

Toward an Ecological Theory of Social Perception

Leslie Zebrowitz McArthur
Brandeis University

Reuben M. Baron
University of Connecticut

The ecological approach to perception (J. Gibson, 1979; Shaw, Turvey, & Mace, 1982) is applied to the social domain. The general advantages of this approach are enumerated, its applicability to social perception is documented, and its specific implications for research on emotion perception, impression formation, and causal attribution are discussed. The implications of the ecological approach for our understanding of errors in social perception are also considered. Finally, the major tenets of the ecological approach are contrasted with current cognitive approaches, and a plea is made for greater attention to the role of perception in social knowing.

Current research on social perception operates within a very narrow schema—the schema. The questions addressed concern the knowledge structures (e.g., schemata, prototypes, scripts) that impose meaning on the blooming, buzzing confusion around us. The questions ignored concern the structured stimulation that exists in our social environment. As such, we have learned much about the processing of information and little about what that stimulus information is. We know, for example, that there are primacy effects in impression formation: The person who is first perceived as industrious and then as stubborn will often be judged more positively than one who is first perceived as stubborn. But, what information (other than a verbal label) communicates industry or stubbornness? This we do not know. Similarly, we know that there are discounting effects in causal attribution: Success on a difficult task will be attributed to ability if little effort is present, but not if there is a great deal of effort. But, what information communicates effort? This we do not know.

To fully understand impression formation or causal attribution or other aspects of social

perception, we must ultimately identify the nature of the stimulus information that reveals industry, hostility, and the other attributes that we perceive in people. Whereas current cognitive approaches fall short in this endeavor, the ecological approach to perception provides a fruitful model for theory and research. The purpose of this article is to advocate this approach. More specifically, we will (a) summarize the basic tenets and advantages of the ecological position, (b) demonstrate the applicability of this approach to the realm of social perception, and (c) consider implications of this approach for our understanding of errors in social perception.

The Ecological Position and Its Advantages for the Study of Social Perception

What we call the “ecological position” is not a unified theory of perception; rather, it draws on several recent theories (e.g., J. Gibson, 1966, 1979; Shaw, Turvey, & Mace, 1982). This approach has four distinguishing features. First, it assumes that perception serves an *adaptive* function and that the external world must therefore provide information to guide biologically and socially functional behaviors. Second, it assumes that this information is typically revealed in objective physical *events*—dynamic, changing, multimodal stimulus information as opposed to static or unimodal displays. Third, it assumes that the information available in events specifies, among other things, environmental *affordances*, which are the opportunities for acting or being acted upon that are provided

The authors would like to thank Teresa Amabile, Susan Fiske, David Hamilton, Bert Hodges, Joann Montepare, Dick Nisbett, David Schneider, and Jim Todd for their very helpful comments on an earlier draft of this paper.

Requests for reprints should be sent to Leslie Z. McArthur, Department of Psychology, Brandeis University, Waltham, Massachusetts 02254 or to Reuben M. Baron, Department of Psychology, U20, University of Connecticut, Storrs, Connecticut 06268.

by environmental entities. Fourth, it assumes that the perception of these affordances depends upon the perceivers' *attunement*, that is, the particular stimulus invariants to which the perceiver attends.

The Adaptive Nature of Perception

The ecological approach to perception begins by assuming that perception serves an adaptive function. That is, by informing action, perception is assumed to promote individual goal attainment as well as species survival.¹ J. Gibson (1979), for example, argues: "The medium, substances, surfaces, objects, places, and other animals have affordances for a given animal. They offer benefit or injury, life or death. This is why they need to be perceived" (p. 143). The idea that perception is a matter of discovering and adjusting to utilitarian properties of the environment has important ramifications for theory and research in social perception. Most generally, it focuses attention on the *what* of perceptual processing (i.e., the useful, structured information in the environment), whereas traditional approaches emphasize the *how* of processing (i.e., structuring mechanisms in the head; see Shaw & Bransford, 1977). More specifically, the proposition that "perception is for doing" (J. Gibson, 1979) focuses our attention on a particular subset of information within the perceiver's environment, namely that information which (a) is revealed in events, (b) affords adaptive action, and (c) is accessible to the perceptual systems of the perceiver.

Information in Events

The ecological position. Within the ecological approach to perception, the units of information in structured stimulation are *events*. The idea of an event is both simple and complex. Viewed descriptively, all we mean by an event is a dynamic as opposed to a static stimulus display—a motion picture versus a posed photo or a person walking versus a person standing still. The dynamic changes over space and time that characterize events come in many varieties. For example, they may be fast or slow (e.g., smiling vs. aging), they may be rigid or elastic (e.g., ro-

tating vs. stretching), they may be reversible or nonreversible (e.g., rolling vs. growing). And, as the foregoing examples illustrate, events occur in the social as well as the physical environment.

Events provide perceivers with structured information that supplements the information that is available in static stimuli. For example, one can perceive certain properties in a stationary sphere, such as its size, its color, and its texture. But there are other attributes that can be perceived only in events. These include the heaviness of the sphere that can be perceived by observing its rate of acceleration down an incline, by observing someone lift it, or by lifting it oneself. This last example highlights an important point, namely, that events may be created by the perceiver; dynamic stimulus information may result not only from the displacement of entities in the environment, but also from the exploratory behaviors of an active perceiver.

Certain properties of an entity will change during an event, whereas others remain the same. Those elements that remain the same are referred to as *structural invariants*. For example, the shape and color of an object remains the same as it rotates; similarly, most of your features remain the same as you smile or even as you age. The styles of change that events may manifest are referred to as *transformational invariants*. For example, we recognize a particular style of biomechanical movement as "walking" over a wide range of structures (e.g., humans, cows, and dogs). Similarly, we identify particular morphological changes as "aging" over a wide range of species and forms (cf. Todd, Mark, Shaw, & Pittenger, 1980).

Advantages for social perception research.

Whereas current research in social perception has concentrated on the cognitive processing of social information—how schemata, memory, and various cognitive heuristics influence the meaning we extract from the social environment—research within the

¹ The proposition that perception is adaptive represents a metatheoretical or primitive assumption that is not directly falsifiable. Making this assumption does, however, lead to empirical hypotheses that are capable of disconfirmation. See, for example, the sections on emotion, error, and attributions in this article.

ecological approach will reveal the meaning that is communicated by social events. More specifically, such research will reveal what it is in a person's movements, gestures, voice, and facial appearance that communicates to us that person's momentary intentions, emotional state, or more stable qualities, and what it is in the interactions between two or more people that communicates to us the nature of their relationship even when we cannot hear their words (cf. Archer & Akert, 1977). We clearly make great use of such information in our daily life, for example, when deciding whom to ask for directions, whom to ask for a date, or whom to steer clear of in the subway. However, current research does not provide us with a description of the stimulus information to which we are responding. A notable exception is research on nonverbal communication, an excellent example of focusing on information in the stimulus. (See Schneider, Hastorf, & Ellsworth, 1979, for a comprehensive review of the pertinent literature.) However, this research has tended to concentrate upon the communication of affect. There is other psychological information in the extensional properties of people, and it needs to be identified.

The ecological approach not only focuses on the neglected and important question of what information is provided by social stimuli, but it also emphasizes the importance of addressing this question by examining dynamic stimulus information, something which is rarely done in social perception research. Perceivers more often make social judgments from written summaries of social events than from direct exposure to those events as they unfold. Thus we study social cognition, not social perception. The ecological approach makes explicit that if we want to study social perception, we must give our subjects a chance to perceive people and their behavior.

Integral to the emphasis on dynamic stimulus information within the ecological approach is an emphasis on the active perceiver. Not only is the stimulus information provided by inert objects shown to become dynamic when perceivers are permitted active perceptual exploration (e.g., J. Gibson, 1966, p. 195), but also, it is assumed that the properties of the external environment will be

more accurately detected when perceivers are allowed such active exploration. The ecological approach emphasizes the intrinsic connection between action and perception, something that has been given insufficient consideration in traditional theories of social perception.

The Perception of Affordances

The ecological position. Perception in the ecological approach is not concerned with just any information. Rather, it concerns the pick-up of useful information. The usefulness of information depends upon its relevance to the perceivers' actions and goals, and for this reason, the ecological approach stresses the perception of the *affordances* of the environment. These are defined by J. Gibson (1979) as "what it offers the animal, what it provides or furnishes, either for good or ill" (p. 127). A more poetic and vivid indication of what Gibson means by affordance is provided by his quotation from Koffka (1935, p. 7): "Each thing says what it is . . . a fruit says 'eat me'; water says 'drink me'; thunder says 'fear me'; and woman says 'love me'" (J. Gibson, 1979, p. 138). Gibson maintains that the action possibilities provided by an object in the environment as well as the consequences of interacting with that object may be revealed in its extensional, physical characteristics. For example, the edibility of fruit may be specified extensionally by color, smell, size, and texture. Of course, any one of these properties may not be sufficient to reveal a fruit's edibility. Rather, the detection of this affordance may require event information such as that provided by grasping the fruit and squeezing it or even breaking it open. This fact highlights the mutuality of the affordances of the environment and the behavior of the animal. And, although Gibson emphasizes the objective reality of affordances, he also emphasizes this synergy: "Affordances are properties of things *taken with reference to an observer* but not properties of the *experiences of the observer*. They are not subjective values." (J. Gibson, 1979, p. 137) Thus, a fruit affords eating by some observers but not others: Monkeys eat bananas and coconuts, whereas ants typically do not.

Advantages for social perception research. Although the concept of affordance is closely linked to Kurt Lewin's (1936) concept of valence, it has not been represented in social perception research any more than in perception research in the nonsocial domain.² Rather, research in social perception has focused on the detection of structural invariants—dispositional properties such as abilities and traits. Conceptualizing our social perceptions in terms of affordances may be both more valid and more useful than the trait approach.

There is now considerable evidence that people may not have traits as traditionally conceived. Rather, behavior may be specific to situations as well as to the person with whom one is interacting (e.g., Mischel, 1968). The concept of affordance deals nicely with this possibility, because an affordance is inherently specific to a particular perceiver—what John affords me may or may not be the same as what John affords you. In addition to better capturing the realities of human behavior, the concept of affordance may often surpass the trait approach in capturing the perceivers' phenomenology. Although we may sometimes use trait terms to think about people (and although our research subjects have almost invariably been forced to do so), it is likely that we often want to know what people can do to or for us and what we can do to them, rather than some abstract information regarding the number of situations in which they will behave thus and so.

Not only do affordances often capture the properties of other people and our perceptions of them better than traits do, but the affordance concept has the further advantage of permitting us to assess the accuracy of perceptions more readily than the trait concept does. Although it is difficult if not impossible to find a criterion appropriate for validating perceived traits, behavioral evidence can serve to validate perceived affordances. For example, if someone is perceived to afford protection, one can determine the accuracy of this perception by ascertaining whether that person will indeed provide protection to the perceiver. However, if someone is perceived as protective, then any instance of protecting or nonprotecting can neither confirm nor disconfirm this trait ascription.

