RANDom NEWS

SEPTEMBER 1964



MAKING IT ON THE MEKONG

WHILE THE U.S. CONTINUES TO HELP SOUTH VIETNAM TOWARD ORDER AND SECURITY, FEW OF US ARE AWARE OF THE WORLD OF THE SOUTH VIETNAMESE PEASANT: THE STAR HE WAS BORN UNDER, THE STATUS OF HIS THREE SOULS AND NINE VITAL SPIRITS, AND HOW HE FEELS ABOUT HIS GOVERNMENT — ALL OF WHICH HAS SOMETHING TO DO WITH HOW HE FIGHTS THE WAR, HOW LONG IT WILL LAST, AND WHAT ITS OUTCOME WILL BE.

MEET THE PEASANT OF THE MEKONG DELTA. THIS ACCOUNT IS BASED ON A RECENT SERIES OF ESSAYS BY RAND ANTHROPOLOGIST GERALD HICKEY, WHO HAS TRAVELED THROUGHOUT VIETNAM AND LIVED FOR EXTENDED PERIODS AMONG THE VILLAGERS.



MAKING IT ON TH

As a farmer in Binh Duong province put it, "Now we don't expect anything from the government *or* from the Viet Cong"; and he added wearily, "we just want to be left alone."

The Vietnamese farmer is tired of the war. Of all the groups in Vietnam, it is he who is paying the highest price for it; casualties are higher among the peasants than among the military. The years of guerrilla warfare have generated conflict and suspicion rather than unity, and the villager has turned inward, clinging to the familiar. His chief concerns are for his family and his farm – if he has one. Some of the peasants are pro–Viet Cong, some progovernment, but most of them have come to believe that nonalignment is the best way to survive. They passively comply with whichever side is in control of the area: If the Viet Cong enter the village during the night to force the peasant to dig up the road, he digs it up; if government troops come the following day and order him to repair the road, the road is repaired without complaint.

The peasant's own government in Saigon appears to him an alien place, constructed by the French and harboring many foreigners. He recalls with nostalgia the gambling, now banned, that had been one of the major pleasures during the lunar-new-year celebration. When asked what he thinks of the Family Bill which forbids divorce, plural marriage, and keeping concubines, he is likely simply to laugh and say it is only for those people in Saigon.

But the traditional autonomy of the village has been gradually yielding. Since the republic was established in 1955, the ministries in Saigon have been playing an increasing role in village education, public works, agricultural programs, financial affairs, judicial matters, and civil order. In the past, village leaders emerged from the older, qualified sociopolitical elite, and prestige was more important than money. Now council members are appointed by provincial authorities, are younger, and receive fixed salaries as civil servants. The qualified villager no longer aspires to a high position on the village council, which is generally thought to have lost its authority. As one farmer said, "The people used to be the servants of the village council. Now the council is the servant of the people."

To an outsider this may look like a democratic development, but to the peasant it means simply that the council has given up its power, as if the father in the family had yielded to his children.

Meanwhile, an unseen web of customs and traditions that are strange to us continue to hold much of the behavior of the peasant in a pattern not likely to be easily understood by the westerner.

THE PEASANTS SHARE A COSMOLOGICAL VIEW.

This is shown in their daily manifest behavior and attitudes, though few of them could articulate it. It is deeply rooted in the Chinese philosophical tradition, absorbed into Vietnamese culture during the long period of Chinese domination. Universal order is the essence, and from this view springs a number of other concepts. The villager believes that his individual destiny is guided by a particular star—the sign of a cosmic force – that shone brightly at the time of his birth. The relationship of this star with other stars affects the cosmic force, predisposing, but not predestining, the individual toward good or evil.

Horoscopy permits the individual and the village to maximize the good influences of the unfavorable periods and evade the bad effects of the unfavorable periods. Certain rituals give the individual some control over his fate; for example, a prescribed offering and the burning of many candles on the day that his star reaches its zenith will draw the light of his star and thereby maximize the good cosmic influences.

Another related concept is harmony: harmony with the existing universal order; harmony with the five elements (metal, wood, earth, water, and fire) – the basis of geomancy; and harmony in attaining the favor of good spirits and avoiding evil spirits. A nation's existing good fortune is a manifestation of harmony and a sign of the approval of *thien* (the celestial forces) for those in power, who, in effect, have the mandate of heaven. Floods, droughts, and other catastrophes indicate disharmony and the disapproval of heaven. They are signs that it is time for *cach mang*, or "change of mandate," the literal Vietnamese expression for revolution.

The concept of harmony also guides the practitioners of Sino-Vietnamese medicine. If any one of the *ba hon* (three souls) and *chin via* (nine vital spirits) which sustain the human body departs, the imbalance results in sickness, insanity, or death; and the healer's first invocation is for the souls and spirits to return to the victim and thus restore him to good health. For the successful treatment of ailments, there must be harmony between the locus of pain in the body and the auspicious point in the calendar. (There are about a thousand vital points in the human body, each corresponding to a specific hour, date, and odd or even number in the lunar calendar.)

According to Hickey, all Vietnamese peasants retain something of this cosmological view, whether they become Christians, receive secondary schooling, or for some reason are removed from the traditional ways. It would be an unusual villager who did not consider his horoscope or adhere to at least part of the folk medical beliefs. On the other hand, this cosmology does not commit the Vietnamese to fatalism. They may approach innovation with some skepticism but will accept technological change when there are obvious advantages.

ALMOST ALL ASPECTS
OF VILLAGE SOCIETY
ARE AFFECTED BY RELIGION.

This religion is an amalgam of the Mahayana Buddhist–Taoist–Confucianist ideology, mixed with popular cults, which can be traced to a number of sources. Père Cadière, one of the foremost experts on Vietnamese reli-

RAW DATA

The Camp of Nam Dong, 35 miles west of Da Nang. July 6, 1964—His research notes finally put aside, Gerald Hickey was sleeping soundly. Suddenly, at 2:30 a.m., the Viet Cong began their battalion attack by pouring mortar fire into the outnumbered camp.

As later described in a letter to RAND Santa Monica from Major Edwin Nance, commanding the U.S. Special Forces Group there:

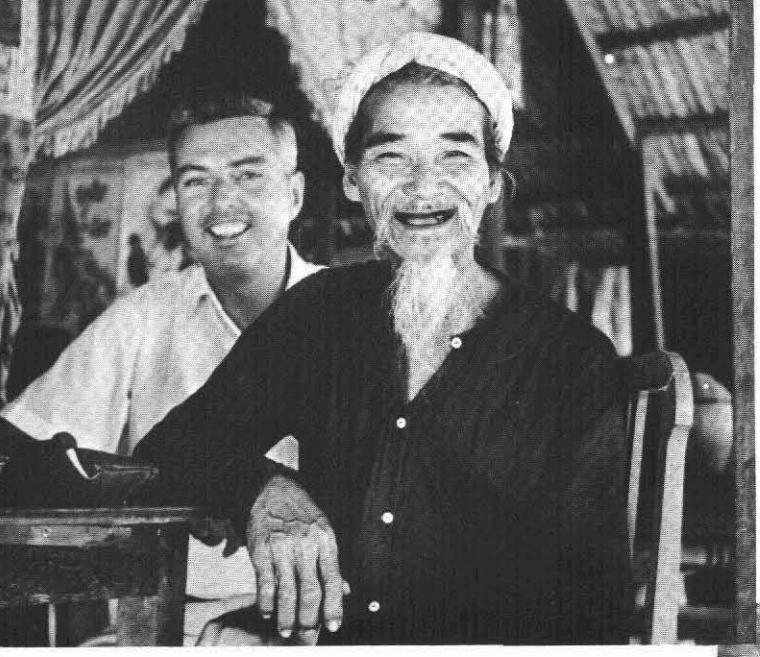
GERALD HICKEY

Gerald Hickey, now on the Social Science Department staff, began as a consultant in 1962. A graduate of De Paul in 1950, he received his M.A. (1953) and Ph.D. (1958) from the University of Chicago. He was a Research Associate in the Department of Anthropology at Michigan State and later at Yale, before becoming a consultant to the Mekong River Project of the Ford Foundation in 1961 and then coming to RAND.

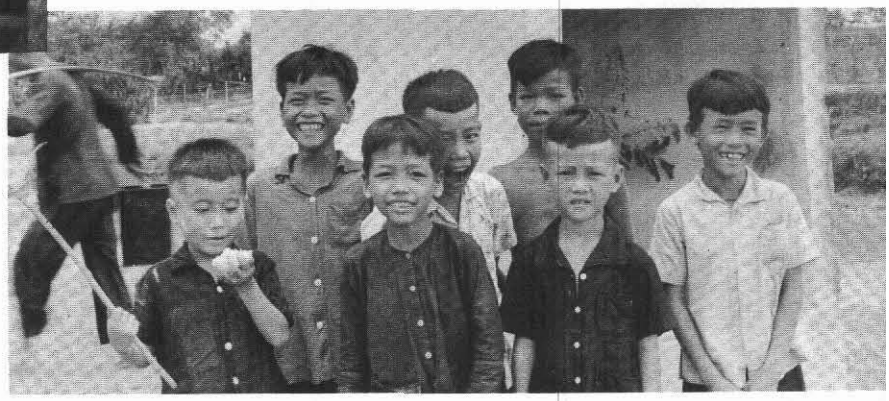
"All of the three hundred and fifty six Vietnamese, twelve Americans and one Australian ran to their defensive positions. Doctor Hickey displayed initiative and common sense by immediately getting an automatic weapon and accompanying other Americans to defensive positions. Throughout the hours of darkness, Doctor Hickey calmly and effectively fired into waves of Viet-Cong attackers, and upon relief provided invaluable assistance in the documentation of the action.

"The camp held against this assault and its defenders inflicted heavy casualties on the enemy. Miraculously Doctor Hickey was not wounded; however, one Australian and two U.S. Special Forces soldiers were killed and five other Special Forces men wounded. The gallant Vietnamese suffered heavy losses: 58 died and 57 were wounded.

"Distinguishing actions by men such as Doctor Hickey are worthy of the highest praise."



Hickey with elderly farmer friend.



Village kids standing before a small shrine.
One is nibbling a handful
of glutinous (sticky) rice.



Hickey with member of the Village Council
at a celebration marking
village ancestor veneration
("That's why we're dressed up").



Wedding: the groom carrying
the traditional gifts of areca nut
and betel leaves, symbols of everlasting unity,
while the bride, in large circular hat, follows.

gion, writing in 1957, characterized it as omnipresent, enveloping all the individual's daily acts.

In the Mekong River delta, two recent religious movements have enriched this amalgam. Cao Daism, described by its leaders as Reformed Buddhism, aims at combining the great religions of the world in preparation for the coming of the Messiah. It combines Buddhism, Taoism, Confucianism, Catholicism, Indian mysticism, and a variety of popular beliefs and practices. Its hierarchy is modeled on the Catholic Church, but includes female cardinals.

Because of the disagreement with the pope's policies, members of the hierarchy in the early 1930's founded separate Cao Daist sects and, eventually, established holy sees of their own. Some supported the Viet Minh during the Indochina War, and their leaders were jailed. Other Cao Daist sects, not having participated in the national movement, functioned without restraint and have expanded considerably since 1955.

Cao Daism holds numerous attractions. The convert is allowed to retain his traditional cults, important to the many who believe that the omission of cult observances invites ill fortune. At the same time he enlarges his pantheon to include some of the deities of the Judeo-Christian tradition. Cao Daism also appeals to the peasant's nationalist sentiments because it is the first religion that is both explicitly Vietnamese and that aspires to become one of the world's great religions.

Hoa Hao, another form of Reformed Buddhism, also amalgamates the existing religious elements, but it adds no new beliefs or deities. Rather, the movement seeks to recapture the purity of early Buddhism in propagating such principles as the notion that Buddha cannot be represented by any image (in Hoa Hao pagodas, a framed red board in the middle of the main altar is the only symbol of Buddha); that an organized priesthood or monkhood is not necessary; and that all members of the movement are considered equal. Founder of the sect, Huynh Phu So, until his death at the hands of the Viet Minh in 1945, was considered a living Buddha.

THE VIETNAMESE PEASANT WILL ACCEPT INNOVATION WHEN IT IS SHOWN TO BE USEFUL.

Though traditions are strong, and taboos and sanctions are observed, they are flexible enough not to inhibit the peasants' economic activities.

And the goal of economic gain meshes well with certain features of the peasant's culture, such as the Cult of Ancestors, so that he has a strong desire to improve his lot: to have land, a fine house, material comfort, and education for his children. One of the dreads of poverty is that the family may disintegrate and quit the village to seek a livelihood elsewhere. An unbroken lineage means immortality, so it is imperative that the immediate family remain together, and that members of the common-descent group — that is to say, all those related through the male line to a common ancestor (the paternal grandfather in southern Vietnam) — retain their identity as a social group.

