A Structural Equation Test of Environmental Factors: A Study of Generational Similarities and Differences

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INTRODUCTION

When studying intergenerational transmission of values, social theorists often have considered the role of the family in maintaining continuity in values over time. Studies have suggested the possibility of family transmission of values, however, the evidence they offer is far from conclusive. Based on research findings of value similarity between parents and their offspring, it can be concluded that the transmission of values is relatively weak and appears to concentrate upon broad value concepts such as attitudes regarding political ideologies and religious beliefs (Dalhouse & Frideres, 1996; Glass, Bengtson, & Dunham, 1986).

The pattern of low levels of parent-offspring concordance might be due to the fact that previous studies used abstract and diffuse orientations that were not well articulated. As a consequence, researchers have suggested that levels of parent-offspring concordance to be found in future studies may be higher if concrete, specific, visible, and salient orientations are included and measured them with high degrees of reliability (Jennings & Niemi, 1982; Smith, 1982).

The present study continues with the exploration of the structure of intergenerational cohesion by examining micro-environmental factors, which have characteristics of concrete and salient orientations. Specifically, this study replicates and extends the work begun by O'Hanlon (1993) in identifying environmental factors for subjects in the Seattle Longitudinal Study. That is, can her original results be replicated across groups with different characteristics such as age and time of measurement? If an adequate model fit of the seven environmental factors can be established not only across different groups, but also within family dyads, then it may be safe to assume that progress has been made in identifying a useful set of descriptions of the environment within which individuals develop.

The goals of this study are twofold: First, the generalizability of the LCI environmental factors (Prestige, Social Status, Physical Environment, Mobility, Intellectual Environment, Social Network, Work Complexity) are tested using confirmatory factor analysis. Seven environmental factors identified by O'Hanlon (1993) are fitted for parent-adult offspring dyads within the Seattle Longitudinal Study (SLS) Family Study database. The models are fitted using covariance matrices and tests of measurement invariance are examined to evaluate model comparability of the latent constructs within parent-adult offspring pairs. Second, concordance of environmental factors is investigated to examine the level of similarity between parents-adult offspring.

METHOD

Samples

The sample for this study includes subjects from the Seattle Longitudinal Study (SLS). This longitudinal study has collected data for seven testing waves at seven year intervals (1956, 1963, 1970, 1977, 1984, 1991, 1998). At each new occasion, former subjects who were still available were retested and additional participants were added from the parent population to match the same age range of the original samples (Schaie, 1996). Subjects were randomly selected from the membership of a Health Maintenance Organization (HMO), stratified by age and sex, in the Seattle, Washington metropolitan area. These subjects represented an extended range of economic, educational, and occupational backgrounds.

Participants in the current study come from the combined longitudinal (target subjects) and the family studies. Family study participants are adult offspring of longitudinal panel members. Two steps were involved in the recruitment of the adult offspring. Subjects who participated in the fifth and sixth data collection were requested to provide names and addresses of their offspring. A recruitment letter was subsequently sent to all nominated members. A total of 1,110 parent-offspring pairs were analyzed for the present study (M_{AgeP} = 67.65, SD_{AgeP} = 10.03; M_{AgeO} = 43.42, SD_{AgeO} = 10.27). Age range for parents was from 41 to 92 years and offspring from 22 to 72 years. Mean education level for parents was 14.46 (SD = 2.86) as compared to 15.56 years (SD = 2.41) of education for their children.

Measures

The Life Complexity Inventory (LCI). This questionnaire is designed for the SLS to obtain a comprehensive inventory of variables that make up the micro-context of adult individuals in the samples. This instrument examines a broad range of adult activities and interests, and includes data on many aspects of the interpersonal, work, social, structural, and cultural aspects of the participants' environment. These variables contain basic demographic information, home environment questions, characteristics of the work and home-making environment, neighborhood composition, travel, mobility, reading activities, continued educational pursuits and social network data (Gribbin, Schaie, & Parham, 1986; Schaie, 1996; for greater detail).

RESULTS

To analyze the LCI questionnaire, O'Hanlon (1993) used exploratory and subsequent confirmatory factor analysis to identify seven micro-environmental factors. The factors were labeled: 1) Prestige; 2) Social Status; 3) Physical Environment 4) Mobility; 5) Intellectual Environment; 6) Social Network; and 7) Work Complexity. The fit indices for the final seven-factor model were : X^2=1565, df = 373, p <.001, GFI = .928, RMSR = .048. Table 1 lists the items associated with the seven factors. The final accepted structure of factor loadings and intercorrelations are presented in Table 2.

