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Commentary

The contributions to this special topic section were organized to illustrate the breadth of major age 4 transitions in child development, and to present some of the major theorizing that addresses these transitions. The motivation for such a focus is twofold: a) to suggest and illustrate the potential universality of an age 4 transition, in contrast to construing these phenomena as multiple unrelated developmental transitions in various domains with accidental age 4 synchrony, and b) to provide a foundation for the discussion of a theory that predicted such a universal age 4 transition as long ago as 1973 [Bickhard, 1973]. In this commentary, then, I will primarily be presenting a theoretical integration of the several models and classes of phenomena that have been presented, as well as commenting on some of the specifics of the particular articles.

The Knowing-Levels Hierarchy

Some years ago, I proposed a major developmental stage boundary occurring at about the age of 4, based on the emergence of the second-level ability, or meta-ability, to reflect on one's first level thoughts, representations, and other first-level system properties [Bickhard, 1973]. The basic idea was that knowing is an interactive, functional relation 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. These properties could be known however, interactively, by systems at the next higher level. These considerations yield 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 by a second-level system, which could, in turn, be known by a third-level system, and so on.

The 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 first level representing the environment. The hierarchy can be climbed by a 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-levels sequence predicts a developmental stage sequence [Bickhard, 1973, 1978, 1980a; Campbell and Bickhard, 1986].

The general form of ascending the knowing-levels stages is akin to Piaget's [1977] reflective abstraction. Such reflective ascen-

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sions of the hierarchy can occur with respect to properties that are specific to particular domains of knowledge. Therefore, the knowing-levels 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 the functional-epistemic relationship to the level below obtains, the relevant system is at the next higher functional-epistemic stage. This fact 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 character of knowing-levels 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 first-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 terms – that is, could not reflect on the representations, but only react to them.

Once such true representations are possible, 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 involves not just a functional development – which requires that level 2 be already present – but an architectural change – an architecturally, not just epistemically, second-level system.

The knowing-levels model, then, predicts one initial architectural (maturational) and, therefore, roughly age-synchronous, major stage transition, followed by an unbounded potentiality for more asynchronous and potentially domain-specific stage changes. The first stage transition should be constituted by the emergence of the initial ability for genuine epistemic reflection and should make possible the development of many specific forms, instances, and consequences of such reflection.

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

The age of 4 was initially determined as the likely age for this first transition on the basis

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 undergoing many transitions. Critically, for my purposes, Piaget's stage model was, early on, interpreted as predicting strongly age-synchronous stage transitions. This is so historically even though Chapman [1988] has convincingly shown that this was a misinterpretation of Piaget. 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.

In the midst of the current dominance of nonsynchronous, domain-specific notions of learning and development, researchers have 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 reappearing. Simultaneously, age synchrony for later transitions is still largely absent (although some would disagree with this assertion).

Knowing Levels and the Age 4 Transition

I wish to contend that the articles in this special-topic section suggest something is going on at age 4 that is not just domain-specific, and seems likely, in fact, to be universal. There is only one current theory that predicts the findings concerning stage transitions – an initial relatively age-synchronous transition, followed by asynchronous transitions, and that one theory is the interactive knowing-levels model of development [Campbell and Bickhard, 1986]. Perner presents evidence of the development of the concept of representation at about age 4, and focuses most strongly on its implications for the development of the child's theory of mind, Campbell reviews a shift at age 4 in the development of natural kind categories, Davidson describes Genevan conceptions of the age 4 shift, and Nelson focuses on the emergence at age 4 of autobiographical memory. Clearly, we have not touched, or at best have only mentioned, many other age 4 shifts, such as mastery of the appearance-reality distinction, the class-to-category shift, role-taking changes, and changes in peer interaction, language, development of the self, and metacognition. There are also older intimations of an age 4 shift, reflected for example in the Kendlers' work on reversal and nonreversal shifts.

My objective is to account for these various phenomena in terms of the knowing-levels model I have described. The authors of the articles included here have presented both reviews of relevant data and the authors' own theoretical accounts of those data. In some cases, these theoretical accounts have already explicity incorporated the knowing-levels model, and in other cases not. In the latter cases, I will offer an abbreviated account in terms of the knowing-levels model and attempt some critique of alternative accounts.

Perner and Metarepresentation

The core of Perner's account is the age 4 development of metarepresentation, or representation of representation. Clearly, these terms are directly convergent with the knowing levels conception of second-level, or metarepresentation, so long as representation is taken in the sense of the interactivist founda-

tion 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) presented in his recent book [Perner, 1991] are also quite consistent with interactive knowing-level concepts. In particular, the knowing-levels model provides convergent accounts of the same class of phenomena.