Perceptual Attunements

The ecological position. The fact that affordances are perceiver referenced highlights a basic tenet of the ecological approach, namely, that perception requires certain compatibilities between the perceiver and the perceived. At the most fundamental level, there must be a match between animals' receptor capabilities and the stimulus information to which they are perceptually sensitive. Indeed, it can be hypothesized that perceptual systems have evolved to be sensitive to the types of structured information available in a given ecological niche. Thus, animals who live in darkened areas, such as caves, have poorly developed visual systems but very well-developed auditory systems that permit navigation and hunting. The concept of perceptual attunement in the ecological approach is not limited to attunements that occur through biological preprogramming in response to evolutionary pressures. Attunements may also derive from what J. Gibson (1966) has called the "education of attention." More specifically, the stimulus information to which perceivers are attuned may vary as a function of their perceptual learning, goals, expectations, and actions.

The influence of perceptual learning on attunements is revealed when one compares the forest that is seen through the eyes of a naturalist to the forest seen through the eyes of a city dweller. Whereas the naturalist will differentiate—that is, *see*—many levels of structure, the city person may never see anything more than a uniform and boring mass of green. On a less anecdotal level, the master chess player sees more moves on an appropriately arranged chessboard than the novice sees. Evidence that the expert actually sees the board differently is provided by Neisser's (1976) report that experts show more board-dependent eye fixations than novices do. Cross-cultural differences in susceptibility to perceptual illusions also provide evidence for

² According to J. Gibson (1979, p. 138), Kurt Lewin's concept of valence is an English translation of the term *Aufforderungscharakter*, which has also been translated as *invitation character*, a translation that probably makes the concept clearer as well as more readily identifiable as analogous to the concept of affordance.

the role of perceptual learning (e.g., Segall, Campbell, & Herskovitz, 1966).

The influence of goals upon perceptual attunements is not a domain of exclusive interest to the ecological approach. Indeed, this topic has been extensively explored in a body of research known as the "new look", which sought to demonstrate that the perception of stimuli may be inhibited or enhanced as a function of the needs or goals of the perceiver (e.g., Postman, Bruner, & McGinnies, 1948). Although this research was earlier subject to considerable criticism (e.g., Goldiamond, 1958), it has recently been revitalized in Erdelyi's (1974) reformulation, and its primary emphasis is quite compatible with the ecological view that perceivers are attuned to the stimulus information that is most relevant to adaptive actions.

Like motivational influences upon perception, the postulated influence of expectations is not limited to the ecological approach. However, one can differentiate between two expectancy effects, only one of which reflects *perceptual* attunement. In the effect that operates at a perceptual level, perceivers with one expectation may partition a complex stimulus differently from those with another expectation. In Asch's (1952) terms, these expectancy effects reflect variations in the object of judgment—the effective stimulus information is different for different sets. Another kind of expectancy effect operates at a more inferential level: Perceivers with one expectation interpret the same stimulus information differently from those with another expectation. In Asch's (1952) terms, such expectancy effects reflect variations in the judgment of the object.

The role of action in perceptual attunements is obvious but often overlooked in traditional approaches that treat the perceiver as a passive receptacle for sensory stimulation. Actions constrain what is perceived. Where one is walking, what one is touching, where one looks, listens, and sniffs will all influence the particular subset of information that is available to guide subsequent actions.

Advantages for social perception research. The assumption that perception is selective and that what is perceived will vary from perceiver to perceiver is not unique to the ecological approach. What is unique is the

basis upon which selectivity and individual differences are postulated and, therefore, the factors presumed to influence them.

According to the ecological position, we are sensitive to adaptively relevant information, as opposed to all possible information. Although this may seem a self-evident truth, it is something that has not been central to research and theory in social perception, and in underscoring this point, the ecological approach highlights new areas for research. In particular, the assumption that what we perceive in the social environment is likely to be first and foremost that which is most essential to adaptive action suggests a hierarchy in the ease with which various social properties are perceived. For example, emotions such as anger and fear should be most readily perceived because they are most essential to adaptive action on the part of the perceiver.³ Similarly, the stable attributes of domineeringness, aggressiveness, and strength should be perceived more readily than kindness, intelligence, or reliability because the former are more essential to adaptive action.

The ecological approach not only draws our attention to the fact that some social properties should be more readily detected than others by all perceivers but also it sheds new light on the issue of individual differences. Different information is essential to the behavioral goals of different people. What low-status people need to perceive in order to interact effectively with their environment may often be different from what high-status people need to perceive; what people in one culture need to perceive may be different from what those in another culture need to perceive; what people in one occupation need to perceive may differ from what people in another occupation need to perceive; and so forth.⁴ Thus, the ecological approach suggests

³ Some evidence consistent with this argument is provided by Averill's (1983) finding that there are many more words in the English language referring to negative emotions than to positive ones.

⁴ The truth of this assertion has been vividly illustrated to the first author recently as a consequence of a new hobby—oil painting. The necessity to create on canvas what is seen in the external world has fine tuned her perceptual capacities in ways never imagined possible—shadows, for example, that formerly went unnoticed, have now become palpable entities with color, texture, and form.

that we may discover much of interest in the domain of individual differences in social perception if we begin our investigations with a careful analysis of what it is that various individuals most need to perceive in order to interact effectively with their social environment.

The concept of perceptual attunement is pertinent to research on the development of social perceptions as well as individual differences. According to J. Gibson (1966), perceptual development involves the "education of attention." More specifically, Eleanor Gibson's (1969) perceptual differentiation theory holds that as perception develops, the organism extracts from the total stimulus flux certain distinctive features and invariant relationships not previously detected. Because developing an attunement to these new properties of stimulation will result from an active search directed by the task at hand, one would expect perceptual attunements to develop in synchrony with the development of behavioral capabilities. As such, we may learn much about the development of social perceptions (i.e., the social invariants to which perceivers at a given developmental level are attuned) if we begin with an analysis of the behavioral goals that the social perceptions can serve. The concept of perceptual attunement has a further implication for studying the development of social perceptions. Intrinsic to the concept of perceptual attunement is the assumption that perceivers can extract certain information from the stimulus environment before the development of conceptual structures and language. Because testing this assumption requires research investigating the perceptions of young children, developmental research becomes an essential component of research on social perception within the ecological approach rather than a separate enterprise.

Applicability of the Ecological Approach to Social Perception

We have shown that an ecological theory of perception offers several advantages over current approaches to social perception. The question to be considered in this section is "Can such a theory be applied to the realm of social perception?"

Adaptive Function of Social Perception

One of the basic tenets of the ecological approach is that perception serves an adaptive function for the organism inasmuch as it informs (and is informed by) action. The fact that it is biologically important to detect properties of the physical environment such as chasms or obstacles or fires bolsters the argument that we are attuned to the stimulus information that reveals these properties and need not rely upon the slower and less sure processes of inference (cf. Nisbett & Ross, 1980). Can we provide the same kind of underpinnings for an ecological theory of social perception? The adaptive value of attunement to stimulus information specifying social events has been acknowledged by J. Gibson (1979), who argued, "For any animal needs to distinguish not only the substances and objects. . . . It cannot afford to confuse prey with predator, own-species with another species, or male with female" (p. 7). Certainly it is as adaptive to differentiate male from female and prey from predator in the social environment as it is to detect properties of the physical environment. Similarly, the helplessness of babies, the looks of fear or anger, and the ravages of disease require fast and sure recognition if our species is to survive. It should be noted, however, that the adaptive value of accurate social perception is not limited to its utility for species survival. Accurate social perception also serves an adaptive function at the level of individual goal attainment—for example, getting from others that which we desire and escaping that which we dislike.

Stimulus Information in Social Events

Although one can make a convincing argument that attunement to stimulus information specifying social events has adaptive value, applying the ecological approach to social perception requires more than demonstrating a Darwinian aesthetic appeal. One must also argue that social perception rests upon the same types of information as perceptions of the physical environment. The first question is "Are social properties revealed in events?" J. Gibson's arguments on behalf of event perception are actually more telling in the realm of social perception than

in the realm of object perception. Perceiving the properties of people, even more than those of inanimate objects, will often require a dynamic stimulus display both because humans are animate and because many of their properties can be detected only in their actions. One can thus argue simply on logical grounds that social properties must often be revealed in dynamic stimulus displays. A second question that must be considered in applying the ecological approach to the social realm is "Do the stimulus properties detected in the realm of social perception include structural invariants, transformational invariants and affordances, just as in the physical realm?"

Structural invariants. Just as the physical appearance of a windmill reveals to perceivers structural invariants (e.g., a vertical shaft and sails), so does the physical appearance of people reveal certain structural invariants (e.g., a backbone and limbs). However, people are also perceived to have invariant properties whose physical extension is not so readily apparent. Consider, for example, Heider's (1958) concept of *dispositional properties*, which he defines as "the invariances that make possible a more or less stable, predictable, and controllable world." According to Heider, these relatively unchanging structures include "such object properties as color and size, and such person properties as character and ability" (p. 80). Can we directly perceive human structural invariants such as character and ability? Although Heider suggests that we can when he says, "Certainly a person's apparent self-confidence often influences our judgments of his abilities" (p. 94), his writings stressed the role of inference in social perception:

Thus, it is very unlikely that we will be able to coordinate univocally certain characteristics of the stimulus manifolds to impressions of personality traits, social acts, or sentiments in a simple way. In order to understand the connection between the stimulus pattern and the impression, we have to resort to thought models which are more complicated. (p. 24)

Following Heider's lead, most research in social perception has assumed that social invariants must be inferred, as opposed to being specified in the stimulus. However, evidence that structural invariants such as ability or personality are indeed specified in the

stimulus has been provided in research examining stimulus information presumed to be important on the basis of ethological theories. For example, Guthrie (1970) has proposed several morphological characteristics that may signal dominance by virtue of their roots in our phylogenetic past. And, consistent with his postulates, recent research by Keating, Mazur, and Segall (1981) has revealed that persons with the broader of two faces or the more receding of two hairlines are perceived as the more dominant by people from a variety of cultures. Similarly, drawing on Lorenz's (1970) postulates regarding infantile stimulus features, McArthur and her colleagues (McArthur & Apatow, Note 1; Berry & McArthur, Note 2) have found that adult males with relatively "babyish" facial features, such as large eyes, short noses and ears, or low vertical placement of all features, are perceived as less strong and domineering than those with more "mature" features—smaller eyes, longer noses and ears, or higher placement of all features.

