Part II

Influences on Development: Disciplinary Views

Psychology forms a recognized discipline; and most of the contributors to the *Handbook* are developmental psychologists. However, child development is an interdisciplinary area. The Society for Research in Child Development, in the United States, has an explicitly interdisciplinary membership base. There are important traditions of child development research in other disciplines such as anthropology and sociology. In addition, disciplines such as genetics and evolutionary theory have important insights to provide. This section overviews these contributions to our understanding of childhood social development.

Alison Pike reviews the relevance of behavioral genetics for our understanding of social development. This area has grown radically over the last 10–15 years. The traditional methods of twin and adoption studies, refined and accumulating, indicate that there is a complex balance between genetic influences on particular characteristics, and shared and nonshared environmental influences. Some heritability influences are substantial. Also, in many areas the importance of nonshared environment appears to outweigh that of shared environment – a finding with an important impact on the balance of parental and peer influences, since parental influence has often been considered as largely shared environment so far as siblings are concerned (see also Chapter 9). These findings are often age-related. Pike looks critically at the methods and assumptions behind this work, highlighting the implications for developmental theories.

Another development that has featured strongly in the last 10–15 years has been the advent of "evolutionary psychology," and a realization that our evolutionary history may have important consequences for how individual psychological nature develops. Ideas of the importance of evolution for psychology do date back over a century (e.g., Stanley Hall), but only recently has a coherent research program been formulated. Evolutionary psychology emphasizes domain-specific aspects of human cognition and behavior, with these domain-specific mechanisms or modules having been selected during some hundreds of thousands of years, broadly described as the "environment of evolutionary adaptedness" and corresponding to a hunter-gatherer lifestyle. David Bjorklund and Anthony D. Pellegrini review the growing subfield of evolutionary developmental psychology, laying out its central tenets and giving examples of its application. Evolutionary developmental psychology places more emphasis on how domain-specific mechanisms, or modules, develop, and also allows for less specificity in some areas, in line with much thinking in cognitive development (e.g., Karmiloff-Smith, 1992).

Anthropology has a long tradition of studying children, though usually from the perspective of "socialization." Evolutionary perspectives have tended to be downplayed in cultural anthropology since the beginning of the twentieth century, with the influence of Boas, Benedict, and Mead (herself trained also as a child psychologist). Sara Harkness gives a clear historical account of trends in anthropological research on child rearing, from the early socialization work, through the "culture and personality" school, to multisite studies and cross-cultural comparisons such as Whiting's Six Culture Study. The more recent cultural–ecological models of Super and Harkness, and Weisner, are then described, and the theme of the "developmental niche" or "ecocultural niche" is explored. Harkness also critically reviews the area of cultural psychology, and especially the construct of "individualism and collectivism" which has been widely used but which may be much too simple to take us any further in understanding cultural differences.

Largely independent of both anthropological and psychological approaches, there has been a substantial current of research on child development from a sociological tradition. Over the last decade this has come together with some coherent viewpoints (e.g., James & Prout, 1990; Jenks, 1992) that challenge the conventional thinking of many psychologists. Chris Jenks sets out this "manifesto" at the start of his chapter. Seeing childhood as a "social construction" seems to take us a long way from the genetic and evolutionary perspectives of the chapters by Pike, and Bjorklund and Pellegrini. Nevertheless there may be some common ground. Both Jenks, and Bjorklund and Pellegrini, point out the conceptual limitations of an "adult-centered" view of child development. For the evolutionary theorist, some aspects of childhood are advantageous for childhood, not a preparation for adult life. For the sociologist, the world of children has its own intrinsic validity and the concept of "development" is subjected to a thoroughgoing critique; indeed the concept of "development" is itself socially constructed. While many psychologists may disagree with parts of the "manifesto" in this chapter, and may feel that some of the psychological examples given have already been surpassed, nevertheless there are profound issues raised here about the ways in which we perceive our domain and operate within it.

References

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Behavioral Genetics, Shared and Nonshared Environment

Alison Pike

Many of the chapters in this handbook consider the varied contexts that affect young children's lives (e.g., family environment, the school, peers, and the wider historical and cultural context). This chapter focuses on an individual-level factor that has pervasive effects for all children's development – genetics. Equally important, this chapter contains convincing evidence from behavioral genetic studies that children's environmental experiences do matter, but in somewhat unexpected ways. To appreciate the significance of findings and recent developments concerning nature and nurture, however, an understanding of behavioral genetic theory and methods is required. Therefore, the chapter begins with a brief explanation of these. Next, behavioral genetic results from selected areas of social development are considered; problem behaviors, self-concept, and parenting. The relative impact of shared versus nonshared environmental influences is then reviewed, followed by recent work considering parenting-adjustment associations within a behavioral genetic framework. The remainder of the chapter is devoted to the lively debate in recent years concerning the degree to which parents influence their children's social development.