Bliss in the afterlife is the reward for having observed the Cult of the Ancestors with proper veneration and offerings for the deceased. In the absence of this cult, the soul becomes a *co hon*, a miserable, malevolent, errant spirit. The essentials for the Cult of the Ancestors are well defined. One must have a son to bear the responsibility for maintaining the cult, and there must be the financial means, land, and an ancestral house where kin and friends can gather for cult rituals.

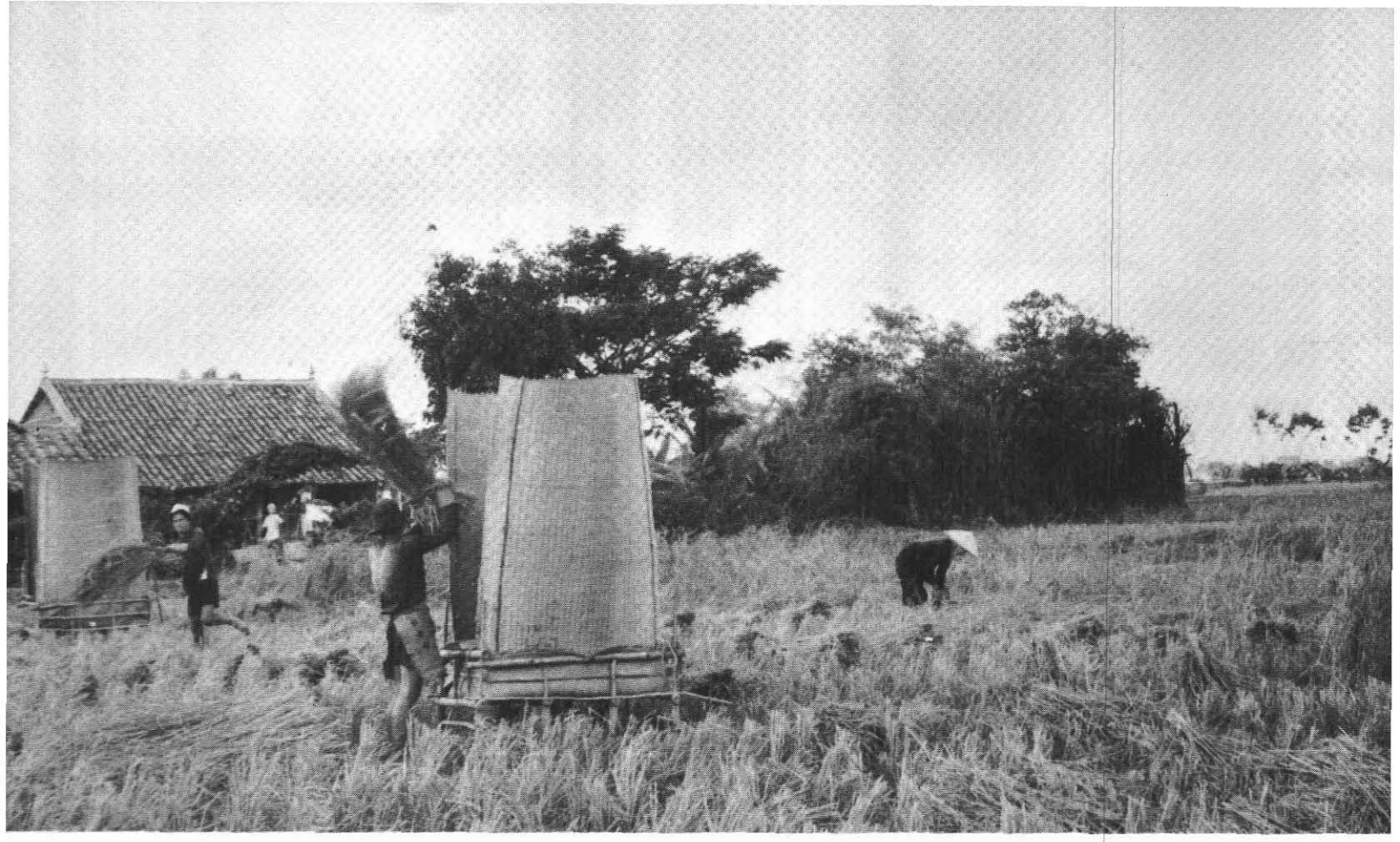
The landless villager assiduously tries to put aside small amounts, so that he eventually can purchase a half hectare as a foundation on which to build. Most peasant families own no land. Still, even the poorer peasants continue to strive in the hope that their destiny may hold good fortune. In Khanh Hau, this faith of the landless was bolstered in 1958 when a poor tenant farmer won 1,000,000$VN in the national lottery. He immediately purchased land, declared a portion of it *huong hoa* (legally dedicated to the support of the Cult of the Ancestors), and then constructed a masonry house with tile roof.

Because in southern Vietnamese society women inherit land, there is danger of rapid fragmentation of holdings. In one family, for example, land holdings dwindled from the paternal grandfather's 7 hectares to 0.467 hectare for each member of the peasant adult generation. This plunge into poverty meant the ancestral house had to be sold — a disgrace for a peasant family.

The individual farmer may attempt to plant new kinds of crops and try various technological and material innovations within his economic ability. Some of the more venturesome engage in extended entrepreneurial activities. One example is the case of several brothers (one of whom had been a Viet Minh village chief) who purchased a truck. They loaded it with paddy, which they sold in Ban Me Thuot, a town in the highlands where little rice is cultivated and prices were high. With the profits they purchased timber, which is plentiful in the vicinity of Ban Me Thuot, and sold it in Tan An, where timber is scarce. This middleman operation yielded sizable profits — until an accident with the truck ended the business.

"PHEP VUA THUA LE LANG."

("The laws of the emperor yield to the customs of the village.") This proverb, known to all the people of Vietnam, reflects the reputation of the



Vietnamese village as an autonomous, homogeneous community jealously guarding its way of life—a little world that disregards, even disdains, the larger world outside.

While the village is noted for its isolation and autonomy, there is at the same time a lack of communal solidarity within it—particularly in the villages of the Mekong delta, which are composed of a number of dispersed hamlets. Hamlets of the same village may be five kilometers apart, and there are no single focal centers that might attract large segments of the village population, giving them the opportunity for social interaction. A villager visits the Council House only occasionally, to take care of such administrative necessities as registering a birth, death, or land transfer, or resolving a conflict with another villager. The temples too are inadequate to serve as social centers. The lack of communal identification manifested itself in Khanh Hau in the first and short-lived attempt to organize a cooperative from all the hamlets of the village. In their last meeting before the cooperative disbanded, some members openly admitted their reluctance to entrust money to the group.

There is greater solidarity at the hamlet level, but the close relationships in the village are found within families that have the means to hold periodic gatherings associated with the Cult of the Ancestors, and also among the residence groups.

A NEW LIFE?

When the French occupied Vietnam in the middle of the nineteenth century, settlers from the central coastal plain were in the process of establishing their villages in the Mekong delta. These settlers were pioneers—clearing, planting, building. But this southern society was removed from Hanoi and Hue, the focal centers of traditional Vietnamese culture. Isolation compounded by the French administration led a new society to emerge in the Mekong River delta, a society identifiably Vietnamese, with many of the culture traits of northern and central Vietnam, yet containing many other features as well, and receptive to new ways of doing things.

A new elite emerged, which was strongly influenced by French culture and values. The traditional intellectual-farmer-artisan-merchant hierarchy gave way to a rank system in which wealth assumed the most important place. In short, the social structure in the south lost much of its rigidity, and the old ways are not always necessarily sacred there.

Meanwhile, recent political events continue to greatly disrupt village life. Whereas war may generate solidarity in a nation, the guerrilla warfare of the present struggle breeds suspicion and conflict. Without battle lines, without an identifiable enemy, the war is everywhere. There are pro–Viet Cong and pro-government factions in the villages as there used to be pro–Viet Minh and pro-French groups. Most villagers, however, do not actively take sides. Their primary concern is to survive—no easy task in itself.

Invariant Imbedding & Time-Dependent Transport Processes

Volume Two — R. E. Bellman, H. H. Kagiwada, R. E. Kalaba, and M. C. Prestrud
A RAND *Corporation Research Study published by the American Elsevier Publishing Company, Inc., 1964.*



R. E. Bellman



H. H. Kagiwada



R. E. Kalaba



M. C. Prestrud

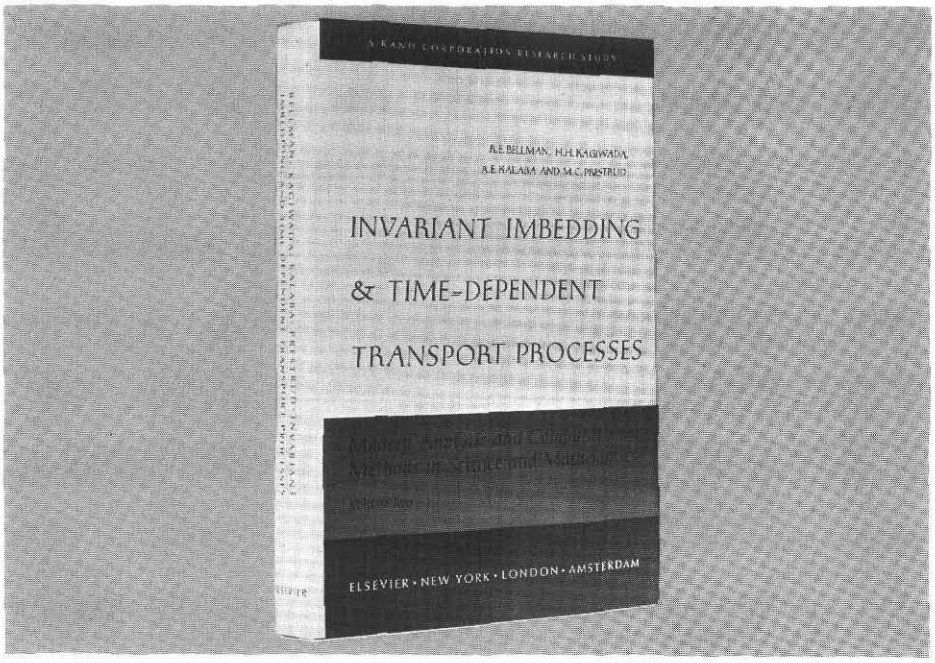
From the Introduction: The principal objective of this volume is to demonstrate that a simple and direct application of invariant imbedding, combined with a relatively unsophisticated use of the modern digital computer, will yield a number of significant results in radiative transfer. These results have immediate application to the study of planetary atmospheres and can, together with minor extensions, be used to obtain a number of the results desired by Van de Hulst in his expository article ["Generalization of Some Methods for Solving an Integral Equation of the First Kind," *Bull. Astronom. Inst. Netherlands,* Vol. 10, 1946, pp. 75-79] . . . .

