KPU Registry ID Number: 1011 Date Submitted: 17th March 2015

Study Registration For the KPU Study Registry

The registration information for the study is given below. Each section can be expanded as needed.

1. The title or name of the experiment (for listing the experiment in the registry).

CardioAlert: a portable assistant for the choice between negative or positive random events.

2. The name, affiliation, and email address for the lead experimenter(s) for the study.

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3. A short description or abstract of the purpose and design of the experiment.

The possibility to exploit the predictive anticipatory activity to predict random negative events will be investigated by using a portable apparatus we named CardioAlert (CA). This apparatus is devised to use the heart rate of each individual to send an alert when a negative or a positive future event presented randomly is going to happen.

4. A statement or list of the specific hypothesis or hypotheses being tested, and whether each hypothesis is confirmatory or exploratory. (confirm/explore guidance)

Confirmatory hypothesis:

- The hit rate of positive events will be higher when the task is performed with the CA than without it;

Exploratory hypotheses:

- We will test if there is a correlation between the mean, median and standard deviation of the heart rate measured at baseline and the hit rate;
- We will test if there will be an order effect, that is if the hit rate will be higher when the task is completed first with the CA, followed by the task without it and viceversa.

- We will test if objective (HR) and subjective reporting of the type of event (positive or negative) that trigger the higher emotional reaction, may predict when the CA will alert a future positive or negative event.

5. The planned number of participants and the number of trials per participant.

We expect a standardized effect size of approximately .20 as observed in a pilot study. To achieve a statistical power of at least .80, we plan to recruit 100 participants. Each task comprises 10 trials.

6. A statement that the registration is submitted prior to testing the first participant, or indicating the number of participants tested when the registration (or revision to the registration) was submitted.

At today, 15th March 2015, we have tested 20 participants.

The following additional information is needed for studies that include confirmatory analyses:

7. Specification of all analysis decisions that could affect the confirmatory results, including: the specific statistical test for each confirmatory hypothesis, whether the test is one-sided or two-sided, the criterion for acceptable evidence, any transformations or adjustments to the data, any criteria for excluding or deleting data, and any corrections for multiple analyses. Checklists and examples for registering classical analyses, Bayesian analyses, and classification analyses are provided in the statistics registration document.

The confirmatory hypothesis will be tested both with a frequentist parameters estimation and a Bayesian model comparison approach.

We will estimate the difference between the percentage and the total number of hits obtained without the CA and the second repetition of the task with the CA (see procedure), calculating a standardized effect size with a 95% confidence intervals. The hypothesis test is that the 95% confidence interval for the difference does not contain zero.

Furthermore we will calculate the BayesFactor of the comparison between the hypothesis that the percentage of hits will be higher when the task is performed with the CA with respect when it is performed without it. We will use a prior of an effect size of

.20 with a Cauchy distribution. A Bayes factor > 3 will be considered acceptable evidence.

All exploratory hypotheses will be tested with a frequentist parameters estimation using 95% one-sided confidence intervals.

Data will be excluded only if due to the apparatus malfunctioning or a clear violation of the instructions given by the research assistant to the participants.

8. The power analysis or other justification for the number of participants and trials.

See item 5

9. The methods for randomization in the experiment.

We will use a pseudo-random procedure using the random function included in the E-Prime™ software, resetting the randomization after each of the 10 trials.

10. A detailed description of the experimental procedure.

The CardioAlert app is a special app to be installed in a normal smartphone. It receives the heart-rate signals from an Arduino microcontroller via Bluetooth signal which calculates the mean, median and standard deviation of the beat-to-beat intervals. The heart rate is obtained with a photoplethysmograph attached to the index finger of the left or the right hand for the right-handed and left-handed respectively and conveyed to the Arduino. See Figure 1 which presents the apparatus.

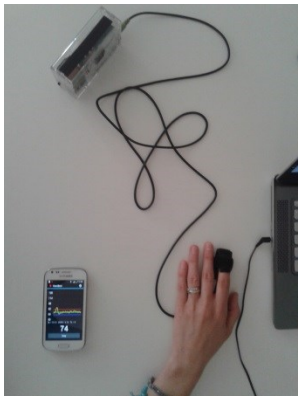

Figure 1: the Apparatus. It consists of a photoplethysmograph attached to the index finger of the participants which convey the heart-rate to an Arduino microcontroller. Arduino send this information via Bluetooth signal to the CardioAlert app installed in a smartphone.

The task

The task, developed with E-Prime™ v.2, consists in the presentation of two doors in the middle of the computer screen with a white dots between them and in the choice of the "winning" door avoiding the "dangerous" door (see Figure 2).

Figure 1: Sequence of events of the task

Behind the "winning" door a smile will appear with the information "you won € 0.5", whereas behind the "dangerous" door a shooting gun will be presented. The randomization of the winning door is implemented using the E-Prime™ random function selecting between the numbers 0 and 1 corresponding to the left and right position respectively.

After 10 seconds which represent the anticipation period, the white dot between the two doors will change its color in green signaling that it is necessary to choose a door. The choice of the left door will be made pressing the "z" key on the computer keyboard, whereas the choice of the right door, pressing the "m" key. Each task comprises 10 trials to avoid boredom and the attempts to search underlying rules regulating the choice of the winning door even if participants will be informed that it was randomized.

Procedure

The task will be performed in a sound attenuated laboratory. The research assistant will give the following instruction to the participants: "Your task is to choose between the two doors you will see on the computer monitor, that one behind which there is a smile and the message, "you won € 0.5". If you choose the wrong door you will see a gun and hear a gun shot. The choice of the "winning door" is absolutely random hence it is impossible to discover an underlying rule. The task consists of ten trials. You must chose the door immediately after you will see the dot in the middle of the two doors colored in red. You will be requested to complete the task three times.

Before the first one, we will calculate the mean and the standard deviation of your heart-rate recording it for three minutes at rest, breathing regularly. Afterwards you will be requested to complete the task, once by using only your intuition and twice by using the CardioAlert. With the CardioAlert, you will alerted hearing a repeated sound similar to an alarm when you are about to choosing the "dangerous" door. In this case you must

change your choice. If at the end of the task you will hit correctly only 4 or less trials, in the next task you will change your choice only when the CA does not alarm you. Note: at this stage of the research program we do not know what variables can be used to predict when the CA alarm is correlated with the positive or negative events. The order of tasks with and without the CA, will be balanced among the participants.

For each participant the alarm threshold will correspond to 7± the mean heart-rate measured at rest. For example, if the mean HR measured at rest = 80 the alarm will be emitted when the heart-rate in the anticipation period will exceed 87 and will be below 73. The value 7 was predefined after a pilot investigation.