Reply

Biological and Cultural Diversity: The Legacy of Darwin for Development

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Scarr, Sandra. Biological and Cultural Diversity: The Legacy of Darwin for Development. Child Development, 1993, 64, 1333–1353. To explain becoming human, becoming a member of a culture and society, and becoming a unique human being calls upon diverse theoretical resources in the biological and social sciences. To integrate such diverse concepts requires the umbrella of evolutionary theory, which alone can encompass so many levels of analysis. I present an elaboration of the theory sketched in my presidential address to SRCD in the hope that a more thorough understanding of the theoretical framework and the implications of cultural and biological diversity will enrich and enliven developmental research. Debates with colleagues of different persuasions are always welcome and often fruitful.

What nature proposes, environment disposes.
[Adapted from an English proverb]

Becoming human is one matter. Becoming French, Mongolian, or African-American is another. Becoming Georges Sand, Ghengis Khan, or Martin Luther King, Jr., is still another. Theories of development should address all of these meanings of the term development and the levels of analysis they imply. It is hard, however, to address all levels of analysis, from species to culture to individual, at the same time in a brief format.

In my presidential address to the Society for Research in Child Development (Scarr, 1992), I focused on the first and third matters: becoming human and becoming a unique individual. Baumrind (1993, in this issue) and Jackson (1993, in this issue) focus on the second: becoming a member of a particular culture. Both challenge the cultural and subcultural applications of my theory, which were not well developed in the original article. Both examine in considerable detail many of my publications between the early 1970s and the present. Although I do not reply to each of their criticisms and errors of fact and interpretation (readers are asked to look at the original articles, chapters, and books which they cite), this reply does speak to many theoretical and methodological concerns they raise.

Elaborations and clarifications of my article (Scarr, 1992) are in order, as there seems to be considerable concern and confusion about what I said and did not say, what I intended and did not intend to say in just 16 pages, including figures and tables. Baumrind's (1993, in this issue) and Jackson’s (1993, in this issue) comments and those of others (Bronfenbrenner, Lenzweger, & Ceci, 1993; Eisenberg, 1992; Hoffman, 1991; Wachs, 1992, in press) have helped me to clarify and elaborate thoughts about the major theme of that address: how genes and environments combine to produce normal human development and individual variations in human species-typical patterns of development.

The major theses of my article were (1) an evolutionary perspective can unite the study of both species-typical development and individual variations; (2) environments within the normal species range are, of

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course, required for species-normal development, but research in modern societies suggests that individual variations among children reared in those environments arise primarily from genetic variation and from individually experienced environments, not from objectively measured environments; (3) environments should be seen as opportunities for experiences that are constructed by persons in developmentally changing and individually different ways; and (4) within dominant cultures in modern Western and Asian societies most individual differences in development are not due to differences in environmental opportunities. I did not discuss ethnic or racial groups, as Jackson (1993, in this issue) notes.

My reply to critics requires first some theoretical background and then more specific points. To place development in the largest possible context and to narrow sequentially the discussion from the human species to the culture, to the society, to the individual, I begin with human evolution and what follows from those assumptions about the nature of development. Human development is affected by biology, cultures, and societies. Because humans evolved to be cultural and social animals, all three must be taken into account, although not in merely additive fashion. Cultural and social explanations complement but do not replace genetic/biological explanations.

Hierarchical Knowledge

Developmentalists, more than most social scientists, have known for decades that both biological and environmental explanations are required to account for human development (Cairns, Gariepy, & Hood, 1990; Charlesworth, 1992; Eibl-Eibesfeldt, 1989). But we too were swayed by the experimental learning theories that dominated psychology in the mid-century with a proximal environmentalism that excluded both larger social explanations and biological ones (Boakes, 1984). We traded Arnold Gesell for John Watson.

Psychologists rediscovered the other social sciences in the 1960s. Parallel with the development of behaviorism in psychology were enormous developments in cultural and social anthropology and in sociology, of which many developmentalists were only dimly aware, having been educated in psychological programs. Political science and economics made their way even more slowly into developmental consciousness. In the last 20 years, the social sciences have been hierarchically arranged for developmentalists (Bronfenbrenner, 1977). What has been missing is a full appreciation of biology, especially genetics, with its enormous implications for human development (Barkow, Cosmides, & Tooby, 1992; Boakes, 1984; Bouchard, Lykken, Tellegen, & McGue, in press; Charlesworth, 1992; Gottesman, 1974; Trivers, 1985).

Darwinian evolution has two very simple concepts: genetic variation and natural selection. Selection acts at the level of individual phenotypes (not genes), who more and less contribute to the next generation, and thereby indirectly affects gene distributions. If there were no genetic variation, there could be no evolution. Evolutionary theory’s central principle is that gene frequencies in breeding populations change from generation to generation because environments differentially affect individuals’ reproductive success. The next generation more closely resembles the successful breeders and nurturers of the preceding generation, because their genes are more frequent in the offspring generation. Generational changes in gene distributions lead to changes in behavioral phenotype distributions across species’ histories. Genetic behavioral selection can proceed very rapidly, over one to four generations, and produce important changes in phenotype distributions, such as aggression and activity, which are also open to variation in the timing of experiences (Cairns et al., 1990). Variation in behavioral development depends, then, on genotype distributions, environmental opportunities, and the timing of experiences.

A Contemporary Synthesis

In 1941 the new synthesis of modern genetics and evolutionary theory was hammered out to the great benefit of biology

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1 Indeed, I have proposed for more than 30 years that development can be best understood when causes are arranged hierarchically, but this position was not well received, then or now. As a graduate student at Harvard, I wrote a term paper for Professor Gordon Allport proposing that causes of development should be arranged hierarchically, and the problem was to understand the linkages among levels in the model. He was entirely unimpressed, told me that psychological phenomena could be explained only in psychological terms (he borrowed that from Alfred Kroeber), and gave me a C on the paper. I believed what I said then, and I still believe it.
(Dobzhansky, 1941; Mayr, 1970). Theory and mechanism were joined. Fifty years later, we need a contemporary synthesis of theory in the biological and social sciences that acknowledges that culture, society (including socialization), and biology are all important in shaping human development. We need to hammer out theory and mechanism of development. For too long psychologists have argued nature versus nurture, biology versus culture, as though one cause excluded others. The social sciences, including much of human development, will benefit from reintegrating evolutionary biology, as well as biological mechanisms, into developmental science. The major parameters of a synthetic theory seem clear to me. Here are 20 propositions, based on many sources, that subsume the major observations about human development.

On Development

1. Development in all species is a probabilistic course of genetically programmed change across the life span whose expression is affected by environments from the cellular to the global level. Environments that do not provide opportunities for species-normal development (see 16 below) inhibit genetic expression; environments that do not provide culturally normal opportunities for development (see 17 below) may shift development to culturally abnormal paths.

2. The course of human development itself evolved across species history. All periods of the life span have been subject to selection and are genetically variable to some extent (e.g., timing of birth, speech, menarche, menopause, for example). Intellectual and personality development are general behavioral tendencies that have evolved and shape what is learned. Developmental patterns are as species-typical as any other aspect of morphology and behavior.

