The potential role of the computer in intuition and self development

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ORIENTATION

From 1966-69, several colleagues and I had opportunity to design and implement a prototypical ISVD (Information System for Vocational Decisions). Dr. JoAnn Harris has been good enough to record that the ISVD and several sister computer guidance systems forecast and piloted the following advances in uniting the capabilities of computers and the purposes of guidance:

1. "Increased use of visuals to supplement words.
2. "Development of programs which will allow counselee to simulate vocational, educational, and personal-social experiences.
3. "Development of languages which allow the student to respond to the computer in his own language.
4. "Development of programs which will allow the counselee to prepare his own instructions to the computer and thus alter the pre-designed processes."

Of the five items Dr. Harris listed as harbingers of computer involvement in guidance the only one which ISVD lacked was the third one, group interaction via computer terminals. The ISVD made no computer provision for that function. The ISVD planned that that function be discharged in its system without computer involvement.

Today I am without my guidance computer. Neither the computer technology nor the educational economics of these days are up to the dream which I had for the ISVD.

Dr. Martin Katz and Dr. Harris are two eminent colleagues in the development of effective unions of computer capability and guidance purposes who entered the field about when I did but have the good fortune still to be in business since they gauged technological capability and user purse more level headedly than I did. Nevertheless we have all continued to remain interested in the common problem of convincing the public that they need the adjuvant computer capability in guidance now available to them. My colleagues have therefore been good enough to invite me to participate with them in this symposium which in its entirety will reveal the effective role which the computer has come to play in career guidance.

The symposium is divided into four parts. I take my own function to be merely that of revealing the potential role of the computer in intuition and self development. Dr. Katz and Dr. Harris will then describe two operational computer guidance examples, SIGI (System for Interactive Guidance and Information) and CVIS (Computerized Vocational Information System) respectively. Mr. Larry Blasch concludes the symposium by considering computer-based career guidance systems of the future.

ERIC AND THE INFORMING PROCESS

Risk is an essential condition for solving the paradox of intuition and development. Possibilities and progress must always be traded off; progress is bought at the expense of possibilities; possibilities at the expense of progress. The person comes to know this fact at increasingly more fundamental levels of understanding as he develops himself hierarchically, the way in which I hypothesize that self development takes place. As the person also comes to know the truth in Polanyi's assumption that "... we can know more than we can tell" (page 4), he comes to know at increasingly more fundamental levels of his being that his own intuition is the engine of his intelligence. The more a person risks to his intuition, the more he develops hierarchically.

My understanding of the gaining of confidence in intuition through risk of the self evolved is my struggle to fashion a relationship between a person and a computer which has the purpose of self enhancement, not self contraction. I offer an account of that struggle in this paper in expectation that its revelation may harmonize with understandings you also have about the potential role of the computer in intuition and self development.

ERIC (Educational Resources Information Center)

Let's start with ERIC, the Educational Resources Information Center. ERIC acquires, selects, abstracts, and
indexes documents. Abstracts and index terms of the selected documents are transferred to computer tapes. The selected documents themselves are transferred to microfiche provided that their authors have authorized such copying if the material is copyrighted. Journal articles receive similar treatment except that a journal article is only annotated, not abstracted, and journal articles are not put on microfiche.

The computer tapes which contain citations of educational research and practice and associated index terms and abstracts or annotations in each case constitute a new adjuvant power for man's mind, a power which I believe is of great import. Although the system has been in existence only since the mid 60's, the educational resources incorporated into ERIC since then are now fairly complete and quite accurately assembled in one place. Completeness and accuracy constitute two of the conditions which man attempts to approximate ever more closely with his mind. By letting their minds cooperate with ERIC, users now prove able to achieve both conditions more fully in relation to educational resources assembled since the mid 60's. The availability of access to these resources through computer tapes gives a flexibility to the use of this more complete and more accurate store than was available prior to ERIC. All that the user has to do is let ERIC become adjuvant to his mind. ERIC and its microfiche then open for every person new vistas of contact with educational developments in the United States and other parts of the world heretofore unavailable.

The adjuvant relationship with ERIC is made available to informed inquirers on the general basis noted above. ERIC also engages in educating potential users so they can take advantage of ERIC's adjuvant capability as well.

In order to keep a general level of contact with ERIC available to all, ERIC publishes Research In Education and Current Index to Journals in Education on a monthly basis. Both of these journals essentially list currently accessioned material by main entry, major subjects and author. The main entry includes the abstract or annotation, as the case may be.

