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ABSTRACT

Assessment of the relationship between ontogenetic (individual) and generational (historical) change in adolescent personality development was the focus of this study. The total sample included 1000 male and female adolescents (ages 13-18) randomly drawn from 32 public school systems in West Virginia following a design using longitudinal sequences and control groups. Longitudinal subjects (birth cohorts 1954-1957) were measured in 1970, 1971, and 1972 with Cattell's High School Personality Questionnaire, Jackson's Personality Research Form, and Thurston'es Primary Mental Abilities. A random sample of retest control subjects was measured in 1972 only. Analyses were aimed at examination of main and interaction effects of age/cohort, sex and time of measurement on 16 personality and ability measures and of intraindividual change and stability on these measures from 1970 to 1972. Control group data were analyzed for testing and selective dropout effects. Findings indicated that age per se is not a very relevant variable. Rather, (1) developmental change is more influenced by the cultural moment than by age sequences; and (2) traditional, simple cross-sectional or longitudinal designs are not adequate for describing developmental change. Theorizing about adolescent development must move toward a dynamic conception of "the changing individual in a changing society". This will mandate rapprochement between ontogenetic and evolutionary models of development. (Author)

FINAL REPORT
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U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

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U.S. DEPARTMENT OF
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I. ABSTRACT

Assessment of the relationship between ontogenetic (individual) and generational (historical) change in adolescent personality development was the focus of this study. The total sample included some 1800 male and female adolescents (ages 13-18) randomly drawn from 32 public school systems in West Virginia following a design using longitudinal sequences and control groups. Longitudinal subjects (birth cohorts 1954-1957) were measured in 1970, 1971, and 1972 with Cattell's HSPQ, Jackson's PRF, and Thurstone's PMA. A random sample of retest control subjects was measured in 1972 only. Analyses were aimed at examination of main and interaction effects of age/cohort, sex, and time of measurement on 16 personality and ability measures and of intraindividual change and stability on these measures from 1970 to 1972. Control group data were analyzed for testing and selective dropout effects.

Findings indicated that age per se is not a very relevant variable. Rather, (1) developmental change is more influenced by the cultural moment than by age sequences; and (2) traditional, simple cross-sectional or longitudinal designs are not adequate for describing developmental change. Theorizing about adolescent development must move toward a dynamic conception of "the changing individual in a changing society". This will mandate rapprochement between ontogenetic and evolutionary models of development.

II. PREFACE

The study described herein was initiated for both substantive and methodological reasons. From a substantive perspective, a review of the literature suggested a tremendous need for objective information on personality development through the period of adolescence, particularly within a framework of structured measurement. From a methodological viewpoint, the period of adolescence -- one of rapid change and great sensitivity toward cultural innovations -- appeared to be a prime candidate for the examination of recent developmental research designs oriented toward separating ontogenetic from generational change components by means of sequential strategies.

In this report the principal features are described of an investigation of adolescent personality development which was started in 1969. The study included three occasions of measurement (1970, 1971, 1972) and involved over 2,000 adolescents. For a variety of reasons, the substantive research design spans two administratively distinct, but conceptually sequential projects, both of which were sponsored by the United States Office of Education. The first one (Project BR9-0289; Grant No. OEG-0-9-580289-4415) was brought to termination, and a final report submitted in August, 1971. A summary of that report, which included only selected aspects of the data and two of the three measurement occasions, has appeared in the professional literature (Baltes & Nesselroade, 1972). The present report, although technically representing only the period during which the third occasion of measurement occurred, is being used as a vehicle to present the total research project.

During the course of the main project, a number of related subprojects were initiated and are in various stages of completion. Some of these have appeared in the professional literature, some have been presented at professional meetings, and reports of others are being written. Since, in differing amounts, these projects were partially supported by the two grants involved, a list of them has been compiled and presented as Appendix A.

It may be worthwhile mentioning that at least two other large-scale longitudinal studies of adolescence currently in progress are somewhat similar to the present project: Youth in Transition (Bachman, Kahn, Mednick, Davidson, & Johnston, 1969) and Project Talent (Flanagan & Cooley, 1966; Flanagan, Dailey, Shaycoft, Gorham, Orr, & Goldberg, 1962). In neither study, however, is the focus on structured personality systems, nor is the primary attention on the simultaneous analysis of ontogenetic and generational change components. Nevertheless, it can be expected that both studies and the present one will provide complementary information.

As in the preface of the earlier report, we wish to acknowledge substantial debts to a great number of persons whose efforts and cooperation made possible the completion of the project. First, we express our profound appreciation to the West Virginia Public School personnel in the counties of Harrison, Wetzel, and Wood: the superintendents and

their assistants; the school principals and their assistants; the teachers and counselors; and, most assuredly, the students, who contributed to the project in the most fundamental way. We wish also to applaud a job well done by our graduate assistants, including Margret M. Baltes, Elizabeth M. Barton, Thomas W. Bartsch, John C. Friel, Rudolph Kafer, Erich W. Labouvie, and Nancy M. Reese. Special thanks are due to our clerical staff -- Carolyn Blose, Nancy Everly, and Mary Kutac -- and to numerous able persons who assisted with the collection, scoring, and card punching of data. Finally, we wish to thank our friend and colleague, K. Warner Schaie, Chairman of the Department of Psychology at West Virginia University, who assumed administrative responsibility for this project when the initial principal investigators moved to the College of Human Development at the Pennsylvania State University.

III. INTRODUCTION

A. Some History

During the recent decade we have witnessed an increasing concern with the analysis of relationships between individual (ontogenetic) and historical (generational) development (e.g., Baltes, 1968; Cattell, 1970; Riegel, 1972; Schaie, 1965). Earlier, developmental research was assumed to provide, for the most part, relatively robust information on ontogenetic patterns that could be generalized to subsequent decades. Present cultural change, however, appears so rapid and pervasive in its effects that results from "one-shot" cross-sectional or longitudinal studies are threatened with obsolescence before they can be marketed for the scientific consumer. In fact, whereas such cultural acceleration phenomena were previously treated under the heading of "secular" trends (e.g., Bakwin, 1964; Muuss, 1970), present-day evidence on the rate of "changing ontogeny" suggests that terms like "yearly" or "decennial" trends may be more accurate, particularly where the behavior systems under consideration are substantially influenced by environmental conditions. In many ways, this acknowledgment of the potential impact of cultural change on psychological ontogeny signals a rapprochement between evolutionary sociological, anthropological and psychological world views relative to the nature and etiology of human development. In fact, it should be noted at the outset that the present focus on the interactive relationships between individual and historical change is nicely paralleled by an equally persuasive trend of methodological and theoretical contributions in the field of sociology (e.g., Ryder, 1965; Keniston, 1970; Riley, 1972).

Originally, within the psychological literature, the impact of cultural change on psychological ontogeny was treated primarily as a methodological issue, the effect of which jeopardizes both the comparability and validity of cross-sectional and longitudinal designs. Thus, for a considerable time, developmental researchers were plagued by the discrepant findings resulting from the application of longitudinal and cross-sectional methodology (e.g., Damon, 1965; Kuhlen, 1963; Schaie, 1970).

In general, from a methodological vantage point, it has been shown that both the cross-sectional and longitudinal method lack a variety of controls and that their internal and external validity (Campbell & Stanley, 1963) are differentially affected by a number of error sources such as selective sampling, selective survival, selective drop-out, testing effects, and generation (cohort) differences. Both Baltes (1968) and Schaie (1965) have argued that discrepancies and contradictions in the conclusions derived from cross-sectional and longitudinal studies are consequences of violations of basic assumptions implicit in these designs. Focusing on the issue of generational or cultural change, they proposed (stimulated by earlier work, e.g., Bell, 1953; Davies, 1954; Welford, 1961) that several cross-sectional and longitudinal studies be combined into more complex developmental designs, so-called sequential strategies. The application of such sequential

strategies, consisting of serial examinations of the ontogeny of successive generations, makes it possible to estimate the relative significance of ontogenetic (individual) and generational (historical) change components.

Research studies in which sequential strategies (e.g., cross sectional or longitudinal sequences) have been implemented, though almost exclusively conducted in the area of intelligence, have clearly substantiated the empirical relevance of generation effects to the study of ontogeny. Moreover, in light of the current impact of social change and increasing cognizance of the influence of individual-society interactions on the course of developmental change, the issue of generational differences has become a substantively compelling phenomenon. In fact, all studies conducted thus far (e.g., Baltes, Baltes & Reinert, 1970; Baltes & Reinert, 1969; Nesselroade, Schaie & Baltes, 1972; Riegel, Riegel & Meyer, 1967; Schaie, 1970; Schaie & Strother, 1968; Woodruff & Birren, 1972) have shown substantial differences between the ontogenetic patterns of different generations or cohorts (e.g., subjects born at different times). Although the available evidence does not allow one to specify the substantive determinants (maturational vs. experiential, etc.) of observed generational change in ability-personality variables, the overriding magnitude of the obtained cohort differences pleads urgently for a careful examination of similar social change components in other classes of behavior as well. Thus, Schaie's (1965) original assertion that practically all age-developmental literature needs re-examination in light of potential cohort differences is convincingly supported by initial empirical findings.

B. Cohort Differences and Adolescent Personality

The systematic analysis of generational change in psychological variables, with few exceptions centering on time-lag comparisons of attitudes and values (e.g., Broderick & Fowler, 1961; Greenstein, 1964; Harris, 1959; Jones, 1960), has been restricted to adult subjects. For a number of reasons, however, similar inquiries into the relationships between ontogenetic and generational change components appear especially promising in the area of adolescent personality development.

First, there is a rich body of data on secular trends in the rate of biological development during adolescence (e.g., Lehr, 1967; Muuss, 1970; Tanner, 1962; Meredith, 1963) which indicate a general process of secular acceleration. Although these data are based on long-range comparisons, they can be taken as suggesting the existence of parallel accelerations (or correlates) in behavior characteristics.

Second, rigorous and comprehensive examinations of the nature of adolescent personality development are badly needed. Despite the multitude of theoretical positions in the area (see e.g., Ausubel, 1955; Horrocks, 1969; Hurlock, 1968; Muuss, 1962, 1971; McCandless, 1970, for reviews), the adolescent period in general and adolescent personality in particular are underresearched areas (L'Abate, 1971). For example, although most theorizing conceives of adolescence as a period

of intensive quantitative and qualitative change, consisting of a series of distinct stages and transitional periods exhibiting high instability, the empirical evidence for such propositions is either lacking or highly equivocal (Bandura, 1964).

It is particularly important to note that, with reference to adolescent personality variables, there is a dearth of research maintaining an emphasis on structured measurement (Cattell, 1957; Fiske, 1963; Jackson, 1971) -- focusing on a comprehensive assessment of "clearly discovered ... and well established structures" (Cattell, 1957, p. 67). Moreover, there is a scarcity of longitudinal work, although it is increasingly being realized that repeated measurement designs which employ adequate controls are a sine qua non for a thorough analysis of ontogenetic sequences (e.g., Baltes & Nesselroade, 1973; Wohlwill, 1970). This is so particularly in areas, such as adolescence, where one expects not only large intraindividual change patterns but also, due to marked epoch-specific, class-specific, and family-specific conditions, large interindividual differences in ontogeny. It appears fair to conclude, therefore, that simple cross-sectional studies have very little to contribute of a positive nature, if the descriptive ontogeny of adolescence is the major goal of research.

Third, the period of adolescence is often seen not only as a distinct developmental stage that is characterized by marked biological, social, and behavioral changes but also by its central role in the origin and maintenance of cultural change patterns. In other words, adolescence is a "critical period" (Eisenberg, 1965) of the life cycle not only for the developmental course of individuals, but also for the impact which adolescents, as a social entity, have on the changing society. As Muuss (1962, p. 164), in line with Sherif's assertations, put it in another context: "... societies in a period of rapid change create a particularly difficult adolescent period; the adolescent has not only the society's problems to adjust to but his own as well". Similar notions about the interwoven association between individual and societal change are most clearly inherent in those cultural and social interpretations of adolescent development which challenge the universality of adolescent phenomena and focus on culture- and time- specific contingencies. Obviously, the existence of cohort differences or generational changes are manifestations of such cultural change phenomena.

One may reasonably hypothesize that any short-term generational change will primarily affect those behavior classes which are largely determined by environmental and/or experiential conditions, although the widely acknowledged man-made changes in biophysical ecology may produce equally rapid changes in evolutionary-genetic species characteristics. Personality variables (such as anxiety, achievement, ego strength, etc.) are among the response classes that are generally assumed to be primarily determined by distinct learning histories and situational factors (e.g., Mischel, 1968; Vandenberg, 1966). In fact, in the few available time-lag studies aimed at comparing related behavior systems such as attitudes and interests in different cohorts of adolescents (e.g., Broderick & Fowler, 1961; Greenstein, 1964; Harris,

1959; Jones, 1960) significant generational change in adolescents has been found consistently. None of these studies, however, appears to have utilized either adequate frameworks of measurement or the type of developmental designs necessary to disentangle ontogenetic from generational change components. Nevertheless, they provide strong suggestive evidence for the susceptibility of personality-ability variables to societal change conditions during the adolescent period of the life span.

C. Statement of Problem and Research Objective

Recent evidence suggests the need for considering both ontogenetic (individual) and generational (historical) components of change in developmental research. The significance of such analyses is evident in light of our rapidly changing society and the increasing difficulty in predicting future societal trends on the basis of simple, continuous growth models.

Adolescent personality development is assumed by most theorists to be particularly sensitive to cultural change phenomena. Moreover, adolescence is seen as being a "critical period" not only for the course of individual development but also for the prominent role adolescents play in shaping the direction of cultural development. Detailed and accurate information about the nature and direction of the changing adolescent personality, therefore, is a necessary prerequisite both for the understanding of adolescence as a developmental phenomenon and for the promotion of effective societal adjustments such as is implied in educational and psychological intervention programs.

Specifically, the present study was aimed at assessing the relationship between ontogenetic and generational change components in personality development of adolescents (age 13-18) from the cohorts 1954 through 1957. A large random sample (base sample N = 1877) was asked to respond in 1970, 1971, and 1972 to two structured personality questionnaires (Cattell's High School Personality Questionnaire, Jackson's Personality Research Form) and a battery of intelligence tests (Thurstone's Primary Mental Abilities). Based on a strategy termed multivariate longitudinal sequences (Baltes & Nesselroade, 1970, 1973), the data analysis was focused on examining quantitative and structural aspects of both ontogenetic and generational change.

The evidence obtained will be used to estimate developmental gradients allowing for both individual (ontogenetic) and historical (generational) change components, to discuss implications for developmental research methodology, and to delineate implications for theoretical conceptions of adolescent personality. Finally, the findings will be employed to examine the relative usefulness of various developmental models. For the most part, this line of reasoning expands on and substantiates the rationale presented in Baltes and Nesselroade (1972). This latter paper covered the first one-year period (1970-71) of the present sequential longitudinal study (1970-71-72) in a highly abbreviated form.

IV. METHOD

A. Design

1. Independent and Control Variables. The design, varying age, sex, and cohort membership, followed the data collection strategies outlined by Schaie (1965) and Baltes (1968). Table 1 provides a summary of the sequential design (longitudinal sequences) which was applied to investigate ontogenetic and generational components in adolescent personality development.

Table 1 next page

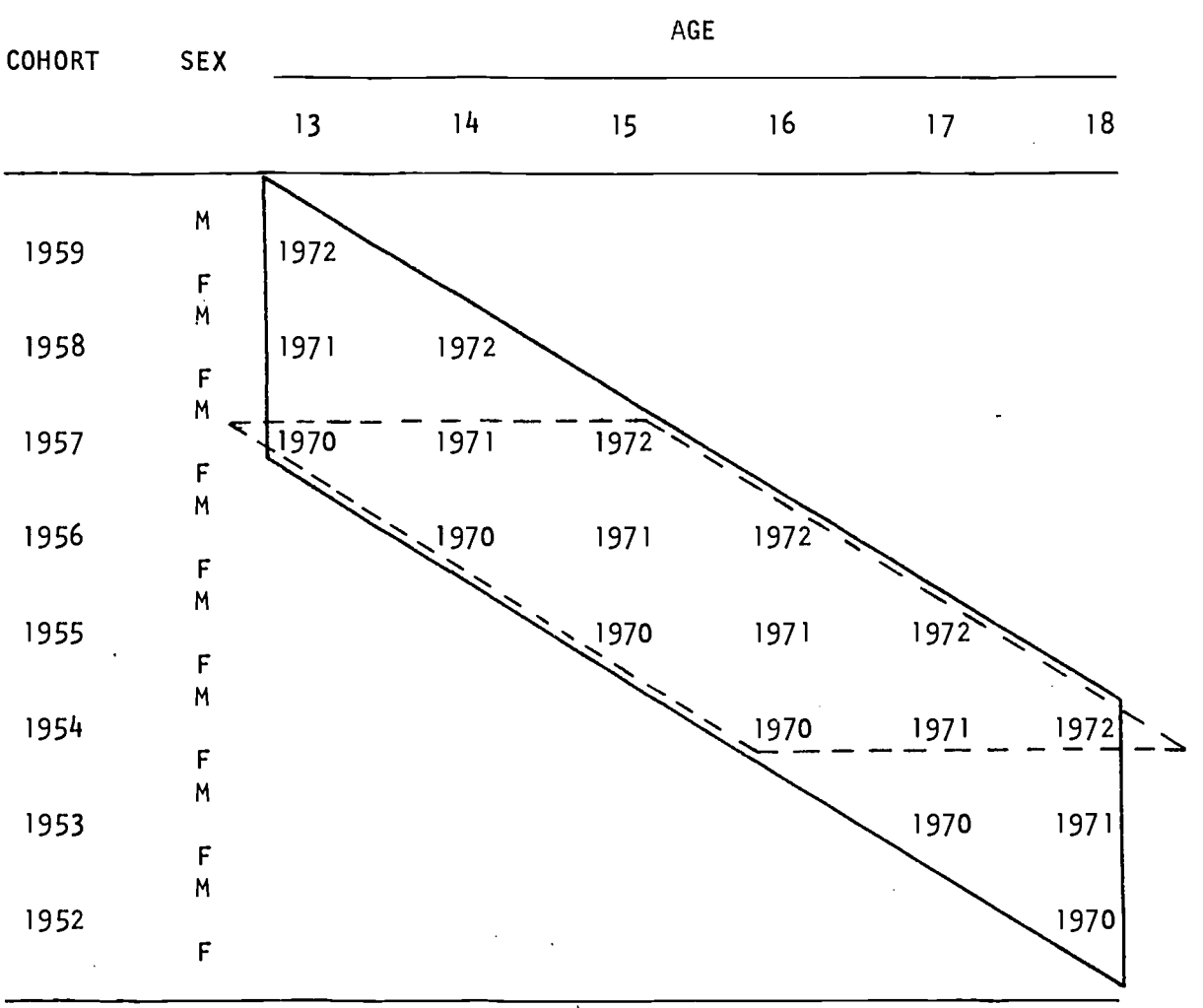
Because of economic constraints, the proposed design (broken parallelogram in Table 1) collapses the complete General Developmental Model (Schaie, 1965) into a series of short-term longitudinal studies, each involving three times of measurement and extending for a period of two years. However, a noteworthy aspect of our design is that three times of measurement in principle are sufficient to analyze the data by each of the three model-strategies (time-sequential, cohort-sequential, cross-sequential) specified in Schaie's (1965) model. In the present situation, however, inspection of the outcome pattern suggested that application of the cross-sequential model of data analysis was most useful for a parsimonious and meaningful description of the relationships between age, cohort, and time of measurement.

Each row in Table 1 represents the same sample of subjects (repeated measurements where applicable). Although the full set of longitudinal sequences are presented (solid parallelogram), two are trivial (cohorts 1959 and 1952, which were measured only once) from a change measurement vantage point, and two include only two occasions of measurement (cohorts 1958 and 1953). Cohorts 1954, 1955, 1956, 1957 (enclosed in the broken parallelogram) represent complete longitudinal sequences and these subjects constitute the core sample used for the major analyses.

In addition to the core longitudinal samples, a set of control groups were included which could be seen as independent 1970, 1971, and 1972 cross-sections following Baltes' (1968) proposal to combine longitudinal sequences with cross-sectional sequences in order to obtain a more powerful experimental design arrangement. One group of controls consisted of a new random sample, stratified by age and sex, drawn and tested at the second occasion of measurement (1971) and a new random sample, similarly drawn and tested at the third occasion of measurement (1972). Posttest control groups of this nature are crucial to providing answers to the question whether or not apparent changes (e.g., from

Table 1

Short-Term Longitudinal Sequences for the Study of Adolescent Development: Design[1]



Note. -- Entries represent times of observation (repeated measurement). Mean testing time (range ±2 months) is January 1 of the year listed. The broken parallelogram indicates the data matrix used for main analyses reported.

[1]To estimate instrumentation and testing effects (internal validity) a set of randomly selected groups of cohorts 1953-1958 were observed for the first and only time in 1972. In addition, to estimate selective drop-out effects (external validity) the core longitudinal sample was contrasted with the drop-out sample at the first time of measurement (1970).

1970 to 1972) in the longitudinal group merely reflect effects of repeated testing. Unfortunately, the control group drawn for the second occasion (1971) was of dubious representativeness due to a high dropout rate between the scheduling and the actual testing of subjects. This condition was alleviated with the third occasion controls by returning the necessary number of times to each school system to insure adequate inclusion of the randomly selected control participants. For purposes of this analysis, therefore, we decided to include only the third occasion (1972) retest controls.

An additional control group consists of those subjects who, although tested initially in 1970, did not complete the study. To the extent that analysis of this group's data indicates that they have selectively dropped out, with respect to our measurement variables, the external validity (Campbell & Stanley, 1963) of the results of this research is jeopardized. For better or worse, this is information that must be taken into account before generalizing from the longitudinal sample to the base population. Comparison of the impact of testing and drop-out effects is also important, since testing effects, in the present design, cannot be estimated independently from drop-out effects.

2. Measurement Variables. The principal objective in selecting the measurement instruments was on comprehensively mapping, using a structured measurement approach, the universe of personality variables. The bulk of measurement variables, therefore, centers on personality (temperament) attributes. A small set of cognitive variables was included to mark the ability domain. Measures from both the personality and ability domains were included so that differential interrelationships between personality and ability attributes throughout adolescence could be assessed. Also, the inclusion of ability measures permits us to increase the range of information about generational change components in cognitive development per se (Nesselroade et. al., 1972), downward through adolescence.

