1

Constructivist Processes in Adolescent Development

ERIC AMSEL
Weber State University
JUDITH G. SMETANA
University of Rochester

In John Godfrey Saxe's poem, *The Blind Men and the Elephant*, based on earlier Chinese and Indian fables, six blind men surround and feel some part of an elephant. Each of them thinks that his part reveals the true nature of the beast. Saxe makes clear that the lesson to be learned involves the dangers in generalizing knowledge claims that are limited in scope. This lesson translates well into research on adolescent development. Although adolescents are popularly seen as having an unpredictable and inexplicable nature, any good adolescence textbook documents a range of conflicting alternative images afforded by multiple theoretical perspectives in the field. Adolescents are presented as *apprentices* (who participate in forms of cultural activities), *architects* (who construct normative mental structures and processes), and *juveniles* (who accommodate to a long, slow biological maturation processes).[1]

Just as Saxe warns, each of the theoretical frameworks underlying these images highlights a particular set of factors or forces as central to understanding adolescence, which is in turn used to paint these generalized but conflicting pictures. For example, fifty or so years ago, adolescence was seen as time for acquiring morality, rationality, and an autonomous sense of self and identity (Erikson, 1968; Inhelder & Piaget, 1958; Kohlberg, 1969), a position articulately defended by Moshman (2005). The constructivist theoretical framework that underlies much of this work presents a view of adolescents as designing their own development by actively seeking to make sense of themselves and their physical and social worlds. These powerful ideas, and the image of adolescents as architects that they imply, gave rise to a research program defining the normative developmental trajectory in adolescence as a progression toward rationality, morality, and autonomy.

[1] Thanks to Cynthia Lightfoot for contributions to these metaphors.

Constructivists were not blind to the challenges that arise as adolescents confront the trials and tribulations of accommodating to puberty and adopting adult social roles. But the theoretical and empirical goal was to lay out the pathways leading toward developmental endpoints rather than charting the deviations, diversions, and detours in development.

However, by the 1970s, the impact of these "grand" theories of adolescent development slowly began to wane as research and theory were directed to the influence of biological (neurological and hormonal), individual (personality and emotional), and social (cultural and contextual) factors in explaining adolescent behavior (for a review, see Lerner & Steinberg, 2009). To Lerner and Steinberg (2009), this research reflected a shift in interest from normative developmental processes (what we alluded to as pathways to endpoints) to a focus on the diversity of biopsychosocial influences on adolescent behavior and on factors that promote particular culturally relevant outcomes. This attention to "deviations, diversions, and detours" in development was described in other adolescent frameworks as evidence of the diversity and plasticity of development in adolescence. It also was used to dispute the narrowly defined normative developmental pathways articulated by constructivists. All this took a toll on the viability of the image of adolescents as architects who construct various socio-cognitive competencies during their teen years. Instead, images of adolescents as *apprentices* and *juveniles* were refurbished after years of lying dormant.

In 2008, the Jean Piaget Society sponsored a conference specifically addressing the constructivist account of development in adolescence. Our goal was not to resurrect the old ideas about normative developmental pathways, as many of them have been revised since the 1950s. Rather, our goal was to reinvigorate interest in the core assumptions and features of the approach in a way that is responsive to the new biological, socio-relational, and sociocultural research. As will be more fully documented later, a major concern motivating the conference was that some of new work on the diversity and plasticity of adolescent development obscures what for constructivists is a core assumption about adolescence as a distinctive period of time in the life cycle, offering adolescents unique opportunities but also creating for them particular vulnerabilities.

As meeting organizers and now editors of this book, our goal was to further explore and reinvigorate a constructivist account of adolescent development. In this introductory chapter, we explore the attributes and processes of the constructivist approach to adolescent development that we think remain key in understanding adolescent behavior and development and the uniqueness of this life phase. We begin with an analysis of

the constructivist approach in and critical features of genetic epistemology. Armed with some general constructivist principles of adolescent development, we address the constructivist vision of what makes adolescence a distinctive period of development, with unique opportunities and vulnerabilities. We then review the chapters of the book. Although not all of the contributors to this volume explicitly view their research as coming from a constructivist perspective, we believe that their work has much to offer such a view. We point out ways in which each of the chapters picks up on features of constructivism we lay out. We conclude with suggestions for future constructivist-oriented research on adolescent development.

