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Child Development, Vol. 63, No. 1 (Feb., 1992), 1-19.

Stable URL:
http://links.jstor.org/sici?sici=0009-3920%28199202%2963%3A1%3C1%3ADTFT1D%3E2.0.CO%3B2-Y

Child Development is currently published by Society for Research in Child Development.

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SCARR, SANDRA. *Developmental Theories for the 1990s: Development and Individual Differences.* CHILD DEVELOPMENT, 1992, **63**, 1–19. Understanding both typical human development and individual differences within the same theoretical framework has been difficult because the 2 orientations arise from different philosophical traditions. It is argued that an evolutionary perspective can unite the study of both species-typical development and individual variation. Research on determinants of development from many perspectives can be understood within an evolutionary framework in which organism and environment combine to produce development. Species-normal genes and environments and individual variations in genes and environments both affect personality, social, and intellectual development. These domains are used as examples to integrate theories of normal development and individual differences. Within the usual samples of European, North American, and developed Asian countries, the results of family and twin studies show that environments within the normal species range are crucial to normal development. Given a wide range of environmental opportunities and emotional supports, however, most children in these societies grow up to be individually different based on their individual genotypes. Understanding the ways in which genes and environments work together helps developmentalists to identify children in need of intervention and to tailor interventions to their particular needs.

Not long ago, most developmentalists believed the major purpose of their research was to discover eternal laws about human development—laws that could apply to all of the people all of the time. *Nomothetic* laws about human development focus on universal sequences and their contexts. At the same time, a smaller group of developmentalists focused its research on individual variation in development and on *idiographic* developmental patterns—patterns that are unique to individuals.[1]

The history of the two orientations to research can be traced to what Cronbach (1957) called "the two disciplines of scientific psychology." Psychology's two scientific disciplines have their parallel in Ernst Mayr's contrast of typological and population approaches in biology. The study of the typical human is philosophically Platonic: Although individual differences within species are observed, they are considered merely unimportant variations on the ideal type. Understanding the "true" nature of development means to abstract typical patterns and to ignore variations. Population theories have their roots in Darwin and evolutionary theory. Variation within species is what exists and must be understood. Developmental patterns are unique to individuals; the causes of these differences are central to developmental research.

I propose that it is possible now to incorporate both typical development and individual variations on typical patterns in new theories that describe and explain human development as both typically human and uniquely so. The first requirement of any scientific theory is that it account for observations to which nearly everyone can agree,

Presidential address to the biennial meetings of the Society for Research in Child Development, April 20, 1991, Seattle, WA. Requests for the paper may be sent to Sandra Scarr, Department of Psychology, Gilmer Hall, University of Virginia, Charlottesville, VA 22903. My thanks to Anne Ricciuti, with whom I have coauthored a chapter from which some of this address is taken (Scarr & Ricciuti, in press). For the past 20 years, Richard A. Weinberg has been my collaborator and friend. It is impossible to thank him enough for all of the synergy that we have found in our research, writing, and mutual understandings.

[1] Unless they are identical twins.

[*Child Development*, 1992, **63**, 1–19. 0009-3920/92/6301-0015$01.00]

the second that its explanatory principles do not violate assumptions of causality held by most scientists (e.g., temporal order of events), and the third that the theory must be scientifically persuasive to one's peers (Scarr, 1985). It is only on the last that I fear my theory may fail.

I argue that most developmental theories today are unnecessarily limited in the observations they subsume and that they seldom address issues of causality in development and individual variations with the same concepts. The underlying question that has motivated my reseach for 25 years is, "How do organisms and environments combine to produce human development and the many variations on that theme?" I hope to persuade you that developmental theories can and should address this question.

Observations and Inferences

First, some common observations to subsume. Both parents and psychologists observe pervasive correlations between characteristics of parents, the environments they provide, and their children's outcomes. Both parents and psychologists make causal attributions on the basis of those correlations: They believe that differences in parental behaviors and environments *cause* differences in children's outcomes. The construction of causal inferences from the web of parent-child correlations is fraught with logical and scientific problems (Scarr, 1985).

Ever since Bell's (1968) seminal paper on children's effect on their own environments, as well as the reverse effect, numerous studies have shown that, indeed, children do have an effect on the behavior of their caregivers (e.g., Bell & Harper, 1977; Breitmayer & Ricciuti, 1988; Lytton, 1980; McCartney, in press). Using a variety of research designs and outcome measures, these studies all have demonstrated that, rather than being passive recipients of care, infants and children are active, influential partners in their interactions with the people around them. The notion that parental behaviors cause all observed differences among children is thus called into question.

European psychologists have for the last decade investigated the participation of young people in their own development (e.g., Magnusson, Stattin, & Allen, 1985; Silbereisen & Noack, 1988). Action theory incorporates the idea that people influence in important ways the course of their development through choices across time. The theory presented here is consonant with this line of theory and inquiry.

It is proposed here that each child constructs a reality from the opportunities afforded by the rearing environment, and that the constructed reality does have considerable influence on variations among children and differences in their adult outcomes.

Constructing Experiences from Environments

The idea that people make their own environments (Scarr & McCartney, 1983) runs counter to the mainstream of developmental psychology. A large base of literature examining the relations between familial, parental, and child characteristics has found that these characteristics are, indeed, related to each other. Developmental psychologists most often interpret these findings as evidence that the rearing conditions that parents provide for their children make differences in the children's life chances and eventual adult statuses—both socioeconomic achievements and mental health. Thus, although some developmentalists have suggested that children may affect their environments as well as vice versa (Bell, 1968), the theory that children actually construct their own environments challenges the basic tenets of much of mainstream developmental psychology.

The idea that children create their own experiences from the environments they encounter also challenges parents' beliefs about their impact on their children's development. After all, most parents invest tremendous efforts in rearing their children—efforts that involve emotional, personal, and financial sacrifices for the parents. If parents can be given accurate information about how much influence they might or might not have on their children's development, it might help alleviate needless sacrifices and emotional turmoil on their part.

How people make the transitions from age to age and stage to stage in life is the most fascinating longitudinal study in all of behavioral science. Accurate information about the extent to which differences between families contribute to differences between children is particularly important for the design and implementation of timely and effective intervention programs for at-risk children and families. Thus, although the theory that children construct their own environments challenges widely held ideas about families and children, it is important to consider and evaluate it, given available data.

Causal assumptions about the direction of effects between parental behavior and children's outcomes have been called into question even more strongly by research over the past 20 years in the field of developmental behavior genetics. Behavioral genetic methods are used to investigate the sources of individual variation in a population (Plomin, 1986). The focus is on what makes individuals different from one another, not on the causes of the particular mean value of a trait in a population. By studying family members with varying degrees of relatedness, estimates can be obtained of the proportion of observed variation in a population that is due to genetic variation. This estimate is referred to as heritability, and is limited to the particular population under study.

