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Conceptual Issues in Studying the Development of Self-Regulation

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> The romantic myth of literary genius which has long promoted an effortless and unfathomable Shakespeare, cannot easily accommodate a model of a Shakespeare whose greatness was a product of labor as much as talent. The humbler portrait of Shakespeare . . . is of a writer who knew himself, knew his audience, and knew what worked.
>
> (Shapiro, 2005, p. 303)

The capacity for self-regulation is a hallmark of successful development. People engage in a variety of interactions with the physical, cognitive, and social world that require responsiveness to the actions of others while at the same time making a variety of choices. The agentic aspect of this engagement is understood as self-regulation. Although the construct of self-regulation originated in general systems theories whose concern was the complexity of bidirectional part-whole relationships in biology and physics, the adoption of the construct by developmental psychologists has tended to isolate the part from the whole, so that regulation is seen as a trait of the individual, rather than the result of the individual's experience with the context of development. Understanding self-regulation as intertwined with experiences in the social context will produce more accurate scientific predictions as well as more efficient intervention programs to improve children's behavioral problems.

Human self-regulation ultimately means knowing one's self, knowing one's context, and knowing how to interact with that context to achieve individual goals. Therefore, study of the development of self-regulation must encompass four issues: how individuals come to know themselves, understand the world in which they live, develop a set of goals, and understand how their actions can lead toward those goals. An important empirical question is whether this knowledge grows through interactions with other

agentic beings or whether it arises as a "romantic myth" of inherent capacities.

Calkins and Fox (2002) proposed three different approaches to the study of self-regulation as an aspect of personality. The first considers the multiple influences on individual development, which include individuals, groups, and cultures, considered separately or in reciprocal interaction. The second adds a developmental dimension and considers these social interactions in a hierarchical cascade in which early face-to-face interactions set the stage for attachment relations that become the basis for later social interactions. The third gives equal considerations to physiological, emotional, behavioral, and social processes within the individual that differentiate and interact over time to produce self-regulation. To these, I would add a fourth approach that bridges individual factors and social factors and defines behavioral self-regulation as an emergent of social regulation.

During early development, human regulation moves from the primarily biological to the psychological and social. What begins as a process for regulating temperature, hunger, and arousal soon turns to the regulation of attention, behavior, and social interactions. These achievements in "self"-regulation are heavily influenced by "other"-regulation. Parents are the ones who keep children warm, feed them, and cuddle them when they cry; peers provide children with knowledge about the range and limits of their social behavior; and teachers socialize children into group behavior, as well as regulate cognition into socially constructed domains of knowledge. Although these other-regulators can be considered background to the emergence of inherent individual differences in regulatory capacities, there has been much evidence from longitudinal research among humans and cross-fostering studies in other animals that "self"-regulatory capacities are heavily influenced by the experience of regulation provided by caregivers. The "other"-regulation position is that the capacity for self-regulation arises through the actions of others.

Sleep is an interesting example of a process in which biological regulation becomes psychological regulation through social regulation. As wakefulness begins to emerge as a distinct state, it is expanded and contracted by interactions with caregivers who stimulate alertness and facilitate sleepiness. Although it remains an essential biological process, eventually sleep takes on a large degree of self-regulation as the child and then adult make active decisions about waking time and sleeping time. But this agentic decision making remains intimately connected with other-regulation in terms of the demands of school and work for specific periods of wakefulness.

REGULATION MODEL

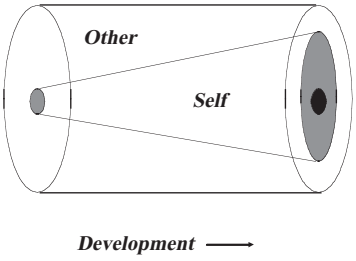

Figure 1.1. Changing balance between other-regulation and self-regulation as the child develops into an adult.

This volume is devoted to presenting the empirical evidence for the development of self-regulation. In what follows, we deal with the definition of self-regulation as it makes the transition from explaining biological to explaining psychological functioning. We will be concerned with delineating and differentiating what the child and the socializing environment contribute to the process. Generally, research on self-regulation has focused on part-processes, such as emotion or attention, separately from each other. This process of isolation obscures the larger picture in which many interacting systems are playing a role. For example, without regulation provided by the social context, the young child would not survive to engage in emotional or attentional processes. The other-regulation of nutrition and temperature provides clear examples of survival necessities.

