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**REASONS  
FOR  
REALISM** "

*Selected Essays of James J. Gibson*

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## Notes on Affordances

### PART I: WHAT IS PERCEIVED? NOTES FOR A RECLASSIFICATION OF THE VISIBLE PROPERTIES OF THE ENVIRONMENT\*

The abstract analysis of the world by mathematics and physics rests on the concepts of *space* and *time*. The study of sense perception by psychologists has conformed to this analysis. *Mass* is exemplified by what we call "objects," and *energy* by what we call "light." So it is assumed that we perceive space, time, and objects, and that we sense light (or color). This way of thinking about perception has a long history. The perceptible qualities of objects were classified in accordance with it. John Locke's list consisted of the primary qualities of *position*, *shape*, *size*, *duration*, *motion*, and *solidity*, to which was added the secondary quality of *color* and other non-visual secondary qualities (sound, taste, smell, and warmth or coldness).<sup>1</sup> Psychology is still trying to explain the perception of the *position* of an object in space, along with its *shape*, *size*, and so on, and to understand the sensations of *color*. The explanations are tortured and success is not in sight.

But a direct explanation of the perception of the properties of the visible environment may be possible if these properties are taken from concepts of ecology instead of from mathematics and physics. (Perhaps they are ultimately "reducible" to the latter, but the psychologist cannot wait for such a reduction.) What might such a list be? Here is a preliminary classification.

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\*Unpublished manuscript, August 1967.

<sup>1</sup>Locke's list varied from place to place in his *Essay*. It was Descartes who first determined to integrate physics and psychology by means of the doctrine of primary and secondary qualities (cf. Maull, 1978). (Eds.)

*Spatial Properties*

(We do not visually perceive "space," but we do perceive the following persisting, i.e., relatively invariant, properties of the world.)<sup>2</sup>

1. *Surface layout.* This includes surface slant, corners (dihedral angles), curvature, and the edges of surfaces which occlude other surfaces. It includes the recession of the ground (distance from "here"). Finally, it includes objects, with the position of each object in the layout, the dimensions of the object (size) and the proportions of its faces (shape). The persistence or permanence of hidden objects is discussed below.
2. *Substance or composition.* This includes the solidity, liquidity, or viscosity of the substance, the color of the surface (reflectance and differential reflectance), and the texture of the surface (its small-scale layout).
3. *Lighting or illumination.* This includes cast shadows, attached shadows ("shading"), and direction of illuminations on a surface.

*Spatio-Temporal Properties*

(We do not perceive "time" as such, but we do perceive changes or varying properties of the world, which are spatio-temporal.)

1. *Motions of rigid objects.* This includes displacements and rotations relative to the ground.
2. *Deformations of elastic objects.* This includes the flow of viscous or fluid surfaces.
3. *Progressive occlusion and disocclusion,* that is, the optical covering and uncovering of surfaces (objects) by edges. An object that is thus covered is specified as persisting. An object may also recede "into the distance" and persist.
4. *The ending and beginning of the solid state,* that is, the melting, decomposition, dissolution, etc., of an object or (occasionally) the opposite.
5. *The onset and cessation of illumination.* This includes many kinds of transients, both naturally and artificially produced (e.g., "flashes" of light).
6. *Animate motions and deformations.* This includes the whole realm of events in the animate and social environment, e.g., expressive movements and social signals.
7. *Events in general.*<sup>3</sup> For events with sufficiently abrupt onset and cessation is is possible to measure duration ("time"). For multiple events of this sort

<sup>2</sup>See Gibson (1979a, Part 1) and also Ch. 1.9 for more details on these properties of the environment. (Eds.)

<sup>3</sup>Cf. Ch. 2.8. (Eds.)

it is possible to measure frequency ("rate"). But, in general, the centimeter-gram-second system of physics can only be applied at present to uninteresting events in the visible environment.

Perceptual research needs a program newer than the one formulated in Newton's *Principles* and Locke's *Essay Concerning Human Understanding*.

#### *The Visual Detection of the Self*<sup>4</sup>

Proprioception accompanies perception; we proprioceive visually as well as perceive visually, and this kind of detection is also spatio-temporal. We can detect the following characteristics or variables of the self as the center of the environment. (The information is multiple but we are considering only visual information.)

1. *The temporary posture of the body.* The upright or inclined posture of the head is "visible."
2. *The locomotion of the body.* The direction and speed of locomotion through the environment is "visible" (by means of motion perspective and the changing occlusion of surfaces at edges). This extends to locomotion in vehicles.
3. *The movements of the limbs.* Gross movements and fine manipulations are "visible." Both movements of the hands and of the tools grasped are thus registered (pointing, reaching and grasping, but also raking, pounding and trace-making).