Sixteen Clearinghouses are an essential current feature of the ERIC network. Clearinghouses cast their nets to acquire documents and assume responsibility for selection, abstracting, and indexing of documents and journal articles. Clearinghouses are also responsible for information analyses in each of their scopes. These information analyses synthesize the literature around current issues or problems of popular concern. Clearinghouses also provide individual service to users upon request provided that such service does not constitute an inordinate drain on time which must be husbanded for the essential accessioning tasks.

ERIC as an information system

Several years ago, Walz and Rich who both had responsibilities in the ERIC Clearinghouse for Counseling and Personnel Services caught my imagination with their article, "The Impact of Information Systems on Counselor Preparation and Practice." After introducing ERIC on somewhat the same terms I have used above, Walz and Rich first listed the essential characteristics of an information system as follows:

1. "The major objective of any information system is to organize and store information in a form which maximizes the user's ability to rapidly locate information which is relevant to his specific professional concerns.
2. "The major processing procedure which preserves the capability of identifying the nature of these educational materials at a later time is indexing.
3. "The primary determinate of which index terms will be used is the article which is being indexed.
4. "The outcome of indexing is a list of index terms which have been selected because they are an accurate representation of the conceptual contents of the article.
5. "The ERIC system, then, is collecting a large number of educational materials and indexing these materials for storage and subsequent retrieval. This file may be searched using two search strategies. First a search may be conducted to identify all materials which deal with any one concept. . . . A second search strategy is to coordinate index terms so that the information retrieved is smaller in quantity but more directly relevant to the user's question.

Walz and Rich went on to argue that an information system which organized and stored information so that the user can retrieve information pertinent to his interest and needs will have the following predictable outcomes:

1. Use will come to be focused on synthesis and evaluation.
2. Use will reveal gaps in the information structure.
3. The use of impersonal information sources will increase because information access will be more commonly available.
4. Opportunities for interprofessional interaction will increase because the material of one profession will be indexed to the different primary terms of another profession.
5. Information rather than books will become the primary focus for retrieval. ERIC will become the user's "book."
6. Information dissemination will become broader and faster.

Finally, Walz and Rich went on to propose that the education of counselors would shift as follows because of the new availability of the ERIC information system:

1. Inquiry will become the primary focus of learning.
2. A need will arise for new learning approach skills emphasizing retrieval and the investment of facts with personal meaning.
3. Evaluation and integration will become more personally essential.
The pedagogy of counselor education will shift to the personal absorption of information once the information system has begun to achieve coagulation of information as it ordinarily does.

Counselor educators will adopt new methods of professional communication which will center on ERIC, not books and journals.

Counselor educators will increase their collaborative efforts.

The number of small esoteric information systems will increase.

**ERIC and the informing process**

The Walz and Rich article came to my attention shortly after several colleagues and I had begun to design the ISVD. As I will show later, the ISVD takes the inquirer himself into consideration thus facilitating his ability to turn data retrieval into information generation. I first proposed this relationship in an article in the CAPS Capsule, the information arm of the ERIC Clearinghouse for Counseling and Personnel Services. I later went on to describe the necessary mediation process more fully in an article with Robert O'Hara.

**From media to mediation**

O'Hara and I argued that mediation, not media, must become the central focus for education, general and vocational. The turning of occupational facts/data into information is a personal and educational process. Therefore, the important question is the means by which media actually prove to mediate the personal educational process. I elect to address in this paper the most important of our questions in vocational guidance: How may we better the personal absorption of information once the ISVD implemented our current technological resources in the service of personally determined career development?

Several years ago I had a confirming experience with a recent book by McLuhan and Fiore. The younger of my sons left his copy of this book on a table in my living room for about a week, but I was not particularly interested in it because, during my early glances at it, I kept reading its title as *The Medium Is the Message*. That seemed a clever, though not an intriguing, title. One day it suddenly came to me that the book's title is *The Medium Is the Message*. My double-take and that realization connected then and with my realization that this was the process of mediation which I develop in this subsection. Thus, a hurried turn to the book reinforced my recognition that, in occupational facts/data as well as in the generality of communication treated by McLuhan and Fiore, the media are not the message. In fact, media can never be the message; only the facts which media convey are the message. The media themselves only become important in message transmission when they actually mediate transmission—when they actually massage the occupational information process as persons are exposed to occupational facts/data.

