to lower levels of arousal. Once an athlete knows what lowered arousal really feels like, it may be possible, through recreating the relaxing REST experience in one's memory, to return to that state of lowered arousal at a later point during competition. In terms of enhancing mental training, the flotation tank environment might produce better focussing ability and increased imagery use. If athletes are able to improve their focusing skills and imagery ability using flotation REST, it is also possible that they may improve their competition performance by having dealt with a sport-related problem, developed a competitive strategy or engaged in skill, confidence enhancing or goal setting imagery during the flotation session. Flotation REST might enhance athletic performance because it provides a profoundly relaxing experience in an environment conducive to greater amounts and better quality of sport-related imagery than possible in other environments. Many authors in the sport and imagery literature advocate that a state of alert relaxation, free from distractions, is conducive to imagery production and beneficial to the creation of vivid and controllable images (Bernstein & Borovec, 1973; Gauron, 1984, Hellstead, 1987; Korn, 1994; Orlick, 1990; Sheikh, Sheikh & Moleski, 1994; Smith, 1987; Weinberg & Gould, 1995). The question arises whether REST is a more effective intervention than more conventional relaxation methods. There is some evidence that REST does not necessarily interact with guided imagery (Suedfeld, et al., 1993); and, elite athletes may even perceive guided imagery during REST to be interfering with the positive REST experience (McAleney, et al., 1990). Studies, examining the use of imagery by athletes in rowing (Barr & Hall, 1992) and other selected sports (Hall, Rodgers & Barr, 1990), found that a large majority of the athletes reported the highest frequency of imagery use prior to their all-time best performance, and the imagery was independent of any script. Furthermore, one of the most frequent uses of imagery by the elite athletes occurred in bed before falling asleep, suggesting that athletes might find the relaxing, stimulus reduced environment of one's bedroom a particularly good place to do imagery. Therefore, removing the imagery script from the REST environment might create less distraction for the athletes and allow them to engage in their own positive imagery. The two studies described in the current paper attempted to investigate the effects of flotation REST on rowing ergometer performance without the inclusion of any in-session guided imagery. In categorizing rowing ergometry as a gross motor activity, it must be noted that rowing not only requires the elements of speed, power and endurance, but also intense mental tenacity, concentration and cognitive expenditure. The incredible endurance pain and muscle fatigue of rowing makes it a tough mental challenge that requires planning, strategy, and rigorous mental preparation in order to be successful. Thus, given the opportunity to engage in rowing related imagery and self-directed mental preparation, many rowers could enhance their performance. As reported by Barr and Hall (1992), most rowers already do this to aid their performance; however, introducing a group of rowers to a regular schedule of flotation REST could prompt them to engage in a greater amount of beneficial mental preparation than a relaxation-control group not exposed to REST. The first of the two studies described in this paper served as a preliminary research project to assess the viability of pursuing an in-depth follow-up study. Both studies utilized change in rowing ergometer performance as the dependent measure and randomly assigned the participants to a REST or relaxation-control condition. Study 1 was a test of the potential for REST to enhance ergometer performance. Study 2 was designed to replicate Study 1 with rowing ergometer performance, but also involved a detailed attempt at explaining the effects of REST on rowing ergometry and mental practice. The following are the hypotheses for the two studies: 1. Study 1: Participants exposed to a series of flotation REST sessions will show significantly greater enhancement of scores from pre- to post- 2000meter test on a rowing ergometer than a control group exposed to simple relaxation sessions. Rowing ergometer performance will be significantly and positively associated with self reports of in-session rowing thoughts/imagery and the REST group will report more rowing thoughts/imagery than the control group. 2. Study 2: Participants exposed to a series of flotation REST sessions will show significantly greater enhancement of scores from pre- to post- 2000meter test on a rowing ergometer than a control group exposed to Progressive Muscle Relaxation (PMR) sessions. The participants experiencing REST are expected to report having had a significantly greater increase from baseline on measures of sport-related imagery production during and following their REST sessions than the control group. It is expected that those athletes who report more rowing-related imagery during the experimental sessions will improve their performance the most. Method Study 1: Preliminary Research Participants Participants (n=40) from the UBC men's and women's rowing crews, varsity, junior-varsity and novice were asked to volunteer in a "relaxation/sport-psychology study". All participants took part in the experimental sessions; however, only 21 participants from the men's team could be used for the analysis. The women were excluded because very few female rowers completed the dependent measure (2000m ergometer test) due to illness, injury, and scheduling problems. Three men also did not complete the dependent measure because they quit the rowing team before the end of the season and one male rower did not complete the dependent measure due to illness. Of the remaining 21 participating members of the men's team there were 12 novice, 2 junior varsity, and 7 varsity rowers. Four of the novices and one varsity athlete were lightweight rowers; the rest of the group was comprised of heavyweight rowers. The average age was 22.67 years (SD = 3.25), with a range of 18 to 32 years. The average rowing experience was 1.77 years (SD = 3.07), with a range of 0 to 10 years. Instrument The Positive Affect Negative Affect Scale (PANAS) was used as a self- report measure to check for individual differences in affect state and differences in response to the experimental and control conditions. The test usually takes about one to two minutes to complete and has been used to demonstrate significant changes in response to therapy (Loor, Daston, & Smith, 1967), physical exercise (Barabasz, 1991) and REST (Barabasz, Barabasz, Dyer & Rather, 1993). Two brief questionnaires were administered during the experimental sessions and two follow-up questionnaires were administered shortly after the experiment. The first questionnaire (Q1) required background information such as age, years of rowing experience, current level of rowing, past experience with mental training and included two questions regarding each athlete's expectancy of the experimental effects. The second questionnaire (Q2) instructed participants to respond to open-ended questions regarding their "relaxation" experience and to report the thoughts they had during the session. The purpose of Q2 was to discern if the athletes engaged, spontaneously, in any mental practice related to rowing. The first of the follow-up questionnaires (Q3) asked participants to report their feelings about their ergometer performance and how and why it may have been affected by the treatment. The final follow-up questionnaire (Q4) consisted of specific questions regarding the types of thoughts each athlete had during the three experimental sessions, including questions on the use of imagery. It also included questions regarding the athlete's opinion of the study and how much it may have helped different aspects of his rowing performance, including training performance, ergometer performance, regatta/race performance, enjoyment of rowing and recovery from fatigue. The purpose of Q4 was to help discern why the intervention may have had a positive or negative effect on rowing performance.

Apparatus

Flotation REST Tank: A lightproof and sound attenuated tank, resembling a large covered bathtub, containing a solution of Epsom salts and skin-temperature water, approximately 30 cm deep. The solution has a density of approximately 1.30 g/cm3, making it possible to float on one's back with face and chest out of the water. Chamber/Relaxation Control: Participants sit in a comfortable, posture-fitting alpha-chair with their feet stretched out on a padded footrest inside a REST chamber. The chamber is a small lightproof room with sound absorbing walls that is used to create a stimulus-reduced environment like the tank. For the control group, however, the lights were turned on and soft relaxing music was playing. The control condition simulated typical relaxation procedures that might take place in the home, yet prompted deeper relaxation due to social isolation, the relaxing feel of the chair, ambient sound reduction (except for the music) because of the sound attenuating walls of the chamber, and experimental expectancy. Concept II Rowing Ergometer: A rowing machine that closely simulates the rowing motion and the force needed to move a rowing shell on the water. Most countries in the world that have competitive rowing programs use the Concept II for rowing ergometer competitions. Most university, club and national team rowing programs in North America recognize the Concept II as the standard in dry-land rowing training. Although it has been suggested that skill measurement precision may be a factor in testing the effects of REST (Suedfeld et al., 1993), and previous studies involving gymnastics, basketball, tennis and ski racing (excluding dart throwing and rifle marksmanship) have utilized more crude measures of skill, the Concept II Rowing Ergometer to be used in this study offers a very precise measures of performance, displaying time to the nearest hundredth of a second. The times achieved for 2000m by a single rower on an ergometer are comparable to the pace achieved when rowing in a four or eight man rowing shell on the water for 2000m.

