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CHAPTER

11

Family Environments and Adult Cognitive Functioning

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There is an extensive literature dealing with the relative contribution of inherited predispositions and the influence of both the shared and unique experiences occurring within the family of origin upon cognitive functioning in children. Much of this work is derived from twin studies because behavior geneticists have advocated the twin model as the most desirable paradigm to investigate the heritability of intelligence and many other traits (cf. Bouchard, 1997; Plomin, 1986). However, because twins represent a rather atypical subset of the general population, the role of family environments has also been investigated in parent–offspring and sibling pairs (e.g., DeFries et al., 1976). Most twin studies report that roughly hall of the individual difference variance in cognitive functioning can be attributed to heritability. On the other hand, very little variance has been allocated to shared family environments. In fact, it has been argued that the environment in the family of origin has quite unique influence upon different siblings (Plomin & Daniels, 1987).

Relatively little is known about the origin of individual differences in the later half of the life span as they might relate to inherited predispositions or to early influences transmitted through the family environment. Again, twin studies dominate because of the argument that both age and early shared environment are maximally controlled in such studies (e.g., Jarvik, Blum, & Varma, 1971; Petrill et al., 1998; Plomin, Pedersen, Nesselroade, & Bergeman, 1988; Saudino-Kimberly, Pedersen, & McClearn, 1994). Hence, it is relatively difficult to extrapolate to the more typical case of family similarities among nontwins.

An important objective of behavior genetic studies in adulthood is to address the question why it is that different persons show such vastly dif-

ferent aging patterns. To do so one would like to know what proportions of individual differences variances can be accounted for by genetic and environmental influences (Pedersen, 1996; Plomin & McClearn, 1990). While some might argue that personality variables might well be implicated in such differences (Saudino-Kimberly, Pedersen, Liechtenstein, & McClearn 1997), the same group of investigators have also shown that personality differences do not account for the influences of family environment factors (Chipuer, Plomin, Pedersen, & McClearn, 1993).

In this chapter we present findings from a large-scale longitudinal study of adult intellectual functioning, the Seattle Longitudinal Study (SLS; Schaie, 1996) that may inform us on the relative contribution of familial similarity due to genetic influences of certain cognitive traits as contrasted to the extent to which current cognitive performance may be attributed to family influences that are shared with other family members during early life as well as the influences of the non-shared family setting currently being experienced by our subjects (also see Plomin & McClearn, 1990; Rowe & Plomin, 1981).

THE SEATTLE LONGITUDINAL STUDY

The research to be summarized here capitalizes on the longitudinal-sequential design of the SLS which offers the opportunity to compare young adult and middle-aged offspring with their middle-aged and old parents, as well as to compare sibling pairs from young adulthood to old age. The data for the parents and target siblings come from our inquiry into adult cognitive functioning that began some 42 years ago by randomly sampling 500 subjects equally distributed by sex and age across the range from 20 to 70 years from the approximately 18,000 members of a Health Maintenance Organization (HMO) in the Pacific Northwest (Schaie, 1983, 1996; Schaie & Hertzog, 1986). The survivors of the original sample were retested and additional panels were added in seven-year intervals; a total of over 5000 different individuals have been studied at least once. The sampling frame for the SLS represents a broad distribution of educational and occupational levels, covering the upper 75% of the socio-economic spectrum. This frame has grown to over 400,000 individuals, but the general characteristics of the HMO remain very similar to its structure at the inception of the study. The study design of the SLS is shown in Fig. 11.1.

Throughout the course of the SLS our primary focus has been the investigation of psychometric abilities within the Thurstonian (1938) framework. This view of the structure of intelligence proposes that there is a rather small number of latent constructs (perhaps no more than 10) that suffice to describe virtually all individual differences in intellectual performance. Moreover, the measures of these constructs are presumed to be only mod-

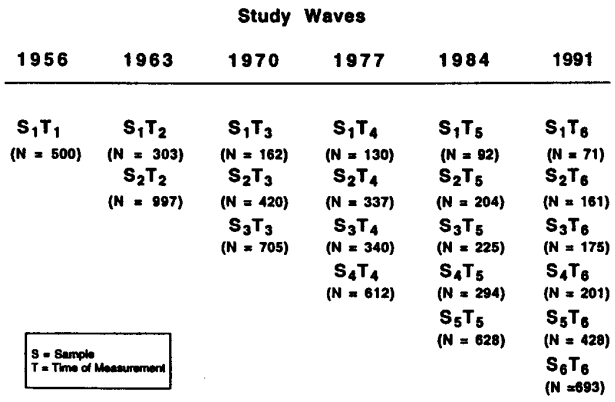

FIG. 11.1. Basic design of the Seattle Longitudinal Study (SLS). From "The Course of Adult Intellectual Development" by K. W. Schaie, 1994, *American Psychologist, 49*, pp. 304–313. Copyright 1994 by the American Psychological Association. Reprinted with permission.

estly correlated. Thurstone's work identified the dimensions of Verbal Meaning, Spatial Orientation, Inductive Reasoning, Number and Word Fluency to be the most important of these abilities. These are the abilities whose relationship with perceptions of family environment are described in this chapter. Utilization of independent abilities rather than a unitary "*g*" concept of intelligence is also reinforced by recent behavior genetic work stressing the importance of specific cognitive abilities (cf. Pedersen, Plomin, & McClearn, 1995).