Behavior genetic research has shown that, for a wide variety of traits, including measures of intelligence, specific cognitive abilities, personality, and psychopathology in North American and European populations, the heritability of such traits is between .40 and .70. Of the remaining reliable variance, there is more variation *within* families than *between* families (Plomin & Daniels, 1987). Being reared in one family, rather than another, within the range of families sampled makes few differences in children's personality and intellectual development. These data suggest that environments most parents provide for their children have few *differential effects* on the offspring. Most families provide sufficiently supportive environments that children's individual genetic differences develop.

Means and Variances

The statement that parents have few differential effects on children does *not* mean that not having parents is just as good as having parents. It may not matter much that children have *different* parents, but it does matter that they have parent(s) or some supportive, affectionate person who is willing to be parent-like. This is essentially the distinction between examining sources of variation between individuals and examining mean values in the population. The methods best suited to the former are not necessarily also appropriate for the latter.

The distinction between causes of mean or average values and causes of variation around mean values can be confusing to both psychologists and parents. For some characteristics, there is very little individual variation around the mean, but for other characteristics, there is a broad distribution of results, for which a mean and a variance can be described. For some human characteristics there is no normal variation at one level of analysis, for example, having bilateral limbs, two eyes, and a cerebral cortex. Every normal member of the species has these characteristics. At another level of analysis, however, all of these species-typical characteristics show variation (e.g., limb length, eye shape, brain size). The structural genes that cause the development of species-typical characteristics may have no normal variants; but there may be regulatory genes that influence the developmental patterns and the eventual amount or type of each characteristic a given individual has. There is no necessary association between the structural causes of species-typical characteristics and the regulatory causes of variation. Research on variation has no necessary implications for the causes of the average value of the population (but see Turkheimer, in press). Thus, a good developmental theory must have concepts of both variant and invariant species patterns.

This distinction is particularly important to remember when considering analyses of heritability, as pointed out by Arthur Jensen (1989): "Hence, the results of any heritability analysis are necessarily limited to statements concerning variation around the overall *mean* of the group in which the analysis is performed, and it affords no information whatsoever about the factors responsible for the particular value of the group mean" (p. 241). Similarly, as McGuffin and Gottesman (1985) emphasize, heritability estimates have no meaning for a given individual. Such estimates simply tell us the proportion of variance in some trait that is due to genetic and environmental variation in that particular population. They cannot tell us what percent of individual A's limb length is due to which influences.

To see the effects of having no parents (or parent surrogates), one would have to return to the orphanages of long ago (or study those in use today in the Soviet Union), or see children trapped in crack houses of inner cities in the United States, locked in basements and attics by vengeful, crazy relatives (see Clarke & Clarke, 1976). Really deprived, abusive, and neglectful environments do not support normal development for any child. Having no parental figures or being reared in terribly deprived cir-

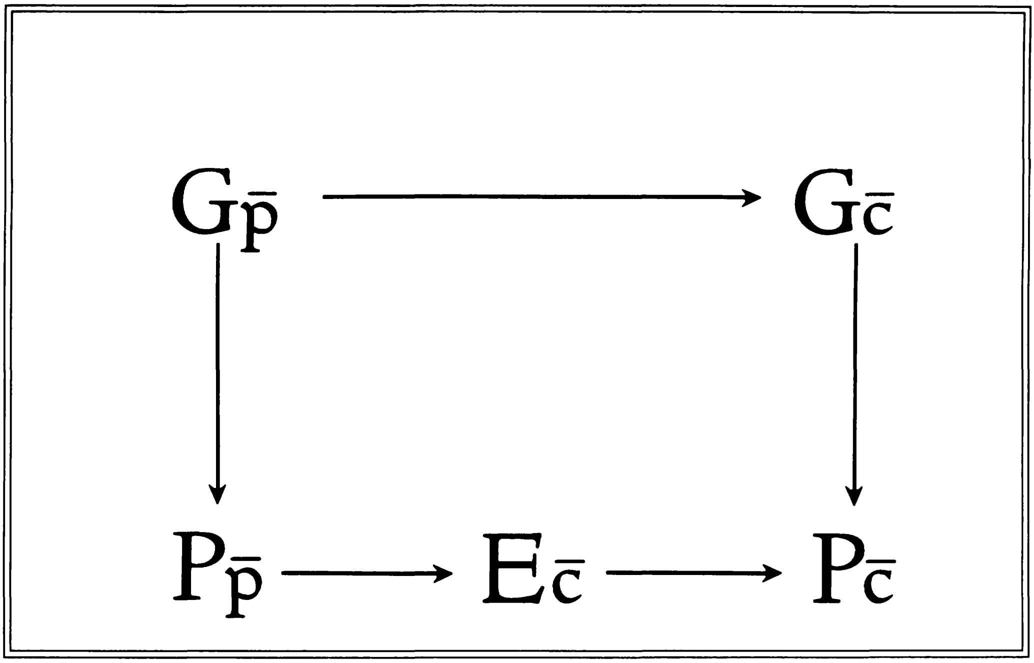

FIG. 1.—A model of parent-child genetic and environmental effects

cumstances have clear detrimental effects on a child's development, regardless of the child's genetic background (Dumaret & Stewart, 1985). The important point here is that *variations* among environments that support normal human development are not very important as determinants of *variations* in children's outcomes.

Common and Uncommon Assumptions

The prevailing belief among both psychologists and parents is that variations in normal environments, particularly those provided by their families, (1) shape children's development and (2) determine their adult futures. The commonly accepted model is one in which parental characteristics (phenotypes, Pp) determine the child's environment (Ec), which in turn determines the child's behavioral outcomes (Pc). A more complete version of this model is shown in Figure 1. Here the transmission of genes from parents to child is recognized, and the role of genes in determining (in part) phenotypes is included in the model. In this model, the parents still determine the child's environment, which affects the child's behavioral development.

It also commonly is assumed that parental characteristics and home environments are arbitrarily or even randomly associated with individual children's characteristics (Bandura, 1982). Parents are, in this sense, "the luck of the draw." The structure of experience is assumed to be given in the environment, which acts to provide stimuli that impinge and shape children, regardless of who they are. The uncorrelated nature of people's characteristics and their environments is challenged by constructivist views of how people determine their own experiences. In fact, several lines of research in cognitive, clinical, and social psychology have been based on theories about individual differences in experience and on the idea that, not only do individuals' responses to environments differ, but people construct their own experiences. Some brief examples follow.

1. In cognitive psychology, Bower has pursued the idea that people construct their own experiences and personal histories (Bower, 1987). Faced with the same brief story, different individuals remembered and recalled different versions of the story.

2. Clinical psychology has found that people differ in their emotional responses to situations; for example, Eysenck (1982, 1983) compared psychopaths and normals in their emotional reactivity to punishment and reward; Wexler, Schwartz, Warrenburg, Servis, and Tarlatzis (1986) examined stress

reactions that shape their behaviors in those situations.