3. Evolution, through co-adapted gene complexes, shaped general patterns of human behavior and development (e.g., general intelligence, emotionality), as well as specific behaviors (e.g., eye blinks, smiles). Behavioral phenotypes can be defined at different levels of generality, but there are positive correlations among specific behaviors that yield more general patterns that are characterized by genetic individual variability.

On Behavioral Evolution

4. All animal (human and other) behavior is the product of evolution. Evolution is a historical process of selective and random forces acting on genetic variation within each species from one generation to the next.

5. All animals (including humans) show versatility and adaptability in behavior. Honeybees learn to anticipate experimental moves of their honey sources. Learning is a common feature of all species—not learning to solve human problems but solving problems of their own, related to survival and fitness. Biology defines what can be learned, when it can be learned, how likely behaviors are to occur, and what is reinforcing.

6. Inclusive fitness explains much about social behavior, altruism toward kin, and self-sacrifice in favor of close relatives (as Haldane remarked, sardonically, he would sacrifice himself for three brothers and nine cousins). Reciprocity among nonkin can be seen as tit for tat; Minnesota farmers send hay to drought-stricken Georgia; Georgia farmers reciprocate when Minnesota needs hay. Alliances of nonkin (friends) are found among other species; for example, in chimpanzees (Goodall, in Degler, 1991).

7. Genetic commonalities determine similarities among species members in morphology and behavior around the world.

8. Genetic variability determines some of what is observed in all species as normal morphological and behavioral variations as well as abnormal characteristics.

On Culture

9. Culture defines the content of what is to be valued and acquired; biology provides the motivation and intelligeience for learning it. Cultures define what is desirable to be learned, what is to be believed, and how to behave. Cultural diversity and genetic diversity coexist in the human species.

10. Cultures set a range of opportunities for development; they define the limits of what is desirable, "normal" individual variation, and what is "abnormal" in that culture (although there is cultural consensus about some forms of deviance and psychopathology being "abnormal" in most cultures).

On Society

11. Human societies evolved with social behaviors, kinship recognition, prolonged infancy, and so forth. Human society is a product of human evolution, just as packs of wolves, hives of bees, and prides of lions evolved with their behaviors.

12. Societies stratify opportunities for development; they determine access to cul-
tural knowledge and developmental supports, or lack of same. Industrial and postindustrial societies stratify opportunities less by tradition and more by achievement than preindustrial societies.

13. Social groups from the family to the body politic socialize the young to live by cultural values. Cultural knowledge is transmitted by adults and peers across an individual’s life span. Children are usually the focus of societies’ efforts to socialize culturally approved ways of being, believing, and behaving. In societies not in turmoil, the family, however culturally defined, is usually the major agent of socialization efforts.

14. Access to dominant cultural knowledge and supports is often less available for racial and ethnic minorities with distinctive cultures of their own.

On Environments

15. Environments provide a range of opportunities for development; the same environments do not have the same effects on all individuals, because individuals construct different experiences from the same environmental opportunities, based on their prior experiences and on their genotypes.

16. Environments must provide opportunities that are necessary for normal species-typical development or else individuals will not become normal members of the human species. Most species-typical developments are maturationally driven changes that find opportunities in every culture for their full development (e.g., language, locomotor skills, sensorimotor and concrete-operational intelligence). Cultural practices that appear dissimilar provide functionally equivalent opportunities for species-normal development.

17. Environments also must include opportunities to acquire developmentally appropriate cultural knowledge or else individuals will not be considered culturally normal. Cultural values about desirable human traits and socialization practices are ends and means, respectively; they vary among cultures within the species-normal range. Cultural beliefs about behavior and socialization practices that deviate substantially from what is culturally normal will lead to individual development that is not culturally acceptable, even if it is species normal (and culturally normal in another context).

18. Given equal access to cultural knowledge and to other environmental opportunities for experience, genetic individual variation determines the many aspects of individual differences that are manifested in what is learned, when, and by whom.

19. Given limited access to cultural knowledge and to essential opportunities for experience, individual differences may reflect those differences in opportunities to learn.

20. Individuals’ unique experiences are, most often, positively correlated with their own characteristics (e.g., good readers read more; attractive children receive more positive attention), but there can be instances of negative correlations (poor readers are given intensive reading interventions; peer-rejected children are taught social skills), and genotype-environment interactions (only good readers profit from advanced instruction; only fine athletes win athletic scholarships).

Corollaries of an Evolutionary View

The Meanings of Normal

In the presidential address, I used the term normal to describe the great variety of developmental outcomes that should be approved, even applauded, as normal, considering the enormous diversity of human genotypes and the large variety of human cultures. I was speaking of normal members of the human species and emphasizing the many different ways societies socialize their young, the vast majority of whom develop into normal human beings. I was arguing against a narrow, Western focus in North American and European developmental research. Citations were made to cross-cultural and anthropological studies. Baumrind (1993, in this issue) proposes that some developmental outcomes are preferable to others, that some can be considered even optimal, presumably in some particular cultural context. She ties preferred developmental outcomes to specific parental socialization practices. Jackson (1993, in this issue) proposes that ethnic subgroup children do not have equal access to developmental opportunities afforded by a dominant culture; I agree and have so argued for many years (e.g., Scarr, 1971, 1988; Scarr & Weinberg, 1976, 1983; Scarr, Weinberg, & Waldman, in press; Weinberg, Scarr, & Waldman, 1992).

Let me hasten to agree with Baumrind’s observation that there are culturally preferred developmental outcomes that fall into only a portion of the normal species range. Western-style children are not supposed to
be completely uninhibited, but they are allowed to be exceedingly selfish and individualistic by other cultural standards. As Le-Vine (1987, p. 25) said, "Most parents in most societies get children with the virtues they most admire and with the vices they are most willing to tolerate." The species developmental program allows latitude in what characteristics can be emphasized and which can be suppressed to some extent.

I distinguish between species-normal developmental outcomes and culturally defined normal development.

Species perspective.—Normal members of the species survive to adulthood to reproduce and rear their offspring to maturity and reproduction; they work and love (Freud). For the most part, humans grow up under functionally equivalent rearing conditions that provide opportunities for species-normal development. The challenge is to understand "the deep structure" of human environments (E. Turkheimer, personal communication, February 11, 1993)—what are the necessary and sufficient elements for normal development? Just as it was crucial to stop using modeling and reinforcement theories to explain why all normal human children acquire language (so that the deep structure of human languages could be understood), it is equally important to refocus research attention from proximal correlates of how contemporary Western children acquire, for example, object permanence, counting routines, or symbolic play to an evolutionary account of the common circumstances, camouflaged by cultural diversity, in which all normal human children develop typical human knowledge and skills. For individuals with defects or handicaps, becoming species-normal can depend on environmental supports provided by the culture/society in which one lives (e.g., individuals with myopia, physical handicaps, and genetic or chromosomal defects have supports for species-normal development in some cultures and not in others).

Cultural perspective.—Cultures define the range and focus of personal variation that is acceptable and rewarded. Roger Brown (1965) used the metaphor of cultural lenses to suggest that each culture defines what is necessary and desirable in personality variation. Cultures define the behaviors that are valuable and important for all members to share (Nsamenang, 1992). Cultures define what is abnormal and what is normal behavior; normal in a cultural sense means functioning well and feeling good in that context. Cultures vary considerably in what is defined as normal, but there seems to be some general consensus about abnormal behaviors that are dysfunctional nearly everywhere and represent severe anger or anhedonia (e.g., schizophrenia, severe depression, murderous aggressiveness) or incapacities to participate in the society (e.g., profound mental retardation).

