A FORECAST OF TELEVISION

Man's range of interest goes beyond the reach of his senses. Of the technical inventions that serve to diminish this disproportion, television is the latest and perhaps the most important. The new gadget seems magical and mysterious. It arouses curiosity: How does it work? What does it do to us? To be sure, when the television sets will have appeared on the birthday tables and under the Christmas trees, curiosity will abate. Mystery asks for explanation only as long as it is new. Let us take advantage of the propitious moment.

First of all, what is the fundamental problem involved in television? Eyes and ears have quite different tasks and, correspondingly, are made differently. The eye gives information about shape, color, surface qualities, and motion of objects in three-dimensional space by registering the reactions of these objects to light. The ear reveals little about the objects as such; it only reports on some of their activities, which happen to produce sound waves. On the whole, the eye takes little interest in the nature, place, and condition of the light sources that make the light rays fall upon the retina. The ear is interested in the source of the sound; it wants the sound waves, on their way to the eardrum, to be as little modified as possible in order to keep the message from the source unaltered. Sound is produced by an object but tells us little about that object's shape, whereas the eye, in order to fulfill its task, must reckon with the fact that a suitable likeness of a three-dimensional object must be at least two-dimensional. The projection of a three-dimensional body upon a two-dimensional plane will give a one-sided but often informative picture. No satisfactory information would be obtained after the even more radical reduction of a body to a one-dimensional object—whether the reduction be spatial, that is, like a line on paper, or temporal, that is, a sequence of changes taking place in one point.

Any sense organ can register only one stimulus at a time so that the eye in order to produce a two-dimensional recording has to consist of numerous receptors that operate one next to the other. The mosaic that results from this collaboration of the receptors depicts three-dimensional space and volume as best it can. The time dimension, which is available in addition, uses the change of stimulation in each receptor to record motion and action.

A different situation is found in hearing. The sounds that exist in auditory space at any one time are not recorded separately but add up to one, more or less complex vibration, which can be received by a single membrane, such as the eardrum. This unitary vibration may be produced by the simple sound of a tuning fork or the complex noises of a crowd of excited people or a symphony orchestra. To some extent the ear succeeds in teasing the complex vibration apart, but
it offers scant information about the locations of the different sound sources. The ear, like the eye, operates with a battery of receptors, and they, too, are arranged in a two-dimensional surface. The receptors of the cochlea are parallel fibers, as different in length and tension as the strings of a harp, and apparently for a similar purpose. The "strings" of the cochlea seem to be activated by resonance when vibrations of corresponding frequencies impinge upon them. This means that the ear uses its receptor field to distinguish between pitches, whereas the eye uses its to distinguish between spatial locations.

Whatever our hearing tells us about space and the directions from which sounds reach us is not strictly indispensable. Radio and phonograph often eliminate the resonance that gives information about space, and never tell about the direction but only about the distance of the sound source from the microphone. Auditory space, as transmitted by these mechanical devices, knows neither right nor left, neither above nor below. It only distinguishes between near and far, and yet we receive a rather complete or at least satisfactory impression. Whatever spatial qualities are transmitted, are derived from modifications sustained by the sound as it moves through space: distant sound is blurred, it is relatively weaker, and so forth.

If we do without directional hearing, the ear needs only three kinds of data, namely, the amplitude of the vibration, which produces loudness, the speed of the vibration, which produces pitch, and the shape of the vibration, which produces timbre (the difference between a flute, a bell, a soprano, a dog's bark). Since all the sounds that occur at a given moment fuse into one complex vibration, only one receptor is needed for the physical recording and transportation of sound. The eye, on the other hand, has to deal with millions of point-sized stimuli, which constitute the visual field. Therefore, in order to see space, volume, and shape, we require a battery of innumerable eyes—all of which are served by one common lens in the human receptor organ whereas insects have individual lenses for every eye. The sensitive surface formed by these eyes reproduces a projection of three-dimensional space.

These are the conditions that determine our modern ways of sending pictures, music, and speech through space. When light and sound do the transmitting themselves, the result is not very accurate even though the distance may be relatively small and our eyes and ears reinforced by mechanical receptor devices. Colors fade, shapes become fuzzy, sounds are blurred as the vibrations that carry them travel through space. In vision, the size of the retinal image depends on the visual angle, which may make objects shrink beyond recognition even at moderate distances. Therefore, definite progress was made as soon as it became possible to translate properties of sound and light messages into properties of electrical waves, for these waves travel through open space or wire without undergoing relevant changes; they adapt themselves to the curvature of the earth, and their speed is so nearly infinite that emission and reception become practically simultaneous. Space and time are annihilated.

