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P. A. R. I. S. */
An Interactive Market Research Information System

by

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*/ Preference Assessment Retrieval and Information System

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ABSTRACT

Marketing research in most firms and public agencies is an ongoing process providing key information to the manager about consumer perceptions, preferences. choice processes, etc. This paper presents a marketing information system, P.A.R.I.S., to augment existing data collection techniques and thus make consumer research more efficient and accurate. P.A.R.I.S. contains a computer package that uses a human-oriented language to encode any consumer survey for use on an interactive computer interviewing system. With one instruction it automatically compiles the questionnaire and sets up three data files -- a master file to monitor the project, a record file to record and encode consumer responses, and a comment file to record qualitative responses. Thus, when the consumer takes the questionnaire via an interactive terminal the files are automatically updated, eliminating the time lags due to key-punching, verifying, coding, and cleaning of the data. The language includes range checks on consumer responses, branching on consumer responses, and special commands for questions relating to evaluation theory (a generalization of conjoint analysis). Further, P.A.R.I.S. is an information system. Simple on-line commands allow market researchers to automatically access selected portions of the data base and to automatically perform statistical analyses such as conjoint analysis and evaluation theory. Further commands allow managers to use the data base to test consumer reaction to new or refined marketing strategies. Empirical experience is reported and practical implications are discussed.

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1. INTRODUCTION

The financial success and timing of marketing strategy often depends on the rapid collection and analysis of high quality market research data. Careful analysis of consumer perception, preferences, and choice has led to the improved design and enhanced success of new products and services in frequently purchased goods, food products, health services, financial services, transportation, management education, and communication services [5,8,10,19]. Collection and analysis of preference data in laboratory simulations can now predict the potential market share of new products so accurately that many firms can safely avoid costly failures in test market [3,21]. Today, successful firms continually tap consumer values and maintain up-to-date marketing information systems so they can react quickly to opportunities, competitive actions, changes in the environment, etc. [14,15,16,19,20].

But the collection and analysis of market research data is costly and time consuming. A typical study takes weeks or even months. To minimize errors, one must traditionally follow at least nine steps in market research: (1) questionnaire design; (2) questionnaire printing; (3) mail, telephone, or personal interview circulation; (4) coding completed questionnaires; (5) keypunching responses; (6) verifying keypunched data; (7) cleaning of the data; (8) statistical data analysis; and (9) interpretation. Furthermore, good research dictates at least one "pretest" to refine questionnaires in an attempt to remove complexity, confusing questions, detectable errors, and biases. Unfortunately, this necessary step can prolong the research delay by causing a second or third iteration of the above process.

Even without the time delay, there are other problems in implementing traditional market research. In telephone or personal interview studies, interviewer bias can undermine attempts at representative random samples.

In fact, in national or multiregional studies, many of the major research firms contract out to local research firms. Furthermore, because of the effort involved, complex survey research is usually cross-sectional and represents but a "snapshot" of consumer attitudes and actions. Additional periodic or supplemental surveys are difficult to integrate into a "master" data base to provide ongoing consumer analysis. Alternatively, ongoing consumer diary panels are limited by problems associated with the representativeness of samples, wearout of the sample, attrition, and instrument sensitization [2,23,24,25]. Finally, no matter how the data is collected, analysis can require trained statisticians and computer programmers to reduce the data to a usable form and to implement the many powerful multi-variate techniques now available.

But marketing research is a dynamic discipline and recently many researchers have investigated the possibility that new technology, i.e., highly portable computer terminals, can be used to address some of the problems faced by traditional marketing research [11,17,18].* The advantages of interactive computer interviewing are many. Among these advantages are: (1) ongoing data collection to continually monitor the environment; (2) more efficient interviews through contingent or flowcharted questions; (3) elimination of some bias due to standardization of "interviewer;" (4) time savings via overnight data collection and analysis; (5) cost savings due to automatic coding, keypunching, verifying, cleaning, and editing of data; (6) instantaneous data entry and updating of the data base; (7) immediate computational results through special on-line commands; (8) improved data integrity by cueing respondent to answer within an allowable range; (9) new capabilities such as automatic

*Consumers, sensitized by pocket calculators, touch-tone telephones, automated banking machines, etc., readily adapt to computer terminals [17], especially when specialized "masked" keyboards are used [11].

timing of consumer response to each question; and (10) integration into a marketing information system. Furthermore, in a recently completed study, Myers [17] has shown that information necessary for product positioning, i.e., attitudes, weights, and beliefs which are collected by pencil and paper surveys, are highly correlated with attitudes, weights, and beliefs collected via interactive computer terminals, and Johnson [11] has shown that certain applications of conjoint analysis are more efficient when interactive computer terminals are used to collect the data. Nelson, Peyton, and Bortner [18] have demonstrated the capability of interactive interviewing for a specific product and are processing an estimated 90,000 interviews per month over a wide geographic area for a major national telephone company. Wind and Myers [30] use a special interactive system for conjoint measurement and decompositional modeling.

But computer interviewing has its problems. Although the interviewer is "standardized," random samples require special effort because either consumers must be brought to a computer terminal or a telephone interviewer must record responses interactively. Furthermore, while a fully developed interactive interviewing system is extremely efficient, existing systems are restricted to specialized tasks and require expensive computer software development for each application. Hence, the typical market researcher finds this new technique difficult to use or not appropriate for the research he or she requires.

Thus, interactive computer interviewing, like any new marketing research technique, requires careful investigation and development to overcome its problems and to make it a feasible option for marketing researchers with or without computer expertise. In this paper we present a marketing information system, P.A.R.I.S.,* which automates not only the computer programming necessary

*Preference Assessment Retrieval and Information System

for interactive interviewing, but which automatically sets up and maintains data files for effective statistical and modeling analysis. Furthermore, special "on-line" commands enable market researchers to quickly access and automatically analyze any portion of the data base. Managers can also use the on-line system to test new strategies or to gain diagnostic information on consumer behavior. Or they can use the data base as input to existing on-line marketing models [1,3,13,14,15,19,27,28].