Table 1

Variable Description	Variable Label
Marital status (Married or Unmarried)	Marital status
Occupation	Occupation
Income	Income
Educational level	Education
Changes in households during the last 5 years	Household
Changes in jobs during the last 5 years	Job
Changes in professions during the last 5 years	Profession
Number of neighbors you confide in	Neighbor
Number of visits to people not in your neighborhood	Visit
Number of meetings you attended in the last month	Meeting
Own a home	Own home
Amount of art objects in home	Art
Number of books in the home	Book
Number of rooms in home	Room
Quality of air in the neighborhood	Air
Number of trees in neighborhood	Tree
Noise level in the neighborhood	Noise
Number of magazines read in the last month	Magazine
Number of educational courses taken	Course
Work status (working vs. not working)	Work now
Percentage of work hours spent reading	Hour read
Working under time pressure	Work pressure
Place where work occurs	Work where
Working with people	Employee

Table 2

LISREL Maximum Likelihood Estimates for Final LCI Model

Variable	I	II	III	IV	V	VI	VII	Unique Variance
Education	.770							.390
Occupation	.758							.426
Marital status		.538						.765
Own home		.535						.782
Income		.549						.362
Room		.711						.608
Air			.690					.516
Tree			.694					.526
Noise			-.371					.861
Job				.777				.447
Household				.588				.659
Profession				.377				.774
Book					.546			.704
Art					.495			.758
Magazine					.358			.871
Course					.383			.852
Neighbor						.384		.857
Meeting						.523		.726
Visit						.367		.860
Hour read							.488	.761
Work now							.831	.342
Work pressure							.536	.707
Work where							-.698	.470
Employee							.395	.834

Factor Intercorrelations

		I	II	III	IV	V	VI
I	Prestige						
II	Status	.299					
III	Physical Environment	.359	.351				
IV	Mobility	.093	-.179	-.081			
V	Intellectual Environment	.594	.411	.366	-.028		
VI	Social Network	.019	-.048	.111	-.312	.173	
VII	Work Complexity	.492	.330	.140	.177	.320	-.355

(from O'Hanlon, 1993)

Structural equation models using LISREL software were conducted to replicate the seven environmental factors identified by O'Hanlon (1993). The models were specified exactly as described by O'Hanlon and were replicated for the parents and offspring. The initial seven-

factor solution model yielded a phi matrix that was not positive definite. As a result, a second model was derived that excluded the Mobility factor. Variables associated with the Mobility factor were found to be highly skewed and kurtotic, and thus were eliminated from the model. In addition, the Employee and Course indicators were dropped because they did not explain significant proportion of variance. The fit indices for the six factor model were: X^2=685, df = 174, p <.001, GFI=.95, RMSEA=.05 for parents, and X^2=690, df = 174, p <.001, GFI=.94, RMSEA=.05 for offspring. The fit of the six factors was considered acceptable for each group, and the final accepted model (i.e., six factor structure) was served as the baseline model.

To extend the baseline model to within-dyad analyses, analogous SEMs were modified to describe a repeated-measure analysis of variance (ANOVA), thus enabling the model to use family data to examine levels of environmental factor similarity. To estimate the repeated six factor model, a 19 X 19 covariance matrix was calculated that included the parents and their offspring LCI variables. Six factors were specified for each group, producing a total of twelve factors that were allowed to covary across groups. The model also freely estimated autocorrelated residuals to account for the lack of independence among the sampling units.

Model testing proceeded from a less restrictive model to a more restrictive model. The first model required that the pattern of loadings be invariant across the two groups. The fit of the model was good: X^2=1514, df = 580, p <.001, GFI=.93, RMSEA=.04. The next model was tested to see if the magnitude of the factor loadings could be constrained to be equal across the two groups. Results indicated a statistically significant reduction in fit: ΔX^2=69, df = 13, p <.01, GFI=.93, RMSEA=.04. This model showed that there were significant differences in factor loadings between the two groups. As a consequence, further analyses were undertaken to identify parameters causing differences. To approximately gauge the differences in the parameter estimates, confidence intervals around the individual factor loadings were examined to see which specific loading was significantly different. The statistical significance of the difference in a given parameter estimate was assessed by determining whether the value of zero was included within its confidence interval. Confidence intervals at the conventional 95% level were constructed around the group difference for each free parameter estimate (see Table 3).

Results showed 4 of 6 factor correlations to be statistically significant: Prestige, Physical Environment, Social Network, and Work Complexity. Table 4 presents the factor correlation matrix for parents-offspring environmental dimensions.

