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Consumer mental workload: Meaning and measurement

Owen, Robert S., Ph.D.
The Ohio State University, 1992
CONSUMER MENTAL WORKLOAD:
MEANING AND MEASUREMENT

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Robert S. Owen, B.A., M.A.

*****

The Ohio State University
1992

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To the torn stropers trapped in the blizzard of LDA.

Each aloen must we discover our own shoevl.
ACKNOWLEDGMENTS

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TABLE OF CONTENTS

DEDICATION ............................................. ii
ACKNOWLEDGEMENTS ......................................... iii
VITA .................................................... iv
LIST OF TABLES ......................................... xi
LIST OF FIGURES ........................................ xiii

CHAPTER PAGE

I. INTRODUCTION ............................................. 1
   Introduction ............................................... 1
   Nature of Related Research ............................... 4
      the limited concept of "overload" ..................... 4
      the quest for programmatic inquiry ................ 7
   Objectives of the Dissertation .......................... 10
   Method .................................................. 11
      the underlying nature of mental workload ............ 11
      the process associated with mental workload ....... 13
   Summary and Organization of the Dissertation ........ 15

II. THE "OVERLOAD" PARADIGM ................................ 18
   Introduction ............................................. 18
   The Information "Overload" Paradigm ................... 22
   The Magical but Fuzzy Red Line ......................... 23
      the multidimensionality of the
      workload construct .................................. 24
      the limited resource issue ......................... 25
      moderators of processing ability ................... 27
      heuristic and peripheral processing ................. 28
      issues of practical application ..................... 30
   Discussion ............................................. 31
### VI. AN INTEGRATED MODEL OF ATTENTION AND ATTITUDE CHANGE

- **Introduction** ............................................ 103
- **Two Aspects of the Information Processing System** ................. 104
- **The Dual-Process Model of Attention** .......................... 106
  - controlled processing .................................. 107
  - automatic processing .................................... 107
- **The Elaboration Likelihood Model of Persuasion** ................. 108
  - central route ........................................... 109
  - peripheral route ....................................... 110
- **An Integrated Model of Attention and Attitude Change** .......... 111
  - contrasting DPM and ELM: IMAAC₃ ......................... 111
  - an example ............................................. 115
- **Discussion** ............................................. 116

### VII. APPLICATION OF IMAAC₃ TO WORKLOAD: A WORKLOAD OPERATING CHARACTERISTIC AND SOME PREDICTIONS

- **Introduction** ............................................. 123
- **A Process Approach to IMAAC₃** ......................................... 124
- **The IMAAC₃ Workload Operating Characteristic** ..................... 127
- **Predictions based on the IMAAC₃ WOC** .......................... 130
- **Discussion** ............................................. 132

### VIII. PROTOCOL AND METHOD

- **Introduction** ............................................. 134
- **Study 3: Protocol** ........................................ 136
  - objectives ................................................ 136
  - stimuli .................................................... 137
  - subjects ................................................... 138
  - general procedure ....................................... 140
  - general analysis ........................................ 141
- **Specific Procedure** ....................................... 143
  - workload choice task ..................................... 143
  - subjective measures of workload .......................... 145
  - product attitude measures ............................... 146
  - agent attitude measures .................................. 147
  - agent free recall ........................................ 148
  - agent aided recall ....................................... 149
  - debriefing ................................................ 149
<table>
<thead>
<tr>
<th>Analysis</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>workload choice task</td>
<td>150</td>
</tr>
<tr>
<td>subjective measures of workload</td>
<td>153</td>
</tr>
<tr>
<td>product attitude measures</td>
<td>154</td>
</tr>
<tr>
<td>agent attitude measures</td>
<td>155</td>
</tr>
<tr>
<td>agent aided recall</td>
<td>156</td>
</tr>
<tr>
<td>Discussion</td>
<td>161</td>
</tr>
</tbody>
</table>

IX. RESULTS: GENERAL ASSESSMENT | 163 |
---|---|
| Introduction | 163 |
| Workload Choice Task | 164 |
| Subjective Measures of Workload | 174 |
| Product Attitude and Certainty Measures | 188 |
| Agent Attitude Measures | 192 |
| Agent Free Recall | 194 |
| Agent Aided Recall | 194 |
| Debriefing Survey | 199 |
| Discussion | 199 |

<table>
<thead>
<tr>
<th>x. RESULTS: MAPPING ON IMAAC3 SPACE</th>
<th>206</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>206</td>
</tr>
<tr>
<td>Review of the IMAAC3 Workload Operating Characteristic</td>
<td>207</td>
</tr>
<tr>
<td>Overload and IMAAC3</td>
<td>211</td>
</tr>
<tr>
<td>Mapping Study 3 results on to IMAAC3 Space</td>
<td>212</td>
</tr>
<tr>
<td>Interpretation of Results with Respect to IMAAC3</td>
<td>216</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>xi. SUMMARY, CONCLUSIONS, AND IMPLICATIONS</th>
<th>227</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>227</td>
</tr>
<tr>
<td>The Underlying Structure of Mental Workload</td>
<td>229</td>
</tr>
<tr>
<td>time</td>
<td>229</td>
</tr>
<tr>
<td>effort</td>
<td>230</td>
</tr>
<tr>
<td>workload dimensions</td>
<td>231</td>
</tr>
<tr>
<td>Overload</td>
<td>232</td>
</tr>
<tr>
<td>The Shape of a &quot;Load Curve&quot;</td>
<td>233</td>
</tr>
<tr>
<td>Load and Attitude Change</td>
<td>240</td>
</tr>
</tbody>
</table>
LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Prestudy 1: rotated factor pattern of workload survey</td>
</tr>
<tr>
<td>5.2</td>
<td>Prestudy 2: performance in 1.5 minute condition</td>
</tr>
<tr>
<td>5.3</td>
<td>Prestudy 2: performance in 2.5 minute condition</td>
</tr>
<tr>
<td>5.4</td>
<td>Prestudy 2: rotated factor pattern of workload survey</td>
</tr>
<tr>
<td>9.1</td>
<td>Study 3: performance in central condition</td>
</tr>
<tr>
<td>9.2</td>
<td>Study 3: performance in peripheral condition</td>
</tr>
<tr>
<td>9.3</td>
<td>Study 3: rank ordered performance</td>
</tr>
<tr>
<td>9.4</td>
<td>Study 3: ANOVA on workload descriptors</td>
</tr>
<tr>
<td>9.5</td>
<td>Study 3: rotated factor pattern of workload survey</td>
</tr>
<tr>
<td>9.6</td>
<td>Means of workload factor &quot;W&quot;: perceived performance</td>
</tr>
<tr>
<td>9.7</td>
<td>Means of workload factor &quot;Q&quot;: cognitive resource load</td>
</tr>
<tr>
<td>9.8</td>
<td>Means of workload factor &quot;T&quot;: time load</td>
</tr>
<tr>
<td>9.9</td>
<td>Study 3: principle component analysis of agent attitude</td>
</tr>
<tr>
<td>10.1</td>
<td>Attitude and recall scores (peripheral condition)</td>
</tr>
<tr>
<td>10.2</td>
<td>Frequency of choice by page</td>
</tr>
</tbody>
</table>
11.1 Performance results of Malhotra (1979) . . . . 236
11.2 Performance results of Jacoby et al. (1974) . . 237
A.1 Stimulus photograph ranking, all subjects . . . 252
A.2 Stimulus photograph ranking, male subjects . . 253
A.3 Stimulus photograph ranking, female subjects . 254
A.4 Results of conjoint analysis . . . . . . . . . . . . 258
A.5 Final header attitudes, neutral header . . . . 264
A.6 Final header attitudes, positive header . . . . 264
B.1 Features describing the alternatives . . . . . . 270
B.2 Length ordered list of apartment names . . . . .272
B.3 Length ordered first sentence list . . . . . . . . .275
B.4 Length ordered last sentence list . . . . . . . . .276
B.5 Length ordered kitchen sentences . . . . . . . . .277
B.6 Utility room, washer/dryer, parking sentences .278
B.7 Patio sentences . . . . . . . . . . . . . . . . . . . . .279
B.8 Entertainment sentences . . . . . . . . . . . . . . .280

xii
# List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>A linear tradeoff</td>
<td>55</td>
</tr>
<tr>
<td>4.2</td>
<td>A non-linear tradeoff</td>
<td>55</td>
</tr>
<tr>
<td>5.1</td>
<td>Prestudy 2: performance in 1.5 minute condition</td>
<td>90</td>
</tr>
<tr>
<td>5.2</td>
<td>Prestudy 2: performance in 2.5 minute condition</td>
<td>91</td>
</tr>
<tr>
<td>5.3</td>
<td>Prestudy 2: comparison of performance about peak</td>
<td>102</td>
</tr>
<tr>
<td>6.1</td>
<td>Controlled-automatic continuum of information processing</td>
<td>107</td>
</tr>
<tr>
<td>6.2</td>
<td>Central-peripheral continuum of information processing</td>
<td>109</td>
</tr>
<tr>
<td>6.3</td>
<td>An integrated model of attention and attitude change</td>
<td>114</td>
</tr>
<tr>
<td>6.4</td>
<td>The structure underlying IMAAC&lt;sub&gt;3&lt;/sub&gt;</td>
<td>121</td>
</tr>
<tr>
<td>6.5</td>
<td>The structure underlying IMAAC&lt;sub&gt;4&lt;/sub&gt;</td>
<td>122</td>
</tr>
<tr>
<td>7.1</td>
<td>IMAAC&lt;sub&gt;3&lt;/sub&gt; processes</td>
<td>128</td>
</tr>
<tr>
<td>7.2</td>
<td>IMAAC&lt;sub&gt;3&lt;/sub&gt; workload operating characteristic</td>
<td>129</td>
</tr>
<tr>
<td>8.1</td>
<td>General layout of workload task</td>
<td>139</td>
</tr>
<tr>
<td>9.1</td>
<td>Performance in central condition</td>
<td>167</td>
</tr>
<tr>
<td>9.2</td>
<td>Performance in peripheral condition</td>
<td>169</td>
</tr>
<tr>
<td>9.3</td>
<td>Rank ordered performance</td>
<td>171</td>
</tr>
<tr>
<td>9.4</td>
<td>Load curve suggested by Study 3 results</td>
<td>173</td>
</tr>
</tbody>
</table>
CHAPTER I
INTRODUCTION

Introduction

To err is human. A momentary lapse in attention, a slight mental miscalculation, or an inability to integrate a momentarily heavy load of ambiguous information by an airline pilot or flight controller can, and occasionally does, lead to tragedy. Less tragically, people can, and occasionally do, mistakenly turn on a car's headlights rather than the windshield wipers while in heavy traffic. That prospective product buyers also can commit processing errors in everyday shopping situations was the focus of the "information overload" studies by marketing and consumer psychology researchers a few years ago. As Jacoby (1984) notes, even a breakfast cereal package might have over 100 separate items of information, exclusive of graphic information, and a single store might carry as many as 90 different brands.

Just as pilots of jet aircraft can and do commit processing errors under conditions of "overload", it seems reasonable to expect that consumers also can commit
processing errors under mentally taxing conditions. Although the purchase of a slightly inferior brand of breakfast cereal might not seem like a major catastrophe in the case of an individual consumer, such mistakes can, in aggregate, cost consumers millions of dollars and can result in huge profits for the seller of the inferior brand. Whatever the process that leads to a decision, the ultimate result of "too much work" might be an inferior product choice. The issue of consumer mental workload is clearly deserving of attention.

However, in considering the variety of constructs that might be associated with mental "work", such as "capacity", "elaboration", "involvement", or "effort", it is not clear how such constructs are different and how each might be defined conceptually, theoretically, and operationally. That is, it is not yet clear just what are the various dimensions (factors) that underlie these various workload-related constructs. As noted by Malhotra (1991), this limitation necessarily constraints our ability to imply the detection of various workload constructs in measurement. Acquiring insights with regard to the underlying structure of "mental workload" is clearly in order.

Additionally, "mental workload" extends beyond the effects of "overload" on decision making. The "workload" studies conducted by engineering psychologists have been concerned primarily with the decisional errors that can
result from "overload", and the consumer psychologists studying "information overload" have also been concerned primarily with "dysfunctional decision making" that might result from "overload". Consumer mental workload, however, may be associated with important issues other than immediate decision making and product choice. Consumer mental workload might be a factor, for instance, in attitude change and persuasion and in memory and recall. If the purpose of a marketing communication is to inform and persuade, then the effects of mental workload on recall and attitude change, which could affect future decisions, is at least as important as the effects of mental workload on immediate decision making.

Past research in consumer psychology has focused primarily on the question, Is more information better or worse? The present dissertation expands upon these earlier studies by exploring the underlying nature of mental workload and by exploring the relationship between mental workload and consumer use of attitude-laden "cues". More specifically, this dissertation explores the questions, 1) What is mental workload, conceptually, theoretically, and operationally? 2) What is the relationship of "mental workload" to "information load" and to "overload"? 3) What is the role of situational "cues" under differing conditions of mental workload, and what is the effect of mental workload on attitude change associated with these cues?
Nature of Related Research

The limited concept of "overload". Initial interest in the notion of "information load" was motivated by issues of consumers' "right-to-know", which implies that "more is better". It also seemed possible, however, that too much information could interfere with people's abilities to make product choice decisions. The results of marketing studies such as Malhotra (1982) suggested that it is indeed likely that prospective buyers can make "dysfunctional", or less than ideal, product choice decisions under conditions of heavy informational loads.

In addition to verifying that an "overload" phenomenon exists, however, such investigations of information load were also interested in identifying the specific point at which overload begins to occur. Although the identification of a "redline" threshold in the number of product features or the number of brands that people can reasonably compare might provide some useful insights, it is, from a managerial perspective, of limited practical value alone. If consumers' right-to-know mandates the listing of specific amounts of information on product packaging, it is out of the domain of marketers to control for limits on packaging information. If the prospective buyer wants to tour fifteen houses, wants to compare ten life insurance policies, or wants the specification listings of a dozen video camcorders, a salesperson simply cannot stop the prospect...
from actively seeking this information.

Additionally, people do not necessarily make immediate purchase decisions in many high-load situations, as had to be assumed in the pioneering studies. Products such as houses, life insurance, or major appliances possess a relatively high number of important features and are not routinely purchased. A product comparison under such conditions is not likely to result in an immediate choice decision, but is more likely to result in some sort of global evaluation of each product under consideration, i.e., an attitude, influencing the ultimate purchase decision to be made at some future time. This global evaluation is likely not to be based simply and wholly on the objective, "central" merits of the products in the comparison set, but is likely to be influenced by a number of subjective, "peripheral" factors in the situation. There is a growing body of evidence that people sometimes form attitudes based less on the "central" merits of the product and more on the objectively less relevant "peripheral cues" associated with the pre-purchase situation, such as the personal attractiveness or apparent credibility of the person selling the product (cf., Petty, Cacioppo, & Schumann 1984).

Most of the earlier studies of the notion of "information overload" were limited primarily to the exploration of whether more product information causes better or worse decisions by the prospective purchaser.
However, it seems possible that in practice, "real" consumers would not consider themselves as making "dysfunctional" decisions, but as making "reasonable" decisions under mentally taxing conditions; that if unable or unmotivated to process the objective, central information in a marketing communication, they will tend to be influenced by more easily processed "peripheral cues" of the pre-purchase situation. The earlier marketing studies of "overload" provided respondents only with objective product features to consider, yet prospective purchasers in a "real-world" setting are likely to be influenced by additional cues that nearly always accompany a marketing communication.

One variable that was missing from these initial studies, then, was "peripheral" information, or "cues", for the respondent to consider. A general objective of a marketing communication is to persuade as well as to inform, whether this be via an advertisement, product packaging, or the ministrations of a sales agent. The line of research that is initiated by this dissertation is an extension of the earlier marketing studies of "overload" by initiating an exploration of the influence of peripheral information on the decisions that people make under varying levels of mental workload. Although the line of research initiated by this dissertation is motivated by a broad hypothesis that such cues might tend to have a greater influence on
decisions at higher levels of load, the focus of the present
dissertation is on defining mental workload and on exploring
the relationship between mental workload and attitude
change.

The quest for programmatic inquiry. The study of
"information load" in the marketing discipline has been
limited primarily to the finding that prospective buyers do
apparently make dysfunctional decisions under conditions of
high "load". The underlying theoretical basis of this
observed phenomenon presumes that people have a finite limit
in processing "capacity" (a la Kahneman 1973) and that
exceeding this capacity will result in dysfunctional
decision making. Researchers such as Malhotra (1982, p.
428) apparently recognized, however, that there was still
more to the "information overload" issue than the mere
observance of the phenomenon:

"Questions such as what type of cognitive mechanisms
are employed to handle overload, how these are
different from those employed in normal information
handling, and under what conditions will these
mechanisms break down completely, demand programmatic
inquiry."

