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REPLY

Constructivism and Development: Reply to Smith's Commentary

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This article is a reply to the commentary made by Smith (1998) regarding these authors' earlier article (1998), which proposes a modified constructivist account of the origins of mental representation. This article focuses on three aspects of Smith's commentary. First, we elaborate on Smith's discussion of differences between empiricist and constructivist approaches to development. Second, we discuss Smith's restatement of Piaget's position in terms of four levels of representational capacities. Finally, we reply to specific comments directed by Smith at our article.

In his commentary, Smith (1998) raises several important issues pertinent to any account of the origin of mental representation, and, in fact, to any account of the development of knowledge. Our reply focuses on three aspects of his commentary. First, we will elaborate on Smith's criticism of empiricist approaches to mental representations. Second, we will critically discuss Smith's restatement of Piaget's theory in terms of four levels of representational capacities and we will examine some aspects of Piaget's theory of

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mental images. Finally, we will reply to specific comments that Smith directs at our article.

EMPIRICISM, CONSTRUCTIVISM, AND OBJECTIVITY

Smith suggests that two of the major differences between constructivism and empiricism revolve around the issues of parsimony and whether the capacity of representation is innate or acquired. Although these are certainly key issues, we have stressed that the major difference lies in the assumptions each approach makes about the working of the mind, and we expect that Smith would agree. Moreover, we have tried to lay bare the conceptual problems that empiricist approaches face because of the untenability of their assumptions. An important assumption of empiricism is that the mind acts as a container for entities (i.e., representations) and that these entities have the power to act on their own, independently of any agent (Judge, 1985). These entities are treated like objects that have physical properties (e.g., spatial properties) or are described in terms of relationships holding between physical objects (e.g., causality). As a consequence, empiricist approaches omit any notion of agency and intentionality. Consequently, empiricist accounts cannot coherently explain, without appealing to some type of homunculus, the origin of meaning in general, or representational meaning in particular (Judge, 1985; Melkman, 1988).

Two examples, one relating to theory of mind research and the other to connectionist models of the mind, illustrate this contention. Gopnik and Meltzoff (1996) argue that a person's theory is a system ''that assigns representations to inputs just as one's perceptual system assigns representations to visual input or one's syntactic system assigns representations to phonological input'' (p. 43). Representations,in their view, are ''innate structures'' (Gopnik & Meltzoff, 1996, p. 50) and the representational system ''reorganizes itself in response to input'' (Gopnik & Meltzoff, 1996, p. 54). Such an account clearly treats representations as independent entities in the mind assuming a life on their own. In order to explain how these representations can have any meaning for an agent, such a theory must, at some point, introduce an homunculus, and, therefore, is conceptually flawed from the very beginning.

The second example of empiricist approaches to development is connectionist modeling (Elman, Bates, Johnson, Karmiloff-Smith, Parisi, & Plunkett, 1996). In connectionist models, the concept of representation is indiscriminately applied to neural and psychological phenomena (''mental/neural representations,'' Elman et al., 1996, p. 39), and representations are defined as ''patterns of activations across a pool of neuron-like processing units'' (Elman et al., 1996, p. 25). The problem faced by connectionist approaches is fundamentally the same as that encountered by classical empiricist approaches: to explain the transition from causal processes in the brain to con-

scious, meaningful experience. As Hacker (1991) remarks, this Cartesian dilemma can have no solution, ''for it is not an empirical problem but a conceptual confusion'' (p. 150). Furthermore, by ascribing capacities such thinking, representation, or perception to neurophysiological processes in the brain, instead of a complete human being, connectionist accounts must appeal to an homunculus to explain meaningful experience (Kenny, 1991). It is, however, not the brain but the person who thinks (Straus, 1956/1963, p. 105), and the ascription of psychological capacities to the brain reveals nothing but the fact that the brain has been anthropomorphisized (Straus, 1956/1963, p. 186).

In our article, we have argued that Piaget's constructivist approach avoids several of the pitfalls of empiricist approaches. Unlike empiricist approaches, constructivism acknowledges the irreducibility of meaningful experience to causal processes on the physiological level (Piaget, 1967/1971, pp. 48–49). More specifically, by grounding meaning in action schemes and introducing the concepts of assimilation (noesis) and accommodation (noema), Piaget provides a way of resolving the problem of where meaning comes from, without implicating an interpreter in the head (Judge, 1985; Melkman, 1988). As Smith (1998) elaborates, constructivism and empiricism also differ in terms of how they explain initial levels of objectivity (categories of space, time, causality, and substance). Whereas constructivist approaches account for the development of these categories through a logic of action, empiricist approaches account for them through representations. As a consequence, empiricist approaches eschew any notion of the development of objectivity and the growth of knowledge is taken to consist of copying a mind-independent world of objects, persons, and events (Melkman, 1988; Overton, 1998). Constructivist approaches, on the other hand, account for the formation of objectivity by introducing the concept of operative development. The significance of this aspect of knowledge which introduces the notion of transformational change (see Overton, 1998) rather than additive change has been elaborated in our article.

