AN EXPLORATION INTO THE RELATIONSHIP OF PHYSICAL GROWTH PATTERN AND CLASSROOM BEHAVIOR IN ELEMENTARY SCHOOL CHILDRFN

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By

Gerald Thomas Kowitz

AN ABSTRACT

Submitted to the School of Graduate Studies of Michigan State College of Agriculture and Applied Science in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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GERALD THOMAS KOWITZ

ABSTRACT

The purpose of the study was to explore the possible relationship existing between growth pattern and classroom behavior in elementary school children. Although much work has been done cross-sectionally attempting to relate morphology or somatology to personality or behavior, the results, at best, have been inconclusive. It was believed that if such a relationship existed, it would be discovered by using a developmental approach involving generalized units of physical maturity, since the cross-sectional methods usually employed only magnitude measurements.

Teacher judgments were used to evaluate the appropriateness of the child's behavior for the instructional situation.

Ratings were obtained from the respective teachers on all the third- and fourth-grade pupils of the Holt, Michigan, school system. The 63 cases selected represented approximately the upper and lower quarters of the total group. The groups were equated for third and fourth graders and for boys and girls. This resulted in four groups: high boys, low boys, high girls, and low girls.

The longitudinal height and weight records of the selected cases were obtained from the Child Development Laboratory, School of Education, Michigan State College. Using the Courtis Technique,

Gompertz equations were calculated for the individual data. The constants of these equations, maximum, rate, and incipiency, were averaged in order to obtain a curve of constants for each of the four groups. These curves were then compared statistically. It was found that among the height constants, highly significant differences appeared between the high groups and the low groups. Between the sexes within the groups, only one true difference appeared. The high girl group was growing to a maximum 0.6 inches greater than that of the high boy group.

Among the weight parameters, only one true difference was found. The high girl group was growing at a rate significantly higher than the low girl group.

It was concluded that any of the three height constants would differentiate the groups with regard to their behavior ratings. The weight constants, however, would not.

An attempt was made to determine whether or not the usual cross-sectional methods would discriminate between these groups. The mean height and ages were determined for each group for a certain date. Statistical comparisons indicated no differences between the groups. Since a difference in pattern did exist, a

comparison of the percentage of development in height for the four groups was made. Highly significant differences were found between the high and low groups, but no differences were found between the sexes within the groups.

It was concluded that a definite relation exists between the developmental pattern in height and the classroom behavior of elementary school children. Furthermore, it was found that this relation is reflected in the level of development rather than in the achieved magnitudes. Those children receiving the higher behavioral rating were more highly developed physically.

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CHAPTER I

INTRODUCTION

Perhaps one of the greatest problems in education is classroom discipline.[1] Fortunately, a behavior problem is more often a teacher judgment than a fact. Judgment, along this line, is perhaps more adequately described as the teacher's belief that the pupil has failed to come up to a prescribed standard. Lack of correspondence between the behavior expected by the teacher and that produced by the pupil is one of the greatest sources of frustration for both teacher and pupil.[2] Many documentations are available. Some of these are most pertinent.

The impact of frustration on an individual's behavior is indicated by the work of Dollard, et al.,[3] and, its impact upon an

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[1] "Discipline," Michigan Educational Journal, Vol. 31, No. 10, p. 263.

[2] Fritz Redl and W. Wattenberg, Mental Hygiene for Teachers, New York: Harcourt, Brace, 1951, p. 23.

[3] John Dollard, et al., Frustration and Aggression, New Haven: Yale University Press, 1939, passim.

individual's ability to learn by the work of Maier.[4] Dollard[5] found that frustration produced "instigations to a number of different types of responses of which the instigation to aggression is the strongest of the hierarchy." That is, an individual will tend to use aggressive and destructive behavior when frustrated. Maier,[6] in an extended series of experiments, found that frustration actually prevented learning. The frustration caused the organism to shift its attention from the task to be learned to the relief of the frustration. When it was impossible to resolve the frustration, an abnormal fixation response was produced in the organism as a compromise between the demands of the two stimuli.

In all the areas of psychology, from the esoteric learning theories of Hull, Skinner, and Maier, to the instinctive theories of psychoanalysts and the projective psychologists, workers have for years urged teachers to seek reasons behind classroom disturbances. Success has been outstanding in a few cases, but no general laws

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[4] N. R. F. Maier, Frustration, New York: McGraw-Hill, 1949, p. 77.

[5] Dollard, op. cit., p. 257.

[6] Maier, op. cit., p. 177.

have evolved.[7,8] Indeed, the work of Wickman[9] indicates that the psychological investigators are not too concerned with the symptoms considered serious by teachers. Jersild,[10] however, in discussing Wickman's work on symptom identification, admits that, to the teacher, the classroom problems of order, discipline, and effort are very real despite clinical opinions of their psychodiagnostic value.

In academic areas, however, the concept of readiness has become widely accepted in explaining why some children do not learn. The hypothesis proposes that a certain level of maturity or maturities must be achieved before the child can benefit from an instructional program.[11]

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[7] J. Wallin, Personality Maladjustments and Mental Hygiene, New York: McGraw-Hill, 1949, passim.

[8] H. H. Anderson, "Domination and Socially Integrative Behavior," in Barker, Kounin, and Wright, Child Behavior and Development, New York: McGraw-Hill, 1943, pp. 477-478.

[9] E. K. Wickman, Childrens Behavior and Teachers Attitudes, New York: Commonwealth Fund Division of Publication, 1928, pp. 124-126.

[10] A. I. Jersild, Child Psychology, New York: Prentiss Hall, 1946, p. 520.

[11] H. M. Robinson, Why Pupils Fail in Reading, Chicago: University of Chicago Press, 1946, p. 220.

Similarly, psychoanalysts point out the necessity of progress through "phases" before certain behavior patterns can be expected.[12] Freud conceived of stoppages or fixations in the normal developmental process as the basis of the repressions and regressions that are the foundations of neurosis and psychosis. When an individual is inadequately developed to handle the situation, he is overwhelmed by it and is unable to progress further until the resulting blockings are removed.[13,14]

From the behaviorist school comes similar evidence that an organism cannot be forced to operate beyond its capacity for an extended time without undesirable results. The work of Maier again provides an excellent summary of this material.[15] In his experiments, the animal was confronted with a problem that it could not solve. Not only did the animal fail to learn, but evidenced various

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[12] Sigmund Freud, Outline of Psychoanalysis, New York: W. W. Norton, 1945, p. 11.

[13] Franz Alexander, The Fundamentals of Psychoanalysis, New York: W. W. Norton, 1948, p. 38.

[14] O. S. English and G. H. Pearson, Emotional Problems of Living, New York: W. W. Norton, 1945, p. 11.

[15] Maier, op. cit., Chapter I.

behavior patterns similar to those seen in maladjusted humans. Another behaviorist, Skinner,[16] as a result of his animal experiments, proposes that school children should be systematically exposed to frustrations that they can handle on their level of development.

Nally,[17] in a study of growth in stature and reading, has shown that a certain level of maturity must be achieved in height before development in reading will begin. Thus it would be impractical to "teach" reading before adequate physical development has been achieved.

Statement of Problem

The purpose of this study is to explore the possibility of a definite existing relationship between the achieved maturity in physical growth and behavior evidenced in the classroom.

Since reading readiness is so closely related to achievement in stature, and if the psychologists are correct in their hypothetical

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[16] B. F. Skinner, Walden Two, New York: MacMillan, 1948, p. 94.

[17] T. P. F. Nally, "The Relationship between Achieved Growth in Height and the Beginning of Growth in Reading," Ph.D. Thesis, unpublished, Michigan State College, 1953, p. 53.

constructs regarding psychodynamics, it would seem plausible that such a relationship between the "readiness to accept classroom discipline" and achievement of physical growth, exists.

This would be in direct line with the "organismic concept."[18,19] If the child developes as a totality, it would be expected that he would be able to accept the classroom regime when he is able to benefit from the instructional situation. Indeed, it is difficult to conceive of a gain from instruction when the environment is an overwhelming threat.

Importance of the Study

To date, social scientists have been unable to discover scientific laws governing the behavior of a specific individual. Courtis[20] states that this is because one of the basic factors, the maturation

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[18] C. V. Millard, Child Growth and Development in the Elementary Schools. Boston: D. C. Heath, 1951, p. 4.

[19] W. C. Olson, Child Growth and Development, Boston: D. C. Heath, 1949, p. 16.

[20] Stuart A. Courtis, "Growth and Development in Children," Advances in Health Education, Proceedings of Seventh Health Education Conference, Ann Arbor, Michigan, 1933, New York: American Child Health Association, 1934, p. 180.

of the individual, has been overlooked. This study will explore the relation of this factor to behavior in the classroom. If such a relation can be established, the way will be cleared to assist teachers in the management of their classrooms and also to assist individual pupils to obtain their optimum development. Such assistance would not only be advantageous to the individual directly involved, but in the final result, must benefit all of society.

Furthermore, if the relation can be established, a new method will have been found for the investigation of psychodynamics, the etiology of psychopathology and psychotherapy. This could promote a shift of concentration from the curative aspects to the preventative aspects of the clinical work in these areas.

Success in the undertaking will further substantiate the merit of the "Organismic Concept"[21,22] and the Courtis technique.[23,24]

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[21] Millard, loc. cit.

[22] Olson, loc. cit.

[23] W. F. Dearborn and J. M. W. Rothney, Predicting the Childs Development, Cambridge: Sci-Art, 1941, p. 218.

[24] T. P. F. Nally and A. R. DeLong, An Appraisal of a Method of Predicting Growth, East Lansing, Michigan, Child Development Laboratories, Michigan State College, 1952, Series II, no. 1.

Failure, on the other hand, should indicate the reformulations which are necessary to make these ideas more exact and profitable.

Definition of Terms

In this study, the following terms will bear these connotations:

1. Development: "The progress towards maturity brought about in an immature organism by the action of appropriate environmental forces under constant conditions."[25] "In actual practice, growth, development and maturation are used interchangeable depending upon the emphasis desired."[26]

2. The Gompertz function:[27] $y = ke^{ce^{at}}$ or $y = ki^{r^t}$ where:

y = achieved development at time "t."

k = maximum towards which development is progressing.

e^c = incipiency (i) or the degree of development at the beginning of the period of growth.

e^a = rate (r) of growth expressed in isochrons.

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[25] Stuart A. Courtis, Towards a Science of Education, Ann Arbor: Edwards Bros., 1951, p. 9.

[26] Stuart A. Courtis, Maturation Units and How to Use Them, Ann Arbor: Edwards Bros., 1950, p. 22.

[27] Ibid., pp. 172-180.

3. Isochron:[28] One percent of the time necessary for the generation of the Gompertz function from 0.000000189 percent to 99.90917 percent.

4. Maturity: Physical maturity is factor "k" of the Gompertz function (q.v.). Social or psychological maturity[29] is relative to the immediate situation. If the organism can adequately cope with the specific situation, it is mature. To the degree that it cannot adequately cope with the specific situation, it is immature. It should be noted that the maturity continua is not relative to the individual, but to the situation.