CONSTRUCTIVISM AND GENETIC EPISTEMOLOGY

Constructivism holds that knowledge is derived from the physical or mental activity of the knower. The role of activity in the constructivist account of the acquisition of knowledge – for infants, adolescents, and octogenarians alike – implies that the nature of the knowledge acquired is intimately tied to the process of its acquisition. For example, if $2 + 1 = 3$ is acquired only as a contingent mathematical *fact*, its meaning and value for the knower is wholly dependent on the context in which it is learned and the source from whom it is learned. Presumably, it would matter whether the fact was learned in the classroom from a teacher as part of a formal lesson or as a casual comment from a sibling at home. The context, including the source's reasons for and trustworthiness in relaying the fact, may be part of what is known by the knower. In contrast, if $2 + 1 = 3$ is acquired as a necessary mathematical *truth*, its meaning and value for the knower lies in other mathematical procedures that can be performed on the expression (e.g., $3 - 2 = 1$; $1 + 2 = 3$; $3 - 1 = 2$) and organized into a coordinated set of procedures. The coordinated mathematical procedures, not the context, are then part of what is known by the knower. A number of central principles of Piaget's genetic epistemology emerge from this example of how knowers' activities affect their knowledge. We review some of these principles that, although not exhaustive, point out some key attributes of constructivism for adolescent development.

One genetic epistemological principle is that *the nature of the knower's activity is central to knowing*. In its most general sense, this is ingrained in Piaget's equilibration process, which holds that a person's knowledge *about* the world is altered (referred to as accommodation) just enough by new knowledge gathered *from* the world (referred to as assimilation) to permit the person to act effectively *in* the world. This effective action is a product

of finding the right balance or equilibrium between accommodation and assimilation.

On the assimilation side, the level of activity in which the knower engages *constrains* what can be learned in the context. This refers to the Piagetian contention that learning is subordinate to development; cognitive development limits the forms and levels of activities that can be performed in a context. More advanced stages of cognitive (or social) development are associated with higher levels of activities, which promote more complete assimilation of knowledge.

On the accommodation side, activity level can be coordinated and abstracted into new forms of cognitive structures. According to genetic epistemology, coordinated activities may be projected onto a more abstract cognitive plane, thereby reorganizing cognitive structures. This is the Piagetian account of the emergence of advanced cognitive structures by the reflective abstraction of activities at one level onto a higher, more abstract level. For example, a knower's coordinated mathematical activities in learning that $3 - 1 = 2$ can be projected onto a higher plane by being transformed into logico-mathematical operations (e.g., reversibility and class inclusion), resulting in the transition to a more advanced stage of cognitive development.

By emphasizing individuals' activities in the acquisition of knowledge, Piaget's constructivism advocates an epistemological position that knowledge is neither innately preformed in the mind nor directly copied from the environment. But more than this, constructivism further advocates that individuals' activities simultaneously set *constraints* on learning in a particular context and *possibilities* of creating new cognitive structures. Of course, these constraints and possibilities shift and expand over time as new experiences are managed and challenges are overcome. But in setting constraints on learning and possibilities of development, a constructivist account of knowledge emphasizes the individual as an indispensible source of learning and development.

This point goes to the second important principle of Piaget's genetic epistemology, that individuals are not just active in knowing, but are *active agents in their own learning and development*. In constructivism, individuals are treated as self-organizing organisms (Reese & Overton, 1970), composed of structurally interrelated parts that form an integral whole. As a result, change and development originate in individuals' actions rather than directly from biological or environmental factors. Langer (1969, pp. 7–8) elegantly makes the point about the self-organizing nature of constructivist organisms:

> The organism is a "self-organizing being": it has self-"*moving* power" and self- "formative power." Although the organism is not necessarily conscious of these powers, they permit it to generate or construct its own growth. It is as if the development of organisms represented a directedness towards ends immanent in their organization. This is possible because the most important characteristics of organic structures is that they have functions; that is, they are both agencies (means) for action and the end products (purposes) toward which action is directed.

