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Over the years we have learned ways to endow these bare crystals with far more uv sensitivity than when Victor Schumann first proposed sticking them out free of the uv-absorbing gelatin. A certain film imported from Kodak-Pathé in delicately packaged strips 35mm x 7 inches has represented the high mark in sensitivity. Still, its touch-me-not nature continued to impose awkward constraints on design of equipment. No more, provided enough interest can be aroused in new domestic Kodak Special Film, Type 101-01.

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For some time now we have been busily adding more and more items to the list of mesomorphic compounds we offer, particularly those of cholesteric habit with its enormous optical rotation power and circular dichroism. Further possibilities are suggested by work reported in Physical Review Letters 18:393; it seems that the random alignments available in cholesteric "swarms" can simplify the generation of second harmonics from Q-switched lasers. Meanwhile, some who are less interested in basic optical principles use "liquid crystals" to depict slight but significant temperature anomalies in the skins of people or airframes. Those concerned with the latter tell us we are doing a good job in making them what they want.

In serving the optical investigator with liquid crystals, the chemical talent we have invested might have been devoted to higher purity for fewer compounds. Instead, we reasoned that once his investigations establish a need for higher purity in a given compound and it happens that purification overtaxes his own chemical facilities, we would be happy to see what we can do for him.

To check on current offerings and prices in cholesteric, smectic, and nematic compounds, write Eastman Organic Chemicals Department, Distillation Products Industries, Rochester, N.Y. 14603 (Division of Eastman Kodak Company).

The way into print

Publish or perish. The doctrine still holds sway despite bitter words spoken against it over ethanol after midnight. For validity one's work must be consecrated by a typesetter. Only after ink has been applied to paper by a decent number of revolutions of a metal cylinder can a piece of scholarship be considered accomplished. This is the custom. It dates from a day when learned men with news to spread were few, which is no longer so.

Now that myriads of learned men and women have to get into print and get into it frequently, the technology by which this is done had better be improved. On top of Gutenberg's 15th century concept of movable type and Mergenthaler's 19th century concept of casting liquid metal into lines of type, photography now further facilitates the printing of the printed word. This involves us.

Companies that built typesetting machines around a pot of simmering Pb-Sh-Sn alloy now build them around computers and certain light-sensitive litho plates of our manufacture. The neatness with which the characters are arrayed on the page—which has come over the centuries to signify commitment and authority—is attended to by the computer. With less asked of human judgment and fingers, the flux of words and symbols onto our plates can be maintained at superhuman levels. As the plates emerge from the machine, they are dunked in solutions that change them to actual printing plates, ready to run on offset presses in certain printing applications today and probably more tomorrow.

Dunking sounds like a bottleneck, and it is. This very year that bottleneck, too, is being broken. To the printing establishments prepared to cope best with the publishing needs of the day we are supplying another machine (called Kodak Versamat Plate Processor, Model 1-N). It sits beside the typesetting machine, smoothing the way into print by bridging the dunking step. What happens to the words and symbols thus at length properly arrayed in a good black on a respectable paper is a question to be disposed of on some other occasion.

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individuals who have indicated their willingness, 127 have Ph.D. or M.D. degrees, 30 have Masters, 19 have Bachelors, and 3 have no degree; 17 are in medicine, 75 in the physical sciences, 54 in biological science, 17 in social science, and 16 in engineering. The areas represented are: Northeast, 35; Middle Atlantic, 54; Southeast, 17; Middle West, 29; South, 10; Mountain States, 5; Pacific Coast, including Alaska, 26; and 3 from abroad.

We have made no plans for action as yet. Suggestions have been made that we make studies on pacification, on health problems, and on biology, and the anti-infiltration barrier. I suggest that we be called "The V.N. Emergency Science Group." Clearly we face problems of placement, of briefing, and of budget. We are starting to consider means of meeting these problems.

Of the 17 letters which opposed my views, there were those who abused me; those who believed that if I were to read Senator Fulbright and Ramparts magazine I would reform; and those who asserted that all terrorism in Vietnam is committed by the United States. The few unsigned letters were discarded.

If I were to attempt to summarize the comments, other than the many expressions of gratitude, I would say that they concluded that dissent has gone too far and the secondary effects of dissent are now more important than the primary goals of the dissenters.

