

Mental rotation test in condition of fatigue

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Introduction

Mental rotation is the ability to rotate two and three-dimensional objects in your mind. Mental rotation of three-dimensional objects have been experimentally studied since 1971 when *R. Shepard & J. Metzler* found that if the angle of rotation increases, then the reaction time for detecting it increases as well. The aim of our study is to examine the possible impacts of fatigue on the ability of mental rotation. Our study has 2 main aims: 1) to estimate a possible correlation between the particular time of day and reaction time in mental rotation task of 2D and 3D objects; 2) to assess the possible impact of fatigue on the reaction time in mental rotation task.

Results

In case of 2D and 3D mental rotation reaction times are longer for mental rotation of mirrored objects. The error rate is higher in evaluating 3D objects than the 2D objects. We support *Shepard & Metzler's* (1971) observation that if the angle of rotation increases, the reaction time for evaluating object pairs increases as well. If the angle of rotation and the speed of detecting the rotation are compared in 2D object, reaction time for some types of figures is faster. According to our results rotation of 3D objects produces more errors if the test is conducted within the first 5 hours after waking up or since 15 hours of being awake. However, we are not able to observe any significant effects of fatigue on the mental rotation task.

Conclusions

The reaction time of 2D figures is longer in the morning, the 3D image has the longest reaction time in the morning and by night. The highest error rate occurs in the morning time (shortly after waking up). We were not observe any impact of fatigue on the mental rotation task.

Reference

Cooper, L.A. (1975). Mental Rotation of Random Two-Dimensional Shapes, *Cognitive Psychology*, 7(1), pp.20-43.

Cooper, L.A. (1976). Demonstration of a mental analog of an external rotation. *Perception & Psychophysic*19(4), pp.296-302.

Shepard, R., & Metzler, J. (1971). Mental Rotation of Three-Dimensional. *Science*, 171(3972), pp.701-703.

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Methods

To evaluate reaction time for recognizing rotated objects (whether they do or do not match each other) we have constructed a special digitized test that consists of 256 object pairs (128 two- and 128 three-dimensional). When the pair of objects is shown on screen the participant has to indicate whether the object is the same (but rotated) or whether it is the mirror image of the same object

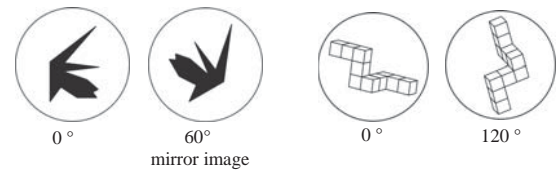


Fig.1 2D and 3D object samples.

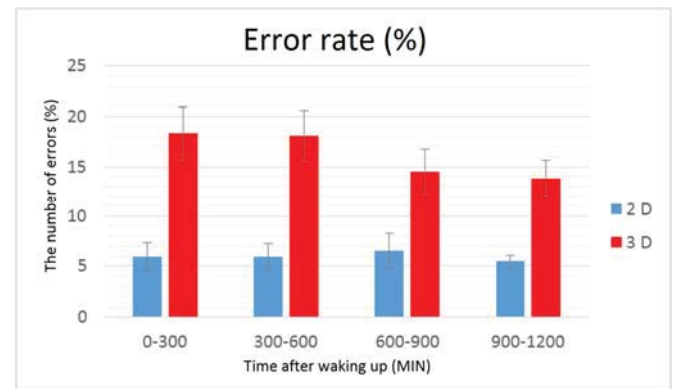


Fig.2. Error rate and time since awakening.

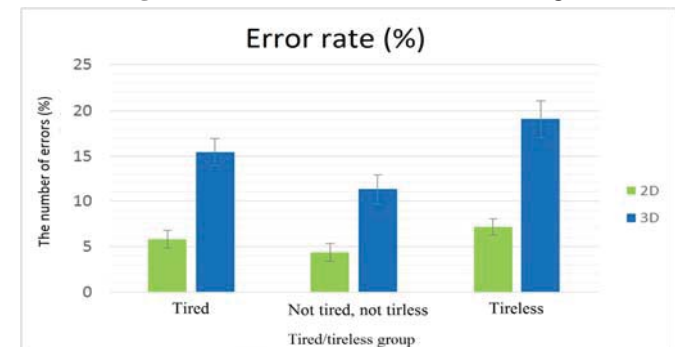


Fig.3. Error rate compared between tired and tireless with 2D and 3D figures.

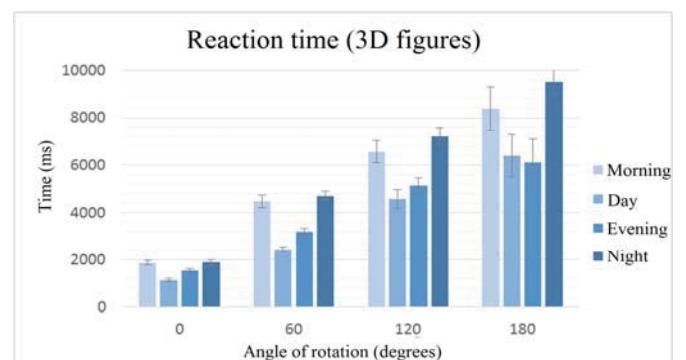


Fig.4. Reaction time of 3D figures in four different times of the day.