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AND THE EVOLVEMENT OF THEIR
OCCUPATIONAL INTERESTS

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SOME RELATIONSHIPS BETWEEN ASPECTS OF GROWTH
OF YOUTH AND THE EVOLVEMENT OF THEIR
OCCUPATIONAL INTERESTS

by
Stewart Charles Hulslander

A dissertation submitted in partial fulfillment
of the requirements for the degree of
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ABSTRACT

SOME RELATIONSHIPS BETWEEN ASPECTS OF GROWTH OF YOUTH AND THE EVOLVEMENT OF THEIR OCCUPATIONAL INTERESTS

This investigation makes inquiry into probable relationships which may exist between aspects of growth of youth and the evolvement of their occupational interests.

Data on growth-in-age units and developmental age are procured from a population of thirty-five boys and thirty-seven girls at chronological ages of one hundred thirty-two months. This population is composed of all pupils in the University High School at Ann Arbor, on whom appropriate growth data were available.

Data on occupational interest choices for this population at the high school level are obtained from an occupational interest inventory.

Chi square, Phi coefficients of correlation, expectancy tables, t tests, and ordering by rank, are employed to test relationships of paired growth and interest variables.

An analysis of the findings, as they relate to each subhypothesis of the study, provides the basis for the following conclusions:

Subhypothesis: A significant relationship exists between certain growth characteristics and interest level patterns.

1 Above average individuals in carpal and reading ages tend to indicate occupational interests at a higher level than do those who are below average.

Subhypothesis: There is a significant relationship between certain growth characteristics and patterns of interest types.

2 Above average individuals in reading, mental, weight, and organismic ages tend to be more interested in the computational area than do individuals who are below average.

3 Above average individuals in Developmental age disclose less interest in the computational area than do those who are below average.

Subhypothesis: There is a significant relationship between certain growth characteristics and fields of interest patterns.

4 Above average individuals in reading and mental ages indicate greater interest in science than do those who are below average.

5 Above average individuals in reading and weight ages indicate less interest in the natural field than do those who are below average.

6 Above average individuals in height age indicate less interest in the arts than do those who are below average.

7 Above average individuals in grip age indicate less interest in the natural and arts fields than do those who are below average.

Subhypothesis: Certain similarities and differences exist between relationships of growth characteristics and interest factors according to sex.

8 Above average girls in height age tend to indicate greater interest in the business field than do boys who are above average height.

9 Above average boys in height age exhibit more interest in the science field than do girls who are above average height.

10 Above average girls in dental age evidence greater interest in the science field than do boys who are above average dental age.

11 No significant sex differences are revealed between reading age and level of interest, and interest in the natural and science fields; carpal age and level of interest; mental age and computational interest; and height age and interest in the arts.

Subhypothesis: Certain growth characteristics vary in their importance as indicators of various interest factors.

12 There are indications that reading, height, and mental ages are more important indicators of occupational interest choices than carpal, organismic, weight, grip, dental, and developmental ages.

It is concluded that relationship tendencies exist between growth and interest factors in the population under study. These limited findings are considered inconclusive for general acceptance and use in practice. The findings, however, give support to the major hypothesis that there is a significant relationship between certain measures of growth of children and their occupational interests.

DEDICATION

This dissertation is dedicated to the members of my immediate family, who, because of their continued patience, understanding, and encouragement, have made it possible for me to conduct this investigation.

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For his counsel and guidance in the planning and conducting of this study, the author is especially grateful to Dr. H. Glenn Ludlow. Likewise, deep appreciation is expressed to Dr. Cecil C. Craig, Dr. Harlan C. Koch, Dr. Willard C. Olson, and Dr. Edward C. Roeber for their continued inspiration and assistance given the author in the production of this study.

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CHAPTER I

NATURE OF THE PROBLEM

One of the more important competencies needed by guidance workers is the understanding of the individual counselees with whom they work. This understanding is, however, only a means to an end. Its ultimate value depends upon the extent to which the counselee is able to accept, understand, and use information about himself in order to better his adjustment. Such understanding about counselees possessed by guidance workers is therefore catalytic in nature, to be used as a tool in bringing about counselee improvement in concepts, appraisals, and evaluations of self and others.

The acquisition of sufficient understanding is difficult to obtain because of the many facets through which human behavior may be observed, inferred, and measured. The dynamic characteristic of growth and development of individuals limits the significance of data at any particular point in time in growth. Such data may be static in nature while the person on whom it is collected is a changing organism.

In many instances data about an individual represent only a narrow segment of his total behavioral picture. Even when data on several segments of behavior are obtained, they may be dissociated one from another and therefore lack the significance which they might possess if they were cast together as a Gestalt. The problem of obtaining a high degree of understanding becomes increasingly difficult when there is added the concept of the socius as constituting the total individual. In the latter instance the field of forces within the

experience orbit of an individual serves to modify, and become part and parcel with those characteristics which are frequently considered intrinsic to the individual. Finally, the limitations inherent in all instruments and techniques which may be used in collecting data for understanding behavior must be considered. At best, within the segment of behavior which these instruments purport to measure, they represent something less than a true measure, ranging downward to points of little or no statistical significance.

An approach to understanding individuals which combines and/or relates the results of various instruments and techniques employed in estimating behavior over a period of time-in-growth appears, therefore, to offer greater opportunities for formulating a more realistic "picture" of behavioral characteristics. Such an approach is consistent with the developmental concept of growth of individuals. It offers possibilities for detecting growth patterns as they may emerge from determining tendencies and learning experiences of individuals. It is inclusive of the total individual including combinations of intrinsic and extrinsic forces which become integral with his uniqueness as a dynamic personality. Finally, the use of multiple instruments and techniques, used to estimate the behavior of an individual during a sequence in time-in-growth tends to add greater validity to the results which are obtained from any respective instrument or technique when used alone.

This brief exposition forms, therefore, a framework of reference on which the specific problem of this investigation is based. It is in direct contrast to a point of view which has historically been held by many persons that certain aspects of behavior spring forth at various chronological points of development, presumably without antecedents in the history of the individual. It is a framework of

reference anchored in the concept of developmental theory and applied to all aspects of physical and psychological growth and maturity.

The problem deals with certain selected aspects of physical and psychological growth as they may relate to provide a more comprehensive basis for estimating one aspect of behavior; namely, the development of occupational interests.

Statement of the Problem

Due to the commonly accepted point of view that certain behavioral manifestations emerge as chronological age phenomena, it has been generally assumed that little or no progress can be achieved towards occupational adjustment of children prior to their late adolescence. School guidance workers have, in general, a very limited span of time in the lives of pupils for providing them with in-school and out-of-school experiences designed to assist them in perceiving their possible vocational goals. The recognition of occupational interests is one of the aspects of vocational adjustment to such goals. The specific problem with which this study is concerned is the determination of relationships of growth age units of children¹ at 132 months of chronological age (1) to their performance on the Furfey² and Sullivan³ tests of developmental age, and (2) to their later

¹ Willard C. Olson and Byron O. Hughes, Manual for the Description of Growth in Age Units (Ann Arbor: Edwards Letter Shop, 1950).

² P. H. Furfey, "A Revised Scale for Measuring Developmental Age in Boys," Child Development, Vol. II, No. 2, 1931.

³ Sister Celestine Sullivan, "A Scale for Measuring Developmental Age in Girls," Studies in Psychology and Psychiatry, Vol. III, No. 4, 1934.

indication of occupational interest obtained from the Lee-Thorpe Occupational Interest Inventory.⁴

Timeliness and Need for the Study

Several studies, notably those by E. K. Strong,⁵ have shown that the stability of occupational interests increases with maturity. Such studies have concluded that differentiation and stability of these interests is not significant for the majority of youth before 15 to 17 years of chronological age. The result is that schools have given relatively little attention to vocational interests of their pupils prior to this age. Carter⁶ has shown, however, that interests may be considered as stable and integral aspects of personality, closely related to emotional, social, and intellectual maturity. He has also pointed out that vocational interests are patterned and that they change in a significant and consistent developmental manner with age. This concept has also been advanced by other leaders in the field of psychology. Olson and Hughes⁷ have shown that individuals grow toward maturity at different rates, and with unique patterns. There is also general agreement among investigators that interests are derived from inherited determining tendencies plus learning experiences.

⁴ Edwin A. Lee and Louis P. Thorpe, Manual of Directions, Occupational Interest Inventory (Los Angeles: California Test Bureau, 1944).

⁵ E. K. Strong, Vocational Interests of Men and Women (Palo Alto: Stanford University Press, 1943).

⁶ H. D. Carter, "The Development of Vocational Attitudes," Journal of Consulting Psychology, 4:185-191, 1940.

⁷ Olson and Hughes, op. cit.

It appears reasonable to assume, therefore, that there are factors associated with growth that may serve as cues to interest patterns exhibited by individuals at chronological ages earlier than late adolescence. Early detection of interests and interest patterns would offer greater opportunities for guidance workers to assist individual pupils in a more effective manner in their vocational adjustments.

Finally, the need for additional investigation of the manner in which interests are developed is frequently noted in the writings of authorities on this subject. In this connection, a quotation from Fagin's article is typical:

Further research may help to focus attention on the vocational side of personality development, and to integrate it more fully with the goals of general education.⁸

Delimitations of the Field of This Inquiry

This study is limited to those pupils who were in attendance at the University of Michigan High School in 1951 and 1954, for whom certain growth data were available in age units at the chronological level of 132 months.

This population, consisting of seventy-two male and female pupils, represented the following grade distribution at the time the Lee-Thorpe occupational interest inventory was administered to them:

<u>Grade Level</u>	<u>Boys</u>	<u>Girls</u>
Ninth	15	16
Tenth	5	12
Eleventh	11	6
Twelfth	<u>4</u>	<u>3</u>
Total	35	37

⁸ T. C. Fagin, "Guiding the Vocational Interests of the Child," Education, 74:171-179, November, 1953.

Basic Assumptions in the General Area of This Study

Several stated theories and much speculation regarding the derivation and development of interests have been advanced by various authorities in the fields of education, psychology, and child growth and development. These are discussed in detail in Chapter II of this study. It seems proper at this time to present certain statements which appear to reflect general agreement among the authorities referred to above. Only those statements which relate to the general problem under consideration in this study are included here. Considered together, they constitute the framework of reference on which the hypotheses of this study are based.

1. Interest is one of many aspects of the total process of growth and development of an individual.
2. Interest patterns tend to crystallize in proportion to the maturation of a person, as a result of endocrine changes, social adaptation, and emergence of self-concepts.
3. Maturity in an individual brings about improved perception, realizations, and self-concepts; interests are a reflection of self-concept.
4. The degree of maturity attained at any chronological age level of growth is a more significant index of the understanding and description of growth than is chronological age.
5. The more mature child tends toward greater social competence and a more mature level of interest.
6. Individuals mature at different rates and attain different degrees of growth; interests appear to be related to the rate of maturation and to the degree of maturity attained.
7. Interest patterns and changes in specific interests appear to be associated with factors which produce maturity.

8. Any growth factors which change with age will serve to differentiate maturity rates of children of the same chronological age.

9. Age units of growth, indicated by Olson and Hughes, are, severally and collectively, aspects of the total growth patterns of individuals.

10. The many opportunities for tryout experiences leading to identification of social approval contribute to the stability of interest patterns.

11. Component parts of occupational interest patterns include levels of interest, type of interest, and field of interest.

Hypotheses

The major hypothesis of this study is: There is a significant relationship between certain measures of growth of children and their patterns of vocational interest.

More specifically, the following five subhypotheses will be tested:

1. There is a significant relationship between certain growth characteristics and interest level patterns.

2. There is a significant relationship between certain growth characteristics and patterns of interest types.

3. There is a significant relationship between certain growth characteristics and fields of interest patterns.

4. Certain similarities and differences of relationship between growth characteristics and interest factors exist according to sex.

5. Certain growth characteristics vary in their importance as indicators of the various interest factors.

Summary

The developmental concept of interest is advanced as the underlying basis for the problem under consideration in this investigation. It is tentatively held that the development of interest is related to the total growth and development of individuals. For purposes of testing the several hypotheses of the study, a selected population of boys and girls is used to provide appropriate data on growth and interest variables, which are then treated statistically to determine the outcomes of the study.

CHAPTER II

A CRITIQUE OF SIGNIFICANT STUDIES AND RELATED LITERATURE

In Chapter I it was pointed out that this study is concerned with probable relationships which may occur between the inventoried interests of individuals and certain other aspects of their growth and maturation patterns. More specifically, it deals with relationships which may exist between identifiable developmental growth factors and certain occupational interest factors of youth.

Consideration is given in this chapter to the nature, kind, and extent of theories and concepts related to this topic of investigation.

Relationships of Personality and Interests

It is appropriate at the outset to present a brief exposition on the relationships of interests to the over-all personality development of individuals. This provides a psychological frame of reference for interests on which the hypotheses of this study listed in Chapter I are established, together with additional assumptions on which other related investigations may be made.

Analysis of definitions of interest.--The first approach deals with an analysis of various definitions of interest as advanced by some of the foremost authorities in the field of interest. From these definitions is developed a working definition of interest to be followed in this investigation. Eight selected definitions of interest follow:

Interest may be thought of as one of the forces that motivate activity . . . a tendency to select one activity or thing in preference to something else, to choose one instead of another . . . interests are likes.¹

Satisfiers that produce continued positive responses are referred to as interests. Interest itself is a kind of mental excitation or preoccupation with certain classes of objects or situations.²

Interest is a feeling which accompanies special attention to some content; an attitude characterized by focusing attention upon certain cognitive data.³

The term "interest," may be defined somewhat technically as a feeling of liking, associated with a reaction either actual or imagined, to a specific thing or situation.⁴

An interest is a dynamic tendency to become absorbed in an experience and to continue it.⁵

An interest is defined by preoccupation with an activity when the child is free to choose.⁶

¹ Clifford P. Froehlich and John G. Darley, Studying Students (Chicago: Science Research Associates, 1952), p. 277.

² William Clark Trow, Educational Psychology (2d ed.; New York: Houghton-Mifflin, 1950), p. 105.

³ Howard C. Warren, Dictionary of Psychology (New York: Houghton-Mifflin, 1934), p. 141.

⁴ Arthur J. Jones, Principles of Guidance and Pupil Personnel Work (New York: McGraw-Hill Book Co., 1951), p. 214.

⁵ Walter VanDyke Bingham, Aptitude and Aptitude Testing (New York: Harper and Brothers, 1936), p. 62.

⁶ Dale B. Harris, "How Children Learn Interests, Motives, and Attitudes," The Forty-Ninth Yearbook of the National Society for the Study of Education: Part I, Learning and Instruction (Chicago: University of Chicago Press, 1950), p. 131.

Vocational interest is defined not as a single choice but as the sum total of many interests that bear in any way upon an occupational career.⁷

Experimentally an interest is a response of liking . . . is present when we are aware of an object . . . [is] an aspect of behavior, not an entity in itself.⁸

An analysis of the above definitions reveals that determining tendency is stated or implied in several instances. Since this is closely akin to the concept of inherited reaction patterns it seems logical that this concept may properly be included in any definition of interests. Furthermore, there is considerable agreement that interests are dependent upon satisfying stimulus situations. It is also noted that interest selectivity is dependent upon knowledge of environmental data by the individual. Learning is therefore an important factor in a definition of interest.

A proposed definition of interest.--From this analysis the following definition of interest is advanced and will constitute the frame of reference to interest whenever the term is used: Interest is a complex of dynamic forces within the developing personality derived in part from inherited reaction patterns which become individuated through cognitive and satisfying experiences; vocational (occupational) interest is considered as a phase of general interest which has become individuated to the extent that certain perceivable relationships to occupational fields are identifiable; and specific occupational interests indicate that further individuation has occurred to the degree that certain manifest relationships to specific occupations are identifiable.

⁷ E. K. Strong, Vocational Interests of Men and Women (Stanford: Stanford University Press, 1943), p. 21.

⁸ Ibid., pp. 6-7.

Interrelationships of personality and interests.--Interests in general appear to be closely integrated with and part of the origin and development of personality. In this respect Jones has this to say:

. . . it is difficult to find any clear distinction between personality and interests. . . . Interests are elements in, or parts of the personality. . . .⁹

In fact, according to several writers and investigators, interests or the "potential" for interests, may well be part and parcel with the underlying factors which give rise to personality.

Strong states that:

Feeling, interest, want, and attitude all involve psychological mechanisms. Such mechanisms may be dormant or aroused.¹⁰

Again he makes reference to this concept of these component relationships when he writes:

An interest is not a separate entity but merely one of several aspects of behavior; . . . an expression of satisfaction.¹¹

Further substantiation of this idea is borne out by Trow. Referring to components of personality, he states:

Similarly the interest pattern of the individual, the classes of things he tends to move towards, manipulate, stay in the presence of, think about, and participate and take pleasure in, serve in part to characterize his unique adjustments to personality.¹²

This general concept of the relationships of interest and personality appears to be in accord with Allport's definition and concept of personality:

⁹ Jones, loc. cit.

¹⁰ Strong, op. cit., pp. 8-9.

¹¹ Ibid., p. 23.

¹² Trow, op. cit., p. 700.

Personality is the dynamic organization within the individual of those psychological systems that determine his unique adjustments to his environment.¹³

Super also indicates that:

Interests are the product of interaction between inherited aptitudes and endocrine factors on the one hand, and opportunity and social evaluation on the other.¹⁴

It would appear, therefore, that factors which tend to affect or characterize personality may well affect and characterize to some degree at least the nature and extent of interests.

Derivation of Interests

With this basis of relationship between interest and personality in mind, we turn now to consider the manner in which interests arise; from whence they are derived. As a generalization on this matter, Strong states:

. . . either these interests are expressions of their abilities and therefore of inborn characteristics or else they result from social forces . . .¹⁵

Trow becomes more explicit on this point by specifying three basic conditions which contribute singly or together to the rise of interests. He writes as follows:

Interests derive from one or more of three conditions. One is the basic inherited nature of the organism, in which they are akin to original satisfiers. The second is from

¹³ G. W. Allport, Personality: A Psychological Interpretation (New York: Henry Holt and Co., 1937), p. 48.

¹⁴ Donald Super, Appraising Vocational Fitness (New York: Harper and Brothers, 1949), p. 406.

¹⁵ Strong, op. cit., p. 13.

rewarded experiences connected with certain activities and not with others . . . the third condition from which interests derive is one of need.¹⁶

In reference to a study made by Carter,¹⁷ on family resemblances in occupational interests, Super draws this conclusion:

It seems necessary, then, tentatively to conclude that the greater similarity of the interests of identical twins, as contrasted with those of fraternal twins, is not due to the potentially greater similarity of their environments but rather to the demonstrably greater similarity of their heredities.¹⁸

This appears to agree with the concept of inherited interest derivation which Strong has termed "inborn characteristics," and which Trow has referred to as "original satisfiers."

Further understanding of the derivation of interests is gleaned from the agreement of several writers and investigators who emphasize the social forces of environment as they relate to needs of individuals and to their experiences which are rewarding to them.

In terms of aspirations of individuals, Snygg and Combs write:

We are interested in those things that are problems to us . . . [when] we perceive that we do not measure up to some aspect of our culture.

Imitation of others to satisfy some need is a frequent behavior pattern of individuals. Interests may arise through the use of this device. In this connection, Harris has this to say:

¹⁶ Trow, op. cit., p. 109.

¹⁷ H. D. Carter, "Twin Similarities in Occupational Interests," Journal of Educational Psychology, 23:641-645, 1932.

¹⁸ Super, op. cit., p. 397.

¹⁹ Donald Snygg and Arthur W. Combs, Individual Behavior (New York: Harper and Brothers, 1949), pp. 103-104.

Some interests arise through the satisfying repetition of behaviors observed in others . . . one of the important devices by which the young child acquires behavior patterns has been called imitation. Undoubtedly this process explains how some interests arise. In the process of playing out the actions and apparent intentions of other persons, the child develops new bases for his own activities, new reasons for the rationalization of interests.²⁰

Rewarding experiences play an important role in the derivation of interests and interest patterns. Allport states:

Psychometric studies have shown that the relation between ability and interest is always positive. A person likes to do what he can do well.

Agreeing with Allport is Harris, who writes:

Many interests distinctly relate to a child's ability to perform. This relationship is most pronounced in the infant and very young child, who works away endlessly at a new performance in which he has just become successful.²²

Finally, interests of an individual may arise by suggestion or influence from another person or persons for whom there is held a high degree of admiration and respect. Harris states:

Some interests may result from activities one undertakes because of a favorable attitude toward an authority source.²³

It would appear, therefore, that interests derive in part from innate predisposing patterns, and in part from an individual's learning experiences. Whether or not such predisposing factors tend to influence directly the quality and kind of manifest interests appears to be a moot question. Such a possibility, however remote or indirect, seems worthy of consideration for further investigation.

²⁰ Harris, op. cit., p. 136.

²¹ Allport, op. cit., p. 201.

²² Harris, op. cit., pp. 137-138.

²³ Ibid., p. 136.

Development of Interest Patterns and Specific Interests

The development of specific interests, or individuation from general interest patterns, is a result of learning experience including the deprivations and satisfactions which a person encounters in his environment. They may be considered manifestations of the needs of an individual.

According to Harris:

. . . interests and attitudes express the personality needs of the individual. Interests and attitudes are the externalizations of the web of desire for status, recognition, affection, dominance, and all the other needs which comprise the motivational structure.²⁴

Interest and motivation.--One of the frequent problems confronting teachers in their teaching function is how to develop motivation in their pupils to learn the classroom tasks to which they are assigned.

Interest is one of the many aspects of motivation which might be cited as contributing to the effectiveness of learning. The importance of utilizing current pupil interests as a means of improving learning is generally recognized by educational and psychological leaders.

Ryans appropriately summarizes this point when he states:

Learning which is related to the interests of the individual may reasonably be expected to be more efficient and to be better retained.²⁴

²⁴ Ibid., pp. 154-155.

²⁵ David G. Ryans, "Motivation in Learning," The Forty-Ninth Yearbook of the National Society for the Study of Education: Part II, The Psychology of Learning (Chicago: University of Chicago Press), p. 312.

The role of set and readiness is an important aspect of the learning process. Pupils who possess a high degree of set or readiness to achieve a certain objective related to classroom learning tasks will respond to these tasks more vigorously and effectively than will those, other things being equal, who have a lesser degree of set or readiness. The interests possessed by pupils may be a vital component part of their set or state or readiness to learn these tasks. In this respect Ryans has this to say:

The individual's . . . interests . . . contribute to his readiness for particular sorts of behavior and help to select and determine the choice of activity.²⁶

Thus it is that interest, serving to arouse activity and to give direction to that activity, becomes one of the conditions which motivates individuals to respond favorably to certain learning tasks.

One of the observable effects of set and readiness is the attentiveness which pupils hold towards a learning activity. The importance of this to effective study is apparent to many teachers. Continuity and closeness of attention by pupils is one of the requisites necessary for them to obtain knowledges and understandings. Here again the interests of pupils become an important teaching aid as through their motivational impact a greater degree of attention is manifest by them.

Ryans, in reference to this point, has this to say:

. . . [interests] not only provide a set or readiness for behavior but also bring the factor of attention prominently in the picture. . . . Interests are learned responses which predispose the organism to certain lines of activity and which definitely facilitate attention.²⁷

²⁶ Ibid., p. 298.

²⁷ Ibid., p. 312.

Interests are learned.--It appears, therefore, that interest in its relationship to learning is both developmental and circular in nature. In the one instance learning is expedited by interest while on the other hand interests are learned.

This has particular practical application to guidance workers and others who are dealing with individuals in the development of occupational plans. For example, the lack of adequate motivation for many pupils to explore occupational fields is a frequent problem encountered by guidance workers. While many reasons may be cited as to the probable causes for this lack of motivation, the one which appears most frequently grows out of methods and procedures employed in the approach to, and development of, the process of orienting pupils to the world of work. Too often it has been attempted without regard to current interests of pupils. Since specific interests or interest patterns held by an individual are predisposing factors to effective learning, the knowledge and use of them for initiating orientation is imperative. Early detection of interests and interest patterns in individual pupils offers greater opportunities for guidance workers to assist individual pupils in a more effective manner, through exploration of these occupational fields related to the pupil's interests. This should provide not only for the recognition of unique patterns of interests of the pupils but for some pupils an earlier opportunity to initiate a survey of occupational fields related to their interests or interest patterns.

In addition to the lack of initial motivation of pupils to investigate occupational fields, there are frequently those who possess an interest, so narrow and so intense, as to preclude any desire on their part to broaden their interests. In many instances this may be indicative of a type of fixation due perhaps to a feeling of insecurity or it may arise from the lack of breadth of information.

Pupils may be unwilling to explore situations outside their narrow ranges of activity and understanding because they see no relationship of these "outside situations" to themselves or because they are entirely without knowledge of them. They must learn about these situations before they can become interested in them.

In this respect, Ryans says:

. . . the very existence of interest necessitates some grasp of the relationships involved. Interests are themselves learned, and therefore learning which uses individual interests as its starting point must be carefully directed so as to extend well beyond the original interest field.²⁸

Kingsley, in reference to this point, states:

We are not likely to be interested in things that do not concern us personally and concerning which we are ignorant.²⁹

Again, the point that interests must be learned is implied by Jersild and Tasch when they state:

. . . the fact that children do not show a certain interest is . . . no sure sign that they could not acquire it.³⁰

But needs of individuals change as through their experiences they perceive new things and old things appear to them in a different manner. This is the function of maturation, of the individuation and integrating aspects of personality development. It seems logical, therefore, that development of interests may well occupy a parallel position with the maturation process and in the total personality development. Harris states:

²⁸ Ibid., pp. 308, 313.

²⁹ Howard L. Kingsley, The Nature and Conditions of Learning (New York: Prentice-Hall, 1946), p. 101.

³⁰ Arthur T. Jersild and Ruth G. Tasch, "Influences on Children's Interests," Psychological Studies of Human Development (Ed. by Kuhlen and Thompson; New York: Appleton-Century-Crofts, 1952), p. 254.

