INDIVIDUALS AND US

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For I dipped into the future, as far as human eye could see,
Saw the Vision of the world, and all the wonders that would be;
Saw the heavens filled with commerce, argosies of magic sails,
Pilots of the purple twilight, dropping down with costly bales;
Heard the heavens fill with shouting, and there rained a ghastly dew
From the Nation's airy navies grappling in the central blue;
Eye, to which all order festers, all things here are out of joint.
Science moves, but slowly, slowly, creeping on from point to point;
Yet I doubt not through the ages one increasing purpose runs,
And the thoughts of men are widened with the process of the suns.
Tennyson – "Locksley Hall"

If I had the prescience of a Tennyson, my remarks today on the topic of "individuality" might have a measure of validity that they currently lack. If I had experimental data, perhaps my remarks on this same topic would have a measure of objectivity that they now lack. But I have no data; I have no mathematical function (except a very simple one), and when I have finished you may well conclude that I lacked even significant purpose. However, I believe that there is a problem in society to which our Society, the Human Factors Society, should address itself immediately. If I'm wrong, please tell me so that I will waste no more time thinking about it, but if I am right then let's join together in trying to help solve it.

I make no claim to having discovered this problem. In fact my first formal reference to it came only 4 years ago when I wrote in our Society's journal,

> *While he (man) may control more machines, more power, perhaps even more people, etc., do not these same elements with which he is interacting also exert greater control over him, essentially reducing individual freedom of choice and action? Such considerations are perhaps beyond the immediate or, at least, current responsibilities of the systems engineer. Yet for the systems engineer to ignore these interactions would patently violate the ultimate objective of his profession* (Christensen, 1962).

Two very wise men in rather different fields had something to say on individuality and creativity. Hobson (1926) in his "Free Thought in the Social Sciences," states "The creative spirit is one and indivisible. It cannot live and work under servitude or external control," and Einstein, in an address that he gave at the California Institute of Technology in 1931, stated:

> *It is not enough that you should understand about applied science in order that your work may increase man's blessings. Concern for man himself and his fate must always form the chief interest in all technical endeavors, concern for the great unsolved problems of the organization of labor and the distribution of good[?] –in order that the creations of our mind shall be a blessing and not a curse to Mankind. Never forget this in the midst of your diagrams and equations.*

In addition, I recall some remarks from a convocation on "the ethical use of knowledge," which was held a few years ago at Baldwin-Wallace College. Dr. Dryden (1960), the late Deputy Director of NASA, stated at that convocation that there are three aspects to life: the materialistic,

the intellectual, and the spiritual. He warned of the dangers implicit in exaggeration of any one of the three, pointing out that an

> *. . . overexaggeration of the materialistic produces a sensual, primitive man, an overexaggeration of the intellectual and egotistical, selfish, soulless egghead who makes reason a God, and an overexaggeration of the spiritual . . . a religious fanatic dominated by instinct and emotion.*

I acknowledge additional indebtedness to my first instructor in psychology who once wrote this simple equation on the blackboard:

B = HE (Behavior is a function of heredity and environment.)

I am of the opinion that this formula has significant implications for each member of our Society. Whether or not you are a psychologist is completely and totally irrelevant. Let us examine this equation.

B = HE

Of all the members of the animal kingdom it is man who most extensively and persistently modifies his environment. With rare exceptions most animals seek a more suitable natural environment when the one that they currently inhabit becomes too hot, too cold, too dry, etc. Man modifies his environment and, incidentally, thereby modifies his behavior and his heredity. As Caspari (1960) has put it, "The adaptive value of a particular gene, i.e., its probability of being transmitted to the next generation, depends on the environment. Consequently, the composition of the gene pool will depend on the environment, and will change when the environment changes." (How many of you in this audience have ever considered the fact that through your work on systems you are determining to some degree the nature of the genetic pool of future generations?)

