

SCIENCE

7 July 1972

Vol. 177, No. 4043

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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We want to be useful ...and even interesting

The difference between electrons and light

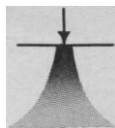
Many a working biologist knows more than we ever knew about how to make a good transmission electron micrograph.

An elementary photography course teaches about the classic density-log exposure curve, where the slope of the linear portion is a measure of contrast and is controlled by the degree of development.

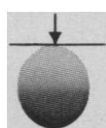


Later one learns that for exposure by electrons instead of light, the working curve changes to this shape. With this shape, for more contrast one simply gives more exposure, with due regard for the danger of frying the biostructures under study. With more exposure comes less graininess. But this is not the graininess they were talking about in the elementary photography course. It is quantum mottle. To create a given density takes a lot fewer 50-kV electrons than photons of sunshine. Paint the picture with more electrons and you see less random fluctuation.

Another difference:

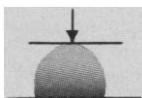


LIGHT



ELECTRONS

The electrons have to slow down from inelastic collisions before they can have much photographic effect. If the emulsion is too thin for the kilovoltage, it will act photographically slow because they are zipping right on through. Hence this principle:



KODAK Electron Image Plates differ from the old Projector Slide Plates by a thicker emulsion. A beneficial side effect yields more uniform sensitivity from center to edge. No apologies, however, are offered for the old Projector Slide Plates, even though they were indistinguishable from the still older Lantern Slide Plates, renamed some years after it became customary to refer to a magic lantern as a projector. They captured some important information about the machinery of life during the earlier, lower-kilovoltage days of EM.

The information package "Kodak Products for Electron Microscopy," from Dept. 412-L, Kodak, Rochester, N.Y. 14650, may prove helpful with operating suggestions. It tells about film, too.

512 colors

It seems possible to detect and identify substances at a distance by a highly specialized kind of color photography, amounting to abridged spectrophotometry. The film would have separate, relatively narrow response bands controlling the three (or more?) dye layers in the end product. For other purposes it would hardly be worth its price. No orders accepted. Not yet anyway. If ever.

"Very slightly different colors, the distinction of which is possible only when two of them occupy large, sharply contiguous areas, can convey information the importance of which may far transcend the information-theory measure of its quantity."

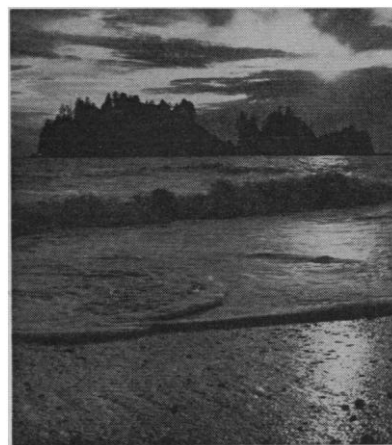
So writes David L. MacAdam, a Kodak man whose surname was long ago draped by the world's psychophysicists around the unit of "least distinguishable difference" in color perception. He is of the opinion that "for the same visual conditions under which there can be sixteen distinctly different grays, 512 equally distinct colors (including those grays) can be produced in a color photograph."

The problem of accessibility

A hundred nations now maintain national parks. The idea originated in, of all places, the U.S.A. To commemorate the centennial of the first national park, we have made six films and presented them to the National Park Service, which is delighted to have them shown on TV. Perhaps you have caught one or soon will.

Our regular business is to make film. It is our customers who make films. In the case of these six films, exception is justified on the grounds of stimulating travel, which in turn and by tradition stimulates picture-taking. But there lurks a problem. Lack of park patronage is not the problem.

Use of the parks concentrates in July and August, the 1/6 of the year when schoolkids get vacation to help with the farming, even if the family has not actually farmed for four or five generations. Very little of our beautiful footage was shot during those months. We were allowed in during the other 5/6 of the year, and so are you. If your own obligations permit, and if you are willing to miss the opportunity to photograph masses of other people's kids licking ice cream cones, you may find other acceptable camera fodder.



