then rephotographing the trace was otherwise unchanged.

Synchronization was insured on the projected film if the light flashed when a portion of film exposed at the first run coincided with the mark on the EEG trace exposed after the film was rewound and the mask changed. Figure 1 illustrates the appearance of the movie during a synchronization check. By this technique, synchronization was maintained throughout 1200 feet of film.

A telemetering system may be adaptable for routine electroencephalography because of the absence of muscle movement artifact despite the patient's unrestricted activity. We are currently developing a miniaturization of the telemeter and increasing the channels to achieve such a system.

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20 May 1960

Relating a Component of Physiological Nystagmus to Visual Display

Abstract. A transactional position suggests the hypothesis that there should be changes in the fine eye movements of a fixating subject if the fixated visual display is altered. It is shown that the mean saccadic eye movements are unequivocally different with different positions of the stimulus within the visual field.

This report resulted from interest in the transactional concepts of perception elaborated by Mead (*1*) and Dewey (*2*) wherein an alteration of the receptor by a motor or centrifugal component of the perceptual act is an implicit necessity. These concepts are the equivalent of saying that at any given instant in the perceptual act the perceptual system has used the data taken in so as to be able to change the state of the receptor suitably for taking in the next increment of data. This implies that if the stimulus changes then the cumulative centrifugal actions taken would change. Livingston (*3*) has recently presented the evidence for centrifugal control mechanisms in the optic nerve, the auditory nerve, the olfactory bulb, and the stretch receptors, but no attempt has yet been made to study the involuntary fine eye movements of fixation (physiological nystagmus) with transactionally derived hypotheses.

If the fine eye movements were part of a centrifugal control process it should follow that they would not occur at random but would be determined in some manner related to the visual stimulus. The operational hypothesis derived was that if the position of the stimulus within the visual display were changed then the saccadic component of the fine eye movements would change.

The fixation eye movements (physiological nystagmus) of a subject (myself) were measured photoelectrically from light reflected by a small mirror mounted on a tight-fitting scleral contact lens worn by the subject while his head was immobilized on a bite board. The apparatus (*4*) and its use were similar to that described by Nachmias (*5*) but differed in that the change in amount of light incident on a photoelectric tube was recorded on a polygraph instead of the movement of a light beam being recorded photographically. The apparatus was sensitive to less than a minute of arc of eye movement. Both the horizontal and vertical components of the eye movements were recorded, and, since the mirror mounted on the contact lens was normal to the visual axis, the torsional eye movements and most head movements were canceled out. Separate runs were made under the four different conditions of having the visual stimulus (Fig. 1) in each of the four visual quadrants, designated clockwise as shown, while the other three quadrants were empty. The display was projected from a slide projector on a white background to cover 14 degrees of visual angle horizontally and vertically, 48 inches from the subject's eye. The runs lasted 45 seconds each and contained an average of 39 saccades (flicks, or small rapid eye movements of a range of 1 to 30 minutes of arc magnitude). There were 20 runs, 5 for each quadrant.

Each saccade was measured horizontally and vertically and a mean saccade was calculated for each run by adding all of the saccadic vectors algebraically and dividing by the number of saccades. Figure 2 shows the distribution of the mean saccades under the four conditions. As can be seen, there is a striking separation of the four groups with only one area of overlap, that between the mean saccades of quadrants 1 and 2. If the grand mean of all mean saccades is taken arbitrarily as a zero point, it can also be seen that there is a tendency for

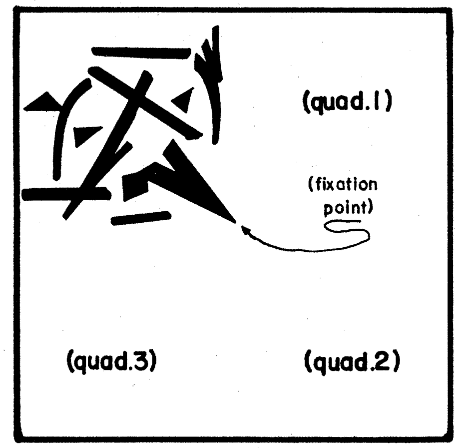

Fig. 1. The visual display. The stimulus is in quadrant 4 in this diagram. The fixation point is always at the center of the field.

the mean saccades to be in a quadrant diametrically opposite to that of the stimulus.

Cornsweet (*6*) has postulated that the function of saccades is to recenter the eye after a random drift which results from the instability of the oculomotor system. Nachmias (*5*) has felt his work consistent with Cornsweet's hypothesis. It now seems justified to go considerably further and suspect that saccades are part of a central ocular control mechanism which functions in a determined manner related to the nature of the stimulus. When this hypothesis is combined with the observations of Ditchburn *et al.* (*7*) and Riggs *et al.* (*8*), which show that perception is affected by eye movements,

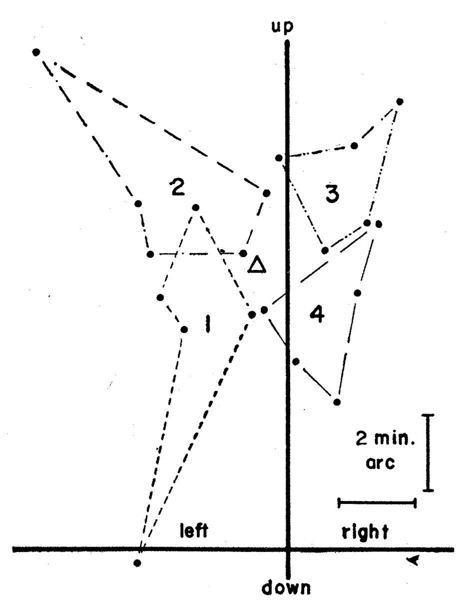

Fig. 2. Distribution of the mean saccades of the four positions. Dotted lines connect the five mean saccades of the same quadrant. Quadrant indicated by number, grand mean of means by Δ.

a new possibility arises, namely, that the fine eye movements are an experimentally predictable derivative of both the stimulus and the percept. This is not to say that other explanations are not possible (*9*).

