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The Theory of Affordances¹

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A description of what the environment *affords* the animal can be given in terms of a list beginning with simple and ending with complex things. Such a list includes features of the terrain, shelters, water, fire, objects, tools, other animals, and human displays. In addition, the information that is available in ambient light for the perception of substances, their surfaces, and the layout of these surfaces must also be described. An attempt should also be made to connect the two, to show that the variables of substances and layout combine to make affordances for animals and to demonstrate that the optical information for perceiving the variables combines to yield information for perceiving the affordances. What is being attempted is an explanation of how the "values" or "meanings" of things in the environment could be directly perceived.

What is meant by *an affordance*? A definition is in order, especially since the word is not to be found in any dictionary. Subject to revision, I suggest that *the affordance of anything is a specific combination of the properties of its substance and its surfaces taken with reference to an animal*. The reference may be to an animal in general as distinguished from a plant or to a particular species of animal as distinguished from other species. Note that the properties of substance and surface are physical properties but that they are not described in classical physics, only in ecological physics. The combination of properties is uniquely related to the animal or species being considered. It is assumed that if the properties of substance and surface are given in light the combination is given, and hence that if the properties are perceivable the special set of properties will be perceivable. In fact we can entertain the hypothesis that the affordance may be more easily perceived by an animal than the properties in isolation, for the

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invariant combination of properties is "meaningful" whereas any single property is not.

The affordances of the environment are what it offers animals, what it provides or furnishes, for good or ill. Let us consider two examples, the first being an affordance for terrestrial animals in general and the second being an affordance for man in particular.

If a substance is fairly rigid instead of fluid; if its surface is nearly horizontal instead of slanted; if the latter is relatively flat instead of convex or concave; and if it is sufficiently extended, that is, large enough, then it affords support. More particularly it affords support to large animals who would sink into a surface of water, or in a swamp. It is a surface of support, and we call it a substratum, ground, or floor. It is stand-on-able, permitting an upright posture for quadrupeds and even for bipeds. Thus it may also be walk-on-able. If there is optical information for the four properties listed, rigidity, levelness, flatness, and extendedness then the affordance can be perceived if the information is detected.

The next example is more particular. If an object that rests on the ground has a surface that is itself sufficiently rigid, level, flat, and extended, and if this surface is raised approximately at the height of the knees of the human biped, then it affords sitting-on. We call the object a seat, stool, bench, or chair. It affords support for the rump, whether or not it affords support for the back. If these five properties coexist the object is in fact sit-on-able; they combine to yield a higher-order property for the human observer. The object may then be perceived as sit-on-able without much attention being paid to the five properties in isolation. Note that knee-high for a child is not the same as knee-high for an adult so that sit-on-ability must be taken with reference to a subclass of the human species. The surface layout may be a natural seat like a log or a ledge or an artificial seat like a chair or a couch; the affordance is the same. Note that some properties like the color and texture of the surface are irrelevant to the fact of being a seat, and that other properties only determine what kind or subclass of seat it is, stool, bench, chair, etc.

Now just as surfaces are stand-on-able and sit-on-able so also are they bump-into-able or get-underneath-able, or climb-on-able, or fall-off-able. Different layouts afford different kinds of behavior and different sorts of encounters, some beneficial and some harmful. I tried to classify these offerings and opportunities of the layout but the classification should now be enlarged upon.

Moreover the objects of the environment afford activities like manipulation and tool using. The substances of the environment, some of them, afford eating and drinking. The events of the environment afford being frozen, as in a blizzard, or burned, as in a forest fire. The other animals of the environment afford, above all, a rich and complex set of interactions, sexual, predatory, nurturing, fighting, play, cooperating, and communicating. What other persons afford, for man, comprise the whole realm of social significance. We pay the closest attention to the optical information that specifies what the other person

is, what he invites, what he threatens, and what he does. For each of these kinds of affordance the question we must ask is, how is it perceived? First, what is the stimulus information to specify it and, second, how is the information picked up?

THE NICHES OF THE ENVIRONMENT AND THE REALITY OF AFFORDANCES

Environmental scientists, ecologists, make use of the concept of a *niche*. A given species of animal is said to utilize a certain niche in the environment. It is not the same as the *habitat* of the species, that is, where it lives, but rather how it lives. I suggest that a niche is a set of affordances. The natural environment offers many ways of life and a way of life is a set of affordances that are utilized.

