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Proceedings of a Meeting of the International Society of Ecological Psychology

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This article describes a new organization, the International Society of Ecological Psychology, and summarizes presentations from a May 1982 meeting. This organization primarily consists of experimental psychologists who study perceiving and acting (each broadly construed) with reference to one another and to the environment in which these activities have evolved. The organization is meant to be a forum defined by the issues and not defined by preferred solutions. Consequently, people from a variety of disciplines outside of psychology and subdisciplines within psychology are welcomed as important contributors. As an interdisciplinary group, the Society may be viewed as roughly complementary to cognitive science, since biology and physics are appealed to more frequently as allied disciplines than are computer science and linguistics. The seven talks presented here are concerned with visual perceiving *of* action (lifting weights), visual perceiving *for* action (climbing stairs), theoretical challenges posed by the findings in the first two reports, lessons from studies of visual and auditory imprinting, facial features of victims of child abuse, differences between "armchair" imagery and parallel tasks in a real environment, and differences between metaphor comprehension in isolation and in paragraph contexts.

The third conference associated with the newly organized International Society of Ecological Psychology was held at Adelphi University on May 15, 1982.[1] Seven presentations were given and about 80 people attended.

Orientation of the Society

The Society primarily consists of experimental psychologists from several subfields who recognize that their work displays an ecological orientation. In keeping with the best traditions of psychology, the Society is a loosely federated group whose full scope and definition will emerge more by evolution than by design. The Society is not a monolithic movement but a forum for people who believe that they would benefit from sharing their knowledge with one another. Most people primarily identify with other subspecialties where their research fits in perfectly well. Despite a fair amount of heterogeneity, themes common to most members are clear. Experimental and theoretical analyses of environments (e.g., *what* is a person or animal perceiving?) and achievements in those environments (e.g., what is a person or animal *doing*?) have priority over principles of mechanism because many mechanisms may serve the same purpose and because a fully relevant understanding of mechanisms requires an appreciation of function.[2] Topics in perceiving and acting are

Robert Hoffman, Edward Cochran, David Gorfein, and their graduate students at Adelphi were responsible for arranging the meeting and are among those who took the first initiatives to organize the Society. Adelphi University provided the funds for the meeting.

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[1] The first of these meetings was held at Trinity College in Hartford, Connecticut on September 26, 1981; the second was held at Trinity College on January 23, 1982. An extensive account of the symposium on Cognition and Ecological Psychology may be obtained from the author. Three groups—memory and concept formation, representation and imagery, and speech and language—discussed the subjects indicated.

[2] The stratification of analyses is similar to the hierarchy for understanding computation offered by Marr (1981) in which the theory of a function must be determined before algorithms for computing it can be determined. Programs to instantiate the algorithm and hardware to instantiate the program follow. To understand one level, one must understand how it fits into the level above. We envision a multilayered analysis as well but accept that the top level will be more like a biological function than like a mathematical function. That is what is meant by the question, What is an animal *doing*? Minimally, the animal is performing biological functions in a real environment directed at the preservation of life

somewhat more central and better focused than are topics in cognition. Nevertheless, many people in the group work on topics commonly associated with cognition, whether or not they accept that label. Such topics include remembering, attending, imagining, and speaking and understanding language. Nearly everyone has at least a nodding acquaintance with James Gibson's writing, and the group's sense of *ecology* as an approach to psychology is derived from his usage of the term. I do not mean that the group is defined as Gibsonian. The purpose of the Society is to facilitate research that might blossom more fully in this mix of disciplines and subspecialties than it would in other existing groups. The Society is not meant to prescribe theories, methods, or results, or, for that matter, to shelter "true believers."

