

Visual acuity monitoring in conditions of psychosocial isolation in a mock-up spacecraft

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Computerized monitoring of visual acuity has been conducted in the framework of international project SIRIUS: two-week isolation of 6 subjects (the group “team”) in a mock-up spacecraft. Project provided a possibility to study influence of some space flight factors: prolonged isolation, limited life volume, LED source illumination, monotony of duties. Control group consisted of 6 subjects whose age, gender, social and visual characteristics were similar to those of the team members. Test stimuli were widely used tumbling E symbols (TE) and modified 3-bar targets (M3B) developed in the IITP RAS. In both groups, the scores obtained with TE appeared to be higher than with M3B by about 15% indicating systematic overestimation due to using the information contained in the low-frequency components of the TE Fourier spectrum. Statistically significant ($p < 0.001$) effect of isolation in the team – decrease of visual acuity by 10% – was only detected by means of the modified 3-bar stimuli.



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Purpose

The purpose of the study was computerized monitoring of visual acuity in the framework of international project SIRIUS. The project implied two-week isolation of 6 subjects (the group "team") in a mock-up spacecraft.

This project provided a possibility to study influence of some space flight factors (prolonged isolation, limited life volume, LED source illumination, monotony of duties, etc.) on psychological state and visual performance.

Subjects & Procedure

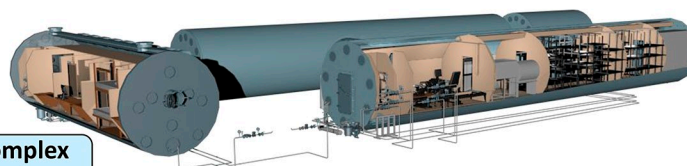
2 groups of subjects

The experimental group (the group "team")
n = 6
(average age 34,5 years)

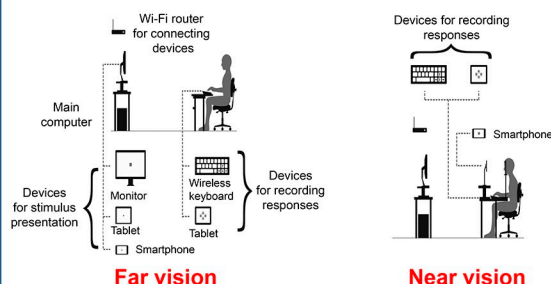
The control group
n = 6
(average age 36,7 years)
The group of researchers working in normal conditions



The mock-up spacecraft where the experimental group spent two weeks



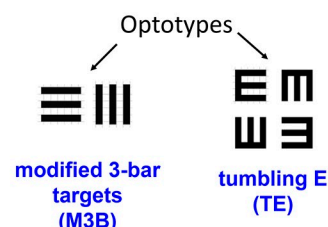
Specialized hardware-software complex "TIP-TOP"



Experimental conditions

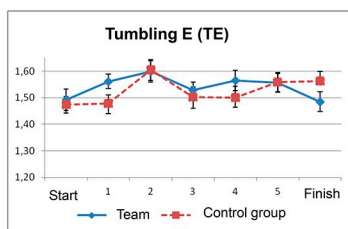
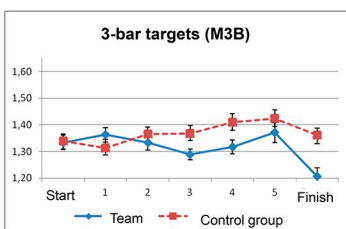
Viewing distances: 0,5; 1,0; 4,0 m
Measuring modes: monocular and binocular
Schedule of measurements:
- before isolation ("start");
- during isolation at the 3rd, 5th, 7th, 9th, 12th day;
- after isolation ("finish")
Total: 7 sessions of measurements

Monitoring of visual acuity



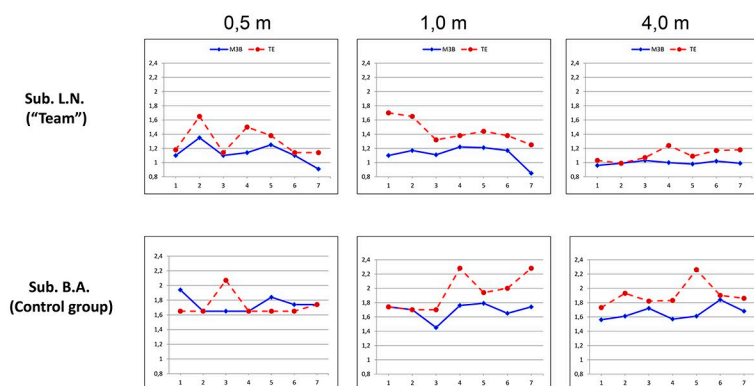
Results

Average values of binocular visual acuity before ("start"), during (sessions 1-5) and after ("finish") isolation



Abscissa: sessions
Ordinate: visual acuity in decimal units

Individual values of binocular visual acuity



Conclusions

In both groups, the scores obtained with TE appeared to be higher than with M3B by about 15% indicating systematic overestimation due to using the information contained in the low-frequency components of the TE Fourier spectrum. Statistically significant ($p < 0.001$) effect of isolation in the team – decrease of visual acuity by 10% – was only detected by means of the modified 3-bar stimuli.

Acknowledgements

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References

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