

CHAPTER 14

The Bioecological Model of Human Development

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The bioecological model, together with its corresponding research designs, is an evolving theoretical system for the scientific study of human development over time (Bronfenbrenner, 2005). In the bioecological model, development is defined as the phenomenon of continuity and change in the biopsychological characteristics of human beings, both as individuals and as groups. The phenomenon extends over the life course, across succes-

sive generations, and through historical time, both past and future. The term *future* raises a question: How is it possible to scientifically investigate phenomena that have not yet taken place? This question is hardly new; indeed, it pervades every field of scientific endeavor. However, we are the only species that, over historical time, has developed the capacity to engage successfully in scientific inquiry, and thereby, in many respects, has

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been able to change the nature of the world in which we live. As a result, within certain limits, we humans have altered the nature and course of our own development as a species (Bronfenbrenner & Evans 2000; Bronfenbrenner & Morris 1998).

To place bioecological theory of human development into a larger context, it is important to recognize that many of the general perspectives advanced and elaborated in this theory are also parts of other related lines of theoretical and empirical inquiry into human development. Examples include life-span psychology (Baltes, Lindenberger, & Staudinger, Chapter 11, this *Handbook*, this volume), cultural psychology (Cole, 1995; Shweder et al., Chapter 13, this *Handbook*, this volume), Magnusson's developmental theory of contextual-interactive holism (Magnusson & Stattin, Chapter 8, this *Handbook*, this volume), and, especially, the work of Robert Cairns (Chapter 3, this *Handbook*, this volume), who through communications and publications extending over 3 decades, has played a major role in the evolution of the four defining properties of the bioecological model: (1) Process, (2) Person, (3) Context, and (4) Time. Cairns is best known as the founder and principal protagonist of developmental science, and there are several excellent examples of his books and articles that have been most relevant to the evolution of the bioecological model (Bergman, Cairns, Nilsson, & Nysted, 2000; Cairns, 1970; Cairns & Cairns, 1994). The specific profile of the bioecological model of human development is its interdisciplinary and integrative focus on the age periods of childhood and adolescence and its explicit interest in applications to policies and programs pertinent to enhancing youth and family development.

In this chapter, we undertake to present the ecological model of human development that has been introduced over the course of the prior two editions of this *Handbook* (Bronfenbrenner & Crouter, 1983; Bronfenbrenner & Morris, 1998). The main focus of the 1983 chapter was on the empirical and theoretical roots of a model already in use, which centered on the role of the environment in shaping development. In contrast, this chapter is oriented toward the future. The present model introduces major theoretical innovations from the 1983 chapter in both form and content. The present formulation makes no claim as a paradigm shift (if there be such a phenomenon); rather, it continues a marked shift in the center of gravity of the model, in which features of earlier versions are first called into question but then re-

combined, along with new elements, into a more complex and more dynamic structure.

The transition in the form and content of the model actually took place over an extended period of time, an expression that will become all too familiar to the reader (Bronfenbrenner, 2005). The transition from a focus on the environment to a focus on processes was first introduced in the context of Bronfenbrenner's unpublished lectures, colloquium presentations, and contributions to symposia. Not until 1986, did reference to an emergent new model first appear in print (Bronfenbrenner, 1986b). The following extended excerpt conveys both its spirit and intended substance. Because both of these attributes are relevant to the gradual evolution of the model to its present form, we quote from the 1986 statement at some length:

It is now more than a decade ago that, being somewhat younger, I presumed to challenge the then-prevailing conventions of our field by describing the developmental research of the day as "the study of the strange behavior of children in strange situations for the briefest possible period of time" (Bronfenbrenner, 1974). Instead, I argued (as if it were simply a matter of choice), we should be studying development in its ecological context; that is, in the actual environments in which human beings lived their lives. I then proceeded to outline, in a series of publications, a conceptual framework for analyzing development in context, and to offer concrete examples of how various elements of the schema might be applied both to past studies and to studies yet-to-come. I also emphasized the scientific and practical benefits of a closer linkage, in both directions, between developmental research and public policy (Bronfenbrenner, 1974, 1975, 1977a, 1977b, 1979a, 1979b, 1981). Now, a dozen years later, one might think that I have good reason to rest content. Studies of children and adults in real-life settings, with real-life implications, are now commonplace in the research literature on human development, both in the United States and, as this volume testifies, in Europe as well. This scientific development is taking place, I believe, not so much because of my writings, but rather because the notions I have been promulgating are ideas whose time has come. . . .

Clearly, if one regards such scientific developments as desirable, there are grounds for satisfaction. Yet, along with feelings of gratification, I must confess to some discontent. My disquiet derives from two complementary concerns. The first pertains to one of the main roads that contemporary research has taken; the second, to some more promising pathways that are being neglected.

Alas, I may have to accept some responsibility for what I regard as the wayward course. It is an instance of what might be called “the failure of success.” For some years, I harangued my colleagues for avoiding the study of development in real-life settings. No longer able to complain on that score, I have found a new *bête noir*. In place of too much research on development “out of context,” we now have a surfeit of studies on “context without development.”

One cannot presume to make so brass an allegation without being prepared to document one’s case. I am prepared. (Bronfenbrenner 1986a, pp. 286–288)

What followed was an early version of the newly evolving theoretical framework, but the purpose of the present chapter is better served by presenting the model in its current, albeit still-evolving, form now called the *bioecological model*. The term *evolving* highlights that the model, along with its corresponding research designs, has undergone a process of development during its life course (Bronfenbrenner, 2005). The bioecological model addresses two closely related but fundamentally different developmental processes, each taking place over time. The first process defines the phenomenon under investigation—continuity and change in the biopsychological characteristics of human beings. The second focuses on the development of the scientific tools—theoretical models and corresponding research designs required for assessing continuity and change.

These two tasks cannot be carried out independently, for they are the joint product of emerging and converging ideas, based on both theoretical and empirical grounds—a process called *developmental science* in the discovery mode (Bronfenbrenner & Evans 2000, pp. 999–1000). In the more familiar verification mode, the aim is to replicate previous findings in other settings to make sure that the findings still apply. By contrast, in the discovery mode, the aim is to fulfill two broader but interrelated objectives:

1. Devising new alternative hypotheses and corresponding research designs that not only question existing results but also yield new, more differentiated, more precise, replicable research findings and, thereby, produce more valid scientific knowledge.
2. Providing scientific bases for the design of effective social policies and programs that counteract newly emerging developmentally disruptive influences. This has been an explicit objective of the bioecological model from its earliest beginnings. To orient the

reader to the present formulation of the biological model, a preview follows.

OVERVIEW

We begin with an exposition of the defining properties of the model, which involves four principal components and the dynamic, interactive relationships among them. The first of these, which constitutes the core of the model, is *Process*. More specifically, this construct encompasses particular forms of interaction between organism and environment, called *proximal processes*, that operate over time and are posited as the primary mechanisms producing human development. However, the power of such processes to influence development is presumed, and shown, to vary substantially as a function of the characteristics of the developing *Person*, of the immediate and more remote environmental *Contexts*, and the *Time* periods, in which the proximal processes take place.

The sections that follow examine in greater detail each of the three remaining defining properties of the model, beginning with the biopsychological characteristics of the *Person*. This domain was given sequential priority to fill a recognized gap in earlier prototypes of the ecological model. Thus, at midstage in the development of the present model, Bronfenbrenner criticized its theoretical predecessors and acknowledged his share of responsibility for failing to deliver on an empirical promise:

Existing developmental studies subscribing to an ecological model have provided far more knowledge about the nature of developmentally relevant environments, near and far, than about the characteristics of developing individuals, then and now. . . . The criticism I just made also applies to my own writings. . . . Nowhere in the 1979 monograph, nor elsewhere until today, does one find a parallel set of structures for conceptualizing the characteristics of the developing person. (Bronfenbrenner, 1989a, p. 188)

Three types of *Person* characteristics are distinguished as most influential in shaping the course of future development through their capacity to affect the direction and power of proximal processes through the life course. First, *dispositions* can set proximal processes in motion in a particular developmental domain and continue to sustain their operation. Next,

bioecological *resources* of ability, experience, knowledge, and skill are required for the effective functioning of proximal processes at a given stage of development. Finally, *demand* characteristics invite or discourage reactions from the social environment that can foster or disrupt the operation of proximal processes. The differentiation of these three forms leads to their combination in patterns of Person structure that can further account for differences in the direction and power of resultant proximal processes and their developmental effects.

These new formulations of qualities of the person that shape his or her future development have had the unanticipated effect of further differentiating, expanding, and integrating the original 1979 conceptualization of the environment in terms of nested systems ranging from *micro* to *macro* (Bronfenbrenner, 1979b). For example, the three types of Person characteristics previously outlined are also incorporated into the definition of the *microsystem* as characteristics of parents, relatives, close friends, teachers, mentors, coworkers, spouses, or others who participate in the life of the developing person on a fairly regular basis over extended periods of time.

The bioecological model also introduces an even more consequential domain into the structure of the microsystem that emphasizes the distinctive contribution to development of proximal processes involving interaction not with people but with objects and symbols. Even more broadly, concepts and criteria are introduced that differentiate between those features of the environment that foster versus interfere with the development of proximal processes. Particularly significant in the latter sphere is the growing hecticness, instability, and chaos in the principal settings in which human competence and character are shaped—in the family, child-care arrangements, schools, peer groups, and neighborhoods.

The latter theme speaks to the fourth and final defining property of the bioecological model and the one that moves it farthest beyond its predecessor—the dimension of *Time*. The 1979 Volume scarcely mentions the term, whereas in the current formulation, it has a prominent place at three successive levels: (1) *micro-*, (2) *meso-*, and (3) *macro-*. *Microtime* refers to continuity versus discontinuity in ongoing episodes of proximal process. *Mesotime* is the periodicity of these episodes across broader time intervals, such as days and weeks. Finally, *Macrotime* focuses on the changing expectations and events in the larger society, both within and across gen-

erations, as they affect and are affected by, processes and outcomes of human development over the life course. The treatment of this last topic draws on Elder and Shanahan, Chapter 12, this *Handbook*, this volume. Our primary emphasis, however, is on the role of developmental processes and outcomes in producing large-scale changes over time in the state and structure of the broader society over time, and the implications of those changes for the society's future.

Before turning to the task at hand, it is important to make explicit three overarching orientations that define the content and the structure of the chapter as a whole. First, we use the term *development* to refer to *stability and change in the biopsychological characteristics of human beings over the life course and across generations*. There are no restrictive assumptions of change for the better or of continuity in the characteristics of the same person over time. Rather, these are issues to be investigated.

Second, from the perspective of the bioecological model, the forces producing stability and change in the characteristics of human beings *across* successive generations are no less important than stability and change *in* the characteristics of the same person over his or her lifetime.

The third orientation is perhaps the most essential, and the most difficult to achieve. It was Kurt Lewin (cited in Marrow, 1977) who said that there is nothing so practical as a good theory. But to be “good,” a theory must also be “practical.” In science, a good theory is one that can be translated into corresponding research designs that match the defining properties of the theory. In the absence of such research designs—or worse yet, in the application of research designs that fail to match or even violate the defining properties of the theory—science cannot move forward. Hence, we have sought, as we proceed through successive stages of theoretical formulation, to specify, and, wherever possible, to illustrate the properties of a research design that corresponds with, or at least approximates, the proposed theoretical structure.

DEFINING PROPERTIES OF THE BIOECOLOGICAL MODEL

An early critical element in the definition of the bioecological model is *experience*, which indicates that the scientifically relevant features of an environment for human development not only include its objective prop-

erties but also the way in which the properties are subjectively experienced by the person living in that environment. This equal emphasis on an *experiential* as well as an *objective* view springs neither from an antipathy to behaviorist concept nor from a predilection for existential philosophic foundations but is dictated simply by the fact that very few of the external influences significantly affecting human behavior and development can be described solely in objective physical conditions and events (Bronfenbrenner & Evans 2000; Bronfenbrenner & Morris 1998).

Critical to the foregoing formulation is the word *solely*. In the bioecological model, both objective and subjective elements are posited as driving the course of human development; neither alone is presumed sufficient. Moreover, these elements do not always operate in the same direction. It is therefore important to understand the nature of each of these two dynamic forces, beginning on the phenomenological or experiential side. Both of the terms are relevant because, while related to each other, they are typically applied to somewhat different spheres. Experiential is more often used in relation to cognitive development and pertains mainly to changes in how the environment is perceived at successive stages of the life course, beginning in early infancy and proceeding through childhood, adolescence, adulthood, and, ultimately, old age.

By contrast, *experience* pertains more to the realm of feelings—anticipations, forebodings, hopes, doubts, or personal beliefs. Feelings, emerging in early childhood and continuing through life, are characterized by both stability and change: They can relate to self or to others, especially to family, friends, and other close associates. They can also apply to the activities in which we engage; for example, those that we most or least like to do. But the most distinctive feature of such experiential equalities is that they are emotionally and motivationally loaded, encompassing both love and hate, joy and sorrow, curiosity and boredom, desire and revulsion, often with both polarities existing at the same time but usually in differing degrees. A significant body of research evidence indicates that such positive and negative subjective forces, evolving in the past, can also contribute in powerful ways to shaping the course of development in the future (Bronfenbrenner & Evans 2000; Bronfenbrenner & Morris 1998).

But these forces are not the only powerful ones at work, other forces are more objective in nature. This presence does not mean, however, that the forces are necessarily either more or less influential, mainly be-

cause the two sets of forces are interdependent and affect each other. Like their subjective counterparts, these more objective factors also rely on their assessment of corresponding theoretical models and associated research designs, which evolved over time. These more objective relationships are documented propositions presented later (see too Bronfenbrenner & Evans 2000; Bronfenbrenner & Morris 1998). The first proposition specifies the theoretical model, and provides concrete examples; the second foreshadows a corresponding research design for their assessment.

However, before proceeding with formal definitions, it may be useful to point out that traditionally such phenomena as parent-child interaction—or, more generally, the behavior of others toward the developing person—have been treated under the more inclusive category of the environment. In the *bioecological model*, a critical distinction is made between the concepts of *environment* and *process*, with the latter not only occupying a central position, but also having a meaning that is quite specific. The construct appears in Proposition I stipulating the defining properties of the model. To place its meaning in context, we cite Proposition II as well.

Proposition I

Especially in its early phases, but also throughout the life course, human development takes place through processes of progressively more complex reciprocal interaction between an active, evolving biopsychological human organism and the persons, objects, and symbols in its immediate external environment. To be effective, the interaction must occur on a fairly regular basis over extended periods of time. Such enduring forms of interaction in the immediate environment are referred to as proximal processes. Examples of enduring patterns of proximal process are found in feeding or comforting a baby, playing with a young child, child-child activities, group or solitary play, reading, learning new skills, athletic activities, problem solving, caring for others in distress, making plans, performing complex tasks, and acquiring new knowledge and know-how.