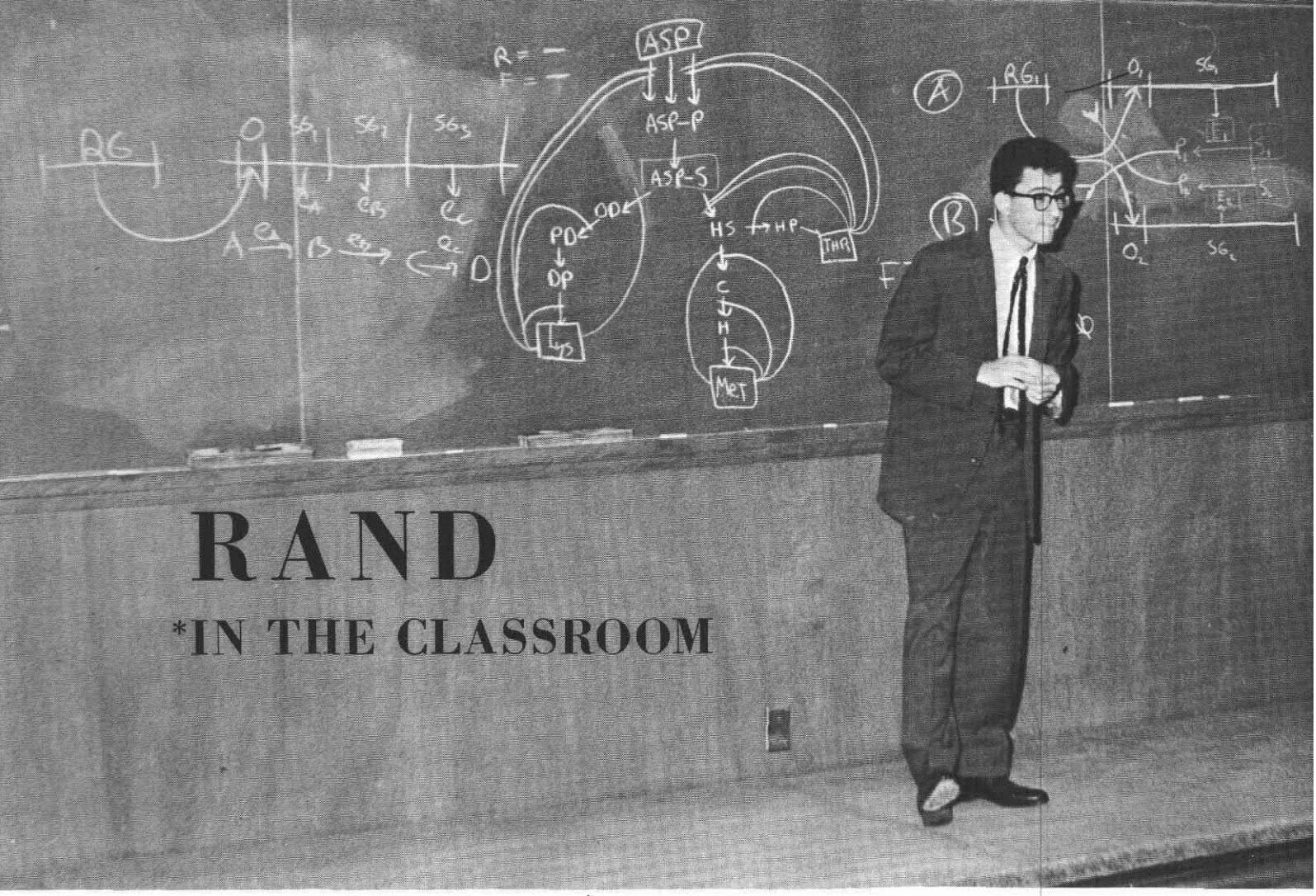
A most important point to stress is that the analytic and computational procedures we employ obviate the need for making some simplifying and often unrealistic physical assumptions to avoid complexities. In many cases, we require only tables of values, essentially experimental data. In many other cases, we are in an ideal position to test physical hypotheses against observation.

The plan of the book is the following. First we shall describe the process for numerical inversion of Laplace transforms which we shall employ. Then we shall discuss an idealized one-dimensional neutron transport process. This will give us an opportunity to derive equations for a time-dependent process using invariant imbedding, to illustrate the use of the Laplace transform to reduce the analytical complexity of the equations, and then to use the numerical inversion procedure to produce various useful tables and graphs.

Once this has been done, we can proceed to a treatment of a time-dependent radiative transfer process in a slab without spending too much time on auxiliary details.

We shall discuss in turn the physical background, the analytic formulation, and the computational procedures. Lastly we present FORTRAN programs, together with selected graphs and tables. The tables give results for the time-dependent slab problem and certain auxiliary quantities which are useful in general problems of the numerical inversion of Laplace transforms.





RAND

*IN THE CLASSROOM

Give or take a score, each year RAND hires about fifty new staff members — about one-third of whom come from the faculties of universities and colleges. But if we start to feel guilty about this drain on America's educational resources, we can assuage our remorse with the fact that the flow isn't all in one direction.

Last year, for example, while fifteen men left college faculties for RAND, more than twice that number from RAND returned to the campus as part-time faculty members. They increased faculties not only by numbers, but also by quality, in the form of the very special knowledge derived from on-the-job interdisciplinary research in contemporary problems. They taught courses ranging from engineering to anthropology — from statistics to the Art of Fiction.

If it does not interfere with their RAND work, the Corporation encourages its staff members to accept part-time teaching opportunities as an aid in maintaining cordial relations with universities and allowing staff members to maintain their professional connections.

And RAND people themselves have a number of reasons for teaching. One staff member calls his class a "forum where I can test my views on a captive audience." Some zealous RAND types, especially those whose work here is unique in some way, plunge in with an eye to "taking the gospel to the heathen." Others undoubtedly enjoy the additional income they may get from teaching. But most choose to teach because teaching provides them with an excellent motivation to dig into new material and really learn it. One veteran part-time teacher feels so strongly about this "search for the new" aspect of teaching that he believes that anyone who teaches the same course more than three times is motivated only by the money.

AT UCLA

Naturally, UCLA's location makes it the favorite haunt of RAND's part-time faculty. The 1963–1964 catalogue included this considerable list of both daytime and Extension courses taught by RAND people.

From RAND's Economics Department were Roland McKean (The Economics of Defense), Ben Massell (Statistics), Egon Neuberger (Theory of the Firm), George Rosen (Anthropology), and Bob Slighton (Monetary Theory).

From the Logistics Department teaching daytime courses were Max Astrachan (Business Statistics), Ken Deavers (Intermediate Price Theory), Will Harriss (Reading and

*Norman Arnheim (Aero) discussing the biology of cell functions. Though admittedly not taken in a classroom, it nevertheless conveys the impression of academic teaching better than other pictures we had available.

Composition), Horst Mendershausen (Principles of International Trade), Craig Sherbrooke (Business Statistics), and Dave Stoller (Business Statistics).

Logistics had several more members teaching Extension courses: Dick Haase (Engineering Economics and Investments), Ed Hearle (Electronic Computers in Business), Ernie Scheuer (Mathematical Statistics), Jack Thygerson (Art of Fiction), and Dick Van Horn (Management Information Systems).

Coming from the Mathematics Department, Al Madansky taught Econometrics during the day, while other Department members taught in Extension: Tom Brown (Complex Analysis), Mel Dresher (Theory of Games of Strategy), Norton Kristy (Cultural Anthropology), and Sidney Port (Calculus).

The Social Science Department had four people teaching regular UCLA courses: Bernard Brodie (Defense Strategy in the Nuclear Age), Seyom Brown (Foreign Relations of the U.S.), Harvey DeWeerd (Conduct of Modern War), and Luigi Einaudi (*Latin American Politics*); and this summer Alton Frye is teaching a six-week course in international relations.

The other RAND Departments, while not having anyone teaching during the day, did have many people teaching at UCLA in the evenings. From Cost Analysis, Fred Pardee taught courses in Management Systems Design and Application of Operations Research to Financial Planning. From System Operations were Gordon Hammer (Strength of Materials), Roger Levien (Linear Algebra), Gay Northrop (Introduction to the Theory of Prediction and Filtering), and Ted Parker (*Probability and Stochastic* Processes for Engineers). Bob Kalaba (from Electronics) taught Dynamic Programming one semester and Calculus of Variations the other, while, from the same Department, Carroll Lindholm did a two-semester stint with Introduction to Active Circuits and Probability Theory. Tony Gabler (from Electronics), who has taught Extension courses for what might be a record – sixteen years – taught Network Analysis by Transform. From Aero-Astronautics, Hans Scheder taught an Extension course called Engineering Dynamics, and Computer Sciences Department Head Willis Ware had a class on Electronic Digital Computer Systems.

OTHER SCHOOLS

Of course, UCLA wasn't the only campus where there was RAND teaching. At Pierce College, Milt Weiner (System Operations) taught a course in abnormal psychology. And at San Fernando Valley State College, Milt taught a second psychology course, along with John Niedercorn (from Economics), who taught statistics. (John also taught a course, History of Economic Thought, at California Lutheran College.) Frank Shieh (Economics) taught an economics course at Los Angeles Metropolitan College. George Armerding and Ivan Finkle of Computer Sciences stayed close to home and taught classes in Fortran Programming at Santa Monica City College.

This summer Paul Baran is teaching a course on digital computers at the University of Michigan's Engineering Summer Conference. Fred Gruenberger (Computer Sciences) taught Introduction to Electronic Computers at L.A. State, and Rein Turn (Computer Sciences) taught a similar course at San Fernando Valley State College.

Some teaching jobs have been really *far-flung. Tony Pascal* (Logistics) spent part of 1961–1962 teaching Macro-Economics at the Universidad de Nuevo León in Monterrey, Mexico. In 1958, Herb Dinerstein (Social Science) taught Soviet Foreign Politics at the Institut Universitaire des Hautes Etudes Internationales in Geneva, Switzerland.

Getting closer to home once again, Bob Kalaba, in addition to teaching regularly on *UCLA Extension*, has served as visiting professor of control engineering at Purdue since 1962. And back at UCLA, Harvey DeWeerd (Social Science) was the first RAND Senior Fellow at UCLA (1961–1962), where he taught a course as well as helped to organize and conduct the National Security Studies Seminar.

In a sense, this is all just the visible part of the iceberg. A multitude of RAND people teach special courses, conduct seminars, or give isolated class lectures. And the ranks of RAND teachers would be further swelled by the RAND husbands and wives who are teaching.

Occasionally RAND, as an organization, *plays a more direct part on the* campus. Every fall the Corporation participates in the RAND–USC seminar on international relations. Working with Paul Barton, associate professor of international relations at USC, Chuck Thomson (Social Science) handles the arrangements, which usually involve five staff members giving two lectures apiece.

In the past, RAND participants have included, besides Chuck himself, Bernard Brodie, Ciro Zoppo, Alice Hsieh, Joe Goldsen, Mac Hoag, Charles Wolf, Leon Gouré, Guy Pauker, and Horst Mendershausen. Last year's participants were *Seyom Brown, Luigi Einaudi*, Alton Frye, Amrom Katz, and Dave Mozingo.

RAND "TEXTBOOKS"

Although the RAND teacher can't lecture in many classrooms nationally, he is often there via the RAND-authored book.

*Information on this neglected contri*bution to education is spotty. Strange as it seems, most authors seem to have little idea about when or where their books are used. Most publishers have only sketchy records that cover not more than three years, thereby omit-

ting older RAND books whose classroom use has been discontinued. While it's not always clear whether a book at a particular university is used as a textbook or as required reading, as a general rule, RAND books are used as required reading on an undergraduate level and more often as texts for graduate courses.

A large contingent of books is out of the running because no official record is kept of RAND-authored books that are not published by the Corporation. These include books such as Willis Ware's text on electronic digital computers or Bob Levine's book, *The Arms Debate.* (Both of these, incidentally, are used as texts.) But even with so many books knocked out of contention, there emerges quite a record.

Dick Bellman, who surely holds a RAND record of some sort, has published seven RAND books—all of which have been used in undergraduate or graduate courses. An eighth RAND book has just come out (see page 7), making a total, including non-RAND books, of seventeen.

But the unquestioned record holder for the greatest number of "course adoptions" is the Gruenberger-McCracken textbook on digital computing. The latest records indicate that it has already been used in forty-nine colleges and high schools from Alfred to Yale. (Fred Gruenberger is holder of two other records. He has undoubtedly taught the youngest students, in that students' ages average twelve years in his computer programming classes. And he is probably the only RAND staff member who has done considerable teaching via educational TV in Los Angeles.)

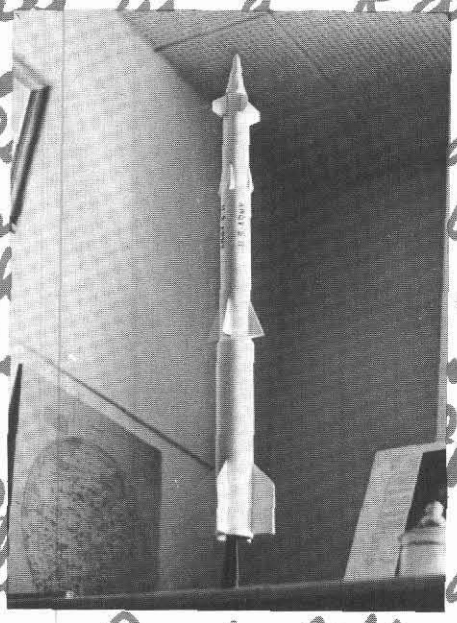
The publishers' records, such as they are, indicate that Harvard and UCLA (including their respective graduate schools) have made the most frequent use of RAND books. (However, Princeton University Press has published more than twice as many RAND books as the Harvard University Press—thirteen by Princeton and only six for Harvard.) RAND books seem to be most popular in California schools—Caltech, Berkeley, Stanford, and UCLA; the Ivy League; and engineering schools. However, RAND books have popped up in such abodes of sociology and home economics as Bryn Mawr, Mary Washington, Mt. Holyoke, Smith, and Wellesley.

