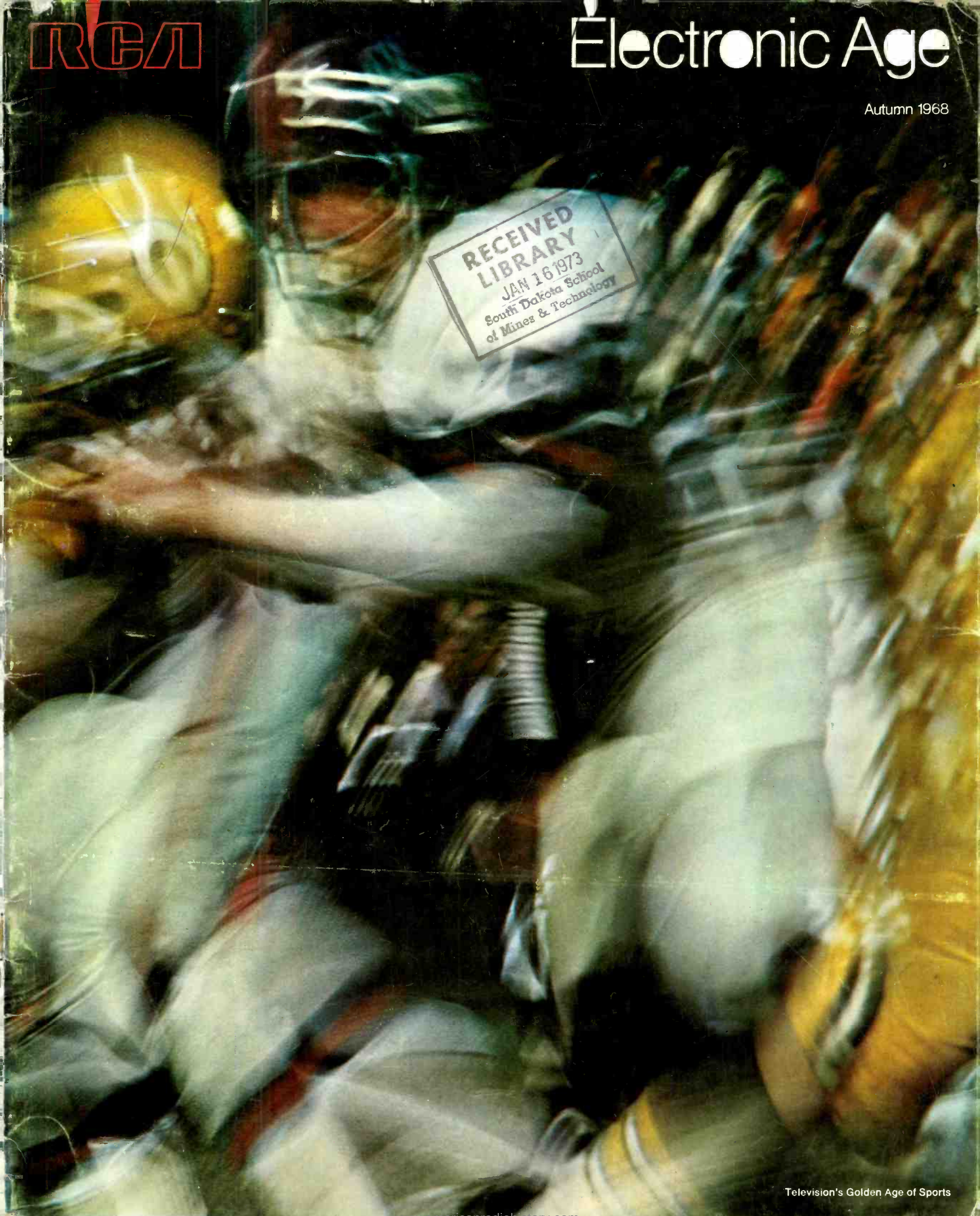
RCA

Electronic Age

Autumn 1968



Television's Golden Age of Sports

Cover: The action and color of professional football are brought into millions of homes every autumn weekend by the TV camera. The same is true for baseball, basketball, and other athletic events. However, far from turning the American sports fan into a living room spectator, television has greatly stimulated attendance at the gate by creating an unparalleled public interest in athletics. For an article on TV's golden age of sports, turn to page 22.

Electronic Age

Published
Quarterly by
RCA
30 Rockefeller Plaza
New York, NY 10020

When requesting a change of address, please include the code letters and numbers appearing with stenciled address.

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Music for TV

Music sets the mood for almost all programs from drama to variety shows. Without it, TV would be as dull as a peacock shorn of his feathers.

by Ray Kennedy

VTOL

antihistamine

Rh factor

digital
computer

bug

phenacetin

ICBM

VTOL
cryogenics

laser

"The linguistic orientation of today's technology is definitely English."

The combination of advances in technology and the communications media has wrought a greater change in the lexicon of the English language in the past 25 years than in any similar period in its past history. In fact, it is said that more new words have come into being during the past 50 years than in the 900 years preceding the twentieth century.

However, the influence of science on language is not new. As early as the sixteenth century, scientific words that are now part of the common vocabulary, such as *skeleton* and *smallpox*, were being introduced. The process has continued since, at an accelerated pace. What distinguishes the present century is not only the enormous number of technical terms being created but also the rapidity with which these terms are made available to the average speaker as part of the general vocabulary. *Antihistamine, LSD, laser, digital computer, cryogenics, phenacetin, Rh factor, ICBM,* and *stereophonic* are good examples.

Although the average person might not be able to define all of these words precisely, each term is probably known to him. With the possible exception of *phenacetin* (also known as *acetophenetidin* —one or the other term appears on almost every bottle of patent aspirin combinations), none of these words existed 25 years ago.

Though linguists still do not fully understand the means by which new words are brought into a language, the major role that technological culture is now performing in this process is unmistakable. It is difficult to predict which of the newly created technical words will become as assimilated by the general vocabulary as have *skeleton* and *oxygen*. But it is certain that a large number of them are already on the way "in."

There are, however, indications as to the acceptance of words. For example, if the hypothetical average person were challenged on his use of certain words, his response would give an indication of what degrees, from the basic to the very specialized, exist in the English vocabulary, and how the central core of the language is being changed and increased. If accused of misusing *tree* or *hat*, he would probably not take it seriously at all. He is absolutely confident of the meaning of these words that have been in general use since Anglo-Saxon times. If he were accused of misusing *stereophonic* or *LSD*, he might be a little more hesitant but still ready to argue. If his use of *cryogenics* were questioned, he might admit, right away, that he was open to correction. His feeling of confidence and familiarity with such words is a clue as to where they lie in respect to the core vocabulary.

None of the words such as *antihistamine, LSD, laser,* and others cited at the beginning of this article is ever likely to be a part of the general vocabulary in the same way as *tree* or *hat*. But it still is too early to say how far some of them will advance along the road of popularization. Widely used terms like *eliminate, acid test, potential,* and *ultimate analysis* were originally technical and limited to the vocabulary of chemistry and physics. And *by and large* and *under way* came into general use from the specialized language of sailors. It is safe to assume that many of the new words will undergo a similar development and become what Fowler's *Modern English Usage* labels "popularized technicalities." It is also probable that they will be popularized quickly, since many are creations of the typically modern fields of nuclear physics, space science, and electronics—highly publicized disciplines that have a pervasive influence on modern life.

Though the student of language cannot accurately predict which of the new terms will prove to have staying power in the vocabulary, he does know the methods by which they will be created. There are three general possibilities for creating technical terms: extend the meaning of existing words; borrow words from other languages; and coin new words from resources already existing in the language.

The first possibility—old words whose meanings are being extended or changed—is the most difficult to analyze. As cultural and social contexts change, so do the associations of old words. Certain meanings become dominant, sometimes to the extent of canceling other meanings. A list of these words might include: *jet, missile, film, cartridge, probe, program* (verb), *bug, tape, space,* and *channel*.

The pressure of the technological associations has not completely changed the older meanings of any of these words, but it is easy to see what influences are at work. It is doubtful that even a young schoolboy, if asked to give an example of the word *missile*, would write "snowball." Similarly with *jet*—which in its most frequent current use has been boiled down from *jet-propelled*—it is evident from the readiness with which it combines with other words in certain phrases *(jetport, jetset)* that its aeronautic meaning is highly active. The verb *program* has been around for a long time, but the context in which it is now used—in popular journalism, for instance—seems almost always to be that of computer technology. As for *space*, it is most unlikely that the average person, if asked to write down his first association, would ever write "roominess." In the un-

A botanical dictionary printed in Latin during the fifteenth century—one of the earliest books linking science and language.

"More new English words have come into being during the past 50 years than in the 900 years preceding the twentieth century."

likely event he had never heard of an astronaut, the spaceships of the comics and science fiction have been around too long not to exert a powerful influence on his choice. These shifts in meaning suggest the lively relationship that exists between technical usage and established words.

The second method, borrowing whole words from foreign languages, is characteristic of earlier periods of science, not of twentieth-century technology. This is true primarily because the linguistic orientation of the technology of today is definitely English.

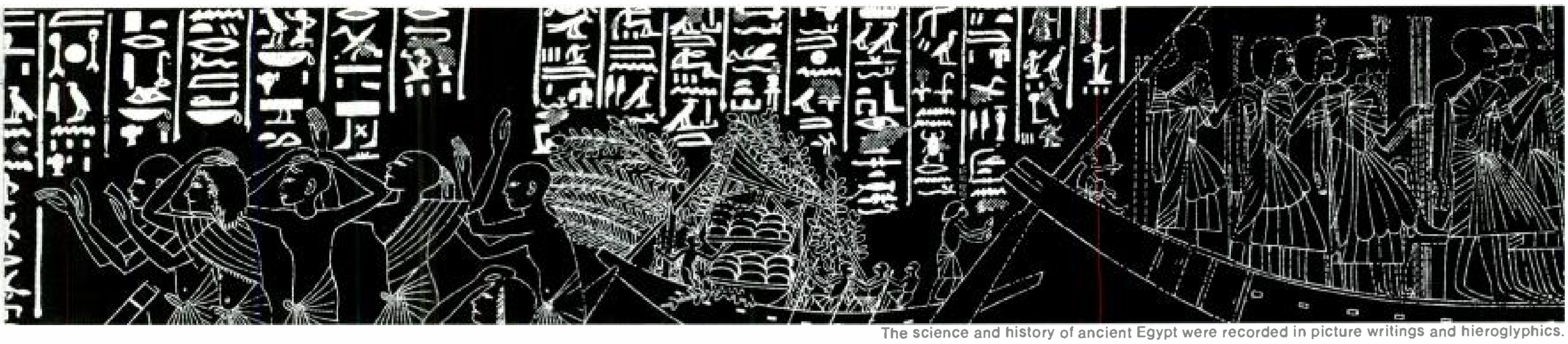
In the past, Latin and Greek have always been the primary sources for borrowings, as, for example, in the eighteenth century, the age of Linnaeus and of the great descriptive systems and classifications in botany and zoology. However, few of these learned borrowings have ever moved into any kind of general use. Because their meanings are not self-evident to the average English speaker, they have on the whole maintained the technical senses for which they were originally needed, and their meanings have not undergone the adulteration typical of "popularized technicalities."

A few of the more familiar classical borrowings are *genus, habitat, saliva, bacillus,* and *quantum,* all from Latin, and *cotyledon, thorax, pneumonia, iris,* and *psyche,* from Greek. If a complete list of such borrowings were drawn up, there would, of course, be a huge number of words with which any educated layman would be perfectly familiar. However, very few of these are of recent technological vintage; most are older terms from such fields as medicine, biology, and mathematics. Moreover, in words that English has borrowed from modern foreign languages, it is often found that, like the French *hélicoptère,* it is a coinage involving elements that could have as easily been put together in English. It is only in the narrowest sense that these words could be called French or German. Thus, *vitamin* was, strictly speaking, borrowed from German, but it was initially coined from classical elements—Latin *vita* ("life") plus *amine*—that have nothing peculiarly German about them.

Outsized dictionary in a mid-nineteenth-century Parisian library shows the catalytic effect of the Industrial Revolution on language.

Thermometer was coined originally as a seventeenth-century French word, *thermomètre.* But only a few years later, it had gained the status of a technical word in English, with its Greek elements intact, but with no traces of its French origin. This stateless, cosmopolitan quality is characteristic of so many technical words that it is superficial to consider them merely as foreign borrowings. Rather, they occupy a middle position between true foreign borrowings, like *chassis* or *coupé,* and words coined in English from elements originally non-English, like *cyclotron.*

Cyclotron is an example of the final heading—the creation of new words from resources already existing in the language. *Cyclo-* and *-tron* are what linguists call combining forms. Though they are learned and foreign in origin, they are illustrative of the elements that the English language freely adapts in compounding, one of its most characteristic methods of forming words. At present, vast numbers of technical terms are entering the language as compounds. The most common


The science and history of ancient Egypt were recorded in picture writings and hieroglyphics.

of these may be roughly divided into two types: those like *cyclotron* or *television*, which are composed of combining forms that are available or well-established in English though not of English origin, and those like *feedback* or *fiberglass*, made by joining words that, in isolation, do not have technical meanings. Some examples of the first type are: *automobile, astronaut, insecticide, osophone, telephone, antibiotic, television, supersonic,* and *vinyl*.

With the exception of *osophone*, all of these are familiar to the layman. *Automobile*, surprisingly, is a word, like *helicopter*, originally compounded in French. It also illustrates a type of compound that purists once referred to as "barbaric"—the kind having elements from two or more languages. From this extreme point of view, *telephone* (Greek *tele-* plus Greek *phone)* is acceptable but *television (tele-* plus Latin *visio)* is not. (A satisfactory all-Greek compound for a television set could be made up—*teleopticon* would do—but would probably lose the adaptability that *television* has shown in producing other forms, like *televise.)*

Of the three terms, *aquaplane, seaplane,* and *hydroplane*, the purist is willing to admit only the last, a Greek-plus-Greek compound. This view is, of course, pedantic and leads to absurdities. But it is less in evidence nowadays than it formerly was, perhaps because a knowledge of Latin and Greek is no longer considered the basic requirement of a good education.

The second type of compounding is deceptive because it involves technical and sometimes highly specialized terms that are produced by juxtaposing non-technical words with obvious meanings. Examples are: *waterproof, airtight, takeoff, throughway, underpass, fiberglass, countdown, input, output,* and *feedback*. These terms offer a convenient shorthand in naming processes, states, structures, and so forth, that are often highly complex. The simple juxtaposition of the elements, which obscures the usual indications that English gives as to part of speech, number, and modifiers, is perhaps a sign that the language is becoming more analytical and less inflectional. In short, it is becoming more like Chinese, which does not indicate grammatical relationships by declensions, conjugations, and singular and plural endings, and less like German, which makes heavy use of these inflectional endings.

A number of technical terms are being created as acronyms, blends, and portmanteau words. An acronym—itself a technical term coined in 1944—is literally a "peak-name," a word that is pronounced as a word and composed of the initial letters or syllables (the "peaks") of other words. Acronyms were first popular as names for governmental and military agencies and offices during World War II. They have also been used by commercial organizations, a widely known one being *Nabisco* (National Biscuit Company).

Strictly speaking, acronyms should be pronounceable, like *NATO*, and not merely abbreviations, like *WPA*, or some sort of in-between creature like *STOL* or *VTOL* in both of which the first letter is pronounced as a letter and the rest as a word. They have proved of use in technical vocabularies for the obvious reason that they conveniently condense often unwieldy phrases, as *radar* (radio detecting and ranging), *sonar* (sound navigation ranging), *scuba* (self-contained underwater breathing apparatus), and *napalm* (naphthene palmitate).

Closely related to acronyms are blends and portmanteau words that combine two or more words into a new whole, as *smog* from *smoke* and *fog*. Like puns, these words have been favorite devices of humorists, a famous instance being Lewis Carroll's blending of suggestive sounds in the verses of *Jabberwocky* ("Twas brillig, and the slithy toves/ Did gyre and gimble in the wabe..."). Carroll's poem, in fact, gives a clue to one requirement for a blend: whatever emerges, it must sound to English-conditioned ears the way a word ought to sound, and the sounds must occur in an order normal to the language. *Quasar* (quasi-stellar radio source), *transceiver* (transmitter receiver), and *bit* (binary digit) are three examples of useful technical blends.

Occasionally, blending causes confusion in the etymological elements of the word. Thus, *triphibious (tri-* plus *amphibious)* obscures the fact that in the model word, *amphibious*, the correct division is *amphi-* (Greek for "both") and *-bious* ("life"), not *am-* plus *phibious*. Looked at in this way, *triphibious* is related to a number of words that have been formed on the basis of false analogy. The derivatives of *hamburger*—*cheeseburger, beefburger*, and *chiliburger*—are perhaps the most famous examples. They became possible because of the mistaken analysis of *hamburger* as *ham* plus *burger* instead of (as is correct) *Hamburg* (the city) plus *-er*, the same suffix as in *New Yorker*.