Table 3

Standardized Solution for Six Factor Model

Factor/Indicators	Parents	Offspring
	Factor Loadings	
Prestige		
Education	.85	.83
Occupation	.59	.61
Social Status		
Marital status	.54	.65*
Own home	.17	.25*
Income	-.78	-.67
Room	-.54	-.55
Physical Environment		
Air	.77	.73*
Tree	.66	.63
Noise	-.41	-.61*
Intellectual Environment		
Book	.60	.42*
Art	.50	.42*
Magazine	.30	.21
Social Network		
Neighbor	.29	.52*
Meeting	.50	.42*
Visit	.46	.32*
Work Complexity		
Hour read	-.72	-.64
Work now	.39	.60*
Work pressure	.38	.42*
Work where	.63	.57*

* differs significantly from Parent loading ($p<.05$).

Table 4
Intercorrelations of Parents-Offspring Environmental Factors

Factor	I	II	III	IV	V	VI
I Prestige	**(.35*)**	-.30*	.18*	.39*	.32*	-.42*
II Social Status	-.47*	**(.03)**	-.35*	-.37*	-.23*	.20*
III Physical Environment	.19*	-.18*	**(.11*)**	.23*	.22*	-.02
IV Intellectual Environment	.45*	-.39*	.42*	**(.09)**	.30*	-.14*
V Social Network	.10	.16*	.12*	.07	**(.20*)**	.17*
VI Work Complexity	-.50*	.43*	-.02	-.21*	.11	**(.11*)**

* $p<.05$. Offspring factor correlations above diagonal, parents factor correlations below diagonal, same factor correlations for parents-offspring pairs on diagonal.

DISCUSSION

The results from the test of same number factors and pattern of factor-variable regressions provided support for at least configural invariance of structure across groups. Given these results, weak factorial invariance (factor loadings invariant) was tested to establish evidence for invariant measurement of both the pattern and magnitude of factor loadings. Groups were found to differ significantly in their parameters for the factor loadings. Upon a close examination of the results, several loadings were identified as responsible for group differences. In particular, these were marital status, own home, air, noise, art, book, neighbor, meeting, visit, work where, work pressure, and work now. These markers differed in their magnitude of loadings across the groups. The loading differences could be attributed to cohort effects or to the focus on different points in development (Schaie, 1996). In addition, Thurstone (1947) regarded factor pattern invariance to be more important than factor loading invariance. Horn, McArdle, and Mason (1983) suggested that configural invariance was often achieved, while metric invariance was more difficult to establish in the social science domain. As such, Horn et al. (1983) suggested that rank order of salient loadings, and covariances (factor intercorrelations) and uniqueness should all be expected to vary from one group to another.

Results from the current study also suggest modest similarity of environmental factors for parents and offspring dyads. That is, parents do exert an influence on the offspring's obtained micro-environments and that the influence exists past early adulthood. However, observed parents-

offspring environment similarity does not necessary imply parental influence and may point to other effectual factors such as personality, peer relationships, health, work satisfaction, and beliefs and ideologies.

REFERENCES

Dalhouse, M., & Frideres, J. S. (1996). Intergenerational congruence: The role of the family in political attitudes of youth. *Journal of Family Issues, 17 (2)*, 227-248.

Glass, J., Bengtson, V. L., & Dunham, C. C. (1986). Attitude similarity in three-generation families: Socialization, status inheritance, or reciprocal influence. *American Sociological Review, 51*, 865-898.

Gribbin, K., Schaie, K. W., & Parham, I. (1980). Complexity of life style and maintenance of intellectual abilities. *Journal of Educational Psychology, 54*, 94-103.

Horn, J. L., McArdle, J. J., & Mason, R. (1983). When is invariance not invariant: A practical scientist's look at the ethereal concept of factor invariance. *Southern Psychologist, 1*, 179-188.

Jennings, M.K., & Niemi, R. (1982). *Generations and politics: a panel study of young adults and their parents.* New York: Princeton University Press.

O'Hanlon, M. A. (1993). *Inter-individual patterns of intellectual aging: The influence of environmental factors.* Unpublished doctoral dissertation, Pennsylvania State University, Pennsylvania.

Schaie, K. W. (1996). *Intellectual development in adulthood: The Seattle Longitudinal Study.* New York: Cambridge University Press.

Smith, T. E. (1982). The case for parental transmission of educational goals: The importance of accurate offspring perceptions. *Journal of Marriage and the Family, 44,* 661-674.

Thurstone, L. L. (1947). *Multiple factor analysis.* Chicago: University of Chicago Press.