Among the features of P.A.R.I.S. are an interactive interviewing system based on a Q-compiler which allows market researchers to enter questionnaires in the system via a special human-oriented questionnaire language. With simple commands, a market researcher with no special computer training can "write" a questionnaire with (1) range-checks, (2) branching on responses, and (3) prompting. Furthermore, special commands enable easy entry of constant sum paired comparison questions lending to efficient measurement of consumer preferences [15]. The P.A.R.I.S. system automatically stores complete consumer responses and comments with codes to enable easy file manipulation for data analysis and it continually maintains "master" files which summarize the study's progress "to date." Special subroutines for pairwise conjoint analysis and evaluation theory can automatically perform the data analysis, store summaries of consumer "utility" or preference functions, and use these preference functions to estimate the market shares resulting from new or refined marketing strategies.

P.A.R.I.S. is a useful tool to enable marketing research to take advantage of a growing technology. We describe P.A.R.I.S. and discuss it in the context of the issues involved in marketing information systems and interactive computer interviewing. Examples are given illustrating the use of P.A.R.I.S. for a wide variety of market research tasks.

2. THE P.A.R.I.S. SYSTEM

The P.A.R.I.S. system was developed to enable the market research specialist to (1) quickly and efficiently develop an interactive computer interviewing program for his or her special or ongoing projects, and (2) develop a dynamic market research data base which is easily accessed and automatically updated over time.

Development of an Interactive Program

The P.A.R.I.S. system allows the researcher to develop an interactive questionnaire as easily as a written question might be developed. The researcher would accomplish this development in three steps.

First, the researcher constructs a questionnaire using the P.A.R.I.S. language described in Section 3. This language consists of simple commands to print questions, record answers, check ranges, branch based on consumer response, etc. The language, which consists of over thirty commands, is sufficiently general to implement most market research questionnaires.

Second, the written questionnaire is either punched on ordinary data cards or written on-line to computer storage (tape or disc). A single command activates the P.A.R.I.S. Q-compiler which converts the human-oriented language into an alpha-numeric, machine-oriented language and sets up the appropriate files to record and decode answers and sets up a system to time and record how long it took each consumer to answer each question. The Q-compiler also checks the questionnaire for coding errors and provides a summary of each question's status, thus alerting the researcher of possible errors in questionnaire design.

Finally, the compiled version of the questionnaire is automatically input to a "mass storage" program. This program stores the questions in a format allowing efficient computer access to any question in any order. The questionnaire is stored as modules on what is known as a "random access" device. This feature

provides for fast effective administration of the questionnaire and makes flowcharted questioning practical. The questionnaire is now ready for implementation. (These steps are summarized in Figure 1.)

[Insert Figure 1 about here]

Development of a Dynamic Market Research Data Base

The actual administration of the questionnaire is accomplished either by seating a respondent at a portable terminal (e.g., Cathode-Ray tube CRT) or by allowing an interviewer to interactively record answers while obtaining them in person by telephone. In either case, P.A.R.I.S. adds the response to the data base together with the time and date when entered. The computer then provides instantaneous range-checking to insure each response is in the legitimate range allowed for that response. Illegal responses (e.g., "yes" when his/her age is asked) may be followed by a gentle computer response informing the respondent or interviewer of an error and providing a clarifying instruction. Once a legitimate response is obtained, the range of that response can determine the next question. For example, if the respondent can only evaluate three brands of deodorants, perception questions about non-relevant brands can be avoided. This branching permits very efficient questioning, minimizing the actual number of questions asked to the most relevant questions for the consumer.

When the interview is completed, summary statistics are automatically provided. Management can access all interviews to date or some selected portion of them. Statistical analysis can be performed periodically and selectively. A master file allows a researcher to determine at a glance the current sample size, progress for the entire study, and how long each questionnaire administration took. More detailed information, e.g., how long a partial question's administration took and the answer given, can be