The reciprocity of animal and environment is implied by this theory for the niche implies a certain kind of animal and the species implies a special niche. But the independent existence of an unlimited environment is also implied, for the niches must be available before animals can begin to exploit them. The affording of life by the environment is presumably of unlimited richness and complexity. The physical, chemical, meteorological, geological and geographical conditions of the surface of the earth, and the preexistence of plant life, are what make possible animal life. They have to be invariant or persisting for animals to evolve.

The environment affords many different kinds of food and many different ways of getting food. It affords various sorts of preexisting shelters or places to hide, in holes, crevices, and caves, and various materials for the making of shelters such as mounds, nests, and huts. It affords various kinds of posture like floating, clinging, resting, and standing, and various kinds of locomotion like swimming, crawling, walking, climbing, and flying. These offerings have all been taken advantage of, which is to say that the niches have been occupied. But, for all we know, there may be many offerings of the environment that have not been taken advantage of, that is, niches not yet occupied.

Architecturally speaking, a niche is a place that is suitable for a piece of statuary, that is, a place into which the object fits. The metaphor is interesting. Ecologically speaking, a niche, although not literally a place, is a setting of environmental features that are suitable for the animal, and into which it fits metaphorically.

The concept of the niche emphasizes an important fact about affordances, namely that they are real. Although an affordance consists of physical properties taken with reference to a certain animal it does not depend on that animal. In this respect an affordance is not like a value which is usually supposed to depend on the observer nor is it like a meaning which is almost always supposed to depend on the observer. An affordance is not what we call a "subjective" quality of a thing. But neither is it what we call an "objective" property of a thing if by

that we mean that a physical object has no reference to any animal. An affordance cuts across the dichotomy of subjective-objective and helps us to understand its inadequacy. The affordances of the environment are facts of the environment, not appearances. But they are not, on the other hand, facts at the level of physics concerned only with matter and energy with animals left out.

The *niche* for a certain species should not be confused with what some animal psychologists have called the *phenomenal environment* of the species. This can be taken erroneously to be the "private world" in which it is supposed to live, the "subjective world," or the world of "consciousness." I will argue that the behavior of an observer depends on his perception of the environment, surely enough, but that this does not at all mean that his behavior depends on a so-called private, or subjective, or conscious environment. The organism depends on its environment for its life but the environment does not depend on the organism for its existence.

MAN'S ALTERATION OF THE NATURAL ENVIRONMENT

In the last few thousand years, as everybody now realizes, the very face of the earth has been modified by man. This means that the layout of surfaces has been changed, by cutting, clearing, leveling, paving, and building. There are still natural deserts and mountains, swamps and rivers, forests and plains, but they are being encroached upon and reshaped by man-made layouts. Moreover the *substances* of the environment have been partly converted from the natural materials of the earth into various kinds of artificial materials like bronze, iron, concrete, and bread. Even the *medium* of the environment—the air for us and the water for fish—is becoming slowly altered despite the restorative cycles that yielded a steady state for millions of years prior to man.

Why has man changed the shapes and substances of his environment? So as to change what it affords him. He has made more available what benefits him and less pressing what injures him. In making life easier for himself, of course, he has made life harder for most of the other animals. Over the millenia he has made it easier for himself to get food, easier to keep warm, easier to see at night, easier to get about, and easier to train his offspring.

This is not a new environment, an artificial environment, distinct from the natural environment, but the same old environment modified by man. It is a mistake to separate the natural from the artificial as if there were two environments. Artifacts have to be manufactured from natural substances. It is also a mistake to separate the cultural environment from the natural environment, as if there were a world of mental products distinct from the world of material products. There is only one world, however diverse, and all animals live in it, although we human animals have altered it to suit ourselves.

The fundamentals of the environment, the substances, the medium, and the surfaces are the same for all animals. No matter how powerful men become we are not going to alter the fact of earth, air, and water, the lithosphere, the atmosphere, and the hydrosphere, together with the interfaces that separate them. For terrestrial animals like us the earth and the sky are a basic structure on which all lesser structures depend. We cannot change it. We all fit into the substructures of the environment in our various ways for we were all, in fact, formed by them. We were created by the world we live in.

FURTHER EXAMPLES OF AFFORDANCES

The theory is that, although the environment consists of substances, surfaces, and the medium at one level, it consists at another level of affordances for animals. The substantial properties and the shape properties combine to make properties of higher order. The latter are not as easily analyzed by chemistry and geometry as substance and shape are but they are just as real. Let us consider some additional examples.

What Do Substances Afford?

