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Differential sibling environments and their influences on educational attainment

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DIFFERENTIAL SIBLING ENVIRONMENTS AND THEIR INFLUENCES ON EDUCATIONAL ATTAINMENT

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Abstract

Four-hundred and eighteen female and male adult offspring completed the Sibling Inventory of Differential Experience (SIDE), by reporting average differences and similarities between themselves and their sibling in their growing up and living at home experiences, as well as responded to measures of personality and demographic information. High alpha reliabilities were obtained for the SIDE (ranging from 0.67 to 0.90). No significant associations of gender, age, birth-order, test site, marital status, or ethnic group with responses to the SIDE were noted.

Only 202 of the initial 418 participants had also responded to measures of cognitive abilities. Only these 202 individual offspring had provided sufficient data for further analyses. Thus, hierarchical multiple regression analysis procedures were utilized for these participants to study the effects of perceived differential environmental influences on attainment levels. First the effect of parental influence was partialled out, followed by the effects of offspring's cognitive abilities and personality, and lastly the effect of the SIDE measure was accounted for in the model.

The overall results indicate that about 27% of the variance in offspring educational attainment level was accounted for by the linear combination of parental

variables, cognitive abilities and personality, and SIDE measure. The SIDE measure's individual contribution to the model accounted for about 8% of the variance over and above parental influences, own cognitive abilities and personality influences. Correlates of attainment were found to differ between ethnic and gender groups. Parental variables had more significant effects on Japanese offspring attainment than for Caucasian offspring. While the SIDE accounted for more explained variance in the Japanese group, own cognitive abilities and personality accounted for more variance in the Caucasian group. Gender differences were also noted in a greater influence of parental variables for female than male attainment. SIDE accounted for more variance in female attainment level, while own cognitive abilities and personality accounted for more variance in male attainment.

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INTRODUCTION

A tremendous amount of data have been and continue to be generated in the area of human variability. Research utilizing adoption and twin studies has proven useful in delineating the effects of genes and between-family variables in the observed variations of human attributes. These studies provide a schematic of the relationship that genes and between-family environmental variables play in personality, cognitive abilities, and attainment level. Yet, with such research focused on genes and on across family environment, neither genes nor between-family differences in environment have accounted for much of this variance.

The focus of the literature review is to demonstrate the general lack of prediction of cognitive abilities and personality from either genetic or across family environmental measures. Further, the review will demonstrate that the influences of cognitive abilities, personality, and across family environmental variance on attainment leave most of the variance in attainment level unexplained. Finally, the influence of within-family variance as a viable predictor of attainment level will be discussed.

Since antiquity, genetics and environment have been used separately as explanations for observed differences in the population (Stubbe, 1965). Although both genetics and

environment have long been recognized as contributing factors that influence individual variability, it took the confluence of Sir Francis Galton's (1822-1911) biometrics movement (Forrest, 1974) with Darwin's theory of evolution (Darwin, 1859) and Mendel's work in genetics (Stubbe, 1972) to create the field of individual differences/behavior genetics (Dixon & Johnson, 1980). This field provided a more comprehensive arena for studying the forces resulting in individual differences; Interactions, varying amount of contributions, and combinations could be investigated.

While some radical behaviorists (e.g., Watson, Skinner, Bijou, Staats) hold fast to their beliefs and deny any genetic influence on behavioral attributes, by the 1920s most behavioral researchers did not subscribe to such an extreme environmental perspective. Presently, contemporary behavioral scientists have assumed a more temperate stance in their redefinitions of contributors to individual differences. Investigations of given dimensions of individual differences have resulted in quantitative measures of relative influences of genetics/heredity and environment.

Traditionally, the emphasis of the environmental dimension has been on assessing variance across or between families. Questions are phrased to elicit responses that provide information pertaining to differences between families. Reports from one family member are assumed to be

representative of all other members in that family. These between-family difference reports are correlated with variables pertaining to individual differences. These relationships, based on between-family differences, are often generalized to every member in the family. For instance, as suggested in the literature (Bem & Allen, 1974; Moskovitz & Schwarz, 1982), personality consistency in an individual develops from combinations of genetic background and experiences. From this blanket statement, we might assume that biologically related individuals should be more similar in personality than unrelated individuals. Recent adoption studies, however, fail to support this assumption.

Adoption studies

The Texas Adoption Project Study (TAPS) (Horn, Loehlin, & Willerman, 1979) is one study that published results contrary to the above assumption. The study reported a lack of personality resemblance for people who live together, regardless of their genetic resemblances. A later study by Loehlin, Horn, & Willerman (1981) reported median correlations of 0.05 for twenty-four pairs of biological siblings and 0.04 for 109 pairs of adoptive siblings for 13 personality scales (from the Cattell 16 PF). Adoptive siblings are reared in the same family as siblings but are genetically unrelated. Any resemblances between these siblings, according to Plomin, DeFries, and McClearn (1980),

would directly estimate shared-sibling environmental variances. Results from this study suggest, however, that children who live together all of their lives (even when biologically related) are no more similar than strangers on such personality inventories. In other words, the low resemblance between siblings may be translated to mean that siblings' shared environment or shared genes have very little effect on their personalities.

Likewise, results from the Minnesota Transracial Study (MTS) (Scarr & Weinberg, 1976, 1977), another adoption study, suggest no significant effects of environmental differences between families. This study reported on 101 white adoptive families, who have adopted at least one black or interracial child. Many of these families also had biological offspring. As heritability is the amount of variation in a trait or a class of behavior that is attributable to genetic factors, it would be expected that natural parent-child correlations would be higher than adoptive parent-child correlations because a genetic relatedness exists. But the results showed natural parent-child correlations to be comparable to the adoptive parent-child values, in both cases, close to 0.00.

Both the Minnesota Adoption Study (MAS) (Scarr, Webber, Weinberg, & Wittig, 1981) and the TAPS (Loehlin, Willerman, & Horn, 1981) reported average adoptive sibling (genetically unrelated children growing up in the same family)

correlations that are not significantly different from zero (0.02 and 0.01 respectively). In such a design, the common domain between adoptive siblings is their rearing environment. Since these children are genetically unrelated, it would be expected that resulting adoptive sibling correlations would be an effect of the common environment. As remarked on above, measurements of adoptive siblings, for most psychological characteristics, yield correlations that hover around zero (Plomin & Daniels, 1987). Collectively, these studies present results that suggest that traditionally defined environmental influences are not shared by children in the same family or if shared, have no measurable influence on the attributes assessed.

Twin studies

Intelligence. Twin studies afford an opportunity to address the heredity-environment question by comparing the correlation of intelligence test scores of varying degrees of genetically similar siblings. Twins are divided into groups of monozygotic (MZ) or identical twins and dizygotic (DZ) or fraternal twins. MZs are genetically identical, as they are the product of the same ovum which has split in two. DZs result from the simultaneous fertilization of two eggs by separate spermatozoa and are no more alike genetically than other sisters and brothers. Comparison of identical twins reared together produces a correlation of

0.90 (the same correlation obtained when a person takes different versions of the same test) for intelligence test scores (Plomin & Daniels, 1987). Aligned with these results, one of the latest findings from the Minnesota Study of Twins reared apart (Bouchard, Lykken, McGue, Segal, & Tellegen, 1990) is that about 70% of the variance in MZ IQs is found to be associated with genetic variation. In contrast, the average correlation of intelligence test scores for non-twin siblings reared in the same environment is 0.50 (Loehlin & Nichols, 1976; Newman, Freeman, & Holzinger, 1937; Wilson, 1977, 1978). In these studies, heredity seems to play an important role in determining intelligence.

Furthermore, H. J. Eysenck in The Intelligence Controversy (1981) cites other studies that heavily support a genetic contribution. He summarized results of studies on MZs reared apart that show correlations of about 0.77 for IQ. He also cited a study out of England by Herrman and Hogben who investigated average differences in IQ between twins or siblings. MZ twins, DZ twins of the same sex, DZ twins of opposite sex, and siblings (biological sisters and brothers) were studied. For 65 pairs of MZ twins, the mean IQ difference was 9.2. For 96 pairs of DZ twins of the same sex, the difference was 17.7, while for 138 pairs of DZ twins of opposite sex, the difference was 17.9. The sibling mean IQ difference was reported to be 16.8. Based

on these findings, Eysenck stated that there is no difference in degree of similarity between DZ twins of the same sex and DZ twins of opposite sexes, "which suggests that genes and environment operate on both sexes in the same way." He goes on to say that "DZ twins are no more alike than ordinary siblings, which indicates that (DZ)twins are not treated differently from ordinary brothers and sisters in any way that would affect intelligence."

Leon Kamin, in The Intelligence Controversy, claims that the studies used to support Eysenck's genetic contribution are strongly biased in similarities of environments between separated twins, participant selection, measurement error, and tester bias. Kamin further goes on to show the bias selection in the Herrman and Hogben studies by presenting several studies that report differences between same and opposite sex DZs (see Table 1).

Table 1

IQ Correlations Comparing Same-Sex and Opposite-Sex DZ Twins.

STUDY:	SAME-SEX DZs	OPPOSITE-SEX DZs
Stocks and Karn (1933)	0.87 (N=27)	0.38 (N=28)
Herrman and Hogben (1933)	0.47 (N=96)	0.51 (N=138)
Huntley (1966)	0.66 (N=135)	0.45 (N=100)
Adams et al. (1976)	0.66 (N=55)	0.47 (N=40)

Note: from The Intelligence Controversy (1981, p. 133).

While Eysenck and Kamin disagree on the extent of the contribution, both genetics and environment contribute to intelligence or cognitive capacities. Presently, behavioral genetic research suggests that estimates of the broad heritability of IQ are lower than previously estimated (Loehlin, 1989; Plomin & Loehlin, 1989; Bouchard & McGue, 1981).

Personality. The genetic contribution to personality characteristics appears to be even less than the genetic contribution to intellectual characteristics but just as ambiguous. From the developmental literature, the two personality attributes which seem to have a hereditary component are sociability or introversion-extraversion and stimulus seeking. These characteristics may be related, however, since the tendency for extraversion is to seek social stimulation, whereas the tendency for introversion is to avoid it (Hetherington & Parke, 1986). Monozygotic twins reared together or apart are reported to be more similar than dizygotic twins in sociability (Buss, Plomin, & Willerman, 1973; Gottesman, 1963; Scarr, 1968; Shields, 1962). Marked differences in the hereditary component in social responsiveness in young children have been found when young children interact with adult strangers than when they respond to their mothers or familiar adults (Lytton, 1980; Plomin & Rowe, 1979). The findings from longitudinal

studies suggest that sociability is a remarkably stable characteristic (Kagan & Moss, 1962; Schaeffer & Bayley, 1962).

Researchers have also found that MZ twins are more similar than DZ twins in seeking stimulation, change, thrills and adventure, and being susceptible to boredom (Buschsbaum, 1973; Fulker, Eysenck, & Zuckerman, 1980). There are also reports of greater similarity of activity levels of MZs than DZs (Goldsmith & Campos, 1982; Goldsmith & Gottesman, 1981; Scarr, 1966; Willerman & Plomin, 1973). Correlations between activity levels of children with their parents when they were children are also reported (Willerman & Plomin, 1973). Results from longitudinal studies indicate that the role of environmental factors cannot be ignored. The responsiveness of parents and environmental stimuli may be manifested in very different personality characteristics.

The issue of the generalizability of twin data to nontwin siblings can be reviewed in the literature. An article by Scarr and Kidd (1983) compared several thousand DZ twins (young adults of same-sex and opposite-sex pairs) found a weighted mean correlation of 0.25 for personality measures. This finding contrasts with the weighted mean correlation of 0.14 for sixty-four biological pairs of siblings in the two adoption studies (TAPS & MTS) and the average correlation of personality traits for adolescent sibling pairs of 0.10 from the Hawaii Family Study (Ahern,

Johnson, Wilson, McClearn, & Vandenburg, 1982). Clearly, the personality resemblances of ordinary siblings are not as great as those of DZ twins, which may imply that there is something special about the twin environment (e.g., same age, similar physical appearance) that increases the similarity. The physical and age similarities of twins increase the possibilities that twins are more likely to interact in similar environments than nontwin siblings. With such a consideration, twin results concerning differential experience may not generalize well to nontwin siblings (Lykken, 1978).