Behavioral Genetic Theory

Behavioral genetics is the study of nature and nurture. The theory postulates that behavioral differences among individuals in a population are due both to genetic differences between people, and to differences in their environmental experiences. Specifically, behavioral geneticists explore the origins of individual differences (i.e., differences between people) in complex behaviors, such as social competence. It is as important to point out what behavioral genetics does *not* address, as well as what it does. For example, researchers may be interested in how, generally, children develop interpersonal skills. This is a question concerning normative development, and is not addressed by behavioral genetics. Similarly, many researchers are concerned with group differences (e.g., differences between children growing up in rural versus urban areas), and again traditional behavioral genetic methods cannot answer such questions. Instead, the focus is on individual differences. Continuing the example, behavioral geneticists would argue that an important question is why some children have difficulty getting along with peers, while others have no trouble. It is worth noting that individual differences, though often ignored in psychological research, or merely thought of as "error," are often of far greater magnitude than group differences.

Behavioral Genetic Methods

Due to space limitations, the following section is necessarily brief. For detailed treatments of the methods that are briefly described below, see Neale and Cardon (1992) and Plomin, DeFries, McClearn, and Rutter (1997).

Using behavioral genetic methods, variability for any given trait may be divided into three sources, heritability, shared environment, and nonshared environment. Heritability is defined as the amount of total variation in scores of a given trait that can be explained by genetic differences between people. For example, the heritability of social competence refers to the proportion of variation in scores of social competence originating from differences in people's genetic make-up. Shared environment refers to those environmental influences that are shared by siblings reared in the same family, and lead to sibling similarity (e.g., neighborhood, parental attitudes). On the other hand, nonshared environment refers to those aspects of the environment that are not shared by siblings, and lead to differences between siblings (e.g., siblings' different peer groups, birth order).

Although behavioral geneticists are beginning to identify specific genes that are associated with behavior, the classic methods are indirect quasi-experimental methods, such as twin and adoption studies. These methods estimate the relative contributions of genetic, shared, and nonshared environmental influence for a given trait or behavior. Studies in which family members (e.g., parents or siblings) are assessed provide indications of familial resemblance, but cannot disentangle this resemblance into its genetic and shared environmental sources.

Twin and adoption studies compare the similarity of family members of varying genetic relatedness, and estimate genetic and environmental contributions to specific traits. The twin method involves the comparison of resemblance between monozygotic (MZ) twin pairs and dizygotic (DZ) twin pairs. MZ twins are 100% genetically similar (they are "identical" genetically like clones), whereas DZ twins, like regular siblings, share only 50% (on average) of their segregating genes. Therefore, if genetic influence is important for a trait, MZ twins will be more similar than DZ twins. To the extent that twin similarity cannot be attributed to genetic factors, the shared environment is implicated. Finally, the extent to which MZ twins differ within pairs is accounted for by nonshared environmental factors.

Because identical twins are identical genetically and fraternal twins are 50% similar genetically, the difference in their correlations reflects half of the genetic effect and is doubled to estimate heritability. For example, MZ twins correlate about 0.90 for height, and DZ twins about 0.45. Here, the reference is to correlations, r, rather than r^2 (the measure of "variance explained"). The reason for this is that the covariance between relatives is of interest, rather than the degree to which, for example, the variance in Twin1 scores can be "explained" by Twin2 scores. Doubling the difference between these correlations yields a heritability estimate of 0.90 (2(0.90 – 0.45) = 0.90), suggesting substantial heritability for height. Shared environmental influence can be indirectly estimated from twin correlations by subtracting the heritability estimate from the MZ twin correlation. In this case the estimate is 0.0 (0.90 – 0.90 = 0.0). Nonshared environmental influence is estimated by subtracting the MZ twin correlation from 1.0 – yielding 0.10 in this case (1.0 – 0.90 = 0.10).

The other classic quantitative genetic design is the adoption design. Because adoptive siblings are unrelated genetically to other siblings in their adoptive family, the degree of similarity between these siblings is a direct index of shared environmental influences. That is, adoptive siblings do not share genes any more than pairs of randomly selected individuals, and so they only resemble one another more than random individuals would because of shared environmental reasons. Heritability can also be estimated using the adoption design. In this case, nonadoptive (biological) siblings share 50% of their genes, while adoptive siblings share 0% of their genes. The difference in correlations between biological siblings and adoptive siblings reflects half of the genetic effect and is doubled to estimate heritability. Biological siblings correlate about 0.45 for height, and adoptive siblings are uncorrelated, 0.00. Doubling the difference between these correlations yields a heritability estimate of 0.90 (2(0.45 – 0.00) = 0.90), again suggesting substantial heritability for height. Finally, in adoption studies, nonshared environment is estimated to be that which is "left over" after heritability and shared environment have been accounted for, that is, 1.0 – 0.90 (heritability) – 0.00 (shared environment) = 0.10. Each design has its strengths and weaknesses; therefore it is the overall picture of results emerging from different studies that is important.