Although consumer researchers have empirically observed a
phenomenon that would initially seem to be intuitively
obvious, there does not yet appear to be any programmatic
line of research in the marketing discipline with regard to
the underlying mechanism that leads to "dysfunctional"
decisions under conditions of "overload".
The same general concern for understanding this mechanism has been expressed in the discipline of engineering psychology (a.k.a. human factors, human performance, ergonomics), which attempts to gain an understanding of human limitations involved in the kinds of problems that introduced this chapter. The "capacity" explanation is the same general theoretical basis underlying the "mental workload" research that has been conducted for the past three decades in engineering psychology. The need for the study of mental workload as summarized by Gopher & Kimchi (1989, p. 439) seems applicable not only to the operators of complex machinery such as aircraft, nuclear power plant control systems, and so on, but seems equally applicable to the everyday problems faced by household and industrial/organizational buyers, who also are:

". . . confronted with multiple and diversified sources of information . . . this state of affairs naturally raises the question of capacity limitations. What are the boundaries of human abilities to attend to sources of information, to process, transform, decide, and carry out the necessary responses? How much information can be provided and in what form? What are the risks and costs of exceeding the limits?"

Rouse & Rouse (1983, cited in Wickens & Kramer 1985) propose two practical reasons for interest in human performance limits which can be paraphrased with relevance to practice in marketing management:
1) Understanding the nature and causes of dysfunctional buyer decision making can lead to effective redesign of marketing communications.

2) The kinds of decisional mistakes that prospective household or industrial/organizational buyers can make can also offer insight into the nature of the human's internal model with regard to the influence of marketing communications on purchase decisions.

It would seem, then, that a cross-fertilization of mental workload theory with practical issues of marketing management and buyer behavior could result in useful new knowledge, both in theory and in practice. However, research in engineering psychology has been concerned with solving problems that result in human decision-making error, not with marketing problems that result in persuasion that might affect present decisions or future buying behavior. The issue of attitude change and future behavior that might result from processing under conditions of high mental workload appears to be unique to the field of marketing.

Although there is a vast amount of literature in the field of social psychology regarding attitude change and persuasion, the issue of attitude change and persuasion under varying conditions of mental workload appears to have not yet been addressed. Again, this issue is apparently
unique to the field of marketing, and a practical or theoretical need to address such an issue has apparently never been raised. Here again, a cross fertilization of the mental workload literature with the attitude and persuasion literature might provide a meaningful theoretical framework on which to study a practical issue in marketing management.

Objectives of the Dissertation

Research in marketing has, to date, only verified that a phenomenon of "information overload" can exist, i.e., prospective buyers have been found to make dysfunctional decision choices under conditions of increasing amounts of information. The observance of a simple "redline" in buyer performance, however, is of limited value in marketing practice. Prospective buyers are likely to be influenced by more than mere amounts of objective product information, i.e., by "peripheral" variables, and it still seems possible that less information could also lead to dysfunctional decision making, depending on where one starts on the "information load curve". Given the importance of the topic area and the sparsity of theoretical bases for hypothesizing about buyer behavior when marketing communications are processed under variations in mental workload, the major objectives of this dissertation are:
1) To integrate relevant theoretical development and empirical findings from the areas of marketing, of engineering psychology and mental workload, and of social psychology and persuasion.

2) To explore the underlying structure of "mental workload" in an attempt to define this notion conceptually, theoretically, and operationally.

3) To develop a conceptual, theoretical, and operational framework that helps to explain how consumer information is processed under conditions of low, moderate, and high mental workload.

Method

The underlying nature of mental workload. The pioneering studies that initially explored the "information overload" phenomenon in marketing are not especially clear with regard to the relationship of "mental work" and "information quantity". The initial chapters of this dissertation attempt to integrate literature related to "information load" and "mental workload" in an attempt to explore the nature of these conceptually, theoretically, and operationally. Although workload related constructs such as "information overload", elaboration, and mental effort, are important in consumer research, the underlying structure of
these and of the broader concept of mental workload is not yet obvious. A study conducted to explore the underlying dimensions of "workload" (Prestudies 1 and 2) is reported in Chapter V.

Independent of any dimensions that might be hypothesized, an exploratory factor analysis was conducted in an attempt to discover the natural dimensions that might underlie mental workload. In Prestudy 1, participants were asked to list words that could describe each of a variety of ordinary daily activities. Forty seven words were chosen to then be used in describing an experimental workload task. Prestudy 2 consisted of a workload generating task, followed by the list of adjectives. Subjects were to indicate how well each word described the workload task just completed. In the workload task, subjects (n=344) were to choose the "best" product from a choice set after a limited amount of time. A between subjects design was used, with each subject being exposed to a condition of 4, 6, 8, 10, 12, 14, or 16 alternatives in the choice set, under a time constraint of 2.5 or 1.5 minutes (only 4 through 12 alternatives in the 1.5 minute condition). The response variable in the choice task was the proportion of subjects in that cell who had correctly chosen the "best" product.

A LOGIT analysis of performance indicated that "load" had been manipulated. The descriptive words were then subjected to a factor analysis, revealing three factors that
appear to concur with the dimensions of time, quantity (resource demands), and force (motivation to expend effort). These results concur with a physical model of workload. Prestudy 2 was also an attempt, in part, to explore the effects of time on the simple time-less notion of "information load", helping to clarify the difference between the notions of "information load" and "mental workload".

The process associated with mental workload. The meaning and underlying structure of mental workload are explored in the initial five chapters, while the remainder of the dissertation is an exploration of the process underlying mental workload as it relates to recall and attitude change. An Integrated Model of Attention and Attitude Change (IMAAC) is proposed as a conceptual and theoretical framework from which propositions can be generated regarding the relationship between mental workload and recall and attitude change. A Workload Operating Characteristic is traced on the space of IMAAC, resulting in the general propositions with regard to cues in marketing communications:

\[ P(A) : \text{Low load is expected to result in less use of cues, greater use of objective product information.} \]
P(B): Moderate load is expected to result in increased use of cues, resulting in greater recall of information related to these cues and in a greater attitude change with respect to these cues.

P(C): High load is expected to result in less ability to use cues, resulting in less recall of information related to these cues yet in a greater attitude change with respect to these cues than under conditions of low load.

Study 3 was conducted to trace a Workload Operating Characteristic based on empirical results for comparison to the general propositions of IMAAC. As with Prestudy 2, Study 3 was a between subjects design (n=290), manipulating "load" by providing respondents with 4, 6, 8, 10, 12, 14, or 16 alternatives in a choice set, under a single time constraint of 2.5 minutes, with the task of choosing the "best" product. These choices, in the form of condominium advertisements, were also accompanied by "peripheral cues", sales agents that differed with respect to attractiveness and credibility.

As in Prestudy 2, a LOGIT analysis of performance indicated that "load" had been manipulated. Differences in performance based on the physical location of an objectively
"best" ad within the choice set were then observed, revealing a point of apparent structural overload (beyond 12 alternatives), or a point at which respondents exhibited an increased likelihood of not finishing the task in the allotted period of time. Differences in measures of respondent confidence in rating the alternatives in the choice set due to physical location concur with the performance based observation of a structural overload point. The range from 4 alternatives to 12 alternatives, or low "information load" to the overload threshold, was then used in plotting an empirically based Workload Operating Characteristic. Measures of recall and attitude were then assessed as load approached this empirically determined overload threshold.

Summary and Organization of the Dissertation

This dissertation grew out of an interest in exploring how prospective purchasers are influenced by peripheral information under conditions of low, moderate, and high informational loads. Prospective product buyers such as household consumers and industrial/organizational purchasing agents are sometimes faced with a large number of products to compare as well as a large number of important product features to consider. Although past marketing research suggests that such buyers can make "dysfunctional" decisions under conditions of "informational overload", little is
known about the underlying structure of mental workload or about the effects of variations in mental workload on the quality of product choice and on attitudes toward the product and its seller. The major objectives of this dissertation are to integrate relevant theoretical development from the literatures of marketing, mental workload, and persuasion; to explore the underlying meaning of the notion of mental workload from a conceptual, theoretical, and operational perspective; and to develop a conceptual, theoretical, and operational framework that helps to explain how consumer information is processed under conditions of low, moderate, and high mental workload.

A general overview of the information load paradigm is first discussed in Chapter II. Chapter III addresses various explanations for apparent processing limitations and interference. Various issues and constructs associated with the "capacity" models of information processing are addressed in Chapter IV.

The Workload Human Analogy Model (WHAM) is introduced in Chapter V to draw an analogy between "work" in a human processing system and work as it is defined in a physical, or machine, system. Empirical results of a factor analytic study are compared to WHAM, providing convergence on the potential characteristics that might define mental workload as a concept and as a construct. These results also provide some initial insight into the difference between the
constructs of "information load" and "mental workload".

The Integrated Model of Attention and Attitude Change (IMAAC) is outlined in Chapter VI, with a discussion of the application of the model to the context of mental workload in Chapter VII, in which a Workload Operating Characteristic curve is predicted. Chapter VIII presents the protocol and method used in the final study for evaluating the predictions of IMAAC. The general results of the final study are reported in Chapter IX, in which an overload point for this data is determined. A workload operating characteristic for this data is projected on to IMAAC space in Chapter X. Chapter XI concludes this dissertation with a discussion of conclusions and of theoretical and practical implications.
CHAPTER II
THE "OVERLOAD" PARADIGM

Introduction

In September 1989, USAir Flight 5050 dropped into the East River at Laguardia Airport one minute after takeoff. The experienced pilot had attempted the takeoff with the rudder in full left trim. In March 1979, a reactor core at the Three Mile Island nuclear power plant overheated. Supervisors manually overrode an automatically activated coolant pump after misinterpreting control panel indicators, resulting in catastrophe. A month later, a marketer reported the observation that consumers were choosing the wrong product when asked to compare too many features or too many product alternatives (Malhotra 1979, 1982).

Given that human and environmental safety is involved, incidents such as the first two are clearly deserving of a quest to understand what went wrong to cause the human error. As a sort of "information processing system", human ability is subject to the same constraints as any sort of machine system; the human system is certainly limited in its capacity to do work, and, like any machine, exhibits problems of reliability as that capacity limitation is
approached. The study of human reliability is based substantially on an attempt to understand causes of error in an entire system which includes both a machine component and a human component (cf., Park 1987; Wickens 1984a). Few would argue the importance of understanding the reliability and causes of error that occur in a system composed of pilots, flight controllers, and a myriad of lights, switches, and circuit boards.

Our understanding of human error is equally important, however, with regard to more typical everyday situations. Pressing the wrong elevator button after an intense business meeting, or turning on the windshield wiper instead of the headlights while in heavy traffic are individually not serious enough incidents to seem worthy of study. Nevertheless, the occurrence of such everyday incidents does suggest that human processing mistakes are not a rarity, but are, rather, quite normal. The pioneering studies of "information overload" in the marketing discipline were concerned with the everyday mistakes that shoppers might make in the purchase of such mundane products as instant rice (Jacoby, Speller, and Berning 1975), prepared dinners (Jacoby et al.), laundry detergents (Jacoby, Speller, and Kohn 1974), or peanut butter (Scammon 1977). The mistaken purchase of the "wrong" brand of peanut butter is certainly not, as an isolated incident, a catastrophe of the magnitude of a downed airliner. On the other hand, if enough
consumers in aggregate make the same mistake, the result can cost consumers millions of dollars and can result in large profits for the seller of an inferior product. In the case of a product like a house (Malhotra 1982) or even an apartment (Payne 1976a), a decisional mistake could lead to the purchase of an inferior choice alternative with which the buyer and his/her family will have to live for a substantial portion of their lives.

Debate over the existence of empirical proof of such a marketing phenomenon as "information overload" which could lead to purchase mistakes by consumers ensued soon after publication of the pioneering studies (Jacoby 1977, 1984; Jacoby, Speller, and Berning 1975; Malhotra 1982, 1984; Malhotra, Jain, and Lagakos 1982; Russo 1974; Scammon 1977; Summers 1974; Wilkie 1974). More recently, Meyer and Johnson (1989) have voiced additional concerns (see also Keller and Staelin 1987, 1989). As Jacoby (1984) notes, however, even a breakfast cereal package might have over 100 separate items of information, exclusive of additional graphic information, and a single store might carry as many as 90 different brands: that people can and would make mistakes under mentally taxing conditions would seem to be intuitively obvious, whether as pilots of jet aircraft or as everyday consumers.

Science does bear the obligation to provide empirical evidence even for that which appears to be intuitively
obvious, and the pioneering studies appear to have provided reasonable evidence in support of intuition. There has been, however, a curious lack of work toward extending the pioneering notion of "information overload" with respect to the broader subject of consumer mental workload; this is only the preface of many more theoretically interesting and managerially rich chapters that still could and should be written on the subject. The notion that there exists some sort of "redline" in peoples' abilities, beyond which there is some kind of breakdown in the reliability of the processing machinery, is conceptually appealing. However, such a "redline", if one exists, is likely to be so smeared and fuzzy in real-world application that it could not alone be especially useful in application by a manager. Moreover, even if a specific "redline" point could be identified, what is a manager supposed to do with this interesting bit of knowledge?

This chapter argues that theoretical and managerial interest should not be directed so much toward issues of information quantity, but more toward changes in processing quality as consumer mental workload is increased. The general purpose of a marketing communication is to inform and persuade, and we should therefore be interested in the kind of information retained and in the changes in attitudes toward a product when a communication is processed under conditions of low, moderate, and high levels of consumer
mental workload. It is additionally argued that we should focus more interest on the quality of particular (non-chance) product choice decisions under conditions of increasing mental workload, rather than the more simple issue of whether or not some "correct" choice, however defined, was made. Although many of the points made in this chapter have previously been noted by others (e.g., Jacoby 1975, 1984; Malhotra 1984), this chapter attempts to provide a review of recent advances in our understanding of issues relevant to consumer mental workload since the conduct of the pioneering marketing studies. It is hoped that this will help to clarify what it is that "information overload" might or might not mean in the broader context of mental workload and, further, that this will help to stimulate research beyond the simple issue of whether or not consumers can or will be "overloaded".

The Information "Overload" Paradigm

The notion of "information load" in marketing has primarily been concerned with product choice "errors" made by prospective consumers under conditions of high informational loads. Information "overload" is assumed to have occurred when the prospective buyer is unable to complete the buying task successfully, as might be evidenced, for example, when an objectively inferior product choice is made by a high proportion of consumers under high
load conditions. The underlying cause of this phenomenon is assumed to be due to a "limited capacity" processing system, and that approaching this limit results in decisional errors (cf., Malhotra 1982).

These assumptions necessarily parallel those of the notion of "mental workload". The concept of mental workload, from engineering psychology, is concerned with errors made by human operators of machine systems under conditions of high mental loads. "Overload" is assumed to have occurred when the operator is unable to complete the task successfully (cf., Albanese 1977, cited in Willeges and Wierwille 1979). The underlying cause of this phenomenon is presumed to be due to a "limited capacity" processing system, and that approaching this limit results in operator error (e.g., Wickens and Kramer 1985; Willeges and Wierwille 1979). The notion of information overload, then, appears to be entirely consistent with the notion of mental workload; "information load" is apparently a limited subset of the broader concept of "mental workload". As such, these should, as concepts and as constructs, share certain similarities and limitations.

The Magical but Fuzzy Redline

The "information overload" studies in marketing appear to have verified that prospective buyers can make dysfunctional choice decisions under conditions of heavy
informational loads. Finding that participants in his study exhibited the effects of "overload" when confronted with 10 or more alternatives in the choice set or with information on 15 or more attributes, Malhotra (1982) suggested that future investigations should attempt to more clearly determine the critical number of alternatives and attributes to information processing breakdown; Miller's (1956) "magical number seven" is certainly an intriguing concept. There are, however, a number of reasons as to why it is unlikely that such a number can be identified in any marketing context and why this number alone would not be of much practical value.