In Piaget's constructivism, an active agent's *means* and *purposes* are intimately connected, resulting in local cognitive activities serving as a basis for transformed cognitive structures. They become more stable, powerful, and abstract, allowing for more effective future activities in the world. This leads us to a third principle, that *cognitive structures regulate behavior and do so in an increasingly effective manner over development*. As we have seen, cognitive structures function to regulate thought and behavior and are in turn a product of equilibration, improving its regulatory function. This improvement lies in cognitive structures supporting forms of activities, which are better at dealing with negative feedback once it occurs and are more effective in anticipating and avoiding the negative feedback (Gallagher & Reid, 1981; Montangero, 1985).

CONSTRUCTIVISM AND ADOLESCENT DEVELOPMENT

In this section, we characterize how these constructivist principles apply to adolescent development. Of course, this was articulated more than a half-century ago by Inhelder and Piaget (1958) in their account of the development of formal operations during adolescence. The book documents the emergence and consolidation of cognitive structures of formal operations (sixteen binary operations and the Identity, Negation, Reciprocity, and Correlativity group of transformations or the INRC group). In the book's last chapter, Inhelder and Piaget (1958) outline the consequences of formal operational thinking for adolescents' everyday thinking, feelings, and social relations. The uniqueness of this chapter in the broader work of Piaget is worth noting and was commented on by Flavell (1963, pp. 222–223) in his review of the theory: "As a rule, Piaget has been much more concerned with conceptualizing developmental change in cognitive structures per se than with trying to show how these changes are causally linked with changes in everyday cognitive, social, and affective behavior. It is therefore of interest that the book on adolescent reasoning concludes with a brief excursion of this type."

Noting that "there is more to thinking than logic," Inhelder and Piaget (1958, p. 335) explore changes in adolescent thinking, feeling, and social relationships as they move from puberty to the adoption of adult social roles. Biological changes in adolescents' bodies and brains serve as a context for adolescents' thinking about their future adult social roles. Such roles correspond to the sociological pressures to orient toward adulthood. But the chapter is notable for its focus not on biological or sociological factors but on the adolescent as an active agent of developmental change, seeking to understand and fit into the adult world. Although some of their account of teenage life seems dated (e.g., constructing *personal theories*, *life programs*, and *projects for changing the world*), Inhelder and Piaget (1958) describe adolescents as using their cognitive capacities to go beyond their immediate circumstances and project themselves into the adult social world. The account picks up the core constructivist view of adolescents as active agents using their cognitive powers in more or less conscious ways to make meaning of their circumstances and solve problems they encounter.

The constructivist account also recognizes inevitable vulnerabilities and opportunities as adolescents make sense of their world. Opportunities abound for adolescents whose self-constructed pathways to their own futures result in successful transitions into adulthood. But Inhelder and Piaget (1958) caution that more often than not, adolescents' visions of adulthood in general and their adulthood in particular are egocentric and immature, each reflecting a lack of adequate coordination. Adolescent egocentrism is the inevitable lack of understanding of the limits of new cognitive powers due to a lack of coordination with others' perspectives (also see Elkind, 1967). As a result, ideas are not well thought through beyond the sense they make to the adolescents themselves. Adolescent immaturity is the inevitable result of the slow process of acquiring new cognitive abilities. Early adolescence is a time of the initial emergence of formal operational thinking skills, but the skills are incompletely coordinated. The result is that young adolescents are able to entertain abstract and hypothetical ideas but are less capable of systematically testing them.

ON BABIES AND BATHWATER

In this section, we consider critiques of constructivist accounts of adolescent development and contend that, in these critiques, the constructivist baby has been thrown out with the Piagetian bathwater. As noted earlier, the Piagetian account of adolescent development has waned over the years. An accounting of articles in PSYCINFO containing the expression *formal*

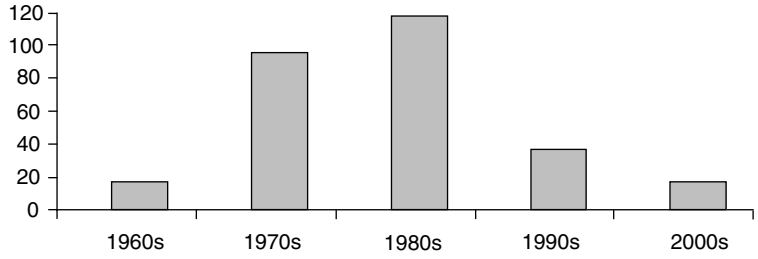

FIGURE 1.1. The frequency of peer-reviewed articles in PSYCINFO containing the expression *Formal Operations*, by decade.

