# Meetings

## Visual Information Processing: Early Experience

One of the goals of the National Research Council's Committee on Brain Sciences is to sponsor conferences on subjects that illustrate the relationship of brain and behavior, that are timely in the sense of being actively and excitingly researched, and that are potentially reinforcing to several disciplinary levels. Such a conference was held 27–30 October 1968 at Mohonk Lake, New York, on some factors underlying perceptual and reading disabilities, titled "The Influence of Early Experience on Visual Information Processing." The plan was to bring together a group of 50, consisting of experimentalists working in the area of perception, especially vision; practitioners dealing with perceptual disabilities; and educators who teach reading to children with these disabilities. The experimentalists were trained primarily as psychologists, neurophysiologists, and neuroanatomists. The practitioners were ophthalmologists, neurologists, optometrists, and pediatricians. The educators were future teachers training and performing research in graduate schools of education.

The desirability of more basic research on learning to read was emphasized by J. S. Chall (Cambridge), who reviewed some of the approaches that have been developed for diagnosing and treating reading disabilities. She indicated that many of these disabilities are based on their proponents' personal experience and intuition without adequate scientific basis. The subsequent wide-ranging discussion included developmental dyslexia and related problems as they occur among boys and girls in this and other cultures.

The first group of talks after this practical keynote described some optical, oculomotor, and retinal factors of visual information processing that can be influenced by early experience. F. A. Young (Pullman, Washington) discussed the effect of the early visual environment on the development of the optical characteristics for seeing and indicated that the use of the eyes greatly influences the development of myopia, which in turn usually leads to a careful visual examination. He stressed the importance of having all children, not just the myopic, receive a careful and detailed visual examination before starting reading instruction. D. C. Schubert (Los Angeles) described some effects of induced visual refractive errors on visual performance of college students—refractive errors that would greatly influence the reading ability of young children if not corrected. Movies of voluntary and involuntary eye movements that develop in a normal child were shown by D. A. Cogan (Boston); he described an eye movement that is not under voluntary control but is controlled by the vestibular apparatus, is difficult to detect, and would influence reading performance. K. R. Gaarder (Washington, D.C.) showed how the discrete packages of information received by the eye are linked together by patterns of eye movements to form a continuous chain of information.

Retinal factors were introduced by R. M. Boynton (Rochester, New York), who described the relationship between the relatively low level of contrast on the retina and the characteristics of the retina itself. Activity in one part of the retina influences simultaneous and future activity in other parts of the retina. M. Alpern (Ann Arbor) talked about eye dominance and retinal rivalry, and pointed out that the locus of retinal suppression has not been determined.

Turning to information processing events central to the eye, M. Glickstein (Providence) discussed duplication within the visual system and the apparent ability, in some circumstances, of a relatively small part of the visual system to perform the role of the entire system. P. Buser (Paris) related the primary visual projection areas to the visual association areas. The activities of these nonspecific areas can be modified by modifying the primary projection areas, for example, by cooling. R. W. Sperry (Pasadena) presented findings from cases of induced and congenital split brains showing that the speech and writing centers are in the left hemisphere, with no similar representation in the right hemisphere. Visual and spatial centers are in the right hemisphere. Thus, there appears to be a differentiation of functions and competitions between the two hemispheres.

Attentional and perceptual mechanisms in visual information processing were considered next. R. W. Doty (Rochester, New York) described the control over visual information input exerted by the lateral geniculate nucleus and mesencephalic reticular formation, which allow "zooming in" on specific inputs out of the total input environment. G. Sperling (Murray Hill) discussed short-term memory as a specialized function that enables the individual to hold materials for a short time and to remove them to permit reception of new materials. In contrast, long-term memory does not show this easy "eraseability." R. Jung (Freiburg) presented his studies on the size of the cortical receptive fields for human vision and described some of the relations between these fields and the perception of the visual stimulus. Unit recording of electrical potentials from cortical visual receptive fields in epileptic patients, carried out by E. Marg (Berkeley), yielded results on humans similar to those on monkeys. J. Hochberg (New York) showed that the attentive reader can participate over a wider area than he can see clearly because he is receiving input from his peripheral visual field; he then can relate speech fragments having a definite temporal order to his visual input to produce a linguistic structure.

The next group of papers dealt with the influence of factors of early experience and learning on visual information processing. A. H. Riesen (Riverside, California) showed the importance of the proper light level for the normal development of the biochemistry and physiology of the retina. The number of ganglion cells in the retina decreases as the time in darkness increases in experimental animals. F. Valverde (Madrid) discussed the effects of sensory deprivation on dendritic spines (which support synaptic connections) in the visual cortex of the mouse. He found that raising animals in darkness, or removing one eye, results in a significant decrease in the number of spines in the apical dendrites in the related areas of the visual cortex.

Turning to the human condition, M. C. Flom (Berkeley) discussed the development of visual coordination and stressed the importance of diagnosing coordination problems at an early age so that treatment may be started as

soon as possible. There appears to be a critical age in strabismus. J. Kagan (Cambridge, Massachusetts) described the cognitive development of the young human and showed that patterns of behavior become manifest relatively early in life and are maintained consistently as the child grows. This suggests the possibility of predicting at an early age which children will have reading problems. L. P. Lipsitt (Providence) discussed the paper "Pattern perception in early infancy" by Robert Fantz, who was absent, and presented his own studies on making young infants work to obtain increased visual stimulation. The results suggest that enriched visual environments are sought by the young human and may be important to his development.