For the younger generation, participation in such interactive processes over time generates the ability, motivation, knowledge, and skill to engage in such activities both with others and on your own. For example, through progressively more complex interaction with their parents, children increasingly become agents of their own development, to be sure only in part.

Proximal processes are posited as the primary engines of development (see Gottlieb, Wahlsten, & Lickliter, Chapter 5, this *Handbook*, this volume; Tobach, 1981; Tobach & Schneirla, 1968). A second defining property, the fourfold source of these dynamic forces is identified in Proposition II.

Proposition II

The form, power, content, and direction of the proximal processes effecting development vary systematically as a joint function of the characteristics of the developing person, the environment—both immediate and more remote—in which the processes are taking place, the nature of the developmental outcomes under consideration, and the social continuities and changes occurring over time through the life course and the historical period during which the person has lived.

Propositions I and II are theoretically interdependent and subject to empirical test. An operational research design that permits their simultaneous investigation is referred to as the *Process-Person-Context-Time (PPCT) model*.

Characteristics of the person actually appear twice in the bioecological model—first as one of the four elements influencing the *form, power, content, and direction of the proximal process*, and then again as *developmental outcomes*—qualities of the developing person that emerge at a later point in time as the result of the joint, interactive, mutually reinforcing effects of the four principal antecedent components of the model. In sum, in the bioecological model, the characteristics of the person function both as an indirect producer and as a product of development (see Lerner, 1982, 2002; Lerner & Busch-Rossnagel, 1981).

Finally, because in the bioecological model the concept of proximal process has a specific meaning, it is important that its distinctive properties be made explicit. For present purposes, the following features of the construct are especially noteworthy:

1. For development to occur, the person must engage in an activity.
2. To be effective, the activity must take place “on a fairly regular basis, over an extended period of time.” For example, this means that with young children, a weekend of doing things with Mom or Dad does not do the job, nor do activities that are often interrupted.
3. Why not? One reason is that, to be developmentally effective, activities must continue long enough to become “increasingly more complex.” Mere repetition does not work.
4. Developmentally effective proximal processes are not unidirectional; there must be influence in both directions. For interpersonal interaction, this means that initiatives do not come from one side only; there must be some degree of reciprocity in the exchange.
5. Proximal processes are not limited to interactions with people; they also can involve interaction with objects and symbols. In the latter circumstance, for reciprocal interaction to occur, the objects and symbols in the immediate environment must be of a kind that invites attention, exploration, manipulation, elaboration, and imagination.
6. The powerful moderating factors specified in Proposition II produce substantial changes in the content, timing, and effectiveness of proximal processes. In particular:
 - a. As children grow older, their developmental capacities increase both in level and range; therefore, to continue to be effective, the corresponding proximal processes must also become more extensive and complex to provide for the future realization of evolving potentials. At the same time, in view of the ongoing developmental advance, the intervals between periods of “progressively more complex” activity can be increasingly longer, although they must still occur on a “fairly regular basis.” Otherwise, the pace of development slows, or its course may even reverse direction.
 - b. The principal persons with whom young children interact “on a fairly regular basis over extended periods of time” are parents, but especially as children get older, other persons—such as caregivers, relatives, siblings, and peers—also function in this role. These are soon followed by teachers or mentors in other activities, and then by close friends of the same or opposite sex, spouses or their equivalents, and coworkers, superiors and subordinates at work. As the examples indicate, the involvement of persons functioning

in this role is not limited to the formative years. Borrowing a term from G. H. Mead (1934), we refer to such persons as *significant others*.

The foregoing constitute the principal elements of the emergent theoretical model. If so, the question arises in what sense is the model *bioecological*? Where and how does biology come into the picture? We present three answers to that question in an order of decreasing certainty about their validity. The first is an unqualified disclaimer. Little in the pages that follow speaks to the operation of biological systems *within* the organism. By contrast, considerable scientific attention is accorded to characteristics of the person generally regarded as *biologically based* that influence proximal processes and their developmental outcomes. Finally, the present model rests on the assumption that biological factors and evolutionary processes not only set limits on human development but also impose imperatives regarding the environmental conditions and experiences required for the realization of human potentials. The position is taken that, to the extent that the necessary conditions and experiences are not provided, such potentials will remain unactualized (Bronfenbrenner & Ceci, 1993, 1994a, 1994b).

It is our belief that, when applied, the bioecological paradigm is scientifically productive. At the present time, however, its most distinguishing characteristic is not its proven scientific power, but its rarity. To be sure, the rarity is hardly surprising, given the fact that successive revisions of the emerging model began to be published only in the past several years (Bronfenbrenner, 1989a, 1990, 1993, 1994, 1995; Bronfenbrenner & Morris, 1998; Bronfenbrenner & Ceci, 1994a). Paradoxically, some concrete examples nevertheless existed much earlier. They were the product of what Bronfenbrenner and Crouter referred to in the 1983 edition of this *Handbook* as “latent paradigms”; that is, theoretical models that were not explicitly stated, but were implicit in the research designs used in analyzing the data (Bronfenbrenner & Crouter, 1983, pp. 373–376). Indeed, a partial precursor of the bioecological model appeared in the 1983 *Handbook* chapter under the rubric of a “person-process-context model.” In that chapter, however, what is meant by process is never specified, and the overwhelming majority of the examples cited do not include a proximal process component as defined in Proposition I. The same holds true for developmentally

relevant characteristics of the Person. The 1983 chapter also made no reference to Time as a defining property of the theoretical model. In these and other respects to follow, today’s bioecological model goes far beyond its predecessors both with respect to basic constructs and their bidirectional, synergistic interrelationships.

FROM THEORY TO RESEARCH DESIGN: OPERATIONALIZING THE BIOECOLOGICAL MODEL

We have come to the point where it is both possible and necessary to examine the requirements imposed by the bioecological model for corresponding research designs. We begin with a concrete example of the latter.

In the 1950s and 1960s, Cecil Mary Drillien (1957, 1964), a physician and professor of child life and health at the University of Edinburgh, carried out a 7-year longitudinal investigation of psychological development in two groups: 360 children of low birthweight and a control group selected “by taking the next mature birth from the hospital admission list” (1957, p. 29). In her follow-up assessments, the investigator found that children of low birthweight were more likely to exhibit problems in physical growth, susceptibility to illness, impaired intellectual development, and poorer classroom performance, with all of these tendencies being more pronounced in boys (1964). In a comparison of children’s school performance with what would have been expected on the basis of their scores on an intelligence test, Drillien found that those of low birthweight were especially likely to be working below their mental capacity. In relation to this finding, the author comments as follows: “In most cases, failure to attain a standard commensurate with ability was associated with problems of behavior, which were found to increase with decreasing birthweight [and] to be more common in males” (1964, p. 209).

Figure 14.1 depicts the results. The figure does not appear in Drillien’s monograph, but was constructed from data presented in tables in that volume. It shows the impact of the quality of mother-infant interaction at age 2 on the number of observed problem behaviors at age 4 as a joint function of social class and three levels of low birthweight—those underweight by a pound or more, not more than one pound, and those of normal birthweight. Measures of maternal responsiveness were based on

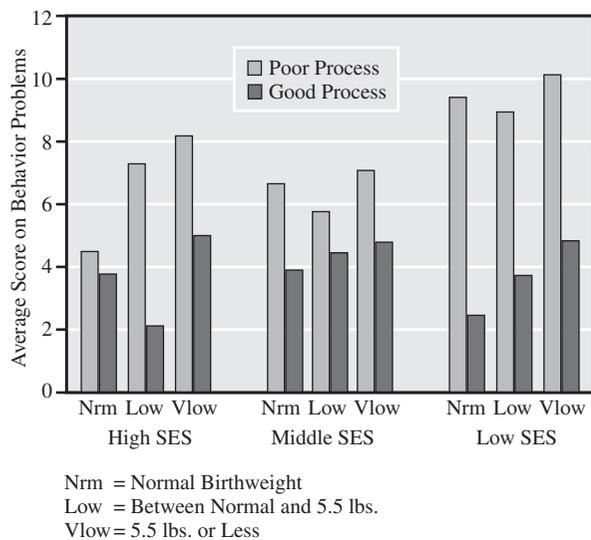


Figure 14.1 Effect of mother's responsiveness on problem behavior of child at age 4 by birthweight and social class.

observations in the home and interviews with the mother. The investigator's measure of social class was a composite index that took into account not only parental income and education but also the socioeconomic level of the neighborhood in which the family lived. The quality of interaction was assessed by extent to which the mother was responsive to changes in the state and behavior of the infant. The measure of the developmental outcome was the frequency of reported behavior disturbances such as hyperactivity, overdependence, timidity, and negativism.

Our primary interest is not in the research findings, but in the extent to which the structure of the research design corresponds with the defining properties of the bioecological theoretical model. The first point to be noted in this regard is that Proposition I defines Proximal Processes as bidirectional. Drillien's measure of process, however, was based only on the mother's responsiveness to changes in the state and behavior of the infant, and no data are reported that would permit calculating a complementary measure of the infant's responsiveness to changes in the state and behavior of the mother. This means that the operational measure available in Drillien's research taps only one side of the theoretical definition of proximal process. For that reason, it appears likely that, to the extent the infant's contribution to reciprocal interaction carries any weight, the obtained results may underestimate the true magnitude of the observed effects.

Nevertheless, as revealed in Figure 14.1, maternal responsiveness across time, a one-sided measure of proxi-

mal process, still emerges as the most powerful predictor of developmental outcome. In all instances, responsive maternal treatment reduces substantially the degree of behavioral disturbance exhibited by the child.

Herein lies the main justification for distinguishing between proximal process on the one hand, and, on the other, the environments in which the processes occur; namely, in accord with Proposition I, proximal processes turn out to be the most potent force influencing the developmental outcome (in this case, the frequency of problem behaviors at 4 years of age). Furthermore, as stipulated in Proposition II, the power of the Process varies systematically as a function of the environmental Context (i.e., social class) and of the characteristics of the Person (i.e., weight at birth). The process appears to have made its greatest impact on young children growing up in the most disadvantaged environment (i.e., the lowest socioeconomic level), but in that environment, it is those who at birth were of normal weight who benefited most. Moreover, it was in this same disadvantaged Context that, under high levels of maternal responsiveness, birthweight showed its most consistent effect, with the number of behavior problems steadily rising as birthweight fell. Finally, across the board, maternal responsiveness had the general result of decreasing or buffering against environmental differences in developmental outcome. Thus, at high levels of mother-child interaction, social class differences in problem behavior became much smaller.

From the perspective of developmental science, what is most noteworthy about these findings is not their specific content but that their simultaneous discovery was made possible by a research design based on a theoretical model that allowed for the emergence of patterns of this form. Not only are the four key components of Process, Person, Context, and Time all represented but the design also provides for the detection of the kinds of synergistic¹ interdependencies among these components that are posited in the bioecological model as a dynamic theoretical system. Two specific examples of such interdependencies are revealed in the analysis of Drillien's data:

1. Proposition II stipulates that the developmental effects of proximal processes vary as a joint function of

¹ *Synergism* refers to "cooperative action of discrete agencies such that the total effect is greater than the sum of the two or more effects—taken independently" (*Webster's Third New International Dictionary*).

Person and Context; that is, the indirect effects of Person and Context on the relation of Process to outcome are not to be conceived as simply additive. Consistent with this expectation is the finding that proximal processes had their greatest impact in the most disadvantaged environment but on the healthiest infant. The combination of Person and Context exhibit a mutually reinforcing, multiplicative, indirect effect on the power of proximal processes as the “engines of development.”

2. In Drillien’s research, the frequency of problem behaviors was assessed at two points in time—first when the infants were 2-years-old, and then again at 4-years-old. If one makes the not unreasonable assumption that mothers continued to interact with their children over the intervening period, then the results shown in Figure 14.2 provide evidence for the effect of proximal processes that have taken place over an extended period of time. Youngsters experiencing low levels of interaction with their mothers exhibited an accelerating increase in the number of problem behaviors from 2 to 4 years of age, whereas those exposed to substantially higher levels of this proximal process showed only a modest rise.

Developmental Science in the Discovery Mode

What about the possibility that the preceding results are chance findings? Some of them are statistically significant, yet others could not be tested because the variances needed for calculating error estimates were not reported. But that is not the principal issue at stake. With concrete

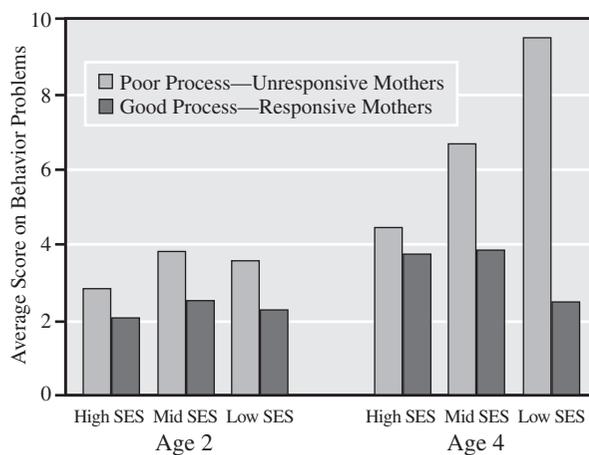


Figure 14.2 Effect of mother’s responsiveness on problem behavior of child at ages 2 and 4 by social class.

examples of the relation between theoretical and operational models now before us, we can address what turns out to be a complex and consequential question: What is the function of research design in the bioecological model? The first point to be made in this regard is that the main function is not the usual one of testing for statistical significance. Rather, the research design must provide for carrying out an equally essential and necessarily prior stage of the scientific process: that of *developing hypotheses of sufficient explanatory power and precision to warrant being subjected to empirical test*. We are dealing with science in the *discovery mode* rather than in the *mode of verification*. In this earlier phase, theory plays an even more critical role. From its very beginnings, the bioecological model, through its successive reformulations, represents a sustained effort to meet this scientific need.

What are the appropriate characteristics of research designs for developmental science in the discovery mode? Finding an answer to this question is complicated by the fact that, compared with the physical and natural sciences, developmental science is admittedly still in an earlier stage of development. Furthermore, because its scope falls between the natural and the social sciences, the discovery process must to some extent be adapted to the requirements of both. Perhaps in part for these reasons, we were unable to find any discussion of the issue in the developmental literature. Under these circumstances, we concluded that the best we could do was to try to make explicit the characteristics of the research designs that had been employed over the past several years to arrive at successively more differentiated formulations of the bioecological model.

