IMPACTS OF FATIGUE ON MENTAL ROTATION

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Introduction

Mental rotation is the ability to rotate two and three-dimensional objects in one's mind. Mental rotation of three-dimensional objects have been experimentally studied since 1971 when *R.Shepard & J.Metzler* found that increase in the angle of rotation corresponds with increase in reaction time for recognizing it. The objective of our study is to examine the possible impacts of fatigue on the ability of mental rotation. Our study has two main aims: 1) to estimate a possible correlation between a particular time of day and the corresponding reaction time in mental rotation task of 2D and 3D objects; 2) to assess the possible impact of subjective fatigue on the reaction time in mental rotation task.

Method

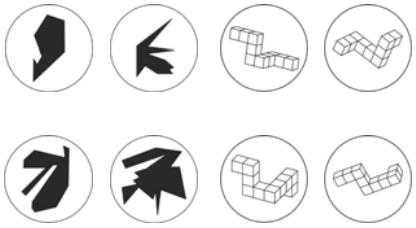

Fig.1 2D and 3D object samples.

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

In the study participated 110 subjects - from 18 to 38 years old (23±4 years).

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 recognizing 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.

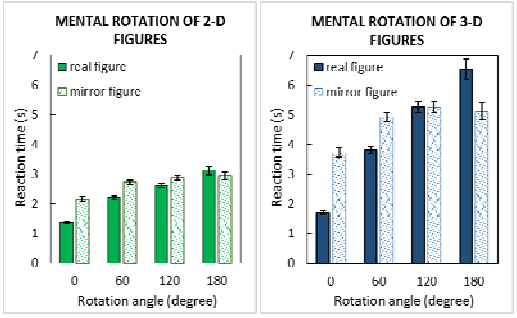

Fig.2. The correlation between reaction time and degree are observed only for real figures.

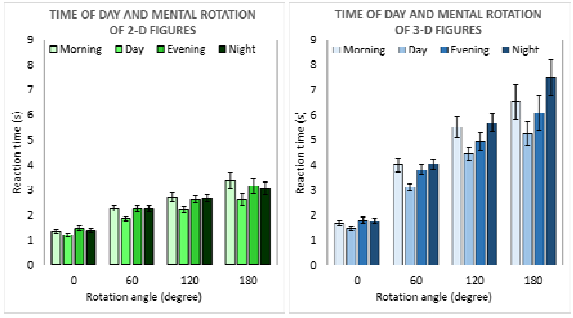

Fig.3. The mental rotation time is faster from 12:00 to 17:00 than at other times of the day.

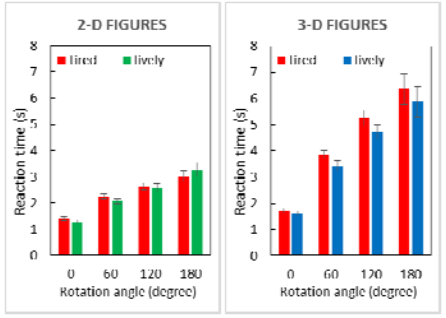

Fig.4. The impact of fatigue higher in mental rotation of 3-D figures ($p<0,05$).

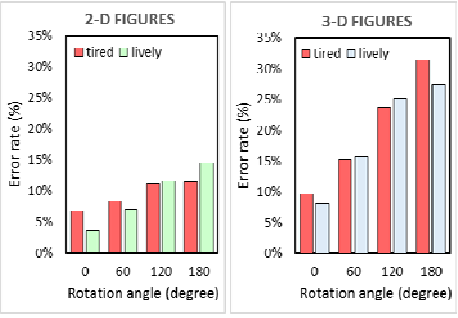

Fig.5. The impact of fatigue cannot be observed on error rate ($p>0,05$).

Conclusions

The reaction time of 2D figures is longer in the morning whereas the 3D image has the longest reaction time in the morning and by night. The highest error rate occurs in the morning (shortly after wakening up). In general, the 3D mental rotation is stronger impacted by fatigue.

References

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Acknowledgement

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