The multidimensionality of the workload construct. Although "overload" in the context of mental workload can be operationally defined with respect to increases in task performance error, there currently appears to be a consensus that there is yet no generally accepted definition of "mental workload" (cf., Chiles and Alluisi 1979; Wickens and Kramer 1985; Willeges and Wierwille 1979). The detection of "overload" is generally based on single-task performance measures, as when the "wrong" product is chosen in an information load task. There are also other measures of mental workload, including concurrent (aka dual-task, secondary, subsidiary) task performance measures, physiological measures, and self report measures. This variety of measures alone would seem to implicate mental
workload as composed of many dimensions. Human performance researchers have recently made attempts to account for various dimensions that might be involved in subjective perceptions of the workload construct, as in the conjoint approach of the Subjective Workload Assessment Technique (SWAT), which attempts to account for the workload dimensions of time load, mental effort load, and psychological stress load (e.g., Reid, Shingledecker, Nygren, and Eggemeier 1981; Tein 1989), or the NASA-TLX (Task Load Index) rating approach (Hart and Staveland 1988), which attempts to account for nine individual dimensions. The implication is that in various real-world marketing situations, "overload" is likely to occur at various points, depending on how various dimensions are affected at the time the marketing communication is received. The marketer would often not have control over all dimensions of workload, e.g., how much time the prospective buyer has to spend making product comparisons, which can, as indicated by the results shown in Chapter V of this dissertation, affect the exact location of the overload "redline".

The limited resource issue. There is substantial evidence of qualitatively different forms of processing mechanisms, and the mere observation of some quantitative threshold of "overload" is of limited value. From the perspective of attention theory, there is substantial evidence of multiple processing resources (e.g., Friedman
and Polson 1981; Friedman, Polson, and Dafoe 1988; Israel et al. 1980; Kantowitz and Night 1976; Navon and Gopher 1979; Sanders 1979; Wickins 1980, 1984b; Wickens and Kessel 1980), each with its own "capacity" limitations, implying that "overload" might occur at different points, depending on what combinations of resources (e.g., mathematical, graphic, textual, oral) are engaged for any particular task.

Additionally, the "capacity" explanations of processing necessarily require the notion of automatism (Stelmach and Hughes 1983); there is evidence of an automatic mechanism of processing which does not consume from "capacity"-limited resources (e.g., Fisk and Schneider 1984; Schneider 1985; Schneider and Fisk 1983; Schneider, Dumais, and Shiffrin 1984; Shiffrin, Dumais, and Schneider 1981; Shiffrin and Schneider 1977), with the implications that there might be differences in the "overload" threshold for the processing of some kinds of information for some people and that new informational inputs will not be retained in memory. Related to the notion of automatism is evidence that processing can sometimes be a "skill" (e.g., Gopher in press; Hirst 1986; Hirst, Spelke, Reaves, Caharack, and Neisser 1980; Spelke, Hirst, and Neisser 1976), with similar implications. For example, "novice" shoppers of a particular product class might experience "overload" at a different point than "experienced" shoppers. The engagement of qualitatively different forms of processing resources
will presumably result not only in different levels of an "overload" threshold, but might also result in qualitatively different outcomes with regard to learning information from a marketing communication.

**Moderators of processing ability.** A number of individual-specific traits might moderate "capacity" or other forms of processing interference that could lead to processing outcome errors (e.g., Gopher and Kahneman 1971). One capacity-based measure, concurrent task performance, has been associated with such individual traits as demographic (Stapleford 1973) and personality variables (Huddleston 1974; Huddleston and Wilson 1974). The effects of distraction also appear to be related to personality (Morgenstern, Hodgson, and Law 1974). Processing ability appears to be affected by the biological effects of aging (Kochhar 1979), apparently increasing from childhood through adulthood (Halford, Maybery, and Bain 1988), although further aging might negatively affect processing abilities (McDowd and Craik 1988). Additionally, a number of environmental factors could affect processing abilities. These might include food intake (Lisper and Eriksson 1980), noise (Finkelman and Glass 1970; Finkelman et al. 1977), sleep (Collins 1977), temperature and clothing (Vickroy, Shaw, and Fisher 1982), and perhaps even time of day (Malaviya and K. 1976). The overload "redline" could differ not only between individuals, but even within individuals,
depending on environmental factors.

Heuristic and peripheral processing. From the perspective of persuasion and attitude change, there is also evidence of qualitatively different forms of information processing. There is evidence that people will sometimes engage in an objective or "systematic" mode of processing, but might at other times engage a more "heuristic" based mode of processing (e.g., Chaiken 1980; Chaiken, Liberman, and Eagly 1989). Related to this is evidence for the notion that people can sometimes engage a "central" mode of processing, where issue-relevant information is elaborated upon, and can at other times engage a "peripheral" mode of processing, where non-issue-relevant information might be elaborated upon or where elaboration might not even be engaged (e.g., Petty and Cacioppo 1981, 1986). Although the engagement of qualitatively different modes of processing might result in similar levels of initial attitude changes, the persistence (Haugtvedt and Strathman 1990) and resistance (Haugtvedt 1989) of attitudes (i.e., delayed effects) might be very different.

There are two implications associated with this. The engagement of a "peripheral" mode of processing might require the use of capacity-consuming effort, as when some sort of heuristic is used, or might not require the consumption of much capacity, where a person can be influenced by the peripheral features of a communication
without deliberately using some sort of decision heuristic. This would roughly correspond to what the IMAAC₃ model of Chapter VI of this dissertation refers to as "controlled/peripheral" and "automatic/peripheral" processing. Whether or not "capacity" gets used will affect whether or not a person made a decision that was affected by "overload", since overload is presumably a capacity-based construct. Exactly how one would define the overload "redline" under these conditions is not clear.

The other implication is that there is more at stake than just the decision outcome. Exactly how increases in mental workload affect attitude change processes is at least as important as any immediate decision outcome of the effects of mental workload. The pre-purchase process associated with products such as houses, automobiles, life insurance, or complex, expensive appliances is likely to result in a high level of motivation to process information as well as a high level of mental workload due to the difficulty in comparing features between such products. It is possible, perhaps likely, that many prospective purchasers of such products would not make an immediate decision when comparing products, but would take several days to "think" about the merits of the products. What should be of more interest in situations of various levels of mental workload, then, are differences in the nature of attitude changes under these conditions, which could affect
a future product choice decision.

Issues of practical application. As a sort of benchmark, knowledge that consumers can compare five or ten attributes or alternatives before exhibiting the effects of "overload" (cf., Malhotra 1982) is useful. The problem in a marketing context is that a number of constraints get in the way of making good use of this as a precisely defined point. Even if one could identify the magical number that defines the "redline" point in the number of product alternatives and number of attributes that people can consider before exhibiting the effects of "overload", it would have little managerial use in many situations. If the prospect wants to look at ten houses, the real estate agent cannot stop him/her. If the government mandates information on product packaging for the sake of consumers' right to know, then the seller must comply. If a life insurance agent is attempting to close a sale on a prospect, but the prospect is being deliberately "overloaded" with too much confusing information on too many policies by a competitor attempting to foil the sale, knowledge that the prospect is likely to have "overloaded" is, alone, of little value. However, an understanding of the process that leads to recall and to attitude change, attitude persistence, and attitude resistance under these conditions could be useful in the design of more effective marketing communication strategies.
Discussion

The results of the marketing "overload" studies appear to support Miller's "magical number seven" as a rough benchmark. The debate resulting from these pioneering studies has also flushed out some crucial conceptual and methodological issues, providing a firm footing for future work on issues of the effects of mental workload in marketing situations. The preface to this interesting and practical subject has been written. Curiously, however, there has been very little work on the subject of consumer mental workload since the pioneering "overload" studies of the seventies.

The problem with closing this issue at this point is that the identification of some quantitative threshold of "overload" has little practical use beyond providing a rough benchmark. This chapter has discussed a number of qualitatively different processing mechanisms that can be engaged. The threshold might change, depending on how different kinds of informational inputs engage different combinations of processing resources, and depending on the processing skills of the person or population of message recipients. A number of other factors have also been discussed, such as individual differences, age, clothing and temperature, or time of day, which could affect an individual's ability or motivation to process a marketing communication. Any quantitative "redline" value that is
identified as the outcome of a study could potentially be a mere artifact specific only to a particular experimental setting and might not be valid in other settings.

A more theoretically interesting and managerially useful issue regards the quality of processing under conditions of increased mental workload, regardless of the exact location of any overload "redline". The general purpose of a marketing communication is to inform and persuade, whether that communication be the labeling on a package, the appeals of a TV commercial, or an encounter with a salesperson. People do not always make some "correct" or "incorrect" decision choice when receiving a marketing communication; it is more likely that most marketing communications lead to the remembering of information and to changes in attitudes. Such learned information and attitudes are likely to affect some choice decision at a future time and are additionally, and importantly, likely to affect perceptions of product performance (i.e., satisfaction) after a purchase is made.

Even if one does consider the situation where a product choice decision is made at the point of the marketing communication (as when comparing package labeling in a store), the purchaser does not make a simple "correct" or "incorrect" choice. There might exist one single objectively best choice for that particular individual, but what actually happens when the person makes a choice that
results in the purchase of a product that was not the "correct" choice? Although too much information could lead to human error, what is the quality of whatever choice was made? It is unlikely that the purchaser in this situation can make only a "correct" choice or a random incorrect choice.

If we assume that a consumer will attempt to make a reasonable (satisficing) choice, even if they lack the ability to adequately process information due to "overload", then we cannot assume that they would make a random incorrect choice. It is quite possible that people use simplifying heuristics based on, say, "peripheral" clues to product quality, such as the appearance of the packaging material or the furnishings in an attorney's office (cf., Jacoby 1984; Olson and Jacoby 1972; Shostack 1977). It is also possible that people can be influenced by more subtle "peripheral" cues in the situation that they do not deliberately consider, as in the automatism that might be associated with stereotyping (e.g., Devine 1989). If one assumes that people do attempt to make "reasonable" decisions, and are influenced by peripheral clues or cues, would it not then be possible to predict what kind of decisional error would be made? Would it not be possible to influence the outcome of potential errors with different strategies in packaging, in personal selling, or other forms of communication?
Two information processing models which attempt to integrate issues of "capacity" with issues of consumer memory and attitudes are those of Bettman (1979) and of Greenwald & Leavitt (1984), perhaps holding some insights regarding the delayed effects of consumer mental workload on such factors as memory and attitude. Owen (1990) described a more simple integration of these issues, one that attempts to describe a process rather than a taxonomy, that forms the basis of the work presented in this dissertation. Work related to consumer mental workload has addressed such issues as automatism (Palmer and Jonides 1988) and heuristics (Formisano, Olshavsky, and Tapp 1982; Lussier and Olshavsky 1979; Payne 1976a, 1976b), and the recent line of research addressed by Keller and Staelin (1987) has addressed the issue of information quality, rather than quantity.

Attitude theories and capacity-based attention theories recognize the influence of motivation and ability on human information processing. Certainly, information load affects and is affected by both motivation and ability (cf., Muller 1984), which are perhaps greater confounds in real-world consumer situations than they might be in the settings of astronauts or airline pilots. A severe limitation to the concept and construct of mental workload as it is studied in human factors is that these researchers are concerned with human error at the time of a task without regard to the
delayed effects that workload might have. The effects of mental workload on memory, on changes in attitudes, and on the quality of future decisions appears to be, importantly, an issue unique to the discipline of marketing.
CHAPTER III
THE LIMITED-CAPACITY PARADIGM

Introduction

That people have a finite limit in their ability as a kind of "information processing system" seems intuitively obvious. Almost a century ago, researchers began empirical investigations into various mechanisms, such as automatism and attention, that might affect apparent processing limitations (e.g., Bryan & Harter 1899; Downey & Anderson 1915; Jastrow 1892; Solomons & Stein 1896; Welch 1898). Although psychologists lost interest in this line of research to the study of behaviorism for a few decades, renewed interest emerged again in the 1950s (e.g., Adiseshiah 1957; Bahrick, Noble, & Fitts 1954; Broadbent 1954, 1957, 1958; Garvey & Knowles 1954; Garvey & Taylor 1959; Miller 1956). Throughout the 1960s and 1970s, an increasing amount of research into issues such as "mental workload", "attention", and "cognitive capacity" was conducted. Much of this research was not conducted entirely for the purpose of theory building, but was conducted in part to solve problems in practical applications. Examples of practical problems that have been addressed include
apparent processing limitations with respect to the work of military pilots (Gabriel & Burrows 1968; Gopher & Kahneman 1971; North & Gopher 1976), professional bus drivers (Brown, 1968; Kahneman, Ben-Ishai, & Lotan 1973), automobile drivers (Brown, 1965, 1967; Brown, Tickner, & Simmonds 1969; Finkelman, Zeitlin, Filippi, & Friend 1977), and so on.

The concept of "information overload" is based on the assumption that the human information processing system has an asymptotic limit in its capacity to process information. The notion of limitations in "capacity" seems so intuitively obvious that it almost universally remains unquestioned by secondary researchers who use this assumption in research on attention, effort, workload, and such. Obviously, most people can effortlessly add two two-digit numbers, but would experience extreme difficulty in attempting to add three ten-digit numbers without the aid of pencil and paper as "scratch pad" memory. In a range of mental arithmetic tasks, a person would begin somewhere between these two extremes to exert an increasing amount of "mental effort", to "pay more attention" to the performance of the task, and to make an increasing number of mistakes as the limits of "cognitive capacity" are approached. The notion of processing limitations seems so obvious that the eminent psychologist William James, who laid a good portion of the foundation upon which attention research still rests, made the oft-quoted statement that "everyone knows what attention
The operationalization of evidence for "information overload" has indeed relied on a measure of the probability of consumer choice "mistakes" (e.g., Malhotra 1982). A sharp increase in decision "mistakes" is taken as evidence that the threshold of "overload" has been surpassed, and the construct of overload is taken to exist because mistakes have been made. Such an operational definition is perhaps reasonably sufficient for initially investigating a concept such as information overload. As a theoretical definition of the construct of information overload, however, the operational definition is insufficient because of its circularity as a theoretical claim. In order to investigate the construct of "information overload" more deeply, it is necessary to more specifically describe the underlying theoretical mechanism more specifically.

The "capacity" explanation of processing limitations is problematic in general, whether it be applied to the investigation of "effort", "attention", "workload", or whatever (cf., Navon 1984, 1985). All "capacity" explanations currently exhibit some degree of circularity if taken as theoretical, rather than operational, explanations. There are a number of explanations as to how and why processing resources exhibit limitations, and they are not all mutually exclusive; all explanations are empirically supported. There does not appear to be any single
communication channel "bottleneck" which limits information throughput nor does there appear to be any single "central processor" of limited "capacity" to process information. It is simply not possible to make a vague assumption based on "capacity" limitations. Any research that is based on the notion of processing limitations must be explicit about the underlying assumptions that are used and must recognize alternative explanations.

As Titchener (1908, p. 173) was to note only a few years after James' statement,

"It is true that the discovery of attention did not result in any immediate triumph of the experimental method. It was something like the discovery of a hornet's nest: the first touch brought out a whole swarm of instant problems."

Study of the mechanisms that result in processing limitations and interference is not so simple as it might initially seem.

**Where is Capacity Limited?**

Although the human information processing system obviously has limitations, the locations and mechanisms involved in causing these limitations have been elusive. Task performance degradation can be explained in terms of structural limitations, bottlenecks in serial communication channels, central processor limitations, individual limitations in various parallel multiple resources,
interference between parallel processing tasks in a processing system of otherwise unlimited "capacity", and so on.

Single channel hypothesis. Many of the studies in the 1950s and 1960s were attempts to locate the "bottleneck" in the processing system. These studies viewed the processing system as something like a single channel, serial transmission line (Welford 1967). Miller (1956) proposed that there is an asymptotic limit in the human as "a kind of communication system" to process units of information. This asymptote was denoted as its "channel capacity", with the proposed limit being set at about seven units of information at any given instant.

In an attempt to locate the position of the "bottleneck" in this communication channel, Broadbent (1954) proposed that there was a many-to-one selection switch in the channel; information throughput was limited by how fast this switch could operate in selecting parallel input signals for serial passage through the channel. Broadbent's "Filter Theory" (1957, 1958) located this bottleneck near the input of the channel. Broadbent's theory very quickly came under attack, however. Deutsch & Deutsch (1963), for example, proposed that the bottleneck was more likely located near the end of the channel, and Treisman (1966) proposed that the "switch" behaved more like an "attenuator".
As the issue of processing limitations was further investigated, it became evident that there were situations in which the processing system did not appear to operate as a single channel, serial transmission line. Keele (1967), for instance, found that the time taken to perform two tasks concurrently is sometimes much less than the sum of the times taken to perform the tasks individually. If the system did operate as a serial transmission line, forced to "switch" between multiple tasks, then the time taken to complete two tasks concurrently should have been linearly additive. Further evidence against the single channel hypothesis was provided in an experiment of Moray & Jordan (1966), which indicated that apparent parallel processing was possible.

Undifferentiated capacity hypothesis. Moray (1967) proposed that some of the problems encountered with the single channel hypothesis could perhaps be explained by a flexible central processor of limited capacity. This conceptualization was further refined and popularized by Kahneman (1973). Labeled the undifferentiated capacity hypothesis by Kerr (1973), the view of Moray and Kahneman was that the overall size of this central processor is limited, but the processor is very flexible in the number and kinds of tasks that it can process concurrently at any given instant. Kahneman viewed the processing system as possessing a very general pool of resources, "that may be
variously labeled 'effort', 'capacity', or 'attention'" (p. 9), which may be allocated to the performance of various tasks.