Some technical words often take the form of shortenings of longer words *(stereo, audio, strobe, intercom, Moho)* or back formations *(televise, destruct)*. Sometimes they are onomatopoetic *(tweeter, woofer, growler, flip-flop)*, though these seem to be fewer of late. They can be based on proper names *(hertz, mach, tesla,* and *baud*, which is actually a shortening of the proper name Baudot). They may be arbitrary or seemingly arbitrary coinages *(Kodak, nylon, chad)*. All of these examples are representative of the ordinary means by which English increases its stock of words.

However, there is a need for even more new words to keep pace with the advances in modern technology. This need is shown by the abundance and variety of words created by analogy. An analogical formation is a word created on the model of another word. From the model *automat*—a shortening of *automaton*—a number of analogical formulations are constructed, such as *laundromat, dialomat, gasomat, vendomat,* and *sodamat*. In science, *electron* has served as the model for one series of *-on* words, the end of which is not in sight. Some of these are *proton, neutron, meson, baryon, lepton, fermion,* and *boson*. In another set of *-on* words, most likely modeled on *rayon*, the ending has come to denote "synthetic fabric" *(nylon, Dacron, Orlon)*. And there are other groups in which the value of *-on* changes to indicate gases *(neon)* or vacuum tubes *(klystron)*. Similar series have developed for *-tron* words *(cyclotron, bevatron, betatron)*. Often, it is difficult to say precisely which word is the model for these long series of technical terms formed by analogy. Whatever the model, however, certain words that have been developed by this means often seem to be monstrosities, as far as normal English prose style is concerned. Thus, *fadeometer, densitometer, intensitometer, absorptiometer,* and *optical interferometer* are derived from the highly fertile *-meter* model. With *resistance* as the probable technical model, there are such creations as *absorptance, capacitance, elastance, inertance, reactance,* and *leakance*.

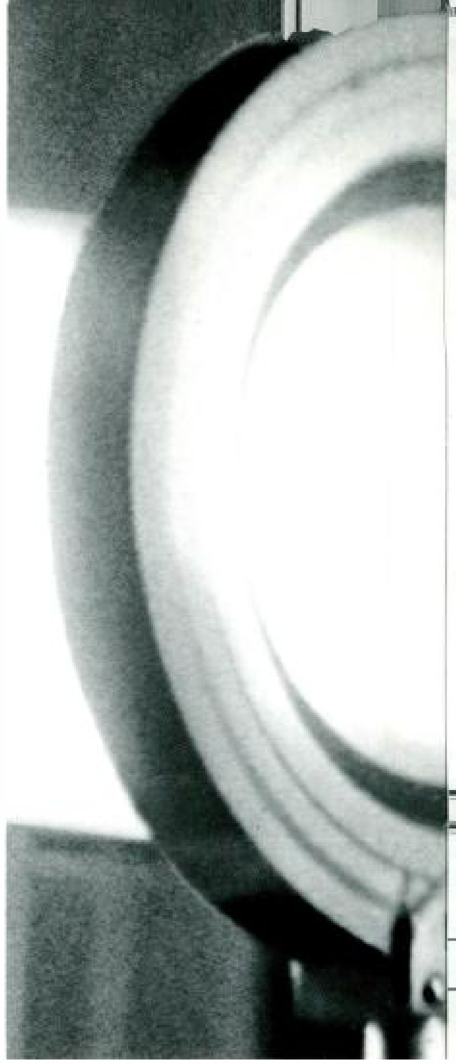
The danger here is that such words easily become true barbarisms if they are generally adopted and their technical meanings distorted or lost, as is often the case. A student of the future, for instance, may use *leakance* for *leakage* because he thinks it gives his writing a more authoritative or "scientific" ring. To cite actual classroom instances, freshmen sometimes use the "scientific" word *analyzation* when all they mean is *analysis*.

The need for new technical terms will multiply in a world in which man's store of knowledge doubles every decade or less. Even now, the rapid advance of technology is being reflected in the English language. As a result, both the professional and layman, who is also bound to encounter many of the new terms, may be helped by knowing the variety of ways that English has for enlarging itself. ■

OP Electronics

Direct control of the electromagnetic properties of light promises to open new vistas in electronic displays.

by Bruce Shore



Scientists are making an audacious bid to harness the electromagnetic properties of light directly without first having to convert them to electrical phenomena as is done in the cases of solar cells and television cameras.

Using a variety of new electronic materials and novel effects, they are presently training light to drill holes in diamond dies, carry radio and TV signals, align tunnel-boring equipment, track earth satellites, provide inertial guidance for missiles, and produce optical memory and logic circuits for computers. In the process, they are also fashioning a new optoelectronics technology that has been popularly dubbed "op" electronics.

But nowhere are the potential benefits of this developing technology more evident than in the field of visible displays. A series of recent breakthroughs promises to revolutionize everything from wrist watches and automotive dashboards to computer read-outs, television screens, and phonograph records.

In its strictest sense, "op" electronics is not new. It was derived, originally, from the work of Julius Plücker, a German physicist. In 1859, Plücker discovered the phenomenon of cathodoluminescence: that light is given off when certain phosphors are struck by beams of electrons, which were called cathode rays in his day, hence the name.

Thirty-eight years later, Karl Ferdinand Braun, also a German, employed this and other discoveries to build the first cathode ray oscilloscope: a vacuum tube with a phosphor screen that produced a beam of electrons that could be deflected up, down, or sideways by external magnets. The beam could be followed visually by the bright spot it created on the screen.

Among the direct descendants of this ingenious tube are the laboratory oscilloscope for observing high-speed electrical phenomena, the radarscope for monitoring the flight of airplanes and missiles, and the kinescope for displaying images received by the ubiquitous TV set.

Thus, the Braun tube was the first practical optoelectronic device. And it still

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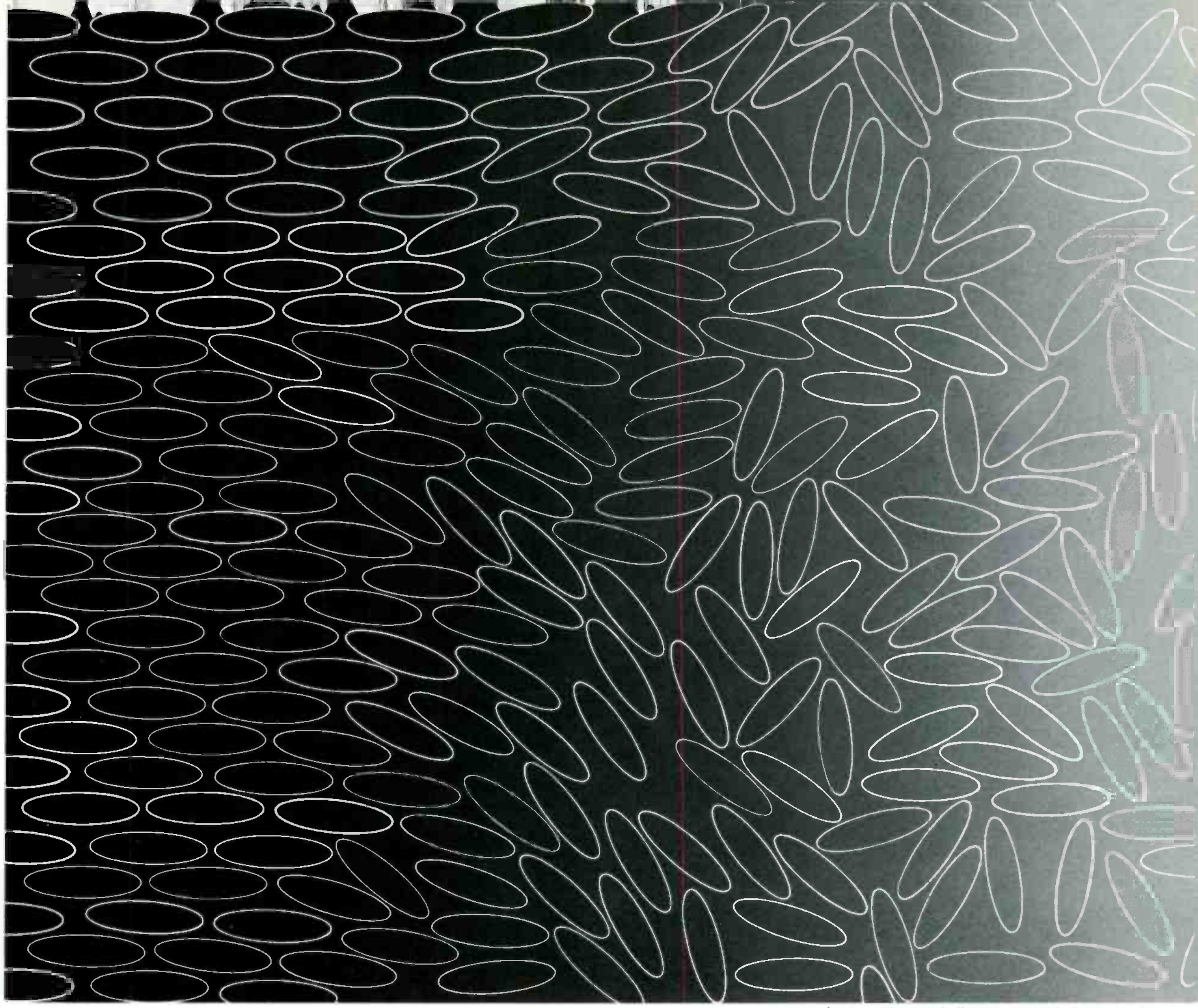


Artist's rendition of liquid crystal screen, in which molecules normally are transparent and line up parallel (left of drawing). When subjected to an electric field, however, they become disordered and cause light to scatter (right). This effect can be used to produce any desired graphic image, which, like a printed page, is viewed by reflected light.

serves, 71 years later, as the technological touchstone and inspiration for many of the modern efforts being made to surpass it. This is especially true in those cases where the only change contemplated is in substituting a new material for the phosphor screen found at the viewing end of most display tubes.

Three such changes that have already been demonstrated experimentally might prove revolutionary if they become practical.

The first involves use of a screen composed of lasers of a remarkable cathodoluminescent type—tiny, crystalline flakes of such materials as cadmium sulfide or zinc oxide. These flakes can be activated (pumped) by an electron beam of sufficient energy, causing them to emit intense, coherent light in a flat, 360° halo whose edge remains extremely narrow over relatively long distances.

By substituting these for the phosphors in a conventional TV screen, Dr. Frederick Nicoll of the RCA Laboratories in Princeton, N.J., hopes to produce a bright visual display that can be viewed directly or be intensified still further for projection onto a distant wall or movie screen. He has already built and successfully operated an experimental tube that contains several such lasers in a row and plans to add still more in the future. Eventually, a tube with a full row of such lasers might even be used as a kind of coherent light "flying spot scanner"—a device like that employed by the Lunar Orbiter satellites to convert film of the moon's surface to television signals for relay to earth.

Another approach of equal scientific interest and far-reaching applications potential is that involving the use of a photochromic instead of a phosphor screen.

Since the invention of paint and the development of clothing dyes, it has been known that certain materials change color when exposed to sunlight. Though virtually everyone has experienced these subtle, often exacerbating, effects at one time or another (housewives even take advantage of them by hanging white laundry out to be both dried and bleached by the sun), it was not until recently that anyone undertook to determine precisely what atomic mechanisms are involved in producing them. Ironically, it was unwanted and deleterious bleaching occurring in the "sun-pumped" crystal laser, announced by RCA in 1962, that triggered such investigations.

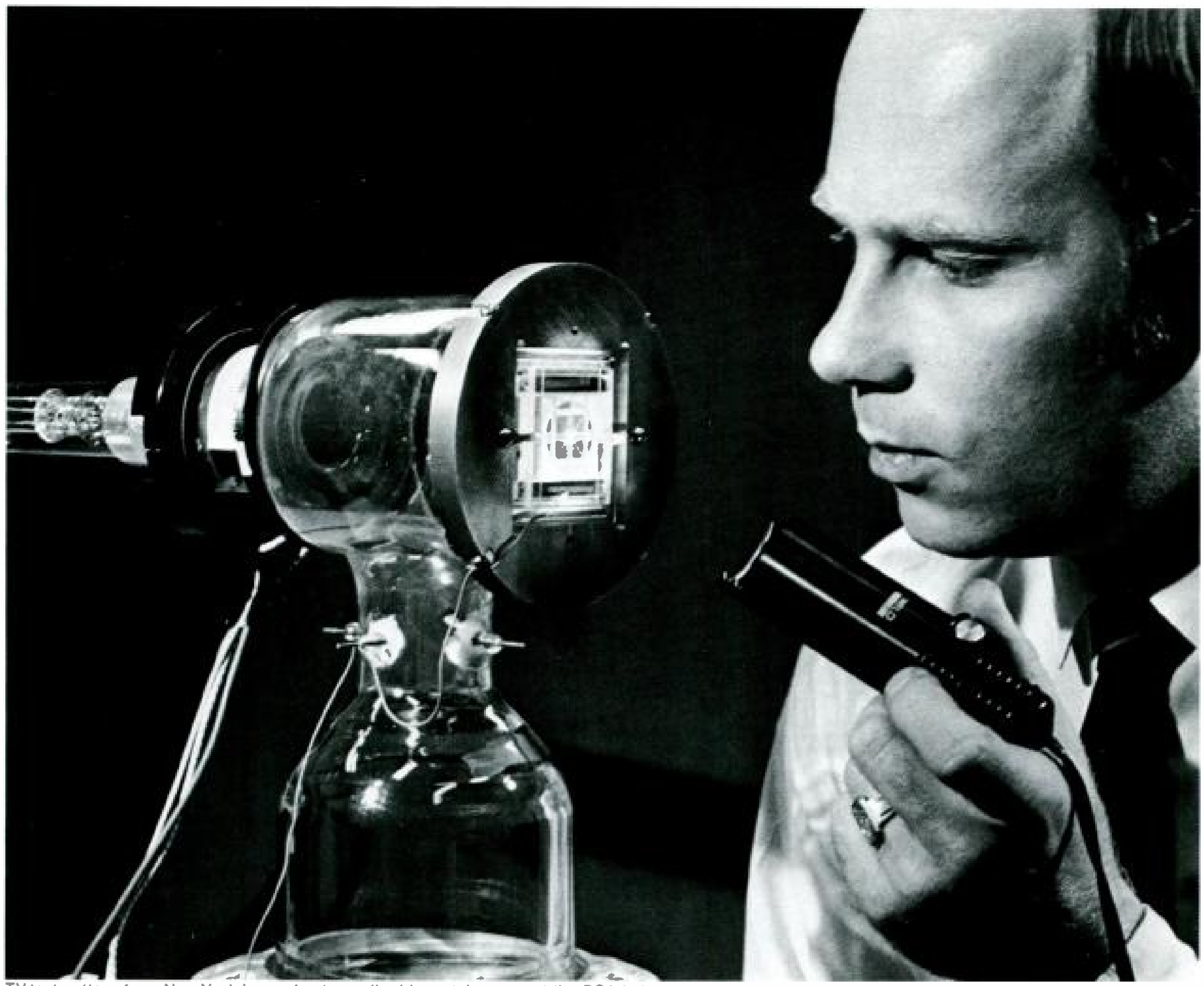
This laser, built by Dr. Zoltan Kiss, was a single crystal of calcium fluoride containing traces of the rare earth, dysprosium, that could be activated either by exposure to sunlight or by the intense radiance of a mercury vapor lamp. Unfortunately, as it turned out, this same illumination also bleached the material and steadily degraded its performance. Though concerned, at first, with counteracting the effect, Dr. Kiss soon became engrossed with trying to exploit it instead. Finally, after an exhaustive series of analytical studies, he was able to show that the dysprosium atoms, which were responsible for the laser action, were slowly losing electrons to the defects in the surrounding crystal. As a result, they were becoming absorbers of the very light they were supposed to emit.

Since these crystal defects or "electron traps," as they are called, could not be controlled or easily eliminated, Dr. Kiss decided to add traces of a second rare earth, europium, to the crystal. He reasoned that the atoms of this material would have greater affinity than the crystal defects for the electrons being lost by the atoms of the first rare earth and would enhance the photochromic effect as well. For similar reasons, he also substituted the rare earth samarium for dysprosium. Happily, the strategem worked. Furthermore, he found that the bleaching or discoloration produced when light of one frequency "kicked" electrons from the samarium to the europium atoms could be reversed by light of another frequency. The latter tended to kick the electrons back again, returning the material as a whole to its original state and hue. Thus, with outside light of at least two distinct frequencies or colors, he found that he could produce a kind of atomic "ping-pong game" within the crystal. This could be the basis for "writing" and "erasing" information on a photochromic surface by means of light.