One such direction of change is increased susceptibility to secondary incentives. The very young child is more likely to occupy himself with activities which are of direct and personal significance to him, however meaningless they may appear to the observing adult.³¹

As the individual matures and develops, his additional experience and knowledge influence the nature and kind of interests. According to Jersild and Tasch:

When children tell what they like best and dislike most in school and out of school, their replies show that their interests are influenced both by general culture factors and by special opportunities that come their way.³²

Substantiating this view, Harris has this to say:

. . . they [interests] are developed in the intricate network of contacts the child has with other persons, with his own performances, and with the environment, both natural and cultural.³³

Developmental concepts of vocational adjustment.--The integrative characteristic of a maturing personality--the process involved in the formation of habits and patterns of behavior which tend to acquire greater and greater permanence in the personality--is paralleled by the development of interests. McKinney writes:

A review of the evidence on the question of the permanence of interests leads writers in this field to generalize: whereas changes in interests occur, changes from one broad category to another are somewhat rare even in young people, and in adulthood interests are rather well established.³⁴

³¹ Harris, op. cit., p. 132.

³² Jersild and Tasch, loc. cit.

³³ Harris, loc. cit.

³⁴ Fred McKinney, Psychology of Personal Adjustment (2d ed.; New York: John Wiley and Sons, 1949), p. 341.

With this discussion of general interest concepts in mind we turn now to a consideration of the application of these concepts to theories of occupational interest in vocational adjustment. According to the definition already advanced, vocational interest is an individuated phase or aspect of general interest. Therefore, the following discussion will be contained within the general frame of reference of the theories and concepts of interest as they relate to personality development. In this manner the developmental concepts of occupational interests will be part and parcel with the total developmental process of the human organism.

Supporting this view, Darley states:

The origin of occupational interest types is a by-product of personality development.³⁵

General developmental process of growth and vocational interest.--Considering human development as a sequence of developmental tasks, Fagin points out the relation of vocational interests to this general developmental process:

The development of vocational interests and the way they change with age is quite consistent with the concept of human development as a sequence of developmental tasks.³⁶

Berg, in emphasizing the individuation aspects of vocational interest development, says:

When considering occupational choice and personality structure, it is important to distinguish between the initial

³⁵ J. G. Darley, Clinical Aspects and Interpretation of the Strong Vocational Interest Blank (New York: Psychological Corporation, 1941).

³⁶ Barry Fagin, "Guiding the Vocational Interests of the Child," Education, 74:171-179, November, 1953.

choice of a broad professional field and the later specialized activity within the larger field.³⁷

Further consideration of vocational interest as a part of the total vocational adjustment process indicates that, ultimately, competence in this adjustment is a function of maturation and growth, which is consistent with the general theory of personality development. In this respect Dysinger has this to say:

Competence in [vocational] planning . . . requires abilities which come with maturation. A vocational choice is in itself a process of growth, reflecting other phases of development.³⁸

Fagin also points out this relationship when he writes:

. . . the development of vocational interests and the readiness for realistic thinking about occupational choices is in integral aspect of intellectual, emotional, and social development as a whole. Anything that arrests or retards growth in social emotional maturity would be expected to delay the child's readiness for vocational choice.³⁹

Again, Dysinger reinforces this concept when he calls attention to the belief that:

It [vocational development] requires physical development, mental growth, social development, and emotional maturation--at least on a minimum level.⁴⁰

It is generally recognized that individuals do not mature in a uniform developmental pattern. Fagin, in discussing this as it applies to vocational interests, has this to say:

³⁷ Irwin A. Berg, "Personality Structure and Occupational Choice," Personnel and Guidance Journal, November, 1953, p. 151.

³⁸ Wendell S. Dysinger, "Maturation and Vocational Guidance," Occupations, December, 1950, p. 198.

³⁹ Fagin, loc. cit.

⁴⁰ Dysinger, loc. cit.

Vocational interests have a developmental history. They do not spring forth suddenly. Vocational counselors recognize that "readiness" for vocational choice and occupational information is seriously retarded in some students and accelerated in others, and that these individual differences are related to problems in social and emotional development and school achievement.⁴¹

Ginzberg's theory of occupational choice.--Probably the most extensive theory of vocational adjustment leading to occupational choice has been proposed by Ginzberg et al.⁴² Ginzberg has summarized the details of his concepts and theories in an article entitled "Occupational Choice Is a Process." The following excerpts from this article will serve to support the developmental process concept of occupational interests:

Occupational Choice Is a Process

The process begins at the birth of the individual and may remain open until death.

We began the study of the process in individuals at about the age of eleven, which appeared to be the first time that a young person recognizes that he will eventually have to do something about choosing his future work. We therefore set for ourselves the task of identifying and evaluating the major factors in the vocational-decision-making of the individual during successive periods of his maturation. Our basic assumption was that an individual reaches his ultimate decision, not at any single moment in time, but through a series of decisions over a period of many years: the cumulative impact is the determining factor. Within this structure we noted two types of major variations, the first in the pattern of choices. There are people who might be characterized by their singleness of purpose. They are found typically among those with a pronounced aptitude or talent which comes to the surface early. Others start with a rather

⁴¹ Fagin, loc. cit.

⁴² Eli Ginzberg et al., Occupational Choice: An Approach to a General Theory (New York: Columbia University Press, 1951).

broad and ill-defined area of interest, which is narrowed during adolescence.⁴³

Ginzberg and his associates⁴⁴ have identified three periods in the developmental process of occupational decision-making by individuals. First, the phantasy choice period, prior to eleven years of age, when the individual believes he can become anything he wants to be. Secondly, the period of tentative choice, between eleven and seventeen years of age, when the individual's needs are translated almost exclusively in terms of his interests, capacities, and values. In the interest state, tentative choices are made nearly always on his interests alone. The other stages in this period are: capacities, values, and transition in which other factors than interest are considered. Finally there is the realistic period, occurring after seventeen years of age, when the individual seeks alternatives (exploration stage), determines choice (crystallization stage), and delimits choice (the specification stage).

Ginzberg⁴⁵ claims that this period and stage analysis is a helpful means of identifying occupational choices appropriate to the maturity development of the individual. In this connection he writes:

The period and stage analysis provides the counselor with better norms than have hitherto been available for estimating whether the young person is approaching his occupational choice in a manner commensurate with his maturity.⁴⁶

⁴³ Eli Ginzberg, "Toward a Theory of Occupational Choice," Occupations, April, 1952, pp. 492-493.

⁴⁴ Ginzberg et al., op. cit.

⁴⁵ Ginzberg, loc. cit.

⁴⁶ Ibid., p. 493.

Finally, he sums up his entire concept of vocational adjustment by listing the following three basic theories:

1. Occupational choice is a process.
2. The process is largely irreversible.
3. Compromise is an essential aspect of every choice.⁴⁷

Dysinger, while he makes no reference to Ginzberg's period and stage classification, presents an almost identical picture of these developmental phases of the sequence of vocational adjustment. These he presents as follows:

The development from immaturity to maturity in vocational planning may for convenience be divided into four stages:

1. Phantasy:

The physical, the mental, the social, the emotional phases of development are all reflected in such vocational phantasies.

2. Exploratory planning:

Exploratory rather than fanciful; sense of reality--is transitional.

3. General preparation:

More maturity--growth in physique, in intelligence, in emotion, and in social awareness has organized the personality on a more mature level. Vocational significant interests crystallize, and aptitudes are identified--It is a rational process.

4. Specific preparation and placement.⁴⁸

Theories of self-concept in vocational adjustment.--In the process of adjustment to a complicated and complex environment, experiences are encountered by the individual which establish, in part, the basis for integration of personality. Interests become closely bound up with and a part of self. Carter points out this interrelationship:

⁴⁷ Ibid., pp. 492-493.

⁴⁸ Dysinger, op. cit., pp. 198-199.

The pattern of vocational interests which gradually form becomes closely identified with self.⁴⁹

The developing concept of self and its relationship to one's interest modification is pointed out by Harris:

As the child develops a concept of the self, that is as he becomes aware of the roles he fulfills in the group (whether at home, school, or with his chums), he may rule out certain activities or interests as inappropriate. Conversely, other interests are strengthened because they are seen by the child to fit the growing notion he has concerning himself.⁵⁰

Bordin⁵¹ and Super⁵² have each advanced a theory of the development of vocational interests based upon self-concept. Since the theory advanced by Super encompasses and is more inclusive than Bordin's, his theory alone will be analyzed.

The exploratory behavior observed in children, according to this theory, is evidence of an emerging concept of self, not something novel but rather a crystallization of a developing process in the life of the child. In this connection Super states:

Self concepts . . . begin to take rather definite form in childhood. The evidence suggests that the exploratory experiences of childhood and adolescence in most cases merely clarify, elaborate upon, and confirm the concept of the self which has already begun to emerge and to crystallize. As a rule, adolescent exploration is an awakening to something that

⁴⁹ H. D. Carter, "The Development of Vocational Attitudes," Journal of Consulting Psychology, 4:185-191, 1940.

⁵⁰ Harris, op. cit., p. 137.

⁵¹ Edward Bordin, "A Theory of Vocational Interests as Dynamic Phenomena," Educational and Psychological Measurement, 3: 49-66, 1943.

⁵² Donald E. Super, "Vocational Adjustment: Implementing a Self Concept," Occupations, November, 1951, p. 88.

is already there rather than the discovery of something new and different.⁵³

It is a dynamic process because in this developmental period self-concepts change, thereby bringing into the perception of the child new and varied relationships and perspectives of self with other individuals, things, and forces. On this point Super has this to say:

Self concepts presumably change in childhood, as the growing individual discovers new things and new people in his world, and tries himself out with them.⁵⁴

The development of self-concept is not only an emerging process, however, but a process which is the outcome of a complicated and complex background of interacting factors of growth and environmental forces. Again, quoting Super:

Self concepts are the product of interaction between inherited aptitudes . . . glandular factors affecting physical energy, opportunity in the form of chances to observe and try out a given type of activity with a given kind of competition, and impressions of the extent to which the results of trying something meet with the approval of superiors and fellows.

Some of the things a person does well because of inherited aptitudes and behavior tendencies exercised in a favorable environment bring him the personal satisfaction of mastery, and some bring him the approval of parents and friends.⁵⁵

The theory of self-concept thus far has been applied to the general view of personality development and adjustment. However, as is pointed out elsewhere in this investigation, vocational adjustment is merely an aspect of the totality of personality development. Furthermore, one phase of vocational adjustment, occupational interest, is in itself an individuation of general interest. Therefore, any

⁵³ Loc. cit.

⁵⁴ Loc. cit.

⁵⁵ Loc. cit.

treatment and analysis of the self-concept theory of vocational adjustment must be concerned with both the general and the aspect approach to the general theory of adjustment and development. Super, in presenting this concept, writes:

. . . the nature of vocational adjustment is very similar to the nature of personal adjustment, for the former is a specific aspect of the latter. In furthering vocational adjustment one is furthering personal adjustment, for he is attempting to help the individual to develop and implement an adequate, satisfying, and realistic concept of himself.⁵⁶

Thus, according to Super, this theory of self-concept, as applied to vocational adjustment, is:

. . . that of developing a picture of the kind of a person one is, and that of trying to make that concept a reality. In choosing an occupation one is, in effect, choosing a means of implementing a self concept.⁵⁷

This process which is then an aspect of the total maturation process offers partial explanation as to why interests in a developmental pattern tend to take on more-permanent patterns as individuals grow towards maturity.

Theory of identification of satisfiers and annoyers in vocational adjustment.--The kind and quality of interests which pupils develop for themselves are not necessarily the result of interests and desires possessed by teachers, parents, or other persons who in some way relate to these pupils. It is due, rather, to the value which pupils perceive for themselves in objects, persons, or ideas. It is the result of their becoming cathected to these objects, persons, or ideas. This cathexis appears to be related to, or based upon, Thorndike's

⁵⁶ Loc. cit.

⁵⁷ Loc. cit.

concept of satisfying and annoying experiences. It is, therefore, rather futile to expect that interests can be developed by pupils through imposition of the interests of others upon them.

Harris, in a generalization on this point, states:

Regardless of which specialized terms and concepts we use to describe the development of interests, we generally fall back on the principle of satisfyingness.⁵⁸

Also in discussing the role of satisfying experiences in the emergence of occupational interests, Kitson points out the importance of appropriate learning activities for pupils in interest development:

Interests can develop only through experience and since most young people have not had the necessary occupational experience they cannot be thought of as possessing vocational interests.⁵⁹

The need for providing satisfying tryout occupational experiences for pupils is therefore an important responsibility of the schools.

The manner in which pupils acquire satisfying experiences leading to greater breadth and intensity of occupational interests may stem from many sources. It appears, from the writings of several authorities in the field, that they roughly fall into two fields. First, there are those experiences from which pupils directly perceive satisfying effects, through such outcomes as perceived ability to satisfactorily perform tasks, the arousal of curiosity, the acquiring of status compatible with their aspirational levels, and the imitation of persons for whom pupils hold high esteem. In the latter instance, Harris points out that:

⁵⁸ Harris, op. cit., p. 136.

⁵⁹ H. D. Kitson, "Creating Vocational Interest," Occupations, XX:567-571, 1942.

Some interests arise through the satisfying repetition of behavior observed in others.⁶⁰

Secondly, the experiences of pupils for generating interests need not, however, always be directly satisfying or pleasant to them. Some pupils may become interested in tasks which are in themselves unpleasant but through which they perceive ultimate satisfactions. Others may derive interest in discovering that a task is not suitable for them and thereby gain satisfaction in being able to arrive at a decision to eliminate the task from their field of choices. Finally, tasks which do not easily and quickly provide a solution may stimulate interest in pupils to continue their quest for an ultimate solution or decision. Likewise, interests may be developed through tasks which are not readily completed.

In this respect, Allport says:

Lasting interests are recurrent sources of discontent and from their incompleteness they derive their forward impetus.⁶¹

The tendency for interests to become more permanent and specific as an individual develops toward maturity may also be explained on the basis of satisfiers and annoyers. One tends to discard those things which one cannot do well (annoyers) and to accept those things in which he perceived proficiency (satisfiers). In this connection Harris writes:

Interest patterns become appreciably more stable during the teen years. It is possible that the relation between expressed interest and skill increases during adolescence by virtue of the fact that unskillful performances are dropped, the individual concentrating more and more on his expertly performed activities.⁶²

⁶⁰ Harris, loc. cit.

⁶¹ Allport, op. cit., p. 205.

⁶² Harris, loc. cit.

In this connection Strong also writes:

The finding in this study that with increased age there is less liking for new activities, especially those that interfere with established habits assumes great importance . . . all three [interest, habit, and attitude] are stabilized.⁶³

Applying this basic psychological principle of satisfactions and annoyingness, as it affects interests in general, to a theory of vocational adjustment, which includes more-specific interests, we have another concept of vocational interest development which Carter⁶⁴ refers to as an identification process. In reference to this view, Fagin says:

Vocational interests are patterned and they change with age in a fairly consistent way. Carter advances the theory that vocational interests are formed through an identification process. Once formed, the pattern remains fairly stable as long as the identification leads to satisfying results for the child but is disrupted by a failure experience.⁶⁵

Theory of developmental task sequence in vocational adjustment.--Havinghurst⁶⁶ introduces yet another concept into the complex picture of the developmental process of vocational adjustment. There is no evidence which indicates conflict with the other theories discussed. On the contrary, it reinforces these theories by the inclusion of a developmental sequence of tasks, not unlike the developmental

⁶³ Strong, op. cit., p. 13.

⁶⁴ Carter, op. cit., pp. 185-191.

⁶⁵ Fagin, op. cit., pp. 171-179.

⁶⁶ R. J. Havinghurst, Human Development and Education (New York: Longman's, 1953).

sequence of growth activities as outlined by Olson⁶⁷ in his child-growth studies. This becomes particularly significant in this connection since it is the basic contention in this discussion that all aspects of growth and development of an individual are interrelated, and that what affects one factor of growth affects the remaining factors.

In reference to developmental tasks, Fagin quotes Havinghurst as follows:

Developmental Task Sequence

Certain skills, knowledge, attitudes or motives must be learned in infancy, others in middle childhood, still others in adolescence; and so on through the various stages of life. Developmental tasks must be learned in sequence; successful achievement in a task appropriate to a given age period makes possible the child's success with later tasks, while failure in the earlier task leads to unhappiness in the individual, disapproval by the society and difficulty with later tasks.⁶⁸

Referring to Havinghurst's theory, Fagin points out the effect of individual maturity differences in the developmental task sequence. He quotes Havinghurst as follows:

At age 12, says Havinghurst, the child's maturity is "high" in an ego-ideal which includes the figure of "glamorous adult." The child of "medium" maturity level has an ego-ideal tied to a, "fairly unrealistic image of a glamorous adult." The relatively immature child's ego-ideal is limited to parental figures.⁶⁹

It would seem, therefore, entirely plausible that a slow-growing child could and would have perceptions quite different from a fast-growing child. This concept is important when considering the

⁶⁷ Willard C. Olson, Child Development (Boston: D. C. Heath, 1949).

⁶⁸ Fagin, loc. cit.

⁶⁹ Loc. cit.

development of interests and interest patterns. In this respect it appears as if it logically should be included as a part of the developmental process concept of vocational adjustment.

Some Relationships Between Theories of Growth and the Emergence and Development of Occupational Interests

Thus far an attempt has been made to point out the interrelationships of the developing personality and the derivation and development of interests. It has been indicated that development of personality and interest stem, at least in part, from inherited tendency patterns, and that these tendencies are modified, individuated, and integrated as the result of environmental forces affecting the individual through the learning process. These concepts are considered basic to the several theories of vocational adjustment and have been elaborated upon to show the role of interest as an integral developmental aspect of this adjustment process.

It has been emphasized throughout this discussion that all aspects and factors of growth and development of an individual are interrelated and that together they determine, at any particular point in time-in-growth, what an individual is and what he will become eventually. This concept raises an interesting and timely question: Can one aspect of growth and development be used to determine in part or in whole what any other aspect of growth and development of an individual is or will become? If it were possible to measure the development of some of the more tangible aspects of growth and development of an individual or individuals for use as predictors of the developmental probabilities of the less tangible aspects of growth, a much more effective basis for counseling, guidance, and instruction would be established.

The child growth and development studies of Olson and Hughes,⁷⁰ in which they have developed certain tangible partial measures of growth (growth-in-age units) offer possibilities in this direction. Their basic concepts of growth are nearly identical with the basic concepts of the developmental process of vocational adjustment. In reference to the growth process, they have this to say:

1. The term 'growth' is applied to all things that change with age.
2. As a philosophy of method, then, we emphasize that the accomplishments of the growing child, whether in inches or in pounds, in reading or in social control, or whether in additions of muscle, of bone, or in number of teeth, be considered as estimates of total growth rather than as separate measures of discrete parts.
3. It is necessary to realize that maturity is emerging slowly and in a cohesive fashion for all variables.
4. An examination of a large body of growth material for children suggests strongly the existence of individual designs for growing. It becomes the task of nurture to fulfill the design.⁷¹

Olson indicates a relationship of growth to educational achievement when he states:

Research in child development is demonstrating how the attainment of goals of educational achievement is dependent on the total growth of the child.⁷²

A pertinent question is raised at this point: May the development of a satisfactory vocational adjustment by an individual be considered an educational achievement? The assumption is made in this presentation that it is definitely a part of educational achievement,

⁷⁰ Willard C. Olson and Byron O. Hughes, Manual for the Description of Growth in Age Units (Ann Arbor: Edwards Letter Shop, 1950).

⁷¹ Ibid.

⁷² Willard C. Olson, "Hazards to Growth," NEA Journal, Vol. 36, No. 8, November, 1947. For a detailed account, see Olson, op. cit., Chapter VI.

and that the various aspects of vocational adjustment including the development of occupational interests and interest patterns are, in part, the result of the total educational experiences of individuals.

With these concepts of child growth and development thus briefly presented it is appropriate at this point to formulate statements which reflect the points of agreement in the theories of vocational interest derivation and development with those of child growth and development. These statements follow:

1. Interests are in part derived from innate predisposing factors and growth is in part dependent upon nature.
2. Interest is a component part of the entire growth and development pattern of an individual.
3. The potential for growth, based upon hereditary factors, is achieved through appropriate experiences, and in a similar manner the development of interests from a hereditary basic potential is the result of learning experiences.
4. There is a uniqueness in the developmental rate, direction, and extent of growth of each individual and likewise there is a similar uniqueness in the developmental process of vocational adjustment.

As has been previously mentioned, the studies of growth of children by Olson and Hughes,⁷³ by means of growth-in-age units, offer a tangible partial measure of the nature of growth of individuals. These growth-in-age units are: reading age, mental age, weight age, carpal age, height age, grip age, and dental age. An average of a representative group of age measures at a point in time is called organismic age. While these age units of growth are, in the main, units of physical development, it is to be noted that reading age and

⁷³ Olson and Hughes, op. cit.

mental age represent other aspects of the total growth process. The former is a nonphysical achievement factor, and the latter is a non-physical mental factor. Each of these growth age units is measured, at points in time in the development of an individual. Thus each unit measured at any point along the continuum of growth must represent a point in the developmental process of an individual; a point, prior to which there is a developmental pattern of these units, and beyond which a pattern continues in the direction of maturity. Thus it is possible not only to observe a pattern of development to a point of growth in time, but also to project the probable nature and direction of that future developing pattern. In the Olson and Hughes studies, it has also been possible to describe categories of growth; i.e., "fast growers," "slow growers," and "split growers."

Another significant area of investigation in developmental growth, including interest, is found in the Furfey⁷⁴ and Sullivan⁷⁵ studies of developmental age in boys and girls. In general they have shown the development of general interest trends within the total growth pattern. These trends show different rates and levels of development for individual children at the same chronological age, and a change of interests in their successive chronological ages.

Johnson⁷⁶ found, in his study of developmental age growth, based on interest development, using the Furfey and Sullivan scales,

⁷⁴ P. H. Furfey, "A Revised Scale for Measuring Developmental Age in Boys," Child Development, 2, 1931.

⁷⁵ Catharine Sullivan, "A Scale for Measuring Developmental Age in Girls," Studies in Psychology and Psychiatry, Vol. 4, No. 3, 1934.

⁷⁶ E. M. Johnson, "The Contribution of Developmental Age to the Study of the Child as a Whole," unpublished Master's thesis, School of Education, University of Michigan, Ann Arbor, 1940.

that the more mature child tends to possess more social skills and a more mature level of interests.

If we now refer to the term 'growth' as including all things that change with age, we not only have the growth age units of Olson and Hughes and the developmental ages of Furfey and Sullivan, but all other developmental factors of growth, which might reasonably be included on a measurable continuum of growth. In this latter group, it is not inconceivable that a pattern of interests might be measured in a manner similar to that of the growth age and developmental age units. Furthermore, it would seem within the realm of probability that, since the aspects of growth are but parts of the whole growth pattern of an individual, there well may be significant relationships among these aspects or parts of growth.

Such a speculation raises many questions relative to the possibilities which may exist in detecting, at various chronological ages of children, certain cues as to their current interests, as well as to future direction of these interests. Pertinent questions might include the following:

1. Does a "fast-growing" child develop, at an earlier age, a greater refinement of vocational interest than a "slow-growing" child?
2. Does an acceleration or retardation in any one or combination of growth age units relate to a type or kind of interest as currently developed or as will be developed in the future?
3. Are there common tangible growth characteristics in populations of children which may offer significant cues to their interests and interest patterns?

Need for Additional Research

It is observed by the author, after extensive review of the literature in the field, that there is little or no significant research which adequately explains the nature and role of interests in learning or the process by which interests are learned. This may be due in part to the ambiguity which surrounds the term "interest," as revealed by the many shades of meaning attributed to it by various writers in the field. It is difficult, if not impossible, to distinguish it as either a cause or an effect of learning. It is evident, however, that interest, as an abstraction of behavior, is a vital and important catalytic agent in the learning process.

The need for additional investigation in the field of interest and learning is emphasized by Harris, who says:

It is hoped that a yearbook such as this one ten or twenty years hence can provide a much more definite statement than is now possible concerning how children learn attitudes and interests.⁷⁷

Ryans gives support to Harris when he states:

Future research may point the way to the means by which attitudes, interests and purposes of general desirability and of specific value for stimulating subsequent learning, may be developed in the school.

In the area of vocational adjustment, it often becomes difficult to incorporate into the school life of many pupils meaningful and significant guidance and training experiences prior to the eleventh or twelfth grades. Too little time is available by that time to assist an individual in choosing and developing an educational and vocational

⁷⁷ Harris, op. cit., p. 155.

⁷⁸ Ryans, op. cit., p. 305.

objective plan adequate to his needs and capacities. Research is needed to discover ways and means by which guidance workers and others can assist pupils in this task at a much earlier age, consistent with their levels of maturity and understandings. The general concept held by many persons that vocational interests for the average child are not crystallized sufficiently to be significant in vocational adjustment until late adolescence has resulted in a "hands-off" policy for earlier possibilities. This practice is in direct opposition to the theories of a developing process. In this connection Fagin has this to say:

Vocational choice is a crucial factor in the individual's psychological and educational development. The school has given relatively little attention to this fact. . . . One reason for this neglect is the widespread belief that vocational interests are of little significance until middle adolescence.⁷⁹

Olson and Hughes⁸⁰ emphasize that a longitudinal, multiple discipline study is vitally important to the understanding of any problem presented on an individual child. Substantiating this contention, Dysinger says:

Counselors can well afford to give serious attention to longitudinal studies of vocational choices, noting both the many changes in plan and the relationship of these changes to developmental level.⁸¹

Berg, in reviewing Super's theory of occupational choice, makes the following suggestions for additional studies.

(Research) Super's Theory

While some modification may eventually be necessary, Super's formulation of occupational choice is quite compatible

⁷⁹ Fagin, op. cit., pp. 171-179.

⁸⁰ Olson and Hughes, op. cit.

⁸¹ Dysinger, op. cit., p. 198.

with current views of behavior; and it offers numerous hypotheses for convenient testing.

