Commentary on the Age 4 Transition

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This is not going to be a standard paper commentary: Instead, I wish to attempt a theoretical integration of the several models and classes of phenonema that have been presented here. In order to explain the rationale for my making this attempt, I will begin with some historical context that led up to this symposium.

History and Motivation for this Symposium

Some years ago I proposed a major developmental stage boundary occuring at about the age of 4, based on the emergence of the 2nd-level ability, or meta-ability, to reflect on one's 1st level thoughts, representations, and other 1st level system properties (Bickhard, 1973). The basic idea was that knowing is an interactive, functional, relational property between systems and their environments, and that such interactive systems would themselves instantiate properties that could not be known (interacted with) by the systems themselves, but could be interactively known by systems at the next higher level. This yields an in-principle unbounded hierarchy of a first level system interactively representing properties of its environment, and itself constituting a potential environment that could be known from a second level system, which could, in turn, be known by a third level system, and so on.

This hierarchy of potential knowing levels is generated by iteration of the basic relationship of representational 'aboutness' — each level's interactive representations are about properties of the lower level, with the 1st level

representing the environment. The hierarchy can be climbed by some particular knowing system, such as a child, only in sequence, since no particular level can exist without there already being something at the level below to be interactively known. Thus, the knowing level sequence predicts a developmental stage sequence (Bickhard, 1973, 1978, 1980a; Campbell and Bickhard, 1986).

The general form by which knowing level stages can be ascended is akin to Piaget's reflective abstraction. Such reflective ascensions of the hierarchy can occur with respect to properties that are specific to particular domains of knowledge, and, therefore, the knowing level stages in general generate a potentially highly asynchronous stage model of development — an individual can in principle be in divergent stages in differing domains of development.

The general logic of these stages is functional and epistemic — each stage is constituted as interactive (functional) representations (epistemic) of the stage below. So long as that functional-epistemic relationship to the level below obtains, then the relevant system is at that next higher functional-epistemic stage. Note in particular that this implies that in principle only one physical system level would be required to be able to instantiate an indefinite number of such epistemic stages, so long as the functioning of that system shifted epistemically relative to other functionings of the system in the proper way. A single computer, for example, could in principle execute programs operating on programs that in turn operate on programs, and so on, to any finite depth. For the most part, the knowing level model predicts that developmental stages have precisely this functional-epistemic character, and do not require separate physical systems for the additional levels.

There is, however, one critical exception to this purely functional-epistemic nature of knowing level stages, and a corresponding exception to the general possibility of asynchrony of development: the ascension from stage 1 to stage 2. The (abbreviated) reason for this exception is that the process of ascension in the general case logically requires the ability to make use of representations (usually language) as representations per se, and not just as incitements to and signals for action. The child (system) must be able to consider such representations with regard to their significance for the properties of the 1st level system that has generated those representations (generally external indicators of first level process steps) in order to accomplish the reflection and abstraction to the next level. This ability, in turn, requires that a second level knowing ability be already available, since a strictly first level system could at best “think in action” in Piaget’s phrase — could not reflect on the representations, but only react to them.

Once such true representations are possible, then, it is consequently also possible to ascend further knowing levels in a strictly functional-epistemic manner — possibly asynchronously. But the first step from level 1 to level 2 requires not just a functional development — which requires level 2 be already present — but an architectual change: an architectually, not just epistemically, second level system.

The knowing levels model, then, predicts one initial architectual — maturational — and, therefore, roughly age synchronous, major stage transition, followed by an unbounded potentiality for more asynchronous and potentially domain specific stage changes. That first stage transition should be constituted by the emergence of the intitial ability for genuine epistemic reflection, and

should make possible the development of many specific forms and instances and consequences of such reflection.

The theory predicts the existence of such an initial transition, but it does not internally fix the age at which it might be expected to occur. The identification of the age requires the determination of empirical manifestations of such second level abilities. Once that age is found, then other manifestations should occur roughly synchronously, taking into account differences in the complexity of construction within such second level reflection that might be required.

