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Motion integration in direction perception of biological motion

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1. Introduction

Human observer exhibits a great sensitivity in identifying biological motion. Indeed, light attached to the major joints of a human walking model are enough to recognize a human figure [1]. This stimulus is called a point-light-walker (PLW). However, the recognition is strongly reduced when the PLW is upside-down (UD-PLW), although local motion signals are identical [2]. The goal of this experiment is to study if this difference can be explained by a better motion integration in upside-right condition (UR-PLW). In order to test this hypothesis, direction discrimination between two translational PLW has been realized. The extraction of common translational vector of local motion signals, necessary to percept the global motion, is used to analyze the motion integration. So, if the integration is really better in an UR-PLW, the direction discrimination threshold must be lower than in an UD-PLW.

2. Method

Stimuli were translational point-light-walker in an upside-right or an upside-down position. The duration of each trial was 2s, which corresponded to 2 walking cycles. Thirteen points have been used for each PLW. The task was to predict between 2 identical stimuli (UR/UR or UD/UD) presented in peripheral field of view (12.6º between each stimulus at the starting position), which one will go in front of the other (forced choice). PLW have been displayed according to the z-axis of the screen (i.e., expansion motion). Five differences of direction, between each PLW, have been tested: 4º, 8º, 12º, 16º, 20º. Data have been collected from four subjects.

3. Results

The perception of the motion direction is statistically better in UR position than in UD position [$F_{(1,3)} = 30.84$; $p<.0115$]. This analysis reveals a significant divergence in performance by 8º [$F_{(1,3)} = 10.37$; $p<.0486$] with the UD-PLW trials remaining significantly below the UR-PLW trials for all angular differences beyond this point (Fig. 1). These results show that subjects can not discriminate the PLW global motion direction in upside-down position, whereas this discrimination is linearly improved with the angular difference for the UR-PLW.
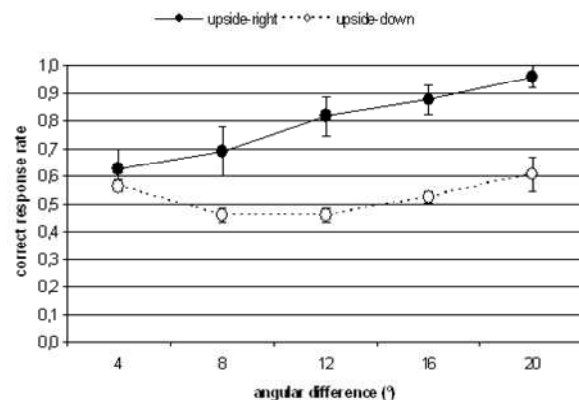

Fig. 1 Discrimination performance for all subjects.

4. Conclusions

This study shows that motion direction discrimination occurs on thinner angular differences for UR-PLW than UD-PLW. It suggests a higher capacity to extract the common translational vector of global motion in an UR condition. This result, in agree with studies realized across apertures [3], can be explain by a better motion integration of local point-light signals arranged in canonical configuration.

5. References

[1] Johansson, G. (1973) Perception and Psychophysics, 14, 201-211.
[2] Sumi, S. (1984) Perception, 13, 283-286.
[3] Shiffrar, M., Litchtey, L. & Chatterjee, S.H. (1997) Perception and Psychophysics, 59, 51-59.