Note that the term *perception* is reserved for the environment, and *detection* or *registration* is applied to the self. Note also that the visual registration of body movement may be either obtained or imposed, i.e., from an active or a passive movement (Gibson, 1966b, Ch. 2). Hence not all movements are self-produced, and not all inputs should be considered as "feedback" or "reafferent," as seems to be widely assumed. The problem of the registering of information is distinct from the problem of the purposive control of movement.

## PART II: A PRELIMINARY DESCRIPTION AND CLASSIFICATION OF AFFORDANCES\*

The hypothesis that things have *affordances*, and that we perceive or learn to perceive them, is very promising, radical, but not yet elaborated (Gibson, 1966b, p. 285). Roughly, the affordances of things are what they furnish, for good or ill, that is, what they *afford* the observer. A list of examples and a classification is

<sup>4</sup>Cf. Chs. 2.4 and 4.6. (Eds.)

\*Unpublished manuscript, February 1971.

needed; the reader is invited to make his own list, or to supplement the tentative list given below.

Not only objects but also substances, places, events, other animals, and artifact have affordances. We might begin with the easy-to-perceive components of the environment consisting of surfaces and surface layouts. And we should assume a human animal as observer, to start with, since the list of affordances will be somewhat different for different animals.

I assume that affordances are not simply phenomenal qualities of subjective experience (tertiary qualities, dynamic and physiognomic properties, etc.). I also assume that they are not simply the physical properties of things as now conceived by physical science. Instead, they are *ecological*, in the sense that they are properties of the environment *relative to* an animal. These assumptions are novel, and need to be discussed.

In a theory of information-based perception, learning to perceive affordances is only one kind of perceptual learning or perceptual development. (For other kinds, see Gibson, 1966b, Ch. 13, esp. p. 283 ff, and E. J. Gibson, 1969, Ch. 5.)

The examples that follow are intended to be only suggestive.

*I. Surfaces and surface-layouts related to posture and locomotion*

- a stand-on-able surface or surface of support; a place that affords rest.
- a walk-on-able surface, one that affords "footing" (For terrestrial locomotion the substratum must be nearly level and rigid; a water surface is excluded.)
- a vertical rigid surface, an obstacle, affording collisions and barring locomotion.
- an interspace or opening between obstacles, affording locomotion.
- a falling-off place, the brink of a cliff, affording injury by collision with the ground.
- a gap between two cliff-edges which (depending on its width) may afford jumping.
- a stepping-down (or stepping-up) place, affording descent (or ascent).
- a sit-on-able surface (affording sitting).
- a stand-on-able object, stool, affording a high reach.
- a climbable layout (tree, ladder, stairway).
- a get-underneath-able surface, affording shelter (roof).

*II. Surfaces that reveal or conceal; transparent or opaque*

- an occluding surface, with its occluding edges (screen, wall, lid, clothing). An *opaque* surface.
  - a revealing surface (glass).
  - a place affording concealment of oneself from others (hiding place, "private" place).
  - a place or layout affording concealment of an object from others.
- (Note that children are deeply interested in the possibilities of occlusion, as in peek-a-boo and hide-and-go-seek and other games of concealment.)

III. *Objects affording manipulation and related activities* (We distinguish *portable* from *immovable* solid objects, and *graspable* from *non-graspable* solid objects.)

- a handle (a graspable object attached to a portable object).
- a hand-hold (a graspable object attached to an immovable layout).
- a stick (or rake). An elongated rigid object affording a long reach (or a long grasp).
- a tree branch (affording arboreal support to a primate).
- a throwable object, missile (rigid, graspable, movable, of moderate weight).
- an object that affords *hitting*; a club, hammer.
- an object that affords cutting; a knife, axe (having an edge with an acute dihedral angle).
- an object that affords *piercing*; needle, spear.
- an object that affords knotting, binding, lashing; string, thong, rope, thread.
- an object that affords *plugging*; a convexity that fits into and fills a concavity.
- a surface that affords support for useful objects; a bench, shelf, table.
- an object that affords *rolling* (sphere or cylinder) as distinguished from one that has a flat *base* and affords *sliding*.

IV. *Substances with affordances*

- a substance that affords pouring, dripping, dabbling. A *liquid*.
- a substance that affords smearing, painting, trace-making. A *viscous* substance.
- a substance that affords being shaped by manipulation. A plastic or malleable substance.
- a substance that resists change of shape. A solid with persisting shape and size. An object. (Note that the properties of a substance are not the same as the properties of an *object*; this fact is recognized in speech, if not in physics, by the use of a "mass noun" instead of a "count noun.")
- a substance or object affording nutrition. Food.
- a substance or object affording illness. Poison. (But note that both food-objects and poisonous objects afford *ingestion* and that they are sometimes hard to distinguish by optical information. Occasionally, if rarely, they are not even distinguishable by taste and smell, i.e., by the chemical value system.)