In subsequent studies, he even determined that such "writing" could be accomplished on one side of the material with an electron beam and, if the material were thin enough, erased by light on the other. Thus was born the cathodochromic electron tube—an experimental device with a photochromic instead of a phosphor screen. Its great advantage is that it can be written on by standard television techniques and will retain its pictures or data for up to a half hour, even when the tube is turned off. This makes it especially well-suited for the display of data that change periodically—airline departure and arrival schedules, stock transactions and last sales, pari mutuel odds, and the like. Moreover, data displayed in this way can be altered or updated from outside, or erased entirely by a light pen, laser beam, or some other source of illumination.

The third candidate for replacing phosphors in the screens of TV tubes is the nematic liquid crystal. The liquid crystal state is a transition, or "twilight zone," that occurs in many organic compounds somewhere between their solid and completely liquid states. Materials in this state possess the physical properties of a liquid as well as the optical properties of a polycrystalline solid. Ergo, their name.

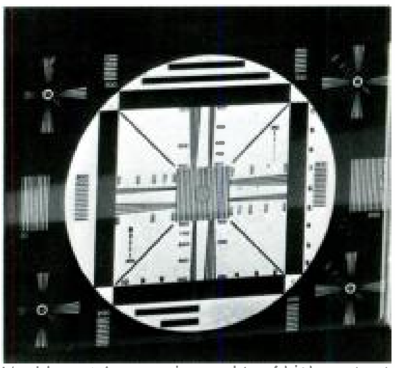
This condition was first identified in 1888 when Friedrich Reinitzer, an Austrian botanist, found that certain organic compounds he was investigating did not melt cleanly. Thereafter, others found that



TV test pattern from New York is received on a liquid crystal screen at the RCA Laboratories at Princeton, N.J.—the first demonstration that liquid crystals can display a live television picture. Light reflected from the lamp provides higher resolution.

"Recent breakthroughs could revolutionize everything from wrist watches and automotive dashboards to computer read-outs and TV screens."

Experimental display unit, made up of hundreds of tiny semiconductor lasers, may one day be able to project color TV pictures on a wall.



Liquid crystal screen is capable of high contrast and fine detail.

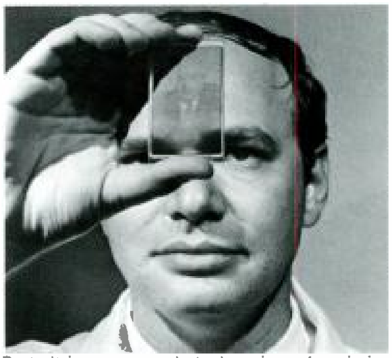
there are three types of liquid crystals: a smectic variety, whose molecules arrange themselves vertically like cans of soup stacked atop each other on a supermarket shelf; cholesteric types, whose molecules are laid out horizontally but are stacked in helical fashion like steps in a winding staircase; and nematic brands, whose molecules are also laid out horizontally but are stacked like stick matches in a box. All of these architectural arrangements, it develops, are due to van der Waals forces—weak electrical attractions between the molecules—whose discovery won a Nobel prize in 1910 for the Dutch physicist Johannes van der Waals. Still later, in 1931, Wilhelm Kast, a German chemist, found that liquid crystal molecules could be forced to line up in an electric field.

Such intriguing features were bound to capture the attention of electronics scientists sooner or later, and, in the early 1960s, impelled Dr. Richard Williams of RCA Laboratories to initiate an intensive study of nematic liquid crystals in particular. Subsequently, new insights developed during this study led Dr. George Heilmeier, a co-worker, to believe it might be possible to employ such materials to achieve all-electronic displays of a novel, reflective type.

Starting with materials that exhibited nematic behavior only within a narrow temperature range of from 90° to about 110°C., Heilmeier and his research team made their first important discovery—that, when a film of the usually transparent material was trapped between two plates of glass and subjected to a small electric voltage, it became instantly opaque. Ions—in this case electrically charged molecules generated in the film by the voltage—were moving from one of the glass plates to the other, disrupting the orderly molecular arrangements of the liquid crystal and causing it to scatter rather than transmit light. In fact, the higher the voltage, up to a certain limit, the more the scattering.

Next, Heilmeier's team went to work on the temperature problem. Could a nematic material be found or fabricated that would have a wider temperature range? After several months of trial and error and patient chemistry, a second important discovery was made. It was possible to produce a material whose liquid crystal state could be maintained over a range from below freezing to the boiling point of water.

Proof was obtained several months later when Dr. John Van Raalte, also of RCA Laboratories, succeeded in building a tube with a small liquid crystal screen that could be scanned by an electron beam in the conventional manner and could receive and display standard broadcast pictures. These differed from ordinary TV pictures only in that they were seen by reflected light from their surroundings (in the same way a printed page is seen), rather than by light that they themselves emitted, as in the case of phosphors.



Portrait image on a photochromic surface is instantly obtained by exposing the material to blue light through a photographic negative. It can be erased by yellow light.

As indicated by Dr. Heilmeier's original discovery, however, it is not necessary to use an electron beam to activate a liquid crystal screen. A simple electric field produced between two electrodes is sufficient to make it scatter light. If one or both of these electrodes is transparent—tin oxide is ideal as such an electrode—it is possible to produce flat displays. These can be used, for example, as the face of an all-electronic watch, a speedometer or other dashboard instrument, a silent cash register or desk calculator, and an alpha-numeric read-out. It might even make possible a flat television display one day, although this would require more than just a flat screen. It also needs some means, other than an electron beam, of lighting up or darkening about 250,000 points on the screen every second. This is the number of "bits," roughly, that make up a standard TV picture.

Cathodoluminescent lasers, photochromic materials, and liquid crystals all figure prominently in the effort to achieve new forms of electronic displays based on the way certain materials generate, absorb, or reflect light. Still others are being worked on, however, that depend upon how certain materials transmit light. Some of the most dramatic of these use lasers as their source of light. Mosaics of tiny electro-optical or magneto-optical "windows" produce rapid changes in intensity at various points in the laser beams as they pass through on their way to a distant screen.

Such systems are based upon the fact that the electric and magnetic fields, which make up light, vibrate both vertically and horizontally as they propagate through space. Furthermore, it turns out that the electric field in this partnership can always be resolved at any instant into two right-angle components much like the cross hairs in a bomb sight. Finally, because of the way these vertical and horizontal components interact with certain transparent materials, it is possible to suppress one of them (to polarize the light) as the light passes through, or to change its direction (to rotate the plane of its polarization). Some materials do this naturally by virtue of the way they are constructed. Others do so only when subjected to an electric or magnetic field.

Focusing on this latter category, scientists have now fashioned materials from which they are able to build tiny, mullioned "windows" whose optical characteristics can be altered electronically and in any pattern. Thus, as light passes through them, their action is combined to produce a sort of electro-optical or magneto-optical "transparency" that can be projected directly onto a screen.

To the standard television technique of producing images by controlling the emission of light from an array of phosphors, scientists are now adding an extraordinary ability to produce these same images by controlling the absorption, reflection, and even transmission of light by other, more exotic materials. In the process, they are paving the way for a myriad of new products built on the developing technology of "op" electronics. ■

The Philadelphia Sound Story

The power, warmth, and elegance of this sound has made The Philadelphia Orchestra one of the world's finest.

by John Pfeiffer

In this cybernetically sophisticated twentieth-century world, the search for aesthetic pleasure through wordless communication still leans heavily on the scraping, blowing, pounding, and plucking of centuries-old noisemakers to create the sound of music. And perhaps nowhere today is this quest more rewarding than in listening to The Philadelphia Orchestra with Eugene Ormandy conducting in the concert hall or in the home through radio, television, or phonograph.

The Philadelphia Orchestra is "...probably the greatest virtuoso orchestra of all times," according to Harold Schonberg of the New York *Times,* and it is "...surely the greatest orchestra in the world," in the opinion of Irving Kolodin, music critic of the *Saturday Review*. These opinions have been echoed by a great proportion of the musically sensitive community since 1912, when Leopold Stokowski took the helm of the then 12-year-old orchestra, and over the last 28 years, Eugene Ormandy's monumental era.

Perhaps the most consistently recognized unique attribute of the Orchestra is its sound, which has been variously described as "sonorous," "warm," "magical," "opulent," and "elegant." For example, the eminent musician and critic Virgil Thomson has written: "The sound [of The Philadelphia Orchestra] is always a surprise, for its power, its wondrous bloom, like the coat of some high-bred animal, and its grace, its tiger-like articulation are finer today than they have been before. . . . It is even better, I think, than any orchestra has ever been."

An orchestra's sound, quite simply, is the sound its conductor creates. An orchestra is the conductor's instrument. And the remarkable instrument known as The Philadelphia Orchestra was originally built by Stokowski, who collected a body of excellent musicians with fine instruments and trained them to respond flexibly and sensitively to his every wish. "He created the brilliant sound. He made it sound like a limitless organ," Ormandy explains, "and I loved it. I grew up in a country [Hungary] where almost everybody has a flair for brilliance." Subsequently, Ormandy took this virtuosic brilliance and re-voiced and refined it. The result was a vitality and musical directness. This has been called the "Philadelphia sound"—a *natural* string quality that applies a velvety patina over the entire orchestral coloration.

The origin of The Philadelphia Orchestra is a tribute to dedication, experimenta-

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John Pfeiffer is Executive Producer of RCA Red Seal records.

In 1941, Eugene Ormandy, conductor of The Philadelphia Orchestra, center, met with Arturo Toscanini, organizer of the NBC Symphony, second from right, and, left to right, Alexander Hilsberg, Saul Caston, and Marcel Tabuteau, who were then members of The Philadelphia Orchestra.

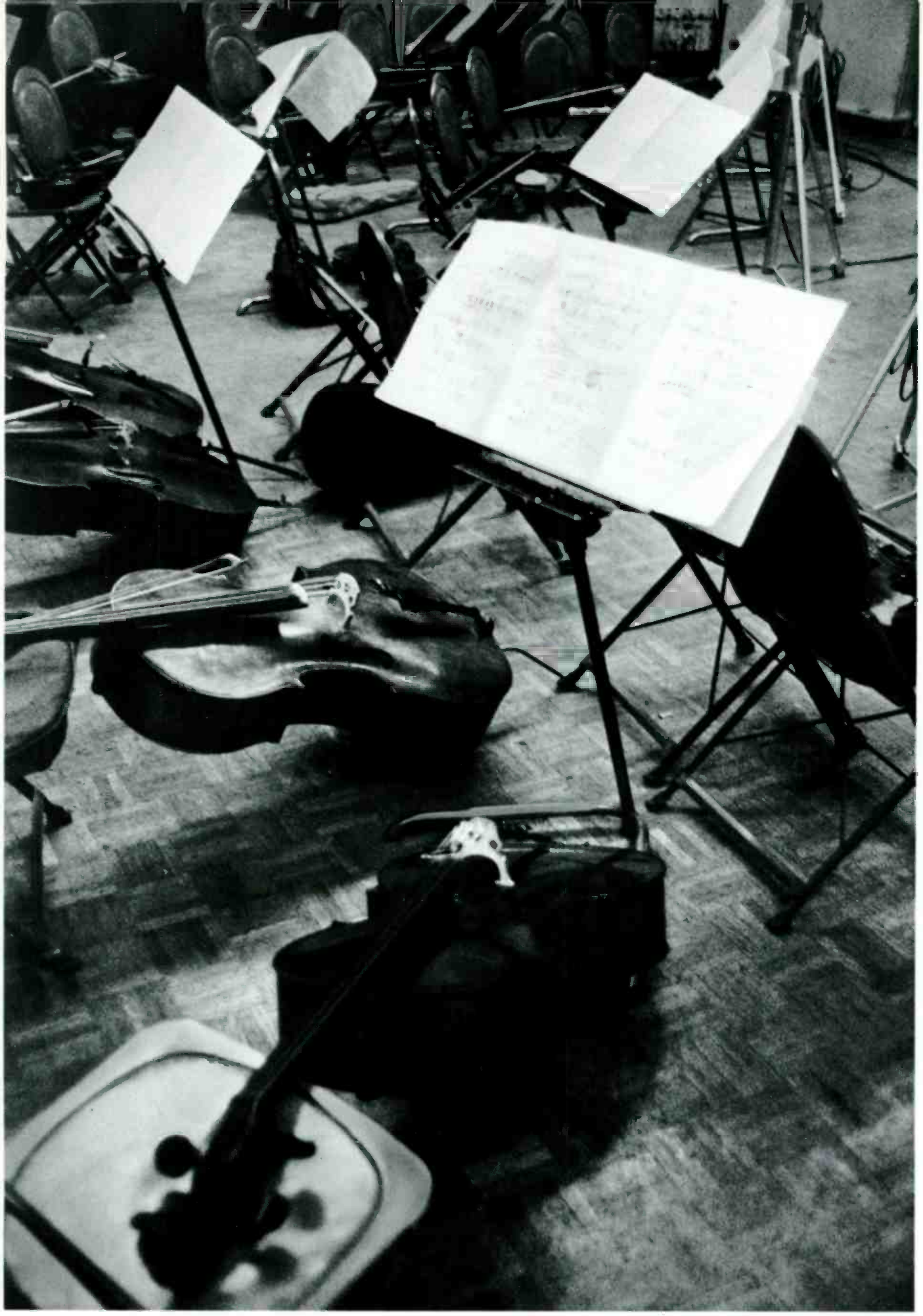
Near right: Leopold Stokowski, conductor of The Philadelphia Orchestra from 1912 to 1940.

Far right: Many of the works of Finnish composer Jean Sibelius were first played in this country by The Philadelphia Orchestra.

Below: Ormandy and famed Russian composer Sergei Rachmaninoff in 1937.

Below right: Fritz Scheel, conductor of the Orchestra from 1900 to 1907.

tion—and chance. In 1899, Fritz Scheel, a highly gifted German conductor, appeared on the Philadelphia scene, where there had been many unsuccessful efforts to establish a high-quality, permanent symphonic life for the city. One of the main problems was the frightening economics of maintaining a major symphony orchestra. Fortunately, at the time, some of the community leaders were promoting two concerts with professional musicians chosen by Scheel at the end of his first casual season with the amateur Symphony Society. Camouflaged behind these benefit concerts for families of Philippine War heroes, the formation of a permanent professional orchestra took root in March, 1900. The resounding success of these concerts—musically and financially (a profit of more than $10,000 for the benefit)—mobilized the cultural and financial forces that offer strong support to this day. By November of 1900, Scheel had assembled 85 competent players and had presented the first undisguised Philadelphia Orchestra concert in an atmosphere of social and musical triumph. The occasion was compared to Boston Symphony nights in Philadelphia, which were then regarded as the only events of symphonic substance in town. Even the *Evening Times* in Glasgow, Scotland, reported that the Orchestra was "... originated by a few American millionaires ... who sent an agent to Europe to spare no expense in getting together the best possible band."

That first season, the Orchestra took its first trip—to nearby Reading—and started its current record for traveling more miles to play more concerts than any other orchestra in the United States. It also began the practice of having eminent guest artists appear with an orchestra. These have included such concert soloists as Ossip Gabrilowitch, Fritz Kreisler,

and Edward MacDowell. It may also have started the history of spunky conductors who have survived the longest and accomplished the most; for example, Scheel was known as the "Fighter." But it most certainly started a pattern that is common to all symphonic organizations—it ended with a deficit.

Although it was a basic theater orchestra of Europeans with few U.S. citizens (today, members must be either native or naturalized Americans), it soon boasted a personnel list that read like a roster of every court orchestra in Germany. With higher musical quality came expanded seasons, a succession of world-famous guest artists, and, of course, greater deficits. Some measure of the quality of this infant of all major American orchestras (except Cleveland, which was 16 years in the offing) is evident from a *Musical Courier* description of the reaction of a notoriously tough audience to its first New York concert in 1902: "They were surprised; they were disconcerted; they were—to put it frankly—intensely envious. As one composer said, 'I feel jealous ... it plays the classics as we seldom hear them performed here. What splendid enthusiasm, what superb aplomb! ...' "

"Enthusiasm" and "aplomb" have been continuous distinctions of The Philadelphia Orchestra members. In some measure, they come from a unique pride each player seems to have just in belonging. In turn, that pride today is due considerably to Ormandy's ability to endow each member with a sense of responsibility not only for his own performance but also for his contribution to the whole. "It is a series of chamber music ensembles in which each player listens to himself in relation to the others," he explains. And another part of this pride undoubtedly has its source in the mutual respect between conductor and player. "You are dealing with great artists and with your equals, and you must treat them like that," Ormandy feels.