Procedure

The procedure was designed to assess the effects of flotation REST on participants' 2000m rowing ergometer performance. With the coaches' approval of the proposed study, the men and women's rowing crews were asked for their voluntary participation in a "relaxation study". Participants were matched based on past ergometer scores obtained from the coach, and then randomly assigned to either the flotation REST condition or the chamber/relaxation-control condition. Participants were brought into the lab in pairs and given a full introduction to both "experimental" conditions, including a brief mention of the potential effects of relaxation training on athletic performance. Participants were informed that they had been randomly assigned to one of the two "relaxation environments" for statistical reasons and that the researcher was interested in looking at the effects on rowing performance of relaxing in environments with differing levels of environmental stimulation. In order to control for the placebo effect, participants were told that, although relaxation had been shown to have a positive association with athletic performance, the amount of relaxation that was optimal for a given sport was not clear; thus, we were testing differing relaxation environments to find one that might be suited best for rowing. Participants were informed that they would be free to try out the alternate environment after the study had been completed. Following the introduction, both participants for each session were asked to fill out a consent form, the first background questionnaire (Q1) and the PANAS, and then each participant entered their assigned environment for a one hour period. Both groups were monitored through a one-way intercom system for the duration of their sessions. Following the one-hour session, each participant filled out the PANAS and the Q2 regarding their thoughts during the "relaxation experience". All participants came for three sessions, once a week for three weeks at the same time and day each week. After the third week, all of the participants had to take an "erg" (ergometer) test of 2000m that had been scheduled by the coach as part of their regular training. The erg test was also part of the criteria for making the top boat, which would be travelling to compete at a large international regatta in California, ensuring maximum motivation on the dependent measure from all rowers. Results from ergometer testing done three weeks prior to the study and results from the post-study ergometer testing were used to generate difference scores for the statistical analyses. Following the post-intervention ergometer test, participants filled out Q3 and Q4.

Results and Summary Pre-experimental expectancy, possible confounds and post-experimental beliefs about effects of the study: A matrix of Pearson's r revealed a significant correlation between pre-experimental expectancy and post experimental perceptions of intervention effects on ergometer performance for the REST group, $r(11) = .70$, $p < .02$, with no significant correlation for the control group, $r(9) = .50$, $p > .10$. There was no correlation, however, between pre-experimental expectancy and ergometer score improvement for either group: REST, $r(11) = .06$, or control, $r(9) = -.20$. A series of one-way ANOVAs revealed no significant differences between REST and control for any of the following factors: level, rowing experience, prior use of mental training, prior use of relaxation techniques and age, suggesting that the matching technique was successful in creating two homogenous groups. Ergometer score performance: Ergometer performance was analyzed using a 2x2 (group x erg-test) repeated measures ANOVA. The ANOVA yielded a significant group x erg-test interaction effect $F(1, 19) = 4.67$, $p < .05$. Follow-up analyses, utilizing the corrected error term from the original ANOVA, revealed that the REST group ($M = 6.23$, $SD = 5.39$) improved significantly from pre- to post- 2000 meter ergometer test {$F(1, 19) = 17.27$, $p < .001$}, and their improvement was significantly greater than the control group ($M = 1.43$, $SD = 4.68$) who did not improve significantly {F (1, 19) =.96, p >.40}. Rowing imagery/ergometer score performance interactions: The answers to the open-ended questions in Q2 were coded for the frequency of rowing related thoughts. For an analysis of the impact of rowing thoughts (imagery) on ergometer performance, two groups were formed by dividing the rowers into either high or low frequency of rowing thoughts. A 2x2 (thought frequency x erg-test) repeated measures ANOVA was performed. The ANOVA revealed a significant interaction effect F (1, 18) = 6.19, p <.05, where the group of rowers who reported a higher frequency of in-session thoughts about rowing improved significantly more (M = 7.07, SD = 3.56) on the 2000 meter ergometer test than rowers who did not spend as much in-session time thinking about rowing (M = 1.32, SD = 2.45), regardless of experimental environment. A 2x2x2 (environment x thought frequency x erg test) ANOVA with repeated measures on the last variable revealed no significant interaction effects among the three variables.

The results, however, were in the expected direction with the group who reported the highest frequency of in-session rowing thoughts, and experienced flotation REST improving the most (M = 7.07, SD = 5.30), and the group who reported the lowest frequency of in-session rowing thoughts and experienced the control condition improving the least (M = 1.9, SD = 4.17). The low power of the test may also have contributed to the lack of a non-significant interaction. PANAS results: For the three experimental sessions, the REST group showed no significant changes in either positive (M = -.17, SD = 3.81) or negative (M = -.96, SD = 2.47) affect from pre- to post-session. The control group showed a significant drop (t (8) = -3.41, p <.02) in positive affect from pre-to post-session (M = -4.42, SD = 3.66), with no significant change in negative affect (M =-.50, SD = 2.37). Two cumulative scores for each affective scale, positive and negative, were obtained by summing the changes in affect from pre- to post-session for all three sessions; these cumulative scores were used to provide a general picture of affective response to the different experimental conditions over the course of the study. These cumulative affect scores were then correlated with pre- to posttest changes in ergometer score. Pearson's r revealed a significant correlation between the positive affect cumulative score and ergometer score improvement, r (8) =.81, p < .02, for the REST group; there were no other significant correlations for either group. A series of one-way ANOVAs revealed a significant difference between REST and control for the general affect scores, whereby the control group experienced a significant drop in post-session positive affect and the REST group maintained high pre-session levels. Although there was a greater drop in negative affect for the REST group than the control, this difference did not reach significance at the .05 alpha level. Summary Study 1 found that the group exposed to the flotation REST environment once a week for three weeks improved significantly from pre- to posttest on a 2000 meter ergometer performance; the REST group's improvement was significantly greater than the relaxation-control group, who did not improve significantly. The other most salient factor was that rowers who reported a high frequency of in-session thoughts about rowing improved significantly more on the 2000 meter erg-test than rowers who did not spend as much in-session time thinking about rowing, regardless of experimental condition. Despite no significant three-way interactions among experimental environment, in-session rowing thought frequency and ergometer performance, the group who experienced the flotation REST environment and reported thinking about rowing with the greatest frequency did improve the most. Subjective reports from rowers in response to the follow-up questionnaire supported the finding that rowers who experienced the tank spent more time engaging in rowing related imagery than those in the relaxation-control condition. While there was a moderately strong correlation between pre-experimental expectancy and post-experimental perceptions about the effects of the intervention on ergometer performance for the REST group, there was no association, among expectancy, post-experimental perceptions of intervention effects and actual ergometer performance, thus suggesting that the effects of the REST environment on ergometer performance could not be attributed only to a placebo effect. PANAS scores indicated that REST was associated with a state of alert relaxation and sustained positive affect. Higher positive affect during REST was also associated with greater improvements in ergometer performance. The control condition was associated with a state of overall decreased affect. The results of the preliminary study provide strong grounds for continuing the research on REST and rowing ergometer performance and for testing the imagery/REST hypothesis. Method Study 2: Principal Research Participants Participants (n=26) from the UBC men's rowing program were approached to voluntarily participate in a mental training study. After the first meeting and gathering of some of the baseline measures, two rowers dropped out of the study. Of the twenty-four participants that remained, the ages ranged from 18-33 years with an average age of 22.54 years. Twelve rowers had four months rowing experience prior to the beginning of the experimental sessions, 11 rowers had 18 months experience, and 1 rower had 2.5 years of experience. The final sample (12 control and 12 experimental) was represented by 15 men from the novice crew, 4 from the lightweight varsity crew and 5 from the heavyweight varsity crew. Instrument The Sport Competition Anxiety Test (SCAT; Martens ??????? ., 1990) was used to gather baseline and post experimental data on individual differences in trait anxiety and arousal. Stable pre- to post-test SCAT scores would indicate that it was a valuable measure to use as a pre-experimental matching