To discover the stimuli that reveal human structural invariants may require not only examining stimulus information that is well grounded ethologically but also scaling up to a higher level of stimulus complexity. For example, it may be possible to detect personality dispositions such as shyness or nurturance when individuals are observed in dyads or in groups but not when they are dyaded in isolation. Similarly, it may be possible to detect certain traits when people are observed in action but not when they are observed in more static displays. Consider, for example, Koffka's (1935) presumption of a mapping of inner qualities into overt actions: "The slow dragging movements of the depressed, the jerky, discontinuous movements of the irritable, correspond, indeed, to the leaden state of depression or the disrupted state of irritability" (p. 658). More substantial evidence that a person's gait can reveal structural invariants is provided by the work of Cutting and his colleagues. By filming people in darkness with point lights on their major joints, Kozlowski and Cutting (1977) demonstrated that a walker's sex can be recognized from the moving point lights without familiarity cues. Subsequent research revealed that the perception of a biomechanical

invariant in a person's gait—the center of moment—is sufficient for the identification of a walker's sex (Cutting, 1978; Cutting, Proffitt, & Kozlowsky, 1978). The foregoing examples suggest that as we begin to consider the stimulus information in events, we may find that there is indeed stimulus information sufficient for the perception of many human structural invariants.

The question remains as to what structural invariants are specified by the stimulus information in social events. Although the answer to this question must be established empirically, some boundary conditions can be derived from the theory of ecological perception, which suggests that there will be stimulus information sufficient for the perception of structural invariants whose perception has important adaptive value either to the perceiver or the perceived. Drawing on J. Gibson's (1979) proposition that animals cannot afford to confuse prey with predator, own species with another, or male with female, one would expect social stimulus information to specify benevolence versus malevolence, in-group versus out-group, and gender and sexual receptivity. Similarly, the adaptive value of detecting structural invariants such as physical strength and illness, mental astuteness and insanity, and social dominance and dependency argues for their specification in the stimulus information that people project. In contrast, there are other physical, mental, and social qualities whose detection has less general adaptive importance (e.g., fine motor coordination, mathematical reasoning ability, sense of humor), and these structural invariants should be less clearly specified in social stimulus information, requiring more inferential processes for their identification. Of course, it should be reiterated that, according to the ecological approach, the detection of any structural invariant is more likely when event information is provided and when its detection is relevant for the perceivers' actions.

Transformational invariants. In addition to manifesting various structural invariants, a windmill reveals in its motions the transformational invariant *rotating*. Similarly, transformational invariants such as *walking* or *running* are given in the physical movement of people. For example, Johansson

(1973) has filmed motion patterns by means of a moving-dot technique in which 10 small luminous points were attached to the main limb joints of an actor who was then filmed in near darkness while walking or running. Although the film depicted nothing but a group of 10 bright dots, each moving in its own path, perceivers were able to detect a walking or a running man when viewing the film for as little as 200 msec. What these data tell us is that perceivers are attuned to very abstract information concerning the invariances in their environment. The abstract character of this information coupled with the speed with which it is translated into a percept indicates that kinematic stimulus information is sufficient for the perception of human locomotion.⁵ Recent research by Runeson and Frykholm (1981) indicates that such information is also sufficient for the perception of human effort, inasmuch as the relative heaviness of lifted weights was perceivable from moving point-light displays. It thus appears that *trying* is revealed in the speed, direction, and/or smoothness of motions.

The transformational invariants that characterize walking, running, and trying in the foregoing research involved changes in the layout (i.e., the position) of an individual. Changes in the layout of two or more people may also be directly specified by the moving stimulus display that they project. Thus, again using the moving-dot technique, Johansson (1973) found that perceivers are able to detect *dancing* when viewing a film that depicts nothing but a group of 20 bright dots that are affixed to the joints of two dancing people. Similarly, the classic, animated film produced by Heider and Simmel (1944) reveals that perceivers detect *chasing* and *fighting* in kinematic stimulus information. It is conceivable that there are transformational invariants specific to other social events such as *lovemaking*, *dominating*, *submitting*,

⁵ It is recognized that the point-light research involves an impoverished stimulus display on all dimensions of a stimulus array except parameters of movement. This is by intention, because this research is designed to demonstrate that kinematic stimulus information is, in and of itself, sufficient for the perception of various meaningful human behaviors.

mothering, and so forth. If so, then sufficient information for the detection of these events may be provided by the motion vectors that people project. Some evidence that complex social relationships *are* specified in the motions of two interacting people is provided by Archer and Akert (1977), who exposed some perceivers to short videotaped clips of a natural social interaction and other perceivers merely to a written transcript of the interaction. The results of this research were very striking: Only those who were able to see the interaction were able to accurately detect a variety of social relationships, including kinship, friendship, and status differentials.

Archer and Akert's data suggest that there are transformational invariants specific to social events such as *parenting*, *winning*, *defence*, and *friendship*. The task remains to locate and to systematically describe the nature of the stimulus information that reveals these invariants. In some cases, sufficient stimulus information may be provided by changes in people's gross motor activity, as is true for walking, running, and dancing. In other cases, sufficient stimulus information may be provided by finer motor activities. Emotional expressions, for example, involve characteristic changes in the facial stimulus array as well as in other nonverbal behaviors, and the sufficiency of such information for the detection of emotions has been demonstrated in a large number of studies (e.g., Rosenthal, Hall, DiMatteo, Rogers, & Archer, 1979). Not only do characteristic facial expressions, gestures, and vocal qualities provide information sufficient for the detection of emotion, but, moreover, some recent research by Bassili (1978) using a modified point-light technique suggests that the emotion may be revealed in the nonverbal changes *per se*. Because separate features, facial lines, and so forth are not visible with this procedure, it allows one to determine whether facial *movement*, apart from the appearance of particular features, communicates emotion. The results reveal that emotions can indeed be specified by facial motor activity occurring over time.

Changes slower than those transformations that reveal emotional state are associated with changes in age. Wrinkling, drooping skin, and changes in craniofacial shape are

invariant transformations of the human face and head with increasing age. Considerable research supports the hypothesis that perceptions of a person's age are strongly tied to these transformational invariants. For example, Shaw and his associates (Shaw & Pittenger, 1977; Todd et al., 1980) have investigated perceivers' sensitivity to differences in the shape of facial profiles that are associated with growth. Subjects' judgments of the age of various facial profiles supported the hypothesis that increasing levels of a cardiodal strain transformation (which simulates actual growth) performed on a standard profile would produce increases in the perceived age of the profile. Furthermore, subjects' sensitivity to the profile differences was very acute: (a) They could detect and associate with age shape differences produced by the strain transformation that were only a few times greater than the absolute limit determined for visual acuity in resolving spatially adjacent lines, and (b) these discriminations were made very quickly. These findings all suggest that changes in craniofacial morphology are sufficient for the identification of changes in a person's age.

Affordances. It has been argued that the structural and transformational invariants that characterize social events may be specified in the physical extensions of those events just as they are for nonsocial events. What about human affordances? It is reasonable to argue that people have physical properties that modulate light and sound waves in a manner that reveals their affordances just as the structure of a windmill may reveal its *climbability*? Although acknowledging that human affordances are in certain respects unique, J. Gibson (1979) would answer in the affirmative.

The perceiving of these mutual affordances . . . is just as much based on stimulus information as is the simpler perception of the support that is offered by the ground under one's feet . . . other persons can only give off information about themselves insofar as they are tangible, audible, odorous, tastable, or visible. (p. 135)

Although there has been little research concerning the perception of affordances, some evidence that they are in fact revealed in social stimuli is provided by recent studies examining perceptions of people who vary in the babyishness of their appearances. Alley

(1981) found that perceivers report a greater desire to protect from attack and to cuddle stimulus persons whose head shape or bodily proportions are babyish than those who have a more mature appearance. Alley also found a greater desire to protect, but not to cuddle, persons with an elderly craniofacial appearance than persons who were young adults. Related findings have been obtained by McArthur and Apatow (Note 1), who found that faces varying in the babyishness of their features are perceived as affording different social interactions. For example, persons with more babyish faces were perceived as less likely to turn a cold shoulder to the subjects' attempts at friendly conversation, less able to move several boxes of the subjects' heaviest books, and more likely to be the kind of roommate who would comply with all of the subjects' wishes about furniture arrangement, quiet hours, and so forth.

Attunements in Social Perception

Although we have discussed the perception of social affordances in a manner that does not distinguish among perceivers, it is important to recall that in the ecological approach to perception "affordances are properties of things *taken with reference to an observer*." (J. Gibson, 1979, p. 137). Thus, the affordances detected by some perceivers may not be detected by others. For example, perceivers of any strength may perceive the structural invariant *high physical power* in a stimulus person with mature facial features. But, whether that stimulus person is perceived as affording defeat in a wrestling match will depend upon the perceivers' own physical powers. Similarly, perceivers of any status may perceive the structural invariant *low social power* in a stimulus person with babyish facial features. However, whether the babyfaced person is perceived as affording compliance with the perceiver's own wishes will undoubtedly depend upon the perceiver's own social powers.⁶ It may also depend upon the perceiver's social goals: The person who has no desire to elicit compliance may not perceive that particular affordance. Although the correspondence between perceived affordances and one's own capabilities and goals has not been extensively studied, one

intriguing finding is the report that prison inmates convicted of assaultive crimes are highly attuned to stimulus information in a person's gait that reveals the person's "muggability"—that is, the affordance of assault (Grayson & Stein, 1981).

Although we have been illustrating the influence of a perceiver's own action potential upon the detection of affordances, it should be noted that the detection of structural or transformational invariants can also vary across perceivers. Most notably, perceivers may be blind to those structural or transformational invariants that have no behavioral utility (i.e., that do not have any related affordance). We are all familiar with the example of Eskimos who differentiate several varieties of snow. In the traditional Eskimo life-style, each snow structure undoubtedly affords different activities. For the urban dweller, snow of any sort affords shoveling and slipping, and the different structures are therefore not perceived. Blindness to perceptual information specifying structural invariants that have low behavioral utility may also be found in the social realm. For example, Gilson, Brown, and Daves (1982) recently demonstrated that perceptions are significantly related to sexual preference. Using a binocular rivalry paradigm, these authors found that gay men tended to report images of men whereas straight men reported images of women.

The perceiver's expectations, as well as behavioral potential, may influence perceptual attunements. For example, binocular rivalry research has demonstrated that people more readily perceive photographic slides whose content is expected by virtue of being drawn from their own culture than slides drawn from an unfamiliar culture (Bagby, 1957). Similarly, people more readily perceive violent photographic slides when such scenes have become expected by virtue of police training than when no such training has occurred (Toch & Schulte, 1961), and they more readily perceive a familiar upright face than an inverted face (Engel, 1956; Has-

⁶ This contrast is akin to Heider's (1958) distinction between *power*, which is a dispositional property of the person, and *can*, which is a relationship between the person and the environment.

torf & Myro, 1959). It is important to note that the impact of a perceiver's expectations or behavioral potential upon perceptions does not negate the impact of information in the stimulus. Indeed, it has been argued that such factors exert their influence by attuning the perceiver to particular aspects of the available stimulus information.

