

CONTINUING COMMENTARY

On Stoffregen's Definition of Affordances

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Stoffregen (2003) has proposed a formal definition of *affordances* as emergent or relational properties of animal–environment systems. This definition contrasts with Turvey's (1992) formal definition of affordances as properties of the environment. In this commentary, my purpose is not to take sides on this issue but instead to bring to light what I believe to be a crucial flaw in Stoffregen's definition. Specifically, I show that Stoffregen's definition places no constraint on which relational or emergent properties legitimately deserve to be counted as affordances, thus allowing any relational property that can be predicated of an animal–environment system to be considered as an affordance. As such, Stoffregen's definition lacks any substantive linkage to the "opportunity for action" notion that has accounted for the scientific utility of the concept to date, a linkage I suggest should be preserved in any definition of affordances.

Stoffregen (2000a, 2000b) is a proponent of the view that affordances are relational or emergent properties of animal–environment systems as opposed to properties of an animal's environment; he is not alone in this regard, as others have also written as if they also viewed affordances in a relational light (e.g., Chemero, 2003; Kirlik, 1995; Kirlik, Miller, & Jagacinski, 1993; Warren, 1984). Until recently, however, the only formal definition of affordances has been that proposed by Turvey (1992), which is explicitly based on an ontological perspective that affordances are properties of an environment. As such, Stoffregen (2003) put forth a formal alternative to

Turvey's definition, one explicitly based on an ontological perspective that affordances are relational or emergent properties of animal–environment systems.

STOFFREGEN'S PROPOSAL

Using the term *higher order property* to mean a relational or emergent property of the animal–environment system, Stoffregen's (2003) proposed "definition of affordance" goes as follows:

Let W_{pq} (e.g., a person-climbing-stairs system) = (X_p, Z_q) be composed of different things Z (e.g., person) and X (e.g., stairs).

Let p be a property of X and q be a property of Z .

The relation between p and q , p/q , defines a higher order property (i.e., a property of the animal–environment system), h .

Then h is said to be an affordance of W_{pq} if and only if

- (i) $W_{pq} = (X_p, Z_q)$ possesses h
- (ii) Neither Z nor X possesses h . (p. 123)

It is not difficult to see what Stoffregen (2003) has in mind here. As Stoffregen elaborates: "Affordances are opportunities for action; they are properties of the animal–environment system that determine what can be done" (p. 124). In the example embedded in Stoffregen's formal definition, the emergent property h would be the climbability of the stairs for a particular person, which arises out of a particular relation existing between properties of the stairs (riser height) and properties of the person (leg length; Warren, 1984). To be more specific, Stoffregen elaborated:

The dynamics of animal locomotion are influenced by the dynamics of the surface of support, and vice versa. The result is that there are dynamics that are unique to "this animal if it climbed these stairs" or "this animal when climbing these stairs," but that do not inhere in either the animal or the stair. The dynamics of the animal–environment system are an emergent property and, as such, cannot be identified in the dynamics of the animal or in the dynamics of the environment. (p. 124)

In addition, Stoffregen goes on to reinforce that his "opportunity for action" notion need not be limited solely to biomechanical properties:

Any property of an animal can bear a relation to some property of the environment that gives rise to an affordance, including biomechanical properties, such as leg length, and other types of properties, such as strength and flexibility. (p. 125)

In this spirit, Stoffregen goes on to illustrate his formal definition in terms of affordances for pedestrians crossing roads (Lee, Young, & McLaughlin, 1984),

which reference temporal properties, and affordances for object grasping (Cesari & Newell, 2002), which reference properties such as size and mass.

ANY PROPERTY?

The feature of Stoffregen's (2003) formal definition of affordances that leads to trouble, in my opinion, is hinted at by his previously cited claim that "any property of an animal can bear a relation to some property of the environment that gives rise to an affordance" (p. 125). This statement, as it stands, might be unobjectionable as an attempt to demonstrate that the proposed definition is broad and does not rule any properties out that give rise to an affordance. The line of argument seems to be, "Show me an affordance, and I can show you that the proposed formal definition of affordances can handle it"; that is, that properties p and q in the definition are completely unconstrained. Although this lack of constraint may well serve this particular purpose, in my view, this lack of constraint is also the source of serious problems for Stoffregen's proposal.