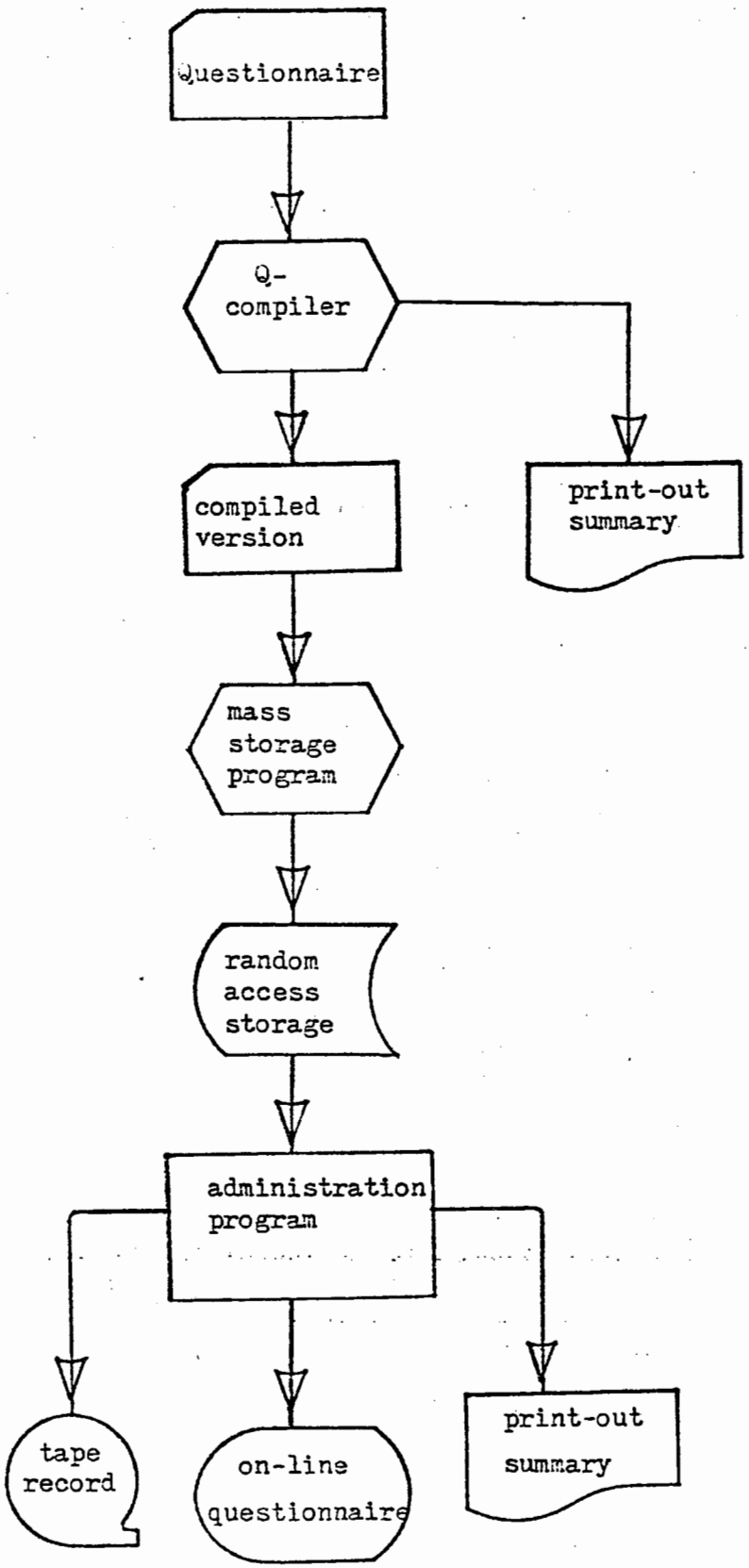

Figure 1: Ordinary Questionnaire to On-line Questionnaire

obtained from the main data-base record. A special comment file records qualitative responses for easy access and analysis. We have found record and comment information, together with the feature that all answers are recorded regardless of whether a question is reasked because of an improper response, is very valuable for the development of test questionnaires. All answers, including mistakes, can be accessed to fully pretest a questionnaire.

3. A QUESTIONNAIRE LANGUAGE

The key to the P.A.R.I.S. system is the human-oriented questionnaire language which allows a market researcher to write the questions he or she wants and to flowchart the survey in a way that is advantageous to his or her project. While this task can now be done in "high-level" general purpose languages such as FORTRAN or PL1, the task rapidly becomes costly and tedious. The special commands in the P.A.R.I.S. system make this task efficient. The complete instructions to the thirty-two commands now available are contained in the P.A.R.I.S. language manual. For illustrative purposes, Figure 2 summarizes eight of the most commonly used commands, and examples 1, 2, 3, and 4 illustrate their use in simple questionnaires.

[Insert Figure 2 about here]

Command	General Explanation[+]	Example
QUESTION n	Informs the computer question number "n" follows.	QUESTION 2
READ ANSWER	Instructs the computer to read and record the respondent's answer	READ ANSWER
*	Instructs the computer to print everything to the right of "*".	*DO YOUR OWN OR RENT?
GO TO QUESTION n	Instructs the computer to ask question number "n" next.	GO TO QUESTION 3
PRINT ANSWER	Instructs the computer to print the respondent's last answer.	PRINT ANSWER
(X,Y)n	If the respondent's last answer is in the range between X and Y (including X and Y), the computer is instructed to ask question number n.	(4,7)3
(X,Y)n FORCE	The same as above, except the computer will continue to prompt "out-of-range" answers with a gentle instruction until the respondent's answer is between X and Y.	(4,7)3 FORCE
ASK n m	Causes a yes or no question to be asked. Includes prompting for answers other than yes or no. Branches to question "n" if answer is yes, to question "m" if answer is no.	ASK 10 20

[+]More precise explanations are given in the P.A.R.I.S. Language Manual

Figure 2: Some P.A.R.I.S. Commands

Example 1

Suppose we want to ask the respondent his/her age and annual income. The initial questionnaire may be constructed as follows:

* WHAT IS YOUR AGE?

READ ANSWER

* WHAT IS YOUR ANNUAL INCOME?

READ ANSWER

When the questionnaire is administered, the respondent will see (respondent's answers are shown in italics):

WHAT IS YOUR AGE?

31

WHAT IS YOUR ANNUAL INCOME?

$10,000

Example 2

Suppose we want to ask the respondent the annual income question only if the respondent is over 20 years of age. Otherwise, we want to ask the respondent his/her parent's income. The questionnaire can be constructured as follows.

QUESTION 1

* WHAT IS YOUR AGE?

READ ANSWER

(0,20) 3

QUESTION 2

* WHAT IS YOUR ANNUAL INCOME?

READ ANSWER

GO TO QUESTION 5

QUESTION 3

* WHAT IS YOUR PARENT'S ANNUAL INCOME? (ANSWER -1 IF YOU DON'T KNOW THEIR INCOME.)

READ ANSWER

When the question is administered, the respondent might see:

WHAT IS YOUR AGE?

18

WHAT IS YOUR PARENT'S ANNUAL INCOME? (ANSWER -1 IF YOU DON'T KNOW THEIR INCOME.)

$10,000

Example 3

Suppose we want to ask the respondent how often he or she went to the grocery store last month. For analysis purposes, we want categorical responses and we want no out-of-range data. If he or she did not go at all, we want to branch to question 10. Otherwise, we want to branch to question 8. Finally, if he or she answers "10 or more trips," we want him or her to specify how often. The initial question may be constructed as follows:

* HOW MANY TRIPS DID YOU MAKE TO GO GROCERY SHOPPING IN THE LAST FOUR WEEKS?
* 1 = NO TRIPS AT ALL
* 2 = 1-4 TRIPS
* 3 = 5-9 TRIPS
* 4 = 10 OR MORE TRIPS

QUESTION 6

(1,1) 10

(2,3) 8

(4,4) 7

* PLEASE ANSWER WITH A NUMBER 1 THROUGH 4.

GO TO QUESTION 6

QUESTION 7

* HOW MANY TRIPS DID YOU MAKE?