At last count, the list of RAND "textbook" authors and co-authors (including some consultants and some who are no longer associated with the Corporation) reads like this: Warren Baum, Richard Bellman, Bernard Brodie, Kenneth Cooke, George Dantzig, Robert Dorfman, Melvin Dresher, Stuart Dreyfus, Merle Fainsod, David Gale, Leon Gouré, Fred Gruenberger, Manfred Halpern, Ted Harris, Cecil Hastings, Ed Hearle, Jack Hirshleifer, James DeHaven, Bob Kalaba, Jerome Milliman, Charles Hitch, Roland McKean, Alice Hsieh, John Johnson (ed.), H. W. Kerr, Paul Kecskemeti, Joe Kershaw, Arnold Kramish, Nathan Leites, H. M. Markowitz, B. Hausner, J. C. C. McKinsey, Allen Newell (ed.), Marcia Prestrud, Paul Samuelson, Robert Solow, Philip Selznik, F. R. Shanley, Hans Speier, G. K. Tanham, Frank Trager (ed.), John Williams, and Charles Wolf, Jr.

Once again, this is only the most accessible part of the iceberg. Besides the authors not mentioned for the reasons given above, there are missing authors who have merely contributed to books. And there are RAND people whose papers and RM's have been widely used in the classroom or whose works have been used by individual students working on term papers or theses.

What effect have these RAND teachers and books had on the campus? There just isn't any real answer to this question, but some observations tend to head in that direction. RAND constantly receives letters from students who, through professors, books, or the RAND *Index* in their library, have heard of RAND and are writing for further information either about the Corporation or a particular subject. There are the new RAND staff members who applied here because of what they learned of the Corporation at their particular college. And there is the considerable number of RAND staff members who, as students, took one or more courses from a RAND teacher.







still lifes



- and trophies from personal exploits





Magic, Math and Mystery . . .

Richard Bellman

About the Author . . .

What are our goals, what should they be? How do we propose to achieve them, and do we care that much?

Since Dick Bellman is the one who raised these questions, it's not surprising that he has emphatic answers to them. And, he's known the answers for most of his life.

Dick's uncle wanted him to become a doctor. Dick himself, from the tender age of twelve on, wanted to be an abstract mathematician. Not surprisingly, mathematics won out over medicine, but later Dick managed to infringe upon the exclusive domain of the doctor by engaging in biomedical research. This latter area constitutes one of his principal goals and at present it is what he believes should be the goal of many more people. He knows how he intends to achieve this goal and he does care very much.

Critics might find him overzealous or a bit too rambunctious for their taste or even his own), but no one can accuse Dick of being obscure about his work or his goals. He makes his points repeatedly with a sledge hammer, while a sledge-hammer purpose drives him on.

The education of Richard Bellman was a many-sided affair, with school being merely the most obvious but least important part. The uncle doctor dragged young Dick on frequent visits to the hospital, where he found he couldn't stand the sight of blood or human suffering; but later he was back at the hospital during the slow, tragic deaths of his parents from cancer and heart trouble. Finally, Dick was educated by the war, during which he learned to understand and respect engineering and physics.

Since the moment Dick decided he wanted to be a mathematician, he has permitted very little to come between him and his goal. He has refused to be bothered even by what might be considered a critical deficiency in his talents—he is not an exceptionally good problem solver. Dick discounts the desirability of problem solving and says instead, "What you do is to have certain basic techniques and theories and then look for problems—like 'Five Characters in Search of an Author.' " Thus, his development as a mathematician has been an evolutionary process of the branching of basic themes.

His first major theme (aside from number theory) was the subject of his Ph.D. thesis: stability theory—the study of the stability of a system and what can be done to the system without disrupting the entire operation. From this point he naturally evolved to control theory: How can one control this changing system? This latter development led him into the problems of multistage decisionmaking and the area of adaptive processes. And finally, he came to work on the theme of time lags and hereditary processes using differential-difference equations. (His work has been well documented in the seventeen books and hundreds of papers he has authored or co-authored.)

While Dick has indeed had an amaz-

Of all the bumps on the human head that fascinate the phrenologist, curiosity is reputed to be the most developed. And it is unquestionably true that there is much to be curious about in this world: the rain and the wind, the thunder and the lightning, the change of seasons and the growth of crops, sleep and illness, birth and death — all of these natural events which intrigue and interest us as much as they did our remote picture-painting, myth-making ancestors.

These primitives, as well as the tribes that today inhabit the primitive areas of the earth, explained natural phenomena in terms of magic and religion. These were generous religions, endowed with a multiplicity of gods and devils, demons and spirits. There are gods of the sun and of the lightning, the demons who possess the ill, the devils who kill the cattle, destroy the crops, and cause the death of loved ones. Let us not, however, in this discussion look down in too supercilious a fashion upon these beliefs and concepts of different cultures. Some of our most cherished concepts will appear equally amusing and naïve to the cultures of five thousand years hence.

The important point we wish to make is that in these early explanations in religious and supernatural terms, we see the beginning of the concept of a unifying scientific explanation. In a recognition of the regularity of the forces of nature, we observe a groping toward the concept of natural laws. Each breath of wind is a manifestation

(Continued on next page)

ing singleness of purpose throughout his life, he did not adhere to his early ambition of being an abstract mathematician. On the contrary, he became increasingly aware that his basic themes cut through many fields including engineering, physics, economics, biology, and medicine.

After coming to RAND in 1948, Dick began his first work (together with Ted Harris) on mutation effects and cancer. At that time they dropped the effort because there was very little experimental information on the subject, but they didn't drop the idea. In the mid-1950's Dick looked into the situation again, this time visiting the Sloan-Kettering Institute, where he talked to John Jacquez, a doctor who, in Bellman's words, "understood the power of mathematics." At that time Bellman and Jacquez decided to work on chemotherapy, with Bob Kalaba (Electronics) and Bella Kotkin (Mathematics).

Meeting Jacquez was a fortuitous circumstance for Dick, who has said, "Problems of medicine and biology are just too important to be left to doctors to decide. They're not intelligent or educated enough." Fortunately, Dr. Jacquez was one of the few exceptions that Dick has made to his rule, and their collaboration has produced extremely interesting results — notably the drug distribution model (see *RANDom News*, March 1963). (Considering Dick's work in this area, it's interesting to note that his only formal education in biology amounts to two years in high school.)

Besides his own research work, Dick, as this paper indicates, is involved in a crusade to get more bright young men to work in biomedical research. He goes about it as if he were mounting a bazooka attack. A typical Bellman talk to graduate students starts off, "One out of every two of you will die of heart trouble. Of the remaining people, two out of three will die of cancer. Now, what are you working on? Nuclear physics? Space travel? You're sick. You don't have the guts to do something for yourself. Somehow or other you think this is unprofessional, unethical. You've been brainwashed."

Yet for all his massive publications, his frequent lectures and talks, his outspokenness, and his (according to some critics) "publicity seeking," Dick is not particularly optimistic about his own success in imbuing others with his zeal. For one thing, the facts, as he sees them, will inevitably lead students toward biomedical research. He notes, "This is one of the few times in human and intellectual history where everything — personal development, economic gain, good of society, and family — points in the same direction." And, above this, he observes, "When you look at most people associated with the biomedical area, you find they have been personally involved. It's a world in which theoretical situations have very little influence. You have to be motivated by personal contact with someone who's suffering, and then you want to do something."

of the same power by the Wind God; each jagged lightning bolt comes from the Thunderer, Zeus or Thor; each spring represents the same triumph of fertility over wintry barrenness.

There is a further factor, the matter of control. Magic provided a systematic means by which man could dominate his environment. Through the intervention of the medicine man, the high priest, or the shaman, by way of personal prayers, offerings, and sacrifices, the individual and the society could exert their influence over the gods and devils. If the crops were failing, the earth required a blood sacrifice; to ensure victory in war, prayers and promises of the sacrifice of prisoners would suffice. Threats and promises, flattery and humility, all were invoked.

It is rather amusing to identify religion as the first science, at a time when Science appears on its way to becoming not only the latest and most fashionable religion, but also the ultimate religion.

What we object to, or should object to, in the invocation of magical explanations and supernatural causes, is the luxury of the situation. The abundance of gods and devils, spirits and gremlins, the ability to create even more of them when necessary, is somehow an affront to our intellectual asceticism. There are too many of them and they don't appear to obey any simple rules and regulations.

Electricity, and certainly gravitation, are as magical in their properties as any soothsayer or haruspex would possibly wish. But we can explain a very large number of occurrences and effects in terms of a few quite simple causes and assumptions. Science certainly does not profess to explain everything. Somewhere, the explanation must cease. All theories at some point become phenomenological, just as all dictionaries must become circular somewhere. How, for example, do we



contemplate an "explanation" of infinite space or infinite time, or of finite space or finite time, for that matter? How do we propose to "explain" the existence of anything at all?

We do, however, expect to reduce the set of unexplained phenomena over time and to simplify and unite the various conceptual schemes which have been proposed.

The constant battle (in which some are volunteers, and some are drafted) of the scientific method, the rational approach, against fuzziness, dogmatism, superstition and stupidity, has in its clash and clangor obscured the fact that science makes its own strenuous demands on belief. But there is a vast difference in the two types of belief.

Probably the only way to make precise this gulf between what we can call the medieval attitude and the rational attitude is by introducing arguments based upon a Russell theory of types.

Science has systematic ways of making statements, of making statements about statements, and so on. We possess techniques for testing and verifying statements, for constructing theories and for discarding theories,

and even for modifying and adapting viewpoints. There are built-in safeguards against the usual weaknesses of human psychology that express themselves in bigotry, fanaticism, stand-pattism and fear of anything new or unknown.

All of this is quite different from the attitudes found typically and habitually among the spiritualists and astrologers, the advocates of telepathy and extrasensory perception, and occultists and cultists in general. Science, for example, does not proudly assert that the greater the paradox, the greater the truth.

It is perhaps well at this point to emphasize that science is relative, not absolute. By this we mean that contemporary science very carefully picks and chooses the areas in which it wishes to compete. The success of science as a whole, as well as success in individual fields, depends crucially upon choosing the appropriate problems. Even more, we must agree very carefully upon what we mean by a problem and what we mean by a solution. We shall return to this discussion below in a different context.

A corollary of the foregoing is that it is not sufficient to describe the scientist as one motivated solely by love of knowledge. He is driven by his curiosity as an antidote to boredom. This is the real and ultimate enemy of the overdeveloped brain of the human. It is not knowledge, therefore, that attracts, but certain types and aspects of knowledge.

There are many facts available at the present time, and their number is increasing in rather an absurd fashion. There are new chemical compounds, additional insect species, particular and not so particular applications of Lyapunov's second method, expensive and extensive trans-uranic elements, stellar maps, and so on and so on. Some of these are useful, and most are not. Since, however, at this stage of science, we don't know how to sort out the two kinds, we must hedge and collect them all.

The collection and cataloging of facts do not, however, constitute our principal goals in science. Our objective is to understand the basic patterns of the world. In essence, theories are mnemonic devices for keeping in mind large bodies of data and the descriptions of complex systems.

Thus, we remember formulas such as $F = ma$, or $u_{xx} + u_{yy} + u_{zz} + \phi(x,y,z)u = 0$. The tremendous contribution of a Newton or a Schrodinger lies in the unification provided by a simple formula. How unified a theory of scientific phenomena can one obtain? Since we know so little at this point in time, it is not clear what we mean by the question or an answer. These matters are quite subjective and are best left for cocktail parties.

The language of science is mathematics, for a variety of reasons which we shall not enter into. This places a burden, often intolerable, upon mathematics itself, which is in its native habitat an art form. Naturally, this argument like most arguments can be inverted. One can say (and it has been said) that mathematics exists solely as a handmaiden of the sciences and that it is intolerable that some should attempt to make it an art form.



This kind of debate pervades the world of culture; we meet it in art, in music and in literature. Does the artist have a responsibility to communicate (whatever that means), or do these fields exist merely to give pleasure to the creative spirit? We shall carefully avoid these abstract questions which breed so much real emotion. It is, nonetheless, worth pointing out, as a parting shot, that almost all of the best in pure mathematics is the result of investigations initiated in the study of physical phenomena. Who was it who said, "They did not know history and thereby condemned themselves to repeating it"?

Let us turn now to a discussion of some of the consequences of the inordinate and unexpected success of the mathematical method in the physical sciences. As pointed out previously, it is, of course, a matter of choosing the area carefully.

In celestial mechanics, we see the flowering of the effort. The ability of Newtonian techniques to predict the behavior of the planets, the moons, the comets and the tides is uncanny. I have been told that the great French mathematicians Laplace and Lagrange could not believe that the observed complicated celestial behavior could be predicted using such simple equations as those deduced from Newton's laws of motion. The more detailed their examination of special cases, the more amazing the agreement.

Successes of this spectacular nature lead naturally to further successes. Mathematical formalism was applied to other areas of science; science was applied to other areas of life. By the end of the eighteenth century and the beginning of the nineteenth century, it was earnestly believed that mankind, in the scientific method, had at last found the key to happiness on earth. The philosopher's stone was merely a set of syllogisms.

