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5. Use of Computer Technology in Behavioral Assessments

Thomas R. Kratochwill
University of Wisconsin-Madison, tomkat@education.wisc.edu

Elizabeth J. Doll
University of Colorado-Denver

W. Patrick Dickson
Michigan State University, pdickson@msu.edu

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Michigan State University

Major developments in the behavioral assessment field have occurred over the past decade (e.g., Barlow, 1981; Ciminero, Calhoun, & Adams, 1986; Haynes & Wilson, 1979; Mash & Terdal, 1988a). The use of computer technology by behavioral assessors has occurred, but this is a relatively recent development (Kratochwill, Doll, & Dickson, 1986; Romanczyk, 1986). Consider, for example, that behavioral assessment texts include little discussion of computer applications and many articles restrict discussion of behavioral assessment to observational measures (see Cone & Hawkins, 1977, for an exception). In psychology and education, issues of journals have been devoted to computer applications in assessment and treatment (e.g., Bennett & Maher, 1984; McCullough & Wenck, 1984a) and these have generally included articles describing applications in the behavioral field.

Developments in computer technology are important in behavioral assessment for a number of reasons. First, although many current applications of computer technology in psychology and education have focused on traditional testing, test scoring, and report generation, there is the potential for application of this technology across a wide range of behavioral measures on various adult and childhood behavior disorders (Reynolds, McNamara, Marion, & Tobin, 1985). Applications (to be reviewed in this chapter) already include interviews, checklists and rating scales, direct observation, self-monitoring, and psychophysiological measures. Thus, the technology available may facilitate behavioral analysis and treatment design, and monitoring across these measures.

Second, computers offer special benefits in practice by reducing the time and cost of assessment. While this might be considered an advantage of computer-assessment applications generally, it is a special feature that should be considered by behavioral assessors. Traditionally, behavioral assessment has been considered very time consuming and costly for use in applied settings. Surveys of practitioners who have engaged in behavioral assessment practices have provided feedback suggesting time and cost limitations (e.g., Anderson, Cancelli, & Kratochwill, 1984), and these dimensions have, in part, explained the reliance on more traditional tests by behavioral assessors (Mash & Terdal, 1988b).

Third, and related, computer technology may help standardize behavioral assessment on procedural and psychometric dimensions. In the past, behavioral assessment has not been highly standardized, even though a movement in this direction could be positive (e.g., Cone & Hawkins, 1977; Kratochwill, 1985; Mash & Terdal, 1988b). Computer programming requires researchers and clinicians to operationalize measures that remained previously at the conceptual level. Thus, this standardization could occur on both psychometric (accuracy, reliability, validity, norming) and procedural dimensions (protocol, instructions, coding) of various behavioral assessment strategies.

Fourth, microcomputer technology, especially accompanying software programs, can facilitate the dissemination of behavioral assessment strategies into diverse areas of practice. The range of applications from least to most influence of the psychologist in therapeutic decision making and client care include the following (Hartman, 1986b): (a) storage and retrieval of clinical records, (b) administration and storage of tests, (c) automated interviewing, (d) automated test interpretation, (e) integrated report writing/evaluations, and (f) treatment programming. Because increasing numbers of practitioners have access to microcomputers, behavioral assessment tools can be disseminated by sharing a disk. Thus, the software provides a portable vehicle for assessment and treatment procedures, encouraging use in diverse settings and with diverse clients.

Fifth, although there is little empirical work in this area, computers in behavioral assessment may strengthen the link between assessment and treatment. Microcomputers have been used for both assessment and treatment of developmentally disabled children (e.g., Romanczyk, 1984, 1986), and may supplement conventional self-help or bibliotherapy formats in psychological treatment (Reynolds et al., 1985). "Expert systems" (discussed subsequently) may also facilitate the assessment treatment link (Kramer, 1985).

In this chapter we discuss the current scope of behavioral assessment and provide an overview of some identifying characteristics. We then review current applications of computer technology across several domains of behavioral assessment. Finally, we present factors bearing on the development and use of computers in behavioral assessment with a specific focus on directions for research.

DIMENSIONS OF BEHAVIORAL ASSESSMENT

Behavioral assessment strategies are associated with contemporary behavior modification or behavior therapy. Within contemporary behavior therapy four major conceptual approaches are represented (Wilson & Franks, 1982). These include neobehavioristic (S–R) theory, applied behavior analysis, cognitive behavior therapy, and social learning theory. The scope of assessment activities and methods vary as a function of the area, but there are some general features that provide unity to the field. Generally, behavioral assessment can be regarded as a hypothesis testing process regarding the nature of problems, causes of problems, and evaluation of intervention programs (Mash & Terdal, 1988b). In this process the assumptions, implications, uses of data, level of inferences, method, timing, and scope of assessment differ from traditional approaches (Hartmann, Roper, & Bradford, 1979).

Table 5.1 provides an overview of the major historical differences between behavioral and traditional assessment. The major differences between behavioral and traditional approaches conveyed in the table vary across the four major areas of behavior therapy. Perhaps the major factor accounting for differences is that the behavioral and traditional approaches to assessment embrace different conceptual systems in explaining behavior (Nelson & Hayes, 1979). Traditional assessors generally consider intraorganismic variables essential in explaining academic and social behavior. Overt behavior, the primary focus in traditional assessment, would be considered symptomatic of some underlying dysfunction or disturbance. For example, in the personality assessment area, computerized testing might be used to reveal unconscious factors or traits potentially related to the client's problem (see Fowler, 1985). Likewise, underlying processes are often said to account for learning problems in reading, math or language and assessment is designed to tap these underlying processes. Traditional assessors generally de-emphasize a situational or environmental functional analysis during the assessment process and in interpretation of assessment data.

In contrast to traditional assessment, behavioral assessors typically place a major focus on sampling *behavior* (overt and covert) in various situations and emphasize the individual–environment interaction (Kazdin, 1978; Mischel, 1968, 1973). Behavior and environmental factors are assessed in multiple settings, and the focus on person and environmental factors is made without heavy reliance on underlying processes or unconscious traits. The methods of behavioral assessment, like those of traditional assessors, include interviews, self-report measures, checklists and rating scales, psychophysiological measures, self-monitoring, and direct observations (see Kratochwill & Sheridan, 1990 for an overview). The utility of computer-based assessment for these measures may vary as a function of the purposes for assessment.

TABLE 5.1
Differences Between Behavioral and Traditional Approaches to Assessment

	Behavioral	*Traditional*
I. Assumptions		
1. Conception of personality	Personality constructs mainly employed to summarize specific behavior patterns, if at all	Personality as a reflection of enduring underlying states or traits
2. Causes of behavior	Maintaining conditions sought in current environment	Intrapsychic or within the individual
II. Implications		
1. Role of Behavior	Important as a sample of person's repertoire in specific situation	Behavior assumes importance only insofar as it indexes underlying causes
2. Role of history	Relatively unimportant, except, for example, to provide a retrospective baseline	Crucial in that present conditions seen as a product of the past
3. Consistency of behavior	Behavior thought to be specific to the situation	Behavior expected to be consistent across time and settings
III. Uses of data	To describe target behaviors and maintaining conditions	To describe personality functioning and etiology
	To select the appropriate treatment	To diagnose or classify
	To evaluate and revise treatment	To make prognosis; to predict
IV. Other Characteristics		
1. Level of inferences	Low	Medium to high
2. Comparisons	More emphasis on intra-individual or ideographic	More emphasis on inter-individual or nomothetic
3. Methods of assessment	More emphasis on direct methods (e.g., observations or behavior in natural environment)	More emphasis on indirect methods (e.g., interviews and self-report)
4. Timing of assessment	More ongoing; prior, during, and after treatment	Pre- and perhaps post-treatment, or strictly to diagnose
5. Scope of Assessment	Specific measures and of more variabls (e.g., of target behaviors in various situations, of side effects, context, strengths as well as deficiencies)	More global measures (e.g., of cure or improvement) but only of the individual

Note. From "Some relationships between behavioral and traditional assessment," by D. P. Hartmann B. L. Roper, and D. C. Bradford (1979), *Journal of Behavioral Assessment, l*,, 3-21. Reprinted by permission

APPLICATIONS OF MICROCOMPUTERS IN BEHAVIORAL ASSESSMENT

Microcomputers would seem to lend themselves most easily to assessment of intraorganismic traits; traditional strategies for the assessment of traits rely on paper-and-pencil or verbal responses, that allow entry into a computer data base. Indeed, the earliest applications of computer technology to the mental health field have involved scoring programs for traditional tests of personality and intelligence.

