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Inter- and En- activism: Some thoughts and comparisons☆

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ABSTRACT

Interactivism and enactivism spring from some similar insights and intuitions. There are, however, some arguably significant divergences, and I will explore a few of the important similarities and differences. Topics addressed include the basic notions of how cognition and mind emerge in living systems; how growth, learning, development, and adaptation can be modeled within the basic frameworks; and how phenomenological investigations can be taken into account and their phenomena modeled.

1. Introduction

Interactivism and enactivism began in roughly the same time period (1970 ± a few years) and with similar, though also significantly different, insights.[1] They have diverged, however, in significant ways. I outline some of the significant aspects of the interactivist model, discuss some important convergences between the two frameworks, and address divergences and criticisms.

2. The interactivist model

2.1. Cognition and living systems

Among the more important initial similarities between the interactivist model and enactivism was that both recognized cognition as an intrinsic realm of properties of living systems. This is embedded in the definition of autopoiesis,[2] and is explicit in, e.g.,: "knowing as explicated above is an intrinsic characteristic of any living system" (Bickhard, 1973, p. 8; also in Bickhard, 1980a, p. 68).[3]

In fact, it is the central insight for both frameworks, though it is not made explicit in the same modeling definitions and it has not always been developed in parallel ways.

2.1.1. Intrinsically open interactive systems

For the interactivist model, cognition and life are intrinsically connected because cognition emerges in intrinsically open interactive systems, and living systems are intrinsically open and interactive. Such systems were originally modeled using the language of abstract machine theory:

> Consider two Moore machines [abstract finite state machines with outputs] arranged so that the outputs of each one serve as the inputs of the other. Consider one of the Moore machines as a system and the other as its environment, and let the system

☆ Thanks to Tom Froese and David Eck for comments on an earlier draft. This paper is a descendent of a talk with the same title given at the 2015 Interactivist Summer Institute (Bickhard, 2015b).

[1] The domain of enactivism has become importantly variegated over the course of its history. In this discussion, I focus primarily on the Maturana-Varela-San Sebastian clade. It should be noted that at times the interactivist model is itself considered to be a variant of enactivism. This is partially justified in terms of similarities in initial beginnings and some later convergences, but it is historically not correct.

[2] See also Froese, Virgo, and Ikegami (2011).

[3] Interactivism is an action-based framework. Any action-based approach to cognition, such as Jean Piaget's, necessarily has strong connections with living systems: it is living systems that act. Autopoiesis is not fundamentally action-based — its focus is internal closure rather than interactions with an environment — but it shares in this insight nevertheless.

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have the initial and final state selections that make it a recognizer.

The system can thus recognize input strings in the standard sense in automata theory [a recognizer "recognizes" strings of inputs that move it from its initial state to one of its final states]. In this interactive configuration, however, an input string corresponds to — is generated by — a state transition sequence in the environment. The set of recognizable input strings thus corresponds to the particular set of state sequences in the environment that could generate them. The recognition, or knowing, relationship is thus extended from inputs to situations and conditions in the environment.

Furthermore, during an interaction, the environment is receiving outputs from the system — and it is these outputs from the system that induce the environmental state transitions that generate the inputs to the system that the system either recognizes or doesn't. Thus the 'recognition' process is no longer strictly passive — the 'recognized' strings are induced from the environment by the system's own outputs. In fact, the interaction doesn't need to be viewed as a recognition process at all. It is equally as much a construction or transformation process — constructing the situations and conditions corresponding to the last state of a 'recognizable' environmental state sequence — or at least a detection process — detecting an initial state of a 'recognizable' environmental state sequence — and so on.

The system need not be thought of as a single undifferentiated recognizer. It could be, for example, a collection of recognizers connected to each other, say, with the final states of one attached to the initial state of another. Such connections could induce functional relationships among the recognizers, such as one testing for the appropriate conditions for another to begin, or a servomechanism being used to create a subcondition for another process to proceed, etc. (Bickhard, 1973, pp. 21–22; also in Bickhard, 1980a, pp. 75–76).