Behavioral Genetic Findings in Social Development

Due to space limitations, three selected areas of social development will be reviewed. The first area, behavior problems, is a relatively well-researched area that has been of interest to behavioral geneticists for some time. Behavior problems fit under the umbrella of "psychopathology," which, along with intelligence and personality, is one of the three major areas that have been of interest to behavioral geneticists. This is due to the fact that these are areas for which individual differences (rather than normative development) have been the focus, and these are often conceptualized as "outcomes" of genetic and environmental processes. The second area, self-concept, counter-balances the first by addressing a positive aspect of development. Far less work has been completed for positive as opposed to negative outcomes, thus the review of this topic represents a new avenue of research. Finally, the "nature of nurture" is explored through a review of parenting. This literature is at the heart of the gene–environment interface, and demonstrates how genetic influences may help explain children's roles in their own socialization.

Behavior problems

After intelligence, behavioral problems have probably been studied more extensively by behavioral geneticists than any other domain during childhood. This is due to the obvious societal importance in understanding their causes, and the present review will include a discussion of how these findings can illuminate and extend nongenetic studies and theories. This review will revolve around three issues: age trends, aggressive versus nonaggressive problem behaviors, and differences found between informants.

Results found for externalizing problems in preschool-aged children can be compared to those found during the middle-childhood period. Two studies have utilized parent reports of the Child Behavior Checklist (CBCL; Achenbach, 1991, 1992) to assess externalizing problems in twins approximately 3 years of age. Schmitz, Fulker, and Mrazek (1995) report moderate heritability (.34) and moderate shared environmental influence (.32), whilst van den Oord, Verhulst, and Boomsma (1996) report a much higher heritability estimate of .60, and a slightly lower shared environmental estimate of .20. The only ready explanation for this discrepancy (other than random fluctuations in sampling) is that the van den Oord study utilized average ratings from *both* parents, whereas Schmitz and colleagues utilized a single report from one parent. As will be elaborated in the discussion of informants, more reliable, composite measures of child behavior have the effect (as displayed here) of increasing the variance accounted for by genetic factors, and decreasing that accounted for by nonshared environmental factors, which includes measurement error. Support for the higher estimate of heritability is given via replication with a different parent-report instrument. This final study also involved 3-year-old twins, and again, reports of problematic behaviors were combined when completed by both parents (Deater-Deckard, 2000). Deater-Deckard reports a heritability of .59 and no shared environmental influence for the total problems score from the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997).

Genetically sensitive parent-report studies during the middle-childhood period have all utilized the CBCL. At this age, the subscales of aggression and delinquency together index externalizing problems. The study best poised to directly address the issue of whether the heritability of these problems increases or decreases over time is that of Schmitz and colleagues (1995), described above. This was a longitudinal study in which the twins were again assessed at seven and a half years of age. Over this five-year period, the heritability estimate for externalizing problems increased from .34 to .57, while the shared environmental effect decreased in magnitude from .32 to .22. In addition, the stability seen across the age span was due almost entirely to common genetic influences at both ages. No other longitudinal data has been used to address this issue, however, other extant results during middle childhood report higher estimates for genetic influence (e.g., Edelbrock, Rende, Plomin, & Thompson, 1995; Leve, Winebarger, Fagot, Reid, & Goldsmith, 1998). This increase in heritability remains speculative, however, given that the other studies of the preschool period indicated higher heritability estimates that are in line with estimates during middle childhood. Furthermore, cross-sectional analyses covering the age span from 5 through to 15 years uncovered no differences by age (Gjone, Stevenson, Sundet, & Eilertsen, 1996).

To summarize thus far; even during the early preschool period, it appears that genetic differences among children are partly responsible for the large individual differences seen in this domain. It should be emphasized, however, that heritability describes *what is* in a particular population at a particular time, rather than what *could be*. Therefore, if environmental factors within a population change (e.g., changes in discipline policy within the education system) then the relative impact of genes and environment will change. Beyond genetic influence, the moderate influence of siblings' shared environment underlines the utility of family-level intervention strategies (Gurman & Kniskern, 1980), and mirrors Patterson's reports of siblings' involvement in "coercive family processes" (Patterson, 1986).

Studies addressing the second issue, aggressive versus nonaggressive externalizing problems, have yielded quite consistent findings. Heritability is greater for aggressive problems, and nonaggressive problems yield higher shared environment estimates. A couple of recent replications will be reviewed. In a study of almost 200 twin pairs aged 7 to 11 years old, the parent-report aggressive behavior and delinquent behavior subscales from the CBCL were analyzed separately. Individual differences in aggressive behavior were substantially genetically influenced (.60), and shared environmental influences were modest (.15) and nonsignificant. The corresponding figures for delinquent behavior on the other hand were similar and moderate (.35 and .37, respectively). A report by Eley, Lichtenstein, and Stevenson (1999) is a particularly persuasive replication because it includes data from twin studies conducted in two countries (Britain and Sweden) yielding remarkably similar results. The heritability for aggressive behavior was estimated at .69 for the British sample and .70 for the Swedish sample, and shared environmental influences were negligible in both cases. In contrast, for non-aggressive antisocial behavior, shared environmental effects were significant and of moderate to substantial magnitude, and heritability estimates more moderate.

