

AN EXPERIMENT ON THE INFLUENCE OF TRAINING ON MEMORY

EDWINA ABBOTT COWAN

*The Callender Laboratory of Psychology and Education, H. Sophie Newcomb Memorial
College, New Orleans.*

A review of the theoretical discussions of the subject of "transfer of training" leaves one with a well defined impression that habits are essentially specific but that, theoretically, a specific habit may be formed, the stimulus of which is a factor so common to immense groups of situations that in its practical effect it is a general habit. Among such general stimuli are found ideals, useful systems of attack on different sorts of problems, and any general concept which modifies our manner of dealing with concrete situations.

The experimenters, on the other hand, seem to have taken no direct account of these habits, general in their effect. They have either considered them *a priori* as necessarily by-products of the formation of a habit highly specific in its effect or as habits impossible to form, according to their personal bias on the question of "transfer of training." It is clear that any such habit as that of crossing a particular letter when seen on a printed page, tossing up one ball and preparing to catch another at sight of the descending ball or imaging the English equivalent when some foreign word is seen would be a highly specific habit the stimulus to which would be common to few situations. Some experimental investigation as to just how common to situations a factor may be and still serve as an adequate stimulus for the formation of a habit might help to clear the theoretical discussion on the subject of "transfer of training." If a habit could be formed with a very common factor as stimulus then we would have at command the mechanism for a process in all practical effects the equivalent of "transfer of training" with no theoretical complications to explain. On the other hand the failure of such experiments as crossing letters and teaching children to write neat arithmetic papers to show any effect of transfer may be explained by the failure of any such common stimulus habit to develop as a by-product during the formation of a habit involving a response to a unique stimulus.

The following is the account of an attempt to set up in a number of children a habit involving a stimulus which is common to very many situations where memory functions, and to test its efficacy in such situations.

A vocabulary, an amount of prose or poetry, the multiplication table or any such material to be memorized offers to the learner a more or less homogeneous mass of units which he must isolate in pairs or groups and attend to until each unit is firmly associated with at least one other unit in the mass. This isolation process is more definite in the matter of a vocabulary than in learning prose but, though the shifting of attention from group to group is more rapid in the case of the prose each word must be held in the focus of attention with another word at least once and usually several times before the prose is learned. An individual with a habit of reacting to any homogeneous mass of material with some such definite process of isolation of pairs or groups might conceivably memorize the mass more readily than one who had no such habit. Such a habit might, it seems, fairly be termed a "habit of attention" and the following means was devised as a possible method for forming a "habit of attention."

Twenty sets of slips seven and one eighth by five and five eighths inches in size were prepared. Each slip had printed on it thirty-two two-syllable English words. The words were arranged on the slip in irregular order and the twenty sets differed in that the arrangement of the words on the slips was unique for each of the twenty sets. Different words were also used in each set. Twenty sets of slips were similarly prepared using nonsense syllables instead of words. Below are specimens of both the word and the syllable slips.

| | | | | | | | | | | |
|---------|----------|----------|---------|----------|---------|---------|---------|-----------|--------|---------|
| sif | | bos | | doz | | hiv | | paj | | kiz |
| | giq | | lih | | luk | | qel | | dup | |
| | | jl | | dek | | | xaq | | jin | quc |
| kul | | teh | | zef | | heq | | zes | | teq |
| | qeh | | goj | | fiz | | reh | | zoz | sab |
| | | zab | | foy | | yez | | bok | | |
| | | | | | | | | | | |
| | balance | money | | portrait | | account | | credit | | |
| against | | contract | | payment | | hundred | | counter | | |
| | outline | | profit | | bargain | | control | | balsam | |
| copy | | unite | | coquette | | coinage | | cordon | | |
| | currents | | cornet | | revise | | | printer | | |
| correct | | shifter | | cutlet | | curtain | | something | | wrapper |
| | paying | | express | | | | | | | |