Likewise, findings from another study (Scarr, Webber, Weinberg, & Wittig, 1981) suggest that biologically-related adolescent siblings' resemblances in personality traits, with a median of 0.20, are more like that of DZ twins (r=0.25, Nichols, 1978). The median correlation for adoptive siblings is 0.07, significantly lower than the 0.20 coefficient for biologically related siblings. Scarr and Kidd (1983) suggest that the evidence of personality variance in family studies is not congruent with existing twin studies. The common denominator of these studies is that they assume environment to be a between-family effect. As evidenced by the incongruent results, between-family environmental dimension has little influence on personality traits.

Further findings from sibling (Crook, 1937; Ahern, Johnson, Wilson, McClearn, & Vandenburg, 1982) and twin studies (Plomin, DeFries, & McClearn, 1980) present a picture of normal personality as one in which there are low levels of resemblances among biologically related people. A study of nearly 13,000 adult twin pairs in Sweden by Floderus-Myrhed, Pedersen, and Rasmuson (1980) found an average DZ correlation of 0.22 for a shortened version of the Eysenck Personality Inventory. This finding suggests that about 75% of the total variation in personality is due to genetic and environmental causes that are not shared by siblings.

The general finding, after comparing sibling and twin studies (Plomin et al., 1980; Nichols, 1978; Falconer, 1970), is that on the average only 0.12 of the variance in personality shared by siblings is entirely genetic in origin. In addition, present research suggests that most of the variance in personality measures is not accounted for by either genetic differences or by between-family environmental differences. It is further suggested that most of the personality variance, excluding what is explained by errors of measurement, must be between individuals of the same families (Rowe & Plomin, 1981). In other words, these findings point toward differential psychological environments between individuals in the same family as a factor in accounting for individual differences.

It has been claimed that personality differences arise primarily from individual differences in experiences within the family and from individual genetic variability (Scarr, 1987). As Daniels (1986) stated, "none of the environmental variance is common for personality of siblings; all is differential" (p.339). Such a statement is based on behavioral genetic studies across several domains of behavior (Rowe & Plomin, 1981). They report that environmental variance is different rather than common for siblings on cognitive, personality, and psychopathological domains, and may in fact vary in degree of difference across ages for two siblings growing up in the same family.

Attainment

The prediction of educational attainment substantially increases when personality measures are included in a prediction model (Johnson, Nagoshi, Ahern, Wilson, DeFries, McClearn, & Vandenberg, 1983). In this study, statistically significant positive correlations of cognitive abilities with educational attainment ranged from 0.13 to 0.48. Personality measures, also, made significant contributions in prediction of educational attainment with correlations ranging from 0.18 to 0.34. Correlations of cognitive abilities and personality with occupational attainment were similar to those found for educational attainment, and educational attainment was found to be a strong predictor of

occupation. Significant gender differences were not observed. In general, results were similar across gender and ethnic groups.

The participants in the study cited above were drawn from the Hawaii Family Study of Cognition (HFSC) (see DeFries et al., 1979; Wilson et al., 1975, for descriptions of the HFSC). Parent participants were a well educated group of individuals who generally had high status jobs. The correlations described above are generally similar across gender and ethnic group. Yet, the contributions from measures of personality and cognitive abilities accounted for less than half of the variance in educational attainment.

A study by Nagoshi, Johnson, Yuen, and Ahern (1986) investigated educational and occupational attainment by assessing 249 offspring from the Hawaii Family Study of Cognition. The data suggest that family background had a relatively trivial influence, own cognitive abilities substantial influence, and own personality some influence on the educational and occupational attainment of males, while family background had a far more substantial influence than own ability on the attainment of females. The inclusion of a within-family environmental measure, along with gender difference investigations, may account for more of the variance.

Family differences

One explanation given by Jencks, in Inequality (1972), for the educational/occupational variance not accounted for by IQ is that it is a combination of "personality plus chance." Another explanation considers within-family differences. Within-family differences may account for the "chance" (non-genetic) factor of Jenck's education/occupation variance formula. The much studied area of family differences has not proved to be a significant factor in the explanation of individual variance. The effects of birth order, age, and sex of siblings fail to reveal much about personality traits and cognitive abilities. Birth order and sex of a child contributions range from one to ten percent of the variance in achievement and ability scores (Plomin & Foch, 1981; Scarr & Grajek, 1982). This small percentage is also reflected in the studies reviewed by Dunn (1983) as well as by Daniels and Plomin (1985).

Likewise, in a review of over 1,000 birth order studies on the relationship between birth order and IQ, school achievement, occupational status, and personality, Ernst and Angst (1983) concluded that when socio-economic status is controlled and when siblings from the same family are compared, birth order behavior relationships approach zero. Sex of the child also explains very little--from one to five percent of the variance in both the areas of cognition and

personality development when SES is controlled for (Hyde, 1984; Jacklin, 1981; Plomin & Foch, 1981).

Currently, socioeconomic status (SES) continues to be one of the major variables used to assess environmental influences. It is usually regarded as a powerful predictor of offspring attainment; however, SES of parents is often confounded with parent ability. When disentangled, SES is usually found to be insignificant or of trivial influence (Johnson & Nagoshi, 1987; Bouchard, 1983; White, 1982; Scarr & Weinberg, 1978).

A review of family socialization research by Maccoby and Martin (1983) found that most of the behavior-environment relationship variability lies within-family on an individual-by-individual basis, rather than between families. Rowe and Plomin (1981) also note low-order family resemblances between siblings on sibling interaction, family structure, treatment by parents, and extra familial networks. This suggests that environmental influences relevant to psychological development largely operate in such a way as to make siblings in the same family different from, rather than similar to, each other.

Studies on adopted siblings and genetically unrelated individuals adopted together show insignificant correlations in resemblances for personality, psychopathology, and for cognitive abilities in adolescence. Likewise, siblings

consistently show greater differences than similarities in major domains of individual differences.

Studies dealing with environmental effects on cognition and/or personality highlights Moos' claim (1974, 1979) of the important impact of the social climate. This is a measurement of the environment in which an individual functions. Inouye (unpublished dissertation, 1987) reviewed studies examining the effects of home environment on children's cognitive and/or personality characteristics and concluded that this social climate may have impact on attitudes, moods, social, personal, and intellectual development. Murray's (1938) operational description of "press" as a measure of home environment aids the assessment of this climate. He defined a press as having the directional tendency of the environment and a qualitative aspect which is assessed by its ability to harm or benefit different individuals or the same individual at different times. Murray (1938) further distinguished between two environments: alpha press and beta press. Alpha press is the press that "actually exists" versus the beta press which is the subject's interpretation of the perceived phenomena.

Studies have mainly focused on the direct relation between measures of the alpha press on home environments and children's cognitive and personality characteristics. Alpha press studies based on a variety of methodologies have found family environment to have moderate association with

cognitive performance and personality characteristics. These studies used structured parent interview schedules to gather information about the family environments of the children (Fraser, 1959; Wiseman, 1967; Plowden, 1967; Majoribanks, 1979a, 1979b), coded narrative accounts of objects and actions during a given time frame (Barker & Wright, 1954), time sampling methods and direct observation of the mother and child interactions in the home (Yarrow et al., 1975).

A study by Steinbock (1978) brought to light the effects of differences in perception. He contrasted adolescents who had run away from home, adolescents in crisis who did not run away, and a non-crisis group. His findings revealed perceptual differences only between adolescents who had run away from home and their parents. These findings underscore the importance of including individual perceptions in assessing environmental concerns.

Collectively, these studies suggested that home environmental factors are related to infants' and adolescents' performance on measures of cognition as well as to their affective states. Therefore, focusing on the environment through direct assessment may clear up some of the ambiguities between environmental and genetic contributions. The Sibling Inventory of Differential Experience (SIDE; Daniels and Plomin, 1984) provides such an

environmental measure by asking participants to directly assess their environment with regards to that of a sibling.

Differential Psychological Environment. The other area of within-family variance to be assessed is the differential psychological environment of siblings (Rowe & Plomin, 1981; Daniels & Plomin, 1985; Plomin & Daniels, 1987). Genotype-environment interaction (G-E I) and genotype-environment correlation (G-E C) are the two perspectives that are being employed to investigate individual differences in children. G-E I and G-E C provide a clearer view of the influences of genotypes, environments, and their permutations (Plomin, 1989). G-E I refers to the possibility that children of different genotypes may respond differently to specific environments. This presents the possibility of siblings, who are not genetically identical, responding differently to the same environment or situation. Therefore, G-E I attempts to account for differential effects of environment on children with different genetic predispositions.

In contrast, G-E C refers to the differential exposure of genotypes to environment. G-E C meshes gene with environment and leads to the consideration of children as active agents of their environment. G-E C proposes that the environments siblings prefer and seek out will depend, in part, on the sibling's genetic characteristics. The implication is that siblings with different genotypes will actively seek different "environmental niches." Thus, the

genotype-environment correlation is the extent to which children receive or create environments correlated with their genetic propensity. Assessment of these genotype-environmental dimensions may prove worthwhile in accounting for within-family variance. The Sibling Inventory of Differential Experiences presents the possibility of assessing differential psychological environments.

Sibling Inventory of Differential Experiences--SIDE

Rowe and Plomin (1981) provided a conceptual framework which investigated differential sibling experiences from a genotype-environment perspective. It includes sibling interaction, parental treatment, extrafamilial network influences, and experiences such as an accident or death of a loved one that were likely to be individually specific. It is from this framework that the Sibling Inventory of Differential Experience (SIDE, see Appendix 1) questionnaire was developed by Daniels and Plomin (1984).

This seventy-three item, self-report, twenty-minute long questionnaire asks participants to compare their experiences to those of their sibling. In this way, more subtle assessments of relative rather than absolute judgments of the siblings' environments are made. For instance, "Who has shown more understanding for the other?" (relative) versus "My sibling and I show understanding for each other" (absolute).

No significant difference occurred when genetically unrelated and genetically related siblings' SIDE means were compared (Daniels & Plomin, 1985). This finding backs their claim that there is little evidence for genetic influence in the dimensions of within-family environment as assessed by the questionnaire. SIDE focuses on social-affective rather than on cognitive experiences and is based on sibling perceptions rather than on observational assessments. The questions contained in the SIDE are phrased so that the responses are a culmination of the participants' growing years. For example, a question is phrased: "In general, who has been more bossy toward the other over the years?" rather than "Who is more bossy toward the other?"

The SIDE assesses four domains of differential experiences: differential sibling interaction, differential parental treatment, differential peer characteristics, and events specific to an individual (Daniels & Plomin, 1985).

Differential sibling interaction is assessed through twenty-four items contained in the SIDE. These questions look into four underlying factors of sibling interaction: antagonism, caretaking, jealousy, and closeness. Within these four dimensions is a range of interaction from mutuality to hostility. For instance, both siblings may have interacted cooperatively and consequently had very similarly perceived environments. In contrast, differently perceived environments for the pairs of siblings (sibpairs)

are created when, for example, one sibling acts in a kind and understanding way towards the other and that other sibling responds with jealousy and anger.

Differential parental treatment is assessed through nine items. These items consider the mother and father separately and assess two factors: affection and control. On these two dimensions siblings can report that they were treated "equally," "a bit differently," or "very differently." Direction of differences are also measured on all the subscales.

Differential peer characteristics are assessed using twenty-six items. Three dimensions of peer group characterisitics are investigated: orientation toward college, delinquency, and popularity.

Events specific to the individual consists of fourteen questions that may be unique to one or the other sibling. In this category, inquiries are made on the impact of intimate relationships, relatives, friendships, accidents, divorce, death of a loved one, extraordinary events, and family psychological problems.

The data for the analyses on the SIDE scales were gathered on a sample of 396 twelve- to twenty-eight-year old siblings from the Denver metropolitan area. The means of the absolute scores centered around 0.75 with a score of 1.00 indicating "a bit of difference" and the standard deviations ranged from 0.4 to 0.9. Considered together

these scores suggest "that siblings in many families perceive their experiences to be quite different (Daniels & Plomin, 1985 p.751)."