Interview

Scope of Assessment. In interview assessment methods, the clinician is concerned with obtaining a verbal report from the client on events and activities related to a problem that usually has occurred at some other time and place. In this regard, interviews represent indirect assessment methods. Interviews have been used relatively often in behavioral assessment, but there still is an inadequate research base in the area (Haynes & Jensen, 1979). While several different formats have been used during conventional behavioral interviews (e.g., Bergan & Kratochwill, 1990; Kanfer & Grimm, 1977; Kanfer & Saslow, 1969), few formal or standardized formats are available for use with computers.

Computer Applications. Computers can potentially be used for the collection of interview data directly from a client, for storage of interview data, and for analysis of the stored data. The interview can proceed according to a standardized format or can direct the client to certain questions contingent upon their answers to other questions, a process called "branching." Specific computer applications in behavioral assessment are relatively rare, even though there are numerous early applications including the interviewing of medical (Logie, Madirazza, & Webster, 1976; Slack & VanCura, 1968) and psychiatric patients (Griest et al., 1973; Griest, Klein, & VanCura, 1973; Gustafson, Griest, Stauss, Erdman, & Laughren, 1977). Sometimes questionnaire formats can be adapted for purposes of an interview. Carr, Ancill, Ghosh, and Margo (1981) administered a self-rating depression questionnaire via microcomputer and found that depressed subjects could be discriminated from normal controls with a very high level of accuracy. Ratings of depression by clinicians correlated .78 with the self-ratings on a microcomputer-administered instrument.

Angle, Ruden–Hay, Hay, and Ellinwood (1977) presented an early application of a computer in behavioral assessment in which they gathered information from up to 16 clients simultaneously in a modified Kanfer and Saslow (1969) interview format.[1] The computer first conducted the Computer Problem Screen, identifying the client's problem behaviors across several life areas (e.g., marriage, child rearing, tension). For problems identified during this initial screen, the client then received a series of more in-depth computer interviews to identify various situational events associated with the behavior. For example, in the sexual area, the computer survey consisted of more than 1,000 questions and took approximately 2 hours. The authors describe their program as quite modest with the major weakness being the omission of a functional analyses of identified problems that would have related directly to treatment. Similar application of computer-based interview assessment is the *Problem Oriented Record* that contains approximately 3,500 multiple-choice questions covering 28 behavioral excesses and deficits (Angle, Ellinwood, Hay, Johnsen, & Hay, 1977; Angle, Johnsen, Grebenkemper, & Ellinwood, 1979).

A more recent application of microcomputer interviewing is the *Behavior Manager* (Tomlinson, Acker, & Mathieu, 1984), a program developed specifically for use by classroom teachers who wish to manage difficult behavior problems of students. The program is designed to help the user develop plans for the following behavior problems: not completing assignments, overactive, attention seeking, work refusal, aggression-anger, shy-withdrawn, social relations, immaturity and self-esteem. The program involves professional consultation through a computer–client interaction. Teachers contribute information about a target child, their personal disciplinary preferences, and the classroom routine. The computer program provides a problem-solving structure bolstered by information about classroom behavior problems and intervention strategies. For example, after choosing a problem area typical of the targeted student (as noted previously), the teacher is asked to review a list of descriptors characteristic of children with the problem and identify those characteristics of the targeted student. The following represents the format used in problem description:

This category includes any of the following characteristics:

- Little participation in class or social activities;
- Little or no group participation;
- Plays or sits by oneself;
- Talks little, soft spoken, few words, passive;
- Doesn't speak at all (elective mute).

[1]Kanfer and Saslow (1969) provided a mode of behavioral assessment that included seven components: an analysis of the problem situation, clarification of the problem situation, motivational analysis, developmental analysis, analysis of self-control, analysis of social situations, and an analysis of the social-cultural physical environment. The seven areas have often served as a conceptual framework for the conduct of a behavioral interview.

> If any of these statements describe Bob, press space bar to continue. If not, press X to make another choice (p. 9).

The program then branches into a series of forced-choice questions to define the problem behavior further. Similar branching procedures allow for the selection of incentives and responses to common objections and questions of teachers.

After moving through the program, the teacher is provided with an intervention that has incorporated teacher-made observations of the problem student, personal preferences for incentives, and the classroom routine. The plan can be printed out for teacher convenience, and a follow-up routine is available after the plan has been implemented for 2 weeks. The *Behavior Manager* demonstrates the use of microcomputer capability to access systematically large amounts of information while guiding users through a branching decision-making structure. Further, decisions are guided by knowledge derived from a research base in classroom behavior management.

The *Behavior Manager* also provides demonstration of the limitations of computer-managed decision-making structures. First, there is a tradeoff between the complexity of the program structure and the scope of decisions that can be made using it. While the *Behavior Manager* uses a relatively complex decision-making structure, it addresses only a limited number of classroom behavior problems and suggests a limited number of intervention strategies. Second, the program's soundness depends heavily on the adequacy of the knowledge base upon which it draws. Additional work is needed to validate the efficacy of the *Behavior Manager* and the adequacy of the literature review upon which its decisions are based. Third, attention may also need to be paid to the acceptability of the intervention strategies suggested by the program. For example, the program tends to suggest time-out strategies with great frequency, a strategy that may be considered aversive and impractical for use in many classrooms. Finally, the introduction of computer assisted decision-making technology into the behavior management process is new and subject to empirical evaluation. An important question is whether the structure and information provided by the program is sufficient consultation for behavior management planning by novice teachers. Can teachers indeed use such a program successfully without supervision by a mental health professional?

Analogue Assessment Procedures

Scope of Assessment. A rather wide range of analogue assessment strategies have been adapted to the computer and can be used in behavioral assessment. These measures include academic achievement and intellectual assessment devices. These strategies are conceptualized as analogue measures of behavior because the measurement often occurs under conditions and on measures that are similar to, but no identical with, the environment and/or task in which the client functions.

Computer Applications. A common application of computer technology to psychological assessment is computer-assisted scoring of examiner-administered tests (Butcher, Keller, & Bacon, 1985; Romanczyk, 1986; Skinner & Pakula, 1986). Test-scoring programs usually save the assessor time over manual scoring. In addition, accuracy is usually increased with the assistance of the computer program. There are many test-scoring programs available for standardized intelligence, personality, and achievement scales. Virtually all of these programs can be useful in behavioral assessment, depending on the nature and purpose of assessment. For example, such assessment might be useful during the early phases of assessment when the clinician is trying to identify clearly the treatment focus. Test scoring is termed a *noninteractive* form of computer-assisted assessment, in that the client never interacts with the computer (Romanczyk, 1986).

In the *interactive* form of assessment the instrument itself has been incorporated into the computer program, allowing the computer to implement the complete administration. The interactive type of program has been adapted for assessment in reading and spelling (Hasselbring, 1984). For example, the *Computerized Test of Reading Comprehension* (Hasselbring, 1983a) is a computerized version of the *Test of Reading Comprehension* (Brown, Hammill, & Wiederholt, 1978). The computerized version makes use of the computer's facility for data collection, analysis, and storage. Students are presented the appropriate reading passages via the computer's monitor and key in their responses on the keyboard. The computer scores responses as they are given, discontinues the subtest administration once a ceiling is reached, and stores the response data. Teacher involvement can be limited to introducing the student to the computer initially, and printing out a copy of the results.

The *Computerized Test of Spelling Errors* (Hasselbring, 1983b) coordinates a microcomputer and a cassette tape recording. The prerecorded tape is synchronized to the software to pronounce words and sentences for each of 40 spelling words. Given responses keyed in by students, the computer scores their performance, conducts a diagnostic spelling error analysis for all identified errors, and stores a permanent record of the results.

The *Computerized Cloze Procedure* (Hasselbring, 1983c) creates an individualized reading test from any passage keyed in by an instructor. The program drops every *n*th word, presents the passage with blanks to a student, and scores the responses that students key in from the keyboard. These applications illustrate ways interactive software can incorporate computers into the process of analogue assessment.

