DESIGNING AND BUILDING A MARKET RESEARCH INFORMATION SYSTEM

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ABSTRACT

Market research information is crucial to marketing strategy. This paper discusses information systems designed to improve data collection (interactive interviewing), develop information capital (storage/retrieval data bases), and provide usable information to marketing decision makers (automatic data analysis). Criteria are developed and needs identified. A new market research information system is then presented that makes interactive interviewing, data base control, and information analysis more available to market researchers. Empirical experience is given including its use for product space maps and extended conjoint analysis. A wide range of potential applications are discussed.

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MOTIVATION

The financial success and timing of marketing strategy often depends on the rapid collection and analysis of high-quality market research information. Refined marketing models based on consumer data have led to: improved product design [27,50,55], reduction of product failures [11,59], analysis of test markets [71], product segmentation [54] improved understanding of consumer preferences [21,23,26,29,30,61,74], more effective construction of advertising copy [58], methods for product line structuring [55,57], salesforce planning [31,61], marketing mix decisions [35,36], and many other improvements in marketing functions. In particular, careful analysis of consumer perception, preferences, and choice has led to the improved design and enhanced success of new products and services for frequently purchased goods, food products, health services, financial services, transportation, management education, and communication services [23,27, 29,50]. 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 identify and eliminate failures before test market [11,59]. But to produce reliable results, these models require accurate and current data; a commodity that is swiftly becoming more costly and difficult to obtain, yet indispensable, and requested with less tolerance for error. Given inflation, rapidly changing public opinion, the high exposure of mass media and the large resources expended on competitive effort, many firms have found it necessary to maintain up-to-date marketing information systems that continually tap consumer values and allow quick reaction to opportunities and environmental demands [11,35,36,37, 50,70,71].

While the need for advancement of current market research techniques and methodology for the resolution of complex marketing problems remains an issue of importance, the problem of obtaining accurate inputs for this research grows in importance but still requires extensive methodological development. As all market researchers know, data collection can be the most costly and time-consuming step in any market research project. Indeed, an entire industry has grown about this task.

Securing accurate, reliable and comprehensive data banks typically takes weeks or even months and often becomes the most frustrating step in any market research project. Perhaps the major challenge in market research today may not be the construction of more sophisticated models and statistical analysis, but instead generating sufficiently high-quality data to justify the precision of existing analysis. High powered and exacting marketing models and analyses are often extremely sensitive to the quality of their inputs. Few models provide better outputs than the supplied input information. Yet the direction of current marketing research tends to be towards models demanding even more precise data, requiring harder to measure variables and needing more individual-specific interviews. Researchers, who are conscientious and sensitive to implementation issues, have realized the necessity of realistic data requirements. Often the application of a truly innovative analysis may be only restricted by the prohibitory cost of data procurement. Thus efficient data procurement methods will allow the use of more sophisticated market research applications and better managerial decisions.

Data collection is not new [22,49,51] and to minimize errors, industrial and academic experience has led to the evolution of the following nine steps in data procurement: (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 differences can lead to bias which undermines attempts at representative random samples. For example, 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 [3,62,63,64]. 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.

Fortunately with today's computer technology marketers can develop information systems to address these problems. No one system is a panacea; each system must make tradeoffs with respect to capabilities, sophistication and cost. But with the proper direction marketing research information

systems (MRIS) can improve data collection through controlled interviews, data accessibility through storage and retrieval systems, and data analysis through on-line models integrated with the data collection, storage, and retrieval systems. A well constructed MRIS can make data collection, retrieval, and analysis more efficient and more accessible to the average marketing manager and thus free him(her) for the important tasks of interpretation and marketing action.

In this paper we explore the concept of an MRIS. We begin by defining a set of information concepts and discussing design criteria for an MRIS. Next the pros and cons of automated data collection are presented and existing systems discussed. Potential marketing applications are explored. Finally, we introduce a new MRIS, PARIS,[1] that includes automated data collection, automated data storage, on-line retrieval systems, and on-line analysis packages. Since the system is meant to be used, we have designed the system to use "English-language" commands so that little or no computer expertise is required of the marketing research manager. Since the PARIS system is illustrative of the potential of MRIS, we discuss empirical experience to indicate how the reader might use PARIS or how he(she) might design a similar system for his(her) own particular needs. Appendices give details of PARIS.

MARKETING RESEARCH INFORMATION SYSTEMS

We begin by discussing the types of information and the basic component flows of MRIS. This paradigm is then used to discuss design criteria.

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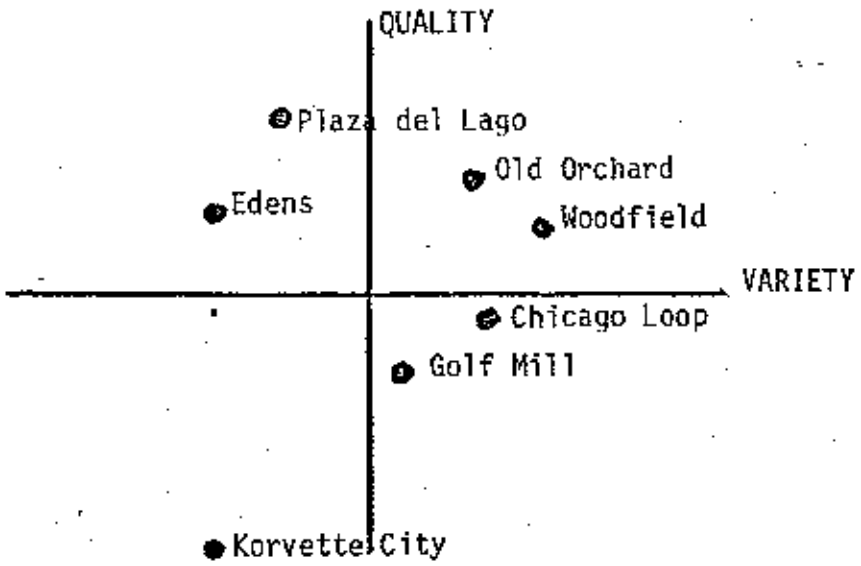
[1] Preference Assessment Retrieval and Information System

Types of Information

The goal of marketing research is to provide information about consumers -- how and why they behave and how they will behave in response to marketing strategy. We can think of this as two types of information. The first type, identification, enumerates the possible "status of the world" [33], while the second type, detection, furnishes an indication of what is the "true" state of the world. For example, consider the product space map in figure 1. Identification enumerates the dimensions, variety and quality that describe shopping centers, while detection measures the way consumers perceive each shopping center relative to those dimensions.

