Working memory may fail in schizophrenia

Researchers have found that an experimental task devised more than 60 years ago can help them elucidate how thoughts unravel in schizophrenia, a devastating mental disorder that afflicts about 1 in 100 people.

Working memory, which temporarily holds and interrelates several pieces of information to allow for understanding of spoken language and other mental operations, causes double trouble in schizophrenia, reports a scientific team at the National Institute of Mental Health in Bethesda, Md., led by psychologist Carmi Schooler.

First, schizophrenia sufferers find it particularly difficult to clear working memory of information that's irrelevant to a current mental task. Moreover, recently encountered visual material that is no longer in plain view cannot be preserved in working memory, no matter how helpful it might prove.

"'Out of sight' might indeed be equivalent to 'out of mind' for [those] with schizophrenia," Schooler's group writes in the March JOURNAL OF EXPERIMENTAL PSYCHOLOGY: GENERAL.

The inability both to weed out distracting information and to preserve useful facts in working memory stems from a disruption of the brain's prefrontal cortex, located just behind the eyes, theorize the NIMH investigators. Numerous studies have indicated that prefrontal areas hold newly acquired information temporarily and help integrate it with previous knowledge.

The new report takes its inspiration from the Stroop task (SN: 5/9/92, p. 312). This test typically shows that it takes people longer to name aloud the color of an ink used to print a word for a contrasting color (such as saying "green" in response to green ink making up the word "red") than to name the same color when it has been used to print a nonsense word. Color naming is fastest if ink color and color word match.

The NIMH group examined a variant of this effect in 59 schizophrenia patients and 41 people with no history of psychiatric disorders. Participants viewed a computer screen displaying random combinations of color names printed in white and colored rectangular patches. Words preceded color patches by 300, 200, 100, or 50 milliseconds, appeared simultaneously with them, or followed color patches by the same time increments.

Volunteers without schizophrenia named the color of a patch most slowly when it preceded a clashing word by 100 milliseconds; color naming was delayed least when a clashing word preceded the patch by 200 milliseconds. It takes about 100 milliseconds longer to state the color of a patch than to read a color's name, which suggests that awareness of a clashing word emerges just as the color of the patch is being identified, the researchers propose.

Patients with schizophrenia named color patches most sluggishly when they had only a 50-millisecond head start on clashing words. When the patch had a 100-millisecond lead, patients did not process the words quickly enough to produce comparable interference, Schooler's team observes.

In a second experiment with most of the same participants, an initial word or color patch appeared for 150 milliseconds, followed by a blank screen for 150 milliseconds and then the corresponding color or word for up to 3 seconds. This brief gap between color and word presentations eliminated the delay in color naming for people with schizophrenia but not for controls.

Thus, schizophrenia renders people more susceptible to distracting information only if it is immediately accessible in their surroundings; if it is out of sight for even a fraction of a second, the material vanishes from working memory and cannot impede color naming on the Stroop task, according to Schooler's team.

In an accompanying comment, psychologist Jonathan D. Cohen of Carnegie Mellon University in Pittsburgh and his coworkers call the new findings "potentially valuable" but interpret them differently.

Results from the second experiment may reflect schizophrenia-related brain problems outside the prefrontal cortex and unrelated to working memory, they contend. Word processing is often impaired in schizophrenia, and the brief word presentations may not have lasted long enough to foster word perception and allow it to retard color naming, says Cohen's group.

Working memory includes only material selected for its relevance to a mental task, not irrelevant information seen for fractions of a second, the group argues. *— B. Bower*

Shedding light on a gamma-ray mystery

In a matter of seconds, gamma-ray bursts generate some of the most energetic fireworks in the universe, then vanish without a trace. In the 3 decades since the first burst was observed, several satellites have detected about 2,000 of these high-energy flashes, which occur uniformly throughout the sky. Yet astronomers still don't know whether the bursts originate within our home galaxy or far beyond (SN: 12/21&28/96, p. 389).

This enduring puzzle may soon be solved. For the first time, researchers believe they have spied the visible-light afterglow of a gamma-ray burst. Within a week, that ember had faded, but astronomers subsequently identified a faint galaxy in the same position. "It may turn out that a breakthrough is in the making," says theorist Bohdan Paczynski of Princeton University.

The saga began Feb. 28, when the Dutch-Italian satellite BeppoSAX detected a bright gamma-ray burst. The satellite, launched last April, has X-ray telescopes that immediately home in on the lower-energy tail of a burst to provide an accurate position for astronomers attempting to observe the flash at other wavelengths.

Eight hours later, while directed toward the patch of sky that contained the burst, a group of higher-resolution telescopes aboard BeppoSAX glimpsed a rapidly fading X-ray source thought to represent the burst as it cooled. Enrico Costa of the Space Astrophysics Institute in Frascati, Italy, and his colleagues reported the finding in a March 1 circular of the International Astronomical Union (IAU).

That announcement sparked a flurry of activity. On March 1, astronomers using two telescopes in the Canary Islands, Spain, discovered a visible-light object that coincided with the fading X-ray source. Intriguingly, observations 7 days later revealed that the object had faded from view, Jan van Paradijs of the University of Amsterdam and the University of Alabama, Huntsville and his collaborators report in a March 12 IAU circular.

Using the New Technology Telescope in La Silla, Chile, the researchers found a galaxy at the same position, they report in a March 14 circular.

Mark R. Metzger of the California Institute of Technology in Pasadena and his colleagues report also finding a galaxy in that place during observations with the Keck II Telescope atop Hawaii's Mauna Kea.

Researchers must still consider the possibility that the burst actually occurred in our own galaxy and just happened to coincide with a faint, distant galaxy. Fortunately, says Abraham Loeb of Harvard University, "we don't need to speculate for long on this matter. BeppoSAX is expected to find such a [burst] event every month." If subsequent events show associations with other galaxies, he notes, it may clinch the case for the extragalactic origin of bursts. *— R. Cowen*