DOCUMENT RESUME

ED 391 817 TM 024 156

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TITLE	New Technologies in Career Guidance: The Interactive Computer.
INSTITUTION	Educational Testing Service, Princeton, N.J.
REPORT NO	ETS-RR-88-17
PUB DATE	Apr 88
NOTE	29p.; Paper presented at the World Congress of Guidance (12th, Annecy, France, September 20-26, 1987).
PUB TYPE	Reports - Evaluative/Feasibility (142) -- Speeches/Conference Papers (150)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Career Guidance; *Computer Uses in Education; Cost Effectiveness; Decision Making; *Educational Technology; Individual Differences; *Interaction; *Online Systems; *Systems Development; Theories; User Needs (Information)
IDENTIFIERS	System of Interactive Guidance and Info Plus; *System of Interactive Guidance and Information

ABSTRACT

Beginning in the 1960s the interactive capabilities of computers were recognized as providing unprecedented opportunities for the development of computerized career guidance systems. Such systems offered individualized assistance in career decision making to large numbers of people at low cost. Recognizing that each user may present a unique combination of needs, experiences, circumstances, values, interests, skills, styles, and perceptions, a developer can enable a well-planned system to respond appropriately to individual differences. A system can store, retrieve, and manipulate vast amounts of information, putting great resources at the fingertips of each user, and it can bring many personal, occupational, and educational variables together, combining them in distinctive ways for each client. These capabilities do not ensure that the substance of any system will be of high quality. Much of a system's worth depends on its conceptual framework, the strength of its theory and rationale, and the coherence of its functions and structures. The "black box" of theory underlying every system should be opened up and exposed to the light of scrutiny and evaluation. Examples from the principles, research, model, and structures for the System of Interactive Guidance and Information (SIGI) and SIGI PLUS are used to illustrate the links between theory and practice. (Contains 21 references.) (Author/SLD)

RR-88-17

RESEARCH REPORT

NEW TECHNOLOGIES IN CAREER GUIDANCE: THE INTERACTIVE COMPUTER

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Educational Testing Service
Princeton, New Jersey
April 1988

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Paper presented at plenary session of the
XIIth World Congress of Guidance
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ABSTRACT

Beginning in the 1960's, the interactive capabilities of computers provided unprecedented opportunities for the development of computerized career guidance systems. Such systems offered individualized assistance in career decision making to large numbers of people at low cost. Recognizing that each user may present a unique combination of needs, experiences, circumstances, values, interests, skills, styles, and perceptions, a developer can enable a well-planned system to respond appropriately to these individual differences. A system can not only store, retrieve, and manipulate vast amounts of information, putting great resources at the fingertips of each user, but also bring together many variables -- personal, occupational, and educational -- and combine them in distinctive ways for each client.

These capabilities do not insure that the substance of any system will be of high quality. Much of a system's worth depends on its conceptual framework, the strength of its theory and rationale, the coherence of its functions and structures. The "black box " of theory underlying every system should be opened up and exposed to the light of scrutiny and evaluation.

Examples from the principles, research, model, and structures for the System of Interactive Guidance and Information (SIGI) and SIGI PLUS are used to illustrate the links between theory and practice.

NEW TECHNOLOGIES IN CAREER GUIDANCE: THE INTERACTIVE COMPUTER

Technology in our lifetimes has been involved in many wondrous accomplishments, some of them beneficial, some of them disastrous, and some of them partaking of both benefit and disaster.

At the simplest level, technological invention seems to begin by finding ways to amplify human powers. Tools and machines have been developed to do things that our human bodies and minds are accustomed to doing; but to do them faster, stronger, more efficiently, on a bigger scale. This does not mean that the products are necessarily better: for example, handcrafted objects are often valued more highly than their mass-produced counterparts.

