Joints covariance, convex hull and motion cues predict biological motion perception in humans

Ankani Chattoraj, Deepak Gopinath, Khashayar Misaghian, Albert Buchard, Santiago Alonso-Diaz

Minneapolis, United States

Abstract

Complex motions of living organisms are promptly and efficiently perceived by the human brain. Biological Motion Perception has been associated with both the dorsal and ventral visual pathways and it is believed to rely on local motion and form cues. In this article we present a novel and more inclusive approach to dissociate the information of local motion and dynamic form. Using point-light walkers, we propose a systematic approach of stimulus perturbation that is able to single out of three types of organized information: the dots' velocity as a measure of local motion information, the covariance between pair of dots as a measure of joint-linkage strength, and the convex hull of the cloud of dots as a measure of higher order shape information. We developed a web based task (http://brainandlearning.org/albert/walker/) in which subjects (N=22) were asked to predict the walking direction of a point light walker made of five dots (hip, knees, and feet). Using integration of evidence across time and a weighted cue combination algorithm we show how each of these isolated cues contribute to the decision making process.This new method could be construed as a step towards analyzing more naturalistic stimuli relative to previous basic motion perception tasks. It could be generalized to dynamic systems with rigid parts to address questions outside the field of biological motion perception involving multiple information sources.

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