Finding moderate and significant shared environmental effects is unusual (see "Shared versus Nonshared Environmental Influences," below), and was first discussed for nonaggressive delinquent behavior by Rowe (1983). In this and subsequent work (Rowe, 1986), adolescent twins reported being "partners in crime" in terms of their delinquent acts. Thus, in addition to shared rearing experiences or parental attitudes being responsible for sibling similarity in this area, it appears that the twins are influencing one another. This is further supported by an adoption study for which the shared environmental component was more modest in magnitude, though significant (Deater-Deckard & Plomin, 1999).

This etiological distinction between aggressive and nonaggressive antisocial behavior is an excellent illustration of the contribution that behavioral genetic studies can make to theoretical issues in development. The distinction between adolescence-limited and life-course-persistent antisocial behavior put forward by Moffitt (1993) is supported by the differing origins of these behaviors. Aggressive behavior, mapping on to life-course-persistent antisocial behavior, is highly heritable and thus quite stable. Nonaggressive antisocial behavior, on the other hand, may be analogous to the adolescence-limited type, elicited by contextual cues particularly salient during the adolescent period, and bolstered by the findings of lower heritability and higher environmental contributions.

The final issue that will be considered is potential differences according to informant.

The studies reviewed above have relied on parental reports. A handful of studies have also utilized observational measures of child behavior, or parental interviews. In Deater-Deckard's study of 3-year-old twins, the children's difficult behavior was coded from videotaped observations of two 10-minute dyadic interactions with the primary caregiver, as well as via parental reports (Deater-Deckard, 2000). Heritability estimates were substantial for parent reports (.59), but nonexistent for the observational measure. Conversely, the shared environmental estimates were .00 and .25, respectively. There are several possible interpretations for this pattern of findings. First, the content of behaviors in the two measures was not identical. Deater-Deckard notes that, "observers were rating behaviors that were less severe in their consequences but parents were rating behaviors that were more extreme indicators of conduct problems" (p. 477). Second, the amount of time sampled (20 minutes) for the observational measure was a tiny fraction of the extensive experience that parents can call upon to answer questions about their child's behavior. Finally, observational interactions are "strong" situations. Perhaps questionnaire measures tap into more heritable, trait-like behavioral patterns of children, whereas the context of a specific parent–child interaction elicits consistency within families.

This finding is not restricted to the preschool period. A study conducted with 154 twin pairs between the ages of 6 to 11 years also compared observations of children's maladaptive behavior with parent reports (Leve et al., 1998). Two different coding systems were utilized for the observations, a global rating made by coders after watching the episode in total, and time-based sampling of discrete behaviors. The two systems yielded remarkably consistent results. Heritability estimates of .29 and .24, and shared environment estimates of .27 and .28 for the global and time-based coding, respectively. In contrast, parent reports of externalizing problems as indexed by the CBCL yielded a heritability estimate of .44, and a shared environment estimate of .41.

Finally, a systematic exploration of interview versus questionnaire data was conducted with a population-based sample of 8 to 16-years-old twins (Simonoff et al., 1995). The questionnaire measures indicated moderate heritability (.23–.34) and moderate shared environment (.25–.58). The interview measures yielded higher heritability results (.40–.73), and negligible shared environmental influences. Particularly striking were the differences between parental reports via questionnaire versus interview. The substantial shared environmental influence found for the questionnaire measures disappeared, suggesting that the questionnaire measures are subject to rater bias. That is, without the aid of an objective "filter," reporting biases (e.g., an optimistic outlook) may artificially inflate sibling similarity thereby inflating estimates of shared environmental influence.

This behavioral genetic evidence adds fuel to the debate regarding differences between informants. Lack of agreement between raters is often treated as error, and the argument is that composite measures (or latent variables) of behavior should be used because of their greater reliability and predictive power (e.g., Epstein, 1983). The counter-argument is that each reporter of a child's behavior has a unique, important perspective that should be examined in its own right. Children themselves, for example, may be in the best position to inform about their own internalizing problems, whereas parent and teacher reports may highlight potentially different frequencies of externalizing problems in contrasting contexts. Behavioral genetic evidence suggests that composite measures, and particularly latent variables of behavior, show higher heritability than do single informant measures (e.g., Simonoff et al., 1995; van den Oord et al., 1996). Is it thus fair to say that the more accurate the measurement, the more heritable will be the behavior in question? Instead, I would argue that assessments which index trait-like behavioral consistency across context are more genetically determined than more specific indices of behavior.