V. *The affordance of injury or benefit*

We now come to a consideration of the positive or negative "valences" of things. Phenomenologists maintain that they are facts of "immediate experience" but have not analyzed the biophysical basis of this perception. Nevertheless the perception *at a distance* of what something affords *if* encountered is said to be the great virtue of vision (cf. Berkeley's *New Theory of Vision*, 1709, on

"the damage or benefit which is like to ensue.") A mechanical encounter or other energy-exchange may cause tissue damage. But the object, place, substance, event, or animal that affords injury need not be encountered; it can be *avoided*, *escaped*, or *averted*, if perceived.

- the edge of a cliff affords falling.
- a wall affords collision (but may afford climbing).
- an approaching missile ("looming") affords injury.
- a knife-edge affords being cut (but also affords cutting).
- a fire affords being burned, but also affords warmth.
- a snake affords being bitten.
- a surface of deep water affords drowning, but a surface of shallow water affords bathing.

These places, events, or animate objects are all specified in an ambient optic array. In each case the affordance can be *seen*, I suggest, and this is not the same thing as saying that the injury can be *foreseen*. The argument is reinforced by the evidence to show that the *imminence* of collision is optically given, as in Schiff's experiment. But there are other places, substances, and events in an environment that are either *not specified* in an optic array, or not obviously, or whose affordances are *not visible*, or not without special training.

- a potential rock-fall or avalanche is hard to see.
- a lightning-bolt is not seen until it occurs.
- the danger of sunburn or gamma rays is not visible.
- the imminence of an "accidental" explosion is not indicated.

#### VI. *The detecting of affordances by young animals*

The human young must learn to perceive these affordances, in some degree at least, but the young of some animals do not have time to learn the ones that are crucial for survival.<sup>5</sup> Ethologists therefore are interested in what they call "sign-stimuli" and "releasers." If the foregoing is correct, however, the behavior in question should be reconsidered in terms of stimulus information, not of stimuli. A listing of releasers in these terms would be interesting.

### PART III: MORE ON AFFORDANCES\*

At one extreme stands the fact that educated adults have a *conception of space*, i.e., mathematical or geometrical space, Euclidean, Cartesian, non-Euclidean, and so forth.

<sup>5</sup>For more on the development of the perception of affordances, see E. J. Gibson (1982) and E. J. Gibson and Spelke (in press). (Eds.)

\*Unpublished manuscript, March 1971.

Then there is what psychologists have called the *perception* of space. Although it is a complete muddle, and full of contradictions, depth-perception implies distance-from *here*, and such perception recognizes at least the fact of a potential observer and a *surrounding* space.

Next there is what I call the perception of *layout*—the actual layouts of environmental surfaces, chiefly opaque solid surfaces, and the geometrical *components* of layout. Such perception depends on optical information for environmental places and objects at the set of all possible points of observation in the medium, and this takes into account both hidden (unprojected) and unhidden (projected) surfaces at a fixed point of observation.

Finally, at the other extreme, there is the perception of the *affordances* of environmental surface layouts (which includes objects and places and even *animate* objects). The activity of an observer that is afforded depends on the layout, that is, on the solid geometry of the arrangement. The same layout will have different affordances for different animals, of course, insofar as each animal has a different repertory of acts. Different animals will perceive different sets of affordances therefore. The perception is of *practical* layout, not *theoretical* layout, but it is nonetheless geometrical for all that.

Animals, and children until they learn theoretical geometry, pay attention to the affordances of layout rather than the mathematics of layout. Hence, although logically one advances from space to affordance, developmentally the progress is in the opposite direction, from affordance to space. The *formless invariants* in the light which the eyes of the very young pick up, instead of the forms of the visual field, are just those that specify affordances.

#### PART IV: STILL MORE ON AFFORDANCES\*

There has been a great gulf in psychological thought between the perception of *space and objects* on the one hand and the perception of *meaning* on the other. But when space and objects are defined in terms of the opaque solid geometry of surface layout, and when meaning is defined in terms of the affordances of places, substances, surfaces, and objects (hereafter termed “things”), these problems are seen to be linked. For example, what anything affords an organism depends in some degree on its shape or the features of its shape (solid shape, of course, not pictorial form). Hence it is that the shape of something is especially meaningful.

The meaning or value of a thing consists of what it affords. Note the implications of this proposed definition. What a thing affords a particular observer (or species of observer) points to the organism, the *subject*. The shape and size and composition and rigidity of a thing, however, point to its physical existence, the

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\*Unpublished manuscript, March 1971.



*object*. But these determine what it affords the observer. The affordance points both ways. What a thing *is* and what it *means* are not separate, the former being physical and the latter mental, as we are accustomed to believe.