But more of the players' enthusiasm must evolve from the spirit of experimentation applied both to music and to sound, which was a hallmark of the Stokowski era. Scheel built a solid foundation in an atmosphere of cooperation,

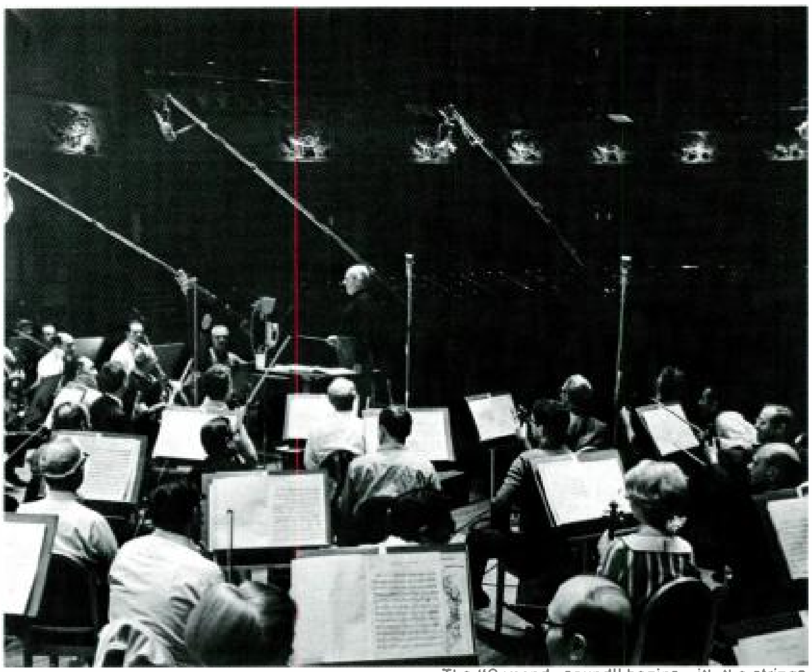
"The ensemble is full of clarity, light, and warmth... as if created by one hand on one magic keyboard."

support, and gratitude until his death in 1907. He was succeeded by another German traditionalist, Carl Pohlig, who first created a stir by conducting two-hour programs entirely from memory, a talent that tended to obscure the lack of variety in his programs. His five-year tenure was primarily distinguished by an increase in the total number of season concerts from 62 to 86—a statistic that may suggest one reason for his demise: overexposure. Justly or not, he is remembered as the man who followed Scheel and preceded Stokowski.

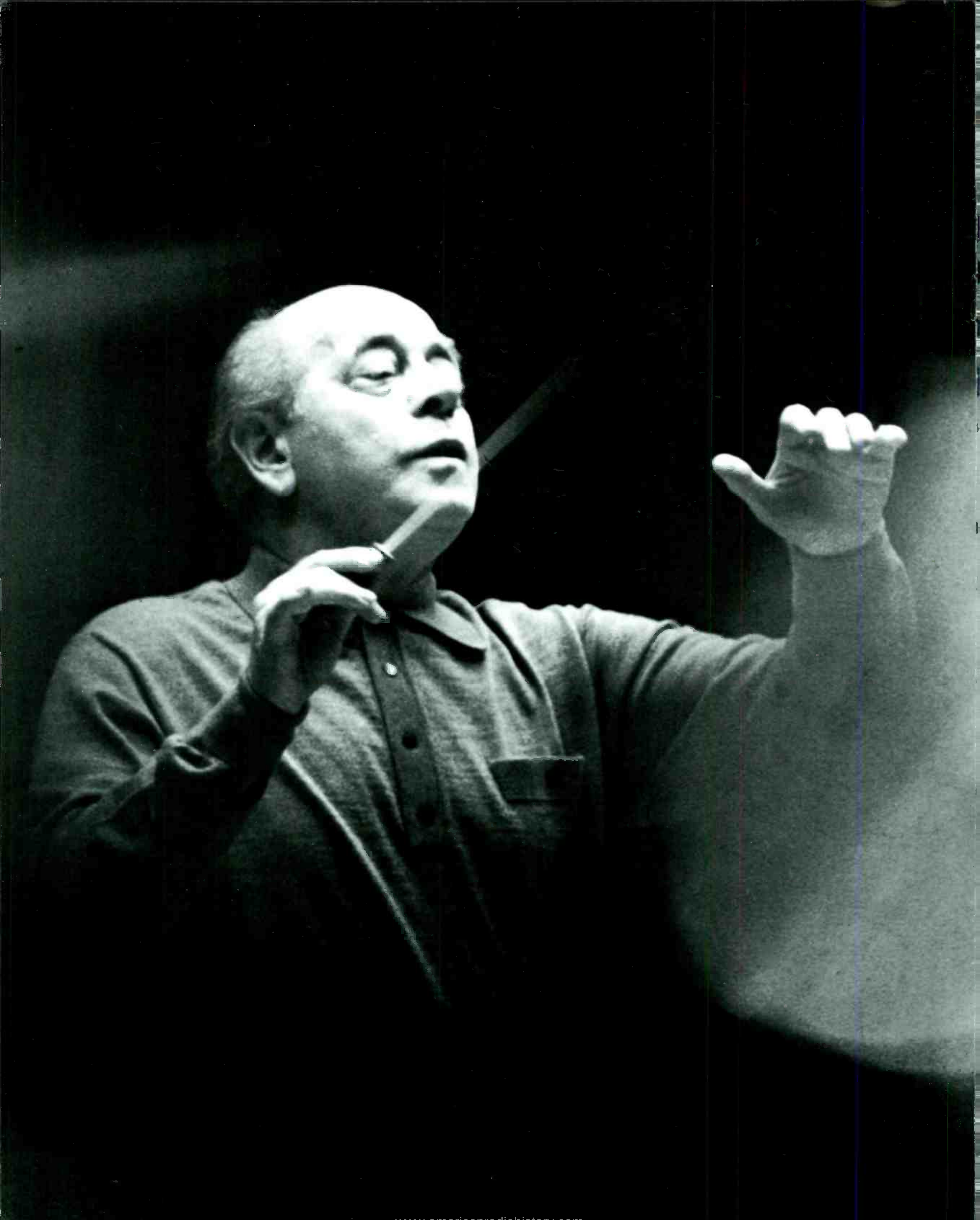
With Stokowski came a totally new vitality and "an embarrassing number of novelties," as one newspaper reported after he announced his plans for the first season. But as the last notes of the season's final concert died away, the directors of the Orchestra knew they had found the right man. Although he had just passed 30, Stokowski had had successful seasons with the Cincinnati Orchestra and musical experience abroad. He had come to America in 1905 as organist for St. Bartholomew's Church, in New York. It was his curious, untamed fusion of talent and restless imagination, appearing at the right moment, that enabled him to weave random threads of music into a brilliant tapestry. Lawrence Gilman, program annotator for the Orchestra and critic of the New York *Herald Tribune*, decided that, when Stokowski took over the Orchestra, "It needed his indomitability, his unslakable passion for perfection, his magnetizing contact, his adventurousness, his superb dissatisfactions" and that he "... shaped and tempered his orchestra into an instrument of almost uncanny perfection...."

Alternating and sometimes violent public and critical darts and kudos never perturbed Stokowski's strong will, and his magnetism converted a provincial orchestra into a world-famous enterprise. During his 28 years with the Orchestra, there were many important "firsts," including the first commercial broadcast of a symphony orchestra (1929, over NBC, sponsored by the Philco Corporation and carried by 50 stations as well as relayed abroad); the first "orchestra-opera" performance in this country; and a distinguished list of world and American premieres of works by many giants of contemporary composition: Stravinsky, Schoenberg, Rachmaninoff, Shostakovich, Richard Strauss, Sibelius, Berg, and Mahler. The *Eighth Symphony* by Mahler—his "Symphony of a Thousand"—premiered in America by Stokowski in 1916, perhaps evoked the most attention, if only by its sheer spectacle. Three choruses totaling 1,000 voices, eight vocal soloists, and an orchestra augmented to 110 musicians performed nine times to enthusiastic Philadelphians and then moved *en masse* to New York's Metropolitan Opera House for a flamboyant climax.

It was during the dynamic atmosphere of Stokowski's second Philadelphia decade—the year, 1931—that Eugene Ormandy, a young Hungarian conductor, made his first appearance with the Orchestra as a substitute for the celebrated conductor Arturo Toscanini, who had suddenly become ill. It was a great challenge. Not only did Ormandy have to impress a Stokowski-oriented audience but he had to please music lovers who were keyed up to a high-pitch anticipation by the guest appearance of maestro Toscanini. Eugene Ormandy met the challenge, conquered his audience, and was permanently engaged—for another orchestra: the Minneapolis Symphony. However, in 1936, he returned to Philadelphia as music director and shared the podium with Stokowski for the next four years. His appointment as conductor in 1940 started a new history of tenure that is unequaled by any other living conductor of a major orchestra.

A student in the Royal Academy of Music in Budapest at the age of five, Ormandy studied with the famous violinist Hubay and became a professor at 17. Although he says he was born in this country at the age of 22 (he had to start his whole career over again when he came to the United States in 1921), it took him only 10 years to work his way from the last stand of a theater orchestra violin section to the podium in Philadelphia.

The "Ormandy sound" begins with the strings.

What does Ormandy do differently from other great conductors that accounts for his uniquely recognizable sound? It starts with the strings. He specifies every bow stroke, determines the appropriate conditions for optimum string tone from height of instrument bridge to the best type of resin to use on the bow, and directs the detailed changes in tone production to serve stylistic musical needs. In short, he "plays" his orchestral instrument with full awareness of not only what he wants but also how to get it. He engages not only orchestral musicians but also their tone and their instrument, and he helps a member acquire a better instrument if his own falls short of the quality mark. Liberally represented in the violin section are famous old Italian instruments: Guarnerius, Stradivarius, Amati, Guadagnini. Violas, cellos, and string basses have equally famous Italian makers, while woodwinds, brass, and percussion are simply the finest instruments available. In these latter groups, a player will often have several instruments, each appropriate for a different tonal or stylistic requirement. First trumpeter Gilbert Johnson, for example,



"The Philadelphia Orchestra sound is embedded in a tradition of experimentation, teacher legacy, and the continuous search for optimum musical substance."

may use eight different trumpets in the course of a week's performances. On tour, the Orchestra's instruments are insured for more than a half-million dollars.

Ormandy's sense of sonic balance builds on solid, articulated string bass sound. The architecture of his sonic spectrum has a foundation that one feels deeply. Structuring his string sound on this support, he builds cellos, violas, and violins in precise forms to create the integral masses to fill primary space (in music, space is a dimension of time). Woodwinds, brass, and percussion are the architectural details of the musical structure, articulating the masses, supplying contrasting colors and adding drama. Balancing these elements with the basic radiance of his string sound structure calls upon Ormandy's sense of dramatic proportion, his instinctive and acquired love for brilliance, and a natural eloquence in large musical forms.

The Philadelphia Orchestra sound is also embedded in a tradition of experimentation, teacher legacy, and the continuous search for optimum musical substance. A great orchestra's experimentation is constantly paraded before its audiences in the form of new compositions that have been carefully thought out and tested to produce just the right sound for every detail of a score. This "research and development" is a quest that is constantly carried on by the Orchestra's 106 musicians, conductor, librarian, and operating staff.

An example of this prevailing search is the story of the percussionist Benjamin Podemsky, who joined the Orchestra in 1923. The idea that drums, gongs, cymbals, bells, and other assorted noisemakers are only that and no more was as foreign to him as it would be to Jascha Heifetz with respect to violins. Podemsky modified, refined, and rebuilt to achieve perfection in the sound of his instruments, some of which were exotic ones collected in Stokowski's travels. But he had no antique cymbals—those tiny, delicate, tintinnabulary devices scored for wonderful effects by impressionistic composers such as Debussy. By experimenting with a bar from a glockenspiel, suspending it on a thread, and striking it with a plastic comb, he found the precise effect, but only after collecting all the different types of plastic combs he could find and testing each one. As he approached retirement, he passed his secrets on to his best pupils, who joined the Orchestra and carry on the tradition.

Many such instances exist where present Orchestra members were trained and inspired by the masters of the early Philadelphia personnel. The finest pupil of the distinguished French horn "first chair" Anton Horner, who joined the Orchestra in 1902, is Mason Jones, the present first horn player and unsurpassed in the world today. His star pupil is already a member of the horn section. Almost every member actively teaches, thereby ensuring quality and stimulation for future Philadelphia orchestras.

William Smith, the highly talented and articulate assistant conductor, points to two other areas of influence on the sound of an orchestra—the shell, or stage enclosure in which the orchestra plays, and the acoustical quality of the hall into which the sound is projected. The stage enclosure is effectively the orchestra's sounding board, the hall its resonant cavity. Deficiencies in either can result in distortions in the sound and balance created by players and conductor. At its home base, the venerable Academy of Music, the Orchestra has faced not altogether favorable conditions for displaying the quality of its sound production. Although popularly considered a fine concert hall, it was designed primarily for operatic performances. Built in 1856 on a design modeled after the most distinguished house for such productions, La Scala in Milan, the Academy's tiered horseshoe brings its almost 3,000 seats close to the stage for maximum delineation of clarity. Orchestral sound, however, should not be heard as individual instrumental tones, and, despite some successful efforts to improve the balance of sound projected to the audience by new stage shells installed in 1922 and again in 1964, the Academy audience still cannot enjoy the full opulence of ideally blended tone colors that is so apparent, for instance, when The Philadelphia Orchestra performs in Symphony Hall in Boston. Although a great sense of intimacy exists between listener and performer in the Academy, there is a lack of sufficient reverberation. It is the effect of multiple reflections of sound in a concert hall that musicians and composers actually use to impart blending, sustaining, and dynamic qualities to their music. Also, reverberant sound returns to the performing musicians from the hall—from which they gain security in knowing their sound is reaching the listener and from which they can judge dynamics, balance, and tone color.

Philadelphia audiences suffer no conscious loss from this absent ingredient, but, in the environment of perfection in which Ormandy and his musicians reside, it is a source of concern and stimulates constant experimentation with the compensating measures within their control. One theory, however, suggests that, had the Orchestra been housed in a more sympathetic acoustical setting, its tonal efforts might not have been so exhaustively exerted and the results not so universally recognized.

When recording production of the Orchestra was recently returned to RCA (its first half-century of recording activity was almost equally divided between, first, RCA and, then, Columbia Records), the problem of *where* to record the Orchestra was discussed. All concerned reasoned that an orchestra plays better in the stage shell and hall where it rehearses and performs—particularly the stage shell that controls its direct sound balance. Without sufficient reverberation, a sonic impression of the hall on a recording is absent. Today, the living room record audience expects symphonic music on records to have the same sonic feeling as that in the concert hall. Columbia Records had met this need over the past 13 years and effectively supplied the consumer with the sound of the Orchestra recorded in the Town Hall ballroom, Philadelphia. Thanks to the responsive flexibility of musicians and conductor in adjusting to this radically different acoustical setting, great recordings in highly sympathetic sonics have delighted music lovers over the world. (Ormandy has recorded more than 300 LP records and holds three of the six classical Gold Records ever given, each representing sales of $1 million.)

The rationale of documenting the sound and substance of this unique orchestra in its natural home stimulated RCA to take steps to modify the reverberation character of the Academy so that it would be able to record there in all its sonic glory. To Ormandy and his players, the effort was a resounding success—they could, for the first time, hear their sound returning to them from the Academy walls. Additional improvements are currently being explored that would allow concert audiences in the Academy to enjoy even greater sonic benefits.

Ormandy conducts about 110 of the Orchestra's 170 performances a year at home and on tour, for radio, television, and recordings. Continuing the record of "firsts" (he gave the first symphonic telecast in 1948), he introduces, on the average, 12 new works in Philadelphia every season, including American or world premieres. Fifty compositions are added to the Orchestra's repertoire annually.

Over the past 28 years, Ormandy has given the Orchestra a stability that is in evidence in his confidence in meeting new projects with the eagerness of a beginner and carrying them through with the efficiency of a pro. He works out details, careful to preserve the phrasing, the harmony, the intonation, and the sonority of every orchestration. His respect for time is evident in the tempos he chooses, both on stage and in his personal contacts. Although he berates himself for a lack of patience and diplomacy in human contacts, it is actually the directness as well as the enthusiasm of his personality that govern both his musical and personal performances.