These design characteristics depend on the constructs, and the possible relations between them, that are posited in the theoretical model at its present stage of development. Both the constructs, and the possible interrelationships, have been indicated in Propositions I and II, but as yet they appear in a relatively undifferentiated form. For example, the directions of the expected effects of Person and Context on proximal processes for different types of outcomes are not specified. The reason for such lack of specificity is that a more precise formulation could not be deduced either from the theory in its present, still evolving state, or induced from any already available data (at least, to our knowledge). Given these limitations, we concluded that an appropriate design strategy at this point in the discovery process could be one that involves a series of progressively more differentiated formulations and corresponding data

analyses, with the results at each successive step setting the stage for the next round. The research designs employed must be primarily generative rather than confirmatory versus disconfirming.

In this generative process, implications derived from the theoretical model play a more prominent role than those drawn from research findings, but the latter are also critical. Their importance is best conveyed by specifying a key feature of the corresponding research design: It must provide a structured framework for displaying the emergent research findings in a way that reveals more precisely the pattern of the interdependencies that are obtained in the data available. Of primary scientific interest are not those aspects of the observed pattern already anticipated in the existing theoretical model, but those features that point to more differentiated and precise theoretical formulations. These can then be evaluated in the light of new evidence, and, if deemed scientifically promising, can be incorporated in the research design for a next step. The proposed strategy for developmental investigations in the discovery mode involves an iterative process of successive confrontations between theory and data leading toward the ultimate goal of being able to formulate hypotheses that both merit and are susceptible to scientific assessment in the verification mode.

In presenting this definition of the discovery mode, we acknowledge that, in actual scientific practice, it is hardly likely to be a discovery. The process we have described, or something like it, is what scientists have always done. Our primary reason for seeking to make that process explicit was the belief that doing so could further the discovery process. But we also hope that the explication and examples of the discovery mode presented in this chapter will have broader utility in developmental research.

To return to the task at hand, the proposed criteria have more specific implications for the critical role in research design played by statistical analysis. First, in the discovery phase, Type I errors can entail an even greater risk than errors of Type II. To state the issue more broadly, dismissing as invalid a finding that points the way to a fuller and more precise explanation for the phenomenon under investigation may result in a greater loss than that produced by accepting a finding that is highly significant because of as yet undifferentiated and thereby confounded factors producing the phenomenon in question (e.g., the failure to distinguish Process from Context). The greater risk in the discovery process of

dismissing findings as Type I errors is further compounded by the phenomenon of magnification of early environmental differences over time. Thus, as illustrated by the escalating effects of proximal processes shown in Figure 14.2, changes in outcome associated with a proximal process at Time 1 can be quite small and nonsignificant statistically. Yet, as shown, they can be powerful predictors of a marked increase in developmental outcome several years later (in the likely event that the process continued to be maintained over the intervening period).

At this point, a methodological note is in order. Statistical models widely used for the purpose of hypothesis testing are often ill-suited as operational models for developmental investigations in the discovery mode. This is particularly true for models that control statistically solely for *linear* relationships among the factors in the research design to obtain an estimate of the independent contribution of each factor in the statistical model to the outcome under investigation. The validity of such analyses rests on what in mathematical statistics is referred to as “the assumption of homogeneity of regression.” To illustrate the assumption in its simplest general case: given a dependent variable y and two independent variables x_1 and x_2 , then the relation between x_1 and y must be the same at all levels of x_2 . This assumption is often not met in developmental data. For example, when applied to the analysis shown in Figure 14.2, it would require that the relation between proximal process and frequency of problem behaviors be the same at every social class level, which is not the case. Nor is this requirement likely to hold with respect to any combination of the four defining properties of the bioecological model. As Bronfenbrenner stated in his 1979 monograph, “*In ecological research, the principal main effects are likely to be interactions*” (p. 38, italics in original).

Any research design based on a bioecological model must allow for the possibility of such interactions. However, it is also essential, especially in the discovery phase, that the particular interactions to be examined be theoretically based, and that—if possible—their anticipated direction and form be specified in advance so that discrepancies between theoretical expectation and observed reality can be readily recognized and thus provide the basis for a next step in the typically slow, iterative process of seeking more differentiated formulations that merit further exploration both on theoretical and empirical grounds. In each case, the new formula-

tion should be consistent with the existing theoretical specifications of the bioecological model, but it also must take into account any old or new research findings bearing on the issue.

The foregoing criteria for research in the discovery mode do not imply neglect of the traditional issues of reliability and validity. These are honored in a somewhat different, theoretically guided way. Essentially, the process is one of cross-validation at two levels. First, in a given study, the results at each successive stage of analysis are validated in the next, more differentiated formulation. Second, the generalizations emerging from a given investigation are cross-validated against findings from other studies of theoretically related phenomena but with a specific focus on the defining components of the bioecological model.

Before we proceed with concrete examples, it is important to emphasize that the criteria we have proposed and applied for conducting developmental science in the discovery mode represent a first attempt to construct a working model. Moreover, the working model is subject to the curious qualification that it is itself the product of the same sequential design that it proposes. The criteria were developed by examining the changes introduced at each successive stage in the evolution of the bioecological model to identify the theoretical and operational properties leading to improvement in the model's predictive power. The example that follows illustrates these concurrent processes.

Different Paths to Different Outcomes: Dysfunction versus Competence

In this instance, our exploratory effort took as its point of departure the stipulation in Proposition II that the effects of proximal processes vary systematically depending on the developmental outcome. Once again, rather than taking time to retrace our steps, we begin with where we ended up; namely, with the following initial formulation:

The greater developmental impact of proximal processes on children growing up in disadvantaged or disorganized environments is to be expected to occur mainly for outcomes reflecting developmental *dysfunction*. By contrast, for outcomes indicating developmental *competence*, proximal processes are posited as likely to have greater impact in more advantaged and stable environments.

The term *dysfunction* refers to the recurrent manifestation of difficulties on the part of the developing person in maintaining control and integration of behavior

across situations, whereas *competence* is defined as the demonstrated acquisition and further development of knowledge and skills—whether intellectual, physical, socioemotional, or a combination of them (e.g., learning how to care for a young infant involves all three).

The preceding emergent formulation is based on the following considerations. Most parents have the capacity and the motivation to respond to manifestations of physical or psychological distress on the part of their children. In deprived or disorganized environments, such manifestations of dysfunction have been shown to be both more frequent and more severe (e.g., in Drillien's research), thus drawing on more of parents' available time and energy. Accordingly, to the extent that, in disadvantaged settings, parents are able to engage in proximal processes, these are likely to have greater impact in reducing dysfunction rather than in enhancing their children's knowledge about and skill in dealing with the external environment. With respect to problems of dysfunction, in deprived environments there is usually a match between young children's needs and their parents' capacity to meet those needs. This does not mean, however, that children in such environments will end up functioning as well as their age-mates growing up in more favorable circumstance, but rather that, over similar periods of time, they will show greater improvement in control over their own problem behaviors as a function of parental responsiveness.

The situation in advantaged and stable environments is rather different. Manifestations of dysfunction are likely to occur less often and to be less intense. Under these circumstances, parents are more apt to be attracted by and respond to the more frequent and more gratifying signs of their children's growing competence, with the result that proximal processes may to be focused mainly in this latter sphere. In addition, parents living in a middle-class world are themselves more apt to possess and exhibit the knowledge and skills they wish their children to acquire. They also have greater access to resources and opportunities outside the family that can provide needed experiences for their children. Taken together, the foregoing considerations led to the formulation of the previously stated "proto-hypothesis."

Because Drillien's study of the influence of mother-infant interaction dealt with only one developmental outcome, one has to look elsewhere for evidence that effects of such processes vary depending on the nature of the outcome under consideration. A rich data archive generously

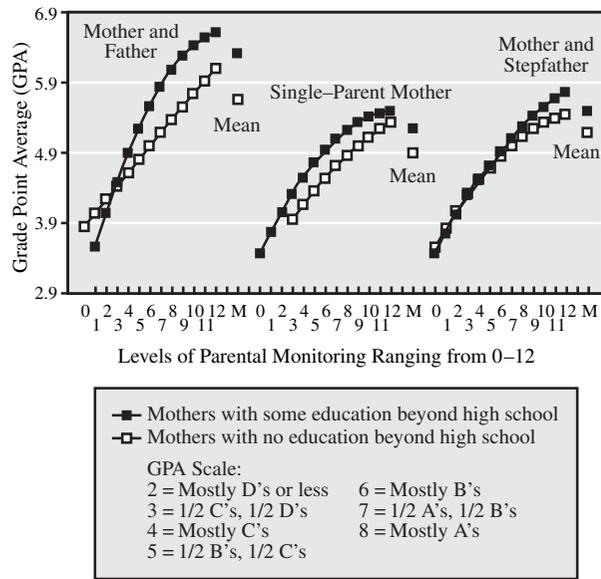


Figure 14.3 Effect of parental monitoring on grades in high school by family structure and mother's level of education. Analyses and graph based on data archives generously provided by Professors Stephen A. Small (University of Wisconsin) and Tom Luster (Michigan State University).

made available by Small and Luster (1990) from their statewide studies of youth at risk in Wisconsin met this need.² Figure 14.3 depicts the results from an analysis of the differential effects of parental monitoring on the academic achievement of high school students living in one of the three most common family structures found in the total sample of over 2,500 cases.³ The students were between 14 and 16 years of age. It was also possible to stratify the sample by two levels of mother's education, with completion of high school as the dividing line. Parental monitoring refers to the effort by parents to keep in-

²The analyses of data from the Wisconsin archive reported in this chapter were carried out in collaboration with Stephen A. Small (University of Wisconsin) and Tom Luster (Michigan State University) who designed and conducted the survey from which the data are drawn. We are deeply indebted to them for the theoretical thinking that underlies the construction of the survey. It is an excellent example of developmental science in the discovery mode. We are also grateful to Regina Cannon (then a graduate student at Cornell University) who carried out the statistical analyses with care and dispatch.

³The large number of cases in this study should not be taken to imply that the bioecological model can be applied only in samples with a large *N*. As illustrated here, precision in the formulation of the theoretical model and in its translation

formed about and set limits on their children's activities outside the home. In the present study, it was assessed by a series of items in a questionnaire administered to adolescents in their school classes. All items referred to parents in the plural, with no distinction as to whether the mother or the father was doing the monitoring. Levels of parental monitoring, ranging from 0 to 12, are shown on the horizontal axis, and grade point average (GPA) is shown on the vertical. The markers to the right of each curve record the mean GPA for each of the six groups.

Once again, the results reveal that the effects of proximal processes are more powerful than those of the environmental Contexts in which they occur. In this instance, however, the impact of the Process was greatest in what emerges as the most advantaged ecological niche—families with two biological parents in which the mother had some education beyond high school. Moreover, the developmental effect of the proximal process on school grades—a measure of *competence*—was stronger for families living in more advantaged socioeconomic circumstances. This finding is directly opposite to that revealed by the analysis of Drillien's data, where the outcome was one of psychological dysfunction (i.e., the frequency of problem behaviors). At the same time, the principal finding from both studies documents the powerful effect of proximal processes on human development, a result consistent with the first defining property of the bioecological model stipulated in Proposition I.

The reader may well ask why the data in each scattergram were fitted to a curve with a declining slope rather than simply with a straight line. In accord with the criteria for research in the discovery mode, the introduction of the quadratic term was based on theoretical considerations. Higher levels of academic performance require mastery of more complex tasks, and hence are more difficult to achieve. As a result, at each successive step, the same degree of active effort would be expected to yield a somewhat smaller result. More specifically, for pupils who are not doing so well in school, parental monitoring

into a closely corresponding research design can produce reliable findings even when there are relatively few cases in some, or even all, the cells of the model. This comes about because, in effect, the bioecological model requires, in its discovery phase, advance specification primarily not only of main effects but also in the form and direction of their most plausible interactions in the light of both the evolving theoretical model and the then available research evidence. This is especially true for well-designed experiments. For examples, see pp. 808–809.

can have a substantial effect by ensuring more stability of Time and place so that *some* learning can occur. But for superior school achievement, students would require in addition high levels of motivation, focused attention, prior knowledge, and—especially—actually working with the material to be learned. These are all qualities that stability of Time and place by itself cannot provide.

As can be seen in Figure 14.3, the relation between parental monitoring and school grades shows a curvilinear trend. Moreover, in accord with criteria for research in the discovery mode (see pp. 801–803), both in its direction and form the trend corresponds with theoretical expectations in being more pronounced when the mother has some education beyond high school, especially in a two-parent family structure. A test for heterogeneity of regression confirms visual inspection. The differences in slopes between the two educational levels are highly significant ($p \leq .01$), with the quadratic component emerging as reliable only in the higher educational group.⁴ Also statistically significant are differences in school achievement by family structure in each level of mother's education, with students growing up in two-parent families getting the highest grades, and those from single-parent families the lowest, a rank order corresponding to the power of the proximal process in each group as measured by the slopes of the associated regression coefficients.

Finally, a result not shown on the graph provides additional evidence pointing to another tentative generalization. The first indication appeared in the analysis of Drillien's data, which, among other findings, revealed that maternal responsiveness had the general effect of decreasing or buffering against environmental differences in developmental outcome. Thus, at high levels of mother-child interaction, social class differences in problem behavior became smaller. A similar pattern emerges for the effects of parental monitoring on school grades. Across the six groups shown in Figure 14.3, stronger parental monitoring was associated not only with a higher mean on school performance but also with a lower standard deviation. These differences, too, were statistically reliable. Hence the following working hypothesis:

For outcomes of *competence*, proximal processes not only lead to higher levels of developmental functioning but also

serve to reduce and act as a buffer against effects of disadvantaged and disruptive environments.

To turn from substance to method, the foregoing findings also demonstrate that tests of significance have a place in research in the discovery mode, but, as with hypothesis verification, only *after* a specific theoretical expectation has been formulated in advance.

In a discovery context, however, the aim is not to claim empirical validity for a particular theoretical formulation but to indicate its plausibility for inclusion in the research design at subsequent stages of exploratory work. To be sure, doing so may result in a failure of replication. But *not* doing so risks missing potentially important, theoretically guided research opportunities not yet recognized. Garmezy and Rutter (1983), in their landmark studies of stress and coping in children's development, did not differentiate between those protective or disruptive forces emanating from the environment, and those inherent in the biopsychological characteristics of the person. As evidenced from the analysis of Drillien's data shown in Figure 14.1, these vectors do not always operate in the same direction. Nevertheless, Garmezy and Rutter's formulations and findings played a significant role in the early stages of the process through which the bioecological model reached its present, still-evolving form.