In addition, we have also collected data on rigidity–flexibility, lifestyles, some personality traits, as well as the health histories of our participants (cf. Schale & O'Hanlon, 1990). Of these we also present here relationship with perceptions of family environment three latent constructs derived from our work on rigidity–flexibility because these dimensions can be conceived as measures of cognitive style. The latent constructs involved are Motor–Cognitive Flexibility, the tendency to be able to shift from familiar to unfamiliar responses; Attitudinal Flexibility, the tendency to display attitudes compatible with being comfortable in adapting to change; and Psychomotor Speed, the ability to emit familiar cognitive responses in a speedy manner.

In order to examine perceptions of shared environments we began to add appropriate scales for this purpose beginning with our 1989–1990 data collections. This work is based on the methods developed by Moos and Moos (1986) to describe multiple dimensions of family environments. Details of the measures included in the study reported here are provided in the following methods section.

This chapter first summarizes briefly what we have already learned about familiar similarity of cognitive functioning in adults and about the similarity of perceptions of family environments across generations. Our major focus in this chapter, however, is on the results of our most recent analyses which try to identify the contribution of family environments to adult cognitive functioning. We believe these analyses permit us to identify some of the salient family environment dimensions that influence adult cognitive functioning. They also permit us to provide estimates of the relative importance of familial factors (familial similarity and other parental or sibling characteristics), early shared family environment, early nonshared family environments, and current family environment as they affect adult cognitive performance.

METHODS

Subjects and Procedure

The participants in our family similarity studies consist of the adult offspring and siblings (22 years of age or older in 1990) of members of the SLS panels and their target relatives (i.e., the adult parents or sibling who had previously been studied). Panel members who participated in the fifth cycle of the SLS (1990–1992) had a total of 3,507 adult children. Of these, 1,416 adult children ($M = 701$; $F = 715$) resided in the Seattle metropolitan area. They also had a total of 1,999 siblings including 779 brothers and 1,020 sisters.

The recruitment of the adult offspring and siblings began with a letter containing an update report on the SLS sent to all study participants tested in 1983–1985. This letter also announced the family similarity study and requested that panel members provide names and addresses of siblings and adult offspring. A recruitment letter was then sent to all siblings and offspring thus identified.

Those who agreed to participate in the study were tested in small groups or individually (no differences were found between subjects tested in groups or individually). Approximately 80% of the subjects tested resided in the Seattle metropolitan area. Other subjects were tested preferably when they visited their Seattle relatives, but approximately 150 subjects were tested in other locations throughout the United States. A total of 1,176 relatives of our longitudinal panel members were tested. Of these 776 were adult offspring (465 daughters and 311 sons), and 400 were adult siblings (248 sisters and 152 brothers) of SLS participants.

Data on the target subjects (i.e., individuals who had previously been members of the SLS panel) were obtained during the 1991 longitudinal follow-up (data collection actually continued from mid-1990 to mid-1992). Subsequent to matching target subjects and their relatives, we were able to identify 512 parent–offspring and 294 sibling pairs on whom complete data is available; or a total sample of 1,612 individuals. These consist of 106 father–son, 118 father–daughter, 115 mother–son, 198 mother–daughter, 51 brother–brother, 139 brother–sister, and 104 sister–sister pairings. The reduction in sample size occurred, because of substantial attrition in the number of study members whose relatives we had been able to assess earlier; among the older study members attrition was due primarily to death or sensory and motor disabilities that precluded further assessment or questionnaire response.

Table 11.1 provides a breakdown of parents, offspring, and siblings by age and gender, using the 7-year cohorts conventionally employed in the SLS (cf. Schaie, 1983, 1996).

Average age of the parents was 70.59 years ($SD = 10.37$) and 41.76 years ($SD = 10.46$) for the offspring. The parents averaged 14.22 years of education ($SD = 2.75$) as compared to 15.64 years of education ($SD = 2.49$) for their children. Total family income averaged $25,002 for the parents and $26,841 for the offspring, respectively.

Average ages for the siblings were 60.75 years ($SD = 14.42$) for the longitudinal study members and 59.62 years ($SD = 14.77$) for their relatives. The tar-

TABLE 11.1
Age and Gender Distribution of study Participants

	Parents			*Offspring*			*Siblings*					
	(Targets)			*(Relatives)*			*(Targets)*			*(Relatives)*		
	(1991)			*(1990)*			*(1991)*			*(1990)*		
Age Range	*M*	*F*	*T*	*M*	*F*	*T*	*M*	*F*	*T*	*M*	*F*	*T*
22–28	–	–	–	19	19	38	–	–	–	1	2	3
29–35	–	–	–	53	76	129	2	11	13	6	13	19
36–42	–	–	–	52	85	137	14	10	24	9	19	28
43–49	–	11	11	50	66	116	19	20	39	10	22	32
50–56	15	29	44	26	37	63	13	21	34	13	15	28
57–63	31	52	83	16	20	36	15	23	38	18	27	45
63–70	41	60	101	3	7	10	28	29	57	22	38	60
71–77	61	67	128	1	5	6	21	27	48	25	28	53
78–84	43	56	99	–	1	1	15	18	34	6	14	20
85–91	14	28	42	–	–	–	2	4	6	2	4	6
92+	9	10	19	–	–	–	–	2	2	–	–	–
Total	224	313	537	221	316	537	129	165	294	112	182	294

get siblings averaged 15.04 years of education ($SD = 2.80$) as compared to 14.90 years of education ($SD = 2.72$) for their brothers or sisters. Average incomes were $29,361 for the longitudinal study members, and $25,682 for their siblings.