Sameroff and Emde (1989), in a discussion of infant mental health diagnoses, argued for a position that infant diagnoses cannot be separated from relationship diagnoses. Their point is that, in early development, life is a "we-ness," rather than an "I-ness." The developmental and clinical question in this case is when does diagnosis become individualized; in other words, when can we say that a child has a self-regulation problem. Their proposal was to examine the point in development at which areas of self-regulation become independent of specific contexts and are carried into new relationships. This issue of the developmental expansion of self-regulation is captured by the *ice-cream cone-in-a-can* model of development (Sameroff & Fiese, 2000). In Figure 1.1, the developmental changes in this relationship between individual and context are represented as an expanding cone within a cylinder. The balance between other-regulation and self-regulation shifts as the child is able to take on more and more responsibility for his or her own well-being. The infant, who at birth could not survive without

the caregiving environment, eventually reaches adulthood and can become part of the other-regulation of a new infant, thereby beginning the next generation.

REGULATION AS A SYSTEMS PROPERTY

There are several ways of thinking about the history of regulation as a developmental construct. One approach is to count the growth in the number of times that the terms "regulation," "self-regulation," or "emotional regulation" occur in indexes of child development meeting programs or the number of times these constructs are mentioned in developmental textbooks (Eisenberg, Champion, & Ma, 2004). This is akin to describing the growth of the child by measuring his or her weight across time. Both measures show an increase. The more interesting question is the source of this increase. Did the increase occur because researchers discovered a new area of development that had gone unnoticed? Did it occur because researchers did not discover a new area, but simply renamed an old one? Or did the increase occur because researchers were using a new theory for examining existing areas of research? The answer is probably a mix of all three. The core change in research orientation came with a shift from static trait models of behavior to dynamic process models (Sameroff, 1983). Frequent attributions are made to the work of Rothbart (Rothbart & Derryberry, 1981) and her redefinition of temperamental traits as process variables – reactivity and self-regulation. Then, in collaboration with Posner, she presented an integrated view emphasizing the emotional aspects of reactivity and the cognitive aspects of self-regulation conceptualized as executive functioning (Posner & Rothbart, 2000).

However, this empirical change in orientation is embedded in a much larger theoretical and empirical context. The theoretical context is reflected in the history of systems thinking (von Bertalanffy, 1968) and considerations of the organismic metaphor (Overton & Reese, 1973). The empirical context is reflected in the explosive growth of molecular biology and its extension into cognitive and affective neuroscience. From the theoretical perspective, there is always a disconnect between the complexity of reality and the necessarily simpler empirical constructs. The belief of bottom-up scientists has been that, by understanding the basic units of life (either physical, biological, or psychological), the more complex forms will be understood. The belief of top-down scientists is that basic units participate in larger wholes that give meaning to the activity of the units – what is usually described as emergent properties.

A wonderful example of the bottom-up approach is the recently completed human genome project that was touted as offering an explanation for all illnesses of humankind (Collins, 1998). However, on completion of this mapping of all human genes, no such explanation was forthcoming. Because of the large number of such genes (~25,000, fewer than expected), predicting the particular combinations that would produce proteins is essentially impossible. Similar to language use but of a different magnitude, the smaller number of 25,000 genes (letters) can produce a much larger set of one to two million proteins (words). Using gene mapping to understand all human illness would be akin to the classic question of whether monkeys at a typewriter could come up with Shakespeare. Recent attempts to answer this question with simulations have been able to get virtual monkeys to type a string of only 19 characters that appear in any of Shakespeare's work, and this minor accomplishment took 42,162,500,000 billion billion monkey years (Wershler-Henry, 2007).

As a consequence of this bottom-up disconnect, molecular biologists interested in the biological contributions to disease have shifted their interest to the more complex biological structure of proteins in the relatively new field of proteomics. And proteins and their combinations are still near the beginning of a bottom-up explanation of human biological functioning. The top-down approach, in which researchers study the disease process and try to identify the genes that contribute to it, has proven to be much more fruitful in understanding disorder.

The primary reason that there is a gap between studying regulatory processes (the parts) and understanding human development (the whole) is that they have evolved together: there has always been a context in which to organize the parts into a viable and replicable system. Species and their environments have evolved together in a coactive and transactional relationship. In Gottlieb's (1992) coaction model for explaining developmental causality, development requires a relationship not only between two components, usually an organism and its context, but also between components of the same organism. Neither the internal expression of genes nor external stimulation can explain development, but their relationship can – what is typically called experience.

