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DISPOSITIONING AND THE SCIENCES OF COMPLEXITY

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ABSTRACT: Field and Hineline use the term *dispositioning* to refer to the tendency to privilege spatially and temporally local entities in psychological explanation. In our commentary we offer reasons for agreeing with their claim that dispositioning is overly prevalent and should be avoided. Drawing on lessons from the sciences of complexity and the ecological approach to perception and action, we suggest some directions for a new approach to explanation in psychology and in science generally.
Key words: explanation, complexity, ecological psychology

In their article, Field and Hineline (2008) offer a critique of what they call *dispositioning* and the role that it plays in psychological explanation. Briefly, what they term "dispositioning" is explanatory appeal to essences rather than to contexts—the privileging of intrinsic qualities as responsible for behavior. Their thesis is that, methodologically and ontologically, both folk psychology and scientific psychology are dependent on dispositional terms, and that this dependency arises from thoroughgoing but frequently unarticulated convictions about the nature of causation. Because of the deeply entrenched assumption that causes must be spatially and temporally local to effects, the role of context is severely restricted and, in its place, local entities or intrinsic qualities (i.e., dispositions) carry the weight of psychological explanations.

Field and Hineline offer extensive evidence drawn from the psychological literature, especially as it concerns explaining behavior (i.e., reasons for actions) to support their claims. Many of their examples concern the attribution of causal force to, for instance, a person's nature rather than to their circumstances, and the attendant problems for both science and society. Their worries are well taken; if an intrinsic and perhaps unalterable quality is posited, then the possibilities for achieving alternate outcomes are restricted. More than simply pointing out the prevalence of this stance in psychological explanation, they argue that this attributional tendency has its roots in assumptions about causation.

We share Field and Hineline's assessment that both scientific and lay explanations and theories rely heavily on a notion of cause as linear and local; action-at-a-distance theories are often criticized or supplanted by theories that posit

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intervening media or other entities. Examples include such abandoned theories as the luminiferous ether, but also include modern successes such as general relativity, which explains gravity as a consequence of local deformations of a continuous spacetime rather than a force that acts over distances (see Geroch, 1978). What concerns Field and Hineline is that such mediating entities are sought as an end unto themselves without regard for their theoretical appropriateness. They are meant to preserve spatially local causes in scientific theories, but perhaps of even more concern are attempts to preserve temporally local causation. Because of the assumption that causes must be temporally as well as spatially proximal to effects, understanding how temporally distal events affect current states of affairs requires the existence of intervening entities that persist across the time scale in question. In other words, if an event in childhood is invoked as an explanation for the behavior of an adult, it is, in virtue of the antecedent event, affecting something like personality—an entity posited and reified for reasons having more to do with saving the underlying concept of cause than with any other type of explanatory utility.

The phenomenon (which is perhaps too unconscious to be labeled an explanatory strategy) that Field and Hineline assert rests on assumptions about cause seems further to rest on assumptions about events. A cause must be temporally local to its effect, and temporally distal events cannot be considered legitimate causes in the absence of some intervening entity. Further, it seems that intertwined with this chain of thought is the idea that an event cannot persist for an arbitrarily long period of time. Rather, there seems to be another (also unarticulated) assumption about the proper duration of an event. In all, the picture of standard explanatory schemes that Field and Hineline paint is one limited to contiguous, local causation events with restricted and nonarbitrary duration and an ontological inventory of theoretical constructs to make up for the first two (see Pattee, 2000). This constellation of deeply held but too-frequently unexamined beliefs informs psychological explanation as Field and Hineline illustrate, but it is also responsible for restricting what counts as explanation in science generally.

Field and Hineline call for a conscious avoidance of crafting theories informed by these beliefs. They are not alone in either recognizing the trap that these assumptions lay or in attempting to seek a different strategy for investigation and explanation (see, for example, Gottlieb, 1997 and Miller, 2009 on development and Ulanowicz, 1997 on ecology). The issues they raise are also central to those concerned with the sciences of self-organization and complexity, or with applying the findings thereof. In the past few decades "self-organization" and "complexity" have grown substantially in popularity both as topics of research proper (Camazine, Deneubourg, Franks, et. al., 2001; Kelso, 1995) and as subjects of scientific (Kauffman, 1993; Yates, 1987), engineering (Prokopenko, 2007) and philosophical (Bickhard, 2008; Chemero, 2009; Juarerro, 1999; McClamrock, 2008; Petrusz, 2008) discussion. Scientists working in areas that fall under one or the other heading have produced a convincing body of data and a range of practical applications, but the theories sitting behind the phenomena are still generally subject to comparison against conceptual frameworks built on the assumptions criticized by Field and Hineline. On the one hand, each successful result seems to make the perspective advocated by Field and Hineline more appealing. On the other hand, no collection of results is sufficient if they do not serve to fuel criticism of the dispositioning assumptions that are still pervasive in much scientifically-based explanation. For the remainder of the paper we will offer some examples from these disciplines and consider how the criticisms of Field and Hineline can inform them.

The label “self-organizing” applies to those systems whose organization and behavior is a consequence not of outside control applied to the system, but of the dynamics of the system itself. Well-known examples include the slime mold, Benard convection, and the Belousov-Zhabotinsky reaction (Goodwin, 1994). In each of these cases the system is sensitive to its surroundings (context-dependency). As a particular aspect of the surroundings changes (usually some kind of energy gradient), the behavior of the system responds with changes of its own. However, the degree of change in a system is not always concomitant with the degree of change in the surrounds; there are nonlinearities at certain critical points characteristic of the system. At these critical points, the behavior of the system will change radically, exhibiting novel organizations and behaviors. These novel behaviors are not arbitrary—though their form cannot be predicted prior to the first observation, a given system will reliably exhibit the same patterns of organization at the same critical values of the relevant quantity (Nicolis, 1989).

