

bands, the significance of which has not been determined. A deep colony of anaerobic species, *Vibrio septique*, in contrast presented a loose or mesh structure composed of filaments of cells bent in an interesting fashion.

5763

Change of Dexterity with Age.*

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It is a common impression that old age is accompanied by a slowing down of the voluntary processes both muscular and mental. Industrial experience and every-day observation of older adults seem clearly to indicate this change. When decrement begins, the rapidity with which it proceeds and the amount of slowing generally to be expected by the chronological ages of 60 or 70 years, are all, at present, largely matters of personal opinion. The developmental increase, for example, in motor facility from early childhood through adolescence and into adulthood, has been studied extensively. But adults in middle age and in the period of later maturity have not been conveniently available for laboratory investigations and moreover, they seem to have been actually neglected as subject material for psychological experimentation.

For the present study, a "laboratory annex" was set up in a small city and people were secured for experiment and measurement through the coöperation and solicitation of clubs, lodges, churches, and many similar agencies. An individual who came to the annex for the 2-hour series of tests was not paid but the club that sent him was paid proportionate to the person's age. The person himself knew just how much he was contributing to this club. The study includes 166 men over 50 years of age, and 169 males, younger; 302 women over 50 years and 226 women and girls younger than 50.

The total period of measurement was 2 hours in length and included several short tests and experiments.^{1, 2} The present report

* Part of a study on Later Maturity conducted in the Psychology Department of Stanford University, and made possible through a grant from the Carnegie Corporation of New York.

¹ Miles, W. R., *J. of Psychol.*, 1931, **43**, 377.

² Miles, C. C., and Miles, W. R., *Am. J. Psychol.*, 1932, in press.

deals briefly with only one of these which came in the first half-hour period, a test of speed and accuracy in reaching and grasping. Two small blocks of wood were located 12 inches apart on a thin panel or lap board. Two holes, $1\frac{1}{2}$ inches apart, were made in each block and the 4 holes were in one line. A small electric clock (operating on 60 cycle A.C.) was placed midway between the blocks so that the button or key controlling the clock was on the line made by the 4 holes. Each hole was $1\frac{1}{2}$ inches deep and $\frac{3}{8}$ inch in diameter. For each block there was a piece of ordinary round lead pencil 3 inches long which was placed in one of the holes. The distance from the key to the nearer hole of each block was 6 inches. The subject sat with the panel directly in front of him on a table. With his right fore-finger he pressed against the clock key and when ready to make a trial reached directly to the right and with his right hand grasped the pencil, thrust it in the other hole of the same block and returned his fore-finger to the key. This was done as deftly and as quickly as possible. The clock hand started and the clock movement began a buzzing sound as soon as he moved his hand in the direction of the pencil. The completion of the act and the return of his finger to the key stopped the clock. The time consumed was evident to both subject and examiner. When this value had been read off and written down the left fore-finger was substituted for the right and the coördination was tried with the left hand reaching for the pencil in the block at the left. Each hand was tried three times alternately. This coördination was, of course, voluntary and self-initiated and did not in any way depend upon signals from the examiner. Each subject, by performing the act, measured his own time. In instructing the subject no demonstration or sample performance was given, he did not imitate another person's action, but was asked to be quick. Motivation was good, since subjects could easily understand the situation and could see their own results.

In this test slowness of movement and inaccuracy both serve to increase the time. In general, adults require about 1.2 seconds to accomplish this coördination with the right or dominant hand and 1.4 seconds for the left or subordinate hand. The range shown by individuals from early to late adulthood is around 0.9 to 5.0 seconds. The correlation between the performance with the dominant hand and that with the subordinate one is approximately $r + 0.53 \pm 0.05$.

The results arranged by semi-decades, and with 2-year steps for the early ages, are presented in Table I. This shows the number

TABLE I.
Age changes of dexterity in reaching and placing.

Ages	Males			Females		
	No. cases	Dom. Hand (Sec.)	Sub. Hand (Sec.)	No. cases	Dom. Hand (Sec.)	Sub. Hand (Sec.)
90-94				2	3.96	5.10
85-89	2	1.81	1.59	4	1.91	2.07
80-84	11	1.85	1.93	14	1.81	1.98
75-79	15	1.58	1.78	23	1.54	1.78
70-74	27	1.39	1.56	41	1.64	1.82
65-69	27	1.41	1.40	54	1.44	1.64
60-64	26	1.35	1.40	60	1.39	1.55
55-59	33	1.24	1.40	53	1.32	1.44
50-54	25	1.17	1.35	51	1.27	1.45
45-49	18	1.12	1.33	30	1.24	1.38
40-44	21	1.15	1.34	27	1.12	1.32
35-39	20	1.16	1.29	22	1.13	1.30
30-34	20	1.14	1.34	28	1.14	1.28
25-29	19	1.12	1.22	17	1.10	1.36
20-24	23	1.11	1.28	21	1.12	1.34
18-19	7	1.19	1.26	10	1.14	1.38
16-17	11	1.10	1.19	13	1.19	1.32
14-15	6	1.15	1.44	21	1.28	1.40
12-13	8	1.26	1.48	22	1.20	1.46
10-11	6	1.29	1.52	7	1.28	1.60
8-9	8	1.37	1.65	8	1.45	1.51
6-7	2	1.69	1.56			
Total	335			528		

of cases examined (males and females) at the different age levels, and gives the average dexterity time for dominant and subordinate hands separately. It will be observed that there is no sharp high peak of dexterity. The best performance falls between the ages of 16-29 where the average for both hands and both sexes is close to 1.2 seconds (dom. 1.15, sub. 1.30 sec.). Groups younger or older require more time. For 15 years above age 29 there is but slight decrement. If we take 1.2 seconds for base, then 55-59 shows 14% increase; 60-64, 18%; 70-74, 33%; and 85-89, 54%; while ages 8-9 show 25% increase.

There is a remarkably close agreement in the results for males and females up to the age of 45 years, beyond this the men score a little faster. The most striking fact in the whole set of results is the relatively small, although steady, decrement shown throughout the life span proceeding in both directions from age 20. It might easily have been guessed that people 80 years of age would require double time for such an act. That they require on the average only 50% longer than so-called prime adults, is significant of the continuity in the powers of man's nervous system.