factor. The Sport Imagery Questionnaire (SIQ; Hall, Mack, & Paivio, 1996), and the Movement Imagery Questionnaire (MIQ-R; Hall & Martin, in press) were used to gather baseline measures of sport imagery use and content and visual and kinesthetic imagery ability. Sport imagery content and use were also assessed again in the post-experimental period to determine the effect of the environment on imagery practiced. Imagery use has been associated with all-time best performances by rowers and athletes in other sports (Barr & Hall, 1992; Hall, Rodgers & Barr, 1990). Imagery ability has been suggested as a mediating variable that must be considered in studies investigating the effects of imagery-based strategies (Murphy, 1994); imagery ability has also been shown to interact with learning during flotation REST (Taylor, 1990). A brief background questionnaire (BQ) required information on age, years of rowing experience, current level of rowing, current rowing goals, and past experience with mental training; it included questions regarding each athlete's expectancy of the experimental effects. The first experimental questionnaire (Q1) instructed participants to report their previous week's physical training (PT) schedule in order to account for training as a possible confound. Training logs were compared to the coaches' schedules and participants were specially instructed to be completely honest. The second experimental questionnaire (Q2) instructed participants to report on the amount of imagery, if any, and amount of relaxation training, if any, that they had engaged in outside of the lab during the previous week. The third experimental questionnaire (Q3) instructed participants to respond to questions regarding their "relaxation/imagery" experience during the session. They were asked for a general description of each session and a detailed description of their thoughts and any associated emotion, sensation or other feeling, and if they engaged in any rowing-related imagery. The second half of the questionnaire included a question asking participants to rate the level of relaxation experienced during the session on a scale of 1-10 with 1 anchored by the statement, very tense; I could feel that my muscles were tight; I could not imagine feeling less relaxed; and, 10 anchored by the statement, very relaxed; my muscles were loose; I felt more relaxed than from any previous experience in my life. A post-ergometer questionnaire (PEQ) instructed participants to rate the contribution that participating in the study made to their erg performance. Participants were asked to describe why the lab sessions did or did not have an effect on their performance. After the final erg test, several more questions were added to the PEQ asking the rowers to report on what they thought were the most important contributors to their performance. The final follow-up questionnaire (Q4) was administered to participants after their last erg test and after they had tried out the alternate experimental condition. Participants were asked the same questions as Q3, regarding each participant's experience of the condition, as well as several questions asking participants to make comparisons between the two environments, such as which environment they thought was better for relaxation and which one was better for imagery practice. They were asked for their general impressions of the study and how they thought that participation in it had impacted upon both their ergometer and on-water performance, and if participation in the study prompted them to engage in more imagery-use outside the lab than they would have otherwise engaged in had they not participated in the study. The Imagery Content Questionnaire (ICQ), asked participants to respond to questions regarding the specific content and frequency of their rowing imagery done in and outside of the lab. Barr and Hall (1992) found a relationship between imagery use and rowing performance for competitive rowers, with the highest frequency of imagery use being associated with all-time best performances. Thus, the ICQ served the purpose of obtaining a measure of imagery frequency for different types of rowing imagery that could be compared with changes in ergometer score. The ICQ included ratings of the following items for on-water and ergometer imagery, with separate scales for in-lab imagery and outside-of-lab imagery: I imaged technique on the ergometer/water; I imaged being motivated while rowing on the ergometer/water; I imaged pushing myself past the pain while on the ergometer/water; I imaged pulling a certain 500m split time while on the ergometer; I imaged focussing and refocussing while rowing on the water; I imaged achieving a certain score while on the ergometer; I imaged winning while rowing on the water; I imaged cue words to keep me going while rowing on the ergometer/water; I imagined my short term goals for rowing on the ergometer/water; I imagined my long term goals for rowing on the ergometer/water. Content frequency was rated on a 7-point scale, from 1 - almost never to 7 - almost always. Apparatus Flotation REST Tank: Same as described in Study 1. Chamber/Progressive Relaxation Control: Participants lay on a comfortable bed inside a lighted REST chamber and listened to a tape taking them through progressive muscle relaxation (PMR) training. The control group was given the PMR training in order to keep them motivated to participate in the study. Motivation to participate and controlling for the placebo effect have been suggested to be crucial elements of performance enhancement studies (Gould & Udry, 1994; Vealey, 1994). PMR training was chosen as a technique for use with the control group for the following reason: flotation REST is a total body relaxation technique that may have a positive effect on sport performance; similarly, PMR is also a total body relaxation technique that may have a positive effect on performance (Onestak, 1989). Since the hypothesis is that REST will have an effect beyond mere relaxation, it is important to compare it to a relaxation control group. Concept II Rowing Ergometer: Same as described in Study 1. Procedure The procedure was designed to assess the effects of flotation REST on participants' rowing ergometer performance over 2000m compared with the effects of a PMR control condition. Participants were introduced to the experimenter by the rowing coach and asked to volunteer for the study, at which time volunteers were asked to fill out baseline measures of imagery-use and ability, and trait anxiety. The baseline measures were collected in the third month of the season, approximately 5-6 weeks prior to the first experimental session. At the midpoint of the season, volunteers were asked to participate in the experimental "relaxation/imagery" sessions. Participants were matched based on past ergometer scores obtained from the coach, level of rowing, baseline measures of imagery use and ability and levels of trait anxiety. They were randomly assigned to either the flotation REST treatment condition or the progressive muscle relaxation (PMR) control condition. Participants were invited to the lab and given a full introduction to both "experimental" conditions and a brief mention of imagery/relaxation use in sport. Both groups were told about the involvement of imagery in the study for several reasons: first, to increase interest and motivation to stay in the study; and, second, to ensure that both groups had equal expectations about imagery and relaxing environments before they began the experiment. Participants were informed that they had been randomly assigned to one of the two "relaxation environments" for statistical reasons, and that the researcher was interested in looking at the effects of different relaxation techniques/environments and imagery on their rowing. In order to create equal expectations and to control for the placebo effect, all participants were told that although relaxation and imagery have been shown to have positive effects on athletic performance, the type of relaxation/imagery combination that is optimal for a given sport is not clear; thus, we were testing differing relaxation/imagery techniques to find one that might be suited best for rowing. Following the introduction, participants were asked to fill out a consent form and the weekly PT training log (Q1). To ensure that all of the participants had equal expectations about what to do with their time in the environment, both groups were given the suggestion before entering the environment for the first time to practice rowing-related imagery. Participants were provided with a standardized outline of the type of imagery they might practice and the following definition of imagery was provided and discussed with each rower: Imagery is the imaginal rehearsal of an action, event, sensation or emotion in the absence of the action, event, sensation or emotion. It is not just a visual picture in the mind; it also includes what is called kinesthetic imagery, which is imagined sensation (or imagining what the body feels like). When doing imagery as it relates to sport, it does not just include visualizing the technical aspects of the movement (although this is part of it); imagery can include mental simulations of a strategy (i.e. how you approach a 2000m ergometer test), mental simulations of winning an event, medal or championship; imagery can also include mental simulations of your mental state during a performance, practice, or training routine (i.e. you may imagine yourself pushing yourself past the pain of a rowing race); imagery also includes how you might feel; you can use it to mentally simulate the positive emotions of success; it can be used to simulate calming yourself before training or competition; it can be used to boost your self-confidence by recalling a past positive event or imagining yourself doing well in the future. Finally, it also can be used for skill practice and anything else that comes to mind in relation to the sport of rowing. Participants were given no imagery script or guidance during their session. The sole purpose of the suggestion/discussion on imagery was to ensure that what was being compared in these two conditions was how