3. Social psychology has presented evidence that personal characteristics affect how others respond to the stimulus person (Langlois & Roggman, 1990). Physical attractiveness may be in the eye of the beholder, but there is a great deal of cultural consensus in judgments about what constitutes physical attractiveness. People judged to be physically attractive by others are more likely to be asked for dates, more likely to be hired for jobs, and once hired more likely to be promoted than others judged to be less physically attractive (Bersheid & Walster, 1974).

4. In personality psychology, Henry Murray (Kluckhohn, Murray, & Schneider, 1953) pursued for many years the idea that each person constructs a personal myth, which gives coherence to his or her life, just as larger cultural myths give coherence to a society. Personality characteristics that are moderately heritable (30% to 50%) have been shown to influence how people react across time and situations. Sociable and outgoing people experience social interactions with strangers differently from shy, fearful people (Eysenck, 1983; Kagan, Reznick, & Gibbons, 1989). Optimistic, internally directed older adults cope much better with aging than others who are less optimistic and feel less in control of their lives. A twin study of older adults shows these life-outlook characteristics, like all personality variables, to be moderately heritable (Pedersen, Gatz, Plomin, & Nesselroade, 1989).

5. The new field of cultural psychology is actually predicated on the assumption that no sociocultural environment exists apart from the meaning that human participants give it (Shweder, 1990). Nothing real "just is"; realities are the product of the way things get represented, embedded, implemented, and reacted to.

Although cultural psychology uses non-Platonic, philosophical constructivism to explore ethnic differences in personality, intelligence, and social behavior, the same ontological and epistemological principles apply to individual differences within cultures (Scarr, 1985). Different people, at different developmental stages, interpret and act upon their environments in different ways that create different experiences for each person. In this view, human experience is the construction of reality, not a property of a physical world that imparts the same experience to everyone who encounters it.

Thus, there are contradictory theories in psychology about how people are influenced by their environments and how they construct their own experiences from those environments.

The Average Expectable Environment

A resolution of the seeming contradictions in theories about how families affect their children can be found in the concept of the "average expectable environment" (Hartmann, 1958). Based on evolutionary theory, there are three components that describe normal organisms in normal environments (LeVine, 1987).

1. *Preadaptation.*—Infants and children are preadapted by their human species genetic inheritance to respond to a specific *range* of environmental opportunities for stimulation and knowledge acquisition.

2. *Variation.*—Within the genetically specified range of normal environments, a variety of environmental patterns of stimulation can act to promote normal human developmental patterns. Wide variations in environments within this normal range present "functionally equivalent" opportunities for people to construct their own experiences (Scarr & Weinberg, 1983).

3. *Limits*—Environments that fall outside of the species-normal range will not promote normal developmental patterns. Contemporary examples are violent, abusive, and neglectful families.

Thus, normal development does occur in a wide variety of human environments, but not in those lacking "average expectable" conditions under which the species has evolved. For infants, species-normal environments include protective, parenting adults and a surrounding social group to which the child will be socialized. For older children, a normal environment includes a supportive family, peers with whom to learn the rules of being young, and plentiful opportunities to learn how to be a normal adult who can work and love. The exact details and specifications of the socialization patterns are not crucial to normal development (although they are crucial to understanding the meaning people give to their experiences), but having a rearing environment that falls within the limits of normal environments *is* crucial to normal development.

Although I argue that genotype-environment correlations are more pervasive and important than gene-environment interactions, there are in the human literature a

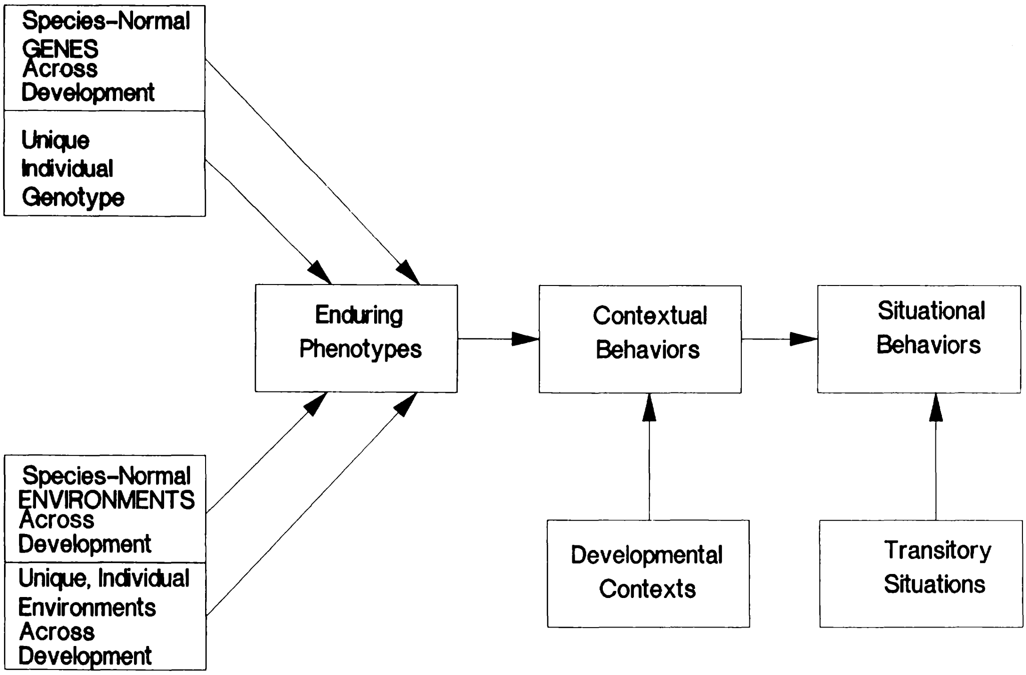

FIG. 2.—Different levels of genetic and environmental influences on behavioral development

few examples of how different genotypes respond to the "same" rearing environment. A striking example of genotype-environment interaction has been reported by Gottesman and Bertelsen (1989) in their follow-up study of offspring of identical and fraternal twins discordant for schizophrenia. They found that the risk for schizophrenia in the offspring of schizophrenic fraternal twins was 17.4% and for the offspring of their normal co-twins was 2.1%. However, the risk for the offspring of schizophrenic identical twins was 16.8% and for those of their normal co-twins was 17.4%. Gottesman and Bertelsen concluded that "discordance in identical twins may primarily be explained by the capacity of a schizophrenic genotype or diathesis to be unexpressed unless it is released by some kinds of environmental, including nonfamilial, stressors" (p. 867).

Thus, it is clear from research in many areas of psychology, most notably cultural psychology, and from the investigation of organism-environment interaction that the "environment" does not necessarily have the same meaning for all individuals.