Self-Concept

Behavioral genetic research is in its infancy in the area of self-concept, with only two studies thus far concerning young children's understanding of their own personalities, strengths, and weaknesses. Participants in the first study (Pike, 1999) were 3.5-year-old twins. The challenge of assessing the self-conceptions of such young children was met by using a forced-choice puppet task (Eder, 1990). Factor analysis yielded two distinct, meaningful, and internally consistent dimensions, representing aggression/assertiveness (e.g., "Sometimes I like to tease people, and say mean things to them,","I think it would be fun to go down a slide head-first") and well-being (e.g., "I really like myself," "I have a best friend"). Both MZ and DZ twin correlations were similar and moderate across the board, apart from the MZ correlation for aggression/assertiveness that was modest in magnitude. This pattern of results indicated that genetic influence is *not* an important factor, that shared environment plays a moderate role, and that nonshared environmental factors are also important determinants of young children's self-conceptions at this age.

The second study involved adopted and nonadopted children at 9 and 10 years of age (Neiderhiser & McGuire, 1994). The Self-Perception Profile for Children (Harter, 1982) was utilized to assess behavior conduct, athletic competence, scholastic competence, physical appearance, social acceptance, and general self-worth. At age 9, over 80% of the variance for children's conceptions of their physical appearance was due to genetic factors, and approximately half of the variability for scholastic competence and general self-worth was also due to hereditary factors. The remaining domains were overwhelmingly influenced by nonshared environmental factors. These results were not, however, consistent at age 10. At this second time point only athletic competence and scholastic competence demonstrated considerable genetic influence, although nonshared environmental influence continued to prevail.

To summarize, the dominance of shared environmental factors in the preschool years suggests that parents or the family atmosphere plays a role in the early formation of children's understanding of their own personalities. This influence appears to decline by middle childhood, by which time those experiences unique to each child in a family (and perhaps emanating from outside the family) become paramount. Extreme caution is warranted, however, as both studies were based on relatively small sample sizes and await replication. These two studies also seem to be in line with an emerging trend that positive child outcomes demonstrate far less heritability than do negative outcomes. For example, in the Edelbrock and colleagues (1995) study described above, the competence scales from the CBCL indicated modest and nonsignificant genetic effects.

Parenting

During the past 15 years there has been a new wave of research that has subjected so-called "environmental" measures to behavioral genetic scrutiny. The majority of these studies have involved adolescents (see Plomin, 1994, for a review), and only the handful of studies concerning younger children will be reviewed here. In addition, this review is limited to child-based genetic designs (i.e., when the twins (or adoptees) are the children rather than the parents). Thus, any genetic influence found reflects heredity factors of the children, rather than the parents. Therefore, when genetic influence is detected on parenting, this indicates that parental behavior is in part shaped by genetically influenced characteristics of the child.

Braungart (1994) explored the parenting practices and more general home environment of preschool-aged children utilizing the adoption design, and avoiding subjective questionnaire measurement by employing home observations. Genetic analysis of a measure derived from the Home Observation for Measurement of the Environment (HOME; Caldwell & Bradley, 1978) was conducted. In contrast to studies of the HOME during infancy (Braungart, Fulker, Plomin, & DeFries, 1992), negligible heritability was demonstrated. This may be explained by inadequate psychometric properties of the scale at this age, an interpretation which is supported given that a more recent, systematic assessment of the family environment of young twins by Deater-Deckard (2000) yielded quite different results. The twin sample (n = 120 pairs) incorporated parent reports, information gained via interview, and observers' ratings of parent–child interactions. Parental reports of both positive and negative affect demonstrated genetic influence (.46 and .55, respectively), however, no heritability was shown for these domains as indexed by observers' ratings. Harsh discipline and control were also not heritable as assessed by interview and observation, respectively, however, observational ratings of parental responsiveness were substantially heritable (.49).

In a study of parenting during middle childhood, mother–child interactions were examined within the Colorado Adoption Study (CAP; DeFries, Plomin, & Fulker, 1994). The older and younger siblings were aged 7 and 4, respectively (Rende, Slomkowski, Stocker, Fulker, & Plomin, 1992). Four aspects of maternal behavior, control-intrusiveness, affection, attention, and responsiveness were coded from the videotaped interactions. Although maternal affection and responsiveness were not influenced by genetic factors, maternal control and attention were moderately and substantially genetically influenced, respectively. Utilizing the same CAP sample, a comparison of parental reports of warmth, control, and inconsistency of parenting were assessed when the children were 7 and 9 years old. Across both time points, heritability for warmth was quite substantial (.56 at age 7 and .40 at age 9). Control was consistent in showing no heritability across middle childhood, while inconsistency in parenting demonstrated no heritability at age 7, but was largely heritable by age 9 (.46). Finally, Deater-Deckard, Fulker, and Plomin (1999) compared child and parent reports of parenting during late childhood, again within the CAP sample. Parent reports of negativity and warmth were moderately heritable, whereas inconsistency demonstrated negligible genetic influence. According to the children, achievement orientation within the family was substantially influenced by genetic factors whereas family positivity was not significantly heritable.