In career guidance, audiovisual technologies, such as motion pictures, videotape, or videodisk, are often used to give young people an opportunity to observe, quickly and conveniently, the performance of tasks in many occupations. In this instance, audiovisual technology provides an extensive but relatively passive experience; it might well be followed by more intensive and active observation of a few selected occupations through personal visits, "job-shadowing," or hands-on tryouts. This example represents two complementary modes of acquiring information: one, through audiovisual technology, is extensive but relatively passive and vicarious; the other, through real-life experience, is more intensive, active, and participatory. The value of such complementarity is implicitly recognized in a limerick about the use of technology in sex education, a "hot" topic of discussio these days in the U.S.A.:

> The word has come down from the Dean
> That, with the aid of a teaching machine,
> King Oedipus Rex

Could have learned about sex
Without ever touching the Queen.

In learning about occupations and about sex, extensity and intensity of information both have their values.

At the next level of technological development, the amplification of human powers often suggests or leads to extended capabilities, and technology is found to be accomplishing new things, or employing processes that were not available to unaided human abilities. Technologies involved in genetic engineering and space exploration are examples. In some instances, it is not the case that a long-felt need provides a stimulus for appropriate technological development. Rather, new technology gives rise to new products and processes for which there had been no previous demand, but which are soon regarded as indispensable. For example, the laser, shortly after its development, was called a "solution in search of a problem." Now we see it making valuable contributions in many applications, from communications to surgery. Of course, new products and processes made possible by new technologies are not uniformly beneficial, as we have sad reason to know from Three-Mile-Island and Chernobyl, from extensive pollution of air and water, from slaughter on the highways, and from a litany of other failures attributed to technology. The argument can be made, however, that these disasters result not from too much technology but too little, that there are technological "fixes" for these technological failures. In any case, it is clear that human judgment is the crucial component in decisions about any technological application, in its design, and often in its operation. Thus, a technological development may be regarded as providing an opportunity for beneficial use, but no guarantee of it. In itself, technology is neither savior

nor devil, and we should avoid being either blind worshipers or Luddites.

So with the most visible technological innovation in career guidance during the last 20 years -- computerized systems. It is useful to compare such systems briefly with an older technology in career guidance, printed publications. The latter permit access to information about occupations and topics in fixed linear order. For example, occupations may be clustered according to a single attribute or a fixed set of attributes (as in the U.S. Department of Labor Guide to Occupational Exploration). But occupations that overlap in some attributes may differ in others; therefore, no single classification system is satisfactory. Computer systems allow for more flexible access: Occupations may be clustered according to any set of specifications chosen by the user (from whatever dimensions are incorporated in the system). In other words, a given occupation is not destined always to be associated with a certain array of other occupations: It can move from one grouping to another, depending on the specifications for search. But of course flexibility does not in itself guarantee that the structures of individual assessment and occupational information will be well chosen and defined.

Members of our profession are sometimes seduced by the marvels of computer technology into thinking that development of a computerized career guidance system is a simple task. I have heard from many people around the world that they have access to a computer, a programmer, and a source of data (usually a government agency); they believe these resources can readily produce a system, with perhaps the aid of a little advice from me on some minor questions. All that is required is to read the occupational information into the machine and enable

students to retrieve it. Indeed, atheoretical systems in the U.S.A. have found this enterprise expedited for them by the existence of a DOT Data Display Tape, providing a data base from the Department of Labor for ready input. In my chapter on the quality of occupational information in our Survey of Career Information Systems in Secondary Schools (Chapman & Katz, 1981), I have demonstrated the fallacies in this procedure, with ample illustrations of the inaccuracies and inconsistencies in the data and the inadequacies of such structures of information, and I will not repeat my critique here. The point is that the genre of computerized career guidance technology is not the issue. Its applications take many forms, and each deserves to be evaluated in its own right. Without adjudicating among the various applications, it may be useful to fill in a bit of historical background.