Elsewhere I have developed the thesis that as man has progressed from his earliest beginning through the Primitive Ages, the Industrial Revolution, etc., he has exerted more and more control over his environment *and thus over his behavior* (Christensen, 1964). In addition, Caspari suggests that environment also affects behavior indirectly by determining to some degree which genes shall be passed on to succeeding generations and which shall disappear. (The employment of more direct methods of controlling the genetic pool is, of course, available through birth control and it appears that direct intervention in the basic genetic structure of the individual will someday be possible.)

Surely no one in this audience will deny that scientists, engineers, and systems designers have a direct and special influence on the environment of modern human. I believe that no one here will deny that if these individuals are influential in the structuring of the environment then to some degree (and I believe a very significant degree) they are determining man's behavior. Now in our By-Laws I find that our Society has as its aims the increase and diffusion of ". . . knowledge of man in relation to machines and his environment . . . and to promote the application of this knowledge to design of systems and devices of all kinds." Thus, we have openly declared that we intend to play a significant role in structuring the environment and have at least implied that we will play a role in determining, to some currently unknown extent, the behavior.

"Well," you say, "what is so bad about that?" Nothing is bad about that if we are aware of, and remain ever sensitive to, this rather awesome responsibility that we have assumed. For we are in the position of being able to control significant segments of behavior by directly influencing the design of the cultural aspects of the environment! My concern, however, is that we, as a profession, might become so engrossed with standards of design, measures of efficiency, the exact meeting of exact requirements, etc., that we, like others before us, will neglect important but unofficial requirements dealing with individuality and the possibilities for creativity that exist

among those who operate and maintain cultural systems. We may already occasionally have been guilty of systems designs that are so deterministic that systems effectiveness has been reduced rather than enhanced because there was no provision or allowance for the expression of individuality and creativity in that system. Let us do all that we can to promote an environment that is responsive to the unique, perhaps even idiosyncratic, characteristics of the individual. We are expanding our influence at an accelerating rate from the civilian systems, so we must be even more sensitive to this need to preserve individuality and creativity.

I realize that I am proposing an extremely difficult task. Pressure to conform, to standardize, and to lose individuality pervade all organizations. It is true in the political realm, in our unions, in our social organization, in our schools, and I fear, even in our homes.

Now those of you who know me know that I have strongly favored the "*systems approach*." And I still do. But this or any other systematic approach to design could eventually prove to be sterile and degrading if in pursuing it we don't make provision for differences among individuals, for their individual hopes and aspirations, for their individual needs, and for their individual potential for creativity. With the advent of modern technology it is not too difficult to envisage a society in which every basic need is met, yet in which the expression of individuality and creativity is seriously stifled or completely expunged.

This Society and its members must resist trends that tend[?] to diminish individuality and creativity. Perhaps one can have too much of a good thing, e.g., security. I recall a recent quotation from a University of Dayton publication:

> *Were it not for insecurity, the human race probably would never have advanced beyond the mentality of the caveman. Insecurity in some form is behind most of the progress mankind has made. Curiosity and ambition are strong driving forces in human nature, but the tension of insecurity is frequently needed to prod men into action. If necessity is the mother of invention, insecurity is surely its father* (Bulletin of the University of Dayton, 1964).

Kierkegaard put it somewhat more succinctly when he said, "*To venture causes anxiety, but not to venture is to lose oneself*" (May, 1949). A variety of organizations are worried about "society," "social problems," etc. Let us devote more of our attention to the individual – the elemental particle of society. Perhaps many of the organizational problems will then solve themselves.

It is often said that individuals today don't feel as responsible for their acts as did individuals of yesterday. Perhaps they really aren't! If you design an environment that markedly limits the control that individuals can exert on that environment, then more assuredly, you are at least jointly responsible for the consequences.