Did you know that the Yellowstone elk spend all summer in the generally inaccessible high country and that wild geese stay all winter near the famous hydrothermals that make that old park the world's most generally accessible demonstration of super-speed geology?



Imagery for purposes new and old

7 July 1972

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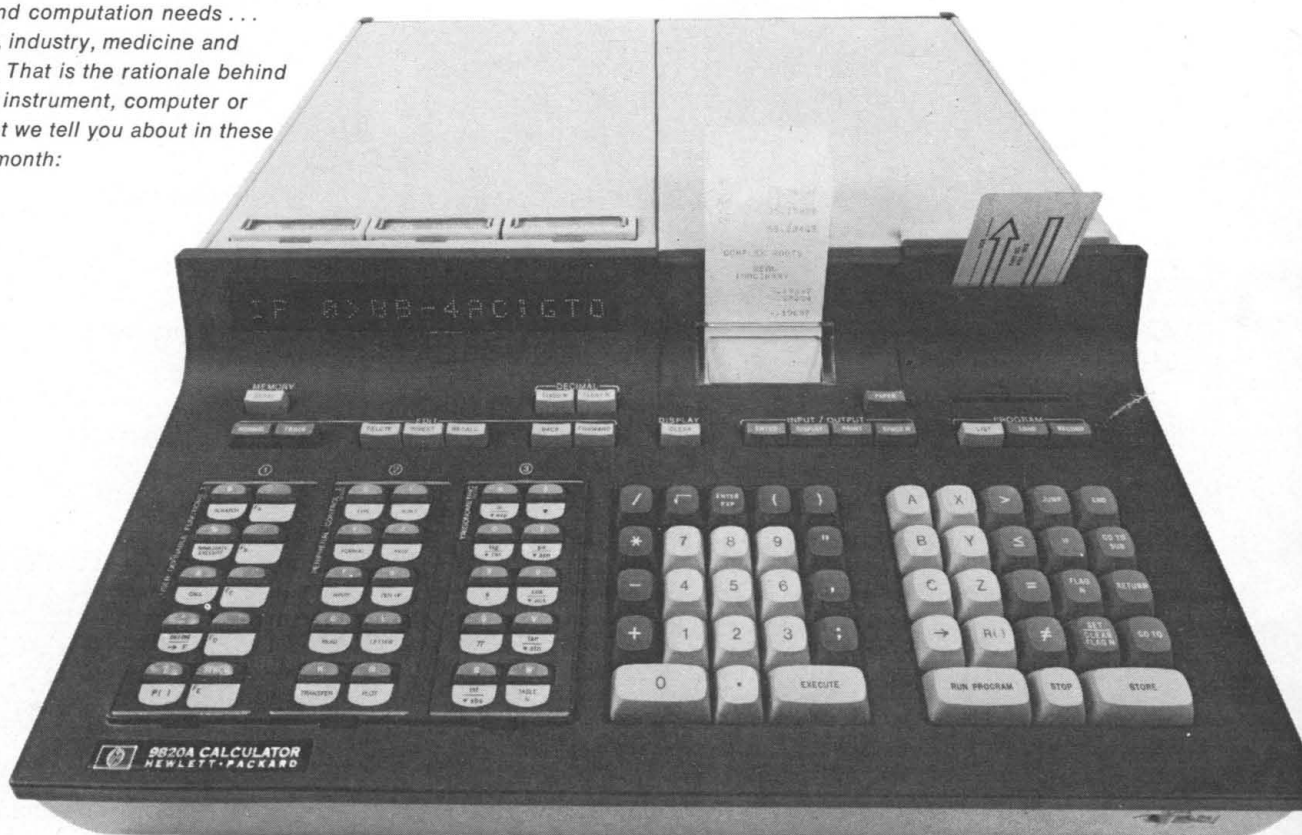
COVER

Jumbled scene used in the experimental investigation of the role of coherence in perception. The same object is more difficult to identify in a scene jumbled in this manner than in the original, coherent scene. See page 77. [Irving Biederman, State University of New York at Buffalo; on leave Stanford University, Stanford, California]

The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

Some things are changing for the better.