Figures 2, 3, and 4 (Scarr, 1992) distinguished enduring phenotypes, contextual behaviors, and situational behaviors as different levels at which phenotypes are defined in developmental studies. Enduring phenotypes, such as intelligence, were distinguished from contextual behaviors, such as school achievement, and situational behaviors, such as a grade on a particular math test. Cultural differences, such as homes and schools, were shown to influence individual differences in contextual behaviors (school achievement) and situational variables, such as study time or temporary illnesses, were shown to influence situational behaviors (math test grade). Enduring phenotypes were shown as influenced by species-normal genes and environments and by unique individual factors. Although the ideas of species-normal and culturally normal were not fully developed, the figures show how, in the theory of $g \rightarrow e$ effects, the processes of normal development, in both senses, and variations occur.

Subcultures coexist with dominant or majority cultures and have their own cultural values about behavioral variation that may or may not be compatible with the dominant values (Jackson, 1993, in this issue; Nunes, 1992; Ogbu, 1988, 1992). In the United States, some Asian groups are more extreme in the same behaviors that are valued by the dominant Eurocentric group; others such as some African-American and Hispanic groups are sufficiently different that their members' behaviors sometimes conflict with developmental outcomes valued by the dominant group.

Human development is a product of dynamic interplays of biology, culture, and society, acting in coevolved concert, across evolutionary time and within the life span of an individual (Cairns et al., 1990). By species-normal criteria, individual patterns of development are more likely to be influenced by genetic differences than by differences in opportunities that cultural and social environments afford. All societies not in
turmoil afford children opportunities to become normal members of the species. By culture-normal criteria, the location of the individual in the social structure may have important effects on access to opportunities that lead to culturally defined normal development (Baumrind, 1993, in this issue; Jackson, 1993, in this issue).

The Environment Has Nonlinear Effects on Development

Environments provide opportunities for development to occur. The range and variety of opportunities provided are important, because below some threshold there are insufficient opportunities for adequate, species-normal development to occur.

Gottlieb (1976) provided useful distinctions about the possible roles of genes and environments in species-normal development. The functions are to induce, maintain, and elaborate developmental change. There is a great deal of evidence that the induction of developmental change (also called experience expectant development; Wachs, 1992) is a maturational process. Normal species environments are required to maintain and elaborate maturationally initiated changes; these are called experience-dependent developments (Wachs, 1992).

Gottlieb (1991) provided an excellent example of nonlinear effects of an extreme deprivation in his research on ducklings. His interpretation of what his findings mean to evolutionary theory, however, is peculiar. First, he proposes that development should be seen as a system, a statement with which nearly any developmentalist would agree. “In recent years, what might be called a ‘systems view’ of individual development has been slowly catching on, both in biology and psychology. The systems view sees individual development as hierarchically organized into multiple levels (e.g., genes, cytoplasm, cell, organ, organ system, organism, behavior, environment) that can mutually influence each other” (p. 5).

Here he described developmental processes, not sources of variation among individuals. But, next he attributed to “certain scientists” the sin of genetic determinism, notably Waddington and Scarr, an epithet that has been cited by several developmentalists (Baumrind, 1993, in this issue; Hoffman, 1991; Wachs, 1992). Gottlieb argued that canalization (restriction of possible developmental outcomes) is due not only to genes but to experiential components at all levels of the developmental system. This is theoretically true, and empirically true under extreme (species-abnormal) conditions (and, I would add, when the organism is species-abnormal; e.g., deafened chicks or profoundly deaf children do not recognize species-typical calls or maintain vocalizations, respectively).

The possible versus the actual.—Gottlieb does not distinguish what actually happens in the real world from what could happen under extreme experimental conditions. He uses animal models that are akin to children with profound sensory deficits and those locked in attics for years. Who would deny that such organismic and environmental events can produce abnormal development? Remember Kuo (1976), who conditioned kittens to be afraid of mice? Did that persuade you that kittens, reared by their mothers, are not likely to become pouncers on small moving objects? That it could happen is hardly germane to the study of what does happen. Deprivation studies can illustrate one mechanism (of many) that may be essential to normal development, but they do not illuminate how development actually occurs.

Gottlieb rejects the probabilistic idea of reaction range, which describes ranges of possible outcomes for individual genotypes, in favor of reaction norm, a species-typical concept of range of possible outcomes for species genotypes. Both reaction range and reaction norm, terms often used interchangeably (e.g., Gottesman, 1968), mean that different environments change the probabilities of outcomes for various genotypes, and vice versa (Turkheimer & Gottesman, 1991). Both mean that phenotypic species development and individual development are biased and not equipotential across the range of possible genotypes and environments. Yet, Gottlieb rejects the idea of individual norms of reaction, in favor of an indeterminate version of the idea.

Thus, the concept of the genetic determination of traits is truly outmoded, as is the concept of a genetically-determined reaction range, used by Scarr-Salapatek (1976a) in the quote above. The reaction range concept has been replaced by the concept of a norm of reaction, which is essentially nonpredictive because it utilizes the developmental systems view, in which each new environment is expected to have a different influence on developmental outcomes that cannot be stated in advance of actual empirical investigation. Therefore, although the genes remain an essential part of any developmental system and plasticity cannot be regarded as infinite, a thoroughgoing
application of the norm-of-reaction concept may make the genetic limitation on development in practice, if not in principle, unknowable. [Gottlieb, 1991, pp. 5–6; emphasis added: see Fig. 1].

Gottlieb's Figure 1 shows the indeterminate model. Confusion occurs here in three realms: (a) what development is likely to occur versus what could under extreme circumstances occur; (b) what models apply to species-typical development versus individual differences; and (c) what kind of science lacks any prediction? In their reply to Gottlieb, Turkheimer and Gottesman (1991) comment: "In the wild, ducklings probably do not display a great deal of variability in responsiveness to the calls of other species: The goal of Gottlieb's research is to explain why all ducklings end up paddling in the same canal. The familiar subject of investigation in human behavior genetics—intelligence, personality, and psychopathology—are defined in terms of their variation among individuals" (p. 18). "Consider the reaction norm for duckling sensitivity to maternal chicken calls. Across a broad range of genotypes and naturally occurring environments, it is relatively flat, as it must be to ensure survival of the ducklings. Gottlieb's (1991) experiments demonstrated that at one extreme of the environmental continuum, where ducklings are completely deprived of embryonic calls, the norm is not flat at all." "Now consider psychometric intelligence in humans. . . . along the environmental axis, the reaction norm for intelligence is flat across a wide range of normal family environments but drops off drastically at the very low end of the environmental continuum, as illustrated in Figure 2" (p. 19). "The description of the reaction norm for intelligence is almost identical to the description of the reaction norm for duckling sensitivity to chicken calls, and one might conclude that 'normal family environment' plays a crucial role: Without it, intelligence cannot develop at all, regardless of genotypic potential" (p. 19).