Age 4 was determined as the likely age for this first transition initially on the basis of the development of the emergence of anticipatory and transformational imagery out of prior static and reproductive imagery (Bickhard, 1973, 1978; Campbell and Bickhard, 1986).

Meanwhile, stage models more generally have themselves been going through many transitions. Critically, for my purposes, Piaget's stage model was, early on, interpreted as predicting strongly age-synchronous stage transitions. This is historically so even though Chapman has convincingly shown that this was in fact a misinterpretation of Piaget (Chapman, 1988). As counterevidence to such synchrony — especially for concrete operations — accumulated, the emphasis shifted away from stage models altogether, or toward those that predicted only asynchronous transitions. Currently, we find models with synchronous transitions, models with asynchronous transitions, and, most dominantly, models with no coherent stages at all.

Meanwhile, on another hand, in the midst of the current dominance of nonsynchronous, domain specific, notions of learning and development, the

field has empirically discovered more and more domains in which major transitions seem to occur at about age 4. For the most part, these phenomena have been approached with relatively domain specific notions about what might be happening, although more general theorizing is beginning to occur. Simultaneously, age synchrony for later transitions is still largely absent (though not all would agree with this).

The Intent and Format of the Symposium

These considerations formed the framework for proposing this symposium. There are two intentions that were involved: 1) to make the point that something is going on at age 4 that is not just domain specific, and seems likely, in fact, to be universal, and 2) there seems to be only one theory currently available that predicts what we seem to find concerning stage transitions — an initial relatively age synchronous transition, followed by asynchronous transitions — and that one theory is the interactive knowing level model of development.

The format was to first present several discussions of developmental transitions at age 4, thus hopefully beginning to make the point that this is not a narrow phenomenon. Josef Perner has presented evidence of the development of the concept of representation at about age 4, and has focused most strongly on the manifestations of that for the development of the child's theory of mind; Robert Campbell has reviewed age 4 shifts in the development of natural kind categories; Phil Davidson's paper looks at the Genevan conceptions of the age 4 shift; and Katherine Nelson has focused on the age 4 emergence of autobiographical memory. Clearly, we have not touched, or have at best mentioned, many other age 4 shifts, such as the appearance-reality

distinction, the class to category shift, role taking changes, peer interaction, language, development of the self, meta-cognition, and so on. There are also older intimations of an age 4 shift, such as the Kendlers' reversal and non-reversal shift.

The second part of the intended format was to present at least an abbreviated account of these various phenomena in terms of the knowing levels — to demonstrate that the knowing levels model does account for them. Here the task gets simultaneously easier and more complicated. The symposium papers have presented both reviews of relevant literature and results, *and* each presenter's own theoretical accounts of those results. In some cases, these theoretical accounts have already explicitly incorporated the knowing levels model, and in other cases not. So, my task is made easier, on the one hand, since I do not need to develop an interactive model if that has already been done, or since I need only show how the interactive model converges with the offered theoretical model where there is agreement, but it is made harder insofar as there might be disagreements between the already presented account and the interactive account — in those cases, I will both abbreviate an interactive account, and attempt some critique of the differences.

Perner

The core of Perner's account is the age 4 development of meta-representation, or representation of representation. Clearly, these terms are directly convergent with the knowing levels conception of 2nd level, or meta-representation, so long as representation is taken in the sense of the interactivist foundation for the knowing levels model.

Presupposing such convergence concerning metarepresentation, Perner's theoretical applications to the child's theory of mind and the child's theory of knowledge (among others) in his recent book (Perner, 1991) are also quite consistent with interactive knowing level notions. In particular, the knowing levels model provides convergent accounts of the same class of phenomena.

I applaud both Perner's attempt here at a broad theoretical account of many, and not always obviously related, phenomena, and his execution of that attempt, both in terms of the theoretical elaborations offered, and of the extensive command of the literature that he has brought to bear.

The convergences with Perner's notions, however, are not complete, and I would like to indicate where some of the differences are. And, of course, argue for my side of them (or at least indicate the existence of such arguments to be found elsewhere).