The still-evolving form imposes the obligation to take advantage of existing opportunities for continued exploration. With respect to the present inquiry, the next step in that process was once again to pose the question about the extent to which the research design meets the defining properties of the bioecological model. At first glance, we appear to be confronted with the same problem that we encountered with Drillien's study. Proposition I defines proximal processes as bidirectional. As previously noted, Small and Luster (1990) defined parental monitoring as the effort by parents to keep informed about and set limits on their children's activities outside the home. As stated, such behavior implies influence from one side only—that of the parents. An examination of the actual items used in their questionnaire, however, revealed that they were of two kinds. Some were cast in the language of parental expectation and prescription (e.g., "If I am going to be home late, I am expected to call my parent(s) to let them know"; "When I go out, my parent(s) ask me where I'm going"). By contrast, other items implied that the desired expectations or prescriptions were being met (e.g., "My parent(s) know where I am after school"; "I tell my parent(s) who

⁴The degree of curvilinearity is measured by the corresponding regression coefficients and not by difference in the length of each curve from top to bottom. The latter is determined by empty cells in the scatter plot below or above which entries for *both* monitoring level and GPA were available.

I'm going to be with before I go out"). Although the first type of item is unidirectional, the second entails some degree of reciprocity to the extent that the adolescent is providing the information desired by the parents. Accordingly, we hypothesized that items of the second type would show stronger relationships to developmental outcomes than those that described only the parents' expectations of how they wished their children to behave.

Separate analyses of scales based on each type of item provided substantial support for our working hypothesis. Although responses to both types of questions showed reliable effects on school performance, the relationships for the reciprocity scale were significantly stronger and were much more likely to show curvilinear effects. Accordingly, the latter was the scale used in analyzing the results presented in Figure 14.3.

From the perspective of the biological model, the research design producing the results shown in that figure is missing an important Person component. It is a general finding in educational research that at the high school level female students score higher on measures of academic performance than do males. The question therefore arises: To what extent is this gender difference attributable to variations in proximal process? Figure 14.4 provides a tentative answer to this question for students whose mothers had more than a high school education. In each family structure, parental monitoring exerted a more powerful effect on the school achievement of girls than of

boys, a result that is paralleled by corresponding differences in average GPA for the two sexes.⁵ In each of the three family structures, girls received higher grades than boys, with the difference being most pronounced in two-parent households and lowest in single-mother families.

As seen in Figure 14.4, however, a distinctive feature of the pattern for girls is a marked flattening of the curve, especially for daughters of single-parent mothers. This result suggests that, in each of the three family structures, mothers may be pushing their already successful daughters to the point where conformity to maternal control no longer brings educational returns, particularly when the mother is the only parent.

An analysis of data on students whose mothers had no more than a high school education showed a similar general pattern, but the effects were less pronounced. The influence of monitoring was appreciably weaker, and its greater benefit to girls was also reduced. Nevertheless, girls with less-educated mothers both in single-parent and in stepfamilies still had higher GPA scores than boys. This means that some other factor not yet identified must account for this difference.

Although a number of possibilities come to mind regarding this unknown, regrettably the Wisconsin archive does not contain any data on the principal suspects. What is available is information about another trail of discovery that we have already begun to explore. Our successively more differentiated working models, both conceptual and operational, for assessing the effects of parental monitoring on school achievement have provided increasing support for the tentative hypothesis that, for outcomes reflecting developmental *competence*, proximal processes are likely to have greatest impact in the most advantaged environments. But what about the other half of the original formulation: the complementary postulate that the greater developmental impact of proximal processes growing up in poor environments is to be expected to occur mainly for outcomes reflecting developmental *dysfunction*?

Data from Small and Luster's archive also provide the opportunity for cross-validating this provisional claim. In addition to measures of academic achievement, the Wisconsin study also included information on teenagers' sexual activity. The decision to analyze this outcome in the context of a bioecological model was prompted by Small and Luster's (1990) finding that such

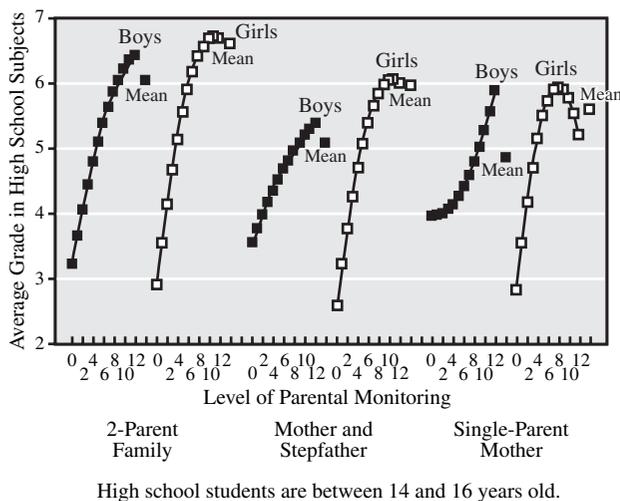


Figure 14.4 Parental monitoring and high school grades by gender: mothers with more than a high school education. Analyses and graph based on data archives generously provided by Professors Stephen A. Small (University of Wisconsin) and Tom Luster (Michigan State University).

⁵Within each pair, both means and regression coefficients were statistically significant, the latter confirming reliable differences in slope.

behavior varied systematically by family structure. Sexual activity was measured by a single question: “Have you ever had sexual relations with another person?”

This documentation of variations in sexual activity by family structure takes on special significance in the light of broader social changes taking place in the lives of children, youth, and families in contemporary U.S. society. Today, the United States has the highest rate of teenage pregnancy of any developed nation, almost twice as high as that of its nearest competitors (Bronfenbrenner, McClelland, Wethington, Moen, & Ceci, 1996, p. 117). Adolescent sexual activity is also one of the prominent elements in the so-called teenage syndrome, an escalating pattern of co-occurring behaviors including smoking, drinking, early and frequent sexual experience, adolescent pregnancy, a cynical attitude toward education and work, and, in the more extreme cases, drugs, suicide, vandalism, violence, and criminal acts (for references and successive summaries of the evidence, see Bronfenbrenner, 1970, 1975, 1986a, 1989c, 1990, 1992; Bronfenbrenner et al., 1996; Bronfenbrenner & Neville, 1994).

In anticipating the effects of parental monitoring on teenagers’ sexual activity, we were again confronted with the issue of the possible direction of influence. In relation to sexual activity as an outcome, however, some leverage for the resolution of the issue was provided because each direction could be expected to produce opposite effects. On the one hand, if parental monitoring functions to defer sexual activity, then the more monitoring the less sexual activity. On the other hand, if the parents begin to monitor only after the fact, the association would be reversed, with monitoring occurring in reaction to the adolescent’s behavior; hence, sexually active adolescents would be monitored more.

The results of the analysis are shown in Figures 14.5 and 14.6.⁶ The most salient finding for both sexes is that parental monitoring does substantially reduce adolescents’ sexual activity. In many other respects, however, the patterns for female and male adolescents are quite different. The results for girls in Figure 14.5 show that the effect of parental monitoring is stronger for daughters of mothers with no education beyond high school—a finding consistent with the working hypothesis

⁶We are also indebted to Kristen Jacobson, now a doctoral student at Pennsylvania State University, for her ingenuity and accuracy in translating into a common format data archives recorded on different computing systems.

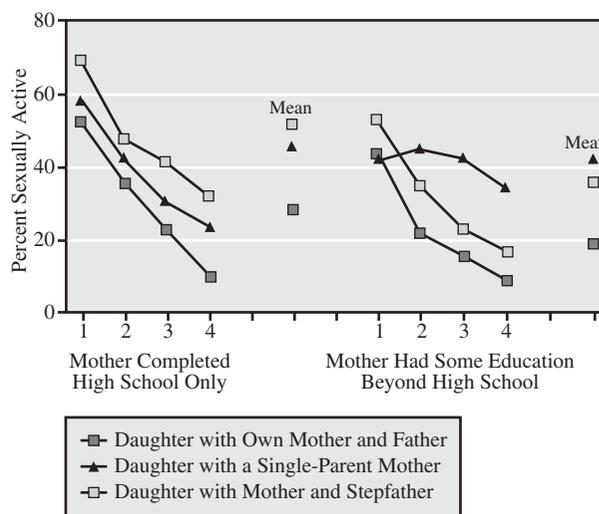


Figure 14.5 Effect of monitoring on girls’ sexual activity (high school students between 14 and 16 years of age).

that, for outcomes reflecting lack of control, proximal processes have greater impact in poorer environments. Tests for heterogeneity of regression confirm that this finding holds for each of the three family forms.

Yet, as shown in Figure 14.6, the corresponding analysis of the data for boys reveals the very opposite result. Parental monitoring has a more powerful effect on boys whose mothers have had *more* education rather than less. Once again, the finding holds in each family structure and is confirmed by tests for heterogeneity of regression.

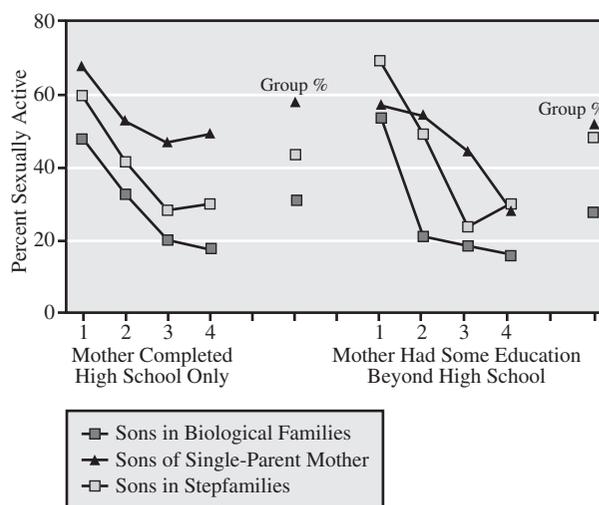


Figure 14.6 Effect of parental monitoring on boys’ sexual activity (high school students between 14 and 16 years of age).

This is not the only departure from the expectations generated by the most recent working model. For example, there was not always correspondence between the developmental power of proximal processes in a given family structure and the percentage of sexually active adolescents in that structure: In stepfamilies in which the mother has only a high school education, maternal monitoring of daughters is as high as it is in two-parent families, but the percentage of sexually active girls is even greater than that for single-parent mothers at the same educational level. The finding is consistent with research indicating that living in a family with a stepfather entails a special developmental risk for girls (Hetherington & Clingempeel, 1992).

And so, we find ourselves engaged in a next stage of the discovery process in which we are seeking to develop a more differentiated formulation that, through a corresponding research design, will be most effective in reducing the observed empirical departures from expectations based on the existing working model. The first step is to ask an obvious question: What is most likely to account for such discrepancies? Restating the question from the perspective of the bioecological model, which of the four components is a likely suspect? It has to be somebody who is already on the scene. Parents are already there. Who else is around who could exert some influence on the sexual activity of high school students? The question answers itself—the peer group. And if it is indeed true that proximal processes are at least as powerful determinants of development as either the characteristics of the person or of the environment, what might that process be?

A tentative first nomination is *progressively more intense interaction with peers who are already sexually active*. Among other considerations, this suggestion is guided by the possibility that peer pressure to engage in sexual activity and the prestige that such activity brings are likely to be higher for boys from less educated families with the result that parental monitoring is not as effective. With respect to the other components in the model, given the findings just reported, gender would still be a Person characteristic of major importance. The choice of an appropriate environmental Context depends on the precise research question being asked. Family structure would also still be appropriate. But from the perspective of the bioecological model, an option to consider would be the parents' beliefs about the activities they wanted their adolescent son or daughter to engage in or refrain from, as well as the closeness of the parent-child relationship.

We offer these suggestions not for their relevance to this particular issue but to illustrate two additional emergent corollaries of the bioecological model:

1. The specific components of Process, Person, Context, and Time to be included in a given investigation should be those that, from a theoretical perspective, are maximally relevant to the research question under investigation and complementary to each other in relation to the given developmental outcome.
2. From a theoretical perspective, the power of a PPCT design is most effectively enhanced by including more than one proximal process in the model.

The next section leads to yet another corollary.

The Role of Experiments in the Bioecological Model

The examples considered thus far are essentially experiments of nature: They show how development is influenced by variations in the components of the bioecological model occurring in already existing societies. They tell us nothing about whether, to what extent, or how these elements and their combinations can be changed. This limitation applies particularly to the most consequential component of the bioecological model—proximal processes. We know of no research bearing specifically on this question, but some indirect evidence does exist. In research findings already presented, improving the quality of the environment has been shown to increase the developmental power of proximal processes. The indirect evidence comes from experiments in which researchers have systematically introduced conditions into the environment in which people lived that were hypothesized to enhance their psychological functioning beyond existing levels.

Here are two examples at contrasting ages.

Environmental Dynamics in Old Age

The first example is Langer and Rodin's oft-cited experimental intervention conducted with residents of a New Haven nursing home for the aged (Langer & Rodin, 1976; Rodin & Langer, 1977). The contextual manipulation employed in this study is well summarized in the authors' words:

The hospital administrator gave a talk to residents in the experimental group emphasizing their responsibility for themselves, whereas the communication to a second, comparison group stressed the staff's responsibility for them as patients. To bolster the communication, residents in the experimental group were offered plants to care for, whereas residents in the comparison group were given plants that were watered by the staff. (Rodin & Langer, 1977, p. 897)

Residents were assigned at random to either the experimental or the control group. Data on psychological and health characteristics were collected at three time points: (1) just prior to the introduction of the experiment; (2) 3 weeks later, when the experiment was formally ended; and (3) in a follow-up study conducted 18 months later.

The substantial effects of intervention found at the end of the experiment (Langer & Rodin, 1976) were still in evidence in the follow-up assessment. To be sure, because the residents were almost a year-and-a-half older, the added age had taken some toll, but, nevertheless, those in the "induced responsibility" group not only significantly surpassed their controls, but were appreciably better off, both psychologically and physically, than they had been months earlier before the intervention had begun. In ratings by observers blind to the experimental conditions, they were judged to be more alert, sociable, and vigorous. The most striking results were seen in the comparison of death rates between the two treatment groups. Taking the 18 months prior to the original intervention as an arbitrary comparison period, in the subsequent 18 months following the intervention, 15% in the "responsibility-induced" group died, compared with 30% in the control group.