REPRESENTATIONAL CAPACITIES AND MENTAL IMAGES

Smith (1998) restates the Piagetian position on representational development in terms of four levels. These levels include: (a) *Level 0* (sensorimotor stages I and II): characterized by the nonuse of representational capacity; (b) *Level 1:* characterized by representational capacity based on the use of indicators; (c) *Level 2:* characterized by representational capacity based on the use of images (standing-in relations); and (d) *Level 3:* characterized by representational capacity based on the use of natural language in a truth-functional manner. First, we will argue that Smith's restatement is not sensitive to the crucial distinction between representational and nonrepresentational capacities as drawn by Piaget. Second, we will take issue with the Piagetian position that pretend play and deferred imitation are based on men-

tal images (Smith's Level 2). Each of these two points will be discussed in turn.

Before discussing Smith's restatement of Piaget's position, let us clarify the use of the terms *representation* and *indication.* Following Piaget, we use the term *representation* in the sense of *re-presentation,* or better, as Smith points out, as *semiotic* or *symbolic representation.* Piaget himself distinguished between two different senses of representation (Piaget, 1936/1963, pp. 147, 242–243, 252): (a) representation in the sense of conferring meaning upon things through sensorimotor actions; and (b) representation as the capacity to evoke through differentiated signifiers such as signs or symbols an absent object or action. Piaget (1936/1963) reserves the term *representation* for the latter capacity because indications are ''connected with direct perception and not with representation'' (p. 191). He claims that representation taken in the former sense ''goes back to the very beginning of mental life'' (Piaget, 1936/1963, p. 243).

Thus, for Piaget, consciousness is always, from sensorimotor stage I (Piaget, 1936/1963, p. 38), a system of meanings. Meanings are constituted by signifiers and signifieds (Piaget, 1936/1963, pp. 189–192). At the sensorimotor level, Piaget distinguishes between different types of signifiers, each corresponding to a particular level of sensorimotor development (Piaget, 1936/1963, pp. 192–196, 247–252, 327–328). Piaget uses the generic term *indication* for the different types of signifiers at the sensorimotor stage (Piaget, 1936/1963, p. 191). Indications are not differentiated from their referent: they are perceptible facts, that is to say, objective aspects of the immediate situation. On the basis of prior interactions with the world, the assimilation of these indications to sensorimotor schemes leads to anticipations, i.e., to the extension of the immediate situation. Consistent with Smith's analysis of the meaning of *tableau,* Piaget asserts that the signified of a perception is the object itself (Piaget, 1936/1963, p. 190) and not a mental image of the object (Piaget, 1967/1971, p. 7). Rather than translating tableaus as images or pictures in an objective sense, as Smith suggests, we prefer to describe perception at the sensorimotor stage as being *objectal* (Melkman, 1988, p. 24). In agreement with Smith, this term implies that perception is directed toward objects and, in this sense, is objective, without the further implication that these objects are integrated into a system of relationships that renders them completely independent of the subject (Piaget, 1936/1963, p. 196). Thus, the notion of objectal perception leaves room for ascent to higher levels of objectivity.

Smith's reasons for drawing a sharp line between Levels 0 and I remain unclear. Piaget (1936/1963, pp. 192–196) included the types of signifiers at sensorimotor Levels I and II under the generic term *indication.* Compared to the signifiers of the previous sensorimotor stages, the signifiers at sensorimotor stage IV become more mobile and flexible (Piaget, 1936/1963, pp. 247–252). However, the signifiers at this level still remain related to

the immediate situation, which makes them similar to the signifiers used at sensorimotor stages I and II and separates them from symbols and signs, i.e., Smith's Levels 2 and 3. By ascribing representational capacities to Level 1, Smith's restatement is not sensitive to the fact that a major transition takes place by moving from indications to symbolic representations, and that this transition is not on par with the transition from Level 0 to Level 1.

A second set of problems is related to Piaget's assumption that mental images are required to explain activities such as the retrieval of invisibly displaced objects, pretend play, and deferred imitation. We have argued that mental images are neither sufficient nor necessary to explain these activities. We criticized Piaget for invoking mental images and, thus, the figurative aspect of knowledge to explain the construction of new knowledge (e.g., objective space) because, according to his overall framework, the development of the operative aspect of knowledge, and not the figurative aspect of knowledge, is primary to the construction of new knowledge. There is another reason why the Piagetian position is flawed to the degree that it attributes the acquisition of new knowledge to mental images: mental images do not supply any new knowledge about the external world because in visually imagining an object one creates exactly this object (Ter Hark, 1990, pp. 221–233). Thus, images cannot surprise us because what we imagine is what we intend to imagine (Sartre, 1940/1948, p. 13).

