needlessly perpetuated the sublimation of biological needs even though prosperity put liberation within reach: Men no longer needed to repress their natural desires to provide for the necessities of life.

But, says Malinovich, Marcuse never clearly defined what "true" needs were. In dramatizing capitalist oppression, he suggested at times that liberation meant sexual anarchy. At other times Marcuse's "freedom" seemed relatively tame: taking greater pleasure in work and family life. "True" needs varied according to the philosopher's polemical requirements. Marcuse used Freud's ideas, says Malinovich, not because he believed them, but to make more palatable his own views about the mediocrity of American life.

Marcuse never explained how psychological liberation would work. What is the place, in his utopian society, of those who are content solely with material satisfactions? Must they be forced to be free?

Malinovich concludes that Marcuse's chief contribution to philosophy was raising the issue of psychological oppression. His prescriptions for psychological freedom were of little value. But though he was shunned by most other philosophers, he did force them to confront contemporary social questions they would have preferred to ignore. And many of his student followers in the '60s are now taking their places in the ranks of today's teachers of philosophy.

SCIENCE & TECHNOLOGY

New Memories

"Micromemories" by John Douglas, in *Science 82* (July-Aug. 1982), P.O. Box 10790, Des Moines, Iowa 50340.

The computer wizards who put a calculator in every pocket are now at work on Phase II of the "microelectronic revolution." Phase I gave us microprocessors, tiny silicon chips that make millions of calculations in seconds. But today's microprocessors cannot store much information—which is where the new micromemories come in, says Douglas, a writer from northern California's "Silicon Valley."

While all microprocessors are made the same way—electronic circuits are etched on a chip of silicon the size of an oatmeal flake—the new memory devices come in several forms. The most important today is the Random Access Memory (RAM) silicon chip. RAM chips are made much like microprocessors and are the only micromemories that work as fast. They can retrieve stored information in ten-billionths of a second. But their capacity is limited. Even the latest "64K" RAM chips can stock only 1,300 words. (Forthcoming Japanese models will quadruple that capacity.) Magnetic bubbles and disks are alternatives with more storage space. Bubbles can store the equivalent of a 600-page novel and disks the equivalent of an unabridged dictionary, but both are one million times slower than the RAMs.

Soon a new development—the optical memory disk—may overshadow all other memory technologies. Pinpoint laser beams encode optical disks by burning tiny pits into them. Recently released by Toshiba, the first commercial optical disks can store the equivalent of 33 books of 300 pages each; but they offer a "sluggardly" retrieval time of half a second. Optical disks have one other serious drawback: They cannot be amended or rerecorded.

The most promising micromemory technology, as Douglas sees it, involves making silicon chips "superconducting"—cutting their resistance to the passage of electricity by bathing them in cold liquid helium. Computers using superconducting chips would require minimal power and generate little waste heat. As a result, circuits could be packed more tightly on the chips, and the shorter distances travelled by electrical currents would mean faster retrieval times.

Until now, only corporations, universities, and governments with the biggest computers have enjoyed large electronic memory capacities. Putting big memories in small packages would allow the most complex problems to be solved on inexpensive home systems. It might even mean the advent of sophisticated robots.

The Impact of Longevity

"Life Expectancy and Population Growth in the Third World," by Davidson R. Gwatkin and Sarah K. Brandel, in *Scientific American* (May 1982), P.O. Box 5969, New York, N.Y. 10017.

In 1945, the average life span in the Third World was 40 years. Today, thanks to better health care and sanitation, it is 55 years. Will further advances in Third World longevity only lead to intolerable population growth? Gwatkin and Brandel, Senior Fellow and Associate Fellow, respectively, at the Overseas Development Council, say no.

The Third World is now going through a demographic change that the West experienced beginning around 1830—a switch from a population equilibrium of high death and birth rates to one of low death and birth rates. The shift begins with an increase in life spans, and in the time it takes for the birth rate to drop, population jumps. The biggest jump occurs at the very beginning of this adjustment, because the average life span grows chiefly as a result of declines in infant mortality. More children thus grow up to have families. That stage, say the authors, has already taken place in the Third World.

As life spans continue to rise, the people saved are increasingly older, and effects on population are smaller. Boosting Third World life expectancy from 55 to 60 years would mean a population jump only half as large as that accompanying the increase from 35 to 40.

United Nations demographers predict that Third World population, at current rates, will increase from 2.89 billion in 1975 to 4.80 billion in 2000, finally leveling off in 2100 at 8.46 billion. They expect the average