Kahneman viewed the earlier models of processing as explanations of "structural" limitations in processing. Eyes, for example, cannot be focused on two objects simultaneously, regardless of the processing abilities of the rest of the system. The limited capacity processor model was proposed as an explanation of how some processing tasks can be performed concurrently. This model attempts to explain how limitations to process a particular task will change, depending on what other processing tasks might also concurrently compete for consumption of "capacity" from the limited capacity processor. Neither of these two models was viewed by Kahneman as adequate alone.

Multiple resource theory. Most marketing researchers rely almost entirely on the Kahneman (1973) model as the basis for a vague reference to the notion of "limited capacity" (e.g. Malhotra 1982; Thorson, Reeves, and Schleuder 1985). Kahneman's model provides a very good conceptual background for the capacity explanation of processing limitations, and Kahneman proposed a number of interesting issues associated with this model that still await empirical exploration. The problem with the undifferentiated resource capacity model is that further investigation has since revealed that the processing of some
tasks does appear to be differentiated.

It is easier, for example, to attend to auditory and visual messages concurrently than to two concurrent audio messages (Rollins & Hendricks 1980; Treisman & Davies 1973). This could be due to structural limitations, but it could also be possible that there are separate communication channels for auditory and visual inputs prior to input to a flexible central processor. Such a finding could also be explained by the existence of multiple, distinctly separate, specialized processors operating in parallel, each with its own individual processing limitation. According to the multiple resource theory, degradation in processing performance occurs when multiple processes attempt to use the same resource pool (Navon & Gopher 1979; Wickens 1980, 1984b).

More recent evidence of Freidman, Polson, & Dafoe (1988) indicates that there are differences in processing degradation between tasks processed in each cerebral hemisphere and a common secondary task. A marketing communication could conceivably, then, trigger processes that use only a single processing resource that must be divided between them or could trigger processes that each use different resources. For example, product packaging could contain a graphically illustrated emotional appeal that is processed in a resource located in one hemisphere, and also contain quantitative information regarding product
amount or size that is processed in a resource located in a different hemisphere. Given the evidence supporting such a possibility, any marketing investigation of "information overload" would have to consider the possibility of such differences when product attribute information is being increased as well as when an increasing number of products is being evaluated. The implication of multiple resource theory is that not all combinations of product attributes or units of information will "stress" or "load" the processing system in the same way.

**Automatism and skilled processing.** A problem with the "capacity" explanations so far discussed is that processing can sometimes appear to be resource free, or to consume from a processing resource with no apparent bottlenecks or processor limitations. Researchers around the turn of the century (e.g., Bryan & Harter 1899) were finding that practice could lead to the automatization of task performance, or skill acquisition. The early dual-task studies of that time (e.g., Downey & Addison 1915; Jastrow 1892; Solomons & Stein 1896; Welch 1898), were conducted primarily out of an interest in investigating how "effort" or "attention" led to the acquisition of automatic processing or motor skills. It was found that when two tasks are performed concurrently, they tend to interfere with each other less and less with continued practice. Either the asymptote of the limitation of the processor is
rising or some other portion of the system is increasingly assuming some of the duties of a processor of finite limitations.

This has more recently resulted in a substantial amount of investigation into the notion of "automatism". Some processing operations appear to become inflexibly "hard wired" after repeated performance, and therefore operate in parallel with and no longer interfere with processing operations that must rely on flexible, capacity limited resources. Processing operations that have become automated in this manner, then, appear to behave in a limitless "resource free" manner. Evidence supporting the notion that processes become "hardwired" outside of the control of more "flexible" processing resources is that once a processing resource becomes "automatic", it can be very difficult for the person to change or override it (cf., Shiffrin & Schneider 1977; Schneider & Shiffrin 1977). The dual process model, which proposes a continuum of processing anchored by "resource free" automatic processing and by "resource dependent" controlled processing will be discussed more fully in Chapter VI.

Related to the notion of automatism is the "processing is a skill" explanation (Gopher in press; Hirst 1986; Hirst, Spelke, Reaves, Caharack, & Neisser 1980; Spelke, Hirst, Neiser, 1976). There is evidence that as a person gains the skill to concurrently perform multiple processing tasks,
improvements in the performance of different other concurrent tasks will be observed. This provides evidence that apparent changes in the limits of the processing system might not always be due to the "hard wiring" of specific sequences of processing operations, but might indeed be a reflection of a not so finite limit in some processing resources.

The evidence supporting the notion of automatism and processing as a skill, then, has important implications for marketing researchers interested in the notion of "information overload". Consumers might exhibit more automatic or skilled processing on some products or attributes but not on others. A full-time housewife who is an "experienced shopper" might exhibit much less difficulty making a decision regarding various brands of a packaged grocery product displayed in varying sizes and grades than the husband who is less experienced at this particular processing task. The processing involved in certain attribute comparisons could conceivable become automated, or the entire task itself could become something of a generalizable skill.

Outcome conflict. Even investigations of automatism and skilled processing rely on the notion of "capacity" limitations to explain the processing of non-automatic or non-skilled processing operations. Navon (1985), however, has provided a logical argument that limitations in
concurrent task processing might not be due to the division of some resource of limited "capacity, but might be due instead to how processing resources are shared. Navon argues that differences in the way various processing tasks interfere might be due to the way they share a relatively limitless resource. Processing limitations might not be caused by processing limitations in a capacity sense, but might be caused by processing interference due to some sort of confusion as a result of what Navon calls "outcome conflict". One possible source of outcome conflict discussed by Navon is "cross talk" among parallel, independent processes similar to electrical cross talk in parallel electrical wires.

Such an idea is analogous to the misfiring and subsequent poor performance that can occur in an automobile if the ignition wires are taped together in parallel, or to the kind of "glitches" and subsequent system crashes or spoiled data that occurred in early microcomputer systems where parallel, uninsulated "ribbon" cable was often used to carry high frequency data. Empirical support for the notion of "outcome conflict" was found by Navon & Miller (1987).

Although Navon's argument is convincing and worthy of further investigation, there currently is not enough empirical support to understand the implications of this explanation of processing limitations. Even if the mechanism of limitations is entirely due to problems of
attention sharing of a limitless resource rather than to problems of attention switching or division of a limited resource, the processing system is nonetheless limited in some way. Whatever the cause of processing limitations, the "capacity" for processing throughput is still constrained, and so a "capacity" conceptualization and operationalization of any applied investigations of system limitations would currently seem reasonable, even if not entirely theoretically correct. Even Navon (1984, 1985) notes that the "capacity" explanations still seem to be useful given the current state of knowledge regarding this issue. His concern seems to be more with the blind acceptance of any particular "capacity" explanation without due caution for problems with the underlying assumptions and for the circularity of empirical support for "capacity" as a theoretical claim.

Discussion

The notion of the limited "capacity" of the processing system, and of "mental workload", "mental effort", "attention", and so on, are not so simple as many secondary investigators seem to assume. Marketing researchers investigating such constructs as "attention" or "information overload" generally make only a casual, vague, passing reference to "capacity" without an adequate discussion of various views of the subject and without an adequate
discussion of the assumptions and limitations of whatever view is being used. In using a dual-task operationalization to investigate television viewer "attention", Thorson, Reeves, and Schleuder (1987) justified the use of the so-called "RT-probe secondary task technique" simply on the grounds that "psychologists have used this technique for many years". In his investigation of "information overload", Malhotra (1982) makes only a passing reference to "capacity" by citing Kahneman (1973).

Many insights into the issues of processing resources have been gained since the conduct of studies such as these. Many views of processing resource consumption and interference have been advanced and many views have found empirical support. Future investigation into applied issues of concepts such as "attention" or "information overload" must recognize that there are several explanations for apparent processing resource limitations. There is currently no single "correct" view of "processing capacity". Whatever view is adopted for any particular investigation must also be justified with regard to relevance, assumptions, and limitations.
CHAPTER IV
WORKLOAD, ATTENTION, EFFORT, ETC.: SOME ISSUES OF DEFINITION

Introduction

The notion that the processing system has an asymptotic limit in "capacity" has been used as the basis for the investigation of a variety of constructs and processes, such as "mental workload", "mental effort", "attention", "elaboration", and so on. One of the most common operationalizations in the investigation of such constructs and processes has involved the dual-task techniques, such as the "RT-probe secondary task technique". Dual-task techniques generally presume a processing system of resource limitations: the "consumption" of processing "capacity" by one processing task will leave less "capacity" for the processing of a second concurrent task. When both tasks attempt to "consume" more "capacity" than is available, the performance of one or both tasks must suffer and this will presumably result in the observation of degraded task performance.

Using dual-task operationalizations in the detection and measure of a variety of constructs and processes would seem to indicate that these are all the same. Although
these are often operationalized in the same manner, they are
certainly not all theoretically the same. A person might,
for example, "consume" a great amount of processing resource
"capacity" by deliberately exerting a great amount of
"mental effort" in mentally solving difficult arithmetic
problems. A person might also "consume" a great amount of
processing resource "capacity" by "elaborating", without
deliberate "effort", while reading a suspenseful,
"involving" detective story.

In each case, an experimenter might expect to be able
to detect the "mental effort" construct or the "elaboration"
construct or the "involvement" construct by noting decreases
in the performance of a concurrent second task, such as the
maintenance of hand pressure (Welch 1898), the maintenance
of finger-tapping patterns (Friedman, Polson, and Dafoe
1988; Jastrow 1892), or the speed of reaction time to an
occasional flash of light or a beep or clicking sound (e.g.,
Lord 1988; Moore, Hausknecht, & Thamodaran 1986; Posner &
Boies 1971). Even though one would expect to be able to
operationalize such constructs or processes in the same
manner, these are not really all the same. It would seem
that any investigation of processing limitations
necessitates a clarification of constructs and processes
that manifest themselves through an apparently limited
processing system.
Tradeoff Analysis

As noted in previous chapters, early empirical attempts to study processing limitations and apparent changes in limitations through the acquisition of skills and memory involved dual-task procedures. Downey & Addison (1915) and Solomons & Stein (1896), for instance, paired various dual task studies which involved the reading of a story while listening to another and the reading of a story while writing memorized verses, noting improvements in each of the paired tasks with continued practice. In an attempt to study a single task, Welch (1898) used a secondary task paired with the primary task of interest. The subject was to attend primarily to the processing task of interest while secondarily maintaining a constant hand pressure. The observation of changes in performance of this secondary task was taken as changes in the use of resources devoted to the primary task. Such secondary task performance changes assume that lesser "capacity" is left for secondary task performance as greater "capacity" is "consumed" by the primary task.

Kahneman (1973) graphically represented "capacity" as something of a hydraulic system. Processing resources were represented as a "pool" of liquid in a container of finite dimensions. The pool was considered as very general in nature, "variously labeled 'effort', 'capacity', or 'attention', which may be allocated to the performance of
various tasks" (p. 9). As some of this "pool" was allocated toward the processing of one task, less of the "pool" was left for concurrent use by any other tasks. A "secondary" task, then, can be used as a "dipstick" into the pool; a decrease in secondary task performance represents a lower level in the "pool" available for secondary task usage, and a lower level represents greater consumption from the pool by the primary task.

This notion also lends itself to something of an economic or budgeting analysis. If there is a limit in the amount of resources available, then it should be possible to increasingly consume resources via one task and quantitatively chart changes in a concurrent second task. A number of researchers have attempted to use such "tradeoff" analyses to study apparent limits in the ability to use information or apparent limits in processing resources. These tradeoff sorts of analyses have been variously labeled "attention operating characteristics" (AOC) first by Kinchla (1969, cited in Kinchla 1980) and independently by Sperling & Melchner (1978), as "receiver operating characteristics" (ROC) by Kinchla (1980), and as "performance operating characteristics" (POC) by Normon & Bobrow (1976).

As an example of how a tradeoff type of analysis works in the study of various "capacity" limitations, consider the simple hypothetical example illustrated in Figure 4.1. As greater performance demands are placed on the subject with
respect to Task A, the performance of a concurrent Task B is observed. Likewise, when greater demands are placed on the subject with respect to Task B, the performance of Task A is observed. At some point, the subject's processing system can no longer "budget" for both tasks concurrently, and the performance of one or the other must suffer. For any given pair of tasks, then, a set of points can be plotted, providing an equation regarding how the system allocates resources for each task for a particular pair of tasks.

The processing resource "budget" will allow for, say, three "units" of the resource to be allocated to Task A and three "units" to Task B without degradation in the performance of either task. The system cannot allocate say, six units to both Task A and Task B; if one task takes priority and obtains, say, five units, then the other task can only be performed at the level of one unit of resource. In actual practice, the asymptotic limit for a pair of tasks will more likely exhibit the characteristics of a curve, as in Figure 4.2, rather than the straight line depicted in Figure 4.1.

Detecting Capacity-Limited Resources: The Secondary Task Technique

A performance tradeoff as depicted in Figure 4.1 is obtained by asking the subject to divide attention between the two concurrent tasks, i.e., "try to perform both tasks
FIGURE 4.1
A LINEAR TRADEOFF

FIGURE 4.2
A NON-LINEAR TRADEOFF
equally well" or "place 80% of your effort into performing Task A and 20% into Task B". This is a problematic method in that it requires the subject to make judgments regarding "mental effort", but was nonetheless useful to gain some insights into how resources were being allocated. Another method that perhaps has somewhat greater validity is the secondary task technique, where the subject is asked to focus almost completely on the "primary" task and only incidentally on the "secondary" task. The secondary task technique has also been termed occasionally as the subsidiary or dual-task technique in the literature on mental workload. A general discussion of the secondary task technique in marketing research can be found in Lynch & Srull (1982) and Owen (1990b).

The secondary task technique has been implemented in a variety of ways. One variation on the secondary task technique to detect "attention" has been used by Children's Television Workshop, producers of Sesame Street, to test television shows on 3- and 4-year old children (Waterman 1990). Children in day-care centers were shown segments of the TV show under test while slides were concurrently projected on a screen next to the TV display. The ability of a TV segment to capture the "attention" or "involvement" of viewers is taken as a function of the attention that is given to the subsidiary vs. the primary task.
A frequently used secondary task in laboratory settings in recent years has been the "RT-probe", in which subjects must press a hand-held switch button in response to an occasional flash of light or an audible click or "beep" sound. A degradation (increase) in reaction time (RT) to an occasional beep (the secondary task) during, say, the reading of a message or the viewing of a television program (the primary task) is taken as a quantitative measure of an increase in attention or effort devoted to the primary task. Points at which RTs greatly increase above "normal", usually accompanied by many "misses" (no response to the beep) or "false alarms" (response where no beep occurred), are taken to indicate degraded secondary task performance and as an indication that the primary task is "consuming" processing resources near the "capacity" threshold. This presumably provides an indication of points within a communication that consume more "attention" or require more "effort" to process. Secondary task performance changes, then, are taken to function as a "probe" into resource consumption by the primary task, or as the "dipstick" into the "pool" of resources in the Kahneman hydraulic sense.

Lord (1988), for example, used the RT-probe to find apparently "high involvement" and "low involvement" segments within a suspenseful Alfred Hitchcock television program. Longer RTs to an occasional audible beep were taken as an indication of higher viewer "involvement". Commercials were
then positioned within these "high involvement" and "low involvement" segments of the program to investigate the effects of program involvement on the processing of commercial messages. Longer RTs continued throughout commercials embedded within "high involvement" segments, but remained "normal" throughout the same commercials positioned within "low involvement" segments. These longer RTs were taken to indicate that processing resources were being consumed by program "elaboration" throughout commercials positioned within "high involvement" program segments. Attitude and recall measures taken after the program viewing indicated that there was some processing interference associated with commercials positioned within "high involvement" program segments.

Thorson and her colleagues (1985; 1987) have similarly used the RT-probe to investigate television viewer "attention". Moore, Hausknecht & Thamodaran (1986) have used the RT-probe in the investigation of "attention allocation" to the processing of audio commercials. Britton and his colleagues have conducted a number of studies (1978, 1979, 1980, 1982) into the usage of "cognitive capacity" with differences in text complexity and structure. All of these uses of the RT-probe are based on the assumption that as the primary task consumes near the threshold of "capacity", secondary task performance will be degraded due to a lack of sufficient reserve "capacity".
Workload, Attention, Effort, Elaboration, Etc.: What's the Difference?