The intercorrelations among the scales are low to moderate. Two-week test-retest reliabilities ranged from 0.77 to 0.93, with a mean of 0.84 found for a sample of fifty-seven biological siblings. The degree of agreement between 149 sibling pairs, though low to moderate, were significant on all of the SIDE scales. This indicates that if sibling A said that he or she was the more supportive sibling, for example, sibling B, tended to agree by stating that sibling A was the most supportive.

People of Hawaii

The present study expands on Nagoshi et al. (1986) by including the SIDE, a nonshared/differential environmental dimension, as a predictor of educational/occupational attainment. DeFries, Corley, Johnson, Vandenburg, and Wilson (1982), and Nagoshi and Johnson (1985) found that Americans of Japanese Ancestry (AJA) offspring living in Hawaii had substantial increases in their cognitive test scores compared to those of their parents. No such increase was witnessed in Hawaii for Americans of European Ancestry (AEA) offspring. While the Johnson et al. (1983) study reported results that were similar for parental ethnic groups, the findings from later studies on the offspring

support the need for investigation of ethnic and gender group differences.

The blurred SES, education, environment, ethnic philosophies, and customs (Nagoshi, 1980) found in the island state of Hawaii, contribute to the range of economic and educational opportunities available to Hawaii's children. The once pervasive effect of societal delineators, such as SES and racial/ethnic differences, on children's academic achievement and attainment are waning as a result of historical changes (Johnson & Nagoshi, 1987; Nagoshi, 1980; White, 1982).

Thus, propelled by current studies assessing family differences (Daniels & Plomin, 1985; Daniels et al., 1985; Dunn, 1983; Lamb & Sutton-Smith, 1982) and theoretical perspectives regarding individual differences (Plomin & Daniels, 1987; McCall, 1983; Scarr & McCartney, 1983; Rowe & Plomin, 1981), it might be concluded that a key factor in understanding why siblings in the same family are considerably different from each other is the effect of within-family influences on offspring. Also in America, these influences may increase in importance as the influence of across-family differences in environment decreases. Another contributing factor that may influence differences is the amount of contact that siblings maintain in adulthood. The less frequent the encounters the lower

degree of similarity reported (Rose, Kaprio, Williams, Viken, & Obremski, 1990).

Purpose

The purpose of this study was to investigate the power of the SIDE as a contributor in a model predicting educational and occupational attainment level. A major advantage in utilizing the SIDE is it directly assesses perceptions of sibling nonshared (differential psychological) environmental influences by asking participants to compare their experiences in specific environmental domains with those they perceived their siblings experienced. The incorporation of a measure that directly assesses individual environmental perceptions in a model, of commonly known significant predictors, may provide the added dimension in accounting for attainment level.

Investigating nonshared environment may account for a portion of the vast amount (+50%) of individual variance in attainment that is not accounted for in conventional predictive models. This study attempted to contribute to the expanding age range of developmental research that continues to assess development beyond childhood to adulthood by involving adult sibling-pairs. By adulthood, the effects of prenatal, postnatal, parental, sibling and peer effects on personality and attainment have, for the

most part, stabilized (Daniels & Plomin, 1985). Similar studies by E. Lowell Kelly (1955), who tracked a group of people for over thirty years, Nesselroade and Reese (1973), and Schaie and Strother (1968) found that personality and abilities do not usually change after people reach thirty years of age.

Sibling comparisons permit direct comparisons of offspring in the same families. In this way, the environmental perceptions (family, social, scholastic influences) may be better assessed. Children do not really know or care about how other families treat their children. They do know and are affected by the manner in which their siblings are treated in respect to their own family constellation. Whether a sister receives more privileges or affection is of greater significance to a sibling than whether their family is the most loving on the block. Likewise, direct measures of perceived experiences provides a quantitative account of the intimate environment where offspring function. This environment has the potential of having a powerful and pervasive influence on the attainment levels of offspring and providing the dimension that may help us better understand gender and ethnic group differences.

In the quest to account for differing attainment levels within families, cognitive measures, along with the Eysenck Personality Questionnaire-revised (Eysenck, Eysenck, &

Barrett, 1985) and the Mach V (Robinson & Shaver, 1975) personality tests, and the SIDE questionnaire were utilized. These personality measures are included based on previous literature that found them to be strong indicators of attainment levels (Johnson et al., 1983). Likewise, the same cognitive measures used by Johnson et al. (1983) and Nagoshi et al. (1986) were employed. This combination of measurements, along with demographic assessments, were utilized as predictors of attainment levels and provided a richer source of data on the interactions and relationships of genes and environment on attainment.

METHODOLOGY

Participants

This study was part of a continuing investigation of the Hawaii Family Study of Cognition (HFSC) 1972-1976 (see DeFries, Johnson, Kuse, McClearn, Polovina, Vandenberg, & Wilson, 1979; Wilson, DeFries, McClearn, Vandenberg, Johnson, Mi, & Rashad, 1975 for a detailed description). The original HFSC sample of 1816 intact families consisted of both biological parents and one or more offspring. Most of the 2949 participating offspring were between 13 and 25 years of age at the time of the original testing. These participants were tested on a battery of 15 cognitive tests (Wilson et al., 1975) in order to assess genetic and environmental influences on cognition. In addition to the cognition data, various subsets of participants were administered personality measures. Demographic characteristics concerning occupational status and years of education of self and parents were also obtained.

Parents in the HFSC with current addresses were recontacted by mail and phone in 1987 and asked to provide the addresses of their offspring. As described in Johnson et al. (1990), more than half of the families were no longer locatable and had probably moved from the state. Four

hundred twenty-two questionnaires out of 530 (about 80%) were returned and used to located HFSC offspring and their spouses. The questionnaire asked them if they would be willing to be tested at the University of Hawaii on the HFSC cognitive abilities test battery and other measures. About one-third of the contacted participants were living on the U.S. mainland and were mailed a questionnaire packet containing all of the measures except the cognitive abilities tests. Those who consented to be tested were administered the HFSC cognitive test battery in groups of 2 to 20 in a classroom at the University of Hawaii, then completed the other measures there: personality, home environment, and demographic characteristics. Total testing time was about three hours, and subjects were paid $25 each for their participation. In all, 437 HFSC offspring along with 175 of their spouses participated in the Hawaii Family Study of Cognition (HFSC) Follow-Up Study.

For the present study, 418 of the initial 437 participants responded sufficiently to the SIDE questionnaire for analyses. Thus, the present study concerned a subset of the Follow-Up participants. As shown in Table A, this group consisted of 221 or 52.9% females and 197 or 47.1% males with an overall mean age of 30.8 years (median = 30 yrs.; mode = 29 yrs.). The majority of the offspring came from the HFSC pool, while about 5% of the tested offspring in the present study were not. Thus 154

sibling pairs were represented in the present sample. One hundred seventy-six (42.1%) of the total sample were single and 242 (57.9%) were married. One hundred forty-five (43.7%) participated via the mail and 273 (65.3%) came to U.H. to complete the battery of tests. One hundred seventy-nine (42.8%) were Americans of Japanese Ancestry, 177 (42.3%) were Americans of European Ancestry, 53 (12.7%) were Americans of Chinese Ancestry, and 9 (2.2%) were Americans of Eurasian Ancestry.

Table 2

Demographic Dimensions, Group Sizes and Percentages

Demographic Dimensions					
Gender:	female	N=221 (52.9%)	male	N=197 (47.1%	
Marital status:	single	N=176 (42.1%)	married	N=242 (57.9%	
Testing site:	mail-out	N=145 (34.7%)	on-site	N=273 (65.3%	
Ethnicity:	AJA	N=179 (42.8%)	AEA	N=177 (42.3%	
	ACA	N=53 (12.7%)	Hapa	N=9 (2.2%	
Age:	mean: 30.8 yrs.	median: 30 yrs.	mode: 29 yrs		

Note.Hapa=Americans of Eurasian Ancestry

As in the Johnson et al. (1983) study, participants were asked to provide information regarding their years of education and occupation. Occupational level is quantified using Duncan's National Opinion Research Council (NORC) rating system (Reiss, Duncan, Hatt, & North, 1961). For a review of studies that have confirmed the reliability,

stability overtime, and the meaningfulness in American society of the concept of occupational status see Harasmiw, Horne, & Lewis (1977).

Participants were generally well educated with high occupational statuses. The NORC rates occupations according to amount of income, level of education, and social prestige which society places on these occupations. Essentially, the higher the NORC rating, the higher the status. Typical jobs in the HFSC sample fell in the NORC range of 66-73 which include those of administrators, computer programmers, city and county inspectors, bookkeepers, and registered nurses.

Procedure

Participants fell into one of two major groups: On-site or Mail-out. On-sites were participants who completed the full battery of tests in the Follow-Up Study and received $25 for their participation. Their physical presence was necessary to complete the timed cognitive abilities section. Mail-outs were participants who mailed in the completed untimed questionnaire portion. Mail-outs were participants who had geographical or temporal constraints which prevented them from participating in the full battery (2 1/2 to 3 hours of testing). Mail-outs were extended the opportunity to complete the battery by finishing the timed portion, at a later time, and would have received $25 upon completion. Thus, on-sites included participants sitting for the full battery or mail-outs coming in to complete the timed portion.

Stimulus Materials

Personality and environmental questionnaires along with demographic characteristics were selected from the untimed portion of the Follow-Up Study. This portion also included other questionnaires, demographic information, and pregnancy information (if pertinent to the participant). The Eysenck Personality Questionnaire-revised (EPQ-R; Eysenck, Eysenck, & Barrett, 1985) and the Mach V (Robinson & Shaver, 1975) comprised the personality measures. The Sibling Inventory

of Differential Experiences (SIDE; Daniels & Plomin, 1984) and demographic data comprised the environmental measures. The fifteen cognitive measures of the HFSC test battery, from the timed portion of the test, as will be discussed below, comprised the cognitive measures.

Cognitive abilities. The same factors from the HFSC cognitive test battery were used for the present study. The 15 test: Primary Mental Abilities (PMA) vocabulary, visual memory (immediate recall), things (a fluency test), Shepard-Metzler mental rotations, substraction and multiplication, Elithorn Mazes, Educational Testing Service (ETS) word beginnings and endings, ETS card rotations, visual memory (delayed recall), PMA pedigrees (a reasoning test), ETS hidden patterns, Paper form board, ETS number comparisons, Whiteman test of social perception, and Raven's progressive matrices where factored into the unrotated first principle component (a measure of general intelligence), verbal ability, spatial visualization, perceptual speed and accuracy, and visual memory ability.

Personality measures. Eysenck EPQ-R (Eysenck, Eysenck, & Barrett, 1985; see Appendix 2): EPQ-R is a revised version of the Eysenck Personality Questionnaire (EPQ) developed by H. J. Eysenck and Sybil B. J. Eysenck (1975). One hundred items comprise the EPQ-R yes/no questionnaire. Out of these items four scales are derived: Psychoticism (P) scale (32 items), Extroversion (E) scale (23 items),

Neuroticism (N) scale (24 items), and Lie (L) scale (21 items).

Reliabilities for the P scale are 0.78 for males (N=693) and 0.76 for females (N=878) (Eysenck, Eysenck & Barrett, 1985). Reliabilities of E (0.88, N=92 and 0.94, N=27), N (0.84, N=92 and 0.92, N=27), and L are much higher, probably because the P scale taps several different facets. Differing psychoticism dimensions such as hostility, cruelty, lack of empathy, and nonconformity may, when combined, yield lower reliabilities than would be true of a scale such as E which is largely comprised of sociability and activity items (Cattell & Tsujioka, 1964). E is a measure of sociability where the "extrovert" and the "introvert" are regarded as idealized end-points of a continuum to which respondents may approach to a greater or lesser degree. An extrovert is viewed as sociable, likes parties, has many friends, is generally impulsive, tends to be aggressive, generally likes change, and is not always a reliable person. An introvert is viewed as a quiet, retiring, introspective person. An introvert is someone who is reserved and distant except to intimate friends, tends to plan ahead, seldom behaves in an aggressive manner, reliable, somewhat pessimistic and places great value on ethical standards. The Lie scale measures dissimulation or the tendency for a respondent to "fake good." This tendency is particularly marked when the questionnaire is

administered under conditions where such a tendency would seem appropriate (i.e., as part of a job interview).

