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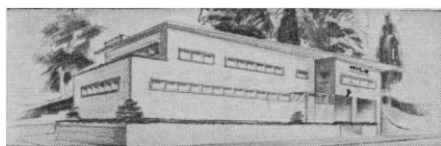
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Letters

The Moon Illusion

In the paper entitled "Magnitude of the moon illusion as a function of the age of the observer" [*Science* **130**, 569 (1959)], H. Leibowitz and T. Hartman stated, "The diminution in the apparent size of an object when viewed overhead as compared with its apparent size in the horizontal plane is greater for children than for adults." They suggested in explanation, "Since children have less experience with distantly viewed objects, especially when viewed directly overhead, the magnitude of the moon illusion is greater the younger the observer." One is not justified, I believe, in assuming that the horizontal "moon" is correctly perceived while the perception of the overhead moon is in error. It is just as reasonable to assume that the size of the overhead "moon" is correctly perceived but the horizontal "moon" is erroneously perceived as being larger than actual size. In this case the explanation of more experience with horizontal objects and therefore better accuracy in judging their size would be contradicted by the experiments of Leibowitz and Hartman.

Furthermore, since some visual cues occurred in these experiments, even in the darkened but not completely dark theater, the explanation of the moon illusion referred to by Thomas Reid seems more credible. "We frequently perceive the distance of objects by means of intervening or contiguous objects, whose distance or magnitude is otherwise known. . . . An object placed upon the top of a high building, appears much less than when placed upon the ground, at the same distance. When it stands upon the ground, the intervening tract of ground serves as a sign of its distance; and the distance, together with the visible magnitude, serves as a sign of its real magnitude. But when the object is placed on high, this sign of its distance is taken away: the remaining signs lead us to place it at a less distance; and this less distance, together with the visible magnitude, becomes the sign of a less real magnitude. Dr. Smith hath observed, very justly, that the known distance of the terrestrial objects which terminate our view, makes that part of the sky which is towards the horizon appear more distant than that which is towards the zenith. Hence it comes to pass, that the apparent figure of the sky is not that of a hemisphere,

but rather a less segment of a sphere. And, hence, likewise, it comes to pass, that the diameter of the sun or moon, or the distance between two fixed stars, seen contiguous to a hill, or to any distant terrestrial object, appears much greater than when no such object strikes the eye at the same time" [T. Reid, *The Works of Thomas Reid, D.D.*, W. Hamilton, Ed. (Longmans, Brown, Green, and Longmans, London, new ed., 1846), sec. 22].

Lastly, the increase of the illusion with distance of the object from the eye may be due to the loss of significant information for depth perception which might ordinarily arise from the ciliary muscles of accommodation. This is reasonable because the adjustments of the ciliary muscles for objects at distances greater than about 30 feet appear to be insignificant.

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The point raised by Cohen in the first paragraph of his letter has previously been discussed [*Science*, **131**, 238 (1960)].

The point raised by Thomas Reid's explanation is logical but was not supported by the verbal reports of our subjects. Most of them expressed surprise when they were informed, after completion of the testing, that the overhead and horizontal stimuli were in fact at the same distance. Their opinion was that the overhead disk was farther away than the horizontally viewed comparison stimuli. Furthermore, the building from which the overhead disk was supported provided a number of cues to distance—for example, perspective and relative size—which were not present to the same degree for the horizontal stimuli. It would seem that the judgment of distance does not influence size judgments in a direct or simple manner.

If the change in the magnitude of the illusion were directly dependent on loss of information from the ciliary muscle, one would expect no further increase at distances beyond 20 or 30 feet. The data of Schur, referred to in our original article, would argue against Cohen's interpretation, for she discovered that the magnitude of the effect was influenced by variation of distance beyond this point.

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