First, Perner develops his notion of metarepresentation on an underlying conception of the nature of representation-in-general that falls within what we call "encodingism", and have demonstrated to be a logically incoherent conception of representation (Bickhard, 1980a, 1987, 1991, in press-a, in press-b; Campbell and Bickhard, 1986). It is in terms of this encodingist presupposition that he defines the basic framework of primary representations, secondary representations, and metarepresentations, upon which the rest of the model is based. Clearly, there are some divergences here.

Second, Perner argues that metarepresentation requires secondary representation, and, therefore, that it must follow it in development, and, furthermore, because of this intrinsically necessary delay of metarepresentation,

there is no need to postulate any maturational aspect of the late development of metarepresentation. I first want to applaud (again), this time for the form of this argument: arguments of why something is so in terms of intrinsic necessity that it be that way are both extremely powerful (they form the core of theoretical physics, to pick one example), and rare in psychology. Even so, such arguments can still be unsound in their details. To this particular one, I mention three points: 1) this argument itself requires the encodingist notions of representation that are involved in the conceptions of primary and secondary representations, 2) the argument does not address the possibility — argued for by the knowing levels model — that purely *functional* ascent to higher epistemic levels is possible only if a second epistemic level is *already* available, and, therefore, that the emergence of the second epistemic level must be architectural — maturational — not just functional, and 3) although this argument could in principle account for a delay of the advent of metareperesentation, it could not account for the breadth of the age 4 transitions unless all of those transitions could be construed as manifestations of meta-encoding-representations, and this seems unlikely. For example, it is not clear how a strictly metarepresentational model could account for shifts in role taking, the development of the self, natural kinds shifts, and so on. Even if such breadth could be attempted, this model still could not account for the relative age synchrony of the development of all those metarepresentations in all those different domains.

Third, to elaborate this last point, Perner addresses a broad sweep of age 4 transition phenomena in a very interesting and fruitful way, but age 4 transition phenomena in general seem to be even broader than the development of meta-propositional-attitudes. The interactive knowing levels

model does address these still broader transitions, and, thus, makes a claim to capture the more general underlying process.

Differences over differences. In his revised paper, Perner has addressed some of the differences between his account and the knowing levels account of early development. In particular, he attributes several predictions to the knowing levels account that would differ from predictions drawn from his own model, and claims that those differences yield a differential empirical falsification of the knowing levels account. Some of the differences turn on his notion of a situation theorist, and some on the nature of the age 4 transition itself. I disagree with Perner's characterizations here, both about the facts of the matter concerning early representation in children and about the properties that he claims follow from the knowing levels account, and will address those differences concerning the theoretical differences now. Interestingly, even these differences seem to turn on the underlying encodingism of Perner's framework.

A fundamental disagreement concerns what is necessary to theoretically account for the phenomena that Perner groups together under the notion of the child as "situation theorist". Perner summarizes a number of ways in which pre-4-year-olds can function consistently with respect to other people, and, in particular, with respect to their mental states. Furthermore, he claims that this ability manifests a kind of knowledge that the child has. To this point, I have no fundamental objections to Perner's account.

Perner's next step, however, is to assume that this "situation theorist" knowledge is reflective knowledge — that the child not only has this knowledge, but is able to reflect on it as well, just not yet to reflect on it qua representation

(that does not occur until about age 4). Since the knowing levels model identifies the initial emergence of the ability to reflect at about age 4, the claim of pre-age-4 reflective knowledge, if true, would be problematic for the knowing levels model. But the evidence for any such reflection is absent — the apparent necessity for such reflection itself derives from an encoding construal of representation and knowledge.

In particular, setting aside concerns about the construal of "situation" knowledge as constituting theory, Perner's construal of situation knowledge as involving the child's ability to *reflectively consider* his or her representations as about the situation — "one can reflect on one's knowledge in different ways. One can treat it as a relation to situations or as a representational state." — is the core of this difference. The evidence is that children can function in various ways that are consistent with certain properties of situations, including certain properties of the functioning of other people with respect to situations. I don't wish to object to this general claim at all. Perner's conclusion from this evidence, however, is that such abilities require that the child be able to *reflect* on his or her representations as being related to these situations. This, I claim, does not follow.

