

**The Demise of the Good Old Days:
Consequences of Stoffregen's
Concept of Information**

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Stoffregen's essay on multiple specification is just the sort of response I had hoped my prior note would elicit. His arguments seem to me to be consistent with the key ideas of the ecological approach and are presented in a compelling fashion.

His central point is that information lies not in the rather local patterns to which we ecological psychologists usually refer (e.g. visual tau and body proportions). Rather, the pattern which specifies an event or affordance consists of a whole complex of co-ordinated patterns across the arrays of all relevant perceptual modalities. Stoffregen's discussions of perception of age and collision are compelling. He shows that the absence of what I took to be a redundant

source of information and what I suppose to be a conflict between sources of information are, at the higher level of abstraction on which he insists, actually cases in which there is unitary information for some *different* event.

In a way Stoffregen's arguments are not really new: The pieces have been discussed for years. However they have not, to my knowledge, been pulled together before so as to make so clear that relatively low level invariants just won't do as information. Many of us, including yours truly, have discussed our research results in terms of redundant information. These comments are clearly inconsistent with Stoffregen's formulation of the concept of information.

If we take his analysis of the concept very strictly it has extremely strong consequences for the meaning of our research to date and for the future conduct of ecological studies. Below I sketch out some (surely not all) of these implications.

The Good Old Days

Ecological research has, in a way, been rather easy to do so far. Using physics and mathematics we first document the availability of information by showing that there is *an* invariant in *an* array which corresponds to a perceivable aspect of the environment. We then demonstrate pickup of that information by showing that measures of perception and/or action follow the values of that information, that distortions of the invariant result in distorted perception, etc. If we take Stoffregen's argument seriously the good old days are over. Research in going to become much different and much more difficult.

Implications for Documenting Availability of Information

Researchers will now face a formidable task in the analysis of the information for the particular events in which they are interested. For example, in the case of human growth, merely showing that cardioid strain captures the pattern of growth would not have been sufficient. Rather we would have needed a) to find the patterns of change of the head, of body proportions, skin texture, etc. and b) specify how all those "components" are temporally co-ordinated. Thus the first consequence of Stoffregen's position is one of practicality. The task of documenting the real information for an event may be so difficult that researchers won't often be willing to complete it.

A second problem arises. In an analysis of the information for a particular event how could the researcher ever know that the complete intermodal invariant had been discovered? This problem does not seem to me to be one of those objections which, while

logically possible, are unimportant in actual practice. (For example, recall that bizarre control condition some journal referee wanted you to include.) I expect that obscure and unexpected invariants abound in everyday events. Consider growth again. Most parents will have noticed that there is an olfactory consequence of growth: Babies smell different from adults and preschoolers smell different from both. Metabolism and diet changes are as inevitable during growth as are changes in body proportions. However, how many researchers interested in perception of growth would have thought to include an analysis of the chemicals on people's skin? Together, these two problems suggest that we may be doomed to producing analyses of information which are incomplete to some unknown degree. Moreover, the informational analyses we have done to date (time - to - collision, growth, etc.) are clearly incomplete according to Stoffregen's formulation.

Implications for Demonstration of Pickup of Information

Let us assume that information lies in the multimodal complexes postulated by Stoffregen. Surely ecological psychologists must suppose that perceivers detect this information. Our research must therefore involve tests of perception with the information available in its entirety. Several issues arise from this position.

First, what shall we now make of the studies we have already completed? It all involves studies of incomplete information. I certainly do not claim that our old work now must be relegated to the status of peephole and tachistoscope studies. However, we have, by artifice, made information unavailable and then assessed the resulting perceptual performance.

Second, we must test whether or not people do, in fact, use the rich intermodal information. This is very important to our theory. However, we no longer can say we have demonstrated that observers actually detect it.

Third, will we really be able to do such tests? Even if we can get around the problems in the analysis of information discussed earlier, it's going to be very difficult to produce controlled displays incorporating the auditory, visual, olfactory, etc. aspects of the information for an event.

Finally, suppose that observers fairly often fail to use the sort of information which Stoffregen postulates as the only information there actually is. By "fairly often" I mean sufficiently frequently and in a wide enough variety of events that we cannot dismiss them as unimportant to theory. I personally suspect

that such failures are quite common. Should they occur, we have several puzzles to solve. First, must we then revise ecological theory to encompass failures to use available information? Second, don't the concerns I raised in my first essay come back again, though in a different form? We couldn't talk about multiple or redundant sorts of information: Auditory and visual tau, etc. aren't any longer themselves information. However, if they are used, we'd need to be concerned with questions of their redundancy, how they can be used in combination, etc.

Conclusion

Stoffregen provides a compelling argument for uniqueness of information by appealing to intermodal invariants. While this avoids the problems raised by the possibility of multiple invariants for a given event, a variety of new problems arise. To summarize the source of the problems in a somewhat inflammatory nutshell: Stoffregen's analysis makes the local invariants which we have so far studied rather like cues. That is, they are not really unique to a given event and cannot, in isolation, serve as information for perception of the environment. If Stoffregen is correct, we need to reinterpret the meaning of our old research and deeply rethink our plans for future studies.

On the other hand, I am still convinced that local invariants will have an important place in the ecological approach to perception and action. Stoffregen's analysis will, however, force us to clarify our understanding of the concepts of invariance, specification, and information. This task is urgent for two reasons. First, we are already performing studies of multiple local invariants (eg. auditory and visual information for control of the bounce pass) and of patterns which do not precisely correspond to the relevant property of the environment (eg. visual tau for accelerating objects). Second, our critics have raised questions about uniqueness for years. Their points need to be addressed more effectively. Have we any volunteers?