From the extant evidence, it is difficult to draw overarching conclusions. Certainly parenting during both the preschool and middle childhood years shows some genetic influence, and this has been demonstrated via multiple informants. The presence of genetic influence on measures of the family environment is consistent with the idea that socialization is bidirectional. That is, when parents interact with their children, this interaction is affected by the child's behavior as well the parent's (Bell, 1968). There is, however, no clear pattern as to *which* dimensions are most heritable. This inconsistency may be due to differences in the degree to which measures index those parenting behaviors elicited by the child versus those that are more purely parent driven. Evidence for this distinction is provided by a small observational twin study by Lytton (1977, 1980). Future research following the Lytton tradition of detailed, time-sequenced coding of parent–child interactions with larger, representative samples would shed light on the exact nature of genetically influenced aspects of parent–child interaction.

Shared versus Nonshared Environmental Influences

Looking at behavioral genetic studies that have examined the traditional domains of personality, cognitive abilities, and psychopathology, it has been purported that genetic factors are important throughout psychology, and equally, that environmental factors are at least as important (Plomin & McClearn, 1993). Heritability rarely exceeds 50% and thus "environmentality" is rarely less than 50%. Somewhat surprisingly, summarizing across the lifespan, these same studies indicate that the environmental influence of primary importance is of the nonshared variety (Plomin & Daniels, 1987). That is, environmental factors that have the strongest effect are those which make siblings in the same family different from one another (Dunn & Plomin, 1990). This finding of the importance of nonshared environment has broad implications. Many global family factors such as the marital relationship, parental personality, neighborhood context, and socioeconomic status may not operate in the same way for all family members as has often been implied. For example, divorce is usually considered an event that is obviously shared by children in a family. However, the key issue might be each child's unique perception of, and reaction to, the divorce.

The balance of shared versus nonshared environmental influences does, however, change over the course of development. For the most widely studied area, cognitive abilities, extant findings converge on the conclusion that shared environmental factors are important during early childhood, and that these influences diminish across childhood and adolescence, becoming negligible by late adolescence (McCartney, Harris, & Bernieri, 1990). During this same period, heritability increases, and nonshared environmental influences remain quite constant (and are small in magnitude). This pattern of results mirrors the changing interaction patterns with family versus "external" influences (such as peers) across this period (Csikszentmihalyi & Larson, 1984). For the present purpose it is important to emphasize that differences between families *do* affect young children's cognitive abilities, a point that is sometimes neglected when emphasis is placed on findings for the adolescent period and beyond.

Behavioral genetic studies of the major areas of personality (e.g., extraversion and neuroticism) that have used twins find that genetics accounts for approximately 50% of the phenotypic variance, and nonshared environmental factors explain the remainder of the variation between individuals (e.g., Eaves, Eysenck, & Martin, 1989; Loehlin & Nichols, 1976). Estimates of nonshared environmental influence from adoption studies are somewhat higher, with estimates of genetic influence being correspondingly lower (e.g., Loehlin, Willerman, & Horn, 1987). The vast majority of this work, however, has involved the use of self-report questionnaires administered to adolescents or adults. For children, parental reports have been used, yielding odd results. Parents of fraternal twins tend to artificially contrast their twins' behavior such that DZ twin correlations are often "too low," or even negative (Plomin, Chipuer, & Loehlin, 1990). Support for this contrast effect comes from more objective measures of temperament/personality. For example, Saudino and Eaton (1991) demonstrated the usual "too low" DZ correlation for parental reports of activity level, whereas ratings from motion recorders yielded no such bias. The important point here is that throughout development, it is nonshared rather than shared environmental influences that dominate.

Psychopathology is a more diverse area of behavior for which broad statements cannot be applied. Still, for many disorders, including schizophrenia, autism, hyperactivity, and anorexia nervosa, nonshared environmental influence is substantial while shared environmental influence is negligible (Plomin, Chipuer, & Neiderhiser, 1994). Alcoholism may be an exception. As reviewed by McGue (1993), a number of adoption studies have found that being reared in an alcoholic family does increase a person's risk of becoming alcoholic. A recent review of behavioral genetic studies of depression concludes that MZ concordance for major depression is about .50, indicating that nonshared environmental influences make a major contribution (Tsuang & Faraone, 1990). Genetic influence appears to account for the remaining variation, again indicating that the environmental variation is of the nonshared variety.

Relating Specific Aspects of the Environment to Children's Outcomes

Traditional behavioral genetic studies do not pinpoint *which* aspects of the environment are important, but do indicate that each child in a family should be considered separately, rather than assessing families as a unitary whole. Thus far, much of the work in trying to detect specific sources of nonshared environment has focused on differential parental treatment. That is, researchers have examined parents' distinct or differing behavior towards each of their children. Most of this work has used siblings rather than twins to detect differential treatment. For example, Dunn, Stocker, and Plomin (1990) found that older siblings receiving less affection from their mothers than their younger siblings also displayed more internalizing problems (e.g., depression, social withdrawal) than did their younger siblings. In addition, older siblings who were the recipients of more maternal control demonstrated more internalizing and externalizing problems (e.g., aggressiveness, delinquency) than their younger siblings.