The major advantages of interactive systems are similar to those in other assessment domains. There may be savings in time and examiner bias may be reduced. It cannot be assumed, however, that scores from the computer-administered version of a test are equivalent to those of the traditional version. Test equivalence must be established empirically, and until it has been established, a computer-administered measure cannot be substituted for the paper-and-pencil version. Standards now exist for determining when a computer-administered version of a test can be assumed equivalent to the traditional paper-and-pencil version (e.g., American Psychological Association, 1986).

Retrospective Assessment Procedures

Scope of Assessment. A variety of standardized checklists, rating scales, and self-report measures are used in behavioral assessment. These are conceptualized as indirect measures of behavior because the data are gathered in a retrospective fashion and may not be associated with the identified problem target behavior. For example, a general anxiety scale is usually completed on problems that occurred at some time in the past and not on a discrete target behavior that might eventually become the treatment focus.

Microcomputer Applications. Like analogue assessment procedures, retrospective assessment measures can be computer-scored and can also easily be made into interactive forms allowing the checklist or scale to be computer-administered.

The *Dallas Problem Rating Interview* (DPRI) (Fowler, Finkelstein, & Penk, 1986) is an application of an interactive program to the administration of a standardized rating scale. The DPRI is a computer-administered problem checklist developed for use in the Veterans Administration Medical Center of Dallas. It is administered at time of intake, and a follow-up version (DRPI–F) administered at regular intervals throughout hospitalization, to inpatient clients of the mental health facility. To complete it, patients note the presence and rate the severity of up to 245 symptoms, behaviors, or dysfunctions. Computer scoring sorts responses of the DPRI into 20 empirically derived factors, including depression, sleep disturbance, social avoidance, respiratory complaints, among others. In an ongoing research program, Fowler and his colleagues are collecting data to evaluate the validity and psychometric properties of the computer-administered scale. Current data show high correlations between the DPRI and the *Behavior Problem Rating Scale* (BPRS), a widely used measure of drug and treatment effectiveness with psychiatric populations. Further studies are in progress to evaluate the scale's sensitivity to effects of specific treatments in homogeneous groups of patients. The program uses a branching strategy, with the administration of some items conditional upon patient responses to earlier items. As a result of the increased efficiency, even the more severely disturbed clients have been able to complete the scale most of the time (Fowler et al., 1986).

Fowler and his colleagues use the DPRI to provide an ongoing, cost-effective measure of client response to treatment. Individual client reports can be produced that show a single client's response over time to a chosen DPRI factor, along with initial and final ratings on selected items. The resulting DPRI data base illustrates the flexibility of a computer-managed assessment system, and the impact that such flexibility can have on services to clients. Because data can be collected at several points in time, and because collected data are easily sorted and accessed, analyses of change over time in client ratings are possible. Composite reports summarizing change scores across clients can be used for program evaluation.

Fowler (1985) suggested that more accessible computer technology may have a direct impact on the amount of measurement of treatment effect that can occur, whether these effects are assessed as continuous rather than pre-/postmeasures, and the accessibility of that data to predictions of change over time. As a result, the ideal of data-based decision making in clinical practice has become more achievable.

Psychophysiological Assessment

Scope of Assessment. Physiological responses are generally assessed through some type of special instrumentation that monitors bodily functions (Kallman & Feuerstein, 1977). Among the more common response options in physiological assessment are heart rate, GSR, respiration, and blood pressure. Computers have a long history of use in psychophysiological assessment and especially in biofeedback research (e.g., Rugg, Fletcher, & Lykken, 1980; Russo, 1984). Computers have been used in this way by behavioral assessors for many years.

Computer Applications. Although it is beyond the scope of the present chapter to review psychophysiological computer assessment in detail (see Romancyzk, 1986; Chapter 10, for a review), a few representative examples will illustrate some exciting applications. Several of the computer applications have focused on assessment as part of treatment of anxiety or anxiety-related problems (Biglan, Villwock, & Wick, 1979; Pope & Gersten, 1977). In the Biglan et al. study, a computer is used to deliver a treatment program for test anxiety. The clients are first presented with a noncomputer program involving audiotaped relaxation. The computer is then used to present a desensitization program. The client is presented with a hierarchy of 20 items related to test anxiety and is instructed to signal comfort level to an item. The program then presents a relaxation period, repeats, or goes on to the next item. The computer stores the assessment information and allows the client to begin the next session at a level appropriate for the client. There is no empirical support for the program, although 9 of 15 subjects showed significant improvement on a self-report measure of test anxiety.

Two issues should be emphasized with this assessment format. First, the amount of data generated through psychophysiological monitoring equipment is extensive, making the computer especially valuable in data storage and organization. The data organization and optional display formats provide a new domain for understanding and interpretation of the data. Second, the quality of information entered into the computer is of primary importance with sophisticated physiological monitoring. Physiological monitoring equipment may fail, habituation and adaptation factors need to be considered, clinician and contextual variables may interact with physiological measures, and physiological measures may not agree with other behavioral assessment procedures (Hersen & Barlow, 1976; Nay, 1979). The computer may not be programmed to discriminate between good and "contaminated" data and the assessor must be alert to the wide range of factors that could lead to error. Nevertheless, the interface of computer and sophisticated physiological monitoring offers promising opportunities in assessment.

Self-monitoring

Scope of Assessment. Self-monitoring involves an individual's discrimination and subsequent recording of his or her own behavior. Self-monitoring is typically used to record various behaviors at the time of occurrence and has been applied to a wide range of target responses (see Ciminero, Nelson, & Lipinski, 1977, for an overview). While self-monitoring is used in assessment, it often is obtrusive and therefore has a reactive effect on the behavior being recorded. As a result of potential recording reactivity, self-monitoring has been used as an active treatment for childhood and adult problems. Self-monitoring is often used as a part of multicomponent self-control programs.

Computer Applications. Microcomputer software for teaching or using self-monitoring are relatively rare. Tombari, Fitzpatrick and Childress (1985) described a computer program to assist in teaching a fifth-grade child, Carl, self-observation and self-recording. The computer was conceptualized as a "program manager" and assisted in goal setting and rehearsal, providing feedback and reinforcement, and maintaining records of behavior change. The target selected was out-of-seat behavior. A Computerized Behavior Management System (CBMS) was executed on an Apple II+. The teacher first provided input into the computer on the average frequency of Carl's out-of-seat behavior, the number of class periods he was expected to take to reach a behavioral goal, a brief description of Carl's behavior problem, and a brief description of his behavioral goal. The computer determined and stored daily goals for Carl.

Carl typed his problem behavior and goal into the computer daily; failure to identify the problem correctly and goal led to a computer shutdown and subsequent discussion with the teacher. When Carl entered his target behavior and goal correctly, he was required to type in the frequency of his out-of-seat behavior for that day. If this frequency met or exceeded the daily goal, he was provided feedback in the form of a graph. Reinforcement was provided in the form of access to video games. Teacher input was also scheduled periodically to check on the accuracy of data and accurate data were reinforced.

Fig. 5.1 shows that the CBMS intervention resulted in a decrease in out-of-seat behavior. What is unclear is what component of the self-control program was responsible for change or whether the computer package was necessary for reduction of the out-of-seat problem.[2] Moreover, the teacher played an active role in the intervention process and it is unclear how much her role in ensuring the integrity of the program was responsible for the observed outcome. This study does demonstrate how self-monitoring computer assessment can be used to document behavior change. The role of self-monitoring in treatment is less clear, however.

Self-monitoring was used as part of a measurement system in a treatment program for obesity in a project reported by Burnett, Taylor, and Agras (1985). The program was implemented using a portable microcomputer system carried by the clients throughout their daily routines. The experimental design in this study provides a more direct test of the impact of computer assistance on a self-monitoring program. Subjects in the experimental treatment group (n = 6) made self-reports of consumption of food between meals, at meals, and during exercise. The computer provided immediate feedback on total meal or snack calories for each session, total calories for the day, percentage of daily caloric intake limit eaten, and the remaining caloric intake limit for the day. The computer also provided contingent praise and instructions.

The program also involved a within series design (A/B/A/B). The control group also used self-monitoring, goal setting, and feedback but without the computer assistance. The mean weight loss after the 8 postbaseline weeks was 8.1 lbs. for experimental subjects, compared with 3.3 lbs. for the control subjects.