Table 2 gives an overview of the measuring instruments used. As marker variables for the ability domain, the subtests from Thurstone & Thurstone's (1962) Primary Mental Abilities (PMA) battery were

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Table 2 on next page

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administered. The measurement instruments selected to cover the personality/temperament domain were Cattell & Cattell's (1969) High School Personality Questionnaire (HSPQ -- Form A) and the recently published Personality Research Form (PRF -- Form E) of Jackson (1968). Since the two personality inventories are quite discrepant in both their underlying theory and development, it was expected that in combined application they would afford a thorough mapping of the total sphere of personality, at least within the realm of questionnaire data.

Table 2

Measurement Systems: Primary Mental Abilities, High School Personality Questionnaire and Personality Research Form

Instrument	Variables	
I. Primary Mental Abilities (Thurstone & Thurstone, 1962)	1. Verbal Meaning	4. Word Grouping (Reasoning)
	2. Number Facility	5. Number Series (Reasoning)
	3. Letter Series (Reasoning)	6. Spatial Relations
II. High School Personality Questionnaire (Cattell & Cattell, 1969)	1. Sizothymia (A)	8. Parmia (H)
	2. Intelligence (B)	9. Premsia (I)
	3. Ego Strength (C)	10. Coasthenia (J)
	4. Excitability (D)	11. Guilt Proneness (O)
	5. Dominance (E)	12. Self-sufficiency (Q_2)
	6. Surgency (F)	13. Self-sentiment (Q_3)
	7. Superego (G)	14. Ergic Tension (Q_4)
III. Personality Research Form (Jackson, 1968)	1. Abasement	11. Exhibition
	2. Achievement	12. Harmavoidance
	3. Affiliation	13. Impulsivity
	4. Aggression	14. Nurturance
	5. Autonomy	15. Order
	6. Change	16. Play
	7. Cognitive Structure	17. Sentience
	8. Defendence	18. Social Recognition
	9. Dominance	19. Succorance
	10. Endurance	20. Understanding

Note. -- Each of the HSPQ scales contains 10 items, whereas the PRF scales consist of 16 items each. The number of items included in the PMA scales varies: Verbal Meaning, N = 60; Space, N = 30; Number Facility, N = 30; and Reasoning, N = 70 (consisting of three subscales): Letter Series, N = 20; Word Grouping, N = 30; and Number Series, N = 20. Letters in parentheses following HSPQ variables are designations used by Cattell to identify personality dimensions.

The HSPQ is the adolescent version of the 16 PF (Cattell, Eber, & Tatsuoka, 1970); the latter being generally recognized as representing most distinctly the notion of convergence between a theory of personality structure and a corresponding set of measurement scales. Of the 14 psychological constructs operationalized in the HSPQ, eight are regarded as being affected by age-development in middle childhood and adolescence, although the available studies have obviously failed to disentangle age from generation effects (e.g., Sealy & Cattell, 1966). An additional, more indirect piece of information favoring the inclusion of HSPQ dimensions for closer scrutiny in developmental research is the finding by Cattell, Blewett, and Beloff (1955) that observed variance on these factors can be attributed to environmental and hereditary sources in a highly differential manner. For example, I, C, F, Q_2, and Q_4 were found to be predominately environmentally determined dimensions. Accordingly, one might hypothesize them to be differentially more susceptible to generation differences, in contrast to the other dimensions, given the comparative stability of a gene pool over the time span of our sequential research.

In contrast to Cattell's HSPQ, Jackson's (1968) PRF was not developed in the framework of the factor analytic model. Using a multivariate convergent and discriminant validation approach (Jackson, 1970), this self-report inventory, however, also was designed to cover a broad spectrum of the behavioral universe, essentially as defined by Murray's (1938) framework for the description of personality, but with additional refinement of concepts by Jackson and his coworkers. Furthermore, at least on the basis of content validity, the dimensions included in the PRF are similar to those emphasized in current research and theorizing on adolescent personality development. The dimensions of affiliation, aggression, autonomy, exhibition, impulsivity, and social recognition represent behavioral characteristics which are rarely neglected in any discussion of adolescent development, although there are no published empirical age-development data on the PRF. Moreover, one might expect that generational change will primarily concern such dimensions as achievement, aggression, exhibition, order, play, and social recognition. In this instance, however, the hypotheses must be speculative because of a lack of any systematic empirical evidence regarding nature-nurture relationships on PRF dimensions.

3. Subjects and Procedure. The subjects in this study were drawn from 32 junior and senior highschools in the public school systems of three West Virginia counties: Harrison, Wetzel, and Wood. The base population includes some 20,000 students. Census data suggest that none of the counties are considered part of West Virginia's underdeveloped region. The sample, stratified by age, sex, and homeroom unit, was drawn at random from the 32 school rosters. The ratio of Caucasian to Negro population is about 95:5. Summary data for the longitudinal, drop-out, and retest control groups are presented in Table 3. Approximately 2,000 students (from cohorts 1954-1957) were asked by letter to

volunteer for a study on social change and adolescent personality. Of those 2,000 students, a total of 1828 (personality analyses) and 1809 (ability analyses) participated in various phases of the project. In terms of summary statistics for the 1954-1957 cohorts, the initial volunteering rate was approximately 91%; further, of the core longitudinal samples approximately 63% participated in all three occasions of measurement (1970, 1971, 1972).

Table 3 on next page

The testing was done in classrooms during regular school periods with groups ranging in size from about 30 to 90. The test administrators were carefully trained and continuously supervised by the project directors and their graduate research assistants. Total testing time consisted of a four hour period which was divided into one morning (PMA, HSPQ) and one afternoon (PRF) session. In a few cases, both sessions were distributed over two days. The 1970, 1971, and 1972 occasions of measurement each extended over a period of approximately four months (late fall till early spring). Thus, January 1 was taken as mean testing date for all occasions.

B. Data Analysis

A number of considerations, both substantive and methodological, were brought to bear in collecting and analyzing the data of the present study. Two major lines of development with regard to data analysis procedures (summarized in Baltes, 1968; Baltes and Nesselroade, 1970, 1972; 1973) may be recognized which will serve to help organize the material to be presented subsequently. These were: (a) Analyses germane to the evolvement of the dependent variable system ultimately used in pursuit of our substantive goals; and (b) design considerations directly pertinent to the primary substantive focus of the study --the examination and separation of ontogenetic and generational components in studying adolescent personality development.

1. Structuring the Dependent Variables. Among our primary concerns during the planning of this project was that of identifying, given the time and economic constraints impinging on data collection activities, a battery of personality measurement variables that would provide, in structured measurement form, a comprehensive but also parsimonious coverage of the personality sphere. As indicated above, we elected to cast a rather wide net at first, so that later data reduction efforts could be addressed to several important methodological issues (involving questions of age-invariant validity and age-comparability) which are becoming familiar to developmental researchers. Among these are the distinction between structural (qualitative) and quantitative change (Baltes & Nesselroade, 1970, 1973; Nesselroade,

Table 3

Sample Size for Sequential Longitudinal, Drop-out, and Retest Control Groups Separately for Personality and Ability Analyses

Cohort	Sequential Longitudinal (1970-1972)		Drop-out (1970-1972)		Retest Control (1972)		Total N
	Male	Female	Male	Female	Male	Female	
			Personality Variables				
1957	102	119	35	37	70	86	449
1956	95	127	64	46	70	72	474
1955	101	123	87	67	50	55	483
1954	83	66	82	79	60	52	422
			Ability Variables				
1957	99	118	44	37	68	84	450
1956	93	123	66	48	69	71	470
1955	99	118	89	69	48	52	475
1954	80	63	86	79	56	50	414
Total Personality	381	435	268	229	250	265	1828
Total Ability	371	422	285	233	241	257	1809

1970) as reflected in a variety of multivariate models of change, examination of convergent and divergent validity of measurement instruments (Campbell & Fiske, 1959), and recognizing the possibility of differential change patterns for identifiable components of more global concepts (Bentler, 1973; Horn, 1970; Nunnally, 1973).

The focus of considerable effort was on the issues just mentioned in order to produce measures about which much was known concerning their structural characteristics before an attempt was made to analyze them further into ontogenetic and generational components of change. Results of two such analyses will be briefly summarized later; one leading to the selection of 10 second-order personality measures and the other to the selection of six ability measures for further study.

2. Ontogenetic vs. Generational Change. As outlined earlier, the analysis of generational and ontogenetic change components followed the strategies outlined by Schaie (1965) and Baltes (1968). Sample cases for the three types of strategies are given in Table 4. Depending

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Table 4 on next page

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upon the research question, the data resulting from observing either independent or dependent samples from different cohorts at various ages (cross-sectional vs. longitudinal sequences) can be analyzed by either of three bifactorial combinations: Cohort by Time of Measurement (Cross-sequential method), Cohort by Age (Cohort-sequential method), and Time of Measurement by Age (Time-sequential method). In fact, according to Schaie (1965), successive application of these three sequential data-analysis models (time-sequential, cross-sequential, cohort-sequential) is purported to lead to inferences which allow the specification of the obtained age, time, and cohort effects in terms of substantively distinct developmental sources of variance (cohort = genetic, time = environmental, age = maturational). One of the present authors (Baltes, 1967; 1968) has challenged this view (see also Buss, 1973) and argued that such an analytical strategy is methodologically unsound, although it may be theoretically appealing. This, since the effects are not only statistically confounded, but also since variation of time per se and subject-related time variables (cohort, age) does not allow for a specification of the substantive correlates and developmental mechanisms that produced the observed time, cohort, and age effects. Accordingly, in the same papers, (Baltes, 1967; 1968) it was proposed to abandon Schaie's (1965) focus on "developmental explanation" and to view Schaie's General Developmental Model as a descriptive one. In the same vein, it was argued that selection of one of the three analytic methods (cross-sequential, time-sequential, cohort-sequential) should be guided either by criteria of parsimony (which bifactorial arrangement provides for the most

Table 4

Examples of the Three Basic Models-Strategies Using a Data Matrix Involving Three Ages, Three Cohorts, and Three Times of Measurement

Cohort (C)	Time of Measurement (T)								
	1970	1971	1972	1970	1971	1972	1970	1971	1972
1958			14[a]			14			14
1957		14	15		14	15		14	15
1956	14	15	16	14	15	16	14	15	16
Strategy	Cross-Sequential (T,C) Method			Cohort-Sequential (A,C) Method			Time-Sequential (A,T) Method		

[a]Table entries give ages at times of measurement.

Note. -- For further explanation of decision rules and interpretation of outcomes, see Schaie (1965, 1970) and Baltes (1968). Concrete examples comparing outcomes when applying different models of data analysis are presented in Schaie & Strother (1968a,b), Baltes & Reinert (1969), and Baltes, Baltes, & Reinert (1970).

simple description), by theoretical considerations that originate from outside the model itself (extramodel perspectives), or in light of additional experimental conditions superimposed on the arrangement provided by the core General Developmental Model.

The sequential data available in the present project could be analyzed by either of the three Schaie (cohort-sequential, time sequential, cross-sequential) arrangements. It was decided to adopt a cross-sequential model of data analysis for this investigation. The cross-sequential model varies cohort and time of measurement while confounding chronological age. There are two primary reasons for this decision. One, in contrast to the time-sequential model, it allows for the analysis of repeated-measurement (intraindividual) change characteristics which is at the core of any developmental approach. Second, analysis of the first two data points (1970, 1971), summarized in Baltes and Nesselroade (1972), had clearly suggested that chronological age accounted for much less variance than did time of measurement and cohort, thus indicating that a cohort by time analysis would provide for the most parsimonious data representation.

The arrangement chosen is depicted in Table 5. The total pool of subjects participating in the 1970, 1971, and 1972 data collection -- the sequential longitudinal group -- was divided into four levels of cohort[1], each composed of all subjects born within a given year (1954, 1955, 1956, 1957). Separate 4 (cohort) by 2 (sex) by 3 (time of measurement) analyses were performed on each of the personality and ability measures (repeated measurement on the time factor) to test for quantitative aspects of ontogenetic and generational change. The slight discrepancies between sample sizes represented in the perso - ality and ability analyses are due to cases of incomplete data on one or the other sets of measures.

Table 5 on next page

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3. Stability Coefficients. As an additional source of information on the descriptive aspects of change, stability coefficients (test-retest) were computed on both the personality and ability measures. Three such coefficients were obtained for each of the 16 measures; two one-year stabilities (1970-71, 1971-72) and one two-year stability (1970-72). These correlations, of course, do not reflect mean changes from one time to another, but rather the extent to which a given sample of subjects tend to retain their relative rank ordering across time.

In describing the nature of change over time, stability coefficients add a somewhat different dimension to one's interpretation than can be obtained from mean changes alone. If, for example, a

Table 5

Cross-Sequential Analysis of Adolescent Development
Age, Cohort, and Time of Measurement

Mean Cohort	Number of Subjects				Mean Time of Measurement		
	Personality		Ability				
	M	F	M	F	January 1970	January 1971	January 1972
May 1957	102	119	99	118	12:6	13:6	14:6
May 1956	95	127	93	123	13:6	14:6	15:6
May 1955	101	123	99	118	14:6	15:6	16:6
May 1954	83	66	80	63	15:6	16:6	17:6

Note. -- Table entries on right are approximate ages (years; months) at the three times of measurement. Range of each cohort and age level is an interval of one year.

significant mean change is found and the standard deviation remains relatively constant from time 1 to time 2, a high stability coefficient implies that increments (or decrements) in score were essentially of the same magnitude for all subjects. Stability coefficients have been the basis for some speculations about developmental processes (e.g., Bloom, 1964) but the present writer's view them as only one (albeit an important one) aspect of change examination. The methodological and theoretical rationale for viewing stability coefficients as important ingredients for developmental theory building is summarized in greater detail in Baltes and Nesselroade (1973) and represents an extension of the thinking involved in the Fels Study as described by Kagan and Moss (1962).

4. Control Analyses. Two analyses were performed to gain information concerning the internal and external validity of the results. First, focusing on the first-occasion data (1970) only, we examined, by means of a 2 (drop-out vs. retestees) by 4 (cohort) by 2 (sex) design, whether or not the core longitudinal sample differed from the drop-out sample on any of the dependent variables.

Second, using the 1972 data, we checked to see whether apparent changes from first to third occasion of measurement might be attributed to the effects of repeated testing. This involved a series of 2 (retestees vs. control) by 4 (cohort) by 2 (sex) analyses of variance -- one on each personality and ability dimension. Both these control analyses need to be considered conjointly when assessing the degree of internal vs. external validity of the present study.

V. RESULTS

A. Reduction of Measurement System (PRF, HSPQ and PMA)

In preparing for the major analyses to examine the relative contributions of cultural and ontogenetic components of developmental change during the period of adolescence, one of the intriguing preliminary issues was that of choosing how to deal with the multitude of personality scales (34) contained in the HSPQ and the PRF. We had expressly aimed for broad initial coverage of the personality sphere in designing the study so that data reduction could be done in an orderly and parsimonious way. The procedures followed are described elsewhere in detail (Nesselroade & Baltes, unpublished, 1972) and will only be sketched out here. The primary objectives of this data-reduction process were to obtain a parsimonious system of dependent variables and a measurement framework that would permit us to perform quantitative comparisons on a set of age/cohort-invariant dimensions (Baltes & Nesselroade, 1970).

The reasoning behind our approach was, first of all, that the 14 HSPQ and the 20 PRF scales, albeit derived from somewhat different personality systems, ought to reflect a substantial degree of overlap since each inventory was designed to be a comprehensive assessment device of personality measured via self report. The commonality among the abundance of personality measurement devices now available is, indeed, a much more general issue than our particular concern with data reduction, as witnessed by the large number of studies published in which comparative analysis of two or more inventories have been conducted (e.g., Comrey & Duffy, 1968; Eysenck & Eysenck, 1969; Howarth & Browne, 1971; and Sells, Demaree, & Will, 1970). In the interest of parsimony, therefore, it was decided to apply a procedure that would reduce the full data matrix to a minimum number of second-order dimensions describing those dimensions that are common to the HSPQ and PRF as well as unique to either instrument.

This rationale of data reduction is further supported by the fact that there is substantial evidence attesting not only to the robust structure of the higher order dimensions obtained by factor analysis of the HSPQ scales, but also to the notion that such second-order factors are behavior patterns (e.g., extraversion, independence, anxiety) which, historically, have been of more interest to developmental researchers. Thus, for the purpose of obtaining a set of parsimonious and robust dimensions, the procedure to be set forth was followed.

First, the 14 HSPQ scales and the 20 PRF scales were factor analyzed separately using the responses from 1877 subjects (cohorts 1951-57) for whom complete personality data were available at Time 1 (1970). As described in Nesselroade and Baltes (unpublished, 1972), seven common factors were extracted from HSPQ scale intercorrelations and eight from PRF scale intercorrelations. These two sets of factors

were then independently rotated to simple structure solutions. The factors were then interpreted[2] and their intercorrelations with the separate scales of the other instrument estimated by an extension analysis procedure (Dwyer, 1937). Finally, the two sets of factors were correlated with each other in order that a single index summarizing the degree of relationship between a given HSPQ and PRF factor could be examined. The resulting correlations between the HSPQ and PRF factors are presented in Table 6.

Table 6 on next page

The factors represented in Table 6 have been serially ordered, along the lines of a Campbell and Fiske (1959) multitrait-multimethod matrix. These data suggest that in four cases, there is a substantial degree of convergence between HSPQ and PRF factors (PRF II - HSPQ I, etc.).

For purposes of quantitative mean comparisons, factor scores were subsequently estimated. The procedure chosen was the one variously described as the method of idealized variables (Harman, 1960) and as the least squares procedure (Tucker, 1971). In line with the arrangement shown in Table 7, then, the 34 personality variables were reduced to a matrix consisting of fourteen sets of estimated factor scores (seven representing HSPQ factors and seven representing the interpreted PRF factors). This number was further reduced to 10 by averaging the scores on the four cross-instrument matched factors.

The resulting 10 factors (4 PRF-HSPQ common, 3 PRF specific, 3 HSPQ specific) were subsequently used as dependent variables. In our judgment (as further discussed in Nesselroade and Baltes, 1972), they represent a parsimonious and reliable framework within which to describe adolescent personality development. Table 7 presents these 10 dimensions in terms of their relationships to the initial personality scales used.

Table 7 follows

The decision concerning what measures to use as dependent variables in analyzing the intelligence (PMA) data for evidence on ontogenetic and generational components of developmental change was based generally on the notion that the subtests of the PMA have a well established factor structure. An analysis of the Time 1 (1970) PMA data (Fitzgerald, Nesselroade, & Baltes, 1973) in fact rather clearly

Table 6

HSPQ-PRF Factor Intercorrelations
on Second-Order Level

PRF Factor	HSPQ Factor I	VII	III	IV	II	V	VI
II	(.83)	-.22	.29	-.09	.03	-.40	.01
I	-.21	(.71)	-.24	-.05	-.33	-.18	-.29
V	.46	-.40	(.66)	-.13	-.04	-.46	-.31
VII	-.42	-.26	.33	(.62)	.14	-.12	-.11
IV	.10	-.40	.48	.43	.45	-.29	-.16
III	.13	-.36	.52	.45	-.32	-.33	-.13
VI	.27	.64	-.01	.01	-.36	-.29	.23

[a]PRF factor VIII which was not interpreted and which showed only minimal correlation with HSPQ factors and scales is not included. (See Nesselroade & Baltes, 1972, for further discussion.)

Table 7

Description of Personality Factors Obtained from HSPQ and PRF Scale Factor Analyses
(See Nesselroade & Baltes, 1972, for greater detail)

			Scales Saliently Loading Factor			
			HSPQ		PRF	
Factor	Name	Origin	Scale	Loading	Scale	Loading
I	Extraversion/ Ascendance	HSPQ(I) PRF(II)	A+ Affectothymia (Outgoing)	.53	Dominance+ (Governing)	.62
			F+ Surgency (Enthusiastic)	.50	Exhibition+ (Exhibitionistic)	.52
			H+ Parmia (Adventurous)	.57	Sentience+ (Aesthetic)	.52
			Q_2- Group Dependency (Conventional)	-.32		
II	Superego Strength/ Impulse Control	HSPQ(VII) PRF(I)	F- Desurgency (Serious)	-.46	Aggression- (Non-aggressive)	-.40
			G+ Superego Strength (Conscientious)	.63	Cognitive Structure+ (Precise)	.60
			Q_3+ High Self Sentiment (Controlled)	.51	Harmavoidance+ (Fearful)	.32
					Impulsivity- (reflective, deliberate)	-.76
					Order+ (Neat, Organized)	.69
					Play- (Serious, Sober)	-.47

Table 7 continued (2nd page)

Factor	Name	Origin	Scales Saliently Loading Factor			
			HSPQ		PRF	
			Scale	Loading	Scale	Loading
III	Tough-Mindedness/ Autonomy	HSPQ(III) PRF(V)	A- Sizothymia (Reserved)	-.48	Nurturance- (Unsympathetic)	-.42
			E+ Dominance (Assertive)	.42	Sentience- (Unfeeling)	-.86
			I- Harria (Tough-minded)	-.86	Understanding- (Lacks curiosity)	-.37
			Q_2+ Self-sufficiency (Resourceful)	.36	Succorance- (Not dependent)	-.26
IV	Independence/ Avoidance of Social Contact	HSPQ(IV) PRF(VII)	J+ Coasthenia (circumspect individualism)	.61	Affiliation- (Aloof, cool)	-.75
			Q_2+ Self-sufficiency (Resourceful)	.52	Change- (Likes routine, consistent)	-.51
					Exhibitionism- (Avoids attention, modest)	-.44
					Nurturance- (Unsympathetic)	-.27
					Play- (Serious, Sober)	-.52
					Understanding- (Lacks curiosity)	-.42

Table 7 continued (3rd page)

Factor	Name	Origin	Scales Saliently Loading Factor			
			HSPQ		PRF	
			Scale	Loading	Scale	Loading
V	Anxiety	HSPQ(II)	C- Low Ego Strength (Emotional Instability)	-.41		
			D+ Excitability (Excitable)	.72		
			H- Threctia (Shy)	-.27		
			O+ Guilt Proneness (Apprehensive)	.27		
			Q_2- Group Dependency (Conventional)	-.30		
			Q_3- Low Self-Sentiment (Uncontrolled)	-.26		
			Q_4+ High Ergic Tension (Tense)	.71		
VI	Social Anxiety	HSPQ(V)	C- Low Ego Strength (Emotional Instability)	-.32		
			O+ Guilt Proneness (Apprehensive)	.42		
VII	Intelligence	HSPQ(VI)	B+ High Intelligence	.47		

Table 7 continued (4th page)

			Scales Saliently Loading Factor			
			HSPQ		PRF	
Factor	Name	Origin	Scale	Loading	Scale	Loading
VIII	Independence	PRF(III)			Autonomy+ (Unmanageable)	.71
					Change+ (Inconsistent)	.47
					Harmavoidance- (Fearless, likes excitement)	-.47
					Social Recognition- (Unconcerned about esteem from others-	-.63
					Succorance- (Independent, distrusting of others-	-.60
					Understanding+ (Inquiring, curious)	.41
IX	Aggression	PRF(IV)			Abasement- (Lacking humility)	-.61
					Aggression+ (Aggressive)	.63
					Defendence+ (Self-protective)	.58
					Understanding+ (Inquiring, curious)	.3[illegible]

Table 7 continued (5th page)

			Scales Saliently Loading Factor			
			HSPQ		PRF	
Factor	Name	Origin	Scale	Loading	Scale	Loading
X	Achievement	PRF(VI)			Achievement+ (Striving)	.86
					Dominance+ (Governing)	.31
					Endurance+ (Persistent)	.63
					Harmavoidance- (Fearless, likes excitement)	-.30
					Understanding+ (Inquiring, curious)	.40

Note. -- Signs and adjectives attached to scales agree with direction of loadings.

supported an age-invariant abilities structure, corresponding to that described by Thurstone and Thurstone (1962) in the PMA Handbook, for our population of adolescents. Accordingly, we elected to examine the six tests of ability (Verbal Meaning, Number Facility, Letter Series, Word Grouping, Number Series, and Spatial Relations) as they are structured by the framework underlying the test version of the Primary Mental Abilities. In other words, it was neither necessary nor advisable to reduce the six PMA dimensions to a smaller set of dependent variables.

