

Introducing a Quadristable Auditory Spatial Illusion: Imagining objects moving through space

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Object perception is a multimodal task, involving both sight as well as sound to localize objects. Several visual illusions have made use of multi-stable percepts of object direction and location (Necker, 1832; Kayahara, 2003). Here, we created an auditory correlate of such visual illusions that causes differential interpretations of object direction and location, yet with a constant visual input. This quadristable auditory illusion makes use of back-front confusions to give varying perceptions of an object approaching and retracting from the listener. Observers can perceive the sound as traveling: 1) front to back, 2) back to front, 3) coming from and returning to the front, and 4) coming from and returning to the back. To test this illusion, participants sat in a symmetrical, customized chamber with four speakers positioned on the cardinal axes around them and performed several psychophysics experiments where participants were asked to discriminate between 1) sounds really moving between the speakers and 2) the illusion (which is played equally in the front and back speakers and does not move). When asked to discriminate between real and illusory sounds, observers performed at chance. They localized the illusory sound as all different directional possibilities. When asked to rate their confidence in perceiving a sound cued by directional instructions, they gave equal confidence for the real and illusory sounds (despite the illusion having no direction). When rotated 90 degrees, so that the sounds now traveled between the left and right speakers, observers performed at ceiling. These results show the illusion along the front-back axis is not differentiable from truly moving sounds, and is successful in producing directional percepts. Such quadristable auditory illusions open new opportunities in multimodal science, for studying the perceptual, cognitive and neural representation of objects and space, as well as exploring multi-dimensional perceptual awareness.

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