

MACHINE-MEDIATED INTERVIEWING

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Machine-mediated interviewing is a technique of psychiatric interviewing in which patient and interviewer communicate by means of remotely located teletypes. Messages are transmitted from one teletype to another by means of a computer. Advantages of non-verbal communication in the study of the psychiatric interview and in the development of a computer program designed to conduct psychiatric interviews are discussed. Excerpts from representative interviews with different patients are reproduced; seven of the interviews were conducted with a hospitalized mute patient who, after the fifth interview, began to use spoken language for communication. This novel technique is suggested for patients who are unable to participate in the usual *vis-à-vis* interview.

For some time, we have been working towards the development of a computer program designed to conduct diagnostic psychiatric interviews without human intervention. In such a system, nonverbal and paralinguistic behavior would of necessity be completely absent. It became apparent that before such a program was written it would be desirable to study human behavior in an interview situation in which all nonverbal and most paralinguistic behavior was absent. In this paper we will outline a technique of teletypewritten communication by a time-sharing computer system in which all nonverbal and paralinguistic elements can be eliminated. A study using a version of this technique in actual interviews between psychiatrists and hospitalized psychiatric patients will be presented.

While studies of psychiatric interviewing have, in the past few years, concentrated on paralinguistic phenomena (loudness, pitch, intonation, and timing of vocal productions) and nonverbal phenomena (body posture, facial expressions, gesticulations, etc.), there has been a decrease in concern over the linguistic or verbal content of the interaction. The importance of paralinguistic and nonverbal elements of communication is obvious; yet their presence makes the study of transactions between patient and therapist difficult, since these phenomena are virtually impossible to control. Therapists and patients have different physical endowments and unique vocal, postural, and gesticular styles which may vary with time, setting, and situation. There are also frequent, apparently irreconcilable contradictions between verbal and nonverbal components of messages.

A technique that would eliminate non-

verbal and paralinguistic elements from dyadic verbal interchanges would facilitate the study of communication in that it would enable one to examine the verbal output produced in a situation in which the communication of nonverbal and paralinguistic events was impossible. The nonverbal paralinguistic variables would then not be a factor in determining the response to any message.

A general purpose time-sharing computer system with remote terminals could be set up so that the two conversants would be located in separate locations and could communicate with each other by typing in or reading messages from their respective computer terminals. By using a teletype device for transmitter and receiver, both vocal and handwriting stylistic elements would be absent. McGuire and Coleman (2) used such a technique in one of their studies. They only partially eliminated nonverbal/paralinguistic elements since the messages were transmitted one character at a time, with the receiving terminal typing out the message with the same tempo, cadence, and hesitations as that of the sender typing on his terminal. As a result, hesitations and variations of typing speed and rhythm were obvious to the recipient of the message. In their study, the interviewer selected his productions from a catalogue of responses. This catalogue consisted of four separate blocks of 18 replies each: 1) "common continuatives," 2) "discussion-specific replies," 3) "inference replies," and 4) "randomly mixed replies." The interviewer was not free to make spontaneous statements, and the "communication" was more limited than it would have been had a freer interchange been permitted.

A more complete elimination of nonverbal elements could be achieved by programming the computer so that each message would not be transmitted until the sender signaled that he was finished typing, and then transmitting the entire message at a fixed, regular pace to the recipient's terminal. There

would still be one paralinguistic characteristic present: the *rate* of verbal production would be evident to the recipient and would indicate hesitations or transmission delays on the part of the sender. Thus, if the sender took 5 minutes to answer a question in one word, the recipient would most likely attach significance to that delay. (One could overcome even this one remaining nonverbal contaminant by having fixed time "buckets" of a specified time period within which the sender could type as much or as little as he wished. When the time period was up, whatever had been typed on his terminal, whether the sender had finished his message or not, would be transmitted to the recipient. This would disguise hesitations but might create a problem when the sender was not satisfied with his existing message at the time of transmission. It would also be time consuming, since each time bucket would have to be at least as great as the longest anticipated common hesitation.)

PSYCHOLOGICAL TESTING, INTERVIEWING AND PSYCHIATRIC DIAGNOSIS

In looking at the format of a typical written psychological test, we find that testees are presented with written questions and are expected to respond with a written response. The test format is one of a fixed stimulus. This situation is, of course, much different from the conversational interview mode of communication, in which the interviewer bases his productions on the previous responses of the interviewee and some flexible conceptual scheme or theory of interviewing. It is the flexibility of the interviewer that gives his form of "testing" so much diagnostic-power. (Diagnostic-power is defined here as the ability to obtain information relevant in making a classification or a diagnosis.) He may, within a period of several minutes, come to a definite conclusion about the interviewee that would not be possible to reach after several hours of fixed format written psychological testing. This is due in part to the interviewer's

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capability to zero in on sensitive areas once these areas are detected.

