SESSION IX

CONTRIBUTED PAPERS:

ON-LINE ASSESSMENT PROCEDURES

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A console for the interactive on-line administration of psychological tests

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A computer controlled console for on-line psychological testing of psychiatric patients is described. The Peabody Picture Vocabulary Test and the Kelly Role Construct Repertory Test are computer administered using three visual, one auditory, and two response modes. Test data are analyzed, interpreted, and incorporated into a program-written psychological report. Benefits and other applications from such a system are noted.

Within psychiatry and psychology, computers have been used: to collect human and animal experimental data; to organize and analyze such data mathematically; to score psychometric or other verbally produced information; to sort people into diagnostic categories; to provide patient therapy; to produce narrative psychological reports; to interview persons to obtain historical and other information; and, finally, to administer psychological tests. Until recently, most attempts to automate the administration of psychological tests have been through the use of noncomputer devices. An exception has been Hedl, O'Neil, and Hansen (1973) who developed computerized administration of the Slosson Intelligence Test; Dunn, Lushene, and O'Neil (1972) computerized the administration of the Minnesota Multiphasic Personality Inventory. In these instances, efforts were restricted to a single psychological test for research purposes.

In an effort aimed toward the automation of psychological services, including the collection of psychometric data, scoring, analysis, and a written report, a psychological test console was developed at Lafayette Clinic in Detroit, Michigan. This console is controlled by an IBM 1800 Computer used in a real-time multiprogramming executive mode. Part of the magnetic core of this machine is divided into seven partitions each with 1024 16-bit words. Each partition is assigned for the exclusive use of a particular laboratory, and the console runs from one of these labs. Also available for

Figure 1. Psychological test console with display scope (left) and rear projection screen (center).

brief intervals is a larger (4096 words) segment of core.

The console is capable of interacting with a subject through visual displays, an auditory presentation, and touch response modes.

VISUAL MODES

There are three visual modes associated with the console. First, a Tectronix 611 oscilloscope capable of generating alphanumeric displays is used to present information and to elicit responses from a subject. A software character generator operating for brief intervals in the 4096 word partition is used to write information on the scope.

A rear projection system using a GAP ESP 1000 random-access slide projector is capable of presenting any of 100 slides with a maximum access time of 4 sec. Interfacing to the projector is accomplished through the use of two stepping switches. The address of a desired slide is set by programming pulses to the switches.

The third visual mode is an IBM 1053 typewriter with a separate keyboard. This is available only to the tester (a clerk) who uses it to initiate testing, modify program flow, enter verbal responses and monitor subject progress.

AUDITORY MODE

Instructions and questions are presented to a subject via a modified Stenocord dictating unit. The standard Stenocord motor was replaced by a stepping motor with appropriate interfacing to allow program control of the record/playback head position. The use of a standard Stenobelt provides random access to 125 5½ sec message tracks. This motor is controlled through computer programmed pulses, each of which rotates the Stenocord drive gear 90 deg. However, a 270 deg rotation between each message track was found necessary to eliminate intertrack interference.

The absolute position of the Steno head is unknown to the computer and is computer driven to a known (home) position at the beginning of each psychological test. The computer then keeps track of the head position by noting the direction of travel and number of pulses henceforth delivered. The stepping motor is driven at approximately 115 steps (pulses) per second, allowing the Steno head to transverse the entire belt length in approximately 4½ sec. This provides fast enough access to adjacent tracks to allow multitrack messages to be presented smoothly.

Messages are recorded using a standard Steno microphone. A computer program was written to control head position during recording sessions. This was found to be easier and more efficient than the circuitry built to perform the same function without the computer.

Playback quality is affected by small shifts in head position due to gear play. To eliminate this variability, the head is positioned by terminating its motion from a forward (away from home) direction. Thus, when the head is required to move in a reverse direction, the program automatically overshoots by one track and then returns to the desired location.

RESPONSE MODES

The computer is able to recognize and record the response of a subject by three methods. First, a Scientific Accessories Corporation sound pen system with microphones mounted on the face of the 611 display scope and on the rear projection screen enables

the computer to recognize the X-Y coordinates of a touch response. Unfortunately, the pen did not consistently produce a spark and a back-up system was built. This consisted of a keyboard (response box) with keys numbered from 1-6. At the time of our construction, the keyboard proved to be more reliable, cheaper, and more convenient to use than the sound pen. The sound pen, however, would provide greater flexibility if its functioning were adequate.

The final response mode consists of the 1053 typewriter/keyboard. Through this, a clerk can enter alphanumerics that typically are a subject's verbal responses to questions being asked.

At the present time, two system tests are available: the Peabody Picture Vocabulary Test (PPVT) and the Kelly Role Construct Repertory Test (Kelly Rep test).