It is these Ormandy qualities—and the over-all quality of his superb orchestral instrument—that have made the "Philadelphia sound" world-famous. A music critic in Katowice, Poland, wrote: "The ensemble is full of clarity, light, and warmth . . . as if created by one hand on one magic keyboard." And an American music lover recently expressed his feeling by this comment: "Listening to Ormandy conducting The Philadelphia Orchestra is an experience comparable in sound to the wondrous sight of the Grand Canyon." ■

Ormandy on the podium.

Television's Golden Age of Sports

New techniques and wider TV coverage have created an unparalleled interest in sports, both in the living room and at the scene of action.

by Ed Weisman

Not too long ago, letters were delivered to the sports vice presidents of the three major television networks. They were official notification that sealed bids would be entertained, two weeks hence, for the exclusive rights to a ping-pong tournament. The ambitious promoter probably had read that a network was awarded exclusive rights to one season of professional football in exchange for $18 million.

In another instance, a Midwestern letter writer informed a network sports department that he had developed a new game, "Broom-ball," which was sweeping his neighborhood. He offered to arrange a match for national television if the network would agree to a $25,000 contract. This optimistic businessman might have heard that soccer, a relatively minor sport in the United States until now, was getting its chance to become "big time" through coast-to-coast TV exposure while realizing a substantial fee from the carrying network.

Another time, a television crew was dispatched to Mexico to cover a Grand Prix auto race. While there, the producer wanted to film a 10-minute segment of the now-famed Acapulco cliff diving act, to help spice the road race program, which could become fairly dull if one car gained a healthy lead at the start. He approached a spokesman for the divers, who obviously had visions of earning a retirement villa with a single leap. "Sure," said the Mexican, "we would be happy to dive for $100,000." The startled producer politely explained that his program budget hardly called for such an expenditure, thanked him, and started to leave. Nonplused, the diver made a second offer. "Would six divers at $10 each be too much, señor?"

The Mexican initially might have thought that, if a World Series was worth $6 million to an American TV network, surely the exciting 80-foot dives from the jagged Acapulco cliffs should call for one-sixtieth of that figure. Although he dropped the price $99,940, it was not a bad move. The national exposure resulted in more television coverage with much higher fees and, in addition, attracted tourists to Acapulco to see the daring athletes perform their specialty, which up to then had been little more than a rumor.

That has been the story of sports in the last half-dozen years. Telecasts of football and baseball games, golf and tennis matches, horse races, track and ski meets, hockey and basketball contests, and other events have increased general interest in these sports. As a result, live attendance has boomed in almost all cases, contrary to predictions by critics that sports would soon be played in empty studio-arenas to an audience of living room spectators. In fact, television has made the present time the true "golden" era of sport, supplanting even the 1920s, which produced such fabled national heroes as Babe Ruth and Jack Dempsey.

While professional football, for example, was certainly more than a rumor before national television became a factor, it is now almost necessary for the networks to schedule nothing but football on fall weekends to satisfy their affiliated stations and the gridiron-hungry public. This season, all three networks have scheduled football games during prime-time evening hours as well as double-headers on weekends. Therefore, the securing of television rights to any one of the three major football packages has become perhaps the most competitive exercise among the three. At the moment, each network has one: NBC, the American Football League; CBS, the National Football League; and ABC, the NCAA college football games. But all three contracts terminate at the end of the 1969 season, and what will happen in 1970 is a question mark.

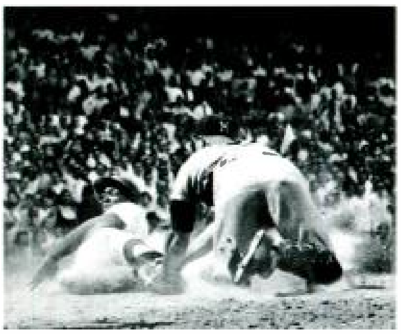
It is hardly disputable that professional football has become the glamour sport of today, although baseball, the venerable national pastime, has shown a steady growth on TV since the first national, no-black-out television contract was signed in 1965.

Ed Weisman is Coordinator of Sports Information for NBC.

One of the major reasons for the popularity of pro football is that it is probably the one major sport best suited for television viewing. Its bruising physical contact and intricate play patterns are kept in constant focus by one of up to seven cameras covering each game, supplemented by ever-improving production techniques such as instant replays, isolated cameras, slow motion, and stop action. In addition, the sport caters to the American fan's desire for "heroes" and high-scoring action.

Yet, popularity was a long time in coming for the pro game. In 1934, for instance, the total attendance figure for the 60 regular season games of the National Football League was only 492,684, or an average of 8,211 a game. The stars of that era were paid on a per-game basis, usually between $100 and $175. Television discovered pro football—via multi-regional contracts—in the 1950s, and both interest and attendance soared. By 1957, total attendance for the 72 NFL games reached a healthy 2,836,318 (39,393 a game), and the average player salary rose to around $7,000 a year. Five years later, the NFL entered into its first single network agreement with CBS, receiving some $4.65 million a season in exchange for exclusive coverage rights. The current agreement with the network calls for the sum of $18 million for regular season television rights.

TV exposure continues to stimulate, rather than discourage, attendance. Last year, nearly 6-million fans paid their way into 112 regular season games with the

average attendance topping 53,000. Salaries have kept pace with attendance. In recent negotiations with the club owners, the NFL Players Association revealed that the average athlete earns about $25,000 a year.

The American Football League, on the other hand, admittedly owes its very survival to television. In 1960, its first year of play, total attendance for the 56-game season was only 926,156, or just over 16,500 for each contest. Yet, the AFL was on solid ground as a result of a five-year TV contract with ABC, signed before the first kickoff. It received $1,785,000 that first year, and the figure graduated slightly in each of the succeeding four years.

Attendance and public interest grew with TV exposure, and the AFL signed another five-year agreement, this time with NBC. It called for the payment of $36 million to televise regular season games and $6.7 million for All-Star and championship coverage during this period. In 1964, regular season attendance for the 56 AFL games rose to 1,447,875, or an average of 25,855 per game. Last year, the AFL—playing under a merger agreement with the NFL that becomes total in 1970—played to a live audience of 2,295,697 for its 63 regular season games, an average of 36,439 for each contest.

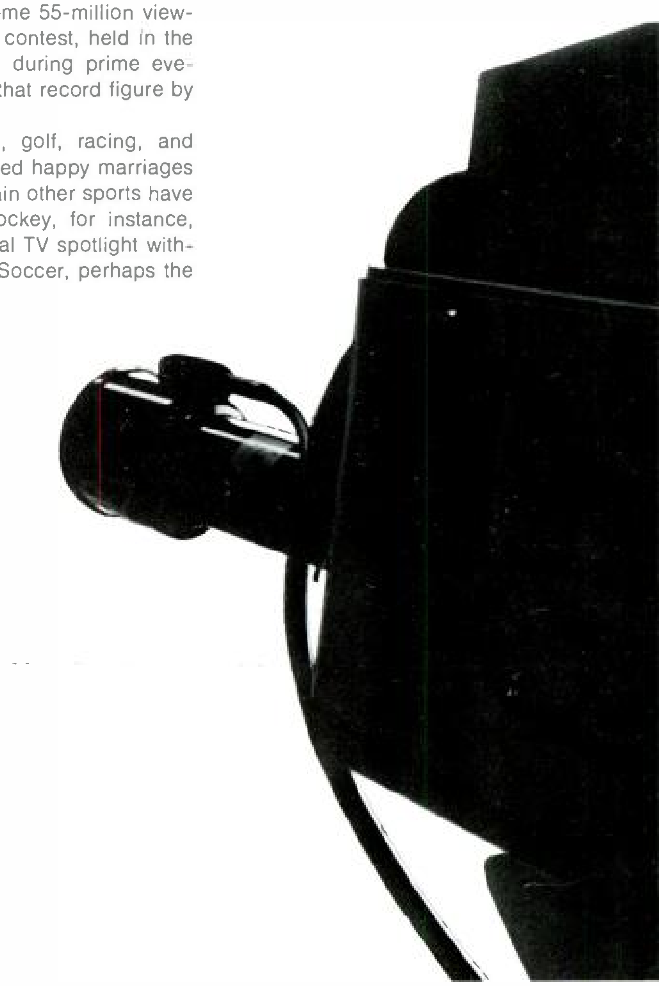
Television rights to championship professional football games have become one of the most sought-after and expensive network prizes. In 1961, NBC secured television and radio rights to the NFL championship contest for two years at a cost of $615,000 a year. Next January, the same network will televise and broadcast the AFL-NFL Super Bowl game after paying $2.5 million for the exclusive rights.

Golf has shown just as dramatic a growth rate as football since television began covering the major tournaments. In 1958, total official prize money for 39 tournaments passed the $1-million mark for the first time in the history of golf, averaging $25,789 a match. An estimated live audience of 940,000 (24,103 a tourney) attended the matches. Arnold Palmer was the leading money winner that year, earning $42,607.

Last year brought a tremendous upsurge in every one of these figures. Total official prize money for 37 tournaments reached $3,979,162, an average of $107,545 a match, and there is no doubt that the total figure will top $4 million in 1968. An average of 47,789 persons attended each 1967 tourney for a total of 1,768,205. Arnold Palmer, with official earnings of $184,065, was only the second leading money winner, topped by Jack Nicklaus who drove and putted his way to $188,988 in official earnings. Again, television exposure and money paid for TV rights are responsible for the great increase in numbers.

Although baseball has been under fire, because of an alleged overbalance of pitching as against hitting, the trend as far as national television is concerned has been "up." In 1965, baseball signed its first exclusive television contract with a national network for a "game-of-the-week" without blacking out any city. Prior to that, there had been network TV but with the major league cities—the biggest markets—blacked out. That year, ABC, the carrying network, reached some 3.5-million homes weekly but did not choose to renew its option. NBC, which already had the rights to the World Series and All-Star games, was awarded "game-of-the-week" coverage rights in 1966 and carried the diamond action into 5-million homes each week. Last year, the figure rose to about 7-million households. The All-Star game last year from Anaheim, Calif., realized a record television audience of some 55-million viewers, and this year's contest, held in the Houston Astrodome during prime evening hours, topped that record figure by 3 per cent.

Although football, golf, racing, and baseball have enjoyed happy marriages with television, certain other sports have not. Soccer and hockey, for instance, were given a national TV spotlight without much success. Soccer, perhaps the



most popular sport in the world as far as attendance is concerned (crowds of 100,000 are common in the large European cities), has at best only an ethnic following in the United States. Some of the reasons given for the general apathy are that there are few, if any, home-grown American players; excitement does not measure up to the typical American games of football and basketball; there is little scoring action; and viewers do not see the plays developing.

Hockey enthusiasts are as rabid as any football fan, and in an arena the game is exciting. But somehow the speed and excitement do not come across on the television screen. The puck is hard to follow and so is the play-making. Major league hockey, too, had been more or less a regionalized sport until its recent expansion, with most of the interest centered in the northeastern quarter of the country. Although there are now new teams in the West and South, it will probably take a few seasons before they gain dedicated fans.

Production techniques have been constantly improved to keep pace with the growing TV sports audiences and their greater knowledge of the games. Women and children as well as men are growing more and more aware of the intricacies and chess-like strategies that are even more important than pure athletic prowess. Twenty years ago, a World Series would be covered by three cameras and, more often than not, viewers would be watching a slide asking them to "stand by" until certain technical difficulties were cleared. Today, as many as nine cameras, each equipped with a variety of newly developed lenses, will cover such an event. These can include cameras high above home plate, low behind first base and third base, and in the center-field bleachers with telescopic lenses that can pick up a dimple in the catcher's chin, and slow-motion, stop-action equipment that ensures that not a thing taking place on the field will be missed.

Sports production people agree that a golf tournament is one of the toughest events to cover. There are usually cameras following the action at the final five holes, and crucial shots can be happening at all five places at once. The task of the producer and directors is to decide in an instant whether to switch from a Palmer putt to a Nicklaus drive. They can't afford to miss a key shot, which means that cameras have to leapfrog and commentators must be apprised of everything that is happening in the match. To tie this TV bundle together, the producer —seated in a control truck, remote from the fairways—captains an intricate line of communications. Instructions from him are beamed to his directors, cameramen, a platoon of sound technicians, and the five commentators who are deployed at each of the greens. Also inside the control truck, a director scans the pictures being fed by each of the cameras. At his direction, a technical director pushes a button that puts the picture from the chosen camera on the air, while at the same time alerting an announcer that his area of coverage is being televised and his microphone is open.

A typical network crew covering a major golf tournament would consist of around 75 men, or about half the number of competing golfers. They are supported by a dozen or more cameras, five miles of camera cable, two or three mobile units, two special trailers, as many as five specially built TV towers, another five miles of telephone and microphone wires, and sometimes even a raft to float a camera on a water hazard.

Football is easier to cover than golf, simply because all the action occurs in the 120 yards from end zone to end zone. On a seven-camera pickup, there are usually a camera on a mobile unit ranging up and down the near side line; one on each of the 20-yard lines high up above the press-box level and two on each side of the 50-yard line, all four high up above the press-box level; one in an end zone, suspended from a crane or placed on a platform near the top of the stadium; and one portable, hand-held camera covering anything of interest on the far side line, including fan reactions.

Again, the pictures from each of these cameras are fed into the mobile control room where the director scans the panel of monitors and decides which picture is to go into the nation's living rooms. Also at his disposal are two video-tape machines and one slow-motion disk apparatus. On a given play, perhaps third down and eight yards to go, the director (or producer) anticipates that the next play will be a pass. He quickly assigns two of the cameras to focus closely on the two likely pass receivers while the other cameras are covering the quarterback and the ball. He then instructs the tape-machine engineer to apply the two video-tape machines to the cameras covering the receivers. If he has guessed right, and the pass is to one of the receivers covered on tape, he informs the announcer that an instant replay, isolated on the pass catcher, is about to be aired. The video tape shows the receiver at the line of scrimmage, running his intricate pass pattern, catching the ball, and being hit by the defensive backs or pulling away for a long gain.

If the slow-motion disk has also captured the particular play, it can be rerun, perhaps from another angle, showing the receiver loping or cutting around the defender and catching the ball—all in slow motion. The engineer can stop the action at any point by merely pressing a button at the instant the ball is caught or at the point where the receiver fakes the defender. In appearance, the slow-motion machinery is a silver, seven-inch record on a turntable, which can record only 30 seconds of action. The disk can be played back at slow-motion speeds of three, five, or seven to one.

Preparation for telecasting a sporting event begins long before the first fan files into the stadium. Weeks in advance, the producer, director, and a technical supervisor visit the site of play to make a survey. They examine the area to decide how many cameras will be needed and where they should be placed, the amount of mobile equipment required, the number of private telephone lines to be installed, and where the microphones should be placed to pick up crowd and game sounds. In addition, arrangements have to be made to secure accommodations for the crew and for the feeding of the small army of TV personnel on the day of the event.

About three days before the game, the network crew descends upon the site for the final set-up. Cables are laid, microphones placed, monitors installed, and platforms built. On the day before the contest, all the equipment goes through a dry run.

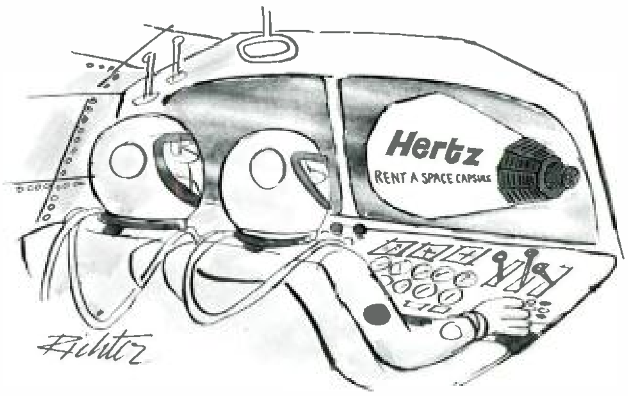
What appears on the screen as three hours of football or 90 minutes of golf is the end product of some 700 man-hours of work and preparation. This does not include the hours of negotiations between the network and the sports producer, interdepartmental meetings at the network and affiliated stations to clear the necessary air time, and the sale of commercial time to advertisers.

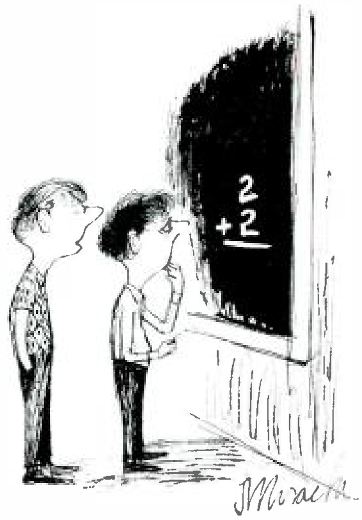
When it's all over, there's another game next week. ■

This Electronic Age...

