

Deep Affordance: Seeing the Self in the World

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Abstract

Affordances, as relational properties between an actor and an object, are here reconsidered. An early account of phenomenal experience is found in the Umwelt theory of Jakob von Uexküll (1934/1992), who also introduces an early discussion of affordances. Phenomenal worlds are found to arise from the union of the discriminatory capabilities, and the potential for action, of an organism. By this account, the epistemological position of a simple cell is not fundamentally different from that of a human: both encounter a world that is drawn in terms that are grounded in the organism's own capabilities for perception/action. This view casts affordances as underwriting all phenomenal experience at all times for all organisms. The term "deep affordance" is suggested to distinguish between this concept, and the shallower sense that 'affordance' is used, e.g. for the purposes of industrial design.

The Umwelt

The notion of an affordance is most closely linked to the tradition of Gibsonian Ecological Psychology, and has found expression within several disciplines. There are many competing definitions, but the essence of the notion is that the capability of an agent to act upon an object defines a relation between the two. A paradigmatic example is a step which is *climbable* precisely in as much as its height stands in a particular relation to the leg length of a climber. Climb-ability is here the affordance of the step for the climber. Those not happy with this brief summary, which ignores efficiencies and numerous other subtleties, need not fret, as the affordance concept will be presented in radically altered fashion in what follows.

The first clear discussion of the affordance concept I am aware of is found in von Uexküll (1934, translation 1959/1989) in his discussion of the phenomenological world of animals:

"How do we manage to see *sitting* in a chair, *drinking* in a cup, *climbing* in a ladder, none of which are given perceptually? In all the objects that we have learned to use, we see the function which we perform with them as surely as we see their shape or color." (1989, p. 358, 1989)

von Uexküll is at pains to point out that the world encountered by each individual agent is a direct function of the sensori-motor capabilities of that animal. In a spirited and poetical treatment, he attempts to do what Thomas Nagel (1974) famously failed to do, and to imagine the world as encountered by a range of animals from ticks to dogs. The phenomenological bubble of a single animal he terms the "Umwelt". Of course the exercise is of limited success, but the logic he applies is sound: he reasons that the perceived world of any organism must arise from the union of the receptor and effector cues (roughly, sensory discriminatory capability and action possibility) available to a specific organism. His best known example is that of a tick hanging on a branch, waiting for a passing mammal. Three stages in the tick's activity are described, each with a specific cue and attendant action, operating in this simplified description essentially as a

finite state automaton: firstly, the tick needs to locate a mammal, which is accomplished by a sensitivity to butyric acid, signalling mammalian skin. This presence of this cue induces the tick to drop from the branch, hopefully landing on the mammal. The tactile shock of landing on the hairy back of the animal extinguishes the olfactory stimulus, and elicits a new action, that of running about. In this stage, the next effective cue is warmth, which elicits boring. His point is not really to elucidate the specifics of the tick life cycle, but to point out that the tick is selectively sensitive to precisely those aspects of the world around it that bear significance to its actions. The combination of stimuli and actions together define the *Umwelt* of the tick. The world the tick encounters and the (same) world upon which the tick acts, form the entire phenomenological world of the tick, and is a direct function of the constitution of the animal itself: the *Umwelt* of the tick is intrinsically meaningful in terms of those functions that sustain the tick.

We might contrast the (from our point of view) impoverished phenomenological world of the tick with that of the human observer, who sees the environment of the tick in tick-independent terms. von Uexküll charmingly describes the phenomenological world of an organism as an enclosing soap bubble, as he goes on to say:

"The fluttering birds, the squirrels leaping from branch to branch, or the cows that browse in the meadows -- all remain permanently surrounded by their soap bubbles, which define their own space. Only when this fact is clearly grasped shall we recognize the soap bubble which encloses each of us as well. Then we shall also see all our fellow men in their individual soap bubbles, which intersect each other smoothly, because they are built up of subjective perceptual signs. There is no space independent of subjects. If we still cling to the fiction of an encompassing universal space, we do so only because this conventional fable facilitates mutual communication." (ibid., p. 339)

and later:

"Whoever denies the existence of subjective realities, has failed to recognize the foundations of his own *Umwelt*." (ibid., p. 383)

He thus alludes to the notion that the world encountered by us, and acted upon by us, might be understandable only in terms that are, in turn, functions of our own constitution. This is a radical suggestion, and I would like to tease it out a little here. It speaks to a long-standing debate that flares up under a variety of guises among different academic communities, as to whether it is coherent to talk of an objective, shared, pre-given world, or whether rather the world encountered in experience is "brought forth" or constructed (Maturana and Varela, 1982).

von Uexküll keenly recognizes that his account, by which the phenomenal world of an organism arises as a direct function of its perceptual and effector systems, demands a recognition of the epistemological specificity of any individual's encounter with the world. This applies in particular to the temporal and spatial scales in which a life is lived and the world encountered. Any sense in which a mountain or galaxy might be considered "big", or an ant or a quark might be considered "small" makes sense only with reference to a spatial frame of reference with a unit size of magnitude comparable to a human, or to the spatial experience of a human. Likewise, to speak of anything at all as being brief or enduring can be considered coherent only if there is a comparator, and in this case it is the order of magnitude of events perceptible to humans. Indeed, when we use the representational tricks of time-lapse or high speed photography to make visible events such as the piercing of the skin of a balloon by a bullet, or the flow of a glacier, what we are doing is rescaling these so that they may be perceived as phenomenal events; pulling them into our own soap bubbles. The temporal and spatial scales that provide our frame of reference in understanding the world we meet are grounded in our own spatial and temporal (or morphological and metabolic) constitution.

The epistemological position of a single cell

The simplest animal considered by von Uexküll is the paramecium. I would like here to consider the simplest of living forms, the prokaryotic cell, and to consider its Umwelt. This example has been used several times lately by authors wishing to point towards a non-anthropocentric view of experience and cognition (ref: Lyon, Thompson). Indeed, prokaryotes, such as E. Coli, are vastly complex organisms, and much of the complexity we can see lies in their collective behavior, rather than in the activity of any single cell. We can simplify radically, however, and consider the role of a chemotactic gradient manifested in a nutrient medium in which such a cell swims. First we provide a sketch of the view from the outside, as human observers.

An E. Coli cell has several thong-like flagellae which act in two modes: they may whip around in an uncoordinated fashion, producing random tumbling behavior, or they may spin in coordinated fashion, leading to directed motion. The likelihood of switching from coordinated behavior to tumbling is inversely proportional to the concentration of nutrient, so that on average, motion will be towards a nutrient source. A slower mechanism adapts to long-term average concentration (van Duijn et al, 2006). The gradient, in turn, is available to the cell only because of its motion through the environment, as it requires sampling at locations separated by distances greater than the length of the cell itself.

Let us now consider the Umwelt of the E. Coli bacterium in this cartoonishly simple sketch. As we have caricatured things here, the world that presents itself to the cell can be described in several complementary ways. I will adopt Scott Kelso's typographic convention here (REF), to relate members of a complementary pair with a squiggle, thus: good~evil is the complementary pair of good and evil. Complementary pairs define each other, as conventionally expressed by the yin and yang symbol. We may interpret the elements as opposites, or we may adopt a more inclusive view that sees them as complementary facets of the same underlying thing.

Perception~Action: These are not the inputs and outputs of some infernal computing device. They stand in no relation as cause and effect, but are, in a very deep sense, complementary notions. In seeing them as opposing notions, as input and output, respectively, we generate the illusion of the spooky middle, or mind, and our metaphysical problems are only just beginning. For the cell, the information that is lawfully related to its movement is the chemical gradient expressed at the membrane surface. This information is only information because of the kind of thing the cell is. It is not particularly privileged information. The gradient just happens to matter to the cell precisely because of its role in the processes that sustain the cell's identity as a cell. As outside observers, we can see both perception (detection of a gradient at the surface) and action (tumbling). But neither stands in the relation of cause to the other's effect. The tumbling is the means by which a gradient is picked up. Action related to perception. The gradient specifies the tumbling behavior. Perception related to action. There is no separation between them, and thus no hidden middle. They stand as lawfully related, in a perpetual state of mutual specification.