The PPVT requires an individual to look at a display of four pictures and choose the one that best represents the meaning of a word that has been presented orally. The plates are presented on the rear projection screen, and the words are produced via the Stenocord. The subject may give his answer using the sound pen or the response box, depending on the clerk's judgment at the time of testing. The computer program which administers the PPVT encompasses the various procedures outlined in the PPVT manual (Dunn, 1965). Besides identifying information, the clerk enters the subject's chronological age, and estimated mental age if retardation is suspected. From this the program selects a starting item according to the standard criteria suggested in the Manual. As the items are presented, a subject's answers as well as his response times are recorded. The opportunity for the subject to change an answer is available. The program automatically presents the plates in the order required to establish a base and ceiling. If a starting point for a given subject is near his ceiling (i.e., six of eight incorrect answers), the program moves to a lower starting point and repeats the procedure.

The test results can be obtained at the conclusion of testing. If requested by the clerk, basal, ceiling, raw score, IQ, mental age equivalent, and percentile are all printed out on the 1053 typewriter. In addition, the scores are stored on magnetic disks for later incorporation into a written psychological report. The IQ is determined by using the linear equations and empirically derived means and standard deviations presented in the Manual. A mathematical fit could not be found for percentiles, and these are stored on disk in table look-up form.

The Kelly Rep test is designed to assess the conceptual structure of an individual and is administered using the 611 display scope, the Stenocord, the sound pen or response box, and the typewriter/keyboard. In the current version, the subject is asked via the Stenocord to provide the names of self, of family, and of personal acquaintances who fit various role descriptions. These names are entered into the computer via the

typewriter/keyboard and then later presented in groups of three on the 611 display scope. With each group of three names, the subject is asked to provide a personality description in the form of a word or short phrase that distinguishes any two of the acquaintances from the third.

The clerk enters the descriptor using the keyboard, and the subject is then asked to provide the opposite of the descriptor. When this is entered, the two descriptors are then presented on the display scope as poles of a six-point rating scale on which all the other names are presented and rated. These ratings are stored by the computer. A new triad of names is presented, and test administration terminates after 22 such cycles have been conducted.

The results of the Kelly Rep test are stored on disk for later analysis, interpretation, and incorporation into a brief psychological report. The data matrix generated from the Kelly Rep test is subjected to a mathematical analysis, including a factor analysis, which provides indices necessary to compile a printed report. Information relevant to self-ideal discrepancy, male-female identification, significant persons the subject describes himself as most/least alike, cognitive complexity, and organization and stability of descriptive constructs, is extracted from the matrix and used to decide among alternative statements/paragraphs previously stored on magnetic tape.

These statements/paragraphs are printed out as a narrative report according to predefined rules. Because of insufficient core necessary to analyze and interpret collected data, the report cannot be processed immediately but requires an off-line batch processing mode. Distribution of the programs are being retained in order to refine them with additional normative data and validity checks.

Built into both the PPVT and the Kelly Rep test program is the ability to respond to testee behaviors that do not conform to instructions. Taking too much time, providing too many answers, making a choice that is not appropriate to the question, and repeating the same name, are all recognized by the computer which then responds via the Stenocord to alert and reinstruct the subject. In the event that a particular error behavior continues, the clerk is alerted by the computer and asked to render assistance.

In spite of the console's considerable flexibility there are a number of inconveniences worth noting. First, because of its size and the need for a clerk to be within

visual distance of the subject, a moderate sized room is required. Second, the slide projection system handles only 100 slides requiring the midtest switching of trays for some applications. Third, the Stenocord itself has a number of limitations: (a) the number of message tracks are limited; (b) a new belt must be placed on the machine at the beginning of each test and aligned to ensure adequate playback; (c) there are going to be unaddressable portions of the Steno belt that contain silences, because messages are not likely to be multiples of 5½ sec, thus reducing storage capacity. Finally, the 611 display scope as used in our application does not have a selective erase feature. The whole screen must be erased in order to change a single part of the display. The accompanying green flash can be mildly annoying if it occurs frequently or in rapid succession.

In spite of some inconveniences, a console of this type with its multimodal communication demonstrates the potential of computers and their peripheral equipment to provide psychological services and/or better documented clinical research. Possible benefits from such a system are numerable. To mention a few: (a) quicker turn around time from referral to return of the report; (b) the use of less highly trained and more economical personnel for routine psychodiagnostic work; (c) the release of trained psychologists and psychometricians for higher level functions; (d) systematic research on various aspects of psychological tests; (e) a potential increase of reliability by reducing the variability that enters into the testee/tester encounter; (f) measuring latencies more adequately than by human examiners; (g) building better norms, both national and local; (h) adopting psychiatric/medical interviewing to the same equipment; and finally (i) increasing the range of available clinical material through the use of tests which, while important, are difficult to administer and score manually but become feasible in an automated paradigm.

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