Interactive representation is already an ability to function with respect to properties of the situation, and it is a strictly functional notion, with no reflection at all. Furthermore, the interactive model holds — just as does Perner — that major representational accomplishments emerge at the end of infancy, and that they have to do with organizations of knowledge with respect to objects, including agents, in space and time. In order for Perner to make good on his claim that the interactive model cannot account for these phenomena, he would have to argue that they necessarily require reflection, and cannot be modeled

as versions of Piaget's "thought in action". Thought in action is precisely what level 1 knowing involves.

Perner's intuitions to the contrary — that these phenomena require reflection — are consistent with his underlying endorsement of the encoding model of representation. Encodings have to be known — interpreted — in order to be used. Therefore, if representation were intrinsically encodings, then knowledge-as-representation about situations and people would have to be reflected on, interpreted and understood, *as being about those situations and people* in order to be manifested in the child's behavior. This seems to be exactly what Perner is presupposing in his claim of reflection in "situation theory". I suggest that this is in error, both because of the foundational problems with the encodingist approach to representation (Bickhard, 1980b, 1987, 1991, in press-a, in press-b; Campbell and Bickhard, 1986), and because of the general possibility of "thought in action" ("implicit representation"), either one of which seems to be adequate to block the inference to reflection from the "situation" phenomena. The interactive-knowing levels model integrates both.

Perner also claims that the knowing levels model does not make the distinction that he points to between "situation theory" and "representational theory". In two senses, he is correct about this: 1) as just discussed, there is disagreement over whether or not the phenomena of "situation theory" require reflection, and 2) nothing corresponding to the end-of-infancy shift is part of the knowing levels stage model *per se*. With regard to the broader interactive model of representation that underlies the knowing levels model, however, Perner is overlooking a long-standing concern with developmental processes and constraints that function *within* the knowing levels reflective stages, both within knowing level 1, and higher knowing levels as well (Bickhard, 1973,

1978; Campbell and Bickhard, 1986, in press). One of the earliest focuses of these concerns, in fact, has been precisely to try to determine which abilities, and what sorts of evidence for abilities, require genuine reflection, and which can be modeled in terms of interactive level one representation, manifested as thought in action, in terms of other sorts of developmental processes and constraints. These non-reflective constraints, I submit, can accommodate and account for the end-of-infancy changes to which Perner is alluding.

Contrary to Perner, then, I contend that 1) the interactive model *does* have the resources to address the end-of-infancy changes, 2) those changes do *not* involve or require reflection, and 3) reflective knowing abilities first emerge around age 4. It is precisely the emergence of such reflective abilities that allows the child to consider representations *as representations*, and not just to enact them. Concerning the additional position that Perner endorses that all perception is intrinsically reflective, see the discussion below.

Perner also makes another pair of claims concerning the implications of the knowing level theory that need to be addressed. He claims that:

> 1) "the basic logic of the knowing level hierarchy applies only to self reflection"
>
> and
>
> 2) "Clearly, the prediction is that knowledge about other people's mind should develop much earlier, during [the] sensori-motor period since it is a level-1 type knowledge. Only knowledge about their own mind should emerge as late as age 4, since only it is of level-2 type."

These statements are a puzzle. If reflection on one's representations were intrinsically restricted to reflection about one's own self or one's own mind — as Perner seems to presuppose here — then why wouldn't this restriction apply equally well to Perner's own claims of reflection, that supposedly begin much prior to age 4? If the knowing levels model is restricted by such supposed properties of reflection, why not Perner's?

I suggest that this is simply not a valid conclusion concerning reflection — knowing levels reflection or Perner's notion. It is not knowledge about one's *self* or one's own *mind* that is the critical emergence with knowing level 2, but the ability to know *properties* of one's own thought and representations. This includes properties of those representations as representations, such as Perner mentions, and higher order relational properties of what is represented. Knowledge and representation of the self, and other higher order phenomena, are interesting and important, but they are not emergent simply with the ability to reflect — and certainly reflection is not restricted to them.