Many people know us as an instrument manufacturer: we make more than 2,000 products for measurement, test and analysis. Others know us as a computer company: more than 10,000 own our programmable calculators and computers. We prefer to think that our business is to serve measurement, analysis and computation needs... in science, industry, medicine and education. That is the rationale behind every new instrument, computer or system that we tell you about in these ads. This month:



Powerful new programmable calculator converses in simple algebraic language.

Hardly a month goes by that doesn't signal the introduction of a new calculator with more power, more memory, more output flexibility. But are things really changing for the better when the improvements so complicate the use of a calculator that one must practically become a computer programmer before he can harness its power?

This is precisely where HP's new Model 20 makes its most significant contribution. It is easier to use, by far, than any other calculator. Its language is the most simple: algebra, the kind you learned in high school. Not only does it 'understand' algebra, it also 'speaks' it, using the same numbers, letters and symbols that you do.

You enter an equation just as you write it on paper including implied multiplication and nested parentheses. The Model 20 displays your entry for verification the same way you wrote it. For example:

$$(-B + \sqrt{(BB - 4AC)}) / 2A$$

It tells you what to do next (in the program mode):

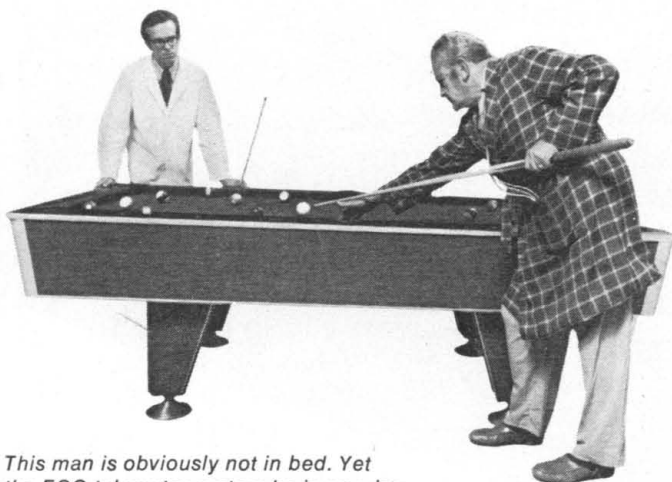
ENTER A

Then you enter the values on the keyboard (for A, B and C in this example) and press a key to execute. The calculator immediately displays and prints the solution to ten significant digits, along with its English label if you desire:

REAL ROOTS

If you make a mistake, the Model 20 tells you so and identifies precisely what the error is... lets you correct it without redoing the entire line, let alone the entire program... and automatically adjusts program storage to occupy the least possible memory.

In addition to its conversational ability, the Model 20 changes things for the better not only through more power and more memory but through a hardworking line of Series 9800 Peripherals: X-Y Plotter, Typewriter and Card Reader, to name a few. Model 20 costs \$5,475.

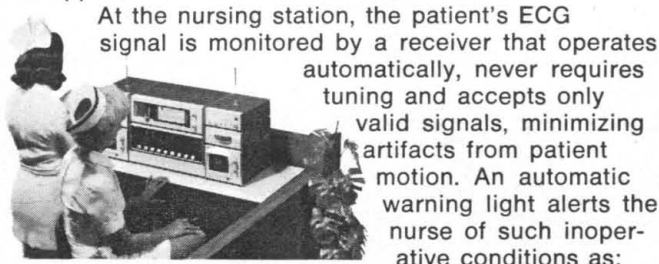


This man is obviously not in bed. Yet the ECG telemetry system he is wearing enables nurses at a central monitoring station to keep close watch on his heart action.

Freedom with protection for the post-coronary patient.

Once the coronary patient is released from the intensive care unit, his recovery can often be aided by freedom to move about and mild exercise . . . provided his ECG can be continuously monitored.

With the new HP ECG Telemetry System, the post-coronary patient can be ambulatory. Wherever he goes, his heart action is transmitted to a receiver at the nursing station where it can be continuously observed. The transmitter is small enough to be carried comfortably in a bathrobe pocket, has a strong enough signal to reach the nursing station from 200 feet even through several masonry walls, and is rugged enough to operate reliably even if dropped.