Representative Applications of An Ecological Theory of Social Perception

Having argued for the advantages and applicability of an ecological approach to social perception, it seems important to consider what kind of research that approach would entail and how it would differ from current approaches. Three research areas will be considered for this purpose: emotion perception, impression formation, and causal attribution.

Emotion Perception

The domain of person perception that is probably most amenable to an ecological analysis is the perception of emotions in others. The strong cross-cultural consensus in emotional expression along with the pancultural accuracy in emotional recognition (Ekman, 1971) supports an ecological interpretation at two levels: (a) It suggests a prominent role for stimulus-based information in the perception of emotions; and (b) it supports the suppositions of Darwin (1872) and others (cf. Andrews, 1965; Sackett, 1966) that emotions have a species-wide adaptive significance.

Stimulus information. Unlike other areas of person perception, the existing research on emotion perception has given strong emphasis to the identification of the stimulus information that is utilized in the detection of other's emotional states. A wide range of motor information has been identified, including facial expressions, gait, and posture, as well as multiple paralinguistic cues (see Schneider et al., 1979). What the ecological approach adds to this research are some novel postulates regarding the nature of the stimulus information that is likely to be important in the communication of emotion.

Much of the existing research on the rec-

ognition of emotion in facial expressions has employed posed, static modes of stimulus presentation, and the results of such research may not provide us with an accurate picture of the stimulus information that is employed in the detection of emotion in more naturalistic situations. For one thing, static photographs tend to provide supranormal displays of emotions, which are not available in more spontaneous expressions. Thus, to the extent that perceivers are accurate in identifying the emotions modeled in posed, static facial expressions, their accuracy may derive from stimulus information very different from that utilized in more naturalistic encounters. Moreover, any inaccuracies may derive from deficiencies in the stimulus information: Although a static display may be adequate for accurate recognition of some emotions, other emotions may require temporally extended stimulus information for accurate recognition. The importance of temporal organization to emotion recognition has recently been demonstrated by Basili (1979), who found that the mouth, eyes, and eyebrows move together in characteristically different ways for different emotions. These data support J. Gibson's (1979) general proposition that perception rests on the ability to pick up formless invariants over time. From this perspective, differences between emotions can be modeled in terms of differences in how the elastic surface of the face is topologically deformed over time.

The hypothesis that emotions are revealed in dynamic facial expressions poses the following question for future research: "What is the nature of facial change in moving from neutrality to joy as opposed to anger or some other emotion?" The ecological approach not only raises this question, but it also suggests a particular sort of answer, namely, that the information for emotion perception is not only dynamic but also holistic. To the extent that we respond to higher order relationships that hold over particular parts, such as the position of the eyes, mouth, eyebrows, and so forth, the detection of emotion will not follow a feature-by-feature analysis. Rather, perceivers respond to changes in the whole facial configuration. This suggests that emotional expressions may be described by transformations that preserve only higher order,

nonmetric relationships between the facial features, just as physical maturation of the craniofacial profile has been described by the topological strain transformation (Shaw & Pittenger, 1977). What remains for future research is to specify the nature of the transformations that reveal each of the emotions. Basilli's use of the point-light technique provides a possible entry into this problem, as does Buck, Baron, and Barrette's (1982) use of unitization breakpoint data as a clue to where significant stimulus changes occur in expressive behavior.

Species-wide attunements. Cross-cultural accuracy in emotion recognition suggests that emotional expressions may have evolved to provide information that is of adaptive significance to the entire species. Such information would include the signaling of environmental danger as well as the regulation of social interactions. Consistent with this evolutionary perspective, there is evidence of a close coordination between the social interaction opportunities available in a given ecological niche and the expressive potential of inhabitants of that niche. For example, Andrews (1965) observed that animals whose niche required a high level of social coordination, such as the plain-dwelling baboon as opposed to the forest-dwelling mandrill baboon, have a more mobile facial musculature for expressing emotion.

A stress on the adaptive significance of emotional expressions shifts the emphasis in the study of emotion perception from emotion as phenomenal experience to emotion as a guide to action. Specifically, emotions may be viewed as social affordances in the sense that they call forth various interpersonal behaviors. For example, anger is likely to provoke avoidance, whereas joy is likely to encourage approach. Relevant research includes the work of Orr and Lanzetta (1980) and Lanzetta and Orr (1981), who have demonstrated that a fearful face facilitates learning the association between a neutral cue and electric shock, whereas a happy face inhibits this association. Similarly, Ohman and Dimberg (1978) found that a correlation between an angry face and electric shock was learned more readily than a correlation between a happy face and shock. It thus appears that a fearful or angry face signals that the envi-

ronment affords danger, and such faces facilitate appropriate adaptive actions, a finding that supports the basic ecological proposition that "perception is for doing" (J. Gibson, 1979). Further research designed to ascertain what other environmental affordances may be detected in various emotional expressions, thereby informing adaptive action, should prove informative.

Individual attunements. In addition to stressing the role of emotional expressions to reveal affordances whose detection has adaptive significance for all humans, the ecological approach to emotion perception emphasizes the influence of individual perceivers' action capabilities and their social experiences on their attunement to the information in emotional expressions. Consistent with this emphasis, the finding that females are more attuned than males are to expressive information (see Rosenthal et al., 1979) has been interpreted as reflecting the greater importance of such information for adaptive actions by those who are relatively powerless (Henley, 1977). Some evidence that black perceivers are more attuned to expressive information than white perceivers also supports this interpretation (Gitter, Black, & Mostofsky, 1972). The impact of experience on attunement to expressive information is suggested by (a) Feldman and Donohue's (1978) finding that black observers are better than white observers at detecting the expressive meaning of the facial and bodily cues of black actors, and (b) Rosenthal et al.'s (1979) finding that people whose professions require effective interpersonal interactions are more accurate in reading emotional expressions than those whose professions are less social.

The role of individual attunements in emotion perception clearly warrants further research. One important question concerns the determinants of such attunements, two of which have already been discussed: (a) the relevance of the expressive information for a particular perceiver's behavior, and (b) the perceiver's past experience with the expressive information. A third possible determinant—the perceiver's motoric preparation for expressive information—is suggested by Zajonc and Markus's (Note 3) recent finding that the most accurate perceivers are those whose own motor behavior shows the greatest

coordination with the expressive behavior of the person being observed. Similarly, Laird, Wagener, Halal, and Szegda (1982) have demonstrated that recall of affect was best when people's manipulated facial expressions were consistent with the emotional content of the material recalled. These data suggest that a happy observer may more readily detect (or recall) happiness than other emotions, an angry observer may more readily detect anger, and so forth. They also suggest that perceivers who are most sensitive to feedback from their own expressive behavior may more accurately detect others' emotions than perceivers who are less self-aware. (See McArthur, Solomon, & Jaffee, 1980, for research pertinent to such individual differences.)

Impression Formation

A large proportion of the research on impression formation has focused on people's utilization and integration of trait adjectives provided in written format by the investigator. Although this approach to impression formation may provide us with valuable information regarding cognitive processes and although it does have some ecological validity—sometimes we do form impressions of others on the basis of written adjectives, such as in letters of recommendation—it fails to capture many of the essential elements of the typical impression-formation situation.

Stimulus information. In an ecological approach to perception, one examines impression formation when perceivers are given the opportunity to see, hear, and/or interact with a stimulus person. Perceivers, thus, are able to extract information available in the extensional properties of that person as opposed to information that has been distilled or fabricated by an experimenter. In such situations, the perceiver has access to information provided by demeanor, vocal qualities, and physiognomic characteristics. Thus, the ecological approach to impression formation places more emphasis than traditional approaches on ascertaining what information is extracted from these directly perceptible attributes.

It has already been argued that vocal qualities and physiognomy provide reliable in-

formation for the perception of emotions, and the existing research literature has provided data to support this assertion. Is it possible that such characteristics also provide information concerning more stable attributes of individuals, such as their traits and/or their continuing affordances? Although the data pertinent to this question have not been well integrated into the mainstream of research on impression formation, there is in fact considerable evidence that vocal characteristics as well as facial physiognomy exert a strong influence upon impressions of a person's abilities and personality traits. (See Knapp, 1980, and McArthur, 1982, for reviews of this literature.)

One problem with the foregoing research is that it has largely been a shotgun approach to ascertaining what stimulus characteristics yield what impressions. The ecological approach provides a sorely needed theoretical framework with guidelines concerning the type of stimulus information that is apt to reveal traits or affordances as well as the types of traits and affordances that are likely to be perceived. More specifically, the ecological approach calls for an examination of the information in dynamic human behavior as apprehended by an active perceiver. It also suggests that configural stimulus information may be more important than individual elements, a point that is consistent with evidence that the impact of particular facial features upon personality ratings may depend upon the other features with which they appear (Secord, Dukes, & Bevan, 1954; Secord & Muthard, 1955). In addition to suggesting a search for dynamic and configural stimulus information, the ecological approach suggests that the psychological attributes that will be most clearly specified in this information are those that are most important for adaptive behavior. The assumption that perception serves an adaptive function also implies that the perceived psychological attributes will be accurate, provided that they are grounded in sufficient stimulus information as apprehended by an appropriately attuned perceiver. Although some studies have provided evidence for accuracy (e.g., Kramer, 1963; Scherer, 1978), most of the existing research either has not been concerned with this question or has manipulated vocal or

physiognomic attributes in a manner that precludes accurate impressions. The ecological approach not only highlights the accuracy question but also, in examining perceived affordances, provides one solution to the problem of finding an acceptable criterion for judging the accuracy of impressions.

Species-wide attunements. One constellation of physical attributes that should reveal affordances that are adaptive for perceivers to detect are those associated with infancy. As noted earlier, stimulus persons who possess babyish physical features (decreased strain in the craniofacial profile, proportionately larger eyes, shorter ears and nose) are perceived as affording different actions and reactions than persons who do not possess these features. There are many other directly perceptible attributes that have adaptive significance, and research designed to determine what impact these have on impressions may prove fruitful. For example, there are hormonally induced qualities of voice, appearance, and gait that may be correlated with physical strength, social dominance, or sexual availability. The choice of perceptible characteristics to study may also be informed by considering Secord's (1958) suggestion that strong associations between particular physical characteristics and particular behaviors derive from the *function* of the physical attribute (e.g., women with large breasts may be perceived to afford nurturance), from *metaphor* (e.g., people with poor posture may be perceived as spineless), or from *temporal extension* (e.g., people with high-pitched voices may be perceived as timid because a temporarily high-pitched voice reflects fear).