"We're fully set up to give you truth, facts, educated guesses, predictions, and hot tips."

"Well, Margaret, I've been able to identify every one but that saucer-shaped thing."





"Of course it isn't easy.
Nothing worth doing is easy."

WANTED: Human Skills for the Computer

Human skills are in increasing demand to design, build, maintain, program, operate, and market the computer.

by Steven Norwood

In 1950, there were only about a dozen electronic digital computers in the United States. Today, there are more than 40,000, many directly affecting the working life of almost every American citizen. They prepare salary checks, process personnel data, and have opened up a large number of career opportunities in fields ranging from missile tracking to banking as well as in the computer industry itself.

Although there are no official statistics, one prominent industry figure estimates that more than a half-million jobs and at least 30 new industries have been created by the computer. In addition, tens of thousands of positions are going unfilled owing to a lack of qualified applicants. For instance, there is a present need for at least 60,000 more programmers. This need will multiply into the 1970s, as the industry continues to expand. "At the current growth rate of the computer industry, society will soon need as many programmers as TV repairmen," forecasts one manufacturer.

Available data point to a continued growth for the industry. It is estimated that the number of computers in this country will more than double by 1975, reaching a total of nearly 100,000. Yet, even this figure understates the situation. Individual computers are becoming more powerful, and shared-time arrangements are increasing operational efficiency. As a result, it has been estimated that computing power is doubling each year. This is necessary to keep up with the global tidal wave of change, in which useful paper is accumulating at a rate of a million new documents a minute and worldwide knowledge will soon be doubling every five years.

Despite all its varied applications, the computer is still basically a machine that adds and compares figures at tremendous speeds. Human skills are required to program, operate, market, service, and adapt the machine to the requirements of the user as well as to design and build the hardware and accessories.

Since computers must be precisely instructed on how to handle each problem that develops, the most critical personnel need, both in numbers and percentages, is for people to design and develop software (programming) systems. To fill this need, business and government are looking for problem-solving-oriented people with orderly minds, able logically to break down a problem into its basic components.

The top-echelon line (operating as opposed to staff or supervisory function) software man is the systems analyst. He is the strategist of the programming team, but in some smaller companies he may be the programmer as well. It is his job to collect pertinent facts concerning informational needs and analyze them to define his objective. He is then able to formulate an efficient pattern of data flow, from the source to the computer, and design a computer process that best turns the raw data into useful information. For example, a systems analyst in an industrial plant might analyze time studies, inventory records, marketing forecasts, and equipment down time to develop a computer-based, integrated production system. In complex scientific and over-all management problems, the analyst may employ operations research and make a mathematical model of the situation to provide quantitative data for a solution.

A typical analyst is young—perhaps in his late twenties or thirties—with at least an undergraduate degree and two years of programming experience. According to a report of Business Equipment Manufacturers Association (BEMA), the business-oriented analyst starts at a salary of about $8,000 a year and, as a lineman, expects to make up to $17,000, though engineers and scientists with advanced degrees can earn a good deal more. However, he probably does not view systems analysis as an ultimate career goal but rather as an entree into middle and top management.

There are usually two disciplines within systems analysis—science and business. The engineering-scientific analyst may handle such problems as fuel requirements for a spacecraft or controlling a nuclear process. Since his work is highly technical, an advanced degree in physics, mathematics, computer science, or an engineering science is almost always required. Educational requirements for the business analyst are much less rigid, although a business administration degree is helpful. Business experience and training, plus the ability to reason logically, are very important. Assignments in this area run the gamut from computerizing payrolls to automating inventory control.

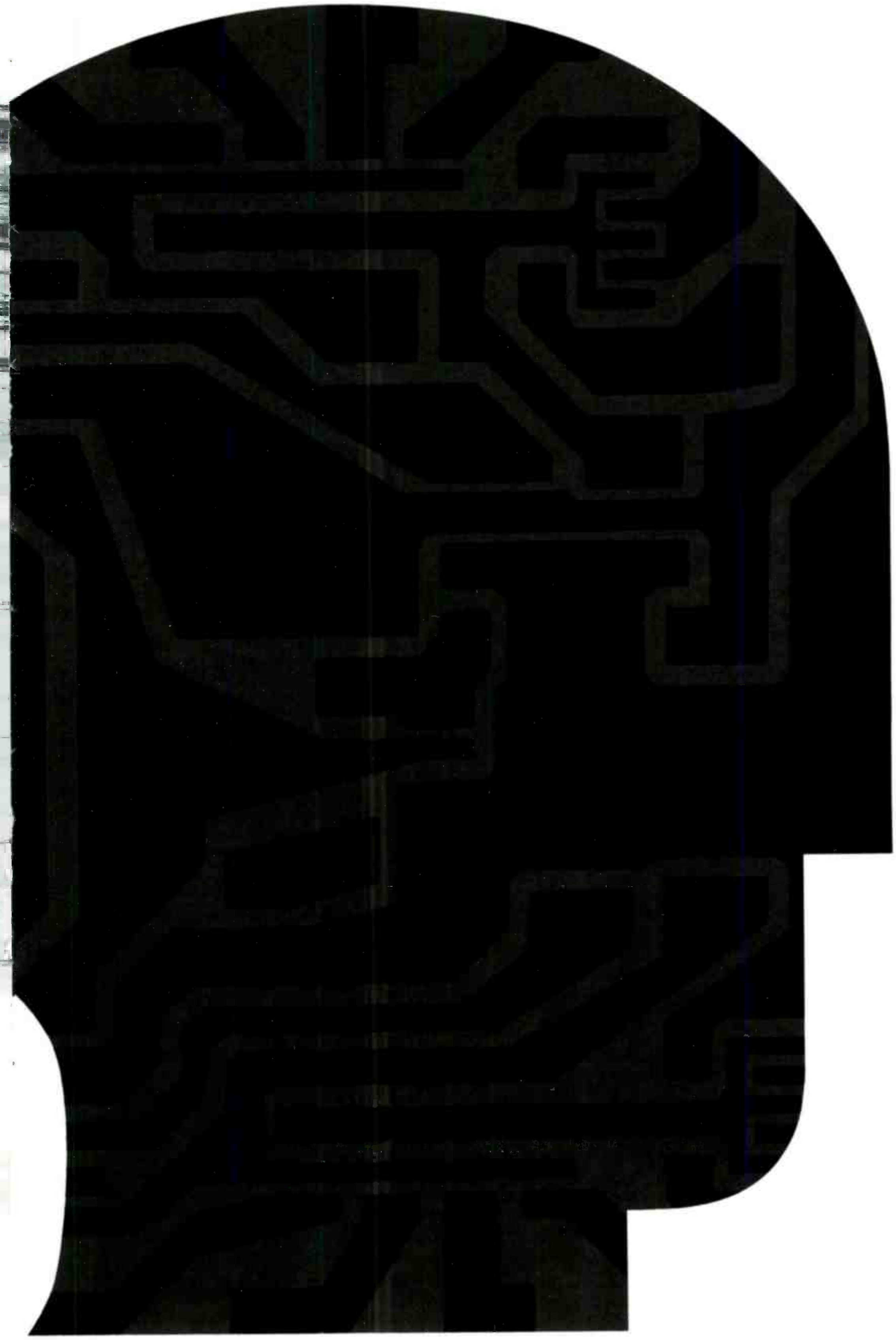
Once the analyst has completed the design of an information processing system or has outlined a computer-oriented solution to the problem, it goes to the programmer, the tactician of the team. It is his job to translate the outline into a detailed instruction plan for the computer. He usually does this by designing one or more flow charts that, in sequence, precisely inform the computer what steps should be taken when a specific condition arises. In many organizations, these charts are then given to a coder (junior programmer) who converts them into the specific computer language of the EDP system involved. The program is then tested and "debugged" by running sample data from the project through the computer.

Until recently, the programmer was the generalist of electronic data processing, handling all assignments regardless of subject. However, with the advent of third-generation computers and increasingly sophisticated EDP applications in both industry and government, the trend has been to specialize in one of three areas—science, business, or operating systems.

The average scientific applications programmer, on the operating level, is usually only a few years out of college and probably equipped with at least one advanced degree. His starting salary is high—scaled up to $750 a month with a B.S. degree and to $950 with a Ph.D.—and his earning power is about $12,000 to $18,000 a year in his present job. If he moves to a supervisory position, however, his salary potential jumps to $24,000 a year or more.

The business applications field, on the other hand, is open to many high school graduates with computer school training and business experience as well as to college men and women. The typical business programmer is probably older than his counterparts in the other specialties, since he may have had several years of coding and computer operations experience before advancing to his present position. Interestingly, this field also attracts people who have made a career change, including such professionals as former schoolteachers, accountants, and lawyers, all with the common denominator of a detailed and logical mind. Starting salaries in this area range from $350 to $425 a month, with $100 more for each degree. But on-the-job experience quickly ad-

Steven Norwood is a free-lance writer.



vances earning power, with top-line salaries reaching $12,000 to $17,000 a year and supervisory positions paying up to almost $20,000.

The third specialty, systems (software) programming, is a highly technical field usually requiring an advanced degree. Unlike other programming areas, it deals with the computer itself rather than with its applications. For instance, the software programmer may schedule the use of the varied components of the computer, such as input/output devices, and assign project priorities so that the EDP system will be used more effectively.

Systems programming can be a lucrative career opportunity for the college-trained programmer. Starting salaries range from $575 to $650 a month, and potential earnings, even in on-line jobs, can reach $24,000 a year. Managerial assignments in software development usually pay between $14,400 and $30,000 annually.

Once the computer is programmed, operations personnel take over. These computer operators, keypunchers, and scheduling and control clerks carry out and help maintain the programmed system. For example, the computer operator may correct minor malfunctions or call in the field engineer. In some cases, he has the option of rearranging the sequence of programming steps, so the operation will continue in case of a breakdown in one component.

The computer operator position is one of the prime avenues to an EDP career for the high school graduate with some college or computer school training. Successful operators can be promoted into a variety of supervisory positions, or they can move into programming and systems analysis. A college degree acquired along the way is helpful, if the operator aspires to the latter course.

One of the most financially rewarding segments of EDP is marketing—but it is also one of the most risky. According to a marketing executive of a large computer manufacturer, only about one out of four trainees ever makes a successful computer salesman. "This is because engineering proficiency is not enough. Successful marketing men in this field must be combination businessmen, salesmen, and technical consultants. Most computer salesmen are articulate and have an outgoing personality. They have a broad-based knowledge of business and management and are thoroughly proficient in the particular industry they service. Finally, they know their computer system inside out," he explained.

Most computer manufacturers look for a sales candidate with an advanced de-

"By the year 2000, many economists expect the computer industry to be the single largest employer in the United States."

gree, preferably in business administration, and then put him through a lengthy training period. At RCA, for instance, the fledgling computer salesman begins his career with intensive formal classroom and laboratory training. About half of this period consists of instruction in computer theory and general EDP applications. The rest of the training cycle entails learning advanced hardware–software interrelationships and dealing with problems of specific industries such as transportation or manufacturing. As one manager explains, "The complexities of business today make it necessary for the computer salesman to have a knowledge of the total management picture before he can plan a solution to a specific problem."

After the classroom training is over, the sales candidate spends up to one year in the field under the supervision of a senior salesman, with frequent trips back to his home base for additional training and evaluation. In the year following his training period, the computer salesman can expect to earn from $10,000 to $12,000. However, if he is successful, his income will probably jump to around $15,000 to $20,000 annually, within the next two years. One executive estimates that the top 2 per cent of the sales force earn $40,000 after only 24 to 36 months on the job.

Failure to make the grade in the highly competitive computer marketing field does not necessarily eliminate a man from an EDP sales career. Well-trained ex-computer salesmen are in high demand by manufacturers of peripheral equipment and computer software companies.

Backing up the computer salesman is the systems engineer. It is his responsibility to aid in the selection of EDP hardware as well as in the design of the software system. In short, he is a consultant for the customer.

The systems engineer is usually a business administration graduate, but an advanced degree is not a necessity. His starting salary after training will range up to $10,000 a year, and he will probably earn from $12,000 to $15,000, after three years on the job. If successful, he will reach a top salary of around $20,000. According to one source, some 60 to 75 per cent of the trainees entering this field are successful. In addition, the experience gained on the job gives the sales systems engineer an excellent background for promotion into higher management.

Once an EDP system is installed, it is the responsibility of the field engineer to maintain it, correct malfunctions, and upgrade equipment when necessary. The aspiring field engineer does not necessarily need a college degree, but he must have a high school diploma and one or two years of computer school training. His earning potential on the job is comparatively high; a typical field engineer will earn between $6,000 and $10,000 a year, with the top supervisors making up to $20,000.

The skills needed for the designing and building of computer hardware are generally higher than for other manufacturing fields, according to a survey by the U.S. Department of Labor. The same survey reveals that a college degree or equivalent experience is required for one out of every four positions in the industry. This is largely because the computer industry is heavily research-oriented, with 60 per cent of all engineers and scientists having R&D as their primary function. According to a BEMA report, computer manufacturers support much basic research in physics, chemistry, and mathematics as well as applied research aimed at developing better techniques, materials, and equipment for their products.

Recruiters for all computer manufacturers scour college campuses across the nation seeking engineers in almost all disciplines. In addition to evaluating a student's academic record, they look for extracurricular activities and other indications that he can work well as part of a team. Testing and interviewing techniques are used in an attempt to determine whether the candidate has an orderly well-disciplined mind and outlook. If a graduate is accepted, he will start at a salary of around $600 to $650 a month, with $75 to $100 a month more for each advanced degree. He can earn up to $18,000 to $24,000 a year in a line engineering position and up to $30,000 as a manager below the executive level.

High school graduates with technical school training can enter the computer hardware field as technicians, engineering aides, and draftsmen, at starting salaries usually ranging between $275 and $375 a month. However, successful technicians can raise their incomes quickly, and they have a chance to move into professional and supervisory positions if they take college courses in their spare time.

The academic world has been responding to the need for skilled manpower in all areas of the computer field. More than 900 colleges and universities in the United States and Canada have courses in computing and data processing. Penn State, Yale, Columbia, Princeton, MIT, and other top-level universities are even offering a doctorate in computer science.

However, the value of a Ph.D. in this field has been questioned by several computer executives. One objects on the ground that "It places the young computer scientist in a one-dimensional, blue-sky world of mathematics, out of touch with the practical EDP business and industrial applications that are the backbone of our business." Other industry figures disagree, pointing to the need for adequately trained young scientists to cope with the increasing complexity of computer technology.

Dozens of colleges and universities also offer computer science degrees at the master's level. Presently, there are still only a handful of institutions that schedule undergraduate courses leading to a degree in data processing, but there is a growing trend in this direction.

In addition, there is the computer school, an institution that is springing up all over the country to train personnel principally in the programming and operating areas. It is estimated that, last year, these schools turned out 30,000 programmers and 25,000 computer operation technicians.

One of the best-known and oldest of these schools is RCA Institutes, an organization whose broad aim is to qualify its graduates for responsible technical positions in electronics as well as to keep scientists and engineers abreast of advances in their fields. There are two basic programs at the Institutes for students who wish to make a career in the computer field. The first is the Digital Computer Electronics Program, a six-month course that offers training in the field of computer devices. In the software area, there is a series of courses in digital computer programming that includes general programming, for any type of computer, as well as courses specifically for the RCA Spectra 70 and IBM 1401.

Another example of a computer school is the Automation Institute of America, Inc., a subsidiary of C-E-I-R, Inc., the programming consultants. The AIA operates more than 50 schools that offer courses at two levels. The first is in computer programming and involves about 420 hours of instruction. A more advanced, 120-hour program trains the student in systems analysis and design.

But the need for human skills to design, build, program, and operate the computer is only part of the story. Tens of thousands of peripheral jobs have been created by the need to service the EDP industry. There are currently more than 28,000 companies producing more than a quarter-million items for computer systems. For example, an entire industry, providing thousands of jobs, has been established to provide the specialized flooring required for computer rooms.

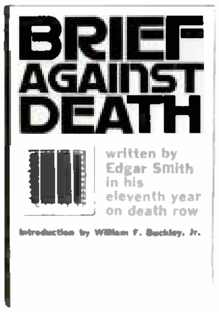
In addition, many new industries and government projects are heavily dependent on EDP. The space program would be grounded without the computer and its ability to handle in seconds problems that otherwise would require thousands of man-hours in computation.

The need for human skills for the computer will increase markedly in the future before leveling off, with the biggest demand continuing to be for people to design programs and feed the data into the hardware. However, the programmer or systems analyst of tomorrow will probably have to be a specialist—an expert on the problems of one specific industry, such as petrochemicals.