Even by the end of the nineteenth century, this ardent belief in salvation through science had weakened considerably. The barbarism of the two world wars, and particularly the fact that Germany, the most educated of nations, was so instrumental in precipitating the holocausts, cast considerable doubt on the thesis that rationality alone was sufficient. It became increasingly clear that whereas we could easily dispense with the supernatural aspects of religion, we could not do without the moral aspects.

Nonetheless, the scientific method, combined with the mathematical method, continued to play a major role in diminishing the influence of traditional superstition. Not enough, of course, to prevent the appearance of a column on astrology, that Chaldean "science," in almost every major newspaper or to prevent new superstitions based on the new religion from arising.

The Constitution that rather explicitly prohibits any intimate connection between the state and the conventional religions is, unfortunately, silent on the subject of science. We now see Big Science as the new official American state religion. We have our Crusades, our High Priests, our Sacred Language, and even our human sacrifices – the Astronauts.

Science has invaded and pervaded every aspect of our life. So much so, that a number of well-meaning people rather mournfully assert that science has destroyed romanticism. Modern life –so the complaint continues – is not as romantic, or happy, or fulfilling as Victorian, Elizabethan, Renaissance, Medieval, etc., existence. Oh, for the Peace and Tranquility of the nineteenth, eighteenth, . . . , twelfth century.

Let us not bother to dissect and demolish these laments. It is sufficient to contemplate a world without dentists and doctors, without Novocain and anesthetics, antibiotics or sanitation, and a world filled with religious warfare and superstitious fear, a world where poverty was a hereditary disease with no cure in sight.

Turning back to the subject of Romanticism, let us agree that this, whatever it is, is essential for human happiness. Two important aspects are mystery and challenge. As a matter of fact, these are today two of the major arguments advanced on behalf of space travel and linear accelerators. Don't we want to know what's on Venus? Don't we want to discover some more strange particles? Isn't the fact that the mountain is there a sufficient motivation for climbing it?

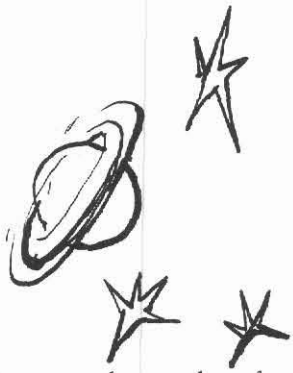
All of this ties together with our previous discussion, since it shows that the problem of choosing problems is a real one and a serious one. What are our goals, what should they be? How do we propose to achieve them, and do we care that much?

This type of question is of particular importance to those of us engaged in the study of control theory. We know that the choice of the criterion function plays a dominant role in the determination of optimal policies.

I start then with a very simple premise: The most important things on earth are human beings. It follows then that all activities, and certainly all major activities consuming appreciable fractions of the GNP, must be evaluated in terms of their influence upon the health, wealth, welfare and happiness of humans.

Frequently, the reaction to this statement is that it is a very selfish one. Of course it is – and what is wrong with that? It is rather sad to see how the scientific intellectuals have contorted themselves in this connection. As mentioned above, using the concepts of science, they have proudly

freed themselves from the enforced asceticism of the desert and the medieval ages. They have rudely renounced the idea that life on earth is a pit stop on the way to heaven, and they insist that we focus on this world. But, they proudly assert, not on the *human* aspects! The stars, the interior of the nucleus, the bottom of the sea, all of



this they accept as mostly worthy of the attention of the most brilliant and creative minds in our society. Science, si; humanity, no!

Thus they have renounced one asceticism for another, and a far more dangerous one at that. Spend 20–30–40 billion dollars on space travel, spend 1 billion dollars on a linear accelerator. Do you dare to ask why? It is for the Glory of Science, and that is sufficient answer.

This is, of course, an absurd argument, but it requires some care in answering. We pointed out before that the scientist is not primarily interested in human welfare. His curiosity bump may be well developed, but there need not be any overflow into social conscience. We cannot expect him to roll bandages at the local hospital, and we do not want him to.

What we do wish to demonstrate is that the major problems that concern humanity are more exciting, more challenging and more mysterious than those currently occupying so many scientists – and consuming so many tax dollars. Why not optimize then? Why not, indeed?

What then are the major areas for research which possess the desired challenges? There is general agreement that the fields of biology and medicine are the new frontiers of science. This is of particular import to those of us interested in control theory.

The reason for this is that in the biomedical area, control problems are paramount. Although it is true that we wish to understand, it is far more true that we wish to put this understanding to immediate use. Perhaps it is here that we see the real reason for the decline of the supernatural in favor of the natural. Prayers and magic have not fared well in connection with control processes. Warts and migraine headaches can occasionally be disposed of by means of panaceas and incantations, but cancer, heart disease, hearing difficulties and broken legs require scientific precision.



Unfortunately, the major control problems of medicine are several orders of magnitude more difficult in every possible way than those which we encounter in engineering and applied mathematics in general. The fundamental challenge is that of obtaining partial control *now* on the basis of our present partial understanding. Furthermore, it is a question of combining theoretical and experimental investigations in one vast adaptive control process. This is the situation we face in attempting to study cancer, nervous disorders, mental illness and other major medical phenomena.

For those then who insist upon challenge and mystery, who pride themselves on tackling only the most difficult problems of their times, we offer the puzzles of the reproductive capacity of the single cell; the memory, or memories, of the brain; the operation of the nervous system; and, on a much less precise plane, the explanation of intelligence and creativity. Observe that these are all problems within the domain of control theory. Furthermore, any hint toward their solution would have tremendous impact not only upon the biomedical field and the control field, but also upon all of the remaining part of the scientific world, and indeed upon all of the world.

Also in the control field are the problems of prosthetics, covering such items as hearing aids, eyeglasses, artificial limbs and artificial kidneys. All of these represent attempts to remedy the cruel caprices of probability distributions in the replication of the human.

For the first time in history, the alleviation and cure of the ills and afflictions of mankind are within the realm of the possible. Through the application of control theory, we can, if we wish, help the blind to see again, the deaf to hear, the crippled to walk. We can rejuvenate the old and guarantee a full and happy life for the infant. We can make the deserts bloom and we can end the tyranny of hunger throughout the world.

What direction will our civilization take? Will it continue to squander our resources and sacrifice our brains to Big Science or will it allow the human use of human beings? It is the people in this audience who will decide. I hope that you will make the correct choice, and I believe that you will.

GILBREATH THE GREAT

Norm Gilbreath does not fit the popular stereotype of the sleek, sophisticated, moustached impresario attired in formal evening dress, and neither does he fit the older image of the bearded wizard in conical cap and flowing robes. But do not be deceived. Among the world of conjurers, illusionists, and prestidigitators, this young man from the Computer Sciences Department is — "a brother."

Theorist, critic, inventor, and performer, Norm has contributed over ninety tricks and effects to the professional repertoire of magic. In addition to being a member of the International Brotherhood of Magicians (treasurer of Local Ring 21) and the Academy of Magical Arts, he was in 1958 awarded the *Linking Ring Magazine's* prize of the year for his invention, "Magnetic Colors" (described below).

Although Norm has been a dabbler in deception for over fifteen years, his first projected endeavor at the age of twelve would undoubtedly have been his most spectacular. And while never enacted on stage, the routine nevertheless deserves honorable mention. For an opener he would have begun by sawing a woman "into four." At this point, however, when most magicians are busily engaged in restoring their victim, Norm transgressed from standard procedure. In his version, the four parts of disjoined anatomy would rise into the air, turn different colors, and float off the stage. Although the routine was feasible in terms of magic, it was prohibitive in terms of Norm's weekly allowance and consequently never got off the drawing board.

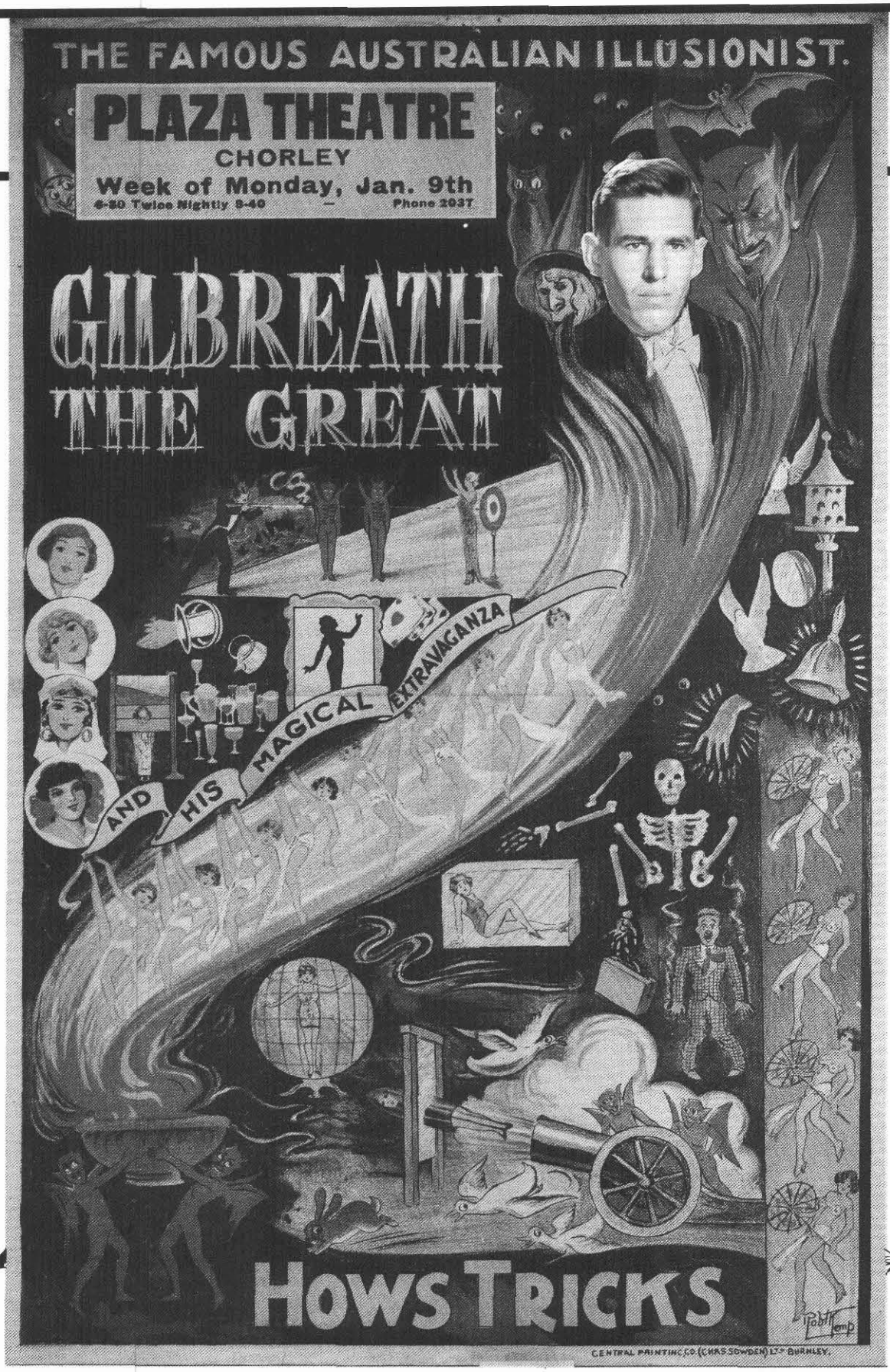
Compelled economically to direct his imagination along more modest lines, Norm turned his attention to magnets, cards, cups, and boxes. "The Mystery Box," an invention of this "earlier period," consisted of a small wooden box with vertical slots along two opposite sides. In performing the trick, a ribbon is drawn lengthwise through the slots (the box is then lifted by taking hold of the two ends of the ribbon), and a borrowed finger ring is dropped from the open lid into the apparently empty receptacle. The lid is shut and a few choosen words are said. (If preferred, a magic wand may be substituted.) Presto! When the box is opened, the ring is no longer at the bottom of the box but around the ribbon!

With all his growing success, our magician never, however, was able to master that special trick of making money appear. And for the sake of economy he was forced to abandon all paraphernalia and to enter an inventive period that dealt solely with one commodity — that mainstay of magic — a deck of fifty-two playing cards. A background in mathematics combined with "card dexterity" led him soon to have a try at inventing what is called the "mathematical card trick." Not to be confused with trick or gimmick card tricks, the mathematical card trick is one that is based on sound mathematical principles. Enjoying a veritable renaissance, Norm has invented thirty-four such tricks.

Shortly after joining RAND's Computer Sciences Department in 1961 he treated some colleagues in mathematics to a command seminar of these card tricks. Having performed a series of six and having explained the mathematical principles involved, he turned to his audience for questions. There was no response. Mathematics? It had looked like hocus-pocus to these professionals.