1. Self-concept and role can be examined in terms of our knowledge of perceptual processes.

2. The approach to approval--disapproval in the growth of self-concept and in testing self-concept when in the role of job holder can be investigated in terms of learning theory, particularly reinforcement theory.⁸²

Ginzberg advances the following proposals for additional needed research in the developmental area:

. . . the theory of occupational choice which we have developed is only a first approach to a general theory. It has not been validated. We believe that many significant areas awaiting exploration have grown out of our tentative formulations.

Recommendations for further research.

1. Test the general theory both for larger samples of the same groups and for different groups.
2. Study the way in which the child preoccupied with play is transformed into an adolescent concerned with his future work.
3. Study the relation of emotional factors to work.⁸³

Berg, however, holds the following reservations on Ginzberg's theory:

As for Ginzberg's three choice periods, they represent meaningful descriptions, but not meaningful hypotheses . . . many research workers have established the existence of developmental periods of the kind listed by Ginzberg that time would be more profitably spent on other more promising leads.⁸⁴

Finally, Fagin makes the following suggestion for additional research in the field of vocational adjustment as it relates to personality development:

⁸² Berg, op. cit., p. 153.

⁸³ Ginzberg, op. cit., p. 494.

⁸⁴ Berg, loc. cit.

Vocational development is an important phase of child development as a whole. It has long been neglected as an object of research and as a consequence has been too often a peripheral concern of educators and child development specialists. Further research may help to focus attention on the vocational side of personality development and to integrate it more fully with the goals of general education.⁸⁵

These concepts and theories form the frame of reference for several proposed theories of vocational adjustment, of which interest is held to be a component part. Ginzberg holds that occupational choice is a developmental process extending over the entire life of an individual. Super, Bordin, and Carter view occupational choice as a developmental process in which self-concept is not only an emerging process, but an outcome of a complicated background of interacting factors of growth and environmental forces. Harris, Kitson, Allport, and Fagin point out that vocational adjustment is a process of identification of satisfiers and annoyers in which pupils perceive for themselves values in objects, persons, or ideas. Havighurst, in his developmental theory of occupational adjustment, reinforces the other theories by the inclusion of a developmental sequence of tasks similar to the sequence of growth activities subscribed to by Olson.

When all the theories regarding vocational adjustment are analyzed and compared with theories of growth, as they are revealed from the findings of Olson and Hughes, it is noted that the basic concepts of both are nearly identical. With these similarities in mind, suggestions are proposed concerning the probability of significant relationships which may exist between growth and interest factors.

⁸⁵ Fagin, op. cit., pp. 171-179.

Finally, attention is called to the need for additional research in this area since little or no investigation has been carried on in the field of interest development.

Summary

An analysis of the various theories, concepts, and results of studies pertaining to the development of interest, as an aspect of total organismic growth and personality integration, reveals many areas of agreement among the proponents of these theories.

Combining the areas of agreement from several definitions of interest there emerges a definition which characterizes interest as a complex of dynamic forces within the developing personality derived in part from inherited reaction patterns which become individuated through cognitive and satisfying experiences. Various degrees of occupational interest specificity are viewed as further individuations or refinements of gross interest patterns.

There appears to be a general acceptance that interests and personality are closely interrelated and that the factors which tend to effect or characterize personality may well effect and characterize the nature and extent of interests.

In reference to the derivation of interests, a generalization states that they arise in part from innate predisposing patterns and in part from an individual's learning experience.

Interest, as an aspect of motivation, appears to have a circular relationship with learning since learning is expedited on the one hand by interest while on the other hand interests are learned. This is held to be of great practical significance for the guidance worker in assisting individuals to explore occupational fields related to their interests.

CHAPTER III

CHARACTER OF THE DATA

Criteria Followed in Selecting, Procuring, and Using the Data

The purposes stated in Chapter I, under the heading, "Basic Assumptions in the General Area of This Study," partially determine the general character of the data used in this study. More specifically, the following questions, designed to establish direction and goals for testing the hypotheses, serve as the guide for selecting, procuring, and using the data:

1. Do any significant over-all relationships exist between the growth age units of children at 132 months of chronological age, their performance on the Furfey or Sullivan tests, and their later occupational interest choices, as revealed by the Lee-Thorpe occupational interest inventory?

2. Do similar patterns exist among individuals who rank in either the upper or lower halves of their population, as between their levels, types, and fields of interest, and their growth-in-age units, and developmental ages?

3. Do any significant relationships exist between the level of growth of individuals, as measured by their growth age units at 132 months, their performance on the Furfey or Sullivan tests, and their later indications of interest levels, interest types, and interest fields, as revealed by the Lee-Thorpe occupational interest inventory?

4. Are there significant similarities and/or differences between sexes in their relationships between growth-in-age units and occupational interest choices, their level of growth and occupational interest choices, and the patterns of similarity of growth-in-age units of those who rank in the upper and lower halves of their population in level of interest, type of interest, and field of interest?

5. Are certain growth-in-age units more important than others as indicators of levels of interests, types of interests, and fields of interests of individuals?

The population selected for this study is one from which sufficient kinds and quality of data could be readily procured to test the stated hypotheses and to provide suitable answers to the above questions. This data requirement demands facts on the growth-in-age units of individuals at 132 months of chronological age; their scores on the Furfey and Sullivan tests of developmental age at approximately 132 months of chronological age; and their scores indicating their occupational interest choices obtained at a later period in their chronological age.

A population which met these requirements was composed of the pupils in the University High School, on whom data on growth-in-age units and developmental age were obtained when they were enrolled in the University Elementary School. Furthermore, it is assumed that a greater homogeneity and lesser contamination of uncontrollable environmental factors might obtain on this population, which in general experienced the same general type of school and community life.

Accordingly, in the fall of 1951 all pupils enrolled in the University High School on whom growth and developmental age facts were available were tested with the Lee-Thorpe occupational interest inventory. This segment of the total population which was tested by

the Lee-Thorpe instrument contained thirty-four individuals, distributed by sex in the University High School as follows:

<u>Grade Level</u>	<u>Boys</u>	<u>Girls</u>
Ninth	4	9
Tenth	2	6
Eleventh	3	3
Twelfth	4	3

The second segment of the population tested by the Lee-Thorpe instrument in the fall of 1954 contained thirty-eight individuals, distributed by sex in the University High School in the following manner:

<u>Grade Level</u>	<u>Boys</u>	<u>Girls</u>
Ninth	11	7
Tenth	3	6
Eleventh	8	3

The combined population consisted of seventy-two individuals, distributed by sex and grade level in school as follows:

<u>Grade Level</u>	<u>Boys</u>	<u>Girls</u>	<u>Total</u>
Ninth	15	16	31
Tenth	5	12	17
Eleventh	11	6	17
Twelfth	4	3	7

This is the population from which the data were obtained for this study.

Attention is now given to the sources of the data procured, the reasons for the selection of these particular sources, and a brief characterization of the basic instruments and techniques employed to obtain and process the original data.

The data on the occupational interests of the pupils were procured from their percentile scores obtained on the Lee-Thorpe Occupational Interest Inventory. The choice of the Lee-Thorpe instrument was made for the following reasons: This instrument, and the Kuder

Preference Record are the only widely used ones suitable to the vocabulary level of the large majority of this population. Of these two instruments, neither has conclusively been shown to be significantly superior in reliability and validity, in the selection and quality of the test items, or in the format and organization of the test items. Reviews of these instruments in the Third¹ and Fourth² Mental Measurements Yearbooks claim advantages and disadvantages for both instruments. In view of the primary objective of this study, which is an investigation of possible relationships among aspects of developmental growth patterns, it was concluded by the author that the Lee-Thorpe instrument, because of its structural feature of classifying occupational interest items into fields, types, and levels, would provide inventories of interest choices that were suitable for determining the developmental pattern concept on which this study is based.

According to the authors³ of this interest inventory, it is an aid for discovering the basic occupational interests possessed by an individual. Furthermore, it is designed to identify interests which are primarily associated with certain types of activities, many of

¹ Oscar Krisen Buros, The Third Mental Measurements Yearbook; reviews on Kuder by Ralph F. Berdie, E. G. Chambers, and Donald E. Super, pp. 658-662; reviews on Lee-Thorpe by Edward S. Bordin and Stanley G. Dulsky, pp. 666-668 (New Brunswick, New Jersey: Rutgers University Press, 1949).

² Oscar Krisen Buros, The Fourth Mental Measurements Yearbook; reviews on Kuder by Edward S. Bordin, Harold D. Carter, and H. M. Fowler, pp. 737-742; review on Lee-Thorpe by Arthur H. Brayfield, pp. 743-744 (Highland Park, New Jersey: The Gryphon Press, 1953).

³ Edwin A. Lee and Louis P. Thorpe, Manual of Directions, Occupational Interest Inventory (Los Angeles: California Test Bureau, 1944).

which are, in turn, associated with several different occupations, rather than with specific occupations. Thus the scores obtained on the inventory are more representative of occupational interest patterns or categories, rather than an interest in a specific occupation.

The intermediate series form of the inventory was administered to the ninth grade population, and the advanced series form to the tenth-, eleventh-, and twelfth-grade population.

The scores obtained from the Lee-Thorpe instrument were converted into percentiles, using the percentile norms for males and females as contained in the Manual of Directions.⁴ It is these data which appear in the statistical computations of this study.

The data on growth-in-age units and developmental age of individuals in the population under study were procured from the files of the Child Development Laboratories in the University Elementary School at the University of Michigan. They are the data from the child growth studies, by Olson and Hughes.⁵

These data were selected because they were readily available; because they were the results of carefully conducted studies in child growth and development; and because they constituted the kind of data appropriate to this investigation. These data are described in detail by Olson and Hughes in their Manual for the Description of Growth in Age Units⁶ and by Olson.⁷ In brief, they are those data

⁴ Ibid.

⁵ Willard C. Olson and Byron O. Hughes, Manual for the Description of Growth in Age Units (Ann Arbor: Edwards Letter Shop, 1950).

⁶ Ibid.

⁷ Willard C. Olson, Child Development (Boston: D. C. Heath and Company, 1949), pp. 174-181.

representing many types of growth unit measures, such as height and weight, obtained from individuals at a certain chronological age, and expressed as age equivalents to the same growth unit measures obtained by typical individuals at various chronological ages. The following growth-in-age units are included in this study: reading age, weight age, mental age, carpal age, height age, grip age, dental age, and organismic age. Each of these is descriptively defined in this chapter under "Definition of Terms."

The third category of basic data used in this study is from the scores obtained by the population on the Furfey⁸ and Sullivan⁹ scales for measuring developmental age. These original scores, on file in the Child Development Laboratories in the University Elementary School, were available on thirty-three boys and thirty-seven girls. The scores on the boys were obtained in a chronological age range from 119 months to 133 months, with 55 per cent of the scores at 132 months. Likewise, the scores of the girls ranged from 121 months to 136 months, with 57 per cent of the scores at 132 months. The average chronological age at which developmental age scores were obtained were, for boys, 130 months, and for girls, 129 months.

These data are used in this study because the scores purport to indicate interest choices of children, and can therefore be assumed as a variable related to the developmental concept of interests related to this investigation. They therefore furnish another facet

⁸ Paul H. Furfey, "A Revised Scale for Measuring Developmental Age in Boys," Child Development, Vol. II, No. 2, June, 1931.

⁹ Sister Celestine Sullivan, A Scale for Measuring Developmental Age in Girls (Washington: The Catholic University of America, 1934).

for indicating relationships between growth and interest factors in this developmental concept.

Briefly, these data may be characterized as interest choices of individuals, at a particular chronological age, representing a point in-time-in-growth in the development of their drives, or objectives. Further description of these data is provided in the section of this chapter devoted to the definition of terms.

Definition of Terms

"Reading age" (RA) is the growth unit measure obtained by an individual from a reading achievement test score at a certain chronological age, and expressed as a growth-in-age unit equivalent to the reading test scores obtained by typical individuals at various chronological ages.

"Weight age" (WA) is the growth unit measure obtained by an individual from an actual measurement of weight in pounds at a certain chronological age, and expressed as a growth-in-age unit equivalent to the measures of weight obtained by typical individuals at various chronological ages.

"Mental age" (MA) is the growth unit measure obtained by an individual from a mental test score at a certain chronological age, and expressed as a growth-in-age unit equivalent to the mental test scores obtained by typical individuals at various chronological ages.

"Carpal age" (CA) is the growth unit measure obtained by an individual from a measure of carpal bone development at a certain chronological age, and expressed as a growth-in-age unit equivalent to measures of carpal bone development obtained by typical individuals at various chronological ages.

"Height age" (HA) is the growth unit measure obtained by an individual from a measure of height in inches at a certain chronological age, and expressed as a growth-in-age unit equivalent to the measures of height in inches obtained by typical individuals at various chronological ages.

"Grip age" (GA) is the growth unit measure obtained by an individual from a measure of strength of grip by means of the Smedly Dynamometer at a certain chronological age, and expressed as a growth-in-age unit equivalent to measures of strength of grip obtained by typical individuals at various chronological ages.

"Dental age" (DA) is the growth unit measure obtained by an individual from the number of permanent teeth erupted at a certain chronological age, and expressed as a growth-in-age unit equivalent to the number of permanent teeth erupted by typical individuals at various chronological ages.

"Organismic age" (OA) is a coined name for a growth unit measure representing the average of the various growth-in-age units obtained by an individual at a certain chronological age, and expressed as a growth-in-age unit equivalent to the average of the various growth-in-age units obtained by typical individuals at various chronological ages.

"Developmental age" is the score obtained by individual boys on "A Revised Scale for Measuring Developmental Age in Boys" by Furfey.¹⁰ This score is relative to developmental age equivalents or norms of the population on which the scale was standardized. It represents an inventory of interest in the following categories: things to do, things to be when you grow up, books to read, things to have,

¹⁰ Furfey, op. cit.

things to see, things to think about. Furfey describes developmental age as follows:

. . . the progressively increasing and non-intellectual maturity of general behavior which shows itself in the growing child's play preferences, in his fantasy life, in his choice of books and movies, in his ambitions, and, in general, in his whole behavior type.¹¹

Comparable scores were obtained by individual girls on A Scale for Measuring Developmental Age in Girls, by Sullivan.¹² This scale, a counterpart of the Furfey scale, contains identical categories of choice, but is adapted to girls on items of choice and is standardized on a population of girls.

Several terms relating to interests are used in this study. The definition of interest followed as a general frame of reference has been presented on page 11. The terms "occupational" and "vocational" interest are used interchangeably.

Other definitions which refer to categories of interest contained in the Lee-Thorpe Occupational Interest Inventory are here presented. They are used in this study within the sole context and meaning ascribed to them by the authors.¹³

"Fields of interest": The individual's occupational interests are classified into six major fields: (a) personal-social; (b) natural; (c) mechanical; (d) business; (e) the arts; and (f) the sciences. Occupational interests vary in scope from a specific part of one of these six fields to a variety of interests in two or more fields. For example, interests in the mechanical field may be accompanied by

¹¹ Ibid.

¹² Sullivan, op. cit.

¹³ Lee and Thorpe, op. cit.

similar interests in science and thus reveal a potential inventor, mechanical engineer, or machinist. A combination of interests in the natural and the arts fields may reveal a potential landscape artist.

"Types of interests": The objective of this feature is to determine whether the individual is most interested in (1) verbal activities which involve facility in the use of language, in (2) manipulative activities in which he works with materials, or in (3) activities which require computational ability and skill. This unique feature should make possible more-exact counseling and guidance in the schools and more-accurate selection and placement in the world of work.

"Level of interests": This is an indication as to the occupational levels on which an individual's basic interests exist. The results indicate whether these interests are associated with routine tasks, with tasks requiring considerable skill, or with tasks requiring expert knowledge, skill, and judgment, and which often involve supervisory and administrative activities.

In several instances in the study these interest terms are abbreviated as follows: personal-social (P-S); natural (Nat.); mechanical (Mech.); business (Bus.); the arts (Art); the sciences (Sci.); verbal (Verb.); manipulative (Manip.); and computational (Comp.).

Investigation Procedures

The basic design followed in organizing, using, and interpreting the previously described data included classification and statistical techniques appropriate for indicating relationships and their significances between growth and interest data. Each of the steps involved in the handling of the data is now described.

The first step was to enter the occupational interest percentile scores of identifiable individuals, by sex and by their grade level in the University High School, on an appropriate form entitled "Record Sheet for Use with Occupational Interest Inventory." An example is included in the appendix of this study. These scores were next ranked from high to low and divided into upper and lower halves of the population by sex and by total population, for use in calculating chi squares and expectancy tables.

Scores of identifiable individuals on growth-in-age units and the Furfey and Sullivan tests were classified and recorded on an appropriate form, according to sex and pupil grade level in the University High School. These scores, ranked from high to low, were divided into upper and lower halves of the population by sex and total population, and were used in calculating chi squares and expectancy tables. These classifications of scores are contained in the appendix of this study.

The next step in classifying the basic data was to align the occupational interest scores, the growth-in-age unit scores, and developmental age score of each and every identifiable individual on appropriate forms designed to provide a ready means of comparison of these scores. Classifications were by sex and by total population. On these forms the growth-in-age unit score and the Furfey or Sullivan score of each and every individual was held constant in descending rank order, while the variable interest scores were entered opposite these constants and identified as to their position in the upper or lower half of each respective population (girls, boys, and total). This type of classification made it possible to directly select the score variables of each identifiable individual for entry into a fourfold table for computing chi square and expectancies. The entire

series of these forms, including the scores of individuals, are found in the appendix of this study.

Five statistical procedures are used in this study for calculating relationships among the variables.

Chi square test.--The chi square test is employed as a means of determining the frequency comparison of the upper and lower halves of the scores obtained and the scores expected to be obtained by the boys, the girls, and the total population on each growth-in-age unit and developmental age, with the scores which they obtained on each of the occupational interest variables. With the chi square test, if the observed frequencies should agree completely with the expected frequencies, chi square would be zero. Under such conditions it could be assumed that the categories of scores are the result of random sampling from the same population. As the value of chi square increases, it indicates a greater differential between the observed and expected frequencies. In such an instance it can be assumed that the categories of scores are not the result of chance distribution.

In this study a fourfold table (2 x 2 classification) is used. The basic formula for calculating chi square is:

$$\chi^2 = \sum [(f_o - f_e)^2 / f_e]$$

in which f_o represents the frequency of occurrence of observed or experimentally determined facts and f_e represents the expected frequency of occurrence on some hypothesis. However, the following simpler formula, found in McNemar,¹⁴ is used in this study:

¹⁴ Quinn McNemar, Psychological Statistics (New York: John Wiley and Sons, 1949), p. 200.

$$\chi^2 = [N(AD-BC)^2] / [(A+B)(C+D)(A+C)(C+D)]$$

In this formula, A, B, C, and D represent observed frequencies in each of the cells, while (A+B), (C+D), (A+C), and (C+D) indicate the outer limits of frequencies in each of the cells.

The determination of the significance of the chi square values obtained, by use of the above formula, at the desired level of confidence, is calculated from tables found in Fisher.¹⁵ It is recognized that, in general, the 5 per cent level of significance is employed as the outer limit of statistical significance. However, in view of the gross nature of the data, representing as it does indications of physical growth and aspects of personality development obtained at different chronological age periods of the population, the between 5 and 10 per cent level is established as the outer limit of significance. When chi square values fall at or below this level, the null hypothesis is discarded, and when they are above this level the null hypothesis is retained.

The chi square test is used because the categorical or gross nature of the data lends itself less adaptable to more-precise measurement, such as might be obtained from the various correlative methods. Furthermore, it is felt that this test is more suitable for use with the relatively small population than are the correlative methods. The limitations of this test are pointed out in a later portion of this chapter. A summary of the chi squares obtained, with their respective levels of significance, appears in the appendix.

Phi coefficient of correlation.--While the test of chi square is a suitable means for determining whether the observed frequencies

¹⁵ R. A. Fisher, Statistical Method for Research Workers (8th ed.; Edinburgh: Oliver and Boyd, Ltd., 1941).

differ significantly from the expected frequencies, it does not provide a measure of degree of relatedness between two dichotomously expressed variables. In this study chi square serves primarily as a screening technique for selecting from the many gross paired variables (score categories) those which are significantly beyond the result of chance distribution. For such paired variables it is inferred that some relatedness exists. However, it is important to know the degree of such probable relatedness between these variables. It is for this purpose that the phi coefficient of correlation (Φ) is employed, as an estimation of a coefficient of correlation in a four-cell table.¹⁶ Phi is a close relative of χ^2 , and is applicable to a wide variety of situations. The computation of Φ can be calculated directly from a χ^2 which is derived from a 2 x 2 fold table, by the formula: $\Phi = \sqrt{\chi^2/N}$. The coefficient of correlation, obtained in this manner, approximates the Pearson product moment correlation.

Whenever the phi coefficient is interpreted as a coefficient of correlation, it should be recognized that it is an underestimate of the correlations which would ensue if numerical values of each distribution were available. It has been suggested that a more satisfactory estimate of relationship ensues if the phi coefficient is divided by 0.637. Empirical evidence tends to confirm the usefulness of this adjustment whenever the correlation is low and to increasingly deny the usefulness as the magnitude of the relationship increases.¹⁷

¹⁶ James E. Wert, Charles O. Neidt, and J. Stanley Ahmann, Statistical Methods in Educational and Psychological Research (New York: Appleton-Century, Crofts, 1954), p. 302.

¹⁷ Ibid., p. 300.

The reliability and significance of Φ is tested against the null hypothesis. When χ^2 's derived from a fourfold table are significant, the corresponding Φ 's are assumed to possess the same level of significance.

Expectancy tables.--Another statistical procedure employed is the organization of the data into expectancy tables. The same categorical division of basic data and contingency tables as used in calculating chi square are appropriate for the calculation of expectancies. The expectancy table is a means of organizing data for interpretation of an individual's chances of ranking in any one of the categories of the contingency table. This is in contrast to a coefficient of correlation which summarizes such data into one mathematical figure. The expectancy table makes apparent the details of the data at various parts of the distributions, whereas the coefficient, being a kind of average, obscures those details. This technique is employed in this study to provide a more comprehensive view of relationships among the variables than would be the case with chi square or correlative techniques alone. These expectancies refer to observed frequencies and must not be interpreted as predictions. The limitations of expectancy tables are discussed in a later section of this chapter. A summary of the expectancy tables appears in the appendix.

The next statistical procedure used in this study is the following formula for comparing two differences of proportions in a contingency table for two tables.¹⁸ This formula, which yields a t value, is used to test the significance of differences between the distribution proportions in the contingency tables for boys and girls.

¹⁸ Adapted for this study from basic formulas proposed by S. S. Wilks, Elementary Statistical Analysis (Princeton: Princeton University Press, 1951).

$$t = \frac{[(a_1 d_1 - b_1 c_1)/(a_1 + b_1)(c_1 + d_1)] - [(a_2 d_2 - b_2 c_2)/(a_2 + b_2)(c_2 + d_2)]}{\sqrt{[a_1 b_1/(a_1 + b_1)^3] + [c_1 d_1/(c_1 + d_1)^3] + [a_2 b_2/(a_2 + b_2)^3] + [c_2 d_2/(c_2 + d_2)^3]}}$$

	L	U			L	U	
U	a ₁	b ₁	a ₁ +b ₁	U	a ₂	b ₂	a ₂ +b ₂
L	c ₁	d ₁	c ₁ +d ₁	L	c ₂	d ₂	c ₂ +d ₂
	a ₁ +c ₁	b ₁ +d ₁			a ₂ +c ₂	b ₂ +d ₂	

The final statistical procedure employed in this study is the development of rank orders of growth variables on the basis of their frequency of appearance with the various interest variables. These rank orders are made, by population, for composite, fields, and level of interest categories, as well as by degree of significance category. Relative percentage rank values are assigned to each growth variable, of which the following is an illustration: If it is found that a growth variable such as reading age occurs most frequently in relatedness with an interest variable in each of the categories, it receives a value of 100 per cent. The next most frequent occurring growth variable receives a relative percentage value based upon the 100 per cent value assigned to reading age. Each of the other growth values receives a similarly calculated value. Finally, all values received by each growth variable are averaged, to obtain an over-all ranking of the growth variables.

Limitations of the Data

A general assumption is made that any data used in this or any other study are usually subject to certain limitations which must always be considered when evaluating the interpretations of data and the conclusions of this study. Furthermore, any investigation which deals with combinations of the dynamic and developmental factors of physical and psychological growth of human beings is subject to greater limitations than with studies in the realm of the physical sciences. It is the purpose here to point out some of the more serious limitations of the basic data and the techniques employed in this study. It is not, however, the intention to state or imply that the findings obtained and conclusions drawn from the study are invalid. It is, rather, the purpose to lend qualification to the results obtained.

The first of these limitations relates to the population under study. It is not a random sampling of an extensive population, but a selected one, on which data appropriate to this study are available. The number of cases is relatively small and cannot be construed to be representative of universality. Furthermore, the population is intrinsically limited in homogeneity, since individuals were scattered throughout the four grades in high school in 1951 and 1954 when their occupational interests were inventoried. There was also a time lapse from the period of 132 months of chronological age when growth and developmental data were obtained and the later high school period when occupational interest data were obtained. In other words, greater homogeneity of the population might have resulted if it had been possible to collect all data on individuals at the same time.

Data were not available on all members of the population for all the variables tested in the study. This accounts for the variation in the number of cases for certain data. These variations, which are

on certain growth and developmental data alone, are presented here to indicate the differentials which exist in the totals of thirty-five boys, thirty-seven girls, and total population of seventy-two.

<u>Data</u>	<u>Boys</u>	<u>Girls</u>	<u>Total</u>
Carpal age	31	34	65
Organismic age	31	34	65
Developmental age	33	37	70

The extent to which this differential affects the results of the study cannot be determined. It is merely pointed out here as a possible limitation.