Recall the formula that air, water, and earth or, more generally, the gaseous, liquid, and solid state, are increasingly *substantial*. Then note that air, although insubstantial, affords breathing because of its oxygen. It also affords unimpeded locomotion. When the air is illuminated it affords visual perception, being transparent. Water, more substantial than air, affords drinking. But for us it does not afford breathing but drowning. Being a solvent it affords bathing and washing. Being fluid it affords pouring from one vessel to another. A *surface* of water will be considered later; only note now that it does not afford support for heavy animals—only for waterbugs.

Solid substances, being still more substantial, afford all sorts of physiological and behavioral activities. Certain of them afford eating, more exactly ingestion, and of those that afford ingestion some afford nutrition as against others that do not. Some few in fact afford the opposite of nutrition, poisoning. (Note that I say nothing here about what affords *pleasure* in eating; that is another matter entirely.) Whether or not a vegetable substance affords nutrition depends upon the biochemical state we call *ripeness*, and this often is specified by the color of its surface. Solids also afford various kinds of manipulation or manufacture depending on the kind of solid state. Some, like flint, can be chipped; others, like clay, can be molded; still others recover their original shape after deformation; and some resist deformation strongly unless smelted by fire. Manipulation and manufacture are forms of behavior that are mostly but not exclusively

characteristic of primates—not exclusively, since wasps and birds manufacture nests.

What Do Surfaces and their Layouts Afford?

Passing from the substances of the environment to their surfaces, consider what the “shapes” of surfaces afford, by which is meant the solid geometrical shapes, or what I have called their *layout*. I said that a solid, level, flat, extended surface affords support and constitutes a ground for a terrestrial animal. He can stand on it and maintain equilibrium, or come to rest on it and maintain a fixed posture with respect to gravity, gravity being a force perpendicular to the ground. He does not fall or slide as he would on a cliff or a steep hillside. Note that equilibrium and a stable posture are prerequisites to other forms of behavior such as locomotion and manipulation. The ground is literally a basis for behavior, and also a sort of basis for visual perception, as I maintained in what I once called the “ground theory of space perception” (Gibson, 1950). If this is true the physical-geometrical features of the ground and its affording of support to a terrestrial animal do not belong to separate realms of discourse; they are one and the same. Geometry, in the last analysis, is connected with life.

If the ground is lie-on-able and stand-on-able it is also walk-on-able and run-over-able. It affords locomotion. For an animal with feet, it affords what we call “footing” although this depends on the absence of foot-sized obstacles like loose rocks, and the absence of slipperiness caused by the presence of banana-peels or smooth ice. Hikers need to pay attention to the footing.

The terrestrial earth, of course, is seldom solid, level, flat, and extended all the way out to the horizon. It is “cluttered.” Usually there are features of the terrain with which the flat earth is furnished. Deferring consideration of relatively small detached objects for the moment, let us list the terrain features that do not afford pedestrian locomotion but require other kinds. They seem to be surfaces of water or of watery earth, slopes upward of varying steepness to the maximum of a cliff wall, slopes downward of varying steepness to the maximum of a cliff brink, and finally simple obstacles.

A surface of water like a stream or a pond affords only special sorts of locomotion, swimming or wading, for which the animal may or may not be equipped. The same is true of a swamp. A slope upward begins to require climbing when steep, and a wall may be unclimbable although a small wall, a “step,” is negotiable. Similarly a slope downward begins to afford falling when steep, and the brink of the cliff is dangerous—a falling-off place. Men have altered the layout of such slopes by building stairways so as to facilitate the behavior of ascending and descending. The steps of a stairway are of such size as afford stepping up or down, given the size of the legs of a man.

In short for the ordinary environment, there are barriers to locomotion in some directions. If there are barriers to locomotion in all directions the observer

is “imprisoned” as in the case of a complete enclosure, or cell. The situation of the saint who lived on top of a high pillar was also that of a prison, be it noted, although he was surrounded by brinks instead of walls. But ordinarily there are openings, that is to say paths, between barriers and then the special kind of locomotion that we call *roundabout* is afforded. A special kind of barrier, smaller than a wall or fence, is a simple *obstacle*. Like a wall, an obstacle affords collision but, being of animal size, it can be avoided without roundabout locomotion.

The progress of locomotion, we can now observe, is visually guided, and it depends on the avoidance of obstacles, barriers, brinks, and surfaces of deep water. The steering of locomotion, the control of it, depends on the progressive perceiving of these features of the environment, their negative affordances. There will be more about the control of locomotion later, but it is worth recalling now that optical information is available in ambient light for the perceiving of these features of the layout as well as for the perceiving of locomotion itself. The features I have listed above are relevant to pedestrian locomotion but a modified list could be drawn up for the locomotion of birds, and for fish.