**Epistemology and pedagogy in mediation**

The point of view I outline here is one which derives important aspects of its validity from being realized again and again through a wide range of personal experiences with facts and ideas. Our "frame of reference" with regard to the interplay of facts, ideas, purposes, and action represents a form of orientation which, while it cannot be specified in the abstract, serves in any given context of personal encounter to articulate immediate concerns with issues of broader relationship and relevance. Therefore, in order to articulate aspects of my immediate topic within a context of issues of broader educational concern, I address two assumptions which I consider to be inconsistent with crucial principles of educational process. It is the alternatives to these principles that I strive to describe here.

The first of these assumptions pertains to the nature of knowing and the known. There are current applications of recent media developments to issues of vocational information which appear to presume that facts, data, or information consist of bits of knowledge which correspond directly to that presumed to be the real, the true, and the knowable. In brief, knowing and the known are presumed to comprise a direct, linear relationship both in the abstract and as we realize them as dimensions of particular circumstances. I shall show the serious limitations of this position as I show how the ISVD implemented our current technological resources in the service of personally determined career development.

The second of the assumptions is in an important sense subordinate to the first, for it pertains to the nature of the relationship between acts of knowing or learning and those of teaching or counseling. This assumption suggests that, on the basis of a "correspondence" theory of knowledge, we can presume to select those aspects of the known and knowable which shall be most effective in determining a subsequent course of events toward an end that we value and which, as "means" toward that end, we call "learning." In brief, the assumption is that we can determine, in advance, both goals and procedures appropriate to the educational process in its distinctive human immediacy and variability.

These assumptions, one "epistemological" and the other "pedagogical," are inconsistent with what seems to be one of the most crucial principles of my own current work, namely, that both knowledge and the process of knowing are functions of a personal and collaborative context of exploration and confirmation—a context which is itself

*Occupational facts/data come in two conditions, fixed and modifiable. We therefore elected to adopt the cumbersome term, "facts/data," to indicate this fact throughout our paper. Occupational facts are directly recoverable without mediation except for storage and later recovery. On the other hand, occupational data must be additionally processed by the numeric and/or linguistic routines of a mediation system.

* I am indebted to Gordon A. Dudley for the structure and ideas of this subsection.
defined by a nexus of human purposes expressed both overtly and covertly, both tacitly and articulately. The alternative position from which I speak suggests that talk about media cannot look in one direction only. It cannot look solely toward facts, data, information in isolation from persons and processes. I hold that the reciprocal interaction between the knower and known entails a "transactional" perspective and an array of procedures more aptly denoted by the notion of mediation. The final turn of this argument is that, because of the interplay of the tacit and articulate dimensions of knowing in the personal act of learning, the experience of mediation is that of a massage. In other words, we inevitably encounter the new with a habitual tensing of our intellectual musculature, with the result that its meaning takes initial form after that which we have long known and to which we have accommodated. Only after we have worked with (and perhaps more importantly, been worked on by) a new possibility do we relax to the point of seeing more clearly that something new has indeed been going on in, as well as around, us, cf. Piaget on assimilation and accommodation as reported by Flavell.10

My advocated perspective is "transactional" by virtue of the implication that both processes of teaching and learning are construed as individual and collaborative acts of "sampling," from among a wide range of on-going events (both personal and environmental), those configurations of meaning and implication which best serve to differentiate means and ends, processes of imagination and structures of knowledge, and acts of discovery and principles of verification. Within this "transactional" perspective, facts and data derive their significance as exemplifications of meaningful coherence among stable dimensions of events reflecting multiple principles of order.11 It is this transactional perspective regarding the interplay of information and imagination which brings my ideas in harmony both with current developments in discovery teaching and the "new" curricula,12 and with the "new" self-knowledge and creative learning developments.13 It is a point of view from which I risk inviting the student to take advantage of my capacity to learn through his ability to teach us.

INFORMING MACHINES

ISVD: A computer-based information system for career decisiona

In prospect for computer technology

The intent of the ISVD was to place an inquirer in potentially repeated interaction with a computer-centered environment programmed for his inquiry, not just for prompt reinforcing of stimulus-response contiguity. The contexts for the inquiries were education, occupation, military service, and family living. The inquirer was permitted to elect at will among contexts. The System was constructed so as to expect the inquirer to learn how to harmonize his goals and their consequences by means of repeated inquiries in those four important realms of personal activity.