Environmental Dynamics in Infancy

A remarkable, independent cross-validation of Langer and Rodin's principal hypothesis appears in the findings of another intervention experiment—this one almost unknown—that was carried out at about the same time with a sample of 100 9-month-old infants and their mothers in the Dutch city of Nijmegen (Riksen-Walraven, 1978). Although this author, Marianne Riksen-Walraven, appears not to have been aware of Langer and Rodin's work conducted during the same period, one of the two intervention strategies she employed with her sample of infants was similar to that used in the New Haven study of elderly patients. Mothers, randomly assigned to what Riksen-Walraven called the "responsiveness" group, were given a

"workbook for parents" stressing the idea that "the infant learns most from the effects of its own behavior" (p. 113):

Caregivers were advised not to direct the child's activities too much, but to give the child opportunity to find out things for himself, to praise him for his efforts, and to respond to his initiations of interaction. (p. 113)

By contrast, mothers of infants in the "stimulation" group received a workbook that emphasized the importance of providing the infant with a great variety of perceptual experiences of all kinds, "to point to and name objects and persons," and "to speak a lot to their infants" (p. 112).

In the follow-up assessment conducted 3 months later, infants of mothers who had been encouraged to be responsive to their babies' initiatives exhibited higher levels of exploratory behavior and were more likely to prefer a novel object to one that was already familiar. The babies also learned more quickly in a learning contingency task.

Neither of the preceding investigations included any systematic assessment of the activities in which the participants in the experiment subsequently engaged, of the balance between unidirectional and bidirectional behavior in the two groups, or of any other specific feature that could provide a measure of the extent to which proximal processes were operating in each of the two contrasting experimental conditions.

In both of the preceding experimental studies, elegant as they are, the keystone of the bioecological model—a measure of proximal process—was not included in the research design. In addition, the demonstration (in Figure 14.3) of the joint, indirect effects of family structure and parents' education on the relation of proximal processes to school grades does only half the job, for it provides no information on whether differences in students' personal characteristics (such as gender) exert a similar indirect effect. Nevertheless, viewed from the theoretical perspective of a bioecological model, all these findings are impressively consistent with expectations derived from the model; the findings illustrate the model's practicability, and—perhaps most promising for the future of developmental science—generate questions that, when answered, provide ways for enhancing the model's scientific power. It is these questions and answers that are addressed in the following sections.

Up to this point, our exposition has given primary attention to the core concept of proximal process and its

key position in the bioecological model as a whole. We now proceed to a more detailed examination of each of the other three defining properties of the model—Person, Context, and Time.

HOW DO PERSON CHARACTERISTICS INFLUENCE LATER DEVELOPMENT?

As already indicated, at midstage in the development of the bioecological model, an effort was begun to arrive at some answers to this question, and it has continued up to the present day. As before, rather than describe the successive stages in this emergent reconception, we present it in its most recent, still-evolving form.

Most developmental research treats the cognitive and socioemotional characteristics of the person as dependent variables; that is, as measures of developmental outcomes. Far less often are such characteristics examined as precursors and producers of later development. From the perspective of the bioecological model, their effectiveness in the latter role derives from their capacity to influence the emergence and operation of proximal processes.

Accordingly, in an effort to identify such process-relevant Person characteristics, we applied the sequential design strategy described in the preceding section. Beginning with implications derived from the theoretical model, which are then related to existing research findings, successive applications of this strategy have resulted in the conceptualization of three kinds of process-relevant Person characteristics, which, for convenience of brevity, we have labeled as Person *forces*, *resources*, and *demands*.⁷

Force Characteristics as Shapers of Development

In the bioecological model, the characteristics of the Person most likely to influence future development would be active behavioral dispositions that can set proximal processes in motion and sustain their operation, or—conversely—actively interfere with, retard, or even prevent their occurrence. It is therefore useful to

⁷As is documented later in this chapter (p. 819), the recently renewed, and far stronger, claims by behavior geneticists for the predominant role of genetic factors in determining both individual and group differences in all forms of human characteristics are directly challenged by alternative explanations and research findings derived from the bioecological model.

distinguish between these two propensities. We refer to the former as *developmentally generative* characteristics; to the latter as *developmentally disruptive*.

Examples of developmentally disruptive dispositions come more readily to mind. At one pole, they include such characteristics as impulsiveness, explosiveness, distractibility, inability to defer gratification, or, in a more extreme form, ready resort to aggression and violence; in short, difficulties in maintaining control over emotions and behavior. At the opposite pole are such Person attributes as apathy, inattentiveness, unresponsiveness, lack of interest in the surroundings, feelings of insecurity, shyness, or a general tendency to avoid or withdraw from activity.⁸ Persons exhibiting either of the preceding propensities would find it difficult to engage in proximal processes requiring progressively more complex patterns of reciprocal interaction over extended periods of time.

By contrast, developmentally generative characteristics involve such active orientations as curiosity, tendency to initiate and engage in activity alone or with others, responsiveness to initiatives by others, and readiness to defer immediate gratification to pursue long-term goals.

We have found few investigations that shed light on the developmental effects of either type of dynamic characteristics on proximal processes and their outcomes. A major reason for this shortcoming is the absence of theoretical constructs for conceptualizing their changing nature over the course of development from early infancy, through adolescence, into and beyond early adulthood. The following framework is offered as an initial basis for meeting this requirement beginning in the Person domain in greater need of conceptual definition—that of developmentally generative characteristics. The corresponding structure for developmentally disruptive Person qualities can then be derived as an inverted mirror image of the former.⁹

Developmentally Generative Dispositions in Life-Course Perspective

The first and earliest manifestation of generative dispositions takes the form of what we call *selective responsiveness*. It involves differentiated response to, attraction by, and exploration of aspects of the physical and social environment.

⁸Depending on the available alternatives, withdrawal may be the only course left for dealing with an unbearable situation.

⁹The material that follows represents a further development by the present authors of ideas first introduced in Bronfenbrenner (1989).

The next generative characteristic to evolve goes beyond selective responsiveness to include the tendency to engage and persist in progressively more complex activities; for example, to elaborate, restructure, and even to create new features in our environment—not only physical and social but also symbolic. We refer to propensities of this kind as *structuring proclivities*.

The transition from one to the other of these dynamic forms of orientation during early childhood is illustrated in successive publications from a longitudinal study of infants being carried out by Leila Beckwith, Sarale Cohen, Claire Kopp, and Arthur Parmelee at UCLA (Beckwith & Cohen, 1984; Beckwith, Rodning, & Cohen, 1992; Cohen & Beckwith, 1979; Cohen, Beckwith, & Parmelee, 1978; Cohen & Parmelee, 1983; Cohen, Parmelee, Beckwith, & Sigman, 1986). Their imaginative and careful work reveals a progressive sequence of such environmentally oriented dispositions from birth through 7 years of age. Thus, immediately after birth, infants are especially responsive to vestibular stimulation (being picked up and held in a vertical position close to the body), which has the effect of soothing babies so that they begin to engage in mutual gazing; by 3 months, visual exploration extends beyond proximal objects, and the mother's voice is most likely to elicit responses especially in the form of reciprocal vocalizations.

From about 6 months on, the infant begins actively to manipulate objects spontaneously in a purposeful way and to rearrange the physical environment. By now, both vocalization and gesture are being used to attract the parents' attention and to influence their behavior. In addition, there is a growing readiness, across modalities, to initiate and sustain reciprocal interaction with a widening circle of persons in the child's immediate environment. This is the emergence of what we call *structuring proclivities*.

A number of other investigations have yielded comparable findings, and have extended them to still other activity domains; for example: individual differences in children's creativity in play and fantasy behavior (Connolly & Doyle, 1984; MacDonald & Parke, 1984) or Jean and Jack Block's longitudinal studies of "ego resiliency" and "ego control" (J. H. Block & Block, 1980; J. Block, Block, & Keyes, 1988).

The nature of the third and final class of developmentally generative Person characteristics reflects the increasing capacity and active propensity of children as they grow older to conceptualize their experience. It deals with what we call *directive belief systems* about

oneself as an active agent both in relation to the self and environment, or, for short, *directive beliefs*. The oldest concept of this kind is Rotter's construct and measure of "locus of control" (Rotter, 1966). Subsequently, a more sophisticated formulation of the concept was introduced by Bandura (1977, 1982) under the rubric of self-efficacy. The principal distinction between these earlier constructs and their counterparts in the bioecological model is that the latter are conceptualized primarily not as characteristics of the person sufficient unto themselves but as directional dispositions interacting synergistically with particular features of the environment to generate successive levels of developmental advance.

The closest approximation to an operationalized bioecological model in which directive beliefs function as Person characteristics appears in a series of findings arising from a doctoral dissertation by Tulkin (1973, 1977; Tulkin & Cohler, 1973; Tulkin & Kagan, 1972). The investigator studied social class differences both in the behaviors and the beliefs of mothers of 10-month-old girls. The research was conducted in the home, employing both interviews and observations. Middle-class mothers were distinguished from their working-class counterparts not only by higher levels of reciprocal interaction with their infants, but also in their views about what a 10-month-old could do, and about their own abilities to influence their baby's development; the more advantaged mothers attributed greater potentials both to their infants and themselves. In addition, the correlations between maternal behavior and attitudes were substantially greater in middle-class than in lower-class families. Several years later, Tulkin and a colleague (Tulkin & Covitz, 1975) reassessed the same youngsters after they had entered school. The children's performance on tests of mental ability and language skill showed significant relationships to the prior measures of reciprocal mother-infant interaction.

Perceptive readers may have detected a sleight of hand in our analysis of Tulkin's research when examined from the perspective of the bioecological model. In that framework, we have been discussing characteristics of the developing Person that influence proximal processes and their outcomes. In Tulkin's work, the developing Person is the infant. But the directive beliefs we have been discussing are those of the mother. The reason for the substitution is the following. Although, in the line of work stimulated by Rotter and Bandura there are many investigations of the relation between personal

beliefs and development, to our knowledge there have been no studies of the effect of personal beliefs on the proximal processes in which the developing person herself or himself becomes engaged. To provide an example, we resorted to a substitution of roles.

The substitution also provides an opportunity to introduce a corollary formulation, the evidence for which appears later in this and subsequent sections of this chapter:

In proximal processes involving interpersonal interaction, the personal characteristics that influence the power of the process and its effects are the same for all parties involved.

To return to the task at hand, we present a second form of Person characteristic posited as affecting future psychological growth—what we have called developmental resources.

Resource Characteristics of the Person as Shapers of Development

These are Person characteristics that in themselves involve no selective disposition to action, but constitute biopsychological liabilities and assets that influence the capacity of the organism to engage effectively in proximal processes. In the first category are conditions that limit or disrupt the functional integrity of the organism. Some obvious examples include genetic defects, low birthweight, physical handicaps, severe and persistent illness, or damage to brain function through accident or degenerative processes. By contrast, developmental assets take the form of ability, knowledge, skill, and experience that, as they evolve over most of the life course, extend the domains in which proximal processes can do their constructive work—thereby becoming another source of the progressively more complex patterns of interaction constituting a defining property of proximal processes.

The similarity between the definitions for the two types of developmental resources, and for the earlier distinction between developmental outcomes reflecting dysfunction versus competence, derives from the fact already noted that characteristics of the Person appear on both sides of the bioecological equation. Developmental outcomes at Time 1 indirectly influence developmental outcomes at Time 2 through their effect on proximal processes during the intervening period. The difference, therefore, lies not in the concepts themselves but in their place in the bioecological model.

A concrete example of a deficiency in developmental resources has already been documented in the analysis of Drillien's results depicted in Figure 14.1. Proximal processes exerted their most powerful effect on children growing up in the most disadvantaged environment, but in that environment youngsters who at birth were of normal weight benefited most. Weight at birth does not imply a directed propensity to engage in or refrain from a particular kind of behavior. What it does represent is variation in the biological resources available to engage in any activity requiring directed activity or response over extended periods of time. Thus, in the present instance, one plausible explanation for the observed asymmetric pattern is that, among families living in stressful environments, infants who are physically healthy from birth are more able to engage in reciprocal interaction than those who are biologically impaired.

This interpretation is called into question, however, by the corresponding results, shown in the same graph, for infants raised under the most favorable socioeconomic circumstances. Infants of normal birthweight profited least from interaction with their mothers. How might this paradox be resolved?

Even though the corresponding interaction term is statistically significant, under normal circumstances the preceding result would—and properly should—be called into question as a post hoc finding. But, in the present instance, that is not quite the case. To be sure, there was no a priori hypothesis predicting the precise pattern of the obtained results. The pattern is consistent, however, with several possibilities envisioned for a third Person attribute posited as influencing proximal processes and their developmental effects. And for science in the discovery mode, post hoc findings that are theoretically relevant are not to be lightly dismissed.

Demand Characteristics of the Person as Developmental Influences

The distinguishing feature of this last set of Person characteristics affecting development is their capacity to invite or discourage reactions from the social environment that can disrupt or foster processes of psychological growth: for example, a fussy versus a happy baby, attractive versus unattractive physical appearance, or hyperactivity versus passivity. Half a century ago, Gordon Allport (1937), borrowing a term originally introduced by Mark A. May (1932), spoke of such characteristics as

constituting “personality” defined in terms of its “social stimulus value.” Rephrasing this concept in terms of its analog in contemporary theories of perception, we refer to such Person qualities as *demand characteristics*.

A striking example of the developmental effect of such a feature emerges as a major finding in one of the follow-up studies of children of the Great Depression carried out by Elder and his colleagues (Elder, Van Nguyen, & Caspi, 1985). The investigators found that economic hardship adversely influenced the psychosocial well-being of girls (but not boys) through its tendency to increase the rejecting behavior of fathers. The effects of rejection, however, varied inversely as a function of the daughter’s physical attractiveness. In the authors’ words, “Attractive daughters were not likely to be maltreated by their fathers, no matter how severe the economic pressure. [The results] underscore the importance of viewing economic decline in relation to both the child’s characteristics and parenting behavior” (p. 361). Here is a classic instance of the power of a PPCT model in revealing the complex interactions between organism and environment that drive the process of development.

The concept of demand characteristics also introduces a new perspective for interpreting the contrasting developmental effects of birthweight by social class shown in Figure 14.1. As noted earlier, at the lowest socioeconomic level it was the children of normal birthweight who benefited most from maternal responsiveness. But does that mean they were also the ones who got the most attention from their mothers? Paradoxically, the picture turns out to be just the reverse. Only 14% of these lower-class mothers were judged to be responsive to changes in their infants’ state or behavior, whereas the percentage for mothers of low-birthweight babies was more than twice as high (averaging 37%). In short, lower-class mothers were responding mainly to those infants who most needed their attention, albeit with a lower return on their investment.