READ ANSWER

When the question is administered, the respondent will see the following (suppose he or she makes an initial mistake):

HOW MANY TRIPS DID YOU MAKE TO GO GROCERY SHOPPING IN THE LAST FOUR WEEKS?

1 = NO TRIPS AT ALL

2 = 1-4 TRIPS

3 = 5-9 TRIPS

4 = 10 OR MORE TRIPS

TWENTY TRIPS

PLEASE ANSWER WITH A NUMBER 1 THROUGH 4.

4

HOW MANY TRIPS DID YOU MAKE?

20

Of course, there are simpler ways to ask this question. The example is meant only to illustrate the P.A.R.I.S. language. Note that range checks could have been applied to question 7 in this example or to any question in either of the preceding examples.

Example 4

Range checks are very useful and are used quite frequently. Thus, P.A.R.I.S. contains commands to make it quite easy to check ranges and prompt out-of-range response. For example, suppose we want to ask a respondent how many hours per day he or she spends watching television. Furthermore, we want a reasonable answer and feel that a reasonable range is between 0 and 20 hours. The questionnaire may be constructed as follows:

```
QUESTION 1
* ON THE AVERAGE, HOW MANY HOURS PER DAY DO YOU SPEND WATCHING TELEVISION?
(0,20) 2 FORCE
```

The respondent might see (suppose he makes two mistakes):

```
ON THE AVERAGE, HOW MANY HOURS PER DAY DO YOU SPEND WATCHING TELEVISION?
50
PLEASE ANSWER WITH A NUMBER BETWEEN 0 AND 20.
TWELVE
PLEASE ANSWER WITH A NUMBER BETWEEN 0 AND 20.
12
```

These range checks insure a higher quality data than is ordinarily available through classical written or telephone surveys. The final data for analysis must be complete and within range or the interactive questionnaire will not accept it.

Finally, we note that these example quesions could have been coded more efficiently using more advanced P.A.R.I.S. commands and could have been written more easily using abbreviations found in the language manual. (For example, the command QUESTION 10 is abbreviated Q 10.)

4. THE QUESTIONNAIRE ADMINISTRATION

The administration program is constructed in a module fashion. The primary administration program simply activates a series of modules which sequentially administer the questionnaire. The module constructions provide P.A.R.I.S. with both good portability and maximum flexibility. When moving P.A.R.I.S. from one computer system to another, only certain system dependent modules need be modified rather than the entire software system. Further,

alterations of the P.A.R.I.S. system for specific applications are made easier by the module structure. Finally, respondent reactions to interactive interviewing are effected by response time which in turn is influenced by program size. In general, the more core-memory of computer storage required, the longer the respondent must wait for a computer response. The module structure of the administration program allows only active modules to occupy core-memory. Hence, the system can incorporate additional features by adding further modules while not significantly increasing computer response time. Remember that the questionnaire is coded automatically by the Q-compiler, creating the needed input for the administration program. This compilation need occur only once for each questionnaire irrespective of the number of times it is administered.

The actual administration of the questionnaire can either be direct or indirect. The direct method entails the seating of the respondent at a portable computer terminal (approximately the size of a typewriter) and having him or her type answers directly into the computer. The indirect method employs an intermediate interviewer who types in the responses obtained either in person or by telephone as they are given.

The direct method tends to be less expensive because it saves on the number of interviewers required. It may also be desirable from a motivation viewpoint since the respondent may be encouraged by the somewhat novel approach to questioning. Unfortunately, although interviewer bias is controlled, human interaction is eliminated. However, personal involvement can be enhanced by writing questionnaires that seem receptive for the respondent. For example, the respondent's first name can be recorded early in the interview and used repeatedly in later questions.

The indirect method avoids some problems but is more expensive since it involves more interviewers. Further, errors can occur when the response recorded by the interviewer differs from the respondent's actual answer (although within the proper range) and the response time includes the response time of the interviewer.

During the direct administration of the questionnaire, responses are typed by the respondent. To eliminate problems relating to typing speed, keyboards can be specially labeled so that appropriate keys are easily identified [11]. This procedure is particularly efficient when the questionnaire is chiefly composed of multiple-choice type questions even though the P.A.R.I.S. system is general enough to allow for all types of responses, i.e., alphabetic, numeric, alpha-numeric, and special characters.

5. DATA CODING AND STORAGE

One advantage of the P.A.R.I.S. system is that it eliminates the need for coding and keypunching of questionnaire responses. When the "questionnaire" is compiled, the Q-compiler automatically sets up three data storage files -- a "master" file, a "record" file, and a "comment" file. When the "questionnaire" is administered, P.A.R.I.S. automatically updates these files with the respondent's answers.

Master file: This file is a relatively short file used by the market researcher to track the progress of his or her study. It contains the respondent's number, his or her name, if given, the date he/she took the questionnaire, the time he/she began, the time he/she ended, the storage location of the complete data, and the status of the response (complete, partially complete, etc.). See Figure 3.

[Insert Figure 3 about here]

RESPONDENT	NAME	DATE	SIGN-ON	SIGN-OFF	PERM-NAME	STATUS
1	NONAME	04/17/77	19.51.54.	20.05.10.	SS10000000	96C
2	JOHN H	04/19/77	12.17.39.	12.32.46.	SS10000001	96C
3	JAY S	04/19/77	12.51.34.	13.17.11.	SS10000002	96C
4	NONAME	04/19/77	12.57.52.		SS10000003	1N
5	MARY R	04/19/77	15.48.57.	16.10.53.	SS10000004	96C
6	ROGER W	04/21/77	16.15.17.	16.35.14.	SS10000005	96C
7	PETER P	04/23/77	11.52.14.	12.05.53.	SS10000006	96C
8	DAVID T	04/25/77	10.10.40.	10.26.11.	SS10000007	96C
9	BRUCE B	04/25/77	15.32.03.	16.07.58.	SS10000008	96C
10	TEST	04/25/77	16.01.46.		SS10000009	1N
11	NANCY T	04/26/77	09.10.07.	09.25.29.	SS10000010	96C
12	STEVE S	04/26/77	13.26.03.	13.59.03.	SS10000011	96C
13	IRENE S	04/26/77	13.40.08.		SS10000012	1N
14	CHRIS P	04/27/77	12.41.03.	13.14.13.	SS10000013	96C
15	KENT L	04/28/77	16.00.03.	16.25.31.	SS10000014	96C
16	JERRY	04/28/77	16.30.59.	16.47.17.	SS10000015	96C
17	TOM	04/28/77	20.48.57.	21.05.22.	SS10000016	96C