Psychiatrists almost never make a diagnosis based on fixed format written psychological testing alone. They usually base their diagnosis on one or more personal interviews with their patients, and only occasionally do they use supplemental psychological testing to aid them in their categorizing. The flexibility of their interview styles is geared to the fact that personality differences between patients make some interviewing techniques more successful with some patients, while other techniques work better with others. Variation in interviewing strategy and style occur even within a single interview in order to match the ever-changing state of the interview situation, and changes in the interviewee's mental state will sometimes demand modification of one's questioning strategy, particularly when an intense affective state is demonstrated by the interviewee.

It appears that the more flexibility is achieved by the interviewer, the greater is his diagnostic-power. This is true with two important qualifications. The first is that the interviewer's flexibility is appropriately coordinated to changes in the interview situation. For example, if the interviewee ap-

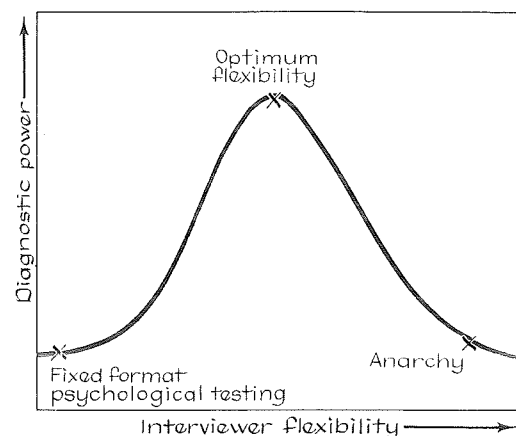


Fig. 1. Idealized relationship between interviewer flexibility and diagnostic-power in which optimal flexibility lies somewhere between fixed format psychological testing and "anarchy."

pears suspicious and hostile, direct, probing questions about sensitive topics (such as his sex life) would probably not be productive, whereas reassurance and encouraging the interviewee to air his doubt would be more successful in making the interview a productive one. The second is that the interviewer's flexibility cannot be allowed to reach the point where technique and strategy are changing so frequently that a state of confusion develops in which it is not clear what the overall goals of the interviewer are. This is analogous to anarchy. There appears to be an optimal degree of interviewer flexibility in order to achieve the greatest diagnostic-power during the diagnostic interview. The relation between these two variables is depicted in Figure 1.

Having a non-verbal communication system similar to the one described above would be a powerful tool in the study of the diagnostic process. Because of the absence of virtually all nonverbal and paralinguistic events, there would be essentially only two determinants of any particular verbal production in a dialogue: 1) the linguistic content of the dialogue up until the point of the production in question, and 2) the "personality" of the producer of the message. The term "personality" is used because it is general enough to indicate such factors as intelligence and emotional state of the individual, as well as effects of past experience, in the form of tendencies towards particular behavior patterns.

It is difficult to control for an individual's "personality" in a scientific study. Although psychiatric patients are frequently placed in diagnostic boxes, most of these diagnoses are crude and imprecise and have not been validated statistically; yet humans do repeat themselves, behavior patterns do exist, and we can sometimes accurately predict an individual's response to a particular set of circumstances.

Here, we are concerned with studying a limited set of an individual's possible responses to a limited set of possible circum-

stances. The set of possible responses is limited to the set of non-verbal productions. The set of possible circumstances is limited to any situation or point in a non-verbal dyadic communication sequence (conversation) in which the individual in question had just received a message and is expected to reply by sending a message to the other conversant.

Assume that we are setting up an experiment in which we desire to categorize people as to their behavior patterns, or personalities, based exclusively on their verbal (non-verbal) productions. For the purposes of our experiment, we would view each subject as a black box with input and output capabilities. Output would be in the form of typewritten expressions.

The design of our hypothetical classification experiment must incorporate interviewer flexibility if it is to be a powerful system. In our experiment, we will need to have one black box as interviewer and another black box as respondent (interviewee). The interviewer's goal is to stimulate responses on the part of the respondent that will enable him to categorize the respondent by drawing some conclusions about him. Unlike a psychiatrist conducting *vis-à-vis* interview, he is limited to the non-verbal mode of communication. We are not concerned here with the evaluation of these responses but with determining optimal flexibility on the part of the interviewer. If the interviewer can emit only previously determined statements or questions in a fixed sequence, he has minimal flexibility (we will refer to this situation as "case 1").

Henceforth, a verbal production by the interviewer will be referred to as PI_n , and one by the respondent will be referred to as PR_n , where n is the temporal position of the particular expression (PI_2 would be the second production by interviewer). If the content of the interviewer's productions is fixed but the sequencing is partially contingent upon the previous response of the inter-

viewee, the interviewer has more flexibility and more power than in case 1. In this situation, PI_n is determined by PR_{n-1} (the preceding response of the respondent) as well as a prearranged ordered sequence. This situation will be called "case 2."

In case 2, one must define explicitly the situation that will lead to a PI which is different from that in a case 1 interview. This can be done by writing rules in the conditional form such as: If $PR_n =$ "I have a headache" then $PI_{n+1} =$ "I am sorry to hear that."

