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THE THEORY OF AFFORDANCES

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I have described the environment as the surfaces that separate substances from medium in which the animals live. But I have also described what the environment affords animals, mentioning the terrain, shelters, water, fire, objects, tools, animals, and human displays. How do we go from surfaces to affordances? And if it is information in light for the perception of surfaces, is there information for perception of what they afford? Perhaps the composition and layout of surfaces contribute what they afford. If so, to perceive them is to perceive what they afford. That a radical hypothesis, for it implies that the "values" and "meanings" of things in environment can be directly perceived. Moreover, it would explain the sense in which values and meanings are external to the perceiver.

The affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill. The verb to afford is found in the dictionary, the noun affordance is not. I have made it up. I mean by it something that refers both the environment and the animal in a way that no existing term does. It implies the complementarity of the animal and the environment. The antecedents of the term and the history of the concept will be treated later; for the present, let us consider examples of an affordance.

If a terrestrial surface is nearly horizontal (instead of slanted), nearly flat (instead of convex or concave), and sufficiently extended (relative to the size of the animal) so that its substance is rigid (relative to the weight of the animal), then the surface affords support. 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 bipeds. It is the ref walk-on-able and run-over-able. It is not sink-into-able like a surface of water or swamp, that is, not for heavy terrestrial animals. Support for water bugs is different.

Note that the four properties listed—horizontal, flat, extended, and rigid—would be physical properties of a surface if they were measured with the scales and standards used in physics. As an affordance of support for a species of animal, however, they have to be measured relative to the animal. They are unique for that animal. They are not just abstract physical properties. They have unity relative to the posture and

behavior of the animal being considered. So an affordance cannot be measured as we measure in physics.

Terrestrial surfaces, of course, are also climb-on-able or fall-off-able or get-underneath-able or bump-into-able relative to the animal. Different layouts afford different behaviors for different animals, and different mechanical encounters. The human species in some cultures has the habit of sitting as distinguished from kneeling or squatting. If a surface of support with the four properties is also knee-high above the ground, it affords sitting on. We call it a *seat* in general, or a stool, bench, chair, and so on, in particular. It may be natural like a ledge or artificial like a couch. It may have various shapes, as long as its functional layout is that of a seat. The color and texture of the surface are irrelevant. Knee-high for a child is not the same as knee-high for an adult, so the affordance is relative to the size of the individual. But if a surface is horizontal, flat, extended, rigid, and knee-high relative to a perceiver, it can in fact be sat upon. If it can be discriminated as having just these properties, it should *look* sit-on-able. If it does, the affordance is perceived visually. If the surface properties are seen relative to the body surfaces, the self, they constitute a seat and have meaning.

There could be other examples. The different substances of the environment have different affordances for nutrition and for manufacture. The different objects of the environment have different affordances for manipulation. The other animals afford, above all, a rich and complex set of interactions, sexual, predatory, nurturing, fighting, playing, cooperating, and communicating. What other persons afford, comprises the whole realm of social significance for human beings. We pay the closest attention to the optical and acoustic information that specifies what the other person is, invites, threatens, and does.

THE NICHES OF THE ENVIRONMENT

Ecologists have the concept of a *niche*. A species of animal is said to utilize or occupy a certain niche in the environment. This is not quite the same as the *habitat* of the species; a niche refers more to *how* an animal lives than to *where* it lives. I suggest that a niche is a set of affordances.

The natural environment offers many ways of life, and different animals have different ways of life. The niche implies a kind of animal, and the animal implies a kind of niche. Note the complementarity of the two. But note also that the environment as a whole with its unlimited possibilities existed prior to animals. The physical, chemical, meteorological, and geological conditions of the surface of the earth and the pre-existence of plant life are what make animal life possible. They had to be invariant for animals to evolve.

There are all kinds of nutrients in the world and all sorts of ways of getting food; all sorts of shelters or hiding places, such as holes, crevices, and caves; all sorts of materials for *making* shelters, nests, mounds, huts; all kinds of locomotion that the environment makes possible, such as swimming, crawling, walking, climbing, flying. These offerings have been taken advantage of; 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.