It still strikes us as uncanny that pictures can be sent by telephone, and that we can see by radio. This
is so because the electric transmission of sound was invented first. There is nothing inherently more or less mysterious in the one than in the other. The electrical waves will transmit the equivalents of amplitude, frequency, and shape of vibration, that is, all the essential properties of the phenomena in question. The particular problem of television is, of course, that pictures are two-dimensional. If analyzed, they decompose into a large number of brightness and color values, only one of which can be transmitted by one transmitter at a given moment. If we consider that the retina of the eye employs something like one hundred and fifty million receptors to produce an image, it seems that millions of telephones or radio stations should be needed to send just one picture. Fortunately, our eyes retain a given impression for a definite, though small span of time so that if all the stimuli that make up the picture are shown within a fraction of a second they will seem to appear all at once. Short though these time intervals need to be, they are long enough for electricity to send the point-sized stimuli one after the other over one and the same transmitter. The problem has been solved, in other words, by translating spatial relations (within the picture) into temporal ones, that is, by transforming a two-dimensional phenomenon into a one-dimensional one.

Speed of transmission is necessary also because visual objects change and move. The motion picture has taught us that a minimum of sixteen to twenty-four images per second is needed to produce smooth motion. Therefore the cathode ray must scan any one image fast enough to deal with a sufficient number of them every second. The scanning device must take care of the first, the second, and the fourth dimensions practically all at once.

Television enormously increases the capacity of radio for documentary information. The auditory world, available to the listener, is poor in documentary qualities. Hearing excels in transmitting speech and music, that is, products of the spirit; it renders little of physical reality. Without the services of a commentator or reporter, the event that radio purports to send over the air waves remains fragmentary to the point of being incomprehensible. Sometimes the rhythmical noise of marching feet, the scraps of band music and voices may add up to the picture of a large crowd moving through the streets of a city. But the concreteness of such an experience is more to the credit of the listener’s imagination than to what comes actually through the loud-speaker. The ear is a tool of reasoning; it is best qualified to receive material that has been given shape by man already—whereas seeing is direct experience, the gathering of sensory raw material.

Through television radio becomes a documentary medium. Only when it ministers also to the eye, radio fulfills its task—not its only task and perhaps not its most important—of making us witness immediately what is going on in the wide world around us. We see the citizens of a neighboring town assembled in the market square, the Prime Minister of a foreign country making a speech, two boxers fighting for the world championship in an arena across the ocean, the British dance bands performing, an Italian coloratura singer, a German professor, the smoldering remains
of a wrecked railway train, the masked street crowds at the carnival, the snow-capped mountains of the Alps as they appear through clouds from an airplane, tropical fish through the windows of a submarine, the machines of a car factory, an explorer's ship battling the polar ice. We see the sun shining on Mount Vesuvius and, a second later, the neon lights that illuminate Broadway at the same time. The detour via the describing word becomes unnecessary, the barrier of foreign languages loses importance. The wide world itself enters our room.

Television is a relative of motorcar and airplane: it is a means of cultural transportation. To be sure, it is a mere instrument of transmission, which does not offer new means for the artistic interpretation of reality—as radio and film did. But like the transportation machines, which were a gift of the last century, television changes our attitude to reality: it makes us know the world better and in particular gives us a feeling for the multiplicity of what happens simultaneously in different places. For the first time in the history of man's striving for understanding, simultaneity can be experienced as such, not merely as translated into a succession in time. Our slow bodies and nearsighted eyes no longer hamper us. We come to recognize the place where we are located as one among many: we become more modest, less egocentric.

The technical gadget of the television set, however, does not cause these beneficial changes by itself. It offers possibilities, which the public must seize. Although the new victory over time and space represents an impressive enrichment of the perceptual world, it also favors the cult of sensory stimulation, which is characteristic of the cultural attitude of our time. Proud of our inventions—photography, the phonograph, film, radio—we praise the educational virtues of direct experience. We believe in traveling, and use pictures and movies in the schools. But as we render man's image of his world immensely more complete and accurate than it was in the past, we also restrict the realm of the spoken and the written word and thereby the realm of thinking. The more perfect our means of direct experience, the more easily we are caught by the dangerous illusion that perceiving is tantamount to knowing and understanding.

