

Does a rhythmic auditory feedback help exercising with an auditory instruction?

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Summary— Rhythmic exercises help to improve both cognitive and physical skills. Significant improvement was especially achieved in gait rehabilitation in Parkinson’s disease and after stroke [6]. With additional feedback, for example auditory, rehabilitation process improves [5].

In this paper we describe the use of an exercise bike as a rhythmic exercising platform. We will briefly report results of the previous research and describe the forthcoming one.

INTRODUCTION

Rhythmic sonic interaction while exercising is a very interesting and crucial topic to investigate, especially since timing and synchronization disorders can lead to, or can be observed in Parkinson, Huntington’s disease, disorders of gait and movement, attention and concentration, Attention deficit hyperactivity disorder (ADHD), among others. Developing new exercising systems and applying rhythm to new kind of exercises can be beneficial for patients suffering from the above-mentioned diseases. Lately, an interesting project called Interactive Metronome was developed and implemented with success in rehabilitation of many patients [3]. In this project rhythm exercises are supported by visual feedback, which helps to control quality of performance. However, because audition often dominates vision for processing temporal information [1,2], it would be interesting to investigate more the role and efficiency of auditory feedback. Auditory feedback can occur in different forms, such as auditory alarms, sonification of movement variables and sonification of movement errors [4, 5]. In our study we are focused on the sonification of movement variables in a form of concurrent feedback, presented during the motor action.

PRESENT EXPERIMENT

The aim of the experiment was to test if an exercising bike can be used efficiently as a rhythmic exercising platform and if the presented auditory concurrent feedback can improve the rhythmic performance. The participants’ task was to follow tempo while exercising on a bike. Each one of the 8 sessions consisted of the one perceived and one unperceived tempo change. In half of the sessions subjects had to follow only the tempo presented by a drum sound – used as guiding sound. In the next four sessions subjects heard in the right ear the same guiding sound and in the left their own feedback from the pedaling on the exercising bike (one sound per round of pedals). Feedback was presented by another drum sound, which was easily distinguishable

from the guiding sound.

DISCUSSION OF THE EXPERIMENT

A preliminary experiment run with 8 subjects showed that feedback presented to the same modality, in this case auditory, can disturb in task execution. It would be worth to consider the auditory concurrent feedback with other types of feedback presented to different modalities. As some of the subjects mentioned in the questionnaire, it is supposed that it would be easier to use the visual feedback and prevent the overloading of the auditory system.

It was also shown that subjects followed both perceived and unperceived tempo changes in the same way. We can see that even if participants do not perceive the tempo change, they follow it in the same way as they follow the perceived changes.

FORTHCOMING RESEARCH

In the forthcoming research we would like to investigate improved versions of feedback. Instead of using one drum sound per round of pedals we would like to use continuous feedback with four sounds per round. The first one will be stressed and inform about basic tempo. Three left sounds will inform about the progress within a round.

Second improvement is the change in guiding sound. We would like to investigate if the presenting of whole melody instead of single drums sound can improve the following tempo performance. Results of this experiment will be presented at the conference

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