operations reveals 289 separate articles in peer-reviewed journals. The distribution by decade of the number of these journal articles (Figure 1.1) indexes the rise and fall of research activity on interest in formal operations. As previously noted, mounting criticisms of the developmental diversity and plasticity in formal operational thinking were based on evidence of the contextual and cultural variation in such thinking.

Notwithstanding these criticisms and the resulting disinterest in studying formal operations, we review the constructivist approach here to reinvigorate the view of adolescence as a distinctive period of time in the life cycle of unique opportunities and vulnerabilities. This research focusing on the diversity and plasticity of development challenged Inhelder and Piaget's view of formal operations as being acquired exclusively (*de novo*) and completely (*in toto*) during adolescence. Research pointed to younger children's surprising demonstration of logical, hypothetical, and abstract thinking in certain domains, contexts, and cultures, as well as adolescents and adults' equally surprising failure to demonstrate such reasoning in other domains, contents, and cultures. All this seems to undermine the notion that a "stage" of formal operation was emerging spontaneously and universally. Among the abilities supposedly acquired uniquely by adolescents but demonstrated by children include scientific (see review by Zimmerman, 2000; 2007), logical reasoning (see review by Kuhn, 2009), moral reasoning (see reviews by Smetana, 2006; Turiel, 2006), and perspective taking (see review by Martin, Sokol, & Elfers, 2008). The abilities supposedly acquired uniquely by adolescents but *not* demonstrated by them or adults include rational judgment and decision making (see a review by Shaklee, 1979) and objective and systematic thinking (Amsel, Klaczynski, Johnston, Bench, Close, Sadler, & Walker, 2008).

In exploring what is distinctive in adolescent development, the authors in this volume focus on forms of adolescent *coordinating activities*. Many

theories have long acknowledged that the developmental process involves connecting individual entities to other ones within a system or network, which increases the former's efficiency or effectiveness, such as its stability, control, power, or flexibility (c.f., Piaget, 1970; Vygotsky, 1962; Werner & Kaplan, 1963). By coordinating activities, we mean the integration of separate elements into an organized system of relations. This may occur at various levels of analysis, including connecting brain structures or processes into a neurological system; connecting cognitive elements such as capacities, beliefs, skills, or understandings into a conceptual structure; or connecting particular persons to others to create a social network. The new organized system of relations may become more efficient or effective in whatever function the individual elements were performing prior to their coordination. Again returning to the simple mathematical expressions, a sense of mathematical truth emerges when one procedure is coordinated with other ones in a set of related procedures. Despite the acquisition of each mathematical procedure, there is no grasp of the mathematical truth tapped by the procedures unless there is a coordination of them in an organized system.

As we discuss more fully later in the chapter, some coordinating activities create permanent connections between elements in the system, but in other cases the coordinating activity leads to temporary connections between elements that must be effectively reinstated in appropriate contexts. In either case, the new organization is a developmental transformation from the previous state of the organism, although all of the elements comprising the new organization were present earlier in development. The focus on adolescents' active coordination of preexisting elements suggests that adolescence changes are not *de novo* transformations, as the individual elements in the system may have existed prior to their coordination. Similarly, the focus on active coordinations that are temporary and need to be consistently reinstated by adolescents and adults suggests that adolescent changes are not *in toto* transformations, as they may extend into adulthood.

THEMES OF THE PAPERS

The book presents what we view as constructivist accounts of the adolescent coordinating activities in the domains of neurological structures and processes (Giedd and colleagues, Steinberg), cognitive systems (Amsel, Steinberg), cognitive strategies and metacognitive processes (Kuhn & Holman), experiences and self-narratives (Thorne & Shapiro), social reasoning and parental relations (Smetana), understanding of and interactions

with friends (Bukowski, Simard, Dubois, & Lopez), and relations between self and the broader developmental ecology (Crosnoe). Although the domains are quite distinct, each account presumes that adolescents make sense of their world through coordinating activities that shape their own development.