The subjects to be trained in the "habit of attention" were presented once a day with one of these slips. For five minutes the subjects were asked to isolate the units (words or syllables) in pairs and attend to these pairs. The subjects were asked *not* to try to learn the units and never to use in combination two units which were adjacent in any direction. The latter was a precaution against the formation of mechanical systems of isolation. They were also told not to try to associate words or syllables which were alike or which had any reason for being associated. It was made as clear as possible that the only thing they were to do was to isolate these units and attend to them in pairs. They were told to do this as often as possible in the time allowed them and to use as many different combinations as they could. They were asked to make on a paper provided for the purpose a straight mark for each combination they attended to. This was mainly for the purpose of holding their attention to the work and as there was no possible check on their reliability the number of these marks was taken as a general rather than as an accurate index of the number of combinations made. At the end of five minutes the papers and slips were taken up. A record was kept of the number of marks each subject made each day. The twenty sets of words were used first and following that the twenty sets of nonsense syllables. Eight times (four while the words and four while the syllables were being used) the subjects were unexpectedly asked to write all the words or syllables they could think of after the slips had been collected. This work with the words and syllables constituted the training series.

It may be urged that even here the stimulus was not a "mass of homogeneous material" but a number of words and again a number of syllables. This objection could be urged against any material when the subject was not specifically told to regard the material only as a mass of homogeneous material. My subjects were children and I doubted their ability to follow such verbal instruction profitably. By using two different sorts of material during the training series and by stressing the emphasis on the isolation of the combination of units as the important factor in the procedure I attempted to shape the conditions of the experiment so that the stimulus to which they reacted should be in effect a "mass of homogeneous material." As a check on

my control of this factor I used yet another entirely different sort of material in the test series the description of which follows.

Before the training series began a test was given based on the old fashioned game of memory played at children's parties. Thirty-two ordinary objects picked up about the house were spread on a small table. Each subject was asked to stand for two minutes in front of the table memorizing the objects and then go to another room and write the names of as many of the objects as she could remember. This test was repeated with a new set of objects at the end of the series with words and again at the end of the series with syllables. It was like the training series in that it presented a homogeneous mass of thirty-two units to the subjects. It was unlike the training series in that the subjects were asked to learn these units while during the training series they were only asked to attend to the units in pairs. The following is a list of the objects used in one of the table tests.

| | |
|--------------------------------|--------------------|
| Pink stationery box | Glove buttoner |
| Letter | Picture hanger |
| Bundle of wire | Paintbrush |
| File | Button hook |
| Box of matches | Perfume bottle |
| Red Cross adhesive plaster box | Sponge |
| Framed photograph | Lens of eyeglasses |
| Memorandum book | Hairpin |
| Eyeglass case | Bodkin |
| Prayer book | Small grey box |
| Spoon | Penknife |
| Candle | Brown box |
| Powder box | Ink bottle |
| Scissors | Pin |
| Candle stick | Drinking cup |
| Pen | Magazine |

A second type of test was given which merely involved ordinary memorizing as it is done in the schools. The subjects were given slips of paper with paragraphs of prose printed on them and told to memorize the prose. They were allowed five minutes in which to do this and then the slips were taken from them and they were asked to write what they could of the prose. One such test was given before the training series began and another, with prose of approximately the same length and difficulty, was given after the training series was entirely over. Below are the two prose selections used.

I

ROBIN HOOD AND HIS MERRY MEN

Lend a courteous ear, all ye that be of gentle birth, while I tell you of a bold outlaw whose name was Robin Hood. The best archer was he that ever drew a bow in Merry England. In the famous town of Locksley hard by the great forest of Sherwood, he was born and nurtured, and there he dwelt until he had seen some fourteen summers. Of noble birth he was and should have been an earl, for his father was a Norman knight, Robert, Earl of Huntington, his mother a noble Saxon lady.

But in the wars between King Henry and his sons, Earl Robert took arms against the king; and it was so that when the king won the victory in the year of grace 1147, Earl Robert was taken captive and soon after beheaded as a traitor to his lord the king. Moreover the king proclaimed Robert, the Earl's only son "a wolf's head," that is, an outlaw whom any man might slay without fear of the law, and gave his inheritance to his uncle, the proud bishop at St. Mary's, and his cousin, the high sheriff of Nottingham, for they had taken the king's side against his sons.