With normal family environments, they duckling or human, youngsters are unlikely to differ much in species-normal behaviors because of variations in those environments. Only extremely poor environments (or impaired organisms) prevent normal species-typical development by depriving the young of opportunities that environment must afford if development is to occur. These are the very features that cultures everywhere provide in a form that meets the needs of experience-expectant and experience-dependent developments. From an evolutionary point of view, the culturally universal availability of developmentally appropriate environments is a tautology; how could it be otherwise, if that culture is to survive?

Some individual ducks and human parents fail to provide developmentally appropriate environments, and their offspring do not become species-normal. Selection acts against such individuals.

Agreements.—Three findings have been fairly well established regarding genetic and environmental influences on intelligence: (a) a moderate linear relation between parental genotype and offspring intelligence (above the severely retarded range) in all populations studied, (b) a powerful effect of severely deprived environments, and (c) very small environmental effects in the range of environments provided by ordinary

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**BIDIRECTIONAL INFLUENCES**

![Diagram of bidirectional influences](image)

**Fig. 1.**—A simplified scheme of the developmental systems view, showing a hierarchy of four mutually interacting components in which there are "top-down" as well as "bottom-up" bidirectional influences (Gottlieb, 1991, reprinted by permission).
families (Bouchard et al., in press; Scarr, 1992; Turkheimer & Gottesman, 1991). The reaction norm surface, shown in Figure 2, shows the nature of those relations.

Thus, I think the seeming disagreement about reaction norms or ranges resolves into three agreements: (a) that environmental and organismic factors at the extreme can prevent species-normal development; (b) that extreme experimental manipulations can illuminate mechanisms by which defective development can occur, even though it seldom does; and (c) that the environment does not have linear effects on development.

**Specific Environmental Opportunities for Normal Development?**

Is it likely that very specific, culturally defined events are necessary for normal human development? Or is it more likely that some range of possible experiences must be available and that there are functionally equivalent possibilities? Do mothers (or other caregivers) have to provide infants with specific kinds of interactions, as Wachs (1992) claims, to promote object permanence and a different kind of interaction to promote means-ends knowledge? Are there societies with biologically intact children who cannot solve infant intelligence problems or do not engage in symbolic play, regardless of their culture of rearing?

Evolution cannot require exquisitely specific environments for species-normal development or there would not be many normal human beings. If specific environmental events are necessary for normal development (to induce, maintain, or enhance developmental changes; Gottlieb, 1976), they must be widely available to species members in all cultures, if they are important to survival; otherwise, they would have been selected against. All species must be either (a) prepared to develop species-typical characteristics from endogenous sources or (b) prepared to respond to widely available environmental opportunities—to know it and respond to it when it is encountered. Most early developments are species-typical, universal responses of human infants and young children to widely varying, but functionally equivalent, culturally sanctioned, environmental opportunities to acquire species-normal behaviors. There are many different routes through early childhood.

**Specific instruction for special skills.**—Specific instruction is required for many aspects of cultural knowledge, however. Many societies use formal schooling, or apprenticeship to adults, to transmit detailed cultural knowledge of how to become a full-fledged adult. Access to that portion of cultural knowledge that is not informally and universally available may be crucial for becoming successful in a particular culture. Harold Stevenson's (1992) cross-national research on mathematics instruction documents culturally different approaches to schooling, where Japan, China, and the United States differ importantly on: (a) relationships between family and school; (b) amount and kind of classroom instruction; (c) amount of homework required; (d) cul-
tural beliefs about the role of effort in school success. His research shows that cultural contexts of mathematics instruction have profound effects on differences in average mathematics achievements in the three societies.

Without community supports for children’s literacy and numeracy, school efforts can be compromised. As Entwistle and Alexander (1992) showed, some ethnic minority children in the United States actually lose mathematical knowledge over summer recess, because they do not have the family and community supports for mathematics learning that are available to children of the dominant culture.

**Raising the mean does not reduce individual variation,** however. Mean achievement levels may be raised by more intensive and better instruction, yet children still vary enormously within each society and within each classroom in their mathematics achievements. Individual differences in response to the same or similar classroom exposure to mathematics are much greater than differences between national averages. Individual differences persist, even as means are raised by educational interventions. Interventions do not lead to equal individual outcomes; they do not usually reduce individual variability and may increase it.

**Parenting Can Be Species-Normal and Culturally Inappropriate**

Parents are the major agents of socialization for most children in the world. They transmit the culture, as filtered through their own location in the social structure and their own personal characteristics. Parents, complemented by relatives and other adults, afford children opportunities and support for both species-normal and culturally appropriate development.

Children must be socialized, or else they will not be normal human beings. The details of socialization by sincere parents matter little in the course of making children normal human beings. There are surely many kinds of materials that can be used to acquire object permanence, many language interactions that scaffold language acquisi-

tion, and many ways to induce culturally sanctioned moral standards.

Details of socialization matter more for children to become culturally appropriate. Of course, I agree with Baumrind (1993, in this issue) that being socialized in one culture does not necessarily make a child believe and behave in ways that are appropriate to another culture. This is surely the case with children who grow up in ethnically diverse communities that exist within dominant cultures (Ogbu, 1988, 1992; Scarr & Weinberg, 1976). Access to the nuances of beliefs and behaviors of the dominant group is not assured for all children. Many ethnically different children need to become bicultural by acquiring the beliefs and behaviors of their own and those of the dominant culture, if they are to succeed as people and as members of the larger society (Cross, 1991; DeBerry, 1991; Phinney, 1990).

Where cultures are in conflict, children are sometimes forced to choose in which cultural world they will live. In fact, the same parental socialization practices have been reported to have quite different effects on children in different cultural groups (e.g., Baumrind, 1972; Dornbush, Ritter, Liederman, Roberts, & Fraeligh, 1987), but not in other reports (Steinberg, Mounts, Lamborn, & Dornbush, 1991).

There are many examples of research on the beneficial effects of educational and social interventions with children from culturally different and socially disadvantaged backgrounds (e.g., Wasik, Ramey, Bryant, & Sparling, 1990). Children with limited access to the dominant culture’s knowledge and behavioral norms, and who are socialized in another culture with different norms, can indeed be changed by intervention. In fact, intervention effects may occur, such that the children who benefit most are those from specially deprived or disrupted homes (e.g., Lera, 1993; Ramey & Ramey, 1990; Scarr, Lande, & McCartney, 1989; see Scarr & Eisenberg, 1993, for a review of child care effects). Day care per se does not have “iatrogenic effects” (Jackson, 1993, in this issue, p. 1329) on African-American, Bermudian, or other children (Scarr & Eisenberg, 1993).²

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² Jackson’s quote from our report of the Bermuda child research makes clear that day care per se is not iatrogenic. Family day care in Bermuda was as supportive of development as maternal care. It was poor center-based care in Bermuda, where ratios of infants to caregivers were 8:1, that had negative effects on children in the first 2 years of life (Scarr et al., 1989). An interaction effect showed that, although both center care and being in a mother-headed household were negative main effects, 2-year-olds from mother-headed households were better developed in center care than in maternal care. All day care effects disappeared by 4 years of age.
Poor-quality care, whether at home or in another setting, can have negative effects on preschool development. Whether those effects persist to school age is debatable.