The term *ecology* could not be avoided, although the word is surely overworked. In popular usage the word may call to mind "anything good that happens far from cities or anything that does not have synthetic chemicals in it" (Gould, 1977, p. 119). Johnston (1981) and many other commentators also discuss the threat of linguistic pollution. Moreover, the group does not now cover all of the topics in psychology that can be labeled *ecological psychology*, but then the term *experimental psychology* does not designate all psychologists who perform experiments.[3] The society welcomes nonpsychologists—artists, architects, computer scientists, biologists, ethologists, physicists, linguists, mathematicians, physiologists, and philosophers—whose interests and expertise seem appropriate. Nevertheless, the term ecological psychology accurately denotes what we do and intend to do because we wish to understand the role of environment in the scientific explanation of psychological phenomena and to give it parity where warranted. Studies of ecology in biology are germane to our interests, and we expect that some work from our group will in turn be germane to ecologists in biology (e.g., Patten, 1982).

Gibbs (1979) discussed ecologically oriented inquiry as a reformist plea. In his examples, the purpose of the reform was to broaden the scope of inquiry by returning meaning and "naturalness" to studies in which methods and data had become ends in themselves. No doubt some people drawn to the Society share this spirit, but it is noteworthy that others are moved by different reasons, which are more similar to Gibson's motives for advocating an ecological psychology. Although Gibson firmly believed that good theory should not be embarrassed in the company of "real life" behavior, his pragmatism developed because of a desire for rigor, not a yearning for relevance. To Gibson, the ecological move *sharpened* the focus of ancient psychological questions. He offered *surfaces* as a substitute for *space*, *events* (changes in surface layout) in place of *time*, and flesh-and-blood bodies in place of abstracted minds. "Ghost" was one of his favorite pejorative images. The problem with most laboratory psychology was not that it was laboratory psychology but that its data provided too little constraint on theories, which allowed them to develop in the forgiving space of logical possibility rather than to develop in terrestrial reality. Gibson's innovations were directed toward *materializing* psychology. To understand Gibson's use of *ecological*, the relevant contrast is closer to *embodied* versus *disembodied* than it is to *natural* versus *artificial*, although the two distinctions certainly overlap. Gibson was scandalized by a psychology that considered photons to be more real than the ground we walk on (Boynton, 1974).

The abstract theme "the consequences of embodiment" runs through many of the papers presented at our meetings. This theme also distinguishes the inclinations of our group from cognitive science, which often glorifies the fact that cognition as computation (e.g., algorithms, programs, mathematical functions) can be studied apart from particular instantiations (e.g., hardware). For example, some society members who study the coordination of action look to the organizing capacity of energy flow in matter first rather than assume that there is a capacity for control that is functionally or anatomically separate (Kugler, Kelso, & Turvey, 1980).

Presentations

The presentations were given by Robert Shaw, Sverker Runeson, William Warren, Timothy Johnston, Viki McCabe, Steven Braddon, and Allyssa McCabe. The first five people addressed topics in perception; Braddon discussed memory; and A. McCabe discussed metaphor in language. The links between perceiving ("remembering" in Braddon's discussion) and acting were exploited in six of the talks. A. McCabe's presentation derived its ecological interest by focusing on task analysis and by sampling natural contexts. The

processes. Any mathematical functional statement of a problem, on the ecological view, would be subordinate to the level of biological function. That is, the problems to be solved are set by an animal's capacities and by the resources offered by the animal's environment for supporting these capacities.

[3] I do not mean to rule out the possibility of fruitful collaborations with people from other areas of psychology, such as developmental and social, who also call their work ecological.

talks by Runeson, Johnston, and V. McCabe extended into social psychology, an area with a solid bloc of Society members. Johnston's discussion of imprinting represents the group's commitment to maintain and to expand its contact with comparative psychology and ethology.

Runeson and Warren presented the major research papers at the meeting. Both addressed the problems of finding accurate characterizations of *what* is perceived and both considered the ties linking perceiving and human action. Shaw's paper was actually delivered first, but it will be easier to describe after Runeson and Warren's presentation.

