THE BERKELEY GROWTH STUDY

HAROLD E. JONES AND NANCY BAYLEY[1]

The Berkeley Growth Study is one of several long-term developmental investigations comprised in the research program of the California Institute of Child Welfare.[2]

Specific aspects of this study have been reported in a series of articles and monographs listed in the attached bibliography; the present report deals with the general program, which has not been elsewhere described. The sixty-one cases originally included in this study were "normal" Berkeley children born in hospitals between September 25, 1928 and May 15, 1929. The families selected included only white, English-speaking parents who could be regarded as permanent residents of Berkeley and who were willing to cooperate in bringing their children to the Institute for the required series of examinations. In consequence of the selective factors involved, the group tends to be somewhat above the average in measures of socio-economic status (parental occupation, income, and education).

The original sample of 61 children (31 boys and 30 girls) has decreased slowly to 46 cases (24 boys and 22 girls) who remain available for regular examination at the present time (average age 12 years, as of January 1, 1941). Reduction in the sample has been due primarily to families moving out of town; so far as possible, relationships with these parents have been maintained through correspondence, with occasional opportunities to renew contact with the children. The original group has been augmented by ten younger cases, five girls and five boys, who have been followed through the same schedule, and now range in age from eight and one-half to ten years. Nine additional children (including a set of triplets) have been tested at less frequent ages on a less complete schedule.

The problems investigated have dealt chiefly with mental, motor, and physical development, observed from birth and with the plan of continuing to maturity. The program of psychological study is essentially descriptive, involving (a) the assessment, seriatim, of each individual's status in the group in a wide range of characteristics, (b) the study of trends and other age variations in status, and (c) the analysis of certain correlated factors. While interest has not been directed primarily toward personality nor toward attempts at the detailed interpretation of growth dynamics, considerable use has been made of qualitative observations and of material from interviews, in addition to the more largely quantitative records. The program of physical measurements and medical examinations is based on a schedule planned by Dr. Herbert R. Stolz. Dr. Bayley has been in direct charge

[1] *From the Institute of Child Welfare, University of California*

[2] *With a varying organization of problems for the several groups of children, the samples studied have included, (a) children in attendance or in previous attendance at the nursery school, a cumulative sample started in 1927, (b) the Berkeley Survey a representative group of children born in Berkeley during an eighteen month period in 1928-29 (c) the Berkeley Growth Study, begun in 1928 (d) twin studies, begun in 1928 and renewed in 1936 (e) the Guidance Study undertaken with sub-samples of the Berkeley Survey in 1930 and (f) the Oakland Study of Adolescence begun in 1931-32*

of the field program since 1931, and as will be noted in the appended list of publications, is the principal author of technical reports based upon the research to date.[3]

GENERAL PROCEDURES

As a first step in the study, cooperation was established with the attending physicians through the Hygiene Department of the University, and with the mothers at the hospital through the Institute of Child Welfare pediatrist. Within four days after birth a number of measurements were taken. These included tests of reflexes and of sensory functions, anthropometric measurements and records of blood pressure, pulse, respiration and temperature. During the first month the following additional information was secured. (a) The medical history of the mother, and pre-natal data, obtained by an Institute nurse in home visits and from physicians' and hospital records; (b) socio-economic data and family histories obtained from home visits by an Institute social worker.

Each child was brought to the Institute for a series of tests and observations at one-month intervals from birth to fifteen months, at three-month intervals from fifteen to thirty-six months, and at six-month intervals thereafter. Some additional visits have been made at irregular intervals for group observations or to collect material for special purposes. Below are listed the principal categories of data

1. Mental tests

California First Year Mental Scale (26)	1 to 15 months
California Pre-school Mental Scale, Schedule I	18 to 60 months
Vocabulary tests (adapted from Thorndike CAVD)(30)	78 and 90 months
Dearborn Puzzle Board (30)	90 and 102 months
Stanford-Binet, 1916 Revision	72 and 84 months
Stanford-Binet, Form L	96, 108, and 132 months
Stanford-Binet, Form M	120 and 144 months

2. Motor abilities

California Infant Scale of Motor Development (36)	1 to 36 months
An unpublished continuation of the above motor scale	42 to 102 months
A series of tests of manual speed and dexterity	42 to 138 months
Foot-print records of standing and walking (21)	From age of first walking alone to 36 months.

