Computational modeling of paradoxical occlusion of a “near” surface

Kaplan (1969) observed that depth perception at an edge can be disrupted by optical texture. Grossberg, Barnes, & Mingolla (2013) developed a neural model of visual figure-ground segregation from non-flickering motion stimuli, with particular focus on how accretion and deletion from motion contribute to depth ordering.

**Goal**

The goal is to understand the primate visual system. Especially how motion is processed, with particular focus on how accretion and deletion from motion contribute to depth ordering.

**Accretion & Deletion**

Occurs all the time. Whenever observer moves or something in the environment moves. Use random-dot textures to eliminate other cues (color, figure etc.). Notice: Surface with accretion or deletion is always “in back”!

**Moonwalk Illusion**

Say one surface is flickering (each pixel is random each frame). Then a moving surface — with accretion and/or deletion — is in front! Remember, a surface with accretion or deletion is always in back.

**Method**

The approach is to create a network with many layers of nodes (neurons) that are controlled by simple, but non-linear, shunting equations.

**References**

Barnes & Mingolla (2013) A neural model of visual figure-ground segregation from kinetic occlusion. Neural Networks, 37, 141-64.


**Results**

Compare the moonwalk stimulus to the standard configuration with one moving surface and one static surface.

**Conclusion**

Model was not designed to explain moonwalk illusion. It was designed to explain standard accretion/deletion phenomena (Kaplan, 1969). Yet model successfully explains moonwalk illusion!

The model separates the motion and form computations, but includes interactions between these systems. It uses the accretion/deletion for both detection of motion boundaries and for the determination of depth order.

The flickering display of the moonwalk stimulus creates fuzzy boundaries without any clear depth ordering. The bias for motion to be closer to the observer creates the correctly perceived depth ordering.

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