

# Current Comments

## Memory and Super-Memory — I'll Never Forget What's His Name!

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Most of us have a special respect for people with super-memories. Ancient Chinese scholars were often ranked and esteemed according to the number of ideographs they memorized. Talmudic scholars were respected for memorizing extensive passages of religious works.

I have known people who seem to have a "photographic" memory, although scientists believe that no such thing exists.<sup>1</sup> When I was an undergraduate premedical student in Berkeley, I took a course in abnormal psychology. I attended all the lectures and studied religiously. My former wife was also a premed. She enrolled in the same course, but never attended a single lecture. She was too busy tutoring students in physics.

The night before the final exam she raced through the textbook — just as they do in the speed-reading ads. Her incredible reading speed, coupled with a "photographic" memory, were more than sufficient. When the grades were posted, she had received the top grade in the class — an A. My B was about average.

Scientists generally agree that memory and intelligence go together. It has been shown, for example, that people in the higher IQ levels usually have better short-term memories.<sup>2</sup> But anomalies do exist. Many years ago, I saw Teddy Nadler, a postal clerk, win \$64,000 on TV. He had a veritable encyclopedia of facts stored in his head. On the other hand, one hears about absentminded professors—brilliant people who are

always forgetting one thing or another. I have never met such a character, but Einstein himself once complained about his poor memory for rote learning.<sup>3</sup>

In Jonathan Swift's *Gulliver's Travels*, students at the Lagado Academy used an unusual technique to remember mathematical formulas. The formulas were written on wafers in special ink. The students ate the wafers after fasting for a few days. As the wafers digested, the ink rose to the students' brains imprinting the formulas upon their minds. Presumably knowledge thus imparted was never forgotten.<sup>4</sup>

I wish memorizing were that easy. And I am not alone. Many of us wish our memories were better. A good memory is particularly useful in social situations. In fact, most people feel embarrassed when they fail to recognize the face of someone they've met before. Politicians use glib phrases that imply they remember.

I have to meet a lot of people, so it is not surprising that I'm interested in the process of face recognition.<sup>5</sup> And although I've never taken a memory training course of any kind, I'm fascinated by the possibility that some external aid or device will make it possible to enhance my memory. No doubt, that is partly why I am fascinated by the new electronic translating machines.<sup>6</sup> In fact, the whole field of information retrieval may be regarded as an effort to augment man's limited memory.

In previous essays, I discussed several techniques for teaching languages.<sup>6,7</sup>

Not all of those techniques were effective. If I had a few of Swift's memory wafers, I'd write whole vocabularies and grammars on them. Lacking the wafers, I decided to examine both the popular literature and some scientific studies about memory training. I hoped to find some technique that would help the student of foreign languages learn faster without endless repetition.

One road to memory improvement involves the use of mnemonic devices. A mnemonic, as defined in Webster's, is simply anything "intended to assist memory."<sup>8</sup> The word is derived from the Greek *mneme*, which means "memory." The elementary school chant "Thirty days hath September..." is a mnemonic that helps English-speaking people remember how many days are in each month.

There are many different kinds of mnemonics. Whole systems of memory training have been built around some of them. Popular books have been written on the subject of memory improvement. For example, Bruno Furst published his *Memory Power Made Easy* in 1952.<sup>9</sup> Many more popular books have been published since then<sup>10-14</sup> that profess to teach one how to remember anything, be it a shopping list, some telephone numbers, or the 50 states in alphabetical order. Formal courses in memory training are not normally offered as part of a college curriculum. But since 1973, Kenneth L. Higbee has been giving such a course at Brigham Young University.<sup>15</sup> In it he teaches a variety of mnemonic systems, including all of those discussed in this essay. The New School for Social Research, New York City, also offers a course in memory training. A recent article in *Quest/80* identified several other places where one can receive memory training. Most of them are in the New York City area.<sup>16</sup>

The American Management Association Extension Institute (AMAEI) offers

a memory training course by mail. The course, entitled *How to Build Memory Skills*, is aimed at the business executive and contains variations of mnemonic techniques found in the popular literature. It is offered as part of AMAEI's correspondence curriculum in business management. But the memory course can be ordered independently of the curriculum for \$65 from American Management Association, 135 West 50th Street, New York, NY 10020.<sup>17</sup>

A huge amount of information is stored in our memory. It is sometimes difficult to retrieve the precise information that we want at a particular time. Unless you use certain information frequently you may need a little help. One reason mnemonic systems work is that they provide the appropriate "cues" to stimulate proper recall.<sup>18</sup> We've all experienced the phenomenon of not being able to say that which is right "on the tip of the tongue." Then after a few seconds someone says something that triggers your recall.