Biological development and evolution are fertile models for understanding the psychological analogs. The activity of single-cell bacteria in the primordial soup from which they evolved produced oxygen that changed the atmosphere and permitted the evolution of newer oxygen-utilizing bacteria with more efficient metabolic processes. The transactional consequence, however, was that the prior oxygen-producing cells could not survive in the

new environment. In addition, species not only transact with the environment but also with each other. Nutritional sources that had been restricted to simple compounds for the original single-cell life-forms became more complex as life became more complex. For example, the evolution of jaws expanded the possible food supplies for a new set of predators. The colonization of land by plants provided a food source for animals to follow. Fish and then amphibians had been limited to the water for reproduction, but reptiles developed the hard-shelled egg that gave them the capacity to live completely on land. Mammals, who developed placental reproduction and could thus provide a highly stable, insulated, internal early environment for their offspring, were even more independent of their environment. Each step in the evolutionary sequence provided new opportunities for adaptation. Whenever the environment changed, either as new species emerged or through geological changes (e.g., the volcanic Galapagos Islands), new adaptations were possible so that new selective advantages could be achieved for one species or another.

The implications for the study of human behavioral regulatory processes are that these processes evolved in a context where such regulations were needed. The study of emotions from a functional perspective (Campos, Frankel, & Camras, 2004) focuses on the organizing and adaptive role of emotions. Functionality implies a relation between individuals and their contexts. However, it can also reflect relations among different aspects of the individual. Much of the recent discussions of temperament describe it as a relationship between arousal and attentional processes, both described in regulation terminology. Moreover, these regulation processes are embedded not only in the relation between child and context but also in the additional relations between the family and its cultural and economic situations (Raver, 2004).

When we turn our attention to the development of behavioral regulation, many additional dynamics become salient. Over time, the brain changes, the body changes, the mind changes, and the environment changes along courses that may be somewhat independent of each other and somewhat a consequence of experience with each other. Discussions of behavioral regulation presented in the chapters in this book primarily focus on short-term processes in the relation between biological measures and child behavior or between child and parent behavior. These micro-regulations gain significance when they are understood in reference to what are described later as mini- and macro-regulations that operate on a larger timescale and incorporate these shorter term processes into a developmental agenda for the child. In the rest of this chapter, I outline a theoretical view of these regulatory systems within an evolutionary, intergenerational framework.

THE ENVIRONTYPE

The study of self-regulation and of other-regulation is highly contextualized. To adequately interpret these constructs, the general scope of developmental psychology needs to be augmented by two relatively recent major approaches, the orientations of life span (Baltes, 1979) and life course theories (Elder, 1979), in addition to the more traditional evolutionary approach. Life span approaches place development within a much larger time frame by redefining adulthood as a period of continuing individual change, but one that is in much more intimate contact with life experiences in the family and the workplace. Life course theory emphasizes the linking of lives – that each individual's development is influenced by and influences the development of other close individuals, especially other family members. For example, the development of the offspring of teenage mothers may take a different course from that of the offspring of mothers in their thirties and forties. Younger mothers may have more energy, whereas older mothers may have more resources. This theory also emphasizes that the life course occurs in history and that major social events have cohort effects on these linked lives. Historical events that stress parents, such as wars and economic downturns, will affect their child-rearing interactions and may have different consequences for younger children than for older ones (Elder, 1979).

The evolutionary approach is more than an acknowledgment that humans have evolved; it also incorporates the realization that communities continue to behave in accordance with evolutionary principles emphasizing reproductive fitness, measured by the number of offspring who will continue to reproduce the species, in general, and their society specifically. The prolonged development of human offspring relative to that of other animals has required an evolution in the complexity of the social organization that supports that development from birth to adulthood and beyond. This entire period that is repeated generation after generation is based on the interactions among a host of regulatory systems. These regulatory systems range from the here-and-now experiences of mother-infant interactions to governmental concern with the burden of national debt that will be passed on to the next generation and to conservationists' concerns with the fate of the planet as a viable environment for future generations of humans. Despite the immense complexity of cataloging all such regulation processes, I attempt to provide here a simple conceptual framework.

Just as there is a biological organization, the genotype, that regulates the physical development of each individual, there is a social organization that regulates the way human beings fit into and reproduce their society. This organization operates through socialization patterns of societal

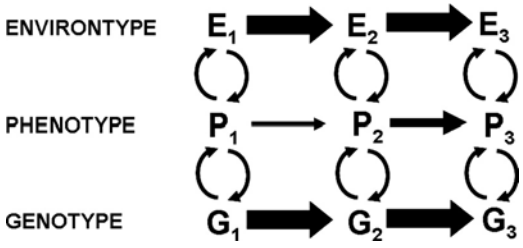

Figure 1.2. Regulation model of development with transactions among genotype, phenotype, and environtype.

institutions such as the family, the school, and the community and has been postulated to compose an *environtype* analogous to the biological *genotype* (Sameroff, 1989). In both cases there is a code, either genetic or environmental, that is preserved and transmitted from one generation to another. The genotype is preserved in a biological set of molecules contained within a genome, whereas the environtype is preserved through psychological meaning systems. Many of the chapters in this book are devoted to specifying the interactions between biological and behavioral systems that are the proximal manifestations of these more distal regulatory systems and that deserve attention especially when these regulations are dysfunctional. The use of developmental psychopathology as a framework in these studies seeks examples of maladaptation in these interactions to illuminate the complexity of adaptive regulations in human development.