The problem, as indicated by the preceding quotation, is that Stoffregen (2003) does appear to want to (and I will suggest, he must) place some constraints on the selection of properties p and q , but he appears to want to let the phrase "that gives rise to affordance" do this work for him. However, this tactic would lead to circularity in Stoffregen's definition: A formal definition such as he has proposed cannot make an intuitive appeal to the nature of affordances as opportunities for action in the selection of properties p and q . Rather, in such a definition, one should be able to pick these properties subject to any constraint provided by the definition, and the emergent or relational property h that results had better well be an affordance. That is, h had better satisfy Stoffregen's own criteria that "affordances are opportunities for action; they are properties of the animal–environment system that determine what can be done" (p. 124).

Because we are not required to let this informal notion of what affordances are guide us in the selection of properties p and q in the formal definition, trouble arises. For example, let environmental property p (e.g., of a staircase) be "was shipped to the United States from a British cathedral in 1894" and let property q (of a person) be "had diphtheria as a baby." Using Stoffregen's (2003) definition, whatever the emergent or relational property h turns out to be in this case (perhaps, "a person who had diphtheria as a child is now climbing stairs that were shipped to the United States from a British cathedral in 1894") hardly seems to be *constitutive* of the existence of an affordance. Properties p and q in this case appear to bear only an accidental rather than essential relation to climbability in this case or to the "opportunity for action" notion Stoffregen (2003) has elsewhere agreed to be central to the nature of an affordance.

One reply to this critique, heroic though it may be, would be to bite the bullet and claim that the preceding example does indeed constitute an affordance, as we do

have a case wherein a person is indeed exploiting an environmental opportunity for action. One problem with this response is that it fails to embrace the idea that any formal definition of a currently vague and debate-ridden scientific term such as *affordance* will succeed to the extent that it serves the empirical process of scientific discovery, that is, that it proves useful. To my mind at least, any such definition should, for example, serve a heuristic role in the discovery of actual properties p and q that do in fact give rise to opportunities for action for various animals. Any definition that places no constraints on selection or discovery of these properties is clearly incapable of providing such heuristic guidance.

Finally, even if one was to bite the bullet in this particular case, it is possible to find truly absurd examples that satisfy Stoffregen's (2003) definition due to the fact that the definition does not even require that properties p and q come into any sort of spatiotemporal contact. For example, let property p (e.g., of Cleveland Browns Stadium) be "has a capacity of 70,000 fans for football" and let property q (e.g., of a person) be "is now sitting in San Diego." Because the proposed formal definition of affordances places no constraint on the nature of the system W_{pq} , as unusual as it may be to consider, a person sitting in San Diego and Cleveland Browns Stadium can indeed be considered to constitute a legitimate system. This arises because as with the selection of properties p and q , the proposed definition places no constraints on the selection of the two different "things" Z and X as system components. My own tendency is to believe that "things" Z and X and properties p and q in this case give rise to no actual affordances at all. My suspicion is that this problem is one reason that Turvey (1992) introduced the notion of a "joining" or "juxtaposition" operator in his own formal definition. An opportunity for action had better be a real opportunity for interaction.

CONCLUSIONS

Although the Stoffregen (2003) article is noteworthy and valuable in many respects, I am not convinced that the formal definition of affordances provided there will play a fruitful role in the advancement of ecological psychology as a scientific discipline. The only manner in which I believe the definition can be used fruitfully is if one initially restricts the selection of systems (animal–environment interactions) and their relevant properties p and q to those in which one has prior reason to believe an affordance exists. This selection would then be based on a predefinitional, intuitive notion of affordances as opportunities for action. In such a case, the proposed, formal definition is circular. When this constraint on system and property selection is not met, the definition provides no analytical or heuristic guidance, as it allows for any relational property, however arbitrary, that can be predicated of an animal–environment system to be considered an affordance. This would have the unfortunate result of cutting any ties that exist between the intuitive—and to some degree scientific productive—conception of affordances as opportunities for action

and their formal definition. This is not a result with which ecological psychology should be content.

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