An important feature of self-monitoring is the feedback and graphic presentation of data. Graphing applications make use of the computer's ability to store large amounts of information and transform it into a variety of formats. Behavioral program data already stored in the computer can be converted readily to graphic form. Progress, or lack of progress, may be easier to recognize, explain, and interpret when accompanied by graphic representations. It is clear that the computer not only has the potential to change the ways in which an intervention might be monitored but can also enhance the power of feedback. The decreasing size and increasing power of microcomputers has made it possible for them to enter natural settings. This has clearly increased their potential and has moved beyond the simple analysis of evaluative data, to include data collection, feed-

[2]Although the A/B/A withdrawal design allows some inference for the treatment effect, a replication of the intervention (i.e., A/B/A/B) would have resulted in a stronger inference procedure. "Goal matching" during the intervention phase would also have resulted in stronger inference for the treatment effect.

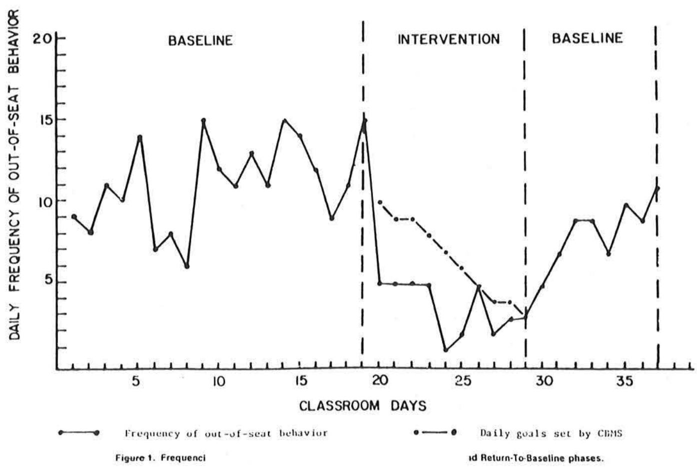

FIG. 5.1. Frequencies of out-of-seat behaviors across Baseline, Intervention, and Return-to-baseline phases. Source: M. L. Tombari, S. J. Fitzpatrick, & W. Childress, 1985. Using computers as contingency managers in self-monitoring interventions: A case study. *Computers in Human Behavior, 1,* 75–82. Reprinted by permission.

back, and display functions as well. Although this may have a reactive effect and therefore, be therapeutic for the client, self-monitoring effects are usually short-lived and typically need to be supplemented with other treatment components, as was true in the study by Burnett, et al. (1985).

Direct Observational Assessment

Scope of Assessment. Direct observational measures are the hallmark of the behavioral assessment field (Cone & Foster, 1982; Hartmann, 1982). Direct measures are obtained through development of response definitions, training of observers, and observation of behaviors in the natural environment or under analogue conditions. Observational measures are considered direct in that the target measure is recorded at the time of occurrence, and not retrospectively, thereby hopefully increasing the accuracy and validity of assessment data.

Computer Applications. Recording complex observational data is often difficult because of the demands placed on the observer. An observer's attention must be divided between accurately observing the behavior and recording the behavior clearly and precisely. Microcomputers have been used to address this and related problems. Using a keyboard, behavior occurrence can be recorded by pushing a button and multiple behaviors can be recorded simultaneously by assigning each behavior to a different key. Current technology allows computers to be fitted with an internal clock allowing for the interval recording of a behavior or for measuring behavior latencies, something that a human observer may

TIME-SAMPLE BEHAVIORAL CHECKLIST (TSBC):

PRODUCTION DATE:
REQUESTED BY:

POR	HOS	INDEX/BEHAVIOR: CONCURRENT ACTIVITIES:	CURNT STATE	CHANGE FROM ENTRY	CHANGE FROM L.WK
___	(AP)	WATCHING OTHERS...........	X.XXX	X.XXX	X.XXX
___	(AP)	TALKING TO OTHERS.........	X.XXX	X.XXX	X.XXX
___	(AP)	LISTENING TO OTHERS.......	X.XXX	X.XXX	X.XXX
___	(AP)	PLAYING A GAME............	X.XXX	X.XXX	X.XXX
___	(AP)	GROUP ACTIVITY............	X.XXX	X.XXX	X.XXX
___	(AH)	READING...................	X.XXX	X.XXX	X.XXX
___	(AH)	WRITING...................	X.XXX	X.XXX	X.XXX
___	(AH)	HOBBY OR HANDICRAFT.......	X.XXX	X.XXX	X.XXX
___	(AH)	WORKING...................	X.XXX	X.XXX	X.XXX
___	(AM)	EATING....................	X.XXX	X.XXX	X.XXX
___	(AM)	DRINKING..................	X.XXX	X.XXX	X.XXX
___	(AM)	PERSONAL GROOMING.........	X.XXX	X.XXX	X.XXX
___	(AE)	SINGING...................	X.XXX	X.XXX	X.XXX
___	(AE)	SMOKING...................	X.XXX	X.XXX	X.XXX
___	(AE)	LISTENING TO RADIO,PHONO..	X.XXX	X.XXX	X.XXX
___	(AE)	WATCHING TV...............	X.XXX	X.XXX	X.XXX
___	(A)	OTHER.....................	X.XXX	X.XXX	X.XXX
___		STEREOTYPE(1)/VARIABLE(17)	X.XXX	X.XXX	X.XXX

POR	HOS	FACIAL EXPRESSION:	CURNT STATE	CHANGE FROM ENTRY	CHANGE FROM L.WK
___	(AP)	SMILING-LAUGHING W/STIM...	X.XXX	X.XXX	X.XXX
___	(AP)	GRIMACING-FROWNING W/STIM.	X.XXX	X.XXX	X.XXX
___	(A)	NEUTRAL NO/STIMULUS.......	X.XXX	X.XXX	X.XXX
___	(IS)	NEUTRAL W/STIMULUS........	X.XXX	X.XXX	X.XXX
___	(IC)	SMILING-LAUGHING NO/STIM..	X.XXX	X.XXX	X.XXX
___	(IC)	GRIMACING-FROWNING NO/STIM	X.XXX	X.XXX	X.XXX
___		STEREOTYPE(1)/VARIABLE(6).	X.XXX	X.XXX	X.XXX

POR	HOS	SOCIAL ORIENTATION:	CURNT STATE	CHANGE FROM ENTRY	CHANGE FROM L.WK
___		ALONE.....................	X.XXX	X.XXX	X.XXX
___		WITH RESIDENTS (PATIENTS).	X.XXX	X.XXX	X.XXX
___		WITH STAFF................	X.XXX	X.XXX	X.XXX
___		WITH OTHERS...............	X.XXX	X.XXX	X.XXX
___		STEREOTYPE(1)/VARIABLE(4).	X.XXX	X.XXX	X.XXX

POR	HOS	PHYSICAL POSITION:	CURNT STATE	CHANGE FROM ENTRY	CHANGE FROM L.WK
___	(A)	SITTING...................	X.XXX	X.XXX	X.XXX
___	(A)	STANDING..................	X.XXX	X.XXX	X.XXX
___	(A)	WALKING...................	X.XXX	X.XXX	X.XXX
___	(A)	RUNNING...................	X.XXX	X.XXX	X.XXX
___	(A)	DANCING...................	X.XXX	X.XXX	X.XXX
___	(IS)	LYING DOWN................	X.XXX	X.XXX	X.XXX
___		STEREOTYPE(1)/VARIABLE(6).	X.XXX	X.XXX	X.XXX

