Third-Eye Rivalry

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Abstract
We showcase an optical phenomenon that we call Third-Eye Rivalry. The effect is most easily induced by viewing one's own reflection in a mirror. Using the pupil of the opposing eye as a fixation target, people can easily cross their eyes in free fusion to experience vivid rivalry. The resulting percept is of a prominent central “third” eye and two peripheral faces rivaling for perceptual dominance. We illustrate the process of achieving third-eye rivalry and discuss historical connotations of the third eye in scientific and mystical contexts.

Keywords
third eye, cyclopean eye, binocular rivalry, conscious perception

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Three-dimensional vision is the result of binocular fusion, which occurs when each eye receives sufficiently similar information. With effort, it is possible to change the vergence angle of the eyes and “free fuse” any two objects in the visual field in an attempt to see them as a singular object in depth. When stable fixation is achieved, and if the brain receives
conflicting information from each eye, the observer can experience a vivid sense of visual alternation (i.e., binocular rivalry). The different interpretations can compete for perceptual dominance so that no percept persists indefinitely. Here, we report a condition in which sustained free fusion results in vivid binocular rivalry from the reflection of one’s own face. The effect is most easily achieved using a mirror to fixate each eye on its opposite.

In the phenomenon reported here, we found that it is rather easy to use one’s own pupils as fixation targets. If you look in the mirror and cross (or uncross) your eyes, the usually singular percept of your own face staring back at you will be doubled, resulting in two

![Figure 1](image)

**Figure 1.** A: A “third eye” results from free-fusing reflections of the left and right eyes in a mirror. B: Normal fixation in a mirror involves binocularly viewing one pupil at a time, whereas third-eye rivalry (C) involves simultaneous fixation of both pupils, either through binocular convergence (as shown in red) or divergence (in blue).
adjacent faces with four eyes distributed horizontally. If you then free fuse two of the
reflected eyes, three will remain—two eyes will be perceived peripherally with a third eye
seen between them. The pupil of the “middle” eye will offer a strong enough vergence cue to
help maintain stable fixation. The effect and procedure are depicted in Figure 1.

As has long been known in the binocular rivalry literature (see Alais & Blake, 2005; Wheatstone, 1838 for a review; also Brascamp et al., 2015), discrepant monocular cues
will be intermittently suppressed or dominant in awareness. In third-eye rivalry, each eye
concurrently fixates the opposing eye (or by uncrossing the eyes, each eye concurrently
fixates itself), and the result is the clear and stable percept of a “third eye” in the midline
of the stimulus. The reflection of the subject in the mirror then becomes the object of per-
ceptual rivalry. Phenomenologically, the observer tends to experience the following four
percepts (Figure 2): two transparent face contours with three eyes (Panel A), the intermittent
alternation of face dominance and suppression (Panels B and C), with periods of percepts in
which only a singular eye is visible (Panel D). The last percept is reminiscent of the one-eyed
cyclops from Greek mythology. From Figure 2, you can get a sense of the effect of third-eye
fixation, assuming you have the ability to free fuse discordant signals after crossing your own
eyes (for best results, find a mirror, or colleague, and stand as close as feasible, approxi-
mately 20–50 cm). The ability to use one’s own face as a rivaling stimulus makes the current
phenomenon a potentially useful stimulus in studying the dynamics of binocular rivalry, the
neuroscience of consciousness, and the perception of one’s own appearance.

For such a simple effect requiring only a mirror, it would be surprising if the third-eye
rivalry effect had not been reported before. A search for the effect (see acknowledgments)
shows no direct depictions of the phenomenon (see Sharp, 1928, for the related Frankfurter
illusion), but a theoretical third eye appears in vision science under different names, such as
the “cyclopean” eye (shown in Figure 3(A)), the visual egocenter, the binocular, the projection
center, and the center for visual direction (Ono & Barbeito, 1982). The concept arises
from the fact that the apparent direction of an object is distorted by differences in the visual
information available to each eye (Hering, 1868/1977; Ono, 1981). Binocular fusion of two
images into one produces a theoretical axis of visual direction centered on a point midway
between the two physical eyes. Estimating the cyclopean eye’s location usually involves

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**Figure 2.** Maintaining Free Fusion of Both Pupils Concurrently in the Mirror Results in Third-Eye Rivalry. The multistable phenomenology includes (A) two face contours with three eyes; (B and C) one dominant and one suppressed face; and (D) a single central eye, as though of a cyclops.
fixating distant objects through an aperture or window, with subjects judging the direction or location of objects when viewed with one or both eyes (Howard & Rogers, 2012). Replacing the window with a mirror maintains the geometry of visual direction and creates the impression of two noses framing the central of three eyes, situated between two rivaling faces (shown in Figure 3(B)). Curiously, most depictions neglect the presence of the nose (which is always visible to both eyes). A sketch of the first-person perspective (Figure 3(C)) similarly shows a central vantage point framed by two noses, which suggests our phenomenon is a novel depiction of the cyclopean eye.