The imminence of collision with an obstacle or barrier is optically specified for any kind of locomotion: walking, flying, or swimming. There are at least some general laws that hold for perception in all animals. The information for imminence of collision is a high rate of symmetrical outflow of part of the ambient optic array, the approach to the maximum possible visual solid angle which specifies zero distance. This can be described as “looming,” (Schiff, 1965). The larger the silhouette the closer to contact or collision.

The Affording of Concealment

This is the place to describe an interesting kind of social behavior that is afforded by a cluttered environment of opaque surfaces. I mean the act of hiding, both the hiding of an object from other observers and the hiding of oneself from other observers. Concealing or screening one's body is something that many animals do, both the hunted and the hunter, both prey and predator, and even human children at play.

One of the rules of ecological optics is that at any fixed point of observation some parts of the environment are projected or revealed and the remaining parts are unprojected or concealed. The reciprocal of this rule is that the observer himself, his body, is revealed at some points of observation and concealed at the remaining points. An observer thus perceives not only that other observers are unhidden or hidden from him but also that he is unhidden or hidden from other observers. The practicing of this kind of perception is what babies do in playing “peek-a-boo” and what children do when they play “hide and seek.” The act of hiding is to position one's body at a point of observation that is concealed at the

point of observation of another or other observers—to go to a *hiding place*. I omit the optics of peepholes; the reader can work it out for himself.

All this depends on the perception of occluding edges in the layout. The reciprocity of the observer and the environment is once more emphasized. The greatest degree of concealment is afforded by an enclosure (as defined earlier) and complete concealment is afforded by a complete enclosure. What we call “privacy” in the design of housing is the providing of opaque enclosures. Note that the screening of perception is not the same as the barring of locomotion; a screen and a barrier may be different. An opaque and rigid sheet does both, but an opaque and flexible sheet like a cloth curtain affords locomotion without perception whereas a transparent and rigid sheet like a glass window affords perception without locomotion. And a translucent sheet affords illumination but not perception, as I pointed out in formulating ecological optics. I omit the complexities of one-way screens for vision but they can be worked out from the principles that govern semitransparency.

Besides hiding himself an observer can hide portable objects from other observers. These are usually objects of *value*, so called. Both animals and men perform this sort of social behavior. Food objects, utensils, and money can be buried in the earth or concealed in a chest or put away in a drawer. All of us, the higher animals, look for good hiding places, both for ourselves and for our treasures.

What Do Detached Objects Afford?

A movable object affords an astonishing variety of behaviors, especially if it is small relative to the size of the animal under consideration. If so, it is portable, that is, it affords lifting and carrying. For an animal with hands, a primate, the object may (or may not) afford grasping. To be graspable, an object must have opposite surfaces separated by less distance than the span of the hand. It must have an appropriate width, and the width can be perceived visually.

Of course an attached or immovable object may also be grasped but then it is not portable. Instead it affords support, as a tree branch supports a monkey. The rung of a ladder and the hand-hold of a mountain climber on a cliff face are graspable in this special sense.

In general graspable detached objects afford *manipulation*. There are so many kinds of manipulation and so many kinds of manipulated objects to accompany them that we can only sample the set. In “a new terminology for surface layout,” I described sheets, sticks, fibers, and containers in geometrical terms, and I mentioned tools and clothing, but that was a bare beginning. Here are a few examples:

1. An elongated object of moderate size and weight affords *wielding*. If used to hit or strike it is a *club* or *hammer*. If used by a chimpanzee behind bars to

pull in a banana beyond his reach it is a sort of *rake*. In either case it is an extension of the arm. A rigid staff also affords leverage and in that use is a *lever*. A pointed elongated object affords piercing; if large it is a *spear*, if small a *needle* or *awl*.

2. A rigid object with a sharp dihedral angle, an edge, affords cutting and scraping. It is a *knife*. It may be designed for both striking and cutting and then it is an *axe*.

3. A graspable rigid object of moderate size and weight affords throwing. It may be a *missile* or only an object for play, a *ball*. The launching of missiles by supplementary tools other than the hands alone, the sling, the bow, the catapult, the gun, and so on is one of the behaviors that makes man a nasty dangerous species.