Models of Genes and Environments

Another source of confusion in theories of how humans develop is the nature of the phenotype (observable characteristics) that is the outcome to be predicted. Some behaviors are indices of enduring personality and intellectual characteristics of the person, traits that show considerable stability across many situations and years. Other behaviors are temporally less stable but consistent responses to contemporary contexts in which development is occurring. Still more transitory behaviors are situation-specific. Figure 2 shows a model of how development can be construed at different levels of behavioral analysis from enduring traits to situational behaviors.

The path model, shown in Figure 2, invokes causality. Having a genotype within the species-normal range is necessary for normal development, as is having a species-normal environment, an average predictable rearing environment. In addition to a "normal" environment that supports development in a normal range, the developing person also has an individual environment selected, evoked, and constructed by the person. The person also has a unique genotype composed of normal alleles in loci that have normal variants in the population. Normal genes, normal environments, and individually different genes and environments combine to produce the development of en-

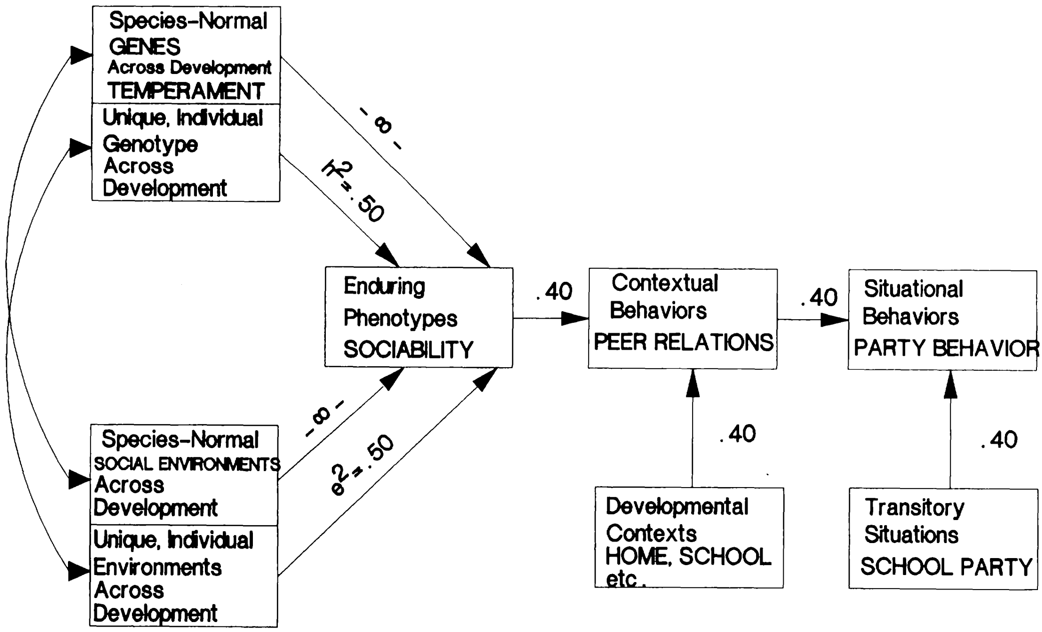

FIG. 3.—Sociability and peer behaviors

during behavioral phenotypes, such as personality, interests, and intelligence.

The model posits that how people behave in various contexts depends on enduring phenotypes and on environmental contexts. Situational or transitory behaviors are further influenced by transitory situations and by contextual behaviors that are relevant to the situation.

The first example of the model does not show all of the possible causal paths, as does the next example. The example chosen is temperament and social development (see Fig. 3). In this model of peer relations and peer behaviors, species-normal genes and species-normal social rearing environments are correlated because normal organisms evoke different rearing than abnormal ones. Unique genes combine with unique individual environments to produce individually variable, enduring phenotypes (measurable traits, such as sociability). Enduring traits are hypothesized to combine with developmental contexts (long-range contexts, such as home and school) to produce contextual behaviors, such as relationships with peers. Finally, relationships with peers are predicted to combine with situations to produce specific, situational behaviors, such as how a child behaves at a school party.

Genes may predict contextual and situational behaviors directly through paths other than the measured personality trait (here, sociability), such as impulsiveness, emotionality, and so forth. The model permits direct as well as indirect or mediated pathways to development and behavior.

Which of these kinds of personal traits or behaviors is to be explained will have great influence on the level of genetic and environmental characteristics one should choose to include in the prediction. Much of the 20-year debate about situation-specific behaviors versus enduring personality traits was mired in the confusion between relatively stable traits and situationally determined behaviors. Discussions of genetic and environmental variability in "behavior" risk the same misunderstandings unless the level of behavior is defined.

I decided to combine information in our field, some of which I will present in the next section of the paper, to speculate about what the solution of this model might yield. Figure 3 shows the path coefficients. Note first that the species-normal environment and genes have infinite coefficients (set at zero in the model), because it is assumed that the data are based only on genetically normal people who developed in average expectable environments. If one were comparing development of abnormal with that of normal genotypes, or development in very

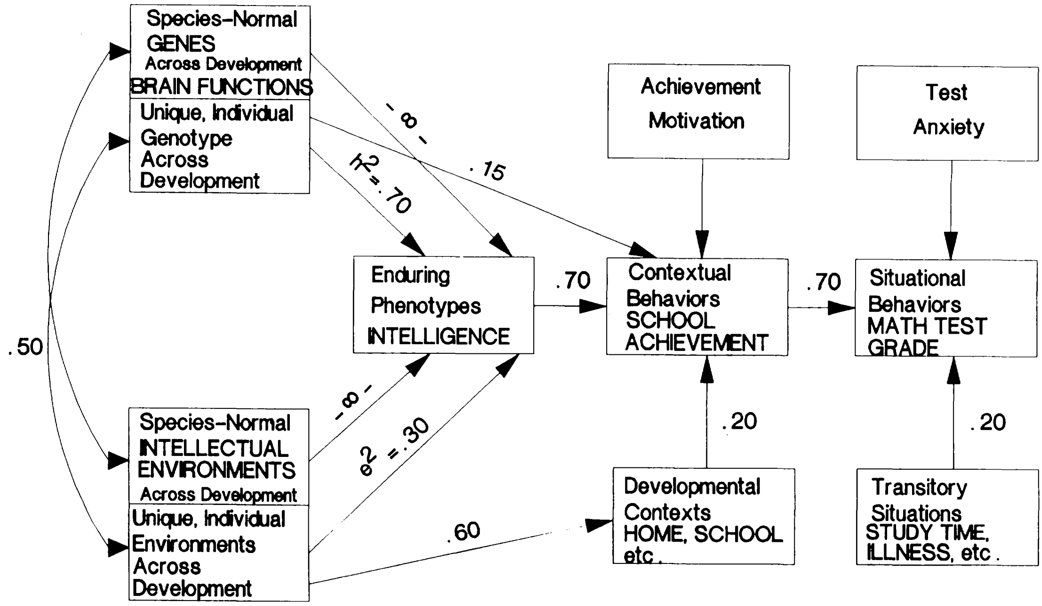

FIG. 4.—Model of intelligence and school achievement

deprived with that in normal environments, these coefficients could have values.