the environment impacted upon imagery practiced. If some of the rowers did not even think to engage in imagery, then what was being measured may not have been the extent to which these environments are conducive to imagery use, but rather the extent to which rowers in general happen to use rowing imagery. Following the imagery suggestion, participants entered the assigned condition for 50 minutes. For the first session of the experiment, both groups only spent 25 minutes in the environment. This session was included to give participants an introduction to the protocol and to ensure that each was comfortable with the environment that he would be going into once a week for the following 6 weeks. The subsequent 6 sessions, including the post-experimental condition-switch, were all of full length. Before each session, participants filled out the Q1 and Q2, physical and mental training logs. Following each session, each participant filled out the Q3 regarding his thoughts, imagery and state of relaxation during the session. Erg testing in this study was part of the coaches' regular training program, ensuring maximum motivation from the rowers. All ergometer scores were gathered from ergometer competitions set up by university, provincial, and national rowing programs. The ergometer scores of interest were obtained from three different 2000m ergometer competitions: "Beat the Beast", a regional competition after week 2 of the study, "Monster Erg", a national competition after week 3, and "Power Erg", an intra-university competition after week 6. Results from the ergometer testing were used to generate difference scores for the statistical analyses. Not all rowers were present at every ergometer test due to illness or other reasons. Tests that were missed were made up during the week following the official test. Following the post-intervention ergometer test, all rowers were asked to spend one session in the alternate environment and asked to compare the two for utility in practicing imagery and relaxation. Finally, all rowers were administered the SIQ, and SCAT again. Results Pre-experimental expectancy question, possible confounds, and post-experimental beliefs about effects of the study: A one-way ANOVA (group x expectancy question) revealed no significant difference between REST ($X(12) = 4.58$, $SD = .67$) and PMR ($X(12) = 4.75$, $SD = .75$) for expectancy of experimental effects, $F(1, 22) = .33$, $p>.50$. A series of one-way ANOVAs revealed no significant differences between REST and PMR for any of the following factors: imagery ability, SIQ (or any subscale), prior rowing ergometer performance, prior use of relaxation techniques, prior use of mental training, rowing goals, rowing experience and age, suggesting that the matching technique was successful in creating two homogenous groups. Ergometer Score Performance: Between and within group comparisons were made for changes in ergometer score for each of the following three erg-test combinations: Beast to Monster Erg, Beast to Power Erg, and Monster to Power Erg. The third erg difference, Monster to Power Erg, was considered the most important difference as it involved competitions with the most important consequences (national ergometer ranking and regatta team selection). A 2x2 (group x erg-test) repeated measures ANOVA was performed for each erg-test comparison. For novice and varsity heavyweight rowers combined, there was a significant interaction effect between erg score improvement and group for the Beast to Power Erg comparison, $F(1,18) = 4.69$, $p<.05$, (the lightweight rowers did not compete at the Beast). For all rowers, the Monster to Power Erg comparison yielded results that approached significance at the .10 alpha level (See Figure 1 and Table 1). Within-group comparisons with paired samples T-tests revealed significant improvement on all three erg-test comparisons for the REST group, with no significant improvement for the PMR group on any erg-test comparison (See Table 1). For several reasons, analyses were also run for the novice and varsity men separately. The varsity group had all participated in the preliminary study the previous year; more varsity rowers than novices missed the scheduled test dates and had to make them up on alternate days; and, the novices were a larger, more homogenous group than the varsities. For the novice men-only, there were significant interaction effects between erg score improvement and group for the Beast to Power Erg and Monster to Power Erg comparisons (See Table 2). Within-group analyses with paired samples T-tests revealed significant improvement on all three erg-test comparisons for the REST group, with no significant improvement for the PMR group on any erg-test comparison (See Table 2). For the varsity men-only, there were no significant interaction effects between any of the erg score improvements and group, nor were there any significant results for any of the within-group comparisons (See Table 3). Imagery measures and Erg score improvement: To assess the relationship of imagery-use, imagery content, imagery duration and changes in all of these to erg score improvement, correlation matrices were generated for the imagery measures/erg score improvement relationships for each group. The matrices were examined for any significant correlations and also for consistent patterns within each of the groups, REST and PMR. As the imagery construct is complex and difficult to measure, looking for patterns in the data was considered important. Where relevant, between-group analyses using ANOVA were also conducted to check for absolute differences in imagery among REST and PMR groups. SIQ Results Between and within group comparisons were made for changes in SIQ and all five subscales from pre- to post-experiment. A 2x2 (group x SIQ score) repeated measures ANOVA was performed for each of the pre-post SIQ total and subscale scores. For all levels, novice and varsity combined as well as for novice and varsity separate, there were no significant interaction effects between pre-post SIQ scores and group; varsity and novice rowers changed their scores on the SIQ about the same amount and in the same direction. Main effects were revealed for the Cognitive General and Motivational General-Arousal subscales for all rowers. All rowers significantly increased their scores on Cognitive General from pre- ($X = 4.35$, $SD = 1.37$) to post-experiment ($X = 4.94$, $SD = 1.17$), $F(1,21) = 8.27$, $p<.01$, and on Motivational General-Arousal from pre- ($X = 4.33$, $SD = 1.33$) to post-experiment ($X = 4.82$, $SD = .94$), $F(1,21) = 4.47$, $p<.05$. Correlational analyses revealed no significant associations or consistent group patterns between any SIQ score changes and erg score improvement. The change in the Cognitive General subscale shared a slight correlation with erg score improvement for the Monster to Power Erg difference, $r(23) = .29$, which approached significance at the .10 alpha level. Weekly Outside-Lab Imagery Report ANOVAs revealed no significant group differences for amount or for changes in amount of imagery done outside of the lab for all rowers. Analyses by level, separately, yielded the same non-significant results. Correlational analyses revealed a significant positive correlation between change in outside-lab imagery and erg score improvement for the PMR group on the Monster-Power erg difference, $r(10) = .75$, $p<.01$, with a non-significant negative correlation obtained for the REST group, $r(10) = -.17$. Imagery-Content Questionnaire (ICQ): For all rowers, ANOVAs revealed no significant group differences on any of the items on the ICQ. A breakdown of the correlational analyses by level revealed different patterns for novice and varsity rowers. Novice Men ICQ Results Results for the novice men yielded a cross-over interaction between the total ICQ score and erg score improvement for REST vs. PMR. Total ICQ scores were positively correlated with erg score performance (erg difference 2) for the PMR group, $r(8) = .87$, $p<.005$, but were non-significantly, negatively correlated with erg score performance for the REST group, $r(7) = -.20$, $p>.25$ (see Figure 2). Examination of the correlation matrix for individual ICQ items and erg score improvement for the REST group revealed a pattern of low, negative correlations for most of the ICQ items and erg difference scores (see Table 4). There was a pattern among the magnitudes of the correlations in which twelve out of the sixteen correlations had a larger magnitude if the imagery was practiced in the lab versus outside of the lab. Examination of the correlation matrix for the PMR group indicated a pattern of moderate to strong positive correlations for several of the ICQ items and ergometer difference scores (see Table 4). There was a pattern among the magnitudes of the correlations in which 13 out of 16 correlations had a larger magnitude if the imagery was practiced outside the lab versus in the lab. Four descriptive variables also were created by summing the ICQ items in the following categories: rowing ergometer imagery done in the lab; rowing ergometer imagery done outside of the lab; total rowing imagery done in the lab; and total rowing imagery done outside the lab. These variables were then correlated with change in ergometer performance. The correlation matrix for the REST group revealed non-significant, negative correlations among ICQ summary scores and change in ergometer performance, with the in-lab imagery/erg difference associations demonstrating higher magnitudes than the outside-lab imagery/erg difference associations. The correlation matrix for the control group revealed the opposite: there were significant positive correlations among all ICQ summary scores and change in ergometer performance, and the outside-lab imagery/erg difference associations demonstrated higher magnitudes than the in-lab imagery/erg difference associations (see Table 4). Varsity Men ICQ Results Results for the varsity men yielded the same pattern of correlations between the ICQ scores and erg score improvement for both REST and PMR; thus, the groups were combined for the analyses. Total ICQ scores were positively correlated with erg score