4. An elongated elastic object like a fiber, thread, thong, or rope affords knotting, binding, lashing, knitting, and weaving. These are kinds of behavior where manipulation leads to manufacture.

5. A hand-held tool of enormous importance is one that, when applied to a surface, leaves traces and thus affords *trace making*. It may be a stylus, brush, crayon, pen, or pencil but if it marks the surface it can be used to depict and to write, to represent scenes and to specify words.

We have thousands of names for such objects and we classify them in many ways, tools like pliers and wrenches, utensils like pots and pans, weapons like swords and pistols. All of these objects have properties or qualities: color, texture, composition, size, shape, and features of shape, not to mention mass, elasticity, rigidity, and the like. Nevertheless I suggest that what we perceive when we look at them are their affordances, not their qualities. We can, of course, discriminate these dimensional qualities if required to compare them as objects. But the unique combination of qualities that specifies what the object affords us is what we normally pay attention to.

If this is true for the adult, what about the young child? There is now a great deal of evidence to show that the infant does not begin by first discriminating the qualities of objects and then learning the combinations of qualities that specify the objects themselves. Phenomenal objects are not built up of qualities. It is quite the other way around. Objects, more exactly the affordances of objects, are what the infant begins by noticing. The meanings are observed before the substances and surfaces are. Affordances are invariant combinations of variables. And it is only reasonable to suppose that it is easier to perceive an invariant combination than it is to perceive all the variables separately.

What Do Other Animals and Other People Afford?

The richest and most elaborate affordances of the environment are provided by other animals and, for us, other people. These are, of course, detached objects with topologically closed surfaces but they change the shape of their surfaces

while yet retaining the same fundamental shape. They move from place to place, changing the postures of their bodies, ingesting and emitting certain substances, and doing all this spontaneously, initiating their own movements, which is to say that their movements are *animate*. These bodies are subject to the laws of mechanics and yet not subject to the laws of mechanics. They are so different from ordinary objects that infants learn almost immediately to distinguish them from plants and nonliving things. When touched they touch back, when struck they strike back, in short they *interact* with the observer and with one another. Behavior affords behavior, and the whole subject matter of psychology and of the social sciences can be thought of as an elaboration of this basic fact. Sexual behavior, nurturing behavior, fighting behavior, cooperative behavior, economic behavior, political behavior—all depend on the perceiving of what another person or other persons afford—or sometimes on the misperceiving of it.

What the male affords the female is reciprocal to what the female affords the male; what the infant affords the mother is reciprocal to what the mother affords the infant; what the prey affords the predator goes along with what the predator affords the prey; what the buyer affords the seller cannot be separated from what the seller affords the buyer, and so on. The perceiving of these mutual affordances is enormously complex but it is nonetheless lawful, and it is based on the pickup of the information in touch, sound, odor, taste, and ambient light. It 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. For other animals and other persons can only give off information about themselves insofar as they are tangible, audible, odorous, tastable, or visible.

The other person, the generalized *other*, the *alter* as opposed to *ego*, is an ecological object with a skin, even if clothed. It is an object although it is not merely an object, and we do right to speak of *you* and *he* instead of *it*. But he has a surface that reflects light and the information to specify what he is, what he invites, promises, or threatens, and what he does, can be found in the light.

Summary: Positive and Negative Affordances

The foregoing examples of the affordances of the environment are enough to show how general and powerful the concept is. Substances have biochemical offerings, and afford manufacture. Surfaces afford posture, locomotion, collision, manipulation, and in general behavior. Special forms of layout afford shelter and concealment. Fires afford being warmed and being burned. Detached objects, tools, utensils, weapons, afford special types of behavior to primates and men. The other animal and the other person provide mutual and reciprocal affordances at extremely high levels of behavioral complexity. At the highest level, when vocalization becomes speech and manufactured displays become images, pictures, and writing, the affordances of human behavior are staggering. No more of that will be considered at this stage except to point out that speech, pictures, and writing still have to be perceived.