Individual attunements. In addition to focusing attention upon stimulus information that reveals properties whose detection has adaptive significance for all humans, the ecological approach to social perception emphasizes the impact of individual perceivers' experience, goals, and action capabilities on their attunement to this and other information. Thus, although one might expect that most perceivers are attuned to the physical signs of chronic illness, these signs may be more readily perceived by the physician than by the lay person, not only because this information is more relevant to the physician's behavioral goals but also because extensive

experience has more finely tuned the physician's perceptual apparatus to the detection of these invariants.

A physician who meets on the street a man with red discoloration of the cornea and notched teeth is meeting someone who openly displays two of Hutchinson's signs and is likely to be syphilitic. Others present, however, medically blind, will see no evil. (Goffman, 1963, p. 51)

Another example of individual differences in attunement to social invariants is provided by the experiences of the first author while she was traveling through Europe. Several people whose acquaintance she made accurately perceived her Jewish identity from her appearance and/or demeanor. As it turned out, these people were themselves Jewish, and they were old enough to have lived through the Holocaust. One can speculate that their own survival required a keener attunement to the stimulus information that reveals "Jewishness" (see Savitz & Tomasson, 1959) than is possessed by the average person whom Jews encounter in the United States. Given the likely impact of perceptual experience and perceiver goals upon the detection of invariants in the realm of social perception, more research devoted to examining these variables should be enlightening.

Causal Attribution

Most of the theory and research on people's causal explanations for social events has focused upon the cognitive operations that might be engaged in by an individual in order to infer the causes of reported behaviors. This approach to causal attributions is certainly a useful and ecologically appropriate one. Although it has been argued that our impressions of others are more often than not based upon first-hand perceptual information, this is probably not the case for our causal attributions. As often as we ponder the causes of observed behavior, we also ponder the causes of those behaviors that we learn of second hand. Although the focus on inferential processes involved in causal attributions is well placed, we can still lament the neglect of perceptual processes.

Stimulus information. Michotte's (1963) work has demonstrated that there is stimulus information sufficient for the perception of physical causality. Yet theories and research

dealing with the attribution of causality in the social domain have focused almost exclusively upon inference. Research that investigates the stimulus information specifying social causality is needed to redress this imbalance. The ecological approach suggests that such research must allow perceivers to watch, listen to, and/or interact with the people for whom they will be making causal attributions. In this manner, one can ascertain what information in the extensional properties of a person or persons is sufficient for making a given attribution. And, one can thus begin to describe the stimulus invariants that give rise to the perception of social causality just as Michotte described the stimulus invariants that give rise to the perception of physical causality.

Some of the research on causal attributions is consistent with the foregoing goals. For example, Dix (in press) has recently demonstrated that the concrete depiction of low-consensus information may allow young children to perceive personal causality before they have developed the cognitive sophistication to infer such causality via the application of logical schemata. Other research (Bassili, 1976) has described the stimulus invariants that give rise to the perception of *chasing*, an example of social causality. Similarly, Kassin, Lowe, and Gibbons (1980) have identified perceptual information that yields the perception of two other causes—*pushing* and *carrying*.

Whereas the foregoing studies have employed either pen-and-ink sketches or animated geometric forms, other studies employing videotapes of real, interacting people have also taught us something of interest regarding the stimulus information that is sufficient for making a given attribution. When we watch or listen to two people having a conversation, the person who is for some reason perceptually salient is seen as exerting more causal influence than the person who is less salient. This effect has been demonstrated for a wide range of salient attributes, including movement, bright lighting, louder talking, boldly patterned clothing, novelty, and unit formation. (See McArthur, 1981, for a review of this literature.) Although the impact of salient stimulus properties upon perceptions of causality has been amply dem-

onstrated, the question remains as to why this occurs. In keeping with the inferential approach to person perception, a number of cognitive mediators have been proposed and tested (e.g., see Fiske, Kenny, & Taylor, 1982). On the other hand, McArthur (1980) has argued that the ecological approach to perception may suggest a more satisfactory explanation for the tendency to perceive salient people as causal. In the context of a dynamic social interaction, each person's behavior is typically both cause and effect: Person A reacts to Person B and that reaction causes a reaction in Person B. The power of certain stimuli to draw attention may cause the perceiver to pick up the salient person's influence on the nonsalient person, rather than vice versa. Thus, a conversation between a soft spoken person and a louder person or between a dimly lit person and a more brightly lit person may be registered in units reflecting the causal influence of the louder or brighter actor on the quieter or dimmer actor rather than in units reflecting the reverse causal influence. Although no research has successfully assessed the perceptual organization of a social interaction involving salient and nonsalient stimulus persons, there is evidence to indicate that such organization is responsive to salience manipulations (Newton, Rindner, Miller, & LaCross, 1978) and that it is related to perceived causality (Massad, Hubbard, & Newton, 1979). Such evidence clearly warrants more research devoted to investigating the impact of perceptual, as opposed to cognitive, influences upon the attribution of social causality.

An Ecological Perspective on the Nature of Error in Social Perception

Most current thinking in the domains of social perception and cognition either takes as axiomatic the proposition that our knowledge of the social environment is highly error prone (e.g., Nisbett & Ross, 1980; Ross, 1977) or simply ignores the accuracy problem altogether in favor of a process analysis that focuses on the cognitive operations intervening between stimulus and response (e.g., Anderson, 1974; Newton, 1976). Moreover, when the problem is discussed, inferential processes are typically assigned the

role of straightening out the noisy data of perception as in Taylor and Fiske's (1978) adaptation of the Brunswikian model of perception. Indeed, within mainstream social cognition, putting the term *perceived* before a construct, as in *perceived control* or *perceived crowding*, automatically confers a subjectivity and lack of trustworthiness to that source of data.

In sharp contrast to such views, the ecological perspective emphasizes the essential accuracy of perception-based knowledge (e.g., Ittelson, 1973). And, because J. Gibson (1979) strongly argues that perception of the social environment is likely to follow the same basic principles as perception of the nonsocial environment, an ecological model challenges the current view that social perceptions are more often flawed than not. Before attempting to reconcile these contrasting perspectives, some comment is needed regarding Gibson's equation of social and nonsocial perception, since one must certainly acknowledge differences between the two. Most notably, people, unlike oak trees, do try to deceive perceivers. However, there is substantial evidence that perceivers can detect deception in the stimulus information that the deceiver projects (e.g., Runeson & Frykholm, 1982; Zuckerman, DePaulo, & Rosenthal, 1981). Moreover, when perceivers fail to detect deception, their error may reflect lack of sufficient motivation or even collusion with the deceiver rather than inadequacies in perceptual ability (cf. Goffman, 1959). These considerations bolster the ecological view that social perception, like nonsocial perception, is essentially accurate. The question remains as to how we can reconcile this perspective with the more current view.

The Meaning of Error and Bias

At the outset, it should be made clear that there appears to be a qualitative difference in the meaning of error when one approaches social perception from an ecological perspective as opposed to an inferential-constructive one. Within the ecological perspective, the criterion for accuracy is the efficacy of one's behavioral adjustments to a distal object: Error occurs when one's knowledge of the world does not permit adaptive action (i.e.,

does not allow one to accomplish behavioral goals). Within an inferential framework, the criterion for accuracy is the logicity of one's reasoning processes, and error occurs when one manifests problems in reasoning. Within the latter framework, error and bias are synonymous. However, within an ecological framework, bias is different from error: Bias is simply a matter of selective attention and action, and whether a given bias leads to error in adaptive behavior is an empirical, not a logical, problem.

Sins of Omission

Although consistently arguing for the general veridicality of perception, J. Gibson (1966) leaves room for certain kinds of error based both on deficiencies in the information available at a given time as well as on the inherent selectivity in any perceiver's pickup of information. Thus, Gibson states:

In an eventful environment with sights and sounds and smells and touches all around, the individual cannot register everything at once, and his perception must therefore be selective . . . What the object really affords may be missed and what the observer perceives it as affording may be mistaken. (p. 309)

Missing what an object really affords may be called an error of omission. However, from an ecological viewpoint such as that espoused by Shaw, Turvey, and Mace (1982), to label all such omissions as error is wrong because such labeling ignores the adaptive specificity of the perceptual system. More specifically, they argue that the essential accuracy of perception rests upon the ability of animals to be sensitive to adaptively relevant information as opposed to all possible information. Thus, these theorists would not want to call a bat's perception in error when it misses purely visual information, nor would they say that humans' perceptions are in error when they miss ultraviolet information or high-frequency auditory information.

When omissions occur at the species level, most would probably agree that it is dubious to even refer to them as errors. However, the issue within species is more controversial. For example, if an expert in a given domain sees more than a novice, do we want to call the novice's perceptions in error? If the Eskimos see more varieties of snow than we do, are

our perceptions in error? If we use as our criterion for accurate perception the detection of affordances that are essential to adaptive action, then we probably would not want to call even these omissions "errors." Of course, there are omissions in which perceivers fail to detect affordances essential to their own actions. Some of these would have to be labeled 'error' within an ecological perspective, for example, failing to perceive an attack dog as vicious. However, even some maladaptive omissions would not be labeled error within the ecological approach if they resulted from impoverished stimulus information.

The failure to detect an affordance may often result from an artificial reduction in the information available to the perceiver. Sometimes the reduction in information derives from static, temporally truncated, or otherwise nonrepresentative stimulus displays that have been constructed in the interests of experimental purity as opposed to ecological validity. At other times, it derives from restricting the perceiver's ability to actively explore the available stimulus information.

Certainly the veridicality of one's perceptions is typically enhanced as more complete stimulus information is provided. In the social domain, for example, accurate identification of personal identity, gender, and type of affect from Johansson-type point-light displays is possible only when dynamic, as opposed to static, displays are used.⁷ Other research indicates that the perception of higher order social properties, such as malevolent and benevolent intent, requires not only dynamic information, but also relational information such as that provided by the joint spatial and temporal trajectories of the entities involved (Bassili, 1976). Thus, information from an interpersonal behavior sequence is likely to yield more complete and accurate perceptions than information about the behavior of a single actor at a single point in time.

Just as impoverished information can result from nondynamic stimuli, it can also result from an inactive perceiver. Consider for example the fact that touch comes to the aid of vision when a stick in the water that looks bent feels straight. Similarly, a closer look corrects a more distant one, and a mi-

rage disappears. Within the social domain, being able to interact with another person as well as to passively watch and listen to him or her may also dispel a number of errors.

Because an intermodal and temporally extended sampling of environmental stimulus information is the natural condition for effective functioning of the perceptual systems, omissions that occur when such sampling is precluded are not viewed as error in the ecological approach to perception.