RESPONDENT: The respondent number

NAME: The respondent's name, if given

DATE: The date the questionnaire was administered

SIGN-ON: The time the respondent started

SIGN-OFF: The time the respondent completed the questionnaire

PERM-NAME: The name of the (permanent) file where the respondent's answers are being kept

STATUS: The last question written into the data base followed by one of the following code letters:

U = Unusable (replaces N)
M = More information to follow (replaces P)
D = Duplicated (replaces C)
C = Completed
P = Partially completed
N = No record
T = Copied to tape

Figure 3: The Master File

This key data gives a concise summary of the study and of the marketing information available. The data provides a reference point for an ongoing study (e.g., monitoring of a test market). The time gives a check on time of day bias, and an indication of how long each respondent is spending with the questionnaire. The status gives an indication of completion rate. (Both the timing and completion rate are extremely important in pretest.) The continual updating allows the research to set a target sample size and continue until it is attained.

Record file: This file records all responses, including respondent "errors" -- even when subsequently corrected -- and certain question summaries for later analysis. For each consumer response, the file contains the respondent's number, the question number, the date, the time, and the raw answer. The time of each response is important in pretest to assess the difficulty of questions and important in implementation to determine respondent motivation. For special questions, such as constant sum paired comparison questions, P.A.R.I.S. encodes the response and stores the simplified response as well as the complete response. A special code is then added to each line to indicate whether the line represents a raw response (code R) or a coded response (code C). This special coding makes data access efficient for subsequent analysis. In practice, the record file becomes quite large and is periodically copied to permanent storage such as tape or cards in which case the status in the master file is changed to indicate that the file was written to tape (code T). Figure 4 contains a copy of a portion of a record file.

[Insert Figure 4 about here]

CODE[+]	RES.	QUES.	DATE	TIME	RESPONSE[++]
S2	1	1	04/17/77	19.51.54.	SS10000000
R	1	3	04/17/77	19.53.10.1	
R	1	5	04/17/77	19.53.22.45	
R	1	7	04/17/77	19.54.13.6	
R	1	11	04/17/77	19.54.35.1	
R	1	16	04/17/77	19.54.48.1	
R	1	19	04/17/77	19.55.01.3	
R	1	29	04/17/77	19.55.50.4	
R	1	36	04/17/77	19.56.02.1	
R	1	41	04/17/77	19.56.19.4	
R	1	43	04/17/77	19.56.28.4	
R	1	49	04/17/77	19.57.47.5	
R	1	49	04/17/77	19.57.51.4	
R	1	51	04/17/77	19.58.03.4	
R	1	54	04/17/77	19.58.20.2	
R	1	56	04/17/77	19.58.30.2	
R	1	59	04/17/77	19.58.45.2	
R	1	61	04/17/77	19.58.54.2	
R	1	65	04/17/77	20.00.23.11	
R	1	65	04/17/77	20.00.26.89	
C	1	65	1100		
R	1	66	04/17/77	20.00.36.11	
R	1	66	04/17/77	20.00.41.89	
C	1	66	1100		
R	1	67	04/17/77	20.00.51.11	
?					

[+]S = start of new respondent, R = response, C = encoded constant sum allocation

[++]Except for code S, in which case the file name is given

Figure 4: Record File

Comment file: At the end of a P.A.R.I.S. questionnaire, the system automatically asks the respondent if he or she wishes to make any additional comments. If respondent answers "yes," the system records his or her comments on a special file, together with an identifier linking the respondent to the comment. The researcher can then quickly access all qualitative comments in a concise summary file and analyze them at his or her convenience. See Figure 5.

```
     RESPONDENT 5 6/10/77 14.02.26.SS10000005
I HAVE BEEN USING A NARROW-BAND VIDEO TELPHONE FOR THE PAST
5 MONTHS.  I FIND IT VERY USEFUL FOR TRANSMITTING DATA BUT
FIND THAT THE UNIT IS TOO LARGE TO FIT COMFORTABLY ON MY
DESK.
     RESPONDENT 6 6/10/77 15.08.55.SS10000006
I FOUND THE INTERACTIVE QUESTIONNAIRE INTERESTING BUT I PREFER
THE TELEPHONE TO ANY OF THE TELECOM. EQUIPMENT.
     RESPONDENT 10 6/12/77 15.37.18.SS10000010
YOUR NEW SYSTEM SOUNDS GREAT! WHY HAVEN'T I HEARD OF IT SOONER.
     RESPONDENT 11 6/12/77 15.59.36.SS10000011
NARROW-BAND VIDEO TELEPHONE SEEMS LIKE IT COULD BE EFFECTIVE
FOR FOLLOW-UP CONTACTS BUT I WOULD PREFER CLOSED CIRCUIT TV
FOR INITIAL CONTACTS, ESPECIALLY IF A MAJOR PROJECT IS AT
STAKE.
     RESPONDENT 13 6/12/77 16.30.12.SS10000013
HOW MUCH RED TAPE WOULD BE INVOLVED?
     RESPONDENT 14 6/12/77 16.51.34 SS10000014
YOU WILL HAVE TO PLACE AT LEAST 10 UNITS BEFORE NBVT IS OF
ANY USE TO ME.
```

Figure 5: Comment File

6. CONJOINT ANALAYSIS, EVALUATION THEORY, AND OTHER PREFERENCE MEASUREMENT

An important market research function in the design of new products and services is the analysis of how consumers form preferences relative to the attributes of products. There are a number of useful techniques to perform

this task, including expectancy value models [4,29], direct utility assessment [9], preference regression [27], tradeoff analysis [10], and conjoint analysis [5]. Many of these techniques give consumers "pseudo-products," i.e., products specified by setting the levels of a number of attributes, and have the consumers indicate preference by rank ordering the "pseudo-products." Given these rank orders, the market researcher can estimate consumer preference functions (also called utility functions) which summarize such effects as tradeoffs among attributes, decreasing returns, risk, and interdependencies [5,9,12].