At the nursing station, the patient's ECG signal is monitored by a receiver that operates automatically, never requires tuning and accepts only valid signals, minimizing artifacts from patient motion. An automatic warning light alerts the nurse of such inoperative conditions as: patient out of range, dislodged electrode, low battery power. It is completely compatible with HP patient monitoring systems. Because it doesn't require new wiring, the ECG Telemetry System is easily introduced into existing facilities. Price is \$1,800 for each patient unit. Write for our new illustrated brochure.

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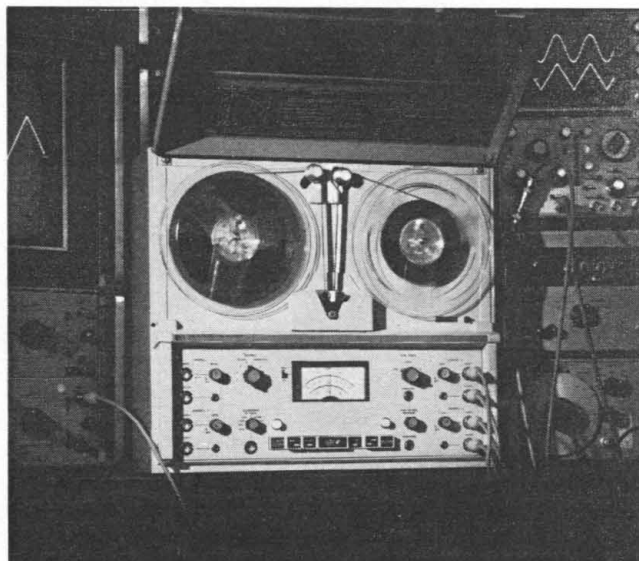
Most scientists would use portable instrumentation tape recorders for analog recording if only they performed as well as the big expensive laboratory machines. Unfortunately, their small size usually meant reduced performance.

Then came the HP 3960. Truly portable in size (50 pounds) and low in price (\$4,270 for a fully-equipped four-channel instrument), the 3960 actually outperforms most laboratory machines costing five times more.

If this sounds too good to be true, listen to some of the 3960's capabilities. At 15/16 ips, its FM signal-to-noise ratio of better than 200:1 lets you play back signals that would be buried in noise (ECG's for example) on many lab machines as well as on any other portable.

The 3960 lets you mix and interchange four FM direct record/reproduce channels at will. You have a choice of three electrically-switched speeds, for a time-base expansion of 16:1 or 10:1 . . . without signal degradation. Tape drive is bidirectional so that you don't have to rewind either to continue recording or to play back.

Built-in facilities let you calibrate the 3960's FM electronics without external equipment. And an integral peak-reading meter lets you optimize record level without using a scope. Options include a 5 to 30 foot loop adaptor, an interrupting voice channel, and an inverter for 12 or 28 VDC . . . all integrally mounted.



Write for Application Note 89, a tape recording handbook useful to scientists interested in tape recording techniques for vibration and test analysis, research and clinical medicine, acoustics, oceanography and other environmentally difficult research projects.

For complete information, write Hewlett-Packard, 1507 Page Mill Road, Palo Alto, California 94304. In Europe: 1217 Meyrin-Geneva, Switzerland; Japan: YHP, 1-59-1, Yoyogi, Shibuya-Ku, Tokyo, 151.

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Ethanol:water 7:3 in combi-vial.

L-Methionine [¹⁴C(U)] NEC-425

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40-60mCi/mmole \$40/10μCi \$150/50μCi
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in dry ice.

S-Adenosyl-L-methionine [methyl-³H] NET-155

2-5Ci/mmole \$38/50μCi \$78/250μCi \$195/1mCi
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in dry ice.