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[28] Ibid., p. 140.

[29] Ruth Bochner and Florence Halpern, The Clinical Application of the Rorschach Test (Rev. Ed.), New York: Grune and Stratton, 1945, p. 10.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

For purposes of study, the world has been customarily divided into two areas: the organic and the inorganic. The generally accepted criterion for this classification is the presence or absence of life. Life, in turn, is designated by the cycle of origin, growth, and death.

The accomplishments of science in the inorganic are generally unquestioned. Within the organic, the opposite is ture, especially in its most recent form: the so-called "social sciences." In this area, the mathematical laws for prediction, which make the physical sciences esoteric (and effective) are almost totally absent.

There have been great accomplishments in the organic, but they are more accurately attributed to the art and skill of the individual than to the application of natural law. Unfortunately, it is difficult to preserve and continue the art and skill beyond the man.

A cursory view of the organic sciences reveals an excessive concentration on the origins and morbidity of the creatures as compared to the investigation of normal growth and its progress. One investigator concluded that the process of growth was too variable to be subject to scientific prediction, and therefore, could only be "judged."[30]

Physical Development

The seriatim study of individuals was found to be hindered by many difficulties:[31,32,33,34,35]

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[30] T. W. Todd, Atlas of Skeletal Maturation, St. Louis: Mosby, 1937, p. 12.

[31] F. G. Benedict and B. T. Fritz, "Metabolism and Growth from Birth to Puberty," Carnegie Inst. of Washington, 1921, Vol. 302, p. 100.

[32] J. A. Harris, et al., The Measurement of Man, Minneapolis: University of Minnesota Press, 1930, p. 176.

[33] F. K. Shuttleworth, "The Physical and Mental Growth of Girls and Boys age 6 to 19 in Relation to Age at Maximum Growth," Monograph of the Society for Research in Child Development, Vol. 4, No. 3, 1939, p. 16.

[34] R. E. Scammon, "The First Seriatim Study of Human Growth," Am. Jnl. of Physical Anthropology, 1927, Vol. 10, No. 3, p. 329.

[35] Margaret Merrell, "The Relationship of Individual Growth to Average Growth," Human Biology, 1931, Vol. 3, p. 1.

1. Not all desired measures can be made in vivo.

2. Accumulation of data consumes long periods of time.

3. Difficulty in retaining the same individuals.

4. The inability to explain the presence of large individual differences.

Therefore, more and more use has been made of the cross-sectional (horizontal) approach.

The result of substituting many individuals at different ages for the study of one individual throughout has not produced a true picture of the development of the individual.[36,37,38,39,40,41,42,43,44,45,46]

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[36] M. M. Adkins, et al., "Physique, Personality and Scholarship," Monograph for the Society in Child Development, 1943, Vol. 8, No. 1, p. 1.

[37] L. G. M. Baas-Becking, "Studies on Growth," Stanford University Publication, University Series, Vol. 4, No. 2, 1926, p. 10.

[38] Nancy Bayley, Studies in the Development of Young Children, Berkley: University of California Press, 1940, p. 35.

[39] Dearborn and Rothney, op. cit., p. 228.

[40] Charles D. Flory, "The Physical Growth of Mentally Deficient Boys," Monograph of the Society for Research in Child Development, 1937, Vol. 1, No. 1, p. 97.

[41] H. Gray and H. K. Faber, "Individual Growth Records of Two Healthy Girls from Birth to Maturity," Amer. Jnl. of Diseases in Children, 1940, Vol. 59, p. 225.

Although no precise mathematical laws have emerged from the statistical analysis of mass data, a factor emerged that, because of its relation to chronological age, was identified with "general growth."[47,48,49,50,51] Gesell and Armatruda[52] have proposed the

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[42] Buford J. Johnson, Mental Growth of Children in Relation to the Rate of Growth in Bodily Development, New York: Dutton, 1925, p. 148.

[43] Merrell, op. cit., p. 53.

[44] W. J. Robbins, et al., Growth, New Haven: Yale University Press, 1928, p. 40.

[45] Barkev S. Sanders, Environment and Growth, Baltimore: Warwick and York, 1934, p. 12.

[46] D'Arcy W. Thompson, Growth and Form, Cambridge: University Press, 1952, Vol. I, p. 137.

[47] G. M. Whipple, Manual of Mental and Physical Tests, Baltimore: Warwick and York, 1914, p. 71.

[48] E. M. Abernethy, "Relationships between Mental and Physical Growth," Monograph of the Society for Research in Child Development, Vol. I. No. 7, p. 79.

[49] Solomon Asch, "A Study of Change in Mental Organization," Archives of Psychology, No. 195, p. 36.

[50] Joseph Berkson, "Growth Changes in Physical Correlation--Height, Weight, and Chest Circumference--Males," Human Biology, Vol. I, 1929, p. 470.

[51] T. F. Carey, "The Relation of Growth to Developmental Age in Boys," Washington: Catholic Univ. Press, 1935, p. 99.

[52] Arnold Gesell, and C. S. Armatruda, Developmental Diagnosis, New York: Hoeber, 1947, p. 4.

use of this correlation in pediatric diagnositics. Another result has been the stated belief that a longitudinal (vertical) study of individuals will be necessary to solve the riddle of growth.[53,54,55,56,57,58,59,60] In comparing the two types of investigation, Merrell[61] has demonstrated both mathematically and empirically that a curve based on averages cannot adequately describe the pattern of an individual's growth.

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[53] Baas-Becking, op. cit., p. 50.

[54] Paul Godin, Growth During School Age, Boston: Badger Gourma Press, 1920, p. 45.

[55] Julian Huxley, Problems of Relative Growth, New York: Dial Press, 1932, p. 5.

[56] Johnson, op. cit., p. 1.

[57] Robbins, et al., op. cit., p. 1.

[58] H. R. Stolz, and L. M. Stolz, The Somatic Development of Adolescent Boys, New York: MacMillan, 1951, p. 3.

[59] Thompson, op. cit., p. 1.

[60] C. P. Winsor, "The Gompertz Curve as a Growth Curve," Prac. Nat. Acad. Sci., 1932, Vol. 18, p. 1.

[61] Merrell, op. cit., p. 53.

In the field of individual growth curves, there are at least four functions that have been extensively used.[62] Although each has been successfully applied by its sponsor,[63] the functions result from very different assumptions of the basic nature of growth.[64] The experiments of Loeb and Carrel[65] with living cells that grew at a constant rate *in vitro* as long as their universe was not finite, seems to abrogate the assumptions of the production of a univerally deleterious metabolites used by both Robertson and Pearl.[66] Brody[67] states that a satisfactory curve for human growth would have to be skewed with an inflection point at about one-third of mature development. Shock[68] finds the Gompertz curve, with its inflection point at 34 percent,[69]

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[62] Nathan Shock, "Growth Curves," in S. S. Stevens *Handbook of Experimental Psychology*, New York: Wiley, 1951, p. 330.

[63] Winsor, *op. cit.*, p. 7.

[64] Shock, *op. cit.*, p. 332.

[65] Robbins, *op. cit.*, p. 38.

[66] Shock, *op. cit.*, p. 337.

[67] Robbins, *op. cit.*, p. 59.

[68] Shock, *op. cit.*, p. 340.

[69] Courtis, *Maturation Units*, *op. cit.*, p. 132.

able to account for the most complex assumptions of growth and that one of its correlaries would be the Weber-Fechner Law,[70] the closest approximation of scientific law that the "social" sciences have made.

Von Bertalanffy,[71] in an analysis and evaluation of developmental theories, considers the two most important results of investigations in growth as:

1. Development is not a simple process but a rather complex of relatively independent (but not unrelated) component processes.

2. "It is not that there is a wholeness in the organic realm in general which is decisive, for such is also exhibited by inorganic systems--but the kind of totality--the developing totality, that gives us the deepest insight into organic nature . . ."[72]

Similar propositions considering growth of the whole as the result of the growths of component parts and individual cells, have

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[70] Shock, op. cit., p. 341.

[71] Ludwig Von Bertalanffy, Modern Theories of Development, London: Oxford Press, 1933, p. 129.

[72] Ibid., p. 182.

been proposed by Huxley,[73] Baas-Becking,[74] and Thompson.[75] Huxley, in his Law of Constant Differential Growth Ratio,[76] found that there is a definite relation between the growth of a component and the totality. Baas-Becking[77] found the "normal" (Gaussian or Bessel) curve representative of the measurements at a point in time and proposed the solid clevoid as most representative of total growth. From the work of Otis, Courtis[78] used the concept of the Gaussian distribution moving through time as a rational for the development of the Gompertz curve.

Not only are these functions representative of individual growth and the growth of populations, but are also found in the autocatalytic reactions of inorganic material.[79,80,81]

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[73] Huxley, op. cit., p. 203.

[74] Baas-Becking, op. cit., p. 63.

[75] Thompson, op. cit., p. 130.

[76] Huxley, op. cit., p. 102.

[77] Baas-Becking, op. cit., p. 63.

[78] Courtis, Maturation Units, op. cit., p. 144.

[79] Robbins, et al., op. cit., p. 60.

[80] Courtis, Maturation Units, op. cit., p. 155.

[81] Shock, op. cit., p. 338.

This presence of "growth" curves in nonbiological data has caused no little concern among various researchers.[82,83,84,85] Although psychologists in the area of learning theories[86,87,88,89] consider "learning" as different from maturation regardless of the obvious similarities of the "growth" curve and the "learning" curve, Wheeler[90] proposed that "learning" and "maturation" are identical processes and claimed great implications of this for the

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[82] Edwin Boring, G. H. S. Langfeld, and H. P. Weld, Foundations of Psychology, New York: Wiley, 1948, p. 64.

[83] Kurt Koffka, The Growth of the Mind, New York: Harcourt Brace, 1925, p. 38.

[84] Raymond H. Wheeler, Principles of Mental Development, New York: Crowell, 1932, p. 367.

[85] Shock, op. cit., p. 330.

[86] Boring, Langfeld, and Weld, op. cit., pp. 64-65.

[87] Shock, op. cit., p. 330.

[88] N. L. Munn, Psychological Development: An Introduction to Genetic Psychology, Boston: Houghton Mifflin, 1938, p. 47.

[89] Clark L. Hull, Principles of Learning: An Introduction, New York: Appleton-Century, 1943.

field of education. Within education, Courtis[91] and Millard[92] have developed a point of view based upon this similarity.

Courtis[93] reduced the mathematically complex Gompertz function, $y = ke^{ce^{at}}$, to an easily useable form, $y = k$ ($rt + i$) by the use of "isochrons" ( ) which are Naperian lologarithms that have been adjusted to remove their negative value. Millard[94] has proposed his "Principles of Growth," utilizing the Courtis Technique.

As a result of the tendency to use the more easily manipulated cross-sectional approach, the most controversial of these principles is the insistence on the individuality of the growth pattern. However, authorities in the medical areas of child development,[95,96]

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[90] Wheeler, op. cit., p. 367.

[91] Courtis, Towards a Science of Education, op. cit., p. 13.

[92] Millard, op. cit., pp. 9-54.