We have also argued that the explanation of pretend play and deferred imitation does not require the introduction of mental images because both activities are grounded, at least initially, in external performance. If children's pretend play were based on mental images, why would they externalize what they imagine? Why would they not be satisfied with simply imagining without acting on their imagination? Visually imagining something means abstaining from executing what is imagined (Ryle, 1949, p. 255). Rather, these activities reflect the important, though perhaps less impressive, fact that meanings have become increasingly independent from the immediate situation.

Piaget (1945/1962, p. 70) derives mental images from the interiorization of perceptual activity. Without entering into a detailed discussion of the problems of Piaget's theory of mental images (see Judge, 1985, pp. 156–166), we think that the concept of interiorization of perceptual activities is not sufficient to explain the origin of mental images. Mental images are not independent, picture-like objects in the mind but are rather used in acts of imagination (Hacker, 1990; White, 1990). To imagine something means to be directed toward an absent or nonexistent object or event. According to Sartre (1940/1948, pp. 266), imagination involves two complementary negations:

> To posit an image is to construct an object on the fringe of the whole of reality, which means therefore to hold the real at a distance, to free oneself from it, in a word, to deny it. Or, in other words, to deny that an object belongs to the real is to deny the real in positing the object.

It is difficult to see how the interiorization of perceptual activities can explain the complex structure of consciousness involved in acts of visual imagination. In our opinion, it is more plausible that visual imagination results from making pretend play activities virtual, rather than from the interiorization of perceptual activities.

In our article, we propose that mental representation emerges in the context of language and not in the context of mental imagery, as Piaget (1945/1962, p. 69) proposes. Specifically, we suggest that the child's grasp that everything has a name serves as an indicator for her understanding of the representational relationship between signifier–signified coupling and referent. Fundamental to this is that the child, by relating different signifier–signified couplings to each other, establishes the representational relation between signifier–signified coupling and referent; we also argue that this insight requires the construction of relations on relations, or, second-order operations. If mental representation indeed emerges through the interrelation of different signifier–signified pairs, it could not make its appearance, prior to language, in mental imagery because there is no way of relating mental images with each other or of establishing the identity of mental images because there are no criteria based on which the subject can establish the identity of mental images (Wittgenstein, 1953, p. 377). Mental images are, therefore, subject to the private language argument, as Smith so eloquently elaborates (see also Gillett, 1987).

PROBLEMS FOR CONSTRUCTIVISM

Smith (1998) criticizes our article on three points; we will discuss each point in turn. First, Smith suggests we incorrectly claim that Piaget's account requires that figurative knowledge generates higher-order operations. However, as Smith correctly points out, Piaget grants figurative knowledge only an auxiliary role in the generation of new knowledge structures. Smith, however, seems to have misinterpreted our position: our argument is that Piaget in discussing the transition from sensorimotor stage V to sensorimotor stage VI inconsistently introduces figurative knowledge to explain the generation of higher forms of knowledge, while, according to his overall epistemological framework, higher forms of knowledge are primarily generated through the development of operative knowledge.

Second, Smith claims that we incorrectly assume that Piaget's account requires the complete detachment of assimilation from accommodation. He points out that in Piaget's account, assimilation and accommodation can exist only in various combinations, not independently. We acknowledge Piaget's position but view it as problematic for the following reasons. First, Piaget uses the terms *assimilation* and *accommodation* in different ways, which leads to inconsistencies in his theory. On the one hand, he defines assimilation as an act of judgment that unites experiential content and logical form, and accommodation as the particular content to which the form is applied

(Piaget, 1936/1963, p. 410, 1975/1985, p. 6). Ros (1983, p. 49) calls this definition of assimilation and accommodation a *logical definition.* The logical definition is also involved when Piaget talks about the primacy of assimilation over accommodation in cognitive functioning in general (Piaget, 1936/1963, p. 410, 1975/1985, p. 6). On the other hand, Piaget (1945/1962, pp. 275–276) defines assimilation and accommodation in an *energetic-affective* sense (Ros, 1983, p. 49) when he talks about different combinations of assimilation and accommodation such as with activities of imitation and pretend play. The energetic-affective and logical definitions of assimilation and accommodation are not compatible with each other. For example, it is unclear how accommodation can be preponderant in imitation (energetic-affective definition), while assimilation has primacy over accommodation in cognitive functioning in general (logical definition). Moreover, the notion of different combinations of assimilation and accommodation is not consistent with the logical definition because it does not make sense to speak of a content that is only, say, half-structured. In order to avoid such inconsistencies, different terms should be introduced for these different definitions of assimilation and accommodation. Piaget did not make this distinction explicit, and, therefore, at times uses assimilation and accommodation in an inconsistent manner. As a consequence, the idea of different combinations of assimilation and accommodation is based on an equivocation and does not constitute good grounds for explaining the origin of mental representation.

