

The result of this study seems to indicate that an average pupil in fifth grade, age eleven years, has at least a reading vocabulary of about 15,000 words. It may vary as much as 6000 words according to these measurements or 12000 words according to the standards set by Dr. Starch, reaching 21000 or 27000 words. An average sixth grade pupil, age twelve years, knows at least 18000 words and ranges as high as 31000. An average seventh grade pupil, age thirteen, has a minimum vocabulary of 21,000 words and may range as high as 34,000 words. An eighth grade pupil will have the use of at least 24000 words and may know as high as 38000.

It is not claimed that these figures are final. It is believed, however, that they do show results sufficiently reliable to be indicative and significant.

After this manuscript was prepared, Professor Seashore reports having used the above as an information test in the selection of radio operators with the following two changes:

First: The examiner took each paper in the order in which the men were ready and marked the two most difficult words that had been checked in each of the four columns. He then required the person tested to use each of these eight words correctly in a sentence. For each failure, two points of merit were deducted. He thinks that this affords a satisfactory control of the checking particularly if internal evidences are taken into account. The test then becomes a test of "writing vocabulary."

The second change was to substitute the words, fa, friar and olivoid, for the three proper names in the original list, for evident reasons.

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TRANSFER AND INTERFERENCE IN CARD-DISTRIBUTING

The object of this study was to discover the transfer and interference effects in card-distributing. The experiment consisted in distributing 150 cards into the 30 compartments of a box. The compartments were arranged in six rows of five each, and were numbered from 11 to 40. The cards were numbered correspondingly, five of each number. The compartments were not numbered consecutively, but quite without system. Before the beginning of each experiment the cards were always thoroughly shuffled.

The subjects were eight University women. They worked in two groups of four each. Practice was for approximately one hour daily. Part of the time was consumed in collecting and shuffling the cards.

The compartments were numbered in two ways, which we shall call scheme 1 and scheme 2. In scheme 2 the same numbers were used but *applied to different compartments*, and entirely without system as in scheme 1.

Group A alternated from scheme 1 to scheme 2 from day to day throughout the experiment, 30 days. Group B used scheme 1 only, for fifteen days, and then scheme 2 only.

We shall first notice the transfer effects. In figure I the results of the whole experiment are shown graphically. The vertical axis represents seconds; the horizontal, days. The practice curves are plotted from the daily averages of each of the two groups.

On the 16th day group B began to use scheme 2. Their average distribution time on this day was only 42.8% of the average time of distribution on the first day with the first scheme. These results show that in spite of the inhibitory effects of the habits established in the first fifteen days, efficiency in scheme 2 was much greater the first day than it had been the first day with scheme 1. On the fourth day with scheme 2 group B lacked only 3 seconds making the time attained on the fifteenth day in the first scheme.

In figure II are shown the results of the first five practices of group B with schemes 1 and 2. In scheme 2 the records are very much better than in scheme 1, showing not only rapid initial speed but also rapid improvement.

It is clear from this experiment that in distributing cards one gains efficiency in mastering such situations. After building up a system of habits for one scheme, a subject can more quickly build up a system of habits for another scheme. What is the explanation? There are probably several factors involved. In the first place, in our experiment the two systems of habits are not entirely different. The stimuli are the same, and the responses are the same, but the stimuli are coupled with different responses in the two cases. Whatever facilitation there is in the passage of nerve impulses through the neurones involved, arising from practice in the first experiment, is available and effective in the second experiment. Only *one* new nerve coupling has to be made for each card-number in the second experiment. This is more easily made than all the couplings originally involved.

In the first experiment the subject acquires skill in perceiving and recognizing the card-numbers; in getting the cards out of the pack; in getting them to the appropriate compartments. All these skills are effective in the second experiment. The transfer effect here is great, but entirely explainable from the standpoint of identical elements involved.

A comparison of A and B in figure 1 shows the inhibitory effects of one set of habits on the formation of the other. Group A alternated from one scheme to the other from day to day. If we may judge from the first day's work, they were faster learners than group B, but the efficiency which they acquired was much less.

Group A's final speed was 10% slower than group B's in scheme 1, and 22% slower in scheme 2.

The comparison can be made in another way: in the case of group B the final speed in the two schemes averaged 19% of first day speed, while in the case of group A the average final speed for the two schemes was 24% of their first day speed. Therefore, whether we compare absolute speed attained, or compare the absolute final speed with initial time, the result is the same. The group that alternated from one scheme to the other from day to day was at a great disadvantage in its method.

The inhibitory effects are further shown by reference to figure III. In the first fifteen days of the experiment, as shown in figure I, group B learns very much faster than group A, but at any time up to the fifteenth day, group B has had twice as much practice on scheme 1 as group A has had, for group A is also perfecting another set of habits; namely, those involved in scheme 2. In figure III are shown the records for group B for the first fifteen days, and all the records of group A for scheme 1, *i. e.*, the records on alternate days for thirty days. At any time after the first day's record, therefore, group A has had twice as much practice in distributing cards as has group B. In spite of this fact, however, owing to the inhibition of scheme 2 on scheme 1, group A does not attain the skill in scheme 1 attained by group B.

