

# Memory Boost From Spaced-Out Learning

How is your memory for the foreign language you took a stab at in high school or college? Chances are it would be better if — instead of having learned words and phrases over several days and being reexposed to the material in homework and tests over three-month semesters — you had had once-a-month language learning sessions spaced out over several years.

That is the implication, at any rate, of an eight-year follow-up study of people who learned 50 English-Spanish word pairs. The 35 subjects were tested for memory of Spanish word meanings and retrained on forgotten words from six to nine times at varying intervals: on the same day as the original training, on successive days, or every 30 days.

"The more spread-out [30-day] distribution of practice had a much stronger effect on memory retained for eight years," says psychologist Harry P. Bahrick of Ohio Wesleyan University in Delaware, Ohio, who conducted the project with Elizabeth Phelps of Princeton

(N.J.) University. "But typical educational strategies don't encourage this approach."

Several years ago, Bahrick tested 773 people, ranging in age from 17 to 70, for memories of Spanish learned in high school or college. After completing classes, subjects soon forgot some of what they learned, but after five years a good deal of their knowledge about Spanish remained and was recalled for at least 25 years (SN: 3/10/84, p.149). The more years of Spanish taken and the better their grades were, the more they remembered decades later.

But Bahrick and Phelps wanted to know what learning conditions promote this kind of memory stamina. They contacted former college students who had learned and relearned the English-Spanish word pairs at varying intervals for an investigation in 1979. Participants, who had not lived in Spanish-speaking or bilingual areas, were sent a list of the 50 English words and asked to write down Spanish equivalents without consulting other sources. They were then sent recognition tests with each word they failed to recall on the first test placed next to five alternative Spanish words. Ten control subjects with no Spanish training were also sent the word-pair tests.

Among those trained on the list of word pairs, about 10 percent of Spanish vocabulary was recalled eight years later, report the researchers in the April *JOURNAL OF EXPERIMENTAL PSYCHOLOGY: LEARNING, MEMORY AND COGNITION*. Controls correctly identified only 1 percent of the words. More important, however, recall improved markedly for subjects who quickly learned words after the first presentation and were retrained at longer intervals. For instance, when words were originally learned after only one or two presentations and retraining took place at 30-day intervals, recall after eight years was nearly 25 percent. If three or four presentations were needed to learn the words and retraining was on successive days, recall fell to 6 percent. Subjects who required seven or more presentations to learn words and were retrained on the same day could not recall any of the material eight years later.

Multiple-choice recognition of words that could not be recalled followed the same pattern, but was high under all conditions. Guessing and incidental learning probably account for some recognition effects, says Bahrick, since controls were able to recognize nearly two-thirds of the Spanish words.

The study is important, says psychologist Ulric Neisser of Emory University in Atlanta, because it shows that the proper

spacing of practice during rote learning of vocabulary can produce lasting memories.

Bahrick acknowledges that if educators heed his data, the organization of language courses will change radically. A small college might test his findings, he suggests, by running monthly learning sessions in a foreign language over several years for a group of students and then comparing their knowledge to that of students from traditional classes.

— B. Bower

## New Parkinson's surgery

For the first time in the United States, adrenal gland cells have been transplanted into the brain of a Parkinson's disease patient. Surgeons performed the procedure last week in Nashville, Tenn., in hopes of alleviating symptoms of the neurological disease.

Parkinson's disease apparently is caused by the loss of brain cells that produce a chemical called dopamine, important in transmitting signals from one nerve cell to another. Dopamine deficiency leads to loss of motor control. Because adrenal glands, which lie near the kidneys, produce dopamine-like hormones, researchers think that transfer of adrenal gland cells to the brain might slow or stop the disease.

It will be several weeks before physicians know whether last week's surgery will produce beneficial results, according to George S. Allen, who led the surgical team at Vanderbilt University Medical Center. He told *SCIENCE NEWS* that at least 12 patients will have to receive transplants before researchers decide whether the treatment is effective. Success of the operation may be influenced by patient age and disease severity, says Allen.

Two patients who received transplants in Mexico City in August and October of last year continue to show "marked improvement," according to a report from their physicians in the April 2 *NEW ENGLAND JOURNAL OF MEDICINE*. □

## Smog-ozone policy shift

Last week Environmental Protection Agency (EPA) Administrator Lee M. Thomas announced a new strategy — including serious federal sanctions — for states that still exceed the federal air-quality ozone standard by year end. The agency estimated last year that one in three U.S. citizens live in urban areas that exceed the standard for ozone, the major irritant in photochemical smog.

By now, such states are supposed to have an EPA-approved plan for controlling air pollutants (such as hydrocarbons) likely to generate ozone. Under the plan, they would have to comply with the 0.12 parts per million ozone limit by Dec. 31, 1987.

Acknowledging that many areas will fail to meet this deadline "no matter how hard they try," Thomas last year proposed a scheme that would have allowed major good-faith efforts by affected states to buy a temporary reprieve from federally mandated sanctions (SN: 6/28/86, p.405), including a construction ban on any project likely to increase ozone, as well as the possibility of withholding federal funds for state highway, sewer and air pollution programs. But in a turnabout, Thomas now says that whether or not out-of-compliance areas make heroic efforts to curb ozone, EPA will impose sanctions.

William Becker, executive director of the Washington, D.C.-based State and Territorial Air Pollution Program Administrators, prefers the policy Thomas proposed last June. He says that even though California has adopted some of the most aggressive ozone-control measures in the nation, its problem is so severe it could not devise a plan to meet the ozone standard. Now, he says, it faces a construction ban not just until it adopts an EPA-approved ozone-control plan, "but until it actually reaches attainment with the standard. Conceivably, that ban could be in effect for the next 50 years."

— J. Raloff