Multistable Perception

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Examples of visually ambiguous patterns.

Multistable perceptual phenomena are a form of perceptual phenomena in which there are unpredictable sequences of spontaneous subjective changes. While usually associated with visual perception, such phenomena can be found for auditory and olfactory percepts.

Classification

Perceptual multistability can be evoked by visual patterns that are too ambiguous for the human visual system to recognise with one unique interpretation. Famous examples include the Necker cube, Schroeder staircase, structure from motion, monocular rivalry and binocular rivalry, but many more visually ambiguous patterns are known. Since most of these images lead to an alternation between two mutually exclusive perceptual states, they are sometimes also referred to as bistable perception.

Auditory and olfactory examples can occur when there are conflicting and so rivaling inputs into the two ears or two nostrils.

Characterization

Transitions from one percept to its alternative are called perceptual reversals. They are spontaneous and stochastic events which cannot be eliminated by intentional efforts (although some control over the alternation process is learnable). Reversal rates vary drastically between stimuli and observers, and have been found to be slower for people with bipolar disorder.

Cultural history

Human interest in these phenomena can be traced back to antiquity. The fascination of multistable perception probably comes from the active nature of endogenous perceptual changes or from the dissociation of dynamic perception from constant sensory stimulation. Multistable perception was a common feature in the artwork of the Dutch lithographer M. C. Escher, who was strongly influenced by mathematical physicists such as Roger Penrose.

Real-world examples

Photographs of craters, from either the moon or other planets including our own, can exhibit this phenomenon. Craters, in stereo imaging, such as our eyes, should appear to be pit-like structures. However, in mono-vision, such as that of photographs, the elimination of our depth perception causes multistable perception to take over, and this can cause the craters to invert their depth

values and instead look like plateaus rather than pits. Sometimes rotating the image so that the photographic direction of the source of light matches a light source in the room can cause the correct perception to suddenly switch.

In literature, the science fiction novel Dhalgren, by Samuel R. Delany, contains circular text, multistable perception, and multiple entry points.

Multistable perception arises with the theater segments of Mystery Science Theater 3000, as due to the construction of the Crow T. Robot puppet, its head can appear to be facing towards the camera rather than towards the film being shown. This was addressed by the creators of the series, even likening Crow to a Necker cube.