[93] Courtis, Maturation Units, op. cit., p. 173.

[94] Millard, op. cit., pp. 11-18.

[95] Gesell, and Armatruda, op. cit., p. 4.

[96] Arnold Gesell and Francis L. Ilg, Child Development, New York: Harper, 1949, pp. 43 and 289.

as well as those in the educational areas,[97,98,99] have recognized that "the child himself is the norm of the last resort."[100]

Essential to the principle of individuality in child development is the "organismic"[101,102] concept. This concept, developing from the psychological "gestalt"[103] and the biological "Fliessgleichgewichte"[104] states that a definite relationship exists among the various dimensions of "physical" and "mental" growth. The delicacy of these interrelationships reopens the question of the relationship between temperament and body build, a problem that has been probed

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[97] Bird T. Baldwin, "The Relationship Between Mental and Physical Growth," Jnl. Ed. Psych. 13: 1922, p. 203.

[98] S. A. Courtis, "Maturation Units for the Measurement of Growth," School and Society, 30: 1929, p. 203.

[99] Millard, op. cit., p. 24.

[100] Gesell and Ilg, op. cit., p. 72.

[101] Millard, op. cit., p. 4.

[102] Olson, op. cit., p. 16.

[103] Kurt Lewin, Dynamic Theory of Personality, New York: McGraw-Hill, 1935, p. 32.

[104] Ludwig Von Bertalanffy, Problems of Life, New York: Wiley, 1952, p. 129.

by nearly every generation of recorded history,[105] without finite results.[106] Von Bertalanffy suggests that the reason for this recurrent failure is a result of the use of the "momentary cross-sections" rather than "developmental histories."[107]

Behavior

Although both Sheldon[108] and Hooton[109] have produced pedantic work on the build-temperament problem, their work has been neither substantiated, nor has it provided the impetus for further research. Hooton,[110] as a result of his work, proposed to "encourage a strike against reproduction in the busy breeders among morons, criminals, and social ineffectuals. We cannot yet

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[105] W. H. Sheldon, The Varieties of Human Physique, New York: Harper, 1940, p. 1.

[106] D. G. Patterson, Physique and Intellect, New York: Century, 1930, passim.

[107] Von Bertalanffy, Problems of Life, op. cit., p. 134.

[108] Sheldon, op. cit., passim.

[109] Earnest A. Hooton, Apes, Men and Morons, New York: Putnam, 1937, passim.

[110] Hooton, ibid., p. 295.

breed genius, but we can prevent breeding morons." To compare with his careful anthropometrics, he used as a criterion of behavior, confinement to a penal institution. Sheldon,[111] on the other hand, while using some of the better measures of behavior, based his physical data upon ratings and judgments.

While horizontal studies of this type are generally discredited,[112] Adler's hypotheses[113] of organic inferiority and compensations are accepted. Also the field of psychosomatic medicine is gaining more attention each day.[114] Both of these points of view utilize a vertical approach through the case history method. It would seem, then, that if such a relation exists, its determinants would be more amenable to a "developmental history" approach than to the "momentary cross section."

The existence of such relationships does not necessarily mean that one is the cause of the other. Both may be a result of a third

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[111] Sheldon, op. cit., Chapter I.

[112] Patterson, op. cit., passim.

[113] Alfred Adler, The Practice and Theory of Practical Psychology, New York: Harcourt, Brace, and Co., 1929, p. 104.

[114] G. K. Yacorzynski, Medical Psychology, New York: Roland Press, 1951, p. 8.

factor or the interaction of several factors. As Anderson[115] points out, "Behavior becomes a problem only when it is a problem to somebody." Adler[116] used a similar approach in his concept of inferiority. It is not the organic inferiority in itself which causes the psychic disturbances but the reaction of the individual to such inferiority. This reaction in turn has its roots in the social climate of the particular individual. In the unconscious compensation for actual or felt inferiority, it is possible to achieve an operational solution to the problem,[117] but in the frustration reaction described by Maier, the behavior elicited is not even oriented towards the solution of the problem.[118] Thus, the relation between growth patterns and behavior could be an effect of the reaction of the individual to situational inferiority resulting from immaturity. On the other hand, it could be the reaction of the individual to a frustrating situation that is overwhelming because of his inferiority.

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[115] H. H. Anderson and G. L. Anderson, "Behavior Problems in Children," L. A. Pennington and Irwin Berg, editors, An Introduction to Clinical Psychology, New York: Roland Press, 1948, p. 69.

[116] Adler, loc. cit.

[117] L. F. Shaffer, The Psychology of Adjustment, New York: Houghton Mifflin, 1936, pp. 162-163.

[118] Maier, op. cit., p. 33.

It is interesting to compare the work of Maier on frustration with that of Dollard, et al. From his work with college students Dollard[119] concluded that aggression was a major product of frustration. Maier,[120] however, points out that aggression is only a byproduct, not a major result of frustration. The process of aggression tends to relieve the tensions built up by the frustration. He points out that the aggressions are rarely goal-oriented, as in the lynchings in the South that increase when the price of cotton decreases, or necessary to complete, as in the writing of a letter intended to tell "just what you think" of a situation, but which is never mailed. Certainly the lynching of Negroes cannot directly affect the market price of cotton, nor can an undelivered opinion directly affect a given situation. Such aggressions tend to relieve the tensions and thus may become conditioned responses to frustration.

In connection with this point, the relation of spontaniety and suppression discussed by Anderson[121] may be applicable. This inverse relationship allows less spontaniety from the individual as the

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[119] John Dollard, op. cit, p. 257.

[120] Maier, op. cit., pp. 101-107.

[121] Anderson, op. cit., pp. 81-84.

suppression from the environment increases. Thus the individual in an authoritarian position (such as a teacher using the classic solution of restraint by punishment) by using conditioned aggression to relieve his tensions, will allow the subject individual (the pupil) less spontaniety with which to resolve his dilemma.

This condition was reproduced by Maier[122] by alternating the proper response between the two possibilities in a chance order. When the animal, in this unsolvable situation, was thus overwhelmed by the environment, it lapsed into an abnormal fixation state in which its activities could not possibly solve the problem or relieve the frustration. The fixation state is a totally ineffective compromise between the two demands. In this condition several rats starved to death in the sight of food rather than even attempt to solve the problem.

The result of such a process in human beings would be close to that characterized by Adorno[123] as the "Authoritarian Personality"

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[122] Maier, op. cit., pp. 43-47.

[123] T. W. Adorno, et al., The Authoritarian Personality, New York: Harper Bros., 1950, pp. 31-39.

or by Hoffer[124] as the "True Believer." Both of these characterizations refer to an individual who cannot operate of and by himself. He has identified with something perceived as greater than himself because he no longer dares to be an individual. He has chosen comfort through security by conformity. Fromm[125] describes this process as an "Escape from Freedom" while Ortega[126] scorns it as "degeneration to the mass," as opposed to the "nobility of responsibility." These social philosophers have pointed out the dangers to civilization, and in particular to democracy, of this aristocracy of mediocrity.

This transition from the experimental laboratory to the area of social philosophy involving the morals, ethics, and value judgments of nations as well as individuals, indicates the severity of the problem. It does not aid the classroom teacher in the original matter of retaining enough control of the classroom to prevent frustration of the pupils and yet allow enough freedom to permit the optimum development of skills, abilities, et cetera. Much research remains

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[124] Eric Hoffer, The True Believer, New York: Harper, 1951, passim.

[125] Erich Fromm, Escape from Freedom, New York: Rinehart and Company, 1945, passim.

to be done before such aid can be given in the form of scientific laws. The present research is an attempt to isolate some of the basic factors involved. It is believed that the analysis of physical development, on an individual basis, may provide an index of the child's ability to operate within the classroom situation.

CHAPTER III

THE DATA

The data used in this study were taken from the records of the Child Development Laboratory, Department of Elementary Education, School of Education, Michigan State College. The records concerned are part of those known as the "Holt data." The data are so named because they are being gathered on the public school children of Holt, Michigan. Holt, an unincorporated community of 850,[127] is primarily a dormitory area for the industrial section of Lansing, Michigan. "The Holt public schools were selected because, in addition to a co-operative staff, the students described in conventional terms, are considered typical. So, also, are the curricular content and teaching methods."[128] The data are being gathered in a longitudinal manner over a period of at least six years. Tests and measurements are concerned with (1) physical development,

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[127] U.S. Census, 1950.

[128] A. R. DeLong, "A Longitudinal Study of Individual Children," Michigan Educational Journal, Nov., 1951, p. 115.

(2) mental development, (3) scholastic achievement, (4) general development, and (5) social status.[129]

The measures of physical development, height, weight, and grip, are recorded three times each year, usually during October, January, and April. Sociograms of each room are made at approximately the same times. Following the fall measurements, the Kuhlman-Anderson Test is administered. After the winter measurements, the Stanford Achievement Tests are given and following the Spring measurements, the Courtis General Development Tests are given. Voice recordings are also made of each pupil in the study, each Spring. All measurements and tests are administered and recorded by staff members and competent graduate students from the Child Development Laboratory.

Although the Holt data are not yet complete, enough material has been collected on those children now in the third and fourth grades to proceed. This use of incomplete data is convenient because it allows the investigator to supplement the available records as needed rather than limiting him to the collected data. From this data pool, the heights and weights of the children to be studied were drawn.

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[129] Ibid., p. 116.

In addition to the record of physical growth, it was necessary to have an estimate of the child's behavior within the classroom. Since the main behavioral focus within the classroom is the teacher-child relationship, it was decided to use teacher judgments of the child's behavior.

In order to codify the judgment, a rating scale was constructed covering the generalities of deportment, effort, citizenship, adjustment, cooperation, and peer relations. Although it would be impossible to establish the validity of such a scale since it forms one of the criteria, a statement of its statistical reliability was desired. While such a statement was not required to include the whole population, it was required to be representative.

CHAPTER IV

PROCEDURE

A rating scale was designed to tap the teacher's opinion of the children in her school room. The scale was used by the third- and fourth-grade teachers to rate each child in their respective rooms on whom the Child Development Laboratory had at least one year of data. This procedure eliminated only those pupils who had entered the Holt Public School System during the immediately past school year. Approximately ninety days later, one third-grade teacher and one fourth-grade teacher again rated their pupils with this scale in order to get an estimate of the reliability of the instrument.

On the basis of the total point score, frequency tables were constructed for each classroom. From these distributions, equal numbers of boys and girls were selected from the extremes. Cutting points were based upon the "natural" breaks of the distributions. By cutting equal numbers of each sex from the extremes, it was possible to compare larger differences and to control any possible sex-linked factors. This procedure resulted in four groups:

"high" boys, "high" girls, "low" boys, and "low" girls, based upon the rating scales completed by the teachers.

From the records of the Child Development Laboratory, the height and weight records were obtained on the selected cases. The individual data were fitted to the Gompertz curve by the Courtis technique.[130] In doing this, the following procedure was closely followed:

1. The data were plotted on logarithmic paper.

2. Those points obviously out of the pattern were discarded for purposes of determining the maximum. These points were included when determining the error of the equation.