At all these levels, from matter to men, we can now observe that some offerings of the environment are beneficial and some are injurious. These are slippery terms which should only be used with great care, but if their meanings are pinned down to biological and behavioral facts the danger of confusion can be minimized. First, consider substances that afford ingestion. Some afford nutrition for a given animal, some afford poisoning, and some are neutral. As I pointed out before, these facts are quite distinct from the affording of pleasure and displeasure in eating, for the experiences do not necessarily correlate with the biological effects. Second, consider the brink of a cliff. On the one side it affords walking-along, locomotion, whereas on the other it affords falling-off, injury. Third, consider a detached object with a sharp edge, a knife. It affords cutting if manipulated in one manner but it affords being cut if manipulated in another manner. Similarly, but at a different level of complexity, an ordinary metallic object affords grasping but if charged with current it affords electric shock. And fourth, consider the other person. The animate object can give you caresses or blows, contact comfort or contact injury, reward or punishment, and it is not always easy to perceive which will be provided. Note that all these benefits and injuries, these safeties and dangers, these positive and negative affordances are properties of things taken with reference to an observer but not properties of the experiences of the observer exclusive of the things. They are not subjective values; they are not feelings of pleasure or pain added to neutral perceptions.

There has been endless debate among philosophers and psychologists as to whether values were physical or phenomenal, in the world of matter or only in the world of mind. For affordances as distinguished from values the debate does not apply. They are neither in the one world or the other inasmuch as the theory of two worlds is rejected. There is only one environment, although it contains many observers with limitless opportunities for them to live in it.

THE ORIGIN OF THE CONCEPT OF AFFORDANCES

The Gestalt psychologists recognized that the meaning or value of a thing seems to be perceived just as immediately as its color. The value is clear on the face of it, as we say, and thus it has a *physiognomic* quality in the way that the emotions of a man appear *on his face*. To quote from the *Principles of Gestalt Psychology* (Koffka, 1935): "Each thing says what it is . . . a fruit says 'Eat me'; water says 'Drink me'; thunder says 'Fear me'; and woman says 'Love me' [p. 7]." These values are a vivid and essential feature of the experience itself. Koffka did not believe that a meaning of this sort could be explained as a pale context of memory images or an unconscious set of response tendencies. The postbox "invites" the mailing of a letter, the handle "wants to be grasped," and things "tell us what to do with them [p. 353]." Hence they had what Koffka called "demand character."

Kurt Lewin had coined the term *Aufforderungscharakter* which had been translated as *invitation-character* (by J. F. Brown in 1929) and as *valence* (by D. K. Adams in 1931). The latter term came into general use. *Valences* for Lewin had corresponding *vectors*, which could be represented as arrows pushing the observer toward or away from the object. What explanation could be given for these valences, the characters of objects that invited or demanded behavior? No one, not even the Gestalt theorists, could think of them as physical and, indeed, they do not fall within the province of ordinary physics. They must therefore be phenomenal, given the assumption of dualism. If there were two objects, and if the valence could not belong to the physical object it must belong to the phenomenal object—to what Koffka called the “behavioral” object but not to the “geographical” object. The valence of an object was bestowed upon it in experience, and bestowed by a need of the observer. Thus Koffka argued that the postbox has a demand character only where the observer needs to mail a letter. He is attracted to it when he has a letter to post, not otherwise. The value of something was assumed to change as the need of the observer changed.

The concept of affordance is somewhat related to these concepts of valence, invitation, and demand but with a crucial difference. The affordance of something does not change as the need of the observer changes. Whether or not the affordance is perceived or attended to will change as the need of the observer changes but, being invariant, it is always there to be perceived. An affordance is not bestowed upon an object by a need of an observer and by his act of perceiving it. The object offers what it does because it is what it is. To be sure, we define what it is in terms of ecological physics instead of physical physics, and it therefore possesses meaning and value to begin with. But this is meaning and value of a new sort.

For Koffka it was the *phenomenal* postbox that invited letter mailing, not the physical postbox. But this duality is pernicious. I prefer to say that the real postbox (the only one) affords letter-mailing to a letter-writing human in a community with a postal system. This fact is perceived when the postbox is identified as such, and it is apprehended whether the postbox is in sight or out of sight. To feel a special attraction to it when one has a letter to mail is not surprising but the main fact is that it is perceived as part of the environment—as an item of the neighborhood in which we live. Everyone above the age of six knows what it is for and where the nearest one is. The perception of its affordance should therefore not be confused with the temporary special attraction it may have.

The Gestalt psychologists explained the directness and immediacy of the experience of valences by postulating that the ego is an object in experience and that a “tension” may arise between a phenomenal object and the phenomenal ego. When the object is in “a dynamic relation with the ego” said Koffka, it has a demand character. Note that the “tension,” the “relation,” or the “vector” must arise in the “field” that is, in the field of phenomenal experience. Although

many psychologists find this theory intelligible, I do not. There is an easier way of explaining why the values of things seems to be perceived immediately and directly. It is because the affordances of things for an observer are specified in stimulus information. They seem to be perceived directly because they are perceived directly.