POR	HOS	INDEX/BEHAVIOR: CRAZY BEHAVIORS:	CURNT STATE	CHANGE FROM ENTRY	CHANGE FROM L.WK
___	(IS)	ROCKING...................	X.XXX	X.XXX	X.XXX
___	(IS)	REPET-STEREOTYPIC MOVEMENT	X.XXX	X.XXX	X.XXX
___	(IS)	POSTURING.................	X.XXX	X.XXX	X.XXX
___	(IS)	SHAKING-TREMORING.........	X.XXX	X.XXX	X.XXX
___	(IS)	PACING....................	X.XXX	X.XXX	X.XXX
___	(IS)	BLANK STARING.............	X.XXX	X.XXX	X.XXX
___	(IC)	CHATTERING-TALKING TO SELF	X.XXX	X.XXX	X.XXX
___	(IC)	VERB DEL-HALLUC-S.THRT....	X.XXX	X.XXX	X.XXX
___	(IC)	INCOHERENT SPEECH.........	X.XXX	X.XXX	X.XXX
___	(IC)	CRYING....................	X.XXX	X.XXX	X.XXX
___	(IH)	SCREAMING.................	X.XXX	X.XXX	X.XXX
___	(IH)	SWEARING-CURSING..........	X.XXX	X.XXX	X.XXX
___	(IH)	VERBAL INTRUSION..........	X.XXX	X.XXX	X.XXX
___	(IH)	DESTROYING PROPERTY.......	X.XXX	X.XXX	X.XXX
___	(IH)	INJURING SELF.............	X.XXX	X.XXX	X.XXX
___	(IH)	PHYSICAL INTRUSION........	X.XXX	X.XXX	X.XXX
___	(I)	OTHER.....................	X.XXX	X.XXX	X.XXX
___		STEREOTYPE(1)/VARIABLE(17)	X.XXX	X.XXX	X.XXX

POR	HOS	AWAKE-ASLEEP:	CURNT STATE	CHANGE FROM ENTRY	CHANGE FROM L.WK
___		EYES OPEN.................	X.XXX	X.XXX	X.XXX
___	(IS)	EYES CLOSED...............	X.XXX	X.XXX	X.XXX

POR	HOS	LOCATION:	CURNT STATE	CHANGE FROM ENTRY	CHANGE FROM L.WK
___		CLASSROOM-LOUNGE..........	X.XXX	X.XXX	X.XXX
___		TV ROOM...................	X.XXX	X.XXX	X.XXX
___		CORRIDOR-LOUNGE...........	X.XXX	X.XXX	X.XXX
___		OWN BEDROOM...............	X.XXX	X.XXX	X.XXX
___		OTHER-BEDROOM.............	X.XXX	X.XXX	X.XXX
___		ACTIVITY AREA.............	X.XXX	X.XXX	X.XXX
___		LIVING ROOM/DAY ROOM......	X.XXX	X.XXX	X.XXX
___		OFFICE....................	X.XXX	X.XXX	X.XXX
___		HALLWAY...................	X.XXX	X.XXX	X.XXX
___		DINING AREA...............	X.XXX	X.XXX	X.XXX
___		KITCHEN...................	X.XXX	X.XXX	X.XXX
___		RESTROOM..................	X.XXX	X.XXX	X.XXX
___		BATHING AREA..............	X.XXX	X.XXX	X.XXX
___		LAUNDRY ROOM..............	X.XXX	X.XXX	X.XXX
___		SITTING ROOM..............	X.XXX	X.XXX	X.XXX
___	(I)	SECLUSION ROOM............	X.XXX	X.XXX	X.XXX
___		OFF UNIT..................	X.XXX	X.XXX	X.XXX
___		STEREOTYPE(1)/VARIABLE(20)	X.XXX	X.XXX	X.XXX
___	(I)	UNAUTH ABS - NO OBSERV....	X.XXX	X.XXX	X.XXX
___		SICK - NO OBSERVATION.....	X.XXX	X.XXX	X.XXX
___		AUTHORIZED ABS - NO OBSRV.	X.XXX	X.XXX	X.XXX

POR	HOS	SUMMARY INFORMATION & HIGHER-ORDER SCORES: HIGHER-ORDER SCORES:	CURNT STATE	CHANGE FROM ENTRY	CHANGE FROM L.WK
___	(A)	TOTAL APPROPRIATE BEHAVIOR	X.XXX	X.XXX	X.XXX
___	(AP)	INTERPERSONAL INTERACTION.	X.XXX	X.XXX	X.XXX
___	(AH)	INSTRUMENTAL ACTIVITY.....	X.XXX	X.XXX	X.XXX
___	(AM)	SELF MAINTENENCE..........	X.XXX	X.XXX	X.XXX
___	(AE)	INDIVIDUAL ENTERTAINMENT..	X.XXX	X.XXX	X.XXX
___	(I)	TOTAL INAPPROPRIATE BEHAV.	X.XXX	X.XXX	X.XXX
___	(IS)	BIZARRE MOTORIC BEHAVIOR..	X.XXX	X.XXX	X.XXX
___	(IC)	BIZARRE FACIAL & VERBALS..	X.XXX	X.XXX	X.XXX
___	(IH)	HOSTILE-BELLIGERENCE......	X.XXX	X.XXX	X.XXX
___	(X)	ASSAULT FREQUENCY.........	X.XXX	X.XXX	X.XXX

PROBLEM-ORIENTED RECORDS: BEFORE ENTRY OR REFERENCE, RECORD "T" FOR TEMPORARY PROBS OR PERMANENT PROB NUMBERS IN "POR" COLUMN AND COMPLETE ID BOX BELOW.

THE "HOS" COLUMN REFERS TO CODES THAT ENTER HIGHER-ORDER SCORES. ALL CODES (A-) OR (I-) ENTER "TOTAL" HIGHER-ORDER SCORES. ALL CODES ENTERING (AP) REQUIR A "WITH" SOCIAL ORIENTATION. "PLAYING A GAME" ALONE ENTERS (AE).

TYPE OF SUMMARY:

NUMBER OF PEOPLE SUMMARIZED W/DATA= TOTAL=
PROPORTION OF OBSERVATIONS WITH DATA =
NUMBER OF OBSERVATIONS WITH DATA.....=
NUMBER OF OBSERVATIONS WITHOUT DATA..=

DATE ADMITTED TO UNIT: / /
DATES SUMMARIZED:

FACILITY/UNIT:

TSBC ID NUMBER:

RESIDENTS NAME

RESIDENTS ID (DEPT)

FACILITY NAME

UNIT/SUBUNIT DATE

STAFF SIGNATURE

not be able to detect systematically. The computer also can produce regular audible cues to mark the recording interval, note whether or not a key was depressed during an interval, or measure the time interval between two behaviors or incidents of behavior. When observational data are recorded via computer, the data subsequently may be analyzed by computer without being re-entered. Computer keying systems allow for more automatic reliable observational systems; dual observer systems even allow simultaneous computation of observer agreement scores while both observers collect data.

Microcomputers can record and analyze observational data when the computer can be placed in the environment in which the behavior occurs, or when the behavior is videotaped and the observational data recorded in another site. Portable computers make these recording devices usable in other settings as well. A lap-top portable computer incorporates the processor, display screen, and data storage device into a machine that approximates the size of a large textbook. Even smaller models are now available.

Several existing programs illustrate how computers have been used in observational assessment (Farrell, 1986; Fitzpatrick, 1977; Flowers, 1982; Flowers & Leger, 1982; Romanczyk & Heath, 1985). Romanczyk and Heath marketed a behavior observation software system that can be used for both data collection and analysis. Their system is designed for use on an Epson HX–20 lap-top portable computer that incorporates a small printer in addition to the processor and display screen. Their system offers six options for recording event mode data collection, event mode data analysis, event mode reliability analysis, interval mode data collection, interval mode data analysis, and interval mode reliability analysis. Multiple behaviors can be observed simultaneously, although only one key representing a single behavior can be depressed at any one time. The user is responsible for determining which mode of data collection is most appropriate for the observation being planned and for assigning the keys to the behaviors.

Farrell (1986) described a microcomputer package to facilitate the collection and processing of behavioral assessment data. The program, called Microcomputer Assisted Behavioral Assessment System (MABAS), is a menu-driven package of six computer programs and is available at cost from the author. The program is designed for an Apple II computer equipped with a clock card, modem, and game paddles. The raw data files can be used to calculate total duration and frequency for a single behavior (e.g., gaze while talking, gaze while listening, mutual gaze), to calculate correlations between the two observers, to derive conditional behaviors and sequences of behavior, and to collect data on

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FIG. 5.2. Format of Time-sample Behavioral Checklist (TSBC) summary reports. Source: G. L. Paul, 1986 . Rational operations in residential treatment settings through ongoing assessment of client and staff functioning. In D. R. Peterson & D. B. Fishman, (Eds.), *Assessment for decision* (pp. 1–36). New Brunswick, NJ: Rutgers University Press. Reprinted by permission.