Sverker Runeson (Uppsala University)

Runeson (1977) had presented an analysis of optical information to support the claim that mass-ratio and damping can be perceived in a display of rectangles that appear to be colliding. Extending this interest in dynamics to cases of human motion, Runeson and Frykholm (1981) demonstrated that observers could determine the weight of a box (4–28 kg) nearly as well by watching a patch-light display of someone else lifting the box as they could by lifting it themselves. Observers could see only patches of light at the actor's head, joints, and on the box. Without relative motion, the display merely appeared as a jumble of dots. Thus, kinematic displays—patterns with variables defined in terms of length and time (L, T)—revealed dynamic properties—events defined over mass, length, and time (M, L, T).[4] Runeson called this the kinematics-specifies-dynamics (KSD) principle. Note that in Runeson's demonstration a quantity (weight, the force of gravity acting on a mass) defined over combinations of three variables is phenomenally more compelling than quantities (the relative motions of the patches) defined over combinations of two variables.

Ordinarily, we think of visual perception as only having access to geometric (written in terms of L) or kinematic (L, T) properties such as space, shape/form, and motion (Hochberg, 1981). To include mass (M) and variables that can be defined over M, L, and T in the inventory of what can be perceived visually is a significant departure from tradition.

The studies reported here extended Runeson and Frykholm's (1981) study by investigating some even higher order characteristics of actors that apparently could be specified in patch-light displays.

The central study on deception caused the greatest stir at the meeting. It had sometimes been suggested that a few crude, voluntarily controlled "cues" were responsible for Runeson and Frykholm's (1981) results. To test this suggestion, Runeson had students pretend after 12 practice trials to lift an empty box as if it had either 7.5 kg or 15 kg added to it; they also lifted the box when the weights were actually present. Runeson asked observers to judge both the real and the intended weights. This proved to be an easy distinction for observers to make, especially for the heavy weights. The observers could determine when an actor was trying to make the box look heavy and when the box actually was heavy. In fact, when the range of weights was 15 kg, the students' faking only changed observers' judgments of the real weight by an average of 2 kg.

Another set of studies again manipulated the actors' intentions in an extension of the gender-recognition work of Kozlowski and Cutting (1977). In the first of these studies, Runeson's actors engaged in a much wider range of activities than Kozlowski and Cutting's actors had. The goal was to discover whether or not recognition accuracy could be enhanced. Actors were then asked to move so as to emphasize what was characteristic of their own sex, and finally, to deceive the observers by moving like the opposite sex. Recognition of sex was best when the actors had no knowledge of the purpose of the study. When the actors tried to deceive, their gender was usually recognized, but not as well as when they walked unselfconsciously. Gender recognition was least successful when actors tried to emphasize their own sex.

Runeson's studies sparked a good deal of discussion, especially about mime. People immediately wondered what would happen if the actors or the observers were skilled mimes. From Runeson's point of view, one can easily see why it is difficult to be a successful mime; the person is trying to control voluntarily many details of an act that are usually controlled by environmental forces acting on the body's mass.

William Warren (Brown University)

In Runeson's studies, observers saw displays of actors performing work. In Warren's research, observers saw a staircase given only geometrically

[4] Force is sometimes used in place of mass as a fundamental variable with mass then derived. In the formulation given here, force would be a derived quantity. Some texts call systems defined over M, L, and T *dynamics* and others call such systems *kinetics*. As long as the term *dynamics* clearly refers here to a system whose fundamental variables are M, L, and T, there should be no ambiguity. Concepts in mechanics defined in terms of M, L, and T include force, momentum, moment of force, impulse, pressure, work, energy (in the same units as work), power, and absolute viscosity.

(i.e., in which L is the only variable) and were asked to judge their own ability to do the work of climbing the stairs (defined over M, L, and T). Normal activity requires an animal to provide appropriately timed forces to perform work. This can be done only if perceiving is informative about these requirements. Because this kind of sensitivity has rarely, if ever, been looked at, Warren's study broke new ground.

Warren's observers saw slides of stairs beside a chair that was also present next to the projection screen (to provide a scale). The observers made two kinds of judgments: (a) whether or not the stairs could be climbed at all and (b) which stairs would be most comfortable to climb. In each case, biomechanical constraints were independently calculated and then compared with the perceptual judgments.