Based on a considerable amount of data from families and twins, the heritability (h^2; path from unique genotype to enduring phenotype) is about .50. Unique environments explain about half of the reliable variance in personality, so that e^2 is also predicted to be .50. I will not try to defend any of the values in this model; I will only say that the numbers fit my reading of the developmental literature. There is much to argue about here! To evoke even more controversy, let me show my estimates for intelligence, school achievement, and a grade on a math test (Fig. 4).

Of greater importance is the idea that one can understand both typical development of normal genotypes in average expectable environments, and individual development of unique persons in unique environments, as they develop enduring characteristics and display contextually consistent behaviors and situationally specific behaviors. The next step is to explain how unique individuals make their own experiences.

A Triarchic Theory of Experience

How might individuals create their own experiences? In earlier publications (McCartney, in press; Scarr, 1985; Scarr & McCartney, 1983; Scarr & Weinberg, 1983), we have proposed that people make their own environments in three ways: First, children's genes necessarily are correlated with their environments because parents provide both, so that their experiences are constructed from opportunities that are correlated positively with their personal characteristics; second, people evoke from others responses that are correlated with their own characteristics; and third, people actively select environments that are correlated with their interests, talents, and personality characteristics.

Although the proposed theory is based on the idea that, given the same "objective" environment, individuals will react differently, Scarr (1989) has argued that *genotype-environment correlations,* rather than gene-environment interactions, predominate in the construction of experiences. Many environmental opportunities are taken in by some individuals and not by others, depending on the individuals' characteristics. This selective use of environmental opportunities is better thought of as genotype-environment correlation than as genotype-environment interaction.

The theory of genotype → environment effects has three propositions:

1. There are three kinds of genotype → environment effects, as described above: passive, evocative, and active.

2. The balance of genotype → environment effects changes from passive to active with development, as children move out from the family to make their own choices of interests and activities.

3. Genetic differences become more important across development, as people actively make their own environments.

The theory of genotype → environment effects holds that *genotypes drive experiences*. Following Hayes (1962), we proposed that the state of development and the individual characteristics of people shape the experiences they gather from exposures to their environments. In this model, parental genes determine their phenotypes, the child's genes determine his or her phenotype, and the child's environment is merely a reflection of the characteristics of both parents and child. Here differences among children's common home environments, *within the normal species range*, have no effect on differences among children's outcomes. The obvious challenge posed by this model is the proposition that differences among normal environments are a product of parental and child characteristics and not a causal path in the determination of differences among children's behavioral phenotypes.

General Theory

People are both individually different and developmentally different in the ways they encode and experience their environments. Experiences the person constructs from exposures to various environments are uniquely correlated to that person's perceptions, cognition, emotions, and more enduring characteristics of intelligence, interests, and personality. In this theory there are three ways by which genotypes and environments become correlated (Plomin, DeFries, & Loehlin, 1977). First, one must take into account the fact that most biological parents provide their children with both genes and home environments. The fact that parents provide both genes and environments means that the child's genes and environments necessarily will be positively correlated. For example, parents who read well and who like to read will be likely to subscribe to magazines and papers, buy and borrow books, take books from the local library, and read to the child. Parents who have reading problems are less likely to expose themselves to this world of literacy, so that their children are more likely to be reared in a less literate environment. Those same children are also more likely to have reading problems themselves and to prefer nonreading activities. Thus, the reading abilities of parents are likely to be correlated with the reading abilities of their children and with the environments parents provide for their children—a positive genotype-environments effect.

Second, each person at each developmental stage *evokes* from others responses that reinforce positively or negatively that person's behaviors. Evocative effects have profound effects on a person's self-image and self-esteem throughout the lifespan. Smiling, cheerful infants who evoke positive social interactions from parents and other adults (Wachs & Gruen, 1982) seem likely to form positive impressions of the social world and its attractions. Infants who are fussy, irritable, and who experience negative or neutral interactions with their caregivers and others would seem less likely to form the impression that social interactions are a source of positive reinforcement. Toddler siblings evoke individually tailored but different verbal exchanges with their mothers at the same chronological ages (McCartney, in press). School-age children from disadvantaged families who are more intelligent and more "spunky" (Garmezy, Masten, & Tellegen, 1984) are more likely to be given positive attention and encouragement by teachers than less intelligent or less "spunky" children. Third, each person makes choices about what environments to experience. Past infancy, people who are in a varied environment[2] choose what to attend to and what to ignore. Depending on their personal interests, talents, and personality, people choose pursuits, whether educational, occupational, or leisure activities.

The idea that people sort themselves into environments according to their interests, talents, and personality has a long history in industrial/organizational psychology. People choose occupational environments that correlate with their personal preferences for social interaction or solitary work,

[2] The entire theory depends on people having a varied environment from which to choose and construct experiences. The theory does not apply, therefore, to people with few choices or few opportunities for experiences that match their genotypes. This caveat applies particularly to children reared in very disadvantaged circumstances and to adults with little or no choice about occupations and leisure activities.

for independent or supervised work, for salesmanship or social service. Preferences for one kind of work environment or another are correlated with other aspects of personality (Grotevant, Scarr, & Weinberg, 1977; Holland, 1973). Differences in preferences for work environments turn out to be just as heritable as other aspects of personality (Bouchard, Scarr, & Weinberg, 1991). Thus, differences in choices among various kinds of environments have been shown to be, in part, functions of the personal characteristics of the individual.

A test of the notion of gene-environment correlation can be seen in a study of reading (Hayes et al., 1989). Pervasive differences in reading choices and amount of reading were found by age, gender, and ability levels—all of which are consistent with the theory that people choose and make their own environments.

> These measurements on popular children's books showed: (*a*) the most able British children read approximately 50 percent more than their less able peers (within that four week period), and (*b*) the average text grows more demanding (lexically) and longer in the older age cohorts. . . . The most able children not only read more books than their peers, those books were slightly more difficult. When this one month language experience is multiplied across years, the highest ability students must have accumulated a huge advantage over their less able peers. They encountered many more uncommon terms and non-mundane topics from their reading. *Even if these most able children were no more efficient* in extracting, integrating and retrieving information from what they read than their less able peers, they would still have the much richer language experience friom their book reading. If it can be shown that they are also more efficient, their advantage over their peers would be still greater. (P. 13)

The genotype → environment effects theory predicts that developmental differences are *very important,* pervasive, and large, based on *the same* principles as individual differences. For many behaviors, developmental changes, based on genotype and environmental changes (genes are turned on; environments are perceived and experienced differently) will be much larger than individual variations at any one age. All of these is in accord with the theory of developmental and individual differences in the selection and construction of experience.