There have been several important additions to this framework since then. One was the recognition that indications of the potentialities of further interactions could constitute 'anticipations' with truth values, thus could constitute representation (Bickhard, 1980b). Another was moving beyond abstract machine theory into dynamic systems theory because abstract machine theory cannot capture essential properties of timing (Bickhard & Richie, 1983). Yet another was elaborating a model of emergence, and particularly normative emergence, in certain kinds of (dynamic) far-from-equilibrium systems (Bickhard, 1993, 2009a; Campbell, 2011, 2015).

The result has been a framework (Bickhard, 2009b) for modeling multiple and multifarious biological, psychological, developmental, and social phenomena, including language and sociality per se (Bickhard, 2008, 2009a, 2013). What gives it such wide scope is the interactive open system framework with which the programme began.

2.2. Representational normative emergence

Some of the most important differences between the interactivist framework and the enactivist framework concern representational normative emergence, and experience. Here is a more systematic overview of the interactivist models of such phenomena. I will first address representational normative emergence, and do so in reverse order:

First, an account of metaphysical emergence.

Second, an account of normative emergence.

And third, an account of the emergence of representational normativity.

I will not develop the arguments in full — they are presented in greater detail elsewhere (e.g., Bickhard, 2009a, 2015a,b,c,d; Campbell, 2011, 2015) — but will show the basic architecture of the arguments and models, and give a fundamental sense of their content.

2.2.1. Emergence

The intuition of emergence is that differing organization (especially, new organization) can yield differing (causal) influences on the world. If causal influence is assumed to be a property only of particles, or other entities or substances, this is a difficult intuition to accommodate — organization is neither a particle, nor an entity, nor a substance, thus, just does not seem to be a candidate for having *any* kind of causal power of its own.[4]

But, if the world is constituted as processes, perhaps as quantum field processes, then organization cannot be precluded from having "causal" influence on the world[5]: Processes are inherently organized, and whatever influences they have on the world necessarily depend on those organizations. To delegitimate organization as a locus of influence on the world is to empty the world of any kind of causal power.

So, a process metaphysics makes emergence a natural kind of phenomenon, because processes necessarily involve the organizational properties that underlie emergence.

Are there reasons to accept a process metaphysics, other than this nice rescue of emergence?

Here are some: 1) A world composed only of point particles would be a world in which nothing ever happens, because point particles have zero probability of ever encountering each other. 2) A world composed of point particles that interact via fields (such as electromagnetic or gravitational fields) already requires the fields, thus requires that their organization have genuine causal influence. 3) According to our best physics, *there are no particles* — what are called particles in contemporary parlance are quantized excitations in quantum fields (Cao, 1999; Halvorson & Clifton, 2002; Hobson, 2013; Huggett, 2000; Weinberg, 1977, 1995; Zee, 2003). Such excitations are quantized in the same sense in which the number of wavelengths in a vibrating guitar string is quantized — and there are no guitar sound particles any more than there are quantum field particles (Bickhard, 2009a; Campbell, 2015).

So, there are good reasons to accept a process metaphysics, and in a process metaphysics emergence is no longer mysterious and no

[4] Kim (1993) argues, for example, that new configurations can manifest new causal *regularities*, but that the causal power resides only with the basic particles (see also Bickhard, 2015a). I argue that this and Kim's better known arguments against emergence (e.g., pre-emption) beg the question. They beg the question precisely in assuming that, most fundamentally, everything consists of particles. Such a metaphysics intrinsically excludes organization from being even a candidate for having causal influence (Bickhard, 2009a).

[5] I put "causal" in scare quotes because ultimately there isn't any unitary kind of relation in the world that answers to the notion of cause (Bickhard, 2011). There are multiple sorts of influence ranging from quantum field couplings to billiard ball collisions to orders from an army commander, and so on. And quantum field couplings cannot themselves model cause because such couplings are forms of influence among quantum processes that are continuous with space and time: they are not relations between events or objects.