improvement, $r(9) = .62$, $p<.08$; the overall correlation matrix yielded mostly positive correlations between individual ICQ items and erg difference 3 (Monster-Power Erg) (see Table 4). The magnitudes of the correlations were greater if the imagery was done inside the lab versus outside of the lab for thirty of the thirty-two correlations. The correlations among the ICQ summary scores and change in ergometer performance showed significant positive correlations for the in-lab ergometer imagery/erg difference associations and the Total in-lab ergometer and on-water imagery/erg difference associations (see Table 4). There were no significant associations among outside-lab imagery summary scores and change in ergometer performance (see Table 4). Physical Training (PT) and Erg Score Improvement: Changes in average weekly training minutes for rowers in each group were examined for their associations to erg score improvement. Difference scores for weekly training were created by subtracting the average weekly training minutes for the 2 weeks preceding one erg test from the average weekly training minutes for the 2 weeks preceding the erg test of comparison. These difference scores were compared with erg difference scores to determine if changes in training were associated with changes in performance. With all rowers together, there were no significant correlations between changes in average weekly training and changes in erg performance. However, with the groups separated, analyses revealed a crossover interaction between physical training (PT) and erg score improvement (see Figure 3). For the REST group, an increase in PT preceding the later erg test over the amount of training preceding the earlier erg test was associated with greater improvement in erg score, $r(10) = .59$, $p<.05$ for the Monster-Power erg difference. For the PMR group, an increase in PT preceding the later erg test over the amount of training preceding the earlier erg test was associated with less improvement, or even a decrement, in erg performance, $r(10) = -.55$, $p<.05$ for the Monster-Power erg difference. The groups did not differ on total training minutes for any week. There were no differences among levels, varsity or novice, for patterns in PT and erg performance. Ratings of relaxation and erg performance: Changes in subjective ratings of relaxation for each experimental session were compared with changes in erg performance.

Analyses yielded no significant associations between changes in ratings of relaxation and erg score for either REST or PMR groups. Examination of the reports of relaxation done outside of the lab also yielded no significant associations between relaxation and erg performance. Beliefs about the effects of participation in the study: Post-experimental inquiry regarding beliefs about the effects of participation in the study on rowing ergometer performance, rated on a scale from 1- "No effect" to 5 - "Most important factor contributing to my erg performance", revealed no significant differences between REST (X = 2.92, SD = .90) and PMR (X = 2.92, SD = 1.31). There were also no group differences in ratings of the effect of participation in the study on recovery from fatigue, REST (X = 4.63, SD = .64) vs. PMR (X = 5.00, SD = 1.13), training performance, REST (X = 5.25, SD = .97) vs. PMR (X = 5.64, SD = 1.29) and enjoyment of rowing, REST (X = 4.83, SD = 1.03) vs. PMR (X = 5.09, SD = .94). Inquiry regarding experimental environment comparisons revealed that REST was preferred 13:8 by all rowers for practicing imagery. Seven out of eleven from the REST group and six out of eleven for the PMR preferred the REST environment for imagery practice. Comparison of the two conditions for relaxation resulted in a 13:9 preference for the PMR condition. Six out of eleven from the REST group and seven out of eleven for the PMR preferred the PMR environment for relaxation practice. Chi-square analyses revealed no significant differences among any of these frequencies. In response to a question about which environment the rowers liked better overall, rowers were split equally. For the REST group, five preferred the REST tank, four preferred the PMR condition, two reported equal liking and two were undecided. For the PMR group, five preferred the REST tank, five preferred the PMR condition and one reported equal liking. The most common reason reported for preferring the REST environment was that it was dark and had fewer distractions; while, the most common reason reported for preferring the PMR condition was that it was better for relaxation. Discussion The results from the interaction effect between ergometer score improvement and experimental condition in the principal study indicate a reliable improvement in 2000 meter ergometer score for novice male rowers who participated in flotation REST on a weekly basis compared to a matched comparison group who participated in a PMR condition. While not all interaction effects reached significance, within-group analysis demonstrated significant improvement for all rowers in the REST group on each ergometer test, with no significant improvement for the PMR group on any of the tests. The lack of REST effects for the varsity rowers in the principal study indicates that flotation REST might be most useful for novice athletes; however, there were several key factors that may have confounded the results. On the last dependent measure, the Power Erg, three of the heavyweight varsity rowers did not show up on the morning scheduled for the test, all of them from the PMR group; these three rowers took the test later in the week at a time best suited to them. Of the varsity rowers that did show up, three from the REST group were highly fatigued from on-water racing done the day before; the remaining participants from the PMR group had not been involved in the on-water racing. All three rowers from the REST group expressed a concern that they were not in a good state to take the test, but they did it anyway as part of the crew commitment. It may be suggested that ceiling effects were being observed with the varsity athletes, thus resulting in the lack of difference between the REST and PMR groups. It is unlikely, however, given the relatively low experience level and large variability in erg score improvements of the varsity sample. Had there been more consistency with respect to the timing of the final ergometer test and to the state of readiness of the varsity rowers, the results may have supported the hypotheses for all rowers. Results from the preliminary study indicated that flotation REST is a useful intervention for both novice and varsity rowers. Although the results of the preliminary study suggest that there may be synergistic interaction between REST and rowing imagery practice, the principal study failed to clarify this possibility. For the most part, the results from the different measures of imagery taken in the principal study (SIQ, weekly outside-lab self-reported imagery, ICQ) do not clearly answer the questions about the role of environment in imagery practice nor the link between imagery and ergometer performance, but do elucidate some interesting possibilities. The lack of difference between REST and PMR groups on the SIQ suggests that either the two experimental conditions did not affect imagery differentially or the imagery measure was not sensitive to the effects of condition on imagery-use. It may be that time of administration was an element in the lack of significant results: taking SIQ measures six weeks before the beginning of the intervention and one week after the last dependent measure might not have been precise enough to capture changes in performance associated with changes in imagery-use, nor to illuminate any between group differences in imagery-use. The small positive correlation between the Cognitive-General subscale and ergometer score improvement from Monster Erg to Power Erg suggests that there might be some sort of relationship between changes in the SIQ and performance that could be tapped by a more refined measurement protocol. The increase in SIQ subscales, Cognitive General and Motivational General-Arousal, from pre- to post-experiment for all rowers is consistent with the fact that the rowers were dedicating extra time each week to participate in a "mental training/relaxation" study. For the weekly reports of outside-lab imagery, the consistent pattern of significant positive correlations between changes in rowing-related imagery-use and improvement in ergometer score for the PMR group, and the small non-significant negative correlations for the REST group, suggest two possible, not mutually exclusive, explanations: the PMR group's outside imagery was more effective than the