3. The percentage of development was calculated by dividing each measurement by the estimated maximum. The results were plotted on isochronic paper. The maximum was varied until the resulting plot approximated a positively accelerated curve, a straight line, and a negatively accelerated curve. Those points that did not conform to this change of pattern were discarded. Again, they were included when determining the error of the equation.

4. From the trial maximum that gave the straightest line, an equation was written. This maximum was then varied in order to more closely approximate the true maximum. That maximum, to the nearest tenth, which gave the smallest isochronic error, was selected as best. In all cases, the equation giving zero error was taken as superior to the equation which balanced the error among several points.

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[130] Courtis, Maturation Units, op. cit., passim.

Equations were thus written for both the heights and the weights of the selected cases. The parameters of the equations, maximum, rate, and incipiency, were analyzed statistically for each group. The curves of constants of the four groups were then compared for both height and weight.

In order to substantiate or refute the belief that height should furnish an index to physical maturity, that would also serve to differentiate children receiving "high" ratings from those receiving "low" ratings, a comparison was made of the percentage of development evidenced by the four groups and of the actual achieved heights. In such comparisons, age was controlled as well as sex.

CHAPTER V

ANALYSIS OF DATA

The rating scale, Figure I, was completed on all children eligible for this study. Approximately ninety days later, two teachers again administered the scale on their pupils. This test-retest correlation of reliability covering the two grades was represented by a Personian Product Moment correlation of 0.819 with a standard error of 0.028. This correlation coefficient, when divided by its standard error, produces a "t" of 28.9. The scale is therefore definitely reliable enough for use in this type of study.[131]

Individuals were selected from each room on the basis of their total point score until approximately equal groups of "highs" and "lows" were formed of boys and girls. In the selected population there were seventeen "high" girls, fifteen "low" girls, fifteen "high" boys, and sixteen "low" boys. These 63 cases were selected from a total of 121 third and fourth graders. There were 32 third graders

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[131] J. P. Guilford, Fundamental Statistics in Psychology and Education, New York: McGraw-Hill, 1942, p. 219.

Figure I

PUPIL RATING SCALE

NAME _____ GRADE ___ TEACHER _____

1. SOCIABILITY

Cannot play with others	Has frequent difficulty	Frequently plays well	Usually plays well	Always plays well
1	2	3	4	5

2. COOPERATES WITH TEACHER

Always	Usually	Frequently	Rarely	Never
5	4	3	2	1

3. COOPERATES WITH OTHER PUPILS

Always	Usually	Frequently	Rarely	Never
5	4	3	2	1

4. SCHOLASTIC EFFORT

Never tries	Rarely tries	Frequently tries	Usually tries	Always tries his best
1	2	3	4	5

5. CONTRIBUTION TO CLASS

Usually contributes	Frequently contributes	Rarely contributes	Frequently detracts	Usually detracts

6. RESPONSIBILITY

Readily accepts	Frequently accepts	Rarely accepts	Frequently rejects	Usually rejects
5	4	3	2	1

7. FOLLOWS INSTRUCTIONS

Always	Frequently	Usually	Rarely	Never
5	4	3	2	1

8. USE OF TIME

Always works well	Makes good use of time	Occasionally wastes time	Frequently wastes time	Usually wastes time
5	4	3	2	1

9. ADJUSTMENT TO CLASSROOM

Superior	Excellent	Good	Fair	Poor
5	4	3	2	1

and 31 fourth graders in the selected groups. It should be noted that approximately the upper and lower quarters of the entire group were selected. The distributions and the selections are presented in Tables 1 and 2.

The individual equations on the height and weight data are presented in tabular form in Appendix I. The means of the three parameters, maximum, rate and incipiency were determined for each group, thus forming an equation for a "Curve of Constants"[132] which is considered to be the most representative equation for the group. As a measure of dispersion, the standard deviation was calculated on the parameters. In order to obtain an estimate of the reliability of the means, the standard error of the mean was calculated. These statistics are summarized in Table 3 for the heights, and Table 4 for the weights.

The selection of these particular statistics made it possible to compare the differences observed between the groups and to determine if the differences are due to chance variation, or if they are true and valid differences. In order to do this, the standard

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[132] Millard, op. cit., p. 60.

TABLE 1

DISTRIBUTIONS OF SCORES ON RATING SCALE
BY TEACHER AND GRADE

Score	Teacher and Grade						
	Trow-bridge 4th gd.	Jenvey 4th gd.	Rooker 4th gd.	Knapp 3rd gd.	Beach 3rd gd.	Somers 3rd gd.	Total
13-15					1	1	2
16-18				2			2
19-21					1		1
22-24	1	2	1	2		3	9
25-27	1	2	1	2		2	7
28-30	4	1	2	4			11
31-33	1	2	6	3	5	2	19
34-36	6	3	4	3	1	2	19
37-39	3	4	5	1	1	2	16
40-42	5	7	5	4	1	3	25
43-45	2	2	1	3	1	1	10
Total	23	23	25	23	11	16	121

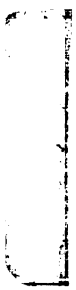

TABLE 2

NUMBER OF INDIVIDUALS SELECTED FOR EACH GROUP FROM EACH ROOM

Group	Teacher and Grade						
	Trow-bridge 4th gd.	Jenvey 4th gd.	Rooker 4th gd.	Knapp 3rd gd.	Beach 3rd gd.	Somers 3rd gd.	Total
High Boys	2	4	2	3	2	2	15
High Girls	5	3	2	4	1	2	17
Low Boys	2	4	1	3	2	4	16
Low Girls	2	1	3	4	1	4	15
Total	11	12	8	14	6	12	63

TABLE 3

SUMMARY OF CURVES OF CONSTANTS FOR HEIGHT EQUATIONS

	k	r	i	Error
High Girls (N = 17)				
Mean	57.4	0.31674	20.13	0.281
Std. Dev.	3.55	0.07494	6.38	
Std. Err. of Mean	0.89	0.18740	1.59	
Low Girls (N = 15)				
Mean	62.0	0.20115	25.60	0.262
Std. Dev.	3.65	0.67380	4.88	
Std. Err. of Mean	0.97	0.18006	1.30	
High Boys (N = 15)				
Mean	56.8	0.31937	21.19	0.232
Std. Dev.	3.99	0.09510	6.19	
Std. Err. of Mean	0.11	0.02541	1.65	
Low Boys (N = 16)				
Mean	61.8	0.18307	27.70	0.204
Std. Dev.	1.67	0.05743	7.62	
Std. Err. of Mean	0.43	0.01483	1.91	

TABLE 4

SUMMARY OF CURVES OF CONSTANTS FOR WEIGHT EQUATIONS

	k	r	i	Error
High Girls (N = 17)				
Mean	87.1	0.37035	7.99	1.10
Std. Dev.	23.81	0.15999	8.90	
Std. Err. of Mean	5.95	0.03999	2.224	
Low Girls (N = 15)				
Mean	78.8	0.33315	9.03	0.759
Std. Dev.	16.39	0.10692	9.82	
Std. Err. of Mean	4.38	0.02857	2.62	
High Boys (N = 15)				
Mean	80.9	0.42696	5.72	1.03
Std. Dev.	19.64	0.24194	18.80	
Std. Err. of Mean	5.25	0.06466	5.02	
Low Boys (N = 16)				
Mean	77.0	0.43450	2.71	1.01
Std. Dev.	26.68	0.21607	15.17	
Std. Err. of Mean	6.89	0.05579	3.92	

error of the mean[133] was calculated. This statistic, when divided into the observed differences between means, yields a "t" score which can be interpreted in terms of the probability of the differences being valid or being due to chance.

This procedure was used to compare the three parameters of the four groups. The results are presented in Table 5.

From this table, it can be seen that the differences in maximum and rate between the high and the low groups for both boys and girls are highly significant. The analogous differences in incipiency are significant at only the 5 percent level of confidence. Thus, it may be said that low groups are growing to higher maxima at lower rates from incipiencies that tend to be higher. In this cycle, the low girl group growing towards a maximum 4.6 inches higher than the high girl group, and the low boy group will achieve a maximum 5.0 inches higher than the high boy group. However, the high girl group is growing towards its maximum 1.5 times isochronically as fast as the low girl

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[133] All statistical formula used in this study were taken from Albert E. Waugh, Laboratory Manual and Problems for the Elements of Statistical Method. New York: McGraw-Hill, 1944, pp. 88-110. The statistical tables used may be found in Guilford, op. cit., pp. 305-327.

TABLE 5

"t" SCORES INDICATING RELIABILITY OF THE DIFFERENCES BETWEEN MEANS OF THE CURVES OF CONSTANTS FOR HEIGHT AND WEIGHT

	k	r	i
Height Group			
High girls-low girls	3.489**	4.448**	2.655*
High boys-low boys	35.587**	4.633**	2.580*
High boys-high girls	2.123*	0.014	0.461
Low boys-low girls	0.1877	1.219	0.909
Weight Group			
High girls-low girls	1.123	3.165**	0.722
High boys-low boys	0.450	0.039	0.472
High boys-high girls	0.781	0.745	0.413
Low boys-low girls	0.221	1.617	1.340

* Difference significant beyond the 5% level of confidence but less than the 1% level of confidence.

** Difference significant beyond the 1% level of confidence.

group, while the high boy group is growing 1.7 times as fast as the low boy group.

In analyzing the groups for sex-linked differences, it was found that no true differences exist between the sexes within the low group, but that within the high group, the girls were growing towards a maximum that is 0.6 inches greater than the boys' maximum. This difference was significant at the 5 percent level of confidence. No other true differences existed between the sexes. It is therefore concluded that the differences in the rate of growth in height and the height incipiencies exhibited by the high and low groups are not sex-linked, but that differences may exist between the sexes with regard to maxima.

In the analysis of the differences between the weight parameters, as evidenced by the four groups, very different results are encountered. In the twelve comparisons of groups and sex, only one true difference appeared. This difference, between the rates of the high and low girl groups is significant beyond the 1 percent level of confidence. It should be noted that in weight, no differences appear between the sexes within the groups. In fact, "t" scores are so low that there is little doubt that the groups are homogeneous with regard to sex.

Thus, if sex is an elemental factor as proposed by Courtis,[134] it does not appear to be effective during this cycle.

This analysis of the equations indicates that the low group would have a gradually breaking curve of achieved height, while the high groups would have sharp, well-defined curves. This is true when the total curve is considered as in Figure II. The difference tends to disappear, however, in the effective area of the equation. This area is so designated because it represents the time span observed in the actual data. In the enlargement of this area, Figure III, it can be seen that there is no group consistency of superiority or inferiority in magnitude of actual measurement. It is believed that at least one postnatal cycle preceded the one written, since the height at time zero would be preposterous. In this connection, it should be recorded that in writing the equations, several of the low curves evidenced a spurious series of points suggestive of a previous cycle, while several of the high cases evidenced points that suggested that the child has already entered the adolescent cycle. This is possible since the changes usually associated with

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[134] Courtis, Science of Education, op. cit., p. 25.