B. Personality Dimensions

1. Overview of Results. The principal results of the 10 analyses of variance of personality factors (by means of time by cohort by sex arrangements) for the sequential longitudinal group are summarized in Table 8, accepting a 1% level of confidence. A series of figures are presented in the next several pages to illustrate those outcomes which are particularly striking in their reflection of the relative impact of ontogenetic vs. generational change. More specific discussions of the outcome for each personality factor will be presented below. First, a brief summary of the general findings in reference to Table 8 will be given. Individual cell means for all personality measures are presented in Appendix B.

Table 8 on next page

In this type of design (varying time and cohort) both main effects can be indicative of the existence of ontogenetic and generational change, although time differences (between 1970 and 1972) may be regarded as the proper indicators of "true" longitudinal, cohort-specific age changes occurring over the two year periods involved (12:6 - 14:6; 13:6 - 15:6, etc.) provided that such time differences are not confounded with extraneous effects such as those due to testing. When evaluating the relative import of ontogenetic (age-related) vs. historical change, however, one would expect cohort effects to occur with high frequency on the assumption of strong ontogenetic (age) effects, since the four levels of cohort (1954-57) cover simultaneously average chronological age differences amounting to three years (13:6 vs. 14:6 vs. 15:6 vs. 16:6). Conversely, if historical (time-related) change effects dominated, one would expect time effects (1970 vs. 1971 vs. 1972) to be of greater import.

Inspection of Table 8 shows that time effects are more prominent than cohort effects. Statistically, significant main effects of time were found for seven of the 10 factors (Extraversion/Ascendance, Superego Strength/Impulse Control, Anxiety, Social-Emotional Anxiety, Intelligence, Independence, and Achievement). Cohort effects, on the other hand, which, as stated before, in this design are indicative of both cohort and cross-sectional age differences, were found to be

Table 8

Summary of Analyses of Variance for Personality Sequential Longitudinal Data

Source	df	Personality Factor						
		HSPQ-PRF					HSPQ	
		I	II	III	IV	V	VI	VII
Between Ss	815							
Cohort (C)	3	0.3	0.2	4.3*	0.5	1.6	1.9	6.1*
Sex (S)	1	58.4*	4.8	860.4*	88.5*	37.2*	132.8*	45.4*
C X S	3	2.1	0.5	2.9	1.5	2.7	0.5	4.0*
Ss within Groups	808							
Within Ss	1632							
Time (T)	2	11.0*	42.4*	4.5	2.2	6.9*	20.3*	63.9*
C X T	6	0.9	5.5*	2.1	0.9	2.4	0.9	0.7
S X T	2	2.6	0.1	7.2*	1.9	6.3*	1.8	2.9
C X T X S	6	1.0	1.2	2.1	1.4	0.6	1.8	1.5
T by Ss within	1616							

Note. -- Table entries are F-values.
*$p < .01$.

Table 8 (Continued)

Source	df	Personality Factor PRF VIII	IX	X
Between Ss	815			
Cohort (C)	3	2.0	2.3	3.4
Sex (S)	1	150.6*	87.7*	25.7*
C X S	3	1.1	0.9	0.7
Ss within Groups	808			
Within Ss	1632			
Time (T)	2	26.6*	0.1	16.3*
C X T	6	1.1	1.2	2.9*
S X T	2	2.0	0.9	3.5
C X T X S	6	1.2	0.9	0.9
T by Ss within	1616			

Note. -- Table entries are F-values.
*p < .01.

significant for only two of the 10 personality factors (Tough-mindedness/Autonomy and Intelligence). Cohort and time interacted significantly, however, in the cases of Superego Strength/Impulse Control and Achievement.

The overview contained in Table 8 points to another major feature, namely that sex differences are the most potent effects in the present data, which is interesting in itself, but not of prime significance for this project, since they interact only in three cases with either cohort or time. Thus, sex effects were highly significant for all personality dimensions except Superego Strength/Impulse Control. Significant sex by time interactions were found for Tough-Mindedness/Autonomy and Anxiety and a significant sex by cohort interaction was obtained for Intelligence. For no personality factor was there found a significant cohort by sex by time interaction effect.

In summary, then, this overview of the analysis on personality dimensions suggests that (next to sex effects) it is the time dimension which most systematically accounts for subgroup differences, whereas cohort effects are less frequent. This outcome pattern already suggests that chronological age per se does not appear to be as powerful a variable as one might have expected.

2. Specific Personality Factor Results. The analytical steps followed in developing the 10 personality factors used as dependent variables in the sequential longitudinal analyses were discussed earlier. The reader is also referred to Table 7 wherein each personality factor was defined in terms of the individual measurement scales which contributed saliently to its factorial description.

When presenting the individual results in greater detail, we will simply identify each dimension by name and present a few representative adjectives to assist the reader in recalling the general nature of the factor. It may also be useful to observe at this point that the data on personality factors are represented as factor scores which are scaled to a mean of zero. Furthermore, it should be noted that graphic representations of the outcomes are presented whenever time and/or cohort effects reached significance. Sex effects are shown only if they interact with either time or cohort. In all relevant incidents, the figures contain the cohort-specific longitudinal gradients determined over three occasions of measurement for each of the four cohorts. The figures also contain, separately for each occasion of measurement, cross-sectional age differences (12 - 15 vs 13 - 16 vs 14 - 17). In fact, it will be helpful to contrast the cross-sectional (vertical comparisons) with the longitudinal findings (horizontal comparisons) in each of the cases to be discussed.

Factor I. HSPQ-PRF (Extraversion/Ascendance: Outgoing, governing, enthusiastic) showed a significant main effect of both sex and time. Males ($\bar{X}$ = .31) were significantly higher than females ($\bar{X}$ = -.20) and the means for the total sample increased significantly over time

(1970, $\bar{X}$ = -.04; 1971, $\bar{X}$ = .06; 1972, $\bar{X}$ = .10). In the absence of significant interactions, these findings can be generalized to all levels of cohort, sex, and time involved. One noteworthy initial developmental implication is that the very marked sex differences observed here had emerged prior to age 12 and were maintained through age 18.

The time-related effects for Extraversion/Ascendance are presented graphically in Figure 1. Data inspection and the absence of

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Figure 1 on next page

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significant interactions suggest that all cohorts show a continuous movement towards a higher level of Extraversion/Ascendance from 1970 to 1972. Note that this effect is associated with time differences and not cohort differences. As argued earlier, this finding may be taken as indicating that chronological age *per se* is not the major ingredient, at least not within the framework of linear and additive relationships.

Factor II. HSPQ-PRF II (Superego Strength/Impulse Control: serious conscientious, non-aggressive, inhibited) exhibited statistically significant time of measurement and cohort by time interaction effects. Pertinent means are plotted in Figure 2.

Initial inspection of Figure 2 shows an overall decrease in Superego/Impulse Control from 1970 to 1971 and 1972 for all cohorts and age levels involved. This overall pattern however, needs qualification due to the significant cohort by time interaction effects. This interaction indicates that the systematic time-related decline in Superego applies to cohorts (1955-1957) but not to cohort 1954 which, from statistical viewpoints, exhibits no longitudinal change at all.

Figure 2 follows

Another way to look at the data presented in Figure 2 is to contrast the four cohort-specific longitudinal gradients (horizontal comparisons) with the findings of the three cross-sectional (vertical comparisons) representations applying to the 1970, 1971, and 1972 time points. Whereas the three cross-sectional gradients present rather discrepant age orderings (12-13-14-15 vs. 16-15-13-14 vs. 17-16-15-14), the longitudinal gradients, with the exception of cohort 1954, present a rather consistent ontogenetic pattern. Similar discrepancies between cross-sectional and longitudinal gradients apply to most

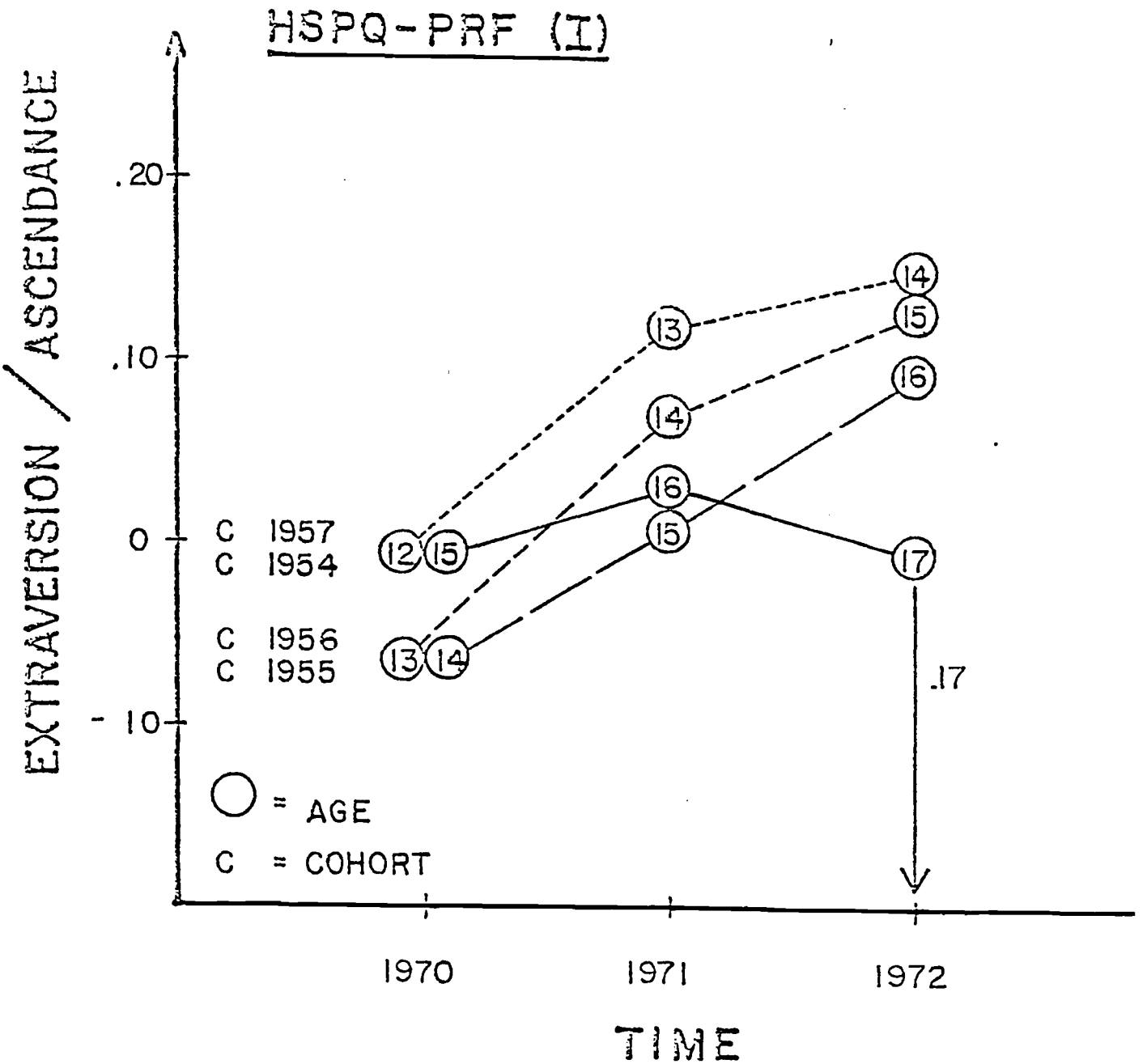

Figure 1. -- Extraversion/Ascendance Longitudinal Sequences: Time Main Effect (Retest effect indicated by arrow)

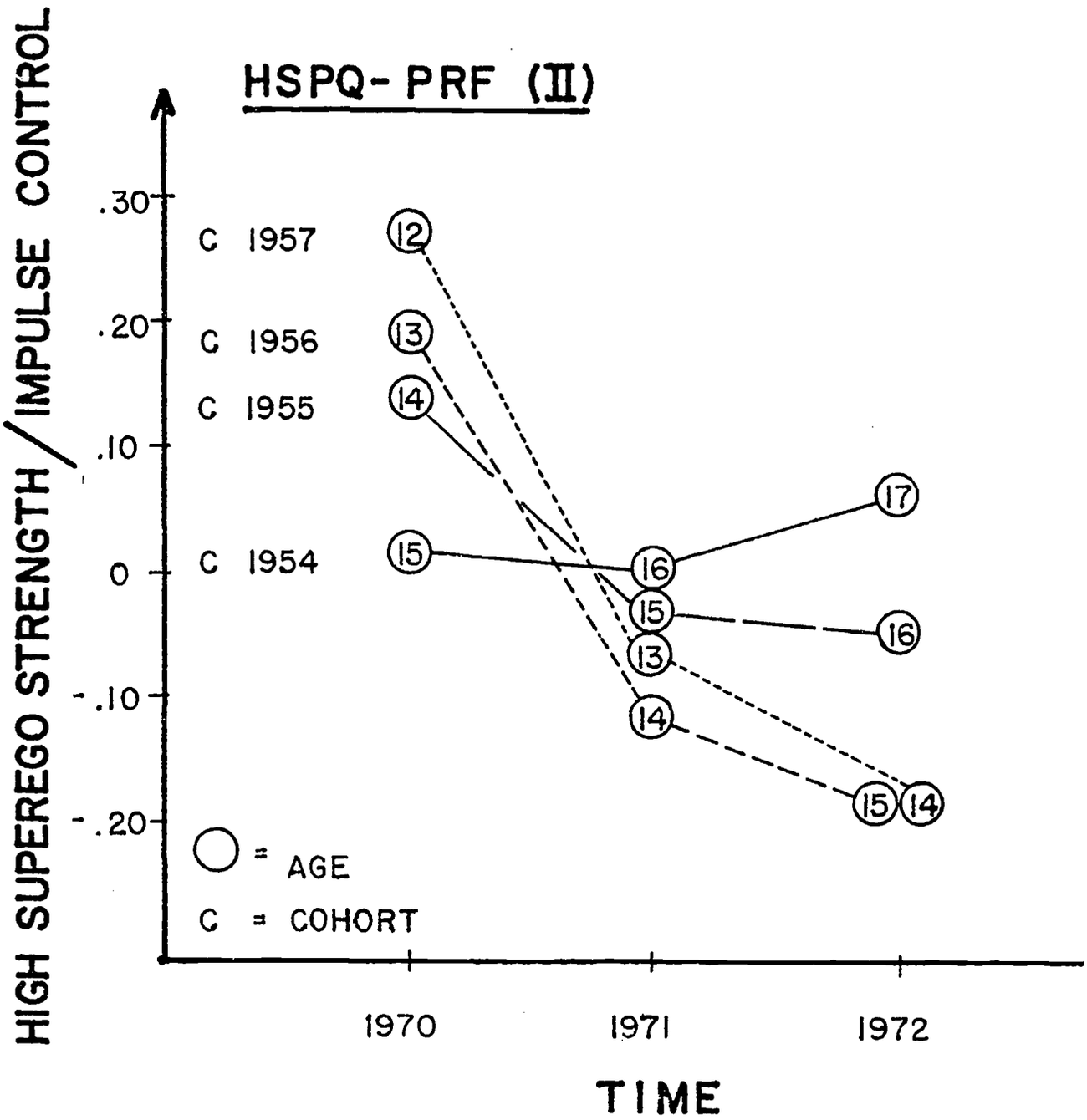

Figure 2. -- Superego Strength/Impulse Control Longitudinal Sequences: Time Main Effect and Cohort by Time Interaction

of the personality findings reported subsequently and will not be dwelled on in the present result section.

Factor III. HSPQ-PRF III (Tough-Mindedness/Autonomy: reserved, assertive, unfeeling) was found to show a significant main effect of cohort, one of sex, and a significant sex by time interaction.

The sex difference was rather dramatic as is shown in Figure 3 with males exhibiting a higher level of Tough-Mindedness/Autonomy than females. Cohort level was found not to be linearly related to mean score on Factor III (1957, $\bar{X}$ = .11; 1956, $\bar{X}$ = -.04; 1955, $\bar{X}$ = -.11; 1954, $\bar{X}$ = .00). Data across the three times of measurement (1970, 1971, 1972) indicate a tendency for the mean of the males to increase ($\bar{X}$ = .64, .76, .78, respectively), and for the females' mean score to decrease ($\bar{X}$ = -.65, -.62, -.69, respectively). This tendency for the two sexes to diverge, although not striking, is reflected in the statistically significant time by sex interaction. Thus, even though sex differences in Tough-Mindedness/Autonomy were quite marked by age 12, there is some evidence that they continue to increase throughout adolescence from 1970-1972. Notably, due to a lack of interactions involving the cohort variable, this effect holds for all four cohorts. Parenthetically, it may be said that this finding contradicts some popular notions concerning present day cultural changes in sex-role identification in the direction of less marked sex differences.

Figure 3 on next page

Factor IV. HSPQ-PRF IV (Independence/Avoidance of Social Contact: individualistic, aloof, cool, serious) manifested a main effect of sex only. Males ($\bar{X}$ = .28) scored significantly higher than females ($\bar{X}$ = -.28). This effect applies to all cohorts at all times of measurement and indicates that the noted sex differences were well established by age 12 and were not further affected during the course of adolescent development from 1970-1972.

Factor V. HSPQ V (Anxiety vs. Good Adjustment: emotionally unstable, excitable, tense) showed statistically significant main effects of sex and time, and a significant sex by time interaction. Means, reflecting the latter effect, are presented in Figure 4.

The main sex effect indicates that females exhibit higher self-reported anxiety than males. The significant sex by time interaction reflects the fact that, over the three times of measurement (1970-1972) females show irregular mean changes ($\bar{X}$ = .19, .28, .21) and no systematic time-related trends, while males manifest a marked decrease in mean anxiety scores ($\bar{X}$ = -.11, -.16, -.36) from 1970 to 1972. These sex differences in longitudinal change patterns, which apply to all cohorts, are also in the direction of further increasing the

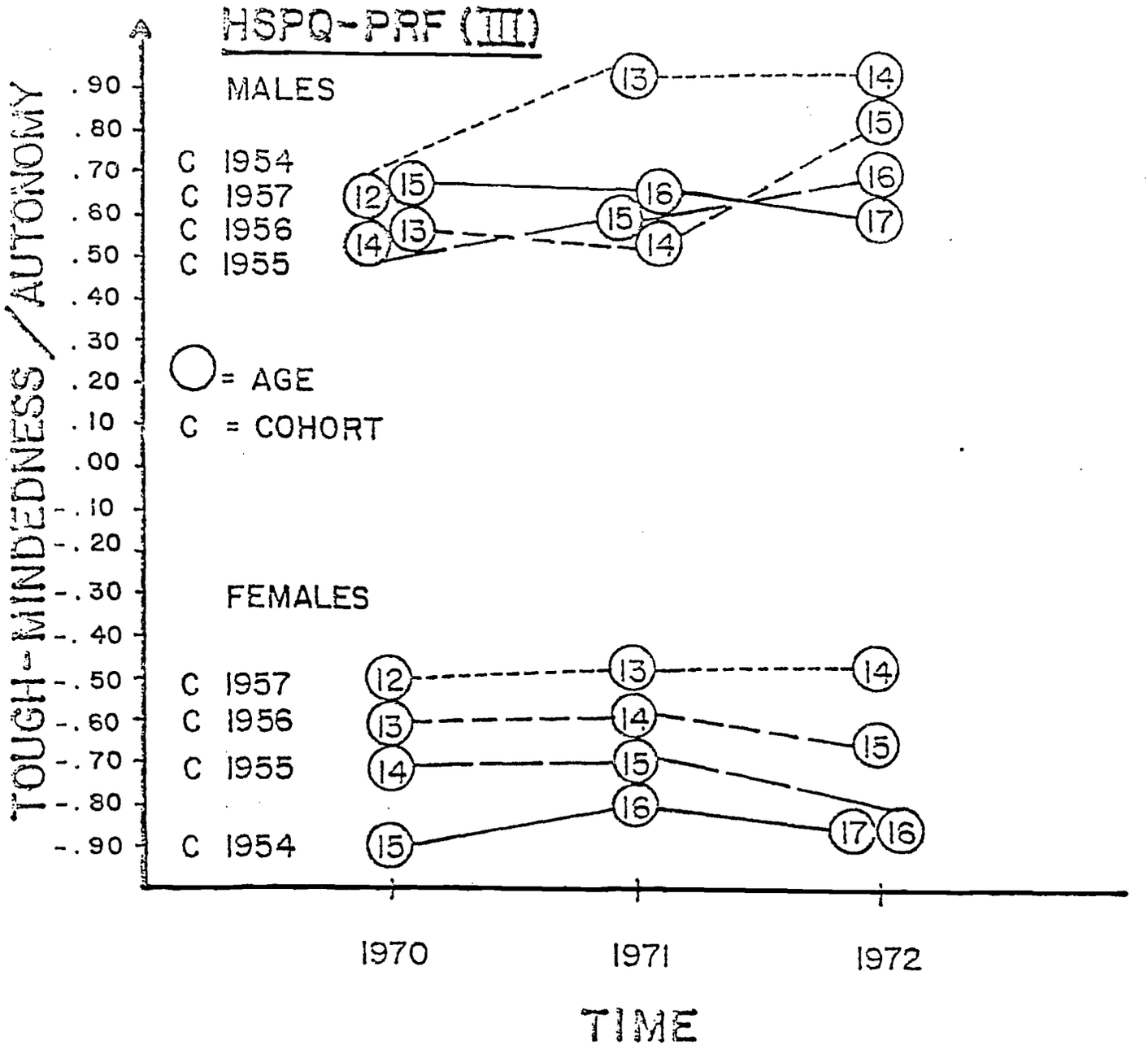

Figure 3. -- Tough-Mindedness/Autonomy Longitudinal Sequences: Cohort Main Effect and Sex by Time Interaction

magnitude of sex differences, from 1970 to 1972. The lack of any significant cohort differences (which also reflect three-year age differences) again underscores that chronological age per se is less relevant in the description of adolescent personality development than the

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Figure 4 on next page

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time variable which, as discussed earlier, points to the operation of antecedents that are intrinsic to historical change rather than age-related ontogeny.