The computer began by helping members of the guidance profession do their arithmetic faster. Representing ones and zeroes by switching currents on and off at electronic speeds, the computer had amplified the powers of statisticians by accelerating their operations. Liberated from time-consuming and tedious calculations, they could process large masses of data quickly. So the guidance profession was able to make increased use of factor analyses, to help define domains and dimensions of individual differences, and regression analyses, to support statements about clients' probabilities of success in various options. This batch-processing of data by the computer provided a resource for the guidance profession to use, presumably for the benefit of clients.

Unfortunately, this technology seemed to encourage a directive trait-and-factor approach to career guidance. As early as the 1920's, Clark Hull was so bedazzled by the prospect of such amplification of human powers that he envisioned giving students in early secondary

school a "single universal battery" of aptitude tests; the scores would be fed into a machine to forecast "probable success in all of the chief occupations of the world. The three or four...in which [each student's] chance of success is greatest...may be given further investigation." [Hull, 1928]

Here we see how technological acceleration of human speed in performing statistical operations might lead to an enlarged role for a computer system -- from assessing probabilities of success to making decisions. As it happens, Hull's prophetic extension and application of trait-and-factor theory, as he gazed into the brave new world of psychometrics and computers, never demonstrated validity for guidance. Hull and his successors did not anticipate the stubbornness with which the data would resist his expectation that scores on differential aptitude tests would lead to neatly differentiated forecasting formulas for large numbers of occupations. The technology was not at fault. The assumptions and conclusions were. As a vast body of research over many years has made amply clear, almost all of the valid predictability of occupational success from scores on batteries of aptitude tests is attributable to the common or general factor in the tests (e. g., Thorndike, 1985). But such batteries have demonstrated very little differential validity. That is, different patterns of scores on the various tests in the battery contribute no more than the general level of scores in predicting success or in differentiating between occupations. Furthermore, most people can succeed in a larger number of occupations than they will want to consider. Scores on an aptitude test battery, therefore, are more useful to an employer for initial screening of a pool of applicants than to a student for initial screening of a pool of occupations. Thus, evaluation of chances of

success can most usefully enter the CDM process at a later point, as students close in on their choices.

By contrast, different patterns of weights that clients place on carefully defined dimensions of values (that have been linked to ratings of opportunities for corresponding rewards and satisfactions offered by occupations) demonstrably differentiate between the occupations. Indeed, each occupation offers a distinctive array of rewards and satisfactions on these dimensions.

Beginning in the 1960's, there was increasing recognition in the U.S.A. that the computer's interactive capability was particularly suited for career guidance, which was perceived as a highly individualized activity. Guidance had emerged from such phenomena as the complex division of labor, which made large numbers of occupations difficult to observe at first hand, and recognition of the differences between people -- in needs, values, interests, skills, circumstances, backgrounds, preferences, plans, styles and development rates. These differences were seen to affect the options available to people, the choices they make, and the processes by which they reach decisions. There was also increasing concern for people's satisfaction and success in their occupations, respect for their autonomy, and attention to developing their competence in informed and rational career decision making (CDM).

The traditional method of providing flexible treatment for individual needs was the dyadic relationship. But the professional counselor working with one client at a time could never meet the widespread need for career guidance. The interactive computer offered an alternative. It could provide immediate feedback, permit as many

revisions of inputs as clients wish, and engage each client in a dialogue in "real time."

Beginnings had already been made in the use of computers to individualize instruction. Computer-asisted guidance resembles instruction in that it aims to foster the acquisition of knowledge, the development of understanding, and the mastery of competencies. It differs, however, in that a substantial portion of the knowledge is about the learner and must be provided by the learner. Career decisions depend largely on the characteristics of each decision maker, such as values, interests, and skills, and on the decision maker's own understanding of these characteristics. So it is essential for informed CDM to bring the client's "latent knowledge" (as Socrates calls it) of these characteristics into explicit awareness and expression.

