***PARTICIPANT INFORMATION SHEET***

**Section A: The Research Project**

* Title of project

The utilisation of biofeedback and the psychophysiologcal factors used in pacing strategies in cycling time trialists

* Purpose and value of study

This study aims to investigate the psychophysiological factors used in pacing strategies in cycling time trialists in a time trial. The use of biofeedback in cycling has become popular with the enhancement of technology and cyclist often tend to use biofeedback to assist their performance. This study aims to compare the pacing strategies used when cyclists have the opportunity to use biofeedback and when removed. The study will help indicate the most effective biofeedback used in cycling time trials.

* Invitation to participate

Participants must be aged between 18 and 30 years old and have a more than 2 years of cycling >50 miles per week.

* Who is organising the research

UCP staff Nathan Thompson and Lee Waters have organised the study for the University Centre Peterborough.

* What will happen to the results of the study

All collected data will be analysed using statistical computer software to investigate the effects of biofeedback on cycling time trial performance. It is our intention to use the data collected in the study to formulate a research paper with the aim of being published.

* Source of funding for the research

No funding is required.

* Contact for further information

Nathan Thompson

Nathan.Thompson@peterborough.ac.uk

Lee Waters

Lee.waters@peterborough.ac.uk

**Section B: Your Participation in the Research Project**

* Why you have been invited to take part

As a member of a cycling club you make an ideal candidate for this research project and your results could be used to recommend the most effective use of biofeedback in cycling time trials.

* Whether you can refuse to take part

You are under no obligation to take part in this research and have the right to refuse to take part.

* Whether you can withdraw at any time, and how

You can withdraw from the research at any time, for any reason and without prejudice. Withdrawal can be completed by filling in the participant consent form withdrawal slip and returning it to Nathan Thompson or Lee Waters at the University Centre Peterborough. You can also email both researchers using the email address provided in section A or on the participant consent form.

* What will happen if you agree to take part (brief description of procedures/tests)

You will be asked to visit the University Centre Peterborough laboratory on three separate occasions all approximately lasting one hour for each session. Seven days before the study begins to complete informed consent and a physical activity readiness questionnaire (PARQ). If your PARQ highlights any contraindications to exercise or issues of concern you will be referred to your GP and you will no longer be able to take part in the study. You will also be given a dietary and exercise log with completion guidelines. Due to the nature of the study any use of performance enhancing supplements would result in exclusion from the study.

You will be asked to take part in three sessions at UCP:

* Maximal VO2max test and familiarisation of the biofeedback equipment and Watt Bike (Session duration = 60 mins)
* A 25km cycling time trial with or without biofeedback (approx 60mins duration)
* A 25km cycling time trial with or without biofeedback (approx 60mins duration)

Your height and mass will be recorded with a stadiometer and SECA scales. Your resting blood lactate will be measured in accordance with the Human Tissue Act (2004), Anglia Ruskin University Standard Operating Procedures: Human Tissue (SOP-14) and BASES guidelines using a blood-sampling lancet and blood lactate scout. A blood sample will be taken from the earlobe to measure blood lactate; the procedure involves a small prick to the ear using the blood-sampling lancet. The blood lactate scout will then be used to collect and analyse a small blood drop from the earlobe using the machines blood-sampling strip. You will then be asked to complete a maximal VO2 ramp test. Throughout this test blood samples will be collected and respiratory measures will be collected using an online metalyzer.

Your familiarisation will be completed following an introduction to the Wattbike, rate of perceived exertion (RPE) scale and the biofeedback equipment.

The study will involve two experimental testing sessions, one will consist of a five minute cycling warm up followed by a twenty five kilometre time trial using a Wattbike with or without the use of biofeedback.

Your RPE, heart rate and blood lactate will be throughout the time trial. Your blood lactate results will be taken from the lactate scout and recorded on an excel spreadsheet. Be aware that a small amount of physical contact will be made to the earlobe during blood sampling. Throughout both trials you will wear a mask in order to collect respiratory measures to analyse at a later date.

**See Appendix 1 for further details**

* Whether there are any risks involved (e.g. side effects from taking part) and if so what will be done to ensure your wellbeing/safety

The tests are all maximal in nature and therefore will require some physical discomfort. As you are already exposed to this type of training it should be no different from the intensities used in your sport. A warm up and cool down will be provided to aid any discomfort.

There will be a small discomfort with the taking of blood from the lancets. As with any blood sampling procedures there are risks associated with blood contamination and bacterial infections however appropriate preventatives have been put in place (see appendix 1).

* Agreement to participate in this research should not compromise your legal rights should something go wrong

Your legal rights will not be compromised by taking part in this research.

* Whether there are any special precautions you must take before, during or after taking part in the study

You will be asked to refrain from any exercise 24 hours before the test. For the second test you will need to match the two logs in order to avoid these factors having any influence on the results. Sports trainers and cycling shorts and a cycling jersey/shirt will need to be worn for both tests. To ensure all participants are faced with the same conditions no cycling cleats will be used in this study. You will be allowed to drink water throughout the trials however no more than 700ml will be consumed. No food will be consumed 2 hours prior to the trials and no caffeine will be consumed 3 hours prior

* What will happen to any information/data/samples that are collected from you

All data will be kept confidently on a password-protected laptop by the investigator. No names will be used and all subjects will be listed using numbers. The data collected will be used to accept or reject the dissertation hypotheses and retained for seven years as required by the Data Protection Act. The data will be deleted in May 2024.