We turn now from a discussion of the limitations inherent in the population to the limitations imposed by factors intrinsic and extrinsic to the data themselves. In general it is recognized that there are countless known and unknown variables which may affect the growth and occupational interest development of individuals, but which are not considered in this study. The variables tested, therefore, represent but a sampling of all possible relevant variables. The assumption is made that, in general, those variables affecting the population, but not considered in this study, equally affect all individuals within the population. All data employed are therefore subject to these unknown variables.

The basic developmental age data, obtained from scores made on the Furfey and Sullivan tests, are, according to the authors of these tests, subject to a very small positive correlation with the growth factors of weight and height of boys and girls. In correlative studies they obtained 0.09 and 0.14 coefficients, respectively, on each relationship. Furthermore, they noted little or no relationship of developmental age to mental age. However, these results are not considered conclusive due to the relatively small population tested. The fact that a small relationship exists is sufficient evidence that

scores made on these instruments by other populations correlated with different variables may indicate relationships at variance with the above-mentioned studies. It is pointed out here that the data obtained from these tests must be considered within the limitations indicated by this previous research.

Certain limitations must also be noted on the growth-in-age data. Olson and Hughes¹⁹ point out that there is only a limited collection of data on a few variables for the same individuals. These data do not give accurate information on the status to which the child is growing in the various qualities; i.e., low present status does not mean permanent low status. It is also to be noted that this technique for obtaining growth data translates unequal units of the original measure into equal units of age, or, conversely, constant physical units have unequal age equivalents. Finally, it is to be observed that these age equivalents are not norms or standards which children are expected to attain. Applied to this study, it simply means that the growth-in-age units of any individual may well be the "optimum" or "best norm" for him, irrespective of any "average" representing group attainment.

The low validity of scores generally obtained from occupational interest inventories may be cited as a limitation of the interest data in this study. No purely objective criteria exist for establishing the validity of an occupational interest inventory. In addition, it should be pointed out that the basic data on occupational interests used in this study are from scores which have been converted from raw scores to percentile scores. They are therefore "categorical" scores. In regard to the classification of interest items into fields, types, and

¹⁹ Olson and Hughes, op. cit.

level of interest, there is no special superiority claimed by the authors nor any research to indicate their significances in terms of validity. Any interpretation of the meaning of data within these classifications must be limited to the description given in the Manual of Directions for the Occupational Interest Inventory.²⁰

Finally, limitations are to be observed in reference to the limitations imposed upon the data by the three basic investigation procedures used in this study.

In the first instance, the chi square method must be regarded as only a means for testing the significance of the difference between observed and expected frequencies over and above a chance departure from zero or no relationship. In itself, χ^2 is not a measure of association.

Secondly, in the case of the phi coefficient of correlation (Φ) it should be noted that Φ can vary from -1.0 to +1.0, and that only under certain conditions can Φ be as large as either of these extremes. Probably the greatest weakness of Φ is caused by the reduction of frequencies to a 2 x 2 table, which places serious restrictions upon it that do not affect the Pearson product moment coefficient.

Thirdly, in regard to an expectancy table, it is important to recognize that its reliability is limited to the number of cases, since it varies directly with the number of individuals on whom the measure is based. An average score of a group is a more stable figure than a score of any individual. The lesser reliability of individual cell entries (or percentages) is therefore a real limitation of this technique. It is a much less precise measure than that which might be obtained by an r correlation. Its sole function is to provide a

²⁰ Lee and Thorpe, op. cit.

means of organizing data for interpretation of an individual's chances of success whereas the r coefficient of correlation summarizes such data for an entire group in one mathematical index.

Fourthly, the rank order procedure followed in determining the frequency of occurrence of the various growth variables with the several categories of interest variables cannot be assumed to bear any particular degree of statistical significance. It is merely an indication of the probable relative importance of any growth variable as an indicator of certain interest characteristics of an individual.

Summary

Appropriate growth measures and developmental age scores, together with occupational interest percentile scores of thirty-five boys and thirty-seven girls, constitute the basic data for this study.

The nature of these basic data is portrayed by means of descriptive definitions of the various growth units and categories of occupational interest. It is from these data that the various measures and scores were obtained for use in this study.

Investigation procedures for processing and treating these data include appropriate classification techniques, tests of chi square, phi correlations, expectancy tables, the calculation of t values, and rank ordering of growth variables according to frequency of occurrence with interest variables.

Finally, certain limitations of the data and of the procedures employed are presented, with the suggestion that they be observed in respect to any interpretations and conclusions pertaining to this study.

CHAPTER IV

ANALYSIS, INTERPRETATION, AND SUMMARY OF THE DATA

The major hypothesis of this study states that there is a significant relationship between certain measures of growth of children and their patterns of vocational interest. In this chapter the data used in testing this hypothesis are analyzed, interpreted, and summarized.

A convenient and functional plan for organizing the data for this purpose is to deal with those data which relate to each of the five subhypotheses advanced in Chapter I. Accordingly, the content of this chapter is organized around each of these following subhypotheses:

1. There is a significant relationship between certain growth characteristics and interest level patterns.
2. There is a significant relationship between certain growth characteristics and patterns of interest types.
3. There is a significant relationship between certain growth characteristics and fields of interest patterns.
4. Certain similarities and differences of relationship between growth characteristics and interest factors exist according to sex.
5. Certain growth characteristics vary in their importance as indicators of the various interest factors.

In the final portion of the chapter the results of the analyses, interpretation, and summaries of data for each of the subhypotheses are combined into a general summary.

The general plan for treatment of the data under each sub-hypothesis heading, and in the general summary, is based upon four analytical techniques used in this study; namely, the test of chi square, phi correlations, expectancy tables, and the t test for comparing the differences of proportions in a contingency table for two tables.

In all instances the results obtained are tested for statistical significance on the basis of the null hypothesis, which is the assumption that no true measure of relationship exists, as between the growth and interest factors related to each respective subhypothesis. It is stated that any observed relationship is the result of random sampling and the accidents of sampling. In each and every instance the null hypothesis is tested against the direct determination of probable outcomes by comparing the observed results with those results expected to occur on the theory of equal probability. The obtained chi square values, phi correlations, and t values are used as the basis for deciding whether to retain or reject the null hypothesis.

The level of significance or confidence value employed is extremely important in determining the reliability of relationships among the variables tested. The accepted significance level for this study has been presented in Chapter III. As pointed out there, the outer limit of significance usually employed is at the 0.05 level. However, the nature of the data, whether gross or specific, and the kind of variables dealt with (whether, a priori, they are generally accepted as having close or wide degrees of relationships) establish the conditions upon which the investigator must make judgment regarding the least confidence level which is to be accepted. In this study the data are considered gross in nature, and the relationships of the variables of physical growth and interest development are relatively unknown. Therefore, the outer limits of significance accepted are those between the 5 and 10 per cent levels. When the obtained

results are at or within the 10 per cent points, they are considered statistically nonsignificant and the null hypothesis is retained.

When the obtained results range between the 5 and 10 per cent levels of significance, they are considered only relatively significant, and the null hypothesis is rejected with caution.

Obtained results at the 5 per cent level are considered statistically significant, and the null hypothesis is rejected. Finally, if the results obtained are significant at less than the 5 per cent level, they are considered to be highly significant, and the null hypothesis is rejected with a high degree of confidence.

The values of the significant phi coefficients of correlation between each of the two variables tested are always the same as their corresponding χ^2 in level of significance. In all instances the phi coefficient of correlation represents the degree of relationship between any two of the associated variables. While it is customary among research workers in psychology and education to describe the correlation between two variables as high, marked, or substantial, or low or negligible, the significance of descriptive labels will vary in meaning according to the investigation. The decision as to meaning is determined by the nature of the data, as mentioned elsewhere in this study. The following descriptive labels are established for this study:

Φ from 0.00 to ± 0.20 denotes indifferent or negligible relationship;

Φ from 0.20 to ± 0.60 denotes a substantial relationship;

Φ from 0.60 to ± 1.00 denotes a high to very high relationship.

The expectancy tables in this chapter are based upon the frequency distributions within the contingency tables from which significant chi square values and phi coefficients of correlation are obtained. While it is possible to recast correlation coefficients as expectancy tables, there is a practical difficulty in that this can best be done

only when a large number of cases are involved. When the number of cases falls below 200, irregularities in the distributions do not permit such inference. Two quite different irregular frequency distributions may result in the same validity coefficient. In brief, the expectancy tables show the percentage of individuals making a given score on one variable who will be expected to equal or exceed a given score on the associated variable. In this study, these scores are interpreted as upper and lower halves of the scores obtained by the population on each variable. The expectancy is that there will be an equal distribution of cases in each of the four cells of the distribution. An example follows for a population of thirty-five cases:

	Interest Lower Level	Interest Upper Level	Total
Upper RA	1 (8.5)	16 (8.5)	17 (17)
Lower RA	7 (9)	11 (9)	18 (18)

In this case it is expected that one-half of the individuals who rank in the upper RA will be distributed equally in the lower interest and upper interest cells as indicated by the figures in parentheses. Likewise, in the case of those who rank in the lower half of RA, the expectancy is for equal distribution in the lower and upper interest cells. It will be noted in this example that the actual distributions do not agree with the expected distributions.

It is more meaningful to convert the number of cases in each cell to percentages in order to render the figures in each row comparable. Converted to percentages, the sample expectancy table appears thus:

	Lower Interest Level	Upper Interest Level	Total
Upper RA	6% (50%)	94% (50%)	100% (100%)
Lower RA	39% (50%)	61% (50%)	100% (100%)

Thus by interpretation the expectancy table reads: The chances for an individual who ranks in the upper half on reading age to rank in the upper half on interest level is 94 out of 100, and for an individual who ranks in the lower half on reading age, to rank in the upper half on interest level is 61 out of 100.

It is recognized that the expectancy table is a gross measure for indicating observed relationship patterns for individuals in those associated variables which have chi square values and phi coefficients within the established limits of statistical significance.

Many variables are tested in this study. The results of the tests of relationship between the variables, which fall within the established levels of confidence, are analyzed in detail. However, it is assumed that, due to the limitations of the data and investigation procedures employed, a knowledge of those variables whose tests of relationship exceed the established level of significance may be important in arriving at a more complete evaluation of growth-interest relationships. Therefore, in connection with the analysis, interpretation, and summary of the data relating to each subhypothesis, a summary of all the nonsignificant chi square values obtained is included. A complete, unclassified summary is also included in the appendix.

This introduction presents the manner in which this chapter is organized, and the conditions governing the treatment of data under each of the subhypotheses. These general conditions are not repeated

in the various analyses and interpretations. We turn now to the analysis and interpretation of data as they relate to each subhypothesis.

Subhypothesis I: There is a Significant Relationship
Between Certain Growth Characteristics and
Interest Level Patterns

The total variables tested which relate to this subhypothesis are: growth factors--reading age, weight age, mental age, carpal age, height age, grip age, dental age, organismic age, and developmental age; level of interest.

Table I contains the paired growth and level of interest variables, from which chi square values, within the established levels of significance, are obtained.

From Table I it is observed that two of the nine growth variables tested by chi square for their association with the interest level variable fall within the established level of significance. Chi square values for reading age and carpal age with level of interest in the population of boys are between the 5 and 10 per cent levels. These are accepted as relatively significant, and the null hypothesis is grudgingly discarded.

In the total population, chi square for reading and carpal ages and interest level are highly significant, and the null hypothesis is rejected with a high degree of confidence.

No significant chi square values are obtained between reading and carpal age, and interest level in the population of girls.

The nonsignificant chi square values obtained among the variables, which relate to Subhypothesis I, are found in Table II.

TABLE I

SIGNIFICANT OBTAINED CHI SQUARES ON GROWTH
AND LEVEL OF INTEREST

Variable I	Boys		Total	
	χ^2	p	χ^2	p
<u>Variable II: Level of Interest</u>				
Reading age	3.69	0.05- 0.10	8.04	0.001- 0.01
Carpal age	3.52	0.05- 0.10	4.93	0.02- 0.05

TABLE II

SUMMARY OF OBTAINED NONSIGNIFICANT CHI SQUARES ON
GROWTH AND LEVEL OF INTEREST

Variable I	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Variable II: Level of Interest</u>						
Reading age			1.24	0.20 - 0.30		
Weight age	0.40	0.30 - 0.50	0.10	0.70 - 0.80	0.32	0.50 - 0.70
Mental age	1.25	0.20 - 0.30	0.58	0.30 - 0.50	2.47	0.10 - 0.20
Carpal age			0.05	0.80 - 0.90		
Height age	0.10	0.70 - 0.80	0.10	0.70 - 0.80	0.00	1.00 - 1.00
Grip age	0.10	0.70 - 0.80	0.10	0.70 - 0.80	0.00	1.00 - 1.00
Dental age	0.25	0.50 - 0.70	1.24	0.20 - 0.30	1.29	0.20 - 0.30
Organismic age . . .	0.81	0.30 - 0.50	0.36	0.50 - 0.70	0.98	0.30 - 0.50
Developmental age .	0.01	0.90 - 0.95	2.07	0.10 - 0.20	0.08	0.70 - 0.80

None of the chi square values in Table II fall within the established levels of significance, and the null hypothesis is therefore retained for each pair of variables.

In Table III are found the phi coefficients of correlation for the paired variables from which highly significant or relatively significant chi square values are obtained.

According to the descriptive values of phi correlation coefficients for this study, all of the correlations in Table III indicate a substantial positive degree of relationship between each of the two pairs of variables.

Table IV compares the expectancies of individuals who rank in either the upper or lower halves of the growth variables with their rank in the corresponding halves of the interest variable.

Referring to Table IV, it is noted that individual boys who rank in the upper half on reading age can expect to rank in the upper half on interest level 94 times out of 100. Individual boys who rank in the lower half of reading age can expect to rank in the upper half on interest level 61 times out of 100. Individual boys ranking in the upper half in carpal age can expect to rank in the upper half on interest level 100 times out of 100. In the same manner, individual boys who rank in the lower half on carpal age have 69 chances out of 100 to rank in the upper half on interest level.

In the total population, individuals who rank in the upper half on reading age can expect to rank in the upper half on level of interest 92 times out of 100, while those who rank in the lower half on reading age have 64 chances out of 100 to rank in the upper half on level of interest. Likewise, individuals ranking in the upper half on carpal age can expect to rank in the upper half on interest level 90 times out of 100, while those ranking in the lower half on reading

TABLE III

SIGNIFICANT OBTAINED PHI COEFFICIENTS ON GROWTH
AND LEVEL OF INTEREST

Variable I	Boys		Total	
	ϕ	p	ϕ	p
<u>Variable II: Level of Interest</u>				
Reading age	0.495	0.05- 0.10	0.522	0.001- 0.01
Carpal age	0.529	0.05- 0.10	0.428	0.02- 0.05

TABLE IV

EXPECTANCY TABLE ON GROWTH AND LEVELS OF INTEREST
BY PERCENTAGE

(U = upper half; L = lower half)

Variable I	Boys				Total			
	UU	UL	LU	LL	UU	UL	LU	LL
<u>Variable II: Level of Interest</u>								
Reading age	94	6	61	39	92	8	64	36
Carpal age	100	0	69	31	90	10	68	32

age can expect to rank in the upper half of interest level 68 times out of 100.

Summary of analysis and interpretation of data relating to Subhypothesis I.--Chi square values within the established significance levels are obtained in the association of reading and carpal age growth variables and the level of interest variable. These occur only in the boys and total populations.

The degree of relatedness between these variables, as indicated by the phi coefficient of correlation, is described as substantial.

In terms of expectancies, the frequency distribution indicates that an individual who ranks in the upper half on the growth variables can expect to rank in the upper half on the level of interest variable.

An individual who ranks in the lower half on the growth variables has a greater chance to rank in the upper half of the interest level variable than in the lower half.

Subhypothesis II: There is a Significant Relationship Between Certain Growth Characteristics and Patterns of Interest Types

The total variables tested which relate to this subhypothesis are: growth factors--reading age, weight age, mental age, carpal age, height age, grip age, dental age, organismic age, and developmental age; interest types--verbal, manipulative, and computational.

Table V contains the paired growth and interest variables from which chi square values within the established levels of significance are obtained.

It is noted from Table V that, for the total population, there are three chi square values, and for the boys there is one chi square

TABLE V

SIGNIFICANT OBTAINED CHI SQUARES ON GROWTH
AND INTEREST TYPES

Variable I	Boys		Total	
	χ^2	p	χ^2	p
<u>Variable II: Computational</u>				
Reading age			2.72	0.05- 0.10
Weight age			5.57	0.01- 0.02
Mental age	3.69	0.05- 0.10	7.95	0.001- 0.01
Organismic age			3.45	0.05- 0.10
Developmental age			2.81	0.05- 0.10

value, between the 5 and 10 per cent level of significance. Since this level is accepted as relatively significant, the null hypothesis is rejected with caution. Two of the chi square values are far less than the 5 per cent level of significance and the null hypothesis is rejected with a high degree of confidence. It is also important to note that there are no significant chi square values for any association between the growth factors, and verbal and manipulative interests.

The nonsignificant chi squares obtained among the other variables used in testing Subhypothesis II are found in Table VI.

Since none of the chi square values in Table VI are within the levels of significance established for this study, the null hypothesis is retained for each pair of variables.

In Table VII are found the phi coefficients of correlation for the paired variables on which highly significant or relatively significant chi square values are obtained.

According to the descriptive values for phi correlation coefficients established for this study, all of the correlations in Table VII indicate a substantial degree of positive or negative relationship between each of the two associated variables.

Table VIII compares the expectancies of individuals who rank in either the upper or lower halves of the growth variables with their rank in the corresponding halves of the interest variables.

From Table VIII it is shown that individual boys who rank in the upper half in mental age can expect to rank in the upper half in computational interest 94 times out of 100. Those who rank in the lower half in mental age can expect to rank in the upper half of computational interest 61 times out of 100.

Also from Table VIII, it is noted that the frequency distribution for the total population indicates that the chances for individuals ranking in the upper half in reading age are 61 out of 100, that they

TABLE VI

SUMMARY OF OBTAINED NONSIGNIFICANT CHI SQUARES
ON GROWTH AND INTEREST TYPES

Variables I and II	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Reading age</u>						
Verbal	1.70	0.10 - 0.20	0.03	0.80 - 0.90	0.23	0.50 - 0.70
Manipulative	1.37	0.20 - 0.30	0.02	0.80 - 0.90	0.51	0.30 - 0.50
Computational . . .	0.10	0.70 - 0.80	1.41	0.20 - 0.30		
<u>Weight age</u>						
Verbal	0.35	0.50 - 0.70	0.25	0.50 - 0.70	0.91	0.30 - 0.50
Manipulative	0.77	0.30 - 0.50	0.27	0.50 - 0.70	0.06	0.80 - 0.90
Computational . . .	1.25	0.20 - 0.30	0.06	0.80 - 0.90		
<u>Mental age</u>						
Verbal	0.35	0.50 - 0.70	0.67	0.30 - 0.50	0.01	0.80 - 0.90
Manipulative	0.24	0.50 - 0.70	0.03	0.80 - 0.90	0.97	0.30 - 0.50
Computational . . .			0.67	0.30 - 0.50		
<u>Carpal age</u>						
Verbal	0.26	0.50 - 0.70	0.10	0.70 - 0.80	0.68	0.30 - 0.50
Manipulative	0.026	0.80 - 0.90	0.002	0.95 - 0.98	0.01	0.90 - 0.95
Computational . . .	0.01	0.90 - 0.95	0.02	0.80 - 0.90	0.01	0.02 - 0.05
<u>Height age</u>						
Verbal	0.35	0.35 - 0.70	0.25	0.50 - 0.70	0.00	1.00 - 1.00
Manipulative	0.77	0.30 - 0.50	0.27	0.50 - 0.70	0.06	0.80 - 0.90
Computational . . .	1.25	0.20 - 0.30	0.06	0.80 - 0.90	0.89	0.30 - 0.50

TABLE VI--Continued

Variables I and II	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Grip age</u>						
Verbal	0.02	0.80 - 0.90	0.25	0.50 - 0.70	0.91	0.30 - 0.50
Manipulative	0.24	0.50 - 0.70	0.27	0.50 - 0.70	0.06	0.80 - 0.90
Computational . . .	0.10	0.70 - 0.80	0.06	0.80 - 0.90	0.89	0.30 - 0.50
<u>Dental age</u>						
Verbal	0.70	0.30 - 0.50	0.03	0.80 - 0.90	2.06	0.10 - 0.20
Manipulative	0.02	0.80 - 0.90	0.02	0.80 - 0.90	0.51	0.30 - 0.50
Computational . . .	0.004	0.95 - 0.98	0.22	0.50 - 0.70	0.22	0.50 - 0.70
<u>Organismic age</u>						
Verbal	0.07	0.70 - 0.80	1.89	0.10 - 0.20	0.42	0.50 - 0.70
Manipulative	0.78	0.30 - 0.50	0.54	0.30 - 0.50	0.41	0.50 - 0.70
Computational . . .	0.01	0.90 - 0.95	0.83	0.30 - 0.50		
<u>Developmental age</u>						
Verbal	0.73	0.30 - 0.50	0.03	0.80 - 0.90	0.23	0.50 - 0.70
Manipulative	1.46	0.20 - 0.30	1.40	0.20 - 0.30	0.53	0.30 - 0.50
Computational . . .	0.01	0.90 - 0.95	0.95	0.30 - 0.50		

TABLE VII

SIGNIFICANT OBTAINED PHI COEFFICIENTS ON GROWTH
AND INTEREST TYPES

Variable I	Boys		Total	
	ϕ	p	ϕ	p
<u>Variable II: Computational</u>				
Reading age			0.284	0.05- 0.10
Weight age			0.427	0.01- 0.02
Mental age	0.497	0.05- 0.10	0.519	0.001- 0.01
Organismic age			0.334	0.05- 0.10
Developmental age			-0.311	0.05- 0.10

TABLE VIII

EXPECTANCY TABLE ON GROWTH AND INTEREST TYPES
BY PERCENTAGE

(U = upper half; L = lower half)

Variable I	Boys				Total			
	UU	UL	LU	LL	UU	UL	LU	LL
<u>Variable II: Computational</u>								
Reading age					61	39	42	58
Weight age					67	33	39	61
Mental age	94	6	61	39	70	30	37	63
Organismic age					64	36	41	59
Developmental age					43	57	63	37

will rank in the upper half on computational interest. Likewise, those individuals who rank in the lower half on reading age can expect to rank in the upper half on computational interest 42 times out of 100. In the same manner, those individuals who rank in the upper half on organismic age can expect to rank in the upper half on computational interest 64 times out of 100. For individuals who rank in the lower half on organismic age, the expectancy is 41 times out of 100 that they will rank in the upper half on computational interest.

Those individuals who rank in the upper half on developmental age can expect to rank in the upper half on computational interest 43 out of 100 times, and individuals who rank in the lower half in developmental age can expect to rank in the upper half of computational interest 63 out of 100 times. In this instance, it should be noted that the greater chances are found in the inversions of upper and lower, thus agreeing with its phi negative correlation.

In Table VIII, individuals in the total population who rank in the upper half on weight age can expect, in 67 out of 100 times, to rank in the upper half of computational interest. Those individuals who rank in the lower half on weight age can expect to rank in the upper half on computational interest 39 out of 100 times. Likewise, in the total population, an individual who ranks in the upper half on mental age has a chance to rank in the upper half on computational interest 70 out of 100 times. An individual ranking in the lower half of mental age can expect to rank in the upper half in computational interest 37 out of 100 times.

Summary of analysis and interpretation of data relating to Subhypothesis II.--Significant chi square values are obtained for reading age, weight age, mental age, organismic age, and developmental age, in their relationship to computational interest type. There are

no significant chi square values, as between any of the growth variables, and verbal and manipulative interest types. No significant chi square values are obtained for height age, carpal age, grip age, and dental age variables in their relationships to any of the three interest types. The significant chi square values do not apply equally to the boys and total populations. There are no significant chi square values obtained for the girls. A substantial degree of positive or negative relationship exists between the associated growth and interest type variables, as indicated by the phi coefficient of correlation.

The expectancy of an individual ranking in the upper half of a growth variable to rank in the upper half of the associated field of interest variable occurs in five of the six pairs of variables. In the sixth pair, an individual who ranks in the upper half can expect to rank in the lower half of the associated field of interest variable.

An individual who ranks in the lower half of a growth variable can expect to rank in the lower half of the associated field of interest variable in four of the six pairs of variables, in both populations.

In two pairs of variables, an individual ranking in the lower half of a growth variable can expect to rank in the upper half of the associated field of interest variable.

Subhypothesis III: There is a Significant Relationship Between Certain Growth Characteristics and Fields of Interest Patterns

The total variables tested which relate to this subhypothesis are: growth factors--reading age, weight age, mental age, carpal age, height age, grip age, dental age, organismic age, and developmental age; interest fields--personal-social, natural, mechanical, business, the arts, the sciences.

Table IX contains the paired growth and interest variables from which chi square values within the established levels of significance are obtained.

From Table IX it is observed that chi square values between reading age and the interest fields of natural and the sciences, for the population of boys, are at the relative significant level, or between the 5 and 10 per cent level. The null hypothesis is discarded with caution. With these same variables, in the total population the level of significance is less than 5 per cent, and the null hypothesis is rejected with confidence.

The chi square value obtained between weight age and interest, in the natural interest field, for the total population, is relatively significant, and the null hypothesis is repudiated with caution.

A high degree of significance of 0.001 to 0.01 is obtained between mental age and the sciences for the total population. The null hypothesis is rejected with a high degree of confidence.

The values of chi square between height age and interest in the arts, for both girls and total populations, lie between the 5 and 10 per cent levels of significance, and are characterized as relatively significant. Accordingly, the null hypothesis is discarded with caution.

With height age and business interest, for the population of girls, a chi square value at a high significance level is obtained, and the null hypothesis is rejected with a high degree of confidence.

A relatively significant level for the chi square value obtained in the relationship of height age and the sciences for the population of boys provides the basis for a cautious discarding of the null hypothesis.