Figure 1

PRODUCT SPACE MAP: IDENTIFICATION AND DETECTION



(Adapted from Hauser and Koppelman [25].)

Let us first consider identification. Identification has traditionally been the strength of exploratory studies and qualitative research such as focus groups [12]. The goal is to generate potential opportunities. For

example, psychological research suggested that a repositioning of 7-up to an "Un-cola" would lead to greater sales. In MRIS terms this partitions the world into the following states:

S_1 = "Uncola" appeal will lower sales.

S_2 = "Uncola" appeal will maintain the status quo.

S_3 = "Uncola" appeal will raise sales but not justify repositioning costs, and

S_4 = "Uncola" appeal will raise sales enough to justify costs.

Clearly identification is important, but quantification of the monetary benefit is elusive without follow-up quantitative measurements. Costs vs. benefits must be justified on previous experience, intuition, and some estimates of the minimum and maximum potential benefits of the research. While an MRIS may not explicitly include qualitative techniques it must incorporate a flexibility to react to identification cues by expanding and enumerating the state space, e.g. $\{S_1,S_2,S_3,S_4\}$. Thus qualitative research is complementary to an MIS. Furthermore, a *good* MRIS should include capabilities for qualitative research.

Detection follows identification. If S_1, S_2, or S_3 is the true state of the world then the marketing manager should not launch the campaign. If S_4 is the true state he should launch the campaign. The role of the detection phase of marketing information is to identify the true state of the world or, since information is never perfect, to reduce uncertainty about the true state of the world. For example, a sample of consumers might be exposed to the campaign and their reactions measured. This information, called a signal, detects the state of the world. For example, a low-grade signal might detect whether the state of the world is $\{S_1$ or $S_2\}$ or $\{S_3$ or $S_4\}$, while a better signal would identify the exact state. A

higher grade signal may represent a finer partition say to within ± 100,000 units of annual sales.

The quantification of detection information is well studied [52]. Basically the expected value of information that is obtained is equal to expected gains that result from making better managerial decisions based on the information. Since this problem is well documented we will not dwell on it in this paper but refer the reader to Raiffa [52].

Since detection usually takes the form of quantitative information, it is the primary focus of an MRIS. In particular we concentrate on primary research, e.g. a market survey, which can be performed through an MRIS. But an MRIS is also a storage and retrieval system. Thus as data is accumulated, low or medium-grade detection questions can be addressed with little or no incremental research costs.

Role of Marketing Research Information Systems

The primary role of an MRIS is to provide usable information to marketing decision makers. As such an MRIS acts as an agent between the environment and the decision maker. See figure 2. There are two flows or interfaces involved and for any application, either or both are used. The quality of an MRIS depends on the quality of information obtained from each flow and on the cost and difficulty of obtaining that information.

Figure 2

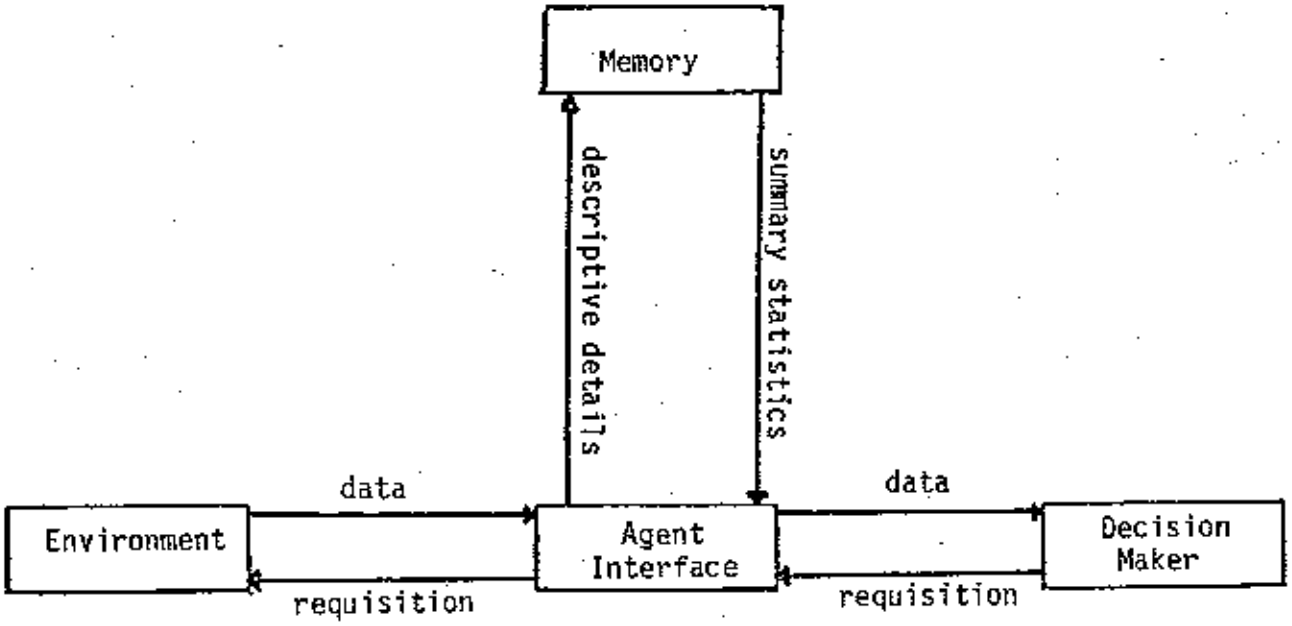
ROLE OF A MARKET RESEARCH INFORMATION SYSTEM

The benefit of using an MRIS is then judged relative to the quality and cost of direct requisition of information by the decision maker from the environment. For example, we would evaluate whether the detection of the state of the world (S_1, S_2, S_3, or S_4) is more efficient through an MRIS, a firm sponsored survey, or a contracted survey. Without information storage this benefit would be assessed for each application.

But an MRIS is a long-term committment requiring an initial investment and ongoing system maintenance. Thus its value must be assessed relative to its incremental benefit over a series of applications. For example, suppose there are no applications over the depreciated investment period of the MRIS. Then in the simple case the net benefit of the MRIS is the sum over the M, $M \leq N$, applications where the MIS is the superior system. We do not pretend these are easy computations, but before implementing an MRIS each firm must consider these computations even if they are only judgmentally considered.