Norm's prize-winning mathematical card trick, "Magnetic Colors," is based on a fundamental mathematical rule. (See if you have better luck than the others in figuring it out.) A spectator is asked to shuffle a deck of cards. The shuffled stack of cards is then dealt by the spectator into two separate piles of twenty-six; one stack for him and the other for the magician. The spectator then lays his first card face down on the table and the magician answers by placing his first card directly on top of it. Finally, when there are twenty-six pairs of cards on the table, the spectator is asked to turn them all face up. In every pair of twenty-six, one black card and one red card have been coupled. Basic principle: If you add an odd and an even number, you end up with an odd number. [Use this formula: $(CN_1 + CN_2)/CN_2 = 52$.]

Another of Norm's specialties, "The Trick of Invaried Orders," also em-


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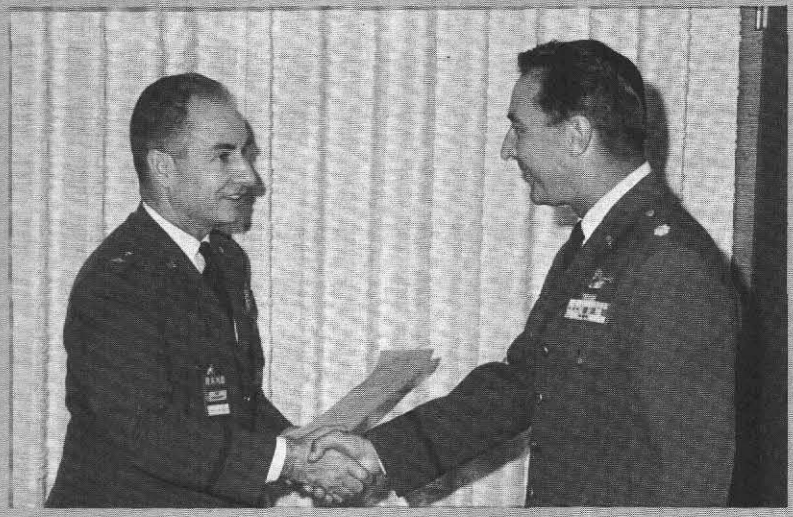
ploys a simple mathematical truth. Two identical decks of cards are placed on a table. Someone in the audience shuffles the two decks together and places them into one pile of one hundred and four cards. Fifty-two cards are counted off the top of the shuffled pile. When the volunteer carefully inspects the two stacks of fifty-two cards, he finds that the cards (remember that he has just shuffled them) are in two *complete* decks again. [Use this formula: $2A + (2B + 1) = 2(A + B) + 1$.]

After devoting almost five years to mathematical card tricks, Norm, saturated, has recently entered a new phase. Currently he is in the process of perfecting and polishing up standard techniques and routines, some of which are his own, some of which are not.

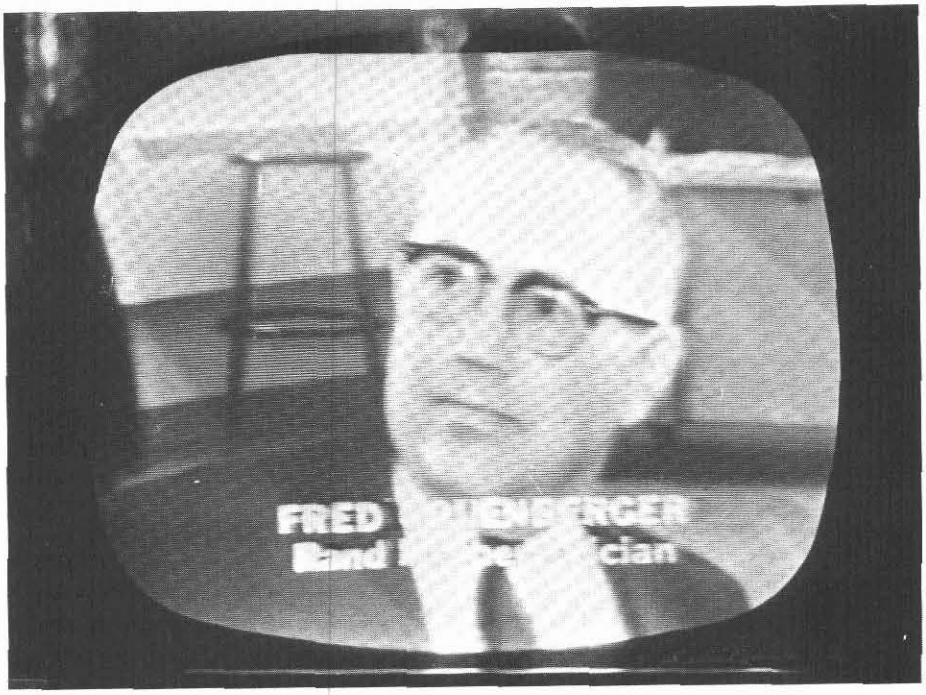
Last July he attended the annual Pacific Coast Academy of Magic Convention, which was held in Oakland, California. There he attended lectures, movies, dealer exhibits, and performances of magic. In general he was able to eat, sleep, and talk magic for seven days and nights. The Convention summoned four hundred people of all types and occupations from all parts of the country (they ranged from engineers and heart surgeons to television directors, postmen, and realtors). Of the four hundred, however, only a handful were professional magicians. Norm explains that in this country there is no audience for magic. The situation is quite different in Europe, where magic is one of the most successful attractions of the night-club circuit. Here, however, the appeal of magic seems to have been replaced by a fascination with whatever carries the name of science or technology. In some ways, of course, activities carrying these labels represent a higher evolution or more subtle form of the art in that they may contain, intentionally or not, a generous mixture of sleight-of-mind magic.

Although primarily an inventor and not a showman, Norm has made some notable public appearances in this country. After an unauspicious beginning before his junior high school class (one classmate, unable to figure out his tricks, announced in front of the class that Norman was a fraud), he has gone on to do his act at the banquet celebration of a retiring railroad man (there he shared the bill with Leo Carrillo) as well as at a Cub Scout "Fun Night." On this memorable evening his act was interrupted momentarily when the stage platform, built by the Scouts, collapsed.

We were reluctant to ask Norm how he manages to satisfy his affinity for magic while working at programming in the Computer Sciences Department. However, he did mention that when the need for professional rapport becomes overwhelming he drops in at the "Magic Castle," a magicians key club located in the Hollywood Hills behind Grauman's Chinese Theatre. There, amidst furnishings that date back to the Victorian Era —velveteen overstuffed sofas and hanging ferns—he and fellow magicians meet to discuss tricks. Above the din of animated conversation one hears the melodic and often haunting strains of a player piano. Invariably someone will remark, "Invisible Irma's at it again."



Major General Curtin (left) presents Lt. Colonel Bob Drebelbis with the Air Force Commendation Medal for duty from 1962 to 1963 with the Inspector General, Headquarters, Eighth Air Force, Operations and Training. The presentation was made on July 27 at RAND.



Pictures taken of home TV screen by father of student at Lincoln Junior High School. The Computer Programming Class and its instructor, Fred Gruenberger of CSD, were film-interviewed by CBS News and were presented as a seven-minute feature of the 6:00 p.m. CBS News on July 31.



NO MERE SCIENTIST . . .

International Science and Technology (July 1964) speaking about the multiple-screen science display in IBM's current World's Fair exhibit:

Sometimes the characters speak . . . and when they do, you find you like them and the way they talk.

For instance, one bit impressed me particularly: At one point we saw, through this scheme of multiple images, a group of mathematicians discussing the problem of modeling the flow of oxygen into a blood cell. One of the mathematicians was overweight, far from handsome. His first comments were less graceful than those of his colleagues. But then the overweight fellow stepped up to the blackboard and began to outline the problem. The camera panned in on him, so close that his somewhat marred complexion was apparent, so close that his honesty and competence were equally apparent. It impressed me, this short scene did, because here was no scientist in a white lab coat; here was an ungainly man with a good mind* – and that, we were made to feel, is what counts.

*Here, in a word, was Norm Shapiro of RAND's Computer Sciences Department.

TRUSTEE PROFILE



Lauris Norstad

RAND Trustee Lauris Norstad's fellow classmates at West Point must have suspected something when they found him reading "heavy" books that weren't required for class. His dedication to scholarship, as a matter of fact, almost caused him to leave the Air Force to pursue a career in law. He didn't, of course, and the fact that just about everyone knows this, attests to the degree of fame he achieved in his distinguished military career.

General Norstad's prowess as a scholar is somewhat lesser known and comes as a surprise to some people – people, for example, in the rarefied academic atmosphere of Oxford University. When he received an honorary degree there in 1963, he found the tremendous honor carried with it all the heaviness of hoary tradition.

During the ceremony the candidates stand while Latin citations are read (but seldom understood by anyone but the scholars in the audience). Norstad recalls, "I had to occupy my mind with *something* during all this," and so he tried to translate his citation with the very rusty Latin he had studied as a boy. Finally, one sentence came out clearly – "... and during his sojourn in Europe he spent much time fishing in his ancestral home of Norway." It turned out to be the single bit of levity in all the typically dry citations, and when Norstad smiled, there was a ripple through the audience. His smile of comprehension marked to the knowledgeable faculty one of the first occasions when a candidate had apparently known what his citation was all about.

While Norstad is amply endowed with scholarship and leadership ability, he has also inherited the notoriously good looks of the Scandinavians. (In a 1957 cover story, *Time* magazine noted that Norstad "could almost as well be a product of central casting as of West Point.") Born in Minneapolis, he grew up in Red Wing, Minnesota, where his Norwegian father was pastor of a Lutheran church.

Starting at an early age, Norstad displayed the seemingly divergent interests that would mark his later career. In his free time he wrote short stories and poems, fished, fiddled with motors and models, and even put together the first radio in Red Wing. As a high school student he played on athletic teams and served as editor of the school paper.

Graduating from West Point in 1930, Norstad started a career that could be likened to a successful Atlas launch. In 1936, after just four years of flying pursuit planes in Hawaii, he was brought back to the U.S. for staff duty and at the start of World War II he was assistant chief of staff for air intelligence. After being chosen by Air Corps' General "Hap" Arnold to "help me do my thinking," Norstad became air operations officer for General Doolittle's Twelfth Air Force in Britain and North Africa. He soon moved up to the same job in the Mediterranean Allied Air Forces. In the last year of the war, while serving simultaneously as deputy chief of air staff and chief of staff of the Twentieth Air Force, he helped to set up the B-29 raids on Japan.

Following the war, General Eisenhower insisted on Norstad as War Department director of plans and operations. As the Army's representative in the dickering that preceded unification of the armed services, he was given a good deal of the credit for writing the unification act. And while serving in this position, he came into contact with the embryonic RAND. When the research program that became known as Project RAND was initiated, Norstad assisted in formulating the Air Force policy and guidelines that determined the manner in which the new organization would interact and report to the Air Staff. He was also responsible for recommending the addition of a Deputy Chief of Staff for Research and Development—a job that was first held by General Curtis Le May.

When the Air Force became an independent organization, one of Norstad's colleagues noted they "didn't know what the hell to do with him. He was too young to be Chief of Staff." In 1950, however, the problem was solved when Norstad became commander of the U.S. Air Force in Europe. Six months later he took on his first NATO assignment—Commander, Allied Air Forces Central Europe. In 1952 Norstad became a full general and in 1956, after serving as air deputy to SACEUR's Matthew Ridgway and Alfred Gruenther, he succeeded Gruenther, as boss of SHAPE.

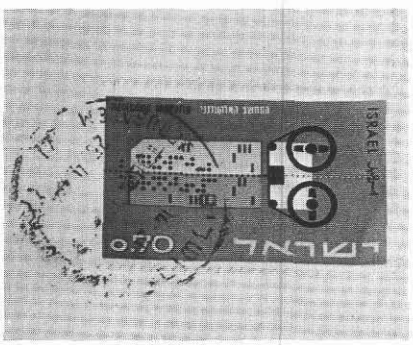
Norstad's success in NATO has been treated extensively. He was a tireless worker who managed to obtain the cooperation and respect of participants in an organization of which he said,

"the damned thing can't possibly work, but it works perfectly well." Much as he tried, he seldom managed to escape the spotlight of public attention that was constantly upon him—during meals when there were often thirty guests at his home or at diplomatic social functions. Discussing Norstad's role in NATO, then Joint Chief of Staff Nathan Twining said, "His job is more diplomatic than anything else. Like a doctor, he is rushing around to fix this crisis here, iron out that difficulty there. It's a helluva job, but the guy's got what it takes to do it." Said Norstad of NATO in a 1963 speech, "One can not be long associated with the North Atlantic Treaty Organization without developing a strong allegiance to it."