TABLE IX

SIGNIFICANT OBTAINED CHI SQUARES ON GROWTH
AND FIELDS OF INTEREST

Variables I and II	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Reading age</u>						
Natural	2.91	0.05- 0.10			4.59	0.02- 0.05
Sciences	2.91	0.05- 0.10			6.02	0.01- 0.02
<u>Weight age</u>						
Natural					3.60	0.05- 0.10
<u>Mental age</u>						
Sciences					6.93	0.001- 0.01
<u>Height age</u>						
Arts			3.07	0.05- 0.10	2.78	0.05- 0.10
Business			6.21	0.01- 0.02		
Sciences	3.11	0.05- 0.10				
<u>Grip age</u>						
Natural					3.60	0.05- 0.10
Arts					2.78	0.05- 0.10
<u>Dental age</u>						
Sciences			9.36	0.001- 0.01		
<u>Organismic age</u>						
Business	3.90	0.02- 0.05				

The value of chi square, as between grip age and the natural field of interest for the total population, is relatively significant at the 0.05 to 0.10 level. Therefore, the null hypothesis is rejected with caution.

One of the largest chi square values obtained is between dental age and interest in the sciences on the population of girls. At the 0.001 to 0.01 level it is highly significant, and the null hypothesis is rejected with confidence.

Finally, the value of chi square for organismic age and business interest relationship is found to be only relatively significant for boys. The null hypothesis is therefore discarded with caution.

In Table X are found the obtained nonsignificant chi square values for the remaining variables which relate to Subhypothesis III.

Since none of the chi square values in Table X fall within the established levels of significance, the null hypothesis is retained in each and every instance.

In Table XI are found the phi coefficients of correlation for the paired variables from which highly significant and relatively significant chi square values are obtained.

According to the descriptive values for the phi coefficient established for this study, the following degrees of relationships are indicated in Table XI:

1. Between reading age and natural interest there is a substantial degree of negative relationship for both boys and the total population.
2. Between reading age and interest in the sciences there is a substantial degree of positive relationship in both boys and total population.
3. There is a substantial degree of negative relationship between weight age and natural interest in the total population.

TABLE X

SUMMARY OF OBTAINED NONSIGNIFICANT CHI SQUARES ON
GROWTH AND FIELDS OF INTEREST

Variable II	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Variable I: Reading Age</u>						
Personal-social	0.06	0.80 - 0.90	0.84	0.30 - 0.50	1.18	0.20 - 0.30
Natural			0.24	0.50 - 0.70		
Mechanical	2.33	0.10 - 0.20	0.30	0.50 - 0.70	1.42	0.20 - 0.30
Business	1.39	0.20 - 0.30	0.07	0.70 - 0.80	1.40	0.20 - 0.30
Arts	0.69	0.70 - 0.80	0.41	0.30 - 0.50	0.51	0.30 - 0.50
Sciences	2.91		1.40	0.20 - 0.30	6.02	
<u>Variable I: Weight Age</u>						
Personal-social	0.96	0.30 - 0.50	0.01	0.90 - 0.95	0.30	0.50 - 0.70
Natural	0.96	0.30 - 0.50	0.10	0.70 - 0.80		
Mechanical	2.33	0.10 - 0.20	2.20	0.10 - 0.20	0.51	0.30 - 0.50
Business	0.23	0.50 - 0.70	1.02	0.30 - 0.50	2.02	0.10 - 0.20
Arts	0.69	0.30 - 0.50	2.07	0.10 - 0.20	0.51	0.30 - 0.50
Sciences	0.06	0.80 - 0.90	0.03	0.80 - 0.90	0.00	1.00 - 1.00

TABLE X--Continued

Variable II	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Variable I: Mental Age</u>						
Personal-social . . .	0.06	0.80 - 0.90	0.01	0.90 - 0.95	2.24	0.10 - 0.20
Natural	0.06	0.80 - 0.90	0.01	0.90 - 0.95	2.07	0.10 - 0.20
Mechanical	0.03	0.80 - 0.90	0.02	0.80 - 0.90	0.97	0.30 - 0.50
Business	0.02	0.80 - 0.90	1.02	0.30 - 0.50	0.47	0.30 - 0.50
Arts	0.30	0.50 - 0.70	0.01	0.90 - 0.95	1.53	0.20 - 0.30
Sciences	1.70	0.10 - 0.20	0.76	0.30 - 0.50		
<u>Variable I: Carpal Age</u>						
Personal-social . . .	0.07	0.70 - 0.80	0.08	0.70 - 0.80	0.39	0.50 - 0.70
Natural	0.41	0.50 - 0.70	0.05	0.80 - 0.90	0.12	0.70 - 0.80
Mechanical	0.81	0.50 - 0.70	0.17	0.50 - 0.70	0.84	0.30 - 0.50
Business	1.55	0.20 - 0.30	0.04	0.80 - 0.90	0.20	0.50 - 0.70
Arts	0.78	0.30 - 0.50	0.97	0.30 - 0.50	0.01	0.90 - 0.95
Sciences	0.50	0.80 - 0.90	0.39	0.50 - 0.70	0.07	0.70 - 0.80

TABLE X--Continued

Variable II	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Variable I: Height Age</u>						
Personal-social . . .	0.06	0.80- 0.90	0.01	0.90- 0.95	0.00	1.00- 1.00
Natural	0.06	0.80- 0.90	0.008	0.95- 0.98	0.00	1.00- 1.00
Mechanical	0.27	0.50- 0.70	0.65	0.30- 0.50	0.51	0.30- 0.50
Business	1.40	0.20- 0.30	6.21		0.90	
Arts	0.31	0.50- 0.70				0.50- 0.70
Sciences			0.76	0.30- 0.50	0.24	
<u>Variable I: Grip Age</u>						
Personal-social . . .	0.96	0.30- 0.50	0.01	0.90- 0.95	0.69	0.30- 0.50
Natural	0.06	0.80- 0.90	0.10	0.70- 0.80	3.60	
Mechanical	0.72	0.30- 0.50	1.30	0.20- 0.30	0.51	0.30- 0.50
Business	1.39	0.20- 0.30	1.02	0.30- 0.50	0.00	1.00 1.00
Arts	0.69	0.30- 0.50	1.80	0.10- 0.20		
Sciences	0.23	0.50- 0.70	2.37	0.10- 0.20	0.96	0.30- 0.50

TABLE X--Continued

Variable II	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Variable I: Dental Age</u>						
Personal-social	0.06	0.80 - 0.90	0.01	0.90 - 0.95	0.30	0.50 - 0.70
Natural	0.23	0.50 - 0.70	1.65	0.10 - 0.20	0.22	0.50 - 0.70
Mechanical	0.25	0.50 - 0.70	0.30	0.50 - 0.70	0.51	0.30 - 0.50
Business	0.05	0.80 - 0.90	0.07	0.70 - 0.80	0.00	1.00 - 1.00
Arts	0.02	0.80 - 0.90	1.02	0.30 - 0.50	1.42	0.20 - 0.30
Sciences	1.46	0.20 - 0.30	9.36		2.17	0.10 - 0.20
<u>Variable I: Organismic Age</u>						
Personal-social	1.06	0.30 - 0.50	1.42	0.20 - 0.30	0.26	0.50 - 0.70
Natural	0.07	0.70 - 0.80	1.05	0.30 - 0.50	2.67	0.10 - 0.20
Mechanical	0.82	0.30 - 0.50	0.17	0.50 - 0.70	0.13	0.70 - 0.80
Business	3.90		0.04	0.80 - 0.90	0.02	0.80 - 0.90
Arts	0.04	0.80 - 0.90	0.04	0.80 - 0.90	0.15	0.50 - 0.70
Sciences	1.27	0.20 - 0.30	1.77	0.10 - 0.20	1.99	0.10 - 0.20

TABLE X--Continued

Variable II	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Variable I: Developmental Age</u>						
Personal-social	0.07	0.70 - 0.80	0.01	0.90 - 0.95	1.94	0.10 - 0.20
Natural	0.01	0.90 - 0.95	1.24	0.20 - 0.30	2.07	0.10 - 0.20
Mechanical	0.28	0.50 - 0.70	0.02	0.80 - 0.90	1.45	0.20 - 0.30
Business	0.73	0.30 - 0.50	0.01	0.90 - 0.95	1.45	0.20 - 0.30
Arts	0.03	0.80 - 0.90	0.07	0.70 - 0.80	0.06	0.80 - 0.90
Sciences	1.04	0.30 - 0.50	1.30	0.20 - 0.30	0.56	0.30 - 0.50

TABLE XI

SIGNIFICANT OBTAINED PHI COEFFICIENTS ON GROWTH
AND FIELDS OF INTEREST

Variables I and II	Boys		Girls		Total	
	Φ	p	Φ	p	Φ	p
<u>Reading age</u>						
Natural	-0.442	0.05-			-0.393	0.02-
		0.10				0.05
Sciences	0.442	0.05-			0.450	0.01-
		0.10				0.02
<u>Weight age</u>						
Natural					-0.350	0.05-
						0.10
<u>Mental age</u>						
Sciences					0.319	0.001-
						0.01
<u>Height age</u>						
Arts			-0.489	0.05-	-0.287	0.05-
				0.10		0.10
Business			0.637	0.01-		
				0.02		
Sciences	0.521	0.05-				
		0.10				
<u>Grip age</u>						
Natural					-0.279	0.05-
						0.10
Arts					-0.287	0.05-
						0.10
<u>Dental age</u>						
Sciences			0.785	0.001-		
				0.01		
<u>Organismic age</u>						
Business	-0.552	0.02-				
		0.05				

4. There is a substantial degree of positive relationship between mental age and interest in the sciences in the total population.

5. Between height age and interest in the arts there is a substantial negative relationship for the population of girls and the total population.

6. There is a substantial negative relationship between grip age and interest in the natural and arts fields for the total population.

7. The relationship between height age and business interest for the girls is interpreted as positive high.

8. There is a substantial positive relationship between height age and interest in the sciences for the population of boys.

9. A very high degree of positive relationship is noted between dental age and interest in the sciences for the girls population.

10. In the population of boys a substantial negative relationship between organismic age and interest in business is found.

In Table XII are found the expectancies of individuals who rank in either the upper or lower halves in the growth variables to rank in the corresponding halves of the interest variables.

Boys population.--Entering Table XII, it is noted that individual boys who rank in the upper half on reading age can expect to rank in the upper half in natural interest 18 out of 100 times. Those who rank in the lower half in reading age have an expectancy of ranking 44 times out of 100 in the upper half in natural interest. Individuals ranking in the upper half on reading age can expect to rank in the upper half in interest in the sciences 82 times in 100. Those who rank in the lower half on reading age can expect 56 times in 100 to rank in the upper half on interest in the sciences. Those individuals who rank in the upper half on height age have 88 chances of

TABLE XII

EXPECTANCY TABLE ON GROWTH AND FIELDS OF
INTEREST BY PERCENTAGE

(U = upper half; L = lower half)

Variable I	Variable II	UU	UL	LU	LL
<u>Boys</u>					
Reading age	Natural	18	82	44	56
Reading age	Sciences	82	18	56	44
Weight age	Natural				
Mental age	Sciences				
Height age	Arts				
Height age	Business				
Height age	Sciences	88	12	56	44
Grip age	Natural				
Grip age	Arts				
Dental age	Sciences				
Organismic age	Business	40	60	75	25
<u>Girls</u>					
Reading age	Natural				
Reading age	Sciences				
Weight age	Natural				
Mental age	Sciences				
Height age	Arts	58	42	89	11

TABLE XII--Continued

Variable I	Variable II	UU	UL	LU	LL
Height age	Business	47	53	6	94
Height age	Sciences				
Grip age	Natural				
Grip age	Arts				
Dental age	Sciences	83	17	37	63
Organismic age	Business				
	<u>Total</u>				
Reading age	Natural	44	56	69	31
Reading age	Sciences	78	22	50	50
Weight age	Natural	44	56	67	33
Mental age	Sciences	78	22	49	51
Height age	Arts	47	53	67	33
Height age	Business				
Height age	Sciences				
Grip age	Natural	44	56	67	33
Grip age	Arts	47	53	67	33
Dental age	Sciences				
Organismic age	Business				

ranking in the upper half on interest in the sciences, while those who rank in the lower half in reading age have 56 chances in 100 for ranking in the upper half on interest in the sciences. Finally, in the boys population, it can be seen that individuals who rank in the upper half on organismic age can expect to rank in the upper half on business interest 40 times out of 100, and those who rank in the lower half on reading age have 75 chances out of 100 for ranking in the upper half in business interest.

Girls population.--From Table XII is shown that individual girls who rank in the upper half on height age can expect to rank in the upper half on interest in the arts 58 times out of 100. Likewise, the chances of individuals who rank in the lower half on height age to rank in the upper half in interest in the arts are 89 times in 100. The chances for upper half ranking individuals in height age to rank in the upper half on business interest are 47 in 100, while those who rank in the lower half on height age can expect to rank only 6 times in 100 in the upper half in business interest. Finally, an individual girl ranking in the upper half in dental age may expect to rank in the upper half in business interest 40 times out of 100, and in the lower half on dental age 75 times in 100.

Total population.--Again, entering Table XII, it is noted that an individual in the total population who ranks in the upper half on reading age may expect to rank 44 times out of 100 in the upper half in natural interest. Those who rank in the lower reading age level can expect to rank in the upper half in natural interest 69 times in 100. For individuals ranking in the upper half in reading age, the chances are 78 times out of 100 that they will also rank in the upper half on interest in the sciences. However, individuals who are in

the lower half rank on reading age can only expect a 50-50 chance of placing in the upper half on interest in the sciences. An individual's chance for ranking in the upper half in natural interest, if he ranks in the upper half on weight age, is 44 times out of 100, but, if he ranks in the lower half on reading age he can expect to rank in the upper half on natural interest 67 times out of 100.

The expectancy for an individual who ranks in the upper half on mental age to rank in the upper half on interest in the sciences is 78 out of 100, but if he ranks in the lower mental age half he can expect to rank in the upper half on interest in the sciences only 49 times in 100. An individual's chances for ranking in the upper half on interest in the arts if he ranks in the upper half on height age are 47 out of 100, with a 67 in 100 chance if he ranks in the lower half on height age. An individual ranking in the upper half on grip age may expect to rank in the upper half on natural interest 44 times in 100, and with a lower half rank on grip age he will have 67 chances out of 100 to place in the upper half on natural interest. If he places in the upper half on grip age, his expectancies are 47 out of 100 that he will place in the upper half on interest in the arts, but if he places in the lower half rank on grip age the expectancies are 67 out of 100 that he will place in the upper half on interest in the arts.

Summary of analysis and interpretation of data relating to Subhypothesis III.--Chi square values within the established levels of significance are obtained for all growth variables, with the exception of carpal age and developmental age, in their relationship with one or more fields of interest variables. There are no significant chi square values obtained between growth variables and personal-social and mechanical fields of interest. The associated variables on which

significant chi squares are obtained are not equally distributed among the boys, girls, and total populations.

The degree of relatedness among the significantly associated variables is either positively or negatively substantial, as indicated by the phi coefficients of correlation.

The expectancy of an individual ranking in the upper half of a growth variable to rank a greater number of times in the upper half of the associated interest variable occurs in six of the fourteen pairs of associated variables, as found in all three populations. In eight instances an individual who ranks in the upper half of a growth variable can expect to rank an equal or greater number of times in the lower half of the associated interest variable.

Likewise, an individual who ranks in the lower half of a growth variable can expect to rank in the upper half of the associated interest variable in nine out of the fourteen pairs of associated variables. In the remaining five associated variables the expectancy is that an individual ranking in the lower half of the growth variable will rank equally with or in the lower half of the associated interest variable.

Subhypothesis IV: Certain Similarities and Differences of Relationship Between Growth Characteristics and Interest Factors Exist According to Sex

The total variables tested which relate to this subhypothesis are: growth factors--reading age, weight age, mental age, carpal age, height age, grip age, dental age, organismic age, and developmental age; fields of interests--personal-social, natural, mechanical, business, the arts, the sciences; types of interests--verbal, manipulative, computational; level of interest.

The variables used for determining similarities and differences by sex are those from which chi square values are obtained within the levels of confidence for at least one sex. The corresponding non-significant variables are also included as a means for comparison. These are the variables included in Table XIII.

In Table XIII are found the growth and interest variables with chi square values within the established limit of significance, for both boy and girl populations. These form the basis for selecting the variables on which to calculate the significance of difference between the distributions proportions in the contingency tables from which the above chi squares were obtained. These contingency tables are found in Table XIV.

Using the following formula,¹

$$t = \frac{[(a_1 d_1 - b_1 c_1) / (a_1 + b_1)(c_1 + d_1)] - [(a_2 d_2 - b_2 c_2) / (a_2 + b_2)(c_2 + d_2)]}{\sqrt{[a_1 b_1 / (a_1 + b_1)^3] + [c_1 d_1 / (c_1 + d_1)^3] + [a_2 b_2 / (a_2 + b_2)^3] + [c_2 d_2 / (c_2 + d_2)^3]}}$$

and entering an appropriate t table for significant values of t, results are obtained which indicate the significance of difference between the distribution proportions in a contingency table for two tables. These results are found in Table XV.

From Table XV it is observed that four t values are significant at the levels established for this study. For t values representing the proportional differences between sexes in height age and business interest, height age and science interest, and dental age and science interest, the probabilities are interpreted as being significant. In these instances the null hypothesis is rejected with

¹ Adapted for this study from basic formulas proposed by S. S. Wilks, Elementary Statistical Analysis (Princeton: Princeton University Press, 1951).

TABLE XIII

SIGNIFICANT AND NONSIGNIFICANT OBTAINED CHI SQUARES
ON GROWTH AND INTERESTS, BY SEX

Variable I	Variable II	Boys		Girls	
		χ^2	p	χ^2	p
Reading age	Natural	2.91	0.05- 0.10	0.24	0.50- 0.70
Reading age	Sciences	2.91	0.05- 0.10	1.40	0.20- 0.30
Reading age	Level	3.69	0.05- 0.10	1.24	0.20- 0.30
Mental age	Computational	3.69	0.05- 0.10	0.67	0.30- 0.50
Carpal age	Level	3.52	0.05- 0.10	0.05	0.80- 0.90
Height age	Business	1.40	0.20- 0.30	6.21	0.01- 0.02
Height age	Sciences	3.11	0.05- 0.10	0.76	0.30- 0.50
Height age	Arts	0.31	0.50- 0.70	3.07	0.05- 0.10
Organismic age	Business	3.90	0.02- 0.05	0.04	0.80- 0.90
Dental age	Sciences	1.46	0.20- 0.30	9.36	0.001- 0.01

TABLE XIV

CONTINGENCY TABLES FOR COMPARING THE DIFFERENCES OF
PROPORTIONS IN A CONTINGENCY TABLE BETWEEN
TWO CONTINGENCY TABLES

Boys	Girls
------	-------

Reading Age - Natural Interest

	L	U	
U	3 a	14 b	17 a+b
L	5 c	13 d	18 c+d
	8 a+c	27 b+d	

	L	U	
U	5 a	13 b	18 a+b
L	3 a+c	16 b+d	19 c+d
	8 a+c	29 b+d	

Reading Age - Science Interest

	L	U	
U	3 a	14 b	17 a+b
L	8 c	10 d	18 c+d
	11 a+c	24 b+d	

	L	U	
U	6 a	12 b	18 a+b
L	10 c	9 d	19 c+d
	16 a+c	21 b+d	

TABLE XIV--Continued

Boys

Girls

Reading Age - Interest Level

	L	U			L	U	
U	1 a	16 b	17 a+b		U	2 a	16 b 18 a+b
L	7 c	11 d	18 c+d		L	6 c	13 d 19 c+d
	8 a+c	27 b+d				8 a+c	29 b+d

Mental Age - Computational Interest

	L	U			L	U	
U	1 a	16 b	17 a+b		U	11 a	7 b 18 a+b
L	7 c	11 d	18 c+d		L	14 c	5 d 19 c+d
	8 a+c	27 b+d				25 a+c	12 b+d

Carpal Age - Interest Level

	L	U			L	U	
U	0 a	15 b	15 a+b		U	3 a	13 b 16 a+b
L	5 c	11 d	16 c+d		L	5 c	13 d 18 c+d
	5 a+c	26 b+d				8 a+c	26 b+d

TABLE XIV--Continued

Boys

Girls

Height Age - Business Interest

Boys			Girls		
L	U		L	U	
8 a	9 b	17 a+b	10 a	9 b	19 a+b
5 c	13 d	18 c+d	17 c	1 d	18 c+d
13 a+c	22 b+d		27 a+c	10 b+d	

Height Age - Science Interest

Boys			Girls		
L	U		L	U	
2 a	15 b	17 a+b	9 a	10 b	19 a+b
8 c	10 d	18 c+d	6 c	12 d	18 c+d
10 a+c	25 b+d		15 a+c	22 b+d	

Height Age - Interest in the Arts

Boys			Girls		
L	U		L	U	
11 a	6 b	17 a+b	8 a	11 b	19 a+b
10 c	8 d	18 c+d	2 c	16 d	18 c+d
21 a+c	14 b+d		10 a+c	27 b+d	

TABLE XIV--Continued

Boys

Girls

Organismic Age - Business Interest

	L	U			L	U	
U	9 a	6 b	15 a+b		U	13 a	5 b 18 a+b
L	4 c	12 d	16 c+d		L	12 c	4 d 16 c+d
	13 a+c	18 b+d				25 a+c	9 b+d

Dental Age - Science Interest

	L	U			L	U	
U	7 a	10 b	17 a+b		U	3 a	15 b 18 a+b
L	4 c	14 d	18 c+d		L	12 c	7 d 19 c+d
	11 a+c	24 b+d				15 a+c	22 b+d

TABLE XV

t VALUES OBTAINED FOR CALCULATING THE SIGNIFICANCE
OF DIFFERENCE IN PROPORTIONS

Boys and Girls Contingency Tables	t Values	p
Reading age - natural interest	0.74	0.50-0.60
Reading age - science interest	0.34	0.70-0.80
Reading age - interest level	0.69	0.60-0.70
Mental age - computational interest	1.02	0.40-0.50
Carpal age - interest level	1.20	0.40-0.50
Height age - business interest	2.99	0.01
Height age - science interest	2.20	0.05
Height age - arts interest	1.02	0.40-0.50
Organismic age - business interest	1.68	0.05-0.10
Dental age - science interest	3.13	0.01

confidence. The remaining t value, representing the proportional difference between sexes in organismic age and business interest, is accepted as relatively significant, and the null hypothesis is grudgingly discarded.

The t values for the remaining proportions are not within the limits of confidence, and the null hypothesis is therefore retained in all instances.

Summary of analysis and interpretation of data relating to Subhypothesis IV.--From the contingency tables on which significant chi square values are obtained for either boys or girls, t values are calculated to indicate differences in proportions in each table for boys as compared to the corresponding table for girls. Significant t values are found which indicate significant sex differences between height age and business interest, height age and science interest, organismic age and business interest, and dental age and science interest.

Similarities exist between each respective proportion within contingency tables for boys and girls in reading age and natural interest, science interest, and level of interest. Other similarities are noted in mental age and computational interest, carpal age and level of interest, and height age and arts interest.

Subhypothesis V: Certain Growth Characteristics Vary in Their Importance as Indicators of the Various Interest Factors

The total variables tested which relate to this subhypothesis are: growth factors--reading age, weight age, mental age, carpal age, height age, grip age, dental age, organismic age, and developmental age; interest fields--personal-social, natural, mechanical,

business, the arts, the sciences; interest types--verbal, manipulative, computational; level of interest.

In Table XVI are included all paired growth and interest variables from which chi square values within the established levels of significance are obtained.

In Table XVI are contained all the associated variables used in this study, with significant or relatively significant chi square values within outer limits of significance. By observation, a difference in frequency of occurrence is noted among the growth variables in their relationships to the various interest variables. If these frequencies of occurrences of the growth variables are ranked from the greatest to the least frequency by relative percentage, a gross estimate of comparison is obtained.

Table XVII presents the rank order of growth variables by relative percentage of frequency of occurrence in their relationship to the composite of all interest variables, interest fields, interest types, and interest level. It is noted that, in general, reading age leads all other growth variables in frequency of occurrence, followed in descending order by mental age, height age, weight age, carpal, grip, and organismic ages, and dental and developmental ages. Rankings of the growth variables for each category can be noted directly from Table XVII.

Another means for ranking the growth variables as they relate to the interest variables is in terms of the degree of significance of the association, as noted in Table XVIII.

In Table XVIII are found the rankings of the several growth variables as they relate to four categories of interest factors, according to the degree of significance of association.