The perception of what a thing is and the perception of what it means are not separate, either. To perceive that a surface is level and solid is also to perceive that it is walk-on-able. Thus we no longer have to assume that, first, there is a sensation-based perception of a thing and that, second, there is the accrual of meaning to the primary percept (the "enrichment" theory of perception, based on innate sensations and acquired images).<sup>6</sup> The available information for the perception of a certain surface layout is the same information as for the perception of what it affords.

The controversies over whether the values of things are "relative" or "absolute," and whether value is a subjective phenomenon or an objective fact, should be reinterpreted in the above terms.

#### PART V: THE AFFORDANCES OF THE ENVIRONMENT\*

The environment of animals can be described at different levels. At the level of fundamental physics it can be said to consist of matter and energy, of particles and their interactions. At a more familiar level, but still one described by physics and solid geometry, it can be said to consist of *substances*, a *medium*, and the *surfaces* between them.<sup>7</sup> With emphasis on the surfaces and their layout, the environment can be described in terms of substratum, enclosures, detached objects, edges, corners, convexities, and concavities; these are the *features* of surface-layout. Note that these features of the environment are geometrical, or mathematically abstract in some degree, but that they begin to be *meaningful*. Edges and corners and surfaces, for example, *combine* to make objects of use and enclosures for shelter. (They are best described by *synthetic* geometry, not by *analytic* geometry.) Then, next, the environment can be described as the *surroundings* of animals who live and get about in the medium. Finally, at the highest level, the environment can be described in terms of *what it affords the animals that live in it*. So considered it consists of objects, substances, places, events, and other animals, all of which have meaning. Note that what these things afford depends on the substances they are made of, the layout of their surfaces, and the ways in which the layout changes.

For example, certain substances afford nutrition but others do not, and a certain surface-layout affords locomotion whereas another does not. The behavior of the animal has to be controlled by the affordance (for him) of the

<sup>6</sup>Cf. Ch. 4.2. (Eds.)

\*Unpublished manuscript, January 1972.

<sup>7</sup>See Gibson (1979a, Part 1) for more details on this distinction. (Eds.)

substance, object, or place. And this affordance has to be perceived by the animal if his behavior is to be controlled. True, the affordances of substances and surfaces differ for different animals. The ant, the bird, and the primate live in different "niches" as the ecologist puts it, but the reciprocity of the animal and its environment is the same for all.

The notion of affordances implies a new theory of meaning and a new way of bridging the gap between mind and matter. To say that an affordance is meaningful is not to say that it is "mental." To say that it is "physical" is not to imply that it is meaningless. The dualism of mental vs. physical ceases to be compulsory. One does not have to believe in a separate realm of mind in order to speak of meaning, and one does not have to embrace materialism in order to recognize the necessity of physical stimuli for perception.

The history of the concept of *affordance* may be illuminating. The term is reminiscent of a word coined by Kurt Lewin, *Aufforderungscharakter*. The term was first translated into English as *invitation-character* (by J. F. Brown in 1929) and later as *valence* (by D. K. Adams in 1931). The latter is more generally used (cf. Marrow's 1969 biography of Lewin). Koffka invented a new term, *demand-character*, when he wrote the *Principles of Gestalt Psychology* (1935). He maintained that the postbox "invites" the mailing of a letter; the handle "wants to be grasped"; the chocolate "wants" to be eaten; things in experience "tell us what to do with them" (p. 353). But the crux of this theory is that the demand character, like the valence, was assumed to be in the *phenomenal* object but not in the physical object. It was in the "field" for Lewin or, for Koffka, in what he called the "behavioral" environment but not in the "geographical" environment. In short, the value of something did not have any "physical" reality. The valence of an object was bestowed upon it by a need of the observer, and a corresponding tension in his field. Koffka agreed, arguing that the postbox has a demand-character only when the observer needs to mail a letter, for only then is he *attracted* to it. Thus the value of something was assumed to change as the need of the observer changed.

In contrast, the *affordance* of something is assumed *not* to change as the need of the observer changes. The edibility of a substance for an animal does not depend on the hunger of the animal. The walk-on-ability of a surface exists whether or not the animal walks on it (although it is linked to the locomotor capacities of that species of animal, its action system). The positive affordance of an object can be perceived whether or not the observer needs to take advantage of it. It offers what it does because it is what it is. The uses of things are directly perceived, as Lewin and Koffka sometimes realized, but this is *not* because of a force between the object and the ego in the phenomenal field, as they believed; it is only because the substance and the layout of the object are visible and these determine its use.