The relation between spoken language and visually perceived language was discussed by I. J. Hirsh (St. Louis) who stressed the necessity of early speech and reading training in deaf or blind children. He suggested that similar early training in normal children may be effective in improving reading performance. W. A. Mason (Covington, Louisiana) described the development of behavior sequences in normal and visually deprived monkeys, and generalized on possibilities that may apply equally well to humans.

Final sessions brought the conference's attention to reading disabilities. T. T. S. Ingram (Edinburgh) defined dyslexia and its many-faceted nature, touching on some of the different problems included under this general heading. A. A. Silver (New York) described some types of visual defects, visual motor dysfunction, and visual memory problems in reading difficulties, tracing the history of several persons with such disabilities as they have grown older. The neurologic aspects of reading disabilities, as discussed by Ingram and Silver, were elaborated on by R. L. Masland (New York). He believes that the fact that language is supported in one hemisphere while spatial organization is in the opposite hemisphere is very important for the understanding of some visual reversal problems.

The interdisciplinary and social implications of understanding and helping children with difficulties in visual information processing were outlined. B. H. Richardson (Washington, D.C.) emphasized the importance of better delivery of educational and health services, which could be brought about by increased cooperation and exchange of knowledge. The conference concluded with a panel discussion on several types of studies of reading performance, the relationship between the early experiences of children and their later reading performance, and the importance of developing wide research approaches to reading problems. Satisfactory selection techniques are available for identifying children with reading problems and for pinpointing the types of problems. Unfortunately, the development of normal reading behavior has not been sufficiently studied, and it may also be necessary to look more closely at both the sociologic aspects of the environment, and the psychologic aspects of the developing visual environment, before understanding the nature of visual information processing and its relation to the reading problem.

The conference was supported by the National Institute of Neurological Diseases and Stroke, and suggested several possibilities for future programs. One of the most intriguing comes from observed differences in how boys and girls solve problems in spatial orientation. Is this related to the preponderance of reading problems in boys? Another specific area that would be fruitful to develop in depth is the coordination of verbal and visual learning. The manuscripts, circulated before the 2½-day conference, and the proceedings will be published.

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## Calendar of Events

### Courses

Workshop in **Heat Transfer Computer Programs**, Los Angeles, Calif., 19–30 May (section I) and 15–26 September (section II). Is intended to provide experience and confidence in the application of adaptable, general-purpose digital computer programs to a broad range of heat transfer analysis and design problems representative of modern practice. This course is for thermal system designers, thermal test engineers, and managers of thermal design groups. Is of particular interest to engineers and scientists working in space vehicle design, infrared, lighting, combustion, radiant heating, weapons effects, human engineering, food processing, and other areas concerned with heat transfer. Enrollment in each section is limited to 30. Fee: $375 for each section. *Deadline for applications: 12 May.* (Engineering and Physical Sciences Extension, Room 6115, Mathematical Sciences Building, University of California, Los Angeles 90024)

**Liquid Crytsals**, Pittsburgh, Pa., 16–17 April or 18–19 June. The purpose is to present a background of basic theory to give participants an understanding of the properties of liquid crystals plus practical applications through a "beginner's laboratory kit" with which "students" will conduct basic experiments showing some uses and applications of liquid crystals. Enrollment is limited to 30 in each session. Fee: $140. (Continuing Education, Pennsylvania State University, 3550 Seventh Street Rd., New Kensington 15068)

**Marine Science**, Port Aransas, Tex. There will be two 6-week sessions for graduate and advanced undergraduate students. Courses in the first period (3 June–12 July) are general marine science, ecology of fishes, and structure and function of marine animals; courses in the second period (16 July–23 August) are marine microbiology, marine geology, and estuarine ecology. *Application deadline* for enrollment and requests for financial aid is *1 May.* (Director, University of Texas Marine Science Institute, Port Aransas 78373)

Workshop on **Laser Interaction and Related Plasma Phenomena**, East Windsor Hill, Conn., 9–13 June. It will provide physicists and engineers on a graduate and postgraduate level with an introduction to the field of laser interaction with solids for different applications as, for example, film technology, power switches, and also research in studying the possibilities of controlled thermonuclear fusion research. The following topics will be treated: lasers, preparation of targets, evaporation technique with lasers, switch control by lasers, scattering of laser radiation, ion energies due to laser irradiation, magnetic field interaction, theory of laser interaction, and possibilities for controlled thermonuclear fusion using lasers. (Prof. H. J. Schwarz, Rensselaer Polytechnic Institute–Hartford Graduate Center, East Windsor Hill 06028)

**Electron and Light Microscopy,** Ithaca, N.Y., 14–25 July. This is an introductory course for professional personnel, with primary emphasis on electron miscroscopy. Enrollment will be limited to 16 in order to permit extensive laboratory practice. The topics covered will include principles of optics, microscope operation and performance, photographic techniques, standard methods of specimen preparation, selected-area electron diffraction, and interpretation of micrographs. Equipment will include light and electron microscopes, vacuum evaporators, an ultramicrotome, and the necessary auxiliary equipment and laboratory facilities. Fee: $400. (Director of Continuing Education, College of Engineering, 251 Carpenter Hall, Cornell University, Ithaca 14850)

**Gel Permeation Chromatography**, St. Louis, Mo., 25–26 April. The subject areas covered include current theory and practice of gel-permeation chromatography from first principles to current applications. Covers choice of gel materials, pore structures, solvents, column sizes and operation, detectors and supplemental instrumentation, practical chromatograph interpretation in terms of molecular size and weight distribution and detail, considerations of polymerization kinetics, reactor design, polymer properties in processing and use. Fee: $130. (Dr. G. L. Esterson, Box 1048, Washington University, St. Louis 63130)