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As implied, the problem of the present investigation was to estimate the effects of a thirty-year age increment upon individual and trait differences in eight measurable mental functions.

The basic procedure employed involved the retesting on Army Alpha, Form 6, of 127 males who had taken this same examination as entering freshmen at The Iowa State College during the Winter Quarter of 1919. Retesting was accomplished during 1950 with identical materials and under conditions presumably identical with those which obtained at the original testing. Approximately 70% of the potential testees were retested, and, of this number, something like one-half were found to be still resident in the state of Iowa.

In order to equate sub-tests, obtain a common referent, and secure approximately equal units of measurement, both initial and final scores on each sub-test and the total were recorded as standard score values derived from normalized norm distributions for 1000 comparable cases. Each norm distribution was arbitrarily assigned a mean of 5 and a sigma of unity, and all computations were based upon the transformed values obtained.

Possible shifts in the magnitudes of individual differences were evaluated by obtaining an estimate of the significance of the difference between the correlated initial (1919) and final (1950) standard deviations for a given test. This was done successively for each sub-test and the total score.

The possibility of a shift in the magniture of trait differences was evaluated by obtaining an initial and a final trait, or sub-test, variance for each subject, and by subtracting the former from the latter. The mean of the resulting distribution of differences was then tested for the significance of its departure from that of a distribution with mean zero.

The results obtained appear in the two mimeographed tables which have been distributed. Referring first to Table 1, it will be observed that constancy is the rule—the magnitudes of individual differences changed but little over the thirty-year period. Even the significant increase on verbal analogies (7) is almost precisely counterbalanced by the significant decrease on disarranged sentences (5).

Table 2 reveals that the situation is comparable in the case of trait differences. The "range" referred to is for the largest indi-

vidual increase and the largest individual decrease in trait differences, respectively, over the thirty year period. Under "N ±" it is indicated that 63 subjects showed apparent increases in trait differences, whereas 64 showed apparent decreases. The obtained "t" value does not remotely approach significance, and constancy again seems indicated.

In discussing these results, it seems to favor clarity to move from the general to the specific. Accordingly, it may be observed that the "probably significant" (5% level) total score increase in indi-

Table 1

The Effects of Age Upon Individual Differences

Content	$1919\sigma^2$	$1950\sigma^2$	t	P
1. Following Direction	0.7972	0.8433	0.329	>.05
2. Arithmetic	0.8071	0.9211	1.027	>.05
3. Common Sense	0.6483	0.5976	—0.550	>.05
4. Verbal Opposites	0.7900	0.7530	—0.349	>.05
5. Disarranged Sentences	1.1155	0.6827	—3.164	<.01
6. Number Series Completion	0.8559	0.6986	—1.451	>.05
7. Verbal Analogies	0.5149	0.8697	3.569	<.01
8. Information	0.5177	0.4479	—1.040	>.05
Total Score	0.5890	0.7431	2.055	<.05

vidual differences should be interpreted cautiously for several reasons. First, on the eight sub-tests which compose the total, the apparent change was in the direction of a decrease in five and of an increase in only three. Second, the two highly significant shifts in sub-tests 5 and 7 were of approximately equal relative magnitude. but were in opposite directions. Third, the fact that there was no significant biserial correlation between initial scores and D-scores clearly implies little observable tendency toward the differential gains which would increase individual differences. Fourth, in a more general vein, when multiple analyses are run some "chance" results must be expected—particularly at the lower (5%) level of significance.

Table 2

The Effects of Age Upon Trait Differences

Sub-Tests		Bangs	N±	t	P
1 through 8	$\Sigma(\sigma^2\,'50-\sigma^2\,'19)$	+2.8869	+63	0.0104	>.05
	0.2303	—1.4513	—64		

$\sigma^2\,'50$ = the variance of the individual's sub-test scores in 1950.
Range = greatest individual increase and decrease in σ units.
N± = number of cases showing an increase or decrease.

Nevertheless, if this finding be accepted at face value, a question still arises as to how or why individual differences, as expressed in one sub-test and in the total Alpha score, did increase on the retesting. The evidence would seem to indicate that they did so, at least in part, because sub-groups within the sample received differing amounts of college education and made, correspondingly, differing amounts of retest improvement. The initial (1919) Alpha scores are related to years of college education in the case of only two sub-tests; number 1, following directions, and number 4, verbal opposites. There is *no* significant relationship on total score. It would thus seem safe to assume that it was not entirely the more able who received more education and who evidenced more improvement in performance on the 1950 retesting. However, it is indicated that there *was* a significant tendency for those with more education to show more improvement in score on sub-test 7, analogies, and on the total, than did those with less college training. That this is not primarily a matter of differential effects of age by ability level is evident in the fact that initial analogies score correlates -0.09 with the amount gained. A comparable relationship is found in the case of the total score. It, thus, seems apparent that individual differences increased because of differential sub-group "treatments" with a D-score correlated variable, i.e., amount of college education.

The decrease in individual differences on sub-test 5, disarranged sentences, is clearly apparent in the dearth of scores thru the very low ranges on the retest and in their piling up near the test ceiling. Part of the observed decrease in variability may no doubt be attributed directly to this "ceiling effect." Of the remainder, a substantial proportion may be accounted for by the fact that the largest gains were made by the sub-group scoring lowest initially. As Garrett[1] and others have pointed out, the disarranged sentences test has a very high verbal loading. It is, thus, more or less expectation that rural subjects should be somewhat handicapped on it, initially, as compared with urban subjects. This was true in the present case. However, 56 of these 88 subjects who were originally from rural areas migrated to urban areas shortly after they had completed college. It was precisely *this* group that increased their scores significantly more on the given sub-test than did any other, thus contributing directly to the observed decrease in variability.

In summary, then, the effect of age upon individual differences was not marked or consistent but varied widely with the function

[1]Garrett, H. E. "Differentiable Mental Traits", Psychol. Rec., 1938, 2, 259-298.

under consideration. There was, nevertheless, a significant tendency (5% level) for these differences, as revealed by the total Alpha score, to increase with advancing age. If this effect can be detected in such a homogeneous sample as the present one, it seems reasonable to assume that it would be magnified in a sample from the hypothetical "general population." This study thus offers confirmation of the familiar view that age is kinder to the more able than to the less able.

In the matter of the effects of age upon trait differences, rational and empirical viewpoints seem to be in some conflict. Casual reflection, for instance, would appear to suggest that the differential practice accorded relatively more outstanding mental abilities during adult life might be expected to increase trait differences. Contrary to this expectation, Garrett, et al., have made successive factorial analyses of common mental ability tests, employing samples of various ages, and have concluded that the "G" factor is more prominent during late than early adulthood. Thus, by implication, trait differences would be assumed to decrease with increasing maturity.

The present data, of course, reveal neither of these tendencies, but only a remarkable constancy of trait differences with increased maturity. While it is undoubtedly true that any number of successive shifts in magnitude—say first an increase and then a decrease—might have taken place during the thirty year period between test and retest, it seems most parsimonious and most plausible to believe that such was not the case. The discrepancy between these results and those of Garrett may be attributable to the homogeneity of the present sample or to the fact that ages much over fifty are not represented in it; or, it may be partially attributable to noncomparability of statistical treatments. On the other hand, cross-sectional studies are admittedly open to the influence of extraneous variables which are less bothersome in a longitudinal investigation. For example, recurring again to the matter of education, the younger age groups in our population have had not only *more* training but more *specialized* training than the older groups. Therefore, if the cross-sectional method be employed this fact will operate to favor the finding of exactly what Garrett found.

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