Culturally different and socially disadvantaged children are benefited by being exposed to rearing conditions approved by the dominant culture, not because the children are species-abnormal (they are not!), but because they had limited access to the values and knowledge of the dominant culture. Contrary to Jackson's (1993, in this issue) assertions, I believe there is evidence for modest effects of educational interventions, even if her example of the Milwaukee miracle is scientifically flawed. The more intense and extensive the intervention, the larger the likely effect (with adoption being the ultimate intervention in this sense; Scarr & Weinberg, 1983).

**People Construct Experiences from Available Environments**

If opportunities are not there in the environment, they cannot be processed into experiences. From the array of available environmental opportunities, however, people selectively attend to some opportunities and neglect others. Similarly, people elicit different responses from others; if others do not respond, do not invite response, or are not there to respond, there is no elicitation. How could an environment become experience except through being processed at some level by the phenotype? The mind stands between the environment and the experience. (Even children dropped on their heads, Baumrind, 1993, in this issue, can interpret the event as an accident or deliberate abuse.) If environments acted directly on the brain, then the same events would be recalled and emotionally responded to in exactly the same ways by different people. We know this is not what happens. It is the person who experiences—selects, reacts to, and interprets environmental events that are available to her. That person is a product of a developing genotype and past experiences, which were similarly filtered and constructed from past environments. In that sense, I mean that genotypes drive experience.

Being members of the same species, humans are, the more likely they are to give similar meanings to the same environmental events. We are not alone, even if we are each unique.

**Determinism versus probabilism.**—Wachs (personal communication, December 1992) accuses me of being a genetic determinist. All scientists are determinists; it is difficult to imagine what not being a determinist could mean. At the same time, most theories make predictions about causal relations that are probably true under some conditions with some likelihood. Certainly, when I say that genes and environments are correlated, I do not mean $r = 1.00$. Between Gottlieb (1991) and Wachs, there is a curious new indeterminacy in developmental theory. “What is essential to understand when discussing covariance is that we are talking about probabilistic and not deterministic relations between covariates... In contrast a probabilistic gene-environment correlation model assumes that development is a function of neither genes nor environment” (Wachs, 1992, pp. 93–94).

Scientific models are always probabilistic. Probabilistic does not mean indeterminate, however. If neither genes nor environments influence development, but both do in concert, Wachs must mean that neither is sufficient, and both are necessary and sufficient for development. Everyone would agree with that statement. But what about individual differences? Does he mean that variations in development are never a function of either genes or environments? The falseness of this statement is easy to demonstrate: Differences between identical twins are exclusively environmental, because MZ twins have the same genotype. The second part of the sentence quoted above is: “rather development is a joint function of the degree of covariance between genes and environments” (Wachs, 1992, p. 94).

Does development not occur when genes and environments are uncorrelated? Does development proceed especially well when genes and environments are highly correlated? What Wachs must mean is that because genes and environments are most often positively correlated, development is probably a function of correlated genes and environments. Baumrind (1993, in this issue) and Jackson (1993, in this issue) both assert that gene-environment interactions

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3 By mind, I do not mean only conscious cognition. Experiences have emotional, sensory, and often unconscious components as well.
(nonadditive effects) account for most developmental differences, but there is no evidence to support that statement (see Scarr, 1992; Wachs & Plomin, 1991), however appealing it sounds. Mostly, there are main effects, correlated genes and environments (Cairns et al., 1990; Scarr, 1992), and occasional interactions.

The flight from "genetic determinism," as defined by Gottlieb and Wachs and endorsed by Baumrind (1993, in this issue), is not the adoption of the kind of probabilism widely shared with other scientists; it is a descent from science into politically correct obfuscation. There is no magical force (no vitalist spirit or melded interaction) that shapes development, apart from genetic/biological systems that propel and guide development and environments that are necessary and provide opportunities for its expression (Piatelli-Palmerini, 1980). Vitalists and Lamarckians are still with us (Degler, 1991).

Development and Individual Differences

Rejection of research on genetic and environmental variability seems often to be based on a confusion between sources of individual differences and the essential interplay of genes and environments to produce development (Goldsmith, in press; Rowe & Waldman, in press; Scarr, 1992; for examples of this confusion, see Baumrind, 1993, in this issue, pp. 1303, 1310–1313). "Sandra Scarr (1992) delineated a position that is essentially an attack on the view that normal environmental forces are critical determinants of development" (Jackson, 1993, in this issue, p. 1318). No, I did not. Human parents (or parent-like adults) are essential to normal human development (Scarr, 1992, p. 9). All species whose offspring require parental care have evolved mechanisms to maintain parent-offspring bonds to rear offspring to maturity, often at considerable costs to parents (Eibl-Eibesfeldt, 1989; Trivers, 1985). Studies of biological mechanisms illuminate ways that environments can affect development; they rarely speak to causes of observed differences in normal human development.

How much do differences among parents affect differences among their children—genetically and environmentally? This is the empirical question that is addressed by the behavior genetic studies I cited but which is not addressed by socialization studies of only biological families. Socialization researchers often reject heritability statistics as estimates of sources of variability because they unwittingly do not discriminate mechanisms of development from sources of individual differences. For example, "it is the view of many social developmentalists (see Hoffman, 1991, and the forthcoming commentaries on the Scarr 1992 SRCD presidential address) that the strong, recent emphasis on biological factors often has been at the expense of recognizing the critical roles of environmental influences. Biological perspectives sometimes are not adequately sensitive to the subtle ways in which environment influences behavior (including the expression of genetic predispositions)" (Eisenberg, 1992, p. 11).

That the environment—some kind of species-normal environment—plays a "critical role" in development and that environment influences behavior by affecting the "expression of genetic predispositions" are truisms, accepted by all developmental scientists. How can "the strong, recent emphasis on biological factors" diminish one-half of a tautology? The same statements can be reworded to say that "the strong, recent emphasis on social environmental factors often has been at the expense of recognizing the critical roles of biological influences."

4 Baumrind (1993, in this issue) takes this argument farther by asserting that all genetic effects are interactions. There is great semantic confusion about the use of the term interaction in developmental science (Wachs & Plomin, 1991, chap. 1). Transactions between organisms and environments are not interactions between organisms and environments in a statistical sense. Transactions are dynamic interplays between organism and environment in development. Interactions occur when different genotypes have different responses to two or more environments. A demonstrated interaction in human development is the familiar textbook example of phenylketonuria (PKU); children with PKU develop more normal intelligence on low than high phenylalanine diets, whereas non-PKU children develop higher intelligence on high than low phenylalanine diets. This is a disordinal interaction, where effect lines cross. Other interactions can be found where one kind of organism (or genotype) responds to only one of two environments, while another responds to neither or both. The use of interactions as a model for all relationships between organisms/genotypes and environments means that what is beneficial for one person is poison for another, and vice versa. When individuals differ quantitatively in their responses to a common environmental opportunity, that is not an interaction but a genetic/organismic difference among them.
And “social environmental perspectives are sometimes not adequately sensitive to the subtle ways in which biology influences behavior (including the expression of genetic predispositions).” Would we not agree that research on development must emphasize both organism and environment?