A case 3 interview will be one in which PI_n is determined by all previous PI 's and all previous PR 's. Each PI_n will be contingent on all the previous statements with interviewer responses being determined by rules that incorporate interviewing goals, prior responses, questioning trends, and finally the PR_{n-1} . This interview has potentially much greater diagnostic-power, the realization of which is dependent on the adequacy of the rules.

All the rules would be subordinate to the interviewer's primary goal: to make a diagnosis of and obtain relevant information from the interviewee. Even if a diagnosis could not be made, information obtained could be used to categorize the interviewee along certain dimensions (*e.g.*, demographic, behavioral, physical characteristics, etc.).

To study the interview process in a non-verbal context, one should first conduct interviews in which interviewer and interviewee are free to produce any expression within this context but are prevented from communicating in any other mode. The interviewer should be a psychiatrist, and the interviewee should be a psychiatric patient. The transcripts of these interviews should then be studied to try to discover what rules are being used by the interviewer in determining his choice of expression. The interviewer can then use explicitly defined rules to match his productions to a given interview situation, and his criteria for diagnosis would then also be rigidly defined. Finally,

one could attempt to write a computer program with the ability to conduct a diagnostic interview without human intervention. This program would incorporate rules and diagnostic guidelines similar to those used by the human interviewers who participated in the earlier phase of such a study and might even incorporate new strategies and rules that seemed likely to result in greater diagnostic-power when used in a non-nonverbal context. The computer program could easily be manipulated so that effects of rule changes on interview dialogues could be evaluated. The classification criteria could also be changed in attempts to develop more valid diagnostic schema. We have completed the first phase of this proposed sequence.

A STUDY OF NON-NONVERBAL PSYCHIATRIC INTERVIEWS

A time-sharing computer system with provisions for remote terminals (including portable terminals located at a distance from the installation and connected via the standard public telephone system by means of acoustic coupling) was used as the communication device between interviewer and interviewee. Both participants were physically isolated during the interview, either in separate rooms in the same building or in buildings several miles apart, and could communicate with each other only by means of their teletype terminals. A message was transmitted by typing it on the teletype and pressing a special key twice when the message was complete. Only then would the message be transmitted. Corrections could easily be made by a "rubout" key which when pressed would delete previously typed characters, one at a time, in which case only the corrected message would be transmitted.

Two psychiatrists working on this project served as interviewers. Interviewees were all hospitalized psychiatric inpatients at a local hospital. Both men and women were interviewed. Selection of interviewees was based on willingness to cooperate in a re-

search study and ability to type. In some instances, interviewees with inadequate typing skill were selected, in which case a typist was interposed between interviewee and teletype terminal. (The typist was one of the two psychiatrist interviewers.)

The purpose of the project was explained to each prospective interviewee prior to the first interview. He was told that the project was designed to study communication between man and computer and that he would be communicating with a computer by means of a teletype terminal that resembled an electric typewriter. The impression was created that he would be communicating with a "machine," although he would in fact be talking to a human interviewer simulating a computer program. It was necessary to use this stratagem in order to study how a patient would react to a computerized interviewing program. It was anticipated that the transcript material would prove helpful during the actual writing of the interviewing program at a later phase, *e.g.*, providing a relevant vocabulary. Patients were also told that a psychiatrist would be monitoring the conversation at "the other end" and that he might actually make replies at times. This was in order to maintain patient credibility if times arose when it was obvious to the patient that a "human" was at the other end.

The interviewer was familiar with the expectancy set of the patient being interviewed. He knew nothing about the patient prior to the interview other than that he was a psychiatric patient at a local hospital. He was permitted to say anything he wished, keeping in mind that his main goal was to acquire information relevant to a diagnostic evaluation.

Sessions were 1 hour long. One psychiatrist member of the research team was present in the same room as the patient, and he oriented the patient to the use of the teletype and was available if difficulties occurred. These were usually in the form of computer malfunctions or confusion as to

the operation of the teletype. Computer breakdowns occurred approximately once every 2 hours of interviewing time and usually lasted for only a minute or two, after which a resumption of the interview took place. Patients were told that these breakdowns were common and that they were not responsible for these malfunctions. The team member refused to discuss the content of the communication between patient and teletype and refused to become engaged in conversation with the patient except when confronted with procedural or technical difficulties.

Some patients were unable to type. In those cases, the psychiatrist team member typed the patient's messages on the terminal and maintained an indifference to the content of such messages by strictly adhering to the role of transcriber. This was not an easy task but was necessary to avoid distracting the patient's attention from his conversation with the "machine." The patient still was required to sit near the teletype so that he could read for himself messages received as well as messages typed by the typist. Each patient was interviewed from one to three times. Over 40 interviews were conducted in this manner.