In a related vein, I fear that the use of statistical analysis (or, perhaps more accurately, the misuse of statistical analysis) has tended to foster the subversion of individuality. Instead of being used to accentuate and highlight our differences, our individuality, our creativity, statistical measures of dispersion are usually employed to show what design or what situation will accommodate those encompassed by the mean plus or minus two standard deviations! I'm concerned not only about that middle 95% of the population which is being lumped into one amorphous mass, but also about that 2 ½% at each end of the distribution which often is completely ignored. I want the artifactual elements of our society designed so as to be adaptable to anyone and everyone who may have legitimate access to them. I view with joy such things as the work on adaptive control systems, the programmed instructional schemes, that adapt themselves to the changing requirements of the individual learner, and, yes, even something as seemingly modest (but in reality as noble) as a completely adjustable chair!

However, I view with alarm the unrestrained and unquestioned acceptance of the idea that what is best for the majority is best for all, whether it concerns design or some other aspect of

our lives. I hope that some day, for example, enlightened managers and union leaders will agree on a labor contract that is not the same for all the workers of a particular union. If an individual worker wants to trade some pay for an extra week's vacation, I'd like to see him allowed to do so. If a competent individual wishes to continue working after he has reached retirement age, why shouldn't he? (Solutions to the programming difficulties associated with such a variety of individual desires should yield to confrontations by a team of programmers and a big computer.) I understand, for example, that our good friend Dr. Dorenberger of Bell Aircraft has been forced to resign because he is 70 years old. If you know this gentleman, then you know that he is one of the truly outstanding individuals in the aerospace business. You know also that at 70 he has the stamina and energy of someone half his age. What a tragedy to apply an arbitrary retirement rule to such a man. In so doing, we fail to recognize him as an individual. We may even have done worse – we may be destroying him. It has happened to others.

Fortunately, I perceive in the very young an eagerness to retain their individuality and creativity. Unfortunately, once they start to become acculturated, there exist enormous pressures to divest them of this treasure. I recall reading somewhere that while the average small child asks 400 questions a day (most mothers will consider this a very conservative estimate!), this measure of inquisitiveness is reduced to only 50 by the time the child is an adult. Don't decry the fact that the young rebel against us. The length of young men's hair, for example, may be their way of showing their disdain for much of what our generation stands for. (Incidentally, if we really want them to cut their hair probably all that we need to do is let ours grow!)

POSSIBLE CONTRIBUTIONS TO A SOLUTION

In asking you to give more consideration to the problems associated with design for the individual, I don't believe that I am posing an insoluble problem nor do I believe that we need to yield significant amounts of the advantages that we have gained from standardization in order to achieve such goals. Let me suggest some ideas.

As I have already stated, I enthusiastically endorse the work being done on adaptive control systems and adaptive teaching machines. They represent clear examples of "mass-produced, standardized items" that take intelligent account of the individual differences among the users. The more complex of these devices rely on computers to store and analyze the operator's input and then present the problem to him in terms most compatible with his state at that moment. (Note that computers will be our servants and not our masters if only we insist on it.)

Since each of you contributes in some way to the design of systems, permit me to quote from a book by Dr. John Gardner (1963), the new Secretary for Health, Education and Welfare: "Too often in the past we have designed systems to meet all kinds of exacting requirements except the requirement that they contribute to the fulfillment and growth of the participants." Let us not nurture these tendencies. Let us be alert for design opportunities in our systems that will stimulate the expression of individuality, flexibility, and creativity. In so doing you will be enhancing, not degrading, systems effectiveness by allowing more of man's truly unique and greatest resources to be tapped. Again to Gardner (1963): *"We must learn to make technology serve man not only in the end product but in the doing."* (my italics)

To the extent that you do not provide for the emergence of these nobler characteristics, you will have degraded you system's operators and your system. If we cannot ennoble the job of the garbage man, for example, then I suggest in all seriousness that each person should have to attend to his own!