[3] *Others assisting in the study have included Drs Lotta V Wolff, Ann Martin C C Stevenson F R Roe and O G Bates, pediatrists Frances Welch and Jean Carter, social investigators Agnes Covalt, research assistant in hygiene, Waye P Nudge, Ruth M Krause and Helene B Schrader statistical assistants During the summer programs in 1938 and 1939 Dr Pearl Bretnall and for the academic year 1939-40, Dr Mary E Shirley, psychologists have assisted in data collection Dr Herbert S Conrad has served as statistical consultant and since 1938 has been in charge of anthropometric examinations of boys Dr Nathan W Shock has been in charge of physiological measurements since 1933*

3. Reflex functions

Tests of approximately twenty reflex functions were made at each testing period through 36 months (24, 37).

4. Physiological measurements

Measurements of temperature (19), blood pressure (23), pulse rate and breathing rate were taken through 36 months. Starting at about 9 years, a series of physiological tests has been made on approximately two-thirds of the group. These include tests of exercise tolerance, basal metabolism determinations, and records of electrodermal reactions (galvanic skin reflex).

5. Anthropometric measurements

A schedule of 22 measures of bodily dimensions was taken monthly from one to 15 months; every 3 months to two years; semi-annually to four years; and annually to nine years (15, 16). After this age, in order to record changes related to the pubertal cycle, five of the measures have been recorded at six-month intervals, while the entire series, now including 27 measures, is administered once a year.

6. X-rays

X-rays of the chest and leg bones were taken at birth and at 1, 2, 3, and 4 years. With the addition of new equipment at the Institute, x-rays of the left hand and left knee were taken at 8 and 9 years, and semi-annually thereafter. These are being utilized for assessments of skeletal age by the Todd standards.

7. Photographs

Still photographs (nude) were taken at every second visit through 9 years, and at every visit thereafter. Motion pictures were made of crawling, creeping and early walking during the ages between six and eighteen months (39). Both still and motion pictures have been taken of the children in social play during picnics when they were near eleven and eleven and a half years.

8. Pediatric examinations

General physical examinations have been made by the Institute pediatrist annually beginning at two years. These include predominantly observations of conditions which might be of importance in the children's development—either physical conditions which themselves exhibit developmental changes, or health factors involving possible effects upon normal growth and development.

9. Emotional reactions and personality

In connection with all testing and measurement situations in infancy, records have been made of resistance and rapport, and of the duration, intensity and circumstances of crying when crying occurred (1).

Rating scales. Rating scales have been used consistently in connection with test situations, to record attitudes and incidental

behavior which might have a bearing on the interpretation of performance in these tests. As the children grew older these scales have been changed to evaluate more adequately behavior which is characteristic of the ages under observation. During the second year observations of behavior were made in standardized social situations, similar to those in the Marston and Berne series.

Projective Techniques. About two-thirds of the group, at 8.5 years, were observed in a creative art class, and samples of their paintings collected.

Other projective techniques introduced at this time (8.5 years) included a Rorschach test and a record of imaginative responses to a series of pictures similar to those employed by Murray. An interview schedule dealing with habitual interests and activities was also used. These procedures were repeated at 10.5 years. At 9.5 years selections from the Murray Thematic Apperception pictures were given; and were repeated at 11.5 years.

Home Interviews. Between the ages of nine and eleven years, Dr. Pearl Bretnall secured additional data on the personalities and home backgrounds of a small group selected for special study; and further case studies were made by Dr. Mary Shirley at eleven years.

Field Excursions. In order to have first-hand observations of social adjustments in free-play situations, the children have been invited to picnics or field excursions composed primarily of the members of the study. Several adults observed, and later rated the children on various aspects of their social behavior. Two such excursions have been held, to date, when the children were approximately eleven and eleven and a half years old.

In analyzing the data, the procedures have included a study of group trends in each field of development, an examination of interrelationships between the various fields through correlations at successive ages, and a study of each individual's growth curves considered separately and together. Standard scores have been used to facilitate comparisons of the data from different fields.

A further method of analysis which has been employed is the use of a simple mathematical function to describe approximately the growth of a given characteristic as measured in the individual child (20). The relative growth constant of this equation can be compared with similar constants for different characteristics of the child when fitted by the same equation, and with the constants for the same measurement in the other children. In the researches now in progress emphasis is being placed on studying interrelationships between various aspects of growth (mental, motor, physical and physiological), with attention also to emotional and environmental differentials. Although the individual curves are examined against the background of the whole group, the principal interest at the present time is less in the study of mass relationships than in the intra-individual comparison of growth curves for the various functions measured. During the past year a non-technical summary (7) was published by the University of California Press, dealing with home and family, early illnesses, growth in size, the trend of bone development, the development of some vegetative functions,

reflex patterns, the development of motor control, growth in intelligence, and the first ten years in review.