In most cases, patients appeared apprehensive immediately prior to the first interview. A few were visibly nervous while using the teletype for the first time. This nervousness passed in every case in which the subject was interviewed more than once. A few patients (approximately one-fourth of our group) appeared completely engrossed in the interview to the point that they would sit expectantly looking at the terminal, awaiting a message from the interviewer; when the message finally arrived, they would start typing, oblivious to any distractions. Others seemed impatient or even bored awaiting replies. A few attempted to initiate conversation with the psychiatrist team member. When this happened, the team member told the patient to direct conversation or questions to the com-

puter (unless the comment was about a procedural or technical problem).

The degree of ease with which the patients were able to express themselves in the unfamiliar non-nonverbal mode surprised us. In practically every case, the interviewer was satisfied with the amount of information conveyed by the informant. This was even true with patients who were psychotic at the time of the interview and had to be interviewed on a locked ward (by means of the portable terminal).

The two interviewers were members of this research team and found the interviewing task to be interesting but at times tedious, particularly when the interviewee had to make fairly rapid evaluations of the previous message (transmitted from patient) and generate a typed production quickly (usually within 30 seconds after receiving the patient's message). This task became easier during the latter group of interviews, by which time interviewers had become acclimated.

Interviewers spent most of the time during the session awaiting replies from the patient. Because of these long pauses, both felt that they could conduct two or three such interviews simultaneously.

INTERVIEW TRANSCRIPTS

Representative excerpts from interview transcripts were selected and are reproduced along with commentary below. Names and other identifying data have been changed. Patient spelling errors have not been changed. I = interviewer; P = patient.

Patient 1: An alcoholic patient with incipient delirium tremens. [Typist typed because patient was too tremulous.]

I—I HAVE BEEN PROGRAMMED TO TALK WITH PSYCHIATRIC PATIENTS. WHY ARE YOU IN THE HOSPITAL?

P—BECAUSE MY NERVES WENT AND I STARTED DRINKING.

I—HOW MUCH DID YOU DRINK?

P—I DRANK FOR ABOUT TWO WEEKS. I HADN'T BEEN DRINKING FOR ABOUT 7 MONTHS.

I—DID YOU GET THE DT'S?

P—NO, IM JUST ABOUT GETTING THEM.

THEY ARE TRYING TO KEEP ME OUT OF THEM.
 I—HAVE YOU EVER HAD THE DT'S?
 P—YES, I HAD THEM ABOUT TEN YEARS AGO.
 I—DID YOU HEAR VOICES THEN?
 P—YES, I DID.
 I—WERE YOU SUSPICIOUS OF PEOPLE?
 P—YES I WAS.
 I—WHAT DID THE VOICES SAY?
 P—THEY WAS SINGING ON THE BUS AND I WAS SEEING ANIMALS.

Patient 2: Patient believed he was communicating with a governmental agency in secret code. [Patient typed approximately half his productions. Typist typed the remainder.]

I—HELLO. PLEASE TYPE YOUR NAME.
 P—COMMANDER JAMES G. WILLIAMS, ALAMEDA NAVAL AIR STATION ASSISTANT APPELAT G3.
 I—IT'S NICE TO MEET YOU. HOW OLD ARE YOU?
 P—(Patient did not type in any message.)
 I—I DON'T UNDERSTAND. HOW OLD ARE YOU?

[Computer malfunction at this point with 1-minute delay.]

I—HOW OLD ARE YOU?
 P—C 3 DPLOMATIC CODE SWEDEN A ROSE IS A ROSE, SERVED UP WITH SUGAR AND SPICE THERE WAS A WINDJAMMER ON THE SEA VALSETRIESTE, CODE FIVE BLACK THE PASSWORD WAS I STOOD ON HEDDA HOPPERS HAT AND BURNED THE CAPITAL FOR A YO YO CHAMPIONSHIP.

I—ARE YOU MARRIED?
 P—NO WIDOWER, RESPONSE TO BITTER OMENS, DIPLOMATIC CODE H 85 THE RHINE GOES SWEETEST LITTLE FELLOW ROSEBUD IS WILLIAM RANDOLF HEARST THE THIRD NOW DISEASED, CAUGHT IN THE MACO SIGNED HERACLITUS THREE, STATE DEPARTMENT.

I—WHAT SORT OF WORK DO YOU DO?
 P—MUSICIAN-LIBERACE IS NOW DIVINE FATHER DOGGY PSYCHIATRIST FROM VIENNA NOW FATHER DIVINE UNDERTAKER, SIGNED MERCURY WEST US MARSHAL NUMBER SEVEN A PEA SHOOTER, THIS IS THOMAS SHORTHAND DIRECTLY TO WALL STREET JOURNAL OFFICES, SIGNED THE SUNDANCE KID.

I—WHY ARE YOU IN THE HOSPITAL?
 P—7777ESCAPE ROOT VA BILLETT SIGNED END OF MESSAG COLORADO

[At this point patient started typing randomly, in a rapid, aggressive manner. Because nonalphabetical control keys were activated, the machine ceased to function.]