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16 May 1960

Transfer of Maternal Calcium to the Offspring via the Milk

Abstract. By measuring the specific activities of milk and of maternal and filial long bones 3 months after calcium-45 had been given to the then nonpregnant mothers, it was found that the magnitude of the contribution of the maternal calcium stores to milk formation is similar to the contribution to the bone calcium of the offspring, that is, 10 to 15 percent of either milk calcium or filial calcium is maternal in origin.

Several groups of authors (*1–3*) have investigated the movement of maternal calcium to the developing fetus and have generally concluded that only a small portion of the maternal skeletal calcium stores is transferred to the embryo, most of the latter's bone calcium deriving from the maternal diet. The actual fraction of fetal calcium that is maternal in origin is imprecisely known, the figures reported varying from 28.6 percent (*1*) to 12 percent (*3*).

Hevesy, studying the conservation of maternal calcium in the offspring, concluded from data on calcium content and turnover in mice and their offspring that "The Ca^{45} taken in by the mother has thus only an opportunity of interchanging in the average with about 1/5 to 1/6 of the body calcium before being utilized in the building up of the embryo" (*4*, p. 15). This estimate thus agrees with the estimates cited.

The implication of these findings is that when the demand for calcium is high, as in pregnancy, the body can divert most of the incoming calcium atoms from the skeleton, their normal target organ, to the rapidly calcifying fetus (*5*). It seemed of interest to determine to what extent the pool of maternal calcium participates in milk formation and to estimate whether the endogenous calcium contributed by the mother to the milk calcium derives from the same source as the calcium supplied to the fetus.

To this end, 1-month-old female rats were given Ca^{45} (*6*) by intraperitoneal injection and caged together with males of the same age. Six to eight weeks later, when the females were found to be pregnant, they were separated and allowed to deliver and then to suckle their young. At predetermined times, the mothers and their litters were killed (ether anesthesia), their right humeri were dissected out, and, in the case of the mothers and older offspring, the proximal ends were separated from the shafts and analyzed for Ca and Ca^{45} (*7*). In the case of newborn rats, the entire humerus was analyzed; in the older suckling rats, all of the shaft, but in the mothers only a portion of the shaft (proximal metaphysis and part of diaphysis), was analyzed. In addition, the stomach of the offspring was excised, cut open, and the curdled milk was squeezed out and analyzed for Ca and Ca^{45}.

Table 1 shows the results of the analyses. It can be seen that the specific activities of the shafts of the mothers are higher than those of the ends; this indicates that much of the isotope, originally deposited at the epiphysial plates, is now in the shafts, in accordance with the pattern of growth of long bones worked out by Leblond *et al.* (*8*). The specific activities of the bones of the offspring were appreciably lower than those of the maternal bones, approximately 1/8 of the specific activity of the ends and 1/10 of the specific activity of the shafts of the maternal bones. These figures are qualitatively similar to, though perhaps lower than, the corresponding figures reported by others (*1, 3, 4*).

The specific activity of the milk recovered from the offspring is similar to that of their bones. This suggests that the magnitude of the contribution of maternal skeletal calcium stores to milk formation is similar to the magnitude of contribution toward fetal bone formation. In other words, about 10 to 15 percent of the calcium in milk or the filial skeleton is maternal in origin. This estimate represents a minimum figure, however, as some nonlabeled dietary calcium may enter the maternal skeleton and then be transferred to the fetus or the milk (*3*). Furthermore, the maternal bones were not labeled uniformly by the single injection of tracer (*7*). Consequently, some unlabeled maternal calcium may also have been transferred to the milk or the offspring.

A comparison of the fraction of the dose of Ca^{45} appearing in the milk (0.06 to 0.34, depending apparently on the relation of milk calcium secreted

Table 1. Comparison of specific activities of milk and of maternal and filial long bones. Percent dose Ca^{45}/gm Ca. (Dose given to mother 3 months earlier.)

Litter age (Days)	Mother		Milk	Litter		
	Ends	Shafts		Total	Ends	Shafts
1	13.6	20.0	1.75	2.57		
				0.99		
				0.96		
				1.29		
				Av. 1.45		
1	48.0	62.5	7.59	8.63		
				7.96		
				4.25		
				6.74		
				Av. 6.90		
10	43.2	50.0	4.61		7.00	4.97
					6.80	5.44
					5.66	5.23
					1.94*	4.97
					Avs. 6.49	5.15
16	21.6	29.4	3.12		4.67	4.84
					4.50	4.70
					6.45	5.63
					6.28	5.33
					Avs. 5.48	5.13

* This figure was not included in calculating the average.