SEMINAR ON MAP READING AND PERCEPTION

The seminar on Map Reading and Perception was held in two sessions. The first session on Monday afternoon was chaired by BARBARA PETCHENIK of the Newberry Library, Chicago, Illinois. Entitled "An Interdisciplinary Forum," it was designed to bring together individuals from various disciplines which are, depending on one's point of view, either peripheral to cartography or at the very heart of it. At the second session, held Wednesday afternoon and chaired by GEORGE MC CLEARY of the University of Kansas, practicing cartographers discussed current research products and methodology.

At the Monday session experts in various disciplines including psychology, urban planning, and cartography, looked at the visual processes involved in extracting information from maps.

The psychologist of art, RUDOLF ARNHEIM, formerly of Harvard University, focused on various problems shared by art and cartography in his paper entitled "The Perception of Maps." These problems include simplification and generalization. Geographic shapes, like other visual shapes, are always seen in context and are the carriers of dynamic expression. The dynamic qualities are essential in impressing students with experiences that give life to intellectual information. Other perceptual aspects, such as orientation in space and the representation of three-dimensional relief, can be studied with the help of psychological principles and techniques developed by artists. Remarks on "generalization" of visual form concluded the paper. Dr. Arnheim's paper is not reproduced in these Proceedings but can be found in The American Cartographer, volume 3, number 1, April, 1976.

DAVID STEA of the University of California at Los Angeles is well versed in the fields of psychology, engineering, planning and geography and brought a wide range of experience to the seminar. In his paper, "Children as Cartographers," he related the results of research conducted over a number of years at the Place Perception Project. He summarized a series of studies which were carried out among children aged 3 to 7 in the United States and other countries. His findings indicate that children appear to have map and air photo reading and mapping

capacities at very early ages, prior to formal school experience. The results of this research have been published in several journals including the Annals of the Association of American Geographers ("Studies of Geographic Learning," with J.M. Blaut, 1971, volume 61, pages 387-393) and the Journal of Geography ("Mapping at the Age of Three," 1974, volume 23, number 7, pages 5-9). Dr. Stea has also written (with Roger Downs) Image and Environment (Chicago: Aldine, 1973).

WILLIAM CHASE, a psychologist at Carnegie Mellon University, described psychological experiments in visual imagery and current theories of image representation. His paper described the cognitive aspects of visual information processing, especially the problem of determining the nature of the skills (spatial and otherwise) related to expert chess playing. His research appears to have rather direct relevance for map use analysis. The topic of his presentation, "Psychological Investigation of Visual Imagery," is discussed in detail in the following two articles: William Chase and Herbert Simon, "The Mind's Eye in Chess," in Visual Image Processing, edited by William Chase, New York: Academic Press, 1973; and William Chase and Herbert Simon, "Skill in Chess," The American Scientist, volume 61 (1973), pages 394-403.

ROBERT C. KLOVE reported on problems in statistical mapping at the Bureau of the Census, concentrating on user definitions and map design. Statistical mapping at the Census Bureau has many problems that are related to map reading and perception. He grouped these under three major headings: 1) statistical map perception problems within the Census Bureau; 2) the nature of the users and the kind of map they need; and 3) statistical map planning and design problems or do the maps tell the story they should. The emphasis was on the United States Map Series (GE-50) developed over the last ten years at the Census Bureau. Dr. Klove also noted the methods used and gave indications of their success, as well as problems that remain to be solved.

BARBARA PETCHENIK of the Newberry Library's Atlas of Early American History Project chaired the first session and presented a paper on "Cognition in Cartography." For more than a decade cartographers have been conducting research in map reading and

perception using the basic assumptions and tools of the field of behavioral psychology. Now, however, there has been an important shift among experimental psychologists toward the field of cognitive psychology. Dr. Petchenik examined the nature of this shift and its implications for cartographic research. She attempted to establish a broad theoretical framework that could encompass the results of research in disciplines other than cartography and proposes a shift in cartographic research from reductionistic points of view to more wholistic approaches.

The second session brought out several of the problems which confront cartographers who embark on a program of research in map reading and perception. The major question to be addressed is: who is the map reader and how will the map affect his behavior and his activities in the environment?

JOHN E. DORNBACH of the National Aeronautics and Space Administration's Johnson Space Center in Houston, Texas, reviewed the background and history of map and chart design investigations prior to the 1950's and touched upon the relationship of the psychological approach to map design. Citing the development of cockpit instrument displays as an example, he stressed the need for integrated graphic design so that information is presented as quickly and as unequivocably as possible. He suggested several areas where research would be of value. The needs of the map user and his ability to effectively extract the information he requires from the map should be foremost in the mind of the map designer. His paper was entitled "An Analysis of Approaches in Map Design."

CHARLES OGROSKY of Rutgers University (New Brunswick, New Jersey) described current research in the field of tactual cartography. Identification of more efficient forms and codes for representing geographic data is an essential part of extending the usefulness of maps to the visually handicapped. Past research has shown that differences of shape, size, texture and relative levels of relief may be used to create qualitative point and linear symbols and area textures. Recently, the use of photomechanical processes and numerically controlled milling devices has made investigation of more complex symbol scaling relationships possible. Current research includes the evaluation of active tactual sensitivity to changes in the planimetric

dimensions of four point and linear symbols. The results of this research will make possible the production of ordinally scaled symbols for use on more meaningful quantitative thematic maps for the blind.

THEODORE STEINKE of the University of South Carolina presented his research on "The Optimal Thematic Map Reading Procedure: Some Clues Provided by Eye Movement Recordings." Cartographers, geographers, and other frequent users of maps commonly allude to the map reading process. Just what that process is has never really been determined despite the existence of numerous technical manuals and college courses dealing with the subject. Eye movement recordings provide a mechanism by which the map reading process can be defined. From these recordings it can be determined where a person looks on a map, how much time is spent looking at the map and its various parts, and the sequence in which these parts are looked at. In this study, eye movement recordings were made of 20 college students while they looked at a typical thematic map. Each was then asked to reconstruct the pattern of graduated circles that made up the body of the map. The reconstruction was used as a measure of how well they understood the map and how much information passed from the map to the reader. Analysis of the eye movement recordings in conjunction with the map reconstructions revealed considerable variation in the map reading procedure used by the subjects but also indicated which attributes of the map reading process are associated with most efficient information flow and thereby provides some insight into the optimal thematic map reading process.

MICHAEL DOBSON of the State University of New York at Albany provided some contributions to an understanding of the role of the eyes during visual search. During map reading, the goals of the reader and the cartographer intermix to produce a specific search behavior. Subject-evoked variability and map-induced constancy are defined as critical components determining the sequence of looking. His paper was entitled "The Map -- In the Mind's Eye."

CARLETON W. COX of Illinois State University applied frame-of-reference psychophysics to adaption level theory in

an attempt to reach a realistic modification of S. Smith Stevens' "power law." He discussed cognitive influences on visual perception and called for the application of frame-of-reference psychophysics to map design in order to develop a "new cartography" which is more responsive to map users both in the classroom and in the environment.

In his paper, "In Pursuit of the Map User," GEORGE MC CLEARY of the University of Kansas and chairman of this second session stated that while many maps are created each year, there has been too little evaluation of their use and effectiveness. Many maps seem to have been developed without real understanding of their use and effectiveness and without real understanding or concern for the map user. He suggested several areas of research which might help the cartographer understand the map user better. Cartographers need to know what and how well map users read; then they will be able to produce, and educate, accordingly.