'Weak' Memories Make Strong Comeback

A widely accepted psychological theory holds that when people try to recall several items, they remember first those items that initially gained a strong foothold in their memories. But this commonsense contention is wrong, says psychologist Charles J. Brainerd of the University of Arizona in Tucson.

By as early as age 6, people who are asked to recall lists of items from memory tests — in any order that springs to mind — first mention items that they previously had the most trouble recalling, Brainerd and his colleagues report in the July PSYCHOLOGICAL SCIENCE. The researchers dub this the "cognitive triage" effect — an analogy to the medical procedure of triage, in which physicians treat the most difficult cases first.

"Deliberate mnemonic strategies are important in memory development, but they're by-products of basic, unconscious memory processes such as cognitive triage," Brainerd argues.

If cognitive triage holds up in further studies, it could have numerous practical implications, he adds. For instance, rather than answering items one after the other on school examinations, students might maximize their recall by scanning the items and attempting the hardest questions first. Moreover, police and lawyers interrogating children who have witnessed crimes might obtain more information by posing questions about critical and disturbing events first, rather than starting out with queries designed to put the youngster at ease.

"Brainerd's data are very compelling," remarks psychologist Stephen J. Ceci of Cornell University. "But it's hard to say if his controlled laboratory findings will generalize to emotionally charged situations such as eyewitness testimony."

While the findings provide hope for improving recollections of child eyewitnesses, Ceci says, young children often store memories in bits and pieces that cannot be reassembled through any retrieval tactic.

Brainerd and his co-workers conducted 11 memory experiments with youngsters between the ages of 6 and 13. The number of participants in each experiment ranged from 50 to 96. Investigators presented each child with a list of 12 to 24 items, such as nouns or simple pictures, and then asked them to perform a brief activity, such as counting backwards, to empty short-term memory. Afterward, children reported all the items they remembered. The youngsters repeated this memory recall procedure up to five times consecutively for the same list of items.

In several experiments, researchers allowed children as many trials as needed to recall all the items on a list. Two weeks later, they administered five consecutive recall tests to reassess the children's memory for the items.

On each subsequent memory trial in all the experiments, children first recalled several "weak" items — those remembered least often in previous trials — followed by "strong" items most often recalled in earlier tests, and finally some more weak items.

The same memory pattern — weak items, then strong items, then weak items again — appeared when the scientists reanalyzed responses on recall tests taken by more than 2,000 adults in several previously reported experiments.

Researchers usually do not track weakly and strongly recalled items across memory trials because they assume stronger items emerge first, Brainerd says.

In 1965, however, scientists reported cognitive triage among adults, notes psychologist Robert G. Crowder of Yale University. The authors of that controversial study suggested adults use conscious strategies to focus on items that have previously given them trouble.

But the new evidence of cognitive triage among children as young as 6 suggests weakly recalled items gain an unconscious memory edge, Brainerd contends. Since each item recalled generates associations to other information in memory storage, which in turn interfere with further recall, Crowder speculates that cognitive triage may be an "unconscious, adaptive strategy" for getting weakly remembered items to surface first. — *B. Bower*

Deep-sea muds hold tight to 'hot' elements

No one wants nuclear waste in their backyard, so why not throw it into the sea? That may sound like environmental blasphemy, but two oceanographers report that seafloor sediments can lock away dangerous radioactive elements for hundreds of thousands of years.

Marine geologists have explored the possibility of "sub-seabed disposal" since 1974. According to the basic plan, nations could bury their high-level "radtrash" below the ocean floor by sealing it in torpedo-shaped steel canisters, then dropping them off ships. The canisters would speed downward through 5 kilometers of water and plow tens of meters into the soft muds that blanket the deep ocean plains. Over the next 100,000 years, the sediment layer would have to prevent waste from leaking into the ocean.

To see how well the plan might work, Sarah Colley and John Thomson of the Institute for Oceanographic Sciences in Godalming, England, studied a 30-meter-long sediment core from an abyssal plain in the northeast Atlantic Ocean. These sediments naturally contain traces of uranium-238, some of which has decayed over time into uranium-234, thorium-230, radium-226 and finally lead-210.

Colley and Thomson compared the relative amounts of the radioactive isotopes to determine whether any had migrated appreciably through the sediments. They found that the uranium and thorium have not moved significantly during the last 500,000 years and the radium has moved only a short distance. Detailed in the July 19 NATURE, the study is the first to investigate migration of radioactive isotopes at depths where the waste would be buried, Thomson says. The findings contradict previous studies of shallower sediments, which suggested uranium-234 should be more mobile.

Thomson calls the new results a "positive sign" for sub-seabed disposal, but he notes that real waste could behave very differently. For instance, the canister's descent through the mud and the waste's radioactive heat might render the isotopes more mobile.

In 1986 — the year after the deep-sea cores were drilled — the U.S. Energy Department stopped funding studies on sub-seabed disposal. "The whole effort just vanished," says Charles D. Hollister of Woods Hole (Mass.) Oceanographic Institute, who led the U.S. work in this field. He believes the Energy Department did not want the prospects for sub-seabed disposal to slow momentum toward selecting Nevada's Yucca Mountain as a dump site. Under congressional mandate in 1987, the department began examining Yucca Mountain as the primary candidate for housing the nation's high-level radioactive waste, which comes from nuclear power plants.

Walter L. Warnick of the Energy Department says budgetary cuts led to the program's demise. Warnick heads the department's office of sub-seabed disposal research, a "ghost" office with neither funds nor staff.

In a more favorable political climate, sub-seabed disposal might gain renewed attention, Hollister says. "Eventually, the deep-sea sediments are going to be found very useful for isolating not only radioactive waste but other heavy metals as well," he predicts. — *R. Monastersky*