Using a technique such as the RT-probe, a number of researchers have investigated a variety of constructs and processes such as workload, attention, effort, involvement, elaboration, cognitive capacity, and so on. Although these are apparently related in that they are all detected by the RT-probe as an apparent "dipstick" into resource usage, these are not all the same constructs or processes. In any individual study, each is defined operationally by increased RTs to a secondary task, but a further theoretical definition is generally not addressed. Each individual construct or process, however, certainly is made up of dimensions other than the dimension of "capacity".

Unfortunately, there seems to be no agreement on the definitions of such constructs or processes. Several investigators of the "attention" construct have commented on the difficulty in providing any clear definition for such a concept (e.g., Kinchla 1980) as have several investigators of the "mental workload" construct (e.g. Chiles & Alluisi 1979; Wickens & Kramer 1985; Willeges & Wierwille 1979; Yeh & Wickens 1988). Processing consumption involved in some mental tasks would seem to involve deliberate "effort" on the part of the subject; other tasks would seem to "absorb" processing resources without any deliberate "effort" on the part of the subject. The solving of difficult arithmetic
problems, for example, would seem to be "effortful", whereas "program involvement" and "elaboration" in the Lord (1988) study would seem to "absorb" processing resources without any deliberate effort on the part of the subject.

Consider, for example, two tasks with which one might use the RT-probe in the detection of a construct or process assumed to compete for extremes of resource "capacity". The first primary task to be paired with the RT-probe involves mental arithmetic; the second primary task to be paired with the RT-probe involves reading an interesting, suspenseful detective story. Each primary task can be expected to produce a measurable decrease in RT-probe secondary task performance. It might be reasonable to assert that "mental effort" was detected in the arithmetic task, but it is unlikely that subjects would regard reading an interesting story as especially "effortful". It might also seem reasonable to assert that "elaboration" was detected in the reading task, but it is unlikely that any sort of "elaboration" was involved in the mental arithmetic task. Both tasks can be expected to consume processing resources to a point where excessive "capacity" usage can be detected, yet the process which results in the consumption of "capacity" is probably somewhat different.

The outcome of each "capacity" consuming process is likely to be very different. When "mental effort" is expended in the performance of the mental arithmetic task,
certain **skill improvements** might be expected as the outcome. After a period of such task performance, subjects might be expected to improve in the ability to perform mental arithmetic, with decreased interference with secondary task performance, and, therefore, less "capacity" usage for problems of a given difficulty. When reading results in the consumption of "capacity" through "elaboration", the outcome might be the **synthesis of new ideas** and increased **recall** of information. **Skill improvements** might result from the effortful performance of mental arithmetic task, but not so much from the reading task. **Information recall** and the **synthesis of new ideas and attitudes** might be the result of reading an interesting, suspenseful story, but is not likely from the performance of mental arithmetic.

**Discussion**

Exceeding the limit of resource "capacity", then, seems to be the result of a variety of processes and constructs, labeled variously as "elaboration", "attention", "effort", "workload", and so on. Although Kahneman (1973) conceptualized the processing resource pool as very "general", and felt that this pool could "variously be labeled" as a variety of processes such as these, these do seem to imply somewhat different processes with different potential outcomes. "Information overload", which presumably results when resource "capacity" is exceeded,
could be the result of a number of different processes.

For example, a comparison of the unit pricing of alternative products could involve mental arithmetic as varying package sizes and prices are compared. "Overload" could occur in this situation without the recall of information or the synthesis of a new attitude that is useful to the seller of any products. Information regarding product benefits or use, on the other hand, could cause "overload" through the comparison of potential product benefits, with a potential for change in attitudes toward products and brand-specific information recall. Any investigation of "information overload" should consider more than simple "capacity" usage, since different processes may lead to "capacity" usage; "capacity" usage is simply one and only one dimension that is common to a variety of constructs and processes.

Furthermore, it is not currently clear just how changes in amount of information or in the type of information might relate to such constructs as "attention", "effort", "capacity", and such. Research results reported by Britton suggest, for instance, that the reading of "difficult" or "complex" text can at times consume more "processing resources" than simple text (Britton & Tesser 1982); yet Britton had earlier reported results that appear to suggest, in conflict with the latter results, that simple text can at times consume more processing resources than difficult or
complex text (Britton et al. 1978, 1979, 1980). As first noted by Inhoff & Fleming (1989), Britton has reported these disparate results without any discussion as to how or why this is possible.

Yalch & Yalch (1984) similarly provide text messages that they presume to be different in what they term as "quantitativeness". The following is an excerpt from what they consider to be a "nine percent quantitative" message:

"From only 5% of total transactions handled by the bank, they are expected to grow to over 45%. In fact, many people do 95% of their banking using the automatic teller machines."

In the "nonquantitative" message condition, "quantitative data were absent":

"From only a small portion of total transactions handled by the bank, they are expected to grow to a significant amount. In fact, many persons do virtually all their banking using the automatic teller machines."

Since Britton found that text "difficulty" or "complexity" can sometimes consume more "processing resources", yet can at other times consume "less processing resources", how might it be possible to hypothesize about the effects of "quantification" on processes, such as, in the case of Yalch & Yalch, attitude formation toward the message source? What are the effects of "quantification" on such constructs as "resources required to interpret the information", or on the way that the appearance of the information might affect "motivation" or the willingness to
exert "effort"? Although Yalch & Yalch determined in a manipulation check that "the messages were successful in varying quantitativeness", it is not clear how these two messages affected processes that are associated with "resources", "effort", and so on.

As is problematic with the Briton studies, it is quite possible that Yalch & Yalch provided messages that varied in difficulty. Perhaps the "quantitative" condition required greater "effort" to process. It is also possible that the Yalch & Yalch messages merely varied the meaninglessness of the messages. Perhaps the "quantitative" condition carried little meaning, therefore requiring less "effort" to process (i.e., nothing worth processing). It would seem possible to obtain a variety of results in varying text "quantitativeness", just as Britton obtained conflicting results in varying text "complexity". It is simply not possible to hypothesize about the effects of such a message on various outcomes without a better understanding of the various workload related dimensions such as "resources", "effort", and such.

¹Thanks to Professor Haugtvedt for suggesting this discussion.
CHAPTER V

DIMENSIONS OF THE WORKLOAD CONSTRUCT: THE WORKLOAD HUMAN ANALOGY MODEL AND EMPIRICAL EXPLORATION

Introduction

The notion of consumer mental workload is apparently related to a variety of concepts and constructs as "information overload", elaboration, involvement, mental effort, and such. Although such constructs are important in consumer research, the underlying structure of these and of the broader concept of mental workload is not intuitively obvious. This chapter first outlines a conceptual model of mental workload based on an analogy to a physical model of workload. Prestudy 1, described in this chapter, was an attempt to discover, without a priori expectations, the natural dimensions that might underlie and define the notion of mental workload under task conditions in which the level of mental workload was not actively varied between subjects. Prestudy 2, which is described in part in this chapter, was an attempt, in part, to extend Prestudy 1 by varying the level of mental workload in a between subjects design. Prestudy 2 was also an attempt, in part, to explore the effects of time on the simple time-less notion of "information load", helping to clarify the difference
between the notions of "information load" and "mental workload".

Engineering psychologists have attempted to understand how much "mental workload" is associated with, say, the landing of a spacecraft or commercial airliner before the human processing system begins to exhibit problems of reliability. Marketing researchers have similarly explored the issue of "information overload", attempting to determine, in part, if consumers can and will make significantly greater product choice errors if they consider too many product alternatives or product features. However, questions that have been asked, but never answered, are, What are the general factors that can lead to processing system "overload"? What are the general dimensions of "mental workload", whether it be a concept associated with the operation of a spacecraft or with determining the most nutritious selection on a restaurant menu?

There has been a curious lack of any effort to conceptually or empirically develop such insights. For example, the consumer "information load" studies of the seventies resulted in substantial on-going debate (eg., Jacoby 1984; Malhotra 1984). Considered in this debate were such issues as time: information load must, in part, be a function of the amount of time that a consumer has available or is willing to invest in "thinking" about a given issue. Yet, despite the amount of scholarly effort expended in
debate of such issues, there has been no programmatic line of inquiry to address the relationship of "time" or other potential factors with the "load" construct.

Researchers in engineering psychology have attempted to address the apparent multidimensionality of the "workload" concept, although many of these efforts have been associated with specific, specialized tasks. Recognizing that more general, multidimensional scales were needed, Reid and his colleagues (e.g., Reid & Nygren 1988; Reid, Eggemeier, & Nygren 1982; Reid, Shingledecker, Nygren, & Eggemeier 1981) have developed a three-dimension workload scale, SWAT (Subjective Workload Assessment Technique), and Hart & Staveland (1988) have developed a nine-dimension scale, NASA-TLX (Task Load Index). A problem with such scales, however, is that the dimensions for these scales were apparently chosen primarily on the basis of face validity. The conjoint task of SWAT, for example, requires military pilots to sort a deck of cards describing the just-completed mission based on the assumed dimensions of psychological load, effort load, and time load. Although an attempt has been made to validate the procedure (Tein 1989), the choice of these particular dimensions used in this procedure remains without conceptual, theoretical, or empirical support. On one issue there seems to be agreement, however: there currently is no generally accepted definition of the concept or construct of "mental workload" (cf., Chiles &
Alluisi 1979; Wickens & Kramer 1985; Willeges & Wierwille 1979; Yeh & Wickens 1988).

The studies described in this chapter, then, were an attempt to discover the nature of any natural order that might underlie the concept of mental workload. Although one might intuitively expect the existence of such dimensions as time, there currently exists no clear conceptual or theoretical structure to guide the search for relevant dimensions. Given the general lack of conceptual or theoretical guidelines, the exploratory factor analytic approach used in the studies described in this chapter is an appropriate means to, as Thurstone (1947, p. 56) commented in his classic text, "lift ourselves by our own bootstraps" in exploring the nature of the yet vague notion of consumer mental workload and its underlying structure.

A Hypothetical Model of Workload

A physical system. Although there is currently no conceptual framework to describe the dimensions of workload in the human mental system, workload is a concept that does possess defined dimensions in physical systems. Consider, for example, an electrical system:

\[(\text{watt-hours}) = (\text{watts})(\text{hours})\]  \hspace{1cm} (eq. 5.01)

or, expressed another way:
Work is increased, then, by increasing time or power inputs. Capacity to do work, then, is set by constraints on these factors.

In this physical example, power is defined by:

\[(\text{watts}) = (\text{amps})(\text{volts})\]  \hspace{1cm} (eq. 5.03)

or, expressed another way:

\[(\text{power}) = (\text{quantity})(\text{force})\]
\[= (Q)(F)\]  \hspace{1cm} (eq. 5.04)

Since the capacity to do work is set by constraints on the factors of power and time, then capacity is set by constraints on Q and F as well as T. Therefore:

\[W = f(Q,F,T)\]  \hspace{1cm} (eq. 5.05)

**Workload Human Analogy Model (WHAM).** In a human mental system, we might consider the following analogy to the physical system:

\[(\text{power}) = (Q)(F)\]  \hspace{1cm} (eq. 5.06)
or, expressed another way:

\[(\text{power}) = (\text{resources})(\text{effort})\]  \hspace{1cm} (eq. 5.07)

where:

\[\text{resources} = f(\text{ability, etc.})\]  \hspace{1cm} (eq. 5.08)
\[\text{effort} = f(\text{motivation, etc.})\]  \hspace{1cm} (eq. 5.09)

Therefore:

\[(\text{work}) = (\text{resources})(\text{effort})(\text{time})\]
\[W = f(Q,F,T)\]  \hspace{1cm} (eq. 5.10)

**Relationship of the Workload Human Analogy Model to SWAT.** The above model appears to bear some resemblance to the conjoint Subjective Workload Assessment Technique (SWAT) of Reid et al. in that SWAT presumes workload to be a function of three variables: time load, mental effort load, and psychological stress load. The factor "time load" appears to be directly analogous to the Workload Human Analogy Model (WHAM) factor of "T". The SWAT factor of "mental effort load" appears to be directly analogous to the WHAM factor "F" if limited to "expenditure of energy" and other operator-controlled variables.

The "psychological stress load" of SWAT appears to be only partially analogous to the WHAM factor "Q".
"Psychological stress" might be expected to affect resource "capacity" through interference, attention division, and so forth, but there certainly are other variables that affect "Q" as well, such as the innate difficulty of the task independent of the effects of motivation. "Psychological stress load" apparently accounts not only for variables that moderate the magnitude of "Q", but for variables that can moderate the magnitude of "F" as well. Nonetheless, SWAT does appear to account for the factors on the right side of WHAM, albeit in a different manner.

Measures of W, Q, F, and T in the human mental system.
"Workload", or the left side of the equation, has been implied in various ways in the human mental system. There appear to be two general categories of measures presumed to imply workload changes: relative measures of actual performance and subjective measures of performance. Measures of actual performance include changes in secondary task performance or changes in decisional outcomes as various workload factors are increased or decreased. Subjective measures of performance consist of asking the subject to indicate a perception of performance.

Measures of Q, F, or T also appear to fit into two general categories: relative measures and subjective measures. Relative measures include a comparison of changes in the amount of time allotted to complete a task, a
comparison of changes in various physiological indices (heart rate, pupil dilation, etc.), or, again, a comparison of changes in secondary task performance which might indicate changes in the expenditure of effort. Subjective measures consist of asking subjects to indicate perceptions of "effort" and such. Note that performance measures such as secondary task performance have been used in the measure of variables on both sides of this equation, illustrating the problem of circularity with regard to claims that are often used in supporting the use of this technique.

Of particular interest in the present research are subjective measures of workload and its various dimensions, whatever they are. As has been noted previously, a problem with such methods as physiological measures or measures of secondary task performance is that it is not at all clear just what it is that these specifically detect. A problem with using relative measures of performance is that these do not indicate the cause of performance degradations used to imply changes in workload. Subjective measures might better permit a multidimensional approach into tapping the various factors, whatever they are, that comprise or cause workload. Examples might include:

\[ W_{\text{subj}}: \text{How confident are you with the answers you have just given?} \]
Q_{subj}: How confident are you in your ability to perform this task?
F_{subj}: Did you work hard to complete this task?
T_{subj}: Did you have enough time to complete this task?

A problem with asking such questions of subjects of a workload task is that such questions assume that particular dimensions of workload do indeed exist. Although it seems reasonable to hypothesize the above human analogy to a physical model of workload in the absence of any guiding theory, it is nonetheless desirable to find some way to explore possible dimensions of mental workload in a manner that is independent of the hypothesized explanation.

**Prestudy 1: Seeding the Potential Workload Dimensions**

*Generating workload: the subsidiary survey.* Prestudy 1 consisted of a task used to generate workload followed by a survey to take measures of workload. The survey used to measure workload will be denoted as the primary survey. The task used to generate workload was a survey used as part of another study, denoted here as the subsidiary survey. The primary survey of interest in the present study, then, was used to detect the "workload" requirements of the subsidiary survey.
The subsidiary survey was part of an ongoing line of unrelated research with regard to people's ordinary daily activities. In an initial phase of the subsidiary study, student respondents had been asked to provide brief descriptions of various common daily activities. A consensus pool of descriptive words was then generated from an aggregation of these descriptions. In a later phase, respondents were given individual daily activities each followed by a single-page list of 86 descriptive words that had been selected from the consensus pool. They were asked to indicate how well each word described that particular activity by placing a number between 1 and 5 (inclusive) in a box next to each word.

This latter survey was used as the workload-generating subsidiary survey in the present research. Each respondent was given a randomly chosen set of six individual daily activities, each activity followed by the same single-page list of 86 descriptor words; the booklet also contained the workload survey (primary survey) as the last task in the booklet. Undergraduate student subjects (n=150) participated for extra credit as part of a marketing principles course, surveyed in groups of about 10 to 30. Respondents were not given a specific time limit to complete the survey booklet, but were told that no one would be allowed to leave the room sooner than 25 minutes after the start of the survey, that they were otherwise free to
quietly leave when they had completed the survey booklet, and that prior survey participants had typically required about 30 minutes. It was hoped that these instructions would motivate respondents to exert a reasonable amount of effort into completing the survey, yet would also provide a motivation to complete the task in a reasonable amount of time. The subsidiary survey was a priori expected to be perceived as interesting in subject matter, as moderately difficult (i.e., not easy but not excessively difficult) as a task, but as rather boring and perhaps even irritating as a task after all 6 survey forms had been completed.

Measuring workload: the primary survey. Many of the descriptive words that subjects had used to describe ordinary daily activities appeared to be appropriate as potential variables of consumer mental workload: e.g., difficult, demanding, hectic, etc. Since no variables or factors were necessarily hypothesized a priori with respect to mental workload, selecting words from this subject-generated pool appeared to be an appropriate method to "seed" the initial search for any natural structure of consumer mental workload. Appropriate words were drawn from this pool, but to limit the size of the final list, selected words were then deleted to minimize the number of words that were similar or directly opposite in meaning. Issues associated with this will be addressed in discussing limitations of the study, but it was felt that the length of
the workload measurement instrument had to be limited to minimize generating workload via the measurement instrument itself. In addition to the pool of descriptive words generated by respondents of the daily activities study, several additional descriptive words were considered because they had appeared in discussions of scale development in the workload literature.