Factor VI. HSPQ VI (Social-Emotional Anxiety: emotionally unstable, apprehensive) manifested significant main effects of sex and time with cohort effects again being of no statistical import. Females ($\bar{X}$ = .43) were found to score higher than males ($\bar{X}$ = -.56); further, total sample means exhibited a relatively steady decrease across the three times of measurement ($\bar{X}$ = .17, -.04, -.23 for 1970, 1971, 1972, respectively).

Lack of any significant interactions among the design components and no main effect of cohort implies a rather straightforward picture of time-related decreases in self-reported Social-Emotional Anxiety from 1970 to 1972 for both sexes, but with the initially observed sex differences maintained. Means reflecting this downward, time-related (generational) trend for each cohort and all age levels are presented in Figure 5. Note that the apparent increase from 1971 to 1972 for cohort 1956 is not supported by statistical tests, since the Time by cohort interaction did not reach significance.

Figure 5 follows

Factor VII. HSPQ-PRF VII (Intelligence) was found to reflect statistically significant main effects of cohort, sex, and time of measurement and a significant cohort by sex interaction. Magnitude of means, some of which are presented in Figure 6, is positively related to age/cohort ($\bar{X}$ = -.11, -.02, .34, .35 for cohorts 1957, 1956, 1955, 1954, respectively) and to time of measurement ($\bar{X}$ = -.23, .13, .46 for 1970, 1971, 1972, respectively). The cohort by sex interaction is not shown in Figure 6. Examination of pertinent means revealed that females ($\bar{X}$ = .21, .48, .55, .50, for cohorts 1957, 1956, 1955, 1954, respectively) scored higher than males ($\bar{X}$ = -.48, -.69, .09, .23, for cohorts 1957, 1956, 1955, 1954, respectively) at all levels of cohort, but by markedly differential amounts, on this highly verbal measure of general intelligence.

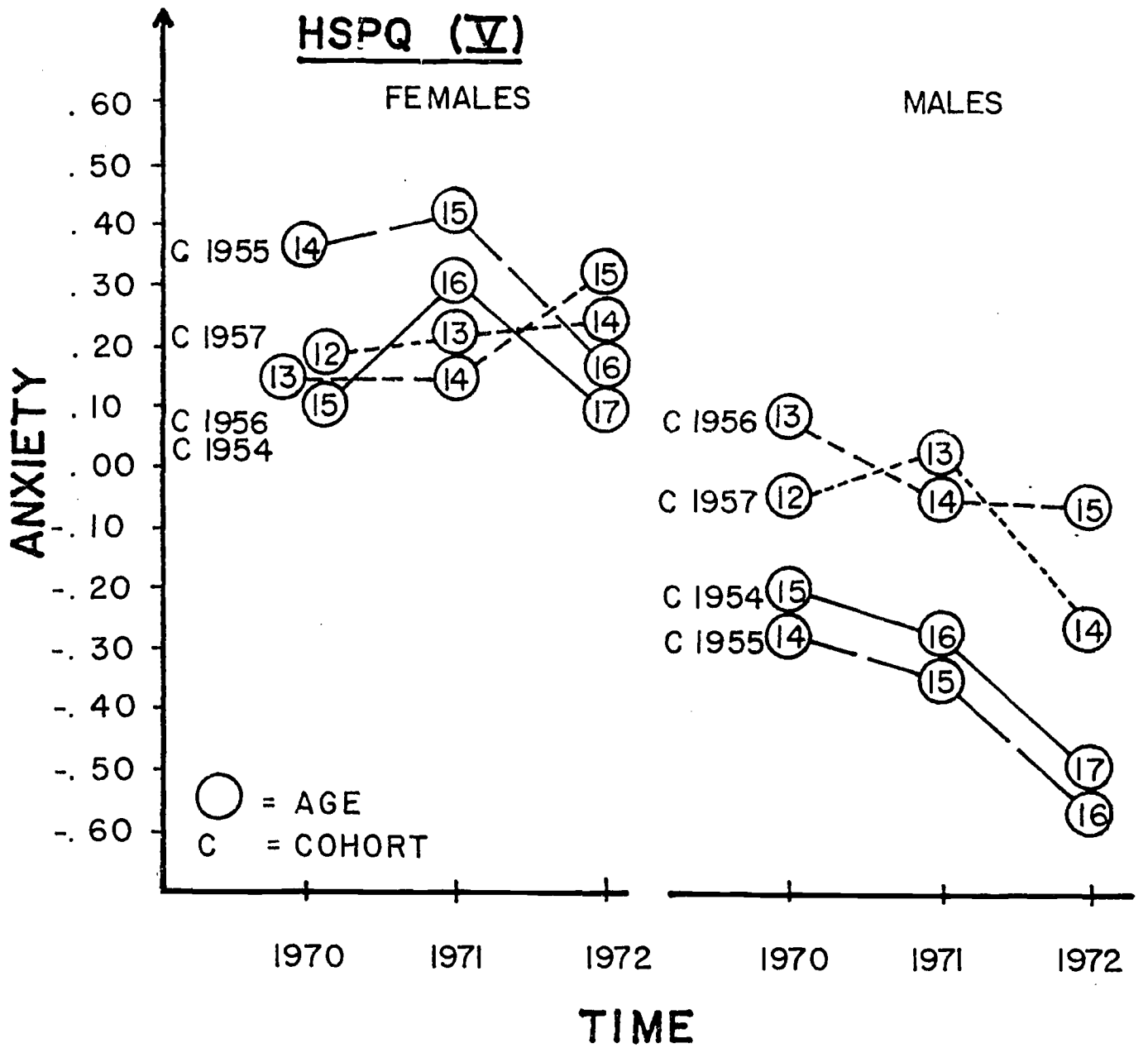

Figure 4. -- Anxiety Longitudinal Sequences: Time Main Effect and Sex by Time Interaction

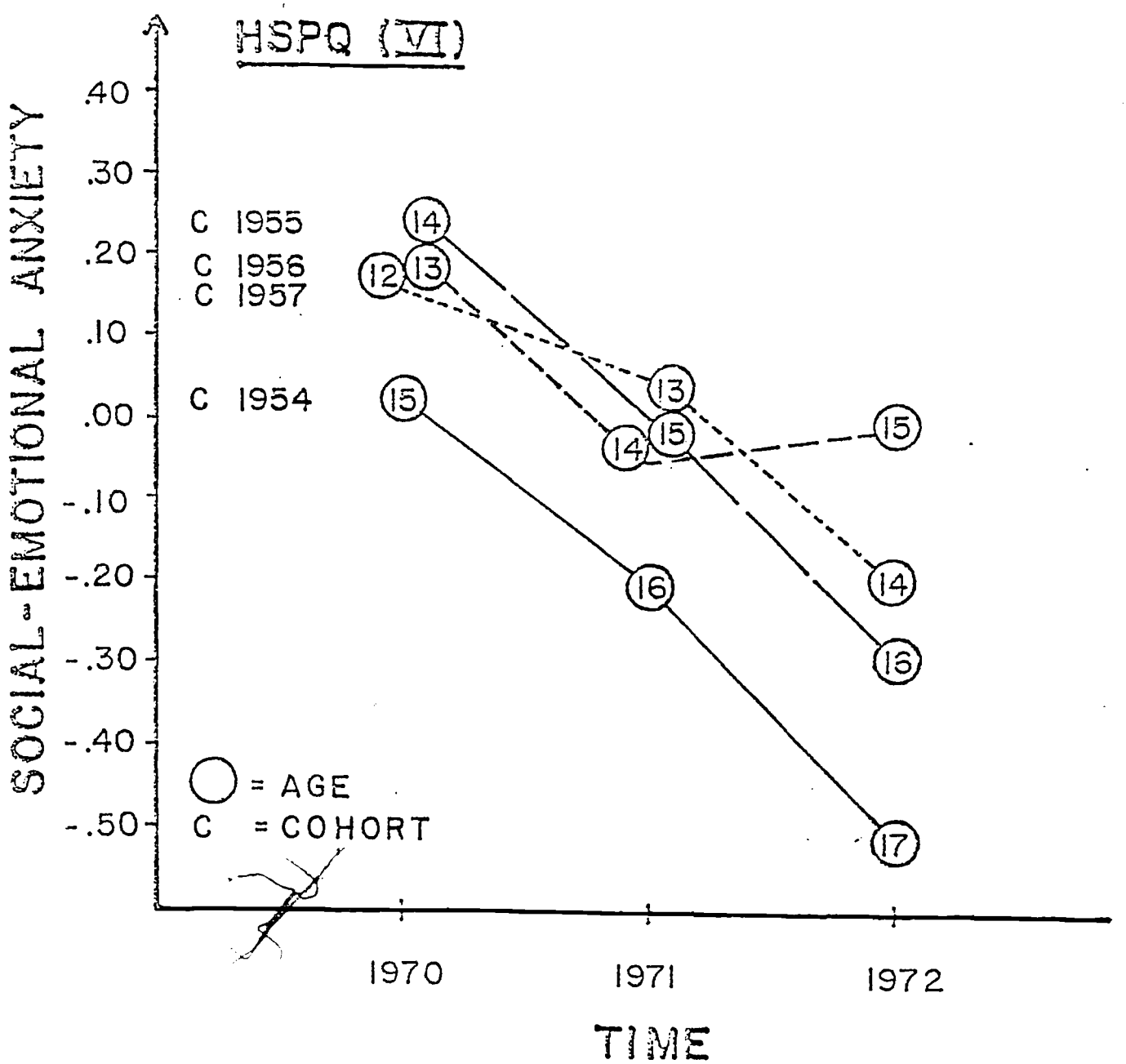

Figure 5. -- Social-Emotional Anxiety Longitudinal Sequences: Time Main Effect

Initially, this outcome pattern may be taken as supporting both systematic age-related (12 to 13 to 14, etc.) and cohort-related (cohort 1954 to cohort 1955, etc.) increments in intellectual performance. Control analyses to be presented later, however, will modulate this straightforward interpretation, since a large share of the variance appears to be due to retest effects rather than intrinsic longitudinal or generational change.

Figure 6 on next page

Factor VIII. PRF VIII (Independence: autonomous, non-recognition-seeking, secure) manifested significant main effects of sex and of time of measurement. Means, reflecting time-related changes are presented in Figure 7.

Males ($\bar{X}$ = .36) were found to be more independent than females ($\bar{X}$ = -.41) and total sample means reflect a fairly systematic time-related increase ($\bar{X}$ = -.16, -.08, .08 for 1970, 1971, 1972, respectively). Again, since no significant interaction effects were found, the developmental pattern is one of increasing independence over time regardless of age/cohort status, but with sex differences having emerged prior to 1970 (as young as age 12) and being maintained through 1972 (as old as age 18).

Figure 7 follows

Factor IX. PRF IX (Aggression: aggressive, lacking humility, outspoken) manifested a sex main effect only. Males ($\bar{X}$ = .36) scored significantly higher than females ($\bar{X}$ = -.31).

With no time-related differences and no age/cohort-related ones, self-reported aggression reflects a rather uninteresting pattern from a developmental point of view, save for the facts that the observed differences between males and females appear to have been clearly set prior to the period of adolescence and that stereotypes of adolescence may have suggested the existence of age- and cohort-related differences.

Factor X. PRF X (Achievement: striving, persistent) showed significant main effects of sex and of time measurement and a significant cohort by time interaction.

Females ($\bar{X}$ = -.18) scored lower than males ($\bar{X}$ = .18) on this

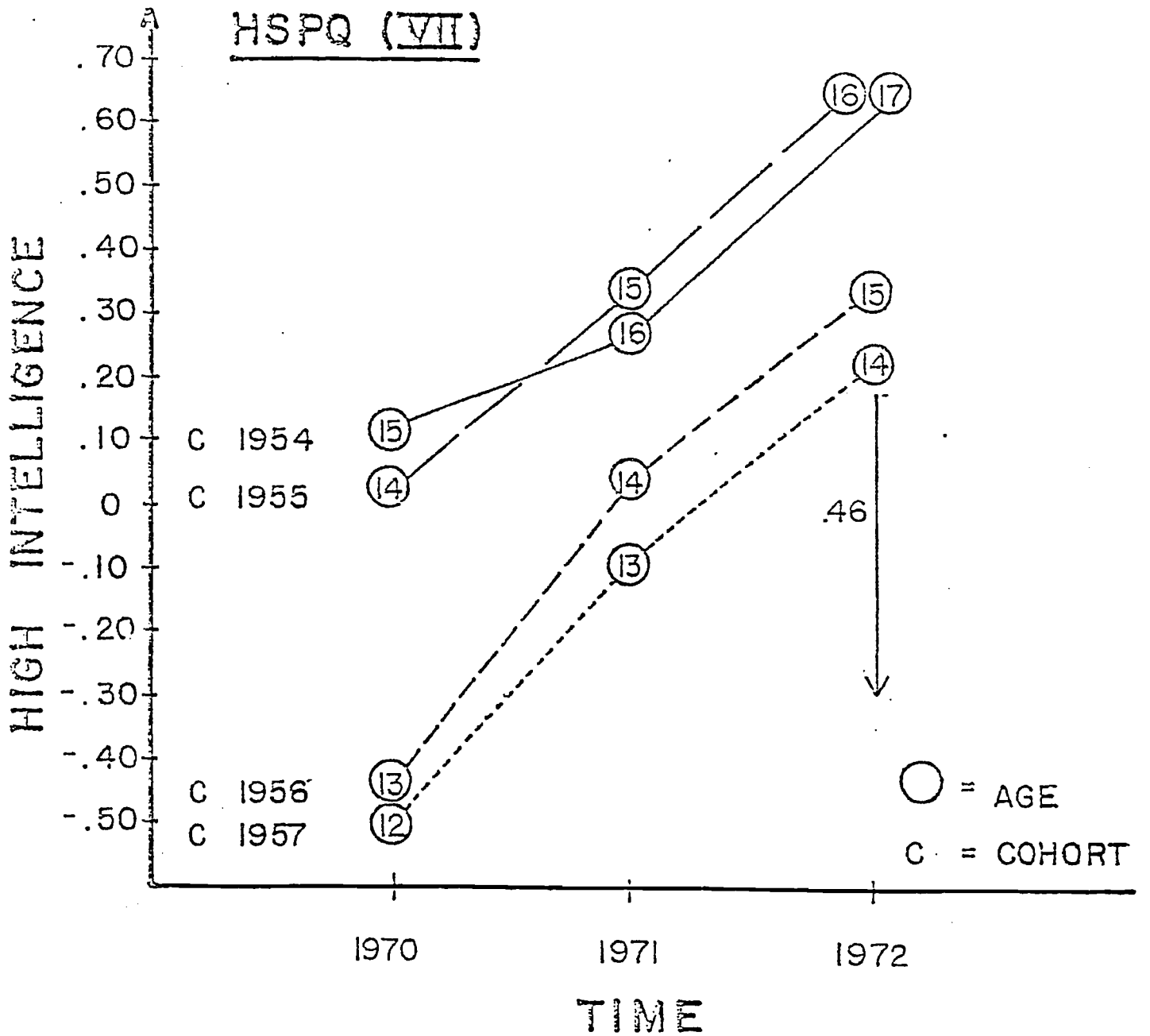

Figure 6. -- Intelligence Longitudinal Sequences: Time and Cohort Main Effects (Retest effect indicated by arrow)

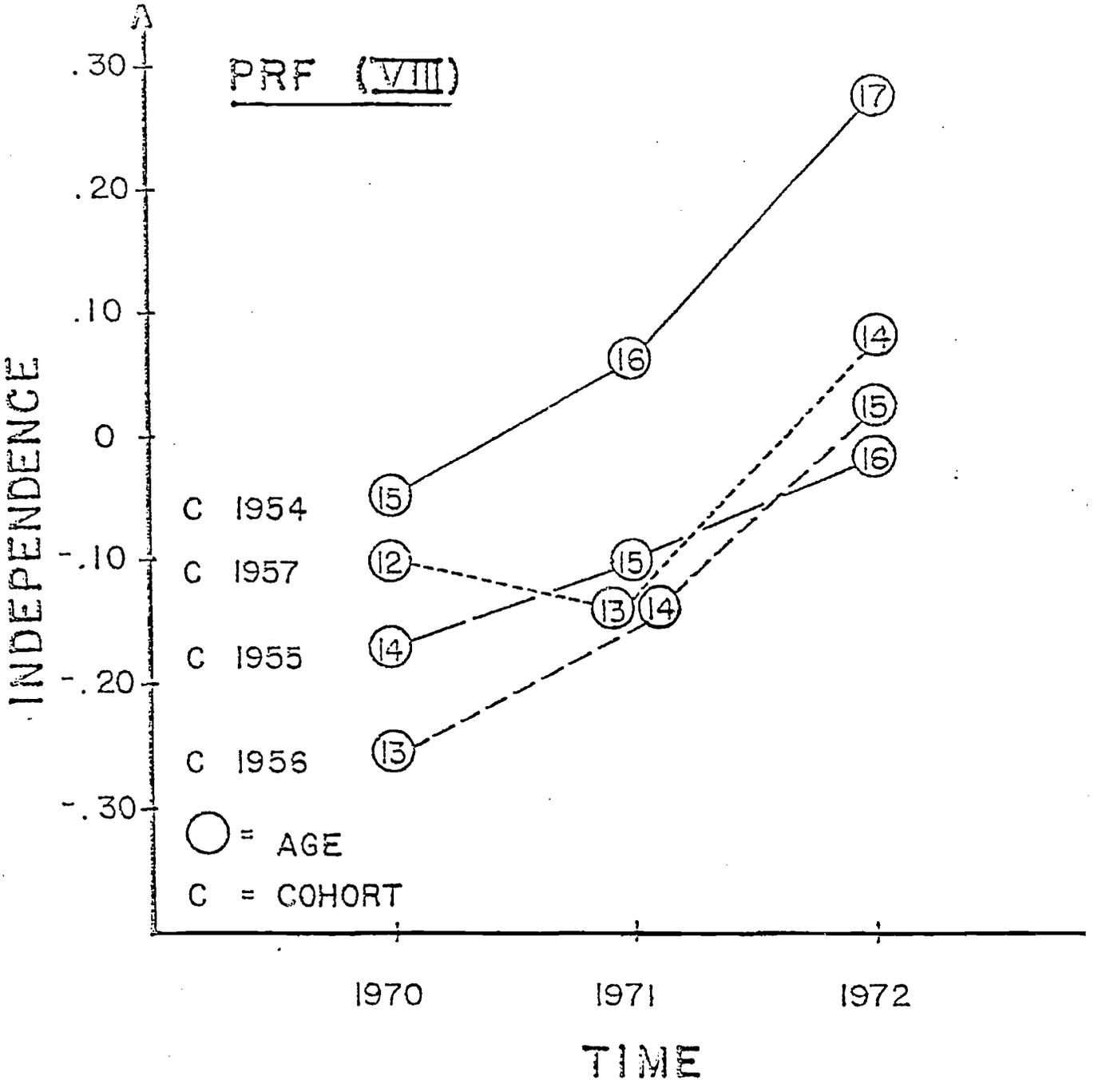

Figure 7. -- Independence Longitudinal Sequences: Time Main Effect

dimension. Means, reflecting the cohort by time interaction, are presented in Figure 8. The general pattern is one of decreasing scores

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Figure 8 on next page

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from 1970-1972 for the two youngest cohorts and one of relative stability across the same time period for the two oldest cohorts. This finding, in other words, indicates that young adolescents (from 1970 to 1972) are exposed to socialization conditions that lead to reductions in achievement, an ontogenetic finding that does not appear to apply to the older adolescence in this period.

Once more, in these plots, dramatic evidence of the discrepancy between longitudinally and cross-sectionally constructed developmental gradients can be seen. Contrast, for example, achievement scores for same-age adolescents (e.g., 13 or 14) obtained in 1970 with those obtained in 1971. Obviously, different-age adolescents (e.g., 14 vs. 15) observed at the same point in time, say 1972, are more similar to each other than they are to same-age adolescents measured at any of the other two times of observation. In view of the fact that sex does not interact with other design components, achievement is another personality dimension on which sex differences are established prior to, and then maintained during adolescence.