Sins of Commission

J. Gibson, as quoted before, suggests that what an object is perceived as affording may sometimes be mistaken, an event that can be called an error of commission. However, from a radical ecological viewpoint, it is inappropriate to label all such mistakes as error in the sense that many of them may have no bearing on adaptive actions. Consider the following example: Based on the fact that the prey of sharks normally produce a characteristic electric field, it is possible to lure a shark to strike at an artificial electric field as if it were prey. If edibility and certain electric field properties are correlated in the shark's natural niche, is the shark really in error? Shouldn't the criterion for error be the natural, as opposed to the experimental, structure of reality, because the perceptual systems are attuned to natural contingencies? Of course, there are commissions in naturalistic settings and one would probably want to call these "errors." However, there is an important difference between an ecological perspective on such errors and more traditional views. From the ecological perspective, the nature of these errors should not be random. Rather, such errors should be rooted in strategies of information pickup and/or attunement to particular invariants that usually serve an adaptive function for the perceiver. Thus, what we label "errors of commission" are likely to be overgeneralizations of highly adaptive perceptual attunements. The phe-

⁷ Needless to say, the point-light research does not provide complete stimulus information. It is cited here only to demonstrate that with increasing stimulus information (e.g., dynamic as opposed to static displays), there will be increased veridicality of perceptions.

nomena of illusory causation and illusory correlation that have received considerable attention within the field of social perception may be instances of such overgeneralization.

Illusory causation. The tendency to attribute causal influence to perceptually salient persons has been called the *illusory causation* effect (McArthur, 1980). It seems plausible to suggest that such "errors" may result from the overgeneralization of a highly adaptive perceptual attunement. More specifically, it may be that perceptually salient stimuli are actually more likely than nonsalient stimuli to exert causal influence in the environment, and our perceptual apparatus may have evolved to process information in a manner that is maximally sensitive to this reality. This proposal gains credence when one considers the causal efficacy of perceptually salient stimuli in the natural environment: Bright lights, such as lightning or fires, and loud sounds, such as thunder, a roaring animal, or a screaming baby, are more apt to exert causal influence than their less intense counterparts. Similarly, moving stimuli, such as a charging bull, and unit-forming stimuli, such as a herd of buffalo, are more apt to exert causal influence than a stationary or unrelated collection of animals. If our perceptual systems were not more attuned to the causal influences of salient stimuli on nonsalient stimuli then vice versa, then we might not live long enough to detect causal invariants through more "objective" registration of the information available.

Illusory correlation. Another error of social perception that may be rooted in adaptive perceptual functioning is *illusory correlation*: People's perceptions of the correlation between events tend to be unduly influenced by certain event pairs. These effects have been demonstrated both in the realm of nonsocial perception (e.g., Chapman, 1967) and in the realm of person perception, where the illusory correlation concerns an actor-behavior link. More specifically, certain types of behavior are perceived to be more representative of certain categories of people than they really are (e.g., Chapman & Chapman, 1967; Hamilton & Gifford, 1976; McArthur & Friedman, 1980). Within the framework of an ecological approach to perception, the interesting question posed by the phenomenon

of illusory correlation is "What strategies of information pickup and/or what kinds of co-occurrences will lead the perceiver to detect an invariant relationship (i.e., a correlation) that is not present?"

Since perceivers cannot possibly process all available information, it seems adaptive for the perceptual systems to be geared to pick up information that is the most ecologically significant. This might include information from stimuli that are intense, unusual, rare, or aversive, because events involving stimuli with these characteristics are more apt to require adaptive responding than events involving more mundane stimuli. In view of this argument it is significant that research reveals greater visual fixation of social stimuli that are extreme (i.e., intense and atypical), infrequent, or negative (Fiske, 1980; McArthur & Ginsburg, 1981). Moreover, these are the very stimuli that tend to be involved in illusory correlation effects (Hamilton & Gifford, 1976; Rothbart, Fulero, Jenson, Howard, & Birrell, 1978). It thus appears that illusory correlation effects may derive from the selective registration of information that it is particularly important for perceivers to detect, such as unfamiliar people performing unusual, negative, or intense acts.

Illusory correlation may also derive from the selective registration of information that is typical or representative of the natural environment. A perceptual system attuned to typical correlations would be more efficient than one that discovered each correlation anew. Thus, for example, large objects (including people) may be perceived as affording more physical resistance, more danger, or even more noise than small ones, because this is typically the case.⁸ This example illustrates

⁸ A similar explanation may be offered for the perceived correlation between physical attractiveness and social and intellectual competencies (e.g., Berscheid & Walster, 1974). Specifically, this illusory correlation may derive from a veridical correlation between the unattractiveness that results from various physical abnormalities and the corresponding disorders of social and intellectual functioning. The perceived correlation between physical attractiveness and honesty (e.g., Berry & McArthur, Note 2) may also have its roots in a veridical correlation. It has been found that when people are telling the truth, they look more attractive than when they are lying (Krauss, 1981).

the possibility that illusory correlations in the realm of person perception may derive from attunement to co-occurrences whose adaptive significance is grounded in the physical realm. It also illustrates the perception of cross-modal correlations, a phenomenon that has been well documented by Marks (1978). Indeed, even newborn infants associate particular auditory stimuli with particular visual ones (Born, Spelke, & Prather, Note 4), which indicates that perceiving certain kinds of information as correlated is not dependent upon extensive learning about natural correspondences, but rather is a fundamental perceptual preparedness.

Self-fulfilling prophecies. A third error of commission that warrants discussion in considering an ecological approach to social perception is that of self-fulfilling prophecies. Such effects fall into two general categories: (a) eliciting from others the behaviors we expect to perceive, and (b) perceiving in others the behaviors and traits we expect to perceive. Although these findings seem problematic for a theory that emphasizes the essential accuracy of social perceptions, a closer analysis reveals that they may be reconciled with the ecological approach.

First, the research documenting a tendency for perceivers to elicit the very behavior they expect to perceive provides no real problem for an ecological theory of perception. In these cases, the perceiver detects properties in the target person that are actually manifested in behavior. Indeed, the accuracy of these perceptions is often affirmed by ratings of the target person's behavior by blind judges who have no "prophecy" (e.g., Snyder, Tanke, & Berscheid, 1977). Thus, the "error" in these self-fulfilling prophecy effects is not misperception but rather misguided action—that is, action that has not been sufficiently informed by perception.

A second type of self-fulfilling prophecy, perhaps better labeled a self-confirming prophecy, is more problematic for the ecological position. This is the tendency for perceivers to detect in other people those properties that they expect to find, such that very different properties may be detected in the same behavioral information by perceivers with different expectations (e.g., Kelley, 1950; Langer & Abelson, 1974; Massad et al., 1979;

Snyder & Frankel, 1976). Like illusory correlation and illusory causation, such effects may reflect in part the overgeneralization of an adaptive perceptual attunement: To the extent that our expectations are more often right than wrong, it may be functional to be particularly sensitive to confirmatory stimulus information. These effects may also be a reflection of ambiguities in the stimulus information. More specifically, they may occur in situations in which the behavioral information has no underlying structural invariant—that is, there are no properties that remain the same under changes in the sampling of behavior across space or time. If so, then two observers, taking different samples of behavior, would not necessarily detect the same underlying property. It follows from this argument that self-confirming prophecies should not occur in the case of attributes that are indeed invariant. Although researchers have begun to question whether people have dispositional invariants (e.g., Mischel, 1968), some people do seem to have some traits (e.g., Bem & Allen, 1974). In these cases, one would expect that different samples of the same person's behavior would tend to reveal the same invariant disposition. One would also expect that the detection of this invariant disposition could not be overpowered by erroneous initial prophecies of a self-confirming nature.

In addition to the possibility that some people will provide information for structural invariants that is immune to self-fulfilling prophecy effects, it is also likely that there exist transformational invariants and affordances that are immune to such effects. More specifically, invariant properties whose detection serves important adaptive actions, such as the transformational invariant *fighting* or the affordance *danger*, may be so strongly manifested in the stimulus information that people project that they could not be overpowered by erroneous prophecies. Some evidence for this assertion is provided in a recent study by Woll and Martinez (1982), who found that biasing labels for a pictured facial expression influenced recognition memory when the expression depicted a pleasant or neutral emotion, but not when it depicted an unpleasant emotion. Insofar as the accurate detection of unpleasant emo-

tions has greater adaptive significance than the accurate detection of neutral or pleasant ones, this finding is consistent with the ecological view. So is the finding that the influence of biasing labels upon recognition of any of the emotions was limited to the condition in which there was a 15-minute delay between the original presentation of the emotional expressions and the recognition task. In a 1-minute delay condition, where perceptual information would be more salient, the labels had no impact on recognition.

Although the ecological approach must acknowledge errors in social perception such as illusory causation, illusory correlation, and self-fulfilling prophecy, it incorporates such errors into a theoretical framework that argues for the general veridicality of perception. In particular, it suggests that errors of commission may reflect the overgeneralization of highly adaptive perceptual attunements.

Conclusions

The ecological approach to social perception provides an innovative conception of what is perceived, how it is perceived, and who perceives it. What is perceived is first and foremost what perceivers need to perceive for adaptive interaction with their environment. Thus, the ecological approach assumes that perception is by and large veridical. It also assumes that we often perceive affordances as opposed to the isolated structural properties that have traditionally been studied. How these affordances are perceived is through the dynamic, multimodal information in events. This is necessitated by the fact that affordances are typically complex properties that have no one-to-one connection to the static, stimulus elements that are provided to perceivers in traditional research paradigms. Who perceives various affordances are those for whom these properties are behaviorally relevant. Perceptual attunements thus vary not only as a function of the cognitive factors that are studied in traditional approaches, but also with perceptual experience, behavioral capabilities, and ongoing behavior.

The advantages of social perception research within the ecological framework are numerous. The emphasis on information in

the stimulus provides a needed balance to the current emphasis on constructive processes in the perceiver. The emphasis on dynamic stimulus displays provides a needed balance to research that examines perceptions of people who are neither seen nor heard. The emphasis on the dynamic relationship between perception and action directs attention to the rather neglected question of social perceptions within ongoing relationships, where perceptions are informed by actions and where people really do have the opportunity to perceive one another's invariant attributes. The emphasis on perceived affordances provides a vital alternative to the trait analysis of social perception. And, more generally, the emphasis upon the adaptive function of perception places formerly disconnected research issues into an integrated conceptual framework that generates new questions and promises to greatly enrich our understanding of social perception.

As the foregoing conclusions reveal, the ecological approach to social perception differs in a number of respects from traditional information-processing models. An additional, metatheoretical difference between the two approaches warrants some explicit discussion. Whereas the ecological approach views perception as the act of picking up invariant information from the environment, the information-processing approach views perception as a process of inference that must be elucidated by specifying the cognitive processes intervening between sensory inputs and the perceptual outcome. This difference between the information-processing and ecological approaches is perhaps best exemplified by their divergent perspectives regarding the meaning and utility of the schema construct. From the ecological perspective, the assumption of an internal, reified state that causally mediates meaning is neither necessary nor desirable. Instead of postulating such a representational structure, the ecological approach simply assumes that the past history of one's interaction with the environment consistently retunes the perceptual apparatus on an online basis. Thus, the "ghost in the machine" becomes superfluous. (See Baron, 1980, for a more extended discussion of logical problems with using the schema construct.) Furthermore, a close look at the

properties of events suggests that they serve many of the same epistemic functions as schemata.