As required by the principle of mediation, the primary goal of the ISVD was inquiry, not reinforcement. Because the System put the inquirer in direct relation with his evolving history and intentions to the extent that such can be motivated and represented through the numbers, letters, and processing available in computer reckoning, it became possible to avoid one of the fears which the public has of using computers in guidance, namely, the fear that computers will determine lives by making decisions for, not with, persons. The System let any inquirer experience practically the same joy and frustration which computer devotees daily do—the realization that the answer is in a devotee of computers, not in the machine. Despite our occasional regret upon such realizations, we know that we still persevere. Therefore, the assumption of the ISVD was that any person can and will persevere through inquiry. A further assumption was that repeatedly-experienced failure to find full solutions to questions can be fashioned into mature capacity to proceed on inadequate bases in adult life as an inquirer is brought to realize the care used in fashioning a System which can take him down the path of, but never completely into, awareness of the operation of his motivational system.

ISVD was therefore different from systems now organized for computer-aided instruction or educational data processing. The ISVD subsumed those conceptions as intermediate in the condition of education for responsible career decisions. However, the primary professional task was to construct a meta-system which permitted analysis and response direction in terms of the majority of the variables of this expected responsibility.

How was that accomplished?

The career and choices in career development

The context of vocational decision-making offers excellent opportunity for realization of my intention when the computer is given centrality, but necessary incompleteness, in the interacting system in which career development emerges. O'Hara and I14 define career as personally-given direction in developing vocational maturity. I therefore bind a career with expectation that the exercise of personal intention brings with it accountability for self-directed and corrected activity. Therefore, I expect that career development requires emergence of self-initiated and controlled activity for which a person permits himself to be held to account. When persons do so, we have opportunity to give power to the process of social control by encouraging the independence of freedom and the interdependence of social consciousness.

The forming of career involves a set of decisions which

* Other principal investigators of the Information System for Vocational Decisions were Russell Davis, Richard Durstine, Allan Ellis, Wallace Fletcher, Edward Landy, Robert O'Hara and Michael Wilson.
are made throughout life, in the joint contexts of education, vocation, military service, and family. The object, plan, and progress of decisions in each of these areas have their own characteristics which are reported in some detail in O'Hara and Tiedeman.7

The system

General framework

The ISVD was deliberately named despite the fact that my connotations for its words are not presently entirely a matter of common parlance. My word “Information” connotes the placing of facts/data into the context of use. This use of the word emphasizes my belief that facts/data require their context of use if they are to be conceived as information.

Students and workers were permitted to turn educational and occupational facts/data into information through the System. Thus the user became an explicit part of my connotation of “System.” My connotation reflects the intention to offer the user complete responsibility in choice of educational and vocational goals. Although it is probably inevitable that the computer will be blamed for “error,” I did not intend to let users of the ISVD enjoy the luxury of that impression without contest.

Data files

The ISVD had a data file for each of the previously noted four areas of living: occupation, education, military service, and family. Data in each file ranged from general to specific. In addition, data attempted both schematically to represent the present and to outline the future for a decade or so, such outlining being in small time-increments. These specifications obligated the System both to deal with local job markets and to incorporate data on local job vacancies which were helpful in placement suggestions.

The fifth data file in the System contained inquirer characteristics. This file was in two parts. One part dealt with characteristics of inquirers in general and reported relationships of these characteristics with later choices and successes of those inquirers. This file was used both to suggest alternatives to users who needed wider scope for consideration and to subject aspiration to the test of “reality” when the user was in a condition of clarification of a preferred alternative. The other part of the inquirer characteristic data file was the private educational and occupational history of the user as portrayed in his context of developing justification for his preferences and their pursuit and consequences.

Decision-making: The paradigm for choosing

Reflection upon facts/data of the several areas was encouraged with the expectation that the facts/data would be put to personal use, and the user was expected to become guided by the Tiedeman and O'Hara paradigm of vocational decision-making.14 The paradigm essentially conceives decision in relation (1) to the passage of time, and (2) to the undertaking of the risk and activity required to achieve what one elects to achieve. This conception permits division of the time interval into a period of anticipation and a period of accommodation. Anticipation occurs before the activities of a discontinuity become required; accommodation occurs after activity is required. Stages of exploration, crystallization, choice, and clarification are distinguished within the period of anticipation. Stages of induction, reformation, and integration become possible within the period of accommodation. Distinctions among these stages was made a central part of a MONTIR computer routine in the ISVD.