The following section deals with a presentation of the various control analyses performed in order to assess the degree to which the observed cohort-specific, longitudinal gradients require re-examination in light of internal and external validity (Campbell & Stanley, 1963) considerations.

3. Control Analyses.

As discussed earlier, two control groups were incorporated in the research design. A first dealing with the potential operation of testing effects (internal validity), and a second aimed at examining potential drop-out effects (external validity). Both control analyses supplement each other in the sense that the retest control group (due to being asked to participate only once at the third occasion of measurement) is not fully comparable to the longitudinal sample. Thus, the longitudinal sample potentially suffers from testing plus drop-out effects, whereas the retest control groups would seem to be less affected by drop-out effects than the longitudinal sample, in addition to being tested for one time only. Accordingly, Table 9 presents a

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Table 9 follows

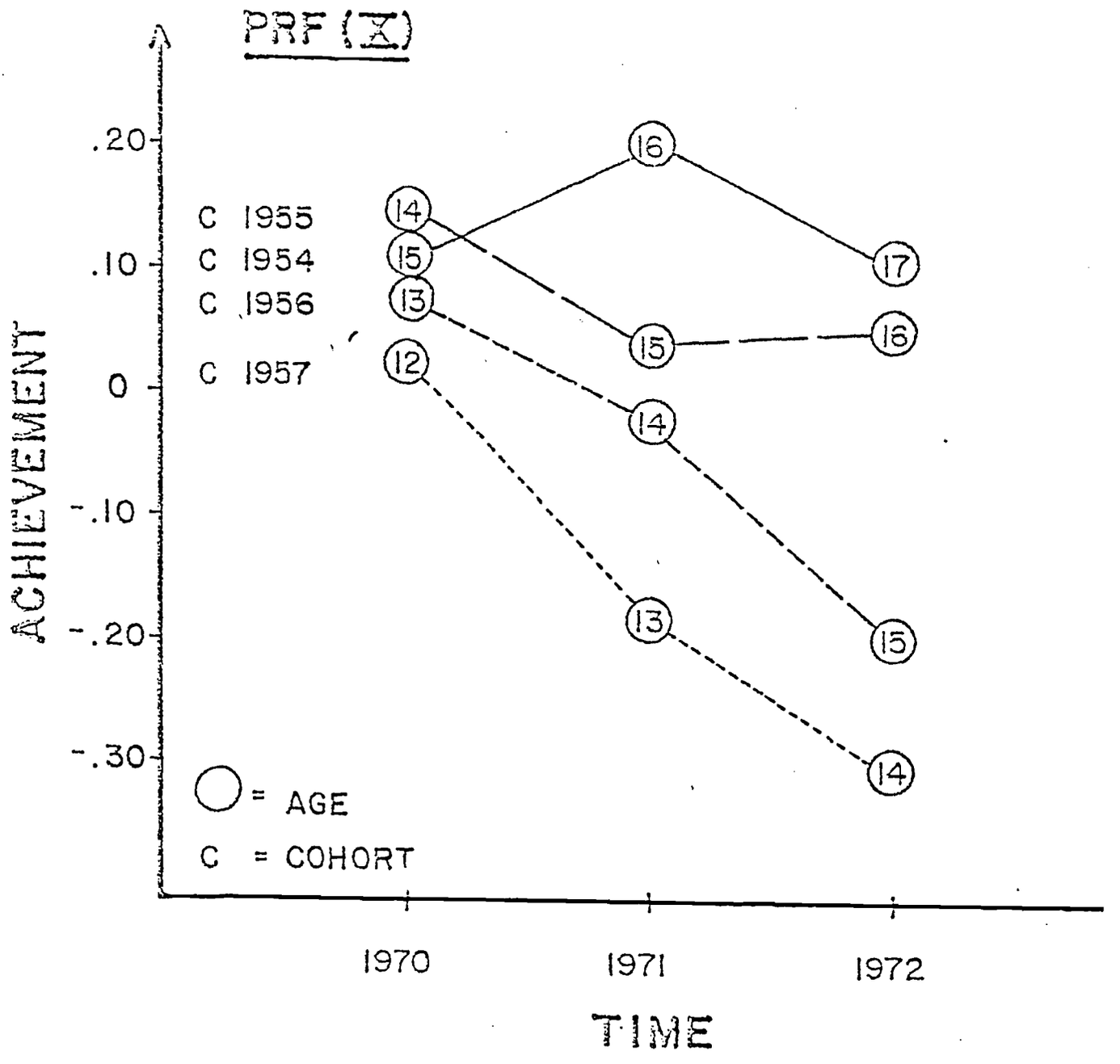

Figure 8. -- Achievement Longitudinal Sequences: Time Main Effect and Cohort by Time Interaction

Table 9

Significant Effects in Three Analyses of Variance Designs Separately by Personality Factor

Factor		Sequential Longitudinal (1970-72)				Retest Control (1972)			Drop-out (1970)		
		C	S	T	I	G	GXC	GXS	G	GXS	GXS
HSPQ-PRF	I		*	*		*					
	II			*	CXT						
	III	*	*		SXT						
	IV		*								
HSPQ	V		*	*	SXT						
	VI		*	*							
	VII	*	*	*	CXS	*					
PRF	VIII		*	*					*		
	IX		*								
	X		*	*	CXT						

Note. -- All significances at 1% level of confidence. (C = Cohort, S = Sex, T = Time, I = Interaction, G = Group).

summary of findings from the longitudinal and the retest and drop-out control analyses.

Fortunately, as shown in Table 9, the overall pattern of the control analyses strongly supports the conclusion that, by and large, the longitudinal gradients are not contaminated by either testing or drop-out effects. In addition, contrary to the Primary Mental Abilities data presented later, the pattern is such that testing and drop-out effects do not operate conjointly on the same personality dimension; an outcome which further simplifies the task of interpretation.

Retest Effects. As the writers' indicated, due to problems with subject availability, the control sample actually tested at the second time of measurement (1971) was suspected of being less representative of the school population than the control group drawn and tested on occasion three (1972). The relevant testing-control analyses, therefore, were based on the 1972 data of both the sequential longitudinal group (their third time of measurement) and the posttest-control group (their first time of measurement).

Each of the 10 personality factors was employed as a dependent variable in a 2 (sequential longitudinal vs. control group) by 4 (cohort) by 2 (sex) univariate analysis of variance. As shown in Table 10, the sequential longitudinal group mean differed from the retest control mean on only two of the ten personality factors at the third time of measurement. Since none of the pertinent interaction effects was significant, these differences obtain across both sexes and all four cohorts. The longitudinal group ($\bar{X}$ = .10) scored higher on Factor I (Extraversion/Ascendance) than the control group ($\bar{X}$ = -.07). Similarly, the longitudinal group ($\bar{X}$ = .46) scored higher on Factor VII (Intelligence) than did the control group ($\bar{X}$ = -.00).

Table 10 on next page

The implications of retest effects for the interpretation of the longitudinal findings on Extraversion (Factor I) and Intelligence (Factor VII) are straightforward. It is necessary to qualify the findings regarding time-related changes in the sequential longitudinal group for the two personality factors by proper adjustments. Therefore, the relative magnitude of the retest effects is represented by an arrow in Figure 1 (p. 33) and 6 (p. 41) discussed before. These adjustments lead to the conclusion that the 1970-1972 time-related increase in Extraversion shown in Figure 1 is probably due to retest rather than time effects. In addition, in the case of Intelligence (Figure 6, p. 41), these adjustments indicate that about half of the longitudinal increments in intellectual performance are due to retest effects rather than intrinsic age-related change. Further data on the magnitude of retest effects in intelligence will be reported in the section on Primary Mental Abilities.

Table 10

Summary of Analyses of Sequential Longitudinal vs. Retest Control Group

Source	df	Personality Factor				
		I	II	III	IV	V
Group (G)	1	6.94*	4.26	.35	.74	.06
G X Cohort (C)	3	1.97	.3[illegible]	.58	.50	.73
G X Sex (S)	1	.17	.7[illegible]	.41	.34	1.17
G X C X S	[illegible]	1.23	1.55	.23	2.22	.95

Source	df	Personality Factor				
		VI	VII	VIII	IX	X
Group (G)	1	4.03	16.71*	.17	1.14	5.32
G X Cohort (C)	3	1.24	1.46	.38	.31	1.02
G X Sex (S)	1	.00	.40	.24	.16	4.15
G X C X S	3	.21	1.44	1.59	.92	.63

Note. -- Table entries are F-values.
df error = 1315
*p < .01

Drop-out Effects. In a similar manner, 10 analyses of variance were performed to check for differences between the sequential longitudinal subjects and those who dropped out of the study after the first occasion of measurement. These analyses, which followed a 2 (sequential longitudinal versus dropout group) by 4 (cohort) by 2 (sex) design, were made on the occasion 1 (1970) data. The results are summarized in Table 11 and in the right portion of Table 9.

Table 11 on next page

Only one statistically significant difference between the sequential longitudinal and the dropout groups was found. Those subjects who dropped out of the study after the first time of measurement was completed were found to be significantly higher ($\bar{X}$ = .10) on PRF Factor VIII (Independence) than were the longitudinally studied subjects ($\bar{X}$ = -.16). This mean difference held across both sex and cohort.

We must conclude, therefore, that with respect to one of the personality variables studied, generalization of findings (external validity) from the longitudinal sample to the parent population should be qualified. This finding, however, should not detract from the general conclusion that, with regard to the personality variables considered, two-year participation in the present longitudinal study did not alter the composition of the parent population under examination.

C. Primary Mental Abilities

1. Overview of Results. While the data on personality variables, for the most part, did not present major interpretative problems due, with few exceptions, to an absence of testing and drop-out effects, the results of the six ability analyses exhibited a different pattern. Accordingly, it was decided to include the control analyses in this overview section in order to set the stage for a more cautious interpretation of the main longitudinal analyses. Cell means for all ability measures are presented in Appendix C.

Table 12 summarizes the outcome of both the core longitudinal and

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Tables 12 and 13 follow

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the two control analyses. Table 13 presents the more detailed results from the longitudinal analysis. All analyses of variance, conducted separately for each of the six ability dimensions (VM = Verbal Meaning,

Table 11

Summary of Analyses of Sequential Longitudinal vs. Drop-out Group

Source	df	Personality Factor				
		I	II	III	IV	V
Group (G)	1	.01	1.86	.92	4.48	.21
G X Cohort (C)	3	.19	.91	.05	.69	1.92
G X Sex (S)	1	.46	2.06	3.24	2.51	1.60
G X C X S	3	1.03	.44	.93	.31	.65

Source	df	Personality Factor				
		VI	VII	VIII	IX	X
Group (G)	1	1.07	4.19	14.27*	.59	2.89
G X Cohort (C)	3	.45	2.43	1.18	.05	.38
G X Sex (S)	1	.07	.20	1.19	1.08	3.34
G X C X S	3	1.82	1.85	.52	1.04	.49

Note. -- Table entries are F-values.
df error = 1297
*p < .01

Table 12

Significant Effects in Three Analyses of Variance Designs Separately by Ability Dimension

Ability Dimension	Sequential Longitudinal (1970-72)				Retest Control (1972)		Drop-out (1970)	
	C	S	T	I	G	I	G	I
VM	*		*	CXT, SXT	*			
NF	*	*	*		*		*	
LS	*	*	*		*	GXC	*	
WG	*		*		*		*	
NS	*		*		*		*	
SR	*	*	*	CXT	*	GXC	*	

Note. -- All significances at 1% level of confidence. (C = Cohort, S = Sex, T = Time, I = Interaction, G = Group, VM = Verbal Meaning, NF = Number Facility, LS = Letter Series, WG = Word Grouping, NS = Number Series, SR = Spatial Relations).

Table 13

Summary of Analyses of Ability Sequential-Longitudinal Data[1]

Source	df	PMA Variable					
		VM	NF	LS	WG	NS	SR
Between Ss	792						
Cohort (C)	3	32.0*	17.6*	5.7*	15.9*	9.7*	8.9*
Sex (S)	1	3.8	24.1*	36.6*	4.2	3.3	27.5*
C X S	3	2.0	1.4	1.2	1.8	0.8	1.6
Ss within Groups	785						
Within Ss	1586						
Time (T)	2	608.7*	315.7*	473.4*	305.2*	217.9*	420.3*
C X T	6	3.2*	1.5	2.4	0.5	2.2	3.1*
S X T	2	7.0*	2.3	0.4	0.8	0.2	0.6
C X T X S	6	1.1	0.3	1.4	0.7	0.8	1.3
T by Ss within	1570						

[1]PMA Variables: VM = Verbal Meaning; NF = Number Facility; LS = Letter Series; WG = Word Grouping; NS = Number Series; SR = Spatial Relations

Note. -- Table entries are F-values.
*$p < .01$.

NF = Number Facility, LS = Letter Series, WG = Word Grouping, NS = Number Series, and SR = Spatial Relations), produced main effects of cohort and time of measurement. In addition to three main sex effects (NF, LS, SR), three of the 24 possible interactions (one sex by time, two cohort by time) reached significance.

Before presenting the outcomes of the sequential longitudinal analyses, the results of the two control analyses will be summarized in order to clarify aspects of internal and external validity.

2. Control Analyses. The outcome of the retest control analyses will be reviewed first and the drop-out control analyses second. Subsequently, the findings of the two analyses will be related to each other and their implications for the interpretation of the sequential-longitudinal data discussed.

Retest Control. Table 14 presents the pertinent result pattern of the retest control analyses in which the means of the longitudinal group at the third time of measurement (1972) were compared with those of the retest control groups observed for the first time at the third occasion of measurement in 1972. In general, the pertinent significant effects of this control analysis are fairly clear-cut, since they

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Table 14 on next page

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are primarily restricted to main effects. For all six ability scales, the longitudinal groups significantly outperform the retest control group. The two significant group by cohort interactions imply further that the magnitude of the retest effect is differential for the different cohort levels. However, it is always significant and in the same direction.

The implications of such a strong retest effect are that, for each of the six ability measures, longitudinal "intrinsic" (time-related) age changes are markedly confounded with retest effects in the sense that testing per se leads to a significant overall increase in age-related performance. Unfortunately, however, this conclusion is based on the assumption that the longitudinal and retest control group are comparable in all respects except for the number of participations. At first glance, this assumption may appear warranted, since the subjects were randomly assigned to both treatment conditions. At closer inspection, however, it becomes obvious that the longitudinal group is not only affected by testing but also by experimental mortality in the sense of drop-out effects. The sampling process of the retest control group, on the other hand, is affected primarily by selective sampling (and only some aspects of 1970-72 experimental mortality). Accordingly, it will be necessary to consider the magnitude and direction of longitudinal drop-out effects,

Table 14

Summary of Pertinent Comparisons Between Longitudinal and Retest Control Groups (Abilities): Significant F-Values and Associated Means

Source	df	PMA Variable					
		VM	NF	LS	WG	NS	SR
Group (G)	1	27.6*	22.1*	86.3*	41.9*	29.1*	140.9*
Longitudinal (Mean)		16.2	14.5	12.2	17.6	8.1	37.3
Control (Mean)		13.8	12.7	10.0	15.9	7.1	25.5
Group X Cohort (C)	3			5.3*			4.0*
Longitudinal (Means)							
Cohort 1957				11.8			34.9
Cohort 1956				12.1			38.0
Cohort 1955				12.5			38.2
Cohort 1954				12.5			38.7
Control (Means)							
Cohort 1957				9.1			21.3
Cohort 1956				9.4			27.0
Cohort 1955				10.8			25.4
Cohort 1954				11.1			29.9
Other Interactions		None Significant					

df error = 1275, *p < .01.

separately for each of the six ability measures, when summarizing the implications of the present retest effects for the interpretation of longitudinal change data.

Drop-out Effects. Table 15 presents the outcome pattern of the second control analysis dealing with the examination of drop-out or experimental mortality effects.

Table 15 on next page

The comparison of the core longitudinal with the longitudinal drop-out group at the first occasion of measurement (1970) yielded a straightforward outcome with no interactions. As shown in Table 15, for five of the six ability measures (NF, LS, WG, NS, SR), the core longitudinal subjects scored higher than those subjects of the initial longitudinal sample which, for one reason or another, did not continue to participate in the remaining two occasions of measurement.

As can also be seen in Table 15, the magnitude of this effect is smaller than that reported for retest effects in Table 14. However, it clearly indicates that, except for Verbal Meaning, the core longitudinal sample is positively biased in ability performance when compared with the total parent population from which the various samples for this research project were drawn.

Implications of Control Analyses. What are the implications of these control analyses for the internal and external validity of the core sequential, longitudinal data on ability development to be presented in the subsequent section? First of all, the data on selective drop-out effects indicate that the external validity of the sequential-longitudinal data is somewhat restricted due to its positive bias on ability dimensions. Second, the retest control analysis shows that the internal validity of our longitudinal age changes is jeopardized by the existence of rather strong age-(time) correlated positive testing effects. Finally, when considering drop-out and testing effects conjointly, the drop-out data point to the fact that the retest analysis itself is not fully internally valid, since it contrasted a positively biased (due to experimental mortality) longitudinal sample with a retest control group that, except for subcomponents of experimental mortality (e.g., change in residence), was not affected to the same degree by experimental mortality effects as the core longitudinal sample. Although it would be desirable to correct these disparities had the control analyses led to unequivocal inferences, the nature of the control effects and their relationships is such that only "estimated" adjustments are possible.

First of all, it is most apparent that the widespread strategy of interpreting simple longitudinal gradients as age change is not

Table 15

Summary of Pertinent Comparisons Between Longitudinal and Dropout Groups (Abilities): Significant F-Values and Associated Means

Source	df	PMA Variable					
		VM	NF	LS	WG	NS	SR
Group (G)	1	--	14.9*	15.9*	25.4*	16.3*	13.9*
Longitudinal (Mean)		--	11.3	8.8	14.8	6.2	23.8
Dropout (Mean)		--	10.8	8.0	13.8	5.7	21.5
Interactions (Group, Cohort, Sex)		None Significant					

df_{error} = 1295, *p < .01.

valid with ability measures, since the retest effects are of such a dramatic nature. Accordingly, in the subsequent presentation, the graphic and statistical reviews of the data will regularly include an indication of the observed retest effect. Moreover, since in five of the six ability measures the sequential longitudinal sample turned out to be more positively biased (due to selective drop-out) than the retest control, the discussions will also consider the magnitude of this bias when assessing the magnitude of the retest effects. In all five cases, this additional correction signifies that the magnitude of the retest effects is smaller than the retest effects observed in the initial retest analysis. However, in no case will this drop-out correction imply that the retest effects do not need to be considered when assessing the meaning of sequential-longitudinal change.

In the next section more specific discussion concerning the nature of the various ability measures and the differences found among means will be presented. Pertinent effects will be illustrated with a series of figures similar to those presented earlier in discussing the personality dimensions.

3. Ability Scale-Specific Results

Verbal Meaning (VM). Verbal Meaning is measured by a 60 item vocabulary test (recognizing synonyms of words). This variable showed significant main effects of cohort and time of measurement and two significant interaction effects--cohort by time and sex by time. The pattern of means is presented in Figure 9. Also shown in Figure 9 is the magnitude of the retest effect (2.4 points) estimated as the (significant) difference between the retest control mean and the mean of the sequential longitudinal group in 1972.

Figure 9 on next page

The sex by time interaction reflects a generally greater increment for females than for males both from 1970 to 1971 and from 1971 to 1972. The mean scores for females are 10.6, 14.2, and 16.9 across the three times of measurement, while those for males are 10.4, 13.4, and 15.5. The pattern of means pertaining to the cohort by time interaction indicates that cohort 1957 (1970 $\bar{X}$ = 7.5, 1971 $\bar{X}$ = 10.5, 1972 $\bar{X}$ = 13.8), cohort 1956 (1970 $\bar{X}$ = 9.9, 1971 $\bar{X}$ = 13.3, 1972 $\bar{X}$ = 15.8), and cohort 1954 (1970 $\bar{X}$ = 12.9, 1971 $\bar{X}$ = 16.7, 1972 $\bar{X}$ = 18.7), although starting from different levels, show similar increments, while cohort 1955 (1970 $\bar{X}$ = 12.7, 1971 $\bar{X}$ = 15.8, 1972 $\bar{X}$ = 17.5) shows a less steep gradient of change across the two years covered.