Procedure. Potential subjects who agreed to participate were scheduled for group assessment sessions. Size of the groups ranged from 5 to 20 participants, depending upon the age of the subjects. The testing sessions lasted approximately 2½ hours plus a "homework" package of questionnaires requiring approximately an additional hour of effort. The homework packages were examined for omissions and obvious errors, with telephone callbacks or mailing of missing pages as appropriate. Each session was conducted by a psychometrist aided by a proctor whenever more than five participants were tested simultaneously. Subjects were paid $25 for their participation.

Measures

Although our data on cognitive functioning are based on formal psychometric assessment of our study participants, we must perforce rely on our subjects' ratings of their perceptions of their family environments. Our efforts to measure these perceptions were motivated by the fact that it is extremely difficult to measure current environments objectively. And it is of course virtually impossible to obtain information directly on the characteristics of family environments that pertained at earlier life stages. We therefore decided that it was necessary. to infer these attributes by asking our subjects to rate both their current environments and their retrospection of the family environment they experienced within their biological family of origin.

Primary Mental Abilities. The test battery administered to the participants in this study included multiple measures of cognitive abilities which broadly sample higher order constructs such as those espoused by Horn and Hofer (1992). Thus fluid intelligence (sometimes referred to as the "mechanics" or procedural aspects of intellectual ability) is represented by the abilities of Inductive Reasoning and Spatial Orientation, whereas Verbal Ability and Numeric Ability stand as representatives of crystallized intelligence (sometimes referred to as the "pragmatics" are culturally acquired aspects of intelligence).

A brief description of these abilities and their measures follows. Test–retest correlations for the ability measures come from a study of 172 individuals tested over a 2-week interval. Similar values for the other measures represent test–retest correlations over a 7-year interval.

Verbal Ability. Language knowledge and comprehension is measured by assessing the scope of a person's recognition vocabulary by matching 1 of 4 synonyms to a stimulus word (Thurstone & Thurstone, 1949; test–retest correlation = .89).

Spatial Orientation. This is the ability to visualize and mentally manipulate spatial configurations, to maintain orientation with respect to spatial objects, and to perceive relationships among objects in space. The study participant is shown an abstract figure and is asked to identify which of six other drawings represents the model in two-dimensional space (Thurstone & Thurstone, 1949; test–retest correlation = .82).

Inductive Reasoning. This is the ability to educe novel concepts or relationships. The study participant is shown a series of letters (e.g., a b c c c b a d e f f e) and is asked to identify the next letter in the series (Thurstone & Thurstone, 1949; test–retest correlation = .88).

Numeric Ability. The ability to understand numerical relationships and compute simple arithmetic functions. The study participant checks whether additions of simple sums shown are correct or incorrect (Thurstone & Thurstone, 1949; test–retest correlation = .88).

Word Fluency. The ability to recall words easily is measured by asking the study participant to recall freely as many words as possible according to a lexical rule within a 5-minute period (Thurstone & Thurstone, 1949; test–retest correlation = .90).

Two summary scores can be generated from the Primary Mental Abilities (PMA) battery. The first is an Index of Intellectual Ability (an IQ equivalent). It takes the form of IQ = V + S + 2R + 2N + W. The second is an Index of Educational Aptitude (EQ; Thurstone, 1962) and takes the form of EQ = 2V + R.

Rigidity–Flexibility. The multiple dimensions of this construct are measured by the Test of Behavioral Rigidity (TBR; Schaie, 1955; Schaie & Parham, 1975; Schaie & Willis, 1991). The TBR was designed to measure the three dimensions of Psychomotor Speed (PS; test–retest correlation = .88), Motor–Cognitive Flexibility (MCF; test–retest correlation = .67), and Attitudinal Flexibility (AF; test–retest correlation = .84). Factor scores on these dimensions are estimated from linear combinations of the scores yielded from the three TBR subtests:

The Capitals Test. Participants copy a printed paragraph that contains some words starting with capital letters, others spelled entirely in capitals, and some starting with a lower case letter and their remainder in capitals. In the second half of the test, the paragraph is copied again, but in reverse form (i.e., substituting capitals for lower case letters, and lower case letters for capitals; adapted from Bernstein, 1924).

The Opposites Test. Subjects respond to three lists of words (at a third-grade level of difficulty). The first list requires providing the antonym, the second list the synonym of the stimulus word, and the third list contains selected stimulus words from the previous lists that are responded to with an antonym if the stimulus word is printed in lower case letters, but with a synonym if printed in capitals (after Scheier & Ferguson, 1952).

The TBR Questionnaire. This is a 75-item true–false questionnaire that contains 22 rigidity–flexibility items (attitudinal flexibility) and 44 masking social responsibility items from the California Psychological Inventory (Gough, 1957; Gough, McCloskey, & Meehl, 1952; Schaie, 1959; Schaie & Parham, 1974). It also contains nine (behavioral flexibility) items suitable for adults obtained from the Guttman-scaling of a perseveration scale first used by Lankes (1915), We include findings on the social responsibility scale in this chapter as a control measure of a trait that should not represent familial factors, but should be responsive to family environment influences.