It is abundantly clear from the letters that those who replied are thoughtful, earnest, and deeply involved. I began this action because my conscience would not leave me alone! I had many misgivings. I now have great pride that I have been able to serve as a focus for these individuals. The schism among scientists caused by the present situation is latent with profound tragedy. If our group can so perform as to lessen that tragedy, the letter to Science will have served a great purpose.

ERNEST C. POLLARD
Department of Biophysics,
Pennsylvania State University,
University Park 16802

In response to Pollard's call to improve the U.S. position in Vietnam, I make the following suggestions:

1) To reduce terrorism, we can stop bombing, quit burning villages, provide no support for any terrorist activities, and make any scientific techniques to counteract terrorism available to all people.

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<th>Dia.</th>
<th>Type No.</th>
<th>Current</th>
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2) To make food available to people who were never short of it before our arrival, we can refrain from fighting in the Mekong Delta rather than be concerned about how better to "hold" it.

3) To "permit humble people . . . to choose their way of life without fear," we could back only those elections in which all organized political groups, rather than just those that meet our approval, are represented on the ballots.

4) Finally, to make the best single improvement in our position in Vietnam, we can remove all of our armed forces and supporting personnel and make our technology available to help rebuild where we have left ashes, both North and South.

As Pollard implies, there appears to be less university-scientist support for this war than for World War II. This seems to be related to the substantial difference in political and moral realities between the two wars.

WILLIAM F. PROKASY
Department of Psychology,
University of Utah, Salt Lake City 84112

. . . I hope you will give a hearing to those who feel that American scientists are already far too closely identified with that military adventure. Far from suffering from a lack of scientific support, our invasion of Vietnam has involved an unprecedented mobilization of scientific resources. Scientists developed the gas which drives civilians and guerrillas alike from their shelters. Scientists developed the napalm and phosphorus and pellet bombs with which we wipe out the villages suspected of sheltering the Vietcong. Scientists developed the crop-destroying agents with which we are creating artificial famine.

And scientists are now perfecting "counter-insurgency techniques"—the methods which are to make certain that a military dictatorship, if once established, can never be overthrown.

WILLIAM PALMER TAYLOR
416 Ross Avenue,
Hamilton, Ohio 45013

. . . when [Pollard] says that the nub of our position is "that we seek to nullify terrorism," I wonder if he is referring to the terrorism of napalm, crop destruction, and scorched earth tactics.

ROBERT B. KELMAN
Department of Mathematics and Statistics, Colorado State University, Fort Collins 80521

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<th>Flow Adapters</th>
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27 OCTOBER 1967

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Information theory is an important intellectual byproduct of the great field of electronic engineering. It has stimulated and challenged the thinking, not only of engineers but also of scientists, mathematicians, and philosophers. This is quite analogous to the impact of mechanical engineering, in the seventeenth century, on the thinking of scientists like Huygens, which led to Newtonian mechanics. It is true that Newtonian mechanics was never a great help to the inventors and engineers of engines, guns, cars and aeroplanes in the following centuries, because they had of course always applied its principles intuitively. It only set a limit of efficiency. On the other hand, it did open a path towards the understanding of the motion of the planets and the atoms and the cell, which led to totally new fields of engineering.

Information theory deals with information as dynamics deals with motion. So far, it is a threefold science, for the first place it describes how to improve the detection of weak signals in random noise. In the second place, Shannon’s theory has shown that all communication channels have a given capacity in bits per second, and how in principle they may be used more efficiently. Finally, in the widest sense, computers are subject to information theory. Despite the fact that chess is a strictly logical game, and the efforts to program machines for such games have clearly reached an impasse. One might say that people use judgment, and that judgment is something quite different from logic. Another example, this one related to channel capacity, is when a radio announcer says: “The next hour will bring you Hamlet by Shakespeare.” These few bits give more information about the time series in the next hour than all statistics of letters and words in the English language could ever supply.

Some examples indicate that information theory can never be made into an all encompassing conceptual framework for information as mechanics is for motion. Does it show that judgment, common sense and intuition are the assets of human intelligence which will forever escape the boundaries of an exact basic formulation? This is what a scientist might say, but not a philosopher. We know today that, physiologically speaking, a man’s decisions are made as a consequence of information processing in his brain, which therefore must be subject to information theory. It would be against the basic tenet of science if these activities of the brain, resulting in intelligence, would not follow from a few clear and basic principles.