But what characteristics of these babies were capturing the mothers’ attention? It appears likely that in this instance, the mothers were responding mainly to their infants’ expressions of distress—behavior less apt to occur among those of normal birthweight. If we look at the corresponding data for families at the highest socioeconomic level, we discover a rather different picture. Mothers are more responsive to the healthiest infants than to those of lowest birthweight, but as shown in Figure 14.1, they get the least return for their pains. Once again a key question becomes “What is capturing the mother’s attention?” A

plausible answer for children of normal birthweight living in the most favored circumstances is that their mothers would be responding primarily not to manifestations of problem behavior, but of growing competence.

THE ROLE OF FOCUS OF ATTENTION IN PROXIMAL PROCESSES

The preceding considerations, generated by a confrontation of data with theory, call for more differentiated formulations in the existing bioecological model. Here is the first of two tentative responses to the call:

When a proximal process involves interaction with another person, the power of the bioecological model is substantially enhanced by including in the research design a measure of the other person’s *focus of attention on the particular aspects of the behavior of the subject that are presumed, on theoretical and empirical grounds, to be most closely related to the developmental outcome*.

For Drillien’s study, the measure of proximal process is the mother’s responsiveness, but we do not know to what particular behaviors of her baby she was responding. As already suggested, the aspect most relevant for reducing future problem behaviors might be expressions of distress. If so, a more precise conceptual and operational definition of the proximal process in this study would be the proportion of manifestations of distress that were responded to by successful efforts to reduce that distress.

However, even though in the Drillien study the mothers’ focus of attention was not known, the extent of her responsiveness was still a strong predictor of the outcome. Even when the theoretical and operational requirements of the bioecological model are not met in full, the results can still contribute to understanding the forces that shape human development.

A second, complementary tentative formulation derives from the definition of proximal processes as bidirectional. Stated succinctly, it posits that the preceding formulation also holds in reverse:

When a proximal process involves interaction with another person, the power of the bioecological model is substantially enhanced by including in the research design a measure of the developing person’s *focus of attention on the particular aspects of the behavior of the other person that*

are presumed, on theoretical and empirical grounds, to be most closely related to the developmental outcome.¹⁰

PROXIMAL PROCESSES IN SOLO ACTIVITIES WITH OBJECTS AND SYMBOLS

The foregoing considerations and complexities give added importance to those proximal processes that do not involve interpersonal interaction but instead focus on progressively more complex reciprocal interaction with objects and symbols. These are activities that can be carried on in the absence of other persons, and therefore the magnitude and effectiveness of the proximal process are not influenced by another participant's behaviors. One would therefore expect that the person's own disposition and resources would play a far stronger role in affecting the direction and power of the proximal process than in the case of interpersonal interaction. Furthermore, such solo activities significantly change the processes involved, their outcomes, and the features of the environment that become most relevant. The contrast in all three domains involves a focus on *human relationships*, on the one hand, and *tasks*, on the other. To understand the developmental importance of this contrast requires a fuller exposition of the features of the environment that influence proximal processes and their effects.

But before turning to this topic, we must give due recognition to three other Person characteristics that push us in the same direction. They are so pervasive in affecting future development that their possible influence routinely needs to be considered in relation to the particular phenomenon under investigation. These are the familiar demographic factors of *age*, *gender*, and *ethnicity*. Another reason for this recommendation is that all three of these factors, although based on differing physical characteristics of the Person, also place that person in a particular environmental niche that defines his or her position and role in society. Recognition of that ambiguity moves us to a change in focus from the developmentally relevant characteristics of the Person to their counterparts in the structure and substance of

environmental Contexts as they affect developmental processes and outcomes.

THE MICROSISTEM MAGNIFIED: ACTIVITIES, RELATIONSHIPS, AND ROLES

In addressing this topic, we return to the earliest formulation of the ecological model. Today, as then, "the ecological environment is conceived as a set of nested structures, each inside the other like a set of Russian dolls" (Bronfenbrenner, 1979b, p. 3). The contemporary definition of the innermost of these structures is similar, but contains additional elements that link it to the "center of gravity" of the bioecological paradigm:

A microsystem is a pattern of activities, social roles, and interpersonal relations experienced by the developing person in a given face-to-face setting with particular physical, social, and symbolic features that invite, permit, or inhibit, engagement in sustained, progressively more complex interaction with, and activity in, the immediate environment. (Bronfenbrenner, 1994, p. 1645)¹¹

We begin with consideration of the first feature of the environment introduced in the foregoing definition.

Effects of the Physical Environment on Psychological Development

The pioneering work in this sphere has been done by Theodore Wachs. In 1979, he published a seminal paper in which he showed a consistent pattern of relationships between certain features in the physical environment of infants during the first 2 years of life and their cognitive development over this same period. To permit examining effects over time, data were grouped into successive 3-month blocks. The results are reported in the form of correlations between characteristics of the environment at an earlier time and the developmental status of the infants at a later time.

From the complex results of the study, we focus on those physical features in the environment that were most frequently and strongly associated with cognitive functioning. These included a physically responsive en-

¹⁰In terms of research design, both of the stated formulations are best assessed through direct observation, but, given the clarity and contrasting nature of the predicted relationship, valid measures can be obtained for older children and adults through well-designed interviews, and even for young children from information provided by parents and other family members.

¹¹The 1979 definition reads as follows: "A microsystem is a pattern of activities, roles, and interpersonal relationships experienced by the developing person in a given setting with particular physical and material characteristics."

vironment, presence of sheltered areas, “The degree to which the physical set-up of the home permits exploration,” low level of noise and confusion, and “the degree of temporal regularity” (Wachs, 1979, p. 30).

Regrettably, few researchers have followed the exciting scientific path that Wachs has been the first to chart. Taken as a whole, his original and subsequent work (Wachs, 1987a, 1987b, 1989, 1990, 1991; Wachs & Chan, 1986) suggests two areas especially worthy of further systematic investigation, in both conceptualization and measurement. The first remains strictly in the realm of the physical environment. The second raises the issue of proximal processes as they relate to that environment.

In the first domain, Wachs’s findings point to two general aspects of the physical environment that can affect the course of cognitive development—one for better, the other for worse. On the constructive side are objects and areas that invite manipulation and exploration, whereas instability, lack of clear structure, and unpredictability of events undermine the developmental process. From an ecological perspective, the existence of these countervailing forces in the physical environment leads to a new working hypothesis:

Not only do developmentally generative features of the surroundings have greater impact in more stable settings, but they also function as a buffer against the disruptive influences of disorganizing environments.

The second issue introduces an additional component into the research design. As stipulated in Proposition I, proximal processes involve progressively more complex interactions not only with persons but also with objects and symbols. The question therefore again arises as to what extent solitary activities involving objects and symbols—such as playing with toys, working at hobbies, reading, or fantasy play—can also foster psychological development? And to what degree does involvement in both objects and symbols produce synergistic developmental effects in each domain? The answers to these questions are as yet unknown but are readily discoverable through the use of appropriate designs that differentiate between measures of process and of environmental structure.

However, the most promising terra incognita for research on the role of the physical environment in human development may well lie beyond the realm of childhood in the world of adults. A preview of this promise appears

in the successive publications of the sociologist Melvin Kohn and his colleagues (for an integrative summary, see Kohn & Slomczynski, 1990) demonstrating the powerful effect of work environments on intellectual development in adulthood. Of particular importance in this regard turns out to be the complexity of the task that a given job entails.

At the conclusion of the preceding section, we called attention to a contrast that cuts across all four domains of Process, Person, Context, and Developmental Outcome. The contrast in all four domains involves a primary focus on *relationships* versus *tasks*. The findings of both Wachs and Kohn fall mainly in the latter category, but Drillien’s data on mother-infant interaction and infants’ problem behavior in lower-class families fall mainly in the former (i.e., an increase in maternal responsiveness functions as a buffer against problems in this sphere of emotional and behavioral control).

But that is not the only effect of rising levels of proximal process.

The Mother-Infant Dyad as a Context of Development

A substantial body of research indicates that such processes also foster the development of a strong emotional attachment between mother and child, which increases the quality of future interaction between the two parties (Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1969, 1973). In addition, the more recent work in this sphere strongly suggests that, as a result of continuing reciprocity in the context of a close relationship, the infant begins to develop a definition of self that mirrors the form and content conveyed through the evolving patterns of interchange between mother and child (Sroufe, 1990). Thus, proximal processes become the measurable mechanisms for bringing about what in an earlier era of developmental theory and research was called *internalization*.¹² Moreover, this sequential process does double duty. Though operating primarily on the relationship side, it also furthers task performance.

According to attachment theory, the emotionally loaded patterns of interchange processes between the infant and the primary caregiver become internalized in the form of “internal working models” (Bowlby,

¹²A resurgence of theoretical and research interest in this sphere has been stimulated by the elegant studies of Kochanska and her colleagues.

1969, 1973). Such working models are representations of the infant in relation to others and become the basis for the development of the self (Sroufe, 1990). Through interactions between the infant and the primary caregiver, the infant develops expectations of the caregiver's behavior and complementary beliefs about him- or herself. For example, an infant who has experienced a history of contingent responsiveness from a primary caregiver will develop a model of that caregiver as available, and expect such behavior. That child will also develop a complementary sense of self that he or she is worthy of responsive care. On the other hand, an infant who has experienced unresponsive care will develop a very different model of the relationship, expecting the caregiver to be unavailable. Such an infant is expected to develop a sense of self as unworthy of responsive care.

More generally, these internalized working models are seen as providing a framework for future interactions, resulting in a repetition of the early attachment relationship (Bowlby, 1973; Sroufe, 1990). The child seeks, responds, and interprets events based on the model that he or she has developed during infancy, and that model is adapted based on new experiences with the environment. A child who has developed a secure attachment relationship is likely to expect positive interactions with teachers, and thus elicit responsive care reminiscent of his or her caregiver's behavior. An insecure child, expecting rejection, will approach relationships with increased hostility, ultimately resulting in further experiences with rejection.

Support for these theoretical expectations comes from a number of studies. For example, the quality of the child's early attachment relationship with the mother has been found to affect the child's later functioning in social interactions with teachers and peers. Thus, early proximal processes produce proximal processes throughout development. Children judged as securely attached in infancy have been shown to approach unfamiliar peers and adults more positively and with greater acceptance (Booth, Rose-Krasnor, McKinnon, & Rubin, 1994; Main & Weston, 1981; Pastor, 1981). Furthermore, they have more positive relationships with peers and teachers in preschool (Sroufe, Fox, & Pancake, 1983; Turner, 1991). Because secure children have developed a positive internal working model in the context of a secure attachment relationship with a primary caregiver,

these children expect and elicit positive interactions with other social partners.

This body of attachment theory and research has important implications for the bioecological model. Its relevance is most succinctly conveyed in operational terms, by assessing quality of attachment in different positions in the research design; for example, as an outcome at Time 2 of proximal processes at Time 1, or, alternatively, in the form of strong versus weak contextual dyads at Time 1 moderating the power of a proximal process to influence developmental outcomes at Time 2. The latter design fits a long-standing proposition derived from the bioecological model, which reads as follows:

In order to develop—intellectually, emotionally, socially, and morally—a child requires, for all of them, the same thing: participation in progressively more complex reciprocal activity, on a regular basis over extended periods of time with one or more other persons with whom the child develops a strong, mutual, irrational attachment,¹³ and who are committed to that child's development, preferably for life. (Bronfenbrenner, 1989c, p. 5)

A second proposition goes a step further:

The establishment and maintenance of patterns of progressively more complex interaction and emotional attachment between caregiver and child depend in substantial degree on the availability and active involvement of another adult who assists, encourages, spells off, gives status to, and expresses admiration and affection for the person caring for and engaging in joint activity with the child. (Bronfenbrenner, 1989c, p. 11)

Taken together, the foregoing propositions present an important qualifier to the general finding that children growing up in single-parent families are at greater developmental risk than those in two-parent structures. What counts most is the quality of the relationships and activities that take place in the family, and situations can occur in which, from this perspective, quality overrides quantity (Hetherington & Clingempeel, 1992).

Both propositions take on added importance because their relevance may extend beyond parental ties to close relationships with other caregivers, relatives, peers, teachers, mentors, coworkers, and supervisors. The propositions may also apply beyond childhood and ado-

¹³ What is meant by the term "irrational attachment"? One answer: This is the first child you try to save in a fire.

lescence to relationships in adulthood and old age. So far as we have been able to discover, these possibilities still await systematic investigation in correspondingly appropriate research designs.

BEYOND THE MICROSISTEM

It is a basic premise of ecological systems theory that development is a function of forces emanating from multiple settings and from the relations among these settings. How can such multiple forces and their interrelations be conceptualized, and what kinds of research designs can be employed to measure their combined effects? The first stage in such an expanded model of the environment involves what in ecological systems theory is called a *mesosystem*, defined as comprising the relationships existing between two or more settings; in short, it is a system of two or more microsystems. Mesosystems and their operationalization in a research design are best conveyed through a concrete example.

Steinberg, Darling, and Fletcher (1995) reported on what they described as “an ecological journey,” which was the consequence of a deliberate decision made at the outset of their research. The initial focus of investigation was on the impact of authoritative parenting on adolescents’ academic achievement. They had at their disposal a range of data collected from a large multiethnic, multiclass sample encompassing several family structures. Under these circumstances, they concluded:

[I]t made no sense at all to control for ethnicity, social class, or household composition in an attempt to isolate “pure” process. No process occurs outside of a context. And if we want to understand context, we need to take it into account, not pretend to control it away. (Steinberg et al., 1995, p. 424)

No sooner had the investigators embarked on this unconventional course than they encountered some unexpected findings. The first of these occurred not in the realm of environmental context but of developmental outcome. When they analyzed adolescents’ school performance, they found that, in contrast to youth from European family backgrounds, Hispanic, African, or Asian American youth did not benefit from authoritative parenting. A first clue to this puzzle emerged when the investigators identified the values

held by the different “peer crowds” (e.g., “jocks, brains, nerds, preppies, or druggies”) in the nine high schools included in their sample. Their subsequent analysis revealed that “European-American youngsters from authoritative homes are more likely to belong to peer crowds that encourage academic achievement” (Steinberg et al., 1995, p. 445).