Family Environment. Moos and Moos (1986) constructed a 90-item true–false family environment scale measuring 10 different dimensions (each measured by 9 items) three of which they described as relationship, five as personal growth and the remaining two as system maintenance an change dimensions. The purpose of these scales was to provide an assessment instrument to examine environmental context of adaptation (Moos, 1985, 1987). We adapted eight of these scales for our purposes by selecting five items per scale and presenting each statement in Likert scale form (1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *in between*; 4 = *somewhat agree*; 5 = *strongly agree*). The eight dimensions included for our purpose and examples of statements scored in the positive direction on each dimension follow:

a. Cohesion (Relationship). Example: "Family members really help and support one another."
b. Expressivity (Relationship). Example: "We tell each other about our personal problems."
c. Conflict (Relationship). Example: "Family members hardly ever lose their temper."
d. Achievement Orientation (Personal Growth). Example: "We feel it is important to be the best at whatever we do."
e. Intellectual–Cultural Orientation (Personal Growth). Example: "We often talk about political and social problems."
f. Active–Recreational Orientation (Personal Growth). Example: "Friends often come over for dinner or to visit."
g. Organization (System Maintenance). Example: "We are generally very neat and orderly."

h. Control (System Maintenance). Example: "There are set ways of doing things at home."

Two forms of the Family Environment Scale (FES) were constructed: The first asked that the respondents rate their family of origin (i.e., past tense statement with respect to their parental family); the second form requested the same information (in present tense) with respect to their current family. They were then instructed to do the ratings with respect to the family grouping identified by them. In other words, for the parents this implied rating the "empty nest" family. In recognition of the fact that significant numbers of our young adult and older study participants lived by themselves, an alternate form was constructed which allowed defining the current family as those individuals (whether or not related by blood or marriage) that the respondent considered as his or her primary reference group and with whom the respondent interacted at least on a weekly basis.

A confirmatory factor analysis was conducted on a random half of the sample of relatives for both forms to determine whether the retained items clustered on the factors described by Moos. The obtained fit (Family of origin: $X^2(701) = 1235.56$, $p < .001$, GFI = .842, RMS = .084. Current family: $X^2(701) = 1254.48$, $p < .001$, GFI = .839, RMS = .089) was then confirmed on the second random half (Family of origin: $X^2(701) = 1266.05$, $p < .001$, GFI = .842, RMS = .090. Current family: $X^2(701) = 1357.07$, $p < .001$, GFI = .829, RMS = .089).

Although we obtained a good fit for the primary dimensions of the FES, we were unable to reproduce the higher order structure postulated by Moos. Our findings are therefore reported only with respect to Moos' primary dimensions. Means and standard deviations for each scale by separate samples are shown in Table 11.2, and Factor intercorrelations for both scales are shown in Table 11.3.

Family Contact. As a measure of the intensity of family contact we asked respondents to indicate on a set of Likert scales the nature of their relationship, the number of years the respondent and their relative had lived in the same household, their physically visiting, talking on the telephone, writing letters, or obtaining news of their relative via a third party. Item scores were then summed to obtain a single contact score (a high score implying closeness and frequent contact).

Analyses

A general linear regression model was fitted to associate each dependent variable with the significant independent variables. The model was initially chosen by the stepwise model selection procedure. To include all potentially significant independent variables, the level for entering the model was set

TABLE 11.2
Means and Standard Deviations for Family Environment Scale

	Family or Origin				*Current Family*			
	Parents	*Offspring*	*Target Sibling*	*Relative Sibling*	*Parents*	*Offspring*	*Target Sibling*	*Relative Sibling*
Cohesion	18.90 (4.38)	17.81 (5.01)	18.62 (4.44)	18.03 (4.64)	21.41 (3.31)	20.32 (4.03)	20.96 (3.48)	20.45 (3.85)
Expressivity	14.76 (3.83)	14.60 (4.05)	15.18 (3.77)	14.36 (4.10)	18.22 (3.39)	18.72 (3.81)	18.35 (3.45)	18.07 (3.64)
Conformity	17.59 (4.44)	16.29 (5.06)	16.60 (4.29)	16.58 (4.77)	19.42 (3.61)	17.98 (4.37)	19.04 (3.93)	18.24 (4.24)
Achievement orientation	18.05 (3.47)	18.14 (3.63)	17.96 (3.54)	18.46 (3.76)	17.60 (3.37)	18.74 (3.20)	17.60 (3.37)	17.76 (3.57)
Intellectual–Cultural Orientation	14.66 (4.76)	16.33 (5.02)	15.20 (5.19)	15.06 (5.11)	18.27 (4.23)	18.59 (4.00)	18.91 (4.24)	18.12 (4.19)
Recreational Orientation	14.74 (4.55)	17.16 (4.45)	15.61 (4.61)	15.00 (4.41)	16.09 (4.41)	17.90 (4.33)	17.28 (4.44)	16.46 (4.34)
Organization	18.99 (3.70)	18.03 (4.30)	18.32 (3.69)	18.92 (3.75)	17.63 (3.84)	16.30 (4.03)	17.59 (3.82)	18.08 (3.96)
Control	17.46 (4.21)	17.07 (4.66)	16.92 (3.99)	18.05 (4.38)	14.14 (3.87)	14.53 (3.99)	14.11 (3.51)	15.08 (4.12)

Note. Parent–Offspring sample: $N = 452$ pairs; Sibling sample: $N = 207$ pairs. Scores can range from 5 to 25. Standard deviations are in parentheses.