Families as Environments

The idea of correlated personal and environmental characteristics has been ignored and even opposed in developmental psychology (e.g., Rheingold & Cook, 1975). Most attention has been focused on differences among families in the opportunities they provide for their children. Beginning with family differences in social class, however measured, it has been assumed that observations of ubiquitous correlations between family education, occupational status, and income and children's intellectual and other outcomes *were caused* by differences *among* families' *environments* (Scarr, 1985). Clearly, there are family differences; it is not clear that most of those differences are environmental. In fact, among families in the mainstream of Western European and North American societies, differences in family environments seem to have little effect on intellectual and personality outcomes of their children.

This point is worth pondering. How can it be that different parents have few differential effects on the intellectual or personality development of their children? For parents who care, it is impossible to believe that this could be the case. This is not to say that parents may not have effects on children's self-esteem, motivation, ambitiousness, and other important characteristics. It is to say that parental *differences* in rearing styles, social class, and income have small effects on the measurable *differences* in intelligence, interests, and personality among their children.

The Data

Family resemblances have been reported for intelligence and personality measures for relatives who vary in genetic and environmental relatedness. Table 1 summarizes much of the data on IQ test score similarities of late adolescent and adult relatives who are genetically identical, of those related by half of their genes, and of genetically unrelated individuals.

Let us focus on genetically identical pairs reared together and apart and on adopted pairs of siblings reared together since infancy. These are the most startling findings. Identical (MZ) twins reared together score as much alike (r = .86) on IQ tests as the same person tested twice (r = .87). MZ twins reared in different families are slightly less similar (r = .76). The remarkable studies of MZ twins reared in different families challenge many cherished beliefs in developmental psychology (but fit very nicely in the genotype → environment theory). The fact that these twins, in four studies, are nearly as similar intellectually

TABLE 1

IQ AND DEGREES OF RELATEDNESS: SIMILARITIES OF GENETICALLY RELATED AND UNRELATED PERSONS WHO LIVE TOGETHER AND APART

Relationship	Correlation	Number of Pairs
Genetically identical:		
Identical twins together	.86	1,300
Identical twins apart	.76	137
Same person tested twice	.87	456
Genetically related by half of the genes:		
Fraternal twins together	.55	8,600
Biological sisters and brothers	.47	35,000
Parents and children together	.40	4,400
Parents and children apart	.31	345
Genetically unrelated:		
Adopted children together	.00	200
Unrelated persons apart	.00	15,000

SOURCE.—Adapted from Plomin and DeFries (1980).
NOTE.—Based on data from Scarr and Weinberg (1978) and Teasdale and Owen (1985) on older adolescents who are comparable in age to other samples in this table. Younger adopted children resemble each other to a greater degree, with correlations around .24, according to samples of 800 pairs.

(Bouchard et al., 1990) as identicals reared together, and are just as similar in personality (Tellegen et al., 1988), raises critical questions about what observed family differences really mean for development. Table 2 shows the IQ correlations for MZ twins reared apart in four studies.

By contrast, genetically unrelated siblings, reared from infancy to adulthood in the same family, do not resemble each other at all in IQ. This result, based on two initial studies (Scarr & Weinberg, 1978; Teasdale & Owen, 1985), has been exactly replicated in two additional studies of late adolescents and young adults (Horn, Loehlin, & Willerman, 1982; Kent, 1985). Studies of younger adopted siblings show that they do have some intellectual resemblance (r = .24), about half that of biological siblings (r = .47). A major reason for the greater resemblance of younger adoptees is that families have greater effects on their younger than older children, as will be explained in later sections. Another reason for greater resemblance of younger than older adoptees is selective placement, as shown in Table 3.

In this sample (Scarr & Weinberg, 1976, 1977), 75% of the 101 adoptive families also had their own biological offspring. Thus, one can examine the resemblances of biological and adoptive relatives, living together and apart. Correlations of parents and their biological children range from .33 to .43, whether the (natural) parents have never seen the children since birth or whether the parents (adoptive parents, but the biological parents of these children) have reared them to the average age of 7 years.

These are intellectual resemblances between adoptive parents and their adopted child, (r = .21) and (r = .27), but this similarity must be modified by the intellectual resemblances between the natural parents of the adopted child and the biological offspring of the adoptive parents (r = .15 and r = .19). There is absolutely no environmental or genetic reason to think that birth parents of adopted children should bear any resemblance to biological children of the families who adopted their children, except for selective placement by adoption agencies.

Social workers are likely to try to match their expectations for children's intellectual development to the adoptive families' educational levels. Thus, by being more likely to place an illegitimate child of two university students with a college-educated family and to place a child of two high school dropouts with a working-class family, adoption agencies can create a correlation between the child's probable abilities and the adoptive home environment. The matching characteristics that social workers select are educational levels of natural parents with educational, occupational, and income characteristics of adoptive families (Scarr & Weinberg, 1977, 1978, 1983).

The implication of the unexpected resemblance between birth parents and bio-

TABLE 2

SAMPLE SIZES AND INTRACLASS CORRELATIONS FOR ALL IQ MEASURES AND WEIGHTED AVERAGES FOR FIVE STUDIES OF MZA TWINS

Study and Test Used (Primary/Secondary/Tertiary)	*N* for Each Test	Primary Test	Secondary Test	Tertiary Test	Mean of Multiple Test
Newman et al. (1938) (Stanford-Binet/Otis)	19/19	.68	.74	...	.71
Juel-Nielsen (1965) (Wechsler-Bellevue/Raven)	12/12	.64	.73	...	.69
Shields (1962) (Mill-Hill/Dominoes)	38/37	.74	.76	...	.75
Bouchard et al. (1990) (WAIS/Raven-Mill-Hill/First Principal Component)	50/45/44	.69	.78	.78	.75
Weighted average	119/113/112	.70	.76	.78	.74

TABLE 3

COMPARISONS OF BIOLOGICAL AND UNRELATED PARENT-CHILD IQ CORELATIONS IN 101 TRANSRACIAL ADOPTIVE FAMILIES

	N (Pairs)	r
Parents–unrelated children:		
Adoptive mother–adopted child	174	.21 (.23)[a]
Natural mother–own child of adoptive family[b]	217	.15
Adoptive father–adopted child	170	.27 (.15)[a]
Natural father–own child of adoptive family[b]	86	.19
Parents–biological children:		
Adoptive mother–own child	141	.34
Natural mother–adopted child[b]	135	.33
Adoptive father–own child	142	.39
Natural father–adopted child[b]	46	.43

SOURCE.—Scarr & Weinberg research.
[a] Early adopted only (N = 111).
[b] Educational level, not IQ scores.

logical children in the family who adopted their children is that the resemblance of adoptive parents and adopted children must be corrected for selective placement (.21–.15 and .27–.19), which reduces adoptive family correlations to small effects (.06 and .08), even in early childhood.