Television is a new, hard test of our wisdom. If we succeed in mastering the new medium it will enrich us. But it can also put our mind to sleep. We must not forget that in the past the inability to transport immediate experience and to convey it to others made the use of language necessary and thus compelled the human mind to develop concepts. For in order to describe things one must draw the general from the specific; one must select, compare, think. When communication can be achieved by pointing with the finger, however, the mouth grows silent, the writing hand stops, and the mind shrinks.

A good documentary or educational film is not raw experience. The material has passed the mill of reason, it has been sifted and interpreted. The direct transmissions of television will not offer much opportunity for such shaping of the stuff. Even so, people who know how to observe and to draw conclusions from what they see will profit greatly. Others will be
taken in by the picture on the screen and confused by the variety of visible things. After a while they may even cease to feel confused: proud of their right to see everything and weaned from the desire to understand and to digest, they may feel great satisfaction—like those hardy British spinsters who after a trip around the world contentedly arrive in the train station of their home town in the same state of mind in which they left.

The senses are useful when their contribution is not overestimated. In the culture we happen to live in, they teach us relatively little. The world of our century is a poor actor: it does show its variegated outside, but its true nature is not immediately apparent either to the eyes or to the ears. The newsreels tell us little, not only because the material is often badly chosen or because we do not know how to observe. They fail because the characteristics of the present world situation, or of a political event, or of a form of government are not as clearly expressed in their perceivable manifestations as a man's personality may be expressed in his face. Symptoms do not reveal much unless there is a physician to interpret them. In order to understand our present time, one must talk to the people, to the industrialists, or read the memoirs of the diplomats. If television is to make us understand the world rather than merely showing it to us, it will, at least, have to add the voice of the commentator to the pictures and the music and the noises—for words can speak of the general when we see the specific, and discuss the causes when we are faced with the effects.

How about the asocial traits, which television inherits from radio? Granted that when large masses of people see the same programs a certain unification of outlook will result. Also the exchange of programs can make for rapprochement among nations. When official pronouncements, parliamentary sessions, ceremonies, or court trials are transmitted, the citizen may feel more intimately concerned with the ways of his country. The complicated system of indirect government by which the central forces of public life reach the individual only through innumerable intermediaries is supplemented by the "wireless participation" of everybody in the affairs of state.

But doing things at the same time and doing them together is not quite the same. Radio and television do give a cozy family touch to public life, but they also keep the individual citizen from meeting his fellows. No longer does one need to be in company in order to celebrate or to mourn, to learn, to enjoy, to hail or to protest. It is true that our concert halls and theaters do not create much group feeling either. Strangers sit in rows, everyone watches and listens by himself, and the presence of the others is disturbing rather than helpful. But whenever the audience makes itself part of the event by laughing, shouting, answering, cheering, and booing, whenever the distinction between active and passive participants breaks down, something happens to the actor, the speaker, the teacher, or the preacher, as well as to the audience, the constituency, the pupils, and the congregation that cannot be replaced by electronics.

Television will make up for actual physical presence even more completely than does radio. All the more isolated will be the individual in his retreat, and the balance of trade will be correspondingly precarious:
an enormous influx of riches, consumption without services in return. The pathetic hermit, squatting in his room, hundreds of miles away from the scene that he experiences as his present life, the "viewer" who cannot even laugh or applaud without feeling ridiculous, is the final product of a century-long development, which has led from the campfire, the marketplace, and the arena to the lonesome consumer of spectacles today.

The following inquiry was suggested by a feeling of uneasiness that every talking film arouses in the author and that is not appeased by increased acquaintance with the new medium. It is a feeling that something is not right there: that we are dealing with productions which because of intrinsic contradictions of principle are incapable of true existence. Apparently the uneasiness is due to the spectator's attention being torn in two directions. In their attempts to attract the audience, two media are fighting each other instead of capturing it by united effort. Since the two media are striving to express the same matter in a twofold way, a disconcerting coincidence of two voices results, each of which is prevented by the other from telling more than half of what it would like to tell.

This practical situation called for a theoretical study of the aesthetic laws whose violation made the talking film so unsatisfactory. Such an undertaking seemed all the more urgent since I had come to suspect that the principles commonly used in discussions of the subject were wrong or at least wrongly applied. The point had been reached at which the persons con-