Susan D. Miller, an associate professor who teaches acting at the University of Illinois in Urbana, says that many actors use self-learned "associative devices" to help them remember their lines. These devices are unique to each actor. But Miller says that novice actors can help themselves if they perform their onstage gestures while studying their lines. "The activity," says Miller, "helps to reinforce what the line is about."<sup>19</sup> But it was difficult to find any documented account of how actors are taught to memorize *per se*. Repetition seems to be the rule for actors as well as for musicians.

Frances A. Yates of the Warburg Institute, University of London, wrote a classic study of the history of memory techniques, *The Art of Memory*.<sup>20</sup> The ancient Greek poet Simonides is credited with developing what became known as the *loci* system of recall, the earliest

known form of mnemonic training. In the *loci* system, one imagines a familiar building, possibly one's own house. To memorize a sequence of ideas, as in a speech, each idea is visually associated with a part of the house. The first idea may be associated with the front door, the second idea with the foyer, and so on until the final idea is associated with the back door.<sup>20</sup>

To give a modern example of how the system works, suppose you were giving a speech on the future of scientific research. Your speech includes a capsule history of how science has advanced since Newton. You might imagine a picture of an apple tree hanging on the front door, since a falling apple supposedly inspired Newton's work on gravity. If your speech ends with the assertion that the future of science depends on continued government funding of basic research, you might imagine a test tube filled with money sitting on a table near the back door. To remember all the parts of the speech, you simply take a mental tour of the house, "seeing" each idea in succession.

The ancient Greeks used the *loci* system as an aid to rhetoricians for remembering points to be made in long speeches. But the system may have applications to other memory problems. A recent study by researchers at Ohio University showed that college students easily remembered a sequence of 20 randomly selected words using places on campus as the *loci*.<sup>21</sup> One can imagine using this system to remember errands to run or a series of appointments. But obviously, there are a number of memory problems we face daily to which the *loci* system cannot be applied. One of these problems is connecting a person's face with his or her name. More about that later.

Another memory technique in frequent use today is called the first-letter mnemonic. Unlike the *loci* system, it does not employ visual imagery. In-

stead, the first letters of the items to be remembered are made to form a meaningful sentence. Thus the phrase *Every Good Boy Deserves Favor* reminds us that the lines of a musical staff are called E, G, B, D, and F. Similarly, *Richard Of York Gave Battle In Vain*, or *ROY, Go Bring In Violet*, reminds us that the colors of the visible spectrum are red, orange, yellow, green, blue, indigo, and violet. Presumably, one can make up a first-letter mnemonic to remember just about anything. A study at the University College of Swansea (UK) showed that first-letter systems are the mnemonic devices most frequently used by college students studying for final exams.<sup>22</sup>

But the system has its limitations. Peter E. Morris of the University of Lancaster, who has authored a number of articles on memory, observes that first-letter mnemonics are effective when the items to be remembered are well-known and only their order is at issue. They are not very effective for helping to remember new words or ideas that are unfamiliar to the learner.<sup>23</sup>

Morris notes that, until recently, psychologists paid scant attention to mnemonics. "The domination of the behaviourist philosophy," he writes, "which maintained that statements about mental events were unscientific, discouraged serious study of the mnemonics."<sup>18</sup> This explains why popular authors have virtually monopolized the subject for so long. But during the past decade, researchers have become increasingly interested in mnemonic techniques. A number of studies have been performed to test the effectiveness of the memory systems expounded in the popular literature.<sup>21,23-27</sup> And it now appears that mnemonic techniques which employ visual imagery, such as the *loci* system, are more effective than those which do not.<sup>24</sup>

Nearly all of the popular books on memory improvement make use of visual imagery. In one book, *Memory Made Easy*, Robert Montgomery employs what is known as a "peg" system.<sup>10</sup> Before learning how to make the visual associations, the reader is urged to learn the peg words by reciting the following chant: "One, bun; two, glue; three, key; four, store; five, drive; six, mix; seven, oven; eight, bait; nine, dine; ten, hen."

Now suppose you have a list of ten things to remember. Whatever the first item is, you imagine yourself biting into a hamburger bun to find the item there instead of the burger. To remember the second object, you imagine yourself pouring glue all over it and becoming stuck to it. To remember the third item, you imagine yourself unlocking a closet door and having hundreds of that item tumble down upon you. And so on through the list of ten.

One advantage of this system is that once you learn the peg words, you can recall the ten items out of sequence if you want to. If the same pegs are used over and over again to remember many lists of things, will there be interference from past associations with the same pegs? The answer is, probably not.