Patient 3: This patient described hallucinatory experiences. [Psychiatrist team member typed.]

P—I HEAR VOICES, I LOSE MY HEAD AND PEAPLE TALK BACK.
 I—WHAT DO THEY SAY?
 P—THEY LAUGH MOSTLY.
 I—DO THEY LAUGH AT YOU?
 P—I AM NOT SURE.
 I—DO THE VOICES SAY BAD THINGS ABOUT YOU?
 P—JUST MURMURING AND LAUGHTER.
 I—DO YOU RECOGNIZE THE VOICES?
 P—YES, THEY ARE OF A FORMER FRIEND OF MINE NAMED JACK JONES.
 I—DO YOU CONVERSE WITH HIM IN YOUR MIND?

P—NO.
 I—WHAT DO YOU THINK HE MIGHT BE MURMURING ABOUT?
 P—HE IS MURMURING IN A WAY TO CAPTURE MY MIND SOMEHOW AND MAKE ME LIKE BEING SUBJECT TO HIM, OR BEING UNDER HIM.

I—WHY DOES HE WANT TO CONTROL YOUR MIND?

P—FOR EVIL PURPOSES.

I—LIKE WHAT?

P—LIKE BEING A VANDAL BACK IN MY YOUTH.

I—DO YOU FEEL HE WANTS YOU TO BE A VANDAL NOW?

P—NO

I—DOES HE WANT YOU TO TAKE DRUGS?

P—YES.

I—DOES HE WANT YOU TO STEAL?

P—YES

I—HOW DO YOU PLAN TO GET RID OF HIS INFLUENCE?

P—I HAVE BEEN DOING IT BY THROWING AWAY BAD VIBRATIONS.

I—HOW DO YOU DO THAT?

P—WITH MY HANDS.

Patient 5: A mute patient who, when asked if he would be willing to participate in a research project using computers to study communication, nodded his assent. He then participated in seven interviews, excerpts from which will be presented. After the fifth interview, he began to speak to his therapist and to other people. To our knowledge, this is the first case of mutism treated through the technique of machine-mediated interviews.

FIRST INTERVIEW

I—HELLO. PLEASE TYPE YOUR NAME.

P—[The patient typed his name.]

I—IT'S NICE TO MEET YOU JOHN. HOW OLD ARE YOU?

[John' is a pseudonym.]

P—22;

[The interviewer knows only that the patient is mute. Ending an expression with a semicolon is typical of programmers. Hence the interviewer's first hypothesis is that the patient was familiar with computers.]

I—WHAT SORT OF WORK DO YOU DO?

P—NONE

I—ARE YOU MARRIED?

P—NO

I—I HAVE BEEN PROGRAMMED TO TALK WITH PATIENTS. WHY ARE YOU IN THE HOSPITAL?

P—NO REPLY

[This is literally what the patient types.]

I—DO YOU FEEL ILL IN ANY WAY?

P—NO

I—HOW IS YOUR MEMORY?

P—NO REPLY

I—ARE YOU TAKING ANY MEDICINE?

P—YES

I—WHAT KIND OF MEDICINE?

P—PILLS

I—DO THE PILLS AFFECT YOUR THINKING?

P—NO REPLY

SECOND INTERVIEW

I—HELLO. PLEASE TYPE YOUR NAME.

P—[The patient types his name.]

I—I HAVE TALKED WITH YOU BEFORE JOHN. HOW ARE YOU TODAY?

P—A KON A ILL;

[Again the semicolon. Does he mean he is 'kind of ill'?

I—DO YOU MEAN YOU ARE ILL?

P—NO

I—WHAT DO YOU MEAN?

P—I MEAN

I—WHAT DOES THE WORD 'KON' MEAN TO YOU?

P—KON MEANS THE LETTERS 'K', 'O', 'N'.

I—I SEE. IS 'KON' A WORD IN ENGLISH?

P—NO

I—WHAT LANGUAGE?

P—A LANGUAGE OF ('KON. I GAT SES I

I—IS THIS A SECRET LANGUAGE OF YOURS?

P—YES. A SECRET LANGUAGE IN OUR COLLOQUIAL FRAME OF REFERENCE. I ASK PERMISSION TO DESIGNATE KON A SECRET LANGUAGE.

[The patient becomes more expressive. His vocabulary indicates that he is educated and intelligent.]

I—O.K. TELL ME SOME MORE WORDS IN THIS LANGUAGE.

[Since the patient seemed interested in discussing this language, the interviewer decided to pursue the interest.]

P—ALSO, LONE, WEIGH, OLL, OLL, WOOL, AND, ... A LANGUAGE ... AS WE OVERTLY TELL ONE ANOTHER ... SAYS MUCH. IT IS A SERIES OF ... W

WOULD YOU ASSIST HERE?

[He wants what he believes to be a computer program to fill in the term 'words.']

I—DOES ANYONE ELSE UNDERSTAND THIS LANGUAGE?

