W. M. Mace

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A Report of the "Workshop on Ecological Optics" held at the Psychology Research Laboratories, Cornell University, Ithaca, N. Y., June 15-20, 1970

Anthony G. Barrand

Considerable progress has been achieved recently in the development of the discipline known as "Ecological Optics," namely the description of the structure of the light available to and detectable by an organism exploring his environment. The aim of the conference was to bring together Psychologists who were either trained at Cornell or who were colleagues of J. J. Gibson in the period since the publication of The Perception of the Visual World, with the faculty and students currently working with both J. J. and E. J. Gibson at Cornell. It was hoped that the theoretical and experimental progress achieved here could be demonstrated, and that contributions to the ideas in Ecological Optics would be made by the visiting participants.

James J. Gibson has distributed a large number of memoranda on certain theoretical issues in perception, many of which were prepared for his seminars on perception at Cornell, and a selection of these (see attached list) plus some reprints of recent publications was sent to each of the visiting participants. Certain participants were asked beforehand to prepare discussions of particular topics.

Participants

Invited. Jacob Beck, John Hay, Julian Hochberg, George and Eleanor Kaplan, Herbert Pick, Horace Reynolds, Olin Smith, Trent Sorenson

Thomas Tighe, Albert and Patricia Yonas.

Guests. Gunnar Jansson and Sverker and Karin Runeson from Uppsala, Lee Benson from the Dept. of History of Art at Cornell.

Local participants included faculty, research associates and graduate students who have worked closely with James J. Gibson here at Cornell.

The total number of participants was approximately 45.

Program

There were eleven sessions in all held in the Seminar room at the Psychology Research Laboratories at Cornell. The final program with a brief description of each session follows:

Monday AM. "What led up to Ecological Optics?" (Gibson) James J. Gibson detailed a number of reasons for the inadequacy of the theory of perception described in The Perception of the Visual World, and the experimental evidence that led to his developing the information based theory of perception, and the discipline of Ecological Optics which underlies it.

Monday PM. "Motion Picture Demonstrations from Cornell & Uppsala" Five movies from the laboratories at Cornell and Uppsala were shown and discussed.

1. 1955, James J. Gibson. "Optical Motions and Transformations as Stimuli for Visual Perception."

2. 1958, J. J. Gibson and Olin Smith. "Further experiments on Optical Motion and Visual Depth."

3. 1968, J. J. Gibson, H. Reynolds, K. Wheeler, & G. Kaplan. "The Change from Visible to Invisible: A Study of Optical Transitions."

4. 1970, J. Maas, G. Johansson, G. Jansson, & S. Runeson. "Uppsala Movie on Introduction to Motion Perception." (This contains some new demonstrations of transforming configurations of ten points of light that are perceived as a man performing various activities, e.g., walking, riding a bicycle.)

5. 1960, H. Reynolds. "Reversible and Non-Reversible Events."

Tuesday AM. "Basic Concepts of Ecological Optics" (Beck & Hochberg) Beck and Hochberg argued that information and invariance should be defined in terms of the particular organism and the relevant sensory apparatus. They objected to the notion of information available at a point of observation, supporting their argument with demonstrations that perception is a function of energy as well as of information, and that perception is a function of the particular sensory mechanisms employed by the organism.

Tuesday PM. "The Problem of Occlusion and the Occluding Eye (Kaplan & Reynolds). G. Kaplan and H. Reynolds discussed the problem of the perception of occluding edges and the hidden layout of the environment. Kaplan showed movies he has made both at Cornell and Stanford in attempting to isolate the information available to an organism given that there are changes in the parts of the world that are hidden from the observer as he moves around in the environment.

Wednesday AM. 1."The Phenomenal Persistence of Hidden Objects: Research with Infants." (A. Yonas). There are two opposed theories about the phenomenal persistence ("permanence") of hidden surfaces: that of Piaget and that of Gibson. Yonas reported on research he had undertaken to investigate certain anomalies in the data collected by Piaget and Tom Bower.

2. "What Gives Rise to the Perception of Motion?" (General discussion). J. Beck led this discussion of Gibson's 1968 paper in Psychological Review, entitled "What gives rise to the perception of motion?", in particular the suggestion that there is information in the array at a moving point of observation for the locomotion of the observer.

Wednesday PM. "The Perception of Rigid and Non-Rigid Motion" (Hay & Farber). Both Hay and Farber have been investigating the information in the array when a rigid object undergoes a rigid motion in the world, and the perceptual consequences of transformations in the array which could not have been the optical result of the rigid motion of a rigid body. They reported their recent experiments on the problem, Farber having studied the effects of magnification on the perceived rigidity, and Hay having looked at the relation between the pictorial or static information for the shape of an object, and the information contained in the transformation over time.

Thursday AM. "Problems of Information Pick-up" (Pick & Tighe). Pick discussed a number of problems associated with the notion of the pick-up of information. For example (a) can we distinguish available information, "sensitivity" to the information, and "attention" to the information; (b) The organism is sensitive to all kinds of structured stimulation, but not all of it is informative. Can we distinguish information about and information as such; (c) Given that pictures contain information in some sense, why is there some learning to perceive by means of pictures?

Tighe presented data obtained from discrimination learning studies involving reversals of reward relations and showed how a description of

these tasks as problems in the perception of relations between features is more meaningful than the descriptions found in classical learning theory.

Thursday PM. "The Information in Pictorial Displays" (J. Kennedy). John Kennedy is writing a thesis this year at Cornell on problems in the perception of line drawings. More generally, he and J. J. Gibson have been revising an earlier theory of pictorial representation from one of point to point fidelity, to one of the re-presentation of some of the information available in the array from an environment. Kennedy introduced the new ideas and presented data of his own.

Friday AM and PM. "The Mathematics of the Optic Array" (Wilcox, Shaw, & Lee). This year there has been considerable progress in the attempt to give a mathematical description of the ambient optic array, mostly due to the work of Gordon Wilcox of the Cornell faculty, Robert Shaw of Minnesota, David Lee, Senior Research Associate, and James Farber, completing his doctoral thesis here at Cornell this year.

Wilcox demonstrated a possible geometrical description of certain aspects of the array, notably the structuring of the light by regularly textured surfaces.

Shaw discussed the application of certain techniques in group theory particularly the notion of "symmetry," to the problem of specifying the boundary conditions that have to be satisfied with respect to any model of the array, and the problem of stating the logical support for invariants in the array.

David Lee argued for what he calls the "spatio-temporal" description of the array, and supported his case with demonstration of invariants

available in the "kinetic structure" of the flow-field and with certain demonstrations of information for binocular disparity available only over time.

Saturday AM. "The Concept of Affordances" (Sorenson). Trent Sorenson has found that undergraduates react very positively to the ideas in Ecological Optics, because it gives them a way of approaching the problems involved in the control of behavior (Social and Person Perception). He argued here that the notion of information and invariance as related to the affordances of the world and the objects in the world would be a profitable direction to procede with the discipline of Ecological Optics, e.g., we need to determine the social invariants.

There followed a general discussion of the relation of optical texture to the affordances of surfaces, and the morning ended with the topic of the relation of the phenomena called "Perception" to the phenomena called "memory."

Note

The formal sessions of the "Workshop" were tape-recorded and will probably be transcribed. A decision will be made at that time concerning any further report of the proceedings.