Kids with schizophrenia yield brain clues

Schizophrenia's mind-shattering, incapacitating symptoms usually materialize as a person stands on the brink of adulthood. Nonetheless, investigations of teenagers who developed this mental disorder as children indicate that a prolonged process of derailed brain development characterizes schizophrenia in general, a team of scientists contends.

Some researchers consider schizophrenia that takes root at or before age 12 to be distinct from its more numerous incarnations in people age 18 or older.

According to the recent results, however, adolescents who received a diagnosis of schizophrenia as children display a progressive loss of brain tissue and quirks in physiological activity that resemble patterns seen in later-onset schizophrenia. Psychiatrist Judith L. Rapoport of the National Institute of Mental Health (NIMH) in Bethesda, Md., and her colleagues report their findings in two articles in the October ARCHIVES OF GENERAL PSYCHIATRY.

"These and other studies add to mounting evidence that the childhood and adult forms [of schizophrenia] are the same illness," Rapoport says. "It seems most economical to assume that a single, continuous process [of brain changes] exists from fetal through adult life."

Schizophrenia includes recurring periods in which individuals hear voices or otherwise hallucinate, experience delusions (such as believing that others control one's thoughts), and display blunted or inappropriate emotions. Social withdrawal, apathy, and an inability to care for oneself also characterize this disorder.

Although symptoms flare up quickly in young adulthood or later, schizophrenia in childhood emerges gradually and often in the wake of developmental disturbances, such as lags in motor or speech skills.

In the first of the two studies, Rapoport's team looked at magnetic resonance imaging (MRI) scans of the brains of 16 teenagers who had been diagnosed with schizophrenia as children and at those of 24 teenagers who had no current or past psychiatric conditions.

Each participant underwent brain imaging at age 14 and again at age 16.

Young people with schizophrenia began the study with unusually large, fluid-filled spaces (known as ventricles) in their brains and a reduced volume of brain tissue. Two years later, their ventricles had expanded substantially, and the teenagers had suffered marked tissue losses in the thalamus and several other brain structures. Earlier studies had linked such changes to schizophrenia.

Enlarged ventricles appear in some investigations of adult-onset schizophrenia, but neither this trait nor any other has been confirmed as a biological marker of the disorder.

Rapoport and her coworkers suspect that the MRI scans of teens with schizophrenia captured neural changes that occurred during a developmental period in which the brain proves extremely sensitive to the disorder. Ventricle expansion probably does not continue at such a rapid rate, the scientists note. The teens with schizophrenia were receiving treatment with an antipsychotic drug, clozapine, that may have contributed to their brain changes.

In their second study, the NIMH researchers found that 10 of 21 teenagers whose schizophrenia began in childhood exhibit a specific combination of physiological characteristics. They exhibit weak arousal, as indicated by electric responses in the skin, when exposed to novel stimuli and show excessive arousal when at rest. The same pattern applies to about half of patients with adult-onset schizophrenia, the scientists say.

These results support the theory that schizophrenia represents a single illness that may produce symptoms at various points in life, hold Henry A. Nasrallah and Herman A. Tolbert, both psychiatrists at Ohio State University College of Medicine in Columbus, in an accompanying comment. Ongoing brain changes rather than prenatal neural disturbances alone (SN: 6/18/94, p. 398) may underlie schizophrenia, they suggest. —*B. Bower*

Immersion for analyzing complex software

Scanning the millions of lines of a computer program's instructions in order to find inconsistencies and other problems is a time-consuming, error-prone task—even when the process is automated.

Researchers are now developing a system that generates a three-dimensional representation of a computer program, letting programmers visualize, experiment with, and modify the software. In effect, the technique immerses a person in the software, says Thomas P. Caudell of the University of New Mexico in Albuquerque. "It's like being inside a brain."

At a high-integrity software conference last week in Albuquerque, Caudell described a prototype virtual reality system, running on a supercomputer, for analyzing complex computer systems.

As a first step, he and his coworkers have used their approach to track what happens within a complicated computer program—an artificial neural network—that drives a simple robot resembling a roller skate. Called Encephalon, the neural network incorporates modules for processing sensor data, controlling the robot's actions, and performing other functions.

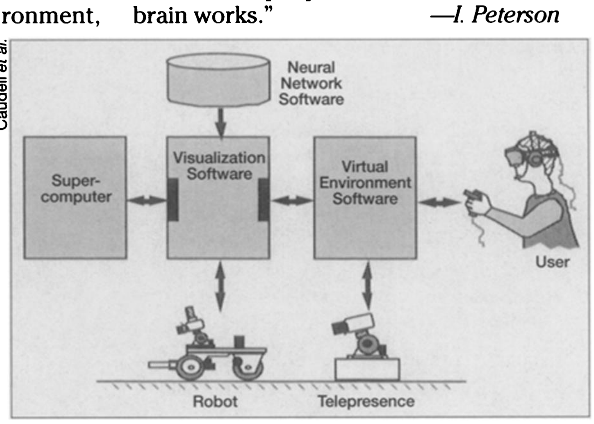
In the virtual reality environment, each software component is represented by a three-dimensional block that flashes colors or makes sounds as the component functions. Paths along which data pass appear as links between blocks. Wearing special goggles, the researcher sees the robot sensor data as if they were projected on the walls of a computer-generated virtual room. The linked blocks float in the middle.

Navigating around the room, the user can modify the software, set or adjust system parameters, monitor information flow, visualize intermediate computational results, view the raw input and output data, evaluate the system's overall performance, and observe the resulting behavior of the robot.

The team's current focus on artificial neural networks is only one possible application, Caudell says. Similar schemes could be used for simulating industrial process control, visualizing enormous databases to facilitate pattern recognition, and improving engineering and software design.

"A large proportion of all computer problems is attributable to the initial, informal, subjective phase of conceptualizing how a system should or should not behave," says Larry J. Dalton of Sandia National Laboratories in Albuquerque. Virtual reality potentially offers a way of exploring such behavior.

At present, however, many research questions remain unanswered, particularly the issue of how best to represent abstract entities in a three-dimensional environment. "We're trying to extend natural human capabilities of seeing patterns and organizing knowledge," Caudell says, "but we need to understand more about how people think and how the brain works." —*I. Peterson*



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Components of a virtual reality system for representing neural network software that drives a simple, mobile robot equipped with various sensors.