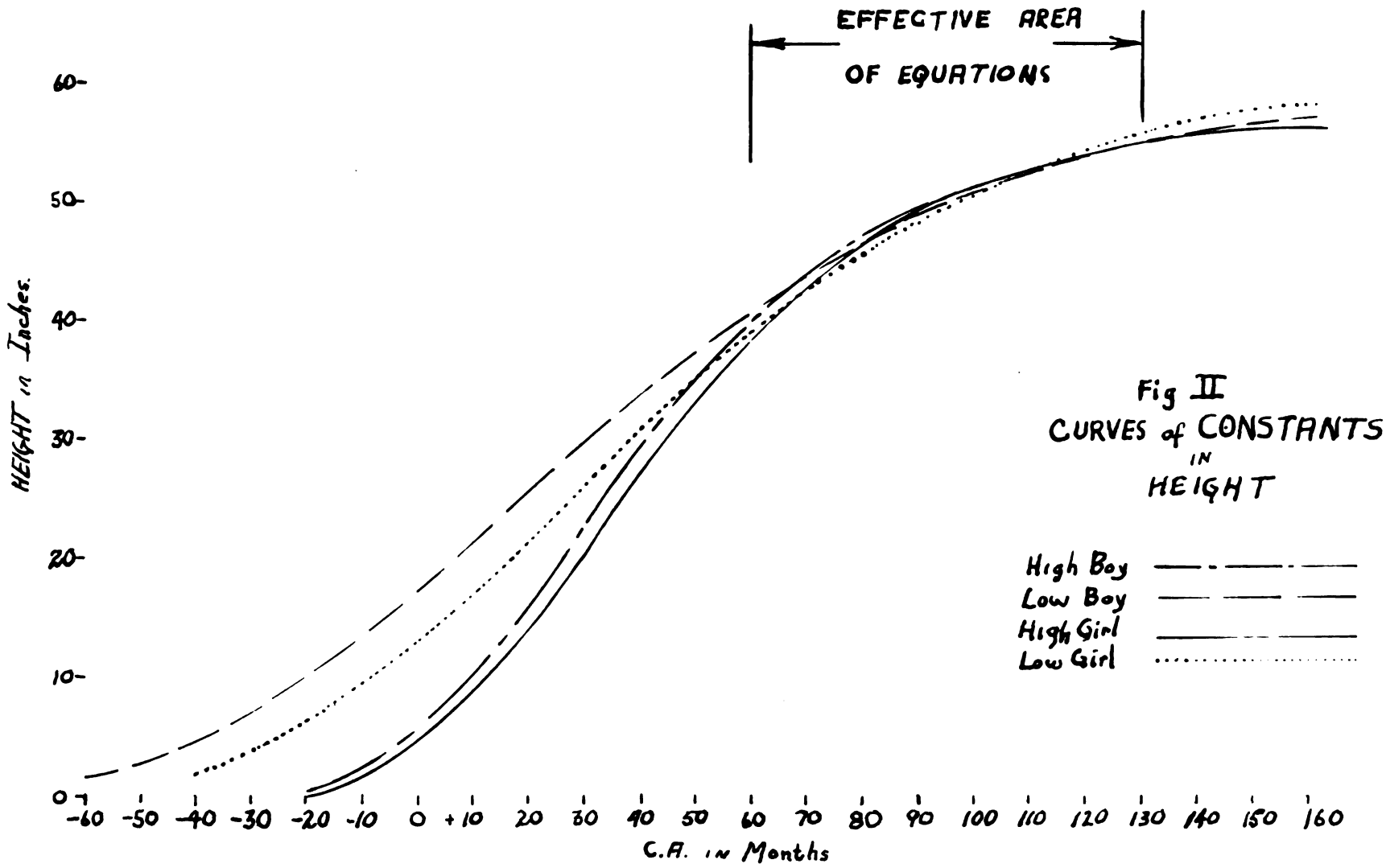

Fig II
CURVES of CONSTANTS
IN
HEIGHT

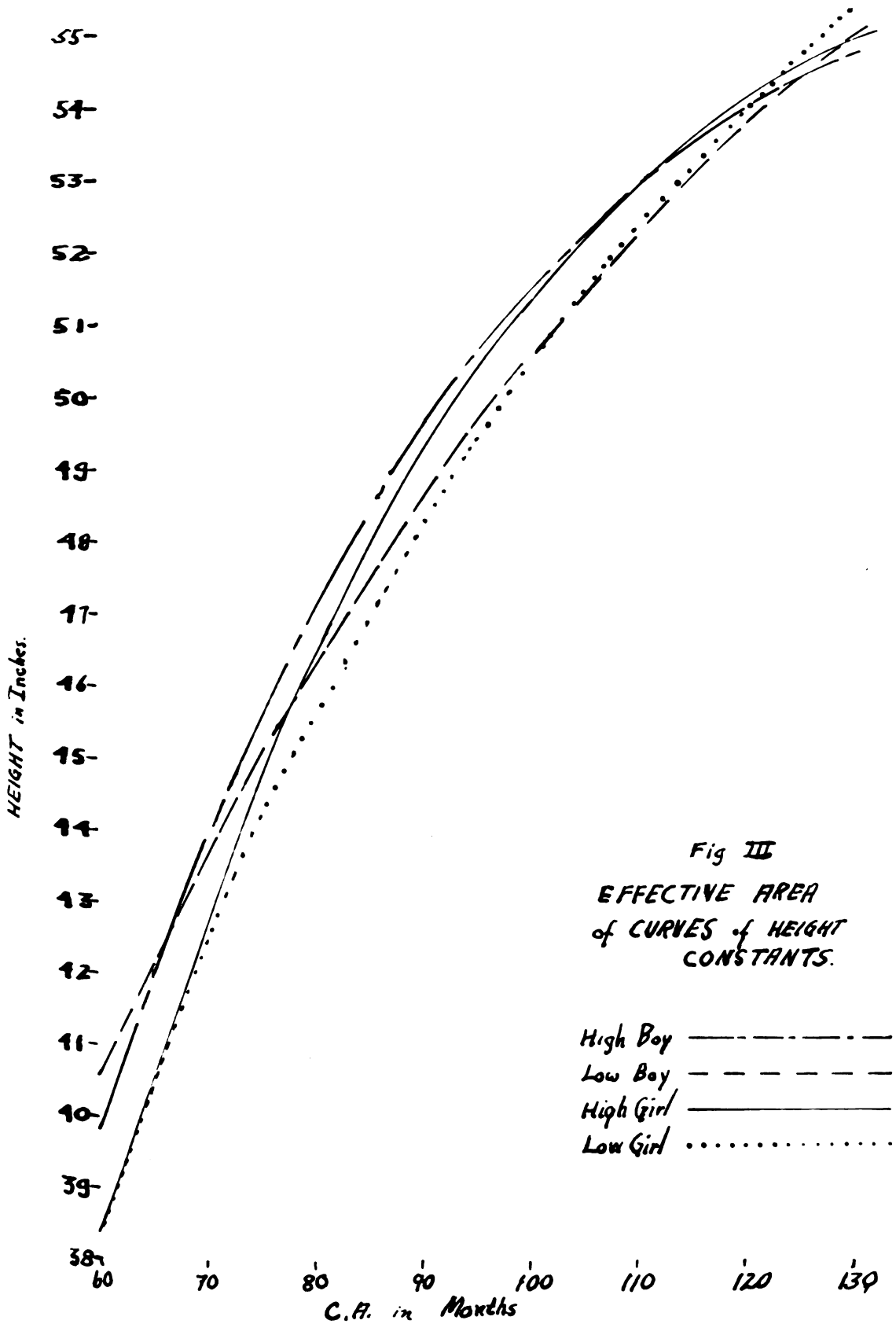

Fig III

EFFECTIVE AREA of CURVES of HEIGHT CONSTANTS.

High Boy ——·——·——·——

Low Boy — — — — — —

High Girl ——————————

Low Girl ....

adolescence do not occur until approximately 70 percent of that cycle has been completed.[135]

In order to determine if height could furnish a reliable index to physical maturity that would also differentiate those children receiving high ratings from those receiving low ratings, the percent of development in height was determined for each child as of a certain date (April 21, 1953). This date was selected because it was the only date on which actual measurements were available on all children when it could be judged with a degree of reliability that the selected points were in the same cycle. Since percentages may not be reliably averaged,[136] it was necessary to average the mathematical factors which were then converted into percentages. Comparison of group means was again made. In order to control the possibility of this difference being sex-linked, comparison of the sexes within the groups was also made. To investigate the possibility of this difference being due to age differences, the mean ages of the groups, as of the same date, were also compared. A third possibility, that the

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[135] Sigurd M. Lee, "The Advent of Menstruation in Relation to Adolescent Development in Height," Unpublished M.A. Thesis, Univ. of Mich., 1933.

[136] Guilford, op. cit., p. 142.

actual height would furnish an adequate index was probed by comparing the actual height means of the groups as of the same date. The results of these analyses are summarized in Table 6. It is shown in this table that the mean difference in the percent of development between the high girl group and the low girl group, between the high boy group and the low boy group was significant well beyond the 1 percent level of confidence. The differences between the sexes within the groups were not significant. The differences in age and actual achieved height were not significant. These "t" scores among the mean ages, between the sexes and among the actual achieved height are so small that it can be said that the population was homogeneous with respect to these characteristics. The percent of development in height, however, is highly significant and thus should be quite diagnostic of the differences in the behavior of the two groups.

It is especially interesting to note that the differences between the actual achieved heights is not significant. This cross-sectional mode of analysis is the conventional method for the interpretation of this type of data. The failure of the vertical type and the success of the horizontal approach with the same data would seem to support

TABLE 6

TABLE OF "t" SCORES INDICATING THE RELIABILITY OF THE DIFFERENCES BETWEEN THE MEANS OF THE GROUPS IN AGE, PERCENTAGE OF DEVELOPMENT, AND ACHIEVED HEIGHT AS OF APRIL 21, 1953

Group	Age	Percent Development	Actual Height
High girls-low girls	0.817	5.23**	0.26
High boys-low boys	0.343	5.79**	0.024
High boys-high girls	0.755	0.169	0.091
Low boys-low girls	0.389	0.870	0.100

** Difference is significant beyond the 1% level of confidence.

the documentary evidence favoring the longitudinal method presented in Chapter II of this study.

Since no consistent parametric differences appeared among the weight equations, a similar analysis was not made. The percent of development is a function of the three parameters. Only with consistent and reliable differences between the parameters could true differences be expected between the percents of development.

The curves of constants representing the weights of the four groups are presented in Figure IV. The observable differences between the high and the low groups that was clearly seen in the height curve is definitely absent among the weight curves. Although the differences observed in this graph are greater than those observed in the height graph, the variability is five to seven times greater for the weight means than for the height means. The lack of significance between the group parameters is probably due to this greater amount of variability. The difference between the rates of the high girl and the low girl groups is completely out of the pattern. However, the magnitude of this "t" score indicates that it cannot be due to chance.

