Neural mechanisms in motion transparency and figure-ground segregation to control visual navigation

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Transparent motion is perceived when multiple motions different in direction and/or speed are presented in the same part of visual space. In several perceptual experiments the conditions have been studied under which motion transparency occurs and how features can be influenced by deployment of selective attention. Figure-ground segregation is a key step in visual selection of a salient object or surface which is important for the behavioral task. Recent physiological evidence suggests that this process evolves over different temporal episodes. Taken together, the underlying mechanisms of motion processing enable the robust perception in complex visual environments.

A neurodynamical model is presented which builds upon a previously developed neural architecture emphasizing the role of feedforward cascade processing and feedback from higher to earlier stages for selective feature enhancement and tuning. It is demonstrated how the above sketched problems can be solved by using the same core architecture building on few core principles of neural processing. Results of computational experiments are consistent with findings from physiology and psychophysics. The model is demonstrated to cope with realistic data from computer vision benchmark databases. Simplified prototypical implementations have also been demonstrated the ability to cope with real data at a visual front-end for robot navigation tasks.

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