To complicate matters an MRIS includes the storage/retrieval function as shown in figure 3. As the number of applications increase the value

Figure 3
AN MRIS WITH DATA STORAGE AND RETRIEVAL



of information in memory increases and for a given application an MRIS with its stored information becomes relatively more attractive. Thus initial applications may be run at a net loss to build up this informational capital. For example, the first few consumer surveys to evaluate advertising copy may be less efficient (benefit vs. cost) than contracting to a market research firm, but once the informational capital is accumulated the remaining applications will be more efficient. I.e., the first few applications may identify sales response to advertising, consumers' evaluative dimensions, preference analyses for the product category, etc., which are useful for later analyses. Note that this concept of information capital applies to any information system whether a computer automated MRIS or simply a filing system.

Design Criteria

The detailed evaluation of an MRIS depends upon the sequence of applications for a given firm and is based upon the quantification of the above ideas of information value and information capital. But if we are to design an MRIS that is to be adapted to a number of application areas, we must consider more general criteria and must incorporate sufficient flexibility. Each market researcher would then evaluate and customize the MRIS for his(her) use. These general criteria are based on the types of information and the MRIS functions represented by the six information flows in figure 3.

The basic criteria are given in table 1. Note that these are dimensions of merit not requirements. They are given differential stress depending upon the application.

Table 1
DESIGN CRITERIA

INFORMATION FLOW CRITERIA	Agent/Decision Maker	Agent/Memory	Agent/Environment
	decision relevance	care of access	precision
	data accessibility	updates	accuracy
	control	data synthesis	feasibility
	cost	cost	flexibility
			cost

Agent/Decision Maker Flows: Almost all of the marketing models to date have concentrated on using an MRIS for this flow including [3,11,21 23,36,38,45,50,54,55,57,61,70,71]. These models are powerful tools for decision makers and have effectively interfaced with the environment through traditional methods. The value of an MRIS for this flow is evaluated with respect to decision relevance, data accessibility, control, and cost.

For identification, relevance refers to whether the model can identify and enumerate the state space relevant to the decision. E.g. can it dentify strategies such as an "uncola" campaign or is the information unrelated to the decision process? In particular, the MRIS should summarize the information in a form, such as product space maps, that is usable and understandable by the decision maker. For detection, relevance refers to the grade of the information. E.g. can it distinguish among S_1, S_2, S_3, and S_4 or is it limited to a distinction between $\{S_1$ or $S_2\}$ and $\{S_3$ or $S_4\}$. While relevance is important, the data must be accessible. Many optimization models [75,76] appear relevant, but require data that is not presently affordable or available with sufficient accuracy to be usable. In consider-

ing this criteria one must consider the match of the A/DM flow with the E/A flow. For example, PARIS was initially developed to provide the data for preference analysis [26] and product line planning [57]. Finally control refers to the ability of the decision maker to request and obtain the appropriate information.

Agent/Environment Flows: To make the best use of marketing models and in general to get good diagnostic information on consumer response, an MRIS needs high quality data. To automate this flow we consider the criteria of precision, accuracy, feasibility, flexibility, and cost. Precision refers to consistency among observations within a given measurement while accuracy refers to how well the observations represent the real world. Thus random errors decrease precision while systematic errors decrease accuracy. The MRIS is evaluated with respect to any such errors it introduces or eliminates. Feasibility refers to whether the measurement is possible on "typical"consumers. For example, most consumers will answer a short set of interesting questions on a relevant topic, especially if opinions rather than facts are solicited. The same consumers will not sit still for a battery of redundant, difficult, and uninteresting questions. Thus the MRIS is evaluated with respect to its ability to increase (decrease) respondent motivation. Finally, flexibility refers to the ability of the MRIS to provide the appropriate information. For example, an MRIS may be extremely useful for one type of analysis, say conjoint measurement, but unusable for other data collection. Thus the MRIS is evaluated on its ability to adapt to the data needs rather than constrain the analysis to limited data collection capabilities.

Agent/Memory Flows: One principal advantage of having an MRIS is that information capital can be accumulated to be used by the decision maker.

Thus we must evaluate agent-memory flows as they serve the decision maker. The criteria for these flows are ease of access, updates, data synthesis, and cost. To make use of information that information must be obtainable in a usable form, thus any stored data must be accessed easily. This means that the storage/retrieval components of the MRIS should be evaluated with respect to its ability to store information in a usable form and provide it to the decision maker on demand. Updates refers to the MRIS's ability to combine existing and new information in the form of a common data base. Thus the ability of an MRIS to perform updates is crucial to the concept of information capital. Finally, we recognize that for decision support vast quantities of data must be reduced or synthesized to a usable form. Thus the MRIS is evaluated with respect to its ability to maintain and supply data summaries.

Summary of Criteria: The above criteria are by necessity quite general. Specific MRIS's are extensively used in marketing, but they have concentrated on the agent/decision maker information flow. We feel it is appropriate to raise the general considerations for each of the three information flows since future systems will not be limited to the one flow. We feel these criteria serve as usable guidelines that individual firms can use to evaluate MRIS's for their own unique needs.

DEVELOPMENTAL NEEDS

As indicated above most MRIS development has concentrated on one of three important information flows. The interested reader is referred to texts such as Fitzroy [20], Kotler [32], and Montgomery and Urban [45,46].

These models represent significant capabilities for marketing managers. Many are widely used -- but usually those that explicitly consider data

collection and develop measurement techniques to obtain the needed data. For example, there are over 500 conjoint analyses performed annually, partly because research has been directed to an efficient data collection as well as data analysis. Lodish's CALL PLAN system, Silk and Urban's ASSESSOR system, Urban's SPRINTER system, and Burger's COMP system are all widely used to support managerial decisions [11,38,59,71]. Each of these systems explicitly considers how to obtain the needed input.

But these applications can be improved with more efficient data collection and storage. There is a need for an MRIS that is *complementary* to these systems. That is an MRIS that uses a computer system to improve the ability of managers to obtain data. We do not expect such an MRIS to replace mail, telephone, and personal interviews but rather to add a new dimension to data collection -- one that is particularly designed with data analysis in mind.