I applaud Perner's attempt 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 the extensive command of the literature that he has brought to bear. The convergences with Perner's ideas, however, are not complete, and I would like to indicate where some of the differences lie, as well as argue the merits of the knowing-levels interpretation.

First, Perner develops his concept of metarepresentation based on an underlying conception of the nature of representation that falls within what can be referred to as 'encodingism' [Campbell and Bickhard, 1986]. Encodingism is a logically incoherent conception of representation [Bickhard, 1980a, 1987, 1991, in press-a, -b; Campbell and Bickhard, 1986]. Interactive representation is fundamentally different from encoded representations. It is in terms of this encodingist presupposition that Perner 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. Furthermore, because of this intrinsically necessary delay in the onset of metarepresentation, there is no need to postulate any maturational explanation for that late development. This is an important form of argument. Arguments as to why something is so in terms of intrinsic necessity are both extremely powerful (they form the core of theoretical physics, to take one example) and rare in psychology.

Even so, such arguments can be unsound in their details. In response to this particular argument, I wish to make three points. First, as I have indicated, the argument presupposes the encoding view of representation that is involved in the conceptions of primary and secondary representations. Second, 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 (and maturational), not just functional. Third, although the argument could in principle account for a delay in the advent of metarepresentation, 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, which 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-kind shifts, and so on. Even if such breadth were attempted, the model could not account for the relative age-synchrony in the development of metarepresentations in all of these different domains.

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 metapropositional attitudes. The interactive knowing-levels model does address these still broader transitions and thus makes a claim to capture the more general underlying process.

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 he claims that the 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. Our theoretical differences seem to turn on the underlying encodingism of Perner's framework.

A fundamental disagreement concerns what is necessary to account for the phenomena that Perner groups together under the concept of the child as 'situation theorist'. Perner summarizes a number of ways in which children younger than age 4 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. In these respects, 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, although not yet able to reflect on it qua representation (which 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 reflective knowledge prior to age 4, 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 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 do not take exception to this claim. 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 conclusion, 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 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 representations were intrinsically encodings, 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 claiming the presence of reflection in 'situation theory'. I suggest that this is incorrect, both because of the foundational problems with the encodingist approach to representation [Bickhard, 1980b, 1987, 1991, in press-a, -b; Campbell and Bickhard, 1986], and because of the general possibility of thought-in-action (implicit representation). Either seems adequate to prevent the inference of reflection from 'situation' phenomena.

Perner 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. First, as just discussed, there is disagreement over whether or not the phenomena of 'situation theory' require reflection. Second, 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]. An early focus of this concern, in fact, was 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 1 representation, manifested as thought-in-action, in terms of other sorts of developmental processes and constraints. These nonreflective constraints, I submit, can accommodate and account for the end-of-infancy changes to which Perner alludes.

Contrary to Perner, then, I contend that (a) the interactive model does have the resources to address the end-of-infancy changes, (b) those changes do not involve or require reflection, and (c) 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.

Perner makes another pair of claims concerning the implications of the knowing-levels theory. First, he claims that the basic logic of the knowing-level hierarchy applies only to self-reflection. Second, he states:

> Clearly, the prediction is that knowledge about other people's minds should develop much earlier, during the sensorimotor period, since it is a level-1 type knowledge. Only knowledge about one's own mind should emerge as late as age 4, since only it is of a level-2 type.

These statements are puzzling. 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 – why wouldn't this restriction apply equally well to Perner's own claimed cases of reflection, that supposedly begin 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 concept of reflection. 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 knowledge includes properties of those representations as representations, such as Perner mentions, as well as higher order relational properties of what is represented. Knowledge and representation of the self, and other higher-order phenomena, are interest-

ing 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 this child to have an explicit model of the hidden mental properties of other people (or the 'hidden variable' properties of other objects). A level 1 child is only capable of representations that he or she can enact. Representations that can only be reflected upon, understood, and thought about – without action – await the ability to reflect.

This ability to construct and consider explicit models of phenomena underlies much of the age 4 shift. It manifests itself, for example, with regard to (a) understanding of the appearance – reality distinction; (b) presumptions of hidden underlying (even if unknown) commonalities in representations as natural kinds; (c) the ability to consider nonperceivable mental processes and properties in other people, such as in genuine cooperative or competitive play, and (d) not-directly-executable properties of representations themselves, such as in their relationships to what they represent. In sum, the distinction between implicit representation manifested only in action, and explicit representation that need not be executable but can be considered and taken into account in understanding and action, is a distinction that Perner's encodingist framework seems incapable of capturing.