The third eye also commonly appears in contexts of anatomy, physiology, philosophy, spirituality, and psychedelia. In Eastern mystic traditions, for example, opening the third eye (called the Ajna chakra; Grimes, 1996; Johari, 2000) is part of the spiritual enlightenment process. The third eye symbolizes the ability to see unobstructed by the illusions of material reality, particularly as these deceptions pertain to a sense of self or ego (Mookerjee, 1984).

Figure 3. Seeing the Cyclopean Eye. A: Hering’s depiction of the cyclopean eye. B: Our phenomenon suggests that the third eye is situated between two noses (above) rather than the more intuitive interpretation (below). C: The first person viewpoint is framed by two noses (image adapted from Harding’s “On having no head: Zen and the rediscovery of the obvious,” 1998).
Spontaneous third-eye opening is associated with intense and vivid intuitions or “visions,” which are described by Kundalini practitioners as profoundly unitive conscious experiences (often called “ego death,” or sometimes a psychotic break in contexts of Western psychology; see Avalon & Woodroffe, 1974; Lukoff, 1985; Sannella, 1987). To intentionally open the third eye, which is to see through “the illusion of a self,” individuals are taught to “turn the mind back on itself,” typically through intense yogic, tantric, meditative, or shamanic practice (Mookerjee, 1984, pp.123-126, p.128; Walsh, 1994). In a similar fashion, we have described a situation where the individual turns each eye on itself, leading the usually solidified, unified visual image of the self to appear illusory; the “self” disappears when looking at/from one’s own third eye.

Figure 4. The Third Eye Depicted Through History and Across Cultures. A: The third “parietal” eye of some amphibians and reptiles. B: The Ayurvedic chakra system including the third-eye chakra. C: Rene Descartes’ depiction of the pineal gland (aka third eye) as the central relay station of consciousness (i.e., the “seat of the soul”). D: The Hindu God, Shiva, with an open third eye on the forehead.
In other contexts, biologists have identified retinal projections from a vestigial third parietal eye in some reptiles and amphibians (Su et al., 2006); modern neuroscientists and medical doctors have identified the pineal gland (the evolutionary homologue of the parietal eye) as being light sensitive in humans (Sapède & Cau, 2013), and which is hypothesized to have a pivotal function in both dreaming (Callaway, 1988) and some psychedelic experiences (Strassman, 2000); Rene Descartes pondered whether the human pineal gland provided the entry point for the soul into the body (Lokhorst, 2005) and the pineal gland is now referred to as “the third eye” by some contemporary authors (e.g., Mano & Fukada, 2007); and modern philosophers refer to the third eye as the mind’s eye (or the mind’s “I”; Dennett & Hofstadter, 1981). The third eye certainly carries with it varied literal and symbolic meanings, some of which are depicted in Figure 4.

In summary, a third eye is observed by focusing each eye on itself or its opposite in a mirror. Third-eye fixation produces the familiar aspects of binocular rivalry: wholesale and piecemeal suppression of conflicting monocular images across time. In terms of its scientific utility, binocular rivalry has often been utilized as a potent tool to study the neural correlates of conscious perception (Blake & Logothetis, 2002; Maier et al., 2012; Tong et al., 2006). As the current phenomenon invokes rivalry of one’s own face, this might have novel implications for the study of conscious experiences associated with self-perception or for understanding the role of the cyclopean eye in vision. With sustained and vivid rivalry easily inducible in untrained individuals, this could also serve as an ideal everyday rivalry demonstration. From the current observations, in which seeing the third eye dissolves the perception of self, we entertain a connection between the geometry of binocular vision and a broader set of cultural and historical depictions of the third “inner” eye.