Sibling studies such as this cannot, however, address the direction of effects. It is often assumed that it is the parental behavior *causing* the differences in sibling behavior, but it could be that the children's behavior is in fact influencing parental behavior. In the example outlined above, it might be more plausible that it is the *children's* problem behaviors driving the maternal differential treatment, rather than the maternal differential treatment driving the children's problem behavior. One specific mechanism whereby children may be affecting their parents' behavior is via their genetically influenced traits.

Thus, as links between parental differential treatment and children's outcome have been found, it has become necessary to disentangle possible genetic sources of these associations. Because siblings differ genetically, relations between their environment and behavioral outcomes may be due to their genetic differences rather than to the parental differential treatment. Continuing the example above, it may be that *genetic* differences between siblings in families were the root of *both* the maternal differential treatment *and* the differences observed in the siblings' behavior problems. In order to study such a possibility, family environment measures (such as parental treatment), as well as children's outcome measures, must both be included within a genetically sensitive design.

For the purposes of this review, the single study of younger children that has utilized this approach will be presented (Deater-Deckard, 2000). Basic genetic analyses are univariate; they decompose observed variance of a single measure into genetic and environmental components. Bivariate genetic analysis focuses on the correlation between traits, decomposing this into its genetic and environmental components (see Figure 2.1), and can, for example, tell us whether a link between parental treatment and children's behavior is due to the nonshared environmental processes that Dunn and colleagues (1990) indicated, that is, differential parental treatment, or whether it is a common genetic component linking parental treatment and adolescent adjustment.

In the preschool twin study described above (Deater-Deckard, 2000), several moderate correlations emerged between parental behaviors and the children's behavior problems. For example, both parent report and observations of parental affect were associated with parent report and observations of the children's behavioral problems. Bivariate genetic analyses were then conducted for these associations to determine the degree of genetic versus environmental mediation. The pattern of results was clear. For parent-rated conduct problems, the lion's share of associations was due to genetic mediation. This finding suggests that genetically influenced traits of these children were being reflected not only in their behavioral difficulties, but also in the treatment elicited from their parents. This was in marked contrast to the results involving observations of child difficult behavior which were primarily due to shared environmental processes, whereby similarity in parental treatment was associated with similarity in sibling outcome.

Finally, a modest degree of nonshared environmental mediation was detected, in line with a previous utilization of this methodology with an adolescent sample (Pike, McGuire, Hetherington, Reiss, & Plomin, 1996). This modest amount of nonshared environmental mediation in no way discounts the wider importance of the nonshared environment. Any single bivariate association is a test for a *single* specific environmental process effective in the development of children's behavioral difficulties. It is sensible to believe that just as the specification of genetic influence involves multiple genes each with a small effect (Plomin & Rutter, 1998), the specification of environmental components of variance will be equally complex, involving a multitude of different factors, each of small effect.

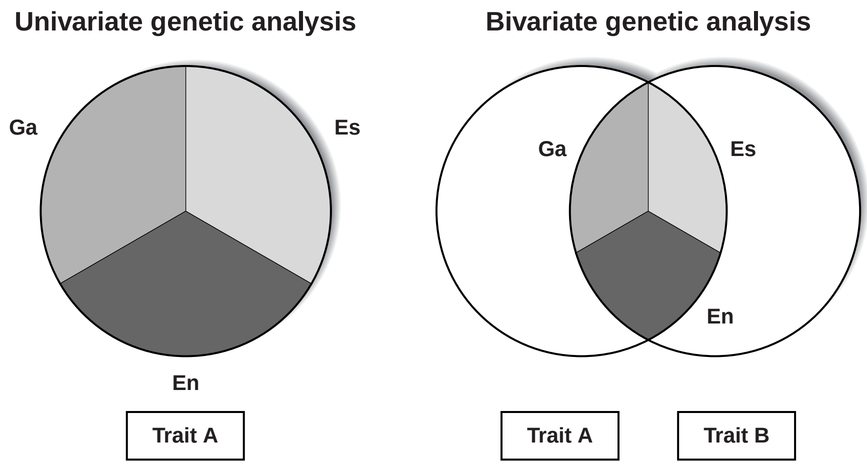

Figure 2.1 Univariate genetic analysis decomposes the variance of one trait into its genetic (Ga), shared environmental (Es), and nonshared environmental (En) components. Bivariate genetic analysis decomposes the covariance between two traits into its genetic (Ga), shared environmental (Es), and nonshared environmental (En) components.