A person can step up on an elevated surface if he or she can raise the body's center of gravity over a foot that serves as a base of support. Warren calculated a biomechanical maximum for the "riser height" of a step—the vertical distance between the steps of a staircase—that could be climbed. By scaling the critical value for people of different heights in terms of their leg length, Warren could express a range of different values. This ratio, critical riser height/leg length turned out to be a constant (.89). In a perceptual task in which both tall people (76 in., 193 cm) and short people (64 in., 162.5 cm) judged the "climbability" of model stairs, both groups' selections indicated a value of approximately .89 as the perceived limit of stair climbability.

Finding an optimal stair height was more complex. As riser heights increase, the effort to climb an individual step also increases. The lower the risers, however, the more step cycles are required to climb a given distance. Warren determined the optimal riser height in tall people and in short people by measuring their oxygen consumption (a good index of energy used) as they walked on a staircase treadmill with variable risers. The optimal riser height expressed as a ratio of riser height to leg length was .257 for the tall people and .261 for the short people. In corresponding perceptual tasks, people judged the apparent comfort of stairs on a 1–7 scale in one case and in pairwise comparisons in another. These observers chose stairs very close to the optimal values of .26. The best stairs seem to be those that are approximately a quarter of one's leg length—and people "know" this fact.

The argument that people perceive dynamic qualities of events around them and that they perceive the environment in terms of their own dynamics is controversial and will be extensively debated. Studies similar to those of Runeson and Warren show that hard data as well as a priori argument can be used in this debate.

Robert Shaw (University of Connecticut)

The purposes of Shaw's talk were (a) to underscore some of the significant theoretical issues raised by the Runeson and Warren studies, (b) to argue that a full explanation of the phenomena of perceptually guided action and the perception of action (which Runeson's and Warren's studies represent) required a foundation in ecological laws, and (c) to sketch some of the properties that ecological laws would have.

The general issue may be schematized by using a notation already introduced to represent dynamics and kinematics:

$$(M,L,T) \rightarrow (L,T) \quad (1)$$

$$(M,L,T) \rightarrow (L). \quad (2)$$

Schema 1 expresses the idea that kinematics lawfully follow from dynamics; and Schema (2) expresses the idea that geometric arrangements lawfully follow from dynamics. In the psychology of visual perception, the direction of the relations is reversed, and the nature of the relation indicated by the arrows becomes a question:

$$(L,T) \rightarrow (M,L,T) \quad \text{Runeson's studies} \quad (3)$$

$$(L) \rightarrow (M,L,T) \quad \text{Warren's studies.} \quad (4)$$

That is, Runeson's observers are given L and T as defined variables and perceive in terms of M, L, and T. Warren's observers are given L and, by hypothesis, perceive in terms of M, L, and T.

Some principled way of going from kinematics to dynamics is required. But where might the mass-related terms come from? The arrows in Schemas 3 and 4 are surely not causal arrows. The time-honored approach is to explain the construals of perception in terms of mental representations in which evidence of a person's or animal's construal of a situation is taken to be evidence for a corresponding mental representation. Although these construals might well account for multiple interpretations of circumstances, neither the origins of the representations nor the occasions of their use are readily explained (Fodor, 1980). Shaw and his colleagues (Turvey, Shaw, Reed, & Mace, 1981) would like to say that restricted subdivisions of the (L, T) space correspond to the (M, L, T) space in a lawful manner so that kinematics may be said to lawfully specify dynamics.

How is the (L, T) space restricted? To say that it is constrained by laws of nature contradicts years of scientific common sense. Rules and representations are more commonly invoked, as above. Howard Pattee, a theoretical physicist who has attended some of our meetings, has studied a case formally similar to the one being discussed here—DNA functions as a rulelike code in controlling the dynamics of cell replication (see Pattee, 1982). Since Pattee's version of the problems encoun-

tered in relating rules to dynamic laws of nature is probably the clearest available, Shaw has used this version as a major framework in his discussion. Pattee argues that both rules and laws must be invoked to fully explain any event, especially in biology. In addition, Pattee maintains that neither can do the work of the other and that they are complementary descriptions of events. Hence, for Pattee, bringing the relation between (L, T) space and (M, L, T) space completely into the domain of law is impossible, and the attempt is a waste of time.