In fact, many computer people expect that many specialized software service companies will be established in the 1970s. These firms will provide expert programming and systems analysis help to the customer in fields too complex for the ordinary programmer.

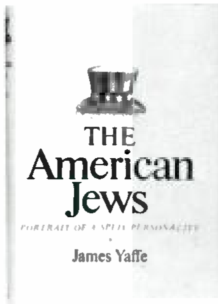
By the year 2000, many economists expect the computer industry to be the single largest employer in the United States, outranking even the auto industry. ■

Books at Random...



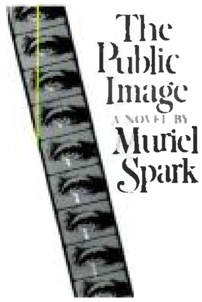
Brief Against Death
by Edgar Smith (Alfred A. Knopf)

The author, an inmate of the Death House of the New Jersey State Prison for the past 11 years, has written an absorbing first-hand description of his arrest, interrogation, trial, imprisonment, and 4,000-day battle to establish his innocence in the brutal murder of a 15-year-old girl. It is the story of a man without status, with no money and little formal education, who has found within himself the resources of mind and courage to fight his case through the labyrinthine machinery of the courts. The book has an introduction by William F. Buckley, Jr.



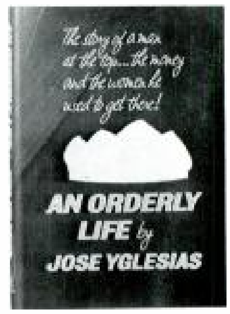
The American Jews
by James Yaffe (Random House)

This widely appealing, detailed picture of the Jew in America today—his accomplishments and failures, his manners and style, and his adjustment to and reaction against his country and community—is not a sociological treatise but a dramatic and human profile. Underscored by a sense of humor, yet understanding and affectionate, this comprehensive book examines the paradoxes and self-contradictions of the American Jew and his attitudes toward everything from sex to religion, from charity to politics, from business to Israel.



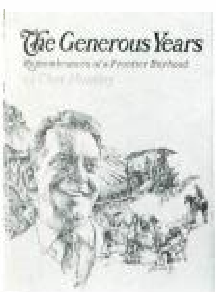
The Public Image
by Muriel Spark (Alfred A. Knopf)

Miss Spark, author of *The Prime of Miss Jean Brodie* and *Memento Mori,* examines the fragile world of the movies and the strain of Annabel Christopher's public illusion on her private life. Nurtured by an Italian film producer and a clever public relations agent, Annabel is known to millions of moviegoers as the "English Lady-Tiger"—a woman whose unexceptional appearance masks a wellspring of passion that may at any moment gush forth, and whose naturally romantic temperament is contained in a marriage of ideal respectability. The author plays with the mysteries of identity and self-knowledge, of image and reality, in a novel that fascinates by its savage portrayal of today's celebrity culture.



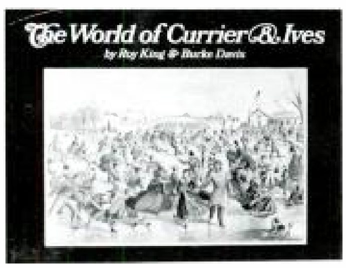
An Orderly Life
by Jose Yglesias (Pantheon)

In his new novel, Jose Yglesias provides a biting and penetrating dissection of Rafael Sabas, a man on his way to the top. The author follows him from his origins among the Latin cigar manufacturers of Tampa to the executive office of a large corporation in New York, describing the methods and morals of a man who uses sex as carefully and as painstakingly as he manipulates money. Rafe has made it: he has ruthlessly, selfishly — and charmingly — used his wife, his relatives, and anyone who can help him. Tough and racy, *An Orderly Life* is a relentless and scathing indictment of the American way of life.



The Generous Years
by Chet Huntley (Random House)

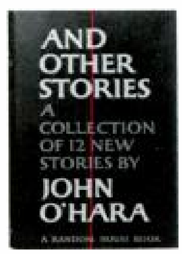
All the joy and adventure of growing up in the last days of the American frontier are recaptured in these reminiscences by one of the best-known TV figures of today. During the period just before World War I and into the mid-twenties, Huntley lived on a ranch in northern Montana, where the characters were tall, traffic accidents were caused by horses, and life — even when it was hard — seemed infinitely simpler than it does today. The author reminisces about rodeos, Indians camping out on the ranch, hobos and his father's fellow railroaders, a living and loving family — and the endless horizon of tall grass, buffalo, and open range.

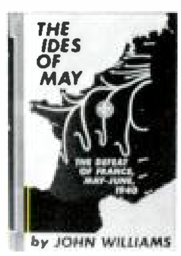


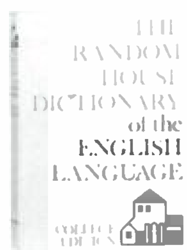
The World of Currier & Ives
by Roy King and Burke Davis
(Random House)

Sixty of the brilliant lithographs that came from the hand presses of "printmakers to the American people" are reproduced in this volume. Selected from Mr. King's collection and printed with complete fidelity by skilled Italian craftsmen, each picture is complemented by a description that evokes the vanished world it represents. The tremendous success of Currier & Ives is traced in a colorful introduction. Also included are an essay on "Collecting and Buying Prints" and a selected list of 250 Currier & Ives prints with market values.

Other Recent Random House Books







The Billion-Dollar Borrowing Business

From computer systems to bulldozers and automobiles to wheelchairs, nearly everything that can be bought today can also be rented.

by Norman H. Solon

Leasing and renting is an expanding multibillion-dollar industry and a catalyst for the American economy.

It is a means for business to obtain the equipment it needs without huge capital outlays while, at the same time, providing a built-in safeguard against premature obsolescence. Leased freight cars and trucks help move basic commodities from coast to coast, and ordinary telephones — also leased equipment — are a vital part of the nation's communications network. At airports, the rented car has become indispensable to the businessman and vacationer in this era of jet travel.

Although most people use the terms leasing and renting interchangeably, they have distinct meanings in the industry. Leasing refers to long-term contracts, with or without service. Renting is short-term agreements with the renting company in most cases providing maintenance and/or other services.

Not only business and industry, but individuals as well, are finding it convenient and economical to rent items that they use only sporadically. The biggest demand in the general renting ("rent all") field is for dishes, silverware, and party supplies, such as bowls and portable bars. However, the more ostentatious host can even rent an expensive antique platter, complete with pedigree, as a conversation piece. And in more than a dozen cities across the country, original paintings from museums and private galleries are for rent.

Most "rent all" firms supply everything from wheelchairs to artificial flowers, or as one lessor put it, "our customers can rent anything from ash trays to zithers." Despite the hundreds of items offered by various companies, general renting is often a surprisingly predictable business. One executive terms it, "almost a barometer of human motivation. In the month before swimsuit weather sets in, we are inevitably swamped with orders for motorized bikes and massage belts by figure-conscious men and women. But by Labor Day, these items are almost always back in the shop, often without much sign of wear."

The rental needs of young marrieds tend to be the same year around—party supplies for eight to 12 people. This will continue until their order is changed to bassinet, buggy, and perhaps a guest bed for a sleep-in nurse. The suburban family, on the other hand, concentrates its general renting requirements on a seasonal basis. It will order spare beds for Christmas visits by in-laws, lawn party equipment in June and July, and oversized serving platters and food warming trays at Thanksgiving.

The needs of the young singles are even easier to anticipate, especially those of the bachelor. Typical are a wine bucket, oil painting, two champagne glasses, and a tape recorder.

Of course, sometimes customer needs can be offbeat. For example, a very proper young businessman startled a clerk at a New York renting company with an order for a live pink elephant. The two-ton pachyderm — doused with removable water-soluble paint — was delivered to the service entrance of the old Ambassador Hotel in time for a New Year's Eve party. Another customer telephoned a request for a rented coffin that she needed, "for just a little while." Very gently, but firmly, she was turned down.

However, "rent all" is just the topping on the leasing and renting industry, with motor vehicle and light and heavy non-vehicular equipment accounting for the vast bulk of business. Although there are no precise over-all figures on the size of the industry, unofficial revenue estimates for all types of leasing and renting range anywhere from $4 billion to $7 billion a year. And it is still expanding rapidly. According to one industry source, the growth rate is about 15 per cent annually, or almost three times more than the gross national product.

Vehicle leasing and renting, which had its modern beginnings about a half-century ago, last year grossed nearly $2.5 billion, according to estimates of the Car and Truck Renting and Leasing Association (CATRALA). However, vehicle renting actually dates back to before the birth of Christ, when Roman entrepreneurs offered racing chariots for hire, complete with driver and whip.

Norman H. Solon is on the RCA Public Affairs staff.

Walter L. Jacobs, an enterprising used-car dealer, in 1918 set aside a dozen Model-T Fords in a corner of his lot and started the first car-renting service, which he called "Rent-a-Ford." A few years later, he sold his growing establishment to John Hertz, who used it as the nucleus in founding the Hertz system. In 1925, General Motors Corporation purchased the business, which was then called the Hertz Driv-Ur-Self System, and, in 1953, sold its interest to the Omnibus Corporation, a New York City private bus company. Omnibus divested itself of its bus interests to concentrate on leasing and renting, and changed its name to The Hertz Corporation. In 1954, Hertz grossed some $22 million. Last year, Hertz, which had registered more than $330 million in revenue in 1966, became a subsidiary of RCA. Today, it is the largest and most diversified leasing and renting concern, with revenue expected to exceed $400 million in 1968.

While the segment of the industry best known to the general public is short-term car renting, truck leasing is the largest from a sales standpoint, accounting for $950 million last year. Car leasing was second, with some $700 million in sales during the same period.

There are three basic types of vehicle leasing contracts, with each type having almost as many variations as there are customers. The first is the full-service contract in which everything from insurance to road service may be included. This arrangement calls for the vehicle to be furnished and maintained by the lessor. The second type is either a partial- or non-maintenance lease that allows the customer to specify the service he wants. It can cover such items as garaging and replacement during down time, be restricted to major repairs, or include any combination imaginable. Finally, there is the finance lease in which the vehicle is supplied without any service. The length of the lease can vary, and, on large fleet contracts, the price is most often settled by competitive bidding.

There are several reasons for the growth of vehicle leasing, which, in most cases, is fleet business. Full- and partial-service contracts eliminate the need for a complex and often expensive maintenance management program. They also provide the company with pay-as-you-use operating expense instead of a prepaid capital investment. This frees cash for other productive purposes—especially important in the tight money market of today.

The finance lease gives the lessee company a source of capital without reducing the money available to it through normal lines of credit.

Illustrations by Tomi Ungerer

One of the fastest growing parts of the leasing and renting industry is car renting, the short-term use of autos by individuals and companies. Last year, American motorists logged some 2-billion miles in automobiles they didn't own. CATRALA estimated that nearly $600 million was grossed in about 10-million rental transactions during the year. Compared to 1966, this would be a growth rate of between 15 to 20 per cent—a growth that is expected to continue at least into the early '70s. The potential is there, since only about one out of every 20 of the nation's licensed drivers has ever driven a rented car.

The largest factor in this growth has been a tremendous spurt in combination airline-rented automobile business and vacation trips, which the renting industry has dubbed "Fly Drive." Now, about two-thirds of all car rentals take place at airports. This market will be broadened still further as more persons fly, especially when the "sky bus" — carrying hundreds of passengers — comes into general use early in the next decade.

The rates of most of the major car-renting companies are based on daily or weekly fees plus a mileage charge. These large renting firms concentrate on providing a broad range of services. For example, they have facilities directly within the airports, at downtown and suburban business centers, in residential areas, and at vacation resorts. In addition, they have "rent it here, leave it there" service between most cities, often without an extra fee. They also offer a wide selection of types and makes of vehicles, including sports and luxury cars. Customers have charge privileges, with renting companies issuing their own credit cards and honoring many other cards. Finally, most major firms have almost instantly confirmed reservation service. In fact, communications have become so sophisticated that the international subsidiary of Hertz uses the Early Bird satellite to transmit reservations to and from some of its overseas offices.

The other major segment of the industry—equipment leasing—is not new, but it has become big business in the past decade and a half. Estimates of revenue vary from $1 billion to $5 billion a year, and leasing may account for as much as 10 per cent of all capital expenditures for equipment in the United States. All types of equipment are leased by industry, ranging from drill presses for fabricating plants to giant cranes and earth-moving machines for construction projects.

Equipment leasing began about a century ago when the United Shoe Machinery Corporation worked out licensing agreements with users of its equipment, and the Union Tank Car Company began to lease its freight cars. However, it was limited primarily to transportation and allied industries until the post-World War II period. Restrictions on the borrowing of money in the early 1950s gave leasing a major boost. They put a squeeze on working capital at a time when industry was under pressure to increase production to offset rising overhead and meet foreign competition. Major corporations, especially in the rapidly expanding electronics and aerospace industries, turned to leasing as a means of acquiring equipment without freezing capital needed for research and sales promotion. Today, according to a recent industry survey, some 90 per cent of all major companies utilize leasing to some extent as a means of acquiring capital equipment. As an executive put it, "Leasing is another form of raising capital. It takes its place alongside bonds, debentures, and preferred and common stock."

There are solid reasons for the continued growth of leasing. Many growing, established firms, as well as small companies that are just getting started, often don't have the cash on hand to purchase all needed equipment at the precise time when business conditions warrant. Leasing can provide the financing they need without a down payment. Companies on firm financial ground also find it profitable to lease under certain conditions. One reason is that lease payments are a tax-deductible item, providing there is no option to buy. Another is that, if a company contracts for a four-year lease on a machine tool whose normal life is eight years, it, in effect, gets the financial benefits of rapid obsolescence. According to an industry survey, most leasing arrangements are on a comparatively short-term basis, with only 14 per cent in excess of five years. In addition, most contracts have an escape clause, although they usually call for a penalty.

Defense business has also stimulated the recent growth of equipment leasing. On "cost-plus" contracts, lease payments are usually counted as part of cost, while interest payments on money borrowed to purchase the same equipment are not.

Leasing also permits a company to risk introducing a speculative new product, knowing it won't be held responsible for the full cost of expensive tooling equipment in case of failure. Also a firm can contract for only the minimum number of units needed for average production, with provision for short-term rental to meet seasonal peaks and emergencies. This eliminates such wasteful expenses for idle units as storage and insurance.

A major part of this equipment leasing business is computers. Until recently, almost all electronic data processing hardware was rented directly from the manufacturer, usually on a short-term basis with an option to renew. Although this was somewhat costly, it gave the fledgling computer industry a chance to incorporate rapidly developing technology into new hardware while protecting the user against obsolescence. However, with the arrival of third-generation equipment such as the RCA Spectra 70 series, the obsolescence factor has been lessened. Most manufacturers of computers foresee improvements in present equipment rather than the development of a new generation of hardware in the next few years.

This is a major reason for the development of a third choice for EDP users—leasing. Computer leasing firms have come into being, offering longer term contracts at a lower cost. (Computer people speak of "renting" from the manufacturer and "leasing" from a computer leasing firm.) These firms, to a large extent, buy their computers from the manufacturer and, after the leasing period is over, sell the hardware to dealers in the emerging second-hand computer market. One marketing executive estimates that between 10 and 20 per cent of all computers are now bought.

Major computer manufacturers tend to regard leasing firms as a stimulant to the industry rather than a new, competing force. In fact, they will provide service and advice to users of their equipment regardless of whether it is bought, rented, or leased. One manufacturer put it this way, "Leasing companies have expanded the entire market area to all our benefit, rather than simply competing for our customers. What's more, these firms are themselves prime customers since they buy rather than rent, thus providing us with immediate working capital."

The future for leasing and renting appears bright, but they are not substitutes for private ownership. The head of one leasing firm explains, "It does not replace traditional methods of procurement, but supplements them. . . . The timing of new assets or asset replacement can be geared to the economics of the item rather than the availability of cash." ■

For the Records...

Martinon: Symphony No. 4 ("Altitudes") and Mennin: Symphony No. 7 ("Variation-Symphony")
Jean Martinon conducting the Chicago Symphony Orchestra LSC-3043

Two influential contemporary composers are represented in this world premiere recording of their works. Martinon's Symphony No. 4 was commissioned by the Chicago Symphony Orchestra and premiered at Orchestra Hall on December 30, 1965. Mennin's Symphony No. 7, which is a single-movement work, was commissioned by the Cleveland Orchestra and George Szell and was first performed in January, 1964.