Mach V (Robinson & Shaver, 1975; see Appendix 3): Christie's Machiavellianism (or Mach V) scale taps the participant's general strategy for dealing with people, and especially feelings about whether other people are manipulable so as to achieve (usually the participant's) desired ends. Twenty items are presented in the forced-choice version of this scale (Mach V). Three statements are presented per item. The participant is asked to first decide which one of the three statements is most true or closest aligned with describing her/his own beliefs by circling a plus (+) in the space provided. Then the participant must decide, from the remaining two statements, which is the most false or is most misaligned from her/his own beliefs, by circling a minus (-) in the space provided. Thus, only two responses can be made per item. Reliabilities for the forced-choice Mach V are in the 0.60's (Robinson & Shaver, 1975). Since social desirability is controlled through the forced choice format, these somewhat lower reliabilities are not totally unexpected.

Points per item depend on the combinations of responses and range from 1 to 7 with 3 and 5 being intermediaries. Summing all the items and adding a constant of 20, to maintain a mean of 100 point, results in a total possible

range of 40-160. Higher scores reflect a higher degree of manipulativeness.

Home environment. SIDE (Daniels & Plomin, 1984; see Appendix 1): The SIDE is designed to assess family environmental influences by asking siblings to compare their environments to that of a sibling. Comparison siblings were predetermined for those families with 3 or more offspring. The determining factor, in deciding on the comparison sibling, was the likelihood of obtaining paired SIDE responses for the agreement and paired-sibling response analyses. Paired-sibling responses are possible only when responses from both siblings in the "pair", each being a respondent at one pairing and a comparison sibling in the other pairing, are obtained.

A 5-point Likert scale, provides quantitative information regarding the amount and direction of sibling differential experience. The SIDE addresses three major areas of experiences: Differential Sibling Interaction, Differential Parental Treatment, and Differential Peer Group Characteristics. Scores are the average of responses from the item combinations. Ownership of characteristics would be reflected in responses that are greater than a score of 3. Scores that are less than 3 would reflect a dimension that is perceived to be more akin to the comparison sibling.

Two scoring procedures were utilized in the investigation of the SIDE: relative and absolute scoring.

Relative scoring maintains the direction of the differential experience by utilizing the actual responses from the questionnaire: range of response 1 to 5; 3=no difference in experience, 1-2=not like me, more like my sibling, 4-5=more like me. Absolute scoring recodes the responses to absolute amounts and disregards the direction of the differential experience. The relative scale is converted to a 3-point absolute scale: a relative score of 3 is recoded as 0 (no difference in sibling experience), relative scores of 2 and 4 are coded as 1 (some difference in sibling experience), and 1 and 5 are coded as 2 (much difference in sibling experience).

Demographic characteristics. Items on this questionnaire included self-reports of education completed (7-point scale ranging from 1 = "less than 8th grade" to 3 = "high school graduate" to 5 = "college graduate" to 7 = "post-graduate degree": converted to years of education), occupational status (National Opinion Research Council (NORC) ratings (Reiss et al., 1961), annual income (6-point scale where 1 = "less than $5000," 2 = "$5001 to $10000," 3 = $10001 to $20000," 4 = "$20001 to $30000," 5 = "$30001 to $40000," and 6 = "more than $40000"), and marital status.

RESULTS

The major goal of the present study is to investigate the power of the SIDE questionnaire as a predictor of educational and occupational attainment level. The responses of 418 participants who completed 80% or more of the items on the environmental questionnaire were factor analyzed, as suggested in the Manual. Techniques of principal component factoring and varimax rotation, as outlined in an article by Daniels and Plomin (1984), failed to replicate the loading pattern of SIDE items on eleven scales in the present sample.

The construction of the SIDE scales involved pilot testing of items from well-known questionnaires on between-family influences (Dibble & Cohen, 1974; Leary, 1957; Loehlin & Nichols, 1976; Schaefer, 1965) worded to compare relative experiences rather than to make absolute judgments of sibling environments over 3 Domains: Sibling Interaction Domain, Parental Treatment Domain, and Peer Characteristics Domain. Given this method of construction, conceptual a priori item groupings were employed to maximize sample size. Thus, the eleven scales were regrouped into seven SIDE measures in the present study as follows: the four scales of the Sibling Interaction Domain were reduced to two measures. The antagonistic aspect of this interaction was represented by combining all the items from the Sibling Antagonism and Sibling Jealousy scales. The closeness dimension was

represented by combining all items from the Sibling Caretaking and Sibling Closeness scales. The 4 scales of the Parental Treatment Domain were regrouped into Parental Affection (Maternal Affection and Paternal Affection scales) and Parental Control (Maternal Control and Paternal Control scales). The remaining three scales/SIDE measures of the Peer Characteristics Domain (Peer Group College Orientation, Peer Group Delinquency, and Peer Group Popularity) were kept intact.

A small proportion (less than 7%) of the 418 cases had not completed all items on individual measures. In these instances mean substitutions were performed. This involved substituting the group mean for those cases that would otherwise have invalid measurements as set forth in the Manual. For the rest of the sample, SIDE measure scores were calculated from their responses.

The overall alpha reliabilities are shown in Table 3. They are quite high (ranging from 0.67 to 0.90), and when considered with the significant low to moderate intercorrelations of the SIDE measures (as shown in Table 4) are supportive of the a priori assumption of the independence of the seven regrouped SIDE measures. Sibling agreement, presented in Table 3, will be discussed later. Further, when alpha reliabilities were performed separately by ethnicities for AJAs and AEAs, these reliabilities were similar in magnitude to those for the full sample. The

reliability range for AJA was 0.65 to 0.90, and 0.64 to 0.89 for AEA (see Table 3).

Table 3

Alpha Reliability and Sibling Agreement for Side Measures

SIDE Measures	Alpha Reliability Overall	AJA	AEA	Sibling Agreement* Overall	AJA	AEA
Differential Sibling Interactions: (DSI)						
Antagonism (AS)	.78	.81	.75	.10	.08	.2 !
Closeness (CS)	.67	.73	.64	-.16@	-.15	-.1 !
Differential Parental Treatment: (DPT)						
Affection (AP)	.68	.65	.70	.01	-.03	.1
Control (CP)	.82	.83	.83	-.03	-.15	.0
Differential Peer Characteristics: (DPC)						
College Orientation (CGP)	.89	.90	.86	-.10	-.11	-.0
Delinquency (DP)	.90	.92	.89	.07	.10	-.0
Popularity (PP)	.82	.85	.80	.01	-.17!	.0
N:	418	179	177	308	140	120
pairs:				154	70	60

Note.SIDE=Sibling Inventory of Differential Experience

!p < 0.05.
@p < 0.01.
#p < 0.001.

*Because of the SIDE's format, negative directionality means agreement.

Table 4

Intercorrelations for SIDE Measures

SIDE Measures	AS	CS	AP	CP	CGP	DP
Differential Sibling Interactions:						
Antagonism (AS)						
Closeness (CS)	-.41#					
Differential Parental Treatment:						
Affection (AP)	-.20#	.05				
Control (CP)	.05	.21#	-.29#			
Differential Peer Characteristics:						
College Orientation (CGP)	-.35#	.30#	.18#	-.11!		
Delinquency (DP)	.30#	-.25#	-.18#	-.21#	-.65#	
Popularity (PP)	.05	.04	-.03	-.02	.17#	.17#

Note.SIDE=Sibling Inventory of Differential Experience

!p < 0.05.
@p < 0.01.
#p < 0.001.

Correlations among the seven measures of SIDE with sex, age, birth order, site, and marital status appear in Table 5. Statistically significant correlations between SIDE measures and age ranged from r=-0.11 to r=0.26 on four of the seven measures. Sibling closeness and parental control were the only two measures that were significantly associated with birth order (r=-0.12). Only sibling closeness showed a significantly greater than chance marital status/SIDE correlation (r=0.15). Neither sex nor site were significantly associated with SIDE scores. Significant sex, age, birth order, site, and marital status correlations were noted for AJA but not for AEA participants, as shown in Table 5a and 5b, respectively. The sporadic occurrences of low correlations of SIDE scores with these variables for the two ethnic groups replicated the data reported on the eleven SIDE scales for the entire sample. This similarity across ethnic groups added support for the use of these seven measures on the present population and will be discussed later.

Table 5

Associations Between SIDE Relative Measures and Sex, Age, Birth Order, Site, and Marital Status

SIDE Measures	Sex[a]	Age	Birth Order[b]	Site[c]	MS[d]
Sibling Interaction:					
Antagonism	-.01	-.11!	.08	.09	-.08
Closeness	-.14	.26@	-.12!	.01	.15@
Parental Treatment:					
Affection	.07	-.06	-.07	-.05	-.02
Control	.04	.18@	-.12!	.03	.05
Peer Characteristics:					
College Orientation	-.03	.08	-.08	-.01	.06
Delinquency	.13	.01	-.05	.01	-.08
Popularity	-.00	-.11!	.02	-.02	-.06

Note.SIDE=Sibling Inventory of Differential Experience N=418.

[a]Sex coded as female(0), male(1)

[b]Birth Order coded as brother(3), sister(4), second brother(5), second sister(6), third brother(7), fourth brother(9)

[c]Site coded as mail-out(0), on-site(1)

[d]MS: Marital status is coded as single(0), married(1)

!p < 0.05.
@p < 0.01.

Table 5a

Associations Between SIDE Relative Measures and Sex, Age, Birth Order, Site, and Marital Status for AJA

SIDE Measures	Sex[a]	Age	Birth Order[b]	Site[c]	MS[d]
Sibling Interaction:					
Antagonism	-.04	-.15!	.12	-.04	-.07
Closeness	-.24@	.39@	-.18!	-.24@	.24@
Parental Treatment:					
Affection	.23@	-.01	-.01	.23!	-.10
Control	-.05	.23@	-.13	-.05	.14
Peer Characteristics:					
College Orientation	-.02	.04	-.06	-.02	.10
Delinquency	.15	-.00	.05	.15	-.07
Popularity	-.01	-.19!	-.19!	.01	-.08

Note.SIDE=Sibling Inventory of Differential Experience N=179.

[a]Sex coded as female(0), male(1)

[b]Birth Order coded as brother(3), sister(4), second brother(5), second sister(6), third brother(7), fourth brother(9)

[c]Site coded as mail-out(0), on-site(1)

[d]MS: Marital status is coded as single(0), married(1)

! $p < .05$.
@ $p < .01$.

Table 5b

Associations Between SIDE Relative Measures and Sex, Age, Birth Order, Site, and Marital Status for AEA

SIDE Measures	Sex[a]	Age	Birth Order[b]	Site[c]	MS[d]
Sibling Interaction:					
Antagonism	.01	-.05	.10	.04	-.06
Closeness	-.08	.13	-.14	.06	.02
Parental Treatment:					
Affection	-.02	-.05	.08	-.13	.02
Control	.13	.12	.05	.06	-.03
Peer Characteristics:					
College Orientation	.06	.12	-.10	-.06	-.00
Delinquency	.07	.06	.01	.06	-.06
Popularity	.01	-.07	.07	.06	-.00

Note.SIDE=Sibling Inventory of Differential Experience N=177.

[a]Sex coded as female(0), male(1)

[b]Birth Order coded as brother(3), sister(4), second brother(5), second sister(6), third brother(7), fourth brother(9)

[c]Site coded as mail-out(0), on-site(1)

[d]MS: Marital status is coded as single(0), married(1)

!p < 0.05.
@p < 0.01.

Descriptive information on SIDE Measures. Means and standard deviations of the relative and absolute SIDE measure scores are listed in Tables 6, 6a, and 6b for the overall population and for AJA and AEA ethnic groups,

respectively. The relative scoring procedure simply uses the actual responses of the siblings in calculating the SIDE measures and maintains the direction of the differential experience: 1-2 represents degrees of "not like me," more like my sibling; 3 represents no difference in experience; and 4-5 represents degrees of "like me," not my sibling. The absolute scoring procedure assess the absolute amount of differential sibling experience which disregards the direction of the differential experience. From the 5-point relative scale the absolute scale is recoded into a 3-point scale. Now the relative scale's 3 is equivalent to a 0 (no difference in experience), 2 and 4 become coded as 1 (some difference in sibling experience, and 1 and 5 are coded as 2 (much difference in sibling experience).