From our adolescent adoption study (Scarr & Weinberg, 1978), the prediction of biological offspring IQ test scores from the average of the parents' IQ scores is remarkable ($r = .68$), as shown in Figure 5. By contrast, the prediction of adopted children's IQ test scores from adoptive parents' scores is minimal ($r = .13$), as shown in Figure 6.

The theory of genotype → environment effects can explain the slight resemblances among adopted relatives and the great resemblances between MZ twins reared together and apart. If genes drive experience, then the degree to which relatives have similar experiences will depend upon their degree of genetic resemblance. Identical twins, whose genetic correlation is 1.00, evoke similar responses from others, and they make similar choices in their environments. They respond cognitively and emotionally in similar ways, and they construe their experiences in similar ways. By contrast, adopted children, who are genetically unrelated, have uncorrelated experiences even within the same household, school, and neighborhood environments. This part of the theory explains the family data from behavior genetic studies more satisfactorily than any other model.

Developmental Patterns

Longitudinal studies of twins, most notably the Louisville, Kentucky, study headed for many years by the late Ronald S. Wilson, have contributed to our understanding of the role of genetic variability in regulating developmental patterns. Wilson (1983) reported on mental development tests administered on nine occasions to infants and young children from 3 months to 6 years. Overall results were that MZ twins scored very similarly (correlations in the mid-80s throughout early childhood) and DZ twins less similarly (correlations declining from the mid-70s in infancy to the low 60s over the preschool years). But the longitudinal pattern of mental development was also strikingly similar for MZ co-twins, as shown in Figure 7. Although each pair had a different pattern of spurts and lags in mental growth, the similarity between co-twins was very high within each pair. The four pairs presented by Wilson were representative of the several hundreds of twin pairs studied over 20 years. Figure 7 also shows the typical patterns of mental developmental resemblance for DZ twins. Because they are siblings with about half of their genes in common, their developmental patterns are similar but not as parallel to one another as those of MZ twins.

Environments within the Family

The same body of behavioral genetic literature that illustrates the importance of genetic variation also highlights the importance of environmental variation (Scarr & Grajek, 1982). As Plomin (1990) indicated, "the majority of the variance for most behaviors is due to non-genetic factors, the environment" (p. 117). However, one of the most striking findings of the behavior genetic literature is that, for a variety of traits, most of

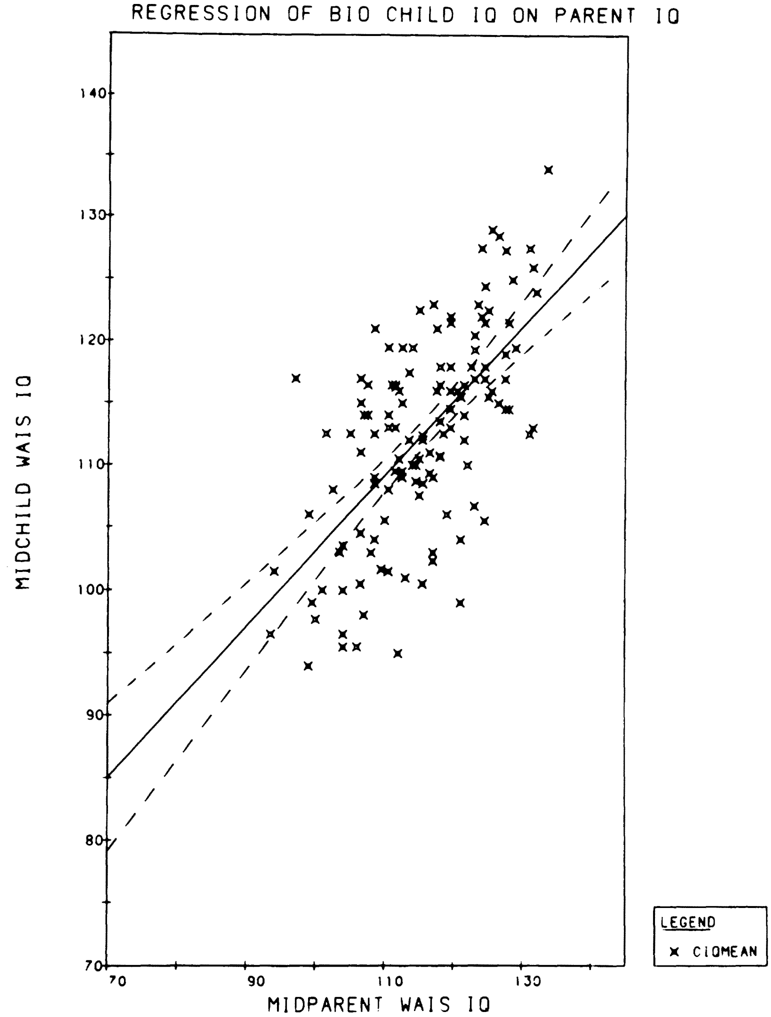

FIG. 5.—Scatterplot of the regression of midchild IQ scores on midparent IQ scores in biologically-related families.

the environmental variance is contributed by *nonshared* environmental influences (Scarr & Grajek, 1982). Nonshared environmental influences are those that are not shared by members of a family; that is, they act to make family members different from one another. As Plomin and Thompson (1987) highlight, this finding "implies that the unit of environmental transmission is not the family, but rather micro-environments within families" (p. 20). I would add that microenvironments are largely the construction of individual family members in the ways they evoke responses from others, actively select or ignore opportunities, and construct their own experiences.

Siblings adopted in infancy do not resemble each other in any measured talents, interests, or personality. Yet, they have grown up in the same home with the same parents, schools, neighborhoods, and overall family circumstances. According to normal developmental science, differences in parental child-rearing techniques, interactional patterns, educational levels, occupational statuses, and income, among many other family variables, should cause siblings to resemble each other, *if common family and larger contexts have common influences* on siblings, regardless of their genetic relationship. The data do not support normal developmental theory and challenge us to rethink how the environment can be construed in such different ways by different family members, even if they are biologically re-