II

PEREDUR, THE SON OF EVRAWC

The next day Peredur went forth by the high road, along a mountain-bridge, and he saw a valley of a circular form, the confines of which were rocky and wooded. And the flat part of the valley was in meadows, and there were fields betwixt the meadows and the wood. And in the bosom of the wood he saw large black houses of uncouth workmanship. And he dismounted, and led his horse towards the wood. And a little way within the wood he saw a rocky ledge, along which the road lay. And upon the ledge was a lion bound by a chain, and sleeping. And beneath the lion he saw a deep pit of immense size, full of the bones of men and animals. And Peredur drew his sword and struck the lion, so that he fell into the mouth of the pit and hung there by the chain; and with a second blow he struck the chain and broke it, and the lion fell into the pit; and Peredur led his horse over the rocky ledge, until he came into the valley. And in the center of the valley he saw a fair castle, and he went towards it.

The kind co-operation of President B. V. B. Dixon and Miss Sue Gillean, Instructor in the Newcomb High School, made it possible for me to use as subjects in this experiment two sections of Class B in the Newcomb High School. They were girls from eleven to thirteen years old. It so happens that at Miss Gillean's request I had previously tested these children for imagery type and the sections had been formed on that basis making one section of ten auditory-motor children and one of eight visual children. This was done to facilitate the emphasis on imagery type in teaching. When I gave my preliminary table test to the two sections I found that the visual section did better at it than the auditory motor section, which seemed natural, and on that account I chose the auditory motor section for the section to give the training series to and reserved the visual section as a check section which should take only the test series. The ten auditory motor children were fairly regular in their attendance,—only one dropping out of school toward the last. Out of the visual section, however, there were only four who took both the first and the last test series. The first test was given November 18, 1914, and the last test May 18, 1915. The results for both the training series and the test series follow.

TABLE I.

Number of marks indicating combinations made during five minutes training with words and syllables.

| Subject | WORDS | | | | | | | |
|---------|---------|---------|--------|--------|--------|--------|--------|--------|
| | Nov. 25 | Nov. 30 | Dec. 1 | Dec. 2 | Dec. 3 | Dec. 4 | Dec. 7 | Dec. 8 |
| 1 | 193 | 303 | 334 | 393 | 382 | 308 | 243 | 201 |
| 2 | 68 | absent | 85 | 160 | 208 | 230 | 270 | 228 |
| 3 | 71 | 128 | 165 | 328 | 305 | 300 | 379 | 419 |
| 4 | 105 | 119 | 183 | 202 | 229 | 240 | 264 | 284 |
| 5 | 83 | 110 | 102 | 134 | 172 | 192 | 200 | 185 |
| 6 | 67 | 128 | 218 | 185 | 251 | 282 | 298 | 276 |
| 7 | 176 | 216 | 165 | 324 | 332 | 264 | 243 | 293 |
| 8 | 76 | 119 | 136 | 231 | 266 | 255 | 239 | 256 |
| 9 | absent | 111 | 209 | 255 | 248 | 244 | 195 | 228 |
| 10 | 153 | 200 | 143 | 186 | 312 | 331 | 295 | 285 |

TABLE I. (continued)

| Subject | WORDS | | | | | | | |
|---------|--------|---------|---------|---------|---------|---------|---------|---------|
| | Dec. 9 | Dec. 10 | Dec. 11 | Feb. 22 | Feb. 24 | Feb. 25 | March 1 | March 3 |
| 1 | absent | 185 | 219 | 240 | 240 | 187 | 184 | 232 |
| 2 | absent | absent | 198 | 221 | 194 | 165 | 181 | 173 |
| 3 | 380 | 313 | 297 | 497 | 163 | 301 | 215 | 250 |
| 4 | 226 | 210 | 272 | 295 | 167 | 258 | 244 | 214 |
| 5 | 152 | 192 | 92 | 239 | 203 | 155 | absent | 158 |
| 6 | 226 | 214 | 233 | 333 | 146 | 335 | 374 | 215 |
| 7 | 208 | 217 | 258 | 259 | 227 | 173 | 222 | 241 |
| 8 | 221 | 240 | 257 | 293 | 248 | 179 | 215 | 224 |
| 9 | 237 | 279 | 278 | 236 | 203 | 207 | 261 | 261 |
| 10 | 168 | 199 | 241 | 119 | 175 | 181 | 166 | absent |