Shostakovich:
Symphony No. 2 ("To October") and Symphony No. 3 ("May Day")
Morton Gould conducting the Royal Philharmonic Orchestra and Chorus
LSC-3044

This album presents world premiere recordings of two Shostakovich symphonies rediscovered by Morton Gould. These "program" or "choral" symphonies were composed when Shostakovich was in his early twenties. Since both came from a period when the composer was "outside" Soviet cultural circles, they were removed from the repertoire and remained in oblivion until the '60s.

"Crown of Creation"
Jefferson Airplane LSP-4058

Jefferson Airplane—which *Life* magazine termed the country's "top rock group" in its recent cover story on the new rock phenomenon in contemporary music—again demonstrates its ability to consummate the marriage between the group's vocal stylings and electronic sounds for possession of the listener's mind. Through songs like "Lather" and "Greasy Heart," both written and sung by Grace Slick; Jorma Kaukonen's "Star Track"; and Marty Balin's "Share a Little Joke"; the group pushes full throttle for a trip down the runways of the mind and into a flight through the imagination.

Zarzuela Love Duets
Montserrat Caballé, soprano
Bernabé Martí, tenor LSC-3039

On her second RCA Red Seal collection of zarzuela excerpts, Miss Caballé is joined by her husband, tenor Bernabé Martí, in love duets from six Spanish operettas. Zarzuela, a form of Spanish lyric theater, comes from "Fiestas de Zarzuela," composed by dramatists and musicians and originally performed at the seventeenth-century court of Philip IV in the royal palace of La Zarzuela near Madrid. Two centuries later, the Teatro de la Zarzuela was formed, from which comes the modern-day zarzuela.

Nero: Fantasy and Improvisations ("Blue Fantasy") and Gershwin: Concerto in F
Peter Nero, pianist
Arthur Fiedler conducting the Boston Pops LSC-3025

In the more than 40 years since the introduction of Gershwin's jazz symphony, "Rhapsody in Blue," the foundation of this new musical structure has remained, for all purposes, untouched. It was with this in mind that Peter Nero wrote his Fantasy and Improvisations, which is presented in its debut recording. The work, which Mr. Nero and the Royal Philharmonic premiered in London on May 27, 1968, was given its first American performance in June, with Arthur Fiedler conducting the Boston Pops. The album also features Gershwin's Concerto in F.

Rachmaninoff: Concerto No. 3
Alexis Weissenberg, pianist
Georges Prêtre conducting the Chicago Symphony Orchestra LSC-3040

In his initial orchestral recording for RCA, Alexis Weissenberg performs the work that, for him, holds many memories. The Concerto was one of the works he selected to play in the Philadelphia Orchestra Youth Concert and for the Leventritt Award competition, in which he took first place. He made his European debut with this Concerto in Paris in 1960, and subsequently performed the piece in Israel and at La Scala and the Colón in Buenos Aires. After a self-imposed 10-year sabbatical, it was the work with which he resumed his career, performing with the New York Philharmonic at Lincoln Center.

Other Current RCA Releases

Electronically Speaking...

News in Brief of Current Developments in Electronics

Satellite Pinpoints Position of Ships

An electronic star, 600 nautical miles above the earth, is providing such precise navigation that commercial vessels can reduce their ocean-crossing time by as much as 10 per cent.

The new U.S. Navy navigation satellite joins several other spacecraft in a system that enables military and commercial ships to compute their positions to an accuracy of 600 feet, compared with two to four miles with conventional navigation techniques. The satellite is in a 600-nautical-mile, circular polar orbit. This and other Navy satellites make possible worldwide position fixes regardless of time of day or weather conditions, which often degrade the quality of non-satellite navigation methods.

The precision and all-weather utilization of the system also are expected to make it useful for offshore oil exploration, fishing fleets, oceanographic researchers, buoy tenders, and many other activities where precise location is important.

The new satellite was built by RCA's Astro-Electronics Division, Princeton, N.J., under the technical direction of the Applied Physics Laboratory of Johns Hopkins University. The new satellite is the first of 12 RCA will build for the U.S. Navy.

Computers Automatically "Match-Up" Stock Orders, Executions

Computers are automatically "matching-up" orders and executions in the buying and selling of stocks at Goodbody & Company, a brokerage firm with 99 offices from coast to coast. The novel system marks a significant advance in the automation of stock-market transactions and results in faster, more accurate service to customers.

The RCA computer system is eliminating more than 50,000 manual steps in the back office at Goodbody's on any busy day—a major step toward relieving the clerical log jam that has forced leading securities markets to close on Wednesdays.

Goodbody offices throughout the country now receive notification by automatic teletypewriter of a purchase or sale within two to five seconds after it has been reported by one of the floor clerks on the New York or American stock exchanges. Previously, notification averaged three to five minutes on a normal trading day.

Inauguration of the new Goodbody system means that, between placement of an order and the typewritten confirmation of its execution, no human beings are involved except the floor broker who executes it and his clerk who sends out the confirmation message.

At the end of each working day, the new system also will automatically produce information in the form needed for computerized bookkeeping and billing. This now must be prepared manually and entered on punch cards.

Single-Unit Navigational System Developed for General Aviation

An airborne navigational system has been developed that, for the first time, combines into a single unit all functions required by a pilot to fly a true course and make instrument-controlled landing approaches in any type of weather.

The AVN-210 Integrated Navigation System, a major advance in avionics, performs operations previously requiring up to six separate units. It is a new and complete navigation system that eliminates the size and weight penalties of previous equipment, is less expensive to acquire and operate, and requires less power.

The system, developed by RCA, has a complete navigation and ILS capability. It is designed for general aviation aircraft ranging from high-performance single-engine planes through turbo prop and business jets, yet weighs only four pounds and fits in one box measuring three by three by 11 inches. This represents a weight savings of 10 to 12 pounds over comparable systems.

A key design feature contributing to the AVN-210's smaller size, weight, cost, and power consumption is the extensive use of integrated circuits throughout. These tiny chips, which carry an entire array of circuits in a minuscule space, replace many components, each of which is several times larger than an integrated circuit.

In addition to its use in general aviation aircraft, the AVN-210 also has application for airliner-type passenger planes as a backup to the primary systems. Its small power requirement would enable it to function off a battery in case of a total power failure aboard an aircraft. Present airline systems draw too much power to be practical for battery operation.

New Transistor Rivals Electron Tubes in Power

A new laminated construction technique has been used to build experimental transistors that, for the first time, rival large electron tubes in power output.

Although the technique, developed by RCA, is still in advanced laboratory development, one of the new superpower transistors has already generated radio waves oscillating at 1-million cycles per second with a power of 800 watts—three times the 250 watts generated by many standard broadcast radio stations. And considerably higher powers and frequencies are expected.

The new RCA technology responsible for these transistors is a result of a long-term development program, sponsored by the Air Force and Navy, that may eventually make possible all-solid-state sonar, high-power communications systems, electric furnaces, and other heavy-duty items that previously have not been able to be transistorized. It makes use of fusing or laminating of semiconductor materials, ultrasonic cutting rather than photo-etch techniques, and glass hermetic sealing.

Now, for the first time, a feasible transistor structure is emerging that can generate substantial powers that have previously been exclusive with electron tubes.

New VHF Radio for Lunar Spacecraft

The first Apollo VHF radio set designed to calculate range between the Command Module (CM) and Lunar Module (LM) while simultaneously providing voice communications between the two spaceships has been delivered for qualification testing.

During the Apollo manned landing on the moon, the LM will separate from the CM and carry two astronauts to the lunar surface while a third astronaut remains in the orbiting CM. Later, the LM will lift off to rejoin the CM for the return to earth. The CM and LM also will separate in earth orbital missions preparatory to the moon flight to practice the rendezvous and docking maneuvers. During these times, the VHF radios can be used to display to the CM pilot the range between himself and the LM astronauts.

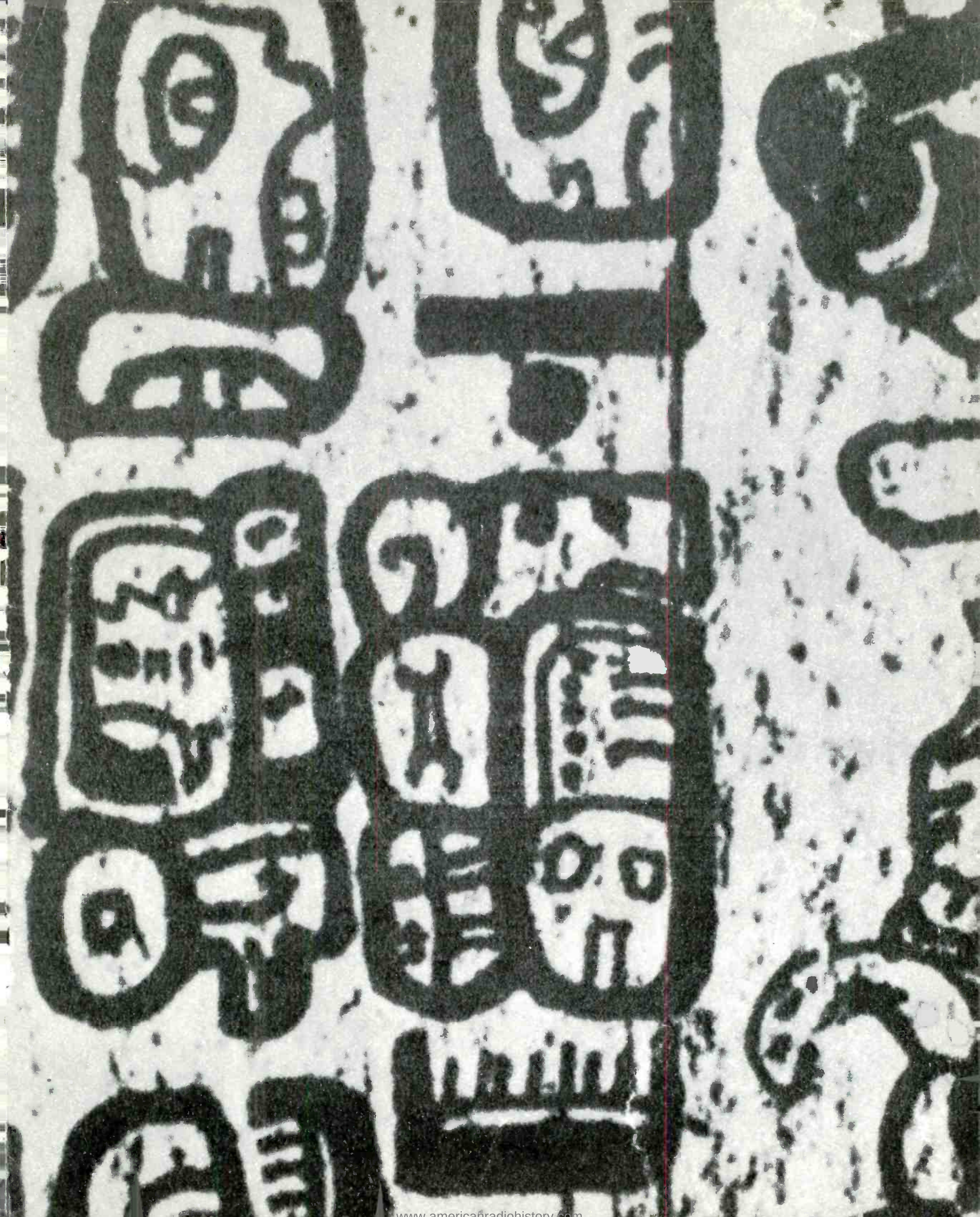
The system, built by RCA's Defense Communications Systems Division, is slated for installation in a Command Module as part of NASA's manned lunar landing program. It includes the VHF radio set plus an associated digital ranging generator that makes it possible to use the radio to determine distance between the two modules when they are separated during maneuvers in space. A ranging tone transfer assembly has been added to the LM VHF radios as part of the ranging system.

The range information will be generated when the CM beams a signal to the LM, which will receive and re-transmit it back. By processing the signal and measuring the time between its transmission and receipt of the LM-relayed return, the CM VHF system will be able to determine distance between the two spacecraft.

The ranging operation can be performed simultaneously while the CM and LM astronauts are communicating over their VHF radios. This dual capacity adds an important source of flight data to the Apollo system at a weight increase of less than 10 pounds total for both spacecraft.

Picture credits: Cover, Werner Wolff—Black Star; pages 2, 3, and 18, Erich Hartmann for RCA; page 24, Erich Hartmann—Magnum; pages 4 and 5, Frank Carroll; pages 9, 11, and inside back cover, New York Public Library; page 10, Bettmann Archive; pages 16 and 17, The Philadelphia Orchestra Association; pages 23 and 24, NBC; page 25 (top), NBC; page 25 (2nd), UPI; page 25 (3rd), Ernst Haas—Magnum; page 25 (bottom), Wide World. All others, RCA.

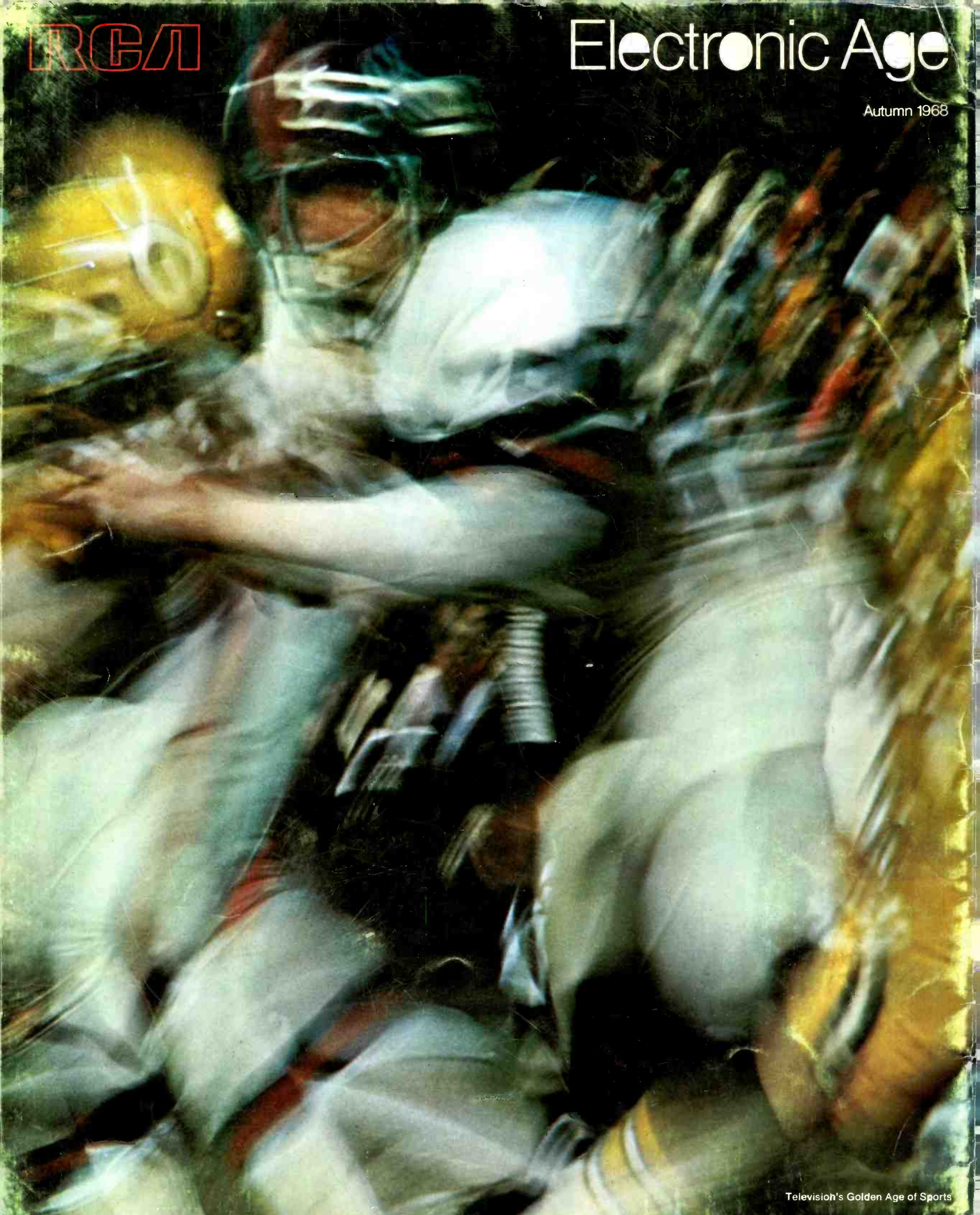
The concept of a word, as it is known in the English language, was unheard of in Mayan. Each symbol or picture represented an entire sentence. When a new term was needed in the language, the symbol was just made longer. In English, the creation of new words, especially technical terms, is more complicated. An article on how technology affects language begins on page 7.



RCA

Electronic Age

Autumn 1968



Television's Golden Age of Sports