The rank order of frequency of occurrence of growth variables at the high significance level for all four categories is: reading age;

TABLE XVI

SIGNIFICANT OBTAINED CHI SQUARES ON GROWTH AND
INTEREST FACTORS FOR ALL POPULATIONS

Variables I and II	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Reading age</u>						
Natural	2.91	0.05- 0.10			4.59	0.02- 0.05
Sciences	2.91	0.05- 0.10			6.02	0.01- 0.02
Computational . . .					2.72	0.05- 0.10
Level	3.69	0.05- 0.10			8.04	0.001- 0.01
<u>Weight age</u>						
Natural					3.60	0.05- 0.10
Computational . . .					5.57	0.01- 0.02
<u>Mental age</u>						
Sciences					6.93	0.001- 0.01
Computational . . .	3.69	0.05- 0.10			7.95	0.001- 0.01
<u>Carpal age</u>						
Level	3.52	0.05- 0.10			4.93	0.02- 0.05
<u>Height age</u>						
Arts			3.07	0.05- 0.10	2.78	0.05- 0.10
Business			6.21	0.01- 0.02		
Sciences	3.11	0.05- 0.10				

TABLE XVI--Continued

Variables I and II	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Grip age</u>						
Arts					2.78	0.05- 0.10
Natural					3.60	0.05- 0.10
<u>Dental age</u>						
Sciences			9.36	0.001- 0.01		
<u>Organismic age</u>						
Business	3.90	0.02- 0.05				
Computational . . .					3.45	0.05- 0.10
<u>Developmental age</u>						
Computational . . .					2.81	0.05- 0.10

TABLE XVII

RANK ORDER OF GROWTH VARIABLES ACCORDING TO FREQUENCY OF OCCURRENCE IN COMPOSITE, FIELDS, TYPES, AND INTEREST LEVEL CATEGORIES

Growth Variable	Frequency (pct.)
<u>Composite of All Interest Variables</u>	
Reading age	100
Height age	57
Mental age	42.8
Weight age	28.7
Carpal age	28.7
Grip age	28.7
Organismic age	28.7
Dental age	14.0
Developmental age	14.0
<u>Interest Fields</u>	
Reading age	100
Height age	100
Grip age	50
Mental age	25
Weight age	25
Organismic age	25
Dental age	25
<u>Interest Types</u>	
Mental age	100
Reading age	50
Weight age	50
Organismic age	25
Developmental age	25
<u>Interest Level</u>	
Reading age	100
Carpal age	100

TABLE XVIII

RANK ORDER OF GROWTH VARIABLES ACCORDING TO FRE-
QUENCY OF OCCURRENCE AT HIGH AND RELATIVE
SIGNIFICANCE LEVELS OF ASSOCIATION
WITH INTEREST VARIABLES

Relative Significance		High Significance	
Growth Variable	Fre- quency (pct.)	Growth Variable	Fre- quency (pct.)
<u>Composite of Interest Factors</u>			
Reading age	100	Reading age	100
Height age	75	Mental age	66
Growth age	50	Weight age	33
Weight age	25	Height age	33
Mental age	25	Dental age	33
Organismic age . . .	25	Organismic age . . .	33
Developmental age .	25		
<u>Interest Fields</u>			
Reading age	100	Reading age	100
Weight age	50	Height age	100
Height age	50	Mental age	50
Growth age	50	Dental age	50
		Organismic age . . .	50
<u>Interest Types</u>			
Reading age	100	Reading age	100
Mental age	100	Mental age	100
Organismic age . . .	100		
Developmental age .	100		
<u>Interest Level</u>			
Reading age	100	Reading age	100
Carpal age	100	Carpal age	100

height, weight, and mental ages; organismic and dental ages; carpal age; and grip and developmental ages.

The rank order of frequency of occurrence of growth variables at the relative significance level for all four categories is: reading age; height age; grip, organismic, and developmental ages; mental and carpal ages; weight age; and dental age.

Rank orders of the growth variables for each category can be directly observed from Table XVIII.

The foregoing analysis deals with the rank order of frequency of occurrence of growth variables in their association with the several interest variables, irrespective of boys, girls, and total population designation. The following analyses deal with these same rank order classifications as they appear in each of the three populations.

Total population.--In Table XIX is shown the rank order of growth variables, by relative percentage of frequency of occurrence in composite, field, type, and level of interest categories. The cumulative rank order of the growth variables irrespective of category is: reading age; weight and mental ages; grip age; carpal, organismic, and developmental ages; height age; and dental age. Rank orders for each category can be obtained directly from Table XIX.

Rankings of the several growth variables according to their frequency of association with interest variables by degree of significance are presented for the total population in Table XX.

In Table XX are found the rankings of the various growth variables as they relate to four categories of interest variables according to the degree of significance. In the category containing a high degree of significance for all interest variables, the rank order is: reading age; mental age; carpal age; weight age; and height, grip organismic, dental, and developmental ages.

TABLE XIX

RANK ORDER OF GROWTH VARIABLES IN THE TOTAL POPULATION ACCORDING TO FREQUENCY OF OCCURRENCE IN COMPOSITE, FIELDS, TYPES, AND INTEREST LEVEL CATEGORIES

Growth Variable	Frequency (pct.)
<u>Composite of All Interest Variables</u>	
Reading age	100
Weight age	50
Mental age	50
Growth age	50
Height age	25
Carpal age	25
Organismic age	25
Developmental age	25
<u>Interest Fields</u>	
Reading age	100
Growth age	100
Mental age	50
Weight age	50
Height age	50
<u>Interest Types</u>	
Reading age	100
Mental age	100
Weight age	100
Organismic age	100
Developmental age	100
<u>Interest Level</u>	
Reading age	100
Carpal age	100

TABLE XX

RANK ORDER OF GROWTH VARIABLES IN THE TOTAL POPULATION ACCORDING TO FREQUENCY OF OCCURRENCE AT HIGH AND RELATIVE SIGNIFICANCE LEVELS OF ASSOCIATION WITH INTEREST VARIABLES

Relative Significance		High Significance	
Growth Variable	Frequency (pct.)	Growth Variable	Frequency (pct.)
<u>Composite of All Interest Variables</u>			
Growth age	100	Reading age	100
Reading age	50	Mental age	66
Weight age	50	Weight age	33
<u>Interest Fields</u>			
Growth age	100	Reading age	100
Weight age	50	Mental age	50
Height age	50		
<u>Interest Types</u>			
Reading age	100	Reading age	100
Organismic age	50	Mental age	100
Developmental age	50		
<u>Interest Level</u>			
		Reading age	100
		Carpal age	100

In the category of relatively significant degree of association for all interest variables, the rank order is: reading age; grip age; height, weight, organismic, and developmental ages; and mental, carpal, and dental ages.

Boys population.--Entering Table XXI, the rank order of growth variables, by relative percentage of frequency of occurrence, is shown for each of four categories of interest variables. The cumulative rank order of the growth variables irrespective of category is: reading age; height age; mental age; organismic age; carpal age; and weight, grip, dental, and developmental ages. Rank orders of the growth variables in each category can be observed directly from Table XXI.

Entering Table XXII, the ranks of the various growth variables are indicated by relative percentage, according to their frequency of occurrence by degree of significance in relationship to interest variables.

The rank order of the growth variables for the total composite of all four categories in high significance is: organismic age; and reading, mental, height, carpal, weight, grip, dental, and developmental ages.

The rank order of the growth variables for the total composite of all four categories, in relative significance, is: reading age; carpal age; mental age; height age; and organismic, weight, grip, dental, and developmental ages. Rank orders of the growth variables in each category can be observed directly from Table XXII.

Girls population.--Since there are but two growth variables in the girls population, it can be directly observed that the rank order is: height age; and dental age. (see Table XXIII).

TABLE XXI

RANK ORDER OF GROWTH VARIABLES IN BOYS POPULATION
 ACCORDING TO FREQUENCY OF OCCURRENCE
 IN COMPOSITE FIELDS, TYPES, AND
 INTEREST LEVEL CATEGORIES

Growth Variable	Frequency (pct.)
<u>Composite of All Interest Variables</u>	
Reading age	100
Mental age	33
Height age	33
Carpal age	33
<u>Interest Fields</u>	
Reading age	100
Height age	50
Organismic age	50
<u>Interest Types</u>	
Mental age	100
<u>Interest Level</u>	
Reading age	100
Height age	100

TABLE XXII

RANK ORDER OF GROWTH VARIABLES IN BOYS POPULATION
 ACCORDING TO FREQUENCY OF OCCURRENCE AT HIGH
 AND RELATIVE SIGNIFICANCE LEVELS OF ASSO-
 CIATION WITH INTEREST VARIABLES

Relative Significance		High Significance	
Growth Variable	Fre- quency (pct.)	Growth Variable	Fre- quency (pct.)
<u>Composite of All Interest Variables</u>			
Reading age	100	Organismic age . . .	100
Mental age	33		
Carpal age	33		
Height age	33		
<u>Interest Fields</u>			
Reading age	100	Organismic age . . .	100
Height age	33		
<u>Interest Types</u>			
Mental age	100		
<u>Interest Level</u>			
Carpal age	100		

TABLE XXIII

RANK ORDER OF GROWTH VARIABLES IN GIRLS POPULATION
 ACCORDING TO FREQUENCY OF OCCURRENCE IN COM-
 POSITE, FIELDS, TYPES, AND INTEREST
 LEVEL CATEGORIES

Growth Variable	Frequency (pct.)
<u>Composite of All Interest Variables</u>	
Height age	100
Dental age	50
<u>Interest Fields</u>	
Height age	100
Dental age	50
<u>Interest Types</u>	
<u>Interest Level</u>	

Entering Table XXIV, it can be readily observed that height and dental ages are of equal rank in the categories of high significance, and the height age alone ranks in the categories of relative significance.

Summary of analyses and interpretation of data relating to

Subhypothesis V.--The growth factors are ranked according to their frequency of occurrence with a significantly associated interest factor. Several rankings are made according to the following categories of interest factors: composite of all interest variables, interest fields, interest types, levels of interest, and degree of significance for the three population groups.

From these several rankings, the following average rank pattern of frequency of occurrence is calculated for the growth variables: reading age; height age; mental age; carpal and organismic ages; weight age; grip age; dental age; and developmental age.

Summary

The original growth and interest data, grouped according to their relatedness to each of the subhypotheses, are processed by the use of the chi square test, phi correlation coefficient, expectancy tables, and the formula for comparing the significance of differences of proportions in a contingency table for two tables, which yields a t value.

The results obtained from this processing are analyzed for their statistical significance, where appropriate, according to the levels of confidence, or in terms of description correlation values, as established for this study.

TABLE XXIV

RANK ORDER OF GROWTH VARIABLES IN GIRLS POPULATION
 ACCORDING TO FREQUENCY OF OCCURRENCE AT HIGH
 AND RELATIVE SIGNIFICANCE LEVELS OF ASSO-
 CIATION WITH INTEREST VARIABLES

Relative Significance		High Significance	
Growth Variable	Fre- quency (pct.)	Growth Variable	Fre- quency (pct.)

Composite of All Interest Variables

Height age	100	Height age	100
		Dental age	100

Interest Fields

Height age	100	Height age	100
		Dental age	100

Interest Types

Interest Level

Finally, the data, which are organized into several tables, are interpreted and summarized in terms of their relationship to each of the five subhypotheses.

CHAPTER V

CONCLUSIONS, INTERPRETATIONS, AND RECOMMENDATIONS

The purpose of this chapter is fourfold in nature. In the first place, conclusions are drawn from the results of the investigation, as they relate to the theoretical concepts and hypotheses of this study. Second, the meanings and interpretations of these results are interpreted. Third, the significance and values of this study are evaluated as they relate to the furtherance of knowledge pertaining to the development of occupational interests in children. Fourth, certain proposals are advanced as suggestions for further investigation in this area.

The content of the chapter is organized around the following general areas: conclusions and their meanings and implications; contributions of the study; and recommendations for further investigation.

Conclusions and Their Meanings and Implications

As a prelude to a discussion of the conclusions and an analysis of their meanings and implications, it is advisable to advance certain generalizations which may apply to all the associated variables found in this study, over and above those which are unique to the several specific associations of variables. It is pointed out elsewhere in this study that each growth-in-age unit should be considered as an estimate of total growth, rather than as a separate measure of a discrete part of growth. Therefore, whenever a particular growth factor is

analyzed in terms of its relationship to an interest factor, it is assumed that its relatedness to the total growth complex of an individual is an influencing factor. When individuals rank in the upper half of their population on any one or all growth factors, it is indicative of a tendency towards "fast growing" and "early maturity" as contrasted to those who rank in the lower half of the same population. It is generally assumed that individuals who rank in the upper half of their population on these growth units may well develop a different perception of things in general, a different experience pattern, and, therefore, a different motivational or interest pattern than will those individuals who rank in the lower half of the same population on these growth units. A further assumption is that there are undoubtedly many unrecognized forces which affect individuals that are not specifically considered in this study. These forces may be associated with individuals' physical growth, achievement, motivations, and personality development, and so influence their occupational interest determination.

Within the findings and limitation of this study the following conclusions are advanced:

1. Individuals at 132 months of chronological age whose carpal development and reading achievement are above the average of their population tend to indicate occupational interests during their high school period which involve originality, inventiveness, careful planning, and professional skills.

2. Individuals at 132 months of chronological age whose carpal development and reading achievement are below the average of their population tend to reveal less interest than those who are above average during their high school period in occupations requiring originality, inventiveness, careful planning, and professional skills.

These findings provide some evidence in support of the hypothesis that a significant relationship exists between certain growth characteristics and interest level patterns.

3. Individuals at 132 months of chronological age who are above the average of their population in reading achievement, and mental, weight, and organismic ages, tend to be more interested in the computational area when they are in high school than do those individuals who are below the average of their population in these same growth factors.

4. These same individuals who, at 132 months of chronological age, are above the average of their population in developmental age disclose less interest in the computational area than do those whose developmental age is below the average of their population.

Such findings lend evidence in support of the hypothesis that there is a significant relationship between certain growth characteristics and patterns of interest type.

5. There is a tendency for individuals at 132 months of chronological age who are above the average of their population in reading achievement and mental age to indicate, at the high school level, a greater interest in the science field than do those individuals who are below the average of their population in these growth factors.

6. Individuals at 132 months of chronological age who rank in the upper half of their population in reading achievement and body weight indicate less interest, at the high school level, in the natural field than do those individuals who rank in the lower half of their population on these growth factors.

7. Individuals at 132 months of chronological age who rank in the upper half of their population in height indicate less interest, at the high school level, in the arts than do those who rank in the lower half of their population.

8. Individuals at 132 months of chronological age who rank in the upper half of their population in strength of grip indicate less interest, at the high school level, in the fields of natural interest and the arts than do those who rank in the lower half of their population.

These findings lend support to the hypothesis that a significant relationship exists between certain growth characteristics and fields of interest patterns.

9. Girls at 132 months of chronological age who are above the average height of their population tend to indicate a greater interest in the business field when they are in high school than do the boys who are above the average height for their population.

10. Boys at 132 months of chronological age who are above average height for their population exhibit more interest in the field of the sciences when they are in high school than do girls who are above average height for their population at the age of 132 months.

11. Girls at 132 months of chronological age whose dental age is above average for their population tend to evidence greater interest in the field of their sciences when they are in high school than do boys at the same chronological age who are above average in dental age for their population.

12. There are no significant sex differences revealed in this study between the following growth and interest variables: reading achievement and level of interest or interest in the natural and science fields; carpal development and level of interest; mental age and computational interest; and height age and interest in the arts.

These findings provide evidence in support of the hypothesis that there are certain similarities and differences of relationship between growth characteristics and interest factors, according to sex.

13. There are indications that reading age, height age, and mental age of individuals at 132 months of chronological age are more important indicators of occupational interest choices of individuals at high school age than are the carpal, organismic, weight, grip, dental, and developmental ages.

This offers slight evidence in support of the hypothesis that growth characteristics vary in their importance as indicators of the various interest factors.

Why should such associations of variables occur? A brief discussion of the possibilities for such occurrences follows.

It is noted that, in general, individuals who rank in the upper half of their population on reading age are more interested in the sciences, computational, and high level of interest areas than are those who rank in the lower half of the population. These higher ranking individuals are assumed to possess a greater amount of reading skills and comprehension than are those who are in the lower half. The occupations represented by these interest factors demand a high degree of reading comprehension and understanding, since they require competencies in research, experimentation, determination of cause-and-effect relationships, numerical calculations, and originality, as well as other skills and competencies on the professional level. Individuals with well-developed reading skills and comprehension have a greater opportunity to acquire more pleasant and meaningful experiences associated with these areas than do those individuals who possess lesser abilities in reading. Since there is a tendency to become motivated toward those things which one knows about, understands, and is able to do well, it is understandable why a positive relationship might obtain between reading age and interest in the sciences, computational, and high level of interest areas.

The field of natural interest bears some relationship to the field of interest in the sciences. However, the occupations represented by natural interest are generally characterized as requiring more of the routine and less-skilled activity than with the sciences. This is likewise true of the occupations represented by the lower level of interest area. In the findings of this study it is noted that there is a negative relationship between reading age and the natural interest field. Individuals who rank in the upper half of the population on reading age tend to be less interested in the natural field than do those who rank in the lower half of the population. Therefore, the assumption is advanced that this may be the result of a pattern of experience of individuals, in which certain motivations have developed in the same manner as described in the previous paragraph.

Reading age, as an achievement factor in the growth and development of individuals, has been shown to possess a positive relationship with the areas of computational interest, interest in the sciences, and high level of interest. Suggestions as to possible reasons for this relationship have been advanced. Further, it is found in this study that individuals who rank in the upper half of their population in mental age tend to evidence greater interest in the sciences and computational areas than do those individuals who rank in the lower half of their population in mental age. High mental age is a potential capacity measure of an individual's ability to perform satisfactorily in tasks requiring a high degree of verbal, computational, and abstract reasoning ability. While, in general, the correlation between mental age and reading test results is only 0.50, it is frequently observed that, barring certain environmental forces which tend to retard an individual's achievement in reading, those persons who rank high in mental age tend to rank high in reading skills and comprehension. Thus it seems reasonable to assume that

the conditions advanced as possible reasons for the positive relationship between reading age and interest in the sciences and computational areas likewise hold as plausible reasons for the positive relationship between mental age and interest in the computational and scientific areas. The less the potential ability an individual possesses for understanding and performing the tasks required in these areas, the greater the chance for encountering disappointing experiences which tend to lower his motivation or interest in these areas.

A reasonable explanation for the positive and negative relationships found in this study between reading or mental ages and the various interest factors appears easier to understand than are certain relationships noted between the strictly physical growth units and interest factors. This is no doubt due in part to the much greater fund of available knowledge concerning the nature and the role of intelligence and reading abilities in the growth, development, and adjustment of individuals. However, in this study it is assumed that each and all known and unknown growth units, including reading and mental ages, are considered as estimates of the total growth of individuals. It is further assumed that each growth unit is related to every other growth unit, and that, together, they constitute the basis for the growth and developmental patterns of individuals. Furthermore, each growth characteristic affects this growth and developmental pattern.

In this study it is found that individuals who are above the average of their population in weight tend to show less interest in the natural field than do those who are below the average of their population in weight. It is also noted that those individuals who are above the average of their population in weight tend to possess a greater interest in the computational area than do those who are below the average of their population in weight. Weight may be

interpreted as a reflection of heredity and/or the manner in which an individual is nurtured. It does not necessarily indicate bodily strength. In all instances it is assumed here that, in general, individuals who exceed the average weight of their population tend to show less expansive and rapid movement than do those who are below the average weight for their group. The occupations which are represented by the natural interest field require much movement and manual dexterity. Referring to the thesis already advanced that individuals tend to be motivated towards those things which they can do well, it is not inconceivable that the experience pattern of the above-average-weight individuals may indicate less-satisfactory achievement in tasks related to the natural field than with those who are below average in weight. This assumption tends to be reinforced when it is noted that the findings of this study indicate that those individuals who are above average weight tend to have greater interests in the computational area than do those who are below the average weight. The occupational requirements in this field demand far less expansive movement and bodily dexterity than those found in the natural field, dealing as they do with numerical calculations, particularly in the business and scientific fields, and to a much lesser degree in other occupational fields.

This study reveals a negative relationship between height age and interest in the arts. Those individuals who are above the average height for their population tend to be less interested in the field of the arts than do those who are below the average height. In general, height is an indication of skeletal growth. While the author has discovered no significant research regarding the relationship between rapid skeletal growth and motor coordination, it is frequently observed that individuals who grow rapidly in this respect are often ungainly and awkward in their movements, frequently displaying

hesitancy behavior. Occupations included in the arts field of interest require skills of self-expression and a high degree of eye-hand coordination. It seems fair to assume, therefore, that individuals who are insufficient in these skills may well have encountered in their experience pattern tasks which they have not been able to deal with satisfactorily. In such instances, a tendency to avoid these tasks and to seek others from which they can derive greater satisfactions may well establish their patterns of motivation or interest.

The findings of this study indicate that individuals who are above the average of their group in carpal development tend to show a higher level of interest than do those who are below the average of their group in this respect. Carpal age, like height age, is an indication of skeletal growth. It seems reasonable to assume that similar characteristics of behavior may be present here as were described for individuals who are above average height. Occupations related to a high level of interest require skills in careful planning, inventiveness, and professional competency. Furthermore, there are involved in these occupations the elements of deliberation, evaluation, and judgment, as contrasted with manual and self-expression skills. In such instances it seems reasonable to assume that individuals who may have tendencies toward awkwardness may find greater satisfactions and interest in these latter activity areas.

In this study a positive relationship is indicated between organismic age and computational interest. Organismic age is but a mathematical average of the various growth factors. It seems logical, therefore, to expect this average growth measure to reflect certain relationships observed between each or all of the various component growth units and interest factors. In this instance there are indications of relationships between several of the growth factors and computational interest. Thus the relationship which appears between

organismic age and computational interest may be indicative of the same kinds of relationships which exist between reading age, weight age, mental age, and computational interest.

The findings of this study indicate a negative relationship between individuals with high rank scores on grip age and interest scores in the field of the arts. By interpretation it would appear that individuals who develop bodily strength above the average of their group tend to be less interested in the arts than do those who possess less than average bodily strength for their group. Activities included in the arts field require, in part, a refinement and preciseness of movement and a high level of eye-hand coordination. It is suggested that there may be a tendency for individuals who possess above-average strength to find a greater degree of satisfaction in activities which demand force, power, and physical energy, rather than those which require precise and refined activities. By contrast, it is also suggested that individuals possessing less than average bodily strength may derive greater satisfactions in the refined precise activities than in those activities which require greater strength and power. It is understandable why unique occupational interest patterns may ensue from such experiences.

In this study a negative relationship is indicated between grip age scores in the upper half of the group and upper half interest scores in the natural field. There does not appear to the author any logical reason for this relationship. It is suggested that other growth units which may accompany grip age may contribute to this negative relationship. According to the general basis for interest derivation, that of satisfaction, it would be expected that individuals who rank high in grip age would tend to be more interested in the natural field than would those who rank low in grip age. The data in this study do not support this expectancy.

The upper half scores obtained on the Furfey and Sullivan scales for measuring developmental age in boys and girls, respectively, indicate a negative relationship between the upper half scores obtained by these boys and girls and their computational interests. It is noted in previous studies made on these tests of developmental age that little or no relationship to mental age is indicated. In this study it will be recalled that high mental age appears to bear an important positive relationship to high computational interest. Assuming, therefore, that this factor may bear weight in determining satisfactions for individuals in computational activities, it is understandable why scores obtained on developmental age may represent other factors than those pertaining to the derivation of computational interest.

Thus far certain suggestions have been advanced concerning the rationale for the occurrence of certain significant associations of growth and interest factors, irrespective of sex of the individuals in the population. Two significant associations occur which are unique to the population of boys, and two which are unique to the population of girls. These are, for boys, a positive relationship between height age and interest in the sciences and a negative relationship between organismic age and business interest. By interpretation, these findings suggest that boys who are above the average height of their group at 132 months of chronological age tend to be interested in the sciences when they are in high school. Likewise, boys who are above the average of their group in total growth at 132 months of chronological age tend not to be interested in the business field. It is interesting to speculate as to why such associations should emerge, in this study, only with the population of boys. As has been presented elsewhere, height age is an indication of skeletal growth. When a boy is above average height, at 132 months of age, he may tend to possess less coordination of bodily movements, and therefore become

attracted to activities which require a minimal amount of body coordination. Such activities involving detailed and precise calculations, analyses, and patience are associated with the field of the sciences. If this is true, then his experience history might conceivable show patterns of interest in those activities which he perceives he is better able to do than in others. This is not to assume that he may not enter some other field at a later period of growth, with interest and competency. It simply suggests that, if such a physical deviation is present in the early years, it may serve as a deterring factor in the development of interest in a particular field.

It is extremely difficult to suggest any specific explanation as to why boys who are above the average of their group in total growth should tend to be less interested in the field of business. It can only be proposed here that fast-growing boys may, because of the energy required for their rapid growth, tend to derive less satisfaction in those high energy-consuming activities which require a great amount of systematic thoroughness or calculation and routine, accompanied with a high degree of persuasive ability, analytical observation, and judgmental decisions. Nature tends to favor the use of energy of an organism for fulfillment of basic physical growth.

The two significant associations unique to the girls population are, first, a positive relationship between height age and interest in business, and, secondly, a positive relationship between dental age and interest in the sciences. By interpretation, the former indicates that girls who are above the average height of their population at 132 months of chronological age tend to be more interested in the field of business than do those girls in the same population who are below the average height for their group. In the latter instance, girls who are above the average of their population at 132 months of chronological age, in terms of the number of deciduous teeth

which have fallen out and the number of eruptions of the permanent teeth acquired, tend to be more interested in the sciences than do those girls who are less advanced in dental age.

As a plausible explanation for this height age-business interest association, it is suggested that girls who are above the average height of others of their same population may experience less satisfactions in personal-social activities which require a high degree of refinement in social and coordinated bodily skills, which carry a high cultural value for girls. They may thus find greater satisfactions in activities which require routine, systematic, and individual initiative skills, such as are associated with many business occupations open to girls. In such situations these girls may encounter less social competitiveness, and thereby derive greater feelings of security and satisfaction than they would experience in activities calling for a high degree of cultural and social skills.

It is interesting to speculate on the reason or reasons which may cause girls who mature earlier than the average of their group in tissue development, as indicated by early dentition, to show greater interest in the sciences than do those who mature at a slower rate in this respect. It is suggested that tissue development may be one of the more important indicators of total maturity and bodily integration. If such were the case, it would seem logical to assume that less conflict in the physical growth pattern is present, that less energy consumption is required for physical growth, and that the possibilities for greater personality integration at an early chronological age could conceivably take place. Such a person might, at an earlier age, possess greater freedom from the physical conflicts of "growing up" than might be experienced by those who are described as "split growers." This greater freedom could conceivably provide situations for these individuals in which earlier development of

personality traits of a more mature stature could affect their perceptions of things in general. In this instance, it is suggested that they may possess a greater accuracy of perceptions of relatedness and differences among things. It is understandable why such a quality as a high degree of inquisitiveness might thus become the basis for much of the behavior experience pattern. Occupations in the field of the sciences include activities related to research, experimentation, invention, determination of cause and effect, and controlled observation. Such activities for the person possessing a high degree of inquisitiveness might well provide satisfactions and motivations which would tend to direct a person to become interested in this field.