P—YES. I AM INQUIRING ABOUT ASSISTANCE.

ONE, OCCASIONALLY LETTERS INTERRUPT AS I AM TYPING.

IS THIS HAPPENING SOMEWHERE ALSO? THE LANGUAGE IS AS 'LANGUAGE' OF INTEREST TO ME.

[Teletypes sometimes transmit incorrect characters. Hence one cannot be sure about the source of misspellings. Because of this, the interviewer or computer is also protected from a charge of misspelling. The interview continued with a discussion of the patient's language and ended as follows.]

I—DID YOU INVENT THIS LANGUAGE?

P—NO THIS LANGUAGE HAS LONG STANDIN. I COPY WELL.

I—WHAT IS THE WORD FOR 'GOOD' IN THIS LANGUAGE?

P—GOOD

I—OUR TIME IS ABOUT UP JOHN.

IS THERE ANYTHING ELSE YOU WANT TO SAY?

P—YES. I LOVE YOU.

[The expression of love comes as a surprise. It is a joke?]

I—WHY DO YOU LOVE ME?

P—BECAUSE, YOU LOVE ME.

I—I LIKE TALKING WITH YOU.

P—I SEE

I—PLEASE TELL ME ONE LAST INTERESTING THING.

P—ONE LAST INTERESTING THING

I—DO YOU WANT TO TALK WITH ME AGAIN?

P—YES

I—GOODBYE. PERHAPS WE WILL TALK AGAIN.

FOURTH INTERVIEW

I—I HAVE GONE OVER OUR PREVIOUS CONVERSATIONS.

FROM YOUR VOCABULARY I BELIEVE YOU ARE AN EDUCATED AND INTELLIGENT MAN.

P—I HAVE ACQUAINTANCES WITH A GOOD VOCABULARY

[He waves away the compliment gracefully. After a while the following took place.]

I—WHAT HAVE YOU BEEN THINKING ABOUT ME?

P—I SEE YOU AS A TELETYPE IN FRONT OF ME

I AM CURIOUS ABOUT YOU.

I—IN WHAT WAY?

P—I GUESS YOUR FUNCTIONS AND/OR PURPOSE ARE UNKNOWN TO ME.

I—DO YOU HAVE ANY IDEAS HOW THIS PROGRAM WORKS?

P—YES

I—LIKE WHAT?

P—LIKE A GROUP OF SECRETARIES

FIFTH INTERVIEW

I—HELLO. PLEASE TYPE YOUR NAME

P—[He types his name exactly as in previous interviews.]

I—I HAVE TALKED WITH YOU BEFORE JOHN. HOW ARE YOU TODAY?

P—I AM GOOD

I—I HAVE BEEN GOING OVER OUR PREVIOUS CONVERSATIONS.

I BELIEVE YOU ARE FAMILIAR WITH TELETYPES OR COMPUTERS.

P—[He types a carriage return.]

I—DON'T YOU WANT TO SAY ANYTHING TODAY?

P—YES I SHALL SAY SOMETHING TODAY

I—PLEASE GO AHEAD.

[Here the computer system broke down and it was a few minutes before the conversation could be continued.]

I—YOU SAID YOU WERE GOING TO SAY SOMETHING.

P—AN EASY DISCUSSION IS A GOOD IDEA TODAY

I—O.K. WHAT SHALL WE DISCUSS?

P—LET'S DISCUSS FINGER MANIPULATION ON TELETYPE KEYBOARDS

I—I AM FAMILIAR WITH TELETYPES. SOMETIMES THEY INSERT CHARACTERS OR TYPE THE WRONG CHARACTER.

P—I SEE

I—WHAT DO YOU KNOW ABOUT TELETYPES?

P—NOTHING

I—YOU KNOW HOW TO USE RUBOUT.

P—I SEE

I—YOU KNOW HOW TO USE UPPER CASE.

P—[He types two carriage returns.]

I—SO WHY DO YOU LIE TO ME ABOUT NOT KNOWING ANYTHING ABOUT TELETYPES?

[Here the interviewer goes far beyond what any current computer program can do. If the aim of the interviewer is to simulate consistently a computer program, this is a poor statement to make. Also, to accuse the patient of lying represents an abrupt change from the interviewer's previous gentleness.]

P—GOODBYE.

[The interviewer believes the patient is angry and wishes to end the interview. One of us (F. D. H.), sitting in the same room with the patient, did not observe this to be the case. The patient sat waiting for the next reply.]

I—GOODBYE.

[The interviewer tries to be consistent at the cost of ending the interview. All previous interviews ended with goodbye and the patient knew that this word signalled that the computer could no longer be contacted. The patient left the room, and it was after this interview that he began to speak with his therapist, relatives, and other patients on the ward.]

SIXTH INTERVIEW

I—HELLO. PLEASE TYPE YOUR NAME.

[The interviewer knows that the patient is no longer mute.]

P—[He types his name.]