Figure 9 also shows the implication of considering the operation of retest effects. It is most obvious that testing per se is a major

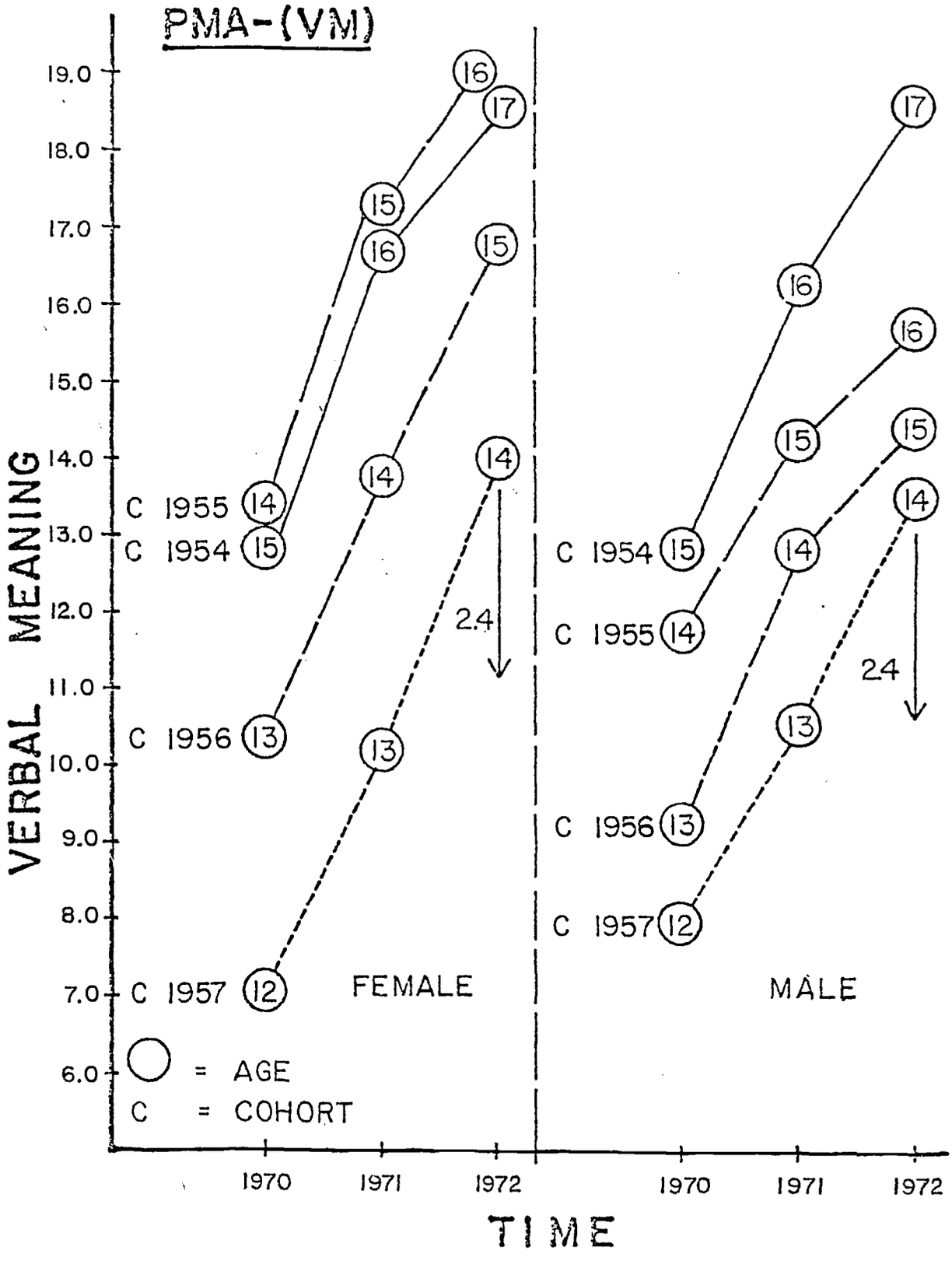

Figure 9. -- Verbal Meaning Longitudinal Sequences: Cohort and Time Main Effects and Cohort by Time and Sex by Time Interactions (Retest effect indicated by arrow; no drop-out effect)

factor in the production of the longitudinal gradients. If one dares to talk about percentage increments, one would conclude that about one third of the 1970-72 increment appears to be due to instrumentation conditions.

Number Facility (NF). Number Facility is measured by 30 items involving the manipulation of numbers, e.g., addition, subtraction, multiplication, and division. Actual calculation with pencil is not permitted. Rather, the subject must recognize the correct answer in a list of five alternatives.

Significant cohort, sex, and time of measurement effects were found for Number Facility. A statistically significant mean difference between the longitudinal group ($\bar{X}$ = 14.5) and the retest controls ($\bar{X}$ = 12.7) was also found, which, in principle, is also present when drop-out adjusted retest effects are considered. However, the overall difference between the experimental and the control group is reduced from 1.8 to 1.3. These effects are presented in Figure 10.

Figure 10 on next page

The pattern of means indicates that males ($\bar{X}$ = 13.9) scored significantly higher than females ($\bar{X}$ = 12.4), that age/cohort is positively related to mean score (cohort 1954 $\bar{X}$ = 14.7, cohort 1955 $\bar{X}$ = 13.9, cohort 1956 $\bar{X}$ = 12.8, cohort 1957 $\bar{X}$ = 11.5), and that time of measurement is positively related to mean score (1970 $\bar{X}$ = 11.3, 1971 $\bar{X}$ = 13.5, 1972 $\bar{X}$ = 14.5). The latter 1970-72 time effect (in addition to the increase in average chronological age) may be largely due to testing effects, since the retest control does not support such a pattern.

Letter Series (LS). Letter Series, one of the Reasoning subtests, is measured by 20 items. The subject's task is to choose, from among five alternatives, the next in an ordered series of letters.

For this measure significant cohort, sex, and time of measurement effects were found. Means are presented in Figure 11. No interactions were significant. Females ($\bar{X}$ = 11.3) scored significantly higher than males ($\bar{X}$ = 9.8). Again, a linear relationship obtained between age/cohort and mean score (cohort 1954 $\bar{X}$ = 11.2, cohort 1955 $\bar{X}$ = 11.1, cohort 1956 $\bar{X}$ = 10.5, cohort 1957 $\bar{X}$ = 9.9). Similarly, mean scores were positively related to time of measurement (1970 $\bar{X}$ = 8.8, 1971 $\bar{X}$ = 10.8, 1972 $\bar{X}$ = 12.2).

Figure 11 follows

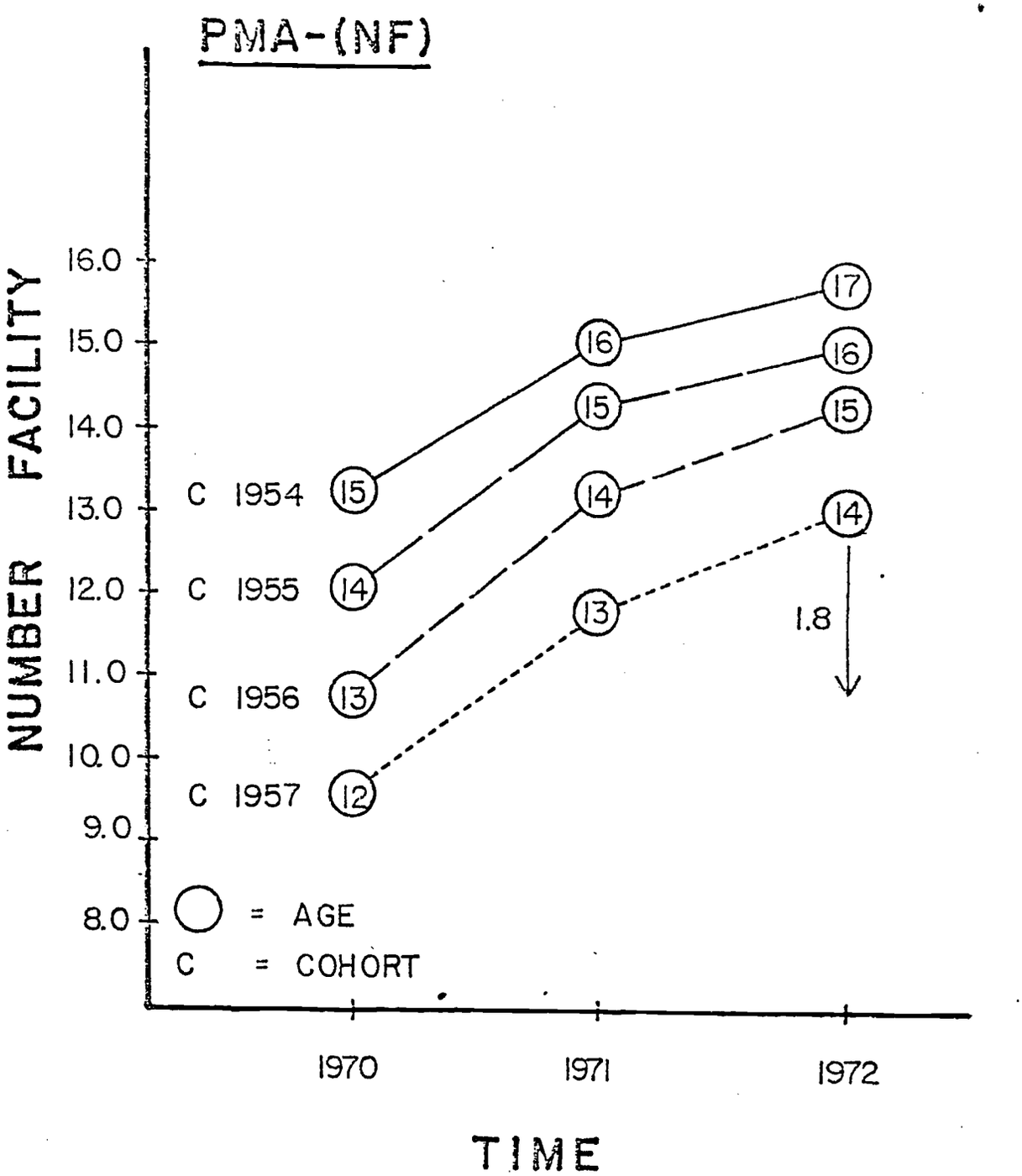

Figure 10. -- Number Facility Longitudinal Sequences: Time and Cohort Main Effects (Retest effect indicated by arrow; drop-out effect = .5; adjusted retest effect = 1.3)

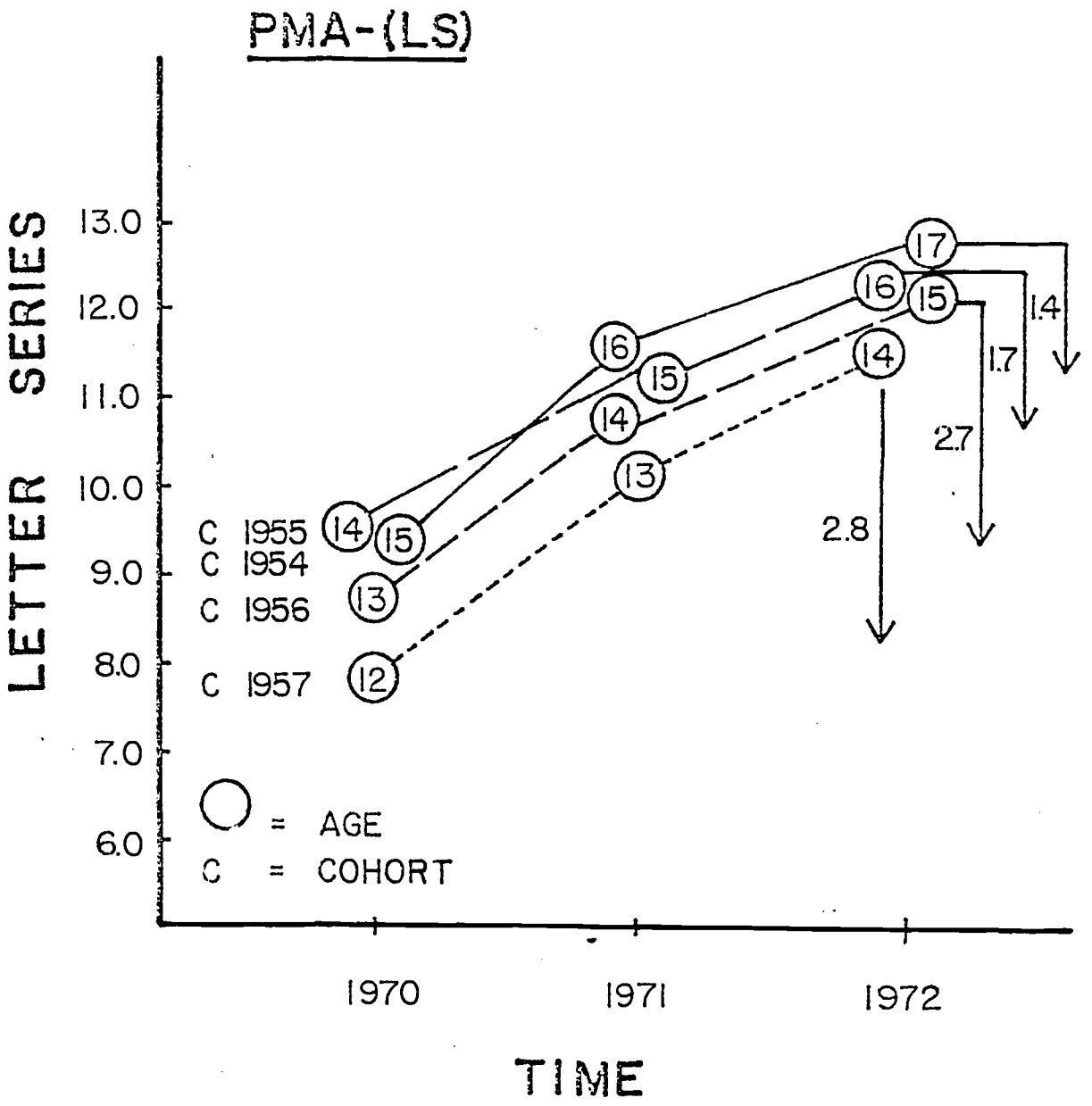

Figure 11. -- Letter Series Longitudinal Sequences: Time and Cohort Main Effects (Retest effects indicated by arrows; drop-out effect = .8; adjusted retest effects = 2.0, 1.9, .9, and .6 for cohorts 1957-1954, respectively)

The analysis of variance conducted to examine possible retest effects revealed both a significant difference between the sequential longitudinal group ($\bar{X}$ = 12.2) and the retest control group ($\bar{X}$ = 10.0) and a significant group by cohort interaction. For the sequential longitudinal group, cohorts 1957 to 1954 showed means of 11.8, 12.1, 12.5, and 12.5, respectively. Corresponding means for the retest control group were 9.0, 9.4, 10.8, and 11.1. The overall difference between the longitudinal and the retest groups becomes smaller (2.2 vs. 1.4) when the retest effects are adjusted for drop-out effects.

Again, when simultaneously reviewing the direction and magnitude of the experimental and control effects, it appears justifiable to conclude that time per se (1970, 1971, 1972) does not contribute a major share to the variance, since most of its associated effects can be accounted for in terms of cohort/age and testing effects.

Word Grouping (WG). Also a reasoning subtest, Word Grouping is measured by 30 items which require the subject to indicate which word in a series of five belongs to a different class than the other four. For example, four words might represent capital cities and the fifth, a city which is not a capital.

Significant cohort and time of measurement effects were found for Word Grouping. The sex effect was not significant, nor were any interaction effects.

On Word Grouping, mean occasion scores, pooled over sex and cohort, were 14.8, 16.4, and 17.6 for 1970, 1971, and 1972, respectively. Age/cohort was positively related to mean score (cohort 1954 $\bar{X}$ = 17.4, cohort 1955 $\bar{X}$ = 17.0, cohort 1956 $\bar{X}$ = 16.0, cohort 1957 $\bar{X}$ = 15.1). A statistically significant difference was found between the mean of the sequential longitudinal group ($\bar{X}$ = 17.6) and the mean of the retest control group ($\bar{X}$ = 15.9) which, in its direction, holds up after adjusting the retest effect for drop-out ($\bar{X}$ = 17.6 vs. $\bar{X}$ = 16.9). Means are plotted in Figure 12.

Figure 12 on next page

Number Series (NS). Number Series is the last of the three reasoning subtests. It is measured by 20 items which require the subject to choose one of five alternatives that correctly continues a progression of numbers.

For Number Series, cohort and time of measurement effects were found to be significant. Time of measurement means were 6.2, 7.4, and 8.1 for 1970, 1971, and 1972, respectively. Cohort/age means were 6.5, 7.2, 7.5, and 7.9 for cohorts 1957 through 1954,

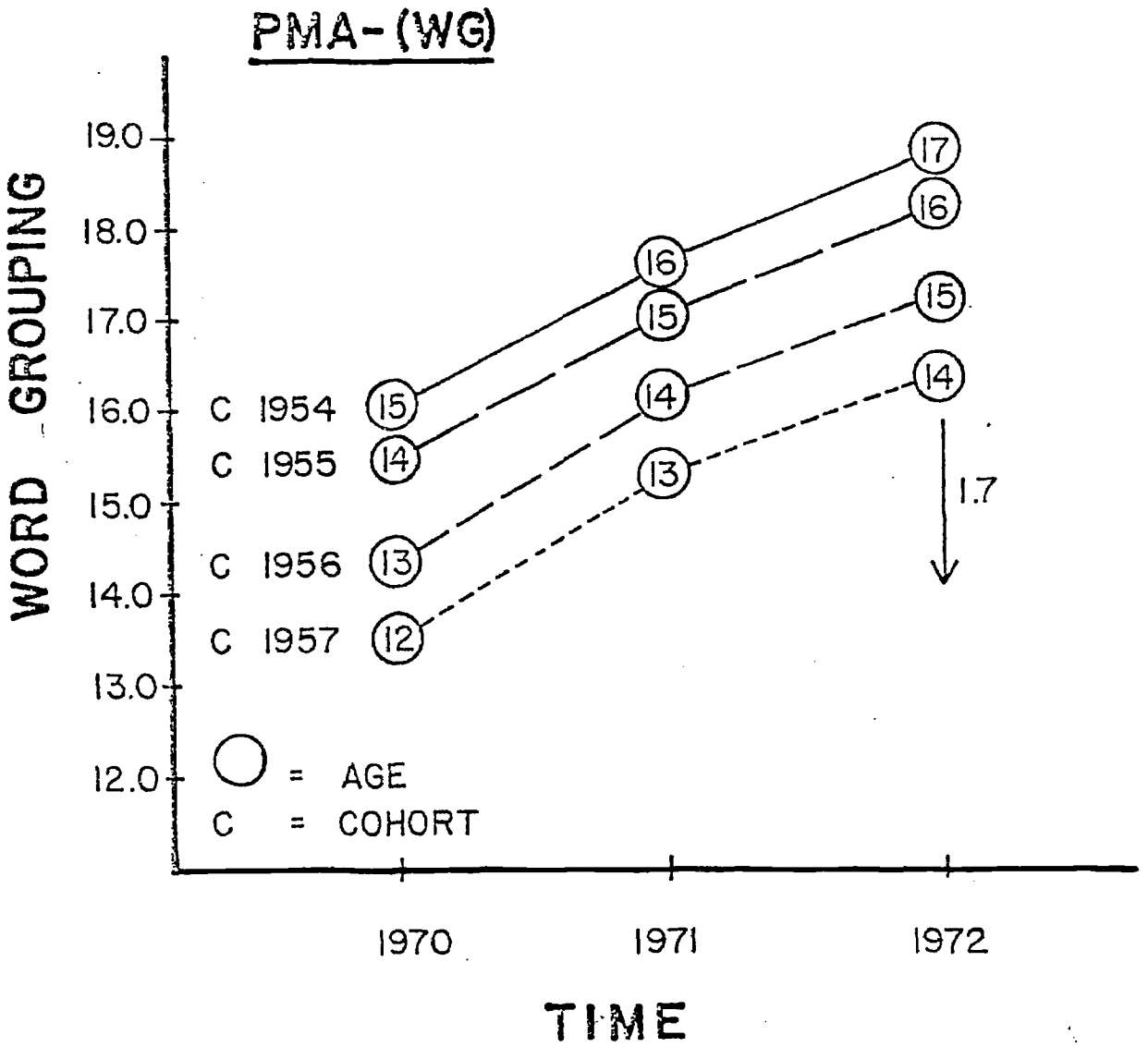

Figure 12. -- Word Grouping Longitudinal Sequences: Time and Cohort Main Effects (Retest effect indicated by arrow; drop-out effect = 1.0; adjusted retest effect = .7)

respectively. Time of measurement means, separately by cohorts, are presented in Figure 13. The mean difference (1.0 points) between the sequential longitudinal and retest control groups was significant and is indicated in Figure 13 as a retest effect, and is, in its

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Figure 13 on next page

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direction, preserved when adjusted (.5). Overall, these data appear to suggest again that the largest share of the true-developmental variance is due to chronological age, and that cohort and time effects are less pervasive.

Spatial Relations (SR). Spatial Relations is measured by 30 items. The items require the subject to visualize objects and figures and the relations between them under different spatial transformations.

Significant main effects were found for cohort, sex, and time of measurement. The cohort by time of measurement interaction was significant also. The interaction is presented graphically in Figure 14. Examination of differences reflecting the sex main effect revealed that males ($\bar{X}$ = 33.7) scored higher than females ($\bar{X}$ = 28.5). The time effect indicates that subjects showed higher performance as we move from 1970 ($\bar{X}$ = 23.8) to 1971 ($\bar{X}$ = 31.7) and 1972 ($\bar{X}$ = 37.3).

Comparison of the sequential longitudinal and retest control groups showed a significant group main effect amounting to a whopping 11.8 raw score points and a significant group by cohort interaction. Longitudinal group means by cohort were 34.9, 38.0, 38.2, and 38.7 for cohorts 1957 through 1954, respectively. Corresponding means for the retest controls were 21.3, 27.0, 25.4, and 29.9. These

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Figure 14 follows

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impressive retest effects are not considerably reduced by drop-out adjustments (from 11.8 to 9.5 points). The implication is that most of the apparent cohort-specific, longitudinal age change is due to retest effects and not to "intrinsic" ontogenetic change. This is particularly true for the younger-aged cohorts.