TABLE 11.3
Intercorrelation of Family Environment Scales
(Family of Origin Above Diagonal, Current Family Below Diagonal)

	Cohesion	*Expressivity*	*Conflict*	*Achievement Orientation*	*Intellectual–* Cultural	*Active–* Recreational	*Organization*	*Control*
Cohesion		.860	.664	.372	.434	.524	.272	-.133
Expressivity	.837		.341	.339	.483	.515	.033	-.208
Conflict	.565	.323		.065	.161	.210	.25	-.286
Achievement–Orientation	.274	.239	.009		.430	.369	.333	.289
Intellectual–Cultural	.492	.562	.251	.234		.659	.056	-.130
Active–Recreational	.448	.453	.093	.445	.606		.138	-.038
Organization	.346	.235	.346	.234	.149	.186		.393
Control	-.013	-.121	-.155	.209	-.216	.006	.446	

Note.. From *Adult Intergenerational Relations* (pp. 174–209, Table 2), by V. L. Bengston, K. W. Schaie, and L. Burton (Eds.), 1995. New York: Springer.

at an alpha of $p < .10$. With independent variables selected from the initial screening step, we fit the linear regression model and then excluded those independent variables with $p > .05$ from the final model.

After selecting the optimal regression models as specified, we conducted several hierarchical regression analyses to assess the proportion of variance explained by several blocks of independent variables. We classified the independent variables into four blocks. Block 1 contains the static familial variables (i.e., parents' or siblings' performance on the corresponding cognitive variable, as well as their level of educational attainment). Block 2 includes the significant variables for characterizing the shared early environment (i.e., parents or siblings' perception of the family of origin of the targeted offspring or sibling). Block 3 includes the significant variables characterizing the non-shared early environment (i.e., the offspring's or targeted siblings' perception of their family of origin). Block 4, finally, includes the significant variables representing the perception of the significant variables characterizing the targeted subjects' perception of their current (non-shared) environment. The proportion of variance accounted for by each block after the first is the increment in R^2. Contrary to the practice of some behavior geneticists, we did not double genetic correlations to estimate heritability. Hence, all proportions of individual differences variances reporting in the result sections should be interpreted as expressions of familial similarity rather than heritability (i.e., as shared correlations between the independent and dependent variables.

RESULTS OF THE FAMILY STUDIES

Family Similarity in Cognitive Performances

We have previously reported our findings on cognitive similarity (Schaie, Plomin, Willis, Gruber-Baldini, & Dutta, 1992; Schaie, Plomin, Willis, Gruber-Baldini, Dutta, & Bayen, 1993). Briefly, we found that significant family similarities were observed for parent–offspring and sibling pairs for all ability measures, except perceptual speed, as well as for cognitive style measures of rigidity–flexibility. However, it should be noted that family similarity was greater for the parent-offspring than for the sibling dyads. Also patterns of similarity coefficient differed across gender combinations in both data sets. The magnitude of correlations for the ability measures were comparable for those found between young adults and their children (DeFries et al., 1976). Our data also strongly supported stability of parent-offspring correlations over as long as 21 years.

We had suspected that cohort effects in parent–offspring correlations would result in higher correlations for earlier cohorts, because of a decline

in shared environmental influence attributed to an increase in extrafamilial influences in more recent cohorts. This proposition could be supported only for the attitudinal trait of social responsibility (systematic cohort differences on this variable have previously been reported; e.g., Schaie & Parham, 1974). For the cognitive abilities, once again counterintuitively, there seems to be stability or even an increase in family similarity for more recent cohorts. It may well be that our rough division of our sample into three cohort groups was not sensitive enough to detect a gradual shift. Our previous data suggest the greatest break between cohort groups born before and after World War I. Because both parents and offspring in our younger cohorts were born after this watershed event, there is greater similarity in educational opportunities and lifestyles than for the cohort pairings containing the oldest parents in our sample. Finally, ability level differences within families equaled or approximated differences found for similar cohort ranges within a general population sample (cf. Schaie, 1996; Willis, 1989). When broken down by cohort groupings, such differences, consistent with the earlier findings, became generally smaller for the more recently born parent–offspring pairs.

Perceptions of Family Environments

We analyzed data for our adult siblings with respect to within generation similarities and differences, and we studied parent–offspring pairs to determine these relations across generations. Because of the possibility of shifts in these relationships for successive cohorts we also included a cohort variable, classifying our offspring into those born prior to World War II, those born during the war years and immediately thereafter, and into the early and late baby boomers (Schaie & Willis, 1995).

Our first and most dramatic conclusion was that there is a clear differentiation for parents, offspring, and sibling in the perceived level of all family dimensions between the family of origin and the current family. They see their current families as more cohesive and expressive but also characterized by more conflict than was true for their families of origin. What these changes reflect, of course, may simply express generally greater openness and engagement in family interactions. More intensive family interactions may also be represented by the reported increase in intellectual–cultural and active–recreational orientation from the family of origin to the current family. At the same time we found lower levels of perceived control, family organization, and achievement orientation. Perhaps these judgments are another way of the increasing complexity of modern American families (cf. Elder, 1981; Elder, Rudkin, & Conger, 1995; Hareven, 1982). When our parent–offspring sample is broken down into four distinct cohort groups, we noted further that the shift in perceived family level occurred primarily for

perceptions of the family of origin, with much greater stability for the perception of current families.

Second, we found that sibling pairs share substantial variance in the perception of their family of origin (i.e., the family that they shared in childhood and adolescence) over all family dimensions that we examined. However, this commonality does not extend to their perception of their current (nonshared) families. The only exception to this finding was a low correlation for intellectual cultural orientation and family organization. In spite of the lack of similarity of current family environments in siblings, we do find that the best predictor for the level of each dimension of the current family turns out to be the corresponding level reported by each person for their family of origin. Perhaps, perceptions of the family environment of origin may be one of the factors entering into marital assortativity, even though such perceptions may differ for and may differentially affect the perceptions of current family environments by different siblings.