On the basis of these and related findings, Steinberg et al. (1995) formulated the following, new working hypothesis:

There is a strong but indirect path between parenting practices and adolescent peer group affiliations . . . by fostering certain traits in their children, parents direct a child toward a particular peer group. Thus to the extent that parents can influence characteristics by which adolescents are associated by peers with a crowd, parents can “control” the type of peer group influences to which their child is exposed. . . . In essence, parents have a direct and primary impact on adolescent behavior patterns—prosocial as well as antisocial. Peer groups serve primarily to reinforce established behavior patterns or dispositions. (pp. 446–447)

But when the investigators put their new hypothesis to the test, they were confronted by yet another unexpected result:

When we attempted to apply this model to youngsters from minority backgrounds, we were in for a shock. We found that among Black and Asian students, there was *no relation* between parenting practices and peer crowd membership. (p. 447)

Once again, the researchers’ “multiple context model” paved the way to solving the puzzle:

Why was there not significant relation between parenting and peer group selection among minority youth? The answer, we discovered, is that models of peer group selection that assume an open system, in which adolescents can select into any number of groups as easily as ordering food off a restaurant menu, fail to take into account the tremendous level of ethnic segregation that characterizes the social structure of most ethnically mixed high schools in the United States. (pp. 447–448)

The authors’ findings with respect to specific minority groups are of considerable interest:

Although [African American] parents score highest on our measure of parental involvement in schooling, [Black adolescents] find it much more difficult to join a peer group that encourages the same goal. (p. 449)

By contrast:

More often than not, Asian American students have no choice but to belong to a peer group that encourages and rewards academic excellence. . . . Asian Americans report the highest level of peer support for academic achievement. Interestingly, and in contrast to popular belief, [their] parents are the *least* involved in their youngsters' schooling. (p. 448)

The Expanding Ecological Universe

As if disappointed at not being confronted with yet another unexpected finding, Steinberg and his colleagues moved on to extend the ecological model to its next higher systems level—that of the *exosystem*. The formal definition of this environmental structure reads as follows:

The exosystem comprises the linkages and processes taking place between two or more settings, at least one of which does not contain the developing person, but in which events occur that indirectly influence processes within the immediate setting in which the developing person lives. (Bronfenbrenner, 1993, p. 24)

The particular exosystem that Steinberg et al. (1995) undertook to investigate was “the network of families that develops through the child’s peer relationships,” more specifically, “the parenting practices of their peers’ parents” (p. 450). The investigators’ analyses led to a series of interrelated findings as shown in these two examples:

Adolescents whose friends’ parents are authoritative earn higher grades in school, spend more time on homework . . . have more positive perceptions of their academic competence, and report lower levels of delinquency and substance use.

Adolescents whose parents are already more authoritative appear to benefit more from membership in a peer network with other authoritatively reared youngsters than do adolescents in similar networks, but from less authoritative homes. It appears that adolescents need certain “home advantages” in order to be able to take advantage of the social capital in their social networks. (Steinberg et al., 1995, pp. 452–453)

Presumably, even an ecological model can only be taken so far, but Steinberg and his colleagues appear to be trying to push it to its limits—their next analysis moves from the parental network of the adolescent’s peers to the neighborhood’s level of *social integration*. The measure of integration was based on a series of questions about parents’ contact with their children’s friends, participation in community and social activities, and ties to other families in the neighborhood. An analysis of the data revealed a modest effect of neighborhood integration on adolescent development. However, this finding was qualified in an important way that refocused attention on the key role played by family processes. In the author’s words:

When we reran these analyses separately in neighborhoods characterized by a high proportion of effective versus noneffective parents, we find that . . . social integration only benefits adolescents whose families live in neighborhoods characterized by good parenting. Social integration into a neighborhood characterized by a high proportion of bad parents has a harmful effect on adolescents’ school performance and behavior. (Steinberg et al., 1995, p. 457)

A subsequent analysis revealed a second, equally critical but not surprising qualifier: “Living in a neighborhood characterized by a high degree of social integration is only beneficial to an individual adolescent if the child’s family is also socially integrated” (p. 457).

Steinberg et al.’s final analysis adds psychological substance to social structure. By aggregating information on parenting practices and attitudes in a neighborhood, he and his associates were able to calculate a measure of the degree of consensus among parents in a given neighborhood. Once again, the principal finding emerging from the analysis was conditioned by a psychological reality:

High neighborhood consensus augments the association between parenting and adolescent outcomes only when the consensus is around good parenting. . . . In other words, it is what parents agree about, not merely whether they agree, that makes the difference. (Steinberg et al., 1995, p. 458)

In this particular study, the investigators did not examine the extent to which the biopsychological characteristics of adolescents, or of their parents, influenced

developmental processes and outcomes. Today, a growing body of researchers (e.g., Plomin, Reiss, Hetherington, & Howe, 1994) claims strong evidence for the view that individual and group differences in a wide range of developmental outcomes are mainly driven by differences in genetic endowment ("Ability Testing," 1992; Plomin, 1993; Plomin & Bergeman, 1991; Plomin & McClearn, 1993; Scarr, 1992). This claim is called into question, however, by alternative explanations and evidence based on the bioecological model (see also Lerner, 1995, 2002, 2004a).

Nature-Nurture Reconceptualized: A Bioecological Interpretation

The theoretical argument is set forth in a series of hypotheses, each accompanied by a corresponding research design (Bronfenbrenner & Ceci, 1994b).

Hypothesis 1: Proximal processes raise levels of effective developmental functioning, and thereby increase the proportion of individual differences attributable to actualized genetic potential for such outcomes. This means that heritability (h^2) will be higher when proximal processes are strong and lower when such processes are weak.

Hypothesis 2: Proximal processes actualize genetic potentials both for enhancing functional competence and for reducing degrees of dysfunction. Operationally, this means that as the level of proximal process is increased, indexes of competence will rise, those of dysfunction will fall, and the value of h^2 will become greater in both instances.

1. The power of proximal processes to actualize genetic potentials for developmental competence (as assessed by an increase in h^2) will be greater in advantaged and stable environments than in those that are disadvantaged and disorganized.
2. The power of proximal processes to buffer genetic potentials for developmental dysfunction will be greater in disadvantaged and disorganized environments than in those that are advantaged and stable.

Hypothesis 3. If persons are exposed over extended periods of time to settings that provide developmental resources and encourage engagement in proximal processes to a degree not experienced in the other settings in their lives, then the power of proximal processes to actualize genetic potentials for develop-

mental competence will be greater for those living in more disadvantaged and disorganized environments.

To test the preceding hypotheses, Bronfenbrenner and Ceci (1994b) reviewed literature on genetic inheritance:

We have been able to find no studies of genetic inheritance in contrasting environments that also contained data on proximal processes and hence would permit a direct test of the previous hypotheses. Hence, most of the available evidence is indirect.

An indirect test can be carried out only when estimates of heritability are reported for the same developmental outcome in different environments. It is fortunate that there are several studies that meet this criterion. To begin with, both Scarr-Salapatek (1971) and Fischbein (1980) found support for the prediction that values of h^2 for IQ would be greater in higher than in lower social class groups. Subsequently, a group of Norwegian investigators (Sundet, Tambs, Magnus, & Berg, 1988) undertook to clarify a series of earlier findings regarding secular trends over recent decades in heritability for measures of cognitive functioning. Using IQ scores as outcome data, the investigators found some support for results of a previous study of educational attainment (Heath et al., 1985) that had shown an increase in h^2 for twins born after 1940. The trend for their mental test data, however, was considerably weaker. The authors offered the following interpretation of the observed similarity and contrast:

This is probably due at least partly to the fact that the Norwegian government in the postwar period has offered loans to young people seeking education, thus enabling youngsters with poor parents to attend higher education. Such factors, together with a more positive attitude toward education among poor people, would tend to decrease the effect of familial environments and maximize genetic potential. (Sundet et al., 1988, p. 58)¹⁴

¹⁴Sundet (personal communication, March 17, 1993) reported that, in response to a preliminary version of the article by Bronfenbrenner and Ceci (1994), he and his colleagues undertook a preliminary analysis that yielded the following results: "For twins with mothers having the least education, the correlation between identical twins is .80, whereas the correlation for fraternal twins is .47. For the twins having mothers with more education, these correlations are .82 and .39, respectively. As you will see, this yields a heritability estimate of .66 for the first group, whereas it is .86 for the second group. If I understand your [Hypothesis 2] correctly, this is in accordance with your predictions. However, the difference between the two DZ [dizygotic] correlations does not seem to reach statistical significance, although it is quite near."

There are also a number of investigations that permit an indirect test of the hypothesized reverse pattern when the outcome is one of developmental dysfunction. For example, Jenkins and Smith (1990) found that the positive effect of a good mother-child relationship on children's problem behavior was stronger in a troubled marriage than in a harmonious one. More generally, in a recent review, Rutter and Rutter (1992) concluded that the impact of protective factors in buffering developmental disorders is greater in "circumstances of risk." (p. 56)

This concludes Process, Person, and Context as shapers of development, it is time to turn to *Time*.

TIME IN THE BIOECOLOGICAL MODEL: MICRO-, MESO-, AND MACROCHRONOLOGICAL SYSTEMS

Time, a defining property of the bioecological paradigm, appears more than once in the model's multidimensional structure. Indeed, its first appearance, in the second sentence of Proposition I, may have well gone unnoticed. Following the definition of proximal processes as involving progressively more complex reciprocal interaction, the Proposition stipulates that to be effective, the interaction must occur on a fairly regular basis.

Why this proviso? A first indication appears in the findings from Wachs's research (1979) on the features of the environment most frequently and strongly associated with individual differences in cognitive competence. Prominent among them were a physically responsive environment, presence of sheltered areas, instability and unpredictability of events, the "degree to which the physical set-up of the home permits exploration," low level of noise and confusion, and "the degree of temporal regularity" (p. 30). As noted earlier, it follows from such findings that proximal processes cannot function effectively in environments that are unstable and unpredictable across space and time.

It also follows that the cumulative effects at this *mesosystem* level are likely to jeopardize the course of human development. One reason for expecting such an escalating effect is that, at this next higher level of environmental structure, similarly disruptive characteristics of interconnected microsystems tend to reinforce each other.

The most informative research evidence bearing on this issue comes from a longitudinal study conducted by the Finnish psychologist, Lea Pulkkinen (1983). Beginning when participating children were 8 years of age, she

investigated the effect of environmental stability and change on the development of children through adolescence and young adulthood. The "steadiness" versus "unsteadiness" of family living conditions was measured by the frequency of such events as the following: the number of family moves, changes in day care or school arrangements, extent of family absence, incidence of divorce and remarriage, and altered conditions of maternal employment. Greater instability in the family environment was associated with greater submissiveness, aggressiveness, anxiety, and social problems among children in later childhood and adolescence, leading to higher risks of violence and criminal behavior in early adulthood (Pulkkinen, 1983; Pulkkinen & Saastamoinen, 1986). Moreover, the factor of stability of family living conditions appeared to be a stronger determinant of subsequent development than was the family's socioeconomic status.

Analogous findings for the contemporary U.S. scene were obtained by Moorehouse (1986) in a study of how stability versus change over time in the mother's work status during the child's preschool years affected patterns of mother-child communication, and how these patterns in turn influenced the child's achievement and social behavior in the 1st year of school. A key analysis involved a comparison between mothers who had maintained the same employment status over the period of the study, and those who had changed in either direction: that is, to working more hours, fewer hours, or none at all. The results revealed that significant effects of work status were pronounced only in the group that had changed their working status. Although the disruptive impact was greatest among those mothers who had moved into full-time employment, it was still present even for those who had reduced their working hours or had left the labor force. Moorehouse concluded that "instability, on the whole, is associated with less favorable school outcomes than stability" (p. 103).

In the framework of the discovery mode, we are once again at a point where a series of findings from different studies suggests yet another tentative formulation. The corollary follows:

The degree of stability, consistency, and predictability over time in any element of the systems constituting the ecology of human development is critical for the effective operation of the system in question. Extremes either of disorganization or rigidity in structure or function represent danger signs for potential psychological growth, with some intermediate degree of system flexibility constituting the optimal condition for human development. In re-

search design, this proposition points to the importance of assessing the degree of stability versus instability, with respect to characteristics of Process, Person, and Context, at each level of the ecological system.

This formulation also applies at the macrolevel to the dimension of Time, both during the individual's life course, and through the historical period in which the person has lived (see Proposition II). It was this observation that gave rise to the first systematic formulation of what was to become the ecological model of human development. The formulation appeared almost 4 decades ago in an article entitled "Socialization and Social Class through Time and Space" (Bronfenbrenner, 1958). In that article, Bronfenbrenner reanalyzed what appeared to be contradictory findings on social class differences in patterns and outcomes of child rearing. The analysis reveals that when the obtained results were reorganized by the years in which the data were collected, the contradictory findings disappeared. Instead, there was a systematic gradual change over the period just after World War II until the late 1950s, with middle-class parents moving away from originally more authoritarian patterns toward greater permissiveness and lower-class families going in the opposite direction. Changes in patterns of child rearing over historical time and their effects on development have been recurring themes in Bronfenbrenner's work beginning in the late 1950s (1958) and continuing up to the present (Bronfenbrenner, 1970, 1975, 1990, 1994; Bronfenbrenner & Crouter 1982; Bronfenbrenner et al., 1996); but in terms of theoretical and empirical contributions this work pales in comparison with that of Elder, beginning with his classic study, *Children of the Great Depression* (Elder, 1974; see also Elder & Shanahan, Chapter 12, this *Handbook*, this volume).

As Bronfenbrenner has noted, Elder's work on life-course development played a significant role in the formulation of the original ecological model (Bronfenbrenner, 1979a, see especially pp. 266–285 and 273–285), and has exerted even greater influence on the model's subsequent evolution in this same domain (Bronfenbrenner, 1986a, 1986b, 1989, 1993, 1995).

Because Elder's contributions deservedly receive extended coverage in Chapter 12, this *Handbook*, this volume, we confine ourselves to the four defining principles of life-course theory as presented in a recent formulation (Elder, 1998),¹⁵ along with implications for correspon-

ding research designs, and examples of relevant research findings.

The first principle is that of *historical time and place*, defined by Elder as follows: *The life course of individuals is embedded in and shaped by the historical times and events they experience over their life time.*

History is exploited as an experiment of nature. The corresponding research design compares groups similar in other respects who have been exposed, versus not exposed, to a particular historical event; for example, Elder's studies of the Great Depression (Elder, 1974; also see Elder, 1998; Elder & Shanahan, Chapter 12, this *Handbook*, this volume); military service and actual combat in World War II and Korea (Elder, 1986; Elder, Shanahan, & Clipp, 1994); the Iowa farm crisis (Conger & Elder, 1994; Elder, King, & Conger, 1996); urban inequality (Elder, Eccles, Ardelt, & Lord, 1995); and, Elder's most recent work, research on youth sent to the countryside during China's cultural revolution (Elder, Wu, & Jihui, 1993).