REST group's, or the effect of the flotation experience was powerful enough that it rendered differences in outside imagery-use for the REST group insignificant. If the baseline measures of imagery-use and ability (SIQ, MIQ-R) are a good indication of individual differences in imagery effectiveness, it may be that the latter explanation bears more weight, as the groups were matched on these variables. Different results on the imagery content questionnaire (ICQ) between the varsity and novice men suggest some interesting possibilities. For the novice men, the consistent pattern of negative correlations between ICQ imagery items and ergometer performance for the REST group suggests the possibility that REST enhances imagery, which, if negative, can degrade performance effects. Several studies in the sport literature (Budney & Woolfolk, 1990; Powell, 1973; Woolfolk, Murphy, Gottesfeld, & Aitken, 1985; Woolfolk, Parrish, & Murphy, 1985) have demonstrated that in addition to performance-enhancing effects of positive imagery, negative imagery rehearsal can inhibit performance. The novice men's results revealed moderate to strong negative correlations between ICQ items and erg score improvement for in-lab ergometer pain imagery - "I imaged pushing past the pain of rowing on an ergometer" ($r = -.85$) and ergometer motivation imagery - "I imagined being motivated while rowing on the ergometer" ($r = -.61$), suggesting the possibility that many of the novice rowers may have imagined the pain without getting past it or imagined negative outcomes in their motivational imagery to the detriment of their performance. The one moderate positive correlation between in-lab ergometer split imagery - "I imaged pulling a certain 500m split time while on the ergometer" -and ergometer performance for the REST group ($r = .60$), suggests that there is potential for REST to enhance performance if the imagery is positive. Finally, the consistently greater correlation magnitudes between ergometer performance and imagery done during REST compared to that done outside the lab suggest that any imagery effects for the REST group were a result of in-lab imagery practice, once again suggesting an imagery-enhancing effect for REST. For the varsity men, the positive correlations between ICQ imagery items and erg score performance among both the REST and PMR groups suggests that imagery-use is important to erg performance. However, the environment where imagery is practiced, whether in the PMR condition or the REST condition, may not be crucial for experienced rowers. Nonetheless, the preliminary study did indicate that rowers experiencing REST were more likely to spend more time practicing imagery than a relaxation-control group. However, the lack of control over the erg testing for several of the varsity rowers precludes any conclusive discussion about group differences in imagery use and its effects on performance for experienced rowers. From the PT results, linking increased training to improved performance for REST participants, it appears that spending one session a week in a flotation REST tank can help athletes to benefit more from increases in training than one session a week doing PMR. While it was not part of this study to examine, in detail, any physiological effects that flotation REST might have in terms of recovery from fatigue, there are some possible explanations for the PT results. To begin with, the physiological relaxation effects reported in the REST literature (Barabasz, 1990; Fine et al., 1993; Francis & Stanley, 1985; Jacobs et al., 1985; O'Leary & Heilbronner, 1985; Turner & Fine, 1983; Turner et al., 1987; Turner, et al., 1989) may be more profound than those experienced using other relaxation techniques, such as PMR, even though there was no subjective difference on the report of relaxation between REST and PMR groups (participants may not have been consciously aware of the physiological differences). Second, there may be some particular physical aspects of the REST tank environment, such as the Epsom salts (magnesium sulfate) that may have some effect on muscle recovery. There is evidence in the medical literature for the relaxing effects of magnesium sulfate on arteries and smooth muscle (Bloch, Silverman, Mancherje, Grant, Jagminas, & Scharf, 1995; Kumasaka, Lindeman, Clancy, Lande, Croxton, & Hirshman, 1996; Nelson, & Suresh, 1991; Okayama, Okayama, Aikawa, Sasaki, & Takishima, 1991), which might suggest a link between flotation REST and recovery from muscle fatigue. Third, it is also possible that the stress reduction effects associated with REST (Barabasz, 1990; Fine et al., 1993; Francis & Stanley, 1985; Jacobs et al., 1985; O'Leary & Heilbronner, 1985; Suedfeld, 1990; Suedfeld et al., 1993; Turner & Fine, 1983; Turner et al., 1987; Turner et al., 1989) may contribute to a release of built-up training, school, or general life stress that, if relieved on a regular basis, might lead to greater training benefits. While this study did not address any of the above-mentioned issues, future research that tries to isolate the mechanism of recovery could be very useful to further understanding of flotation REST effects. The question that might arise concerning REST is whether the effects are beyond those of a placebo. In the current study, mechanisms of the performance enhancement effects of REST were sought after but not clarified. Many REST studies (Barabasz, 1982; Barabasz & Barabasz, 1990; Barabasz et al., 1993; Suedfeld & Baker-Brown, 1986; Suedfeld et al., 1987; Suedfeld, Landon, Epstein, & Pargament, 1971), however, including the current studies, have included expectancy manipulations or measures and have demonstrated REST effects independent of expectancy. Suedfeld et al. (1987) found REST enhanced creativity significantly more than a control condition despite subject expectancy that was contrary to the hypothesis and outcome; Barabasz and Barabasz (1990) demonstrated that high expectancy induction did not have any greater impact on REST effects than low expectancy induction. Suedfeld et al. (1971) found that induced subject expectancy affected subjective reports of stress following REST but did not affect objective scores on a cognitive test; similarly, Melchiori and Barabasz (1990) found no consistent relationship between subjective feelings following REST and improvements in objective flight simulator performance. In the sport research, Barabasz et al. (1993) found no differences in expectations between REST and control groups participating in a rifle marksmanship study, with most of the control group reporting improved confidence. The preliminary study did uncover a link between pre-experimental expectancy and post-experimental beliefs about the effects of the interventions for the REST group, but none of these beliefs were associated with ergometer performance. In the principal study expectancy was well controlled. The groups differed neither on a pre-experimental expectancy question nor on any post-experimental questions regarding beliefs about experimental effects. Both groups were treated equally by standardized procedural protocol and there were no group differences in preference for one environment versus the other. Furthermore, the fact that the subjective similarities between REST and PMR were not congruent with the objective differences in the dependent measures of the study suggests that REST participants were not aware of the effects of REST on their performance. In essence, REST effects do remain to be explained, but the enhancement effect of flotation REST over that of a comparable expectancy-inducing technique, PMR, suggests that the effects go beyond those of a placebo. Summary The results from the two studies are congruent with the previous research on REST and sport performance, demonstrating that REST can be a powerful tool for enhancing athletic performance. The studies also extend the application of REST to include power/endurance sports. Although the studies did not clearly identify the mechanisms underlying REST effects on rowing ergometer performance, they did illuminate several possible explanations that could be examined by future research. Testing the imagery hypothesis could still prove fruitful with further refinement of methodology; looking into the physiological effects of flotation REST is a logical next step. References Barabasz, A. (1982). Restricted environmental stimulation and the enhancement of hypnotizability: Pain, EEG alpha, skin conductance and temperature responses. International Journal of Clinical and Experimental Hypnosis, 30, 147-166. Barabasz, A. (1984). Antarctic isolation and imaginative involvement - Preliminary findings. International Journal of Clinical and Experimental Hypnosis, 32, 296-300. Barabasz, A. (1991). Effects of aerobic exercise on transient mood state. Perceptual and Motor Skills, 73, 657-658. Barabasz, A. (1990). Effects of sensory deprivation on EEG theta and skin conductance. 5th International Congress of Psychophysiology, Budapest, Hungary, July 9-14. Barabasz, A.F. (1992). Human performance enhancement case trials. Unpublished manuscript, Washington State University. Barabasz, A. & Barabasz, M. (1996). REST research in the enhancement of human performance. Paper presented at The International Congress of Psychology, August 20, 1996. Barabasz, A., Barabasz, M., & Bauman, J. (1993). Restricted environmental stimulation technique improves human performance: Rifle Marksmanship. Perceptual and Motor Skills, 76, 867-873. Barabasz, A., Barabasz, M., & Mullin, C. (1983). Effects of a brief Antarctic isolation on absorption and hypnotic susceptibility. International Journal of Clinical and Experimental Hypnosis, 31, 235-238. Barabasz, A., Barabasz, M., Dyer, R., & Rather, N. (1993). Effects of chamber REST, flotation REST and relaxation on transient mood state. In A. Barabasz & M. Barabasz (Eds.), Clinical and Experimental Restricted Environmental Stimulation, New York: Springer- Verlag, p. 113-120. Barr, K., & Hall, C. (1992). The use of imagery by rowers. International Journal of Sport Psychology, 23, 243-261. Bernstein, D., & Borovec, T. (1973). Progressive relaxation training, a manual for the helping professions. Champaign, IL: Research Press. Bloch, H., Silverman, R., Mancherje, N., Grant, S., Jagminas, L., & Scharf, S. (1995). Intravenous magnesium sulfate as an adjunct in the treatment of acute asthma. Chest, 107, 6, 1576-1581. Budney, A.J., & Woolfolk, R.L. (1990). Using the wrong image: an exploration of the adverse effects of imagery on motor performance. Journal of Mental Imagery, 14 (3 & 4), 75-86. Budzynski, T.H. (1976). Biofeedback in the twilight states of consciousness. In G.E. Schwartz and D. Shapiro (Eds.). Consciousness and Self-Regulation: Advances in Research, Vol. 1. New York: Plenum, pp. 361-385. Fine, T., Mills, D., & Turner, J. (1993). Differential effects of wet and dry flotation REST on EEG frequency and amplitude. In A. Barabasz & M. Barabasz (Eds.), Clinical and Experimental Restricted Environmental Stimulation, New York: Springer-Verlag, pp. 205-213. Francis, W.D., & Stanley, J.M. (1985). The effects of restricted environmental stimulation on physiological and cognitive indices. In T.H. Fine & J.W. Turner, Jr. (Eds.), Proceedings of the First International Conference on REST and Self-Regulation (pp. 40- 49). Toledo, OH: International REST Investigator's Society. Gauron, E. (1984). Mental training for peak performance. Lansing, NY: Sport Science Associates. Hall, C., Mack, & Paivio (1996) SIQ ??????? Hall & Martin (in press) MIQ-R ????????? Hall, C., Rodgers, W.M., & Barr, K.A. (1990). The use of imagery by athletes in selected sports.