Self~Other: And so, in the spirit of von Uexküll, we can venture some epistemological guesses about the experience of the cell. Barring spooky action at a distance, the world encountered by the cell makes its mark, or impinges upon the cell, only at the membrane surface, where the gradient lies. In the simple form we have sketched it here, the gradient is particularly simple. It contains sufficient information to distinguish *this* direction from *that* direction. It doesn't contain or specify any information about the nutrient *qua* nutrient. It merely points in one direction, distinguishing it from its opposite. So the kind of distinction available to the cell is spatial. If the world encountered by the cell is limited to that, we can talk about perceiving a gradient, or, with just a little forced empathy, as sensing a direction. (And the cell might answer, if questioned about its tumbling: "I did it".) But we could also note that the action or

movement of the cell is lawfully related to that gradient. (And so the cell might reply "It was done to me".)

Scaling things back up

The evolutionary distance from a prokaryotic cell to a human is large, but there is a continuity to the relation between perception and action. In the human case, all perception is based upon gradients expressed at sensory surfaces that spatially delimit the domain of organization of the organismic unity from the domain that is its environment. At each and every stage along the evolutionary path from cell to human, perception/action systems make distinctions, and those distinctions that perservere are those that contribute in some way to the continued viability of the lineage of which the organism forms part. The distinctions are of informational value to the organism precisely because of the kind of being that the organism is.

Of course, much happens along the way. Cells give way to multicellular forms of organization. Nervous systems develop that introduce a high degree of complexity or mediation in the perception/action relation. With this complexity, organisms appear to possess a more convincing degree of agency in their actions. It is also to be presumed that a lot of distinctions that get built into perception/action systems do not remain important for the sustained viability of descendents much further down the line. We are quite conscious of such evolutionary junk, for example in the forced link between the sneeze and the eye blink.

Heft (2003) distinguishes clearly between direct experience (or an "aboriginal mode of awareness", p. 151) and conceptual knowledge, that stands at a reflective remove from direct, first-order experience. This distinction has been drawn by many, including James (1912/1976), who sometimes described it as a difference between *percepts* and *concepts*. As humans, it is difficult to ignore the conceptual mediation that clutters our accounts of experience, and to recognize the direct immersion in the world that constitutes present experience. Techniques such as some forms of meditation, or mindfulness training, attempt to highlight this immediate mode of experience and contrast it with the conceptual, often language-like, elements to our mental lives (Varela et al., 1991). By considering the origin of experience in its putatively simplest form, as the manner in which an organism encounters the world in terms predicated upon the constitution of the organism itself, we begin to see that the world presented to us in immediate experience is not at all pre-given, but is generated, or brought-forth, as a result of our capacity for discrimination and our capacity for action.

Affordance reconsidered

The term "affordance" has found favor in a variety of communities. It is useful to designers of computer interfaces and better toothbrushes, as well as metaphysicians. Often, it is useful to bracket some collection of properties that collectively constrain or determine the function of a given object, and this is the relatively shallow sense in which the term is used in the world of industrial design. I wish to argue that the notion has a much deeper sense that needs to be seaprated from this pragmatic usage. Affordance, by the account sketched here, refers to the fundamental co-determination of the phenomenological world of an organism and the capacity of that organism for discrimination and action. If we consider an organism not as an isolated individual with a short life-span, but as part of a continuum of biological development that extends over phylogenetic time back to the single cell, then the world such an organism encounters is, in a very literal sense, written in the language that defines the organism itself. What such a being "sees" is determined by what such a being is. Affordance, then, is not one among many properties that serve to characterize things, or relations between people and things. It is the very principle that underwrites the phenomenal world of an organism. This, I tentatively suggest, is so far removed from the shallow usage of the term, that it might usefully be referred to as "deep affordance".

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