Recent work has shown that all of these preference functions satisfy a common mathematical framework called evaluation theory [7]. Furthermore, if the consumer task is to make constant sum paired comparisons among "pseudo-products," then there is a statistical test to determine whether the resulting preference function is ordinal, interval, ratio, probabilistic, or hybrid [7].

P.A.R.I.S. is designed with special commands for preference analysis by conjoint or evaluation theory. For example, a single command "READ n CHIPS" sets up a constant sum paired comparison question with automatic range checks and tests to ensure that the consumers' responses sum to n. If the responses do not sum to n, or if negative or non-numeric answers are given, the system diagnoses the problem and informs the respondent of his or her mistake. The respondent can than type "?" and the system will explain the mistake and indicate how to enter a "correct" response. The researcher can select either the short form for quick answers or a longer form with more explanation. See Figure 6.

[Insert Figure 6 about here]

DIVIDE 100 CHIPS BETWEEN EACH OF THE FOLLOWING PAIRS OF HYPOTHETICAL DEODORANTS:

PRODUCT A	PRODUCT B
PUMP SPRAY	AEROSOL
HERBAL SCENT	NO SCENT
VERY EFFECTIVE	MODERATELY EFFECTIVE

LONG FORM

. . . ENTER CHIPS FOR PRODUCT A

53

. . . ENTER CHIPS FOR PRODUCT B

37

SHORT FORM

. . . ENTER CHIPS

53,37

Figure 6: An example of a constant sum paired comparison question.

Furthermore, the system automatically sets up a computer routine to encode the constant sum response and place it in the record file for easy access. This encoded data is input to a related subroutine, PREFCOM, which uses linear programming to estimate the preference functions [7]. (PREFCOM is a modification for constant sum data of ideas expressed by Srinivasan and Shocker in LINMAP [22]). Experience to date has shown that the constant sum paired comparison task for preference measurement is extremely accurate [6,20,26] and is readily accepted by consumers for "pseudo-products" [7]. For an application of evaluation theory implemented through P.A.R.I.S. and PREFCOM, see Hauser and Shugan [7].

Note that because constant sum rather than rank order data is collected, PREFCOM uses more information per consumer question and thus requires fewer questions for the same level of accuracy. Of course, traditional conjoint analysis is made possible by treating the constant sum paired comparison questions as simple paired comparions and using MONANOVA or related techniques [5].

7. INFORMATION RETRIEVAL AND ANALYSIS SYSTEM

Questionnaire implementation, data storage, and automtaic analysis are important components of an information system, but not the only components. If an information system is to be effective, it must be a two-way system. That is, not only must the system control the respondent/data base interaction but it must enhance the data base/management interaction through an information retrieval and analysis system.

P.A.R.I.S. enhances the managerial use of the data base through a series of special on-line subroutines which allow the market researcher or the manager to efficiently access and analyze the data collected by the P.A.R.I.S. implemented questionnaire. See Figure 7.

[Insert Figure 7 about here]

DATA BASE

. MASTER file (summary of study)

. RECORD file (raw and coded responses)

. COMMENT file (qualitative responses)

QUESTIONNAIRES (RESPONDENT)

. P.A.R.I.S. language

. Q - compiler

. Administration programs

MANAGEMENT

. RETRIEVE (data access)

. PREFCOM (conjoint and preference analysis)

. PREDICT (predicts market share)

Figure 7: P.A.R.I.S. is a two-way system

Data access: As was explained earlier, the respondent's answers are specially coded for easy access. An on-line subroutine, RETRIEVE, allows management to access any portion of the data base and create new subfiles containing selected portions for statistical analysis. All the researcher must do is enter a single command to call the RETRIEVE program. This program then explains a human-oriented retrieval language which allows the researcher to access the information he or she needs at that time.

Market share prediction: One use of conjoint analysis and related techniques is to predict the market share of new products [5,8,19,27]. Thus, another on-line subroutine, PREDICT, takes the output of PREFCOM (see Section 6) augmented with information from the manager or from specific questions in the questionnaire and estimates the market share of a new or modified product.

Product line structuring: In related work, Shugan and Balachandran [20] have developed a mathematical programming system to couple the preference information with the firm's financial and planning considerations to select a product line that is optimal in terms of the firm's financial goals. At present, P.A.R.I.S. automatically prepares the market research information for input into the optimization system. Future work will integrate the two systems with an on-line subroutine that will allow managers to input "soft" data concerning tax rates, product line characteristics, expected competitive reaction, expected advertising expenditure, etc. P.A.R.I.S. will then automatically tap the marketing research data base to determine consumer reaction to a series of product line strategies and therefore select the optimal product line strategy.

Together, the general purpose data access subroutine and the special purpose data analysis subroutine enable market researchers and/or managers to effectively use the data base created by P.A.R.I.S. Although some multi-

variate techniques are automated in PREFCOM and PREDICT, the information retrieval system, RETRIEVE, is sufficiently general to enable a researcher to efficiently access any portion of the data for whatever analyses are appropriate for his or her study.

8. EMPIRICAL EXPERIENCE

P.A.R.I.S. is now being used in a market research study, funded by the National Science Foundation, to design an optimal mix of telecommunications technology for use in a small scientific community, Los Alamos Scientific Laboratory. Among the "products" tested were closed circuit television,* teletype terminals, facsimile transfer devices,** narrow-band video telephones,+ personal visits, and telephones. The marketing research, which follows a methodology described in Hauser and Urban [8], is designed to produce predictions of consumer response and consumer response diagnostics by modeling consumer perceptions, preferences, and choice within each consumer segment.

