THE FUTURE OF ELECTRICITY AND ELECTRONICS IN THE THEATRE

George C. Izenour

The problem of the design, development, and utilization of machinery for the theatre is old--as old as the theatre itself--and I choose to leave its history to the scholars--discussing here only the more pertinent and modern aspects of this problem that all of us in this room,--architects, theatre directors, and technicians--are having to cope with daily in an attempt at making an inadequate plant work through intelligent re-design or at solving the problem with a new building. Most of us working in the theatre find ourselves resolving this problem, however, by plain everyday hard work and improvisation while hoping for that day when that dream building will have become a reality. And so we have many conferences and forums such as this one, where the accusing finger is sometimes directed at the architect with the admonishment, "It is up to you to provide us with a building that is truly representative and worthy of the twentieth century mode of theatrical production." But alas, even when though such an event comes to pass we find ourselves dissatisfied with the result, not realizing that as much of the fault lies with us as with the architect, and the chief reason being: JUST WHAT KIND OF MACHINERY HAVE WE HAD THE ARCHITECT DESIGN THIS MODERN THEATRICAL PALACE AROUND? Is it modern? Does it adequately accomplish all we ask of it? Or are we a modern Flying Dutchman expecting to launch a guided missile from a sailing ship?

My interest for the past fifteen years has been these machine design problems. They have ranged from problems of light and sound on the one hand, to problems of revolvers, elevators, and systems for both the vertical and horizontal handling of scenery on the other. One thing has been made very clear to me--these problems are all related in a strictly modern sense, as the most satisfactory prime mover in practically all cases is electricity. This is at once obvious when we speak of lighting and its control and also when we speak of the production of sound. However, when we speak of the more basically mechanical aspects of the theatre machine, this is perhaps not so evident, and since the time-worn and ancient methods for the counteraction of gravity and friction are much, much older than the production of light by means of electricity, we place before us a certain fixed set of design conditions which have long since become outworn dogma in practically every field of engineering activity excepting that which is applied to the theatre. At the outset may I say that it does not seem to me that there is sufficient awareness in the various theatrical crafts as they are now practiced as to just what electricity as a prime mover can accomplish, and even less of what the particles of which it is comprised can do for us when we seek control over the manifold electro-mechanical and light energy emitting devices and the many combinations and sub-combinations of both that constitute modern engineering practice. Electricity is truly a most versatile and easily adaptable prime mover, but by its very nature it also facilitates control not only of itself but, which is even more significant, by itself. This introduces us to the anciently observed phenomenon, but recently reduced to practice by the use of various types of mechanical and electrically operated relaying devices, and now given the name Cybernetics. This new approach to all problems of control encompasses the known methods of communication be they human, animal, or mechanical and

places them on a mathematical basis by which reasonable prediction of both cause and effect is possible. Sometimes it has been better than reasonable, for all practical purposes it has been exact in those machines wherein a closed control loop without a human link were practical. To mention a few--gun laying radar, the M. I. T. differential analyzer, and the many types of calculating machines developed during and since the war. "Very interesting", I hear someone say, "but not relevant to the theatre." Let us consider a few basic facts, however.

To begin with, let us illustrate with light control. I am sure that no one in this day and age would consider a means other than electricity for the production of light. What is the problem here? The controlling of a stream of radiant energy? That much is known about, as to its manifestation. About the physics there is still some doubt as to its composition and its method of travel through space. How do we originate it at present? By exciting electrically a filament to incandescence, which fundamentally means the driving of negatively charged particles through it. These particles we call electrons, and again, we understand a great deal about them and even much more about what they will do and how they will react under various controlled situations when they are produced in a confined space and subjected to localized forces, which can be controlled both manually and automatically. These confined spaces we call electron tubes of which there are many families of hundreds of members each, yet all slightly different from their relatives within the same family. Sounds perilously human, doesn't it? What does all this mean? Briefly, that there is an electronic control device which, if the proper external circuit is designed for it, will control any design function of this light beam. Furthermore, to describe these functions over which we need to exercise control, they are: its intensity, which function everyone understands; its size and shape; its placement in space (which also entails movement); and its color modification. Our problem is to design a machine which will accomplish all of this effortlessly, so that the end result is that of assisting in an artistic expression rather than hindering the artist in his desire for full expression. To do this mechanically without the assistance of remote subdivision of the control elements is well nigh impossible if not downright foolish. I know we all at some time have tried it, but eventually have given up for the plain and simple reason that there is no way yet known for applying the principles of the predetermined enclosed control loop to the action of a single human mind and body, let alone synchronizing the actions of many minds and bodies. To attempt to do so would be to imitate the ancients who devised the system of human machines (slaves) as a means of ship propulsion and the whip lash which served both as the means of control and of synchronization. Are not the problems of lighting control solvable by the same calculus of infinite variables as in the instance of differential analyzation? If we analyze the meaning of a light cue, what do we mean? Oft times only a change in intensity. But how many times do we not wish it could be a change in color and hue as well, or even a reshapement and movement of the beam? We all understand, however, that to expect all this to happen at once with the known means of control is literally impossible, but let us keep the illustration as simple as possible and include only an intensity change. Can we not consider the beginning and end of a cue as statics to which we can give a numerical designation? And is not the proceeding from one set of statics to another simply adding algebraically? This does not seem complicated until considered abstractly, does it? Unfortunately it cannot be solved until we do so. To illustrate let us take for an example the combination