TABLE I. (continued)

| Subject | WORDS | | | | Number of words recalled during unexpected tests immediately after five minute training | | | |
|---------|--------|--------|---------|---------|---|--------|--------|---------|
| | Mar. 5 | Mar. 8 | Mar. 10 | Mar. 11 | Nov. 25 | Dec. 7 | Mar. 1 | Mar. 11 |
| 1 | 223 | 242 | 194 | 210 | 6 | 8 | 8 | 11 |
| 2 | absent | 185 | 158 | 171 | 14 | 12 | 10 | 11 |
| 3 | 205 | 241 | 486 | 242 | 8 | 5 | 11 | 10 |
| 4 | 269 | 261 | 252 | 239 | 10 | 10 | 11 | 9 |
| 5 | 263 | 162 | 185 | 223 | 12 | 8 | absent | 6 |
| 6 | 340 | 327 | 284 | 285 | 15 | 17 | 17 | 15 |
| 7 | 251 | 269 | 137 | 233 | 12 | 12 | 11 | 14 |
| 8 | 220 | 254 | 174 | 206 | 9 | 5 | 8 | 7 |
| 9 | absent | 176 | 231 | 203 | absent | 8 | 12 | 7 |
| 10 | 266 | 180 | 185 | 242 | 9 | 7 | 4 | 9 |

TABLE I. (continued)

| Subject | SYLLABLES | | | | | | | |
|---------|-----------|---------|---------|---------|---------|---------|---------|---------|
| | Mar. 17 | Mar. 18 | Mar. 22 | Mar. 24 | Mar. 25 | Mar. 25 | Mar. 29 | Mar. 31 |
| 1 | absent | 145 | 132 | 204 | 186 | 284 | 168 | |
| 2 | 139 | 218 | 224 | absent | absent | absent | absent | |
| 3 | 371 | 295 | 358 | 213 | 309 | 357 | 246 | |
| 4 | 151 | 276 | 215 | 238 | 185 | 219 | 212 | |
| 5 | 105 | 165 | 119 | 116 | 185 | 150 | 131 | |
| 6 | 149 | 225 | 351 | 146 | 151 | 171 | 135 | |
| 7 | 59 | 178 | absent | 154 | 139 | 182 | absent | |
| 8 | 168 | 162 | 57 | 76 | 73 | 133 | 103 | |
| 9 | 203 | 128 | 229 | 185 | 180 | 306 | 106 | |
| 10 | 128 | 174 | 141 | 148 | 162 | 187 | 240 | |

TABLE I. (Continued)

| SYLLABLES | | | | | | | | |
|-----------|---------|---------|---------|----------|----------|----------|----------|----------|
| Subject | April 1 | April 5 | April 8 | April 12 | April 14 | April 15 | April 19 | April 21 |
| 1 | 215 | 251 | 150 | 265 | 181 | 168 | 95 | 155 |
| 2 | absent | absent | absent | absent | absent | absent | absent | absent |
| 3 | absent | 290 | 259 | 329 | 276 | 185 | 219 | 246 |
| 4 | 201 | 234 | 208 | 247 | 208 | 195 | 227 | 284 |
| 5 | 164 | absent | 114 | 141 | 158 | 181 | 183 | 168 |
| 6 | 220 | 297 | 269 | 239 | 273 | 247 | 235 | 145 |
| 7 | 192 | 160 | 150 | 204 | 140 | 182 | 234 | 175 |
| 8 | 131 | 120 | 72 | 116 | 101 | 113 | 80 | 131 |
| 9 | 290 | 216 | 204 | 209 | 138 | 283 | 105 | 115 |
| 10 | 334 | absent | 304 | 296 | 259 | absent | absent | absent |