Third, supporting evidence for the continuity of family values and behaviors (cf. Bengtson, 1986) was provided by substantial correlations between the parents' description of their current family environment and their offspring's description of their family of origin. Even though there is a substantial time gap in the period rated, these two rating do refer to the same parental family unit. These relationships were particularly strong for the three dimensions most closely reflective of value orientations (achievement, intellectual-cultural, and active-recreational) and for family organization.

Fourth, we concluded that the intensity (frequency) of contact between parents and offspring has virtually no impact upon the similarity of reported family environments. However, there were family environment dimensions (particularly level of family cohesion) that could predict almost one fourth of the variance in the total family contact scores.

Finally, we suggested that the hierarchy of the magnitude of shared perceptions, from low correlations when describing nonshared environments, to moderately high correlations when describing commonly experienced environments provides at least indirect evidence for the contention that self-descriptions of family environments (perceptions) may well be useful indicators of the actually experienced environments.

Family Environments and Cognitive Performance

In our most recent analyses we combined the two databases to determine the extent to which family environments influence current cognitive performance. We now present findings for the mental abilities, their composites, and the measures of cognitive style, as well as for a Scale of Social Responsibility, for which trait we assume zero familial influences (see Tables 11.4 and 11.5).

TABLE 11.4
Regression Coefficients for Parent–Offspring Study

Predictors	*Verbal Meaning*	*Spatial Orientation*	*Inductive Reasoning*	*Number*	*Word Fluency*	*IQ*	*EQ*
Parents' Ability	.149	.176	.239	.180	.256	.229	.191
(Familial Similarity)							
Parents' Education		.156	.134			.117	.118
Parents' Perception							
Cohesion							
Expressivity	.088						
Conflict							
Achievement							
Intellectual–Cultural				-.129			
Active–Recreational							
Organization							
Control							
Offspring's Perception of Family of Origin							
Cohesion		.134					
Expressivity	-.213		-.163			-.130	-.217
Conflict				.095	-.146		
Achievement				.090			
Intellectual–Cultural	.141						
Active–Recreational	-.110		.107				
Organization			-.088				
Control	-.131	-.139					-.130
Offspring's Perception of Current Family							
Cohesion							
Expressivity	.154	-.134	.110		.115	.126	.168
Conflict							
Achievement							
Intellectual–Cultural	.099						.119
Active–Recreational							
Organization							
Control		-.109				-.103	

(continued)

TABLE 11.4
(Continued)

Predictors	*Motor–Cognitive Flexibility*	*Attitudinal Flexibility*	*Psychomotor Speed*	*Social Responsibility*
Parents' Status (Familial Similarity)	.112		.204	
Parents' Education	.142	.129		
Parents' Perception				
Cohesion				
Expressivity				
Conflict				.138
Achievement				
intellectual–Cultural				
Active–Recreational				
Organization	.112			
Control				
Offspring's Perception of Family of Origin				
Cohesion				.164
Expressivity	-.124		-.106	
Conflict				
Achievement				
intellectual–Cultural				-.132
Active–Recreational				
Organization				
Control				
Offspring's Perception of Current Family				
Cohesion				
Cohesion				
Expressivity		.148	.146	
Conflict				.082
Achievement		-.159	.088	
intellectual–Cultural		.155	.106	.256
Active–Recreational	.129			
Organization		-.147		
Control		-.128		.113

TABLE 11.5
Regression Coefficients for Sibling Study

Predictors	*Verbal Meaning*	*Spatial Orientation*	*Inductive Reasoning*	*Number*	*Word Fluency*	*IQ*	*EQ*
Target Sibling's Ability (Familial Similarity)	.209	.163	.295	.122	.230	.218	.269
Siblings' Education		.115	.123				
Target Siblin's' Perception							
Cohesion							
Expressivity	-.174				-.252	-.218	
Conflict			-.155				
Achievement							
Intellectual–Cultural	.194				.171	.205	
Active–Recreational				.158			
Organization		-.179					
Control		.265					
Sibling's Perception of Family of Origin							
Cohesion							
Expressivity							
Conflict	-.119		-.233			-.148	
Achievement							-.140
Intellectual–Cultural							
Active–Recreational							
Organization			.142		.153	.163	
Control				-.126			
Sibling's Perception of Current Family							
Cohesion							
Expressivity	.179			.190			
Conflict			.176				.161
Achievement							
Intellectual–Cultural	.180		.139		.125	.125	.211
Active–Recreational	-.206	.139	-.215			-.191	-.227
Organization							
Control							

(continued)

TABLE 11.5
(Continued)

Predictors	Motor–Cognitive Flexibility	Attitudinal Flexibility	Psychomotor Speed	Social Responsibility
Target Sibling's Status (Familial Similarity)	.241	.226	.268	
Target Siblings' Perception				
Cohesion			-.203	
Expressivity			.138	
Conflict	-.150			
Achievement	.224			.159
intellectual–Cultural			.173	
Active–Recreational				
Organization	-.147			
Control				
Sibling's Perception of Family of Origin				
Cohesion	-.161		-.148	.202
Expressivity				
Conflict				
Achievement				
intellectual–Cultural				
Active–Recreational			.107	
Organization				
Control				-.113
Sibling's Perception of Current Family				
Cohesion				
Cohesion				
Expressivity	.182		.142	
Conflict	-.126			
Achievement	.173		.149	-.166
intellectual–Cultural				.372
Active–Recreational		.200		
Organization	-.226	-.123		
Control		-.194		

Note. All reported values are significant at or beyond the .05 level of confidence.

