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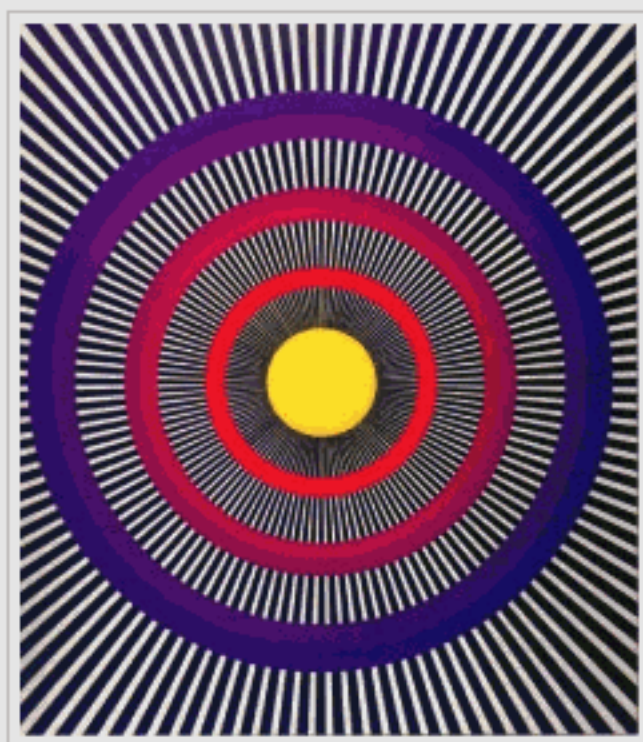


Nobel Intent

Ars Technica's science-centric journal

An Enigma solved

By [Yun Xie](#) | Published: September 29, 2008 - 07:14AM CT



Enigma, Isia Leviant

If you will humor us, please stare at the center dot in the picture to the left. Does it appear that the rings are moving? Now, do it a second time, but consciously fixate your eyes very strictly at the center. Finally, stare at the center a third time while only loosely fixating your eyes. Does the apparent flow of the rings change relative to how steady your eyes remained?

Ever since French artist Isia Leviant drew *Enigma* in 1981, scientists and artists have wondered why we perceived flowing movements to the concentric rings. Scientists have collected evidence to support or discount a few hypotheses. For example, brain imaging of people looking at the picture showed activity in the area of the brain that is responsible for identifying movement. This led scientists to

propose that brain processes caused the illusion of movement in *Enigma*.

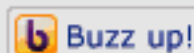
Another hypothesis pointed to the regular, rapid movements of the eye (called microsaccade), but this appeared to be ruled out in a different study. In that experiment, participants wore contact lenses imprinted with a version of the illusion. Scientists believed that it ensured the picture would always stay stationary relative to the eye. Since the volunteers still saw the illusion, it suggested that only the brain was responsible.

A team led by Susana Martinez-Conde from the Barrow Neurological Institute in Arizona found flaws in the previous work. For instance, contact lenses do not remain absolutely still on the eye; they can slip and not keep up with its rapid movements. Martinez-Conde's research group conducted their own experiment to test if microsaccades produced the appearance of motion.

They asked three subjects to look at a simplified version of *Enigma* and monitored their eye movements at the rate of 500 times per second using fast video-based system. Whenever the participants thought the perceived motions were slowing down or stopped, they had to press a button. They then released the button when the speed picked up again. By correlating the button pushing and the eye measurements while accounting for the reaction times of the participants, the researchers found that the illusory motions were slowest or stopped when microsaccades were minimal. Fast microsaccades lead to greater perceived movements.

Thus, microsaccade seem responsible for the false impression, but this doesn't rule out other contributing factors. For instance, Martinez-Conde named the accommodation fluctuation of our eyes as another possible trigger. Accommodation is the change in the shape of our lens when we shift our attention from a distant point to a close one, but it also happens when we're holding our gaze. Experiments that address accommodation fluctuations will be necessary to determine its role in the illusion of *Enigma*.

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Filed under: [Enigma](#), [Neuroscience](#), [Science](#)