According to Shaw, however, Pattee's complementarity only holds when one uses the classical entities of physics and considers psychology a separate realm. If the scientist selects "physical" entities at a scale determined by animals, then those entities can be thought of as relational in a way that is neither physical nor psychological, but is ecological. Gibson's (1979) concept of affordance is just such a concept, and the climbability of stairs as studied by Warren would also be an example (see also, Patten, 1982, for an ecologist's appreciation of this point).

Shaw hoped that in cases that seem to lend themselves to theories involving rules, the rules would eventually turn out to be elliptical statements of more comprehensive laws.

Shaw's position is not easy to describe or defend because many intertwined components of traditional theorizing must be changed simultaneously before there is a possibility of making it coherent (Shaw & Turvey, 1981; Turvey et al., 1981). Shaw finished his talk with a sketch of some of the properties of an expanded notion of law that he thought would be necessary.

Shaw described an enterprise to find the most fundamental principles that could explain the regularities observed in action and perception. Whether or not Pattee's complementarity can be successfully avoided remains to be seen, but Shaw knows that the program is sufficiently undeveloped and that valuable contributions may come from any serious investigator who understands the problems in the same way, regardless of theoretical bias. He hoped that the Runeson and Warren experments would allow people to concentrate more on understanding the issues and less on defending the orientations.

Timothy Johnston (Dorothea Dix Hospital, Raleigh, North Carolina)

Johnston (1981) has presented the case for an ecological approach to learning that focuses on the tasks animals must master in their normal environments. For this meeting, however, he chose to describe the recent history of a particular topic in perceiving and acting (i.e., imprinting) in which a great deal of research has been directed toward the question, What is perceived? Johnston asserted that the ecological origin of the problem has been lost in some of the laboratory research so that major generalizations from laboratory work reported here failed to consider the basic facts of an animal's (mostly mallard ducks) normal development and expected environment. The research Johnston described was all conducted in an ethological framework, which has produced more theory and research that is obviously ecological than have most other approaches related to psychology. Ethology is, therefore, an important source of ideas and research for members of our society to consider.

Johnston noted that some literature gives the impression that imprinting is primarily a visual phenomenon and that newly hatched ducks or chicks are willing to invest their species-typical action in a host of odd objects. He argued, however, that this idea developed because the visual characteristics we have sampled have themselves been an odd lot, that sounds used for comparison have been arbitrary, and that sources of information have been passive, not interactive as a normal mother would be. When these properties are reversed, the overall picture looks quite different. For example, incubator-hatched ducklings show a preference for approaching the maternal call of their own species when given a choice between that and a call of another species. In addition, when similarly "motherless" ducklings are given a choice of following a moving, realistic (but silent) model of the hen of the species and a moving box with the natural, maternal call, the ducklings usually follow the box. Gottlieb and his associates argue that "the early sensory-perceptual basis of species identification is auditory in all avian species studied to date" (Gottlieb, 1981, pp. 6–7). This observation supports Gottlieb's choice of duck sounds for further experimental analysis. Some of the critical acoustic properties of the maternal call have been identified (e.g., 4 notes/sec repetition rate, as opposed to 2.3 or 6 notes/sec) as well as some of the important developmental experiences that support this specification. More specifically, ducklings selectively respond to their own species' call more than 3 days before hatching but need to hear the call during the last 3 days to maintain the preference. This response is usually accomplished by self-produced vocal sounds in the shell, but a tape recording is an effective substitute.

Viki McCabe (University of Connecticut)

McCabe's research report continued Johnston's theme of perceiving social opportunities, which could be elaborated as an example of Gibson's affordance concept. The action she studied, however, was the abuse of children by parents. Mc-

Cabe's findings suggest that children who are perceived by their parents to be older than they actually are may be more subject to abuse. Historically, her topic fits into the literature on person perception in social psychology, which in turn is often discussed as a cognitive topic. We honored that convention in grouping the presentations.