Descriptive words related to two other specific issues were added to the "seed" list. One issue associated with asking student subjects to complete a survey is demand artifacts. The amount of mental effort expended on the subsidiary survey by a respondent may be a function, in part, of how important, necessary, or worthwhile the research is perceived. Several words relating to this specific potential dimension, then, were added to the list.

The other specific issue regards the respondent's perceived performance; words that might describe subjective perceptions of performance reliability were naturally absent from the initial "seed" list. Words that seemed related to perceived performance, then, were included as a separate list in addition to the main list of workload descriptors.

The workload survey was the last task in the booklet containing the subsidiary survey. The first page of this survey contained the perceived performance measures with the instructions:
HOW WELL DO THESE WORDS DESCRIBE YOUR PERFORMANCE?

How do you feel about the answers that you have just given on this survey? Place an "X" on the line next to each word to indicate how well that word describes your feelings about your performance in completing this survey.

This was followed by six words (confident, content, displeased, satisfied, successful, uncertain), each next to the following line:

not well ___:___:___:___:___:extremely well

The next three pages contained the 47 workload descriptors in alphabetical order and in the same format as above, but with the instructions:

HOW WELL DO THESE WORDS DESCRIBE THIS SURVEY?

How well do the words below describe this survey? Place an "X" on the line next to each word to indicate how well that word describes the survey.

Analysis. The responses from the list of 53 words on the primary survey were factor analyzed using maximum likelihood (ML) as the initial method. On the basis of a "scree" plot of eigenvalues, six factors were retained.
This method of determining the number of factors to retain may be best when the interest is in locating only the major common factors (cf., Linn 1968). An orthogonal rotation was then performed using the varimax method. Further rotation to an oblique solution yields the same factor interpretations, and so the varimax solution is retained.

Factor loadings are reproduced in Table 5.1. Factor 1, explaining 24% of the variance (weighted), appears to be a rather general dimension, and might best be interpreted as what SWAT considers as "psychological load". Factor 2, explaining 21% of the variance, appears to be dominated by descriptors associated with time constraints, and might therefore best be labeled as "time load". Factor 3, explaining 10% of the variance, loads on descriptors that were expected a priori to be associated with demand artifacts, designated as "motivation 1".

Factor 4, explaining 8% of the variance, loads on the measures of perceived performance, as expected a priori, designated as "perceived performance". Factor 5, explaining 6% of the variance, appears to load on descriptors of task resource demands, and might best be interpreted as "resource load". Finally, Factor 6, explaining 6% of the variance, appears to be another motivation factor, designated here as "motivation 2". A summary of the above interpretations is:
TABLE 5.1

PRESTUDY 1:
ROTATED FACTOR PATTERN (VARIMAX) OF WORKLOAD SURVEY

<table>
<thead>
<tr>
<th>Factor</th>
<th>FAC.1</th>
<th>FAC.2</th>
<th>FAC.3</th>
<th>FAC.4</th>
<th>FAC.5</th>
<th>FAC.6</th>
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<tbody>
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<td>-10</td>
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<td>-16</td>
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<td>-5</td>
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<td>-3</td>
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<td>3</td>
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<tr>
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Table 5.1 (continued)
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<td>9</td>
<td>3</td>
<td>9</td>
</tr>
</tbody>
</table>

(Values greater than 45 have been flagged by '*')
1. Psychological Load
2. Time Load
3. Motivation 1
4. Perceived Performance
5. Resource Load
6. Motivation 2

Discussion of Prestudy 1. The above analysis suggests that "mental workload" could indeed be a multidimensional construct. Since most of the descriptor words used to "seed" this exploratory analysis were not chosen a priori with respect to any hypothesized dimensions, these factors suggest "natural" dimensions on which to build further conceptualization. The basic factors suggested by Prestudy 1 do seem to loosely concur with the dimensions presumed by SWAT, and the motivation dimensions do seem reasonable as factors that might be associated with the expenditure of effort by the subject, as differentiated from resource demands of the task.

Prestudy 1 provides some useful initial insights with respect to the nature of the structure underlying the concept of consumer mental workload, but it does have some important limitations as an exploratory study. Most importantly, the number of observations to variables is very small, and workload was not actively varied via the subsidiary survey. One plausible explanation for these
results, then, is that certain words have a natural relationship that may be evidenced regardless of their relationship to any changes in workload. If these factor loadings are merely an artifact of language, however, that in itself is still useful as a starting point to help define the natural components of consumer mental workload.

Prestudy 2: Generating Varying Levels of Workload

Workload vs. information load. The two most important limitations to Prestudy 1 were that the sample size was very small given the number of variables and that the level of workload was not actively manipulated via the workload generating task. Prestudy 2 was conducted, in part, to actively vary the level of workload in a between-subjects design. Prestudy 2 was also conducted to assist in centering the "overload" threshold for the conduct of the final Study 3, and will be described in greater detail in a later chapter. The present discussion will be limited to a discussion of Prestudy 2 only as it relates to the observation of the natural dimensions of workload. Subjects in Prestudy 2 (n=344) completed the workload task described below and then immediately completed the same workload survey that had been used in Prestudy 1.

The pioneering "information overload" studies of Jacoby, Malhotra, and others varied "information load" by varying the number of product alternatives a subject was to
consider in a choice set, or by varying the number of attributes used to describe each alternative in a choice set. As a measure of the outcome effects of "information load", subjects were asked to indicate a product choice, and a significant rise in the frequency of choice "mistakes" at some increased condition of load was taken to imply that the threshold of "overload" had been surpassed. In an effort to maintain consistency with these pioneering studies, Prestudy 2 and Study 3 also varied "load" by varying the number of alternatives in a choice set in a between subjects design. Additionally, Prestudy 2 varied workload by using two levels of time constraints.

As subjects are provided an increasing number of alternatives in a choice set, with the objective of choosing the "best" product, this task would presumably require increasing amounts of processing resources and an increasing expenditure of cognitive "effort". It seems reasonable to assume, in absence of any specific theory, that there must be some limitation in the amount of information that can be processed, regardless of any limitations on time. That is, Miller's (1956) "magical number seven" seems intuitively plausible as an issue that is independent of constraints in processing time. If a limitation in time to process is introduced, then the task shifts from one of a time-limitless "information load" task to one of a "mental workload" task, assuming that constraints in time are
introduced at levels below the threshold of "information overload". Hence, Prestudy 2 varied "workload" by introducing conditions of two levels of time constraints.

This is to say, then, that the notion of "workload" necessarily requires the dimension of time if the physical analogy is used, whereas the notion of "information load" would seem to be a special case that necessarily requires that time is specifically not a constraining dimension. Subjects who receive a greater number of ads to read and compare in a fixed amount of time, then, would presumably suffer the effects of "workload" as well as "information load" since there is less time on a per-ad basis. In absence of evidence to the contrary, subjects would be expected to work "harder" and "faster" if given more "work" to do in a given amount of time, i.e., to adjust effort to the difficulty of the task. Bryan & Locke (1967) found that subjects given more time to complete math problems took more time to complete them. Apparently, subjects with shorter time limits will adjust their "effort" accordingly.

Generating varying levels of workload. Housing was chosen as the product class to use in these studies since virtually everyone is familiar with the basic features of the product, yet few people have extensive experience in purchasing the product. Undergraduate student respondents were used since buying experience with this product class is likely to be highly homogeneous (i.e., almost non-existent)
within this group. No subjects in Prestudy 2 were younger than age 20; only five were older than age 22. Variations in knowledge or experience, then, are likely to be reasonably minimal with respect to potential confounding of "capacity" or other variables of the workload construct. These subjects were shown advertisements for condominiums described with apartment features (see Appendix B).

Subjects were provided with stimulus materials in the form of condominium ads with 4, 6, 8, 10, 12, 14, or 16 product alternatives, both with and without "peripheral" information, at time constraints of 2.5 and 1.5 minutes (the 1.5 minute conditions only included the first five levels). The "peripheral" information was provided in a header at the top of each of the two pages of ads, picturing as well as describing the credentials of competing sales agents. Half of the subjects received this "peripheral" information and half received ads in which this "peripheral" information was blocked out. The relevance of the "peripheral" manipulation will be described more fully in Study 3; for the present study, the "central" and "peripheral" conditions were pooled. This was, then, a between subjects design, with about 30 subjects in each cell (number of alternatives in the choice set) in the 2.5 minute condition, and about 27 subjects in each cell (number of alternatives in the choice set) in the 1.5 minute condition. Each subject, under a single level of mental workload, was to choose the "best"
product after the allotted reading time.

The cover story implied that the business school was conducting a survey for employers who assist new recruits who must relocate. Subjects were asked to scan condominium listings from "selected pages" of a bogus real estate magazine of another unnamed city, where after the allotted time they must indicate the condominium that they would most like to see if they had a limited amount of spare time while on a brief interview visit to the prospective employer's city. The listings were provided in a folder on two side-by-side pages, with half of listings under the heading of one sales agent and half of the listings under the other sales agent.

An objectively superior listing was included under one sales agent while an objectively second-best listing was included under the other sales agent. Listings of lesser objective value were included in the remaining listings. All listings describe the same features (e.g., inclusion of specific appliances), including similar types of neutral "filler" material (e.g., "meticulous landscaping"), and all are the same number of lines and about the same number of words in length. The objective value is varied by varying the kinds of appliances that are included (e.g., washer and dryer vs. washer and dryer hook-ups; kitchen sink disposal vs. dishwasher), by whether a garage or carport is included, and so on. Price, location (distance from work and
shopping) and several other features are held constant (via the cover story which describes the criteria ostensibly used by the researcher to select these ads) so that products can be compared on specific objective features. Again, the objective was for the subject to indicate a preference for the "best" product after the allotted reading time and to then complete the workload survey.

**Analysis of performance results.** One response variable of interest was the probability (percentage) of choosing the objectively "best" product in each cell. A significant decrease in such performance has been used by Malhotra (1982; Malhotra, Jain, & Lagakos 1982) to imply that the threshold of "information overload" had been surpassed. The percentage of subjects indicating a preference for the objectively "best" product in each cell of Prestudy 2 is illustrated in Figures 5.1 and 5.2. Results of the "peripheral" and "non-peripheral" conditions do not vary in ways that are relevant to the present discussion, so these two conditions were pooled so that the effects of changes in the number of ads can be compared to changes in task performance.

It appears possible, in the 1.5 minute condition and perhaps the 2.5 minute condition, that more information is better, to a point, and then more information is worse with regard to performance. The various ad conditions, then, must be treated as qualitative, rather than quantitative,
variables. That is, if these performance results are observed in absence of any other workload measures, it appears that it is not necessarily appropriate to presume that more ads create greater informational "loads" if subjects perform better under conditions of greater information. Therefore, a point of comparison is set at the apparent 10-ad peak for the 2.5 minute condition and at the apparent 8-ad peak for the 1.5 minute condition; of interest is a test of whether performance decreases at lower amounts of information and whether performance decreases at higher amounts of information.

The effects of these qualitatively different levels of "load" can be compared using a LOGIT analysis similar to that described by Malhotra, Jain, & Lagakos (1982), modelled in the form:

$$\log_e\left[\frac{P_i}{1-P_i}\right] = \sum b_k x_{ik}$$

(eq. 5.11)

where the response transformation is denoted as "log odds", $P_i$ is the probability (percentage) of choosing the objectively "best" product, $x_{ik}$ represents terms associated with the number of product alternatives in cell (i), and the interpretation of the parameters $b_k$ is qualitatively the same as in a non-transformed linear regression model, with the 10-ad peak of the 2.5 minute condition and the 8-ad peak of the 1.5 minute condition set as intercepts. Prior to
analysis, the data must be adjusted for the effects of
chance, using the correction:

\[ P_i = \frac{(P_{io} - P_{ic})}{(1 - P_{ic})} \]  
(eq. 5.12)

where:

- \( P_i \) = probability of "correct" choice adjusted for chance.
- \( P_{io} \) = uncorrected probability of "correct" choice.
- \( P_{ic} \) = probability of "correct" choice by chance alone.

A more detailed explanation regarding the use of this logistic transformation and the effects of chance will be provided in a Chapter VIII, but for the purpose of the present discussion, the direction and relative magnitudes of the b-parameters will assist in interpreting the shape of the load curves of Figures 5.1 and 5.2.

The results of a main effects only analysis, in which the 1.5 minute and 2.5 minute conditions are treated independently, are listed in Tables 5.2 and 5.3. Using this model, there is a significant decrease in performance between 8 ads and 10 ads and between 8 ads and 12 ads in the 1.5 minute condition, and a significant performance decrease between 10 ads and 12, 14, and 16 ads in the 2.5 minute condition. In either of these conditions, these results would be taken by Malhotra as an indication of "information overload" beyond the peak in each condition.
FIGURE 5.1

PRESTUDY 2: PERFORMANCE IN 1.5 MINUTE CONDITION

Note: results adjusted for the effects of chance (eq. 5.12).
FIGURE 5.2
PRESTUDY 2: PERFORMANCE IN 2.5 MINUTE CONDITION

Note: results adjusted for the effects of chance (eq. 5.12).
### TABLE 5.2

**PRESTUDY 2: PERFORMANCE IN 1.5 MINUTE CONDITION**

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>b</th>
<th>STDERR</th>
<th>TRATIO</th>
<th>FREQ</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>intercept (8 alts)</td>
<td>0.809</td>
<td>0.425</td>
<td>1.905</td>
<td>19/26</td>
<td>.05</td>
</tr>
<tr>
<td>4 alternatives</td>
<td>-0.861</td>
<td>0.578</td>
<td>-1.490</td>
<td>16/26</td>
<td>.10</td>
</tr>
<tr>
<td>6 alternatives</td>
<td>-1.411</td>
<td>0.590</td>
<td>-2.390</td>
<td>12/26</td>
<td>.015</td>
</tr>
<tr>
<td>10 alternatives</td>
<td>-1.363</td>
<td>0.578</td>
<td>-2.356</td>
<td>12/28</td>
<td>.015</td>
</tr>
<tr>
<td>12 alternatives</td>
<td>-1.401</td>
<td>0.585</td>
<td>-2.410</td>
<td>11/27</td>
<td>.015</td>
</tr>
</tbody>
</table>

Note: Freq. is original data; analysis adjusted for the effects of chance (eq. 5.12). The b-parameters represent the results of a LOGIT transformation, and so are interpreted qualitatively, but not quantitatively, as in the regression model.

### TABLE 5.3

**PRESTUDY 2: PERFORMANCE IN 2.5 MINUTE CONDITION**

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>b</th>
<th>STDERR</th>
<th>TRATIO</th>
<th>FREQ</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>intercept (10 alts)</td>
<td>0.866</td>
<td>0.400</td>
<td>2.166</td>
<td>22/30</td>
<td>.02</td>
</tr>
<tr>
<td>4 alternatives</td>
<td>-0.071</td>
<td>0.562</td>
<td>-0.126</td>
<td>22/30</td>
<td>ns</td>
</tr>
<tr>
<td>6 alternatives</td>
<td>-0.461</td>
<td>0.547</td>
<td>-0.843</td>
<td>20/30</td>
<td>ns</td>
</tr>
<tr>
<td>8 alternatives</td>
<td>-0.782</td>
<td>0.538</td>
<td>-1.455</td>
<td>18/31</td>
<td>.10</td>
</tr>
<tr>
<td>12 alternatives</td>
<td>-1.732</td>
<td>0.561</td>
<td>-3.088</td>
<td>11/31</td>
<td>.0025</td>
</tr>
<tr>
<td>14 alternatives</td>
<td>-1.468</td>
<td>0.553</td>
<td>-2.655</td>
<td>12/30</td>
<td>.0075</td>
</tr>
<tr>
<td>16 alternatives</td>
<td>-1.810</td>
<td>0.584</td>
<td>-3.129</td>
<td>19/29</td>
<td>.0075</td>
</tr>
</tbody>
</table>

Note: Freq. is original data; analysis adjusted for the effects of chance (eq. 5.12). The b-parameters represent the results of a LOGIT transformation, and so are interpreted qualitatively, but not quantitatively, as in the regression model.
Note from the graphic illustration of Figures 5.1 and 5.2, however, that the 1.5 minute condition appears to replicate the 2.5 minute condition, except that the 1.5 minute condition is offset to the left. That is, the apparent "overload" threshold appears to occur at a lower level of information in the 1.5 minute condition. This is a significant observation, in that it suggests that the shape and location of whatever curve is obtained in a particular "load" experiment is not necessarily due solely to the effects of changes in the amounts of information, but is, at least in this case, due to the effects of workload, which includes the factor of time.