A further distinction lies in a comparison of the purposes of education and guidance. Education purports to deal primarily with the "universals" in the culture, while guidance is concerned with the "alternatives." There are no predetermined "right answers" in CDM. Thus guidance aims to help clients understand not only the content of options and the content of individual characteristics, but also a rational process of decision making. This is one of the most difficult and challenging functions of the counselor, yet it is not beyond the capabilities of interactive computerized career guidance systems.

A number of systems have been developed in the U.S.A. Perhaps without getting into substantive differences between them, we should note the changes in technology that have enabled some of these systems to gain widespread use. When development began in the 1960's, computers were available at most educational institutions, but were still relatively cumbersome and costly, and were dedicated largely to

administrative and research purposes. Most of the systems were first developed on time-sharing mainframes. To keep hardware costs as low as possible in developing SIGI, we tried to make do with a minicomputer, compressing our data storage in ingenious ways. But always we kept our eye on developments in microcomputers. They already had all the power we needed; once again, storage capacity for large data bases was the problem. Finally, in 1980, low-cost microcomputer storage had been increased to the point that SIGI could be "shoehorned" into it. Other systems followed with microcomputer versions.

The microcomputer had, in effect, shrunk the computer to the point where it virtually "disappeared" into the CRT. Desktop micros now contain more power, speed, and capacity than most mainframes did 20 years ago. All this, plus easy portability, is available at a total hardware purchase price under $2000 per micro, including a color monitor and a printer. Adding annual license costs for guidance systems, one can calculate, with some reasonable assumptions about rate of use, a cost of less than 50 cents per student hour. To compare this with the cost of a counselor's hour does not suggest that the counselor and the computer system do the same thing. Each has distinctive, as well as overlapping, contributions to make. The computerized systems do not provide a warm human relationship; they do not purport to solve social and emotional problems. But they can be more effective in storing, retrieving, and manipulating vast amounts of information, putting great resources at the fingertips of each client, tailored to his or her individual inputs and responses. They can bring together many sets of variables -- personal, occupational, and institutional. By combining these sets of variables in distinctive ways for each client, they can construct new and unique information.

These capabilities of computerized systems do not insure that their substance will be of high quality, any more than the fact that technology permits me to telephone a friend in Taiwan insures that I will have something worthwhile to say. The hardware and operating software offer a low-cost medium for communication and assistance in CDM. They provide certain opportunities and certain constraints. Let us now consider the substance of the communication and the nature of the assistance.

Various computerized guidance systems differ greatly in their scope, content, structure, procedures, style, and (more fundamentally) in their underlying rationale and model of career guidance. Indeed, some systems seem to have no explicit rationale, and appear to have been developed ad hoc.

Counselors also sometimes operate without a rationale. Even when they do offer theories of CDM and guidance as a basis for practice, the connections between such theories and what they do are not always clear. Those who espouse the same theoretical orientation may differ in their practices. Indeed, a given counselor may be inconsistent from one occasion to another. Presumably, notwithstanding these idiosyncratic variations, counselors can still help people make career decisions, but their procedures in a private dyadic context are rarely observed, and they are seldom held to account for their adherence to a professed rationale or model. Consequently, it is often difficult to define actual counseling treatments, and therefore to ascribe outcomes to specified treatments and to compare the effects of one treatment with another.

The treatment represented by a computerized system, on the other hand, is perfectly consistent. It may be responsive to individual

differences, but the distinctive responses emerge from a constant content and structure. The hardware, the displays, the scripts, the software, the printouts are all highly visible components of the system. "System" itself implies coherent structures and functions, an orderly attempt to accomplish certain specified purposes. These purposes, structures, functions, and all their components should be accessible to scrutiny. Since a computerized system is available for use by many times the number of people any counselor will see, such a system can and should be held to high standards of accountability: Its rationale should be made explicit and compared (along with its scope, content, structure, style, cost, and procedures) with counter propositions that support other systems. It is appropriate to ask, for example, what model of CDM was used; why was one structure and not another used for individual assessment and for occupational information; what procedures were followed to obtain, analyze, and interpret occupational information and to insure its accuracy and currency. In short, the "black box" of theory for every system should be opened up and exposed to as much light as the visible features of the system. Then, when a specified treatment is found to be related to certain outcomes, the findings can make a significant contribution to greater understanding of theoretical issues of general concern.