The study began with focus group analysis to identify issues and determine consumer semantics for the questionnaires. The next phase was a mail-back questionnaire to identify the basic dimensions of consumer perceptions and to estimate aggregate preference functions via preference regression and logit analysis. (The dimenions were efficacy and ease-of-use

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*Requires the equivalent of 100-300 telephone lines.

**Transmits documents over ordinary telephone lines. Sort of a long-distance copying machine

+Transmit still television pictures over ordinary telephone lines.

with relative weights of .82 and .18.) P.A.R.I.S. was then used to estimate each consumer's preference function with respect to basic dimensions of perception so that those scientists most likely to use each system could be idenfitied.

This P.A.R.I.S. questionnaire contains 96 questions* divided into the following six sections: (1) warmup questions, (2) questions to establish a scenario for usage of the technology, (3) consumer rating of the basic dimensions for existing products and new product concepts, (4) sixteen constant sum paired comparison questions, (5) preference ranking and usage intent for the existing products and the concepts, and (6) personal and demographic questions. Once compiled, the questionnaire took 15-40 minutes for a consumer to complete (average time was 24 minutes). The administration cost, including on-line hookup, was $1.00 per respondent on a CDC-6600 computer ($510 per cpu hour). An appendix shows the first few questions in the questionnaire.

To date, consumer experience has been favorable for tests on both student populations and on field populations. We found that one strong advantage of the Q-compiler is that the wording changes identified in pretest could be incorporated into an updated questionnaire in a matter of minutes.

9. PRACTICAL IMPLICATIONS

The great advantage of P.A.R.I.S. is that it is specific on some important marketing models, but is sufficiently general that a market researcher can use the system for his or her special problems. The applications of P.A.R.I.S. are limited only by the imagination of the market researcher. We present here but a few of the potential uses.

New Product Positioning: It is important early in the new product design process to learn the dimensions that consumers consider (i.e., per-

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*Due to branching, not all respondents answer all 96 questions.

ceptions such as efficacy and gentleness for laundry detergents), the positions of product in that space, and the way consumers make decisions with respect to these dimensions [8,19]. P.A.R.I.S. could be used to set up a questionnaire to probe perceptions, to get consumer ratings of existing products for the product space map, and to estimate preference functions to describe the consumers' decision processes. Note the P.A.R.I.S. can do the latter analysis automatically and further use the data bank to estimate market shares for potential new products.

Laboratory Simulation: Many firms are now using pretest market simulators such as ASSESSOR [21] or COMP [3] to test and refine new products before they are taken to a full test market. Such systems cost less than 5% as much as a full test market, but have proven almost as accurate in predicting market share. P.A.R.I.S. is ideal for these systems because consumers are intercepted in a shopping area and brought to a fixed facility that is a simulated purchase environment. On-line terminals could replace or augment human interviewers at these facilities, thus resulting in tremendous savings. Furthermore, such complex questions such as branching on evoked set and constant sum paired comparison measures* are readily implemented on a P.A.R.I.S. system. Because clean data is automatically entered into the data bank, statistical analyses are done overnight and can be ready for the next day's testing.

Test Market: To be effective, test markets must be carefully monitored. Firms want detailed information on why a product is performing the way it is and they want it as soon as possible. There are at least three forms of information necessary to properly "read" a test market: (1) store audits; (2) telephone surveys for awareness, trial, repeat, etc.; and (3) personal or mail

*Constant sum paired comparisons are key to ASSESSOR's predictions of draw and cannabilization.

surveys for in-depth analysis. With universal product codes (UPC) a reality, systems are now available to give overnight store audits [16]. P.A.R.I.S. can be used by telephone surveyers to provide overnight measures of awareness, trial, repeat, etc. (Here questions are still asked by telephone, but P.A.R.I.S. tells the interviewer what to ask, ensures that all data is complete and within range, and automatically enters it into the data bank.) Further, P.A.R.I.S. can be used to get twenty-four-hour turnaround on the analysis of the in-depth surveys. Thus by coupling P.A.R.I.S. with automated store audits based on UPC, managers can monitor test markets almost on a daily basis and with only a one-day lag between what is happening in test market and when management knows about it. Of course, P.A.R.I.S. can be used to provide the data bank necessary for such test market analysis systems as SPRINTER [28] and NEWS [18].

Advertising Copy Testing: Advertising copy is often tested by showing consumers a series of executions and having them evaluate them via a self-administered or interviewer-administered survey. Here again P.A.R.I.S. can automate the surveying and analysis process to ensure that all data is complete and within range and to provide overnight analysis. Furthermore, the automatic timing of consumer response to the questions can provide unobtrusive measures of the effect of advertising copy and execution. E.g., Can they state the appeal immediately, or does it require some thought?

Diary Panels: As terminal prices drop, it will be feasible to place a terminal with each member of a diary panel so that a variety of surveys can be automatically given to the panel to augment traditional "diary" information. Furthermore, the technological capability now exists to build a "coupler" that will enable a consumer to see the questionnaire on his or her home television screen and to respond via the buttons on a touch-tone telephone.

10. CONCLUSIONS AND FUTURE PROSPECTS

Computer interviewing is a valuable research tool for marketing. Although it cannot be used in all situations for all purposes, it does present new opportunities for improved data collection and consumer analysis. It can be very effective when used judiciously in conjunction with traditional research tools such as focus groups, telephone, mail, or personal interviews. The advantages of computer interviewing are many, including:

- cost and time savings on coding and keypunching
- improved data integrity through range checks and prompting
- automatic branching based on previous respondent answers
- automatic storage of data for overnight statistical analysis
- standardization of "interviewer," and
- timing of respondent.

Of course, in any application these advantages must be carefully weighed against disadvantages such as:

- the terminal must be available to the respondent or an intermediate interviewer
- capital cost of equipment, and
- man-machine interfaces that are still to be explored.

When used in the right situation, we feel the enhanced speed, flexibility, and accuracy outweigh the disadvantages that must be overcome.