The Sport Psychologist, 4, 1-10. Hellstead, J. (1987). Sport psychology at a ski academy: Teaching mental skill to young athletes. The Sport Psychologist, 1, 56-68. Hutchinson, B. (1984). The book of floating. New York: Morrow. Jacobs, G.D., Heilbronner, R.L., & Stanley, J.M. (1985). The effects of short term flotation REST on relaxation: A controlled study. In T.H. Fine & J.W. Turner, Jr. (Eds.), Proceedings of the First International Conference on REST and Self-Regulation (pp. 86- 102). Toledo, OH: International REST Investigator's Society. Korn, E.R. (1994). Mental imagery in enhancing performance: Theory and practical exercises. In Sheikh, A.A., & Korn, E.R. (Eds.), Imagery in Sports and Physical Performance (pp. 201-230). Amityville, NY: Baywood Publishing. Kumasaka, D., Lindeman, K., Clancy, J., Lande, B., Croxton, T., & Hirshman, C. (1996). MgSO4 relaxes porcine airway smooth muscle by reducing Ca2+ entry. American Journal of Physiology, 270, L469-l474. Lee, A., & Hewitt, J. (1987). Using visual imagery in a flotation tank to improve gymnastic performance and reduce physical symptoms. International Journal of Sport Psychology, 18, 223-230. Lilly, J.C. (1977). The Deep Self. New York: Simon & Schuster. Loor, M., Daston, P., & Smith, I.R. (1967). An analysis of mood states. Educational and Psychological Measurement, 27, 89-96. Martens et al (1990) SCAT reference ?????? McAleney, P.J., Barabasz, A., & Barabasz, M. (1990). Effects of flotation restricted environmental stimulation on intercollegiate tennis performance. Perceptual and Motor Skills, 71, 1023-1028. Melchiori, L.G. & Barabasz, A. (1990). Effects of restricted environmental stimulation on simulated flight performance. In P. Suedfeld, J. Turner, Jr., & T. Fine (Eds.), Restricted Environmental Stimulation: Theoretical & Empirical Developments in Flotation REST. New York, NY: Springer-Verlag, pp. 135-142. Murphy, S. M. (1994). Imagery interventions in sport. Medicine & Science in Sports & Exercise, 26(4), 486-494. Nelson, S., & Suresh, M. (1991). Magnesium sulfate-induced relaxation of uterine arteries from pregnant and nonpregnant patients. American Journal of Obstetric Gynecology, 164, 1344-50. Okayama, H., Okayama, M., Aikawa, T., Sasaki, M., & Takishima, T. (1991). Treatment of status asthmaticus with intravenous magnesium sulfate. Journal of Asthma, 28, 1, 11-17. O'Leary, D.S., & Heilbronner, R.L., (1985). Flotation REST and information processing: A reaction time study. In T.H. Fine & J.W. Turner, Jr. (Eds.), Proceedings of the First International Conference on REST and Self-Regulation (pp. 50-61). Toledo, OH: International REST Investigator's Society. Onestak, D.M. (1989). The effects of progressive relaxation, mental practice, and hypnosis on athletic performance: a review. Journal of Sport Behavior, 14 (4), 247-282. Orlick, T. (1990). In Pursuit of Excellence: How to win in sport and life through mental training. Champaign, IL: Leisure Press. Powell, G.E. (1973). Negative and positive mental imagery in motor skill acquisition. Perceptual and Motor Skills, 37, 312. Sheikh, A.A., Sheikh, K.S., & Mopleski, M.L. (1994). Improving imaging abilities. In Sheikh, A.A., & Korn, E.R. (Eds.), Imagery in Sports and Physical Performance (pp. 201-230). Amityville, NY: Baywood Publishing. Smith, D. (1987). Conditions that facilitate the development of sport imagery training. The Sport Psychologist, 1, 237-247. Stanley, J., Mahoney, M., & Reppert, S. (1985). REST and enhancement of sports performance. In T.H. Fine & J.W. Turner, Jr. (Eds.), Proceedings of the Second International Conference on REST and Self-Regulation (p. 40-49). Toledo, OH: International REST Investigator's Society. Suedfeld (1979) ????? p. 5 increased imaginative involvement Suedfeld, P. (1980). Restricted environmental stimulation: Research and clinical applications. New York:

Wiley. Suedfeld, P. (1990). Distress, no stress, anti-stress, eustress: where does REST fit in? In T.H. Fine & J.W. Turner, Jr. (Eds., Restricted Environmental Stimulation: Research and Commentary. Toledo, OH: Medical College of Ohio Press. Suedfeld, P., & Baker-Brown, G. (1986). Restricted environmental stimulation therapy and aversive conditioning in smoking cessation: Active and placebo effects. Behavior Research and Therapy, 24, 421-428. Suedfeld, P., & Bruno, T. (1990). Flotation REST and imagery in the improvement of athletic performance. Journal of Sport and Exercise Psychology, 12, 82-85. Suedfeld, P., Collier, D., & Harnett, B. (1993). Enhancing perceptual motor accuracy through flotation REST. The Sport Psychologist, 7, 151-159. Suedfeld, P., Landon, P. B., Epstein, Y. M., & Pargament, R. (1971). The role of experimenter and subject expectation in sensory deprivation. Representative Research in Social Psychology, 2, 21-27. Suedfeld, P., Metcalfe, J., & Bluck, S. (1987). Enhancement of scientific creativity by flotation REST. Journal of Environmental Psychology, 7, 219-231. Taylor, T. (1990). The effects flotation restricted environmental stimulation therapy on learning: Subjective evaluation and EEG measurements. In P. Suedfeld, J.W. Turner & T. Fine (Eds.) Restricted Environmental Stimulation: Theoretical and Empirical developments in Flotation REST. Springer-Verlag, pp. 125-142. Turner, J.W., Jr., Bayless, J., & Fine, T.H., (1989). The effect of flotation restricted environmental stimulation on plasma ß-endorphin. Unpublished manuscript, Medical College of Ohio. Turner, J.W., Jr., & Fine, T.H. (1983). Effects of relaxation associated with brief restricted environmental stimulation therapy (REST) on plasma cortisol, ACTH, and LH. Biofeedback and Self-Regulation, 8, 115-126. Turner, J.W., Jr., Fine, T.H., McGrady, A., & Higgins, J.T. (1987). Effects