His allegiance was noted and greatly appreciated by the member nations. Perhaps one indication of his success in Europe is the great number of foreign decorations Norstad holds. They include: the Grand Cross of the Order of Merit (Germany), Grand Cross of the Royal Order of George I (Greece), Knight of the Grand Cross of the Order "On Merit of the Italian Republic" (Italy), Grand Cordon of the Order of Leopold (Belgium), Grand Cross of the Royal Norwegian Order of St. Olaf (Norway), Great Cross of the Order of Orange-Nassau (The Netherlands), Grand Cross of the Legion of Honor (France), and the Grand Cross of the Order of the Crown of Chene (Luxembourg).

Last year, Norstad retired from the Air Force and immediately launched a new career. As president of Owens-Corning Fiberglas International, he plunged into the job with the vigor and skill he had applied to everything else he had done. Perhaps some people had muttered "figurehead" when he arrived, but the people who knew him also knew that passivity is contrary to his nature. Starting close to the top as he did, there wasn't much room to rise, but he managed it by becoming president of Owens-Corning Fiberglas Corporation last spring. A recent article on Norstad in IBM's *Think* magazine notes, "Those close to him believe that his skills may well be the same as those he displayed at NATO—an ability to get compromises and a masterful hand at diplomacy."

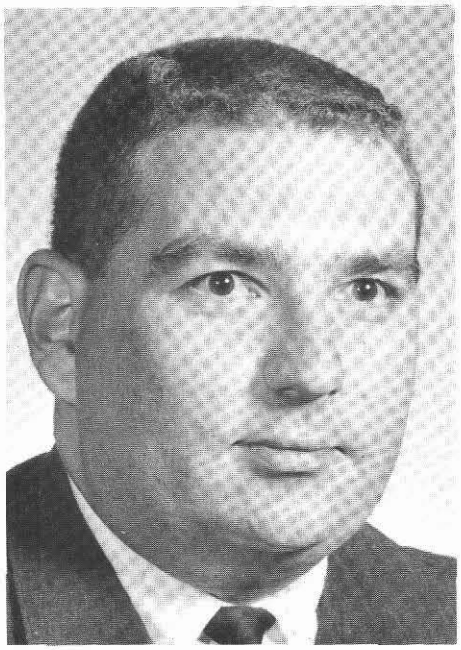
Norstad is still making an unsuccessful effort to get away from the spotlight of public attention and the pressures of work. While he and his wife Isabelle are living in a New York City apartment, he has a great desire to own a country home where he can escape now and then. But he's realistic enough to acknowledge that he might never get to it. In fact, it's becoming increasingly difficult for him to get out to pursue his favorite pastime of golf.



Creeping Automation

Ed Hearle recently received a letter from Israel with this postage stamp.

Who's New...



Steve Drezner

Steve Drezner (Logistics), a native of New York City, received his B. A. in mathematics from Queens College in 1957. In 1959 he received a B. S. degree in industrial engineering from Columbia University and shortly thereafter entered Rutgers College for graduate studies in statistics. After two years at Rutgers, Steve followed his instincts westward to Southern California: "Everyone should be given the chance of growing up in New York City. After that—the place to live is California."

In the fall of 1961 he entered the UCLA School of Business, majoring in operations research. Transferring to USC in the fall of 1962, he is presently working toward his doctorate in quantitative analysis.

Employed during his school years as sometime soda jerk, music counselor, and short-order cook, Steve, after graduating from Columbia in 1959, joined the Standard Oil Company of New Jersey. His work at the Bayway Refinery came under the general heading of operations research

and included large-scale computer simulations, linear program models, and inventory models.

In September 1961 Steve was hired by Hughes Aircraft in Culver City, where, as a member of the Industrial Dynamic division, he worked in the field of operations research–primarily in cost effectiveness, process control, mathematical models, and simulations. In 1962, when a group from Industrial Dynamics decided to form Hughes Dynamics (a division of Hughes Tool Company) Steve joined them. On the staff of the Director of Management Technology, he did work involving mathematical models, economic analysis, and budgeting. "Even though a great future was expected for the firm," Steve explains, "it didn't turn out quite as we had expected." Early in 1964 the group began to disband.

In April Steve joined RAND's Logistics Department as part of the management systems group. Currently he is at work on two projects: an adaptive countdown system for the Apollo program and automated Air Force base maintenance – an extension of LP-IV.

A precocious child, Steve met his wife at PS 13. He was in the fourth grade, so was she. ("I remember liking Naomi because she had long hair and I could tie her to posts with it.") Although rejected in his first proposal of marriage (made in the fifth grade), his ardor never cooled. And by the time graduation from Queens College approached, the lady's heart had been won.

A musician as well, Steve began to study the piano at the Manhattan School of Music when he was only four years old and continued there until he reached thirteen. It was at that point that he decided to make music an avocation rather than a vocation. Among his other interests are basketball in the spring and touch-football in the fall.

The Drezner family – Steve, Naomi, Jeffrey (4), and David (1) – will shortly be making Canoga Park their home.

Who's Retired... and New Too?

On July 31, Lt. Colonel T. M. Longridge retired from the Air Force and left the ranks of RAND's System Operations Department. But ten days later, he officially joined RAND as a regular staff member in Administration. Longridge (left) is pictured receiving his Air Force Certificate of Retirement from Colonel John Shinners.

Jeff Longridge spent twenty-three years in the Air Force. During World War II he flew B-24's, and later (in mid-1947) he received a regular commission. For the next five and a half years he was with SAC at Castle Air Force Base as a command pilot flying B-29's and B-50's and as wing operations officer in the 93rd bomb wing.

From 1953 to 1954 Longridge was Chief, Current Operations, 15th Air Force Headquarters at March Air Force Base. The following year he attended the Air Command and Staff College. From 1955 to 1959 he served as staff officer, HqUSAF, Strategic Division, Directorate of Requirements, in the



Pentagon. He came to RAND's System Operations Department in 1959 and remained there for the five years until his retirement from the Air Force. His new job includes technical classification, as well as overseeing RAND's foreign travel and the visits of foreign nationals to RAND.

Who's New...

Bob Spicer, a native of Wellsville, a small town of six thousand in upstate New York, graduated from Purdue University in 1960 with a Bachelor of Science degree in aeronautical engineering. Following graduation (1960–1962) he worked at Douglas in Santa Monica in the field of advanced missile technology – on the Nike-Zeus in particular. In the fall of 1962 he returned to Purdue, sponsored by the Douglas Scholarship Program and began graduate studies in aeronautical engineering. Receiving his master's degree from Purdue in January of this year, Bob came to RAND in May, after working for a brief three-month period at Douglas. A member of the Aero-Astronautics Department, he is presently working on projects involving the study of hypersonic air dynamics and flight mechanics.



Bob Spicer

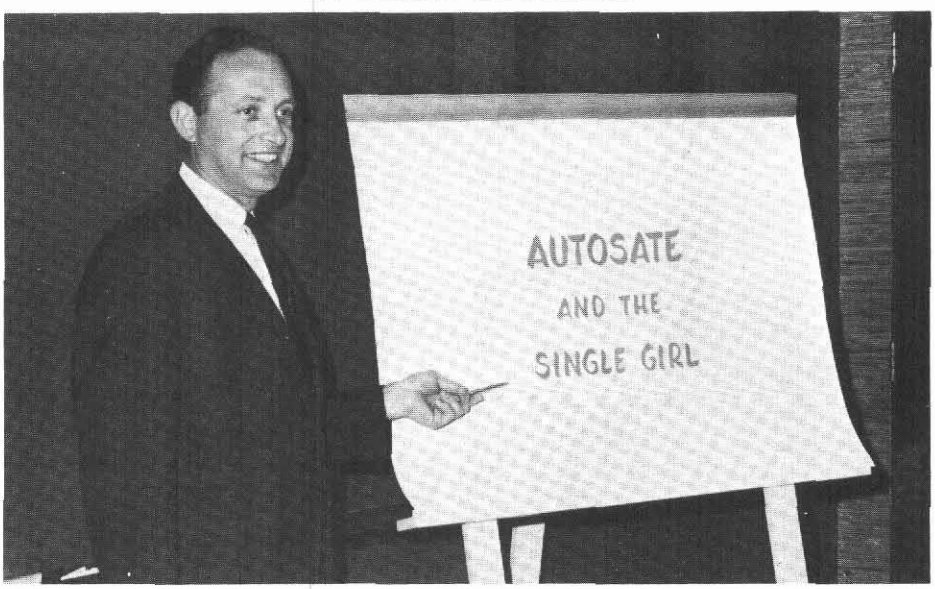


In general Bob finds Southern California to his liking. A sportsman and outdoor type, he hunts, camps, fishes, skis, swims, and skin dives. At the moment the slalom is his passion. Translation: He's flipped over sports car racing.

The slalom, an open car-racing event, usually sponsored on weekends by the various Southern California sports car clubs, is comparable only to a landbound loop-the-loop. Ill-advised for the faint hearted, the slalom course is set up on a flat, hard surface – frequently races are held in the desert, on air fields, or in large supermarket parking lots. Marked by pylons, which are rubber cones that have been set upright on the ground, the course zigs and zags at treacherous angles, usually for one mile. Clocked electronically from the starting position, the drivers race against time, frequently reaching speeds up to seventy and seventy-five miles an hour.

Bob, who drives a custom-built Corvette, does all the work on his car himself. He explains that if it were not for the fact that he's an engineer, it's more than likely he'd be a mechanic. If his interest continues, Bob eventually hopes to have a crack at road racing. (Apologies, Bob, for the *inexcusable pun.*)

A BEST SELLER



Ted Gatto recently gave the Logistics Department a lesson in "upmanship." As the story goes, Ted was getting a ribbing from certain people in the department about the number of times he's given briefings on the subject of Autosate, the automated data-system technique he developed at RAND.

Scheduled to address a department meeting on the growth of automation in Apollo pre-launch checkout, Ted began by saying he was "*not* going to give the usual." "Rather," he said, nonchalantly flipping over the first diagram on his easel, "I am going to talk about . . . ." (See picture.)

The joke broke up the house and Ted laughed last.

Rand picnic







First of all, it was an occasion for children — whether they were talking to the clown, riding a pony, or scrambling for candy. But it wasn't all for kids. There were RAND people hiking to an abandoned copper mine; a group of men playing as sandy a game of sandlot baseball as has ever been played; men flat on their backs while their wives tried to pour water into bottles precariously balanced on their foreheads. And there was the majority of the more than 600 attendees who enjoyed the spectacle from the sidelines, swam, ate, and just plain relaxed.

Soledad Sands Park – Aug. 1, 1964









Who's New...



Tony Russo

So far this summer, Tony Russo has (1) received a master's degree from Princeton, (2) moved to California, (3) come to RAND's Cost Analysis Department, and (4) married. And the summer isn't even over yet.

Born in Suffolk, Virginia, Tony attended Virginia Polytechnic Institute on its engineering co-op program. Interspersed with his classroom studies, he worked for the National Advisory Committee for Aeronautics (later NASA) at the Langley Lab in Hampton, Virginia. In 1960, after completing the five-year program, he came out with a B.S. in aeronautical engineering and a good deal of valuable work experience. He continued work at Langley for fifteen months after his graduation and published the results of a project he had undertaken in relation to the problems of radio communication with space vehicles during the re-entry phase.

In the fall of 1961, Tony entered Princeton University, planning to work toward an M.S. in engineering. A year later he decided to enter the Engineering and Public Affairs program of Princeton's Woodrow Wilson School of Public and International Affairs. (If this relatively new program seems strange in combination with his previous work, Tony points out that in the real world the engineer is very much involved in public affairs.) As a result of his dual approach, Tony received his M.S. in engineering in 1963, as well as a second master's in public affairs this past June. The curriculum in public affairs covered a wide range of topics such as military strategy, politics, economics, and government operations.

As part of the M.P.A. program, Tony was a member of a group from Woodrow Wilson that went to Mexico City on a research project during the summer of 1963. The general topic was the study of problems of a developing country, and Tony's initial part of this effort was an analysis of the Mexican military. While the Mexican military has, in fact, been broken to the point where it doesn't exert much force, there are still many interesting areas worthy of study. Unfortunately, however, the Mexican military felt less than kindly toward this gringo interloper, and the amount of cooperation Tony encountered was nil. Giving up on the military as a lost cause, Tony switched to a safer area – a general study of management in Mexico. In this case he dealt with economic leaders who were considerably more cooperative.

During this notable summer of 1964, Tony was married on July 31 in Charleston, South Carolina. He and his wife Elizabeth, a recent graduate of Bryn Mawr College, immediately returned to California and a home in Topanga. Tony was back at RAND the following week. Their "honeymoon" will consist of some short trips on the west coast.

