

TABLE III

THE DAILY AMOUNT OF ERROR IN RECOGNIZING 4 SHADES OF GRAY OUT OF A SET OF 50

The figure is the average per person of the difference between the position-numbers of the 4 shades which were selected and the position-numbers of the 4 shades which were sought and should have been selected. The amount of error decreases with practice.

Trial	1911, 33 Persons	1913, 37 Persons	1913, Errors on Probable Scale	1914, 22 Persons
1	15.5	14.8	14.9	14.2
2	13.4	16.4	16.3	11.3
3	12.7	11.8	12.8	9.9
4	8.3	12.3	12.2	9.6
5	9.1	9.6	10.0	7.5
6	8.2	11.6	11.1	9.9
7	8.2	10.5	11.4	6.4
8	9.5	8.6	9.0	9.8
9	5.9	8.2	8.2	8.3
10	5.8	9.0	9.9	10.0

during the practice such spots multiply, and better records can be made with their help at the end of the period of practice than at the beginning. None of the students of the 1911 group realized that he was making much use of these marks but the result shows that this group made a larger apparent improvement than the latter group who were deprived of this help by being required to select the cards from another set. In 1913 this source of error was eliminated. The subject scattered the cards of a second set and selected from among them according to the directions which have been reproduced above.

The experiment of 1914 was designed to eliminate another possible source of error. It was felt by many of the worker that the familiarity with the cards which was acquired in the course of arranging them in order of brightness might be responsible for a large amount of the apparent improvement of memory. Accordingly the experiment was so arranged as to reduce the amount of this factor to a minimum. On the first day the procedure was the same as in the preceding season in order that the first test of memory might be made under exactly the same conditions, but after the first day there was no arranging of the cards in order by degrees of brightness.

Instead, the cards were arranged by the subject according to number with their faces down (they were numbered according to the 'most probable order' described above), then the whole set was turned over and the four cards for the memory test were selected. The worker then proceeded to scatter another set and pick out the cards which seemed to be the same, just as in the experiment of the year before. The experiment was identical with the one of the year before in every respect except that the workers were not familiarized with the material through practice in arranging it. Precisely the same opportunities were afforded in 1914 as in 1913 for the employment of special devices, illegitimate as well as legitimate, as helps in choosing the shades.¹

The scoring in 1914 was on the basis of the average of previous determinations as shown in Table I. under the heading 'most probable position.' In order to make a comparison possible between these results and those of 1913 the latter were rescored on the same basis; that is to say, the error was stated in both cases as the difference in position between the card sought and the card found if they were all arranged in the 'most probable' order. The results obtained for the 1913 experiment according to this method of scoring are not essentially different from those obtained when the scoring was done on the basis of the worker's own arrangement for the day, and are only a little more regular.

The improvement of recognition through practice is no less rapid in 1914, without the additional familiarity which comes from arranging the cards in order, than in 1913 when this factor was fully operative. With this assurance that the factor of familiarity is of no great importance, and with the evidence that the results can be scored satisfactorily on the basis of the learner's own daily arrangements of the cards without undertaking the laborious process of measuring the actual brightness of the different ones, this experiment gives a simple and easily workable demonstration of the improvement of a form of memory through practice.

¹ The most important of these devices is the estimation of the distance from the end of the scale to the lightest or darkest of the four cards to be memorized. It is

comparatively easy to find these cards by simply counting up mentally, as the cards lie scattered at random on the table, from the white or black extreme to the eighth or whatever one is desired. The other two cards are frequently found by grading in between the two extremes. Only half as many errors were made on the lightest shades as on the middle ones and fewer errors occurred on the darkest shades than on the middle ones. There was no general tendency to under- or over-estimate the shades of gray in the memory test, but too light a shade was selected for the lightest and too dark a shade for the darkest, and the same tendency appeared with the other two shades, as may be seen from the following tabulation of the average number of errors per card.

	Too Light	Too Dark
Lightest card.....	1.08	0.77
Second card.....	1.90	1.57
Third card.....	1.72	1.80
Darkest card.....	1.17	1.52
Average all four cards.....	1.47	1.42