At least three systems have been developed for data collection. Johnson [30] has developed an interactive system for conjoint analysis. Respondents are presented with pairs of product profiles via a computer terminal. Input is obtained via masked typewriter keyboards. The system automatically provides summaries for each respondent and for the population but is limited to conjoint analysis. Nelson, Peyton, and Bortner [48] have demonstrated the capability of interactive interviewing for a specific product and are processing an estimated 90,000 per month over a wide geographic area for a major national telephone company. Their system is quite general, but each questionnaire requires a special computer program and the use of this system requires programming support. Finally Myers [47] has developed systems for product positioning and conjoint analysis and have shown that data such as attitudes, weights, and beliefs collected via an MRIS are high correlated with similar data collected by traditional

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methods. Wind and Myers [74] have used that system for conjoint analysis.

These systems are on the frontier of data collection. For some applications they increase accuracy and precision while for others they decrease it. This will be discussed in the next section. In each case the data collection is feasible at a reasonable cost. Thus on four of the five design criteria they do well when used appropriately, but their flexibility should be improved. In each case the concept is generalizable but the specific system must be redesigned for new applications. For example, Johnson's system can be rapidly altered for almost any product category, but is limited to conjoint analysis.

If MRIS's are to be widely used then one must be designed that can be quickly and easily customized for each application. Furthermore, this customization should be possible without major technical support. Each market researcher must be able to *adapt the system to his or her needs* and must be able to do so with extensive computer training.

Furthermore the agent/environment systems have not been well integrated with automatic agent/memory systems nor have they been integrated with agent/decision maker systems.

Thus the development needs are for a system that:

- controls the agent/environment information flow,
- adapts to a wide range of applications,
- is usable by "typical" market researchers,
- integrates the agent/environment information flow with a storage and retrieval system, and
- is compatible with the marketing models developed for the agent/decision maker information flow.

The primary purpose of such a system will be for the collection and analysis

of detection information although it should be compatible with identification (qualitative) research. Before describing one such system, we will discuss the advantages and disadvantages of interactive data collection.

INTERACTIVE DATA COLLECTION: DISCUSSION

The use of an MRIS for the agent/environment information flow represents a new dimension in data collection. When used judiciously it has advantages, but it is not without its disadvantages. See table 2. Most of the advantages result from the ability of the computer to perform large numbers

Table 2

ADVANTAGES/DISADVANTAGES OF INTERACTIVE INTERVIEWING

ADVANTAGES	Reasons
more efficient interviews	flow charted questions
reduce interview bias	standardized "interviews" (machine)
time savings	overnight data collection and analysis
cost savings	automatic coding, keypunching, verifying, cleaning, and editing
more control	"real time computations allow branching on analyzed partial responses
improved data integrity	cueing respondent to answer within an allowable range
information capital	integration into MRIS
new capabilities	automatic timing of consumer response
sensitive questions	use of successively more sensitive questions and avoidance branching
strategic secrets	no paper survey for competition to monitor
DISADVANTAGES	
sampling	at present consumer must be brought to terminal or telephone interface is required
personal approach	machine rather than human interviews
literacy	assumes consumer can read all questions
scale of cost	fixed cost, cost of terminals

of computations rapidly and without error, while the disadvantages result from the difficulty in making the computer terminal available to consumers. These specific advantages/disadvantages impact on the criteria of table 1 as follows:

Precision: Threats to precision result from random errors introduced in the data collection process. Interactive data collection eliminates coding and keypunch errors and improves data integrity with cues to respondent to answer within a preset range, e.g. 100 purchases per day is automatically questioned. Furthermore random differences among interviewers are eliminated because the "interview" is standardized. Thus on average, interactive systems increase precision.

Accuracy: Accuracy is enhanced by automatic computations for internal consistency and subsequent re-asking of questions. On the other hand, consumers must be brought to the terminal. This can introduce sampling bias if these consumers differ systematically from the target population. Thus until the cost of terminals is reduced (currently $1-2 thousand for highly portable terminals) interactive systems are limited to applications, such as shopping mall intercepts, where the consumer can be brought to the terminal. Though one application method worth considering is the use of interactive systems by telephone interviewers. Thus depending on the application accuracy can be enhanced through internal checks or compromised through sampling biases.

Feasibility: When the consumer can be brought to the terminal, interactive systems have proven quite feasible [26,30,47,48]. Consumers have been sensitized by pocket calculators, touch-tone telephones, and automated banking machines.

Flexibility: In theory MRIS's are quite flexible. Programs can be written to implement almost any questionnaire, visuals can be displayed, and samples can be given the consumer. Furthermore, special features make systems more flexible than personal interviews. Flow charted questions and branching based on "real time" computations ensure that the respondent is asked the right questions. Interviews can be shortened by avoiding unnecessary questions. New capabilities allow timing of responses making it easier to debug pretests and infer respondent motivation. Systems can be used for sensitive questions, such as consumer attitudes on spent nuclear fuel [56], since branching can occur based on successively more sensitive questions. Finally, firms can avoid tipping off competitors since no printed questionnaires are in the field. On the negative side MRIS's are limited to those applications where the limited availability of terminals does not introduce major sampling biases.

Cost: The final consideration is cost. There is a fixed cost involved with maintaining an MRIS (including terminals) as well as a fixed development cost for study. These must be balanced against the cost savings due to the elimination of coding, keypunching, verifying, and editing. Another component of cost is the time to complete the study. MRIS's offer tremendous advantages here, making overnight studies (including analysis) feasible thus providing more current market intelligence. Of course timing is limited by the speed at which consumers can be interviewed and the number of "interviewers" (terminals). Thus, on average, the per study cost should be less with an MRIS, but the cost of maintaining a system must be justified by high usage.

Based on the above discussion it is clear that MRIS's hold promise *when used appropriately*. They can enhance precision and accuracy, are feasible and flexible, and in many cases cost effective.

But to take advantage of an MRIS, a market researcher must have one available. Unfortunately, most market researchers do not have the necessary time or funds to develop an MRIS. Thus we have developed a highly flexible MRIS that can be customized to specific research needs *without extensive computer expertise.* We will now present this system, PARIS. It is not the only system possible. Instead we present it as an example of how one group of researchers can develop and implement an integrated MRIS that explicitly considers all three information flows. We encourage readers to use PARIS or to develop their own MRIS. The next section summarizes the key features of PARIS. Empirical experience is discussed and potential applications are examined.