of biobehaviorally assisted relaxation training on blood pressure and hormone levels and their variation in normotensives and essential hypertensives. In J.W. Turner, Jr. & T.H. Fine (Eds.), Proceedings of the Second International Conference on REST (pp. 87-109). Toledo, OH: International REST Investigator's Society. Ungerleider, S., & Golding, J. M., (1991). Mental practice among Olympic athletes. Perceptual and Motor Skills, 72, 1007-1017. Wagaman, J. & Barabasz, A. (1990). Flotation REST improves intercollegiate basketball performance. In A. Barabasz & M. Barabasz (Eds.), Clinical and Experimental Restricted Environmental Stimulation, New York: Springer-Verlag, p. 87-92. Wagaman, J., Barabasz, A., & Barabasz, M. (1991). Flotation REST and imagery in the improvement of collegiate basketball performance. Perceptual and Motor Skills, 72, 119-122. Woolfolk, R., Murphy, S., Gottesfeld, D., & Aitken, D. (1985). Effects of mental rehearsal of task motor activity and mental depiction of task outcome on motor skill performance. Journal of Sport Psychology, 7, 191-197. Woolfolk, R., Parrish, M., & Murphy, S. (1985). The effects of positive and negative imagery on motor skill performance. Cognitive Therapy and Research, 9, 3, 335- 341. Author's Note The flotation REST and rowing study was conducted at the Department of Psychology at the University of British Columbia, Vancouver, British Columbia, Canada. I would like to express my deep gratitude to Dr.'s Peter Suedfeld, Sharon Bleuler, and Kevin Hamilton for their valuable contribution to and critical review of the manuscript. Correspondence concerning this article should be addressed to Sean O. Richardson, UBC REST Lab, Department of Psychology, University of British Columbia, 2136 West Mall, Vancouver, British Columbia, Canada V6T 1W4; telephone (604) 822-6666 or (604) 913-1409; e-mail [oarsman@netcom.ca]. TABLE 1. Means for Ergometer Score Improvements (in seconds) across Conditions for all Levels Erg Difference X Group Condition Interaction Effects Erg Difference PMR REST df F p Novice & Varsity* (excluding Lightweights) (n=10) (n=10) Erg Difference1 Beast - Monster M (SD) -0.08 (4.38) 2.37** (1.74) 1, 18 2.70 .118 Erg Difference2 Beast - Power M (SD) 2.72 (5.92) 9.10** (7.19) 1, 18 4.69 <.05 All Rowers (n=12) (n=12) Erg Difference3 Monster - Power M (SD) 2.51 (5.67) 6.55** (6.74) 1, 22 2.52 .126 Note. * The four lightweight varsity rowers did not compete in the Beat the Beast ergometer competition. Means denoted by ** differ significantly from zero, p<.005. TABLE 2. Means for Ergometer Score Improvements (in seconds) across Conditions - Novice Men Only Erg Difference X Group Condition Interaction Effects Erg Difference PMR (n=8) REST (n=7) df F p Erg Difference1 Beast - Monster M (SD) 0.06 (4.89) 2.79** (1.79) 1, 13 1.93 .188 Erg Difference2 Beast - Power M (SD) 2.04 (6.21) 10.89** (5.89) 1, 13 7.95 <.02 Erg Difference3 Monster - Power M (SD) 1.97 (6.41) 8.10** (4.71) 1, 13 4.33 <.05 Note. Means denoted by ** differ significantly from zero, p<.005. TABLE 3. Means for Ergometer Score Improvements (in seconds) across Conditions - Varsity Men Only Erg Difference X Group Condition Interaction Effects Erg Difference PMR REST df F p Heavyweights Only* (n=2) (n=3) Erg Difference1 Beast - Monster M (SD) -0.65 (2.19) 1.40 (1.41) 1, 3 1.72 n.s. Erg Difference2 Beast - Power M (SD) 5.45 (5.16) 4.93 (9.55) 1, 3 0.00 n.s. Light & Heavyweights (n=4) (n=5) Erg Difference3 Monster - Power M (SD) 3.57 (4.45) 4.38 (9.04) 1, 7 0.03 n.s. Note. * The four lightweight varsity rowers did not compete in the Beat the Beast ergometer competition.TABLE 4. Correlations between ICQ Scores and Ergometer Score Improvements ICQ Test Item Erg Score Improvement: Monster-Power Erg Novice Varsity REST PMR REST + PMR Total ICQ Score -.20 .87*** .62* Total In-Lab Erg Imagery -.51 .72* .52 Total Outside-lab Erg Imagery -.10 .78** .80*** Total In-lab Erg & Water Imagery -.36 .80** .51 Total Outside-lab Erg & Water Imagery -.13 .88*** .76** Imagery Related to Erg Performance Erg Cue-word Imagery Lab -.31 .53 .81*** Erg Cue-word Imagery Outside .08 .49 .75** Erg LT Goal Imagery Lab -.46 .66* .61* Erg LT Goal Imagery Outside -.09 .28 .13 Erg Motivation Imagery Lab -.61 .59 .58 Erg Motivation Imagery Outside -.15 .83** .32 Erg Pain Imagery Lab -.83** .62 .80*** Erg Pain Imagery Outside -.15 .78** .32 Erg Score Imagery Lab -.25 .72** .70** Erg Score Imagery Outside -.15 .65* .29 Erg Split Imagery Lab .60 .39 .59* Erg Split Imagery Outside -.06 .33 .42 Erg ST Goal Imagery Lab -.21 .73** .62* Erg ST Goal Imagery Outside -.06 .84*** .13 Erg Technique Imagery Lab -.59 .73** .74** Erg Technique Imagery Outside -.22 .86*** .31 Imagery Related to On-Water Performance Water Cue-word Imagery Lab -.57 .45 .51 Water Cue-word Imagery Outside -.18 .67* .46 Water LT Goal Imagery Lab -.17 .14 .18 Water LT Goal Imagery Outside .01 .64* .19 Water Motivation Imagery Lab .15 .38 .16 Water Motivation Imagery Outside -.13 .80** .22 Water Pain Imagery Lab -.14 .60 .91*** Water Pain Imagery Outside -.38 .78** .50 Water Focussing Imagery Lab .13 -.07 .80*** Water Focussing Imagery Outside -.21 .57 .44 Water Winning Imagery Lab -.23 .68* .42 Water Winning Imagery Outside -.19 .73** .16 Water ST Goal Imagery Lab -.41 .39 .14 Water ST Goal Imagery Outside -.12 .81** .18 Water Technique Imagery Lab .40 -.28 .14 Water Technique Imagery Outside .11 .71** .03 Note. *p < .10. **p < .05.***p<.01 two-tailed. Figure Captions Figure 1. Average improvement in ergometer score: REST vs. PMR. Figure 2. Relationship between ICQ scores and erg score improvement for novice men. Figure 3. Relationship between changes in training load and erg score improvement