Similarly, the capacity of an object, place, or animal to injure the observer, its negative affordance, does not depend on his being afraid of it, or being repelled

by it, or on his avoiding it. When a falling-off place (for example) is perceived, his locomotor behavior can be therewith controlled, but that does not imply that the mountain goat or the mountaineer automatically retreats from the cliff-edge.<sup>8</sup> It affords walking-along as well as falling-off. There are paths, obstacles, slopes, barriers, and openings in the terrestrial layout, as well as brinks, and they all either afford or do not afford locomotion.

The *affordances* of the environment are permanent, although they do refer to animals and are species-specific. The positive and negative *valences* of things that change when the internal state of the observer changes are temporary. The perception of what something affords should not be confused with the "coloring" of experience by needs and motives. Tastes and preferences fluctuate. Something that looks good today may look bad tomorrow but what it actually *offers* the observer will be the same.<sup>9</sup>

The notion of affordance, therefore, is not the same as the notion of *valence*, *invitation character*, or *demand character* although it is in the same line of theoretical development. The Gestalt theorists were not clear about it, for they could not resolve the subjective-objective dichotomy. They sometimes talked as if a valence were a fact of the environment but at other times as if it were only a fact of experience. The physical world for them was the world of physics as this was described by physicists like Eddington, without meanings or values, and thus they were forced to suppose in the last analysis that meanings and values were mental.<sup>10</sup> Now, forty years later, we should know better, for the environment is no longer quite so physical and experience is no longer quite so mental as it was then.

The meaning or value of anything consists of what it affords an observer, or species of observer. But what it affords the observer is determined by its material substance and its shape, size, rigidity, motion, etc. What it means and what it is are not separate, as we have been led to believe. And the observer who perceives the substance and the surfaces of anything has thereby perceived what it affords.

## PART VI: AFFORDANCES AND BEHAVIOR\*

Affordances are invariant combinations of properties of things (properties at the ecological level) *taken with reference to* a species or an individual. I now add: with reference to its *needs* (biological and social) as well as to its action-systems and its anatomy. The affordances for behavior and the behaving animal are *complementary*.

Affordances are perceived, i.e., attended to.

<sup>8</sup>Cf. Ch. 1.3. (Eds.)

<sup>9</sup>Cf. Ch. 4.7. (Eds.)

<sup>10</sup>See the discussion of Eddington in Ch. 4.5. (Eds.)

\*Unpublished manuscript, April, 1975.

Affordances do not *cause* behavior but constrain or control it.

Needs control the perception of affordances (selective attention) and also initiate acts.

Acts are *not* responses to stimuli, and percepts are not responses to stimuli. An observer is not "bombarded" by stimuli. He extracts invariants from a flux of stimulation.

Affordances, and the stimulus information to specify affordances, are neither subjective nor objective but transcend this dichotomy.

The actor/perceiver and the environment are *complementary*.

An affordance is not the outcome of a perceptual process, as a "meaning" is supposed to be.

#### PART VII: NOTE ON PERCEIVING IN A POPULATED ENVIRONMENT\*

A populated environment is not just a terrestrial environment with a special set of animated social objects in it. People *are* animated objects, to be sure, with complex affordances for behavior; but they are more than that. People are not only *parts* of the environment but also *perceivers* of the environment. Hence a given observer perceives other perceivers. And he also perceives *what* others perceive.<sup>11</sup> In this way each observer is aware of a shared environment, one that is common to all observers, not just *his* environment.

There are two interconnected reasons for having a shared environment, first, that every observer gets about and thus can take the point of view of another observer and, second, that an observer can be told about things he has never seen or shown pictures of these things. In the latter case he perceives what others perceive by way of the information they give him, that is, by perception at second hand, or vicarious perception. In the former case he perceives what others perceive without the mediation of words or pictures. In other words, speaking subjectively, I have the ability to see objects and places from your present standpoint; and I have the ability to learn about objects and places that you describe or portray. The two abilities go together. To know what *you* know, I must realize the partial identity of you and me, that is, I must in some sense be able to "identify" with you.

I must first of all come to understand that you and I can look at the same object and can *see* the same object even though your perspective view of it is not the same as mine, since you see it from *there* and I see it from *here*. Your perception and mine can be identical even though your "sensation" and mine can never be identical *at the same time*. The same invariants over time are available to both of

\*Unpublished manuscript, August 1974.

<sup>11</sup>Cf. Gibson & Pick (1963). (Eds.)

us. I cannot occupy your point of observation *now* but I can in the future, and I could in the past. This, I suggest, is what is meant by the metaphorical assertion that I can "put myself in your place." (It means I can put myself in your position. But it does *not* mean that I can put myself in your body. I am a body myself, not a disembodied spirit, and two bodies cannot exist in the same position.)

If you see a head-on view of a bounding tiger and I see a side view, you are in greater danger than I am; but we both see the same tiger. We also see the same event: You see him approaching you and I see him approaching you.