THE PARIS SYSTEM

The PARIS system was developed to fulfill the development needs described earlier. In particular, PARIS enables the market researcher to (1) quickly and efficiently develop an interactive computer interviewing program for his or her special or ongoing projects, (2) develop a dynamic market research data base which is easily accessed and automatically updated over time, and (3) use the latest marketing models in conjunction with user supplied data and the system's data base.

Questionnaire Language

To provide the utmost control, minimum cost and maximum accessibility, the PARIS 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 PARIS language described in appendix 1. 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 yet simple enough to be readily used. For example, the questionnaire in table 3a is encoded as shown in table 3b. This is all the market researcher need do -- all else including administration and setting up and updating data files is done automatically.

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 PARIS Q-compiler which converts the market research-oriented language into an alpha-numeric, machine-oriented language and sets up the appropriate files to record 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 important 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 4).

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)

Table 3

EXAMPLE OF QUESTIONNAIRE LANGUAGE

(a) Respondent sees the following where his(her) answers are shown in italics. Suppose he(she) makes a number of mistakes.

```
ON THE AVERAGE, HOW MANY HOURS PER DAY DO YOU SPEND WATCHING TELEVISION?
50

PLEASE ANSWER WITH A NUMBER BETWEEN 0 AND 20.
4

DO YOU WATCH I LOVE LUCY?
It's great!

PLEASE ANSWER YES OR NO.
Yes

WHO DO YOU FIND FUNNIER, LUCY OR RICKY?
      (1) LUCY          (2) RICKY
3

PLEASE ANSWER WITH A NUMBER BETWEEN 1 AND 2.
2

DO YOU WATCH JACKIE GLEASON?
No

THANK YOU FOR YOUR TIME.
```

(b) The above questionnaire would be coded in the PARIS Language as follows.

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

QUESTION 2
*DO YOU WATCH I LOVE LUCY?
ASK 3 4

QUESTION 3
*WHO DO YOU FIND FUNNIER, LUCY OR RICKY?
*      (1) LUCY          (2) RICKY
(1,2) 4 FORCE

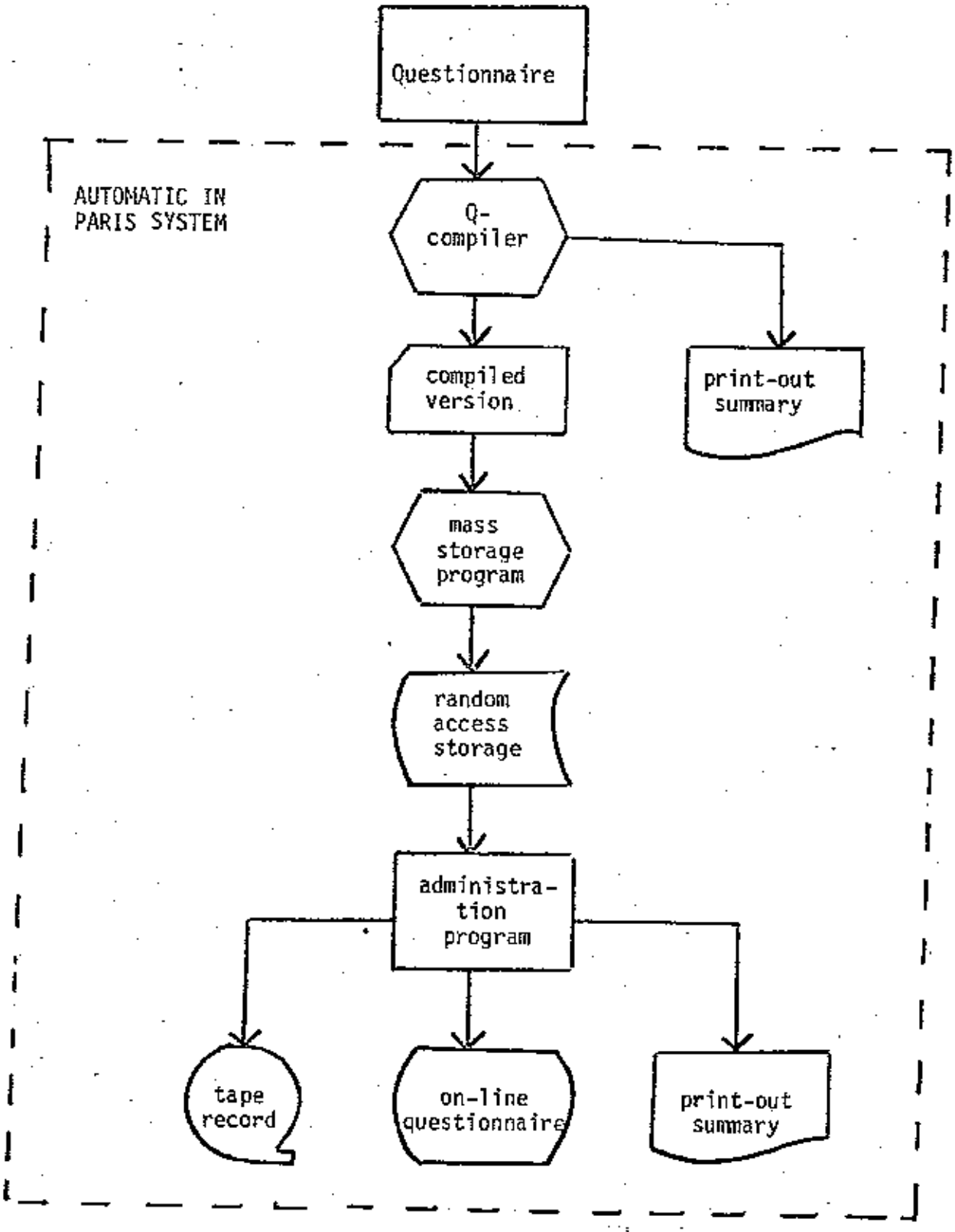
QUESTION 4
*DO YOU WATCH JACKIE GLEASON?
ASK 5 6

QUESTION 5
*WHO DO YOU FIND FUNNIER, JACKIE GLEASON OR ART CARNEY?
*      (1) JACKIE GLEASON    (2) ART CARNEY
(1,2) 6 FORCE