D. Stability Coefficients

1. Personality Measures. The one year (1970-71, 1971-72) and two

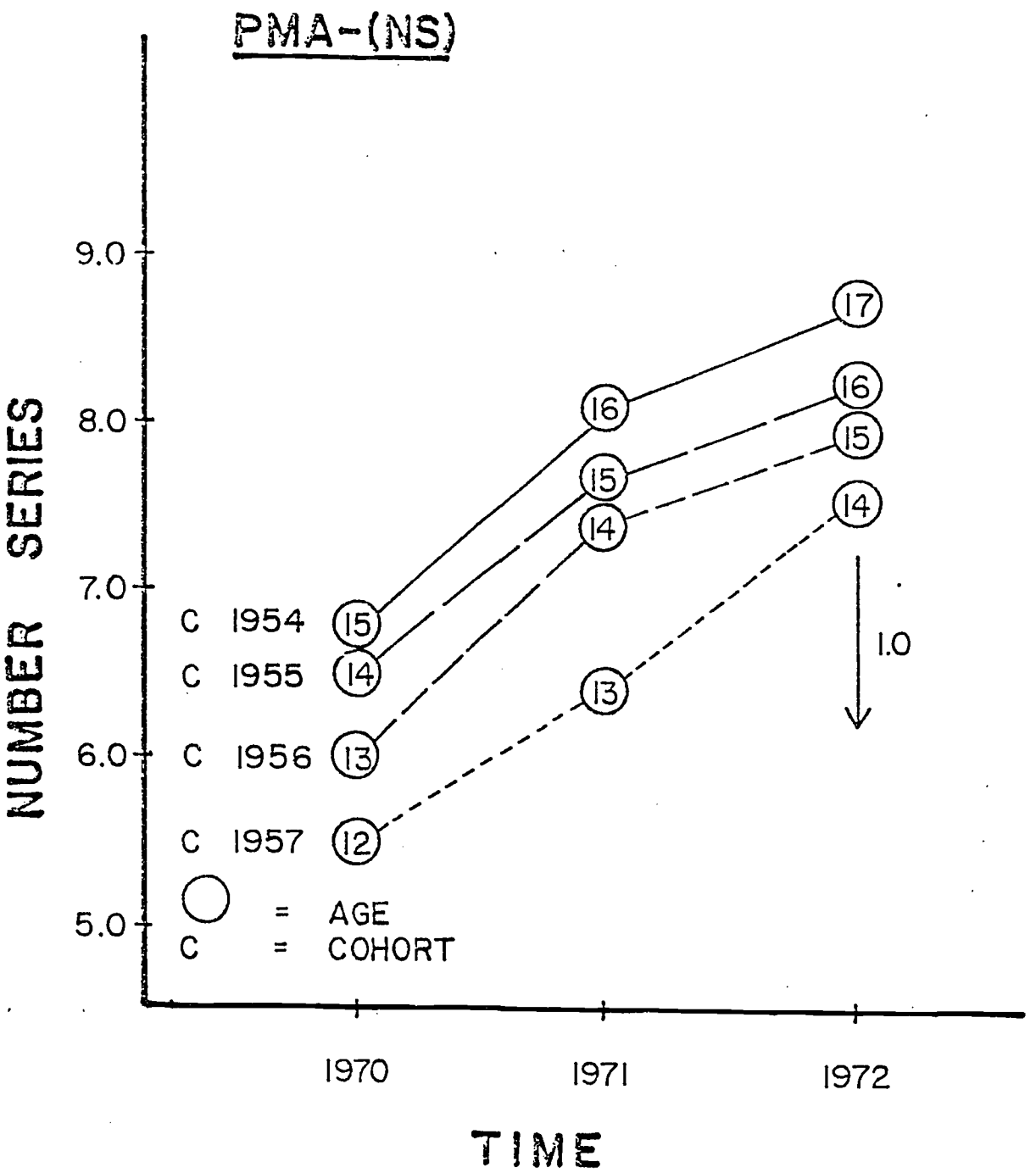

Figure 13. -- Number Series Longitudinal Sequences: Time and Cohort Main Effects (Retest effect indicated by arrow; drop-out effect = .5; adjusted retest effect = .5)

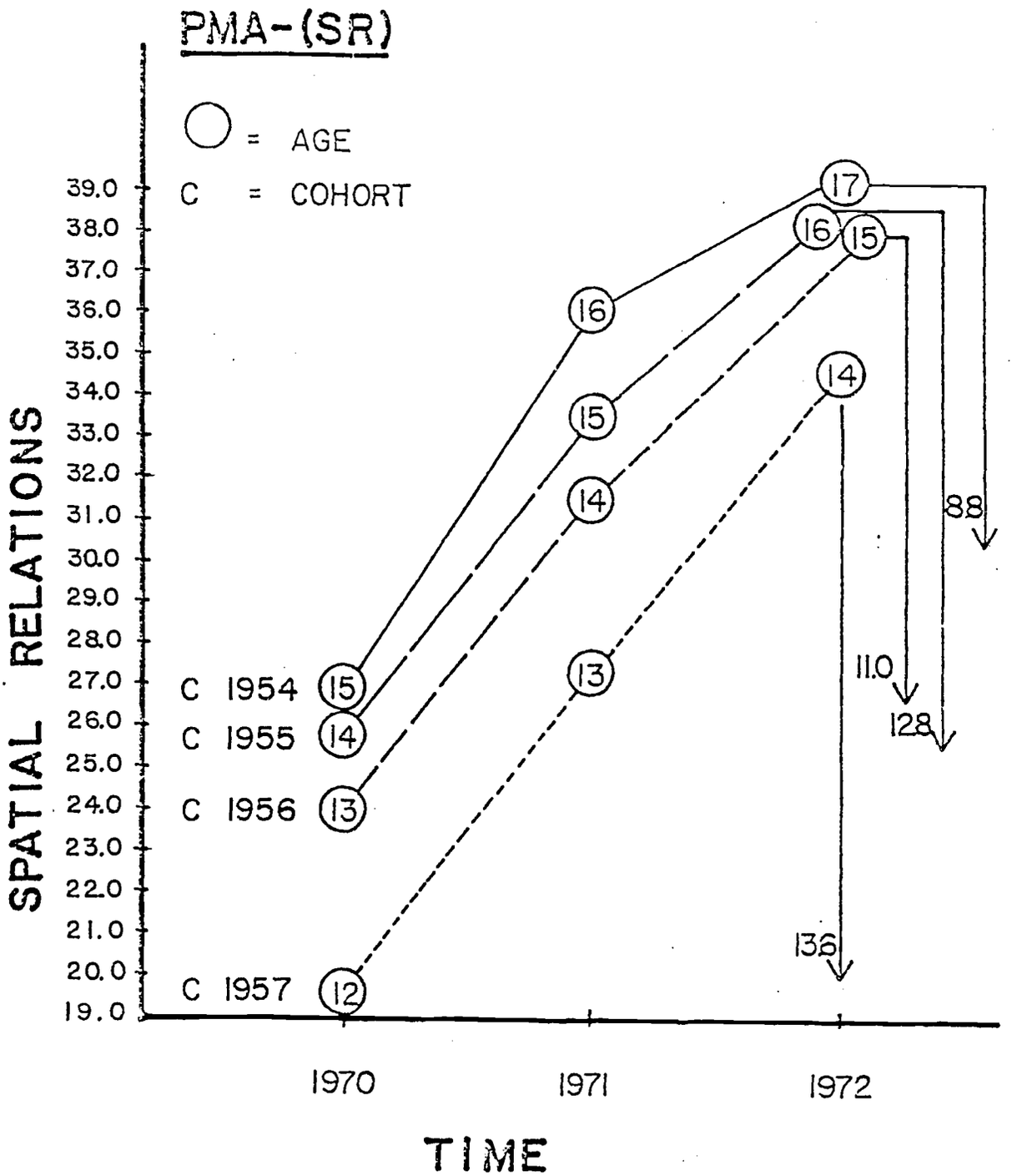

Figure 14. -- Spatial Relations Longitudinal Sequences: Time and Cohort Main Effects and Cohort by Time Interaction (Retest effects indicated by arrows; drop-out effect = 2.3; adjusted retest effects = 11.3, 8.7, 10.5, and 6.5 for cohorts 1957-1954, respectively)

year (1970-72) stability coefficients for the 10 personality dimensions are presented in Table 16, separately by cohort and sex, and separately for males and females, across the four cohorts.

The total range is quite large (+.06 - +.81), although the average magnitude is fairly high for personality dimensions and the total matrix shows a positive manifold. The general pattern is one of increasing stability with increasing age and decreasing stability as the time interval increases (1970-71, 1971-72 vs. 1970-72). The increasing stability with age reflects a systematic ontogeny towards a preponderance of trait rather than state characteristics. Note, for example, that the stabilities for the oldest cohort (1954) are nearly comparable to those for ability-trait data.

Table 16 on next page

In addition, when comparing the 1970-1971 with the 1971-1972 stability data for the total sample, it is interesting to note that in 9 out of 10 cases (except for VI), the 1971-72 stability coefficients are higher than the 1970-71 results. This may be partially due to average age differences involved, however, it is also suggestive of potential shifts in the stability of environmental patterns mediating the degree of stability (see Baltes & Nesselroade, 1973 for a discussion of a developmental view of changes in stability indicators). In 9 out of 10 cases (except for VI), again for the total sample, the 2-year stabilities are lower than both one-year stabilities--which is in line with simplex arrangements. There are, however, occasional reversals (particularly Factors VI, VII, and IX) which may be of high theoretical interest.

Finally, on the basis of pooled data, females show higher stability (in 24 out of 30 cases) than males. Again, this finding can be taken as pointing to a higher degree of stability of time-related environmental fields for females than for males.

2. Ability Measures. Stability coefficients for the six ability measures are presented in Table 17. As one might expect, the magnitude of these coefficients is higher and the range (+.41 to +.86) is substantially smaller than that found for the personality measures. Marked sex differences in the magnitude of the stability coefficients were not found, nor was there a clear tendency for stability to be positively related to age.

Table 17 follows

Table 16

Stability Coefficients of Personality Dimensions

Personality Factor	Interval	Cohort 1957		Cohort 1956		Cohort 1955		Cohort 1954		Total Sample	
		M	F	M	F	M	F	M	F	M	F
I	70-71	.52	.69	.59	.63	.59	.74	.76	.75	.63	.70
	71-72	.71	.70	.67	.67	.74	.75	.73	.74	.71	.72
	70-72	.43	.53	.49	.52	.57	.63	.70	.73	.55	.59
II	70-71	.45	.64	.56	.63	.68	.73	.69	.64	.59	.66
	71-72	.64	.74	.51	.74	.68	.75	.65	.68	.61	.73
	70-72	.40	.51	.41	.59	.54	.65	.61	.62	.48	.58
III	70-71	.51	.60	.53	.64	.52	.62	.67	.71	.55	.64
	71-72	.66	.68	.59	.73	.67	.70	.70	.75	.66	.71
	70-72	.51	.51	.44	.51	.41	.62	.68	.59	.50	.56
IV	70-71	.56	.56	.67	.61	.52	.60	.61	.61	.58	.59
	71-72	.57	.56	.61	.64	.57	.75	.68	.60	.61	.65
	70-72	.46	.33	.48	.45	.42	.59	.58	.46	.48	.46
V	70-71	.63	.42	.61	.61	.51	.61	.68	.66	.61	.58
	71-72	.62	.56	.62	.66	.60	.78	.75	.74	.66	.68
	70-72	.46	.37	.56	.52	.32	.64	.72	.64	.52	.54

Table 16 (continued)

VI	70-71	.33	.43	.30	.39	.38	.40	.48	.44	.37	.41
	71-72	.06	.42	.08	.27	.26	.58	.51	.58	.23	.43
	70-72	.09	.41	.18	.35	.37	.38	.44	.45	.27	.39
VII	70-71	.37	.52	.50	.50	.48	.61	.55	.58	.49	.55
	71-72	.34	.42	.48	.39	.61	.66	.54	.44	.50	.48
	70-72	.30	.32	.60	.43	.31	.53	.49	.61	.46	.47
VIII	70-71	.42	.54	.51	.60	.62	.73	.69	.79	.57	.66
	71-72	.56	.56	.64	.68	.65	.70	.69	.77	.64	.68
	70-72	.44	.53	.41	.54	.50	.57	.58	.76	.49	.59
IX	70-71	.39	.49	.61	.55	.61	.68	.72	.65	.60	.59
	71-72	.64	.69	.63	.62	.66	.81	.75	.74	.68	.71
	70-72	.45	.45	.59	.45	.52	.66	.66	.75	.56	.56
X	70-71	.46	.65	.68	.55	.66	.62	.62	.77	.62	.63
	71-72	.57	.66	.77	.72	.77	.73	.65	.77	.71	.71
	70-72	.31	.60	.59	.59	.61	.59	.63	.72	.55	.62
Total Average	70-71	.46	.55	.56	.57	.56	.63	.65	.66	.56	.60
	71-72	.54	.60	.56	.61	.62	.72	.67	.68	.60	.65
	70-72	.39	.46	.48	.50	.46	.59	.61	.63	.49	.54

Table 17

Stability Coefficients of Ability Measures

PMA Variable	Interval	Cohort 1957		Cohort 1956		Cohort 1955		Cohort 1954		Total Sample	
		M	F	M	F	M	F	M	F	M	F
Verbal Meaning	70-71	.68	.64	.76	.83	.82	.80	.75	.66	.78	.79
	71-72	.69	.77	.82	.81	.84	.86	.84	.80	.82	.83
	70-72	.63	.70	.80	.78	.82	.80	.75	.74	.77	.77
Number Facility	70-71	.62	.64	.77	.77	.74	.74	.82	.76	.76	.75
	71-72	.71	.64	.75	.82	.81	.80	.84	.78	.79	.77
	70-72	.61	.62	.73	.74	.75	.71	.84	.81	.75	.72
Letter Series	70-71	.58	.57	.65	.70	.71	.73	.57	.72	.64	.68
	71-72	.57	.71	.69	.74	.74	.76	.68	.78	.68	.74
	70-72	.54	.48	.48	.71	.72	.77	.61	.80	.60	.69
Word Grouping	70-71	.57	.64	.73	.69	.65	.73	.68	.70	.68	.71
	71-72	.64	.59	.73	.75	.62	.78	.76	.78	.70	.73
	70-72	.62	.60	.72	.62	.71	.74	.71	.71	.71	.68
Number Series	70-71	.51	.53	.59	.54	.58	.60	.60	.62	.58	.58
	71-72	.66	.61	.74	.64	.63	.67	.70	.71	.69	.66
	70-72	.50	.41	.57	.56	.61	.52	.62	.73	.58	.54

Table 17 (continued)

Spatial Relations	70-71	.61	.62	.63	.77	.60	.67	.59	.75	.62	.71
	71-72	.73	.71	.68	.74	.61	.70	.45	.86	.63	.74
	70-72	.46	.56	.57	.62	.54	.68	.70	.74	.57	.64
Total Average	70-71	.60	.61	.69	.72	.68	.71	.67	.70	.68	.70
	71-72	.67	.67	.74	.75	.71	.76	.71	.79	.72	.75
	70-72	.56	.56	.65	.67	.69	.70	.71	.76	.67	.67

What is also noteworthy is that the overall differences between one-year (1970-71 and 1971-72) and two-year (1970-72) stabilities is much less pronounced than in the case of personality dimensions. In fact, for the most part, the difference between one-year and two-year coefficients is negligible.

VI. DISCUSSION AND CONCLUSIONS

A substantial body of sequential-longitudinal data such as the present one can be viewed from many perspectives, both when deciding how to analyze it and when reviewing its implications for existing literature and future research. Obviously, as is true for most programmatic, longitudinal research, the authors intend to examine further the present array of data in relation to additional hypotheses during the coming years. The present report, therefore, is preliminary in many ways. It is believed, however, that such preliminary reports are imperative in the case of longitudinal studies, since rate and extent of present cultural change renders findings on the nature of ontogenetic change of progressively dubious value as time passes. Obviously, one focus of the present study is exactly on this aspect -- the relationship between individual and historical change, the changing nature of psychological ontogeny.

The present section will focus primarily on issues pertaining to the examination of ontogenetic and generational change components in adolescent personality and ability development and their implications for theory building and research design in developmental psychology. Both the major substantitve and methodological implications of the results will be discussed. Although we shall not pause to qualify our conclusions at each instance, the writers very much appreciate that the generalizability of the present findings is subject to certain limits. We have pointed out the nature of the subject population, the measurement battery, and the procedures followed, as well as other reasons for qualifying our conclusions (e.g., retest effects, selective dropout). In light of our own finding regarding the impact of cultural change on development, it is our responsibility to make explicit also that one of the directions in which generazation is most questionable is to other time periods. The period from 1970 to 1972 is not a sizeable interval of historical time, especially in a rapidly changing culture.

A. Implications for Conceptions of Adolescent Personality

1. Age vs. Cohort/Time Effects. The data examined in the present study have indicated, rather unequivocally, the profound impact of cohort/time or generational differences on adolescent personality development. The results are interpreted by the writers as offering a serious challenge to conceptions of adolescent psychological development which postulate that the course of development is characterized by an orderly, sequential unfolding of universal, stage-like behavior patterns. The consistent discrepancies between cross-sectional and longitudinal data offer scant evidence for the invariant and robust developmental trends which are inherent in many biologically oriented models favoring a phase and/or stage-type organization of development through the period of adolescence.

The present results, rather, support the position that the average, quantitative standing of adolescents on personality and ability

dimensions is less dependent upon their chronological age than upon the time of measurement (cultural moment) to which they have been exposed. Realization that a substantial amount of influence on the developmental process lies outside the developing organism has a number of profound substantive implications. First, allotting a major role in adolescent personality development to age-related patterns of cultural change underscores the desirability of avoiding disciplinary parochialism by enlarging one's conceptual framework and attempting to broaden the knowledge base in approaching the study of development.

Second, even the relatively restricted objective of predicting status on an attribute at time x from status on that attribute at time x-1 must be undertaken with less than total optimism, given a rapidly changing cultural milieu, unless measures of cultural change can be accommodated by the prediction model. The fact is that, despite great interest and some noteworthy efforts, the environment has not been dimensionalized nearly as precisely as have organismic response patterns.

Third, there is no reason to adhere rigidly to a paradigm specifying cultural change as an independent variable. Adolescents constitute a substantial portion of our population and as such may be presumed to exert an influence on the course of social change. Conceptual schemes for exploiting this genre of interactive changes at the level of empirical research are indeed inadequate. In subsequent sections the writers will expand on such implications of the present data for both theory and method in developmental psychology in greater detail.

2. Adolescent Development and Sex Differences. No comprehensive text on adolescence omits considerable discussion of the extent and nature of differences between the two sexes, either physical or psychological. The outcome pattern of this project provides no exception but does add some new perspectives to the issue.

First of all, while main effects of sex exist on seven of the 10 personality and on five of the sex ability dimensions, the number of significant double (sex by time and/or sex by cohort) interactions is relatively small (four out of a possible 32). This general scarcity of interactions with sex indicates that most of the sex differences, though pervasive, were established prior to age 12 for the cohorts involved. Conversely, these findings indicate that the time period from 1970-72 did contain significant influences in the shaping (accentuating or redirecting) of sex differences in a few personality and ability traits. What 1970-72 contributed to sex-differences development is reflected in the finding that the sex differences shown at age 12 tended to become more, rather than less, pronounced during this period. This result, particularly if seen in conjunction with higher female than male 2-year stability, does not suggest a gradual dissolution of sex-role boundaries over the period examined,

although such a view enjoys growing popularity in the nonscientific literature.

B. Implications for Developmental Research Design

1. Simple vs. Sequential Designs. One of the major questions the present study dealt with is the relative merits of simple cross-sectional and longitudinal vs. sequential designs in descriptive developmental research. The findings, both on the level of age vs. cohort vs. time effects and on the level of control analyses, are extremely clearcut: neither simple cross-sectional nor the often praised longitudinal method is in any way a satisfactory design for research on developmental change. Without elaborating on a variety of methodological rationales (e.g., Baltes, 1968; Schaie, 1965, 1970; Wohlwill, 1970; Nunnally, 1973), the following paragraphs will summarize the empirical evidence gathered by the present project for this conclusion.

The pervasiveness of cohort or generation differences, known to be substantial in measures of cognitive behavior of adults before the present study was undertaken (e.g., Nesselroade, Scahie, & Baltes, 1972; Schaie, 1970; Woodruff & Birren, 1972), seems to be even more firmly established by the results reported herein. Indeed, present findings extend the range of evidence in three essential directions. First, the data reported clearly imply that generational (associated with cohort and time effects) differences obtrude into the ontogenetic measurement of personality as well as ability dimensions; a finding expected for sometime but, except for a mere handful of indirect examinations, essentially unsupported empirically. Second, in addition to adulthood and aging, the present study clearly implicates adolescence as a period in which cohort/time differences must be taken into account, if precise information about developmental change is to be obtained. Third, substantial cohort/time effects were noted even when the temporal definition was reduced to the relatively short span of one chronological year. It is not customary to regard organisms differing in time of birth by only one calendar year to be, in some sense, members of different "generations" yet, clearly, the data support the validity of such a distinction. Similarly, it is unusual to consider same-age subjects living at different times (1970 vs. 1971 vs. 1972) to be as different in their standing on personality dimensions as evidenced in the present study.

Perhaps the most salient of all the implications which these findings carry for methodological advance in the study of human development is that, because of the major role played by cohort and time differences in the assessment of personality, traditional cross sectional research design is simply not appropriate for the investigation of developmental patterns. Cross-sectional and longitudinal gradients do not coincide, in the main, and we should not, therefore, attempt to substitute one for the other, regardless of the amount of convenience involved.

Moreover, as the data indicate, the alternative to cross-sectional design is not simple longitudinal studies. First of all, as shown by cohort effects and their interactions with age and time, simple longitudinal designs, by their nature, are woefully lacking in external validity. Different cohorts, at least on the subset of traits involved here, can show marked differences in the direction and rate of age-related change functions. Further evidence from the study, especially the spectacular retest effects on ability measures, shows that the internal validity of longitudinal designs may be jeopardized substantially by the effects of testing and instrumentation. Obviously, as Baltes (1968) has demonstrated in a review of the literature on cross-sectional and longitudinal designs, such questions have been raised for a long time (in fact one insightful paper by Sussmilch goes back to 1741). However, one cannot resist the conclusion that, either for theoretical or economic reasons, behavioral scientists have reluctantly, if at all, paid attention to such basic design requirements.

The primary methodological conclusions following from the present and earlier outcomes are compelling. First, it is imperative at this time to use sequential designs (cross-sectional or longitudinal sequences) when the description of intraindividual change characteristics is at stake; apparently, the rapidity and pervasiveness of historical/cultural change is such that transgenerational invariance is the exception rather than the rule. Second, use of more complex, sequential designs alone is not enough, since, for internal and external validity objectives, the inclusion of adequate controls for potential confounds is mandatory.

Many scientists view the description of a given phenomenon to be the essential first step in moving toward the development of theories and conceptual models to explain, predict and, ultimately, to gain control of that phenomenon. The present study is, admittedly, a descriptive one, but the findings suggest that even this relatively preliminary step, for the domain of human development, is far from complete. As the authors have argued in another context (Baltes, Nesselroade, Schaie, & Labouvie, 1972), developmental researchers have to become more aware of such methodological issues and to take appropriate remedial steps, if they are to avoid becoming lost in the wilderness created by fallible data.

2. Stability Coefficients. There is a second aspect of research design that deserves emphasis in light of the present findings. Only repeated-measurement (longitudinal) designs provide information about individual change. Occasionally, researchers have in fact proceeded, when longitudinal data were available, to apply analytic models that focus on intraindividual change aspects, although many longitudinal studies have not made use of this unique piece of information. Moreover, when stability coefficients, for example, were computed, most researchers focused on predictive, psychometric validity rather than

on a developmental interpretation of such coefficients. The major and classical exception to this nondevelopmental perspective on stability indices is Kagan and Moss' (1962) discussion of age-and sex-related differences in stability in light of differential socialization practices. Further discussion of this view -- in conjunction with the development of explicit theoretical and methodological models of analysis -- is offered by Emmerich (1968), Wohlwill (1970), and Baltes and Nesselroade (1973).