The means across the 7 scales of the absolute scores center around 0.75, 0.77, and 0.73, respectively, for the whole sample and separately for AJA and AEA (a score of 1.00 indicates "a bit of difference") and are discussed later. The means of the relative SIDE measures center around 3.06, 3.09, 3.03 respectively (a score indicating no differential sibling experience), which is to be expected, because scores of 4 and 5 indicate "self more than sibling," and scores of 1 and 2 indicate "sibling more than self." Importantly, the standard deviations range from 0.42 to 0.79, 0.41 to 0.82, 0.43 to 0.81 respectively. These results are congruent with the standard deviations range from 0.4 to 0.9 (n=224 to 382)

reported in the Daniels and Plomin (1985) study. This suggests that siblings in many families perceive their experiences to be quite different from one another.

Japanese-American offspring reported higher absolute SIDE scores means for 4 of the 7 measures than AEA offspring, with a significant mean score difference noted for differential parental control. In this measure, Japanese offspring reported experiencing more parental control in their growing up years than Caucasian offspring. The relative mean score also reflected this difference as Japanese offspring reported to have experienced more parental control than they perceived their sibling to have experienced. Another significant difference between groups was noted for the relative scores on the Sibling Antagonism measure: on the average, Japanese offspring reported more antagonism toward their sibling. Also the standard deviation range is broader for Japanese offspring than for Caucasian offspring. This suggests that, on the average, more diversity in responses are reported by Japanese offspring than Caucasian offspring.

Table 6

Means and Standard Deviations for SIDE Measures

SIDE Measures	Relative scores Mean score	SD	Absolute scores Mean score	SD	N
Differential Sibling Interactions:					
Antagonism	2.97	.50	.82	.33	418
Closeness	3.05	.56	.84	.38	418
Differential Parental Treatment:					
Affection	3.07	.42	.54	.39	418
Control	3.10	.61	.59	.46	418
Differential Peer Characteristics:					
College Orientation	3.10	.69	.77	.40	418
Delinquency	3.10	.78	.87	.40	418
Popularity	3.00	.79	.83	.44	418
Overall average	3.00	.62	.75	.40	418

Note.SIDE=Sibling Inventory of Differential Experience

Table 6a

Means and Standard Deviations for AJA SIDE Measures

SIDE Measures	Relative scores Mean score	SD	Absolute scores Mean score	SD	N
Differential Sibling Interactions:					
Antagonism	3.03*	.51	.82	.33	179
Closeness	3.07	.60	.86	.39	179
Differential Parental Treatment:					
Affection	3.05	.41	.54	.39	179
Control	3.15	.67	.67*	.46	179
Differential Peer Characteristics:					
College Orientation	3.11	.73	.78	.40	179
Delinquency	3.12	.81	.88	.42	179
Popularity	3.08	.82	.85	.46	179
Overall average	3.09	.65	.77	.41	179

Note.SIDE=Sibling Inventory of Differential Experience

*Significant difference ($p < 0.05$) between AJA and AEA ethnic groups as determined through t-test analysis.

Table 6b

Means and Standard Deviations for AEA SIDE Measures

SIDE Measures	Relative scores Mean score	SD	Absolute scores Mean score	SD	N
Differential Sibling Interactions:					
Antagonism	2.89*	.48	.82	.35	177
Closeness	3.04	.54	.83	.39	177
Differential Parental Treatment:					
Affection	3.07	.43	.53	.39	177
Control	3.04	.57	.52*	.44	177
Differential Peer Characteristics:					
College Orientation	3.12	.63	.75	.38	177
Delinquency	3.08	.81	.90	.41	177
Popularity	2.95	.75	.80	.44	177
Overall average	3.03	.60	.73	.62	177

Note.SIDE=Sibling Inventory of Differential Experience

*Significant difference ($p < 0.05$) between AJA and AEA ethnic groups as determined through t-test analysis.

Sibling agreement for SIDE Measures. Sibling agreement on the SIDE measures is low for the 154 total, 70 AJA, and 60 AEA pairs in which both siblings completed the questionnaire (see Table 3). Because relative scoring was employed, negative correlations on the SIDE measures indicate that siblings are in agreement regarding their perceptions. For instance, if one sibling feels that the other sibling has been more antagonistic, by reporting scores of 1 or 2, the corresponding sibling is also likely to agree with that feeling, by reporting scores of 4 or 5. The median correlation between sibling perceptions of differential experience on the SIDE is 0.01, with agreement on only a few scales reaching statistical significance. In this instance the present study fails to replicate the results from the 1985 article by Daniels and Plomin, who report statistically significant levels of agreement on nearly all the scales.

One reason for this discrepancy might be that the average age of the groups differ. The present study is an older sample (mean age of 31 years) compared to Daniels and Plomin's study (mean age of 18.1 years). One might suspect that with retrospective reporting, the older one gets the more confounded the responses become. But when reflecting back over the growing up period, a 31-year old's response, tempered by a set personality (Kelly, 1955) rather than clouded by emotional turmoil embroiled between 2 adolescent

siblings, should have proved to be a more accurate assessment. A factor that was not considered and may have an effect is the degree of contact between siblings after they reach adulthood. Rose et al. (1990) found that closer contact between adult twins tends to increase similarity, and for purposes of this study may have had an influence on sibling agreement. Another important reason for poor agreement among participants is the heterogeneity of the present sample. The sample that the SIDE was originally tested on was a middle class Caucasian sample. The present sample is a mixture of middle to upper-middle class Caucasian and Asian ethnic groups. Results of the SIDE, when factor analyzed, yielded many ambiguous loadings. While this lack of agreement might be caused by the heterogeneity of the present population, it also brings up the question of what differences are actually being measured. Are these perceptions a result of within-family differences, as claimed by Daniels and Plomin, or a result of something else (i.e., some external influence). The findings from the agreement analysis suggest that these differences may not be a result of within-family differences. This notion of subjective differences in perceptions of the same event will be investigated later, using the difference scores.

Amount of Differential Sibling Experience

The focus of the SIDE is in assessing differential experiences of siblings with each other, with parents, and with peers. In assessing the amount of differential sibling experience, the absolute scores on SIDE items were analyzed. As in the Daniels and Plomin study, analyses began at the item level and were averaged over the SIDE items in each category to determine the percentage of siblings who reported similar or different experiences.

Table 7 shows that for the 24 differential sibling interaction items, 31.3% of the participants (on the average) report mutuality of experience, 54.6% report "a bit" of difference, and 14.1% report much difference. Averaging over the eighteen differential parental treatment items, 53.9% of the participants report similar parental treatment, 35.7% "a bit" of difference, and 10.4% report much difference. For the 26 differential peer characteristics items, 35.2% report similar peer group characteristics, 48.3% have peer groups that are "a bit" different, and 16.5% have peer groups that are much different. These results were similar to those reported by Daniels and Plomin (1985). While they would claim that each domain of the proposed differential experience is indeed a within-family environmental influence, since 46% to 69% of the sample report that their experiences over all categories differ to some extent from their siblings' experiences, an

investigation into this will be forthcoming. Of particular interest was the reporting of more similarity for Parental Treatment than for the other categories of differential experience. This would suggest that parents try to treat their children as equally as possible, despite any existing differences.

Table 7

Item Analysis of Sibling Responses of Experiences in the SIDE Categories

	Perceived Experiences		
Domain	Mutuality	"a bit" of difference	Much difference
DSI (24 items)	31.3%	54.6%	14.1%
DPT (18 items)	53.9%	35.7%	10.4%
DPC (26 items)	35.2%	48.3%	16.5%

Note. N=418

DSI: Differential Sibling Interaction
DPT: Differential Parental Treatment
DPC: Differential Peer Characteristics

The item analysis of SIDE scores, from Table 7, are consistent with the results reported in Table 6. Means of the absolute scores (0 = no difference in sibling experiences, 1 = "a bit" of difference in sibling experiences, 2 = much difference in sibling experiences) are 0.83, 0.57, and 0.83 for the Sibling Interaction, Parental Treatment, and Peer Characteristics, respectively. In accord with the data presented for relative and absolute SIDE scores, the results from the item analysis suggest that Sibling Interaction and Peer Group Characteristics are more

influential sources of differential experience than is Parental Treatment. For all the measures, the standard deviations indicate considerable variability in differential sibling experience, suggesting that siblings in some families share similar environments, whereas siblings in other families perceive their environments to be quite different.

Origins of Differential Sibling Experience

Table 8 shows mean scores and standard deviations based on absolute scoring of the SIDE measures for same-sex sibling pairs and opposite-sex sibling pairs. Opposite-sex siblings perceived significantly more differential experience than do same-sex pairs for only the Parental Affection Treatment scale. In general, however, same-sex and opposite-sex siblings reported differential experiences to the same extent; thus, sex seems to have little effect on the amount of these perceived differences.

Table 8

Means and Standard Deviations for Same-Sex and Opposite-Sex Pairs on SIDE Absolute Measures

	PAIRS					
	Same-Sex			Opposite-Sex		
SIDE Measures	Mean score	SD	N	Mean score	SD	N
Differential Sibling Interactions:						
Antagonism	.83	.33	152	.83	.36	156
Closeness	.83	.40	152	.87	.40	156
Differential Parental Treatment:						
Affection	.45	.39	152	.62@	.39	156
Control	.59	.46	152	.63	.47	156
Differential Peer Characteristics:						
College Orientation	.77	.40	152	.76	.38	156
Delinquency	.85	.40	152	.90	.40	156
Popularity	.86	.46	152	.81	.44	156

Note. SIDE=Sibling Inventory of Differential Experience

@Significant difference ($p < .01$) between same-sex and opposite-sex pairs as determined through t-test analysis.

Table 8a

Means and Standard Deviations for Same-Sex and Opposite-Sex Pairs on AJA SIDE Absolute Measures

SIDE Measures	PAIRS: Same-Sex Mean score	SD	N	Opposite-Sex Mean score	SD	N
Differential Sibling Interactions:						
Antagonism	.83	.35	72	.84	.34	68
Closeness	.85	.43	72	.89	.40	68
Differential Parental Treatment:						
Affection	.47	.38	72	.62@	.40	68
Control	.70	.48	72	.67	.45	68
Differential Peer Characteristics:						
College Orientation	.81	.44	72	.74	.39	68
Delinquency	.87	.45	72	.89	.40	68
Popularity	.89	.49	72	.82	.46	68

Note. SIDE=Sibling Inventory of Differential Experience

@Significant difference ($p < .01$) between same-sex and opposite-sex pairs as determined through t-test analysis.

Table 8b

Means and Standard Deviations for Same-Sex and Opposite-Sex Pairs on AEA SIDE Absolute Measures

	PAIRS					
	Same-Sex			Opposite-Sex		
SIDE Measures	Mean score	SD	N	Mean score	SD	N
Differential Sibling Interactions:						
Antagonism	.80	.32	54	.82	.37	66
Closeness	.81	.37	54	.89	.42	66
Differential Parental Treatment:						
Affection	.41	.32	54	.60@	.37	66
Control	.46	.46	54	.57	.48	66
Differential Peer Characteristics:						
College Orientation	.69	.35	54	.78	.35	66
Delinquency	.85	.38	54	.95	.41	66
Popularity	.78	.45	54	.81	.44	66

Note.SIDE=Sibling Inventory of Differential Experience

@Significant difference ($p < .01$) between same-sex and opposite-sex pairs as determined through t-test analysis.

In the domain of differential parental treatment, older siblings reported that they were more likely to feel that they experienced more parental control than their younger siblings (age, r=.18). Another slight but significant age correlation emerged for Differential Peer Popularity; younger siblings reported that they were more likely to belong to a popular peer group (age, r=-.11).