of gunlaying radar and the proximity fuse as used to shoot down an airplane. If we were to attempt to shoot down an airplane using the same methods as we use presently in the theatre to light a show we would go out into a field with a gun with an unlimited supply of ammunition and blaze away without any organization whatsoever, but as soon as we correlate the speed of the airplane with the gun by a very subtle means of detection and control, and give the shell the knowledge of just when to explode the situation is much changed. But in the case of the gunner with the proper prediction devices vs. the switchboard operator working haphazardly without control devices, we have a contrast between a well-thought out and planned machine which leaves very little to chance on the one hand and the operator of the switchboard who has to depend upon what someone else sees and relays to him while he himself has no opportunity to predict even the simplest of situations, due to the fact that his machine is incapable of either remembering or predicting. Using this logic the comparison is ludicrous. To imagine control extended to the afore-mentioned functions of light in addition to intensity means that we too must avail ourselves of the same principles used in Cybernetics. By all this I do not mean to imply that an imaginative use of light is not desirable, quite the contrary, but it is certainly clear that our imaginations do not go deep enough into the means by which we hope to facilitate its use, to repeat the words of Winston Churchill, "Imagination without deep and full knowledge is a snare."

This is stage lighting control in the year of our Lord 1950, almost 50 years since the invention of the vacuum tube and almost 750 years since the invention of gun powder. It is sometimes difficult to decide which exercises more influence on the so-called modern Theatre. Does it not seem strange that in this era of engineering and invention we find practically none of its benefits in the theatre, yet the economic plight of the theatre has, to a very great extent, become its cancer. Indeed, to disregard the competition of screen and television by neglecting further development of the means of production seems to me to be tempting disaster.

Now to mention another vexing problem that has resisted modernization for too long a time. The gridiron--the means by which we handle scenery vertically. Without going into the argument as to whether a vertical system is preferable to a horizontal one, let us simplify the problem for the purpose of this discussion by limiting it to the vertical method. In the first place, we have a two-fold purpose in mind when we design a gridiron structure as it has both to support scenery presently being used, and to store that which is to be used subsequently. This further means that it should be flexible enough so as not to place artistic restrictions upon the designer. This immediately suggests to us that it might be a good idea to get rid of the parallel sets of lines that we have used ever since the theatre went indoors at the time of the Renaissance and which has become accepted practice in this craft. How many stage sets in this day and age are designed with back walls parallel to the proscenium? Any of us could count on one hand the times this has occurred in our theatres during the past few years, yet we persist in designing gridiron structures in the same old fashion. Consider--Here our purpose is to overcome gravity, and we are by design supplying the friction in great abundance, by using quantities of pig iron which is permanently tied to parallel sets of lines, an inflexible mechanism if ever one existed. What a wondrous thing--a block of pig iron, so concentrated, so fully packed, so free and easy on

the drop. This traditional use of it has oft times made me wonder whether even in the institutional theatre where labor is plentiful and cheap--is it that cheap? How much time is lost over fighting with this monstrously inflexible machine for the handling of scenery? Do we not exemplify the axiom that man has placed himself in competition with machinery, and in so doing has lowered himself to the rank of machine? Haven't we in the theatre a rather peculiar outlook upon machinery in the light of the progress made in the last fifty years? Aren't we slaves to an obsolete machine? Do we serve the machine or does the machine serve us?

All of us I am sure have heard of electric motors. Perhaps one day someone in the theatre shall rediscover a particular combination of them which can execute this task of vertical scenery handling in a way that will be truly useful. Once again our sin lies in our lack of awareness of tried techniques. We need to remind ourselves that the lock gates of the Panama Canal have been opening and closing in perfect synchronization for thirty-five years by means of self-synchronous motors, and this know-how coupled with the knowledge of telemetering devices and cross-coupled control circuits might supply us with a gridiron system of great versatility and economy of labor. Here again imagination is but the beginning, because this system has to actually work in the theatre as well as on paper. Unfortunately, the principles of these devices have not been adapted to the theatre's problem. Here is where engineering must find full flower, and it behooves the theatre artist as well as the architect to take heed. The truth is inescapable--if we are to have the modern theatre of which we now boast, we must avail ourselves of tested modern techniques lest our present short-sightedness make our theatre a museum of past mistakes.