

## Perception of biological motion in central and peripheral visual field

I. Laicane, E. Zimasa, J. Skilters  
V. Liakhovetckii, G. Krumina



LATVIJAS  
UNIVERSITĀTE  
ANNO 1919

Center for the  
COGNITIVE SCIENCES &  
SEMANTICS

## Visual perception in peripheral visual field

- There are anatomical and functional differences between central and peripheral vision:
  - the structure, density and location of neurons;
  - higher information processes;
- It has been demonstrated that appropriate stimulus magnification can compensate for eccentricity-dependent sensitivity loss

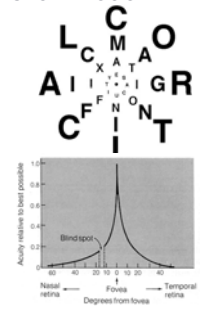


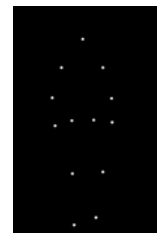
Figure 1: <http://anstislalab.ucsd.edu/files/2012/11/eyechart.jpg>  
Figure 2: <http://www.sandesignguild.org/editions/edition12/images/acuity.gif>

## Motion perception in peripheral visual field (Finlay, 1982)

- Central retina is more specialized for motion perception
  - lower least perceptible angular velocity;
  - smaller displacement threshold.
- What about stimulus magnification?
  - Johnston & Wright (1986) demonstrated that velocity perception in central and peripheral visual field can be matched by changing the frequency of sine-wave gratings.

## Biological motion

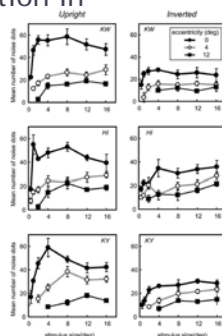
- Detection and motion analysis of a biological object is possible even when only information about the movement of major joints is available (Johansson, 1973);
- Biological motion stimuli can give information about the gender, age, mood, familiarity and other characteristics of the biological object (Clarke et al., 2005; Cutting & Kozlowski, 1977; Kozlowski & Cutting, 1977).



<http://www.biomotionlab.ca/Demos/BMLwalker.html>  
<https://www.mada.org.il/brain/BioMotion/BioMotionWeb.html>

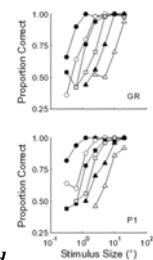
## Biological motion perception in peripheral visual field

- Ikeda, Blake, Watanabe (2004)
- Normal and scrambled versions of biological object that were embedded in motion noise;
- Analyzing the number of dots that allows discrimination between the two versions of biological motion
- *Stimulus magnification cannot compensate for reduced perception of biological motion in peripheral visual field*



## Biological motion perception in peripheral visual field

- Gurnsey, Roddy, Ouhanna, Troje (2008)
- Measuring the accuracy of analyzing the direction and identification of point light walkers;
- No noise was used;
- *Size scaling is sufficient to equate discrimination and identification of point-light walker across visual field*

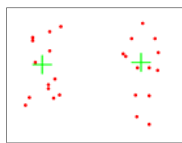


## Why are the results and conclusions completely different?

- Experimental setup (Gurnsey (2008) did not use noise; the tasks in both experiments were different):
  - different contribution of global and local information in the discrimination of point light walkers
- Different data analysis;
- Probably different influence of top-down and bottom up information analysis processes.

- The aim of current research work is to analyze the eccentric perception of visual motion when only limited information of the movement is given

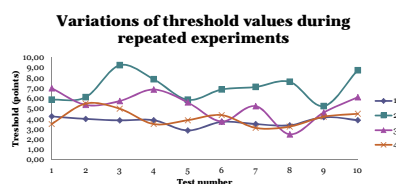
- Stimuli were generated based on database of biological motion stimuli created by Vanrie & Verfaillie (2004);
- Biological motion and its scrambled version were presented to the participants;
- Depending on the precision of discrimination between the two stimuli, the number of demonstrated dots was either reduced or increased (based on BUDTIF method developed by Campbell & Lasky, 1968)



## Experiment 1

- It was important to ascertain whether the developed stimuli was applicable for analyzing the perception of biological motion:
  - Different aspects had to be evaluated: the repeatability of the experiment, as well whether improvement during sequential performance of the can be observed;
  - We also have to take in mind that different body parts give different contribution to detection of biological motion (Troje & Westhoff, 2006; Mather & Murdoch, 1994)

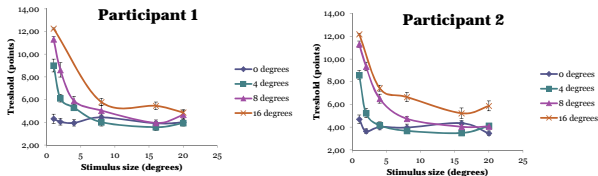
- The results of experiment 1 demonstrate that perception of biological motion is highly individual (average thresholds range from 3.8-7.1 points);
- Repeated experiments are necessary for accurate analysis of perception of biological motion



## Experiment 2

- Biological object or its scrambled version was demonstrated to the participants;
- 4 eccentricities: 0, 4, 8 and 16 degrees;
- Stimuli sizes: 1, 2, 4, 8, 16 and 20 degrees;
- Can stimulus magnification equate for the reduced performance in the peripheral visual field?

- Stimulus magnification is not sufficient to equate the perception of biological motion across the visual field



## Discussion

- We have demonstrated that stimulus magnification is not sufficient to equate the perception of biological motion across the visual field;
- The difference between the results of Ikeda (2005) and Gurnsey (2008) is not entirely associated with global and local processing of the stimuli;

Thank You for attention!

Study is supported by ESF project  
No.2013/0021/1DP/1.1.1.2.0/13/APIA/VIAA/001