These characteristics of self-organizing systems (context-sensitivity, exhibition of novel but nonarbitrary organizations, nonlinearities between inputs and outcomes) are possessed by complex systems in general. Aside from the examples mentioned above, complex systems science covers phenomena in a wide range of disciplines. Physics, chemistry, biology, ecology, psychology, computer science, and robotics all have lines of research that use the vocabulary of complex systems (e.g., Guastello, Koopmans, & Pincus, 2009; Lehn, 2002; Prokopenko, 2007; Ulanowicz, 1997; Yates, 1987). Field and Hineline make the point that psychological explanation is fraught with dispositioning tendencies to the extent that explanations that feature context sensitivity and spatially or temporally distant causes are frequently not even entertained. But it is not only explanation in psychology where a frontier between dispositional and nondispositional strategies exists. The dialogue also exists in any discipline wherein phenomena described as “self-organizing” or “emergent” are found, and the lessons from these encounters are, in turn, applicable to psychology.

The study of self-organization places a scientific emphasis on aggregate systems that exhibit novel behavior that is not predictable from component behavior and which have very many components that interact. Prior to this framework, the primary explanatory problem for such systems had been to acquire knowledge of the properties of the components sufficient to predict and, in some cases, govern the outcomes of their actions and interactions. If this is taken to be the central issue, then the biggest problems are gaining sufficiently detailed knowledge of the component properties in question—which could be arbitrarily many or arbitrarily difficult to measure—and then using that knowledge for prediction and control. Crucially, what is missing from this overall strategy is a concern for gaining knowledge about the contexts or histories of the components, or about systems as a whole. All the emphasis is placed on knowledge of the properties possessed by the entities in question. Such a strategy implicitly weights the ontology of explanation in favor of entities and properties rather than on dynamics and interactions. The addition of each entity in an aggregate is taken to be an additional demand for prediction and control, and aggregate behavior can be determined only probabilistically.

The characteristics of complex systems are different. Number of components is still important, but each additional component does not add one component's worth of complication. Rather, there are nonlinearities associated with number of components or with the value of some other quantity associated with the system. The context in which the system is embedded is, in some cases, more valuable to explanation than knowledge of component properties. Most importantly, the weight of explanation is carried by the dynamics of the system's behavior rather than by the system's properties.

Although it seems like much explanatory ground is ceded by acknowledging that emergent properties may not be predictable in advance of their observation, important insights have also been gained. In the first place, the study of self-organizing systems shows that detailed knowledge of component properties is not necessary for characterization of a system as a whole. Rather, because complex, self-organizing systems exhibit a reliable range of behaviors at reliable values of certain parameters associated with the system, identification of the collective variable that expresses the organization and knowledge of the critical values of the important control parameters that change the collective variable is all that is necessary for description of the system. As noted above, a complex system will switch to new organizations reliably. Although the exact behavior that emerges at a critical point may not be predictable, the system will continue to switch to specific behaviors at specific values of relevant parameters. Moreover, even when multiple behaviors are seemingly available to a system, few turn out to be real possibilities. In consequence, the space of explanation is much smaller than might be supposed from a strategy that emphasizes the role of components.

In the realm of psychology, ecological psychology (Gibson, 1979; Shaw, 2003) in particular distances itself from "dispositioning." It does so by virtue of its goals and its affinity with the sciences of complexity. With respect to pursuing an understanding of perception and behavior Gibson's ecological psychology promotes (a) the system of organism and its environment as the proper domain for theory and analysis, (b) law-based alternatives to explanations *sui generis* (e.g., special dispositional, computational, or neural mechanisms), and (c) the development of an ontology geared to nature's ecological scale to replace the ontology that underwrites Newtonian physics (Turvey, 2008). The physics and mathematics of systems that self-organize have provided a conceptual framework for furthering the promoted goals (e.g., Chemero, 2009; Kelso, 1995; Kugler & Turvey, 1987; Richardson, Shockley, Fajen, et. al., 2008; Swenson & Turvey, 1991; Van Orden, Holden, & Turvey, 2003; Warren, 2006). We envisage the theoretical and empirical successes to date (represented in the cited articles) as spadework for a new methodology whose products will be more in line with the type of explanation Field and Hineline advocate.

Field and Hineline assert that the approach they criticize is common because it is entrenched, with an ancestry that traces back at least to Hume. Certainly some of the story lies in historical reasons, informed by the trajectory of scientific development, but it also lies in the usefulness of acting as though only proximal causes matter (Pattee, 2000), or acting as though there are consistent entities inside people that cause them to reliably act in certain ways on separate occasions. Without such heuristics, reliability of outcome might seem miraculous because so many things could be possible. But the important lessons from the sciences of complexity are that (a) while context matters, not just any context matters, and (b) the determinants of system organization are rarely local, rarely focal, and rarely low dimensional. What counts must be discovered rather than extrapolated. And while outcomes may be unpredictable in the strictest sense of scientific prediction, not just any outcome is possible. There are still constraints on processes and on expectations, such that neither scientific nor everyday explanatory endeavors are intractable under the new strategy.

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