STAFF RESIDENT INTERACTION CHRONOGRAPH (SRIC)

PRODUCTION DATE: / /
REQUESTED BY:
SRIC-ID NO.: NO.-1:
: NO.-2:

TYPE OF SUMMARY:

DATES SUMMARIZED: NO.-1:(/ / - / /) FACILITY/UNIT: NO.-1: / NO. STAFF: NO.-1:
NO.-2:(/ / - / /) NO.-2: / NO.-2:

NO. OF SRICS SUMMARIZED: NO.-1: AVG INCIDENCE/HR FOR A SINGLE OCCURRENCE WITH THIS NO. OF SRICS & STAFF IS: NO.-1:X.XX
NO.-2: NO.-2:

AVERAGE HOURLY INSTANCES OF STAFF ACTIVITY (MEAN)

CATEGORY OF STAFF BEHAVIOR	CATEGORY OF RESIDENT BEHAVIOR TO WHICH STAFF RESPONDED: APPROPRIATE (AP)		INAPPROPRIATE FAILURE (INF)		INAPPROPRIATE CRAZY (INC)		REQUEST (R)		NEUTRAL (N)		TOTAL STAFF BEHAVIOR		% OF INTERACTION		CATEGORY OF STAFF BEHAVR
	NO.-1	NO.-2	NO.-1	NO.-2	NO.-1	NO.-2	NO.-1	NO.-2	NO.-1	NO.-2	NO.-1	NO.-2	NO.-1	NO.-2	
POSITIVE VERBAL	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(POS VERBAL)
NEGATIVE VERBAL	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(NEG VERBAL)
POS NONVERBAL	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(POS NONVERB)
NEG NONVERBAL	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(NEG NONVERB)
POS NONSOCIAL	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(POS NONSOC)
NEG NONSOCIAL	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(NEG NONSOC)
POS STATEMENT	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(POS STATMT)
NEG STATEMENT	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(NEG STATMT)
POSITIVE PROMPT	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(POS PROMPT)
NEGATIVE PROMPT	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(NEG PROMPT)
POS GRP REFERENCE	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(POS GP REG)
NEG GRP REFERENCE	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(NEG GP REF)
REFLECT/CLARIFY	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(REFL/CLARIF)
SUGGEST ALTRNATIV	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(SUGGEST ALT)
INSTRUCT/DEMONSR	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(INSTRUC/DEM)
DOING WITH	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(DOING WITH)
DOING FOR	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(DOING FOR)
PHYSICAL FORCE	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X		(PHYS FORCE)
IGNORE/NO RESPONS	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XX.X	___	(IGNORE/NO R)
ANNOUNCE	***	***	***	***	***	***	***	***	XX.XX		XX.XX		XX.X	___	(ANNOUNCE)
ATTEND/RECORD/OBS	***	***	***	***	***	***	***	***	XX.XX		XX.XX		XX.X	___	(A/R/O)
TOTAL INTERACTION	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		XXX.XX		XX.X	___	TOTAL INTERAC
% OF INTERACTIONS	XX.XX		XX.XX		XX.XX		XX.XX		XX.XX		***	***	***	***	% OF INTERACT-
TOTAL ACTIVITY	***	***	***	***	***	***	***	***	XX.XX		XXX.XX		***	***	TOTAL ACTIVIT

NOTE: "% OF INTERACTIONS" COLUMN FOR (ANNOUNCE) (A/R/O) AND "TOTAL INTERACTIONS" REFLECT % OF TOTAL ACTIVITY INSTEAD OF INTERACTIONS. "(IGNORE/NO R)-(N)" CODES ARE NOT IN CLUDED IN "% OF INTERACTION FIGURES".

AVG RESIDENTS PRESENT: NO.-1: XX.X CONTACTS/HOUR/RESIDENT: INDIVIDUALLY: NO.-1: X.XX IN A GROUP: NO.-1: X.XX TOTAL: NO.-1: X.XX
NO.-2: NO.-2: NO.-2: NO.-2:
AVG INTERACTIONS/CONTACT: NO.-1: X.XX AVG ATTENTION RECVD BY INDIVIDUAL RESIDENT: NO.-1:XX.XX
NO.-2: NO.-2:

AVG FUNCT RESPONSIBLE: NO.-1: XX.X CONTACTS/HOUR/RESIDENT: INDIVIDUALLY: NO.-1: X.XX IN A GROUP: NO.-1: X.XX TOTAL: NO.-1: X.XX
NO.-2: NO.-2: NO.-2: NO.-2:
AVG INTERACTIONS/CONTACT: NO.-1: X.XX AVG ATTENTION RECVD BY INDIVIDUAL RESIDENT: NO.-1:XX.XX
NO.-2: NO.-2:

latencies between two subjects or behaviors such as speech latency. Farrell (1986) identifies the strength of the system as the low level of computer sophistication needed, simplified coding process, ability of the MABAS to record both total frequency and the duration of behavior in real time, and the cost and flexibility of the system.

Computers have also been central to the success of large-scale observational assessment and data management programs such as that described by Paul (1986). Paul and his associates have developed a computer-managed observational information system called the Time-sample Behavioral Checklist (TSBC)/ Staff-Resident Interaction Chronograph (SRIC). The TSBC/SRIC System was "designed to improve the quality, effectiveness, and cost efficiency of residential treatment operations" (p. 16). Computer management is necessary to collect and evaluate efficiently the large amounts of data that result from the large scale observation project.

The TSBC is the primary system for providing data on the nature and amount of client and staff functioning. Data from staff conducted observations are entered into the computer daily. Fig. 5.2 displays the format for computer summaries of the TSBC. The TSBC allows *standard weekly reports* for each individual or group for each treatment unit and *special reports* for individuals and subgroups from a continuous data file, time, behavior setting, or biographical data. Computer-generated reports are used to monitor changes in client behavior and to guide clinical decisions.

The SRIC provides information on the nature and amount of interaction provided by staff to the residents or clients. Like the TSBC, data from observations are entered daily and the system provides *standard weekly reports* and *special reports*. Fig. 5.3 presents the format for the SRIC. While the TSBC involves discrete-momentary hourly time samples of clients and staff, the SRIC involves a continuous-chronographic, 10-minute observation period of a staff member, with an observation of all staff members at the rate of once or twice per hour within a treatment unit. Data from the computer generated SRIC reports are used to provide regular, relevant feedback to staff and to guide staffing decisions.

The TSBC/SRIC System is a sophisticated assessment paradigm that can be used for a wide range of adult populations in residential treatment facilities. A nice feature of the system is that it provides information relevant to any specific theoretical treatment approach.

FIG. 5.3. Format of Staff-resident Interaction Chronograph (SRIC) summary reports. [Source: Paul, G. L. (1986). Rational operations in residential treatment settings through ongoing assessment of client and staff functioning. In D. R. Peterson & D. B. Fishman (Eds.), *Assessment for decision* (pp. 1–36). New Brunswick, NJ: Rutgers University Press. Reprinted by permission.

CONSIDERATIONS IN THE USE OF COMPUTER-BASED BEHAVIORAL ASSESSMENT

Integration of computer technology into behavioral assessment raises numerous conceptual and methodological issues (Kratochwill et al., 1986). These issues include standardization of assessment procedures, integration and application of assessment data, acceptability of computers, and ethical/legal considerations. We will elaborate on each of these issues.

Standardization of Assessment Procedures

Standardized assessment procedures are an important first step toward the development of an applied clinical science (Barlow, Hayes, & Nelson, 1984). Standardization can occur on both procedural (e.g., development of protocols, administration and scoring instructions) and psychometric (e.g., accuracy, reliability, validity) dimensions. Relative to traditional assessment approaches, behavioral assessment has generally reflected an informal and nonstandardized approach to clinical measurement. The application of computer and microcomputer technology can facilitate standardization of behavioral assessment techniques and further capitalize on benefits that standardization brings to assessment efforts generally.

First, a major positive feature of standardization through computer software is that wide-scale dissemination of these procedures may be facilitated in applied settings. The TSBC/SRIC System developed by Paul and his associates (Paul, 1986) provides a good example of how this move toward standardization may facilitate dissemination. Surveys of behavioral practitioners indicate a strong interest in the availability of more standardized assessment techniques (e.g., Anderson et al., 1984). The use of standardized microcomputer formats may well make assessment less costly and more efficient in delivering services in applied settings.