It should be noted that finding evidence of genetic mediation suggests that nongenetic studies be interpreted with caution. Much of the developmental research relating parenting to children's adjustment is interpreted to mean that the parent's behavior is *causing* the child's behavior. The genetic findings suggest that this is not always the case. Instead, it is the children's genes that are reflected in both the parent's behavior and in the child's adjustment. In terms of process, it is quite plausible that a child's genetic propensities that lead to adjustment difficulties would also lead to displays of negativity from parents.

Socialization from a Behavioral Genetic Perspective

The seeming lack of communication between developmental psychologists (especially socialization researchers) and developmental behavioral geneticists is troubling (Goldsmith, 1993; Wachs, 1993). This can, in some measure, be attributed to the necessarily different methodologies employed by the two "camps." Behavioral genetic designs require the recruitment of quite large numbers of special families, often at the expense of more detailed assessments. This also does not (readily) allow some forms of data collection such as the assessment of peer relationships within the classroom context.

How can behavioral genetic findings such as those reviewed here inform socialization research? Estimates of genetic and environmental effects provide a useful roadmap in terms of where (and when) effective environmental factors are likely to occur. Finding differing etiologies across time highlights the likely location of potent socializing agents at different times during the life course. For example, as explained above, for intelligence shared environmental factors play a role in early and middle childhood, however, by the time of adolescence this effect has disappeared. I would argue, then, that familial factors should have an impact in the early years. If, however, familial factors (e.g., SES) are associated with IQ scores in late adolescence, behavioral genetic evidence suggests that this is likely to be a genetically mediated association.

Recently, behavioral genetic findings have been incorporated into two rather far-reaching theories concerning children's socialization. The first was put forward by Scarr in her presidential address to the Society for Research in Child Development in 1991 (Scarr, 1992). Scarr utilized behavioral genetic evidence to make the case that children's experiences are driven by their genetic propensities. That is, children are seen as active agents in their own socialization, and this active selection and creation of environmental experiences is genetically determined. Perhaps most controversially, Scarr made the claim that "average" parents are "good enough." Due to the lack of shared environmental influence found for most psychological traits, Scarr argued that within the species-normal range of environments, parents do not have a differential impact on their children's development. This idea runs counter to the traditional socialization theorists' claim that parents are the key socialization agents for young children, and Scarr's theory created lively debate and criticism (Baumrind, 1993, Jackson, 1993).

Scarr's theory received much attention; however, she is not the only behavioral geneticist to interpret lack of shared environmental influence as a lack of parental influence. For example, in his book *The Limits of Family Influence,* Rowe (1994) argues along the same lines, that a random allocation of children into families would not impact their developmental trajectories. These two authors emphasize the genetic link between parents and their children, but do not consider the impact of the nonshared environment. Firstly, a lack of shared environment does not necessitate that families are unimportant for children's development; parents may have a profound impact on their children, impacting each of their children in a unique, nonshared fashion. Secondly, although emphasizing the role of genetics on behavior, the nonshared environment is also of substantial magnitude for many domains, and these authors do not propose an alternative socialization agent for this role.

In her recent, well-publicized book, *The Nurture Assumption,* Judith Harris (1998) proposes that the peer group is this alternate socialization agent. Using behavioral genetic evidence, parents are deemed to be unimportant in determining individual differences in children's personality. Instead, it is children's genes that are responsible both for the way that parents respond to their children, and for children's personality characteristics. Genetic factors explain only half of the variance of personality development. The other half is due to environmental factors. As an alternative to parental environmental influence, Harris proposes that children's peers are the main source of these nonshared environmental influences. She argues that personality development is shaped through a process of peer imitation and pressure that encourages the child to conform to group rules. It is this environmental process that ultimately determines adult personality beyond hereditary influences.

What is not considered in Harris' thesis is that peer group characteristics, like parenting, might also be genetically influenced. That is, children are not randomly allocated to peer groups. Genetic factors might also influence the peer context experienced by children. An empirical test of this hypothesis measured adolescents' peer-group preferences for college orientation, delinquency, and popularity (Iervolino et al., 2000). Substantial genetic influence emerged for adolescents' self-reports of peer preference for college orientation and delinquency, with the remaining variance accounted for by nonshared environmental influences. For peer preference for popularity, genetic influence was not important and nearly all of the variance was due to nonshared environment. These results suggest that peers, at least peer preferences, may also show genetic mediation, as is the case for parenting. It remains to be seen, however, if these findings will also be true for younger children, or whether peer-group characteristics, like intelligence, show shared environmental influence at younger ages, this disappearing across development into adolescence.

Conclusion

Behavioral genetics has already made a sizeable contribution to many aspects of the social development literature. Such studies indicate that genetic factors are not only important for children's "outcomes," but also for "environmental" aspects such as parent–child interactions. Recent work at the heart of nature *and* nurture is combining the best of traditional socialization research with genetically sensitive designs. Emerging from such work are exciting, if controversial, new theoretical approaches to children's socialization.

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