I have elsewhere described and compared major models of career guidance (e.g., in The Counseling Psychologist, 1983) and will not take the time to repeat the comparison of models here. Instead, in the time that is left, I will illustrate some of the links between theory and practice by sampling from our work on SIGI and SIGI PLUS.

The Rationale for SIGI/SIGI PLUS

Let me start by making our premises explicit. Our first premise is that the objective of decision makers, in general, is to maximize utility. In CDM, this objective translates into making choices that provide the greatest rewards and satisfactions. Pragmatically, this aim is usually modulated by a concern for avoiding excessive risks or investment. Individual perceptions vary, however, on the importance of each reward or satisfaction and on how much risk or investment is tolerable. These individual differences in the importance attached to any given array of rewards and satisfactions make values and interests central constructs in CDM. Similarly, differences in abilities, skills, and resources constrain or ease people's access to various options -- that is, they account for different probabilities of success in entering some occupations. Furthermore, people differ in the extent to which they can appraise and express all these characteristics -- their values, interests, skills, and resources. So another premise is that self understanding, through examination and exploration of all these characteristics, is an essential component of guidance if people are to gain competence in making their own career decisions. To help people understand themselves, to sort out and appraise their characteristics, a clear-cut structure is useful. Such a structure will include relevant domains (such as values, interests, skills) and, within each domain, well defined dimensions along which individual differences are to be construed.

It is also axiomatic that occupations (and other career options) vary in their attributes: the particular configuration of opportunities for rewards and satisfactions that they offer (which we may call their instrumentality); the activities that they involve; their requirements for entry; their criteria for successful performance; their outlook

(that is, the number of openings that may be expected in the future); their visibility and accessibility; the number and kinds of paths by which they can be approached; and the quality of information available on all these attributes. So a structure of occupational information and procedures for collecting, analyzing, interpreting, evaluating, and communicating data for such information are essential components of guidance for CDM.

Also essential is a strategy for linking the domains of individual characteristics to the domains of information about options. Ideally, people might be expected to prefer an occupation that provides ample opportunity to obtain all the rewards and satisfactions that they value highly; can be readily entered within the scope of their qualifications and resources; and presents a rosy prospect for their continuing success. Needless to say, such an option can be identified but rarely.

One problem is that the domains of individual characteristics do not tend to be isomorphic with the domains of occupational attributes. Therefore, ways of linking the personal and occupational domains -- for example, values to instrumentalities, interests to activities, resources to requirements -- may be ill-fitting and awkward. Furthermore, even if complete self understanding, complete information, and perfect articulation between the two sets of domains were possible, trade-offs and compromises would have to be made. For example, people would have to decide whether to sacrifice some degree of satisfaction in respect to one value in order to retain satisfaction of another, or compromise between rewards and risks associated with various choices. But of course all variables can not be clearly recognized and perceived. Self understanding of one's own characteristics is often

dim. Information about occupations may be insufficient, misleading, or irrelevant. In all cases, outcomes are uncertain. So CDM is bound to be muddled and cumbersome. No unequivocal strategy for CDM may be apparent. Again, these problems are not functions of technology. Private dyadic counseling may skim over them or brush them aside. But the attempt to apply technology, namely, the interactive computer system, in a system that is open to scrutiny, stimulates us to take careful cognizance of them. The effort to develop a strong model for a computerized system compels us to cope with them.

In the face of all these deficiencies and uncertainties, what is the path to wisdom? How can a guidance system best intervene and assist? Not by cranking out decisions, as it were; the system cannot "know" the "right" choice for a person. But it can help clients in the process of choosing. Our major premise is that enlightened processes are intrinsically valuable in education and in guidance. So our model aims to foster a process of learning -- helping clients develop competencies by following and comprehending a model of informed and rational decision making. That is, they master the process by using it.