Correlations of Predictor Variables with Attainment

The Pearson product moment correlation coefficient procedure, using a two-tailed test of significance, created a matrix of correlations among the variables as shown in Tables 9, 9a, and 9b for the entire sample. SIDE scores derived from the relative scoring procedures were used in the matrix. A limitation of correlation coefficients with large numbers of correlations is that a certain proportion (5%) of the significant correlations would be expected to occur by chance. Five percent computes to a probability of there being 8 spurious correlations in a correlation matrix of 16 variables. But with 70 observed significant correlations, most of these significant at the 0.01 or 0.001 level, few would be expected to occur by chance. However, some correlations are not independent of each other, because many of the scores have been derived from a global index of measurement. For instance, the first principal component or general intelligence (FPCTP/FCOGFPC) is a linear combination of VFACTP/FCOGVRB, SPFACTP/FCOGSPT, PSFACTP/FCOGPSP, and

MEMFACTP/FCOGMEM. Significant correlations between them were expected and, as shown in Table 9, 9a, and 9b were obtained. The decision to use the first principal component as a measure of cognitive abilities of parents and offspring was supported by the high correlations of the first principal component with the 4 other factors.

Parental influences derived from the original HFSC included father's occupational attainment (NORCF), mid-parent educational attainment (EDUCP), midparent scores on the battery of 15 cognitive tests which loaded on four factors: verbal ability (VFACTP), spatial ability (SPFACTP), perceptual speed and accuracy (PSFACTP), visual memory (MEMFACTP), and the first principal component (FPCTP).

Offspring cognitive abilities and attributes gathered from the Follow-Up study: verbal ability (FCOGVRB), spatial ability (FCOGSPT), perceptual speed and accuracy (FCOGPSP), visual memory (FCOGMEM), and the first principal component (FCOGFPC), and personality measures: Eysenck Personality Questionnaire-Revised (EPQ-R); extraversion-introversion scale (EPQEXT), neuroticism scale (EPQNEU), psychoticism scale (EPQPSY), lie scale (EPQLIE); and Mach V Attitude Inventory (MACHV) were included.

Finally, the Sibling Inventory of Differential Experience (SIDE) relative scores were entered as an "environmental" measure. The measures were: differential sibling antagonism (AS), differential sibling closeness

(CS), differential parental affection (AP), differential parental closeness (CP), differential peer group orientation toward college (CGP), differential peer group delinquency (DP), and differential peer group popularity (PP). The significant intracorrelations of EPQ-R and SIDE were expected and observed, and supported the utilization of these measures in the predictive model of attainment.

Correlations were computed between and among the predictors and social attainment levels in order to determine which of the predictors were most strongly related to offspring attainment. Attainment levels are based on level of school progression (years of schooling or degrees earned (FEDUC)) and NORC occupational status (Reiss et al., 1961) (FNORC).

Correlations between social attainment and predictor variables are shown in Table 10. Results replicated earlier findings of Nagoshi et al. (1986) which were based on parental reports when offspring were at least 3 years younger. Results from this subset, of the same cohort, suggested that family background had a relatively trivial influence and that own cognitive abilities (particularly verbal and general intelligence) and own personality had some influence on educational attainment. In the present study, however, predictor variables had a lesser influence on occupational attainment. Own verbal factor (r=.38)

Table 9

Significant Correlations of Predictor Variables

	NORCF	EDUCP	FPCTP	VFACTP	SPFACTP	PSFACTP	MEMFACTP
NORCF							
EDUCP	.21#						
FPCTP		.41#					
VFACTP		.44#	.66#				
SPFACTP		.15@	.62#				
PSFACTP			.24#	-.21#			
MEMFACTP			.39#	.11!			
FCOGFPC			.24#		.14!	.18@	
FCOGVRB		.22#	.19^	.34#			
FCOGSPT			.16!		.34#		
FCOGPSP		-.21#				.29#	
FCOGMEM							
EPQEXT							
EPQNEU							
EPQPSY							
EPQLIE							
MACHV							
AS							
CS							
AP							
CP							
CGP						.15@	
DP							
PP							

Note: see text for definitions of labels

! p < 0.05
@ p < 0.01
^ p < 0.005
# p < 0.001

Table 9a

Significant Correlations continued

	FCOGFPC	FCOGVRB	FCOGSPT	FCOGPSP	FCOGMEM	EPQEXT	EPQNEU
FCOGVRB	.56#						
FCOGSPT	.65#						
FCOGPSP	.39#						
FCOGMEM	.34#						
EPQEXT	-.17@	-.14!		-.14!	.13!		
EPQNEU			-.23#	.20#		-.22#	
EPQPSY				-.12!	-.17^	.12!	
EPQLIE		-.13!				-.13@	
MACHV							.12!
AS							
CS		.13!					
AP		.13!					
CP							
CGP		.13!	.19^	.19^			
DP		-.13!					
PP						.36#	-.12!

! p < 0.05
@ p < 0.01
^ p < 0.005
# p < 0.001

Table 9b

Significant Correlations continued

	EPQPSY	EPQLIE	MACHV	AS	CS	AP	CP	CGP	DP
EPQLIE	-.24#								
MACHV	.18#	-.21#							
AS	.12#	-.12!							
CS			-.41#						
AP	-.11!		-.20#						
CP	.11!			.21#	-.29#				
CGP	-.14^		-.35#	.30#	.18#	-.11!			
DP		-.13!	.30#	-.25#	-.18#	.21#	-.65#		
PP							.10#	.17#	

! p < 0.05
@ p < 0.01
^ p < 0.005
# p < 0.001

correlated strongest with educational attainment followed by own first principal component (r=.35), differential peer group orientation toward college (r=.20), and own perceptual speed (r=.19). The highest correlation with occupational attainment was with own educational attainment (r=.20) followed by own perceptual speed (r=.19), own first principal component (r=.16), and EPQ-R extraversion-introversion (r=.12).

Correlations of the predictor variables with age, sex, birth order, marital status, and site are shown in Table 11. Five significant correlations with age were found, ranging from -.11 to .26. The correlations between cognitive abilities and age were not sufficiently noteworthy for age correction conversions. Likewise, birth order, marital status, and site correlation matrices did not yield sufficient significant correlations to warrant separate analyses. However, the correlations of sex with scores showed that the women, in this sample, scored higher on verbal ability, perceptual speed and accuracy, visual memory and level of internal control than men.

Table 10

Correlations of predictor variables with educational attainment for the whole sample

Predictor Variables		Attainment	
		Educational	Occupational
FEDUC	(N=418)		.20#
NORCF	(n=372)	.07	.04
EDUCP	(n=366)	.15@	.03
FPCTP	(n=341)	.01	.02
VFACTP	(n=341)	-.05	-.05
SPFACTP	(n=341)	.00	.03
PSFACTP	(n=341)	.10	.11!
MEMFACTP	(n=341)	-.00	-.03
FCOGFPC	(n=271)	.35@	.16@
FCOGVRB	(n=271)	.38@	.07
FCOGSPT	(n=271)	.09	.06
FCOGPSP	(n=271)	.19@	.19@
FCOGMEM	(n=271)	-.01	.00
EPQEXT	(n=412)	-.07	-.12!
EPQNEU	(n=415)	-.07	.01
EPQPSY	(n=413)	-.17@	-.09
EPQLIE	(n=418)	.00	.09
MACHV	(n=376)	-.03	-.11!
AS	(n=418)	-.03	-.02
CS	(n=418)	.11!	.10!
AP	(n=418)	.11!	.07
CP	(n=418)	.00	.03
CGP	(n=418)	.20@	.10!
DP	(n=418)	-.12!	.00
PP	(n=418)	.05	-.03

!p < 0.05
@p < 0.01
#p < 0.001

Table 11

Significant Correlations of Predictor Variables with Age, Sex, Birth Order, Marital Status, and Site

Variables		Age	Sex[a]	Birth Order[b]	Marital Status[c]	Site[d]
FEDUC	(n=418)					-.12!
NORCF	(n=372)					
EDUCP	(n=366)					
FPCTP	(n=341)					-.18@
VFACTP	(n=341)					-.18@
SPFACTP	(n=341)					
PSFACTP	(n=341)					
MEMFACTP	(n=341)					-.12!
FCOGFPC	(n=271)					
FCOGVRB	(n=271)	.23#	-.18@			
FCOGSPT	(n=271)	-.16@	.34#	-.16@		
FCOGPSP	(n=271)	-.12!	-.36#		.14!	
FCOGMEM	(n=271)		-.14!			
EPQEXT	(n=412)	-.12!				
EPQNEU	(n=415)		-.27#	.10!		
EPQPSY	(n=413)		.20#		-.20#	
EPQLIE	(n=418)		-.15@			
MACHV	(n=376)		.12!			
AS	(n=418)	-.11!				
CS	(n=418)	.26#	-.14@	-.12!	.15@	
AP	(n=418)					
CP	(n=418)	.18#		-.12!		
CGP	(n=418)					
DP	(n=418)		.13@			
PP	(n=418)					

[a]Sex coded as female(0), male(1)

[b]Birth Order coded as brother(3), sister(4), second brother(5), second sister(6), third brother(7), fourth brother(9)

[c]Marital status is coded as single(0), married(1)

[d]Site coded as mail-out(0), on-site(1)

!p < 0.05
@p < 0.01
#p < 0.001

As shown in Table 12, Japanese offspring had a significantly higher mean educational attainment level than did Caucasian offspring. While no significant sex differences nor significant interactions in mean attainment levels were found, findings concerning gender differences are supported by the Nagoshi et al. (1986) and Johnson, Nagoshi and Honbo (in press) studies. Both studies found own abilities were more important predictors of the attainment of men than women.

As shown in Table 13 and 13a, a similar correlation pattern between educational attainment and predictor variables was observed for both Japanese and Caucasian offspring. Own verbal factor scores followed by own first principal component score were the best predictors. While mid-parent educational attainment score followed next for Japanese offspring, own perceptual speed score followed for the Caucasian offspring.

Similar ethnic group differences were also reported by Nagoshi et al. (1986). The fourth and least strongest significant correlation with educational attainment for both Japanese and Caucasian offspring was differential peer group orientation toward college. These correlations also supported the utilization of the first principal component as the measure of cognitive ability over the 4 individual factors. Recall that the first principal component is the

Table 12

Analysis of Variance of Educational Attainment Scores: Effects of Ethnicity, Sex, and Ethnicity x Sex

Source	df	SS	MS	F	Sig. of F
Main Effect	2	18.015	9.007	6.987	.001
Sex	1	.168	.168	.130	.719
Ethnicity	1	17.885	17.885	13.873	.000
Two-way Interactions	1	.585	.585	.454	.501
Sex by ethnicity	1	.585	.585	.454	.501
Explained	3	18.600	6.200	4.809	.003
Residual	352	453.805	1.289		
Total	352	472.404	1.331		

Variables and categories	Educational Attainment n	Mean
Sex:		
0 (female)	189	5.16
1 (male)	167	5.13
Ethnicity:		
0 (Japanese)	179	5.37
female	94	5.35
male	85	5.39
1 (Caucasian)	177	4.92
female	95	4.98
male	82	4.85

linear combination of the 4 factors and is regarded as a measure of general intelligence. In summary, the results presented indicate that there are at least some ethnic group effects on variables influencing sibling educational attainment levels. Thus, ethnic differences were investigated in the hierarchical multiple regression model for educational attainment along with post hoc tests for the gender differences found in past studies.