P.A.R.I.S. is one way for any market researcher to use the powerful measurement technique of computer interviewing. The human-oriented questionnaire language, the Q-compiler, the automatically generated master, record, and comment files, and the encoding of data, the preference analysis, and the data retrieval system serve the market researcher to free him or her from the mundane task of computer programming. He or she can then devote more time to careful questionnaire design and data interpretation. P.A.R.I.S. makes it possible for a market re-

searcher, with or without computer expertise, to use interactive interviewing for his or her special or ongoing research projects.

The field of computer interviewing is expanding rapidly. In sections 8 and 19, we discussed how to use P.A.R.I.S. for the traditional market research function of collection of data on consumer perceptions, preferences, and choice. The availability of on-line capability makes for exciting new experiments in market research. Myers [17] has provided the capability of allowing consumers (after they have completed a questionnaire) to access summary statistics of other consumers' responses to these questions. The consumer is then allowed to retake the questionnaire and the change in attitude is recorded. Johnson [11] uses branching to cut down on the number of rank order questions necessary in tradeoff analysis. Others have suggested that the timing of a consumer response can give valuable clues to the consumers' cognitive process and perhaps indicate relative importances of various aspects of the choice process. Such applications are available to each and every market researcher through P.A.R.I.S.

As with all developing techniques, there are challenges to be met, but P.A.R.I.S. and related developments in computer interviewing hold great promise for improved market research.

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APPENDIX

The following is a hard copy printout of what a respondent sees as he or she completes a P.A.R.I.S. questionnaire. This is the questionnaire referred to in the empirical study of section 8, except for a few deletions made to protect the confidentiality of the study participants.

```
*************************************************************

 N O R T H W E S T E R N   U N I V E R S I T Y

P.A.R.I.S.  INTERACTIVE SURVEY SYSTEM
*************************************************************


...WOULD YOU LIKE TO STATE YOUR NAME
.PLEASE ANSWER EITHER YES OR NO.
? YES
...ENTER YOUR NAME
? EXAMPLE
...YOUR NAME IS -EXAMPLE                         -
CORRECT      (YES OR NO?)
? YES

...NOW PREPARING QUESTIONS !!









DEAR COLLEAGUE:          6/10/77

WE ARE CONDUCTING THIS SURVEY TO DETERMINE YOUR OPINION SO THAT
WE CAN PLAN FOR FUTURE IMPROVEMENTS IN THE LABORATORIES'
COMMUNICATION SYSTEM AT           .

WE GREATLY APPRECIATE YOUR COOPERATION!!

        SINCERELY,

        ASSOCIATE DIRECTOR OF RESEARCH
                   SCIENTIFIC LABORATORIES


    WE WOULD LIKE TO KNOW ABOUT A RECENT SIGNIFICANT INTERACTION IN-
VOLVING YOU AND A COLLEAGUE, OR A VENDOR, ETC., TO DISCUSS A
PROBLEM ON WHICH ONE OR MORE OF YOU IS PRESENTLY WORKING.  PLEASE
CONSIDER INTERACTIONS ONLY WITH THOSE PEOPLE WHO DO NOT WORK
IN THE SAME BUILDING AS YOU DO AND DON'T CONSIDER CALLS JUST
TO SET UP APPOINTMENTS.
```

```
   1.  WAS THIS INTERACTION:
        1=A SCHEDULED WEEKLY (OR MONTHLY, ETC.) INTERACTION?
        2=NON-SCHEDULED INTERACTION INITIATED BY YOURSELF?
        3=NON-SCHEDULED INTERACTION INITIATED BY ANOTHER?
        4=A CHANCE INTERACTION?
        5=OTHER

        (PLEASE ANSWER WITH A NUMBER 1 THROUGH 5)
? 1
BESIDES YOURSELF, HOW MANY OTHER PEOPLE PARTICIPATED
IN THE INTERACTION:  (PLEASE TYPE IN THE NUMBER OF PEOPLE.)
? 2
DID YOU USE:
   1=TELEPHONE
   2=INTEROFFICE MEMO
   3=MAIL
   4=TELETYPE OR TELECOPIER
   5=PERSONAL VISIT [YOU WENT TO HIM (THEM)]
   6=PERSONAL VISIT [HE (THEY) CAME TO YOU]
   7=PERSONAL VISIT (CONFERENCE ROOM, AUDITORIUM, ETC.]
   8=OTHER

        (PLEASE ANSWER WITH A NUMBER 1 THROUGH 8)
? 8
PLEASE SPECIFY
? TELETYPE

(IF YOUR INTERACTION INVOLVED TWO OR MORE PEOPLE, PLEASE ANSWER
THE FOLLOWING QUESTIONS FOR THE MAJORITY OF THE PARTICIPANTS
OTHER THAN YOURSELF. IF THERE IS NO CLEAR MAJORITY PLEASE AN-
SWER THE QUESTIONS FOR THE "PRINCIPAL" PARTICIPANTS IN THE
MEETING.)

WHERE DID THE OTHER PERSON(S) COME FROM (AFFILIATION)?

   1=INSIDE THE LABORATORY
   2=OUTSIDE THE LABORATORY
   3=SOME FROM INSIDE AND SOME FROM OUTSIDE THE LABORATORY

? 1
HOW LONG WOULD IT HAVE TAKEN YOU [OR THE OTHER PERSON(S)]
TO TRAVEL TO AND FROM THE PLACE OF INTERACTION?
          -- --- ----
   1=LESS THAN 10 MINUTES
   2=10 TO 30 MINUTES
   3=30 MINUTES TO 1 HOUR
   4=1 TO 2 HOURS
   5=3 TO 4 HOURS
   6=5 TO 6 HOURS
   7=MORE THAN 6 HOURS

? 10 MINUTES
   PLEASE ANSWER WITH A NUMBER 1 THROUGH 7.
? 1
HOW MUCH WOULD IT HAVE COST FOR YOU [OR THE OTHER PERSON(S)]
TO AND FROM THE PLACE OF INTERACTION?
-- --- ----

   1=THERE WOULD BE LITTLE OR NO INCREMENTAL COST
   2=LESS THAN $10
   3=$11 TO $50
   4=$51 TO $100
   5=$100 TO $200
   6=MORE THAN $200
```