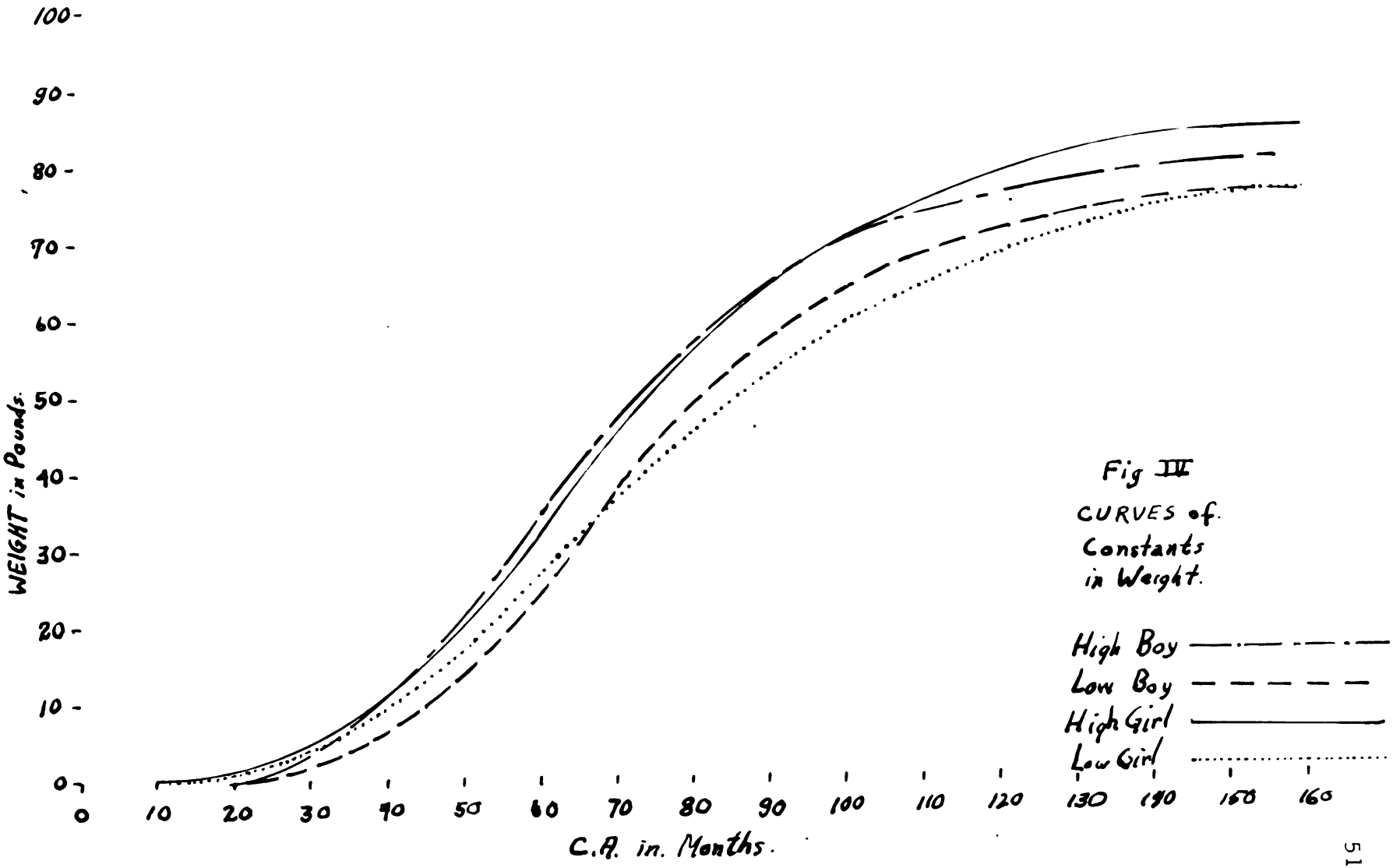

Fig III

CURVES of Constants in Weight.

CHAPTER VI

DISCUSSION OF RESULTS

From the results of this study, it would seem that the height maximum, the rate of growth in height, and the percent of development in height furnish reliable indices to the teachers' judgments of the child's behavior in the classroom. Since the percentage of development depends upon the three parameters, the writer feels that it would form a more reliable index than the parameters taken separately. The rating scale used to codify the teacher's judgments of the behaviors of the child contrasted less mature behavior on the low point total with more mature behavior on the high point total. Therefore, it can be concluded that relative social maturity, that is the ability to show socially acceptable behavior and to suppress unacceptable behavior is related to maturity in height. Although nothing has been found regarding the nature of this relationship, the theoretical background of psychodynamics suggests that if the undesirable behavior is simply "immature" behavior, the child may be expected to "outgrow" it. If, however, a point is made of attempting to force the child to act more mature (in a more

acceptable manner) the situation may well become overwhelming and cause a pathological development.

Neither the actual achievement in height nor chronological age furnished an index which could distinguish the two groups. This suggests that chronological age, our current standard for school admission, is not a crucial factor insofar as the ability to present socially acceptable behavior is concerned. Achieved height, as measured, is no better than chronological age. Only when the pattern of measured height through time, as described by the parameters of the Gompertz equation, is considered, does physical growth become an index to classroom behavior.

The interrelationship of behavior and physical growth is in direct line with the organismic concept. If the child develops as a totality, a measure of one factor should furnish an index to other factors. However, it should be noted that the parameters of weight were not useful in distinguishing the groups. This could indicate a serious inaccuracy in the organismic concept, or the presence of an additional factor or factors affecting weight, but not height.

DeLong[137] proposes a hypothetical construct, "build," to account for the difference in the height-weight ratio of individuals. That is, when persons of equal height differ in weight, it may be attributed to "build." "Build," then, is one factor that affects weight but not height.

Re-examination of Tables 3 and 4 will indicate that the differences between the mean height maxima of the groups was no larger than the differences between the mean weight maxima. The standard deviations, however, were five to seven times as large for weight as for height. Thus, it may be said that the weights were more variable than the heights.

This greater variability would also suggest the presence of a factor or factors which affect weight but not height. Research in psychopathology and psychosomatic medicine indicates that a person's weight may be closely linked, not only with his level of adjustment, but also with the kind of adjustment. English and Pearson[138] list

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[137] A. R. DeLong, "Methods for Isolating Variables in Educational Measurement," Unpublished manuscript reported to the American Educational Research Association, Atlantic City, N.J., Feb. 16, 1953, pp. 5-7.

[138] English and Pearson, op. cit., p. 179.

seven varieties of eating patterns that reflect emotional disturbances. Several of these are used as defense mechanisms against specific situations. This could, in part, account for some of the variability in the weight pattern. Bochner and Halpern[139] consider emphasis on such oral behaviors as "indication of serious psycho-sexual disturbance."

It should be recalled that the high and low groups, used in this study, were selected on the basis of teacher evaluation.. The work of Wickman[140] should also be recalled at this time. This study indicated that many symptoms regarded as serious by the teacher were regarded as normal developmental sequence by the clinicians, while some traits favored by the teachers were considered pathological by the clinicians. Thus, classroom behavior and personal adjustment are not necessarily the same. Both are probably related to some basic process as height and weight are both reflections of over-all physical development. The height parameters have been demonstrated as diagnostic to classroom behavior by this study. It is the belief of the writer that the weight parameters may be

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[139] Bochner and Halpern, op. cit., p. 287.

[140] Wickman, loc. cit.

diagnostic of personal adjustment, and that perturbations of either pattern, weight being the more sensitive, probably indicate the occurrence of strongly disturbing experiences. In such a case, the height pattern, as the more stable index, would indicate the severity of the disturbance.

It is interesting to note that the only sex-linked difference was between the height maxima of the high boy and high girl groups. This difference of 0.6 inches favored the girl group and was significant at only the 5 percent level of confidence. This would seem to indicate that at least up to this stage of development there is little outstanding difference in the physical development of boys and girls.

When the results of this study are compared with the work of Nally[141] in relating reading to physical development, and Barber[142] in relating reading to psychosocial development, the developmental pattern assumes a primary place in the evaluation of the school child and in the determination of the readiness of the child for the school regime and the instructional situation.

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[141] Nally, op. cit., p. 53.

[142] Lucille K. Barber, "Immature Ego Development as a Factor in the Retarded Ability to Read," Unpublished Ph.D. Thesis, University of Michigan,, 1942, p. 153.

CHAPTER VII

IMPLICATIONS FOR FURTHER RESEARCH

Conflicting and inconclusive results from experiments have been the bane of the social sciences for years. The significant results of this study, and its agreement with others that dealt with developmental design, indicate that Courtis[143] was correct when he diagnosed this difficulty as being due to neglect in considering maturation as a factor in the behavior of the individual. Since one of the outstanding characteristics of a scientific study is that the results are verifiable, the greatest need created by this study is to verify its results.

In attempting to verify them, it is recommended that more complete physical data be obtained so that the spurious series of points mentioned earlier can be identified as either the remnants of an infant cycle, the inauguration of the adolescent cycle, or mere perturbations. Extension of such data would also indicate the

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[143] Courtis, "Growth and Development in Children," op. cit., p. 180.

existence or absence of sex-linked differences in other cycles. It is further recommended that a differential psychiatric diagnosis be obtained to determine if personal adjustment is related to the weight parameters. The evaluation of behavior should be done on a longitudinal basis so that specific behavioral manifestations may be identified as "normal developmental sequence" or as "pathological developmental sequence."

The emphatic results of this study were achieved by averaging the parameters which, while superior to using the "massed" data, is inferior to analysis on the basis of the individual equations.[144] This, however, was necessary because no procedures have been evolved for the analysis of the individual equations and for the synthesis of meaning from them. Although several procedures have been suggested,[145,146] they have been neither verified nor sufficiently explored for general use.

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[144] Merrell, op. cit., p. 53.

[145] A. R. DeLong, loc. cit.

[146] S. A. Courtis, "Personalized Statistics in Education," Unpublished manuscript, Reported to Michigan Academy of Science, Arts and Letters, Ann Arbor, Michigan, March 27, 1954.

An approach to the analysis of individual developmental data that deserves special mention is presented by Millard[147] in School and Child: A Case History. This use of case study techniques to parallel the developmental curves of several areas of achievement should be especially useful in the exploration of spurious points and perturbations and in the examination of fortuitous cases.

On the basis of the work done by Nally[148] in relating reading to development in height, and Barber[149] in relating reading to ego-development, it would seem that several measures of academic achievement should be included in further studies of behavior and physical development. Not only would this further corroborate the organismic concept, but may indicate some of the interrelation among the several factors of development.

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[147] C. V. Millard, School and Child: A Case History, East Lansing: Michigan State College Press, 1954, In Press.

[148] Nally, op. cit., p. 54.

[149] Barber, op. cit., p. 154.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

This study was done to investigate the possibility of a relationship existing between the patterns of physical growth and behavior in the classroom.

A behavior rating scale was completed on all third- and fourth-grade children of the public schools of Holt, Michigan, by their teachers. From the results of these scales, children with high and low scores were selected. Within each group, sex and age were approximately equated. Thus, 32 third graders and 31 fourth graders were further classified as: 15 high boys, 16 low boys, 17 high girls, and 15 low girls. These groups represented approximately the upper and lower quarters of the total group.

