

Visual attention in dual-task with central and peripheral stimuli

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Introduction

In everyday life we do not differentiate central and peripheral visual field, although there are two main visual pathways – M and P – that carry information within the cortex [1]. These pathways might not always work properly, for example, dyslexia is thought to be linked to a M visual pathway dysfunction [2] and P visual pathway is impaired in autism spectrum disorder [3]. As far as there are several disorders connected to M, P visual pathways that can be improved until certain age [4], it is essential to differentiate which pathway is responsible for the problem as soon as possible. Tests that are used to evaluate properties of visual pathways are mainly invasive and does not stay in the centre of attention long enough. In this pilot study we use a type of visual search task that is interesting enough to keep the attention focused as long as possible. As far as there could be people whose peripheral vision sidetracks attention, additional peripheral stimuli appears several times during the visual search task and different noise is used.

Methods

- We made a program with a type of visual search task using Microsoft Visual Basic 6.0.
- A set of black Latin letters was used as a near vision object (see Fig.1.).
- There was a different peripheral noise – no noise, small noise, greater noise – consisting from dots (0.4° each) (see Fig.2.).
- Peripheral noise was selected randomly, each of them ten times during the experiment.
- Additional peripheral stimuli of different size (see Table 1) appeared 44.1° from the center of a projection screen (see Fig.2.).
- One figure was presented at a time for 0.5 seconds during 3rd and 6th second.
- Overall eleven individuals (age 20-23 years) participated in the experiment in accordance with the tenets of the Declaration of Helsinki.

- An individual sat 60 cm from a projection screen (89.7° x 64.9°).
- An individual counted a specific letter from a set of letters that matches to the first one in the upper left row (see Fig.2).
- An image was projected using Viewsonic PJ678 LCD Projector.
- Constant illumination in the room 797 lx was used (measured with Conica Minolta T-10M).
- Statistical data analysis was made using MS Office Excel 2003 ANOVA Two Way With Replication.



Fig.1. Properties of the set of letters

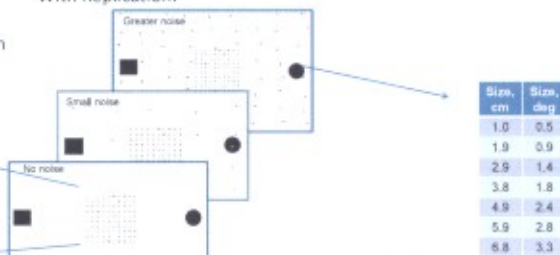


Fig.2. A set of letters with different peripheral noise and additional peripheral stimuli

Size, cm	Size, deg
1.0	0.5
1.9	0.9
2.9	1.4
3.8	1.8
4.9	2.4
5.9	2.8
6.8	3.3

Table 1. Additional peripheral stimuli size in centimeters and degrees

Results

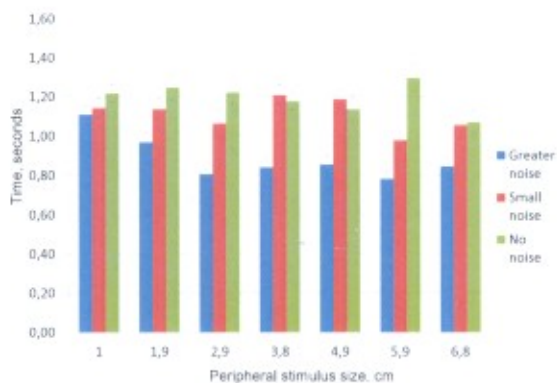


Fig.3. Average time per letter needed to accomplish near vision task with additional peripheral stimulus.

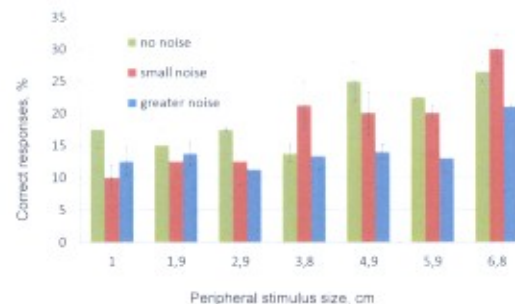


Fig.4. Noticing peripheral stimulus according to peripheral stimulus size and background noise.

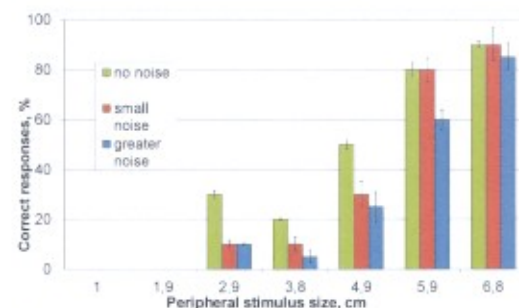


Fig.5. Correct responses in distinguishing peripheral stimulus shape according to peripheral stimulus size and background noise.

Conclusions

1. Four out of five individuals were able to accomplish central task faster with big peripheral noise comparing with no noise or small noise.
2. Noticing peripheral stimulus is significantly affected by peripheral noise ($p < 0.05$) due to a masking effect.
3. All the individuals demonstrated that there were more errors in central task performance as the peripheral stimulus size increased on a background without noise or with small noise.

References

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