In conclusion, it is again emphasized that any suggestions advanced as possible reasons for the associations between any of the specific growth units and occupational interest factors must be considered within the context of the generalizations dealing with the total growth of individuals, as proposed in the early portion of this chapter.

Contributions of the Study

This study, which is exploratory in nature, has made the following contributions:

1. It provides some evidence that a relationship exists between the physical growth patterns of individuals and the development of their occupational interests. This suggests that a parallel development of all growth and personality factors, including interest, may be taking place in a continuing manner throughout the entire growth period of childhood and adolescence. While the findings are inconclusive, it suggests for counselors and others the possibilities for detection or indication of occupational interest patterns or tendencies in children at an early chronological age.

2. The findings point out that different interest patterns may exist between boys and girls. This suggests that personnel workers who interact with children in guidance settings may profitably give close attention to those growth factors which appear unique to either of the sexes, and for which there is shown some relationship in the development of their occupational interests.

3. Implied in the findings of the study, which indicates a developmental process in the emergence of occupational interest, is the suggestion that forced interest choice may be futile or damaging to a child.

4. The study tends to reinforce the several theories of occupational adjustment of which interest is a component part. It supports the developmental process concept which holds that interests stem in part from predetermining tendencies which serve to influence an individual to move towards or away from certain activities encountered in his experience pattern.

5. Finally, the study provides many suggestions for additional investigation in this area.

Recommendations for Further Investigation

The need for further investigation regarding the developmental aspects of occupational interests is brought into bold relief as a result of this study. An examination of the findings indicates many inconclusive and inadequate results in areas essential to an understanding of the evolvment of occupational interests as an integral part of total growth and personality development of individuals. While certain relationships among growth factors and interest choice areas are indicated in this study, much more conclusive information is needed before a practical application of the developmental theory of interests

can be used in the guidance process with pupils. Accordingly, certain suggestions are made for further investigation. A longitudinal study of possible emerging occupational interest patterns of individual boys and girls in relation to their unique growth and personality developmental patterns might conceivably result in findings of extreme value for counseling purposes. This approach would be consistent with the concept of the "law of the case," as a basis for studying growth and development, as contrasted to the population-norm approach used in this study. Such an investigation might include the study and interpretation of ways in which a child's pre-occupation with various play activities may be transformed into occupational interests at the adolescent level. Another approach would be to study the child's approval or disapproval reactions to his various experiences over a long period of time in growth, as they may relate to occupational interest choices made at the adolescent period.

A greater significance and meaning of relationships between growth-in-age units and occupational interest areas might be obtained in a study which would provide for control of intelligence and other possible variables.

It is further suggested that an investigation of relationships between growth and occupational interest variables might yield more-conclusive results if it were conducted on a larger population than the one used in this study. Furthermore, a population which possesses a greater homogeneity of chronological age at the time interests are sampled might yield more-significant results than the one used in this study, which extended over four years in high school.

For a study dealing with the relationship between growth and occupational interest factors, the suggestion is made that the population might be divided into segments which approach homogeneity of

of background experience identified with the dominant occupations of parents and the community in which they live; i.e., industrial, agricultural, professional, business, et cetera.

Productive findings might be obtained if individuals were arranged into categories of fast and slow growers, as correlated variables to their occupational interests and their ultimate occupational choices.

It is also suggested that a control be set up for identifying occupational interests of individuals which stem from free choices as against forced choices, or highly influenced choices. A population identified with free interest choice would conceivably constitute a better basis for measuring possible relationships between growth factors and interest choices.

An analysis of the common basic skills and competencies required by the occupations included in the various fields, types, levels, or other categories of occupational interests might reveal basic interest determinants more closely identified with emerging behavior patterns. The use of these occupational "interest elements" rather than interest categories as variables for measuring association with the growth variables might show important relationships which are not otherwise revealed.

A study which would include several samplings of occupational interest for the population of individuals at successive chronological ages would provide a pattern of interests for indications of relationships with their growth units. A follow-up study on occupational choices made by individuals in populations from which results of growth-in-age unit - occupational interest relatedness have been obtained would tend to add validity to such findings.

It is further recommended that attention be given to the development of techniques and instruments which might provide evidence

of occupational interest patterns at various earlier chronological ages than is the case of those now available.

Finally, the suggestion is advanced that the use of interest inventory instruments other than the Lee-Thorpe be employed, to obtain interest variables which might be tested for their association with growth units in a fashion similar to this study.

Summary

Certain generalizations and assumptions have been proposed which establish a framework of reference applying to all apparent relatedness of growth and interest factors noted in this study. Within this framework of reference, tentative explanations have been advanced for the associations of specific growth and interest variables, from which thirteen conclusions have been drawn. These conclusions lend limited support to the several hypotheses on which the study is based. It is pointed out that this study reinforces the developmental process theory of occupational adjustment, of which interest is a component part, and calls attention to its implications for guidance workers. Finally, several suggestions are made for further exploration and investigation into the area of occupational interest development.

Recapitulation

The general purpose of this study was to make inquiry into probable relationships which may exist between aspects of growth of youth and the evolvment of their occupational interests.

The several theories, suggestions, and results of very limited investigation in this area, as noted in the review and analysis of

related literature, established the frame of reference and rationale on which this investigation was launched.

Data on growth-in-age units and developmental age were procured from a population of thirty-five boys and thirty-seven girls at the chronological age of 132 months. Data on the occupational interest choices of this same population at the high school level were obtained by means of an occupational interest inventory.

The above-mentioned data contained several pairs of growth and interest variables which were tested by appropriate statistical methods for indications of relationship. Chi square values, phi coefficients of correlation, expectancy tables, t values for significance of difference, and rank order patterns, when appropriate, were calculated for the several variables. The obtained results were analyzed, interpreted, and summarized as they related to each of the five sub-hypotheses of the study.

An analysis of the findings, presented in the form of conclusions, indicated that certain significant relationships exist between growth-in-age units and occupational interest choices of individuals. It is therefore concluded that there are relationship tendencies between the growth and interest factors of the population on which this study is based.

However, it should be pointed out that these findings were subject to limitations, and are considered inconclusive for general acceptance and use in practice. Nevertheless, evidence was found to support the major hypothesis of this study, that there is a significant relationship between certain measures of growth of children and their patterns of vocational interest.

Finally, several proposals for further research in this area were indicated.

APPENDIXES

APPENDIX A

ORIGINAL OCCUPATIONAL INTEREST DATA ON BOYS

APPENDIX A

ORIGINAL OCCUPATIONAL INTEREST DATA ON BOYS
(in percentiles)

Indi- vid- ual	Per- sonal- So- cial	Nat- ural	Me- chan- ical	Busi- ness	Arts	Sci- ences	Ver- bal	Ma- nip- ula- tive	Com- puta- tional	Level
<u>Grade 9</u>										
1	90	10	70	90	70	1	80	30	60	50
2	10	1	20	80	90	90	40	80	90	80
3	90	10	90	90	10	20	80	10	50	30
4	30	90	10	40	40	80	80	50	50	90
5	70	60	20	20	80	70	40	40	10	80
6	70	40	20	40	90	30	90	60	20	90
7	60	80	30	50	40	30	50	50	20	20
8	30	1	90	70	40	70	50	60	50	80
9	10	99	30	10	80	50	1	20	20	50
10	70	99	20	60	10	20	20	1	30	10
11	20	20	60	90	30	50	70	50	90	30
12	60	60	60	50	30	40	40	20	60	70
13	70	20	20	80	80	40	90	30	80	80
14	60	90	10	20	70	50	50	40	50	80
15	90	10	70	80	50	30	50	1	70	20
<u>Grade 10</u>										
16	90	10	30	30	60	80	60	10	70	90
17	1	60	80	40	30	90	1	90	70	60
18	50	40	40	40	30	90	70	10	50	60

APPENDIX A--Continued

Individual	Personal-Social	Natural	Mechanical	Business	Arts	Sciences	Verbal	Manipulative	Computational	Level
19	99	10	10	80	20	80	60	10	90	80
20	70	10	80	50	30	70	70	50	50	60
<u>Grade 11</u>										
21	99	10	30	50	70	30	90	70	50	80
22	50	50	50	60	20	60	40	50	60	90
23	30	70	50	60	30	50	40	30	60	80
24	90	40	30	10	20	90	60	40	30	20
25	20	40	60	80	20	60	40	10	50	50
26	40	20	70	60	30	80	80	70	60	70
27	99	80	10	10	50	30	99	40	1	50
28	20	10	70	80	20	99	30	90	90	30
29	50	40	90	10	60	50	20	99	10	90
30	50	10	20	80	40	90	70	50	80	60
31	80	10	50	60	40	80	80	30	50	40
<u>Grade 12</u>										
32	30	20	50	90	10	90	40	50	90	90
33	99	10	1	80	90	10	90	10	80	70
34	60	40	40	30	70	50	50	20	50	50
35	80	20	60	30	20	90	50	40	60	90

APPENDIX B

ORIGINAL OCCUPATIONAL INTEREST DATA ON GIRLS

APPENDIX B

ORIGINAL OCCUPATIONAL INTEREST DATA ON GIRLS
(in percentiles)

Indi- vid- ual	Per- sonal- So- cial	Nat- ural	Me- chan- ical	Busi- ness	Arts	Sci- ences	Ver- bal	Ma- nip- ula- tive	Com- puta- tional	Level
<u>Grade 9</u>										
1	80	90	10	99	30	1	70	10	30	20
2	80	20	60	50	60	40	60	30	60	20
3	1	90	70	10	99	50	10	50	50	80
4	50	30	50	40	90	50	50	50	80	70
5	80	50	60	30	40	50	50	30	10	30
6	20	10	60	20	70	99	20	80	80	90
7	50	80	70	10	80	20	20	50	1	80
8	50	60	50	40	70	30	90	1	40	90
9	50	90	20	10	50	80	10	50	10	30
10	60	80	30	20	90	30	20	80	20	40
11	70	30	10	70	80	30	99	50	50	30
12	10	50	10	50	70	99	50	40	80	60
13	20	20	30	30	99	99	80	40	40	90
14	70	20	20	70	70	20	30	40	60	50
15	80	20	30	90	30	60	80	40	90	80
16	70	90	10	50	30	50	20	30	40	40
<u>Grade 10</u>										
17	70	99	90	1	10	30	10	60	1	20
18	80	90	30	60	1	30	50	40	50	60

APPENDIX B--Continued

Individual	Personal-Social	Natural	Mechanical	Business	Arts	Sciences	Verbal	Manipulative	Computational	Level
19	90	60	10	40	60	20	50	50	20	90
20	50	90	20	20	80	10	60	40	50	80
21	90	90	40	1	30	90	20	40	1	70
22	10	60	60	60	60	50	20	60	30	60
23	60	80	20	20	80	30	70	30	10	90
24	60	60	10	30	60	50	60	40	20	70
25	60	80	40	30	80	10	30	40	20	80
26	90	90	20	20	70	1	50	50	10	70
27	60	99	10	1	20	90	20	50	10	90
28	50	80	30	1	90	60	50	50	1	50
<u>Grade 11</u>										
29	90	90	60	10	30	80	40	40	10	60
30	40	80	20	1	90	70	40	40	30	90
31	1	10	80	80	90	50	10	40	70	80
32	70	90	10	1	80	60	50	40	1	99
33	80	80	10	10	60	60	80	30	10	90
34	50	80	60	1	70	70	10	10	20	99
<u>Grade 12</u>										
35	80	50	50	10	90	40	70	50	1	70
36	80	90	80	10	1	70	20	70	30	90
37	70	60	40	40	50	50	40	80	40	90

APPENDIX C

GROWTH AND DEVELOPMENTAL AGE DATA ON BOYS

APPENDIX C

GROWTH AND DEVELOPMENTAL AGE DATA ON BOYS
AT 132 MONTHS CHRONOLOGICAL AGE

Indi- vid- ual	Read- ing Age	Weight Age	Men- Tal Age	Car- pal Age	Height Age	Grip Age	Den- tal Age	Organ- ismic Age	Fur- fey	Sulli- van
<u>Grade 9</u>										
1	111	146	188	129	144	123	126	138	114	
2	190	138	192	-	143	97	107	-	124	
3	129	139	132	-	144	146	107	-	97	
4	191	156	188	122	153	157	122	156	-	
5	185	195	170	138	150	125	149	159	85	
6	98	144	167	139	130	153	113	135	91	
7	108	102	150	96	114	128	128	118	-	
8	182	137	174	140	134	106	126	143	149	
9	134	104	153	108	111	139	116	124	104	
10	117	138	138	-	142	149	143	-	120	
11	139	147	173	134	149	130	150	146	78	
12	115	140	154	108	136	95	133	126	82	
13	111	152	166	138	132	136	135	139	106	
14	116	115	176	120	130	120	123	129	110	
15	143	171	160	-	147	147	130	-	116	
<u>Grade 10</u>										
16	169	178	201	141	149	153	119	159	121	
17	148	149	202	146	151	148	140	155	117	
18	191	155	184	150	151	145	107	155	140	
19	216	172	228	148	172	166	144	178	109	
20	191	148	208	118	127	137	119	150	132	

APPENDIX C--Continued

Indi- vid- ual	Read- ing Age	Weight Age	Men- tal Age	Car- pal Age	Height Age	Grip Age	Den- tal Age	Organ- ismic Age	Fur- fey	Sulli- van
<u>Grade 11</u>										
21	191	182	223	137	143	162	132	167	106	
22	150	153	193	168	160	161	107	156	131	
23	145	117	178	128	142	134	125	138	110	
24	150	125	146	100	116	144	118	128	114	
25	158	152	168	144	150	150	110	147	99	
26	163	114	172	130	141	139	146	144	113	
27	162	172	181	144	157	155	138	158	122	
28	191	150	246	119	152	149	144	164	133	
29	167	144	170	139	134	148	140	149	132	
30	191	190	192	150	148	151	107	161	102	
31	142	142	178	132	148	141	116	143	140	
<u>Grade 12</u>										
32	133	152	170	144	126	121	159	144	127	
33	163	155	150	126	146	171	107	145	146	
34	170	152	184	144	155	152	145	157	123	
35	161	166	183	137	154	162	144	158	129	
N	35	35	35	31	35	35	35	31	33	

APPENDIX D

GROWTH AND DEVELOPMENTAL AGE DATA ON GIRLS

APPENDIX D

GROWTH AND DEVELOPMENTAL AGE DATA ON GIRLS
AT 132 MONTHS CHRONOLOGICAL AGE

Indi- vid- ual	Read- ing Age	Weight Age	Men- tal Age	Car- pal Age	Height Age	Grip Age	Den- tal Age	Organ- ismic Age	Fur- fey	Sulli- van
<u>Grade 9</u>										
1	122	146	158	144	149	156	121	142		141
2	127	115	160	126	120	112	103	123		124
3	191	135	188	132	129	148	117	148		124
4	170	120	172	127	144	124	128	141		131
5	125	127	133	131	132	112	126	126		132
6	191	123	173	146	136	102	137	144		99
7	114	186	205	156	170	160	144	162		146
8	170	120	172	127	144	124	128	141		131
9	186	147	180	155	135	135	136	153		115
10	152	123	162	133	132	118	111	133		128
11	191	155	199	132	157	144	138	159		130
12	144	167	162	144	157	134	156	152		93
13	191	105	211	120	135	132	149	149		119
14	111	204	165	144	177	142	146	155		124
15	192	162	216	152	182	168	134	172		160
16	106	127	130	135	146	138	125	129		117
<u>Grade 10</u>										
17	127	151	143	147	151	166	116	147		157
18	182	136	169	-	145	135	117	-		151
19	108	133	156	144	150	152	124	138		139
20	182	99	181	109	109	106	122	130		149

APPENDIX E

FORMS USED FOR COMPARING GROWTH AND
DEVELOPMENTAL AGE DATA

[illegible]

[illegible]

[illegible]

APPENDIX F

SIGNIFICANT CHI SQUARES AND EXPECTANCIES OBTAINED

SIGNIFICANT CHI SQUARES AND EXPECTANCIES OBTAINED

χ^2 , Method of Calculation, McNemar, Psychological Statistics, p. 200
 Expectancy, Method of Calculation, Psychological Corp., Test Service
 Bulletin, December, 1949

Sex BOYS

GROWTH FACTOR	INTEREST FACTOR		
	NATURAL		
READING Age	Lower Half	Upper Half	Totals
Upper Half	A 14	B 3	(A+B) 17
Lower Half	C 10	D 8	(C+D) 18
Totals	(A+C) 24	(B+D) 11	(A+B+C+D) N 35

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{2.91}$$

df = 1 p = 0.05 < p < 0.10

Expectancies

%A 82 %B 18 %C 56 %D 44

GROWTH FACTOR	INTEREST FACTOR		
	LEVEL		
READING Age	Lower Half	Upper Half	Totals
Upper Half	A 1	B 16	(A+B) 17
Lower Half	C 7	D 11	(C+D) 18
Totals	(A+C) 8	(B+D) 27	(A+B+C+D) N 35

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{3.69}$$

df = 1 p = 0.05 < p < 0.10

Expectancies

%A 6 %B 94 %C 39 %D 61

SIGNIFICANT CHI SQUARES AND EXPECTANCIES OBTAINED

χ^2 , Method of Calculation, McNemar, Psychological Statistics, p. 200
 Expectancy, Method of Calculation, Psychological Corp., Test Service
 Bulletin, December, 1949

Sex BOYS

GROWTH FACTOR	INTEREST FACTOR		
	SCIENCES		
READING Age	Lower Half	Upper Half	Totals
Upper Half	A 3	B 14	(A+B) 17
Lower Half	C 8	D 10	(C+D) 18
Totals	(A+C) 11	(B+D) 24	(A+B+C+D) N 35
$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{2.91}$			
df = 1			
p = <u>0.05 < p < 0.10</u>			
Expectancies			
%A	18	%B 82	%C 44 %D 56

GROWTH FACTOR	INTEREST FACTOR		
	COMPUTATIONAL		
<i>MENTAL</i> Age	Lower Half	Upper Half	Totals
Upper Half	A 1	B 16	(A+B) 17
Lower Half	C 7	D 11	(C+D) 18
Totals	(A+C) 8	(B+D) 27	(A+B+C+D) N 35

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{3.69}$$

df = 1

SIGNIFICANT CHI SQUARES AND EXPECTANCIES OBTAINED

χ^2 , Method of Calculation, McNemar, Psychological Statistics, p. 200
 Expectancy, Method of Calculation, Psychological Corp., Test Service
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Sex BOYS

GROWTH FACTOR	INTEREST FACTOR		
	LEVEL		
CARPAL Age	Lower Half	Upper Half	Totals
Upper Half	A 0	B 15	(A+B) 15
Lower Half	C 5	D 11	(C+D) 16
Totals	(A+C) 5	(B+D) 26	(A+B+C+D) N 31

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{3.52}$$

df = 1

p = 0.05 < p < 0.10

Expectancies

%A 0 %B 100 %C 31 %D 69

GROWTH FACTOR	INTEREST FACTOR		
	SCIENCES		
HEIGHT Age	Lower Half	Upper Half	Totals
Upper Half	A 2	B 15	(A+B) 17
Lower Half	C 8	D 10	(C+D) 18
Totals	(A+C) 10	(B+D) 25	(A+B+C+D) N 35

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = 3.11$$

df = 1

SIGNIFICANT CHI SQUARES AND EXPECTANCIES OBTAINED

χ^2 , Method of Calculation, McNemar, Psychological Statistics, p. 200
 Expectancy, Method of Calculation, Psychological Corp., Test Service
 Bulletin, December, 1949

 Sex BOYS

GROWTH FACTOR	INTEREST FACTOR		
	BUSINESS		
ORGANISMIC Age	Lower Half	Upper Half	Totals
Upper Half	A 9	B 6	(A+B) 15
Lower Half	C 4	D 12	(C+D) 16
Totals	(A+C) 13	(B+D) 18	(A+B+C+D) N 31

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{3.90}$$

df = 1

p = 0.02 < p < 0.05

Expectancies

%A 60 %B 40 %C 25 %D 75

GROWTH FACTOR	INTEREST FACTOR		
Age	Lower Half	Upper Half	Totals
Upper Half	A	B	(A+B)
Lower Half	C	D	(C+D)
Totals	(A+C)	(B+D)	(A+B+C+D) N
$\chi^2 = \frac{(AD-EC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{\hspace{2cm}}$			
df = 1 p = <u> </u>			
Expectancies			
%A <u> </u>	%B <u> </u>	%C <u> </u>	%D <u> </u>

Sex *GIRLS*

GROWTH FACTOR		INTEREST FACTOR		
		BUSINESS		
HEIGHT	Age	Lower Half	Upper Half	Totals
Upper Half	A	10	B 9	(A+B) 19
Lower Half	C	17	D 1	(C+D) 18
Totals		(A+C) 27	(B+D) 10	(A+B+C+D) N 37

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{6.21}$$

df = 1

p = 0.01 < p < 0.02

Expectancies

%A 53 %B 47 %C 94 %D 6

GROWTH FACTOR	INTEREST FACTOR		
	ARTS		
HEIGHT Age	Lower Half	Upper Half	Totals
Upper Half	A 8	B 11	(A+B) 19
Lower Half	C 2	D 16	(C+D) 18
Totals	(A+C) 10	(B+D) 27	(A+B+C+D) N 37

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{3.07}$$

df = 1

p = 0.05 < p < 0.10

Expectancies

%A 42 %B 58 %C 11 %D 89

SIGNIFICANT CHI SQUARES AND EXPECTANCIES OBTAINED

χ^2 , Method of Calculation, McNemar, Psychological Statistics, p. 200
 Expectancy, Method of Calculation, Psychological Corp., Test Service
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Sex GIRLS

GROWTH FACTOR	INTEREST FACTOR		
	SCIENCES		
DENTAL Age	Lower Half	Upper Half	Totals
Upper Half	A 3	B 15	(A+B) 18
Lower Half	C 12	D 7	(C+D) 19
Totals	(A+C) 15	(B+D) 22	(A+B+C+D) N 37

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{9.36}$$

df = 1

p = 0.001 < p < 0.01

Expectancies

%A 17 %B 83 %C 63 %D 37

GROWTH FACTOR	INTEREST FACTOR		
Age	Lower Half	Upper Half	Totals
Upper Half	A	B	(A+B)
Lower Half	C	D	(C+D)
Totals	(A+C)	(B+D)	(A+B+C+D) N

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{\hspace{2cm}}$$

df = 1 p =

SIGNIFICANT CHI SQUARES AND EXPECTANCIES OBTAINED

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Sex TOTAL POPULATION

GROWTH FACTOR	INTEREST FACTOR		
	LEVEL		
<i>CARPAL</i> Age	Lower Half	Upper Half	Totals
Upper Half	A 3	B 28	(A+B) 31
Lower Half	C 11	D 23	(C+D) 34
Totals	(A+C) 14	(B+D) 51	(A+B+C+D) N 65

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{4.93}$$

df = 1

GROWTH FACTOR	INTEREST FACTOR		
	NATURAL		
GRIP Age	Lower Half	Upper Half	Totals
Upper Half	A 20	B 16	(A+B) 36
Lower Half	C 12	D 24	(C+D) 36
Totals	(A+C) 32	(B+D) 40	(A+B+C+D) N 72

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = 3.60$$

df = 1

$$p = 0.05 < p < 0.10$$

Expectancies

%A 56

%B 44

%C 33

%D 67

SIGNIFICANT CHI SQUARES AND EXPECTANCIES OBTAINED

χ^2 , Method of Calculation, McNemar, Psychological Statistics, p. 200
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Sex TOTAL POPULATION

GROWTH FACTOR	INTEREST FACTOR		
	ARTS		
HEIGHT Age	Lower Half	Upper Half	Totals
Upper Half	A 19	B 17	(A+B) 36
Lower Half	C 12	D 24	(C+D) 36
Totals	(A+C) 31	(B+D) 41	(A+B+C+D) N 72

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{2.78}$$

df = 1

p = 0.05 < p < 0.10

Expectancies

%A 53 %B 47 %C 33 %D 67

GROWTH FACTOR	INTEREST FACTOR		
	ARTS		
GRIP Age	Lower Half	Upper Half	Totals
Upper Half	A 19	B 17	(A+B) 36
Lower Half	C 12	D 24	(C+D) 36
Totals	(A+C) 31	(B+D) 41	(A+B+C+D) N 72

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = 2.78$$

df = 1

p = 0.05 < p < 0.10

Expectancies

%A 53

%B 47

%C 33

%D 67

SIGNIFICANT CHI SQUARES AND EXPECTANCIES OBTAINED

χ^2 , Method of Calculation, McNemar, Psychological Statistics, p. 200
 Expectancy, Method of Calculation, Psychological Corp., Test Service
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Sex _____ TOTAL POPULATION _____

GROWTH FACTOR	INTEREST FACTOR		
	NATURAL		
READINGAge	Lower Half	Upper Half	Totals
Upper Half	A 20	B 16	(A+B) 36
Lower Half	C 11	D 25	(C+D) 36
Totals	(A+C) 31	(B+D) 41	(A+B+C+D) N 72
$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{4.59}$			
df = 1			
p = <u>0.02 < p < 0.05</u>			
Expectancies			
%A	56	%B 44	%C 31 %D 69

GROWTH FACTOR	INTEREST FACTOR		
	COMPUTATIONAL		
READING Age	Lower Half	Upper Half	Totals
Upper Half	A 14	B 22	(A+B) 36
Lower Half	C 21	D 15	(C+D) 36
Totals	(A+C) 35	(B+D) 37	(A+B+C+D) N 72

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{2.72}$$

df = 1

Expectancies

p = 0.05 < p < 0.10

%A 39 %B 61 %C 58 %D 42

SIGNIFICANT CHI SQUARES AND EXPECTANCIES OBTAINED

χ^2 , Method of Calculation, McNemar, Psychological Statistics, p. 200
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 Sex TOTAL POPULATION

GROWTH FACTOR	INTEREST FACTOR		
	SCIENCES		
READING Age	Lower Half	Upper Half	Totals
Upper Half	A 8	B 28	(A+B) 36
Lower Half	C 18	D 18	(C+D) 36
Totals	(A+C) 26	(B+D) 46	(A+B+C+D) N 72
$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{6.02}$			
df = 1			
p = <u>0.01 < p < 0.02</u>			
Expectancies			
%A	22	%B 78	%C 50 %D 50