On these selected cases, the longitudinal height and weight measurements collected by the Child Development Laboratory, School of Education, Michigan State College, were obtained. These individual data were then fitted to the Gompertz curve by the Courtis Technique. The parameters of these equations were then analyzed statistically for the four groups. The constants for the groups

were then compared statistically. The mean height, age, and percent of development in height on a certain date (April 21, 1953) was then found for each group. These means were then compared statistically. From these analyses, the following conclusions were drawn concerning the height patterns:

1. The high girl group was growing to a maximum 4.6 inches lower than the low girl group. This difference was significant well beyond the 1 percent level of confidence.

2. The high girl group was growing 1.5 times faster (in isochronic units) than the low girl group. This difference was also significant beyond the 1 percent level of confidence.

3. The incipiency for the high girl group was 5.47 isochrons lower than the incipiency for the low girl group. This difference was significant beyond the 5 percent level of confidence, but less than the 1 percent level of confidence.

4. Thus, the high girl group, with an incipiency somewhat lower, was growing much faster to a lower maximum than was the low girl group. The high girl group would be expected to have achieved a higher percent of development. The analysis of the percent of development showed that this difference existed and that it was significant beyond the 1 percent level of confidence.

5. The high boy group was growing to a maximum 5.0 inches lower than the low boy group. This difference was significant well beyond the 1 percent level of confidence.

6. The high boy group was growing 1.7 times as fast (in isochronic units) as the low boy group. This difference was also significant beyond the 1 percent level of confidence.

7. The incipiency for the high boy group was 6.51 isochrons lower than the incipiencies for the low boy group. This difference was significant beyond the 5 percent level of confidence, but less than the 1 percent level of confidence.

8. Thus, the high boy group, with an incipiency somewhat lower, was growing much faster to a lower maximum than was the low boy group. The high boy group, then, would be expected to have achieved a higher percent of development. The analysis of this factor showed that the expected differences existed and that it was significant beyond the 1 percent level of confidence.

9. Thus, the difference between the high boys' group and the low boy group followed exactly the same pattern as did the differences between the high and low girl groups. The consistency of this pattern also tends to verify its existence.

10. No differences existed between the low boy group and the low girl group. Between the high boy group and the high girl group there was a difference of 0.6 inches but significant at only the 5 percent level of confidence, in favor of the girls. No other differences were observed between the sexes.

11. Although two grades were sampled, the differences in age among the four groups were not significant. In fact, in no instance did any difference exceed 0.9 of a standard deviation. This would indicate with considerable reliability that with regard to age, the groups formed a homogeneous population.

12. Comparison of the groups was also made on the basis of actual height achieved. No true differences were found. In fact, the "t" scores were so low, the highest was 0.26, that it can be said with considerable reliability that the four groups formed a homogeneous population with regard to actual height.

This fact, together with the lack of differences in ages and the very clear differences between the group parameters indicated that longitudinal analysis of individual data is far superior to the statistical analysis of grouped data. Furthermore, these results indicate that the development of the individual is certainly a factor in the teacher's rating of his behavior. It suggests that development

in height would make a far superior criteria for school admission than the conventional chronological age.

The following conclusions were drawn concerning the weight patterns:

1. No differences were observed to exist between the high girl group and the low girl group except in rate. As in height, the high girl group was growing 1.5 times as fast as the low girl group. This difference was significant beyond the 1 percent level of confidence.

2. No differences were observed to exist between the high boy group and the low boy group.

3. While the differences in the height patterns were striking and consistent, the differences in weight patterns were mostly chance differences. As noted above, the rate of development in weight for the high girl group was significantly higher than that of the low girl group.

4. Because of the lack of true differences among the parameters of the groups, no further analysis was done on the weight equations.

5. The lack of valid differences among the weight parameters, while clear differences exist among the height parameters, indicates

the existence of an additional factor or factors that affect either the height pattern or weight pattern, but not both. The concept of build and pathological eating habits are two such factors. The role of these factors should be investigated.

This study has shown that a definite relation exists between the developmental pattern of height as described by the parameters of the Gompertz Curve and the teacher's estimate of classroom behavior. The relationship is apparent in the highly significant differences between the levels of development of the high and low rated groups. Thus, the analysis of the height pattern should be able to provide an index to the readiness of the child for the school situation. Furthermore, the emphatic results of this study indicate that in future studies of classroom behavior, the developmental patterns of physical growth must be considered.

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APPENDIX I

TABLE 1

HEIGHT EQUATIONS (HIGH GIRLS)

Case No.	Maximum	Rate	Increase	Error
H-0-60F	58.0	0.38050	+15.54	0.07
H-0-106F	58.8	0.22742	+24.07	0.25
H-1-4F	57.0	0.24607	+26.09	0.37
H-0-56F	59.0	0.21833	+27.43	0.23
H-1-108F	57.0	0.40556	+11.92	0.44
H-0-120F	60.0	0.31556	+18.51	0.42
H-1-162F	57.5	0.32667	+16.69	0.01
H-0-147F	65.0	0.22650	+22.81	0.54
H-0-99.27F	53.7	0.29708	+29.21	0.23
H-1-214F	60.0	0.28500	+17.96	0.02
H-0-24F	54.0	0.40294	+18.39	0.11
H-0-103F	55.9	0.28700	+23.40	0.31
H-1-26F	55.9	0.29950	+22.75	0.43
H-1-107F	54.8	0.28864	+27.69	0.18
H-0-164F	52.1	0.37611	+15.51	0.32
H-0-160F	59.2	0.51074	+ 3.02	0.30
H-0-144F	58.5	0.29091	+21.15	0.58
Mean	57.4	0.316737	+20.13	0.28
Std. Dev.	3.55	0.07494	+ 6.378	
Std. Err. of Mean	0.888	0.187400	1.595	

TABLE 2

WEIGHT EQUATIONS (HIGH GIRLS)

Case No.	Maximum	Rate	Increase	Error
H-0-60F	130.0	0.29875	+10.51	1.44
H-0-106F	120.0	0.10452	+21.99	0.61
H-1-4F	55.6	0.61818	+ 1.53	0.36
H-0-56F	85.0	0.31050	+13.85	2.50
H-1-108F	110.0	0.14320	+19.64	1.09
H-0-120F	90.0	0.30625	+10.70	0.74
H-1-162F	110.0	0.20333	+16.39	0.34
H-0-147F	85.0	0.41333	- 1.62	0.07
H-0-99.27F	59.8	0.35833	+18.53	0.58
H-1-214F	77.4	0.39875	+ 1.00	1.31
H-0-24F	62.9	0.61750	- 0.73	0.50
H-0-103F	79.0	0.34821	+ 5.47	0.41
H-1-26F	58.1	0.54609	+ 2.16	0.89
H-1-107F	66.3	0.64444	- 4.22	1.40
H-0-164F	65.5	0.47724	- 3.54	1.69
H-0-160F	106.8	0.28292	+11.44	0.56
H-0-144F	119.3	0.22444	+12.67	1.09
Mean	87.1	0.37035	+ 7.99	1.099
Std. Dev.	23.81	0.15999	+ 8.897	
Std. Err. of Mean	5.95	0.039998	2.224	

TABLE 3

HEIGHT EQUATIONS (HIGH BOYS)

Case No.	Maximum	Rate	Increase	Error
H-0-167M	55.5	0.36920	+17.60	0.31
H-0-99.32M	59.4	0.26516	+26.37	0.23
H-0-99.6M	56.5	0.25233	+27.56	0.27
H-1-143M	60.5	0.26250	+23.52	0.17
H-0-157M	56.6	0.29571	+21.56	0.36
H-2-214M	64.5	0.23500	+25.38	0.13
H-0-23M	51.3	0.32545	+23.96	0.25
H-0-150M	52.2	0.58120	+ 2.80	0.33
H-0-99.21M	47.9	0.47750	+14.81	0.11
H-1-25M	59.3	0.22840	+27.76	0.24
H-2-210M	56.0	0.34667	+17.52	0.08
H-1-137M	60.2	0.27211	+24.97	0.35
H-2-312M	60.0	0.23600	+20.44	0.08
H-1-211M	58.0	0.28250	+24.08	0.30
H-0-169M	54.0	0.36077	+19.58	0.27
Mean	56.8	0.31937	+21.19	0.23
Std. Dev.	3.99	0.095104	+ 6.19	
Std. Err. of Mean	0.107	0.025410	1.654	

TABLE 4

WEIGHT EQUATIONS (HIGH BOYS)

Case No.	Maximum	Rate	Increase	Error
H-0-167M	111.0	0.19690	+16.87	0.57
H-0-99.32M	85.0	0.23741	+19.57	0.92
H-0-99.6M	60.1	0.44968	+12.39	1.21
H-1-143M	88.8	0.33583	+ 9.21	0.23
H-0-157M	80.1	0.27800	+15.51	0.67
H-2-214M	96.5	1.02222	-46.09	0.01
H-0-23M	70.8	0.23950	+20.35	0.49
H-0-15M	55.7	0.94333	-29.50	0.57
H-0-99.21M	50.1	0.35625	+14.39	0.17
H-1-25M	98.0	0.41579	+ 5.65	1.89
H-2-210M	67.8	0.63667	-10.44	0.56
H-1-137M	120.2	0.28792	+11.67	1.65
H-2-312M	88.0	0.26083	+15.66	0.52
H-1-211M	79.9	0.36792	+10.48	0.49
H-0-169M	61.5	0.37609	+20.0	1.44
Mean	80.9	0.42696	+ 5.72	0.76
Std. Dev.	19.64	0.24194	+18.80	
Std. Err. of Mean	5.249	0.064660	5.024	

TABLE 5

HEIGHT EQUATIONS (LOW GIRLS)

Case No.	Maximum	Rate	Increase	Error
H-0-116F	69.9	0.10450	+31.55	0.24
H-0-98F	62.0	0.16435	+28.07	0.42
H-0-99.25F	55.8	0.37900	+15.52	0.11
H-0-37F	60.0	0.28407	+22.29	0.40
H-1-95F	58.0	0.19310	+28.31	0.38
H-1-105F	61.1	0.19970	+30.59	0.16
H-0-89F	62.1	0.14000	+28.55	0.22
H-2-320F	60.0	0.29266	+16.58	0.10
H-2-200F	61.0	0.21550	+26.56	0.21
H-0-45F	65.0	0.15964	+27.23	0.30
H-2-251F	59.8	0.15850	+31.03	0.03
H-1-13F	66.0	0.18100	+26.57	0.36
H-0-99.33F	62.0	0.15906	+28.46	0.19
H-2-314F	63.0	0.21167	+19.91	0.15
H-2-252F	65.0	0.17444	+22.73	0.67
Mean	62.0	0.20115	+25.60	0.26
Std. Dev.	3.65	0.68738	+ 4.876	
Std. Err. of Mean	0.975	0.180060	1.304	

TABLE 6

WEIGHT EQUATIONS (LOW GIRLS)

