Abstracts

Abstracts of Papers Presented at the Twenty-First Annual Meeting of the Society for Psychophysiological Research

The Twenty-First Annual Meeting of the Society for Psychophysiological Research was held at the Sheraton-Washington Hotel in Washington, D.C., October 29, 30, and 31, and November 1, 1981.

Werner, G., & Steinhauser, S. R. (Department of Psychiatry, University of Pittsburgh, and Biometrics Research, VA Medical Center, Pittsburgh) Ocular fixations and stimulus complexity in normals and schizophrenics. Deficits in the interaction between central and peripheral visual processes have been implicated as components of the information processing deficit in schizophrenia. The contribution of informational complexity in eliciting voluntary eye movements was quantified by examining the pattern of visual fixations elicited by patterns of variable complexity.

Stimuli could be presented as either a homogeneous field of dots or as quasi-random distributions whose dot density varied across the visual display. Increasing density was considered to represent greater informational complexity. Ten normal subjects were instructed to search for hexagonal targets that could be embedded within the display, and to report the number seen. The data of interest were the search patterns employed by the subjects, rather than the number of targets reported.

Horizontal and vertical eye movements were recorded using an infra-red TV pupillometer, stored on floppy disk, and analyzed off-line to provide information on the number, regional distribution and duration of fixations, and length of saccades. The distribution of fixations was related to the local density of any region, with a greater number of fixations where dot density was higher, and duration of fixations was longer in high density regions. The length of saccades was greater following fixations in low than in high density regions. Thus, when the complexity of information to the central retina was low, peripheral retinal mechanisms were adequate to direct attention to regions of greater informational complexity.

Preliminary data from 7 schizophrenic subjects indicates a deficit in optimal scanning patterns, characterized by a more even distribution of fixations across the visual field. Thus, the temporal pattern of fixations and the spatial programming of saccades in schizophrenics is apparently independent of the surround of the foveally fixed visual field, supporting the notion of a deficient peripheral visual mechanism among schizophrenics.
Ocular Fixations and Stimulus Complexity in
Normals and Schizophrenics

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Central and peripheral visual mechanisms interact in the directing
of attention. Selective processes in the visual field operate to
regulate the pattern of saccades and foveal fixations relative to the
complexity of visual signals. Deviations in the interaction between
central and peripheral visual processes have been implicated as
components of the information processing deficit in schizophrenia. The
contribution of informational complexity in eliciting voluntary eye
movements was quantified by examining the pattern of visual fixations
elicted by patterns varying in complexity.

Preliminary data are presented from studies of ten normal subjects
(20-35 years of age) and psychiatric patients meeting Research
Diagnostic Criteria for schizophrenia.

Stimuli could be presented as either a homogeneous field of dots
or as quasi-random distributions whose dot density varied across the
visual display. Increasing density was considered to represent greater
informational complexity. An example of one of the stimulus displays
is shown in Figure 1. The visual angle subtended in either the
horizontal or vertical axis ranged from 10 to 16 degrees.

Subjects were instructed to search for hexagonal targets that
might be embedded within the display, and to report the number seen.
The data of interest were the search patterns employed by the subjects,
rather than the number of targets reported. Each of five stimulus
displays was presented for a period of 20 seconds.

Horizontal and vertical eye movements were recorded using a Gulf &
Western Applied Science Laboratories infra-red TV pupillometer/eye view
monitor system. The analog output of the system was digitized at 40
msec intervals (maximum data rate is 60/sec), stored on floppy disk,
and analyzed off-line to provide information on the number, regional
distribution and duration of fixations, and length of saccades.
Fixations were defined as successive measurements (40 msec apart) that
clustered within one degree of visual angle for 120 msec or longer.

The distribution of fixations was related to the local density of
any region. Representative data are presented for one of the control
subjects. Figure 2 indicates that the length of a saccade following
fixation was shorter following fixation to a region of high dot density
than after fixation to a region of low dot density (see Figure 1).
Successive fixations, thus, were to adjacent regions when informational
value was high, but when informational value was low, a saccade served to bring fixation to a more remote region providing new information, indicating use of the peripheral visual field in the selection of the subsequent target.

In Figure 3, the duration of individual fixations to the same display are plotted. Fixation durations tended to be distributed similarly over regions of high vs. low density, with the exception that extremely long durations were clustered among the regions of highest density.

The distribution of fixations across the visual display field can be related to dot stimulus density by graphing a density function representing, in the Z-axis, the density of dots within arbitrarily grouped regions (Figure 4, rotated 90 degrees counterclockwise for clarity of display). The latter can be compared to the number of fixations performed within the same regions (Figure 5). Fixation density for a normal subject shows a high degree of correspondence to stimulus density.

Preliminary data from seven schizophrenic subjects indicate a deviation from the normal scanning patterns. Those patients showing the deviation are characterized by a fixation pattern that is more evenly distributed across the stimulus field and does not follow the density pattern. The data for one patient are shown in Figure 6, corresponding to Figure 2 for the normal subject above. Both the length of saccades and distribution of fixations show little relation to the information provided by the stimulus display.

Thus, the temporal pattern of fixations and the spatial programming of saccades in schizophrenics is apparently independent of the surround of the foveally fixed visual field, supporting the notion of a deviant peripheral visual mechanism among schizophrenics.

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**Figure 1.**

SAMPLE STIMULUS PATTERN (NOTATIONS ADDED)

DENSITY FUNCTION: \(25 \times 10^2 \sin(x/3) - 10^2 \cos(y/2)\)
Figure 2. Length of Saccades following fixations; data for one normal subject viewing Figure 1.

Figure 3. Duration of individual fixations of Figure 1.
Figure 4. Dot-Density for Figure 1.
(Rotated 90° counterclockwise)

Figure 5. Fixation-Density for one normal subject viewing Figure 1.
(Ploitted as in Figure 4)
Figure 6. Distribution of fixations showing saccade length for schizophrenic patient viewing Figure 1; compare with data for Figure 2.