Table 13

Correlations of Predictor Variables with Educational Attainment by Ethnicity

Dependent Variable: Educational Attainment

Predictor Variables	Japanese	Caucasian	Chinese
NORCF	.09 (n=150)	-.00 (n=163)	.30 (n=50)
EDUCP	.23@ (n=149)	.13 (n=160)	.38@ (n=48)
FPCTP	.08 (n=128)	.05 (n=162)	.13 (n=42)
VFACTP	.06 (n=128)	.02 (n=162)	.33! (n=42)
SPFACTP	.02 (n=128)	.03 (n=162)	-.15 (n=42)
PSFACTP	.06 (n=128)	.02 (n=162)	.13 (n=42)
MEMFACTP	.04 (n=128)	.05 (n=162)	-.01 (n=42)
FCOGFPC	.40@ (n=127)	.34@ (n=99)	.17 (n=41)
FCOGVRB	.41@ (n=127)	.44@ (n=99)	.33! (n=41)
FCOGSPT	.16 (n=127)	.03 (n=99)	-.13 (n=41)
FCOGPSP	-.02 (n=127)	.26@ (n=99)	.30 (n=41)
FCOGMEM	.17 (n=127)	-.05 (n=99)	-.24 (n=41)
EPQEXT	-.06 (n=175)	-.04 (n=175)	-.15 (n=53)
EPQNEU	-.16 (n=176)	-.07 (n=177)	.11 (n=53)
EPQPSY	-.18! (n=178)	-.16 (n=174)	-.14 (n=52)
EPQLIE	.03 (n=179)	-.04 (n=177)	.06 (n=53)
MACHV	.02 (n=164)	-.09 (n=153)	-.11 (n=51)

Table 13a

Correlations of Predictor Variables with Educational Attainment by Ethnicity Continued

Dependent Variable: Educational Attainment

Predictor Variables	Japanese	Caucasian	Chinese
AS	-.05 (n=179)	-.07 (n=177)	.05 (n=53)
CS	.08 (n=179)	.10 (n=177)	.20 (n=53)
AP	.13 (n=179)	.14 (n=177)	.04 (n=53)
CP	.02 (n=179)	-.10 (n=177)	.17 (n=53)
CGP	.19@ (n=179)	.24@ (n=177)	.05 (n=53)
DP	-.16! (n=179)	-.09 (n=177)	-.04 (n=53)
PP	.08 (n=179)	.01 (n=177)	-.13 (n=53)

!p < 0.05
@p < 0.01

Subgroup Demographics

Two hundred and two valid individual offspring cases were utilized in the regression analyses, because they had provided sufficient information on the variables of interest. In this subgroup the majority of the subjects (84%) were Japanese or Caucasian (Table 14), as was the case for the larger sample. Eighty-eight (43.6%) were AJA, 81 (40.1%) were AEA, 29 (14.4%) were ACA, and 4 (2.0%) were Hapa. Likewise, the sex distribution with 105 or 52% females and 97 or 48% males was similar to the primary sample. The mean age was 31.3 years, with most having a

college degree, and an average NORC score of 67.1 (a level of an optician, medical assistant, person in sales-retail).

Table 14

Demographics of the Subgroups

Ethnicity	N	Group %	Age (in yrs.)	Attainment Educational	Attainment Occupational
AJA	88	43.6%	30.3	5.4	67.3
AEA	81	40.1%	32.5	4.9	66.2
ACA	29	14.4%	31.2	5.3	68.2
Hapa	4	2.0%	30.0	4.2	71.2
TOTAL	202	100%	31.3	5.2	67.1

Note.Hapa=Americans of Eurasian Ancestry

Regression Analyses

To study the effects of differences in perceived environments sibling's educational attainment, personality, and SIDE scores were converted into difference scores. The small number of sibling pairs with complete cognition data precluded the use of cognitive ability scores and separate ethnic group analyses. Difference scores were derived by subtracting the scores of one sibling from the corresponding sibling, in order to quantify the discrepancies within that pair. One of three possible sibling combinations occurred, sister-sister, sister-brother, and brother-brother pairs. Each sibling received two sets of converted scores, relative difference scores which retained the direction of the converted score and absolute difference scores which were directionless (by taking absolute values). Five personality

and 7 SIDE difference scores were entered as two blocks into the hierarchical regression equation computing the amount of explained variance accounted for in predicting difference in educational attainment level. Both relative and absolute difference scores failed to reach significance for any sibling pair, sister-sister, sister-brother, and brother-brother pairs, in predicting differences in educational attainment. These findings, combined with the earlier observed lack of agreement on the SIDE measures between sibling pairs, strongly suggest that the SIDE assesses perceptions of sibling environmental differences rather than actual within family (paired sibling) environmental differences. As reflected in the lack of sibling agreement, the SIDE is more of that sibling's own perception of a common situation rather than the actuality of the situation. Therefore, further analyses involved individual offspring responses rather than paired sibling responses.

Hierarchical Regression Analysis

The effects of perceived differential environmental influences on attainment levels were studied via hierarchical multiple regression analysis procedures were performed with parental variables entered first, followed by own cognitive ability and personality variables, and lastly, the relative SIDE measures, as predictors of educational attainment level. Recall that the relative scoring procedure simply uses the actual responses of the siblings

in calculating the SIDE measures and maintains the direction of the differential experience.

The major question to be answered by the analyses was to establish the extent to which participant's attainment level can be predicted by the combination of parental attributes, own cognitive ability and personality, and environmental variables. A multiple regression equation was run using an a priori ordering of predictor variables based on logical assumptions about the nature of the relationship among them. Parental variables that had an enduring effect on offspring intelligence were entered first as a block: these were father's occupational attainment (NORCF), mid-parent educational attainment (EDUCP), and mid-parent cognitive ability (FPCTP) scores, since they reflect genetic and long term environmental influences on offspring intelligence. In the second step, participant's own cognitive ability (FCOGFPC) was entered. Thirdly, personality scores (EPQEXT, EPQNEU, EPQPSY, EPQLIE, and MACHV) were entered as a block. In the fourth step, the interest was in the influence of the environmental variables over and above that of all the other variables; the SIDE measures were entered in the final step by hierarchical multiple regression to determine their predictive power on participant attainment levels.

The result of this model performed on participants with complete data on the variables of interest (202

participants) is presented in Table 15. (Out of the 418 participants, 216 were not available to complete the Follow-Up cognitive battery.) The results indicate that about 27% of the explained variance in offspring educational attainment level was accounted for by the linear combination of these variables. Parental variables did not account for a significant amount of explained variance. Own cognitive ability, over and above parental influence, accounted for about 12% of the explained variance in educational attainment levels. Personality significantly accounted for about 5% more of the variance than parental and own cognitive ability. The SIDE measures accounted for about 8% more variance than parental attributes and own cognitive ability and personality.

Table 15

Educational Attainment as Predicted from Family Background, Cognitive Ability, Personality Scores and SIDE Measures (N=202)

Component	Beta*	Multiple R	R^2 Change	F Change	F	DF
Father's occupation	.07					
Mid-parent education	.27^					
Parental first principal component	-.19!	.15	.02	1.56	1.56	4,198
Own first principal component	.31&	.37	.12	26.74&	8.01&	4,197
EPQEXT	-.03					
EPQNEU	-.05					
EPQPSY	-.21#					
EPQLIE	-.06					
MACHV	-.03	.43	.05	2.25!	4.92&	9,192
Sibling Antagonism	.17!					
Sibling Closeness	.01					
Parental Affection	.06					
Parental Control	.09					
Peer Group:						
College Orientation	.27#					
Delinquency	.02					
Popularity	.07	.52	.08	3.03#	4.30&	16,185

*Beta for final equation.

!p<0.05
@p<0.01
#p<0.005
$p<0.001
&p<0.0001

The significant predictors for the multiple regression analysis of the combined subsamples are presented in Table 15. The two significant parental predictors were mid-parent education level, which positively predicted attainment level, and mid-parent cognitive ability which negatively

predicted attainment level. Own cognitive ability also contributed positively, while EPQ-R psychoticism negatively predicted attainment levels. Of the SIDE measures, peer group orientation towards college and sibling antagonism contributed significantly as positive predictors. Because the overall hierarchial multiple regression model was significant, further analyses were done to determine if ethnic differences in influences on educational attainment exist.

The results of the predictive equation for 88 Japanese offspring are presented in Table 16. The results indicate that about 40% of the explained variance in Japanese offspring attainment levels was accounted for by the model. Parental background accounted for about 12%, own cognitive ability accounted for about 8% more, and personality scores accounted for about 6% of the explained variance in attainment levels after parental variables and own cognitive abilities were accounted for. The SIDE measures accounted for about 14% of the explained variance after parental and own cognitive ability and personality variables.

Table 16

Japanese Offspring Educational Attainment as Predicted from Family Background, Cognitive Ability, Personality Scores and SIDE Measures (N=88)

Component	Beta*	Multiple R	R^2 Change	F Change	F	DF
Father's occupation	.07					
Mid-parent education	.46&					
Parental first principal component	-.30!	.34	.12	3.73!	3.73!	3,84
Own first principal component	.25!	.44	.08	8.21@	5.10!	4,83
EPQEXT	.02					
EPQNEU	-.14					
EPQPSY	-.13					
EPQLIE	-.07					
MACHV	-.04	.51	.06	1.32	3.04#	9,78
Sibling Antagonism	.09					
Sibling Closeness	-.25!					
Parental Affection	.01					
Parental Control	.18					
Peer Group:						
College Orientation	.23					
Delinquency	-.17					
Popularity	.03	.63	.14	2.35!	2.94$	16,71

*Beta for final equation.

!p<0.05
@p<0.01
#p<0.005
$p<0.001
&p<0.0001

Mid-parent educational attainment and own cognitive ability positively predicted educational attainment. The mid-parent cognitive ability factor negatively predicted attainment. Of the relative SIDE measures, differential sibling closeness negatively predicted educational

attainment. The model predicts Japanese offspring who score higher on own cognitive abilities, have parents with higher educational attainment levels, and who report less sibling closeness would have higher educational attainment levels. The negative correlation of parental cognitive abilities with offspring educational attainment comes as little surprise. This negative relationship is consistent with other findings that reported negative correlations of attainment levels with parental cognitive abilities for Japanese living in Hawaii (Nagoshi et al. 1986; Johnson et al. 1983). For the parents of the present participants, the Johnson et al. study suggests that a strong commitment to education as a vehicle for upward mobility may account for the observed inverse relationship between attainment and cognitive ability. Alternatively, parents of lower ability but higher attainment may provide a model for better use of one's time and abilities. This relationship also highlights the need for identifying and measuring the "factor" which affects attainment.

The results shown in Table 17 indicate that the model accounted for about 34% of the explained variance in 81 Caucasian offspring attainment levels. Participant's own cognitive ability accounted for about 13% and personality factors accounted for about 11% of the explained variance over and above preceding influences, while the SIDE measures added about 10% to the explained variance.

Table 17

Caucasian Offspring Educational Attainment as Predicted from Family Background, Cognitive Ability, Personality Scores and SIDE Measures (N=81)

Component	Beta*	Multiple R	R^2 Change	F Change	F	DF
Father's occupation	.05					
Mid-parent education	.12					
Parental first principal component	.02	.08	.01	0.16	0.16	3,77
Own first principal component	.30!	.38	.13	11.91$	3.11!	4,76
EPQEXT	.05					
EPQNEU	-.04					
EPQPSY	-.41#					
EPQLIE	-.09					
MACHV	.01	.50	.11	2.01	2.59!	9,71
Sibling Antagonism	.01					
Sibling Closeness	-.06					
Parental Affection	-.10					
Parental Control	-.12					
Peer Group:						
College Orientation	.35!					
Delinquency	.32!					
Popularity	.03	.59	.10	1.36	2.10!	16,64

*Beta for final equation.

!p<0.05
@p<0.01
#p<0.005
$p<0.001
&p<0.0001

Predictors shown in Table 17 are own cognitive ability, EPQ-R psychoticism (negatively), differential peer group orientation toward college, and differential peer group delinquency. The model predicts that Caucasian offspring

who score higher on cognitive abilities, are less troublesome, and report having delinquent and college oriented peers would achieve higher educational levels.

Post hoc gender comparisons were performed on the gender groups and are presented in Table 18 and 19. These results replicate the findings reported by Nagoshi et al. (1986) that family background was a greater influence than own cognitive ability on female educational attainment, while own ability was of greater significance for male attainment. In the present study personality and SIDE measures also contributed significantly in accounting for the variance in educational attainment.

For 105 adult females about 39% of the explained variance in educational attainment was accounted for by the model. As shown in Table 18, each block significantly contributed in accounting for the explained variance in attainment. About 9% of the variance was accounted for by family background, about 6% more was accounted for by own cognitive ability, and about 11% of the variance was accounted for by personality over and above the preceding influences. The SIDE measures accounted for about 13%, the largest amount of the explained variance. The model predicts that females who have parents that attain higher educational levels, and who themselves are less anxious, less troublesome, and more assertive, report more antagonism toward their sibling and report associating with college

oriented peers would achieve higher educational attainment levels.