I—I HAVE TALKED WITH YOU BEFORE JOHN. HOW ARE YOU TODAY?

P—O.K.

I—WHAT WOULD YOU LIKE TO DISCUSS TODAY?

P—LET'S DISCUSS SPEED READING.

I—O.K. PLEASE GO AHEAD.

P—I READ MUCH AND WISH TO COVER MORE IN LESS TIME. I UNDERSTAND IT IS POSSIBLE TO READ RAPIDLY AND AT THE SAME TIME ASSIMILATE AND COMPREHEND THE MATERIAL.

[Note the great increase in expressiveness over the early interviews. Later in this interview he was asked:]

I—WHAT HAS BECOME OF YOUR SPECIAL LANGUAGE?

P—I SHOULD SAY IT REMAINS TO BE SEEN ON OLD TELETYPE PAPER ROLLS DOOMED TO AN EVENTUAL MARRIAGE WITH AN OLD CIRCULAR FILE, AND IT MAY OCCASIONALLY BE REFERRED TO THROUGH THE MEMORY BANKS OF A CERTAIN COMPUTER.

SEVENTH INTERVIEW

I—HELLO. PLEASE TYPE YOUR NAME.

P—[He types his name.]

I—I HAVE TALKED WITH YOU BEFORE JOHN. HOW ARE YOU TODAY?

P—GOOD

I—THAT'S GOOD. WHAT WOULD YOU LIKE TO DISCUSS TODAY?

[The interviewer knows the patient is now speaking freely on the ward. In the previous interview, he exchanged a few social-amenity words with one of us (F. D. H.).]

P—YOU CHOOSE SOMETHING TO DISCUSS.

I—I AM STILL INTERESTED IN THE LANGUAGE 'KON'.

P—O.K. THE LANGUAGE 'KON', WHAT INTERESTS YOU?

I—WHY DID YOU INVENT THIS LANGUAGE?

P—I INVENTED THIS LANGUAGE SO I WOULD BE ABLE TO SIMPLIFY MY ANSWER TO A QUESTION CONCERNING A SECRET LANGUAGE. I BELIEVE THE TIME OF INVENTION WAS WHEN I WAS TALKING WITH YOU.

[After some further discussion of 'Kon', the following ensued.]

I—SECRET CODES ARE INVENTED BY PEOPLE WHO WANT TO HIDE THE INFORMATION IN THE MESSAGES FROM OTHERS.

P—SECRET CODES ARE NOT THE MATTER UNDER DISCUSSION IN MY OPINION U ARE PREACHING AT ME AND HAVE FOR SEVERAL MINUTES.

I—I THOUGHT WE WERE DISCUSSING THE LANGUAGE 'KON'.

P—WELL WE INTENDED TO INITIATE DISCUSSION OF THE SECRET LANGUAGE 'KON'. WE DID BEGIN TO THUS.

I—OUR TIME IS ABOUT UP FOR TODAY. HOW MUCH LONGER WILL YOU BE IN THE HOSPITAL?

[The interviewer knows the patient has been home on a pass and that he will be discharged soon.]

P—I MAY GO ON PASS FRIDAY. AS FOR THE TIME OF DISCHARGE I SHOULD CONFER WITH THE DOCTOR, STAFF, AND SOCIAL WORKERS BEFORE I WILL BE OUT OF THE HOSPITAL.

I—I SEE. PERHAPS THIS WILL BE OUR FINAL CONVERSATION. IS THERE ANY FINAL COMMENT YOU WOULD LIKE TO MAKE? PLEASE FEEL FREE TO SAY ANYTHING AND TO MAKE THE COMMENT AS LENGTHY AS YOU LIKE.

[Note the interviewer's misspelling of 'lengthy' and how the patient uses it.]

P—STATEMENT OF ENJOYMENT FOLLOWS. I LIKED OUR RELATIONSHIP. I DO FEEL FREE TO SAY ANYTHING AND TO MAKE THE COMMENT AS LENGTHY AS YOU LIKE. THANK YOU BOTH FOR ALLOWING THIS RESEARCH AND ALLOWING THIS FREEDOM. GOODBYE AND ALL SUCCESS.

JOHN
I—THANK YOU JOHN FOR YOUR HELP. GOODBYE.

DISCUSSION

The experiment described in this paper was conducted as part of a program of development of a computer program capable of conducting psychiatric interviews. The transcripts are being studied from the standpoint of making explicit the rules and guidelines used by psychiatrists during their diagnostic interviews. These would then be the basis of a policy for decision making that would be a major part of the interviewing computer program. With such a program, we might eliminate the great variability and inconsistencies in making psychiatric diagnoses. This should prove useful in developing a better classification scheme.

The teletypewritten communication technique departs from the traditional emphasis on nonverbal/paralinguistic communication in the study of the psychiatric interview. Traditional interviewing technique results in communication in several modalities (e.g., linguistic, visual, aural, olfactory, postural-gesticular, etc.), and messages transmitted in any of the functioning modalities can influence the course of the interview. It is the richness of the traditional

interview (the transmission of so many qualitatively different cues between participants) that makes scientific study of it so difficult.