Peter E. Morris and R.L. Reid performed an experiment in which subjects memorized several lists of words using a peg system similar to the one described here. The lists each contained the same words but in different orders. The subjects performed the memorization far better than a control group and, when questioned, reported no interference in learning each list.<sup>25</sup>

Perhaps the most famous American author of memory books is Harry Lorayne. He has appeared often on television performing fantastic feats of memory. Lorayne has written *How to Develop a Super-Power Memory*,<sup>12</sup> *The Memory Book*,<sup>13</sup> and *Remembering People*.<sup>14</sup> Lorayne uses a visual system called the "link." It's a method of remembering a series of things by link-

ing them together through visual associations.

Lorayne writes that if visual imagery is good, then strong visual imagery must be better. Therefore, the visual images the readers are told to see are exaggerated and sometimes grotesque. Suppose you want to remember a list of words. The first word is airplane. The second word is tree. According to Lorayne, it does no good to imagine an airplane parked next to a tree. That image is too plausible. Better to imagine trees boarding airplanes like passengers.<sup>13</sup> (p. 10) The next word on the list is envelope. You should imagine yourself trying to stuff a tree into an envelope. You have now visually linked three words together. You can presumably link together a list of any size. The very act of forming the associations and visually linking them together forces you to concentrate on the items to be remembered. This in part explains why the link is supposed to work.

One corollary to any mnemonic system is that words which can't be visualized must be changed to words that can. Suppose you wanted to memorize the 50 states in alphabetical order. You cannot picture "Alabama," but changing that to "album" will give you a concrete image. For Alaska, it is suggested that you visualize the dessert "baked Alaska." To start the link, you can imagine an album serving baked Alaska to other albums.

Other books make use of the link system, including Montgomery's *Memory Made Easy*.<sup>10</sup> Lorayne's *The Memory Book* is of particular interest because it covers the learning of foreign languages. The technique used here is called "paired association." It operates on the same principles as the link, except that it is not used to remember long chains of items. The French word for the noun "duck" is *canard*. This is translated into *can hard*. To remember that *canard* means duck, you imagine

someone throwing a *can* at you *hard*, and you *duck* to avoid it. The French word for bread is *pain*, pronounced "pan." It is suggested that you imagine the handle of a frying pan to be a loaf of French bread.<sup>13</sup>

Michael R. Raugh and Richard C. Atkinson of Stanford University have shown the system to be an effective aid to acquiring a foreign vocabulary.<sup>26,27</sup> In one of their studies, they gave a list of Spanish words to two groups of undergraduates. One group was instructed on the use of paired association. As a control, the other group was not. When the two groups were tested for vocabulary recall, the mnemonic group scored an average of 88%, while the control group scored 28%.<sup>27</sup>

Lorayne and other authors of popular memory books apply their techniques to connecting names with faces. Suppose you meet someone named Andrea Sheldon. You might convert the name to "hand-dryer shell-on." Now suppose the most distinguishing feature of Andrea Sheldon's face is her large, bulging eyes. You might picture her eyes to be seashells bulging from her head while she is using a hand-dryer on her hair. The point is to change a person's name to something that can be visualized, and to associate that visualization to a prominent part of the person's appearance.<sup>14</sup>

Several authors of memory books also propose a system for remembering numbers by substituting a consonant sound for each digit: 1=T and D; 2=N; 3=M; 4=R; 5=L; 6=J, Sh, and Ch; 7=K, C, and G; 8=F, V, and Ph; 9=P and B; 0=Z and S. Vowel sounds signify nothing. Once one has learned which consonant sound goes with each digit, sentences can be formed to remember numbers. Thus, the sentence "Everyone loves to sing" suggests the number 8,425,801,027.<sup>10,11,13</sup>

Morris observes that the link system is indeed effective, although there is no evidence that bizarre imagery works any better than normal pictures.<sup>18</sup> ISI's

Tom Di Julia tried the link system and reports some success. He was able to remember some of the exercise lists presented in the books. He was even well on his way to memorizing the 50 states in alphabetical order, but gave up the project because of the sheer time involved in forming the images and linking them together.

For all the effectiveness of the popular mnemonic systems described here, they fall short of the claims of their authors. Lorayne and the others assert that their techniques can be adapted to all situations. Once you have mastered these systems, the spiel goes, there's no reason why you should forget anything. But in order to employ these memory systems, you must first be aware that something is worthy of remembrance. For example, seeing an automobile parked in the street is a very small event in your life. You think nothing of it. But suppose you later learn that the parked auto you saw was involved in a crime. Could you describe the auto in detail to the police? Could you recall the license number? In other words, mastery of these techniques does not confer *automatic* total recall, as the front matter on a number of popular books imply.

Such automatic total recall would require a photographic memory, if such a thing existed. With a photographic memory, a person would be able to "briefly look at materials, including pictures and printed matter, and to recall them as visual images."<sup>1</sup> This memory "snapshot" would last long enough for the person to recall details some time later.