The accepted theories of perception, to which the Gestalt theorists were objecting, implied that no experiences were direct except sensations, and that sensations mediated all other kinds of experience. Bare sensations had to be clothed with meaning. The seeming directness of meaningful perception was therefore an embarrassment to the orthodox theories and the Gestaltists did right to emphasize it. They began to undermine the sensation-based theories. But their own explanations of why it is that a fruit says “Eat me” and woman says “Love me” is a bit strained. The Gestalt psychologists objected to the accepted theories of perception but they never managed to go beyond them.

THE PROCESS OF PERCEIVING AFFORDANCES

The definition of an affordance can now be elaborated by saying that it is a combination of physical properties of the environment that is uniquely suited to a given animal—to his nutritive system or his action system or his locomotor system. A substance is chemically valuable relative to a given nutritive system, herbivorous or carnivorous. An object is valuable relative to a given action system, one with claws or another with hands. A surface layout has locomotor value relative to the kind of legs and feet the animal possesses.

If there is information in ambient light to specify substances, solid objects, and surface layouts there is information to specify their affordances for eating, for manipulation, and for locomotion, that is, for behavior. When an observer perceives edibility he perceives it in relation to his mouth and teeth and digestive system; when he perceives manipulability he perceives it in relation to his hands, to which the object or tool is suited; when he perceives the possibility of locomotion he perceives it in relation to what his locomotor system is capable of in walking or climbing, the slopes it can descend or the ditches it can jump over. This is only to reemphasize that perception of the environment is inseparable from proprioception of one's own body—that egoreception and exteroception are reciprocal. A man can bite into an apple but not a rock; he can get a grip on a handle but not on a wall; he can jump over a gap commensurate with his size and strength but he will fall into a crevasse that is too wide to jump. He measures these features of the environment by the standard of his body. And this is just as true for a mouse as it is for a man.

Many of the chemical, physical, and geometrical properties of the natural environment are specified in ambient light, as I tried to show in my discussion of ecological optics. The hypothesis I proposed in *The Senses Considered as*

Perceptual Systems (Gibson, 1966) is that the visual system of a mature observer can *pick up* this information or else can be altered by perceptual learning so that it is picked up. I now want to extend this proposal to cover the perception of affordances. These unique *combinations* of chemical, physical, and geometrical properties are also specified in ambient light. A compound invariant of optical structure is just another invariant. And a genuinely invariant compound can presumably be detected as a unit, without any need to associate the components. In classical terminology, several "stimuli" that always go together constitute one "stimulus." If these unique optical compounds are meaningful in the sense that they specify benefits and dangers for the given observer they should be easier to detect, that is, picked up with less learning, than other combinations of optical information that are not ego-related. The properties of things as such are less important to an observer than the affordances for him.

For example, the meaning of an arbitrary combination of properties invented by an experimenter in a laboratory should be harder to detect than the meaning of a natural invariant compound. An ape can learn that a one-inch flat blue triangle on the panel of a discrimination apparatus specifies a piece of banana behind the panel. But he should learn more easily that a 6-inch long rounded yellow surface specifies a banana behind its skin. The solid yellow object says "Eat me," in Koffka's words, more directly than does the flat blue form. The panel of the apparatus may come to say "Push me," but only that.

If this is true, some compound invariants specify their affordances directly and we say that the object or surface looks like what it is. Other compound invariants do not specify their affordances so directly and then we are apt to say that the object or surface does not look like what it is. The fact that a small piece of metal in a complex household gadget affords electric shock may be a hidden fact; to perceive it entails the apprehension of a set of concealed connections. Learning to apprehend electrical connections is rather difficult, and even the electrician sometimes makes mistakes.

The Misperceiving of Affordances

The brink of a cliff affords falling off; it is in fact dangerous and it looks dangerous to us. It seems to look dangerous to many other terrestrial animals besides ourselves, including infant animals. Experimental studies have been made of this fact. If a sturdy sheet of plate glass is extended out over the edge it no longer affords falling and in fact is not dangerous, but it may still look dangerous. The optical information to specify depth-downward-at-an-edge is still present in the ambient light; for this reason the device was called a "visual cliff" by Gibson and Walk (1960). Haptic information was available to specify an adequate surface of support but this was contradictory to the optical information. When human infants at the crawling stage of locomotion were tested with this apparatus many of them would pat the glass with their hands but would not

venture out on the surface. The babies misperceived the affordance of a transparent surface for support, and this result is not surprising.