The Model for SIGI/SIGI PLUS

To provide an overview of the practical purposes of the model derived from the foregoing rationale, we can define two major functions. The first is to help each user narrow the staggering number and bewildering variety of occupations to a comprehensive but manageable list of options worthy of further consideration. (I say "narrow" from the point of view of the developer. For the student, the search does not just eliminate occupations; it often suggests occupations not previously known or considered, and may be seen as expanding options.) The second function is to make distinctions between

occupations on the list and so close on a choice that offers an optimal combination of desirability and probability of successful entry.

The first function is initiated through a structured search: Students specify the occupational attributes that are important to them. They have previously determined what is more or less important through self assessment along carefully defined dimensions of several major domains such as values, interests, and skills. Their specifications are used by the computer program to sort through a data base that includes ratings of occupations on all attributes relevant to the possible specifications. This structured search generates a list of occupations that meet or exceed each set of specifications. Students can play "What if?" games by changing their specifications and arranging them in various combinations. Thus they can slice different planes through the universe of occupational attributes to identify sets of occupations that offer opportunities for valued rewards and satisfactions. (Sometimes these lists omit occupations previously favored, and the user can ask, "Why not?" to find out in what respect such occupations failed to meet a given set of specifications.)

After structured search, the user can query the data base extensively about each occupation of interest, asking pointed questions and getting specific answers. This direct access to information serves to enrich the client's knowledge and usually results in refining the list under consideration. These two modes of acquiring information, structured search and direct access, represent two related aspects of occupational information. For the search mode, summary information is required, such as median pay for an occupation, ratings on opportunities for independence, security, variety, and the like. Summary ratings of this sort lose some information but gain in

simplicity and power. The direct access mode captures more of the detail and diversity of each occupation, giving distributions for each attribute and showing variations by region, industry, and so on.

Further scrutiny of occupations is accomplished through providing detailed information about the preparation required or recommended for entry and through predicting probabilities of success in such preparation. Often the view of steps that must be taken to enter an occupation leads to reconsideration of its inclusion on a list.

Then the client is ready to come to grips with the second major function of the system, gaining a greater degree of closure on choice of an occupation. Our model recognizes two sides to the choice: One side represents the desirability of each occupation, that is the extent to which it offers the rewards and satisfactions that are important to the student. The other side represents the student's probabilities of success in entering each occupation, taking into account the skills and education required and the outlook for openings. SIGI uses a numerical algorithm to calculate desirability and its modulation by probability. SIGI PLUS provides "Deciding Squares" on which a summary of the student's conclusions about these two sides is represented graphically: With desirability represented along one axis of the square and chances of success along the other, the student can readily see the position of each occupation in the two-dimensional space. The system then provides decision rules to help students balance desirability and chances of success in comparing occupations. The idea is for each student to maximize desirability while avoiding risks and investments that he or she regards as excessive. Finally, the system helps students formulate action plans and take steps to achieve their plans.

Obviously, students differ in their perceptions of the importance and magnitude of various rewards, satisfactions, risks, and investments and in their willingness to make certain trade-offs or compromises. The model, therefore, requires carefully designed structures for self assessment and for occupational information, with provision for linking the two structures.

Self Assessment: Domains and Dimensions

Assessment of individual characteristics is enlightening for informed and rational CDM only when students can introcept the results of the assessment, i.e., incorporate the assessment as part of their own self concepts. It is essential, therefore, for students as well as counselors to understand both the content and the relevance of what is being assessed. To define a structure for assessment has required a considerable research effort.