Psychologists have studied the possibility that photographic memory exists.<sup>28</sup> In their investigations, they found that some people do retain visual images after taking a brief look at an item. However, the images are retained for only a short time, lasting from a few seconds to a few minutes. This type of recall, called *eidetic* memory, is

reportedly found in no more than 5 to 10% of children and is even rarer in adolescents.<sup>28</sup> It is true that subjects who are shown many pictures in quick succession can recognize them again at a later time. But they are not able to reconstruct the picture in every detail within their own minds.<sup>24</sup> There is no doubt that some people do have superior memories. Anecdotal evidence supports this contention.<sup>1,29</sup> Nevertheless, psychologists conclude that super-power memories differ from "normal" memories in degree only, not in kind.<sup>28</sup>

Several developments within the neurosciences over the past two decades may ultimately lead to the best memory "techniques" of all. In 1965, F.R. Babich and colleagues at UCLA published a paper in *Science* that was to touch off a lively controversy among neuroscientists. They trained rats to approach a food dish at the sound of a click. Then they extracted brain matter from these trained rats and injected it into untrained rats. The untrained rats showed a marked tendency to approach the food dish at the sound of the click, even though no food was there.<sup>30</sup>

As far back as 1957, this "transfer of memory" phenomenon had been demonstrated in planarians, simple animals with rudimentary nervous systems.<sup>31</sup> But the discovery that memory can be transferred in rats, animals of much greater complexity, caused excitement within the scientific community.

The Babich paper was not the first to report such results in rats, but it received wide attention. A number of researchers set out to reproduce the Babich findings, but the results were mixed. Although many researchers confirmed the transfer of memory phenomenon, many others failed to achieve positive results. It was this failure to consistently achieve positive results that eventually discredited the whole line of research. Louis Neal Irwin, of the Shriver Center for Mental Retardation, wrote: "In retrospect, it seems clear that

given a marginally observed phenomenon, those who wished to see it, did; and those who doubted it saw too much inconsistency to become convinced."<sup>32</sup>

But in a review article, S.R. Mitchell and colleagues at the University of Alabama suggest a reason why the Babich results were so hard to reproduce.<sup>33</sup> They note that at the time of the Babich paper, it was widely assumed that RNA was involved in memory storage. Researchers began using ever more highly purified RNA extracts from rat brains for their memory-transfer experiments. But as Mitchell reports, most researchers who failed to achieve results used higher concentrations of RNA, while those who were "ignorant of the prevailing dogma" used cruder preparations and achieved positive results. Mitchell supports G. Ungar's theory that it is through peptides, the constituent parts of proteins, that memory can be transferred from one animal to another.<sup>34</sup>

It will be interesting to watch future developments in this line of research. Incidentally, about five years ago ISI's A.E. Cawkell produced a selected bibliography of the most significant papers on memory transfer up to that time.<sup>35</sup> The bibliography was developed to demonstrate how the *Science Citation Index*<sup>®</sup> (*SCI*<sup>®</sup>) can be an effective search tool even in the hands of someone with no prior knowledge of a given subject.

More promising than memory transfer is the current research into drugs that may enhance memory, particularly in the elderly. One drug under study is Piracetam, an anti-vertigo compound. In 1976, Per Mindus of Karolinska Hospital, Stockholm, tested the drug on elderly patients who complained of memory impairment.<sup>36</sup> He found that patients who took Piracetam scored higher on learning and memory tests than those who took a placebo. Mindus acknowledges, however, that the effect of the drug on some patients was small.

Other drugs such as Praxilene and Vasopressin are also under study as likely candidates for a memory drug for the elderly.<sup>37,38</sup>

Recently, Nikolaus R. Hansl of Creighton University, Omaha, tested an experimental memory drug on 58 undergraduate students. The drug, 3-(2-benzylmethylaminoethyl) benzoate hydrochloride, was found to improve the subject's recall of geometric patterns and nonsense syllables.<sup>39</sup> Although the drug currently has no clinical application, it may someday prove to be a memory enhancer for young and old alike.<sup>40</sup>

Last year, *Omni* published an article which identified several common chemicals, including choline and lecithin, that might have a positive effect on memory.<sup>41</sup> The article also described several other experimental drugs which the FDA disallows for any purpose other than research. It is surprising that progress of this sort can be made at all.

Very little is known about how the brain processes and stores information. And we must be cautious about forming conclusions, since research into memory drugs is new. The results of this research are not unequivocal, and negative results do appear in the literature.<sup>42</sup> Nevertheless, it's fascinating to think that someday something akin to Swift's memory wafers might become available. Until that happens, keep your writing pad and pen handy — and don't forget the batteries for your electronic notebook.

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