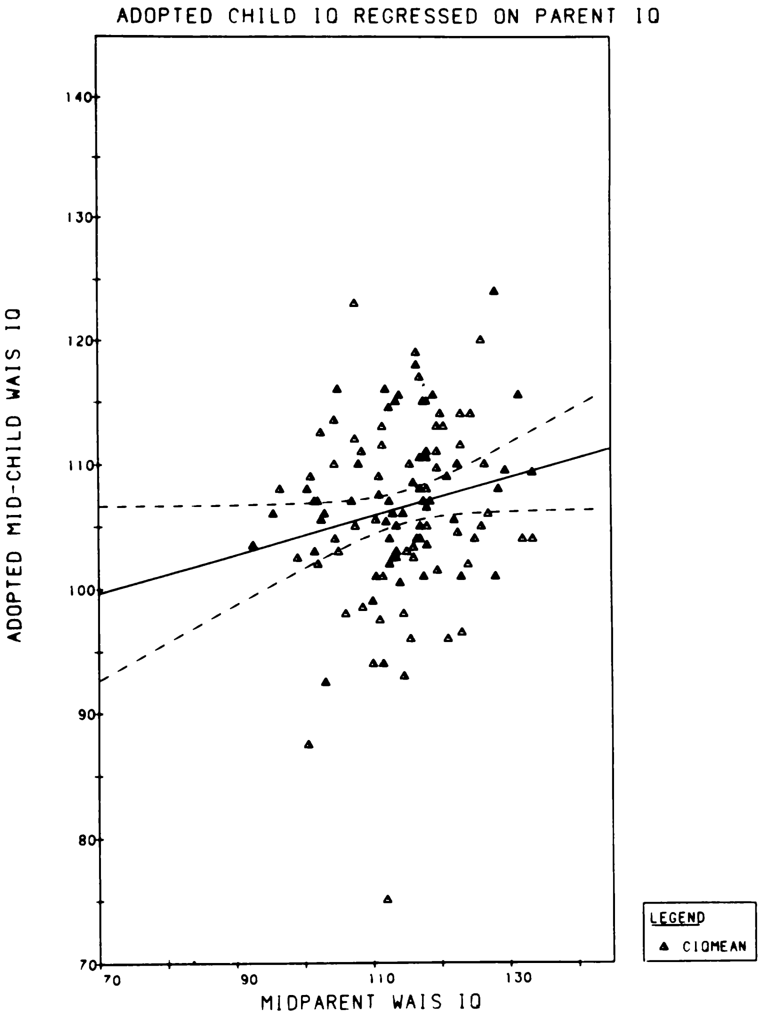

FIG. 6.—Scatterplot of the regression of midchild IQ scores on midparent IQ scores in adoptive families.

lated and especially when they are not genetically related.

Good Enough Parents

Ordinary differences between families have little effect on children's development, unless the family is outside of a normal, developmental range. Good enough, ordinary parents probably have the same effects on their children's development as culturally defined super-parents (Rowe, in press). This comforting idea gives parents a lot more freedom to care for their children in ways they find comfortable for them, and it gives them more freedom from guilt when they deviate (within the normal range) from culturally prescribed norms about parenting. As Richard Weinberg and I said (Scarr & Weinberg, 1978), children's outcomes do not depend on whether parents take children to the ball game or to a museum so much as they depend on genetic transmission, on plentiful opportunities, and on having a good enough environment that supports children's development to become themselves.

The idea of good enough parents is a constructive step toward recognizing that parents do not have the power to make their children into whatever they want, or in John Watson's (1928) terms, to ruin them in so many ways. Fortunately, evolution has not left development of the human species, nor any other, at the easy mercy of variations in their environments. We are robust and able to adapt to wide-ranging circumstances—a lesson that seems lost on some ethnocentric

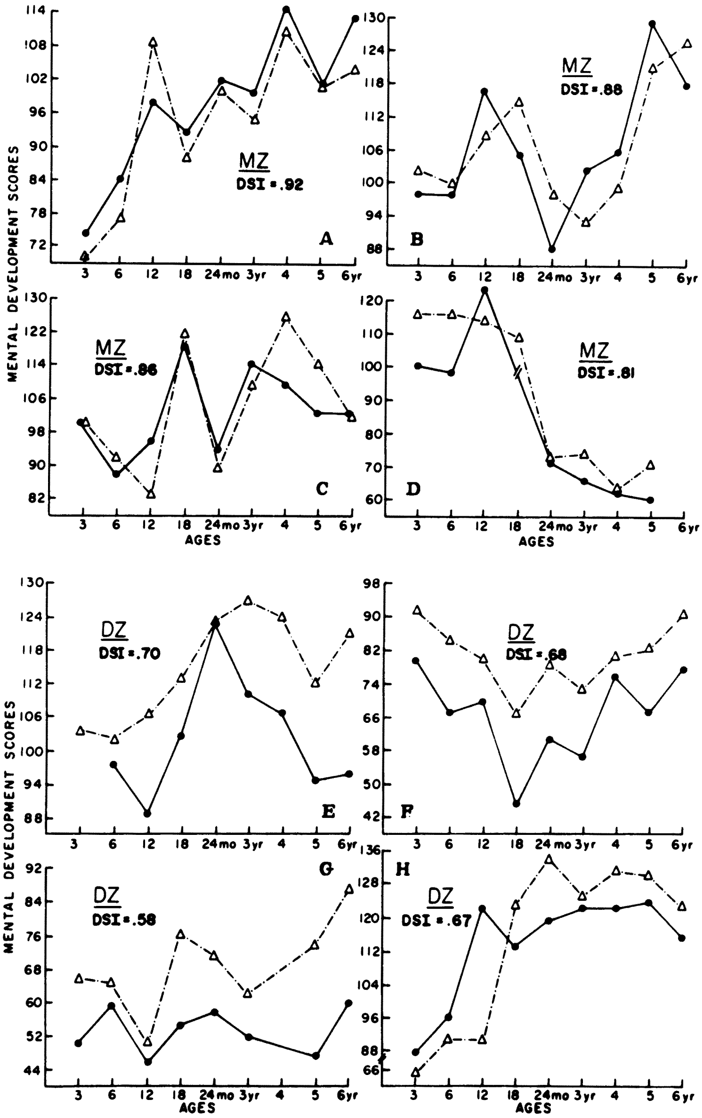

FIG. 7.—Trends in mental development during early childhood for four MZ and four DZ pairs (Wilson, 1983). DSI is the developmental synchronies index, a measure of how closely the curves of the co-twins correlate.

developmentalists. If we were so vulnerable as to be led off the normal developmental track by slight variations in our parenting, we should not long have survived.

The flip side of this message is that it is not easy to intervene deliberately in children's lives to change their development, unless their environments are outside the normal species range. We know how to rescue children from extremely bad circumstances and to return them to normal developmental pathways by providing rearing environments within a normal range. But for children whose development is on a predictable but undesirable trajectory and whose parents are providing a supportive environment, interventions have only temporary and limited effects (Clarke & Clarke, 1989). Should we be surprised? Feeding a well-nourished but short child more and more will not give him the stature of a basketball player. Feeding a below-average intellect more and more information will not make her brilliant. Exposing a shy child to socially demanding events will not make him feel less shy. The child with a below-average intellect and the shy child may gain some specific skills and helpful knowledge of how to behave in specific situations, but their enduring intellectual and personality characteristics will not be fundamentally changed.

Developmentalists can have more respect for individual differences among parents in the ways they rear their children. And we need to take our own textbook advice and actually believe that correlations are not causes. The associations between a child's characteristics, those of the parents, and the rearing environment they provide are neither accidental nor a likely source of fruitful intervention, unless the child's opportunities for normal development are quite limited. Developmental reseach of the past 25 years supports the idea that normal genes and normal environments promote species-typical development and that, given a wide range of opportunities, individuals make their own environments, based on their own heritable characteristics.

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