Although members of the guidance profession disagree with one another on the domains of individual differences that should be considered in CDM and on the dimensions that each domain comprises, there appears to be consensus on the relevance of three domains: values, interests, and a set of characteristics that have been called by such names as aptitudes, abilities, skills, and knowledge (all operationally related to probabilities of success). Values and interests are sometimes blurred, but we have collected evidence that each domain, as we have defined it, is independent of the other. Briefly, people's occupational values express what they want and desire in an occupation, what outcome or state is important to them. Their occupational interests indicate preferences for various ways of obtaining what they want, a liking for one set of activities or field of knowledge more than another. For example, altruism and high income

are two occupational values. How one likes to help people or make money, say, through writing and speaking or solving mathematical problems, is a function of occupational interests.

People sometimes get confused because the concept of interest itself -- engaging in an activity that is intrinsically enjoyable -- may be more or less highly valued by various individuals in choosing an occupation. The widespread emphasis on use of interest inventories assumes that intrinsic activity interest is almost universally the main source of satisfaction in occupations. Our studies have demonstrated that, although interests are very often among the main satisfactions sought in occupations, they are not the sole concern. For many people, such rewards and satisfactions as may come from high income, altruism, security, independence, and other values dimensions are often more important (see, e.g., Chapman, Katz, Norris, & Pears, 1977; Norris, Katz, & Chapman, 1978). Indeed, many people seek satisfaction of their main interests not in their chosen occupation but in avocational activities. (For example, the majority of people with a strong interest in areas that require exceptional talent for occupational success, such as sports and the performing arts, satisfy these interests in their recreation and hobbies.)

Here I must again plead lack of time and skip an elaboration of the three domains in order to give some attention to the dimensions included in one domain. I will illustrate the kind of research that went into defining dimensions by focusing on the domain of values.

Dimensions of Values

We wanted users to take cognizance of the full range of occupational values, without undue redundancy. So we set out to identify dimensions that would include all values of importance to

significant proportions of the population, without exceeding a manageable number. The dimensions had to be meaningful and relevant, capable of being defined in operational terms and capable of being linked to corresponding occupational rewards and satisfactions. They had to be relatively independent; the degree of importance attached to one must not automatically subsume the same degree of importance for any other.

We did a number of studies on the dimensions of values, and of course took into account the research of others. In our own research (summarized in Katz, 1974), we asked students in structured interviews questions designed to elicit the dimensions along which they construed and evaluated occupations. For example, we asked them to tell us what they knew about an occupation of interest to them, and to indicate what other information they would like to have; what appealed to them most about it, and what least; what events or additional information might make them change their preference for that occupation; what characteristics an "ideal" or "dream" occupation might have, and also a "nightmare" occupation -- the worst they could imagine (Katz, Norris, & Kirsh, 1969). But the sets of constructs used by many students seemed impoverished; so we went to more highly structured types of interviews.

In a variation on the Role Construct Repertory test (Kelly, 1955), we gave students triads of occupations and asked them to indicate which two of the three seemed to offer satisfactions and rewards that were more nearly alike than the satisfactions and rewards offered by the third. From their responses we were able to determine the dimensions along which they construed similarities and differences in occupational satisfactions. Again, although students collectively used a substantial

number of constructs, individuals tended to mention only a few -- with a maximum of five. So we invented a new procedure.

In a simulated occupational choice (Katz, Norris, & Pears, 1976, 1978), we gave students an opportunity to ask us questions about a set of unknown "occupations of the future"; they used the information we gave them in response to their questions to rate the attractiveness of each occupation. Then we gave them unsolicited information on values they had not asked about; once again, they rated the attractiveness of each occupation. We observed frequent large changes in the ratings based on this more comprehensive array of values and information. Our observations from this procedure (as well as the other structured interviews mentioned above) confirmed our belief in the need for systematic consideration of the values domain; they also increased our confidence in the usefulness, comprehensiveness, and relevance of the values dimensions we had already assembled.

In addition, as part of a questionnaire follow-up of a large national sample of high school students whose aptitude and interest scores were already recorded, we asked them to weight the importance of some dozen values dimensions. Unrestricted maximum likelihood factor analyses showed that the three domains -- aptitudes, interests, and values -- were independent, and also indicated the structure of values and the relative independence of the dimensions (Norris & Katz, 1970).