Table 18

Female Educational Attainment as Predicted from Family Background, Cognitive Ability, Personality Scores and SIDE Measures (N=105)

Component	Beta*	Multiple R	R^2 Change	F Change	F	DF
Father's occupation	.17					
Mid-parent education	.30@					
Parental first principal component	-.10	.29	.09	3.16!	3.16!	3,101
Own first principal component	.19	.38	.06	7.22@	4.32#	4,100
EPQEXT	.05					
EPQNEU	-.20!					
EPQPSY	-.25!					
EPQLIE	-.10					
MACHV	.25@	.51	.11	2.83!	3.67$	9,95
Sibling Antagonism	.25@					
Sibling Closeness	-.07					
Parental Affection	-.02					
Parental Control	-.01					
Peer Group:						
College Orientation	.37@					
Delinquency	.09					
Popularity	.06	.63	.13	2.79!	3.55&	16,88

*Beta for final equation.

!p<0.05
@p<0.01
#p<0.005
$p<0.001
&p<0.0001

About 44% of the explained variance of male educational attainment was accounted for by the model, as shown in Table

19. For 97 adult males about 16% of the explained variance was accounted for by own cognitive ability over family background. Significant contributions were also observed for personality, which accounted for about 17% more variance, and SIDE measures contributed about 10% over the preceding influences. The model predicts that males who have parents with higher educational attainment levels, higher own cognitive abilities and are less assertive would have higher educational attainment levels.

To study the effects of perceived differential environmental influences on occupational attainment levels, similar hierarchical multiple regression analysis procedures were employed for occupational attainment as were utilized with educational attainment. The difference were that educational attainment was incorporated into the occupational attainment model as the first step. Thus, the occupational attainment model had one more step added in than did the educational attainment model. The variables, however, did not significantly account for the explained variance in occupational attainment for the total sample nor in individual subsample analyses. This lack of significance was expected, as low correlational relationships between predictor variables and occupational attainment had been previously observed. Another factor that may account for

Table 19

Male Educational Attainment as Predicted from Family Background, Cognitive Ability, Personality Scores and SIDE Measures (N=97)

Component	Beta*	Multiple R	R^2 Change	F Change	F	DF
Father's occupation	-.04					
Mid-parent education	.26!					
Parental first principal component	-.24!	.11	.01	0.38	0.38	3,93
Own first principal component	.48&	.41	.16	17.55&	4.72#	4,92
EPQEXT	-.13					
EPQNEU	.05					
EPQPSY	-.14					
EPQLIE	8.415E-05					
MACHV	-.35$	.59	.17	4.57#	5.05&	9,87
Sibling Antagonism	.08					
Sibling Closeness	.06					
Parental Affection	.06					
Parental Control	.18					
Peer Group:						
College Orientation	.06					
Delinquency	-.24					
Popularity	.15	.66	.10	1.97	3.92&	16,80

*Beta for final equation.

!p<0.05
@p<0.01
#p<0.005
$p<0.001
&p<0.0001

the low correlation between occupational attainment and predictor variables is that the 2 digit NORC scores may no longer reflect current occupational diversities or may be less reliable than years of education.

DISCUSSION

The major purpose of this study was to investigate the power of the Sibling Inventory of Differential Experience (SIDE) as a predictor variable in the linear regression model accounting for attainment level. The reliability and applicability of the SIDE, for the present study, was based on a sample of 418 adult offspring (average age 31 years) from the Hawaii Family Study of Cognition Follow-Up Study that reported average sibling differences and similarities in their growing up and living at home experiences by completing the SIDE. Of the initial 418, further analyses were performed on data from 202 offspring because they had sufficiently answered the SIDE questionnaire and the items for the variables of interest.

A major portion of the sample was of Caucasian or Japanese ancestry, while a minor portion consisted of offspring of Chinese or Hapa (a mixture of Caucasian and Chinese or Japanese) ancestry. The participants from this study are not representative of the State of Hawaii; they are more educated and affluent than the median population level. Like their parents before them, the offspring were paid for their participation. They are essentially a volunteer sample of middle and upper-middle socioeconomic status.

The SIDE

Although it was necessary to regroup the original 11 scales into 7 measures, the contribution of this assessment of perceived environment to the model predicting attainment (which also included parental variables, participant's own cognitive abilities and personality characteristics) seems supported by the present data. The SIDE measures accounted for 8% of the explained variance in educational attainment level when entered last in a hierarchical multiple regression analysis performed on 202 (mixed ethnicities) subjects, 14% in a subsample of 88 AJA, 10% in a subsample of 81 AEA; when divided by gender alone, 13% in a subsample of 105 females and 10% in a subsample of 97 males. The SIDE contribution to predicting educational attainment level was over and above the influence of parental variables, own cognitive abilities and personality characteristics.

The notion of subjective differences in perceptions of the same event was investigated with difference scores when the findings from the agreement analysis indicated that these differences may not be a result of within-family environmental variations. The lack of sibling agreement in SIDE scores suggests that siblings may be perceiving similar events differently. The lack of even low to moderate agreement correlations between siblings' judgments leaves open the possibility that if offspring perceive similar environments differently, could their perceptions be

influenced by something other than within-family environmental differences such as psychosocial (peer, significant other or event) influences or non-shared genetic influences. The analyses performed on difference scores were not significant. Difference scores of sibling pairs on personality characteristics and SIDE measures did not significantly account for the difference in attainment level. Thus, it will be assumed that the SIDE assesses retrospective perceptions of sibling environmental differences rather than, as posited by Daniels and Plomin, actual within family environmental differences. In consequence, SIDE relative scores were utilized in further analyses rather than absolute or difference scores.

Educational and Occupational Attainment

The results of the hierarchical multiple regression analyses performed separately for the individual participants, ethnic groups, and gender groups showed a statistically significant relationship between the predictor variables and educational attainment. However, nonsignificant results were obtained for the effects of retrospective perceived differential environmental influences on occupational attainment level using a similar hierarchical multiple regression analysis employed (parental status, mid-parent education, own cognitive ability and personality) with educational attainment.

A noteworthy ethnic difference between Caucasian and Japanese offspring is the negative correlation occurring between Japanese parental cognitive abilities and offspring attainment and the significant contributions that Japanese mid-parent education made in accounting for educational attainment. Being relatively newer immigrants to America as compared to Caucasians may mean that the Japanese have not had as much opportunity to diversify. This paradoxical relationship with offspring attainment may suggest that the Japanese parents may be more homogeneous than the Caucasian parents. Despite the negative correlation between Japanese parental cognition scores and offspring attainment level, Japanese offspring, from this study, showed higher attainment levels than their Caucasian counterparts. Japanese parents traditionally are known for stressing education as a vehicle for social attainment to their offspring. Japanese parents devote much of their energy to providing for their children's education, which may explain the higher offspring attainment in spite of the negative correlation with parental cognitive abilities scores. Another possibility is that parents who score lower on cognitive abilities measures but achieve higher social status may provide a model for more efficient, effective use of time and abilities. For a culture that rarely expresses or displays affection, the prediction of higher educational attainment from Japanese offspring reports of lower sibling

closeness is consistent. For the Caucasian offspring, associating with college oriented peers and being individualistic were predictors of higher attainment level. Also, a low psychoticism score (or being less troublesome) was associated with a higher attainment level in Caucasian offspring. These behavioral and personality traits are predictive of college completion.

For the most part the results of the present study replicate findings reported by Nagoshi et al. (1986). In both studies, female offspring's family background was a greater influence than own cognitive abilities on attainment. Added information gleaned from the gender groups suggested that even with the addition of the other predictor variables, midparent educational attainment is still a strong predictor of female educational attainment. This is not to infer that females' own ability does not influence attainment level, but that females may be more likely to be passive recipients of their parents' social attainment than males, and females are less likely to tailor their own environments beyond that provided by their parents. However, as is predicted by the model, females who were less troublesome, had less internal discomfort, were more assertive and reported more sibling antagonism and college oriented peer associations had higher attainment levels. This may suggest a trend that women are asserting more control over their own environments: whom they associate

with and how they choose to relate to their environment, and in the following years, females' own ability, will influence their attainment level more than parental abilities.

Interestingly, individual SIDE measures did not contribute significantly to male attainment level. A lower interpersonal manipulativeness score predicting higher attainment in males ran contrary to Turner and Martinez's findings. In their study, manipulativeness predicted attainment, with high manipulativeness positively related to high attainment. The pervasive Oriental cultural influence in Hawaii may provide an explanation for the inverse relationship between MACH V scores and attainment. Here in Hawaii, where a certain degree of conformity is expected, interpersonal manipulativeness may be detrimental to the individual's interaction in a group setting.

At face value, the SIDE questionnaire provides information that teases out the effects of the within-family environment. In light of the twin study by Bouchard, Lykken, McGue, Segal, and Tellegen (1990), which presents evidence that a broad range of personality and behavioral traits are heavily influenced by genes, the SIDE seems a timely tool for assessing dimensions of environment not measured in most studies. While the SIDE's contribution to educational attainment is significant, modification to its item grouping was necessary. First, the factor analysis on the present sample resulted in many misgrouped items (along

with a high attrition level) precluded the use of the original 11 scales; instead items were grouped into 7 scales/measures. The heterogenous mixture of the Hawaii sample is commonly characterized by having more varied responses especially when compared to the more homogeneous Colorado sample on which the SIDE was tested. Thus, the composition of the samples may account for the factor discrepancy. Another reason for the factor discrepancy could be that the instructions on the SIDE do not urge the participants to answer every item, and skipped items strongly affect the item means and prevent calculation of some scale means. Most importantly, the SIDE is assessing perceptions of difference in sibling environments rather than actual within-family environmental difference. While genes may determine the kind of environment one seeks, and that environment may affect personality and behavioral traits, the SIDE falls short in providing an accurate measurement of within-family environmental differences.

Furthermore, subjects' retrospective perceptions may have been clouded by the more advanced age of the current sample the mean age (31.5 years), hence the lack of agreement on SIDE measures found therein as compared to the significant, moderate to high agreement correlations reported by Daniels and Plomin's sample, in which the mean age was 18 years. The low sibling agreement in the present sample did not hinder the SIDE from accounting for

significant amounts of the explained variance in offspring educational attainment over and above traditional variables of SES, cognitive abilities, and personality traits. The SIDE's contribution to educational attainment in the face of low sibling agreement correlation underscores the effect of perception on behavior. These findings further support the importance of factors other than from IQ and SES in predicting attainment level.

IQ has long enjoyed a reputation as a fairly reliable predictor of academic success, but falls short as a predictor of occupational attainment (Nagoshi et al., 1986; Scarr & Weinberg, 1978). Likewise, the effects of present day parental SES on offspring attainment level has proven to be trivial (Johnson & Nagoshi, 1987; White, 1982). SES may well have been an important predictor of attainment at a time when social mobility was directly associated with parental social status. In contemporary society, educational opportunity, culture and arts, and sports activities are widely available to over 95% of the population. Present day society is closer to being homogeneous for such experiences than at any other time in our history. At this point, where experiential opportunity is nearing equality, genetic factors may play a more dominant role. At one time, it may have been only children from wealthy families who were permitted to participate in ballet lessons at a young age and aspire to be prima

ballerinas. Now, the opportunity to enroll in the cultural arts is not exclusive to the elite. Children from diverse backgrounds are being exposed to and have the opportunity to participate in a wide range of endeavors. With similar training repertoires, influence on ability tend to be genetic.

As evidence supporting the connection between genetics and behavior continues to mount, the endeavor to investigate within-family differences becomes even more worthwhile and pertinent. This study has demonstrated that the SIDE significantly contributes to explaining the variance in educational attainment by measuring a dimension that is distinct from those assessed in measures of cognitive abilities, personality traits and SES. Addressing the differences in social-affective dimensions between offspring creates a window into the microenvironment of the family. This window provides a clearer picture of the interplay between genes, behavior, and environment, with the possibility of clarifying their effects on each other. Since distinct ethnic and gender differences in the SIDE scores were exhibited in this study, ethnic and gender differences need to be investigated further. Likewise, larger sample sizes would probably reveal some ethnic by gender interactions. Focusing on selected effects of within sibling differences would provide a greater understanding of

genetic-environmental relationships as mediated by culture and gender.

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