Yiddish Wisdom

Der bester shuster fun ale shnayders iz Yankl der beker. (The best cobbler of all the tailors is Yankel the baker.)

Der emes shtarbt nit, ober er lebt vi an oreman. (Truth never dies, but lives a wretched life.)

Az men khazert tsu fil iber vi gerekht men iz, vert men umgerekht. (Protest long enough that you are right, and you will be wrong.)

Az men ken nit baysn, zol men nit sh'tshiren mit di tseyn. (If you can't bite, don't show your teeth.)

A kluger farshteyt fun eyn vort tsvey. (A wise man hears one word and understands two.)

The RANDom News

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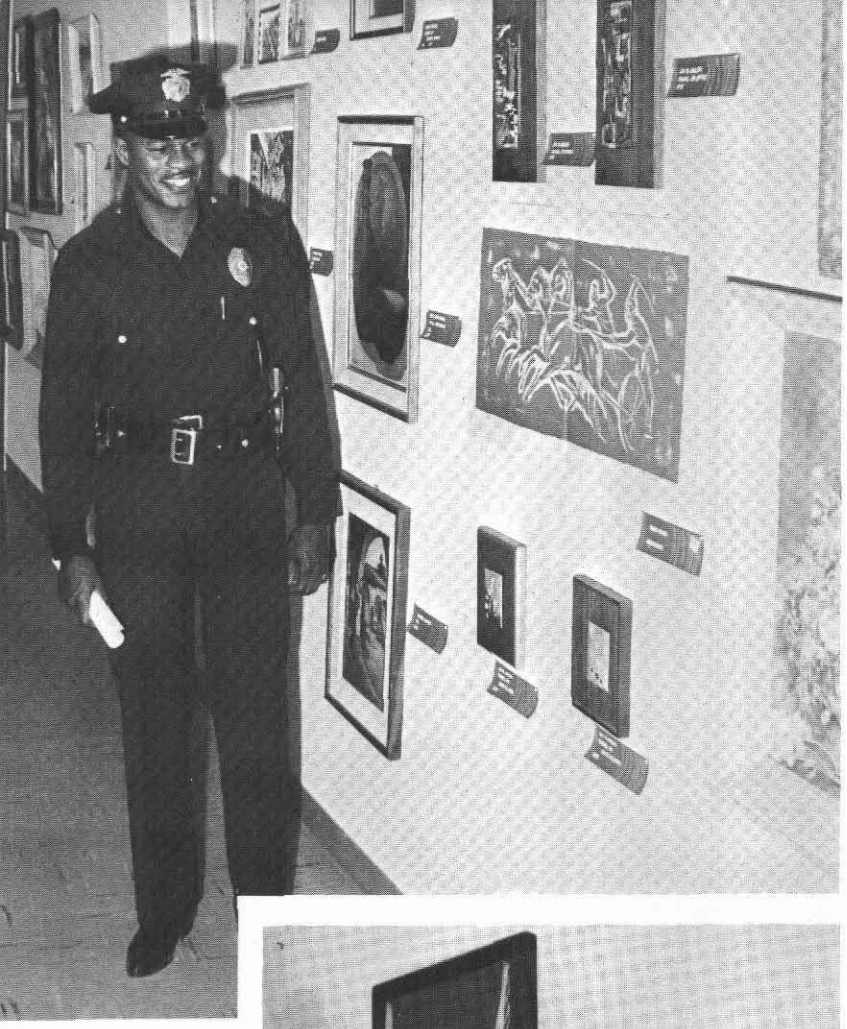
RAND Art Show

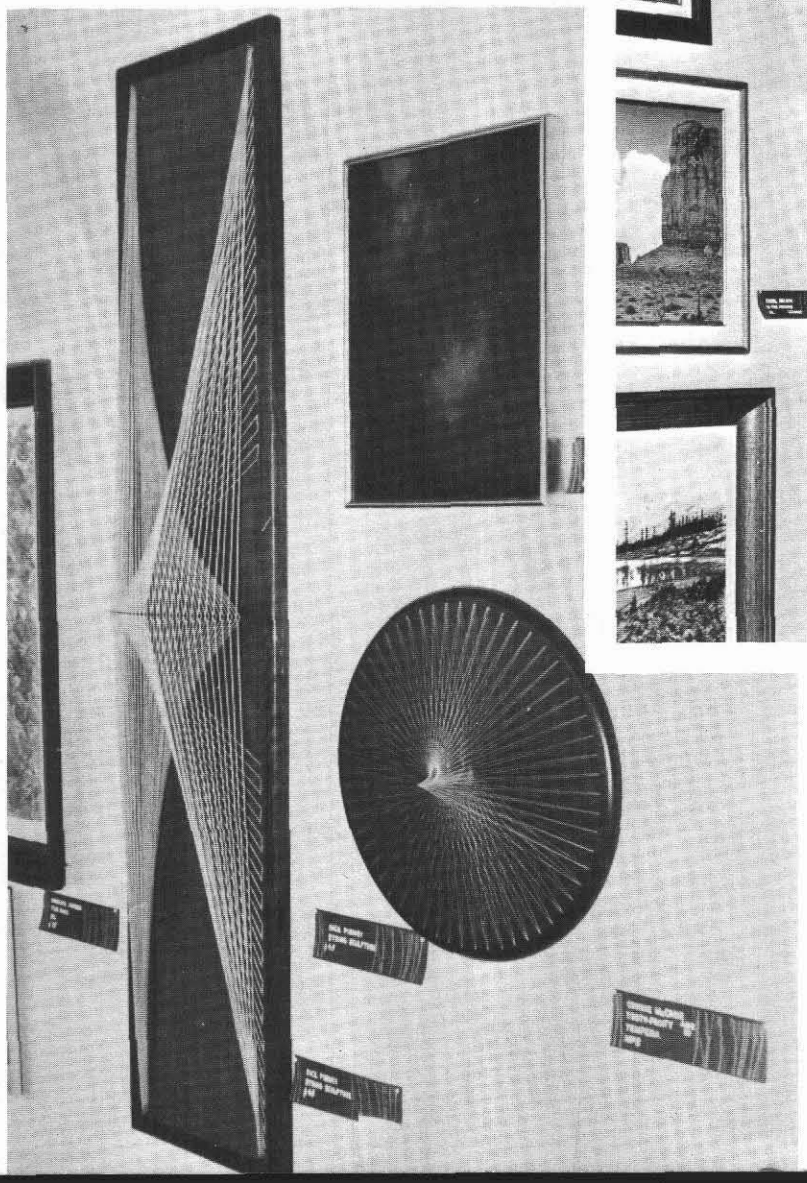


The artist has been called everything from "the heart of humanity" to the "curse of mankind." Socrates banned him, the Greeks worshipped his gods, and Freud psychoanalyzed him. Over the course of time he has served science, magic, and many causes in between. What can you say about the "RAND artist" and his works?

*What can you say about the "*RAND *artist" and his works?* You can play professional critic and make sensitive remarks about light and dark passages, about the golden mean, about rhythm, color statement, boldness, style, or composition.

Or, you can commune with the soul of the artist, his "Geniessen ist Nachschaffen." (You stand there, breathe in heavily; and then as you spy some ambiguous detail on the canvas, exclaim: "Yes, it's here all right, right in this frame.")







Or you can judge the success of the show according to how many works were sold. (Several were.)

Or, you can go psychological, and charge off into the symbolism and conditioned-response history; or, one may find that a picture suddenly seems to put him in touch with a person, a feeling, or a place long forgotten. One can admire the skill of the drawing, the color—even the nerve of the artist for hanging the thing up in public. The RAND Art Show offers you ample opportunity for all these avenues of appreciation — and more.

None of this means that the language of vision is a trivial affair. It's not by almost any standard.

Architects get their inspiration from it. Business spends millions to harness it to salesmanship. Hospitals use it to rehabilitate patients. Doctors use it to diagnose the mentally ill. Scholars use it as raw data of man's past. Children do it. Grandmas do it. Presidents do it. RANDsmen do it! And yes — Universities give Ph. D's in it!

What kind of person is the RAND *artist?* A review of the show's participants reveals that he is a scientist, a secretary, a maintenance man, a guard, and an editor; he is their wives, their children, their brothers and sisters. He represents every department at RAND—except Physics. If he is a professional researcher, he is most likely male, working in the Computer Sciences Department. He may, however, also belong to Planetary Sciences, Logistics, Mathematics, Economics, or Cost Analysis. Chances are he's not a female researcher. If related, he is likely a wife or child of a RAND professional staff member. By and large, however, the "RAND artist" is a RAND secretary.

The "RAND artist" has been painting anywhere from six months to twenty years; has sometimes sold work for good prices, but not often. He generally has had some form of training, either privately or at a university. (He may have attended the RAND art class taught by Andrea Day last year.)

*Why does the "*RAND *artist" paint?* One who was asked answered with her own questions: "Why does one breathe, eat, or sleep?" By and large this kind of dedication is definitely in the minority. Another answered, "I paint mainly because I can enjoy, without too much formal training, the experience of creating, from start to finish, something that is entirely my own." The majority of answers centered around three words — "fun," "enjoyment," and "relaxation."

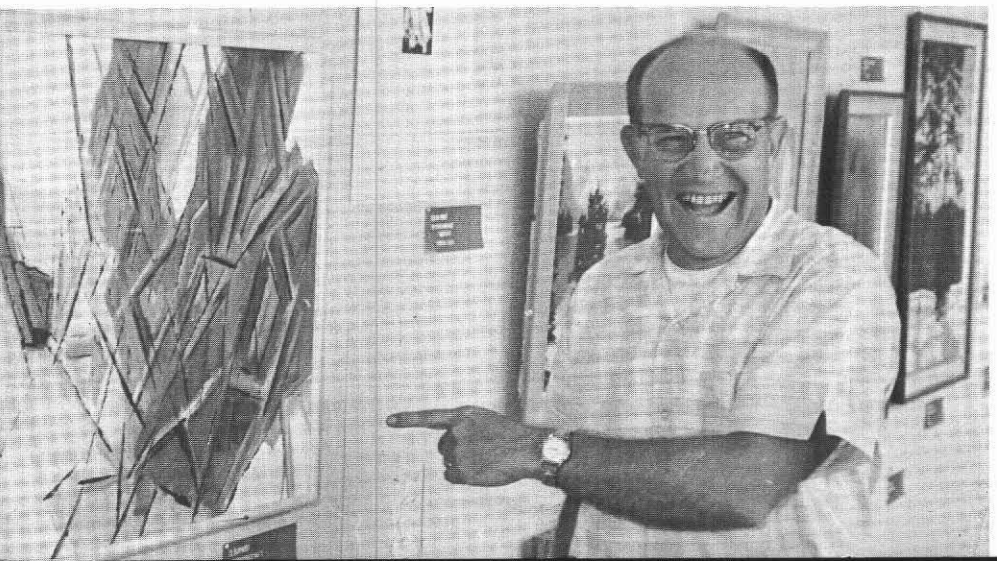
If some consensus exists as to why the RAND artist paints, certainly no uniformity can be found in his finished product, which runs the gamut of style from photo-realism to abstractionism of the highest order; the gamut of media from tissue paper collage to string, from tapestry to mosaic, and from crayon to serigraph. Subjects are no less diverse: landscape, portrait, decorative design, still life; next to a madonna hangs a harbor cove, a scarlet forest, a butterfly, and a bare-bottomed child.

Confusing? Why shouldn't it be, particularly for analytical types. As every analyst knows, establishing a proper criterion is one of the prime requirements for judgment. But in art today, and as demonstrated by the show at RAND, there may be a different criterion — not only for every artist and work, but for every viewer too. These may take in countless qualities in many dimensions, from simple design and color, to the ability to paint a "photograph," to the ability to stir a childhood memory or fantasy to life.

What can you say about the RAND Art Show? Almost anything, and so really nothing. No matter. Certain people, as they have since prehistoric times, will continue to paint for their own purposes — whether it be for fun for communicating their observations. their fears, their hopes; or for seriously seeking their own answers to their own questions.

And as they always have, certain other people will come to see what is painted — again for their own good reasons. And a few works will eventually be made objects of great value, even by those who remain mystified.

But of the RAND Art Show, one thing remains to be said: That the efforts of Shirley Story and Jack Thygerson and all who helped* to bring something of human worth and pleasure to the bare, impersonal walls of RAND have been a success and greatly appreciated by many. And already plans are in the wind to make the second-floor passageway connecting the old and new buildings into the official RAND art gallery.



*Gary Brown, Doris Carlson, Jerry Jensen, Marilyn Jensen, Clint Smith, Barbara Townhill, and Cecil Weihe—and, of course, the fifty-five participating artists.

What's in an Office? Family Reminders.

My Father goes to work. My Father has fun fun fun fun fun...