Even more fundamentally, aside from seeming to contradict his own model, this claim of Perner's overlooks the most relevant consequence of the emergence of reflection in the interactive knowing levels model. Since level 1 knowing is restricted to thought in action, it may be quite possible for a level 1 child to function in ways that are *consistent with* multiple properties of situations and people and people in situations, but it is not possible for a level 1 child to have an *explicit model* of the hidden mental properties of other people (or the "hidden variable" properties of other objects either). The reason is that a level 1 child is only capable of representations that he or she can enact, but representations that can only be reflected upon, understood, and thought about — without action— await the ability to reflect.

It is this ability to construct and consider explicit models of phenomena that underlies a great deal of the age 4 shift. It manifests itself, for example, with regard to

- models of what is real as differentiated from what is appearance,
- presumptions of hidden underlying (even if unknown) commonalities in representations as natural kinds,
- the ability to consider non-perceivable mental processes and properties in other people — such as in genuine cooperative or competitive play,
- not-directly-executable properties of representations themselves — such as in their relationships to what they represent,
- and so on.

This distinction between implicit representation that is manifested only in action, and explicit representation that need not be executable, but can be considered and taken into account in understanding and action, would seem to be a distinction that Perner's encodingist framework is not capable of capturing.

I agree with Perner, then, that there are — in spite of some strong convergences — also some strong differences between his model and the interactive model. I do not agree, however, with his explications of the nature of several of those differences, nor with his conclusions concerning which stance is most empirically and logically acceptable. Finally, I suggest that the differences that are to be found derive from differences in the underlying notions concerning the encoding or the interactive nature of representation. The interactive model of representation is contrary to millennia of tradition and intuition, and it is not easy to capture the ramified differences and consequences that it involves.

Campbell

Campbell has already couched his discussion in terms of the knowing levels model, so I will restrict my comments to a review of the general model presented for the development of natural kind concepts. In a strictly level 1 system, representation is implicit in the interactive relationship between an object and the system. Only at level two can that representational relationship itself be represented. In particular, definitions of categories in terms of necessary and sufficient conditions is not possible without level two representation. Still more particularly, one version of necessary and sufficient conditions is the postulation of some — perhaps not fully specified — underlying commonality across the extension of the category. Such representations in terms of a "promissory note" for an underlying commonality are natural kinds. These clearly require metarepresentation, and, therefore, ought to become possible for the child to construct only with the advent of second level knowing at around age 4.

Davidson

Davidson's paper emphasizes the age 4 emergence of the ability to abstract functional meanings of actions. In the interactive model, this is precisely what is to be expected with the advent of second level knowing: first level knowing is intrinsically interactive in nature, and second level knowing represents properties of first level interactions. With this convergence, Davidson's basic interpretation of Piaget's later work, and the corresponding account of developmental phenomena, becomes derivable within interactivism.

There are some divergences here as well, however. I am not as sanguine as Davidson concerning the power of category theory to capture all

developmental phenomena. Certainly category theory is an enormously powerful mathematics — it can replace set theory as the foundation for all of mathematics — but we have elsewhere argued that Piagetian epistemic structuralism in general, and, therefore, its category theoretic instantiation in particular, commits a subtle, but nonetheless fatal, encodingism error. The basic notion is that such structural models may describe organizations of the potential interactions of the system — may describe the general competencies of the system — but are mistakenly construed as modeling the processes by which the system can manifest those competencies. In other words, a valid such structural model will be something that a developmental process model will have to account for, but to take the structural descriptions of system competencies as themselves accounting for those competencies is circular. The issues here are complex, so I will leave further elaborations of the argument for elsewhere (Bickhard, 1988; Campbell and Bickhard, 1986; Bickhard and Campbell, 1989).