Both schemata and events are abstract, global, and generalized structures involving higher order relationships that hold over particulars. Indeed, at the conceptual level the major difference between these constructs is whether one assumes that such abstract knowledge or information structures exist solely in one's head or have counterparts in the world as events. For example, is the causal efficacy of personal effort an event to be detected or the creation of a schema? Similarly, are higher social relationships, such as dependency, events to be perceived given a properly attuned observer or are they the products of a higher level constructive process? The ecological view is that most, if not all, adaptively relevant properties are extensionally projected. However, it is acknowledged that the detection of some of these properties requires extensive perceptual learning and, in the absence of such learning, may require inference. Thus, it is possible—even likely—that there are both internal and external sources of organization and structure. Still, we would argue that the internal structures must be based upon the external ones. As such, to fully understand schemata requires an understanding of the stimulus information that is out there serving as grist for the schema mill.

There are several types of evidence relevant to differentiating the direct detection of stimulus information from constructive, inferential processes. Before enumerating these, it is important to state that direct perception basically refers to the sufficiency of the perceptual apparatus to extract certain environmental meanings (e.g., affordances) without the intervention of higher order cognitive operations. Directness in this view does not mean directness in the phenomenological sense of the immediacy of the perceptual experience, although this is often a concomitant of direct perception.

The most basic evidence for the direct detection of functional information independent of constructive cognitive operations is provided by research that demonstrates the ability of organisms with very limited cognitive abilities (e.g., young infants and infra-

humans) to detect relatively abstract, cross-modal invariances in stimulus information. (See Born, Spelke, & Prather, Note 4, and also E. Gibson & Spelke, in press, for a comprehensive review of the infant literature on this topic.) A second source of relevant evidence is naturalistic and experimental situations that demonstrate people's ability to preserve the essential characteristics of rapidly changing stimulus displays in their online responses. For example, the tennis player at the net is able to adroitly adjust his or her racket to the trajectory of a speeding ball.⁹ Similarly, in the social realm, people adroitly adjust their own nonverbal responses to rapid changes in such responses by those with whom they interact (e.g., the "eyebrow flash", Eibl-Eibesfeldt, 1975). In these examples, perceiving and responding are instantaneously coordinated, and to posit intervening cognitive processes seems gratuitous. A third type of evidence for the sufficiency of the perceptual apparatus to extract environmental meanings is demonstrations that changes in those meanings are closely, if not perfectly, tied to changes in the available stimulus information. For example, in research on the perception of aging, Shaw and Pittenger (1977) have argued for a psychophysical relationship between the objective, physical changes that characterize the aging face and the perception of aging: As certain systematic changes occur in the cranium and the jawline of a face (the cardiodal strain transformation), so will there be systematic changes in the perceived age of that face. In sum, the direct detection of meaning in objective stimulus information, as opposed to the subjective construction of meaning, is evidenced by (a) adaptive responses to stimulus information by cognitively limited organisms, (b) adaptive, online responses to stimulus information that is rapidly changing, and (c) re-

⁹ The online coordination of seeing and doing speaks to the directness of perception in at least two ways: (a) The joint locomotor movements of the perceiver and the target modulate the visual flow field in ways that help specify the location of the target (J. Gibson, 1966; Turvey, 1977), and (b) the requirement for both speed and accuracy of responding suggests that the fine-grained control of action occurs at lower levels of brain functioning that do not involve the higher order cognitive mechanism of the executive (Turvey, 1977).

sponses that vary directly with specifiable changes in the objective stimulus information.

Whether or not readers accept all of the specific suppositions of the ecological framework, we hope that they now do accept the distinct and important role of perception in social knowing—a role that goes far beyond a primitive, first-state, registration of inputs. And we hope that at least some readers will be challenged to pursue research that can explicate the nature of social stimulus information and social *perception*. Perceptual information is sometimes sufficient for social knowledge, sometimes it is only the necessary datum for social inference processes. In either case, we cannot hope to fully understand social cognition without understanding the perceptual information on which it is based: "The idea exists only by virtue of the form."

Reference Notes

1. McArthur, L. Z., & Apatow, K. *Impressions of baby-faced males*. Unpublished manuscript, Brandeis University, 1983.
2. Berry, D., & McArthur, L. Z. *Impressions of college males rated as baby-faced versus mature-faced*. Manuscript in preparation, Brandeis University, 1983.
3. Zajonc, R. B., & Markus, H. *Affect and cognition: The hard interface*. Unpublished manuscript, University of Michigan, 1981.
4. Born, W. S., Spelke, E. S., & Prather, P. *Detection of auditory-visual relationships by newborn infants*. Paper presented at the International Conference on Infant Studies, Austin, Texas, March 1982.

References

- Alley, T. R. *Caregiving and the perception of maturational status*. Unpublished doctoral dissertation, University of Connecticut, 1981.
- Anderson, N. H. Cognitive algebra: Integration theory applied to social attribution. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 7). New York: Academic Press, 1974.
- Andrews, R. J. The origins of facial expressions. *Scientific American*, 1965, 213, 88–94.
- Archer, D., & Akert, R. Words and everything else: Verbal and nonverbal cues in social interpretation. *Journal of Personality and Social Psychology*, 1977, 35, 443–449.
- Asch, S. E. *Social psychology*. Englewood Cliffs, N.J.: Prentice Hall, 1952.
- Averill, J. *Anger and aggression: An essay on emotion*. New York: Springer-Verlag, 1983.
- Bagby, J. W. A cross-cultural study of perceptual predominance in binocular rivalry. *Journal of Abnormal and Social Psychology*, 1957, 54, 331–334.
- Baron, R. M. Social knowing from an ecological event perspective: A consideration of the relative domains of power for cognitive and perceptual modes of knowing. In J. Harvey (Ed.), *Cognition, social behavior, and the environment*. Hillsdale, N.J.: Erlbaum, 1980.
- Bassili, J. N. Temporal and spatial contingencies in the perception of social events. *Journal of Personality and Social Psychology*, 1976, 33, 680–685.
- Bassili, J. N. Facial motion in the perception of faces and of emotional expression. *Journal of Experimental Psychology: Human Perception and Performance*, 1978, 4, 373–379.
- Bassili, J. N. Emotion recognition. The role of facial movement and the relative importance of upper and lower areas of the face. *Journal of Personality and Social Psychology*, 1979, 37, 2049–2058.
- Bem, D. J., & Allen, A. On predicting some of the people some of the time: The search for cross-situational consistencies in behavior. *Psychological Review*, 1974, 81, 506–520.
- Berscheid, E., & Walster, E. Physical attractiveness. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 7). New York: Academic Press, 1974.
- Buck, R., Baron, R., & Barrette, D. Temporal organization of spontaneous emotional expression: A segmentation analysis. *Journal of Personality and Social Psychology*, 1982, 42, 506–517.
- Chapman, L. J. Illusory correlation in observational report. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 151–155.
- Chapman, L. J., & Chapman, J. P. Genesis of popular but erroneous psychodiagnostic observations. *Journal of Abnormal Psychology*, 1967, 72, 193–204.
- Cutting, J. E. Generation of synthetic male and female walkers through manipulation of a biomechanical invariant. *Perception*, 1978, 7, 393–405.
- Cutting, J. E., Proffitt, D. R., & Kozlowski, L. T. A biomechanical invariant for gait perception. *Journal of Experimental Psychology: Human Perception and Performance*, 1978, 4, 357–372.
- Darwin, C. *Expression of the emotions in man and animals*. London: Murray, 1872.
- Dix, T. H. Inference complexity and informational salience in the development of a consensus-based causal attribution. *Child Development*, in press.
- Eibl-Eibesfeldt, I. *Ethology: The biology of behavior*. New York: Holt, Rinehart, & Winston, 1975.
- Ekman, P. Universals and cultural differences in facial expressions of emotion. *Nebraska Symposium on Motivation*, 1971, 18, 207–283.
- Engel, E. The role of content in binocular resolution. *American Journal of Psychology*, 1956, 69, 87–91.
- Erdelyi, M. H. A new look at the new look: Perceptual defense and vigilance. *Psychological Review*, 1974, 81, 1–25.
- Feldman, R. S., & Donohue, L. F. Nonverbal communication of affect in interracial dyads. *Journal of Educational Psychology*, 1978, 70, 979–987.
- Fiske, S. T. Attention and weight in person perception: The impact of negative and extreme behavior. *Journal of Personality and Social Psychology*, 1980, 38, 889–908.
- Fiske, S. T., Kenny, D. A., & Taylor, S. E. Structural models for the mediation of salience effects on attribution. *Journal of Experimental Social Psychology*, 1982, 18, 105–127.