This research concerns a demonstration that is robust enough to show any audience. McCabe presents a set of paired photographs of young elementary school children matched for age, sex, and race. In each pair, one child has been abused, the other has not. A naive observer's task is merely to select the older child in each pair. The child selected is usually the abused child. Abused children are perceived as older than other children of the same age. McCabe is pursuing this provocative result with larger samples of abused children and with an intent to analyze the critical facial characteristics in more detail. McCabe does *not* believe that facial features cause child abuse or anything remotely like that. Most children whose faces belie their age are not abused. Rather, her theory is that expectations of children may be inflated by the older appearance of the child.

Steven Braddon (Sacred Heart University, Bridgeport, Connecticut)

Braddon argued for more research on traditional cognitive tasks that allow the participants to engage in actual, embodied activity. He suggested that cognitive activities such as searching and constructing should be "demetaphorized." Braddon asked, What characteristics might real searches share with mental searches? His point was that normally, much control of action is supported by environmental features and forces, and that many purely cognitive tasks might give people roles analogous to mimes, in which they assume almost complete control over a task in which control might otherwise be equally shared by the environment and the actor. Braddon discussed some cognitive research that indicates how memory performance varies with a person's task activities. Braddon pointed out that memory search tasks should also include conditions in which real search occurs (e.g., looking for a misplaced object). Braddon noted that a research program was needed to discover the roles of task definition, physical activity, and rich environmental support in remembering, problem solving, and so forth.

If performing in a "physical" environment can be distinguished from purely mental performance, then the idea that the mental world is an internal mirror of the external (even in a functional sense of Shepard's second-order isomorphism) loses force (Shepard & Chipman, 1970).

As an example, Braddon (1981) mentioned his dissertation research in which people were given a series of instructions (which functioned like landmarks) on how to move through a grid drawn on the floor. One group of people actually followed the instructions and another group passively watched. Recall and recognition were tested for both characteristics of the signs and for the paths indicated. Participants tended to recall the paths better than did observers, whereas observers recalled the landmarks better. The experiments clearly supported Braddon's basic thesis that real and mental action differ in important ways. The detailed pattern of results, however, was more difficult to interpret.

Allyssa McCabe (Wheaton College)

The credit for flavoring the study of metaphor with a dash of ecology probably goes to Robert Verbrugge (1977). Since his first papers, many people have found the ecological approach helpful in thinking about constraints on metaphor. Investigators of metaphor have constituted a clearly special interest of our Society since it was founded. McCabe's work represents that group.

McCabe reported research on judging the quality of metaphors. She distinguished her studies from previous ones by varying the context for judging metaphor quality. She claimed that a common answer (dating from the time of Aristotle at least) to the question "what makes a metaphor good?" was similarity between the tenor (i.e., topic) and vehicle (i.e., what the topic is compared to). The evidence for the claim, however, comes from comparisons of sentences in isolation. McCabe's studies revealed that judgments for quality and similarity were indeed highly correlated when judged in isolation (the usual result), but not when a fully elaborated context (such as a long paragraph) was provided.

McCabe also used the occasion to note the host of methodological nightmares lurking in research on context effects and to ask for suggestions.

Discussion

Although the Adelphi meeting provides a good sample of the range of subjects that Society members deemed relevant to their interests, it is worth repeating that this sample is not exhaustive. We have yet to take full advantage of having active nonpsychologist members. For example, an artist in the group, Nathan Knobler, has collaborated with psychologists in the past and hopes that the Society will be able to promote serious cooperative investigations in the future. Computer scientists Darryl Lawton and Pat Hayes have made important contributions in keeping artificial intelligence

in the scope of the Society, even if the topic of artificial intelligence does not embrace our core concepts.

The response to the Society thus far suggests that many people regard it as a potentially useful mix of disciplines that does not duplicate other organizations. Whether or not this potential will be realized cannot be judged now.

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