Campbell and I have also argued elsewhere that Piaget's move to a more strictly reflective model of development was very much in the right direction, but that vestiges of his epistemic structuralism remained and prevented a fully consistent development of those later insights.

Nelson

There are several aspects of Katherine Nelson's presentation that I would like to address.

First, the distinction she proposes between episodic and autobiographical memory seems to me to correct a serious oversight in the literature. There is a shift in memory ability around age 4, but autobiographical memory captures it much better than episodic memory. Furthermore, episodic memory in the sense of memory of past events without the autobiographical aspect very clearly can occur prior to age 4.

Second, Nelson's emphasis on the variations in the ages of emergence of autobiographical memory, and the likely dependence on, among other factors, the nature of language use to which the child is exposed, highlights the point made earlier that the advent of age 4 second level knowing is the advent of a general potentiality, which must still be developed in application to any particular domain — and, therefore, that constructive development is subject to environmental influences on the timing and likelihood of that further construction.

Third, the emergence of the ability to treat language as representational per se is the paradigmatic example that we have used to illustrate the advent of second level knowing (Bickhard, 1973, 1980a; Campbell and Bickhard, 1986). The argument for the necessity of an initial architectural second level knowing system has usually been presented in terms of true symbolic language being required for strictly functional-epistemic ascent up the knowing levels, and the further lemma that only a species that already had two architectural knowing

levels would ever develop language with adequate representational power. There is another part of the interactive model that proposes an account of the evolution of such second level knowing species capacities. Nelson's model of an age 4 shift in the functions for which language can be used, and the consequences for memory, therefore, connect directly with the core of the knowing levels model.

Fourth, I would in addition propose that, without reflection, the child cannot consider his or her self, but can only act — think in action. With reflection, the child can consider and develop representations of his or her characteristics as an agent in the world and amongst others. In other words, without reflective ability, there will be no representation of self per se for the child with respect to which the memories *can* be autobiographical. The self is at best implicit for the prereflective child (though such implicitness can be much more powerful and important than we are used to thinking).

Acredolo

Curt Acredolo has graciously provided a commentary on the papers of the symposium — including my original comments — from a perspective outside of the symposium itself. I now take the opportunity to comment on Acredolo's comments — undoubtably, a meta-commentary.

Acredolo agrees with the existence and importance of an age 4 shift, but takes issue with the explanation of it that the interactive model offers. There are two aspects to his disagreement: 1) a complaint that the interactive model of the age 4 shift is incomplete — in particular, "why should the system ever reflect on itself?", and "what is the source of reflective abstraction?" and 2) a claim that the deficiencies of the interactive model in this regard can be avoided by

recognizing that age 4 cannot be the emergence of reflective knowing, since perception is itself already intrinsically reflective. In this view, the phenomena that the interactive model fails to explain — viz., the emergence of reflective knowing — do not occur anyway, since even perception is already inherently reflective.

I will address Acredolo's contentions in reverse order. First, to the notion that perception, or other forms of knowing, are intrinsically reflective:

1) Acredolo cites Gibson in support of this position, but "all perception is the knowing system reflecting on the sensory, motor and mental 'behavior' to which it is a witness" is a direct violation of Gibson's own arguments against homunculus models of perception — it simply recreates the problem of the observer at the level of the "witness" (Bickhard and Richie, 1983).
2) If knowing is intrinsically reflective, then the reflectivity of knowing — such as, I know that I am thinking about reflection — will itself also be reflective, so I will be knowing that I am knowing that I am thinking. But this too will necessarily be intrinsically reflective, so we get still another iteration, and a clear infinite regress of reflections in any act of perception (Rosenthal, 1991).
3) If knowing is intrinsically reflective, then it could not have evolved through a simpler version of nonreflectiveness, but that both creates logical problems of how it could ever evolve at all, and empirical problems of accounting for, say, the perceptions of fish. Acredolo's account requires fish to be reflective, and even euglena.
4) Whenever we examine our own thinking, we always find it to be reflective, but that is because the very act of examination is an act of

reflection — it is a non-sequitur to conclude that thinking is intrinsically and always reflective.