In architecture a niche is a place that is suitable for a piece of statuary, a place into which the object fits. In ecology a niche is a setting of environmental features that are suitable for an animal, into which it fits metaphorically.

An important fact about the affordances of the environment is that they are in a sense objective, real, and physical, unlike values and meanings, which are often supposed to be subjective, phenomenal, and mental. But, actually, an affordance is neither an objective property nor a subjective property; or it is both if you like. An affordance cuts across the dichotomy of subjective-objective and helps us to understand its inadequacy. It is equally a fact of the environment and a fact of behavior. It is both physical and psychical, yet neither. An affordance points both ways, to the environment and to the observer.

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 the species is supposed to live, the "subjective world," or the world of "consciousness." The behavior of observers depends on their perception of the environment, surely enough, but this does not mean that their 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. The layout of surfaces has been changed, by cutting, clearing, leveling, paving, and building. Natural deserts and mountains, swamps and rivers, forests and plains still exist, 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 such as 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? 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 millennia, 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. We have done so wastefully, thoughtlessly, and, if we do not mend our ways, fatally.

The fundamentals of the environment—the substances, the medium, and the surfaces—are the same for all animals. No matter how powerful men become they 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.

SOME AFFORDANCES OF THE TERRESTRIAL ENVIRONMENT

Let us consider the affordances of the medium, of substances, of surfaces and their layout, of objects, of animals and persons, and finally a case of special interest for ecological optics, the affording of concealment by the occluding edges of the environment (Chapter 5).

THE MEDIUM

Air affords breathing, more exactly, respiration. It also affords unimpeded locomotion relative to the ground, which affords support. When illuminated and fog-free, it affords

visual perception. It also affords the perception of vibratory events by means of sound fields and the perception of volatile sources by means of odor fields. The airspaces between obstacles and objects are the paths and the places where behavior occurs.

The optical information to specify air when it is clear and transparent is not obvious. The problem came up in Chapter 4, and the experimental evidence about the seeing of “nothing” will be described in the next chapter.

THE SUBSTANCES

Water is more substantial than air and always has a surface with air. It does not afford respiration for us. It affords drinking. Being fluid, it affords pouring from a container. Being a solvent, it affords washing and bathing. Its surface does not afford support for large animals with dense tissues. The optical information for water is well specified by the characteristics of its surface, especially the unique fluctuations caused by rippling (Chapter 5).

Solid substances, more substantial than water, have characteristic surfaces (Chapter 2). Depending on the animal species, some afford nutrition and some do not. A few are toxic. Fruits and berries, for example, have more food value when they are ripe, and this is specified by the color of the surface. But the food values of substances are often misperceived.

Solids also afford various kinds of manufacture, depending on the kind of solid state. Some, such as flint, can be chipped; others, such as clay, can be molded; still others recover their original shape after deformation; and some resist deformation strongly. Note that manufacture, as the term implies, was originally a form of manual behavior like manipulation. Things were fabricated *by hand*. To identify the substance in such cases is to perceive what can be done with it, what it is good for, its utility, and the hands are involved.

THE SURFACES AND THEIR LAYOUTS

I have already said that a horizontal, flat, extended, rigid surface affords support. It permits equilibrium and the maintaining of a posture with respect to gravity, this being a force perpendicular to the surface. The animal does not fall or slide as it would on a steep hillside. Equilibrium and posture are prerequisite to other behaviors, such as locomotion and manipulation. There will be more about this in Chapter 12, and more evidence about the perception of the ground in Chapter 9. The ground is quite literally the *basis* of the behavior of land animals. And it is also the basis of their visual

perception, their so-called space perception. Geometry began with the study of the earth as abstracted by Euclid, not with the study of the axes of empty space as abstracted by Descartes. The affording of support and the geometry of a horizontal plane are therefore not in different realms of discourse; they are not as separate as we have supposed.

The flat earth, of course, lies beneath the attached and detached objects on it. The earth has "furniture," or as I have said, it is cluttered. The solid, level, flat surface extends behind the clutter and, in fact, extends all the way out to the horizon. This is not, of course, the earth of Copernicus; it is the earth at the scale of the human animal, and on that scale it is flat, not round. Wherever one goes, the earth is separated from the sky by a horizon that, although it may be hidden by the clutter, is always there. There will be evidence to show that the horizon can always be seen, in the sense that it can be visualized, and that it can always be felt, in the sense that any surface one touches is experienced in relation to the horizontal plane.