QUESTION 6
*THANK YOU FOR YOUR TIME.
```

Figure 4

ORDINARY QUESTIONNAIRE TO ON-LINE QUESTIONNAIRE



or by allowing an interviewer to interactively record answers while obtaining them in person by telephone. In either case, PARIS 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 or 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. Three data files are set up and maintained by PARIS: a master file, a data-record file, and a qualitative comment file. The 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 obtained from the main data-base record. Finally, the comment file records qualitative responses for easy access and analysis.

We have found that the 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 extremely valuable for the development of questionnaires. All answers, including mistakes, can be

accessed to fully pretest a questionnaire. Furthermore, once the study is underway, the market researcher can readily monitor the rate of study completion and any qualitative comments. He(she) can perform preliminary analysis while the data is being collected and if necessary modify the questionnaire.

Examples of the three data files are given in appendix 2.

Information Retrieval and Analysis

Questionnaire implementation, data storage, and automatic analysis are important components of an MRIS, but not the only components. If an information system is to be effective, it must be a three-way system as shown in figure 3 . 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.

PARIS 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 PARIS implemented questionnaire. See table 4.

Table 4
SPECIAL PARIS SUBROUTINES

DATA BASE

- MASTER file (summary of study)
- RECORD file (raw and coded responses)
- COMMENT file (qualitative responses)

QUESTIONNAIRES (ENVIRONMENT)	MANAGEMENT
- PARIS language	- RETRIEVE (data access)
- Q-compiler	- PREFCOM (conjoint and preference analysis)
- Administration programs	- PREDICT (predicts market share)

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 inter 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(she) needs at that time.

Preference analysis: 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 [19,73], direct utility assessment [28], preference regression [27], tradeoff analysis [29], and conjoint analysis [21,22,23]. Many of these techniques give consumers "pseudo-products", i.e., products specified by setting the levels of a number of attributes, and have 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.

PARIS is designed with special commands for preference analysis. For example, a single command "READ n CHIPS" sets up a constant sum paired comparison question with automatic range checks and tests to insure that the consumers' responses sum to n. If the responses do not sum to n, or if negative of non-numeric answers are given, the system diagnoses the problem and informs the respondent of his(her) mistake. The respondent can then type "?" and the system will explain the mistake and indicate how to enter a "correct" response. 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 [26]. (PREFCOM is a modification for constant sum data of ideas expressed by Srinivasan and Shocker in LINMAP [61].) Experience to date has shown that the constant sum paired comparison task for preference measurement is extremely accurate [24,59] and is readily accepted by consumers for "pseudo-products" [26].

PARIS automates constant sum paired comparisons but other preference analyses such as standard (ordinal) conjoint analysis, are compatible with the system and can be readily implemented with the questionnaire language and modifications to PREFCOM.

Market share prediction: One use of conjoint analysis and related techniques is to predict the market share of new products [23,27,50,55,70]. Thus, another on-line subroutine, PREDICT, takes the output of PREFCOM 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 [57] 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, PARIS 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, expected advertising expenditures, etc. PARIS 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 subroutines and the special purpose data analysis subroutine enable market researchers and/or managers to effectively use the data base created by PARIS. Although some multivariate 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.

EMPIRICAL EXPERIENCE

PARIS was 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, facsimile transfer devices, narrow-band video telephones, personal visits, and telephones.[2] The marketing research, which follows a methodology described in Hauser and Urban [21], 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. (The perceptual dimensions were efficacy and ease-of-use as shown in figure 4a with relative

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[2] Closed circuit television provides motion and color with the resolution of a home television but requires the equivalent of 100-300 telephone lines. Facsimile transfer devices transmit documents over ordinary telephone lines. It is similar to a long-distance copying machine. Narrow-band video telephone transmits still television pictures over ordinary telephone lines.

weights of .82 and .18) PARIS was then used to estimate each consumer's preference function with respect to basic dimensions of perception so that those consumers most likely to use each system could be identified.

This PARIS questionnaire contains 96 questions[3] 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). Appendix 3 shows the first few questions in the questionnaire.

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.

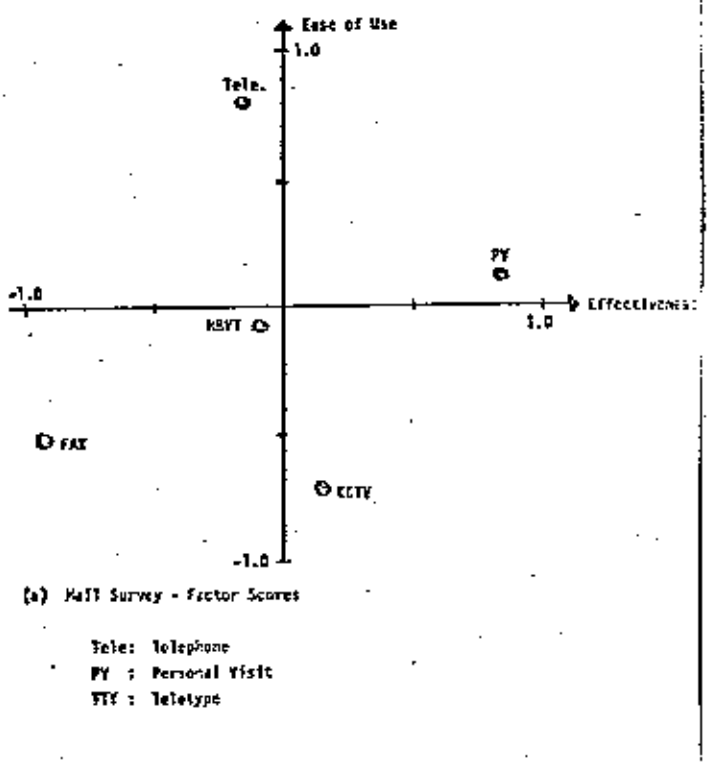
Complete results of the application are contained in Hauser and Shugan [26] and will not be repeated here. Instead we will present a few key results to indicate the power of PARIS. Figure 5a gives a perceptual map derived from factor analysis mail question sent to scientists. This same information was collected via PARIS with direct measures on managers and is shown in figure 5b. Note the similarity among the maps even though the