So what’s the problem? The problem is a confusion between the study of development and the study of individual differences (Goldsmith, in press; Rowe & Waldman, in press; Rutter, Silberg, & Simonoff, in press), as the remainder of the quotation makes clear: “Behavior geneticists often study twins or related individuals from a similar environment, yet the more extreme an individual’s environment, the more one can expect variance in his or her behavior to be due to environmental factors” (Eisenberg, 1992, p. 11, emphasis added). Although Eisenberg agrees that extreme environments have nonlinear effects, she addresses variation not between individuals but within the development of a single individual. Intraindividual variability is itself an interesting topic (Nesselroade, in press), but that is demonstrably not what she means. Rather, this sentence recasts the meaning of the earlier ones: She was not talking about development but about individual differences, and the claim is that behavior geneticists are not sufficiently sensitive to subtle ways behavior is influenced by (variations among) environment(s). The problem with this assertion is that it is not supported by data from behavior genetic studies, where degree of genetic relatedness and subtle individual differences in environments are often found to be about equally influential in creating developmental differences, within the range of cultural environments studied (Plomin & Daniels, 1987; Scarr, 1992).

To Whom Does the Theory Apply?

Baumrind (1993, in this issue, p. 1299) noted that the range of families included in behavior genetic studies was not well specified and that I used the terms “average expectable environment” and “good enough” parenting without precise definitions. She also acknowledges that I exempt people whose environments do not provide opportunities for normal development, as shown in Figure 2.

Limitations in the generalization of behavior genetic studies to the populations studied are understood but mooted by the replications of results across many modern Western and Asian societies. The assertion that behavior genetic studies are based on “extraordinary populations” (Baumrind, 1993, in this issue, p. 1301) of “atypical individuals” (Jackson, 1993, in this issue, p. 1325) is simply not the case. Samples of families in behavior genetic studies include ordinary biological ones, step-parent families who are hardly rare today, families of adult twins, families with twin offspring who are not abnormal, and adoptive families, whose parents are on average quite normal but infertile, and whose adopted children born prior to 1973 (Roe v. Wade) were an intellectual cross-section of the U.S. population (Scarr & Weinberg, 1978).

We have studied some extraordinary families, who adopted transracially, but the major motive for that study was not to estimate genetic and environmental variability but to look at the effects of rearing African-American children “in the culture of the tests and the culture of the schools” (Scarr & Weinberg, 1976; Weinberg et al., 1992). The analogy to this study is intervention research. Although we estimated sources of individual variation within the sample (Scarr & Weinberg, 1977; Scarr et al., in press), we did not attribute differences among adoptees to race (Jackson, 1993, in this issue, pp. 1323–1324) but to differences in preadoption experiences and to individual differences among their birth parents (Scarr & Weinberg, 1976). Estimates of genetic and environmental sources of individual differences in IQ in this sample of children, both at school age and at late adolescence, were similar to results of other adoption studies. This should not be surprising, since they were reared in the same range of “good enough” environments.

There is another reason for many of Baumrind’s and Jackson’s objections to my article. Like Baumrind (1993, in this issue) and Jackson (1993, in this issue, passim), I am not happy with the current plight of many American children and youth, especially African-Americans. Some American children do not have adequate opportunities or “good enough” families. I do not agree, however, that “most of the people in most of the world” lack adequate opportunities for normal development (Baumrind, 1993, in this issue, p. 1302). Most children in most of the world, in poor nations and rich, become species normal and normally functioning members of their societies. Where societies crumble, as in Somalia and Bosnia-Herzegovina, many children live under conditions...
that cannot promote any kind of normal development.

Family studies in many modern societies show that children from a broad array of families, in perhaps three-quarters of the social class distribution, have functionally equivalent opportunities (Scarr & Weinberg, 1978); environments in perhaps the lowest income quartile restrict children’s opportunities for optimal development. (We agree that individual family pathology can have damaging effects on children.) And, as I have stated many times, ethically different and socially disadvantaged children may not have equal access to the knowledge and skills valued by the dominant culture.

*Parents Produce and Socialize Their Own Offspring, Thus Confounding Developmental Theories*

The need to incorporate environmental measures in behavior genetic studies has been recognized (e.g., Plomin & McClearn, in press), but the need to include genetically informative designs in socialization studies is less often mentioned. The omission of genetically informative families in socialization studies has produced only uninterpretable results. With only these data, there is no way to test competing theories about sources of individual differences.

Socialization studies, many of which are described by Baumrind (1993, in this issue), have hopelessly confounded genetic transmission of parental characteristics to children with socialization practices, because these are studies of biological families. Moreover, it is not at all clear how to measure family “environments” without including genetic differences among parents and offspring. In fact, there is considerable evidence now that popular measures of family “environments,” such as the HOME Scale, and the Family Environment Scales, are confounded by genetic differences among parents (Plomin & Neiderhiser, 1992).

Whatever modest degree of similarity in intelligence, personality, and interests exists among biological family members is not due to growing up or living in the same household (Hoffman, 1991; Loehlin, 1992; Plomin & Daniels, 1987; Scarr & Grajek, 1982; Scarr, Webber, Weinberg, & Wittig, 1981). Loehlin and Rowe (1992) recently summarized the effects of genetic and environmental differences on individual variation on the “Big Five” personality dimensions, the five factors that emerge repeatedly from self-reports and ratings of personality in five languages, around the world. The Big Five are extraversion-introversion, agreeableness (altruism, nurturance), conscientiousness, neuroticism-anxiety, and intellectual openness.

The results, shown in Table 1, are very consistent across personality measures: Unshared environments within families account for about half of the variation; 43% of the variance is due to genetic variation (31% additive and 12% nonadditive, including g-e correlations and interactions), and 6% is due to shared family environments.

Socialization researchers have recently said that they do not expect that living in the same family makes siblings or parents and children similar to each other (Baumrind, 1993, in this issue; Bronfenbrenner et al., 1993; Hoffman, 1991), because each person perceives and reacts to the family environment in different ways (Scarr & McCartney, 1983). “There is a basic consensus across behavior genetics and developmental psychology that both genetics and environments play a role in personality development and that environmental influences do not result in sibling similarity” (Hoffman, 1991, p. 190).

Socialization researchers say that children in the same family have different experiences; they should not be expected to be alike, based on parental characteristics or behaviors, because parents do not treat their children alike. Rather, they claim that specific parenting practices have predictable effects on individual children’s personality development. “The lack of similarity in traits between parents and children does not seem convincing evidence of the absence of a family effect” (Hoffman, 1991, p. 190). “How alike siblings are to each other or to their parents on personality tests, or to what extent parents treat siblings differently, says

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5 Jackson (1993, in this issue, p. 1328) asserts that I am an expert on intellectual development, but I apply my theory to personality and socio-emotional development, which I have only recently studied. This is puzzling because my Ph.D. dissertation was a twin study of personality and motivation (Scarr, 1966a, 1966b); my study of African-American and white MZ and DZ twin pairs (Schaaf, 1981) included results of intellectual and personality resemblances; and Richard Weinberg and I have published personality results from our adoption studies (Scarr & Grajek, 1982; Scarr et al., 1981; Scarr & Weinberg, 1983).
nothing about how much parents do, or can, influence each child's development” (Baumrind, 1993, in this issue, p. 1303).