Computer routines

Computer routines and supporting materials were fashioned to conform with expectation that this vocational decision paradigm both existed and could become explicit and useful to someone who practiced its use. The paradigm determined the computer routines which were developed to permit access to each of the data files and to provide data upon request. There were three primary computer routines: REVIEW, EXPLORATION, and CLARIFICATION.

The REVIEW computer routine permitted call-up and comparison of a prior statement about a then future event both after that expected future event had occurred and after the user had provided indication of how his prior expectations were fulfilled before he sees his prior statement of those expectations. The procedure expected a person to experience insight with regard to consistency and inconsistency available during comparison, and to learn from such insight that his own intuition guides his activity. The intended outcome of REVIEW was that the user learn from his history.

The EXPLORATION computer routine allowed the person to rove through a data file as near randomly as possible. The routine encouraged use of randomness largely at only general levels of materials in order to conserve time but did not forbid specific exploration if, and when, desired. Furthermore, routines were developed to suggest alternatives on the basis of comparison of personal characteristics with established associations between such characteristics of others and their preferred alternatives. The intended outcome from this routine was (1) emergence of a set of alternatives, and (2) the bases on which the alternatives are preferred. I emphasize this latter point in an effort to increase awareness of the reasoning process that is actually involved in career development.

The CLARIFICATION computer routine was available after specific alternatives were selected. CLARIFICATION took the user into queries about the depth of his knowledge concerning then favored alternatives and the understanding
of future alternatives which are likely linked with present preferences. The outcome desired was the dispelling both of some doubt and of some ignorance concerning the next step in the progress of career which the person is evolving. Lessening of both doubt and ignorance is likely to increase the user's confidence in meeting the required activities of his next step.

In addition to the three primary computer routines, MONITOR was available as the only secondary computer routine. It essentially consisted of the evaluations which we were able to concoct to determine existence of mastery of stages in the paradigm of vocational decision-making. For this reason, it had to play back into, as well as over, the computer inputs which the person generated. There were three essential aspects of MONITOR. The first was a procedure which we concocted and programmed the computer to provide. The second was the bases on which we caused our judgments to operate among the data put in by the person during his interaction with the computer. The third was the basic computer routines themselves which the person was taught to use if and when he desired to have them. This latter aspect made it possible for the user to write his own monitoring bases to some extent and to have these monitoring procedures play among his material, as ours did originally. I hoped through MONITOR to encourage mastery of the concept of feedback and to give practice and supervision in its application.

Materials

The computer routines incorporated the vocational decision-making paradigm. I did not expect the computer itself to mature fully the capacity and confidence for use of the decision-making paradigm. I therefore designed two other activities into the System in its totality. One of these was the simulation of decision-making. Simulation was available in (1) games, (2) booklets in which the concepts were taught, and (3) decision problems of a vocational nature which had to be solved in interaction with the computer.

The second of our other activities, which I hoped would further mature the use of the paradigm of vocational decision-making, was the provision of responsibility for work under laboratory and practice conditions. In laboratory practice, reality can replace imagination if there is intentful supervision of users as they practice. This supervision was of the same nature as that employed by counselors with users as they are engaged in the simulated activities of vocational decision-making during the user-computer interactions.

Career: The maturation of personal responsibility through vocational development

I have attempted to show that the ISVD expected choice and cultivated the capacity for, and confidence in, choosing by giving users an almost infinite possibility for the exercise of decision-making among data files while simultaneously attempting to make the processes of decision-making both explicit and mastered. These are elements in vocational development which are generally neither unified in this manner nor made available for practice in modes in which complexity is possible but time is not of the essence, at least not the time of persons other than the person engaged in the exercise. The existence of the ISVD therefore created a first-time physical representation of the "outside" which the person must first learn to bring "inside" and then to act toward knowing that it is there but that he need not be "driven" by it if he is the master of it.

In its totality, the ISVD represented "reality" in its data files, offered processes for working with facts/data through its primary computer routines, and provided practice under supervision through (1) its secondary computer routine, (2) its simulation of decision-making, and (3) its personal supervision (a) by a counselor of the person in interaction in the computer routine, and (b) by a vocational educator as the student user assumed real work responsibility in laboratory and practice work situations.