Now consider perception at second hand, or vicarious perception. This is perception at a different level; perception mediated by communication and dependent on the "medium" of communication, like speech sound, painting, writing, or sculpture. The perception is indirect since the information has been presented by the speaker, painter, writer, or sculptor, and it has to have been *selected* by him from the unlimited realm of available information.<sup>12</sup> This kind of apprehension is complicated by the fact that direct perception of sounds or surfaces occurs along with the indirect perception. The sign is often noticed along with what is signified. Nevertheless, however complicated, the outcome is that one man can metaphorically see through the eyes of another in the case of the painter, and apprehend through the eyes and words of another in the case of the writer. The apprehensions of the traveller, the explorer, and the investigator become available to all men.

It is often believed that perceiving is a private affair, unique to the individual, whereas knowing is shared with others because of the common language. But this assumption of private perception and public knowledge is quite mistaken.<sup>13</sup> Even the direct perception of objects and surfaces is shared over time because of common points of observation and the ability to see from other points than the one now occupied. The mediated perception of part of the environment obtained by looking at a picture is shared, since it is a sort of window on another scene that anyone can look through. And the even more mediated perception (knowledge) obtained by a verbal description or a symbolic description of the sort found in mathematics is obviously shared with all others who have learned the language or the symbols.

The awareness of a common world, the sharing of our perceptions, is not entirely due to our verbal agreements with one another, as so many philosophers are tempted to believe. It is also due to *the independence of our perception from a fixed point of observation, the ability to pick up invariants over time*.<sup>14</sup> This underlies the ability to get knowledge by means of pictures and words. The social psychology of knowledge has a basis in ecological optics.

<sup>12</sup>For further discussion of mediated perception see Chs. 3.2, 3.4, 3.6, and Gibson (1979a, Chs. 14 & 15). (Eds.)

<sup>13</sup>Cf. Ch. 4.5 for a critique of the private-public dichotomy. (Eds.)

<sup>14</sup>Cf. Gibson (1974b). (Eds.)

## PART VIII: THE THEORY OF AFFORDANCES AND THE DESIGN OF THE ENVIRONMENT\*

Architecture and design do not have a satisfactory theoretical basis. Can an ecological approach to the psychology of perception and behavior provide it?

Assume that the environment consists of *substances* and their *surfaces*, a surface being the interface between the substance and the medium, air. Assume also that surfaces have a more or less persisting "layout."

*Substances.* There exist natural substances like earth, clay, rock, water, and plant tissue. They can be modified by man, as when bricks are made of clay, mortar is mixed, wood is fabricated, and ore is smelted. Substances can be artificial, like glass, metal, or plastic. These are the "materials" of the designer, architect, and builder.

*Surfaces.* Similarly, the surfaces of substances and the "layout" of these surfaces can be natural, modified, or artificial. The horizontal surface of a pond or stream is a natural layout. The horizontal ground, or a hillside, or a cliff are kinds of natural terrestrial layout. But men have modified the shape of the terrain by levelling it, or making earthworks, ramps, ditches, and hedgerows. And men have formed quite artificial layouts by fabricating and constructing objects, enclosures, panels, walls, bridges, and tools.

Substances and their surfaces afford benefit or injury when they are encountered by a mobile animal. Different kinds of surface layout will afford different kinds of posture, different kinds of locomotor behavior, and different kinds of manipulation. Here are some examples of what the environment, natural or artificial, affords.

1. A solid horizontal surface affords *support*. A water surface does not.  
—A surface of support affords *resting* (coming to rest).
2. An extended surface of support affords *locomotion*, for a terrestrial animal.
3. A *vertical* solid surface stops locomotion and affords *mechanical contact*. It is a *barrier*.  
—A rigid barrier surface affords injury by abrupt contacts, i.e., collision. It is an *obstacle*. Deceleration is necessary to achieve contact without collision.  
—A *non-rigid* barrier surface can avert injury by collision.
4. A *vertical double surface*, that is, a wall or screen, affords *hiding behind*, that is, being out of sight of observers on the other side. This is true if the double surface is *opaque*.

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5. A double surface at sufficient height above the ground affords *getting under*. It is a *roof*.
6. Any layout of surfaces that encloses an appropriate volume of air affords *shelter* (from the wind, cold, rain, snow). A cave, burrow, or hut.  
—An enclosure affords being out of sight of observers in all directions (“privacy”) and thus it affords protection from predators. (All animals sometimes need to *hide*.)
7. An aperture or gap in an enclosure affords *entry* and *exit*.  
—It also affords *vision* within the enclosure by admitting illumination (sunlight).  
—It also affords *looking through* (both looking *out* and looking *in*).  
—It also affords long-term *respiration* (breathing fresh air).  
—Note that all the complexities of doors, windows, shutters, grilles, and panes of glass, etc., get their utilities from these basic affordances. (E.g., the misperception of a glass door is a real danger in modern buildings.)
8. A horizontal surface at about knee-height above the surface of support affords sitting, a *seat*.
9. A horizontal surface at about *waist-height* above the ground affords support for objects and facilitates manipulation of objects, e.g., tools, and materials for writing and reading, a workbench, desk, table.
10. A large drop-off in the surface of support affords injury by falling-off, a “brink.” But a railing affords protection from falling off (like a fence, which is a barrier to locomotion).  
—A *small* drop-off in the surface of support affords stepping down without injury.  
—A series of “steps” in a *stairway* affords ascent or descent of a cliff by a pedestrian.  
—A *ladder* affords ascent or descent.  
—A *ramp* affords a different mode of ascent or descent.