Analysis of workload survey. On the assumption that variations in workload must indeed have been manipulated, then, the responses to the workload survey of Prestudy 2 were factor analyzed using maximum likelihood as the initial method as in Prestudy 1. On the basis of a "scree" plot of eigenvalues, four factors were retained, and an orthogonal rotation was performed using the varimax method.

Factor loadings are reproduced in Table 5.4. Factor 1, explaining 22% of the variance (weighted), appears to be interpretable as a factor related to the cognitive resource demands of the workload task. Factor 2, explaining 16% of the variance, appears to be interpretable as a factor related to the motivation to perform the task by the subject, or the amount of effort that the subject might be
<table>
<thead>
<tr>
<th>FACTOR1</th>
<th>FACTOR2</th>
<th>FACTOR3</th>
<th>FACTOR4</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRAINING</td>
<td>71 *</td>
<td>-13</td>
<td>21</td>
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<tr>
<td>COMPLEX</td>
<td>69 *</td>
<td>24</td>
<td>21</td>
</tr>
<tr>
<td>EXHAUSTING</td>
<td>66 *</td>
<td>-5</td>
<td>21</td>
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<tr>
<td>LABORIOUS</td>
<td>66 *</td>
<td>0</td>
<td>35</td>
</tr>
<tr>
<td>DIFFICULT</td>
<td>65 *</td>
<td>-2</td>
<td>34</td>
</tr>
<tr>
<td>DEMANDING</td>
<td>63 *</td>
<td>5</td>
<td>41</td>
</tr>
<tr>
<td>STRESSFUL</td>
<td>61 *</td>
<td>4</td>
<td>34</td>
</tr>
<tr>
<td>EASY</td>
<td>-61 *</td>
<td>3</td>
<td>-25</td>
</tr>
<tr>
<td>INTENSE</td>
<td>58 *</td>
<td>23</td>
<td>49 *</td>
</tr>
<tr>
<td>TIRESOME</td>
<td>57 *</td>
<td>-21</td>
<td>16</td>
</tr>
<tr>
<td>LENGTHY</td>
<td>57 *</td>
<td>-9</td>
<td>14</td>
</tr>
<tr>
<td>FRUSTRATING</td>
<td>56 *</td>
<td>-23</td>
<td>55 *</td>
</tr>
<tr>
<td>EFFORTFUL</td>
<td>56 *</td>
<td>22</td>
<td>25</td>
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<tr>
<td>DISCOURAGING</td>
<td>55 *</td>
<td>-27</td>
<td>31</td>
</tr>
<tr>
<td>CONFUSING</td>
<td>54 *</td>
<td>-17</td>
<td>34</td>
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<tr>
<td>SIMPLE</td>
<td>-53 *</td>
<td>2</td>
<td>-13</td>
</tr>
<tr>
<td>IRRITATING</td>
<td>51 *</td>
<td>-42</td>
<td>39</td>
</tr>
<tr>
<td>TIME CONSUMING</td>
<td>50 *</td>
<td>-6</td>
<td>-3</td>
</tr>
<tr>
<td>THREATENING</td>
<td>49 *</td>
<td>6</td>
<td>22</td>
</tr>
<tr>
<td>IMPOSSIBLE</td>
<td>49 *</td>
<td>-9</td>
<td>45 *</td>
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<tr>
<td>CHALLENGING</td>
<td>48 *</td>
<td>43</td>
<td>23</td>
</tr>
<tr>
<td>AGGRAVATING</td>
<td>47 *</td>
<td>-44</td>
<td>32</td>
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<tr>
<td>TIDIOUS</td>
<td>44</td>
<td>-20</td>
<td>14</td>
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<tr>
<td>QUICK</td>
<td>-41</td>
<td>20</td>
<td>8</td>
</tr>
<tr>
<td>INTERESTING</td>
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<td>77 *</td>
<td>11</td>
</tr>
<tr>
<td>ENJOYABLE</td>
<td>-12</td>
<td>76 *</td>
<td>-8</td>
</tr>
<tr>
<td>PURPOSEFUL</td>
<td>-8</td>
<td>73 *</td>
<td>0</td>
</tr>
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<td>PLEASURABLE</td>
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<td>72 *</td>
<td>2</td>
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<tr>
<td>WORTHWHILE</td>
<td>-13</td>
<td>67 *</td>
<td>-8</td>
</tr>
<tr>
<td>IMPORTANT</td>
<td>13</td>
<td>66 *</td>
<td>-3</td>
</tr>
<tr>
<td>CAPTIVATING</td>
<td>15</td>
<td>64 *</td>
<td>6</td>
</tr>
<tr>
<td>NUISANCE</td>
<td>34</td>
<td>-61 *</td>
<td>22</td>
</tr>
<tr>
<td>MOTIVATING</td>
<td>32</td>
<td>58 *</td>
<td>15</td>
</tr>
<tr>
<td>INVOLVING</td>
<td>36</td>
<td>56 *</td>
<td>21</td>
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<tr>
<td>UNNECESSARY</td>
<td>32</td>
<td>-55 *</td>
<td>16</td>
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<tr>
<td>BORING</td>
<td>24</td>
<td>-52 *</td>
<td>13</td>
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<td>EXACTING</td>
<td>27</td>
<td>49 *</td>
<td>-1</td>
</tr>
<tr>
<td>ANNOYING</td>
<td>48 *</td>
<td>-49 *</td>
<td>21</td>
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<tr>
<td>MINDLESS</td>
<td>-7</td>
<td>-47 *</td>
<td>-7</td>
</tr>
<tr>
<td>MUNDANE</td>
<td>9</td>
<td>-47 *</td>
<td>11</td>
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<tr>
<td>MONOTONOUS</td>
<td>19</td>
<td>-45</td>
<td>6</td>
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<tr>
<td>LEISURELY</td>
<td>-26</td>
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<td>-15</td>
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Table 5.4 (continued)

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<th></th>
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<th>FACTOR3</th>
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</tr>
</thead>
<tbody>
<tr>
<td>FRANTIC</td>
<td>24</td>
<td>2</td>
<td>87 *</td>
<td>-15</td>
</tr>
<tr>
<td>FRENZIED</td>
<td>32</td>
<td>4</td>
<td>86 *</td>
<td>-12</td>
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<td>FRETFUL</td>
<td>39</td>
<td>0</td>
<td>75 *</td>
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</tr>
<tr>
<td>HECTIC</td>
<td>47 *</td>
<td>-2</td>
<td>73 *</td>
<td>-17</td>
</tr>
<tr>
<td>RUSHED</td>
<td>27</td>
<td>-9</td>
<td>50 *</td>
<td>-29</td>
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<td>UNCERTAIN</td>
<td>15</td>
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<td>23</td>
<td>-19</td>
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<tr>
<td>CONFIDENT</td>
<td>-14</td>
<td>28</td>
<td>-21</td>
<td>84 *</td>
</tr>
<tr>
<td>SATISFIED</td>
<td>-18</td>
<td>25</td>
<td>-17</td>
<td>83 *</td>
</tr>
<tr>
<td>CONTENT</td>
<td>-22</td>
<td>22</td>
<td>-19</td>
<td>83 *</td>
</tr>
<tr>
<td>SUCCESSFUL</td>
<td>-15</td>
<td>22</td>
<td>-21</td>
<td>80 *</td>
</tr>
<tr>
<td>DISPLEASED</td>
<td>19</td>
<td>-6</td>
<td>21</td>
<td>-25</td>
</tr>
</tbody>
</table>

(Values greater than 45 have been flagged by '*')
willing to expend toward the use of cognitive resources. Factor 3, explaining 21% of the variance, is clearly associated with the time demands of the task. Factor 4, explaining 17% of the variance, is clearly associated with subjective perceptions of performance. A summary of the above interpretations is:

1. "Q": Cognitive resource load: Subjective assessment of cognitive resource demands of the task.
2. "F": Cognitive force: Subjective assessment of willingness to allocate cognitive resources (i.e., expend effort).

Discussion of Prestudy 2. It appears that the task of Prestudy 2 did indeed provide variations in workload, as evidenced by the performance curves of the 2.5 and 1.5 minute conditions. The workload survey was administered, then, after a task that apparently provided variations in mental workload. In addition to the expected factor of perceived performance, three factors emerged. One was clearly a factor associated with time constraints. Of the two remaining factors, one appears to be associated with a subject's perception of cognitive resources that the task requires, whereas the other appears to be associated with
the willingness of the respondent to allocate resources toward performing the task.

**General Discussion**

Although there has been an interest in issues of attention, information "overload", mental workload, and such, for over a century, there has been a curious lack of any conceptual, theoretical, or empirical development which helps to specify exactly what these concepts really mean. This chapter has proposed a conceptual model of mental workload, WHAM, and has empirically explored the potential natural dimensions of mental workload.

Although Prestudy 1 lacks a large enough sample size to be especially useful in determining the dimensions of mental workload, it was useful for the purpose of "seeding" an initial "bootstrap" procedure in the search for the natural underlying dimensions of mental workload; Prestudy 2 then used this list on a more reasonable sample size. Additionally, Prestudy 1 did not actively vary workload, whereas Prestudy 2 attempted to actively vary workload by varying the amount of work required and by varying the amount of time allotted to complete the task.

A limitation at this exploratory stage is the nature of the "seed" list of descriptive words. These words were generated by student subjects describing ordinary daily activities. Although these descriptors are associated with
a wide variety of ordinary everyday situations, they surely do not cover all issues that might relate to consumer mental workload. An issue currently considered in engineering psychology, for example, is personal risk (considered an element of psychological load by SWAT). Even as long as three decades ago, Russian researchers were attempting to model the effects of emotion on processing reliability (Simonov 1964, cited in Yankelevich 1965/1966), as when a jet pilot attempts to restart an engine in flight. Although the emotion generated during altitude loss in a flame out might not be of the same magnitude as the sorts of risk felt by a prospective purchaser, dimensions associated with such issues as financial risk or product performance risk (cf., Jacoby & Kaplan 1972) certainly might cause some sort of additional processing load or processing interference in some consumer situations. It is expected that dimensions other than those suggested by this analysis do exist in some situations.

The list of words used to "seed" this exploratory study is further limited in that no attempt was made to generate polar pairs of words, and some polar pairs of words were even removed from the initially long list. The measurement scales are unipolar, making it necessary to generate pairs of "opposites" if the present method is to be useful in the ultimate development of a more valid scale for the measurement of consumer mental workload. Such an issue is
the domain of future research, however. The nature of the studies presented in this chapter was not to hypothesize about the variables (words) or factors of workload, but to "seed" a "bootstrap" procedure without any particular a priori bias (excepting the "demand artifacts" and "perceived performance" issues) with the objective of uncovering the natural structure underlying the mental workload concept.

The structure that appears to emerge does loosely concur with the structure posited by WHAM. WHAM posits that the amount of cognitive work that can be performed is a function of resources, effort, and time. "Time" did clearly emerge as a distinct factor in Prestudy 1 and Prestudy 2. "Effort" seems to emerge as a motivation sort of factor, possibly related to a subject's willingness to allocate cognitive resources. "Resources" seems to emerge as a factor related to a subject's perception of the cognitive resources required by the task.

Perhaps missing from WHAM and the results of the workload survey of Pretest 2 are what SWAT refers to as "psychological load"; it seems reasonable to expect that there can be some sort of processing interference caused by such factors, but the workload task used in Prestudy 2 or the "seed" list itself do not flush this out. Conceptually, the interference caused by "psychological load" of SWAT would seem to be an inhibitor of "cognitive force", whereas the motivation factors resulting from the workload surveys
of Prestudy 1 and Prestudy 2 would seem to act as enhancers of "cognitive force". Nonetheless, the "bootstrap" procedure used in this chapter does appear to verify the dimensions of human mental workload as being analogous to a physical system. The possible existence of the dimensions apparently identified in this study perhaps offers additional explanation for findings that improvements in task performance sometimes also corresponds to increases in subjective workload (Yeh & Wickens 1988).

Additionally, the results of Prestudy 2 suggest that "information load" is a construct distinctly different from mental workload. In the 1.5 minute condition, 8 ads results in significantly better performance than 6 or 4 ads. Perhaps fewer ads provide fewer points of comparison, possibly leading to greater mental workload than at higher levels of information. Perhaps greater processing time assists when confusion occurs at levels in which not enough information is provided, but does not assist processing beyond the "overload" threshold, evidenced when the two curves are overlaid in Figure 5.3. Although this implication is very interesting, this dissertation will not pursue this notion further.

For the purpose of Study 3, the shift in the response peak when time allotted to the task is varied does indeed suggest, albeit not conclusively, that varying the number of ads in the choice set provides a workload dimension of time,
at least to the right of the peak, as would be suggested by the Bryan & Locke (1967) study. That is, near and beyond the peak, "more ads" yields the same performance results as "less time". This chapter has attempted to break down the underlying dimensions of mental workload. The remainder of this dissertation will address issues beyond the simple notion of processing mistakes by exploring the effects of mental workload on attitude change.
FIGURE 5.3
PRESTUDY 2: COMPARISON OF PERFORMANCE ABOUT PEAK
CHAPTER VI
AN INTEGRATED MODEL OF ATTENTION AND ATTITUDE CHANGE

Introduction

Such notions as "information overload" and "mental workload" are based on the assumption of a processing system of limited "capacity". Unfortunately, a simple, vague reference to "capacity" has no meaning without specifying the processing context in which "capacity" limitations are expected. There could be a variety of mental resources which process different kinds or aspects of informational inputs; capacity might be constrained by the kind of information that is input rather than by the overall quantity of information. The processing of some kinds of information can result in the automatization of some processes, altering the apparent limits in "capacity" for some processing tasks for some people who have acquired certain processing skills. Furthermore, "capacity" might be used differently by different processes such as "effort" and "elaboration"; different capacity-consuming processes might result in different kinds of outcomes.

Although the notion of "capacity limitations" seems intuitively obvious, it is evident from the discussion of
previous chapters that there are many aspects of apparent processing limitations that need to be addressed with respect to the study of "information load", "mental workload", and such. Given current limitations in our understanding of how the human information processing system works, it is unlikely that a single comprehensive model of information processing will soon be developed. This chapter will develop an integrated model of attention and attitude change (IMAAC) that, although limited, might be useful with respect to situations of consumer information processing. Specifically, this model accounts for:

- Capacity-limited processing
- Resource-free automatic processing
- Acquisition of information in memory
- Acquisition of skills
- Synthesis of new ideas
- Synthesis of or change in attitude

Two Aspects of the Information Processing System

The dual-process model of attention (DPM) has been proposed as a model for understanding how the processing of various stimuli might or might not result in learning or skill acquisition and how information is processed under the influence of previous learning and skill acquisition (e.g., Schneider 1985; Schneider & Fisk 1982; Schneider & Shiffrin 1977; Schneider, Dumais, & Shiffrin 1984; Shiffrin &
Schneider 1977). This model is relatively comprehensive in that it accounts, from the perspective of attention theory, for the effects of resource-consuming "effortful" processing as well as the effects of apparently resource-free automatic processing. In the context of "information overload", this model might be useful in the investigation of the effects of skill and automatism on the threshold of "overload" and might be useful in predicting what kinds of information will be retained in memory. In practical application, however, marketers are interested in more than just the level of "information overload" or in knowing what amount of information a person can recall from a marketing communication. Marketers are also interested in the persuasive effects of a marketing communication, or the attitude change that will result from a message.

The Elaboration Likelihood Model of Persuasion (ELM) presents an interesting and potentially useful complement to the DPM. The ELM has been proposed as a framework for understanding how various factors affect a person's attitude change (e.g., Cacioppo & Petty 1984; Petty & Cacioppo 1981, 1984, 1986a, 1986b). This model is relatively comprehensive in that it seems, from the perspective of attitude theory, to account for the effects of persuasion over a relatively wide range of situations and source factors, at least in a general manner. In the context of "information overload", this model might be useful in the investigation of attitude
change under conditions when processing abilities are and are not overwhelmed. The DPM and ELM provide slightly different aspects of the information processing mechanism. Although the DPM and ELM have evolved independently in different lines of research, both are concerned with explaining the mechanism of information processing. A most remarkable aspect of these two models is the conceptual consistency between them. This consistency is used to integrate these two models into a single framework that is more comprehensive than either model alone.