Can a machine counsel?

Allan Ellis immeasurably advanced my understanding of the mediational processes which had to be built into ISVD by seriously addressing with me the question: Can a machine counsel?24 The reasoning pursued in addressing that question led to my more certain understanding that it is the decisional process itself that a person must come to understand in vocational decision-making, not just his vocational decisions. Since the argument has been published more fully elsewhere, I merely summarize the argument here since I do need the summary for credibility of my later assertions.

Ellis and I cannot even completely specify the procedures necessary to create such a machine. Therefore, either a counselor must counsel as he does now or students must be educated to live as if they counsel themselves, as we preferred and advocated in that paper. The argument starts with the proposition first that the ultimate goal in counseling is to help another come to ever more thorough understanding of his processes of problem solving. Then think of counseling in relation to so called knowledge as if counseling is to use knowledge. In doing so, define counseling problems as design problems, namely problems associated with the "as if" use or purpose of an operation and its better understood assimilative strategies.

Next assume that the goals of a Counseling Machine are those of counselors, thereby making the goal in both enterprises identical to that extent. If the purpose of counseling is to cultivate man's capacity for personal problem solving as then argued, then the content and the process of counseling must become one for the student just as Bruner25 contends for education itself. Ergo, counseling is a paradox.
The principle product of counseling is the matured capacity to guide one's self. Counselors themselves formally attempt to help a student to counsel himself. Hence, there is a seemingly simple solution to the paradox; the helper or counselor must have some initiative but the student must maintain control.

Next, analyze the question, “Can a machine counsel?” as means of specifying how the counselor might have initiative while the student maintains control. A machine and a human need neither be nor act alike to warrant belief that a machine can ground education in research. All that is required is indication that the machine and the counselor have the same goals.

Counseling and its machine have identical goals if, when a person has a problem related to his understanding, he could be equally well sent to either. Understanding is a time extended working out or articulation of self in problem. The mechanism for the working out of self in problem and thus for the inscription of understanding, is the activity of deciding and the problems with which counselors really ought to concern themselves are, therefore, those of deciding. The process of deciding is distinguished by aspects of anticipation and of accommodation with potentially notable steps being in each of the aspects. In enunciating the aspect of accommodation, one thing to which the individual must accommodate in decision-making is the decision process itself. In the most general sense, before we would be willing to say that a person has been counseled by machine, this machine would have to accomplish at least three things. First, it would have to reflect the elements of decision-making about self in career problem in such a way that the language of the process was exposed to the student. Second, the machine must encourage the development of awareness of the process of articulating the decisions in the problem and the relation of self to problems as viewed by that process. Finally, the machine must allow and foster the individual’s accommodation to the decision process both in terms of specific predicament and, more importantly, in terms of the process in general.

The ascription in the above model of counseling of the capacity for something in the person to be both object and subject is what causes the counselor difficulty ordinarily one step removed from the student being counseled and, therefore, an even more insidious difficulty unless closely watched. We must, therefore, take considerable pain to associate counseling with this primary process in the individual, not just in the “helper” or counselor.

Can a machine X a Y in Z?

Vistas loomed before me as I began to understand the power of the logic to which Ellis had introduced me. I began to understand that in answering a question such as, Can a machine X? I was not necessarily building a machine, merely engaging in the exercise of specifying the procedure I would use were I to fulfill the goals of X. And I was doing so sufficiently explicitly so that another could know not alone what I was doing, he would know what I was not doing in terms of what he wanted the procedure to do and/or accomplish. But most important of all, I was writing a procedure in which a person interactively came to comprehend X. The question, Can a machine X? therefore became a favored means by which I began to tackle a number of vexing interactive or thought problems.

My first extension of the question, Can a machine counsel? was an attack on the question, Can a machine develop a career? This paper laid out my then current thinking about a theory of career development. The theory was a lot like I have written in describing ISVD above. But the paper also extended the form of the question, Can a machine X? to that of Can a machine X a Y? The form proved up to extension. The issues evolved around what purposes you wanted the machine to fulfill. If you stated those purposes with care, seeing to it that you left comprehension of problem forming to the interacting person himself, the problem still stayed that of comprehending the decisional process itself during times of decision, not just the decision itself.