S-Adenosyl-L-methionine [carboxyl-¹⁴C] NEC-604

5-10mCi/mmole \$45/10μCi \$175/50μCi
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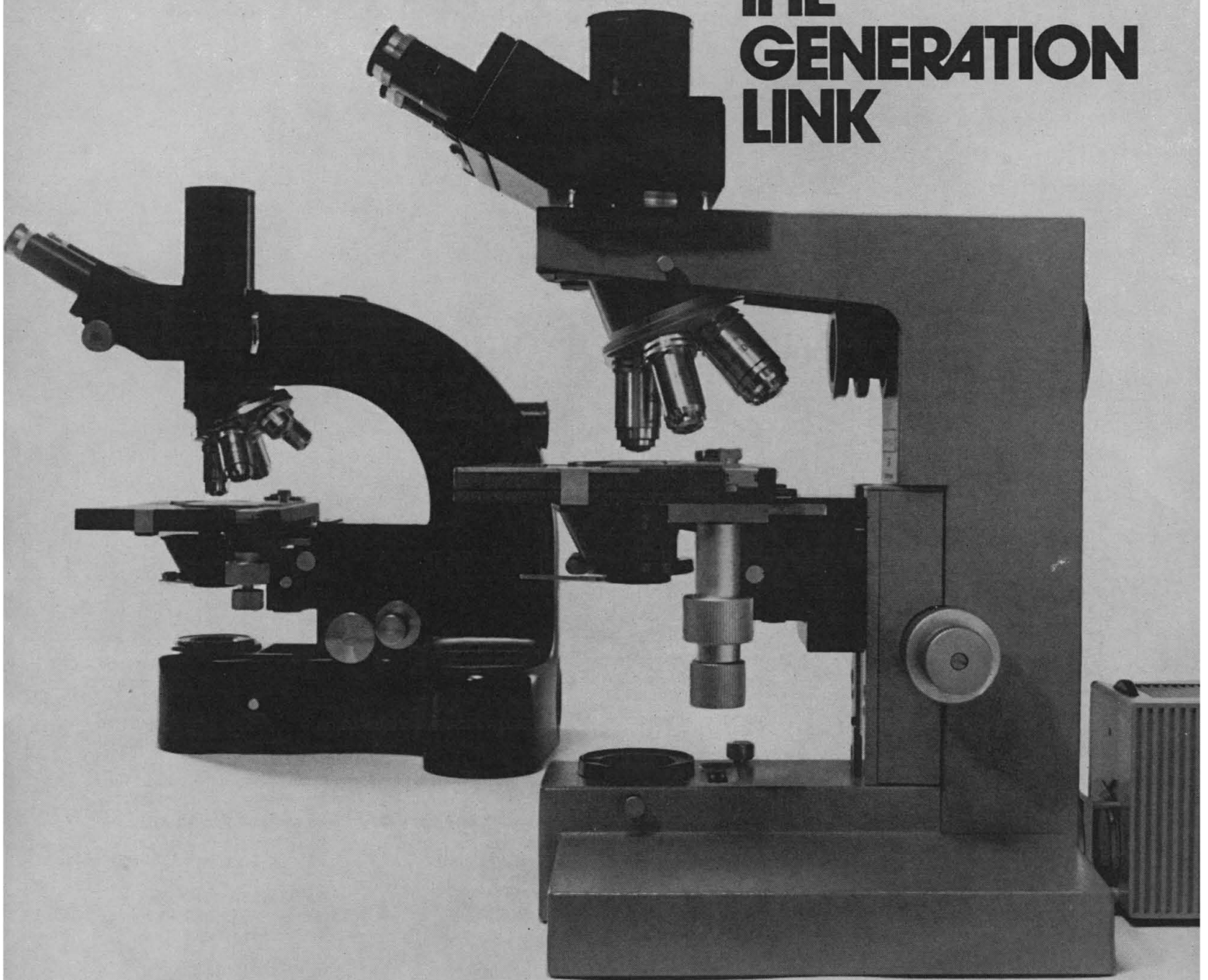
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Behind the President's Message

Reactions to President Nixon's 16 March message to Congress on science and technology have ranged from damnation to high praise, with several intermediate critics complaining that it fell far short of the advance billing of the New Technology Opportunities Program or that it added little to what had already been said in the 1973 budget or the State of the Union message. Generally, the critics have treated the special message (or the special message and related statements from the White House) as an isolated event.