In the scientific literature today, a persistent debate exists: when, if ever, does binocular rivalry occur in ecological contexts (Arnold, 2011; O’Shea, 2011; Shimojo & Nakayama, 1990)? To this point, this article might be informative. As with enlightenment, binocular rivalry can happen when you are brushing your teeth, bleary-eyed, at about seven in the morning.

The summary of the advice of all prophets is this; Find yourself a mirror.

—Shams Tabrizi

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References

Alais, D., & Blake, R. (Eds.). (2005). Binocular rivalry. MIT Press.
Arnold, D. H. (2011). Why is binocular rivalry uncommon? Discrepant monocular images in the real world. Frontiers in Human Neuroscience, 5, 116.
Avalon, A., & Woodroffe, J. G. (1974). Serpent power. Dover Publications.
Blake, R., & Logothetis, N. K. (2002). Visual competition. Nature Reviews Neuroscience, 3(1), 13.
Brascamp, J. W., Klink, P. C., & Levelt, W. J. (2015). The ‘laws’ of binocular rivalry: 50 years of Levelt’s propositions. Vision Research, 109, 20–37.
Callaway, J. C. (1988). A proposed mechanism for the visions of dream sleep. Medical Hypotheses, 26(2), 119–124.
Dennett, D. C., & Hofstadter, D. R. (Eds.). (1981). The mind’s I: Fantasies and reflections on self and soul (p. 3). Harvester Press.
Grimes, J. A. (1996). A concise dictionary of Indian philosophy: Sanskrit terms defined in English. State University of New York Press.
Hering, E. (1977). The theory of binocular vision. Plenum Publishing Corporation. (Original work published 1868)
Howard, I. P., & Rogers, B. J. (2012). Perceiving in depth, volume 2: Stereoscopic vision. Oxford University Press.
Johari, H. (2000). Chakras: Energy centers of transformation. Simon and Schuster.
Lokhorst, G. J. (2005). Descartes and the pineal gland. Available at: https://plato.stanford.edu/entries/pineal-gland/.
Lukoff, D. (1985). The diagnosis of mystical experiences with psychotic features. Journal of Transpersonal Psychology, 17(2), 155–181.
Maier, A., Panagiotaropoulos, T. I., Tsuchiya, N., & Keliris, G. A. (2012). Introduction to research topic–binocular rivalry: A gateway to studying consciousness. Frontiers in Human Neuroscience, 6, 5.
Mano, H., & Fukada, Y. (2007). A median third eye: Pineal gland retraces evolution of vertebrate photoreceptive organs. Photochemistry and Photobiology, 83(1), 11–18.
Mookerjee, A. (1984). Inner cosmic energy. Ancient Wisdom and Modern Science, (pp.115–134).
Ono, H. (1981). On Wells’s (1792) law of visual direction. Perception & Psychophysics, 30(4), 403–406.
Ono, H., & Barbeito, R. (1982). The cyclopean eye vs. the sighting-dominant eye as the center of visual direction. Perception & Psychophysics, 32(3), 201–210.
O’Shea, R. P. (2011). Binocular rivalry stimuli are common but rivalry is not. Binocular Rivalry: A Gateway to Consciousness, 48, 819–830.
Sannella, L. (1987). The Kundalini experience: Psychosis or transcendence? Integral Pub.
Sapède, D., & Cau, E. (2013). The pineal gland from development to function. In Current topics in developmental biology (Vol. 106, pp. 171–215). Academic Press.
Sharp, W. L. (1928). The floating-finger illusion. Psychological Review, 35(2), 171–173.
Shimojo, S., & Nakayama, K. (1990). Real world occlusion constraints and binocular rivalry. Vision Research, 30(1), 69–80.
Strassman, R. (2000). DMT: The spirit molecule: A doctor’s revolutionary research into the biology of near-death and mystical experiences. Simon and Schuster.
Su, C. Y., Luo, D. G., Terakita, A., Shichida, Y., Liao, H. W., Kazmi, M. A., Sakmar, T. P. & Yau, K. W. (2006). Parietal-eye phototransduction components and their potential evolutionary implications. Science, 311(5767), 1617–1621.
Tong, F., Meng, M., & Blake, R. (2006). Neural bases of binocular rivalry. Trends in Cognitive Sciences, 10(11), 502–511.
Walsh, R. (1994). The making of a shaman: Calling, training, and culmination. *Journal of Humanistic Psychology, 34*(3), 7–30.

Wheatstone, C. (1838). Contributions to the physiology of vision. *Philosophical Transactions of the Royal Society, 128*, 371–394.

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