The second principle, called *timing in lives*, states that *the developmental impact of a succession of life transitions or events is contingent on when they occur in a person's life.*

Here an appropriate research design is one that compares early versus late arrivals at a particular transition with respect to their subsequent life course. For example, Elder et al. (1994) reanalyzed follow-up data on subjects from Terman's 1925 classic *Genetic Studies of Genius* (all subjects with very high IQs) and were able to show marked differences in subsequent adult development depending on early versus late entrance into military service during wartime. Some of the costs of late entry include:

- A higher risk of divorce and separation
- A work life of disappointment and loss of lifetime income
- An accelerated decline of physical health, most notably after the age of 50

On the opposite side:

- For many men, and especially those who entered at an early age, military service was a recasting experience. It provided a bridge to greater opportunity and an impetus for developmental growth up to the middle years.

¹⁵ For an earlier, but more comprehensive account, see Elder's Chapter 16, this *Handbook*, this volume.

One is reminded of Brutus's fateful choice in response to Cassius's urgings:

There is a tide in the affairs of men
Which, taken at the flood, leads on to fortune;
Omitted, all the voyage of their life
Is bound in shallows and in miseries.

—Shakespeare, *Julius Caesar* (IV. iii. 218–221)

The third principle, *linked lives*, asserts that *lives are lived interdependently and social and historical influences are expressed through this network of shared relationships*.

The basic research design corresponding to this principle involves examining the differential impact of historical events and role transitions on different members of the same family experiencing these same events and transitions. In a study of mother-daughter dyads in the broader historical context of the societal changes in gender roles that have taken place since World War II, Moen and Erickson (1995) offered the following concluding comment, on the basis of their statistical analysis of data across two generations:

Conventional mothers embracing traditional gender roles may find themselves with daughters who are in the vanguard of the women's movement. Some mothers may even push their daughters to achieve what was impossible for themselves. The fact that mothers and daughters experience historical events and social changes from different vantage points means that their lives are differentially touched by them and that their perspectives may well diverge. (p. 180)

Environmental changes across historical time can produce significant developmental changes in either direction. On the one hand, they can disrupt the timing and duration of normative transitions during the life course, thus interrupting the sequence of learning experiences that are essential for meeting societal expectations as one gets older. On the other hand, they can offer to the person new, at once more stable and more challenging opportunities that enhance psychological growth or even reverse a previously downward course (e.g., Elder's 1974 studies of effects of military enlistment on young men from poverty backgrounds).

FROM RESEARCH TO REALITY

The fourth and last of Elder's principles of life course development he calls *human agency*. It states that "*individuals construct their own life course through choices and actions they take within the opportunities and constraints of history and social circumstances*." A striking example is his finding that the young men most likely to volunteer early for service in World War II were often those who came from the most deprived circumstances, but then benefited the most from the opportunities of training and experience that the military provided. Nevertheless, he cautions that "Not even great talent and industry can ensure life success over adversity without opportunities" (Elder, 1997).

Finally, to Elder's four principles, we add a fifth, which in effect reverses the direction of his very first principle regarding the importance of historical changes in shaping the course of human development. Simply stated, the fifth principle asserts that changes over time in the four defining properties of the bioecological model are not only products but also *producers* of historical change. To spell out the argument and evidence on which the principle is based: Periodically, since the late 1950s, Bronfenbrenner, together with colleagues, has been publishing articles documenting changes over time in three domains: child-rearing practices, the relation of these practices to child outcomes, and in family demographics reported annually in the U.S. Census and other government publications.

One report of these analyses appears in a volume entitled: *The State of Americans: This Generation and the Next* (Bronfenbrenner et al., 1996). The book consists of almost 300 pages and 150 graphs, but, for present purposes, the principal findings can be summarized in 10 points shown in Table 14.1. Considered as a whole, the findings constitute the basis for our proposed addition to Elder's four principles.

To illustrate, although proximal processes function as the engines of development, the energy that drives them comes from deeper sources that take us back to the experiential world of Proposition I (Bronfenbrenner et al., 1996; Bronfenbrenner & Evans, 2000; Bronfenbrenner & Morris, 1998). Both subjective and objective forces exert an especially strong influence on development during the formative years (from early infancy to young adulthood). A substantial body of research over the past century indicates that, 2 or 3 decades ago,

TABLE 14.1 Summary of Selected Findings

1. Annual surveys over the past two decades reveal growing cynicism and disillusionment among American youth, reflected in a loss of faith in others, in their government, in the basic institutions of their society, and in themselves.
2. In the United States far greater percentages of youth and women are victims of homicide, with rates more than 10 times as high as those for any other developed country.
3. The young are not only likely to be the victims of murder, they are also more likely to commit it. Youth and young adults (ages 18–25) now account for the majority of those arrested for homicide.
4. The percentage of Americans in prison is four times higher than in other developed countries, and the number is rising rapidly.
5. Despite recent gains made by youth from Black families. American high school students are still far behind those from other developed countries in academic achievement. This includes the top 10% of students in each nation. The trend already threatens our productivity and capacity to compete economically in the future.
6. The United States stands in first place in the percentage of children growing up in single-parent families, which now includes over a quarter of all America's children under 6 years of age.
7. Families with children under 6, particularly single-parent mothers, are those who most seek—and desperately need—a job. But they also have the highest unemployment rates. The proportion of Black mothers working full time is much higher than for white mothers (in 1994, 76% vs. 29%).
8. The percentage of U.S. children living in poverty today is twice as high as that for any other developed nation.
9. Among developed nations, the incomes of rich versus poor families are farthest apart in the United States. We are rapidly becoming a two-class society.
10. Two-thirds of children in poverty live in families with working adult. Less than one-third of poor families with a young child rely solely on welfare.

We are indebted to our colleagues who, as coauthors of chapters of the volume *The State of Americans: This Generation and the Next*, provided the findings summarized in Table 14.1. Besides ourselves, they include the following: Steven J. Ceci, Helen Hembrooke, Peter McClelland, Phyllis Moen, Elaine Wethington, and Tara L. White. *Source:* From *The State of Americans: This Generation and the Next*, by U. Bronfenbrenner, P. McClelland, E. Wethington, P. Moen, and S. J. Ceci, 1996, New York: Free Press.

these forces lay mainly in the family, with parents acting as the principal caregivers and sources of emotional support for their children, and with other adult family members living in the home being next in line. To a lesser extent, other relatives, family friends, and neighbors also functioned in this role.

However, there has been a marked change in this pattern over the past 4 decades. Parents, and other adult family members as well, have been spending increasing amounts of time commuting to and working at full-time

jobs (in which overtime is increasingly required or expected). The nature of this trend and its relevance for human development are conveyed in the idea that to develop—intellectually, emotionally, socially, and morally—a child requires, for all of these, the same thing: participation in progressively more complex activities, on a regular basis over an extended period of time in the child's life, with one or more persons with whom the child develops a strong, mutual emotional attachment, and who are committed to the child's well-being and development, preferably for life (Bronfenbrenner & Evans, 2000; Bronfenbrenner & Morris, 1998; also see Lerner, 2004b). The establishment of a strong mutual emotional attachment leads to internalization of the parent's activities and expressed feelings of affection. Such mutual ties motivate the child's interest and engagement in related activities in the immediate physical, social, and—in due course—symbolic environment that invite exploration, manipulation, elaboration, and imagination.

The establishment and maintenance of patterns of progressively more complex interaction and emotional attachment between parent and child depend, to a substantial degree, on the availability and involvement of another adult, a third party, who assists, encourages, spells off, gives status to, and expresses admiration and affection for the person caring for and engaging in joint activity with the child. It also helps, but is not absolutely essential, that the third party be of the opposite sex from that of the other person caring for the child, because this is likely to expose and involve the child in a greater variety of developmentally instigative activities and experiences (Bronfenbrenner et al., 1996). Where this is an attachment to two or more parent figures, each can serve as a third party to the other.

The research evidence for this idea comes mainly by default. It was produced by demographic data documenting a rapid rise in the proportion of single-parent households. The trend began in the 1980s, and then continued at an even faster rate through most of the 1990s. The overwhelming majority of such homes were those in which the father was absent and the mother bore primary responsibility for the upbringing of the children.

A large number of investigations of developmental processes and outcomes in families of this kind have since been conducted across a range of cultural and social class groups. The findings lead to two complementary conclusions:

1. Even in families living in favorable socioeconomic circumstances, children of single-parent mothers, or of fathers, for whom no other person is acting reliably in a third party role are at greater risk for experiencing one or more of the following developmental problems: hyperactivity or withdrawal, lack of attentiveness, difficulty in deferring gratification, poor academic achievement, school misbehavior, and frequent absenteeism.
2. At a more serious level, there is the so-called teenage syndrome of behaviors that tend to be associated together: dropping out of school; involvement in socially alienated or destructive peer groups; smoking, drinking, frequent sexual experience: adolescent pregnancy; a cynical attitude toward work; and in the more extreme cases—drugs, suicide, vandalism, violence, and criminal acts. Most of these effects are more pronounced for boys than for girls (Bronfenbrenner et al., 1996).

Not all single-parent families, however, exhibited these disturbed relationships and their disruptive effects on children's development. Systematic studies of the exceptions have identified what may be described as a general immunizing factor. For example, children of single parents were less likely to experience developmental problems especially in families in which the mother (or father) received strong support from other adults living in the home. Also helpful were nearby relatives, friends, neighbors, members of religious groups, and, when available, staff members of family support and child care programs. What mattered most was not only the attention given to the child—important as this was—but also the assistance provided to the single parent or by others serving in the supportive roles previously noted. It would seem that, in the family dance, it takes three to tango.

But dancing is not the whole story. By the 1980s, theory and research in the ecology of human development had documented an accelerating trend toward greater permissiveness in styles of child rearing in U.S. families. At the same time, successive scientific investigations had revealed progressively greater developmental advantage for strategies that placed increased emphasis on parental discipline and demand. The interpretation that emerged from analyses of the available data suggested that widespread application of these research findings would serve as an effective response to the de-

velopmentally disruptive changes taking place in contemporary society.

At a more general level, the research findings reveal growing chaos in the lives of families, in child care settings, schools, peer groups, youth programs, neighborhoods, workplaces, and other everyday environments in which human beings live their lives. Such chaos interrupts and undermines the formation and stability of relationships and activities that are essential for psychological growth. Moreover, many of the conditions leading to that chaos are the often unforeseen products of policy decisions made both in the private and in the public sector. Today, in both of these arenas, we are considering profound economic and social changes, some of which threaten to raise the degree of chaos to even higher and less psychologically (and biologically) tolerable levels. The most likely and earliest observed consequences of such a rise are still higher levels of youth crime and violence, teenage pregnancy and single parenthood,¹⁶ as well as reduced school achievement, and, ultimately, a decline in the quality of our nation's human capital (Bronfenbrenner et al., 1996).

Thus, we have arrived at a point where the concerns of basic developmental science are converging with the most critical problems we face as a nation. That convergence confronts us, both as scientists and as citizens, with new challenges and opportunities.

THE BIOECOLOGICAL MODEL: A DEVELOPMENTAL ASSESSMENT

In this chapter, we have undertaken two challenging tasks, each an example of science in the discovery mode with developmental science as its subject matter. The first was to describe a next stage in the evolution of an ecological theory of human development, first introduced more than 20 years ago. The second task was unintended, but nevertheless begun, for this chapter also documents early steps in the design of a third-generation model.

As one of those early steps, we found it necessary to spell out the requirements for conducting developmental research in the discovery mode. To our knowledge, this is a first effort to do so systematically, and may there-

¹⁶Once again we emphasize that the relationships and activities in which parent and child are involved can override the influence of purely demographic factors such as mother's age and family structure (p. 1015).

fore receive—and deserve—more criticism than any other section in the chapter. But at least readers will know what criteria we were trying to meet and will have a basis for assessing the validity of the proposed strategy as reflected in the more differentiated theoretical and operational models emerging from the successive confrontations between theory and data.

Among the more promising products of this effort is the demonstration of the power of *proximal processes* as the engines of development, and their systematic variation as a function of the characteristics of both *Person* and *Context*. We have also presented evidence that, in accord with specifications of the bioecological model, different pathways through space and time lead to different outcomes. In this regard, distinctions between two types of outcome appear especially relevant: (1) between outcomes of competence versus dysfunction and (2) between activities focusing primarily on interpersonal relationships versus objects and symbols. A third potentially productive contrast speaks to the question of who develops and who doesn't by identifying dispositional characteristics of the Person that are *developmentally generative* versus *developmentally disruptive*. Two additional Person characteristics deemed consequential for development are also distinguished and illustrated. The first are *resources* in terms of ability and acquired knowledge and skill. The second are *demand* characteristics that attract or encourage progressively more complex interaction. An analogous taxonomy is proposed for the quality of environments, accompanied by illustrations of their corresponding differential effects on proximal processes and outcomes. In each instance, the evolving tentative hypotheses derived from successively more differentiated formulations based on the bioecological model are accompanied by their operational analogs in terms of corresponding research designs and the findings generated by them.

The discovery process points also to the scientific need and benefit of including, in research designs for the same subjects, two different developmental outcomes that complement each other. For theoretical reasons deriving from the bioecological model, likely to be even more productive would be the inclusion in the same research design of two different, but theoretically complementary proximal processes.

Finally, in our view, the most scientifically promising formulation emerging from the discovery process documented in this chapter is easily stated, but it is also one that presents the greatest theoretical challenge:

The four defining components of the bioecological model should be theoretically related to each other and to the developmental outcomes under investigation. This means that the choice of variables to represent each of the defining properties should be based on explicit assumptions about their presumed interrelations.

This may seem a disappointing conclusion for so long an exposition. Perhaps, even more in developmental science than in other fields, the pathways to discovery are not easy to find. The trails are not marked, there are many dead ends, the journey is far longer than expected, and at the end, little may be there. What counts is what one learns along the way and passes on to future explorers of the uncharted terrain. Here are some final ideas for those of you whose work will fill the future landscape of developmental science. At this still early moment in the twenty-first century, we are left with a troubling question: From the perspective of the bioecological model, what is the prospect for the future development of our species? The answer to that question lies with the willingness of the United States and other economically developed countries to heed the emerging lessons of developmental science. At the moment, it is difficult to know what the answer will be. The future could go either way. Given this alternative, it becomes the responsibility of developmental science to communicate such knowledge as we possess, and to do so in words that can still find an echo. Here is a first draft:

In the United States it is now possible for a youth, female as well as male, to graduate from high school, or university, without ever caring for a baby; without ever looking after someone who was ill, old, or lonely; or without comforting or assisting another human being who really needed help. The developmental consequences of such a deprivation of human experience have not as yet been scientifically researched. But the possible social implications are obvious, for—sooner or later, and usually sooner—all of us suffer illness, loneliness, and the need for help, comfort, and companionship. No society can long sustain itself unless its members have learned the sensitivities, motivations, and skills involved in assisting and caring for other human beings.

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