The next extension of the question, Can a machine counsel? was to the question, Can a machine admit an applicant to continuing education? That paper laid out my current thinking about how the admissions decision might be collaboratively attacked by college applicant and admissions officer, not just unilaterally attacked by the admissions officer himself. This extension stretched the Can a machine X? question into a Can a machine X a Y to Z? question. Now theory in measurement becomes possible within such a context. So does new theory in collaborative decision making. And the logic of Can a machine X? remained valid so long as I kept the focus on a decisional process which would itself be comprehended to the mutual satisfaction of two parties, not just applied unilaterally by one.

In the last few years, I have extended the logic to the question, Can a machine ground education in research? I approached this question of the form, Can a machine X a Y in Z? in two phases. In the first phase I wrote “Research and an Education Machine.” This paper adapts the logic of “Can a Machine Counsel?” step by step and outlines a so-called Research Machine which would become an ISED (Information System for Educational Decisions). I next extended the argument in “An Educating Research Machine Game.” This paper essentially argues that the logic of the Research Machine is generally available—as it should have been had the John Dewey Volume come out in 1971 as expected—and proposes that we continue to program for the imaginary Educating Research Machine as a game if we can’t get together enough financial resources to program an Educating Research Machine itself. In both of these papers I proposed that an ISED (a hypothetical Information System for Educational Decisions) would need to program the capacity to create IDM’s (instructional decision models) within the dual capacities (a) of ERIC (Educational Research Inquiry Centers) in which an IDM could be tacitly implied from its literature, and (b) of
interactive logical analyses in which the functions of data construction for IDM testing could take place.

A major problem in education is that of delegation, the freely offered and freely accepted responsibility for knowing. In designing the research-grounding educational machine, we must, therefore, carefully watch the processes by which a person can inform himself while making his educational decisions in interacting with an IDM programmed along with educational research literature and numeric data as well. The ISVD is an example of how this informing process must be further programmed as the higher order programming about the informed self acting upon thought-grounded decisions. In the ISVD example, we can more explicitly see the substance and functions which the research-grounded education machine would have to offer the student if it were to fulfill its assigned purpose of making the student an applied scientist of the art of living. These functions include a substance (machine capacity needed is data files) which could be queried and used to inform one's percepts (machine capacity needed is scripts) so that accommodation of the decision-making process in that substance (machine capacity needed is access routines) would ensue and be used with effortless ease in the system (machine capacity needed is system programming). In relating the ISVD example to the research-grounding education machine, we should thereby partially design the latter so that it has the functions of the former in relation to assimilating the known.

At the present time, I am engaged with John Peatling in writing a monograph which we are tentatively entitling, "A Group Theory of Constructionist Personality Reconstruction." This monograph draws together much that ISVD has birthed. The monograph begins with "Research and an Education Machine." It then goes through a series of chapters in which John Peatling has opportunity to present a mathematical group theory of personality reorganization. In this theory, a group of 16 personality traits are presented which have, through empirical research, proved themselves to satisfy the properties of a mathematical group. Furthermore, Peatling extends the framework of the group to show how new elements can be brought into the group through the self to make it a group of 32, 64, etc. elements. The monograph concludes with the conception of hierarchical restructuring which is applied to the self. The last chapter uses what has now emerged for me as the proven logic of the question, Can a machine X a Y in Z? to address the ultimate personal question, Can a machine ground self in personality?

A proposal—initiate and play a life career machine game

What currently exists as a Life Career Machine, itself is impressive although still relatively trivial. True, there are several programs for interactive career guidance and a proposed theory of interactive career development. There are several programs for interactive numerical analysis which go far in helping the educational researcher to solve his problem by relating to his data in more penetrating ways. However, not many people have dared challenge educational research in terms of its capacity to illuminate the problems and understandings of students so that they grow in self-correcting ways from the improved judgmental functions and structures of others. The achievement of that objective requires the giving of the powers of numeric analysis to students themselves, not just to educational researchers. The writing of computer programs which give students and citizens the capacity to conceive problems as educational researchers and responsible citizens do, when students and citizens are supposed to be in the step of induction in the deciding process, would go far in improving the education of all in an ISLD-like machine, an Information System for Life Decisions. However, the potential would essentially have to embed an existing or revised computer program for computing multivariate and other statistics in the general linguistic decisional framework of an ISED. Hutchinson made a step in this direction when he programmed for the ISVD a procedure which would have given students in the system opportunity to specify conditions which they wanted to fulfill in their choices of occupation and/or education and then reported from variables and observations available in the system the discriminating probabilities of a student's fulfilling his desires.