PUBLICATIONS

GENERAL

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(2) Bayley, N.: Some comparisons between growth in motor and in mental abilities in young children. Psychol. Bull., 1934, 31, 608. (Abstr.)
(3) Bayley, N. A story of child care. San Francisco, Hearst Publications, 1937, pp. 26.
(4) Bayley, N.: The first Berkeley growth study. Berkeley, Univ. California Press, 1938, pp. 8.
(5) Bayley, N.: Mental and emotional growth in personality adjustment. Chapter II, Mental Hygiene in Modern Education. New York, Farrar & Rinehart, 1939, pp. 25-65.
(6) Bayley, N.: Mental and motor development from two to twelve years. Rev. Educ. Research, 1939, 9, 18-37 + 114-125.
(7) Bayley, N.: Studies in the development of young children. Berkeley, Univ. California Press, 1940, pp. 45.
(8) Jones, H. E.: Child study at the University of California. School and Soc., 1930, 31, 674-677.
(9) Jones, H. E.: The growth study as a psychological method. Psychol. Bull., 1935, 32, 538. (Abstr.)
(10) Jones, H. E. and Bayley, N.: Child Psychology. A home study course in the Extension Division of the University of California.
(11) Jones, M. C.: Neo-natal behavior. The Medical and Professional Women's Journal, 1933, (December), 362-364.
(12) Paraschivescu, O.: A comparative study of the socio-economic status of forty Berkeley families in 1929 and 1932. M.A. Thesis, University of California, 1933.
(13) Prentiss, S. W.: A preliminary study of data from a baby survey. M. A. Thesis, University of California, 1930.
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(17) Bayley, N.: Some aspects of physical growth in young children. Psychol. Bull., 1935, 32, 526. (Abstr.)

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(19) Bayley, N. and Stolz, H. R.: Maturational changes in rectal temperatures of sixty-one infants from one to thirty-six months. Child Develop., 1937, 8, 195-206.

(20) Jenss, R. M. and Bayley, N.: A mathematical method for studying the growth of a child. Human Biol., 1937, 9, 556-563.

(21) Rawlings, E. B.: Development of the longitudinal arch during the first two years of walking. M. A. Thesis, University of California, 1933.

(22) Wolff, E. and Stone, R. S.: Chest roentgenograms of non-tuberculous children suspected of being tuberculous. J. Am. Med. Assoc., 1930, 94, 458-460.

(23) Wolff, L. V.: Systolic blood pressure in early infancy. Arch. Pediat., 1930, 47, 165-170.

(24) Wolff, L. V.: The development of neuromuscular coordination during the first year of life. Transactions of the Second International Pediatric Congress. Acta Paediat., 1930, 9, 117-118. (Abstr.)

MENTAL DEVELOPMENT

(25) Bayley, N.: The consistency of mental growth during the first year. Psychol. Bull., 1931, 28, 225-226.

(26) Bayley, N.: The California first-year mental scale. University of California Syllabus Series, No. 243, 1933, pp. 24.

(27) Bayley, N.: Mental growth during the first three years. A developmental study of sixty-one children by repeated tests. Genet. Psychol. Monog., 1933, 14, 1-92.

(28) Bayley, N.: The maturation of mental functions. Chapter VIII, Readings in Psychology. New York, Farrar and Rinehart, 1935, pp. 219-251.

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(32) Bayley, N. and Jones, H. E.: Environmental correlates of mental and motor development: A cumulative study from infancy to six years. Child Develop., 1937, 8, 329-341.

(33) Jones, H. E. and Bayley, N.. Mental development and cultural-economic factors: A nine-year study. Psychol. Bull., 1938, 35, 681-682. (Abstr.)

(34) Jones, H. E. and Jorgensen, A. P.: Mental growth as related to nursery school attendance. Part II, Thirty-Ninth Yearbook of the National Society for the Study of Education, 1940, Chapter XII, 207-222.

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(36) Bayley, N.: The California infant scale of motor development. University of California Syllabus Series, No. 259, 1936, pp. 11.

(37) Wolff, L. V.: The response to plantar stimulation in infancy. Am. J. Dis. Children, 1930, 39, 1176-1185.

MOTION PICTURES

(38) Bayley, N. and Jones, H. E.: Case 75. I. 1 reel, 16 mm., silent. (The development of a child from one month through four years of age, as seen during testing procedures.)

(39) Jones, H. E. and Bayley, N.: The development of locomotion. 1 reel, 16 mm., silent. (Motion pictures of creeping, crawling and early walking of infants, illustrating developmental sequences, and the various forms of early locomotion.)