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THE *QUESTRONIC* PROJECT AND THE FERRANTI MRT 100 A BOON FOR SURVEY RESEARCH*

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The overall aim of the Questronic project has been to focus upon techniques in data recording, data preparation and processing for computer input. The development and subsequent commercialization of these specific routines has come to fruition with the production of the Ferranti MRT 100. This initial product of the Questronic project has major ramifications for behavioral-survey investigations. Key Words: Questronic, data recording, field technique, data recording terminal, behavior.

This paper reports on a major and fundamental development in survey-behavioral research. The *Questronic* project, based at the University of Sheffield, and its first commercialized product, the Ferranti MRT 100, focuses upon the procedures of data recording techniques, data preparation and evaluation. It has sought to remove the tedious and costly subsequent encoding of data and preparation for input to the computer from field situations [7]. It is hoped the achievements of the *Questronic* project to date will provide an impetus for behavioral research in general and will be of particular advantage in market, opinion, economic, social and medical-survey research programs. Various aspects of the work here have been the subject of a number of filed patents [2].

The MRT 100, a battery-operated hand-held data capture terminal, is an electronic replacement for the "clipboard and pencil" used for gathering questionnaire-type information, i. e., responses to lists of multiple-choice questions. It has a keyboard for data entry and electronic storage for the data to be typed in. This approach to data capture offers major advantages for survey research, both economic and operational. They are:

- (1) Since the data are typed in and then stored electronically, they are already in a form that can be fed directly into a computer for subsequent processing, which eliminates the need for data preparation.
- (2) Elimination of the data preparation stage means that not only are costs saved, but introduction of errors will be avoided.
- (3) Elimination of data preparation means that the associated time delay is avoided, enabling faster and therefore more topical surveys or conversely, larger samples.
- (4) Paper questionnaires for a survey are reduced from one per interviewee to one per interviewer, again saving on stationery and handling costs. It is also likely to save on time for the duplication of questionnaires.
- (5) For a particular survey, the interviewer does not have to keep clipping and unclipping questionnaires for each interview.
- (6) Interviewers become more productive and accurate through the use of a keyboard for data entry.
- (7) If, traditionally, one has relied on the mailing system to transfer completed paper questionnaires to a central survey office, one may now perform this function electronically. The MRT 100 can transfer

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its stored data in conjunction with a low-cost acoustic coupler or modem via a telephone line to the computer. This step means that data can be entered for processing much faster, again permitting the survey to be more topical.

- (8) The MRT 100 is reliable and robust; the above advantages will accrue throughout its long life.

The unit is lightweight and convenient to use. It is weatherproof and ideally suited for the rigors of outdoors. Interviewers require no technical expertise to operate the device beyond the minimal training required to become fully proficient in its use.

What The MRT 100 Does

There are three "modes" of operation for the MRT 100, (1) the normal questionnaire filling operation, (2) the standard link-up operation and, (3) the master set-up operation. The first of these is used by the interviewer during the course of the survey, the second for transmitting the answers to the computer after the survey, and the third to set up the MRT 100 prior to its use in the survey.

Normal Operation

In this mode the interviewer uses the MRT 100 to type in answers to the questionnaire which is clipped onto the device. The interviewer sees on the display his/her identification followed by the identification of the questionnaire for which the device has been set up. There follows a series of prompts for each question in turn giving the question number and the permitted answers, the multiple choices, for that question. The interviewer simply types in the answers and moves to the next question. This process is repeated until all the questions are answered and the questionnaire is complete. At any time during this process an answer that has been typed wrongly can be corrected. If required, the current questionnaire can be abandoned and all its answers deleted. Finally, the interviewer can display how many questionnaires have already been filled in during the current survey.

Standard Link-Up Operation

In this mode the MRT 100 can transfer the data that has been keyed in during a survey directly into the computer. The exact operation of this function will depend on how the computer software is arranged and the way the MRT 100 has been set up. In addition to user identification and questionnaire data, the MRT 100 can store messages which can be used to control the software in one's computer. One can set up the device so it will activate the data processing software in the computer with simple keystrokes at the MRT 100. This software will then be ready to receive and process the data from the MRT 100. This use has the obvious advantage of enabling the interviewer to run the appropriate software in the computer as required and requires no prior knowledge of the computer system.

The MRT 100 can also display messages transmitted from a computer. One might, for example, arrange for the computer to send personalized messages and perhaps guidance information to the interviewer during the course of the link-up. If such messages are too long to be displayed all at once on the device's display, the display can be scrolled to the left or the right, or to the end of the message, using the MRT 100 keyboard. If for any reason a message sent to the computer fails to obtain the expected response, the message can be retransmitted by the MRT 100. When the initial message transactions between the computer and the MRT 100 are complete, the data are sent. During the data transmission the MRT 100 displays the current stage of the transmission.

When the data transmission is complete, one can arrange for the computer to set up the MRT 100 for a different questionnaire for the next survey. This feature provides an automatic means of setting up the device.

Master Set-Up Mode

In this mode the following groups of facilities are provided:

- (1) Test facilities for the MRT 100.
- (2) Facilities for setting up the MRT 100 using the keypad.
- (3) Facilities for setting up the MRT 100 using your computer, 300 or 1200 baud communications.
- (4) Facilities for transferring questionnaire data to the computer.