TABLE I. (continued)

| SYLLABLES | | | | | | | | | |
|--|----------|----------|----------|----------|--------|----------|---------|----------|--------|
| Number of syllables recalled during unexpected tests immediately after five minutes training | | | | | | | | | |
| Subject | April 22 | April 26 | April 28 | April 29 | May 3 | March 18 | April 1 | April 15 | May 3 |
| 1 | 78 | 126 | 98 | 99 | 211 | 1 | 8 | 1 | 10 |
| 2 | absent | absent | absent | absent | absent | 1 | absent | absent | absent |
| 3 | 187 | 265 | 379 | 207 | 245 | 3 | absent | 4 | 4 |
| 4 | 236 | 256 | 300 | 218 | 256 | 2 | 9 | 7 | 8 |
| 5 | 106 | 226 | 229 | 183 | 198 | 5 | 6 | 4 | 5 |
| 6 | 136 | 222 | 135 | 328 | 419 | 9 | 17 | 13 | 10 |
| 7 | 195 | 193 | 301 | 196 | absent | 5 | 6 | 7 | absent |
| 8 | 102 | 108 | 116 | 89 | 115 | 1 | 4 | 1 | 6 |
| 9 | 97 | 208 | 187 | 125 | 221 | 1 | 6 | 0 | 7 |
| 10 | absent | absent | absent | 297 | 376 | 1 | 1 | absent | 3 |

TABLE II.

Table Tests

Percentage of objects recalled

| Subject | Test | | | Subject | Test | | |
|---------|-------|-------|--------|---------|--------|--------|-------|
| | 1 | 2 | 3 | | 1 | 2 | 3 |
| 1 | 53% | 75% | 87% | 1 | 53% | 69% | 56% |
| 2 | 34 | 59 | absent | 2 | 53 | 65 | 75 |
| 3 | 47 | 56 | 69 | 3 | 56 | 78 | 50 |
| 4 | 50 | 75 | 78 | 4 | 31 | 69 | 97 |
| 5 | 44 | 78 | 78 | Average | 48 25% | 70 25% | 69.5% |
| 6 | 44 | 72 | 97 | | | | |
| 7 | 53 | 72 | 72 | | | | |
| 8 | 44 | 50 | 47 | | | | |
| 9 | 47 | 59 | 69 | | | | |
| 10 | 47 | 81 | 87 | | | | |
| Average | 46 3% | 67.7% | 76% | | | | |

TABLE III.

*Prose Tests**Percentage of correct words recalled in correct order*

| Subject | Test 1 | 2 | Subject | Test 1 | 2 |
|---------|-----------|--------|---------|-----------|-----|
| 1 | 26% | 32% | 1 | 63% | 63% |
| 2 | absent | absent | 2 | 10 | 11 |
| 3 | 39 | 32 | 3 | 25 | 27 |
| 4 | 56 | 50 | 4 | 34 | 7 |
| 5 | 39 | 36 | Average | 33% | 27% |
| 6 | 41 | 75 | | | |
| 7 | 50 | 35 | | | |
| 8 | 33 | 28 | | | |
| 9 | 50 | 50 | | | |
| 10 | 6 | 8 | | | |
| Average | 37.77% | 38.44% | | | |

Both sections show a marked improvement in the record for the second table test over that for the first. But while the untrained section did slightly worse on the occasion of the last table test the trained section again made considerable improvement. There is also a distinct drop in the results of the second prose test from those of the first in the case of the untrained section. There is a slight corresponding rise in the records of the trained subjects. In view of the wide disparity between the type of work in the prose test and that in the training series this seems rather significant.

The subjects were so few and the time available with them so comparatively short that I hesitate to draw conclusions on the basis of these results. But they seem to indicate that at least there still remains the possibility of forming by direct means a habit which may be genuinely general in its effect. To my own infinite astonishment I seemed to have given these children a "habit of attention" which was useful to them in memorizing. At any rate from the evidence now at hand further experiments along this line need not necessarily be unprofitable.

The significance that this might have for the problem of transfer of training has already been noted. But the problem of "formal discipline" would not, I believe, be implicated because, to my mind, the rise of any habit as a response to a stimulus common to many situations in connection with any study would be accidental and unpredictable since the study is directly concerned only with the formation of habits with unique stimuli. In this event the possibility of forming a habit with a stimulus generally common would be no more directly related to the study of Latin than to the study of cooking.