We review each contribution with an eye to highlighting the constructivist aspects that each author incorporates in his or her view of adolescent development. To this end, we highlight each contribution not only for the forms of coordination within levels or planes of analysis (neurological, cognitive, and social), but also between these levels, including the neurological and cognitive levels (Giedd and colleagues, Steinberg), cognitive and social levels (Amsel, Bukowsky et al., Crosnoe, Smetana, Steinberg, Thorne & Shapiro), and neurological and social levels (Steinberg). Additionally, adolescents' coordinating activities are explored in terms of opportunities for positive developmental outcomes they provide and vulnerabilities they pose if these coordinations are unsuccessful. These outcomes include the impact of unsuccessful coordinations for adolescent well-being (Bukowski et al.), mental health (Giedd, Crosnoe), risk taking (Steinberg, Amsel), parental conflict (Smetana), and academic underachievement (Kuhn & Holman, Crosnoe).

Biological and Cognitive Development

Giedd and colleagues present a broad description of neurological changes in cortical and subcortical regions from childhood to adolescence. They also summarize important new work exploring the genetic and environmental contributions to those brain changes based on the longitudinal twin study Giedd has been leading over the past several years. Many of the brain changes across neurological subdivisions appear to be inherited, suggesting that these changes were evolutionarily shaped and genetically mediated. Against this background, Giedd and colleagues report that there are dynamic changes in the heritability of neurological changes across ages. The volume of white matter in the brain lobes grows linearly and becomes more strongly associated with additive genetic contribution over age, whereas the volume of gray matter, which grows in an "inverted U"-shaped trajectory, becomes more strongly associated with unique environmental contributions over age.

Giedd and colleagues note that brain mechanisms responsible for the neural reorganization of white and gray matter is more coordinated and connected than it may appear, with a few dedicated mechanisms being

implicated. They acknowledge that myelinization has been thought to underlie the increase of white matter in the adolescent brain. However, recent work suggests that the change may be due to a speeding up of neurotransmission-related machinery in the axon (Giorgio, Watkins, Chadwick, James, Winmill, et al., 2010; Paus, 2010), which may also be influenced by environmental factors, including learning (Fields, 2008a, 2008b). Whatever the underlying mechanism, white matter increase is associated with improvements in the timing and flow of information between neurons.

Giedd and colleagues also note that changes in cortical gray matter may be due to processes of synaptic overproduction (synaptic blooming) and elimination (synaptic pruning) and to the myelinization of intracortical axons. Although the researchers do not offer an explanation of the increasing unique environmental contributions to the changes in gray matter over age, it may be related to the later synaptic pruning process, which is more dependent on experience than the earlier synaptic blooming process (Huttenlocher, 1994, although see Paus, 2005, 2009). Again, whatever the process, gray matter changes during adolescence, particularly in the prefrontal cortex, are associated with increased efficiency, effectiveness, and control of brain function (Casey, Jones, & Hare, 2008; Paus, 2005, 2009).

Giedd and colleagues make clear how the shaping of the brain during adolescence creates potential opportunities for positive developmental outcomes and vulnerabilities to more negative ones. The age x heritability findings suggest that normal developmental trajectories depend on the appropriate timing of the expression of particular genes to initiate brain reorganization; otherwise the adolescent is susceptible to the emergence of a range of mental health disorders. However, critical to this discussion, the normal trajectory of brain maturation during adolescence makes for faster, more efficient, and better controlled neural activity, resulting in adolescents having greater opportunities to coordinate neurological networks. That is, the evolutionarily shaped, genetically mediated, and environmentally impacted mechanisms of brain sculpting create a neurological platform in which opportunities for active coordinations between neurological systems become more available to adolescents, as compared to children.

Steinberg's chapter continues the focus on changes in adolescent brain function and organization to predict important cognitive changes with which they may be associated. He articulates an account of two relatively distinct neurological networks – the "socioemotional" and "cognitive control" systems – and highlights their normal trajectory of development. The socioemotional system is activated through puberty-related mechanisms during early adolescence and is associated with increases in reward-seeking