Case No.	Maximum	Rate	Increase	Error
H-0-116F	95.0	0.17160	+17.71	0.95
H-0-98F	63.0	0.34375	+12.97	0.73
H-0-99.25F	70.9	0.33848	+13.23	0.74
H-0-37F	70.0	0.39050	+ 8.47	0.32
H-1-95F	62.5	0.39103	+ 9.90	0.52
H-1-105F	64.0	0.41476	+14.54	1.85
H-0-89F	60.4	0.20542	+21.05	1.57
H-2-320F	73.0	0.53066	-15.45	0.04
H-2-200F	96.0	0.30059	+10.47	1.50
H-0-45F	123.0	0.25032	+15.51	2.37
H-2-251F	90.0	0.20385	+15.96	1.39
H-1-13F	81.6	0.51700	- 2.05	0.51
H-0-99.33F	74.0	0.20875	+17.67	0.76
H-2-314F	88.5	0.38333	- 5.21	0.93
H-2-252F	69.7	0.34717	+ 0.66	1.21
Mean	78.8	0.33315	+ 9.03	1.03
Std. Dev.	16.39	0.106916	+ 9.817	
Std. Err. of Mean	4.38	0.028573	2.624	

TABLE 7

HEIGHT EQUATIONS (LOW BOYS)

Case No.	Maximum	Rate	Increase	Error
H-0-153M	61.0	0.18500	+28.97	0.19
H-0-213M	65.0	0.15393	+27.07	0.15
H-0-158M	62.0	0.22930	+23.55	0.37
H-0-131M	58.0	0.13333	+30.16	0.15
H-0-110M	64.2	0.13130	+31.28	0.26
H-0-209M	62.4	0.21345	+23.38	0.19
H-1-151M	64.8	0.17467	+24.98	0.17
H-0-99.5M	62.5	0.16821	+28.26	0.33
H-2-209M	64.3	0.18150	+27.09	0.13
H-1-145M	61.1	0.21750	+24.07	0.20
H-1-99.14M	57.0	0.18958	+29.05	0.20
H-0-1M	56.5	0.24042	+30.72	0.17
H-0-133M	60.0	0.18519	+28.53	0.13
H-2-212M	60.5	0.14000	+31.00	0.05
H-1-134M	65.1	0.19500	+27.72	0.31
H-1-156M	63.8	0.19077	+27.41	0.26
Mean	61.8	0.18307	+27.70	0.204
Std. Dev.	1.67	0.057425	+ 7.616	
Std. Err. of Mean	0.431	0.014830	1.905	

TABLE 8

WEIGHT EQUATIONS (LOW BOYS)

Case No.	Maximum	Rate	Increase	Error
H-0-153M	118.0	0.13950	+22.01	0.53
H-0-213M	85.0	0.19640	+19.90	0.57
H-0-158M	80.0	0.45120	- 3.30	0.94
H-0-131M	63.1	0.23028	+19.23	1.84
H-0-110M	62.3	0.68760	-13.11	1.17
H-0-209M	80.1	0.38105	+ 3.58	0.81
H-1-151M	70.3	0.34792	+ 6.96	0.73
H-0-99.5M	56.7	0.44303	+12.37	0.82
H-2-209M	80.1	0.34133	+ 7.51	0.59
H-1-145M	62.7	0.58800	-10.34	0.48
H-1-99.14M	53.5	0.40000	+15.12	0.80
H-0-1M	88.0	0.23364	+19.49	0.84
H-0-133M	70.6	0.52650	- 1.83	1.78
H-2-212M	76.0	0.56889	-11.46	1.35
H-1-134M	111.0	0.73125	-28.13	1.90
H-1-156M	74.8	0.68542	-14.80	1.07
Mean	77.0	0.43450	+ 2.71	
Std. Dev.	26.68	0.216073	+15.168	
Std. Err. of Mean	6.889	0.055789	3.917	

TABLE 9

ANALYSIS OF DIFFERENCE BETWEEN CURVES OF CONSTANTS

Ht. or Wt.	Maximum		Rate		Increase	
	Std. Err. of Mean	t	Std. Err. of Mean	t	Std. Err. of Mean	t
			High Boys - Low Boys			
Ht.	0.14	35.56**	0.03	4.63**	2.52	2.58*
Wt.	8.66	0.45	0.1k	0.04	6.37	0.47
			High Boys - High Girls			
Ht.	0.28	2.12*	0.19	0.01	2.29	0.46
Wt.	7.93	0.78	0.08	0.94	5.49	0.41
			High Girls - Low Girls			
Ht.	1.32	3.49**	0.03	4.45**	2.06	2.66*
Wt.	7.39	1.12	0.02	3.16**	1.43	0.72
			Low Girls - Low Boys			
Ht.	1.07	0.19	0.01	1.22	2.31	0.91
Wt.	8.16	0.22	0.06	1.62	4.72	1.34

* Difference significant beyond the 5 percent level of confidence but less than the 1 percent level of confidence.

** Difference significant beyond the 1 percent level of confidence.

APPENDIX II

TABLE 1

RELIABILITY CORRELATION FOR RATING SCALE

Case No.	Grade	First Rating	Second Rating
H-1-25M	3	41	44
H-0-99.32M	3	41	44
H-0-99.5M	3	25	32
H-1-145M	3	24	27
H-1-99.14M	3	23	24
H-0-1M	3	22	32
H-0-60F	3	45	45
H-1-26F	3	40	42
H-0-139F	3	38	32
H-0-163F	3	38	41
H-0-164F	3	39	41
H-0-45F	3	32	32
H-0-99.33F	3	31	35
H-0-89F	3	26	31
H-0-98F	3	15	20
H-0-109M	4	32	26
H-2-213M	4	37	27
H-0-152M	4	33	27
H-0-133M	4	25	31
H-0-113M	4	34	31
H-0-168M	4	33	33
H-0-216M	4	32	33

TABLE 1 (Continued)

Case No.	Grade	First Rating	Second Rating
H-0-140M	4	36	34
H-0-128M	4	38	37
H-2-312M	4	41	37
H-0-126M	4	39	39
H-0-136M	4	37	39
H-1-211M	4	42	40
H-2-252F	4	23	24
H-1-205F	4	33	29
H-0-130F	4	35	31
H-2-200F	4	29	31
H-0-129F	4	33	32
H-2-314F	4	28	32
H-1-165F	4	35	34
H-2-207F	4	37	37
H-0-148F	4	40	39
H-0-207F	4	40	40
H-0-144F	4	42	42
H-0-160F	4	43	44

N = 41 r = 0.819 Std. Err. = 0.028 t = 28.97

APPENDIX III

TABLE 1

INDIVIDUAL DEVELOPMENTAL DATA AS OF APRIL 21, 1953
(HIGH BOYS)

Case No.	Percent Development	Chronolical Age (months)	Height (inches)
H-0-23M	92.5	97	47.50
H-1-25M	86.4	94	51.25
H-0-99.21M	93.4	88	44.74
H-0-99.23M	89.6	97	53.25
H-0-99.6M	88.5	93	50.00
H-1-137M	91.4	107	55.00
H-1-143M	90.2	111	54.50
H-0-150M	96.9	106	50.50
H-0-157M	92.3	114	52.25
H-0-167M	92.6	103	51.25
H-0-169M	93.1	102	50.25
H-2-210M	87.9	95	50.25
H-1-211M	91.8	108	53.25
H-2-214M	82.2	89	53.00
H-2-312M	83.8	114	50.50
Mean	90.2	101.2	51.17
Std. Dev.	3.04	8.35	24.71
Std. Err. of Mean	0.81	2.23	6.61

TABLE 2

INDIVIDUAL DEVELOPMENTAL DATA AS OF APRIL 21, 1953
(LOW BOYS)

Case No.	Percent Development	Chronological Age (months)	Height (inches)
H-0-1M	90.1	90	50.90
H-1-99.14M	81.3	88	46.25
H-0-99.5M	76.9	90	48.10
H-0-110M	81.0	109	52.00
H-0-131M	78.5	105	45.25
H-0-133M	81.6	94	49.00
H-1-134M	85.3	106	55.50
H-1-145M	81.8	101	50.00
H-1-151M	77.5	107	50.25
H-0-153M	84.8	103	51.75
H-1-156M	83.1	102	53.00
H-0-158M	88.3	119	54.75
H-0-209M	87.3	125	54.50
H-2-209M	84.4	114	54.25
H-2-212M	77.9	92	47.13
H-2-213M	80.4	118	52.25
Mean	82.5	103.9	50.93
Std. Dev.	4.09	29.24	30.05
Std. Err. of Mean	1.06	7.56	7.76

TABLE 3

INDIVIDUAL DEVELOPMENTAL DATA AS OF APRIL 21, 1953
(HIGH GIRLS)

Case No.	Percent Development	Chronological Age (months)	Height (inches)
H-1-4F	85.8	92	48.75
H-0-24F	94.25	99	52.00
H-1-26F	90.4	100	50.50
H-0-56F	84.1	92	49.75
H-0-60F	90.7	99	52.63
H-0-99.27F	93.2	92	51.10
H-0-103F	92.1	110	51.50
H-0-106F	86.2	110	50.30
H-1-107F	93.6	102	52.00
H-1-120F	91.2	112	54.75
H-1-144F	88.9	104	52.00
H-0-147F	86.5	112	57.90
H-0-160F	94.2	108	55.50
H-1-162F	88.9	100	51.13
H-0-164F	94.1	113	49.25
H-1-214F	86.9	111	52.13
Mean	90.0	103.3	51.95
Std. Dev.	3.44	6.65	21.57
Std. Err. of Mean	0.86	1.66	5.39

TABLE 4

INDIVIDUAL DEVELOPMENTAL DATA AS OF APRIL 21, 1953
(LOW GIRLS)

Case No.	Percent Development	Chronological Age (months)	Height (inches)
H-1-13F	76.5	92	50.50
H-0-37F	87.5	98	52.50
H-0-45F	74.5	94	47.50
H-0-89F	74.0	96	45.90
H-1-95F	83.9	99	48.00
H-0-98F	80.0	103	49.60
H-0-99.23F	88.2	93	49.50
H-0-99.33F	78.5	99	48.70
H-1-105F	85.3	89	52.00
H-0-116F	74.0	100	51.75
H-2-251F	81.3	93	48.60
H-2-252F	78.8	124	51.20
H-2-314F	79.8	118	50.25
H-2-320F	86.5	112	52.00
Mean	80.9	100.8	50.02
Std. Dev.	5.63	9.62	18.30
Std. Err. of Mean	1.51	2.57	4.89

TABLE 5

DIFFERENCES DERIVED FROM ANALYSIS OF DEVELOPMENTAL DATA AS OF APRIL 21, 1953

Group	Percent Deviation		Age		Height	
	Std. Err. of Mean	t	Std. Err. of Mean	t	Std. Err. of Mean	t
High boys-low boys	1.33	5.79**	7.88	0.34	10.19	0.02
High boys-high girls	1.18	0.17	2.78	0.76	8.53	0.09
High girls-low girls	1.74	5.23**	3.06	0.82	7.28	0.26
Low girls-low boys	1.84	0.87	7.98	0.39	9.17	0.10

** Difference significent beyond the 1 percent level of confidence.