It is a mistake to consider the 16 March message by itself, for that message constitutes presidential affirmation of some proposals for change in science policy that have been brewing for several years. The President's concern for innovation and some of his proposals for encouraging innovation parallel closely recommendations contained in *Technological Innovation: Its Environment and Management*, the 1967 report of an external advisory committee to the Secretary of Commerce.

Or again, the President called for "a new partnership in science and technology—one which brings together the federal government, private enterprise, state and local governments, and our universities and research centers in a coordinated, cooperative effort to serve the national interest." The statement that "A more effective use of these resources can be made by combining the talents of industry, government, and universities in a new type of research organization" sounds as if it came directly from the President's message; in fact, it came from the 1971 report of the National Science Board (NSB). Similarly, some of the recommendations of the 1972 NSB report, *The Role of Engineers and Scientists in a National Policy for Technology*, are repeated in the President's message. This support, be it noted, came from the 25 members of the NSB, 20 of whom must be classed as academics rather than as industrialists or government managers.

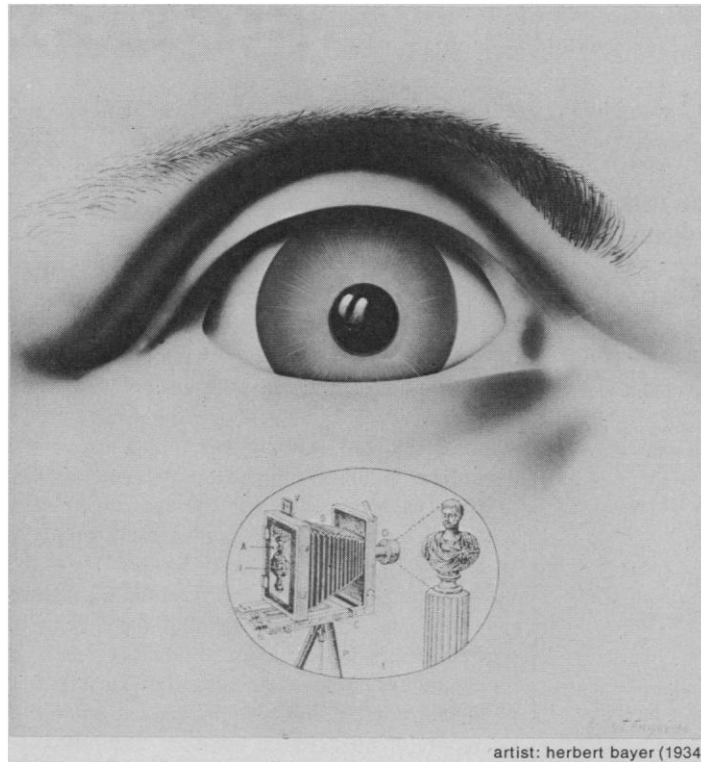
None of these documents presents a fully worked out program; all recognize the need for more detailed planning. The President says, "We must define our goals carefully," and the NSB calls for the careful establishment of priorities. This hard work remains to be done; we have an outline of new policy, but not yet the working drawings.

A similar situation existed from 1945 to 1950, when the basic science policies of the next quarter century were being formulated. The federal government then outlined broad scientific and technological goals, and it decided to support the private sector instead of using governmental institutions as the major performers of research and development. But details of planning and emphasis were left to evolve.

Now the President has announced a new turn in national policy for research and development: more central planning and "directed" research; more multidisciplinary team studies; more emphasis on social goals; and more university-government-industry cooperation. Presidential support for these changes is in itself important, but the ideas are what call for primary attention. Their objectives are social and economic, and hence inherently political, a fact that has important implications for all the scientists and institutions of higher education involved. The specific proposals therefore deserve searching debate, for, if they are adopted, the current period will be remembered as the time of the most significant turning point in national science policy since the late 1940's.—DAEL WOLFFLE, *Graduate School of Public Affairs, University of Washington, Seattle 98105*

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