5) The dualism of contending that knowing is intrinsically reflective has been rejected many times over — by Heidegger, the later Wittgenstein, Merleau-Ponty, and Buddhism, to mention a few at the philosophical level, and Gibson, Piaget, and Vygotsky, for a few at the psychological level. It requires more than a simple contention that knowing is intrinsically reflective to counter these positions.

And 6) the claim that knowing, or perception, is intrinsically reflective is committed to the encodingist model of representation — if knowing is intrinsically reflective, then knowing implies knowing that one knows, which implies that one knows both the existence of the encoding correspondence relationship, the element that is the encoding representation, and that which is represented by that encoding — but encodingism, in turn, encounters very serious, fatal I argue, logical incoherences (Bickhard, 1980b, 1987, in press-a, in press-b; Campbell and Bickhard, 1986).

I suggest that a view of knowing as intrinsically reflective is not viable.

Concerning the alleged inadequacies of the interactive model of reflective abstraction: I certainly would be among the last to claim that the interactive model is complete, but I would like to review briefly what *has* been addressed within that framework. Concerning why the system should ever reflect on itself: there is new knowledge potentially available at each new level of knowing, that can only be known by the appropriate reflection. This knowledge is often quite useful to the organism, such as conservation properties of objects, or logical properties of propositions, or the ability to

reflectively plan into the future, or the ability to reflectively consider properties of social situations, and so on (Bickhard, 1973, 1980a, in press-a; Campbell and Bickhard, 1986). These advantages of reflection are offered to the question of why the system should ever reflect, both phylogenetically and ontogenetically.

Concerning the source of reflective abstraction: the underlying evolutionary model provides a sequence of advances of adaptiveness, beginning with simple interactive knowing systems, evolving through two intermediate levels of a macro-evolutionary hierarchy, and ending with a second knowing level meta-system. The basic "source" of this macro-evolutionary sequence is monotonic increases in adaptiveness (Bickhard, 1973). With one level of reflective knowing possible in a given species via biological evolution, it is argued that higher knowing levels can be attained in single individuals with functional iterations of the basic reflective process. A model is offered of how this can occur (Campbell and Bickhard, 1986). It is, I suppose, a matter of taste concerning whether the issues regarding reflection are "clearly and convincingly resolved" by these parts of the interactive model. Most certainly the model is incomplete in many respects. But no case seems to have been made that there are any in-principle problems with either the model itself or with those incompletenesses of the model such that it should be abandoned.

For at least the time being, then, I would urge the interactive model of reflection as being a more rational ground for theoretical elaboration and development than is a model of the intrinsic reflectiveness of knowing. All models are tentative and defeasible, however, so I would urge Curt (and others) to pursue the identification of incompletenesses that need to be developed and

the diagnosis of problems that need to be resolved: the ultimate fate of all theories should be to be superceded by more powerful ones.

Conclusion

I wish to emphasize the two main points of this symposium. First, that major age 4 developmental transitions seem to occur in many, if not all, domains. The generality of these phenomena has not been well addressed.

Second, many contemporary developmental models do not and could not account for such a general developmental transition. Many others could, but would in addition propose additional age synchronous transitions that do not seem to occur. Interactivism both predicts an initial relatively age synchronous transition at about age 4 in terms of the emergence of reflective knowing — and proposes possible accounts of the multiple empirically observed transitions in terms of this underlying shift — and interactivism predicts further non-synchronous transitions (or, perhaps better put, no intrinsic restrictions to synchrony in further transitions) which also seems to be borne out in the data. Interactivism is the only current developmental model that predicts such an initial synchrony followed by the possibility of asynchrony.

I, of course, have a particular investment in, and appreciation of, interactivism. Whether or not you feel some kinship or sympathy with the interactive approach per se, however, I would like to stop with the fundamental observation that something seems to be going on around age 4 that is broader than most current theories could account for even in principle, and that is unique in its relative age synchrony, in contradiction to the current theories that could in principle account for such a broad synchronous shift. There's something interesting here.

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