Although rather foreign to the interests of many of us, I wish that some team of union and management specialists would make a sincere effort to tailor their contract more in accordance with the individuality of the workers while still retaining a balance of fair and equal money for equal work – the same amount of money is not necessarily the same amount of reward to two

individuals. One individual might very much have preferred to exchange money for an additional week's vacation, a larger paid-up insurance policy, or some other form of compensation.

Vast improvements could be made in education for individuality and creativity, and we can help by designing instructional devices, laboratories, and buildings that maintain the maximum degree of flexibility and provide an environment that encourages the expression of creativity. It is discouraging to note that in many schools essentially the same techniques are used to teach the student with an IQ of 160 as are used with the student who has an IQ of one-half of that. This is patently unfair to both of these students. In others, instead of trying to find better and more interesting methods of teaching those subjects that offer immediate and later enrichment of the student's life, surrender is made by diverting him to a vocational school, often only to hasten his subservience to a machine by learning skills that probably will have to be relearned when he gets in a "real job" situation. As Gardner (1963) put it, "Our educational purposes must be seen in the broader framework of our convictions concerning the worth of the individual and the importance of the individual fulfillment." Our schools must be more than tool sheds, as Gardner says.

We should support more research on assessment of the abilities and prediction of success or failure *of the individual* in various fields of endeavor. Even the best measures of ability are far from satisfactory for making predictions of the likelihood that an individual will succeed or fail in a specific job. Some will suggest that this is because the criteria are invalid. All right then, let's get to work on methods for making them more valid. We must promote studies in such poorly understood areas as motivation and means of enhancing it by providing a stimulating environment.

More thorough examinations should be made of the characteristics of inheritance, home, school, and job that stimulate creativity. No thinking person wants complete equality in anything except opportunity. But in a democracy each individual has a right to expect an environment that will provide him an opportunity to develop his individual, distinctive talents to the utmost.

I can't conceive of a scientist or engineer being against the space program, although many are. In addition to the material progress that will result from this challenge, does it not lift your spirits just to live in an era when we are breaking the chains that have fettered us to this speck of dust for almost 2,000,000 years? And, as has been pointed out by many, the studies associated with manned space programs will have direct and significant payoff in the social and biological sciences as well as in the physical sciences.

We must extend our ideas to other nations and associate closely with other organizations, such as the Ergonomics Research Society, that believe essentially as we do. There are no independent nations or societies any more – the environment and resultant behavior of the people of one affect those of another.

Finally, I feel that we should constantly review our requirements for membership. We should encourage, regardless of background, those who display a sincere desire to devote their talents to the development of an environment that enriches men's lives. We may have unduly and unwisely restricted ourselves to those who can show that they can contribute to an understanding of human beings as effective (in its narrowest sense) members of a human-machine complex. We must nurture our interdisciplinary point of view. We must never forget that the human will never be completely understood from the vantage point of any single discipline or any single facet be primarily material, spiritual, or intellectual. Herein lies our strength; we must exploit it.

I am for the measurement, description, prediction, and control of human behavior. But I am concerned as to where that *control* will reside. Obviously, I want as much of that control as possible to reside with the individual. And, equally obviously, I want the members of our Society to be in the front ranks of those who recognize the threat of modern civilization to individuality and creativity and who will join together to do something about it. It's a tough problem and those who solve it will have to overcome the subtle but powerful forces at work in modern systems to stifle individuality and creativity. But when you consider the beauty and even utility of the goal,

is it not worth all that we can do to attain it? Obviously, I feel that it is. I hope that a significant number of you do also.

Since I began with a quotation from Tennyson, perhaps I should conclude with one – this one from his "Ulysses."

. . . and tho'
We are not now that strength which in old days moved heaven and earth;
That which we are, we are;
One equal temper of heroic hearts,
Made weak by time and fate, but strong in will
To strive, to seek, to find, and not to yield.

I hope that we will strive, seek, find, and never yield in our search to provide humans an environment in which an important element in the effectiveness of responses is the satisfaction that they derive from making them.

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