Second, the creation of software programs may further facilitate the investigation of various psychometric features of behavioral assessment. For example, in development of the TSBC, Paul (1986) reports good interobserver interactions replicability coefficients for both one-day and a week's observations. By generating an extensive computer data base of observations of clients and staff, Paul (1986) has been able to converge data into highly reliable composite scores that represent observations across an entire week. Analysis has shown these composite scores to have good psychometric properties: They account for all reliable between-client variance on traditional measures of client change (questionnaires, checklist, rating scales, etc.); they predict client success and level of functioning in the community after discharge; they serve as sensitive measures of treatment effects for a variety of interventions.

Although there continues to be debate over the type of psychometric models to be used in behavioral assessment (see Cone, 1981, for an overview), the use of standardized protocols represents a first step toward an empirical evaluation of different psychometric approaches. The development of formal protocols and adaptation of these to computer data bases does not guarantee development of satisfactory psychometric properties in the protocols. However, the development and adaptation of various standardized measures to the computer data base would appear to make it possible to determine systematically the psychometric properties of the measures.

Third, the development of behavioral assessment software in research may also increase the integrity of the assessment. Careless errors in scoring and administration are less likely to occur when the measures are computer-administered and -scored. This integrity may impact favorably on the decision-making process involved in establishing and monitoring intervention programs. Behavioral assessment may be considered a decision-making hypothesis testing process that requires a great deal of human information processing and clinical judgment (Kanfer, 1985). One of the most promising applications of microcomputers in this regard involves the development of expert systems (Hasselbring, 1985; Schoolman & Bernstein, 1978). As a result of rapid advances in the field of artificial intelligence, diagnostic systems have been developed in medical fields that outperform trained clinicians in making medical diagnoses. For example, a program called MYCIN is designed to diagnose meningitis more accurately than any of a group of experts (see Ham, 1984, for a discussion of MYCIN and other expert systems). Expert systems are developed by analyzing multiple decisions made by experts to determine rules that govern these decisions. The abstracted rules are then applied by the computer to new data. Applications of expert systems to behavioral assessment will need to incorporate all important data used to reach behavioral diagnoses. To the extent that this is possible, expert systems may be able to store and analyze large amounts of clinical information and *assist* in making clinical judgments. We do not believe that such expert systems should or will replace the human clinician. At this time the contribution of expert systems to psychological evaluations is an empirical question (Hartman, 1986b).

Bias in the assessment/treatment link might also be reduced by developing programs that systematically alter their own implementation of treatment or assessment procedures (Reynolds et al., 1985). For example, in the interviewing program presented by Angle et al. (1977), certain types of assessment data are gathered, depending on prior responses from the client. These data, in turn, might lead to the identification of different target behaviors with a unique treatment focus. Human clinicians might be biased toward certain types of questions that might lead to a preferred treatment that has little or no empirical support. As Reynolds et al. (1985) note, computer programs contain the bias of their creators, but modification of software may be easier than changing clinicians' theoretical persuasions. Clearly, this issue also needs to be addressed at the empirical level.

Integration/Application of Assessment Data for Treatment Planning

Microcomputer applications in behavioral assessment have been summarized in separate areas in this chapter. Behavioral assessment is more than a series of separate measurement domains, however. Behavioral assessment is guided by a conceptual framework and various models for organizing the data from separate assessment areas have been developed (e.g., Kanfer & Saslow, 1969). Behavioral assessment also involves multiple uses of data, including diagnosis, design of a treatment program, and monitoring the program. Our thesis is that computers offer more than a duplicate of services performed previously by the clinician; they offer new options for the nature of services. This option appears most evident in some recent developments in behavioral assessment where computer feedback has been used to enhance treatment of obesity (Burnett et al., 1985) and where computers have been used for data management and treatment planning in residential settings (Paul, 1986). Unfortunately, computer applications in behavioral assessment have not developed to the level of multiple data use and integration.

One potentially useful application of computers to data integration in behavioral assessment is the "free form data base" (Romanczyk, 1986). Many computer-filing systems search files only for perfect matches between the entered data and the value guiding the search. For example, if asked to find all bills owed by "John Doe," the computer might not select bills owed by "J. Doe" or by "John T. Doe, Jr." Data-filing systems are now available that can be searched "free form," and would select all of the examples that have been given. If client notes were kept on a computer, free-form searching would allow a practitioner to select from clinical case notes the dates of all instances where specific clinical information emerged during the course of an assessment process, such as all instances where a client reported anxiety. Research on this process should be a high priority.

There should also be a rapid increase in the use of graphic displays of data in software for behavioral assessment, both for analyzing the assessment data and for communicating the results of the analysis to clients. Visual displays can make quantitative data easier to understand and communicate. On the negative side, visual displays have the potential to distort the meaning of data unless accompanied by instructions from a clinician. Stimulated by developments in computer graphics, substantial research is being conducted on the issue of how the characteristics of graphic displays affect their interpretation (see Kosslyn, 1985, for a review of recent works). Given the potential importance of graphic displays in behavioral assessment, software developers and practitioners should scrutinize carefully the types of displays being generated. Researchers in this area should bring the research on graphic displays in other fields to bear upon the special needs of behavioral assessment.

Traditionally, behavioral assessors have conceptualized assessment as a process where the focus is unique to individual environments in which the client functions. The practical (and empirical) issue that emerges is whether computer assessment can facilitate treatment efficacy. Recently, a conceptual approach for the investigation of the treatment utility of assessment has been proposed (Hayes, Nelson, & Jarrett, 1986, 1987). The treatment utility of assessment refers to the "degree to which assessment is shown to contribute to beneficial treatment outcome" (Hayes et al., 1987, p. 963). Treatment utility research can span a wide range of questions on the assessment–treatment link. Within the present context, the treatment utility of computerized assessment strategies can be evaluated. For example, the treatment utility of a computer assessment of a client's problems can be examined by comparing treatment outcome of clients exposed to the computer program with those individuals receiving noncomputerized assessment for some target problem. Questions related to the efficacy of the computer in assessment should be framed within the context of treatment utility.

Acceptability of Microcomputers

In the past few years there has been increasing concern on the part of behavior therapists with the acceptability of the various procedures used (see Elliott, 1988; Reimers, Wacker, & Koeppl, 1987; Witt & Elliott, 1985, for a review). With the proliferation of microcomputers in assessment, important questions regarding acceptability have also been raised (Hartman, 1986b; Romanczyk, 1986; Skinner & Pakula, 1986).

Acceptability of the computer may affect the use of the computer as well as the data obtained during assessment. Romanczyk (1986) reviewed research examining client reactions to computerized assessment and raised some methodological issues. For example, the groups to whom questions are posed may yield important differences in reports of acceptability. Griest et al. (1973) assessed the reactions of suicidal and nonsuicidal clients on six dimensions. On one dimension, 52% of the suicidal clients indicated they would rather provide personal information to the computer than to the physician. In contrast, only 27% of the nonsuicidal group indicated they would prefer the computer. As part of a study designed to assess the reliability of computer-controlled administration of the *Peabody Picture Vocabulary Test* (PPVT), children (4–13 years) were asked their reactions to the computer-administered test (Elwood & Clark, 1978). They tended to evaluate it favorably as being easy and more like play than work.

Acceptability of computers by clients has been documented and should increase as they are exposed to this form of assessment (see Skinner & Pakula, 1986). However, as Skinner and Pakula note, acceptability of computers by mental health staff has been problematical. These authors advance three factors that may influence acceptance of computerized assessment; structure, process, and function. Structural factors refer to the interaction between the human and computer, such as the manner of inputting and outputting data. Process factors refer to involvement of the user in the design of the system. Presumably, client and/or staff involvement in design of a system would promote greater acceptability of computers. Function factors relate to the role computers play in professional job roles. These factors are likely to revolve around such questions as, "What is the role of the computer in client decision making?" and "What job functions will the computer replace?"

Studies of the acceptability or satisfaction with computerized assessment need to be more methodologically sound before any firm conclusion can be drawn (Romanczyk, 1986). Studies focusing primarily on the three acceptability dimensions outlined by Skinner and Pakula (1986) are needed. To assess these issues properly, studies need to be designed that involve acceptability as the primary dimension of the analysis. In research and practice, measures of acceptability also need to be more systematic, reliable, and valid (see Witt & Elliott, 1985). In existing studies, measures tend to be quite informal and lack the psychometric characteristics necessary to draw valid conclusions. For example, it would be useful if standardized measures of "computer satisfaction" were developed and used to study acceptability as aspects of the situation and the computer application were varied. Although many studies have typically assessed "client" responses to computer use, there is no reason why responses of clinicians-assessors should not be evaluated as well. Information is needed on the acceptability of computer assessment from the individuals who draw conclusions, make inferences, and develop treatment programs.