GROWTH FACTOR	INTEREST FACTOR		
	LEVEL		
READING Age	Lower Half	Upper Half	Totals
Upper Half	A 3	B 33	(A+B) 36
Lower Half	C 13	D 23	(C+D) 36
Totals	(A+C) 16	(B+D) 56	(A+B+C+D) N 72

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = 8.04$$

df = 1

SIGNIFICANT CHI SQUARES AND EXPECTANCIES OBTAINED

χ^2 , Method of Calculation, McNemar, Psychological Statistics, p. 200
 Expectancy, Method of Calculation, Psychological Corp., Test Service
 Bulletin, December, 1949

Sex TOTAL POPULATION

GROWTH FACTOR	INTEREST FACTOR		
	NATURAL		
WEIGHT Age	Lower Half	Upper Half	Totals
Upper Half	A 20	B 16	(A+B) 36
Lower Half	C 12	D 24	(C+D) 36
Totals	(A+C) 32	(B+D) 40	(A+B+C+D) N 72
$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{3.60}$			
df = 1			
p = <u>0.05 < p < 0.10</u>			
Expectancies			
%A	56	%B 44	%C 33 %D 67

GROWTH FACTOR	INTEREST FACTOR		
	SCIENCES		
MENTAL Age	Lower Half	Upper Half	Totals
Upper Half	A 8	B 29	(A+B) 37
Lower Half	C 18	D 17	(C+D) 35
Totals	(A+C) 26	(B+D) 46	(A+B+C+D) N 72

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{6.93}$$

df = 1

p = 0.001 < p < 0.01

Expectancies

%A 22 %B 78 %C 51 %D 49

SIGNIFICANT CHI SQUARES AND EXPECTANCIES OBTAINED

χ^2 , Method of Calculation, McNemar, Psychological Statistics, p. 200
 Expectancy, Method of Calculation, Psychological Corp., Test Service
 Bulletin, December, 1949

Sex TOTAL POPULATION

GROWTH FACTOR	INTEREST FACTOR		
	COMPUTATIONAL		
WEIGHT Age	Lower Half	Upper Half	Totals
Upper Half	A 12	B 24	(A+B) 36.
Lower Half	C 22	D 14	(C+D) 36
Totals	(A+C) 34	(B+D) 38	(A+B+C+D) N 72

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{5.57}$$

df = 1

p = 0.01 < p < 0.02

Expectancies

%A 33 %B 67 %C 61 %D 39

GROWTH FACTOR	INTEREST FACTOR		
	COMPUTATIONAL		
<i>MENTAL</i> Age	Lower Half	Upper Half	Totals
Upper Half	A 11	B 26	(A+B) 37
Lower Half	C 22	D 13	(C+D) 35
Totals	(A+C) 33	(B+D) 39	(A+B+C+D) N 72

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = 7.95$$

df = 1

p = 0.001 < p < 0.01

Expectancies

%A 30 %B 70 %C 63 %D 37

SIGNIFICANT CHI SQUARES AND EXPECTANCIES OBTAINED

χ^2 , Method of Calculation, McNemar, Psychological Statistics, p. 200
 Expectancy, Method of Calculation, Psychological Corp., Test Service
 Bulletin, December, 1949

Sex TOTAL POPULATION

GROWTH FACTOR	INTEREST FACTOR		
	COMPUTATIONAL		
ORGANISMIC Age	Lower Half	Upper Half	Totals
Upper Half	A 12	B 21	(A+B) 33
Lower Half	C 19	D 13	(C+D) 32
Totals	(A+C) 31	(B+D) 34	(A+B+C+D) N 65
$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{3.45}$			
df = 1			
p = <u>0.05 < p < 0.10</u>			
Expectancies			
%A 36	%B 64	%C 59	%D 41

GROWTH FACTOR	INTEREST FACTOR		
	COMPUTATIONAL		
DEVELOPMENTAL Age	Lower Half	Upper Half	Totals
Upper Half	A 20	B 15	(A+B) 35
Lower Half	C 13	D 22	(C+D) 35
Totals	(A+C) 33	(B+D) 37	(A+B+C+D) N 70

$$\chi^2 = \frac{(AD-BC)^2 N}{(A+C)(B+D)(A+B)(C+D)} = \underline{2.81}$$

df = 1

p = 0.05 < p < 0.10

Expectancies

%A 57 %B 43 %C 37 %D 63

APPENDIX G

SUMMARY OF ALL CHI SQUARES OBTAINED

APPENDIX G

SUMMARY OF ALL CHI SQUARES OBTAINED
IRRESPECTIVE OF SIGNIFICANCE LEVEL

Interest Factor	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Reading Age</u>						
Personal-social	0.06	0.80- 0.90	0.84	0.30- 0.50	1.18	0.20- 0.30
Natural	2.91	0.05- 0.10	0.24	0.50- 0.70	4.59	0.02- 0.05
Mechanical	2.33	0.10- 0.20	0.30	0.50- 0.70	1.42	0.20- 0.30
Business	1.39	0.20- 0.30	0.07	0.70- 0.80	1.40	0.20- 0.30
Arts	0.69	0.70- 0.80	0.41	0.30- 0.50	0.51	0.30- 0.50
Sciences	2.91	0.05- 0.10	1.40	0.20- 0.30	6.02	0.01- 0.02
Verbal	1.70	0.10- 0.20	0.03	0.80- 0.90	0.23	0.50- 0.70
Manipulative	1.37	0.20- 0.30	0.02	0.80- 0.90	0.51	0.30- 0.50
Computational	0.10	0.70- 0.80	1.41	0.20- 0.30	2.72	0.05- 0.10
Level	3.69	0.05- 0.10	1.24	0.20- 0.30	8.04	0.001- 0.01

APPENDIX G--Continued

Interest Factor	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
	<u>Weight Age</u>					
Personal-social	0.96	0.30- 0.50	0.01	0.90- 0.95	0.30	0.50- 0.70
Natural	0.96	0.30- 0.50	0.10	0.70- 0.80	3.60	0.05- 0.10
Mechanical	2.33	0.10- 0.20	2.20	0.10- 0.20	0.51	0.30- 0.50
Business	0.23	0.50- 0.70	1.02	0.30- 0.50	2.02	0.10- 0.20
Arts	0.69	0.30- 0.50	2.07	0.10- 0.20	0.51	0.30- 0.50
Sciences	0.06	0.80- 0.90	0.03	0.80- 0.90	0.00	1.00- 1.00
Verbal	0.35	0.50- 0.70	0.25	0.50- 0.70	0.91	0.30- 0.50
Manipulative	0.77	0.30- 0.50	0.27	0.50- 0.70	0.06	0.80- 0.90
Computational	1.25	0.20- 0.30	0.06	0.80- 0.90	5.57	0.01- 0.02
Level	0.46	0.30- 0.50	0.10	0.70- 0.80	0.32	0.50- 0.70

APPENDIX G--Continued

Interest Factor	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Mental Age</u>						
Personal-social	0.06	0.80- 0.90	0.01	0.90- 0.95	2.24	0.10- 0.20
Natural	0.06	0.80- 0.90	0.01	0.90- 0.95	2.07	0.10- 0.20
Mechanical	0.03	0.80- 0.90	0.02	0.80- 0.90	0.97	0.30- 0.50
Business	0.02	0.80- 0.90	1.02	0.30- 0.50	0.47	0.30- 0.50
Arts	0.30	0.50- 0.70	0.01	0.90- 0.95	1.53	0.20- 0.30
Sciences	1.70	0.10- 0.20	0.76	0.30- 0.50	6.93	0.001- 0.01
Verbal	0.35	0.50- 0.70	0.67	0.30- 0.50	0.01	0.80- 0.90
Manipulative	0.24	0.50- 0.70	0.03	0.80- 0.90	0.97	0.30- 0.50
Computational	3.69	0.05- 0.10	0.67	0.30- 0.50	7.95	0.001- 0.01
Level	1.25	0.20- 0.30	0.58	0.30- 0.50	2.47	0.10- 0.20

APPENDIX G--Continued

Interest Factor	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Carpal Age</u>						
Personal-social	0.07	0.70- 0.80	0.08	0.70- 0.80	0.39	0.50- 0.70
Natural	0.41	0.50- 0.70	0.05	0.80- 0.90	0.12	0.70- 0.80
Mechanical	0.81	0.50- 0.70	0.17	0.50- 0.70	0.84	0.30- 0.50
Business	1.55	0.20- 0.30	0.04	0.80- 0.90	0.20	0.50- 0.70
Arts	0.78	0.30- 0.50	0.97	0.30- 0.50	0.01	0.90- 0.95
Sciences	0.50	0.80- 0.90	0.39	0.50- 0.70	0.07	0.70- 0.80
Verbal	0.26	0.50- 0.70	0.10	0.70- 0.80	0.68	0.30- 0.50
Manipulative	0.026	0.80- 0.90	0.002	0.95- 0.98	0.01	0.90- 0.95
Computational	0.01	0.90- 0.95	0.02	0.80- 0.90	0.01	0.90- 0.95
Level	3.52	0.05- 0.10	0.05	0.80- 0.90	4.93	0.02- 0.05

APPENDIX G--Continued

Interest Factor	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
	<u>Height Age</u>					
Personal-social	0.06	0.80 - 0.90	0.01	0.90 - 0.95	0.00	1.00 - 1.00
Natural	0.06	0.80 - 0.90	0.008	0.95 - 0.98	0.00	1.00 - 1.00
Mechanical	0.27	0.50 - 0.70	0.65	0.30 - 0.50	0.51	0.30 - 0.50
Business	1.40	0.20 - 0.30	6.21	0.01 - 0.02	0.90	0.30 - 0.50
Arts	0.31	0.50 - 0.70	3.07	0.05 - 0.10	2.78	0.05 - 0.10
Sciences	3.11	0.05 - 0.10	0.76	0.30 - 0.50	0.24	0.50 - 0.70
Verbal	0.35	0.50 - 0.70	0.25	0.50 - 0.70	0.00	1.00 - 1.00
Manipulative	0.77	0.30 - 0.50	0.27	0.50 - 0.70	0.06	0.80 - 0.90
Computational	1.25	0.20 - 0.30	0.06	0.80 - 0.90	0.89	0.30 - 0.50
Level	0.10	0.70 - 0.80	0.10	0.70 - 0.80	0.00	1.00 - 1.00

APPENDIX G--Continued

Interest Factor	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Grip Age</u>						
Personal-social	0.96	0.30- 0.50	0.01	0.90- 0.95	0.69	0.30- 0.50
Natural	0.06	0.80- 0.90	0.10	0.70- 0.80	3.60	0.05- 0.10
Mechanical	0.72	0.30- 0.50	1.30	0.20- 0.30	0.51	0.30- 0.50
Business	1.39	0.20- 0.30	1.02	0.30- 0.50	0.00	1.00- 1.00
Arts	0.69	0.30- 0.50	1.80	0.10- 0.20	2.78	0.05- 0.10
Sciences	0.23	0.50- 0.70	2.37	0.10- 0.20	0.96	0.30- 0.50
Verbal	0.02	0.80- 0.90	0.25	0.50- 0.70	0.91	0.30- 0.50
Manipulative	0.24	0.50- 0.70	0.27	0.50- 0.70	0.06	0.80- 0.90
Computational	0.10	0.70- 0.80	0.06	0.80- 0.90	0.30-	0.50
Level	0.10	0.70- 0.80	0.10	0.70- 0.80	0.00	1.00- 1.00

APPENDIX G--Continued

Interest Factor	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Dental Age</u>						
Personal-social	0.06	0.80- 0.90	0.01	0.90- 0.95	0.30	0.50- 0.70
Natural	0.23	0.50- 0.70	1.65	0.10- 0.20	0.22	0.50- 0.70
Mechanical	0.25	0.50- 0.70	0.30	0.50- 0.70	0.51	0.30- 0.50
Business	0.05	0.80- 0.90	0.07	0.70- 0.80	0.00	1.00- 1.00
Arts	0.02	0.80- 0.90	1.02	0.30- 0.50	1.42	0.20- 0.30
Sciences	1.46	0.20- 0.30	9.36	0.001- 0.01	2.17	0.10- 0.20
Verbal	0.70	0.30- 0.50	0.03	0.80- 0.90	2.06	0.10- 0.20
Manipulative	0.02	0.80- 0.90	0.02	0.80- 0.90	0.51	0.30- 0.50
Computational	0.004	0.95- 0.98	0.22	0.50- 0.70	0.22	0.50- 0.70
Level	0.25	0.50- 0.70	1.24	0.20- 0.30	1.29	0.20- 0.30

APPENDIX G--Continued

Interest Factor	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Organismic Age</u>						
Personal-social	1.06	0.30- 0.50	1.42	0.20- 0.30	0.26	0.50- 0.70
Natural	0.07	0.70- 0.80	1.05	0.30- 0.50	2.67	0.10- 0.20
Mechanical	0.82	0.30- 0.50	1.17	0.50- 0.70	0.13	0.70- 0.80
Business	3.90	0.02- 0.05	0.04	0.80- 0.90	0.02	0.80- 0.90
Arts	0.04	0.80- 0.90	0.04	0.80- 0.90	0.15	0.50- 0.70
Sciences	1.27	0.20- 0.30	1.77	0.10 0.20	1.99	0.10- 0.20
Verbal	0.07	0.70- 0.80	1.89	0.10- 0.20	0.42	0.50- 0.70
Manipulative	0.78	0.30- 0.50	0.54	0.30- 0.50	0.41	0.50- 0.70
Computational	0.01	0.90- 0.95	0.83	0.30- 0.50	3.45	0.05- 0.10
Level	0.81	0.30- 0.50	0.36	0.50- 0.70	0.98	0.30- 0.50

APPENDIX G--Continued

Interest Factor	Boys		Girls		Total	
	χ^2	p	χ^2	p	χ^2	p
<u>Developmental Age</u>						
Personal-social	0.07	0.70- 0.80	0.01	0.90- 0.95	1.94	0.10- 0.20
Natural	0.01	0.90- 0.95	1.24	0.20- 0.30	2.07	0.10- 0.20
Mechanical	0.28	0.50- 0.70	0.02	0.80- 0.90	1.45	0.20- 0.30
Business	0.73	0.30- 0.50	0.01	0.90- 0.95	1.45	0.20- 0.30
Arts	0.03	0.80- 0.90	0.07	0.70- 0.80	0.06	0.80- 0.90
Sciences	1.04	0.30- 0.50	1.30	0.20- 0.30	0.56	0.30- 0.50
Verbal	0.73	0.30- 0.50	0.03	0.80- 0.90	0.23	0.50- 0.70
Manipulative	1.46	0.20- 0.30	1.40	0.20- 0.30	0.53	0.30- 0.50
Computational	0.01	0.90- 0.95	0.95	0.30- 0.50	2.81	0.05- 0.10
Level	0.01	0.90- 0.95	2.07	0.10- 0.20	0.08	0.70- 0.80

APPENDIX H

SUMMARY OF ALL EXPECTANCIES OBTAINED

APPENDIX H

SUMMARY OF EXPECTANCY TABLES INDICATING PERCENTAGE
OF POPULATION IN EACH CATEGORY BASED ON THE 100
PERCENT TOTAL IN UPPER AND LOWER
HALVES IN THE GROWTH FACTOR
(G = growth factor; I = interest factor)

Interest Factor	Upper (G)	Upper (G)	Lower (G)	Lower (G)
	Upper (I)	Lower (I)	Upper (I)	Lower (I)
<u>Reading Age</u>				
Boys				
Personal-social . .	71	29	67	33
Natural	29	71	33	67
Mechanical	47	53	50	50
Business	59	41	61	39
Arts	35	65	44	56
Sciences	76	24	56	44
Verbal	71	29	61	39
Manipulative	47	53	39	61
Computational	94	6	61	39
Level	88	12	67	33
Girls				
Personal-social . .	84	16	78	22
Natural	79	21	78	22
Mechanical	26	74	50	50
Business	37	63	17	83
Arts	63	37	89	11
Sciences	53	47	56	44
Verbal	47	53	56	44
Manipulative	47	53	39	61
Computational	32	68	28	72
Level	79	21	78	22
Total				
Personal-social . .	69	31	81	19
Natural	44	56	69	31
Mechanical	36	64	50	50
Business	39	61	53	47
Arts	61	39	53	47
Sciences	78	22	50	50
Verbal	61	39	56	44
Manipulative	47	53	39	61
Computational	61	39	42	58
Level	92	8	64	36

APPENDIX H--Continued

Interest Factor	Upper (G)	Upper (G)	Lower (G)	Lower (G)
	Upper (I)	Lower (I)	Upper (I)	Lower (I)
<u>Weight Age</u>				
Boys				
Personal-social . .	76	24	61	39
Natural	24	76	39	61
Mechanical	35	65	61	39
Business	59	41	67	33
Arts	47	53	33	67
Sciences	71	29	67	33
Verbal	70	30	60	40
Manipulative	35	65	67	33
Computational	88	12	67	33
Level	82	18	67	33
Girls				
Personal-social . .	84	16	78	22
Natural	79	21	78	22
Mechanical	26	74	50	50
Business	37	63	17	83
Arts	63	37	89	11
Sciences	53	47	56	44
Verbal	47	53	56	44
Manipulative	47	53	39	61
Computational	32	68	28	72
Level	79	21	78	22
Total				
Personal-social . .	78	22	72	28
Natural	44	56	67	33
Mechanical	39	61	47	53
Business	53	47	36	64
Arts	53	47	61	39
Sciences	64	36	64	36
Verbal	64	36	53	47
Manipulative	44	56	42	58
Computational	67	33	39	61
Level	81	19	75	25

APPENDIX H--Continued

Interest Factor	Upper (G)	Upper (G)	Lower (G)	Lower (G)
	Upper (I)	Lower (I)	Upper (I)	Lower (I)
<u>Mental Age</u>				
Boys				
Personal-social . .	71	29	67	33
Natural	29	71	33	67
Mechanical	47	53	50	50
Business	59	41	61	39
Arts	35	65	44	56
Sciences	76	24	56	44
Verbal	71	29	61	39
Manipulative	47	53	39	61
Computational	94	6	39	61
Level	88	12	67	33
Girls				
Personal-social . .	78	22	84	16
Natural	72	28	79	21
Mechanical	39	61	37	63
Business	17	83	37	63
Arts	72	28	79	21
Sciences	67	33	53	47
Verbal	44	56	58	42
Manipulative	44	56	47	53
Computational	39	61	26	74
Level	89	11	74	26
Total				
Personal-social . .	68	32	83	17
Natural	46	54	63	37
Mechanical	49	51	37	63
Business	41	59	49	51
Arts	51	49	66	34
Sciences	78	22	49	51
Verbal	59	41	57	43
Manipulative	49	51	37	63
Computational	70	30	37	63
Level	86	14	71	29

APPENDIX H--Continued

Interest Factor	Upper (G)	Upper (G)	Lower (G)	Lower (G)
	Upper (I)	Lower (I)	Upper (I)	Lower (I)
<u>Carpal Age</u>				
Boys				
Personal-social . .	73	27	62	38
Natural	73	27	38	62
Mechanical	40	60	56	44
Business	47	53	69	31
Arts	47	53	31	69
Sciences	80	20	69	31
Verbal	60	40	75	25
Manipulative	47	53	44	56
Computational	73	27	81	19
Level	100	0	69	31
Girls				
Personal-social . .	81	19	83	17
Natural	75	25	78	22
Mechanical	38	62	44	56
Business	31	69	22	78
Arts	62	38	83	17
Sciences	56	44	67	33
Verbal	50	50	56	44
Manipulative	44	56	44	56
Computational	31	69	28	72
Level	81	19	72	28
Total				
Personal-social . .	77	23	71	29
Natural	52	48	56	44
Mechanical	39	61	50	50
Business	39	61	44	56
Arts	55	45	56	44
Sciences	68	32	65	35
Verbal	52	48	62	38
Manipulative	45	55	44	56
Computational	52	48	53	47
Level	90	10	68	32

APPENDIX H--Continued

Interest Factor	Upper (G)	Upper (G)	Lower (G)	Lower (G)
	Upper (I)	Lower (I)	Upper (I)	Lower (I)
<u>Height Age</u>				
Boys				
Personal-social . .	71	29	67	33
Natural	30	70	33	67
Mechanical	41	59	50	50
Business	53	47	72	28
Arts	35	65	44	56
Sciences	88	12	56	44
Verbal	71	29	61	39
Manipulative	35	65	50	50
Computational	88	12	67	33
Level	76	24	78	22
Girls				
Personal-social . .	79	21	83	17
Natural	80	20	78	22
Mechanical	32	68	44	56
Business	47	53	6	94
Arts	58	42	89	11
Sciences	53	47	67	33
Verbal	47	53	56	44
Manipulative	47	53	39	61
Computational	32	68	28	72
Level	79	21	78	22
Total				
Personal-social . .	75	25	75	25
Natural	56	44	56	44
Mechanical	39	61	47	53
Business	50	50	39	61
Arts	47	53	67	33
Sciences	67	33	61	39
Verbal	58	42	58	42
Manipulative	42	58	44	56
Computational	58	42	47	53
Level	78	22	78	22

APPENDIX H--Continued

Interest Factor	Upper (G)	Upper (G)	Lower (G)	Lower (G)
	Upper (I)	Lower (I)	Upper (I)	Lower (I)
<u>Grip Age</u>				
Boys				
Personal-social . .	76	24	61	39
Natural	29	71	33	67
Mechanical	41	59	56	44
Business	53	47	72	28
Arts	47	53	33	67
Sciences	65	35	72	28
Verbal	65	35	67	33
Manipulative	47	53	39	61
Computational	76	24	78	22
Level	82	18	72	28
Girls				
Personal-social . .	84	16	78	22
Natural	79	21	78	22
Mechanical	32	68	50	50
Business	37	63	17	83
Arts	62	38	83	17
Sciences	47	53	72	28
Verbal	47	53	56	44
Manipulative	47	53	39	61
Computational	32	68	28	72
Level	74	26	83	17
Total				
Personal-social . .	81	19	72	28
Natural	44	56	67	33
Mechanical	39	61	47	53
Business	44	56	44	56
Arts	47	53	67	33
Sciences	58	42	69	31
Verbal	64	36	53	47
Manipulative	44	56	42	58
Computational	58	42	47	53
Level	81	19	81	19

APPENDIX H--Continued

Interest Factor	Upper (G)	Upper (G)	Lower (G)	Lower (G)
	Upper (I)	Lower (I)	Upper (I)	Lower (I)
<u>Dental Age</u>				
Boys				
Personal-social . .	71	29	67	33
Natural	35	65	28	72
Mechanical	53	47	44	56
Business	65	35	61	39
Arts	41	59	39	61
Sciences	59	41	78	22
Verbal	59	41	72	28
Manipulative	41	59	39	61
Computational	76	24	83	17
Level	71	29	83	17
Girls				
Personal-social . .	78	22	84	16
Natural	67	33	89	11
Mechanical	33	67	42	58
Business	28	72	26	74
Arts	83	17	63	37
Sciences	83	17	37	63
Verbal	50	50	53	47
Manipulative	44	56	42	58
Computational	33	67	26	74
Level	89	11	68	32
Total				
Personal-social . .	72	28	78	22
Natural	53	47	58	42
Mechanical	47	53	39	61
Business	44	56	44	56
Arts	64	36	50	50
Sciences	72	28	56	44
Verbal	50	50	67	33
Manipulative	47	53	39	61
Computational	50	50	56	44
Level	83	17	72	28

APPENDIX H--Continued

Interest Factor	Upper (G)	Upper (G)	Lower (G)	Lower (G)
	Upper (I)	Lower (I)	Upper (I)	Lower (I)
<u>Organismic Age</u>				
Boys				
Personal-social . .	80	20	56	44
Natural	33	67	31	69
Mechanical	40	60	56	44
Business	40	60	75	25
Arts	40	60	44	56
Sciences	87	13	62	38
Verbal	67	33	69	31
Manipulative	53	47	38	62
Computational	80	20	75	25
Level	93	7	75	25
Girls				
Personal-social . .	72	28	94	6
Natural	67	33	88	12
Mechanical	44	56	38	62
Business	28	72	25	75
Arts	72	28	75	25
Sciences	72	28	50	50
Verbal	39	61	62	38
Manipulative	50	50	38	62
Computational	39	61	19	81
Level	83	17	69	31
Total				
Personal-social . .	73	27	78	22
Natural	45	55	66	34
Mechanical	42	58	47	53
Business	42	58	41	59
Arts	55	45	59	41
Sciences	76	24	59	41
Verbal	55	45	62	38
Manipulative	48	52	41	59
Computational	64	36	41	59
Level	85	15	75	25

APPENDIX H--Continued

Interest Factor	Upper (G)	Upper (G)	Lower (G)	Lower (G)
	Upper (I)	Lower (I)	Upper (I)	Lower (I)
<u>Developmental Age</u>				
Boys				
Personal-social . .	69	31	71	29
Natural	25	75	29	71
Mechanical	56	44	47	53
Business	56	44	71	29
Arts	38	62	47	53
Sciences	81	19	59	41
Verbal	56	44	71	29
Manipulative	50	50	29	71
Computational	81	19	76	24
Level	81	19	76	24
Girls				
Personal-social . .	83	17	79	21
Natural	89	11	68	32
Mechanical	39	61	37	63
Business	28	72	26	74
Arts	72	28	74	26
Sciences	50	50	68	32
Verbal	50	50	53	47
Manipulative	33	67	53	47
Computational	22	78	37	63
Level	89	11	63	37
Total				
Personal-social . .	83	17	69	31
Natural	63	37	46	54
Mechanical	51	49	37	63
Business	37	63	51	49
Arts	60	40	57	43
Sciences	60	40	69	31
Verbal	60	40	54	46
Manipulative	46	54	37	63
Computational	43	57	63	37
Level	80	20	77	23

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