The inference from this experiment is that it is not economical to form at the same time two mutually inhibitory sets of habits. The better procedure is to form one, and then the other.
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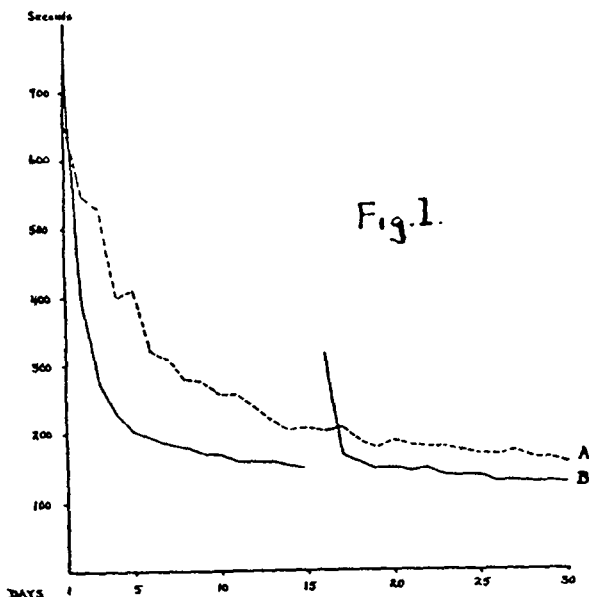


Figure 1. B shows the record for the group distributing 15 days with scheme 1, then 15 days with scheme 2. A shows records of group alternating between the two schemes from day to day for 30 days.

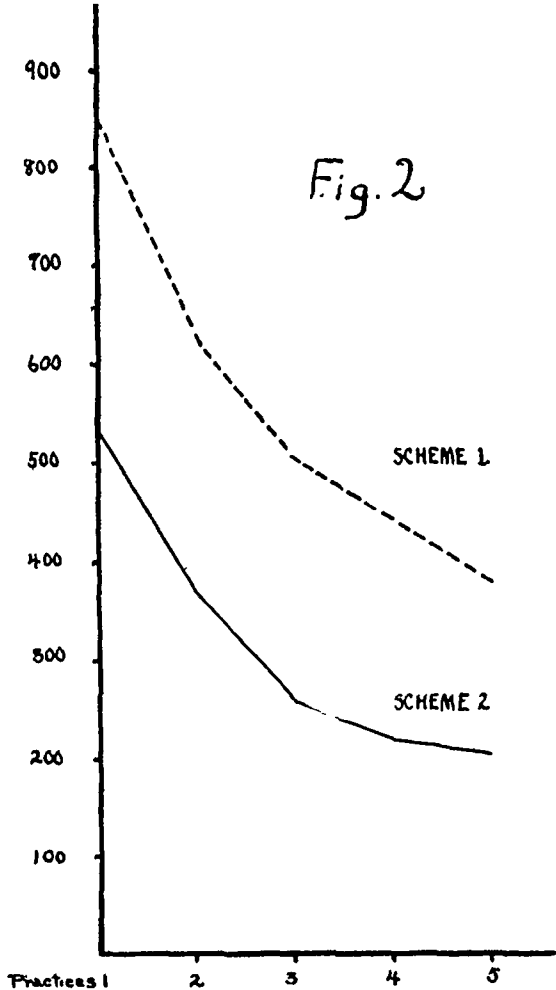


Figure 2. These graphs show the records for the first five distributions of group B with schemes 1 and 2. The effects from scheme 1 greatly reduces the time in scheme 2.

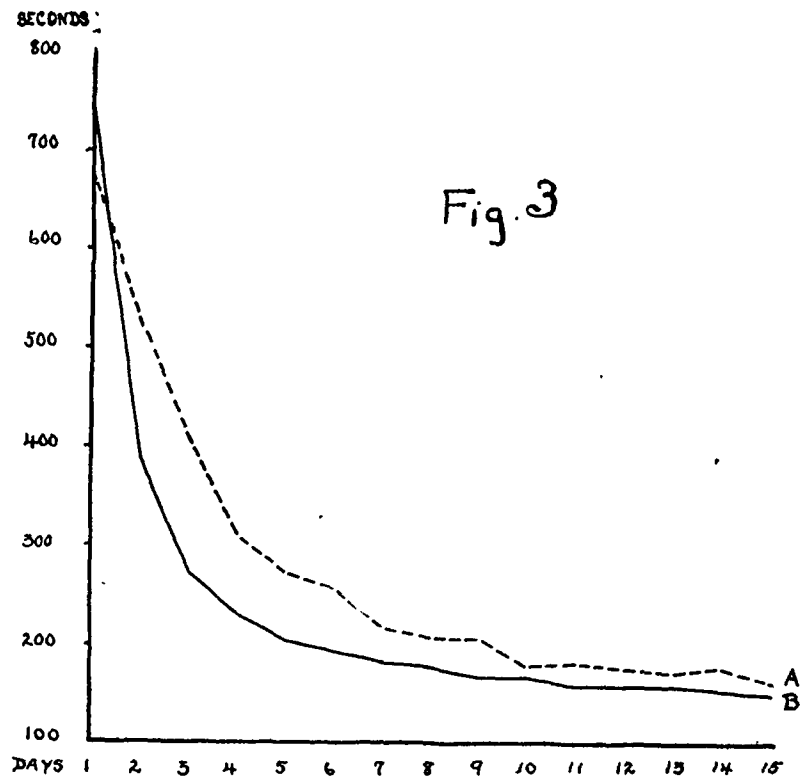


Figure 3. B shows the speed records for the group distributing daily according to scheme 1. A represents the records for scheme 1, of group A, distributing over a period of 30 days on alternate days. At any point after the first day, group A has had an equal experience with group B in scheme 1, and in addition, an equal amount of practice in scheme 2.