* Whether there are any benefits from taking part

The study will investigate how effective biofeedback is when used in cycling time trials. This could influence your own training programmes. In addition the VO2max tests will provide you with a VO2 value used to identify aerobic performance.

* How your participation in the project will be kept confidential

Your details will be kept secure and confidential on a password locked laptop. The investigator will be the only person who has access to your details. Your details will be retained for seven years as required by the Data Protection Act and deleted in May 2024.

YOU WILL BE GIVEN A COPY OF THIS TO KEEP,

TOGETHER WITH A COPY OF YOUR CONSENT FORM

**Appendices**

**Appendix 1 – Methodology**

You will be asked to voluntarily take part in 3 trials each with a duration of approximately 1 hour: Below is a detailed explanation of trials required.

**Trial 1 (Familiarisation and VO2 max test)**

Descriptive statistics age (years), height (cm) and weight (kg) and gender will be collected at the start of the study. Participants will be required to complete a PAR Q, informed consent and training experience indictor prior to taking part in the study. Limb length will be measured with a goniometer and set at the most appropriate seat position.

* Resting levels of lactate will be collected using a lactate scout device and lancet. Resting levels of Hematocrit will be taken and analysed using a hemocue. Resting heart rate will be collected using a polar F6 heart rate monitoring device.
* Participants will be familiarised with the outputs (heart rate, blood pressure, muscle tension, skin conductance, blood flow) of the nexus 4 EEG. The nexus system is a medical grade system for biofeedback and neuro feedback applications. The hardware NeXus-4 can measure up to two channels of EEG, EMG, ECG and EOG signals as well as up to two peripheral signals like heart rate, relative blood flow, skin conductance, respiration, temperature (mindmedia, 2017). It communicates wirelessly with a computer and provides freedom in movement during a session. The software is BioTrace+ which uses algorithms for precise assessment and analysis and is highly customisable. Unlike other systems, the raw signal data is sent straight from the NeXus device on the computer meaning it is not filtered at source and therefore everything is analysed within the software
* A cycling ramp test will be performed on a Watt bike pro trainer ergometer to determine the VO2 max of each participant. The following protocol will be used for the VO2 protocol:

-Subjects start at an initial wattage of 50 W

-Watt to be increased at the rate of 25 Wmin -1

-The tests will be terminated when the subjects are unable to maintain a cadence of 70 rpm

-Verbal encouragement will be used throughout the test until they are exhausted

-All participants will have had experience of this type of testing protocol

**Test Termination**

- The test will be terminated if subjects are unable to maintain a cadence of 70rpm

* A cool down (5-10mins) will be self selected by the subjects on completion of the protocol

**Trial 2 – Completion of either a 25KM cycling time trial with exposure to biofeedback or without (Control)**

Participants will be set up on a wattbike pro trainer using their recorded seat position.

* Resting levels of Bla, Hct will be taken from the ear lobe of the cyclist. Resting heart rate will also be recorded using a Polar F6 monitor. The researchers will place the heart rate straps on the subjects.
* Subjects will be set up on the Metalyzer 3b which will collect respiratory samples throughout the time trial. The VO2 raw data will be later exported into Microsoft Excel and analysed at a later date in IBM SPSS Statistics version 21. Measures of VE, VCO2, VO2, RER will be collected and analyzed at a later date.
* Subjects that are exposed to biofeedback will be set up on the Nexus 4 EEG. The researcher will place the electrodes on the following locations:

-Index finger and ear lobe

* Throughout the time trial subjects will be able to see their heart, blood pressure, muscle tension, skin conductance and blood flow. In addition the Wattbike expert software will continually record the mean power, peak power and indicate cycling efficiency between both legs in each revolution. Subjects will be able to view both the nexus 4 EEG and Wattbike Expert Software outputs which may be used to assist their performance.
* Subjects will complete a 5min warm up between 100-150 watts at a self selected resistance
* On completion of the warm up subjects will be asked to complete 25km in their best time possible. Subjects may alter resistance on personal preference. No motivation will be provided throughout the time trial. A blood lactate sample, RPE and heart rate will be collected and recorded every 5km. On completion of the time trial time will be recorded.
* Subjects will then be asked to conduct a 5min cool down at 100-150 watts at a self selected resistance.

**Qualitative Interview**

On completion of the cool down a semi structured interview will be conducted with the subjects once they have self declared their recovery from the trial. The interview will take place no more than 10mins after the trial. The interview will take place in the sports science laboratory. Questions will be the same orientation for each subjects looking at the following themes:

* What pacing strategies did they use and why?
* How and did they use the biofeedback for their time trial?
* What biofeedback was most beneficial?
* If biofeedback was not used how did their pacing strategy change or not?

**Trial 3**

Repeat of trial 2 – opposite conditions to previous trial