

demonstration that it is possible, at least under some conditions, for observers to separate translation from rotation on the basis of retinal flow information alone¹³. We have recently shown that simulated rotation displays of realistically textured scenes (which contain denser motion parallax than random-dot displays) yield quite accurate heading judgments in most observers¹⁴. These results are consistent with a model that relies on local motion parallax information⁷.

This finding is more remarkable when one considers that all simulated rotation displays are actually ambiguous; the velocity field in Fig. 1b may correspond to a straight path (s), or a circular path (c), or indeed any of a family of curved paths together with an eye or head rotation. Our observers thus report straight paths with small errors even when the display is ambiguous and the extra-retinal information specifies no eye or head rotation (consistent with a circular path). This suggests that the visual system tends to extract the translational component when sufficient motion parallax is available. Further, when the ambiguity is resolved by telling observers outright that

they are traveling on a straight path, heading judgments are consistently accurate, and conversely when they are told they are traveling on a curved path, errors become predictably large¹⁵. I believe this convincingly demonstrates that the visual system has the capacity to decompose translation from rotation on the basis of retinal flow information alone.

Crowell and colleagues have shown that extra-retinal information about head turns as well as eye movements contributes to the perception of heading with a mobile eye in a mobile head. A natural question is whether such information about the neck also acts to modulate MSTd receptive fields in monkeys. Researchers might similarly investigate MSTd responses to more realistically textured displays of simulated translation and rotation, in addition to random-dot displays. I suspect that the visual system makes use of both retinal flow and extra-retinal solutions³, as they are normally both available in everyday locomotion, but precisely how these processes are entwined in the recovery of heading remains to be disentangled.

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Light detection: who needs eyes?

The blind mole rat (*Spalax ehrenbergi*) is a short-legged, mole-like rodent that lives entirely underground. Presumably as a result of this subterranean lifestyle, its eyes are atrophied and covered over by skin. The retina contains very few ganglion cells, and brain structures involved in image processing are either absent or dysfunctional. However, it does have functional suprachiasmatic nuclei, the site of the primary biological clock in mammals. On page 655, Russell Foster and colleagues (University College London) show that these 'blind' mammals actually sense light and regulate their body clocks accordingly.

The authors isolated a functional cone-like pigment from the degenerate eye of the blind mole rat, which they show entrains circadian rhythms to light. In the laboratory, upon entrainment to a 12:12 light/dark cycle, the majority of animals show greater periods of spontaneous locomotor activity (running on a wheel) during the subjective day. When the animals are then given a 15-minute light flash, they entrain their activity to this single stimulus. Most animals then become active before the pulse, almost as though they were anticipating 'dawn'. When the eyes are removed, this photoentrainment does not occur.

In the wild, blind mole rats are solitary and highly territorial. They dig extensive burrows with separate nesting, storage and defecation sites. During the breeding season, females build 'breeding' mounds, surrounded by smaller mounds connected via tunnels that the males occupy. Their habits raise a question: how would they be exposed to light outside the laboratory? The best guess is that this happens during mound building when they clear debris from their tunnels.

Photo courtesy of Tania Joyce

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