POSTER PRESENTATION



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Neural model of biological motion recognition based on shading cues

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Point-light or stick-figure biological motion stimuli, due to the absence of depth cues, can induce bistable perception, where the walker is perceived as heading in two alternating directions [1,2]. Psychophysical studies suggested an importance of depth cues for biological motion perception [3]. However, neural models of biological motion perception so far have focused on the processing of features that characterize the 2D structure and motion of the human body [4,5]. We extend such models for the processing of shading cues in order to analyze the three-dimensional structure of walkers from monocular stimuli.

Model

As extension of a learning-based neural model [4], we add a 'shading pathway' that computes the internal contrast gradients that vary with the 3D view of the walker, even if the silhouette information remains identical (Figure 1A-C). The model exploits physiologically plausible operations. After suppression of strong external luminance gradients caused by the boundaries of the silhouette, internal luminance gradient features are extracted by a hierarchy of neural detectors. These gradient features, combined with the shape features extracted by the form pathway of the model in [4], are used as input for 'snapshot neurons', RBF units that detect 3D body shapes (Figure 1D). These model neurons are embedded within a two-dimensional recurrent neural field [6] that jointly represents the sequential temporal structure of the stimulus and the view of the walker.

Results

The neural field dynamics reproduces perceptual multistability and spontaneous perceptual switching between



the internal gradient detectors of the model. **B**. Silhouette stimulus without shading cues is ambiguous and compatible with view angles ±45°. **C**. Snapshot and internal shading gradients for +45° side view. **D**. 'Shading pathway'. After suppression of strong boundary gradients, internal luminance gradients are extracted, using a hierarchy of neural detectors similar to a convolutional network. At the highest level is formed by 'snapshot neurons', RBF units that have been trained with keyframes from 3D walker movies, which are embedded in a dynamic neural field.

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stimulus views, observed for silhouette stimuli in psychophysical experiments [1,2]. It also reproduces the disambiguation by addition of shading information and a new perceptual illusion, which illustrates a lightingfrom-above prior in the processing of biological motion stimuli.

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