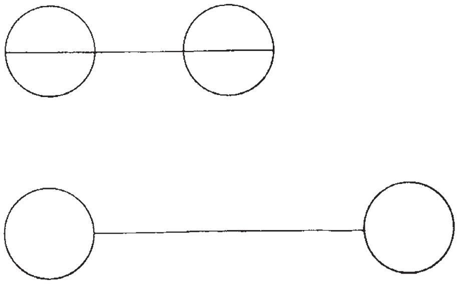

Fig. 4. The 'dumb-bell' illusion. The horizontal lines are equal in length

Gregory has also attempted to explain spatial after-effects in terms of inappropriate constancy. These effects occur in judgments of visual patterns following prolonged stimulation by another. To attribute these effects to the same processes as those responsible for spatial illusions fails to take into account that in using the same patterns to generate an illusion and an after-effect the directions of distortion are frequently opposite. This opposition between illusion and spatial after-effect is illustrated in Fig. 5. The surrounded dotted circle appears larger than the objectively equal but non-surrounded circle. If, however, the surrounding circle is fixated for a minute and then the dotted circle compared, the circle falling within the hitherto stimulated region appears smaller. In any event, it has now been shown that there is no necessary relation between spatial illusions and spatial after-effects[13].

Fig. 5. Figures for showing the opposition between illusion and after-effect

There now seems to be little doubt that certain illusory phenomena derive from an apparent distance-apparent size invariance. The Moon illusion is one such case[7] and is probably a special case of Emmert's law as demonstrated by King and Gruber[13]. The argument that the classical spatial illusions and spatial after-effects derive from an essentially similar size-distance invariance is, to say the least, questionable in view of the contrary evidence presented here. In point of fact there is evidence which strongly suggests that the apparent distortions of illusory figures derive from neural interactions between the processes induced by the judged and background elements of the pattern[14]. If this explanation can be sustained then apparent distance would be a consequence, not a cause, of spatial distortions.

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Prof. Day omits the major feature of my theory. The omission is evident in his reference to the Moon illusion. What is interesting about the Moon illusion is that its apparent size is not a simple function of its apparent distance. On the horizon it appears large and near. Ptolemy was not correct in attributing its apparent size simply to its apparent distance, and the effect is not a straightforward example of Emmert's law. For this and other reasons I suggested that there is more to constancy than apparent distance: that constancy can be set directly by depth cues which are not always appropriate. Prof. Day disregards what I have called "primary constancy scaling[1]" without which I believe we cannot hope to develop a consistent theory of these distortions in terms of depth perception.

The reported illusions in the tactile modality are certainly interesting, but should not be regarded as a straightforward "criticism", or objection, to a theory of the visual illusions in terms of depth. It seems much more to the point to discover more about these tactile illusions—to discover how they are related to the visual ones. The fact is we know very little about them. Further, it is not at all clear why this "criticism" is reinforced by the fact that borders and edges are neurally enhanced in both touch and vision. Why should the Mach effect be relevant to distortion illusions ?

The discussion of the Zölner, Wundt and Orbison illusions is not aimed at my theory, because the essential point of primary scaling is omitted. In each case the depth features of these figures can be related, by isolating the features and measuring the perceived depth of each, with the technique described briefly in my reply to Brown and Houssiadas[2].

Regarding figural after-effects: the notion that they may be due to constancy scaling taking some time to recover after prolonged fixation was put forward as a suggestion which seems worth following up. It is probably consistent with the known facts; but again it must be discussed in terms of 'primary' scaling. This is set by local depth features which may be opposed by other features or countermanded by the texture of the background. It is not synonymous with apparent distance except in the simplest cases, but in all cases it is possible to isolate the depth features and measure the primary constancy. This can then be directly related to the distortion of visual space in the X- and Y-co-ordinates.

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SOIL SCIENCE

Tracer Technique used in Examination of Activity of Roots of Grass Swards

The interpretation of measurements of the uptake by plants of tracer isotopes from the soil is complicated by at least three factors. First, exchange takes place between the added labelled ions and the isotope ions present in the soil; the rate of this exchange has been shown to be affected by many factors[1,2]. Secondly, continuous exchange occurs between the nutrient ions in the roots and those in the soil[3-6]. The factors controlling this exchange are unknown. Thirdly, there is the possibility of damage to plant tissues, resulting from accumulation of the tracer. Although a number of experiments have shown no appreciable effects of radiation in terms of yield of dry matter[9-12] and uptake[9,12], the question of radiation damage to plant tissues in long-term uptake experiments remains unsettled. Critical studies[13,14] have shown that even very low doses of radiation may produce some physiological changes in plant cells.

The problems of isotopic exchange make it impossible to compare quantitatively the amounts of tracer found in plants, at different sampling dates, in experiments in