Of course, a horizontal, flat, extended surface that is *nonrigid*, a stream or lake, does not afford support for standing, or for walking and running. There is no footing, as we say. It may afford floating or swimming, but you have to be equipped for that, by nature or by learning.

A vertical, flat, extended, and rigid surface such as a wall or a cliff face is a barrier to pedestrian locomotion. Slopes between vertical and horizontal afford walking, if easy, but only climbing, if steep, and in the latter case the surface cannot be flat; there must be "holds" for the hands and feet. Similarly, a slope downward affords falling if steep; the brink of a cliff is a falling-off place. It is dangerous and looks dangerous. The affordance of a certain layout is perceived if the layout is perceived.

Civilized people have altered the steep slopes of their habitat by building stairways so as to afford ascent and descent. What we call the steps afford stepping, up or down, relative to the size of the person's legs. We are still capable of getting around in an arboreal layout of surfaces, tree branches, and we have ladders that afford this kind of locomotion, but most of us leave that to our children.

A cliff face, a wall, a chasm, and a stream are barriers; they do not afford pedestrian locomotion unless there is a door, a gate, or a bridge. A tree or a rock is an obstacle. Ordinarily, there are paths between obstacles, and these openings are visible. The progress of locomotion is guided by the perception of barriers and obstacles, that is, by the act of steering into the openings and away from the surfaces that afford injury. I have tried to describe the optical information for the control of locomotion (Gibson, 1958), and it will be further elaborated in Chapter 13. The *imminence* of collision with a surface during locomotion is specified in a particularly simple way, by an explosive rate of magnification of the optical texture. This has been called *looming* (e.g., Schiff, 1965). It should not be confused, however, with the magnification of an opening

between obstacles, the opening up of a vista such as occurs in the approach to a doorway.

THE OBJECTS

The affordances of what we loosely call *objects* are extremely various. It will be recalled that my use of the terms is restricted and that I distinguish between *attached* objects and *detached* objects. We are not dealing with Newtonian objects in space, all of which are detached, but with the furniture of the earth, some items of which are attached to it and cannot be moved without breakage.

Detached objects must be comparable in size to the animal under consideration if they are to afford behavior. But those that are comparable afford an astonishing variety of behaviors, especially to animals with hands. Objects can be manufactured and manipulated. Some are portable in that they afford lifting and carrying, while others are not. Some are graspable and other not. To be graspable, an object must have opposite surfaces separated by a distance less than the span of the hand. A five-inch cube can be grasped, but a ten-inch cube cannot (Gibson, 1966b, p. 119). A large object needs a "handle" to afford grasping. Note that the size of an object that constitutes a graspable size is specified in the optic array. If this is true, it is *not* true that a tactual sensation of size has to become associated with the visual sensation of size in order for the affordance to be perceived.

Sheets, sticks, fibers, containers, clothing, and tools are detached objects that afford manipulation (Chapter 3). Additional examples are given below.

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 its 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 the human animal a nasty, dangerous species.
4. An elongated elastic object, such as 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*. The tool 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: pliers and wrenches are tools; pots and pans are utensils; swords and pistols are weapons. They can all be said to have properties or qualities: color, texture, composition, size, shape and features of shape, mass, elasticity, rigidity, and mobility. Orthodox psychology asserts that we *perceive these objects insofar as we discriminate their properties or qualities*. Psychologists carry out elegant experiments in the laboratory to find out how and how well these qualities are discriminated. The psychologists assume that objects are *composed* of their qualities. But I now suggest that what we perceive when we look at objects are their affordances, not their qualities. We can discriminate the dimensions of difference if required to do so in an experiment, but what the object affords us is what we normally pay attention to. The special combination of qualities into which an object can be analyzed is ordinarily not noticed.