As we attempt to understand how clients and clinicians react to computer assessment, we should be alert to the likelihood of large individual differences on dimensions of computer satisfaction. Wagman (1983) reports a factor-analytical study of attitudes toward the computer across 10 areas of application. Interestingly, the respondents had the least favorable attitude toward the use of computers in counseling. Further, men had more favorable attitudes toward computers than women. Analysis further revealed several different aspects of the use of computers that loaded on different factors. Rather than seeking answers to the question of whether computers should be used in assessment, perhaps we should attempt to identify types of individuals who may be especially uncomfortable with computerized assessment and attempt to design environments that make use of computers more acceptable to these groups. As a practical application, the introductory part of any computer-generated assessment might include assessment of the user's comfort with the process and, if discomfort is indicated, the program might terminate with a suggestion that concerns should be discussed with a human clinician before proceeding.

Legal and Ethical Issues

There is a rapidly growing body of literature being published on legal and ethical issues in application of computer-based assessment. These papers may serve as a blueprint for issues that must be addressed in computer-based behavioral assessment (e.g., Hartman, 1986a; Hofer, 1985, Reynolds et al., 1985; Skinner & Pakula, 1986; Thomas, 1984; Walker & Myrick, 1985).

Legal liability issues have been raised over the use of software in psychological diagnosis, assessment, and treatment. The issue relates to legal *responsibility* in the event of inadequate or harmful psychological care (Hartman, 1986a). It is not completely clear if the software manufacturer or licensed (or unlicensed) psychologist is responsible if harmful decisions are made. Responsibility may fall on the manufacturer if the software is considered a *product;* whereas if it is considered a *service,* a reasonable standard of care doctrine is applied and the psychologist is legally accountable. Hartman notes:

> Current practice of clinical psychology suggests that diagnosis or treatment determined solely via software output might violate this doctrine, in which case the psychologist might be held legally accountable. However, as psychologists increasingly adopt the computer, it may soon become the norm for software to determine diagnosis or treatment. This could have the paradoxical effect of lessening rather than increasing the liability of the psychologist. (1986a, pp. 463–464)

In the ethical domain, a number of issues can be raised. One issue that must be the focus of attention relates to the development of guidelines. Past discussions of ethical and legal considerations in the behavioral literature (e.g., Martin, 1975; Stolz & Associates, 1978) have not included computer issues, and ethical guidelines from the Association for Advancement of Behavior Therapy (1977) contain no statements for computer use. Some professional psychological organizations have recently developed guidelines. For example, the revised version of the *Principles for Professional Ethics* of the National Association of School Psychologists (1984) includes three items that relate to computerized or technological services.

The most current discussion of the ethical implications of computer-based assessment can be found in the *Guidelines for Computer-Based Tests and Interpretations* (American Psychological Association, 1986). Included are 31 guidelines addressing ethical responsibilities of both users and developers of computer-based assessment programs, based on the *Ethical Principles of Psychologists* (APA, 1981), the *Standards for Providers of Psychological Services* (APA, 1977), and the *Standards for Educational and Psychological Testing* (American Educational Research Association, 1985). Although these were written clearly with traditional psychological testing in mind, their applicability to behavioral assessment is great. Some of the most relevant issues will be discussed here. For a more complete description of the issues, readers are referred to the original documents.

First, the psychologist providing services retains ethical responsibility for ensuring that services are appropriate. Users of computer-based assessment procedures cannot abdicate responsibility for clinical decisions to the software developers, but must actively continue to review and edit decisions made for clients using the computer-based data. Similar cautions have been made by Walker and Myrick (1985) when they note that computer packages should be used for developing tentative hypotheses, but computer interpretations should not be considered sufficient to make program recommendations. Clearly, clinicians cannot monitor unfamiliar clinical procedures properly, and so psychologists are admonished in the *Guidelines* not to use the microcomputer to extend their clinical competence. Rather, use of the computer should be confined to procedures the psychologist would be competent to perform without computer assistance.

Second, clinicians utilizing computer-based assessment strategies assume additional responsibility to ensure that the integrity of the equipment used is monitored carefully. Minor differences in the computer system used could inadvertently alter the functioning of or decisions made by the program. Where clinicians interact with the computer, the primary concern must be with the continuing accuracy of the program. Whenever the client interacts directly with the computer, additional concerns with the legibility of the monitor screen and comfortable placement of the machine also need be addressed. Clients should be trained on the equipment prior to using it in order to limit any impact of the program due to the lack of familiarity or comfort with the equipment. Finally, accommodations should be offered to any clients who are unable or unwilling to adapt to the machine.

The clinician utilizing computers in behavioral assessment must establish that the computer-based procedures used are both reliable and validated for the purposes for which they serve. Equivalence with similar assessment procedures implemented without the use of the computer cannot be assumed, but the *Guidelines* offer some useful suggestions for the kinds of evidence needed to support such equivalence.

The clinical utility of large data bases of client information has been discussed earlier. Where large amounts of client information are maintained in computer recorded data banks, psychologists are ethically responsible for seeing that special steps are taken to ensure the confidentiality of the records. In the same way that the computer permits rapid analysis of data in its memory banks, rapid access to that data is also permitted unless special protections are implemented to control access (Doll, 1985). Similarly, steps must be taken to ensure that the data are not lost due to mishandling of the storage or memory crashes.

Integration of computers into behavioral assessment and intervention training seems like a useful focus for a significant impact on responsible computer use. Competency-based approaches to training could be useful since the focus would be on training clinicians in specific assessment and treatment techniques. For example, Alpert (1986) demonstrated that a microcomputer could be used to increase the reflective response skills of novice counselors. In view of the rapid expansion of computer programs, trainers can provide education only for a few exemplary programs.

We see no easy way to address the potential abuse of computers by unqualified individuals (Reynolds et al., 1985). Realistically, nothing seems likely to prevent companies from marketing "psychological software" such as Mind Prober with the advertising slogan, "We'll get you into her mind—the rest is up to you" (Doll, 1986; Lima, 1984). The marketplace is being flooded with the software equivalent of patent medicine for every human ill. Hartman (1986a) has suggested, as have others (e.g., Langyon, 1984), that federal regulation may be necessary to protect the public.

Another ethical concern in computerized assessment relates to the importance of human relationships in the assessment process (Matarazzo, 1983; Reynolds, et al., 1985). Reynolds et al. argued that:

> Until research proves otherwise, it is proposed that the use of computers in psychology be restricted to health and mental health services for which relationship variables are not hypothesized to be essential to positive outcomes. When relationship variables are deemed important, the computer can provide services (e.g., MMPI administration and interpretation) to supplement human clinical activity (e.g., psychotherapy). (1985, p. 349)

In behavior therapy there is evidence that the relationship between therapist and client plays a role in treatment effectiveness (e.g., Goldfried & Davison, 1976; Wilson & Evans, 1977), but there is no research in the area of computer-based behavioral assessment. Researchers need to examine both client and therapist factors (Morris & Magrath, 1983). Such factors as expectancy (i.e., the client's expectation for beneficial effects of therapy), imitation (i.e., structuring the assessment relationship so as to make the client act like an assessor), and general characteristics and style (e.g., personality characteristics, history of treatment, and interactional style) should be examined. Therapist variables that may have a bearing on the assessment process include the presence of the therapist during assessment, physical proximity, and therapist "warmth."

CONCLUSIONS

In this chapter we provided an overview of behavioral assessment and recent adaptations, modifications, and innovations of computer technology in the field. Behaviorally oriented practitioners can learn much from the rapidly growing literature on computer-based psychological assessment and, hopefully, avoid some of the pitfalls that have become apparent in applications of computers in traditional assessment.

There is one area that will hopefully guide applications of the computer in behavioral assessment activities. One of the most salient and fundamental characteristics of behavioral assessment is its relation to design, implementation, and monitoring of treatment program. Basically, this issue translates into one of utility of assessment, but this *treatment utility* concept is not yet well recognized in current measurement standards, despite its importance in clinical treatment.

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