miles. Binocular thresholds as low as 2″ were found by one of the undersigned (Anderson and Weymouth, *Am. J. Physiol.*, **64**, 561 [1923]) for vernier acuity, which would mean that under optimum conditions a "cliff" less than 1 ft in height could be recognized as a change in contour at a distance of 13 miles.

The conditions of contrast, illumination, absence of haze, and others mentioned by Olmsted and Olmsted would, of course, have to be optimum to obtain thresholds like those mentioned. In addition, since it is vernier acuity that is being considered, each line (ground and cliff level) would have to be of sufficient length.

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OUR paper was not primarily concerned with an exact definition of the resolution limits of the human eye under conditions of laboratory technique. Rather, we are attempting to evaluate the observations it will make in the field as an "instrument" of the reasonably careful observer of terrain.

It is true that the precision of laboratory instruments such as range finders, vernier scales, and the like is attained through observations of linear discontinuity far more subtle than 1′ of arc. Here the field is well illuminated, contrast is enhanced, and, above all, attention is meticulously directed to a single predefined region, line, or point. Under these conditions distinctions of the order of 2″–10″ are observed because the image on the mosaic of cones overlaps.

Again, it is true, as we pointed out below Table 1 of our paper, that the average normal eye will distinguish as unique a visual image subtending 1′ of arc. Indeed, many eyes will better this resolution somewhat. Here, again, good black-and-white contrast and adequate illumination are implied. The Snellen E is made up of three bars, subtending (for the 20/20 line) 1′ each and spaced 1′ apart. This 5′ form is easily observed at 20 ft by a normal eye as a recognizable letter when printed to extreme contrast and well illuminated.

We concluded, then, that under field contrast, haze, thermal distortion, and illumination, a cliff subtending about this angle would be recognizable by a careful observer scanning the horizon for detail. The chart of Fig. 1 was carefully drawn to illustrate this when viewed at 20 ft, to allow the interested reader to form his own "standard" based on this concept. In the construction of the chart other discontinuities of the order of 1′ of arc were purposely included. The knoll to right of center rises above the adjacent background by 1′. The notch half an inch to the left of it is of like dimension but with lower contrast of shading. The former is marginally distinguishable when sought as a known point, but the latter cannot be found. We agree, therefore, that meticulous attention to a minute sector of the horizon might permit the definition of these subtle discontinuities. However, such microscopic examination is not the method of even the most objective observer of topography in the field.

Hirsch and Weymouth have transferred our original subject matter from the field of geomorphology to that of a fine point of physiological optics. They quote our warning about haze, contrast, and illumination and admit that they would have to be "optimum" to reach their stated limits. They would not be satisfied by attainable optima. Rather they would have to be supernatural for 67,000 ft of atmosphere. Simple geometric extrapolations of the type being made by Hirsch and Weymouth are only valid in a vacuum. Thermal currents and minimum dust and haze completely vitiate them in the earth's atmosphere.

You can perhaps obtain from your window a line of sight to a building 1 mile away. Normal architectural cornice work allows discontinuities of the order of 1 in. If you could perceive these on a building 1 mile away, you would begin to approach Weymouth's 1 ft at 13 miles.

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A Choice of Difficulties

IN A recent letter G. W. Leeper (*Science*, **113**, 213 [1951]) states that scientific journals should either suppress bad work or else publish criticism of it. While agreeing with his main contention, I think attention should be called to a third course that is unfortunately followed by many editors. This is the publication of a paper after the removal of its worst features. In this form it may look like a contribution to knowledge and may mislead any reader who does not know the author personally.

If a paper has not been heavily edited, it is often possible to assess the competence of the author from the manner in which he writes or from internal inconsistencies in the paper. But when the style has become that of the editor, and when referees have ironed out the inconsistencies, what is the reader to do? Undoubtedly many papers are only sent to the editor after they have been improved in this way as a result of criticism by colleagues in the laboratory. This criticism, however, generally leads to some experimental revision; editing is a purely literary matter.

I contend that, if any paper has been subjected to significant editorial improvement—that is, to more than is needed to bring it into line with the conventions of the journal—this fact should be noted. An indication of the actual extent of the editing would be even more valuable.

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