Actually, there is very little information on differential treatment of siblings by parents (see Rowe, in press). What is the magnitude of effects; how much of the variance in personality differences between siblings is due to differences in parenting practices? A new study is aimed at answering exactly those questions (Reiss, in press; Reiss et al., 1992). The study includes large samples of families with MZ twins, biological siblings, half-siblings, and unrelated step-siblings. No analyses based on genetic relatedness of the siblings have yet been published. Based on earlier analyses of family data (see Rowe, in press), one would predict that MZ twins and their parents will perceive more similar treatment and outcomes than DZ families do and that biological siblings and their parents will perceive more similar treatment and outcomes than step-families do.

One would also predict that the data from the Reiss et al. study will not satisfy socialization researchers. Their explanations of why and how siblings are similar and different in personality are ad hoc (Bouchard, in press). MZ twins are more alike because they look and act alike, and parents treat them more alike than DZ twins, unless they are African-Americans, and then “extended family contexts . . . probably confound behavior geneticists’ conceptions and measurements of environmental influences” (Jackson, 1993, in this issue, p. 1323). But the data on MZ twins reared in different homes, whose personalities are just as similar as MZs reared together (Tellegen et al., 1988) are dismissed, because some separated MZ twins lived together for periods of their lives or were acquainted as adults (Hoffman, 1991, p. 188n.; T. D. Wachs, personal communication, December 1992).

On the other hand, adopted children are not as similar as biological siblings because of “differences in the dynamics of the adoptive family” (Hoffman, 1991, p. 190) or because they are an “extraordinary population” (Baumrind, 1993, in this issue) of “atypical individuals” (Jackson, 1993, in this issue). Siblings are also different because they differ in birth order, although birth order was thoroughly discredited as a source of sibling differences in personality (Ernst & Angst, 1985). Gender differences are asserted as sources of personality differences between siblings, although no attempt was made to compare same- and opposite-sex pairs for similarity (their personality correlations do not differ; Rowe & Plomin, 1981; Scarr & Grajek, 1982), and few sex differences in socialization can be documented (Lytton & Romney, 1991). (Incidentally, gender and physical appearance are genetically variable characteristics, and individual differences in gender-related characteristics are also genetically variable; e.g., Susman et al., 1987).

Perhaps measurement is an issue; perhaps siblings are more alike on observational than self-report measures (Baumrind, 1993, in this issue, p. 1304). Perhaps other personal characteristics, such as dependency, social competence, and moral internalization, which are said to be related to more general parenting styles, show more sibling similarity (Hoffman, 1991). Ad hoc speculation, mostly untested or untestable hypotheses, are generated as needed to explain away any genetic results. Baumrind’s reliance on Kamin’s (in Scarr, 1981) analyses of biased subsamples of my data is scientifi-
cally indefensible, as I explained (Scarr-Salapatek, 1976b).

Research is needed on why and how siblings are different and similar and how parental socialization practices play a role in creating those differences, if they do. It is hard to imagine a research design, however, that could meet all of the actual and potential objections of socialization researchers. Designs must include siblings with different degrees of genetic and environmental relatedness, if socialization hypotheses are to be tested at all.

The Big Picture

Let's look again at the data on individual variability under species-normal and culturally normal rearing conditions. Theories, whether socialization or behavior genetic, must fit the observations. Bouchard and colleagues (Bouchard et al., in press) provide a stunning summary of the pattern of family IQ correlations for adults in their samples of five critical kinships, under two rearing conditions—same and different families—in Figure 3.

These observations yield broad heritabilities (including nonadditive genetic and environmental effects) of .70 to .94 for IQ differences in white North American and Western European populations from which the samples were drawn. Differences in socialization history had negligible effects on these results (Bouchard et al., in press). The implication of these results is that any redistribution of existing environments considered favorable to those in environments considered unfavorable can have limited effects on culturally approved intellectual development, because environments experienced by these samples are largely functionally equivalent. Although estimates of environmental variance (\(e^2\)) range from .06 to .30, unique individual experiences, which cannot be programmed, comprise most of \(e^2\).

As McCartney (McCartney, Harris, & Bernieri, 1990) has shown, heritabilities for IQ increase from childhood to adulthood, in keeping with the theory of genotype → environment effects (Scarr, 1992; Scarr & McCartney, 1983). Cairns and his colleagues (Cairns et al., 1990) have demonstrated experimentally the same developmental changes in genetic effects on differences in mouse aggression. There is converging evidence that an explanation of differences among species, among individual genotypes, and among environments requires reference to developmental timing, and that genetic differences are more pervasive in adulthood than in infancy.

That there may be historical changes in the heritabilities of various phenotypes in populations undergoing social change is both exciting and expected. Two cardinal principles of heritability statistics are: (1) the more egalitarian the society, the higher the

![Fig. 3.—IQ correlations and sample size for adult data from five kinship groups reared apart and together (Bouchard et al., in press, reprinted by permission).](image-url)
heritabilities, because there are fewer arbitrary differences in developmental opportunities among individuals; and (2) changes in heritabilities are predicted by population genetic theory, including the theory of $g \rightarrow e$ effects (for evidence of changes in $h^2$, see Bronfenbrenner et al., 1993; Fischbein, 1980; Scarr-Salapatek, 1971; Sundet, Tambs, Magnus, & Berg, 1988).

**Biology versus Social Reform**

Biology was thrown out of the social sciences in the 1920s for political reasons, because cultural and social explanation seemed to free humans from their animal natures and challenge the social and economic status quo. There is still considerable backlash against what some believe to be undesirable political implications of evolutionary and biological ideas (Degler, 1991). "The nature-nurture issue is inherently political with implications both for research funding priorities and public policy programs which may lean towards or away from analysis of the role of environmental factors in developmental outcomes and the search for interventions that promote optimal development" (D. Baumrind, personal communication, May 30, 1992).

The rejection of evolutionary and other biological thought in the social sciences (Degler, 1991) has its roots in a seeming conflict between biological determinism and social improvement. Child developmentalists were and are concerned about the applications of knowledge to the betterment of humankind, especially the young. Biological, especially genetic, explanation appeared fatalistic: biology was a dead-end destiny for the poor, for social outcasts, and their generations to come. Social environmental explanations seemed to offer the hope of improvement within a single generation for the poor, the outcasts, and bright futures for their generations to come. Reform-minded social scientists embraced a kind of cultural explanation that excluded biology (Degler, 1991).

Misuses of biology in the service of maintaining privilege (social Darwinism), involuntary eugenics, and racism pervaded society and science in the early twentieth century (Degler, 1991; Scarr, in press). Racism, ethnocentrism, and sexism used faulty biological reasoning in ways that contemporary scientists find repulsive. The rejection of racism et al. led to the rejection of proper biology as well. For political reasons, cultural and social environmental explanations replaced, rather than augmented, biological explanations of human behavior and development by the middle of this century (Degler, 1991).

Behaviorism, with its exclusive focus on proximal causes of learning, seemed to promise endless optimism about behavioral change. Given a properly executed reinforcement schedule, or proper habit training, any desirable developmental outcome was within reach for any child. There were dissenters: some psychologists, such as Beach (1959), never abandoned evolutionary explanations of animal behavior; others such as the Brels (Brel & Breland, 1961) found that trained animals reverted to species-typical behaviors despite the best laid reinforcement schedules.