Parent-Offspring Data. In the parent–offspring data set we find significant familial similarity for the five primary mental abilities and the derived summative indices, as well as for Motor–Cognitive Flexibility and Psychomotor Speed. In addition parental education regresses significantly on adult offspring performance on Spatial Orientation, Inductive Reasoning and the composite cognitive induces as well as on Motors–Cognitive and Attitudinal Flexibility. However, only one of the regression coefficients for the abilities and one coefficient for the regression of social responsibility upon the parental perceptions of their current family environment (the estimate of shared environment) are significant. It seems that the time since our adult offspring shared the current family of their parents is simply too long to have the parents' current environment serve as a surrogate for the early shared environment.

Nevertheless, there were a number of significant regressions for the offspring perception of the family of origin (the unique experience of their early environment). These regressions, at least for the cognitive abilities, accounted for as much or more variance then the subjects' perception of their current environment (see later). Cohesion related positively to Spatial Orientation and Social Responsibility. Expressivity was negatively related to Verbal Meaning, Spatial Orientation, Motor–Cognitive Flexibility and Psychomotor Speed, as well as the indices of Intellectual Ability and Educational Aptitude. Perceived conflict related positively to Number and negatively to Word Fluency. Achievement orientation related positively to Number. Intellectual–Cultural orientation related positively to Verbal Meaning and Social responsibility. Organization related negatively to Inductive Reasoning. Finally, perceived Control related negatively to Verbal Meaning, Spatial Orientation, and the index of Educational Aptitude.

Significant regressions for the effect of the current environment of the offspring were also found. Cohesion related positively to Word Fluency and the IQ and EA indices, but negatively to Spatial Orientation. Expressivity related positively to Verbal Meaning, Inductive Reasoning, Attitudinal Flexibility, and Psychomotor Speed. Conflict related positively to Social Responsibility. Achievement orientation related positively to Psychomotor Speed, but negatively to Attitudinal Flexibility. Intellectual–Cultural orientation related positively to Verbal Meaning, Educational Aptitude, Attitudinal Flexibility, Psychomotor Speed, and Social Responsibility. Active-Recreational orientation related positively to Spatial Orientation. Organization related negatively to the IQ index and Attitudinal Flexibility. Control related positively to Social Responsibility but negatively to Attitudinal Flexibility.

Sibling Data. Significant heritabilities were again observed for all Primary Mental Abilities and their composite indices, as well as for Motor–Cognitive Flexibility, Attitudinal Flexibility, and Psychomotor Speed. Siblings' educational level yielded significant regressions for Spatial Orienta-

tion and Inductive Reasoning. Substantial regressions were also found for the shared environment in the family of origin. Cohesion influences negatively Word Fluency, Intellectual Ability, and Psychomotor Speed. Expressivity relates negatively to Verbal Meaning, but positively to Psychomotor Speed. Achievement Orientation relates positively to Motor–Cognitive Flexibility and Social Responsibility. Intellectual–Cultural orientation relates positively to Verbal Meaning, Word Fluency, Intellectual Ability, and Motor-Cognitive Flexibility. Active-Recreational Orientation relates positively to Number. Organization relates negatively to Spatial Orientation and Motor-Cognitive Flexibility. Finally, Control relates positively to Spatial Orientation.

Smaller but significant contributions are provided by the siblings' unique perceptions of the family origin. These include a positive correlation of cohesion with Social Responsibility, but a negative correlation with Motor-Cognitive Flexibility and Psychomotor Speed. There is a negative relation between Expressivity and Inductive Reasoning as well as the index of Intellectual Ability, Conflict relates negatively to Verbal Meaning. And the measure of Intellectual Aptitude. Active–Recreational Orientation relates positively to Inductive Reasoning, Word Fluency, and intellectual aptitude, as well as to Psychomotor Speed, and Control relates negatively to Social Responsibility.

Significant regressions were also found for the influences of perceptions of the current family environment. Here Cohesion relates positively to Number. Expressivity relates positively to Verbal Meaning Inductive Reasoning, Educational Aptitude. Motor–Cognitive Flexibility, and Psychomotor Speed. Conflict relates negatively to Motor–Cognitive Flexibility. Achievement orientation relates positively to Motor–Cognitive Flexibility and Psychomotor Speed, but negatively to Social Responsibility. Intellectual-Cultural orientation relates positively to Verbal Meaning, Inductive Reasoning, Word Fluency, the composite indices, Motor–Cognitive Flexibility, and Psychomotor Speed, but negatively to Social Responsibility. Active-Recreational orientation relates positively to Spatial Orientation and Attitudinal Flexibility, but negatively to Verbal Meaning; Inductive Reasoning, and the composite indices. Organization relates negatively to Spatial Orientation, Motor–Cognitive Flexibility, and Attitudinal Flexibility. Control, finally, relates negatively to Attitudinal Flexibility.

PROPORTIONS OF INDIVIDUAL DIFFERENCES ACCOUNTED FOR BY FAMILIAL INFLUENCES, SHARED EARLY ENVIRONMENT, UNIQUE EARLY ENVIRONMENT, AND CURRENT ENVIRONMENT

We now come to the critical issue of the extent to which individual differences in cognitive performance in adulthood can be allocated to familial influences (including genetic influences) and shared early environment, and how much is due to the unique influences of early and current family environments.