The child's behavior at any point in time is a product of the transactions among the phenotype (i.e., the child), the environtype (i.e., the source of external experience), and the genotype (i.e., the source of biological organization; see Figure 1.2). This regulatory system is reciprocally determined at each point in development. On the biological side, the genotype in each cell is identical, but the particular set of genes active at any point in time is regulated by the state of the phenotype. Depending on the current chemical environment, certain genes are activated that alter the phenotype. The altered phenotype may then act reciprocally to deactivate the original genes and activate another set that will produce further developmental changes in the phenotype. On the environmental side, the environtype contains a range of possible reactions to the child, but the particular regulating experiences that are active at any point in time are in response to the behavioral status of the child's phenotype. Once the child changes as a consequence of one set of experiences, that set of experiences may be inhibited and another set activated in response to the changed status of the child. An

early example would be the change in human parent feeding behavior as the milk provided by breast or bottle leads to growth and changes in the child's digestive capacities that permit solid feeding and the reduction in nipple feeding.

Traditional research on child development has emphasized the child's utilization of biological capacities to gain experience and the role of experience in shaping child competencies, but has paid far less attention to how that experience is organized. Indeed, the organization of experience is explicit in the great amount of attention given to curriculum development in educational programs, but far less attention is given to the implicit organization of experience found in the family and social contexts that comprise the environtype. The environtype is composed of subsystems that transact not only with the child but also with each other. Bronfenbrenner (1977) provides the most detailed descriptions of environmental organizations that influence developmental processes within these categories: microsystems, mesosystems, exosystems, and macrosystems.

For our present purposes, we restrict the discussion to levels of environmental factors contained within the culture, family, and the individual parent, although other social settings, such as schools, have their own encoded traditions. Developmental regulations at each of these levels can be conceptualized as codes: a cultural code, a family code, and a code of the individual parent. These codes regulate cognitive and social-emotional development so that the child ultimately will be able to fill a role defined by society. They are hierarchically related in their evolution and in their current influence on the child. The experience of the developing child is partially determined by the beliefs, values, and personality of the parents; partially by the family's interaction patterns and transgenerational history; and partially by the socialization beliefs, controls, and supports of the culture.

We should recognize a distinction here between codes and behaviors. The environtype is no more a description of a specific experiential context than the genotype is a description of a specific biological phenotype. In each case, the code must be actualized through behavior. The environtype and genotype represent a range of responses. The environtype codes have an organizational and regulatory influence on parent behavior, for example, but any specific behavior is only one of a number of possible behavioral or biological manifestations.

Although the environtype can be conceptualized independently of the child, changes in the abilities of the developing child are major triggers for regulatory changes and in most likelihood were major contributors to the evolution of a developmental agenda (Sameroff, 1987); that is, each

environtype's timetable for developmental milestones. Although developmental milestones have always been thought to be a property of the child, their significance is much reduced unless there is a triggered regulation from the environtype. Different parents, different families, and different cultures may be sensitive to different behaviors of the infant as a regulatory trigger (deVries & Sameroff, 1984).

There is increasing variability in regulations as one moves from the cultural level through the family to the behavior of the individual parent, but typically the result is adaptive toward the future development of the child. When these regulations are either missing or outside the range of typical social experiences, the resulting maladaptations become the concern of developmental psychopathology.

Cultural Code

Culture is often defined by anthropologists as a shared meaning system that is transmitted across time. The ingredients of the cultural code are the complex of characteristics that organize a society's child-rearing system and that incorporate elements of socialization and education. These processes are embedded in sets of social controls and social supports. They are based on beliefs that differ in the degree of community consensus, ranging from mores and norms to fads and fashions, and can systematically vary among subpopulations within a culture. They can be encoded in written documents such as constitutions and laws or transmitted through the daily activities of social groups.

Many common biological characteristics of the human species have acted to produce similar developmental agendas in most cultures. In most cultures, formal education begins between the ages of 6 and 8 when most children have attained the cognitive ability to learn from structured experiences (Rogoff, 1981). However, historical and cross-cultural differences can emphasize or ignore changes in child behavior. Informal education can begin at many different ages depending on the culture's attributions to the child. For example, some middle-class parents have been convinced that prenatal experiences will enhance the cognitive development of their children and consequently begin stimulation programs during pregnancy, whereas others believe it best to wait until the first grade before beginning formal learning experiences. Such examples demonstrate the variability of human developmental contexts and the openness of the environtype to modification.