A Challenge to Constructivism:
Internal and External Sources of Constructive Constraint.

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Abstract

Constructivism is forced by any action based model of individual cognition, and action based cognitive models are the only viable kind, in spite of the continued dominance of information processing and innatist models. Constructivist models, however, must ultimately address a number of issues that are internal to the constructivist framework. Piaget, of course, has explored issues of constructivism as deeply or more deeply than anyone else, and Becker's paper (this issue) has highlighted some important interrelated issues within the Piagetian framework. In particular, what is the relationship between construction that is guided by interactions with the environment and construction that is guided internally by relationships with other constructions. In this commentary, I elaborate on this issue, and offer some thoughts on its resolution.

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Models of representation as being impressed by the environment into a passive mind have been dominant in Western thought since at least the signet rings pressing into wax of Plato and Aristotle (Bickhard, in press-a). Contemporary models of light being "transduced" into encoded representations in the retina involve at best a merely a technological update of the metaphor. They contain not one iota of conceptual advance regarding how any such process is possible. In one sense, this should not be surprising, because such models suffer inevitable fatal problems (Bickhard, in press-b), but, historically, alternatives have been absent.

Peirce, however, introduced an action framework for understanding mind, and this new Pragmatist perspective has been developed most thoroughly in psychology by Piaget, with the historical path of influence from Peirce and James to Baldwin to Piaget. If we assume that representation is some sort of copy of, or correspondence with, the world, then we may (still) be tempted by models of the world impressing itself into a passive mind, but there is no such temptation to assume that the world can impress a competent action system into a passive mind. Action systems bear no particular structural or atomistic correspondence with the environmental conditions with which they are competent to interact. Signet rings in wax, and all more modern equivalents, are inconsistent with any action based approach to cognition. Action systems must be constructed.

Furthermore, unless this construction is somehow prescient, those constructions must be tentative and subject to error, and, therefore subject to error correction. Action approaches to cognition must involve an evolutionary epistemology (Campbell, 1974). Details must be elaborated — for perception, for example (Bickhard, 1992; O'Regan & Noë, 2001), and heuristic problem solving and learning, for another example, requires additional more complex architecture (Bickhard & Campbell, 1996) — but all such further considerations must fit within a framework of constructivist variation and selection processes.

Piaget's notion of scheme began as a description of the organization of task competencies, and then became an explanation of those competencies — the internal locus of control of organism interactions (Campbell & Bickhard, 1986). Schemes must be constructed (though Piaget maintained an unfortunate resistance to variation and selection constructivism [Bickhard, 1988]). Clearly, this constructive process must be in some sense guided by successes and failures of interactions that are controlled by the scheme as it has been constructed at any given point in time.

But schemes are not tracings in a passive mind — are not forms pressed from a signet ring — they are organizations of an active interacting mind. That is, a pragmatist orientation to cognition not only forces a model of the organism interacting with its environment, not just passively perceiving its environment, it also forces the modeling constraint that that mind must be active in at least two senses: 1) it must guide those external interactions, and 2) it must engage in internal processes to bring those internal schematic organizations to bear on *appropriate* environmental interactions (interacting with a ball as if it were a key might be a somewhat odd form of play, but it won't open the door).

This second modeling constraint, in turn, itself has two components: 1) the schematic competencies must be constructively learned or developed, and 2) they must be deployed in appropriate situations. That is, Piagetian schemes are not only guides for environmental interactions, they are also themselves activities: they are internal processes, not just static controls of interactive process. Furthermore, they must not only be constructed in learning and development, they must also be made available in the moment as appropriate to the interactive situation of that moment.

At this point, if not before, we encounter deleterious mental habits of thought that inevitably leak into anyone's thinking in the current age from the ubiquitous computer models and metaphors. In a computer, the activity that is controlled is the activity of the central processing unit(s). This control is guided by the program that is currently being executed as stored in the memory. Relevant parts of the program are retrieved from memory and used to set-up the central processing registers to engage in some form of processing, perhaps a fixed point add, perhaps a floating point multiply, perhaps a

Boolean exclusive OR. The appropriateness of the way in which the processing is set-up is controlled by the overall control flow of the program: if it works well, it will set-up the processing unit to do the right kinds of things in the right kinds of circumstances. If the program logic is in error, that control flow will initiate the wrong set-up, the central processing unit will engage in inappropriate activity for the task at hand (and possibly will attempt impossible activity, such as a division by zero), and the program will not work.

In an organism, the *failure* of interactive activity is intrinsic to the organism itself. This is not the case in a computer: the failure of the program is only relative to the programmer's or user's goals. In an organism, there is feedback from interactive failure to the specifics of the schematic guides for that interaction; there is selection against such a guide, such a scheme, that has produced an error. Again, this is not the case in a computer: such feedback does exist, but only via the programmer recognizing the failure and attempting to correct the code that produced it.

Crudely, then, the mind incorporates its own programmer, both in the normative sense of having criteria for and the ability to (fallibly) detect error, and in the sense of attempting corrective alterations to the schematic guides of interactions that encounter error. This is crude in multiple ways: the mind is not discrete; the mind is massively concurrent and in parallel; the normativities of the mind are intrinsic and are themselves central domains of learning and development, and there is nothing in the computer metaphor that can begin to capture such normative phenomena (Bickhard & Terveen, 1995); and so on. Nevertheless, comparison with the computer model helps to emphasize that the sense in which schemes guide interactive processes with the environment is not the same sense as that in which schemes are themselves activities, and neither one is the same as the processes by which schemes are constructed or are made available ("activated" is sometimes the term used, though what that should mean is seldom clear).