The present data on differential stability during the adolescent period from 1970-72 contains a great deal of information that further contributes to a better understanding of the significance of developmental changes in stability indices. First of all, the data support (see Baltes & Nesselroade, 1973, for a detailed discussion of this view point) the notion that, developmentally, stability is far less valuable as an indicator of reliability or predictive power, than as an index representing a continuum of intrinsic substantive interest; i.e., developmental variation in stability is a substantively compelling phenomenon which: (a) deserves explication; (b) is apt to guide subsequent experimental research; and (c) contributes to developmental theory building.

Specifically, the general finding of the present study is that a given measure does not show one characteristic level of stability. On the contrary, stability indices vary according to age, sex, cohort membership, and time of observation. Accordingly, from a developmental view, the explanation of negative or zero stabilities is as important as the explanation of the occasional high long-term stability which allows long-term prediction and, therefore, excites most developmentalists.

Thus, the fact that females on the average show higher stability than males warrants further examination to pinpoint the nature of the underlying gene-environment mechanisms. Further, the information that 1971-72, on the average, produced higher age-related stability than 1970-71 suggests, among other things, that socialization patterns during the 1971-72 period were more apt to maintain individual differences of trait-like attributes than the 1970-71 period. Similarly, the finding of age-related differences in personality stability (increase with age) testifies to the developmental emergence of trait-like behavior patterns from state-like systems (as simulated by Baltes and Nesselroade (1973) in terms of increasing solidification of socialization differentials. Of particular pertinence are the two observations that: (1) some personality traits show such a remarkable state-trait transition during adolescence that they finally exhibit stability levels that are fully comparable to those of ability measures; and (2) contrary to informal expectations, the 1970-72 cultural period seems to have further enhanced the differential stability of sex differences.

Obviously, such developmental changes in stability indicators

need further explication in terms of underlying mechanism. However, they suggest quite clearly that the interactive effects of individual vs. historical change components not only affects average scores but intraindividual change attributes as well. To illustrate this conclusion by a concrete example, if cultural change is of the pervasiveness reported here, the Kagan and Moss (1962) findings on sex differences in short vs. long-term stability of such traits as dependency and aggression are in serious need of re-examination in terms of their trans-cohort and trans-time invariance or change.

3. Measuring Individual and Environmental Change. A third set of implications for developmental research design inherent in the present findings will be briefly touched upon. It deals with the simultaneous examination of time-related changes of the organism and the environment in order to obtain the information necessary to construct more powerful theories of development. More detailed exposition of such thinking has been presented recently in Baltes & Nesselroade (1973), Gewirtz (1969a, b), Wicker (1973), and Willems (1973).

The empirical support for this position, in the present research, is that most of the behavior variance generated during adolescence was due to time-related antecedents which, in turn, did not appear to exhibit unidirectional change but, rather, were highly cultural and moment-specific. This suggests that research should be designed to explicate the meaning of cohort and time effects. More direct implications, however, are that the individual organism can be characterized by partially pre-programmed change matrices, and that environment with which the organism interacts can be construed to change in similar ways. Although an environmental orientation is not new to developmental theorizing in psychology, the theoretical models generated thus far do not allow for the aligning of behavioral and environmental systems on conceptually equivalent (Gewirtz, 1969a, b) dimensions. Within an interactive framework, developmental psychologists have made some progress in explicating age, but we are unable to respond when asked to specify the conditions and mechanisms mediating cohort/time effects.

Elaboration of such a behavior-environment posture will not only require the development of a general model of the environment, but also of models delineating age-, cohort-, and time-correlated changes in the environment. Subsequently, it may be possible to align time-correlated changes in the environment with time-correlated changes in the ontogeny of behavior systems. Research on parent-child interactions (e.g., Becker, 1964; Kagan & Moss, 1962) and on the importance of environmental variables in predicting later ontogeny (e.g., Bloom, 1964) are prominent examples of domains for this type of behavior-environment orientation. However, much more refined analyses of the parallel processes that characterize behavior and environmental ontogeny are necessary. Baltes and Nesselroade (1973, for

example, have presented a simulation experiment that exemplifies how structural changes in intelligence (emergence of structure, integration, differentiation, trait-state differentiation) can be accounted for by time-correlated changes in environmental matrices. Similar models can and should be developed for adolescent personality development and subsequently examined via experimental designs. Moreover, on the most general level, the necessity that longitudinal designs be formulated to assign as much importance to the assessment of environmental patterns and their ontogeny as to the examination of behavior patterns and change in the individuals should be realized.

Finally, it would seem desirable to plan such longitudinal research with clearcut hypotheses in mind about the nature of the man-environment systems involved. Again, except for the limitation that the "changing environment" is restricted largely to maternal behavior and does not incorporate a more comprehensive mapping of other environmental systems, the authors are struck by the insight that characterizes the Fels Longitudinal Study (Kagan & Moss, 1962) in this respect. In order to move towards a substantive explanation of the cohort-time effects observed in the present study, one obvious next step is to speculate about the substance of time-correlated changes in environmental fields to plan a follow-up, sequential-longitudinal study directed toward explicitly assessing both individual- and environmental-oriented variable networks.

C. Implications for Theory Building in Developmental Psychology

Beyond direct implications for conceptions of adolescent personality and the specific design of developmental research, the present findings, particularly in relation to other recent similar data on adult development, can be construed to have profound implications of a matatheoretical and metamethodological nature for theory building in developmental psychology. A first set of propositions deals with the relationship between evolutionary (phylogenetic) and ontogenetic developmental models, on the one hand, and organismic vs. mechanistic developmental models on the other. A second class of implications pertains to the question: To what extent are developmental theories and models adequately oriented towards a conjoint and interactive analysis of organism-environment interchanges during ontogeny?

1. Phylogeny-Ontogeny. Although the writers do not intend at this time to dwell extensively on the complex issues surrounding the relationships between phylogenetic and ontogenetic processes of development, it seems fair to conclude that current human development theorizing proceeds as if phylogenetic sequences do not exist.

For the most part, psychological ontogeny is conceptualized as occurring in a context of genetically invariant organisms and ecologically invariant environmental fields or socialization histories. Admittedly, there is some focus on genetic differences and the

analysis of the effects of environmental differences on behavior development. However, as so persuasively discussed by Riegel (1972, 1973), American developmental psychology does not explicitly address itself to the construction of developmental models that incorporate concepts and notions about a "changing individual in a changing world" -- models of sufficient complexity to capture the myriad interactive processes that lead to the pervasive social change phenomena witnessed today.

Consider, for example, how impotent some developmental theories (e.g., Piagetian) are when a discussion or explanation of cultural change phenomena is at stake (e.g., Toffler, 1970). The nonevolutionary stance inherent in this type of developmental theorizing seems to restrict its usefulness to a society and a cultural moment in which the rate of overall change is minimal.

Present findings on the impact of cohort and time of measurement effects lend considerable support to the proposition that the continuous impact of evolutionary processes needs to be considered not only when studying psychological ontogeny, but should be incorporated explicitly into developmental models, if they are to show satisfactory external validity. Concretely speaking, the environmental fields that 12-year olds in 1970 and 12-year olds in 1972 interact with seem far from identical; a finding which, for example, requires attention to both age- and time/cohort-related gradients of socialization norms and mechanisms (see Neugarten & Datan, 1973; Bengston & Black, 1973 for more detailed expositions).

The often argued position that such time-related trends are not so important since they are not "truly" evolutionary and that they affect mean trends only rather than the "basic" underlying processes (e.g., learning), seems at best defensive, since the evidence that such basic processes do not show useful homologies either across species, or across levels of ontogeny is increasingly mounting (e.g., Botwinick, 1970; Baltes & Labouvie, 1973).

2. Organismic vs. Mechanistic vs. Dialectic Models of Development. In a similar, though more focussed vein a number of developmentalists have recently examined the meta-theoretical and metamethodological implications of the various classes of theories and models that have dominated developmental theorizing over the last two decades (Reese & Overton, 1970; Overton & Reese, 1973; Langer, 1970). Reese and Overton in particular have examined the meta-assumptions underlying organismic and mechanistic models of development as they relate to the nature of the concept of development and developmental change, the explication of time, and the status of distinct properties of causality and determinism. In addition, Riegel (1972, 1973) and Wozniak (1973), for example, have examined the concept of development from the vantage point of dialectic materialism (see also Schmidt, 1970) and have emphasized the discontinuous and interactive attributes that are

involved for both individual and societal change phenomena in a dialectic worldview.

One of the most compelling implications of such metatheoretical expositions on the nature of developmental models is an acknowledgment of the overriding import such meta-models have for the generation and interpretation of specific research. Obviously, this is also true for the interpretative meaning of cohort/time effects in developmental research as found in the present study. Although we must be careful to restrict conclusions to the time period and personality-ability dimensions studied, it is most apparent that the present data do not support the usefulness of an organismic model for adolescent development, since the outcome in no way assigns a major role to intra-organismic and sequential change sequences; nor do the findings support the type of linear, cumulative learning models that characterize most mechanistic developmental models.

The pervasive occurrence of multidirectional and multidimensional cohort/time effects, on the contrary, points to the need for acknowledging an open system of behavior change that: (a) does not predetermine the outcome of personality and ability development during adolescence, and (b) which explicitly focuses on developmental models that consider interactive changes in both the individual and society. A rapprochement between psychological and sociological theorizing is one of the necessary consequences of such a view and dialect models, therefore, appear useful in providing the meta-perspectives for such theoretical attempts. To what extent it will be possible to combine, for example, mechanistic with dialectic concepts is an open question.

D. Implications for Educational Policy

Although it is tempting to speculate about the psychological, sociological, and educational determinants of the observed cohort/time effects on adolescent personality, we shall refrain from such efforts, since the experimental design employed does not permit such interpretative inferences. However, an attempt will be made to briefly outline some of the implications for educational policy.

There are two sets of implications. A first relates to methodological aspects of educational evaluation; a second set to the delineation of substantive educational goals in light of a changing cultural context.

1. Evaluation Methodology. The present study lends strong support to the need for applying sequential strategies in educational research, in order to disentangle generic intervention effects from extraneous effects that are due to historical change.

Obviously it is naive, at least with regard to personality variables, to assume continuous, monotonic growth models that exhibit robust time-related invariance. On the contrary, in line with

Campbell and Stanley's (1963; Campbell, 1969) concern for external validity, it is imperative to assess to what degree educational intervention efforts: (1) are unconfounded with naturalistic, normative cultural change; (2) lead to historically generalizable effect patterns; and (3) interact with the existing levels of cultural milieu. For the most part, we are left to speculation relative to all these questions until educational evaluation explicitly incorporates the type of sequential strategies employed in the present project. Consider, for example, the tremendous complication imposed on general educational intervention models, if trait by treatment interaction models would need to be viewed in their further interaction with cultural change parameters.

2. Definition of Educational Goals. The present study lends also strong support to the notion that a delineation of the objectives or target behavior patterns for educational intervention or curriculum planning should consider the nature of ontogenetic and historical change conditions.

First, it is evident that the strong impact of time/cohort effects implies that educational delivery does not occur in a fixed and stable societal reference frame. Instead, the present data show that those aspects of society which are relevant in shaping adolescent personality development are currently in a period of rapid social change. Such cultural change patterns may override whatever personality-related curricular material characterizes the thrust of educational intervention during the secondary school years.

Second, again with a focus on the substance of educational goals, the present data do not only draw attention to noncognitive aspects of educational curriculum planning, but also to its complexity, in light of the finding that personality measures of the type employed do not seem to follow an intraorganismic, continuous-monotonic growth model. Accordingly, it will be necessary to regularly monitor the nature of historical-cultural change patterns in order to specify the type of educational intervention desired.

The present data indeed are apt to impose a relativistic perspective on human development phenomena and their implications for educational planning. As indicated in an earlier section, however, it appears crucial that both developmental theory building and educational planning do not restrict themselves to the narrow stance of viewing cohort/time effects as undesirable detriments to generalization, but rather face the phenomenon of the interaction between individual and historical change with a constructive and innovative posture.

VII. FOOTNOTES

[1] Cohort definition was based on the interval 1 November of year X through 31 October year X + 1. Thus, for example, cohort 1954 included adolescents born during the November 1953 through October 1954 time period. This definition of cohort differs slightly from that used in an earlier analysis (Baltes & Nesselroade, 1972) and resulted in changes in cohort membership assignment for a small number of subjects. The adjustment, however, served to make each cohort group somewhat more homogeneous with respect to grade level.

[2] The authors wish to express their thanks to Douglas N. Jackson for his help in interpreting the PRF factors.

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Appendix A

A number of activities related to this investigation, although not all dealing with the primary data of the study, were engaged in and partially supported by the grants during the course of the granting period summarized in this report. Before the adolescent data became available, several investigations aimed at examining and testing models and developing and checking computer programs were launched and have been completed. Other projects are in various stages of completion and will be submitted for publication eventually. Included are:

I. Papers published.

Baltes, P. B., Baltes, M. M., & Reinert, G. The relationship between time of measurement and age in cognitive development of children: An application of cross-sectional sequences. Human Development, 1970, 13, 258-268.

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II. Papers presented at professional meetings.

Baltes, P. B., & Nesselroade, J. R. The developmental analysis of interindividual differences on multiple measures. Paper presented at West Virginia University Conference on Life-Span Developmental Psychology: Methodological Issues, Morgantown, West Virginia, April, 1971.

Baltes, P. B., & Nesselroade, J. R. Adolescent personality development and cultural change examined by longitudinal sequences. Annual Meeting of the American Educational Research Association, New Orleans, February, 1973.

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Bartsch, T. W., Nesselroade, J. R., & Baltes, P. B. Cultural change and adolescent intellectual development: An application of longitudinal sequences. Paper presented at the Regional Meeting of the Southeastern Conference of the Society for Research in Child Development, Williamsburg, Virginia, 1972.

Nesselroade, J. R., & Baltes, P. B. Higher order convergence of two distinct systems of personality: Cattell's HSPQ and Jackson's PRF. Paper presented at the annual meeting of the Society of Multivariate Experimental Psychology, Ft. Worth, Texas, November, 1972.

Appendix B

Personality Factor Means by Group, Cohort, Sex, and Time of Measurement

Cohort	Sex	Time	N	Personality Factor									
				I	II	III	IV	V	VI	VII	VIII	IX	X
Sequential Longitudinal Group (1970-72)													
1957	F	1970	119	-.21	.34	-.53	-.26	.14	.55	-.27	-.39	-.35	-.07
	M		102	.23	.19	.65	.19	-.05	-.24	-.76	.24	.37	.15
1956	F		127	-.18	.24	-.61	-.35	.13	.55	.06	-.48	-.18	-.03
	M		95	.07	.12	.64	.37	.08	-.23	-1.12	.04	.46	.22
1955	F		123	-.34	.15	-.67	-.21	.36	.65	.12	-.55	-.18	-.05
	M		101	.26	.13	.60	.23	-.25	-.28	-.09	.28	.27	.36
1954	F		66	-.41	.14	-.90	-.42	.12	.53	.16	-.49	-.60	-.10
	M		83	.30	-.07	.66	.25	-.23	-.39	.08	.30	.17	.31
1957	F	1971	119	-.14	.11	-.51	-.41	.21	.67	.40	-.48	-.28	-.29
	M		102	.43	-.23	.92	.28	.02	-.75	-.64	.32	.55	-.05
1956	F		127	-.01	-.07	-.56	-.33	.18	.27	.47	-.41	-.24	-.12
	M		95	.17	-.17	.69	.35	-.04	-.43	-.53	.29	.56	.10
1955	F		123	-.19	-.04	-.71	-.26	.42	.52	.58	-.47	-.37	-.16
	M		101	.25	-.01	.70	.22	-.36	-.65	.03	.34	.27	.29
1954	F		66	-.41	.11	-.76	-.31	.30	.39	.54	-.47	-.56	.10
	M		83	.38	-.11	.72	.32	-.28	-.68	.05	.50	.04	.27

Cohort	Sex	Time	N	Personality Factor									
				I	II	III	IV	V	VI	VII	VIII	IX	X
1957	F	1972	119	-.12	-.11	-.48	-.31	.22	.20	.49	-.33	-.23	-.42
	M		102	.46	-.29	.94	.27	-.28	-.66	-.05	.55	.47	-.18
1956	F		127	-.03	-.17	-.66	-.28	.30	.49	.91	-.27	-.31	-.40
	M		95	.36	-.22	.84	.44	-.07	-.69	-.43	.43	.59	.05
1955	F		123	-.25	.04	-.85	-.12	.15	.11	.93	-.31	-.30	-.19
	M		101	.51	-.17	.69	.11	-.58	-.78	.34	.35	.24	.36
1954	F		66	-.42	.18	-.85	-.05	.10	.07	.80	-.25	-.53	-.24
	M		83	.32	-.04	.63	.32	-.52	-.99	.55	.70	.20	.38
				Dropout Group									
1957	F	1970	37	-.42	.32	-.48	-.27	.30	.50	-.28	-.33	-.53	-.10
	M		35	.30	-.00	.67	.64	.17	.44	-.34	.56	.61	.01
1956	F		46	-.34	.29	-.52	-.22	-.23	.88	-.73	-.22	-.04	.00
	M		64	.21	-.01	.68	.58	-.01	-.43	-1.16	.57	.41	-.05
1955	F		67	-.25	.11	-.52	-.30	.15	.84	-.19	-.36	-.30	-.06
	M		87	.28	-.23	.53	.24	-.09	-.35	-.74	.36	.47	.02
1954	F		79	-.31	.16	-.70	-.33	.32	.55	.17	-.35	-.52	-.11
	M		82	.20	-.04	.52	.41	-.06	-.52	-.32	.47	.25	.21

Cohort	Sex	Time	N	Personality Factor									
				I	II	III	IV	V	VI	VII	VIII	IX	X
				Retest Control Group									
1957	F	1972	86	-.24	-.12	-.59	-.19	.14	.69	-.05	-.15	-.40	-.15
	M		70	.11	.03	.87	.43	-.14	-.34	-.86	.39	.59	.06
1956	F		72	-.51	-.00	-.66	.07	.24	.60	.23	-.13	-.41	-.23
	M		70	.23	-.16	.68	.23	-.39	-.62	-.39	.56	.33	.12
1955	F		55	-.34	.35	-.76	-.18	.09	.25	.69	-.50	-.29	-.09
	M		50	.21	-.14	.71	.21	-.38	-.46	-.12	.52	.18	.21
1954	F		52	-.28	.42	-.82	-.14	-.06	.05	.42	-.39	-.44	.36
	M		60	.31	-.16	.60	.34	-.32	-.95	.36	.78	.00	.31

Appendix C

Ability Variable Means By Group, Cohort, Sex, and Time of Measurement

Cohort	Sex	Time	N	Ability Variable					
				VM	NF	LS	WG	NS	SR
Sequential Longitudinal Group									
1957	F	1970	118	7.0	9.2	8.4	13.7	5.4	17.9
	M		99	8.0	10.2	7.1	13.5	5.6	21.0
1956	F		123	10.4	10.6	9.2	14.7	6.0	20.7
	M		93	9.3	11.3	7.8	13.8	6.2	28.3
1955	F		118	13.3	11.8	10.4	16.1	6.5	23.6
	M		99	11.9	12.7	8.4	14.9	6.6	28.8
1954	F		63	12.9	12.0	10.2	15.5	6.6	24.2
	M		80	13.0	14.2	8.9	16.4	6.9	29.0
1957	F	1971	118	10.4	11.1	10.7	15.6	6.2	26.3
	M		99	10.5	12.7	9.4	14.8	6.7	28.2
1956	F		123	13.7	12.8	11.5	16.6	7.5	27.9
	M		93	12.8	13.9	9.8	15.4	7.4	35.9
1955	F		118	17.1	14.0	12.4	17.7	7.7	32.5
	M		99	14.3	14.9	9.8	16.5	7.7	35.1
1954	F		63	17.1	13.5	11.7	17.1	7.5	30.8
	M		80	16.4	16.4	11.4	17.6	8.6	40.3

Cohort	Sex	Time	N	Ability Variable					
				VM	NF	LS	WG	NS	SR
1957	F	1972	118	14.0	12.3	12.4	16.8	7.5	33.6
	M		99	13.5	13.9	11.0	16.0	7.9	36.4
1956	F		123	16.8	13.9	12.7	17.9	8.0	35.1
	M		93	14.5	15.0	11.5	16.8	8.2	41.8
1955	F		118	18.9	14.4	13.3	18.5	8.3	37.0
	M		99	15.8	16.0	11.5	17.9	8.1	39.7
1954	F		63	18.8	14.0	13.1	18.7	8.2	35.1
	M		80	18.6	17.3	12.1	19.0	9.2	41.4
				Dropout Group					
1957	F	1970	37	7.8	8.5	7.1	12.9	4.7	15.6
	M		44	8.5	9.7	6.9	12.7	6.1	23.0
1956	F		48	8.3	9.5	7.3	13.4	4.9	18.6
	M		66	8.3	10.2	7.4	13.1	5.4	19.7
1955	F		69	11.1	10.5	9.0	14.1	5.9	18.0
	M		89	11.0	11.4	7.5	14.0	5.8	22.3
1954	F		79	13.0	11.6	9.7	14.8	5.9	25.4
	M		86	12.3	12.2	7.9	14.2	6.0	25.0

Cohort	Sex	Time	N	Ability Variable					
				VM	NF	LS	WG	NS	SR
				Retest Control Group					
1957	F	1972	84	11.0	10.4	10.3	15.2	6.5	20.3
	M		68	10.5	11.7	7.5	13.7	6.0	22.4
1956	F		71	14.0	12.0	9.9	15.9	6.7	24.7
	M		69	12.7	13.1	8.9	15.4	7.4	29.3
1955	F		52	16.0	12.9	11.2	16.8	7.7	23.8
	M		48	13.9	14.7	10.4	15.5	8.1	27.2
1954	F		50	18.5	12.8	11.0	18.1	6.7	26.9
	M		56	16.8	16.1	11.2	18.0	8.6	32.5