To formulate such a complete foundation of information theory is the first objective of the present book. The fundamental question to be answered is: Let all my information received in the past be given in the form of books, films, magnetic tapes or any other physical records; what are my rational expectations of the future? Please notice: a basic theory does not have to give a concrete answer in every complex situation. Newtonian mechanics has never even resulted in an exact solution of the three body problem! The requirement for a fundamental theory is that it is simple, intuitively satisfying and that it completely and expertly explains all the things of every individual situation which may present itself in reality. Very important is that the theory is operational, which means that it only speaks in terms of operations which can actually be carried out in the real world.

This basic problem of rational prediction, once put in this general form, and once we know that there must exist a general theory, is readily solved. This is done by generalizing common sense analyses of specific, real situations in which the rational prediction is intuitively obvious. The general and simple mathematical formulation then follows naturally. Formulated in words, the universal principle of prediction is: “Whatever in the records is found to be constant over a sufficient time, we will expect to remain constant in the immediate future.” (Notice the analogy with Newton’s first law of motion!)

Once this main goal is achieved, one can realize that this generality had already been anticipated by philosophers and scientists. The philosopher Hume, around 1740, arrived at the conclusion that this was the ultimate foundation of all human knowledge. Although nobody has ever been able to refute his idea, it remained mostly ignored, apparently because it is so unpleasant to admit that all our rational knowledge of the future, and the past, is ultimately based on so simple-minded a principle. The language of information theory however gives his idea an authority which will be hard to ignore. It leaves little doubt that information theory now replaces speculative philosophy as an ultimate foundation of human knowledge.

Furthermore, it turns out that the very fundamental uncertainty relations in physics, formulated by Heisenberg around 1930, now can be looked upon as a consequence of information theory. While up till the present these wave-particle aspects of Nature have been considered as mysterious and even paradoxical, they become perfectly natural if we assume that physics does not deal with reality, but only with information about reality. In a previous book, “The Foundation of Physics,” the author has discussed this new point of view and shown that it leads logically to a new and promising mathematical formulation of quantum mechanics.

Having arrived at the solution for the basic problem of information theory, which is how to predict the future rationally, one can turn to the general problem of intelligence. Human intelligence is defined as follows: “To be intelligent is to try to satisfy one’s psychological needs by all available rational means.” It is the power of well formulated basic principles in the mind to make things easy which looked highly mysterious and abstruse before. The new foundation of information theory allows one to translate this simple and scarcely contestable statement into a rigorous and precisely defined form of information processing. One thereby has solved the problem of intelligence. The information processing required, to achieve significant intelligence turns out to be truly enormous. It amounts to a search through all the stored information for the one piece that most closely matches the information presently received. However, it turns out that a simple model of the brain makes this process quite feasible.

Information theory therefore provides a general blueprint for understanding the operation of the human brain. One could hardly expect less from a basic theory.

Artificial intelligence is the field of engineering which tries to construct machines, able to perform tasks, which at present can only be clearly defined as human or animal. On the basis of the present theory of intelligence, it is shown in detail how artificial intelligence, comparable to that of living beings, lies within the reach of present day technology.

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41-18 Air-Conditioning and Refrigeration Inst., annual mtg., Miami, Fla. (1815 N. Fort Myer Dr., Arlington, Va. 22209)


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18-21 International College of Surgeons, 5th Western regional mtg., Las Vegas, Nev. (F. M. Turnbull, Jr., 1127 Wilshire Blvd., Los Angeles, Calif. 90017)


20-22 Geological Soc. of America, annual mtg., New Orleans, La. (G. E. Murray, Texas Technical College, Box 4680, Technical Station, Lubbock, Tex., or Miss D. Curtis, Shell Oil Co., Box 3109, New Orleans 70160)


20-22 Paleontological Soc. of America, New Orleans, La. (R. L. Langenheim, Dept. of Geology, Univ. of Illinois, Urbana)

26-29 American Medical Assoc., clinical conv., Houston, Tex. (W. E. Burmeister, Director, Convention Services Dept., AMA, 535 N. Dearborn St., Chicago, Ill.)

26-30 American Inst. of Chemical En-