Similarly, a man can misperceive the affordance of a sheet of glass by mistaking a closed glass door for an open doorway and attempting to walk through it. He then crashes into the barrier and is injured. The affordance of collision was not specified by the outflow of optical texture in the array, or insufficiently specified. He mistook glass for air. The occluding edges of the doorway were specified and the empty visual solid angle opened up symmetrically in the normal manner as he approached, so his behavior was properly controlled, but the imminence of collision was not noticed. A little dirt on the surface, or highlights, would have saved him.

These two cases are instructive. In the first a true affordance of support went unexploited because a false negative affordance of falling opposed it. In the second a negative affordance of collision went unnoticed and a positive affordance of exiting (going out) was mistakenly registered. A failure to perceive what is present in the environment and a perceiving of something not present in the environment are both cases of misperception. Usually they go together. To see what is there implies not seeing what is not there.

The very possibility of perceiving entails, of course, the possibility of misperceiving. The problem for the psychology of perception is to discover the conditions that govern both. For a theory of visual perception based on the pickup of available information, a theory of direct perception not mediated by subjective sensations, misperception can be explained in two general ways: either the available information is inadequate or, if not, the process of information pickup is deficient. On the one hand, visual perception fails in the dark because of the absence of stimulation, and it fails in a fog-filled medium because of the absence of structure in ambient light even with the presence of stimulation. Information is not available. It may also fail because the available optical information is equivocal or contradictory, or even sometimes because it is discrepant with the information given to touch, although this is rare. On the other hand invariants may fail to be picked up because the eyes are closed, or because the lens of the eye is opaque, or because the retina is diseased or dazzled, or because the optic nerve is severed. At the level of the whole visual system information may not be registered because the retina-nerve-brain-eye system is immature, or because the observer has not yet learned to extract the specifying invariants, or simply because the observer fails to look around him, or fails to look at the fine details. I have described the possible reasons for misperceiving in Chapter 14 of *The Senses Considered as Perceptual Systems* (Gibson, 1966).

No wonder, then, that quicksand is sometimes mistaken for sand, that a pitfall can be mistaken for solid ground, that poison ivy is sometimes mistaken for ivy, and that acid can be taken for water. A wildcat is not easy to distinguish from a cat, and a thief may look like an honest man. When Koffka asserted that "each

thing says what it is" he neglected to mention that it may lie. The affordances of danger are sometimes hidden, like the electric shock in the radio cabinet and the shark under the calm water.

Nevertheless, however true all this may be, the basic affordances of the terrestrial environment are perceivable, and are usually perceivable directly, without an excessive amount of learning. The reason is that the basic properties of the environment that combine to make an affordance are specified in the structure of ambient light and that hence the affordance itself is specified in ambient light. And, moreover, an invariant variable that is commensurate with the body of the observer himself is more easily picked up than one not commensurate with his body.

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4

Some Comments on the Nature of the Perceived Universe

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INTRODUCTION

The 1960s saw a burst of new approaches to persistent problems in psychology. For me these approaches were heralded in the concepts of Image and Plan (Pribram, 1960). In a series of papers and books, often with the help of colleagues, I attempted to portray the power of these conceptions. At the neurological level, a two-process mechanism was detailed to show how Images and Plans were, in fact, generated (Pribram, 1971). At the behavioral level the concept Plan originated early on in observed similarities in the organization of serial actions and the organization of computer programs (Pribram, 1960). The concept Image took somewhat longer to ground in a model that allowed specific hypotheses to be generated. But by the mid-1960s it became clear that optical information processing systems could provide this model, especially in the construction of holographically produced Images (Pribram, 1972). These rather sketchy proposals have gradually been filled out with the accumulation of data from several laboratories, including my own. *Languages of the Brain* (Pribram, 1971) spells out the relevance of these data to the theory and more recent additions are to be found in two papers: "The Holographic Hypothesis of Memory Structure in Brain Function and Perception" (Pribram, Nuwer, & Baron, 1974) and "How Is It that Perceiving So Much We Can Do So Little?" (Pribram, 1974a).

Rather than detail once again the supports for the concepts of Image and Plan, I want here to address a set of specific issues that derive from the theories as they have been developed and to show that the computer theory of Plans and the holographic theory of Images are not mutually exclusive but stand in relation to each other much as other fundamental scientific theories (specifically theories in theoretical physics) do today.

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PERCEIVING, ACTING, AND KNOWING

Toward an Ecological Psychology

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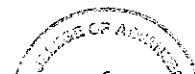


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