Appendix

CEHD Grant Application Form

Submit this application form by one of the following due dates along with your proposal. Applications must be received, at tate-center@wmich.edu, by 5:00 p.m. on August 15, November 15, March 15, and June 15.

Application	
Applicant Name:	Nicholas J Hanson
Title:	Assistant Professor
Department:	Human Performance & Health Education
Title of Proposal:	Using biofeedback deception to improve athletic performanc e
Amount Requested:	$2,000
Dates of Project:	January 1, 2017 through August 1, 2017

Evaluation Guidelines	
Strongly Agree 5 Agree 4 Undecided 3 Disagree 2 Strongly Disagree 1	
The proposed research/creative activity is well conceived and organized.	☐ ☐ ☐ ☐ ☐ 5 4 3 2 1
The proposed work will increase the likelihood that the applicant will secure external funding in the future.	☐ ☐ ☐ ☐ ☐ 5 4 3 2 1
The methods and/or procedures are clearly stated and appropriate for the proposed activity.	☐ ☐ ☐ ☐ ☐ 5 4 3 2 1
The plans for data analysis or evaluation critique are clearly stated and appropriate for the proposed activity.	☐ ☐ ☐ ☐ ☐ 5 4 3 2 1
The costs for the proposed budget are clearly itemized and justified.	☐ ☐ ☐ ☐ ☐ 5 4 3 2 1
This project has the potential to advance the scholarly/creative reputation of WMU.	☐ ☐ ☐ ☐ ☐ 5 4 3 2 1

USING BIOFEEDBACK DECEPTION TO IMPROVE ATHLETIC PERFORMANCE

BACKGROUND

It is crucial for exercise/sport scientists and coaches to understand how the brain interacts with and influences athletic performance. Physiological training methods used in endurance sports have been studied very closely and it is well understood that factors such as cardiorespiratory fitness, lactate threshold and economy are important for performance (2, 8, 10). However, these variables have limits and they are reached athletes often search for alternatives to improve their performances. Psychological methods are increasingly being used in combination with physiological training, such as mental skills exercises, using competitors, imagery and self-talk (9, 11). Another method that has shown promise is deception.

The use of deception involves modifying athletes' expectations prior to and during a performance, and acts to alter their perceptions about current or previous performances (13). There has been some research recently investigating the effects of deception on endurance performance, but the studies have been somewhat inconclusive. This is likely due to differences in subjects, research methodology, or ineffective deception (e.g. the athlete knew about the deception or did not believe it). A recent review paper (13) indicated that out of 31 studies using deception with endurance athletes, 10 (or 32%) showed improvements in performance. An interesting approach of using visual avatars on a computer screen has been used by some research groups, such as Stone et al. (12). For their study, a 4 kilometer time trial was the performance measure. In the deception condition, they raced against an avatar whose power output was set to 102% of each subject's baseline trial. The researchers found that this small difference led to a significantly faster 4 km time trial. Another study using a visual avatar deceived cyclists into believing that they were competing with a simulated competitor with a similar ability level. They were in fact competing against their own best completion time during a 2 km time trial. In the end, the subjects finished the time trial against the avatar significantly faster than any other trial.

Conversely, some studies have not shown deception to be an effective approach to increasing performance (1, 5-7). In a recently completed study in our lab (manuscript currently in review) using an environmental chamber, subjects were deceived of ambient temperature. In addition to a control condition (21°C, 43% relative humidity (RH)) they were asked to run a simulated 5 km race in hot, humid conditions (31°C, 65% RH) and another condition where they were told that it was 5°C cooler than it actually was. When subjects were questioned after the conclusion of the study, it was apparent that they did not realize that the two hot conditions were actually the same exact temperature and humidity. However, the deception did not lead to a significantly faster completion time of the 5 km run, and no differences in perceptions. This

study was designed around a study by Castle et al. (4) using cyclists and the same environmental conditions. However, an addition to their study was biofeedback deception of the athletes' core temperature. In their deception conditions, subjects were shown an incorrect (lower) core temperature, which led to a significantly faster time trial. Results from the two studies, taken together, indicate that it is likely the biofeedback deception that was the key to eliciting performance benefits. Unfortunately, athletes do not have access to core temperature information during an event, which decreases the ecological validity of their results. A more readily available physiological measure is heart rate (HR). To the best of our knowledge, biofeedback deception of HR has not been explored.

PURPOSE

The purpose of this study is to explore the use of biofeedback deception of heart rate in an attempt to improve athletic performance. Specifically, I want to determine if this form of deception will 1) lead to a significantly faster completion time and 2) positively affect perceptions, such as ratings of perceived exertion.

HYPOTHESIS

1. Biofeedback deception will lead to a faster completion time for in a simulated 4km cycling time trial
2. This deception will also lead to similar or lower perceived exertion for the subjects

METHODOLOGY

Subjects

Fifteen subjects will be recruited for this study. We will seek out trained cyclists in the community and on campus who will be able to come to the lab for three visits. Inclusion criteria will be healthy, "low risk" individuals as determined by the American Heart Association/American College of Sports Medicine (AHA/ACSM) pre-participation heath screening questionnaire. Exclusion criteria will be those individuals who have had an injury in the previous six months, or are outside the age range of 18-50 years. They will be informed of the purpose of the study and the details. If they agree to participate they will be asked to sign an informed consent form that is approved by the WMU Human Subjects Institutional Review Board (HSIRB).

Procedures

The subjects will be asked to come to the Human Performance Research Laboratory (HPRL) for three visits. The first visit will be a VO_2max test, which is a graded exercise test that is used to assess cardiorespiratory fitness level. During this visit they will also be familiarized with the laboratory equipment, and the rating of perceived exertion (RPE) scale (3). This is a subjective scale ranging from 6-20 with verbal descriptors such as "somewhat hard" and "very hard." The second and third visits will be randomized and will each include a 4 km time trial that will be performed on a Lode cycle ergometer. On one of these visits the subject will be shown their correct, accurate HR. On the other visit, subjects will be shown an incorrect HR that is 10 beats per minute lower than the actual HR. RPE will be assessed every three minutes. They will be told that the purpose of the study is to validate a computer-based HR measurement system.

Statistical Analysis

Paired-samples t-tests will be used to compare the two conditions (control and experimental). The dependent variables will be completion time, RPE and actual HR. Analyses will be conducted using SPSS version 23, and the alpha level will be set *a priori* at $p<.05$.

ANTICIPATED OUTCOMES

Heart rate is a very commonly used physiological measure of exercise intensity. If successful, biofeedback deception could be integrated into wrist-worn heart rate monitors and be used by coaches of athletes to improve performance.

PLANS FOR CONTINUING RESEARCH

I plan to submit the results from this study to two conferences: the Midwest ACSM conference, which is due mid-September, and the national ACSM conference (typically due the first week of November). I will also prepare a manuscript for submission to a peer-reviewed journal; likely high-impact factor candidates are the International Journal of Sports Physiology & Performance or the Journal of Strength & Conditioning Research. In addition, this research could serve as pilot data for a larger scale grant such as the Young Investigator Grant offered through the National Strength & Conditioning Association ($20,000) or the Research Endowment grant as part of the ACSM ($10,000).

References

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4. Castle, PC, Maxwell, N, Allchorn, A, Mauger, AR, and White, DK. Deception of ambient and body core temperature improves self paced cycling in hot, humid conditions. *Eur J Appl Physiol* 112: 377-385, 2012.
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Budget and Justification

(Redacted)