Second, it is unclear how the differentiation and integration of assimilation and accommodation in itself could lead to the generation of differentiated signifiers. The differentiation of assimilation and accommodation might be compared with the widening of the blades of a pair of scissors, which always remain connected at their joint (i.e., the immediate situation). Therefore, such a process can only lead to the extension of the immediate situation (i.e., the emergence of increasingly flexible and mobile indicators), but not to differentiated signifiers necessary to evoke absent objects. Within Piaget's theory, the construction of differentiated signifiers would require *the dissociation of accommodation from the immediate situation.* Such a dissociation, however, would be incompatible with the definition of accommodation as particularization of assimilatory schemes. Thus, we must leave Piaget's theory behind in order to explain the construction of differentiated signifiers.

Finally, Smith is critical of our using the term *social* in a global manner, and he reminds us that participants in social interactions do not necessarily function on the same developmental level. Smith's criticism is well-founded, and the claim that development is an inherently social process needs to be qualified in terms of particular social relations and knowledge structures.

CONCLUSION

We thank Smith (1998) for his insightful and helpful commentary in which he raised a number of important issues. We have tried to address most of

these issues, although some, such as the development of atemporal knowledge, transcend the boundaries of our article. In the end, we agree with Smith's conclusion that constructivist approaches are to be preferred to empiricist approaches. Empiricist approaches are fraught with conceptual problems and entail a basically agenetic orientation. Given that such approaches are currently pervasive, a major reorientation of the field of developmental psychology appears to be necessary. We hope that our article has highlighted some of these problems and that we presented a favorable approach to their solution.

REFERENCES

Elman, J. L., Bates, E. A., Johnson, M. H., Karmiloff-Smith, A., Parisi, D., & Plunkett, K. (1996). *Rethinking innateness.* Cambridge, MA: MIT Press.

Gillett, G. R. (1987). Concepts, structures, and meanings. *Inquiry,* **30,** 101–112.

Gopnik, A., & Meltzoff, A. N. (1996). *Words, thoughts, and theories.* Cambridge, MA: MIT Press.

Hacker, P. M. S. (1990). *Wittgenstein, meaning, and mind.* Oxford: Blackwell.

Hacker, P. (1991). Seeing, representing and describing. In J. Hyman (Ed.), *Investigating psychology* (pp. 119–154). London: Routledge.

Judge, B. (1985). *Thinking about things. A philosophical study of representation.* Edinburgh: Scottish Academic Press.

Kenny, A. (1991). The homunculus fallacy. In J. Hyman (Ed.), *Investigating psychology* (pp. 155–165). London: Routledge.

Melkman, R. (1988). *The construction of objectivity: a new look at the first months of life.* Basel: Karger.

Müller, U., Sokol, B., & Overton, W. F. (1998). Reframing a constructivist model of the development of mental representation: The role of higher-order operations. *Developmental Review,* **18,** 155–201.

Overton, W. F. (1998). Developmental psychology: Philosophy, concepts, and methodology. In R. M. Lerner (Ed.), *Theoretical models of human development, Vol. 1: Handbook of child psychology* (5th ed., pp. 107–188). New York: Wiley.

Piaget, J. (1962). *Play, dreams, and imitation in childhood.* New York: W. W. Norton. (Original work published in 1945).

Piaget, J. (1963). *The origins of intelligence in children.* New York: W. W. Norton. (Original work published in 1936).

Piaget, J. (1971). *Biology and knowledge.* Chicago: Univ. of Chicago Press. (Original work published in 1967).

Piaget, J. (1985). *The equilibration of cognitive structures.* Chicago: Univ. of Chicago Press. (Original work published in 1975).

Ros, A. (1983). *Die genetische Epistemologie Jean Piagets: Resultate and offene Probleme* [The genetic epistemology of Jean Piaget: results and open problems]. Tübingen: J. C. B. Mohr. (Philosophische Rundschau, Beiheft 9).

Ryle, G. (1949). *The concept of mind.* London: Hutchinson.

Sartre, J.-P. (1948). *The psychology of imagination.* New York: Philosophical Library. (Original work published in 1940).

Smith, L. (1998). On the development of mental representation. *Developmental Review,* **18,** 202–227.

Straus, E. W. (1963). *The primary world of senses.* London: Glencoe. (Original work published in 1956).

Ter Hark, M. (1990). *Beyond the inner and the outer. Wittgenstein's philosophy of psychology.* Dordrecht: Kluwer.

White, A. R. (1990). *The language of imagination.* Oxford: Basil Blackwell.

Wittgenstein, L. (1953). *Philosophical investigations.* Oxford: Basil Blackwell.

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