Although Peatling and I obviously are far from having a self-grounding personality machine, we think that we have proposed a generally interesting possibility for career education, educational research, and self in personality through our analysis. The possibility is to start with a definition of self in personality intended simultaneously to inform the person being analyzed, not just the analyzer engaged in the investigation. Furthermore, by acting if a machine could be constructed which would ground self in personality within the outlined purpose, we would essentially force ourselves to specify as best we can and whenever we can what that machine would have to be like. We would thus take the obvious step of acting upon realization that computers are not one but many machines and that the writing of procedures is in effect specifying machines. The machines may not themselves exist and perhaps need never exist. We only ourselves need to think that they could exist when they satisfy the functions outlined for them and take the forms programmed for them. Therefore, what we would actually do, which we consider of far more value, is to discipline ourselves to specify a procedure which might elaborate our understanding of giving meaning to grounding self in personality, thereby figuratively closing the logical gap between the two. As we do so, we must expose the procedure as well as the understanding. Understanding must be our end thought, procedure our means whereby. Psychology may well be our product, particularly an embryonic psychology of the tacit mechanism of comprehension—including the comprehension of career, counseling, educational research, and self in personality.

The most fundamental premise of our argument is that accommodation of a particular decision is not only itself
possible but that accommodation of the general decision process in a subject and in comprehension is itself possible. Accommodation of the general decision process itself is a phenomenal feat both literally and figuratively. Accommodation of the decision process itself requires that one is able to comprehend the principles of design in purpose well enough to deal with them somewhat as objects while being beset on all sides during decision by their subjective effects. However, the realization of this power seems to open one to the interactive life which is now so much in demand and even seems so much more frequently present among us these days. Reasoning with thought as if there were a machine in man seems to me to bring this potential of man closer to the surface than has heretofore been possible. However, as you determine if I did that or not, set your understanding as your end thought goal, use my procedure as your means whereby, and comprehension of epigenesis in decision-making development may well be the synergetic product for yourself—if you interact privately with your doubts sufficiently to understand, of course.

Some of the capabilities of computers are now nearing manlike proportions. Computers, of course, will never be men. However, an understanding of how computers function may well raise for us the question of how much of a machine man really is. Comprehension rests in questions, not answers. Let ourselves question—"... dividing in order to combine, combining in order to divide—and simultaneously."\(^2\)

THE ROLE OF THE COMPUTER IN INTUITION AND SELF DEVELOPMENT

I undertook this exercise to show you the role of the computer in intuition and self development. I deliberately started my exposition by describing the simple involvement of the computer in an information system we are all familiar with, the ERIC information system. I then went on to note the effects which Watz and Rich predicted that an information system has in general and would specifically have on counselor education. I next proposed that the effects Watz and Rich suggested for educational research in general and for counselor education specifically were too precious to be limited to researchers and counselor educators. I therefore proposed that we help them to be realized by every person by arranging the right adjuvant relationship between persons and facts/data, namely that of mediation. I proposed that the ISVD which I next described in its theoretic detail was an example of such a needed relationship.

I took off from the relatively specific detail of the ISVD into realms of the mind which can be conjured up when you design a system which has the purpose of facilitating the comprehension of the decisional process itself during times of decision. I suggested that you could advance from considering the question, Can a machine X? to the question, Can a Machine X a Y in Z? without invalidating the logic of the paper, "Can a Machine Counsel?" I proposed that my current extension of that question was to comprehension of the machine which is in each of us and can with appropriate programming bring about a grounding of self in personality.

I have obviously left the practical realm far behind me by now. It therefore remains for Katz, Harris, and Blasch to return you to the realm of reality. Katz will do so by treating his SIGI as an example. Harris will do so by treating her CVIS as a second example. Both of these systems have compatibility with the design of the intended ISVD. They therefore remain as operating illustrations of the rudimentary circumstances which ISVD was designed to bring about. Blasch concludes by considering computer-based computer systems of the future. I trust he mentions Discover as a new system in that future potential. Discover is the offspring of CVIS which comes closer than any other system to approximating the extensiveness of ISVD. In doing so it will also come closer than other systems to facilitating the comprehensions of the decisional process while helping another with his decisions. This is the condition needed to cause comprehension of the value of intuition in self development.

REFERENCES


