# PERCEPTION OF BIOLOGICAL MOTION IN CENTRAL AND PERIPHERAL VISUAL FIELD

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## Introduction

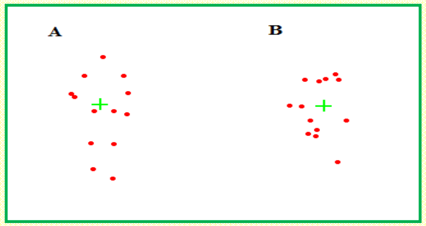
Studies analyzing motion perception in peripheral visual field demonstrate that the central retina is more specialized for motion perception (Finlay, 1982). When analyzing the differences between central and eccentric perception of biological motion using stimulus magnification (Gurnsey et. al., 2008; Gurnsey, et. al., 2010; Ikeda et.al., 2005), results of different studies are ambiguous. While Ikeda et al. (2005) describes the eccentric perception of biological motion as “unscalably poor”, Gurnsey et al (2010) demonstrates that biological motion perception is equally accurate across all eccentricities of visual field when stimulus magnification is applied.

In the current research we use biological motion stimuli (consistent with and extending the paradigm by Johansson, 1973) with a two-fold aim: first, to explore the perception of biological motion when limited information of object’s movement is given; second, to determine whether stimulus magnification can compensate reduced motion perception in the peripheral visual field.

## Method

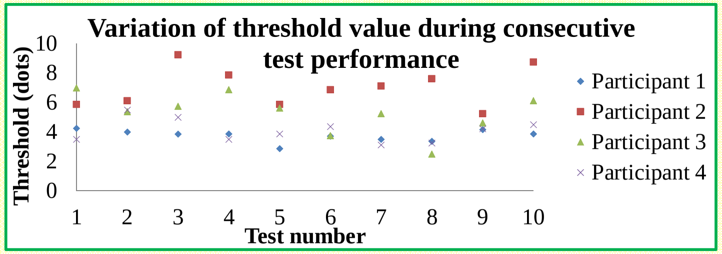
In order to determine the threshold of detecting biological motion in central and peripheral visual field the current study uses an experimental design with a reduced number of randomly chosen dots representing joints for demonstration of biological motion in four different eccentricities (0, 4, 8 and 15 degrees). The stimuli were presented in 6 sizes (1, 2, 4, 8, 16 and 20 degrees).

8 participants (1 male, 7 female, 20-25 years old) had to determine whether the presented stimulus is (A) a biological object walking in any of five different directions or (B) a scrambled version of it. The number of dots representing motion varied from 1 to 13 (block up-down temporal interval forced-choice method BUDTIF).




## Results

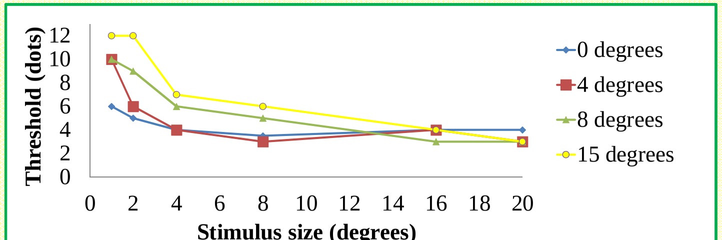
The variation of threshold value during repeated experiments was analyzed. The pilot study (4 participants) demonstrates that the threshold value is varying within 4 dots when performing the test 10 consecutive times. (Demonstrating 4 dots is sufficient for perceiving a biological object). Therefore, we decided to conduct a subsequent study with 10 consecutive trials to avoid inaccuracies caused by different factors. Significant learning effects were not observed.

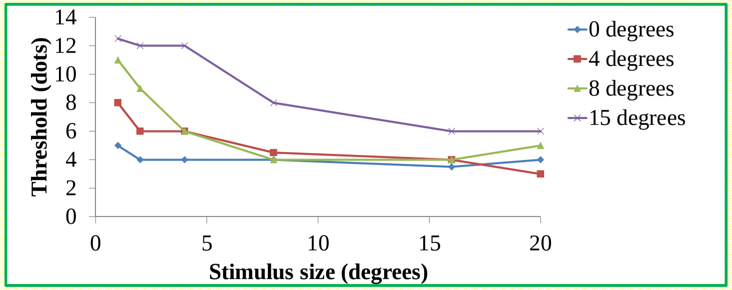



## Results

The perception of biological motion in the central visual field is highly individual: average thresholds range from 3-7 dots. With increasing eccentricity the threshold value for smaller stimulus size is also increasing but, as we expected, the performance can be improved by stimulus magnification.

When demonstrating the stimulus at 4 degrees eccentricity, the stimulus magnification can compensate for the task performance: all 8 participants are able to reach the same threshold value as in the central visual field (Mann-Whitney U test, p>0.05).




When demonstrating the stimulus at 8 and 15 degrees eccentricities, only 5 of 8 participants were able to reach the same threshold value as in the central visual field with appropriate stimulus size (Mann-Whitney U test, p>0.05)).

## Discussion

Stimulus magnification can compensate for the performance of the task only for smaller eccentricities (4 degrees) but cannot always compensate for larger eccentricities (8 and 15 degrees). Although more than a half of the participants in our study reached the same threshold value in the peripheral visual field, biological motion perception might be affected by individual differences and previous experience of the participant. This explanation is supported by the fact that there was a significant proportion of those who did not reach the threshold value. Additionally, the study conducted by Gurnsey et al (2008) indicates that not all participants are able to reach the same threshold level. Thus, we are inclined to agree with Ikeda et. al. (2005) that in some cases performance of biological motion in the peripheral visual field is deteriorating.

The results of our study do not conclusively answer the question whether the perception of biological motion is equally accurate across all visual field. Further studies have to be conducted by analyzing larger eccentricities and individual differences of perception of biological motion.

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