Although I agree with Perner that there are strong differences between his model and the interactive model, I do not agree with his explications of several of those differences, nor with his conclusions as to which position is more correct. I have suggested that the differences between us derive from differences in underlying notions concerning the encoding versus 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 consequences that it involves.

Further Dimensions of the Age 4 Transition

Campbell on Natural Kinds

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 with respect to 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 2 can that representational relationship itself be represented. In particular, definitions of categories in terms of necessary and sufficient conditions are not possible without level 2 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 on Action

Davidson's article emphasizes the emergence at age 4 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 form of mathematics. It can replace set theory as the foundation for all of mathematics. But we have argued elsewhere [Campbell and Bickhard, 1986] that Piagetian epistemic structuralism in general, and, therefore, its category-theoretic instantiation in particular, commits a subtle, but nonetheless fatal, encoding error. Such structural models may describe organizations of the potential interactions of the system (the general competencies of the system) but these models are mistakenly construed as modeling the processes by which the system can manifest those competencies. In other words, a valid 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. Since the issues are complex, I will refer the reader elsewhere for further elaborations of the argument [Bickhard, 1988; Campbell and Bickhard, 1986; Bickhard and Campbell, 1989]. Campbell and I have also argued that Piaget's move to a more strictly reflective model of stage 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 on Memory

There are several aspects of Nelson's article 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 existing literature. There is a shift in memory ability around age 4, but autobiographical memory captures it much better than does 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 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 second-level knowing at age 4 is the advent of a general potentiality that must still be developed in application to any particular domain. Therefore, that constructive development is subject to environmental influences on the timing and likelihood of 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 of 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. Another part of the interactive model 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, connects 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, or 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 for the child with respect to which 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 may think).

Knowing and Perception

In his 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. The first is his 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? Second, he claims that the deficiencies of the interactive model in this regard can be avoided by recognizing that the age 4 shift cannot mark the emergence of reflective knowing, since perception is itself already intrinsically reflective. In Acredolo's view, the phenomenon that the interactive model fails to explain – the emergence of reflective knowing – does not occur anyway, since even perception is already inherently reflective.

I will address Acredolo's contentions in reverse order, beginning with the idea that perception, or other forms of knowing, are intrinsically reflective. First, Acredolo cites Gibson in support of this position, yet his claim that 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]. Second, if knowing is intrinsically reflective, then the reflectivity of knowing – for instance, 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 knowing too will necessarily be intrinsically reflective, yielding still another iteration, and a clear infinite regress of reflections in any act of perception [Rosenthal, 1991]. Third, if knowing is intrinsically reflective, it could not have evolved from a simpler, nonreflective kind of knowing, a fact that creates both 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. Fourth, when 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 nonsequitur to conclude that thinking is intrinsically and always reflective. Fifth, 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. Finally the claim that knowing, or perception, is intrinsically reflective commits one to the encodingist model of representation. If knowing is intrinsically reflective, 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 the objects in the world that are represented by that encoding. However, as I claimed earlier, encodingism is logically incoherent [Bickhard, 1980b, 1987, in press-a, -b; Campbell and Bickhard, 1986]. I conclude, then, that a view of knowing as intrinsically reflective is not viable.

Regarding 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. As for 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. Such knowledge is often quite useful to the organism, as in the case of 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 [Bickhard, 1973, 1980a, in press-a; Campbell and Bickhard, 1986]. These advantages of reflection should help to explain 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 macroevolutionary hierarchy and ending with a second knowing-level metasystem. The basic source of this macroevolutionary sequence is a monotonic increase 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 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 has been made that there are any problems in principle with the model that would require it to be abandoned.

For at least the time being, then, I would recommend the interactive model of reflection as superior ground for theoretical elaboration and development, compared to a model of the intrinsic reflectiveness of knowing. All models are tentative and defeasible, however, so I would urge Acredolo (and others) to identify areas of incompleteness and diagnose problems. The ultimate fate of all theories is to be superseded by more powerful ones.

Conclusion

I wish to emphasize two main points. First, 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. Others could but would in addition propose additional age-synchronous transitions that do not seem to occur. The interactivism model I have advocated predicts an initial relatively age-synchronous transition around age 4 based on the emergence of reflective knowing, and it proposes possible accounts of the multiple empirically observed transitions in terms of this underlying shift. The interactivism model predicts further non-synchronous transitions (or, perhaps, better put, no intrinsic restrictions to synchrony in further transitions) which also seem to be borne out by available data. Inter-

activism is the only current developmental model that predicts such an initial synchrony followed by the possibility of asynchrony. Whether or not one is sympathetic to the interactive approach, something seems to take place around age 4 that is broader than most current theories can account for, even in principle. There is clearly something interesting and worth pursuing here.

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