1. The combined head and eye movements together were very nearly equal to the angle of the stimulus position, as would be expected, within the limits of accuracy of the recording system (*3*).

The results of Table 2 show the angular rotation of the combined PH and P of Fig. 1. The P value is the extent of eye movement from center fixation to the maximum excursion of the eyes prior to the backward compensatory movement. The PH value, or partial head movement, is the extent of rotation of the head at the time when the eye movement reaches its maximum. As can be seen, the combined eye and head movement fell considerably short of the stimulus angle. The differences between the actual combined movement and the display angle were significant beyond the .01 level, indicating that the eyes began their compensatory backward movement *before* they had reached the stimulus. This result is in disagreement with earlier studies (*1*).

A possible explanation for this finding would be that the initiation of the compensatory movement is provided by extra-foveal stimulation rather than foveal stimulation. In other words the eye would begin its compensatory movement when the peripheral signal came into the field of view on the retina, and would not require the signal to be represented on the fovea. The compensatory eye movements would be directed by the location of the stimulus, and would not necessarily involve an identification of the stimulus.

This hypothesis seems a possibility in light of some incidental observations made after the close of the experimental sessions. In this pilot study a decade interval timer was used to turn off the peripheral stimulus shortly after the eyes had reached the peak of their rotation. In no case was the subject able to identify the numeral in the indicator tube when the stimulus was turned off shortly after the compensatory movement began. In many cases identification was possible only when the stimulus was kept on until both eye and head movement had almost ceased. If the compensatory eye movements were initiated by foveal representation of the peripheral stimulus, it would seem that the purpose of the compensation would be to keep the peripheral stimulus foveally fixated. If such were the case, identification of the numeral should be possible during the compensatory backward movement.

The results of Table 2 would predict that eye movements would miss a foveal fixation by an increasing amount as the display angle increases. In a recent study (*4*) it was shown that proportionately more undershoots were made in a manual tracking task as the extent of movements required was increased. This result was confirmed for eye movements (*5*), and would support a hypothesis that the backward compensatory eye movement begins before foveal fixation and that the discrepancy between actual eye movement and the display angle is a function of the display angle.

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References and Notes

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6. Supported in part by the USPHS, grant AC 00165. I thank Louis Banderet, Roy Welsandt, and Carol Dahl for technical assistance.

25 February 1966

Pesticide Residues in Total-Diet Samples: Bromine Content

Heywood's comments (3 June, p. 1408) in reference to the bromide and arsenic levels given in our report [R. E. Duggan, H. C. Barry, L. Y. Johnson, "Pesticide residues in the total-diet samples," *Science* **151**, 101 (7 Jan. 1966)] are quite appropriate. We did not mean to imply that the bromide or arsenic levels found were solely due to pesticides containing these elements. The qualifying statement in the report that the values were total bromide and arsenic was intended to draw attention to the natural content. Our Table 1 indicates the number of residues exceeding 25 parts per million. Pharmacologists have expressed interest in the total amount of bromides ingested from food since current petitions for bromide tolerances are under consideration. Although bromide tolerances range as high as 400 ppm, in our opinion bromide values exceeding 25 ppm in any composite warrant further investigation to determine the source, particularly if sustained increases are observed.

We appreciate Heywood's clarifying statement and hope our exchange has presented a clearer picture of the meaning to be derived from the bromide and arsenic values presented.

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Experimental Pain

Beecher has pointed out that experimentally induced pain differs from clinical pain in that the affective tone (anxiety) associated with the latter is missing in the former (*1*). He describes a method (*2*) of inducing this anxiety by using a tourniquet to produce sustained pain, and reports that the method is effective for laboratory tests of analgesics, whereas threshold pain produced by heat is not.

Hill found (*3*) that when subjects had no control over the pain stimulus they reported more severe pain than when they could turn the stimulus on or off at will. We have extended Hill's results to the measurement of pain thresholds (*4*). Our data indicate that pain thresholds for radiant heat are significantly lower when control of the stimulus is taken from the subject. The method is easier to use and less time-consuming than Beecher's tourniquet.

In at least two studies (*5*) in which the effect of analgesics could not be distinguished from placebo effects on radiant-heat pain, the subjects had control of the pain stimulus. We conclude that anxiety associated with lack of stimulus control is an important variable in experimentation on pain.

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28 March 1966