- Gibson, E. J. *Principles of perceptual learning and development*. New York: Appleton-Century-Crofts, 1969.
- Gibson, E. J. The concept of affordances in development: The renaissance of functionalism. In W. A. Collins (Ed.), *Minnesota Symposia on Child Psychology* (Vol. 15). Hillsdale, N.J.: Erlbaum, 1982.
- Gibson, E. J., & Spelke, E. The development of perception. In J. H. Flavell & E. Markman (Eds.), *Cognitive development*. In P. H. Mussen (Ed.), *Handbook of child psychology* (Vol. 3). New York: Wiley, in press.
- Gibson, J. J. *The senses considered as perceptual systems*. Boston: Houghton Mifflin, 1966.
- Gibson, J. J. *The ecological approach to visual perception*. Boston: Houghton Mifflin, 1979.
- Gilson, M., Brown, E. C., & Daves, W. F. Sexual orientation as measured by perceptual dominance in binocular rivalry. *Personality and Social Psychology Bulletin*, 1982, 8, 494-500.
- Gitter, A. G., Black, H., & Mostofsky, D. Race and sex in the communication of emotion. *Journal of Social Psychology*, 1972, 88, 273-276.
- Goffman, E. *The presentation of self in everyday life*. Garden City, New York: Doubleday, 1959.
- Goffman, E. *Stigma: Notes on the management of spoiled identity*. Englewood Cliffs, N.J.: Prentice-Hall, 1963.
- Goldiamond, I. Indicators of perception: I. Subliminal perception, subception, unconscious perception: An analysis in terms of psychophysical indicator methodology. *Psychological Bulletin*, 1958, 55, 373-412.
- Grayson, B., & Stein, M. I. Attracting assault: Victims' nonverbal cues. *Journal of Communication*, 1981, 31, 68-75.
- Guthrie, R. E. Evolution of human threat display organs. In T. Dobzhansky, M. K. Hecht, & W. C. Steere (Eds.), *Evolutionary Biology* (Vol. 4). New York: Appleton-Century Crofts, 1970.
- Hamilton, D. L., & Gifford, R. K. Illusory correlation in interpersonal perception: A cognitive basis of stereotypic judgments. *Journal of Experimental Social Psychology*, 1976, 12, 392-407.
- Hastorf, A. H., & Myro, G. The effect of meaning on binocular rivalry. *American Journal of Psychology*, 1959, 72, 393-400.
- Heider, F. *The psychology of interpersonal relations*. New York: Wiley, 1958.
- Heider, F., & Simmel, M. An experimental study of apparent behavior. *American Journal of Psychology*, 1944, 57, 243-259.
- Henley, N. M. *Body politics*. Englewood Cliffs, N.J.: Prentice-Hall, 1977.
- Ittelson, W. H. Environment perception and contemporary perceptual theory. In W. H. Ittelson (Ed.), *Environment and cognition*. New York: Seminar Press, 1973.
- Johansson, G. Visual perception of biological motion and a model for its analysis. *Perception and Psychophysics*, 1973, 14, 201-211.
- Kassin, S. M., Lowe, C. A., & Gibbons, F. X. Children's use of the discounting principle: A perceptual approach. *Journal of Personality and Social Psychology*, 1980, 39, 719-728.
- Keating, C. F., Mazur, A., & Segall, M. H. A cross-cultural exploration of physiognomic traits of dominance and happiness. *Ethology and Sociobiology*, 1981, 2, 41-48.
- Kelley, H. H. The warm-cold variable in first impressions of persons. *Journal of Personality*, 1950, 18, 431-439.
- Knapp, M. L. *Essentials of non-verbal communication*. New York: Holt, Rinehart, & Winston, 1980.
- Koffka, K. *Principles of gestalt psychology*. New York: Harcourt Brace, 1935.
- Kozlowski, L. T., & Cutting, J. E. Recognizing the sex of a walker from a dynamic point-light display. *Perception & Psychophysics*, 1977, 21, 575-580.
- Kramer, E. Judgment of personal characteristics and emotions from non-verbal properties of speech. *Psychological Bulletin*, 1963, 60, 408-420.
- Krauss, R. M. Impression formation, impression management, and non-verbal behaviors. In E. T. Higgins, C. P. Herman, & M. P. Zanna (Eds.), *Social cognition: The Ontario symposium* (Vol. 1). Hillsdale, N.J.: Erlbaum, 1981.
- Laird, J. D., Wagener, J. J., Halal, M., & Szegda, M. Remembering what you feel. *Journal of Personality and Social Psychology*, 1982, 42, 646-657.
- Langer, E. J., & Abelson, R. P. A patient by any other name . . . clinician group difference in labeling bias. *Journal of Consulting and Clinical Psychology*, 1974, 42, 4-9.
- Lanzetta, J. T., & Orr, S. P. Stimulus properties of facial expressions and their influence on the classical conditioning of fear. *Motivation and Emotion*, 1981, 5, 225-234.
- Lewin, K. *Principles of topological psychology*. McGraw-Hill, 1936.
- Lorenz, K. Z. Die angeborenen Formen Moglicher Erfahrung. *Z. Tierpsychol.*, 1943, 5, 235-409. Cited in P. H. Mussen (Ed.), *Carmichael's manual of child psychology* (Vol. 1). New York: John Wiley and Sons, 1970.
- Marks, L. E. *The unity of senses: Interrelations among the modalities*. Academic Press: New York, 1978.
- Massad, C. M., Hubbard, M., & Newton, D. Selective perception of events. *Journal of Experimental Social Psychology*, 1979, 15, 513-532.
- McArthur, L. Z. Illusory causation and illusory correlation: Two epistemological accounts. *Personality and Social Psychology Bulletin*, 1980, 6, 507-519.
- McArthur, L. Z. What grabs you? The role of attention in impression formation and causal attribution. In E. T. Higgins, C. P. Herman, & M. P. Zanna (Eds.), *Social cognition: The Ontario symposium* (Vol. 1). Hillsdale, N.J.: Erlbaum, 1981.
- McArthur, L. Z. Judging a book by its cover: A cognitive analysis of the relationship between physical appearance and stereotyping. In A. Hastorf & A. Isen (Eds.), *Cognitive social psychology*. New York: Elsevier, 1982.
- McArthur, L. Z., & Friedman, S. Illusory correlation in impression formation: Variations in the shared distinctiveness effect as a function of the distinctive person's age, race, and sex. *Journal of Personality and Social Psychology*, 1980, 39, 615-624.
- McArthur, L. Z., & Ginsberg, E. Causal attribution to salient stimuli: An investigation of visual fixation mediators. *Personality and Social Psychology Bulletin*, 1981, 7, 547-553.
- McArthur, L. Z., Solomon, M. R., & Jaffe, R. H. Weight differences in emotional responsiveness to proprio-

- ceptive and pictorial stimuli. *Journal of Personality and Social Psychology*, 1980, 39, 308-319.
- Michotte, A. *The perception of causality*. New York: Basic Books, 1963.
- Mischel, W. *Personality and assessment*. New York: Wiley, 1968.
- Neisser, U. *Cognition and reality*. San Francisco: Freeman, 1976.
- Newton, D. Foundations of attribution: The perception of ongoing behavior. In J. Harvey, W. J. Ickes, & R. F. Kidd (Eds.), *New directions in attribution research* (Vol. 1). Hillsdale, N.J.: Erlbaum, 1976.
- Newton, D., Rindner, R., Miller, R., & LaCross, K. Effects of availability of feature changes on behavior segmentation. *Journal of Experimental Social Psychology*, 1978, 14, 379-388.
- Nisbett, R., & Ross, L. *Human inference: Strategies and shortcomings of social judgment*. Englewood Cliffs, N.J.: Prentice-Hall, 1980.
- Ohman, A., & Dimberg, U. Facial expressions as conditioned stimuli for electrodermal responses: A case of preparedness? *Journal of Personality and Social Psychology*, 1978, 36, 1251-1258.
- Orr, S., & Lanzetta, J. Facial expressions of emotion as conditioned stimuli for human autonomic responses. *Journal of Personality and Social Psychology*, 1980, 2, 278-282.
- Postman, L., Bruner, J. S., & McGinnis, E. Personal values as selective factors in perception. *Journal of Abnormal and Social Psychology*, 1948, 43, 142-154.
- Rosenthal, R., Hall, J. A., DiMatteo, M. R., Rogers, P. L., & Archer, D. *Sensitivity to nonverbal communication*. Baltimore, Md.: Johns Hopkins University Press, 1979.
- Ross, L. The intuitive psychologist and his shortcomings: Distortions in the attribution process. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 10). New York: Academic Press, 1977.
- Rothbart, M., Fulero, S., Jensen, C., Howard, J., & Birrell, P. From individual to group impressions: Availability heuristics in stereotype formation. *Journal of Experimental Social Psychology*, 1978, 14, 237-255.
- Runeson, S., & Frykholm, G. Visual perception of lifted weight. *Journal of Experimental Psychology: Human Perception and Performance*, 1981, 7, 733-740.
- Runeson, S., & Frykholm, G. Kinematic specification of dynamics as an informational basis for person and action perception: Expectation, gender recognition, and deceptive intention. *Uppsala Psychological Reports* (No. 324). Uppsala, Sweden: Department of Psychology, University of Uppsala, 1982.
- Sackett, G. P. Monkeys reared in isolation with pictures as visual input: Evidence for an innate releasing mechanism. *Science*, 1966, 154, 1468-1473.
- Savitz, L., & Tomasson, R. The identifiability of Jewish identity through appearance, gesture, voice. *American Journal of Sociology*, 1959, 64, 468-475.
- Scherer, K. R. Personality inference from voice quality: The loud voice of extroversion. *European Journal of Social Psychology*, 1978, 8, 467-487.
- Schneider, D. J., Hastorf, A. H., & Ellsworth, P. C. *Person perception*. Reading, Mass.: Addison-Wesley, 1979.
- Secord, P. Facial features and inference processes in interpersonal perception. In R. Tagiuri & L. Petrullo (Eds.), *Person perception and interpersonal behavior*. Stanford, Calif.: Stanford University Press, 1958.
- Secord, P. F., Dukes, W. F., & Bevan, W. Personalities in faces: I. An experiment in social perceiving. *Genetic Psychology Monographs*, 1954, 49, 231-279.
- Secord, P. F., & Muthard, J. E. Personalities in faces: IV. A descriptive analysis of the perception of women's faces and the identification of physiognomic determinants. *Journal of Psychology*, 1955, 39, 269-278.
- Segall, M. H., Campbell, D. T., & Herskovitz, M. J. *The influence of culture on visual perception*. Indianapolis, Ind.: Bobbs-Merrill, 1966.
- Shaw, R., & Bransford, J. Introduction: Psychological approaches to the problem of knowledge. In R. Shaw & J. Bransford (Eds.), *Perceiving, acting, and knowing: Toward an ecological psychology*. Hillsdale, N.J.: Erlbaum, 1977.
- Shaw, R., & Pittenger, J. Perceiving the face of change in changing faces: Implications for a theory of object perception. In R. Shaw & J. Bransford, (Eds.), *Perceiving, acting, and knowing: Toward an ecological psychology*. Hillsdale, N.J.: Erlbaum, 1977.
- Shaw, R., Turvey, M., & Mace, W. Ecological psychology: The consequences of a commitment to realism. In W. Weimer and D. Palermo (Eds.), *Cognition and symbolic processes* (Vol. 2). Hillsdale, N.J.: Erlbaum, 1982.
- Snyder, M., & Frankel, A. Observer bias: A stringent test of behavior engulfing the field. *Journal of Personality and Social Psychology*, 1976, 34, 857-864.
- Snyder, M., Tanke, E. D., & Berscheid, E. Social perception and interpersonal behavior: On the self-fulfilling nature of social stereotypes. *Journal of Personality and Social Psychology*, 1977, 35, 656-666.
- Taylor, S. E., & Fiske, S. T. Salience, attention, and attribution: Top of the head phenomena. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 11). New York: Academic Press, 1978.
- Toch, H. H., & Schulte, R. Readiness to perceive violence as a result of police training. *British Journal of Psychology*, 1961, 52, 389-393.
- Todd, J. T., Mark, L., Shaw, R., & Pittenger, J. The perception of growth. *Scientific American*, 1980, 242, 132-144.
- Turvey, M. T. Preliminaries to a theory of action with reference to vision. In R. Shaw & J. Bransford (Eds.), *Perceiving, acting, and knowing*. Hillsdale, N.J.: Erlbaum, 1977.
- Woll, S. B., & Martinez, J. M. The effects of biasing labels on recognition of facial expressions of emotion. *Social Cognition*, 1982, 1, 70-82.
- Zuckerman, M., DePaulo, B. M., & Rosenthal, R. Verbal and nonverbal communication of deception. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 14). New York: Academic Press, 1981.

Received September 1, 1982

Revision received February 19, 1983 ■