Note that the separations, sizes, and shapes of the surfaces described are relative to the size and shape of the animal being considered, man. We design on what we call the “human scale.” Small and large are relative. Now consider again the affordance of *locomotion* (#2).

11. An extended horizontal surface of support that is “uncluttered” affords *footing*, i.e., bipedal locomotion. If cluttered, however, it may not afford locomotion by planting the feet.  
—An aperture in the surface of support, a hole, or a foot-sized obstacle, affords *stumbling*. Either a concavity or a convexity does so. A small gap affords *stepping over*; a wider gap affords *jumping over*; a still wider gap affords *falling into* (consider the experiment on rats with a “jumping

stand"). A small obstacle affords *stepping over*; a larger obstacle affords only *jumping over*, or *climbing over*.

12. A large gap in a barrier affords *walking through*. A smaller gap only affords *squeezing through*, or *ducking under*, or *creeping under*.
13. Any acute dihedral angle between two rigid surfaces, a "sharp" edge, affords *injury* on contact. But a junction of non-rigid surfaces does not. The latter explains the advantage of soft or padded surfaces in the artificial environment. Automobile interiors are now padded; why not domestic interiors?

We are now prepared to consider the visual perception of these surface layouts in advance of behavioral contact with them, that is, the perception of *what they afford*. For what we perceive first of all is not abstract color and space, as psychology has taught, but surfaces and their layout. Ecological optics provides a new explanation of how we see surfaces and their layout. They are specified by gradients, discontinuities, and other invariants in the *array* of light, not by the light as such.

We need to perceive the slant of the ground. We need to see the holes in it and the protuberances on it. We need to distinguish the solidity, rigidity and opaque-ness of surfaces from their opposites. For *if* we can detect the gaps, separations, sizes, and shapes relative to our bodies, we will perceive directly and immediately their affordances for us. The meanings will be tacit, of course, not explicit, and whatever words we may apply to them will be inadequate, but that does not matter. Things will look as they do because they afford what they do.

Herein lies the possibility for a new theory of design. We modify the substances and surfaces of our environment for the sake of what they will afford, not for the sake of creating good forms as such, abstract forms, mathematically elegant forms, esthetically pleasing forms. The forms of Euclid and his geometry, abstracted by Plato to the immaterial level, have to be rooted in the substances and surfaces and layouts that constrain our locomotion and permit or prevent our actions. Surfaces have to be illuminated if they are to be seen. You cannot see them in darkness. But there is no use trying to illuminate a triangle.

Illuminated surfaces at a place in the environment are projected to a point of observation in the medium. The projections constitute what I call an ambient optic array. The surfaces constitute what I call a vista.<sup>15</sup> What one sees as he looks around is not a patchwork of forms but the possibilities of support, of falling, of resting, of sitting, of walking, of bumping into, of climbing; of taking shelter, of hiding, of grasping, of moving movable things, of tool using, and so on and on. There are also of course the possibilities of eating and drinking and those of social and sexual encounters, but I will leave them out of account. They

<sup>15</sup>Cf. Gibson (1979a, pp. 198-200). (Eds.)



are all in the surfaces of the vista. What I now want to emphasize is the fact that one also sees the possibility of *entering the next vista*, of going around the corner, or through the door, or over the hill. More exactly, one sees the occluding edges of the presently projected surfaces. A living observer is never frozen in the vista of the moment. Perceiving is sequential.

To see a vertical occluding edge is to see that it affords walking around, or peering around, or reaching around. This is a fact of ecological optics, not of physical optics. Of all the affordances I have mentioned this one is the most radical. For it implies that an observer perceives in some sense the surface that is occluded, that he detects the next vista. One sees around corners because one can go around corners in the course of time. The concept of the arrested image has misled us. The static picture is not the basic element of visual perception.

Architects need to pay attention to the affordances of locomotion and action in the layouts they design. To be oriented in a building (or a city, or a maze, for that matter) is to know where to go to get what you want. You have to open up a sequence of vistas until the final vista contains the surfaces of your goal. The perceiving of this affordance is made unnecessarily difficult in modern buildings.