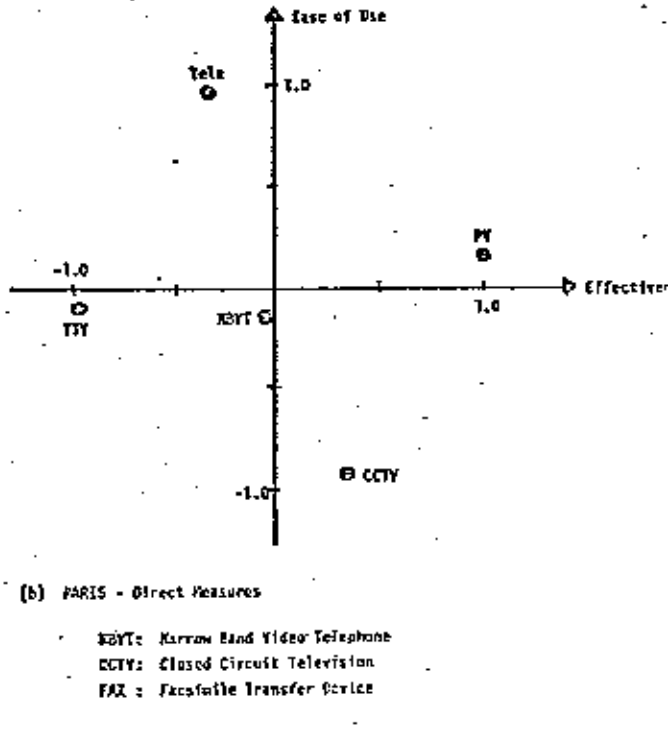
[3] Branching made the questionnaire more efficient so that any particular consumer did not necessarily answer all 96 questions.

data collection and consumer populations differ.

Figure 5

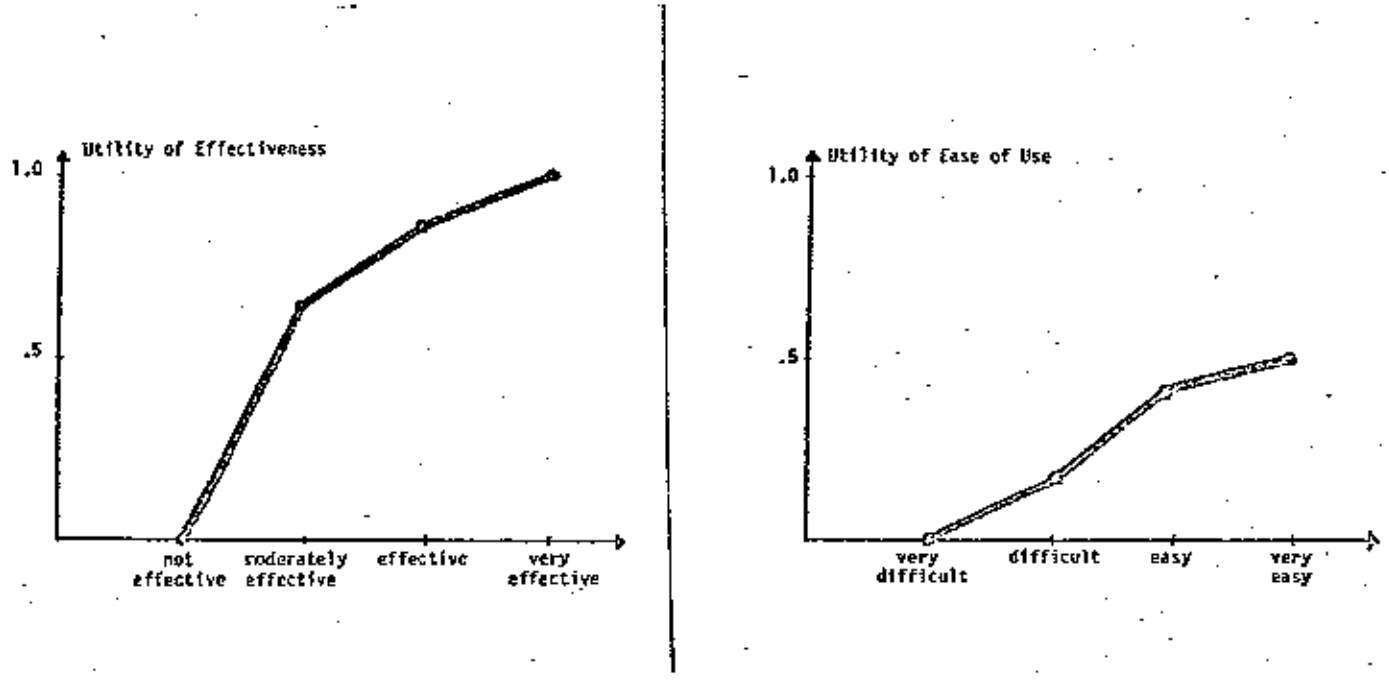
PERCEPTUAL MAPS OBTAINED WITH ON-LINE SYSTEM





Consumer preferences were then measured with the constant sum paired comparison questions and preference functions were estimated with PREFCOM. The averaged preference functions are shown in figure 6. This model correctly predicted the most preferred communications option for 71.6% of the consumers. Conjoint analysis (treating the constant sum measures as ordinal measures) gave similar preference functions and was able to correctly predict the most preferred option for 57.1% of the consumers. Other analyses indicated the situations in which consumers were most likely to use new communications options such as narrow-band video telephone.

Figure 6
PREFERENCE ANALYSIS WITH ON-LINE SYSTEM



TYPICAL APPLICATIONS OF AN MRIS

The previous section described the one empirical application of PARIS to date. In that application PARIS was used primarily to develop a product space map and perform preference analysis. But the great advantage of PARIS is that it is sufficiently general to be applied to a larger class of market research problems. Each researcher can adapt the system to suit the problem at hand. The applications of PARIS are limited only by the imagination of the market researcher. For example:

Managerial Applications

New Product Positioning: It is important early in the new product design process to learn the dimensions that consumers consider (i.e., perceptions 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 [21,23,27,50,54]. PARIS can 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 that PARIS 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 [45] or COMP [10] to test and refine new products before they are taken to a full test market. PARIS is ideal for improving these systems. Consumers are intercepted in a shopping area and brought to a fixed facility that is a simulated purchase environment. On-line terminals can 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 PARIS 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: Test markets provide an indication of consumer reaction to a new product, but 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 surveys for in-depth analysis. With universal product codes (UPC) a reality, systems are now available to give overnight store audits [37]. PARIS can be used by telephone surveyers to provide overnight measures of awareness, trial, repeat, etc. (Here questions are

still asked by telephone, but PARIS tells the interviewer what to ask, ensures that all data are complete and within range, and automatically enters it into the data bank.) Further, PARIS can be used to get twenty-four hour turnaround on the analysis of the in-depth surveys. By coupling PARIS with automated store audits based on UPS, 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, PARIS can be used to provide the data bank necessary for test market analysis systems such as SPRINTER [71].

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 PARIS 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?

Analyzing Deals and Other Marketing Mix Variables: Considerable interest has grown about the measurement of the effectiveness of brief changes in marketing mix variables [9]. Displays, deals, extended hours and other special promotional efforts play an important role in the retail establishment. PARIS interviewing incorporates automatic and precise data recording and therefore automatic discrimination of pre- and post-deal attitude measurement.

Sales Force Allocation: An interesting and important problem in industrial marketing is the optimal deployment of the sales force. Static mathematical programming analysis has increased efficiency and lead to

excellent pre-planned strategies for salesman allocation. But given the dynamic capabilities of the PARIS system, salesmen can report in on-line. A computer query quickly ascertains the salesmen's physical position, progress and prior probability distribution over anticipated sales. This data is instantly fed into an extensive data base from which the optimal allocation problem can be resolved. Updating in this manner can lead to substantially better deployment than simple static procedures.

Market Research Methodology

De-bugging Questionnaires: The frustrating process of perfecting questionnaires can be tedious and time consuming. Ambiguous wording can invalidate a questionnaire and cause costly delays. Fortunately, with the PARIS system, testing of questionnaires occurs literally overnight. Not only are all respondent errors recorded with their corrected response, but timing of responses identifies troublesome questions. These helpful features combined with immediate processing capability enable quick and easy formation of better constructed questionnaires.

Controlled Questioning: Market researchers have realized that in some interviews the sequencing of questions can be crucial. To gain the utmost control over the interview, the respondent must see questions in the proper sequence and only in that sequence. This ability is automatic in the PARIS system. The respondent is exposed to questions only in the pre-determined order. Training interviewers for complex branching based on responses is eliminated.

Other types of control are also available. Sequential questioning prevents respondents from haphazardly rushing through the questionnaire. Pacing can be carefully regulated to insure maximum respondent involvement. The automatic recording of response time for each question permits monitoring

this involvement.