It is clear that schemes are constructed and that that construction is at least in part guided by selections from interactive failure. But, if schemes are themselves internal activities, themselves internally constructed and internally "activated", and if mental activities are massively concurrent and in parallel, the possibility is opened up that

schemes might perhaps act on each other. Piaget clearly assumes that they do, and it is the nature of the *guidance* of that internal inter-activity that Becker's paper focuses on, and, thereby, highlights the issue of the nature of that activity *per se* — the issue that I am focusing on.

The problem is that the interactions between schemes cannot be the same sort of activity as the interactions with the environment that schemes guide. But, what then is it? The problem might perhaps be taken as perplexing — after all, computer programs do not relevantly interact with each other — and we might be best advised to drop the question as ill-conceived. But there is nothing straightforwardly incoherent about the notion, and it does seem clear that schemes do in some sense adjust to each other without necessarily involving the mediation of incompatibility of the schemes with each other in their respective guidances of environmental interactions. We do sometimes, perhaps a lot of the time, learn and develop via internal processes, perhaps internal "failures" of some sort, but, in any case, not always in direct consequence of environmental interactive failure. Again, how does that work?

There was a caveat above about computer programs interacting with each other. One program can act upon another, or even on a part of itself, but this is crudely akin to one program taking another as its interactive environment. It is not akin to two or more programs inherently adjusting to each other as they lie inert in their memory store. Programs do not have the right kind of nature for that. They are codes, not processes, and certainly not activities (*activities* require inherent normativity). They cannot manifest the kinds of mutual adjustments that are at issue.

A different and perhaps more helpful metaphor might be that of soap films adjusting to each other. They will be modified in their adjustments by external factors such as the ambient breeze, but there is nevertheless an inherent dynamic of adjustment, that results from everywhere-all-at-once local tension adjustments, that yields an overall global surface with specifiable characteristics.

But we need not only a model, or metaphor, of a dynamic process that could manifest the sort of mutual adjusting that seems to occur among schemes, we need that dynamic to somehow honor or manifest the cognitive and representational and action

properties of the schemes that we are attempting to model. A physical or brain process that manifested the local to global characteristics but was arbitrary relative to the cognitive and action properties could at best give us a model of some kinds of deterioration and demise of the mind. It could not address the constructive and productive further integration of mental activities.

So, we need a model of processes of mutual adjustment among schematic processes that guide organism-environment interaction. Such adjustment processes must honor the action and cognitive properties of the schemes that are involved in the adjusting process. Such inter-scheme adjustment is *not* the same as schematic guidance of interaction: it is the cognitively sensitive adjustment *among* such schemes.

The intent of my comments is to further delineate the problem that Becker's paper has highlighted, and to emphasize its importance. Constructivists must ultimately address this issue — and the connected issue, of central concern to Becker, of the relationship of the internal adjustment process to consciousness.

I will not attempt here the presentation of a model that arguably solves the problem. Nevertheless, I would like to point out what seems to me to be the appropriate dynamic realm in which the solution is to be found. Schemes must be ongoingly "set-up" as forms or organizations of functioning. This setting-up is itself a process. Elsewhere, I have suggested that an appropriate term for this process is *microgenesis* (this is not the microgenesis of studying short term development, though, I would argue, they are related: see, for example, Bickhard & Campbell, 1996). Microgenesis will be ongoing concurrently and in parallel over the entire brain, setting-up appropriate, or at least mostly appropriate, modes of schematic functioning, likewise concurrently and in parallel. Such microgenesis processes will necessarily involve local adjustments in virtue of their forming a kind of field process: overlapping microgenesis processing cannot be dynamically inconsistent, without destabilizing one or both or all of the microgenesis processes involved. Such destabilization, in turn, forces adjustments (whether they are unforesighted or are heuristically guided is a further issue, as well as how any such heuristic guidance could emerge and occur).

Still further, microgenetic adjustments must honor cognitive and action properties because it is schematic processes with those properties that microgenesis constructs. That is, microgenetic processes construct cognitive processes, so alterations in microgenesis will alter cognitive processes, and such alterations will tend to cognitively coherent (which is not necessarily to say that they will correct, only that they will still constitute cognitive processes, they will still be processes in which representation, cognition, and action guidance are inherently emergent [Bickhard, in press-c]). Microgenesis, then, seems to be the realm in which internal schematic adjustments are to be modeled.

Conclusion

Becker has done an important service in focusing on several issues that are of central importance, even though massively overlooked, to all constructivists. In this comment, I have focused even more narrowly on the nature of internal schematic mutual adjustments, and have set aside the issues of the guidance of such adjustments and the nature of the involvement of consciousness in that guidance. I have attempted to point out some of the complexities in this issue, and suggested that microgenesis might be the proper locus within which to model the phenomena.

Most important, however, at least in my judgment, is that these issues are not just issues of Piagetian exegesis, but are issues that must be addressed by any action based, therefore constructivist, approach to understanding the mind and development. Piaget is still one of our most sophisticated thinkers in this framework, and so Piagetian exegesis remains of fundamental importance. But, as Becker argues, it is not enough to just try to determine what Piaget proposed. We want to correct and go beyond his work; we would like to transcend the mostly arid wasteland of contemporary developmental theorizing.

Pragmatist action based approaches are the future: they are the only kinds that do not suffer fatal conceptual problems (Bickhard, 2001). Such approaches force a constructivist approach to development. There are myriads of interesting and important problems to be addressed within such perspectives, with Piaget as one of our deepest exemplars and guides to the issues. Just rescuing the problem definitions from the

contemporary incoherence of guiding theoretical assumptions can itself, hopefully, be a contribution.

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