The diagnostic facilities provide a self-test for the MRT 100. One can, for example, test the device's memory module, ROM (Read-Only-Memory), communications port, display and keypad. These facilities enable one to be sure that the device is in proper working order prior to the start of a survey.

The facilities for setting up the MRT 100 using the keypad also enable one to specify the following items:

- (1) The messages that are to be transmitted to the computer during a link-up session.
- (2) The identification of the interviewer, transmitted to the computer during a link-up session.
- (3) The identification of the questionnaire, transmitted to the computer during a link-up session.
- (4) The transmission rate for the data transfers between the computer and the MRT 100 which may be set to 300 or 1200 baud depending on the requirements of the host computer.

The facilities for setting up the MRT 100 using the computer enable the computer to specify all the items mentioned above for setting up and using the keypad, excluding the transmission rate, which must be selected using the keypad. Also one can use the computer to set up the "dimensions" of the questionnaire, i. e., specify how many multiple choice questions there are and how many choices there within each individual question. This feature ensures that the interviewer does not mistakenly type in answers for questions or choices that are not on the questionnaire.

The facilities for transferring questionnaire data to the computer function in the same way as already described for the standard link-up operation mode. The only difference is that as a subset of the master set-up operation mode, one has access to the rest of the master set-up facilities as well. Typically, the interviewer would be restricted from using the master set-up mode, but would use the standard link-up mode to transfer the questionnaire data. The MRT 100 provides for such a restriction.

The Physical Specifications of the MRT 100

The MRT 100, compact and lightweight for comfortable use over long periods, has the following overall dimensions. It has a length of 13.7 in (346 mm), a width of 12.5 in (316 mm), a depth of 1.2 in (30 mm) and weighs some 3.3 lbs. (1.5 kg). The device has an A4 clipboard for the questionnaire, with a keypad and display alongside (Figure 1). The keypad has 16



Figure 1. The battery-powered Market Research Terminal allows field researchers to key questionnaire responses directly onto plug-in answer modules. Data are then directly transferred to a computer. Reproduced by permission of Ferranti PLC.

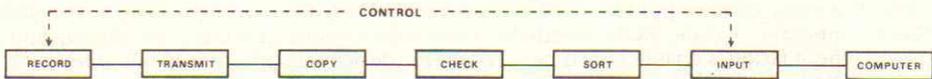


Figure 2. The developed *Questronic* routines eliminate the costly and time-consuming intermediate stages in data collection and survey research.

membrane-type keys whose values depend upon the current mode of operation; the display is of 16 characters, single line, 5-dot-wide by 8-dot-high matrix, LCD.

The device provides the following communications interface to a computer. The MRT 100 has a 15-pin, D-type plug connector. The data cable is approximately 6 ft 6 in (2 m) long with a 15-pin D-type socket at one end. The signal to pin allocations are defined within the unit and one will need to add a connector appropriate for the host computer. The signals are at RS 232C/V245, while transmission is asynchronous, 300 or 1200 baud and the data format is ASCII, 10 bits per character, 1 start bit, 7 data bits, 1 even parity bit and 1 stop bit. The MRT 100 has an interchangeable, non-volatile memory pack (reference BRM2) with usable storage capacity for questionnaire answers being 7298 bytes.

Each questionnaire answer requires two bytes of storage and one extra byte is required to finish each questionnaire. The above usable storage capacity is provided in addition to that for storing the messages that are to be sent to the computer, the user identification and the questionnaire identification. When the answer capacity is used up, the MRT 100 stops one from inputting further answers until either the current answers are transmitted to the computer or until the memory pack is changed.

The MRT 100 questionnaire format has a limit of 99 multiple-choice questions per questionnaire and a maximum of 12 possible answers. It has rechargeable batteries (reference BRM3) of 10 volts with an operation time of ten hours in normal operation mode, although this is less when transmitting to the host computer. The recharge period is for 10–14 hours, although a spare battery set is of quite reasonable cost. The charger reference is BRM4; it plugs into a main socket and has 5 ft 4 in (1.6 m) cable with jack plug for connection to the MRT 100.

Further details may be obtained from the senior author or from the Ferranti International Computer Corporation, P.O. Box 36556, Houston, TX 77236. The retail price of the unit in the U.K. is presently £350 (\$400) per unit but sizeable discounts are available upon bulk purchases.

Concluding Remarks

The developed routines represent significant savings in actual and overhead costs in performing survey research. A particular attraction is the removal of a traditional bottleneck at the data preparation stage for input into the computer. How those boring sessions were loathed by one and all! The MRT likewise provides for improved data accuracy and results in a dramatic decrease in the elapsed time from designing a survey to its fine completion. Field-workers become more efficient and effective; they are released from carrying numerous copies of completed and uncompleted questionnaires; they are free to concentrate on the survey target subjects. The completed survey details are rapidly relayed to and assimilated by the computer for immediate analysis (Figure 2). In essence this instrument results in the saving of those two prime resources—financial cost and time.

The efficiency and rapidity of developed *Questronic* routines can overcome certain of the traditional vagaries of behavioral research, e.g., those associated with the Heisenberg uncertainty principle. That is, the very act of measuring a phenomenon changes the phenomenon being measured in such a way as to make future readings, if not unpredictable, somewhat more uncertain [3].

Finally, it is hoped in academic research at least, the development reported here will provide a fillip for behavioral work in general. Who knows, it might even induce certain armchair human geographers to enter again into field work [4]. But that's another story for another time!

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