Sensitive Issues: There are occasions when a market research study is not conducted because of the sensitive nature of the market research question. For example, a test market may "tip-off" competitors to the firm's innovation allowing a competitive firm to pre-empt the innovator in national roll-out. PARIS allows two unique capabilities that mitigate and sometimes eliminates this problem. First, branching on previous responses allows each respondent to see only relevant questions and non-essential information need not be supplied to the respondent. Second, when interviews are administered on a CRT-type device, no written record of the interview is left with the respondent which may be circulated to unauthorized readers such as competitors in a new product introduction.

Design Flexibility: PARIS provides the luxury of design flexibility previously enjoyed by only heavily funded research projects. Given some fixed cost per observation and sampling leading to a marketing decision, the sequential sampling will have a smaller total risk than that of any procedure in which the statistician must commit himself to a fixed number of observations [16]. With conventional mail questionnaires, uncertainty surrounding response rate detracts from the advantages of sequential sampling. Second, the ability to allow complex branching on responsent answers without any added burden on the respondent, permits the researcher to use a very sophisticated experimental design. Designs of this type can extract more key information, reduce unwanted redundancy and lead to shorter, less exhausting interviews [18].

Accurate Project Cost Estimates: Market researchers always face the problem of estimating total project cost before beginning the venture.

This task can be difficult because of peak demand for keypunchers, coders, programmers, etc. PARIS automates and therefore smooths out labor demands. This feature leads to better estimates of total project cost -- nearly constant known cost per respondent processed -- and allows better estimates for project duration. Further more automatic computer accounting systems reduce accounting costs and provide good records.

Diary Panels: As terminal prices drop, it will be feasible to place a terminal with each member of a diary panel [62,63,64] 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.

CONCLUSIONS

Market research information systems are valuable tools for marketing. Numerous MRIS's have been designed to improve data analysis and to provide decision makers with relevant marketing intelligence. But the success of such systems depends on high quality data. Given today's computer technology it is possible to design and implement an MRIS to improve information collection, storage, and retrieval as well as data analysis.

Although an MRIS cannot be used in all situations for all purposes, it does present new opportunities for improved data collection and consumer analysis. A three-way MRIS 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 such systems 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.

PARIS 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(her) from the mundane task of computer programming. He(she) can then devote more time to careful questionnaire design and data interpretation. PARIS makes it possible for a market researcher, with or without computer expertise to use interactive interviewing for his(her) special or ongoing research projects.

The field of computer interviewing is expanding rapidly. The availability of on-line capability makes for exciting new experiments in market research. Myers [47] 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 [30] 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 PARIS.

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

Appendix 1: Questionnaire Language

The key to the PARIS system is the market research-oriented questionnaire language which allows a market researcher to write the questions he(she) wants and to flowchart the survey in a way that is advantageous to his(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, time consuming and tedious. The special commands in the PARIS system make this task efficient. The complete instructions to the thirty-two commands now available are contained in the PARIS language manual. For illustrative purposes, Table 5 summarizes eight of the most commonly used commands.

Table 5

COMMONLY USED PARIS COMMANDS

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

Appendix 2: PARIS Data Files

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 or she took the questionnaire, the time he or she began, the time he or she ended, the storage location of the complete data, and the status of the response (complete, partially complete, etc.).

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.

RESPONDENT	NAME	DATE	SIGN-ON	SIGN-OFF	PERM-NAME	STATUS
1	NO NAME	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	NO NAME	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.

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, PARIS 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). The following page contains a copy of a portion of a record file.

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	
?	1				

Comment file: At the end of a PARIS questionnaire, the system automatically asks the respondent if he or she wished 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.

RESPONDENT 5 6/10/77 14.02.26. SS10000005
I HAVE BEEN USING A NARROW-BAND VIDEO TELEPHONE 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.

Appendix 3: Sample Questionnaire

The following is a hard copy printout of what a respondent sees as he or she completes a PARIS 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 AR.. 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 INVOLVING 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.
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1.   WAS THIS INTERACTION:
      1=A SCHEDULED WEEKLY OR MONTYLY, 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 WITH 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 ANSWER 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
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