If this is true for the adult, what about the young child? There is much 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 them. Phenomenal objects are *not* built up of qualities; it is the other way around. The affordance of an object is what the infant begins by noticing. The meaning is observed before the substance and surface, the color and form, are seen as such. An affordance is an invariant combination of variables, and one might guess that it is easier to perceive such an invariant unit

TO PERCEIVE AN AFFORDANCE IS NOT TO
CLASSIFY AN OBJECT

The fact that a stone is a missile does not imply that it cannot be other things as well. It can be a paperweight, a bookend, a hammer, or a pendulum bob. It can be piled on another rock to make a cairn or a stone wall. These affordances are all consistent with one another. The differences between them are not clear-cut, and the arbitrary names by which they are called do not count for perception. If you know what can be done with a graspable detached object, what it can be used for, you can call it whatever you please.

The theory of affordances rescues us from the philosophical muddle of assuming fixed classes of objects, each defined by its common features and then given a name. As Ludwig Wittgenstein knew, you *cannot* specify the necessary and sufficient features of the class of things to which a name is given. They have only a "family resemblance." But this does not mean you cannot learn how to use things and perceive their uses. You do not have to classify and label things in order to perceive what they afford.

than it is to perceive all the variables separately. It is never necessary to distinguish *all* the features of an object and, in fact, it would be impossible to do so. Perception is economical. "Those features of a thing are noticed which distinguish it from other things that it is not—but not *all* the features that distinguish it from *everything* that it is not" (Gibson, 1966b, p. 286).

OTHER PERSONS AND ANIMALS

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, for they are not *governed* by these laws. 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 the *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 *he* or *she* instead of *it*. But the other person has

a surface that reflects light, and the information to specify what he or she is, invites, promises, threatens, or does can be found in the light.

PLACES AND HIDING PLACES

The habitat of a given animal contains *places*. A place is not an object with definite boundaries but a region (Chapter 3). The different places of a habitat may have different affordances. Some are places where food is usually found and others where it is not. There are places of danger, such as the brink of a cliff and the regions where it is not. lurk. There are places of refuge from predators. Among these is the place where mate and young are, the home, which is usually a partial enclosure. Animals are skilled at what the psychologist calls place-learning. They can find their way to significant places.

An important kind of place, made intelligible by the ecological approach to visual perception, is a place that affords concealment, a *hiding place*. Note that it involves other observers and the hiding of a detached object from other observers have different kinds of motivation. As every child discovers, a good hiding place for one's body is not necessarily a good hiding place for a treasure. A detached object can be concealed both from other observers and from the observer himself. The observer's body can be concealed from other observers but *not* from himself, as the last chapter emphasized. Animals as well as children hide themselves and also hide objects such as food.

One of the laws of the ambient optic array (Chapter 5) is that at any fixed point of observation some parts of the environment are revealed and the remaining parts are concealed. The reciprocal of this law is that the observer himself, his body considered as part of the environment, is revealed at some fixed points of observation and concealed at the remaining points. An observer can perceive not only that other observers are unhidden or hidden from him but also that he is hidden or unhidden from other observers. Surely, babies playing peek-a-boo and children playing hide-and-seek are practicing this kind of apprehension. To *hide* is to position one's body at a place that is concealed at the points of observation of other observers. A "good" hiding place is one that is concealed at nearly all points of observation.

All of these facts and many more depend on the principle of occluding edges at a point of observation, the law of reversible occlusion, and the facts of opaque and nonopaque substances. What we call privacy in the design of housing, for example, is the providing of opaque enclosures. A high degree of concealment is afforded by an enclosure, and complete concealment is afforded by a complete enclosure. But note that there are peepholes and screens that permit seeing without being seen. A transparent sheet of glass in a window transmits both illumination and information, whereas

a translucent sheet transmits illumination but not information. There will be more of this in Chapter 11.

Note also that a glass wall affords seeing through but not walking through, whereas a cloth curtain affords going through but not seeing through. Architects and designers know such facts, but they lack a theory of affordances to encompass them in a system.

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 warming and burning. Detached objects—tools, utensils, weapons—afford special types of behavior to primates and humans. 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, we can now observe that some offerings of the environment are beneficial and some are injurious. These are slippery terms that 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, a middle-sized metallic object affords grasping, but if charged with current it affords electric shock. And fourth, consider the other person. The animate object can give 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*. They are not subjective values; they are not feelings of pleasure or pain added to neutral perceptions.