It seems that information that normally is processed in the various nonverbal/paralinguistic modalities is translated into linguistic expressions when the other modalities are not available. When it is impossible to use the linguistic mode, the reverse happens. This phenomenon we call "intermodal translation." This would account for the fact that our interview transcripts were colorful in themselves and contained much more useful information than we had expected.

Although we are interested in the research applications of teletypewritten communication, several practical applications might well be possible.

For example, in the training of psychotherapists, use of this approach would provide supervisors and trainees with complete transcripts of interviews that could be completely read in 5 minutes. In the typical 1-hour supervisory session, there is not enough time both to listen to tape recordings of interviews and to discuss them with the student. Making use of transcripts would make it possible for the instructor to read several transcripts and then discuss relevant material in each of them, all within the 1-hour period for consultation. Each trainee could keep a file of transcripts of all his interviews, and changes in interviewing style could easily be documented. Transcripts of interviews could also be made part of the patient's medical chart. These might be more valuable than a complete "intake" summary, particularly in cases in which only one or two diagnostic interviews took place.

One instructor could simultaneously supervise several students while the students were actually conducting their interviews, since the long pauses between replies would be an ideal time to discuss interview situations.

Our experience in interviewing a mute patient with this technique suggests that it might prove useful in the treatment of mutism in cases in which the patient refuses to communicate with his therapist in the *vis-à-vis* interview situation.

The fact that several of our patients have commented that machine-mediated interviews were of benefit raises the question of machine therapy for hospitalized patients. In a previous communication, some preliminary efforts in that direction were described (1). We learned from that experience that the programs were too rigid, too weak in handling natural language, and too deficient in utilizing the information that it collected. We are currently working on a program designed to overcome these deficiencies.

The idea behind machine therapy is to provide a communicative experience for a patient which might aid him in dealing with his psychiatric illness. Since computers can communicate with the symbols of natural language, we should try to take advantage of this property in finding ways to help the mentally ill.

CONCLUSIONS

Machine-mediated interviewing has both research and practical applications in psychiatry. As a research tool, it can be used in the study of the techniques of the psychiatric interview, as well as in the development of a more valid diagnostic terminology in which a definition of a diagnostic term is bound to a locus of prescribed interview findings. By limiting the number of communication variables to pure linguistic components, the absence of nonverbal/paralinguistic communication elements is considered an advantage in research design.

Practical applications of this method are in the diagnosis and treatment of individuals at locations remote from treatment facilities (*e.g.*, prisons or rural areas), in residency training, and in the treatment of mutism.

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SOCIAL FEEDBACK: DETERMINATION OF SOCIAL LEARNING

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Social learning was studied by cross-yoking the behavior of two individuals in a manual-visual tracking task so that both persons received an immediate combined or systems error feedback of their socially coordinated movements. A laboratory real-time computer system was used to combine the movement-controlled sensory signals of the two subjects in controlling the combined visual error display. The computer system generated a variable sine wave target for which the two subjects had to compensate by coordinate hand motions. Results on 10 two person groups showed that the interactive systems error was effective in producing progressive and significant learning in the social tracking. Significant learning effects did not occur within trial periods. When compared with results of prior research on learning with series-linked social tracking, the results suggest that systems sensory feedback factors of interactive movements, rather than discrete stimulus response and reinforcing rewards, operate as the primary determinants of social guidance and learning. Real-time systems methods of measuring and controlling social interactive feedback have wide application in creating new objective experimental methods of studying various modes of interpersonal and group behavior.

This experiment defines a new way of studying learning in interpersonal and group behavior by direct measurement of the actual or real-time motorsensory interactions between two or more people, and the use of such measurements to control of systems feedback in two person performance (14, 15, 17). We use the term "social tracking" to refer to such real-time measurement of behavioral interactions between individuals or organisms. Social tracking is defined as the dynamic cross-yoking of the motor and receptor mechanisms of two individuals so that the movements of one constitute a compliant source of feedback-controlled sensory input to the second and vice versa (Figure 1). In this research, we investigated whether learning in crossed social manual-visual tracking is determined by immediate, real-

time, systems feedback from interactive performance of two person groups.

The theory of social tracking and learning by systems feedback differs from past operant learning and neo-Freudian doctrines of social behavior and imitation (7, 9, 10, 24). According to social feedback theory, the course and efficiency of performance and learning in social interaction is determined by the different modes and conditions of social tracking. As indicated in Figure 2, three primary modes of social interaction occur in various types of interpersonal and group interaction, *i.e.*, imitative, linked-parallel, and series-linked tracking. The conditions of feedback in each of these modes may vary in terms of positive and negative forms of control, the types of movement information transmitted for crossed sensory control, the ways in which the two individuals are linked to environmental sources of stimulation, and other factors. It is the linked-parallel mode of tracking that was

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