**Biological Mechanisms and Evolutionary Thought**

A partial revival of biological thinking about development came with mechanistic approaches in psychobiology and more recently in neuroscience. In these fields, the search was for biological substrates or mechanisms of behavior—rather than the evolutionary search for causes of species and individual variation. Evolutionary theory is implicit in much psychobiological research, but its major questions are how a mechanism works, not why it exists or how it came to be. It is important to understand the differences in the two streams of biological thought—mechanisms underlying behavior and evolutionary sources of species and individual differences. The former appeals to proximal causes, the latter to ultimate or historical causes.

A complete explanation incorporates both proximal and distal causes; they do not compete but complement each other. A few behavior geneticists (see Fuller & Thompson, 1978), developmentalists (Cairns & Kroll, in press; Cairns et al., 1990), and sociobiologists (Buss, 1992) use evolutionary ideas to frame hypotheses about developmental mechanisms, but most scientific mechanics do not. We need to understand, theoretically and empirically, how and why development occurs in all its normal variety—mechanism and theory must be joined.

Although social reformers accuse biological, mechanistic explanations of reductionism, they seldom exclude biological substrates of behavior for political reasons. Behavior genetics and sociobiology, however, do not elicit the same acceptance from social reformers. Both programs of research
are inspired by evolutionary principles—behavior genetics by the evolutionary focus on genetic variability within species, sociobiology by principles of selection and variation between species. Behavior geneticists began to be an active minority in the social sciences in the 1960s, with the publication of the first textbook (Fuller & Thompson, 1960), and have continued to work on questions of individual variability in behavior and development on a path blazed by differential psychologists (Cronbach, 1957). It was not until 1975, with the publication of E. O. Wilson’s monumental Sociobiology, that evolutionary biology directly challenged the hegemony of cultural/social environmentalism in the social sciences.

Behavior geneticists and sociobiologists have fought a lonely and sometimes acrimonious battle with mainstream social scientists to keep the Darwinian lamp lit during behaviorism’s heyday. In my 1986 presidential address to the Behavior Genetics Association (Scarr, 1987), I claimed that evolutionary thought had been safely integrated once again into mainstream psychology, as demonstrated in introductory textbooks and in the lessened hostility such ideas were then receiving. In 1993 I know my optimism was premature.

Studying individual, genetic variability evokes hostility from some colleagues; studying gender or racial differences can be especially dangerous (Scarr, 1988), for one is easily misunderstood (Jackson, 1993, in this issue). Few if any mainstream psychology journals require environmental explanations of individual or group differences to be countered by alternative genetic or sociobiological hypotheses; nearly all behavioral science journals require the reverse. Political correctness, rooted in fear of unpalatable results, seeks to stifle legitimate inquiry and intellectual discourse. Political correctness does not generate good science.

**Do Biology and Culture Work Together?**

There are important developmental questions that can be framed in an evolutionary, biological perspective. For example, does culture work to curb biological instincts or does culture enhance evolved characteristics of development and behavior? This question remains an important debate about human nature and the roles of biology and culture in human affairs. Those who think that biology and culture act in opposition include Sigmund Freud and Donald Campbell. In their view, culture acts to tame biological instincts and to make society possible. Evidence for the opposition of biology and culture comes from the virtually universal insect taboo (why would culture need to proscribe insect if there were no biological instincts toward it?). Campbell (1975) argued that morality is a cultural invention, made necessary by socially disruptive biological drives.

Other theorists, for example, Richerson and Boyd (Boyd & Richerson, 1985; Richerson, 1993), Scarr and Ricciuti (1991), and Kagan (1987) argue that biology and culture work together to shape human behavior. For humans, biology and cultures have evolved in concert to promote adaptation and survival. Sociobiologists, such as Wilson (1975), Crawford, Buss, Trivers, and Alexander (see Crawford, Smith, & Krebs, 1987), see culture as a thin veneer on a biological core, but as a cooperative overlay. One can imagine questions sparked by evolutionary theory on the nature and functions of the family in child development, on adolescent cliques, or juvenile play (Charlesworth, 1992).

One would not be likely to look for very specific environments that “cause” children to walk, speak, play, or use symbols because these behaviors develop in all cultures under diverse rearing conditions. One might focus on the functions of these species-typical behaviors in children’s changing adaptations, and study the interplay between maturation in motor, language, play and symbol-using abilities and the changing uses of environmental opportunities. Rather than focus on microanalyses of culture-specific, proximal settings that are correlated with changes in walking, speech, and play, one might study how the systems, in which walking, speech, and play are parts, change with the child’s development. Or one might focus on individual differences in rates of achievement of these species-typical behaviors, especially if differences in rates of development predicted later behaviors of some interest.

**Backlash**

Some of the backlash against genetic and biological explanations of human development and variability arises from miscommunications between biologically oriented social scientists and others (Goldsmith, in press; Wachs, in press). Recent collaborations (e.g., Wachs & Plomin, 1991) seemed to promise greater understanding and mutual acceptance.

Social reformers still oppose genetic
and biological hypotheses because they believe they cause pessimism for social change. "For psychologists, as for medical researchers, the purpose of identifying undesirable predispositions of individuals should be to devise more effective health-promoting interventions, not to discourage such attempts on the supposition that these predispositions are genetically based and therefore intractable" (Baumrind, 1993, in this issue, p. 1313). One can disagree with both the assumptions of this statement and its factual base. First, one might want to know the scientific truth per se, because deceit does not enhance the scientific enterprise. Second, if some predisposition were found to be "genetically based" (presumably, genetically variable), would denying that result enhance intervention efforts? Surely not. Third, genetic does not mean intractable! Baumrind herself offered several examples of treatments for genetic disorders, but like many socialization researchers, fears a misuse of genetic information. Now that The Decade of the Brain and The Human Genome Project are well launched, and the Human Genome Diversity Project is near acceptance, it is too late for social scientists to prevent advances in genetic knowledge. Perhaps, becoming more educated on the potentially positive uses of such information will allay some fears.

Suppose that the predispositions Baumrind mentions were culturally variable; would those differences be so easy to eradicate? Cultural patterns are actually very slow to change, and cultural groups would often rather fight than switch their ways of being, believing, and behaving. More important, would we want to eliminate genetic and cultural variation, or do we want to adjust social and economic rewards toward a more egalitarian society that recognizes the richness of diversity? Societal rewards need not be tied to only a few ways of being, believing, and behaving. In my opinion, they should not be. Developmentalists who believe that the ultimate good is to help all people to be, believe, and behave in ways approved by our largely European-North American cultures are promoting social views we should want to change.

Racism, sexism, and ethnocentrism serve to maintain the status quo for privileged groups (Scarr, 1989). They are, and always have been, unwarranted denials of evolutionary wisdom about the desirability of genetic and cultural diversity. The battle against social injustice is best fought on principles of law, however, rather than by denial of human cultural and biological evolution. Vigilance to protect civil liberties for everyone is a price we pay for cultural, genetic, and individual diversity (Dobzhansky, 1973). Acknowledging diversity does not signal tolerance of race, gender, or any other kind of discrimination.

All children should have opportunities to become species-normal, culturally appropriate, and uniquely themselves—their own versions of Georges Sand, Chengis Khan, and Martin Luther King, Jr. Today many children in the world lack those opportunities. Their needs should be addressed. But humanitarian concerns should not drive developmental theory.

References


Child Development