Since the values dimensions we retained are evident in SIGI and SIGI PLUS, there may be some interest here in an indication of what was discarded, and why. One such value is often called "creativity." We could not come up with a viable operational definition of it, nor were students at all consistent in their perceptions of it. It was not clear whether those who considered creativity important valued a chance to be

creative in general, or in some particular type of activity, such as verbal, scientific, artistic.

Another example is a value called sense of accomplishment or pride in work. We found that although rewards and satisfactions corresponding to definitions of this value might differentiate between some unskilled and higher-level occupations, it did not seem useful in differentiating between the occupations to which guidance programs are usually addressed. (Most unskilled positions are chosen as a function of job characteristics, as indicated below, rather than occupational characteristics.) Furthermore, how could one rate an occupation low on this dimension in the face of the doctrine that all socially useful work can be a source of pride or sense of accomplishment?

Other values frequently found in the literature tend to be attributes not so much of occupations as of jobs. While such characteristics as "easy commute," "pleasant co-workers," "flexible hours," and so on may be important to many people, the opportunity to obtain these benefits varies more between jobs within an occupation than between occupations. Their flavor is local rather than generic, and we could not use them to differentiate between occupations.

Finally, in research studies and guidance resources, one often encounters values labeled, "Work that seems important or interesting to me," "Self-actualization," and the like. Such labels try to wrap up virtually the entire domain of values and interests in one all-encompassing dimension, leaving the task of self assessment still undone. These global labels cannot be linked to the attributes of occupations. Such a composite rating of an occupation on all attributes of importance is the outcome, not the starting point, of an analysis of

what a person wants and what opportunities an occupation offers to obtain it.

The dimensions of values finally used are not exhaustive. The list presented for assessment, however, has stood up very well in the use of SIGI (Chapman, Katz, Noris, & Pears, 1977). College students perceive the dimensions as independent (intercorrelations of the weights do not tend to be high); the weights given each value tend to vary greatly across students (as indicated by the standard deviations); each value is regarded as important by substantial numbers of students; and students rarely say that values of importance to them have been omitted (as determined by interviews and questionnaires after their use of SIGI). Aside from studies of SIGI and SIGI PLUS users, these characteristics of the values have been confirmed in interviews with high school students (Tittle, 1981). Evidence of the stability of such values over a period of seven to ten years has been found in several studies (e.g., Mortimer & Lorence, 1979; Lindsay & Knox, 1984).

This brief summary of research undertaken to identify values dimensions serves to illustrate the nature and extent of the research underlying the dimensionality of the other domains in individual assessment. Of much greater magnitude is the scope of research necessary to obtain accurate occupational information. Accuracy is often difficult to evaluate. The best way to judge is to consider the procedures used to collect, interpret, prepare, and document the information used in a system. These procedures involve many decisions, definitions, and rules (as exemplified by the handbook for occupational information in SIGI -- Pears & Weber, 1980). In the beginning, one can assume that there is a universe of occupations (which have to be defined) and there is a universe of facts about these occupations. Some

of these occupations and facts have come under observation (according to what decisions and by application of what rules?). Observations are collected and organized as data (what decisions, rules, and definitions govern the categories, scales, and intervals used?). Data, in turn, are interpreted and transformed into information (by what rules and definitions?). The progression from universe to observations to data to information continues as information, when filtered and absorbed by a user, becomes knowledge, which usually feeds into decisions, plans, and actions. If the information is inaccurate, the clients who make the decisions, plans, and actions will be misguided. There is no technology I know of that can substitute for human judgment and effort in formulating and applying these procedures to ensure accuracy of occupational information.

Thus I conclude by reiterating a point I made early in this speech: Technology provides previously unequalled opportunities for applying human intelligence and judgment in the service of career guidance.

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