The course in "basic design" with which architects now begin their training is at fault, I believe. It teaches *graphics*, on the assumption that an understanding of "form" is as necessary for architects as it is presumably for painters. But no one is ever going to understand "form," in my opinion. The use of the term only promotes confusion.<sup>16</sup> What architects are concerned with is the layout of surfaces.

#### PART IX: A NOTE ON WHAT EXISTS AT THE ECOLOGICAL LEVEL OF REALITY\*

I have been assuming that ecological reality (as distinguished from physical reality) consists of substances, the medium, the surfaces that separate them, and the varieties of surface layout. To these must be added the changes that occur in all of them, since they change in some respects and persist in others, the changes being no less real than the persistences. All such changes I call *events* (Gibson, 1979a, Ch. 6).<sup>17</sup>

The medium, the surface of support, and some substances are very persistent. Many local substances and layouts are very changeable, and their surfaces may even go out of or come into existence.

Substances, media, surfaces, layouts, and events are what there is to perceive, that is, know directly. Perceiving is extracting the information in ambient

<sup>16</sup>For a complete discussion of these issues, see Ch. 4.1. (Eds.)

\*Unpublished manuscript, November 1978.

<sup>17</sup>Cf. Chs. 2.8 and 2.9. (Eds.)

light, sound, odor, and mechanical contact. The invariant combinations of features that constitute the *affordances* of these realities are what the animals pay attention to.

By this formula *objects* are by no means the only realities; an object is merely a substance with a topologically closed surface (a detached object) or a nearly closed surface (an attached object). An object is one form of layout and there are many other forms of layout such as enclosures, hollow objects, places, convexities, concavities, edges, corners, etc. It is an important form of layout, to be sure (animals are detached objects), but objects do not constitute reality and objects in space emphatically do not make up the world. There is an enormous variety of objects with affordances for human animals, and the imposing on them of *categories* using words (subordinate and superordinate) is what makes knowledge explicit instead of tacit, but the perceiving and naming of objects does not comprise the whole problem of perception as is often assumed.

On this formula *abstract* objects do not exist. There are, to be sure, realities that cannot be perceived directly but only known indirectly by means of instruments, measuring operations, pictures, and language, but it seems to me mistaken to call such realities "abstract" as against "concrete." Indirect knowledge based on communication (chirographic pictures and words) is uncertain and ill-understood by psychology.

The course of development of the perception of these different kinds of reality, by growth and by learning, is surely different. Consider learning to perceive detached *objects* and learning to perceive *places* (as in learning one's habitat). Moveable objects can be displaced, permuted in arrangement, put side by side for comparison, can be counted, and fall into a hierarchy of classes. Places, however, are nested within larger places, do not have sharp boundaries, cannot be displaced or permuted, are classified in a quite different way, and are learned in the course of locomotion (by the opening up of vistas). The ways in which children develop concepts of objects, therefore, cannot be the same as the ways in which they develop knowledge of places.

The ways in which children learn to perceive events are still different. Events at the ecological level are ill-understood; investigators are not even sure what an event *is*, being preoccupied with the "motions" of "objects." But the evidence suggests that very young children begin to distinguish happenings, transitions, deformations, displacements, and other changes in the environment before they distinguish objects.<sup>18</sup> Progressive and non-reversible events are distinguished from repeating or cyclic events by very young infants. The movements, sounds, and touches made by a person are especially worthy of attention since they specify what the person affords.<sup>19</sup>

<sup>18</sup>Cf. E. J. Gibson, Owsley, & Johnston (1978) and E. J. Gibson, Owsley, Walker, & Megaw-Nyce (1979). (Eds.)

<sup>19</sup>Cf. Spelke & Cortelou (1980) and Walker (1980). (Eds.)

Events, like places, are nested, episodes being contained within longer episodes. For perception this nesting is what counts, not the metric dimension of empty time with its arbitrary instants and durations. Time as such, like space, is not perceived.

What about so-called "subjective" reality? Awareness of the persisting and changing environment (perception) is concurrent with the complementary awareness of the persisting and changing self (proprioception in my extended use of the term). This includes the body and its parts, and all its activities, from locomotion to thought, without any distinction between activities called "mental" and those called "physical." Oneself and one's body exist along with the environment. They are co-perceived. They are inescapable *in* the environment at the place called "here." They exist, but in a radically different fashion from the ecological realities. The two kinds of existence should not be confused. One's nose, hands, feet, heart, and stomach are co-perceived; and so are one's pains and itches and the aftereffects of stimulation (after images and feelings of vertigo); and so are one's ideas, insights, fantasies, dreams, and memories of childhood. But they should not be thought of as constituting a different realm of existence or a different kind of reality than the ecological, nor are they "mental" as against "physical."