Parent–Offspring Data. When we diaggregate perceived environmental from static familial influences we find that the former account for relatively small proportions of variance, ranging from 1.7% for Attitudinal Flexibility to 7.5% for Inductive Reasoning. No such influences can be found for Attitudinal Flexibility and Social Responsibility. As mentioned earlier, the lack of temporal coincidence in the parental ratings for the offspring families of origin, we find only trivial influences for the perceptions of the shared early family environment. Significant, but fairly small proportions of individual differences in cognition in adulthood are accounted for by the unique offspring perceptions of the family origin. These range from 1.7% for the Number ability to 9.5% for Verbal Meaning. No effects of the unique early environment are found for Attitudinal Flexibility. Current family environment influences range from 1.2% for Inductive Reasoning to 10.9% for Attitudinal Flexibility. The only dependent variable not significantly affected is the Number ability. Detailed findings are shown in Table 11.6.

Sibling Data. We first note that static familial influences range from zero for Social Responsibility and Motor–Cognitive Flexibility to a high of 10.2% for Inductive Reasoning. Contributions of early shared environment range from zero for Attitudinal Flexibility to 9.4% for Attitudinal Flexibility. Perceptions of the unique early environment range from zero for Spatial Orientation and Attitudinal Flexibility to 7.4% for Inductive Reasoning. Current environment influences range from 1.6% for Word Fluency 16.6% for Social Responsibility.

TABLE 11.6
Proportion of Variance by Source for Parent–Offspring Study

Variables	*Familial Similarity*	*Shared Early Environment*	*Unique Early Environment*	*Unique Current Environment*
Verbal Meaning	2.2	0.8	9.5	3.4
Spatial Orientation	5.5	–	3.7	3.0
Inductive Reasoning	7.5	–	4.6	1.2
Number	3.2	1.7	1.7	–
Word Fluency	6.6	–	2.1	1.3
IQ	6.6	–	1.7	2.6
EQ	5.0	–	6.4	4.2
Motor–Cognitive Flexibility	3.3	1.3	1.5	1.7
Attitudinal Flexibility	1.7	–	–	10.9
Psychomotor Speed	2.6	–	1.1	4.0
Social Responsibility	–	1.5	4.4	9.2

The total contribution of all family environment sources ranges from a low of 7.7% for Number to a high of 25% for Motor–Cognitive Flexibility. When we consider the joint effect of static familial influences and early shared environment, the proportion of explained individual differences ranges from a low of 2.5% for Social Responsibility to a high of 16% for Psychomotor Speed.

For the primary mental abilities these values are Verbal Meaning, 11.2%; Spatial Orientation, 14.2%; Number, 4%; and Word Fluency, 12.6%. Table 11.7 shows the detailed breakdown into the various sources of variance.

CONCLUSIONS AND IMPLICATIONS

Given the assumption that individual's perceptions of family environments are reasonable representations of such environments we find that a significant impact of shared early environment upon adult cognitive performance can be demonstrated in sibling but not in parent–offspring dyads. This discrepancy is readily explained by the fact that the parental family perceptions must be measured by inquiring about their current family (which in most cases is the family of origin of the offspring). On the other hand, the siblings' perception of their family of origin involves retrospection to that time interval most of which was shared with the target sibling. By contrast, influences of the unique early environment (involving the subject's own retrospection) and current environment yielded significant proportions of variance in adult cognitive performance in both the parent–offspring and sibling samples.

We once again noted significant differences in both static familial characteristics and shared early environment estimates between same-gender and

TABLE 11.7
Proportion of Variance by Source for Sibling Study

Variables	*Familial Similarity*	*Shared Early Environment*	*Unique Early Environment*	*Unique Current Environment*
Verbal Meaning	4.4	6.8	1.4	10.7
Spatial Orientation	4.0	10.2	–	5.7
Inductive Reasoning	10.2	2.4	7.4	9.7
Number	1.5	2.5	1.6	3.6
Word Fluency	5.3	9.3	2.3	1.6
IQ	4.8	9.0	4.8	5.2
EQ	7.2	–	2.0	12.2
Motor–Cognitive Flexibility	5.8	9.4	2.6	13.0
Attitudinal Flexibility	5.1	–	–	9.3
Psychomotor Speed	7.2	8.8	3.3	4.2
Social Responsibility	–	2.5	5.4	16.6

cross-gender pairs. Although subsamples were too small to provide stable estimates in this chapter, we observed that familial similarity estimates were generally higher in same gender pairs, while the effect of shared early environment was greater in cross-gender pairs for most (but not all) variables.

What were the family environment dimensions that were most salient in predicting adult cognitive performance? As far- as the early environment was concerned there was a clear positive effect of a strong intellectual–cultural family orientation. On the other hand high levels of family cohesion had a negative effect.

High expressivity estimates from the unique perceptions of the early environment also seemed to have negative effects on several cognitive variables, whereas the unique perception of high active-recreational orientation had positive impact. By contrast, positive influences on cognitive performance and positive cognitive styles of the current family environment involved primarily high levels of cohesion, expressivity, and intellectual cultural orientation coupled with low levels of family organization.

In this chapter we do make somewhat strong assumptions about the utility of perceptions as measures of family environment and further investigations with better estimates of early environment as reported by the adult parents are needed. Nevertheless, we think that it is fair to conclude that we have provided significant evidence for the importance of early family environment (both shared and uniquely experienced) in understanding family similarity in adult cognitive performance. Although we do not wish to deny the important contribution of genetic transmission of individual differences in cognition, and the not insignificant contribution of current family environments, we nevertheless here do call attention to a substantial influence of early family environment in shaping cognitive performance throughout the life span.

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