The Dual-Process Model of Attention

A prevailing view in attention research over the past 15 years has been that there are two qualitatively different forms of human information processing: those processes that do require the thoughtful attention of the person, such as "mental effort" and "elaboration", and those that are carried out automatically outside the direct control of the person. This notion is accepted as less of a dichotomy, however, than two ends of a continuum (c.f., Whitaker 1983). The DPM (dual-process model) assumes that there are two forms of information processing, but that these can be carried out simultaneously (Fisk & Schneider 1984; Schneider & Fisk 1982). The DPM postulates a continuum of information processing, anchored at one extreme by controlled processing and at the other by automatic processing. This model
assumes that people are neither universally "thoughtful" in the processing of information nor universally "mindless" (Figure 6.1).

![Diagram](image)

**FIGURE 6.1**

**CONTROLLED-AUTOMATIC CONTINUUM OF INFORMATION PROCESSING**

**Controlled processing.** According to this model, controlled processing is a mode used to deal with novel or inconsistent information. It is a sequence of processes activated through the attention of and under the control of the person. Controlled processing is characterized as slow, effortful, and limited by the capacity of short-term or working memory. The performance of tasks which involve such effortful processing are expected to result in learning and skill acquisition.

**Automatic processing.** Automatic processing is the activation of a learned sequence of elements in long-term memory. When an appropriate stimulus activates a learned sequence, processing proceeds automatically, characterized as a fast and relatively effortless process which is not
limited by the capacity of working memory and is not under the direct control of the person. The performance of tasks which involve such effortless processing are expected to be the result of previous learning and previously developed skill behavior, and are expected to result in little new learning and skill acquisition.

The DPM was proposed as a model for understanding how the processing of various stimuli might or might not result in learning and skill acquisition and how information is processed under the influence of previous learning and skill acquisition. It is not introduced here as the true or complete model of attention. It does, however, seem to account for the effects of attention and automatism over a wide range of situations.

The Elaboration Likelihood Model of Persuasion

There is evidence that there are two qualitatively different processing strategies that might be used by the processing system to synthesize an attitude: a strategy whereby thoughtful, "issue-relevant" thinking is engaged and a strategy whereby superficial, "non-issue-relevant" thinking is engaged. Like the DPM, this notion is accepted as less of a dichotomy than two ends of a continuum (cf., Cacioppo & Petty 1984, p. 673). The ELM postulates a continuum of message elaboration anchored at one end by a central route to persuasion and at the other by a peripheral
route. This model assumes that "people are neither universally thoughtful in evaluating a persuasive message nor universally mindless" (Petty & Cacioppo 1984, p. 668; Figure 6.2).

![Central-Peripheral Continuum of Information Processing](image)

**FIGURE 6.2**

**Central-Peripheral Continuum of Information Processing**

**Central route.** According to this model, when conditions are such that a person has the motivation and the ability to engage in issue-relevant thinking, the elaboration likelihood is said to be high. The person is likely to scrutinize and elaborate upon the message and to draw inferences about the merits of arguments presented in the message based upon his/her analysis of information derived from the message and from his/her own memory. When the elaboration likelihood is high, people will tend to engage in effortful thinking about the issue, which is expected to result in an attitude change that is more enduring, more temporally stable, and more accessible in memory (i.e., persistent and resistant).
Peripheral route. As various factors in the situation reduce a person's motivation or ability to think about an issue, the elaboration likelihood is said by this model to be low. A person will tend to avoid effortful thinking, and will conserve cognitive resources or expend them on some other task not relevant to the primary task (e.g., daydreaming). When the elaboration likelihood is low, people will tend to engage in a superficial analysis of the issue, drawing a "reasonable" attitude based on non-issue-relevant cues, such as the attractiveness or the apparent expertise of the source. This is expected to result in an attitude change that is less enduring, less temporally stable, and less accessible in memory (i.e., less persistent and resistant). The ELM suggests that when the elaboration likelihood is low, people will tend to process information along the "peripheral route" to persuasion, and when the elaboration likelihood is high, people will tend to process information along the "central route" to persuasion.

The ELM was proposed as a framework for understanding how various factors affect a person's attitude change. It is not introduced here as a true or complete model of persuasion. It does, however, seem to account for the effects of persuasion, at least in a general manner, over a relatively wide range of situations and source factors.
An Integrated Model of Attention and Attitude Change

Contrasting DPM and ELM: IMAAC. In an apparent effort to downplay similarities between the DPM and ELM, Petty & Cacioppo briefly address certain concepts relating their model of persuasion with attention theory (1986b, p. 11-14). One objective in their discussion is to emphasize that their notion of central/peripheral processing and the notion of controlled/automatic processing are not the same. It would seem, however, that this difference can be used to advantage in detecting and discriminating different processes and constructs if both approaches are used.

The two theories are similar in that each is conceptualized along a continuum, ranging (in a very basic, simplistic sense) from "mindless" sort of processing to rather "thoughtful" processing. They differ in how various stimuli will trigger or engage a "mindless" or "thoughtful" mode of processing and in the outcome of such processing.

Controlled processing and central processing might both be described as somewhat "thoughtful" in the sense that both involve effortful, deliberate control of message processing by the subject and both result in enduring changes in memory or attitude. Both require the synthesis of a unique response based on stimulus information and on information engaged from long-term memory.

Automatic processing might be described as somewhat "mindless" in the sense that it does not involve effortful,
thoughtful, deliberate control by the subject and does not result in changes in long-term memory. Peripheral processing might be described as somewhat "mindless" in the sense that it does not involve effortful, thoughtful, deliberate processing of issues relevant to the issue of the message and does not result in enduring, stable changes in attitude. Peripheral processing, however, might be effortful in the attentional or workload sense in that non-issue-relevant information might activate processing sequences which consume greater reserves of capacity-limited working memory.

It would seem that if peripheral processing results from a rather superficial analysis of source factors such as attractiveness or apparent expertise, this would usually be a form of automatic processing. The response to the stimulus is not a unique synthesis of external or internal information and is not unique to the situation, but is generalizable across a variety of situations. This response is not expected to result in enduring changes in memory or attitude.

As Petty & Cacioppo note, however, peripheral processing can engage effortful thinking. It is possible that a person can perform a superficial analysis of a message because of lack of motivation or lack of ability. If a person lacks the motivation to process a message, s/he might have to expend additional effort in order to process
the information because the limit on processing "capacity" is lowered when motivation or arousal is low (Kahneman, 1973). This, then, is a form of peripheral/controlled processing.

If a person lacks the ability to process the arguments of a message, then the person might have to rely on a strategy based on non-relevant information. Although the message content is not being elaborated, the strategy involved in arriving at a conclusion might involve effort in attempting to synthesize internal information with irrelevant external information. In this situation, attitude theory would predict that the attitude adopted from such superficial processing would not be so enduring or stable, but attention theory would predict that some skill would be acquired or that learning (in the sense of a change in long-term memory) would take place if effort was expended. In this sense, perhaps this peripheral/controlled processing mode results in a skill acquisition which results in future peripheral/automatic processing in similar situations. It is also possible that something in this situation is learned that is not relevant to the message.

It appears, then, that the application of both theories would result in a three dimensional continuum, anchored by central/controlled processing, peripheral/automatic processing, and peripheral/controlled processing. Central/controlled processing would be expected to result in
an enduring attitude change and in memory of issues associated with the communication. Peripheral/automatic processing would be expected to result in a less stable attitude change and in less memory for issues associated with the communication. Peripheral/controlled processing might be expected to result in a less stable attitude change but to result in greater memory for issues irrelevant to or possibly unintended by the communication (Figure 6.3).

FIGURE 6.3
AN INTEGRATED MODEL OF ATTENTION AND ATTITUDE CHANGE
An example. Borrowing on the example of Petty & Cacioppo (1986b, p. 13-14), consider the scenario of a student who is taking an exam. The student is very familiar with most of the material over which s/he is being tested. After carefully reading each question and set of answers, s/he thoughtfully relates this information with what s/he remembers about the material, attempts to integrate all new and recalled information in synthesizing an answer, and chooses an option which most closely matches this synthesis. As Petty & Cacioppo note, the student's responses from such "thoughtful" processing are likely to be more stable and enduring than if the answers were based on a more "peripheral" analysis of the question.

Now consider that the student encounters a question regarding material over which s/he is very unfamiliar. The student might read the question and set of answers but make a minimal attempt to relate this information with what s/he remembers about the material and make only a minimal attempt to synthesize an answer. The response given by the student in this situation is likely to be based on information not relevant to the issue of the question. The student might, for instance, choose the answer "d" because "d" was less frequently marked than other options on previous questions. The response to this question by the student is not necessarily irrational or "effortless", but rather is based on a decision rule which is irrelevant or peripheral to the
primary issue of the question. The student is likely using some form of "effortful" processing by relating information about the exam with what s/he remembers about exam-taking in general.

In eliciting a response to this latter question, information was processed in both a "peripheral" and "controlled" manner. The response with regard to issues relevant to the question is likely not to be stable and enduring. The student is likely to be unable to recall what answer was given to this question after completing the exam. The student might very well, however, be able to recall which letter option ("d") was chosen, and why, in hallway discussions with fellow students after the exam. Additionally, the student might be unable to recall the question, but might be able to recall a global evaluation of the question, as in commenting to fellow students that it was a "bad" question. Something is remembered and clearly recalled, but it is not what was intended by the instructor who prepared the exam.

Discussion

A limitation of IMAAC₃ is that it assumes a capacity-limited processing system. As noted in previous chapters, a problem with the "capacity" assumption is that it is somewhat circular as a theoretical claim, and it might not be entirely correct. Given current limitations in
understanding the human processing system, however, the
capacity assumption does not seem entirely unreasonable.

A restriction of IMAAC$_3$ is that it does not account for
multiple resources, except for the special case of
automatism. It is clear from discussion in previous
chapters that a single-resource assumption is not valid.
IMAAC$_3$ currently cannot easily be extended to account for
multiple resources because there is currently not a clear
understanding of just what these different resources are;
there is only evidence that more than one resource is
apparent. Reasonable precautions must be taken, then, to
limit the use of IMAAC$_3$ to apparent single-resource
situations.

The integrated model is not proposed here as anything
new, but rather as an integration of currently existing
models of information processing which might provide a
useful framework on which to study the concept of mental
workload in the context of attitude change. Although never
modelled graphically, the concept of the integrated model
has been considered by Petty & Cacioppo (Cacioppo, personal
conversation, January 1990). Furthermore, this is not the
first model of information processing that has considered
issues of "capacity" and attitude change; existing well
known models include those of Bettman (1979) and Greenwald &
Leavitt (1984). In addition to "capacity" residing in
multiple resources (i.e., more complex than a simple
continuum when the whole of the processing system is considered), processes involving attitude structures are also likely to reside at various levels (i.e., more complex than a simple continuum when the whole of the processing system is considered), as elegantly conceptualized in Greenwald's "Levels of Representation" (1988a; see less complete discussion in 1988b).

IMAAC, however, takes a "process" approach rather than a taxonomic approach to the human processing system. Although the "continuum space" model of IMAAC might ultimately prove to be too simplistic, it follows "Occam's Razor"; without compelling evidence to suggest otherwise, start with the simplest model. IMAAC is not to be viewed here as a necessarily true or correct model, or even as a competitor of other existing models, but as a reasonable model of a particular aspect of the processing system on which to base an investigation of processing outcomes in marketing applications under varying conditions of mental workload.

In considering IMAAC\textsubscript{3} as a reasonable model, it must be recognized that the three-dimensioned model presented in this chapter is not a comprehensive model. Specifically, it ignores the ambiguous issue of expertise. Before discussing the issue of expertise, let us redraw the three dimensioned IMAAC\textsubscript{3} with its underlying axes overlaid (Figure 6.4). Evidently, the three-dimensional model is a non-orthogonal
mapping of a "controlled-automatic" axis and a "central-peripheral" axis. The "controlled-automatic" dimension apparently represents task-relevant cognitive effort; the "central-peripheral" axis apparently represents issue-relevant cognitive effort.

It seems possible and quite reasonable to view the arrangement of these axes as arbitrary. Consider, for example, pivoting these axes at the "automatic" and "central" ends, allowing the tails to slip around at will. The "slippery axes" of IMAAC might now be arranged in, say, an orthogonal manner, perhaps representing a four-dimensional model, IMAAC\textsuperscript{4} (suggested by Cacioppo, personal conversation, January 1990). The four-dimensional model now has an additional mode of processing, "automatic/central" (Figure 6.5).

The notion of an "automatic/central" form of processing presents a paradox, however. The ELM posits that central processing is associated with message elaboration, which implies that some sort of cognitive effort is required. The notion of automatism, however, implies that cognitive effort is not required. It does seem possible that a person with some sort of expertise could arrive at a decision based on the central merits of a message, yet expend very little effort in doing so: i.e., not "elaborate". Cacioppo, Marshall-Goodell, Tassinary, & Petty (in review) have begun to address this issue, but there is yet little theory or
empirical exploration to guide any predictions regarding the outcome of such a mode of processing. Given the ambiguities presented by this fourth dimension, IMAAC\textsubscript{4} will not be used in the present research. In using IMAAC\textsubscript{3}, care must be taken, then, to control for the possible effects of expertise.
FIGURE 6.4
THE STRUCTURE UNDERLYING IMAAC$_3$
FIGURE 6.5

THE STRUCTURE UNDERLYING IMAAC$_4$
CHAPTER VII
APPLICATION OF IMAAC\textsubscript{3} TO WORKLOAD: A WORKLOAD OPERATING CHARACTERISTIC AND SOME PREDICTIONS

Introduction

Of interest in the final chapters of this dissertation is the effect of mental workload on attitude change. The "elaboration" construct that forms the basis of the ELM implies the use of processing resources (Q) and the expenditure of effort (F), but these are considered only under moderate or low workload conditions. That is, the "elaboration" construct, not specifically defined as it relates to the notion of workload, does not alone account for extremes in task demands, as in conditions of "information overload".

Although the operators of aircraft and other machinery have been observed to exhibit decreases in processing reliability (i.e., decisional mistakes) as mental workload becomes excessive, what might happen in a typical consumer situation? There appears to be evidence from the results of studies such as Malhotra (1982) and Prestudy 2 discussed in Chapter 5 that people in consumer situations will exhibit a higher likelihood of decisional error under high "load" conditions. Such studies of decision making ignore,
however, the important issues of memory and attitude change. If the purpose of a marketing communication is to inform and persuade, then any model of workload in a consumer context should attempt to account for the effects of "load" on memory and attitude change as well as on immediate decision making.

A Process Approach to IMAAC3

Consider again the example of the student taking an exam. The student knows most of the material covered in the exam, and can make an "objective" and "rational" decision in answering most of the multiple choice questions. When the student encounters a question, learned information is recalled from memory to "systematically" synthesize a new structure that is used to derive an answer. The central/controlled mode of processing of IMAAC3 might, then, be characterized in this situation as rational, objective, and systematic in nature.

Now consider what happens when the student encounters a question over material that is unfamiliar. Information in memory cannot be systematically assembled from memory to synthesize an answer. The student can use other clues in the situation, however, such as the frequency of letters used in previous answers on the multiple choice exam. The student might use a "heuristic" based on these frequencies, as in choosing the answer "d" because it was less frequently
marked on previous questions. This is still a very
"rational" way to arrive at a decision, and does indeed
require some amount of cognitive effort. It is, however,
"subjective" in that this decision is not based on the
"objective" information relating to the question, but is
based on the use of available cues.

As noted in the discussion of IMAAC₃, this cue-based
"heuristic" mode of information processing corresponds to
peripheral/controlled processing. This corresponds directly
with Shostack's (1977) notion of "peripheral clues". For
example, given an inability to objectively assess the
performance of an attorney, a physician, or an auto
mechanic, a consumer's assessment of service quality might
be more influenced by situational cues, such as the
furniture and wall coverings in the attorney or physician's
office, or the neatness and cleanliness of the mechanic's
repair shop (cf., Lovelock 1984; Shostack 1977). A coffee
stain on an airline seat might influence a passenger's
perceptions regarding engine maintenance (cf., Peters &
Waterman 1982). The future reliability of a complex product
such as a microcomputer cannot be easily examined, and a
prospective purchaser might therefore be more likely to be
influenced by some other clues to judge future product
performance (cf., Owen & Cooper 1991). The
peripheral/controlled mode of processing of IMAAC₃ might,
then, be characterized in such situations as rational,
subjective, and heuristic-based in nature.

Now consider the situation of "overload". Under the assumption of a "capacity" based model of information processing, "capacity" is "used up", resulting in "dysfunctional" system performance. If "capacity" is fully consumed, then there must be no "rational" mechanism left to be utilized in recalling information from memory or in synthesizing new information to make a decision, to form new memories, or to form new attitudes (i.e., change from neutral). If "capacity" is a cortex-based process, and capacity becomes fully consumed, then the only processing mechanisms left must be the more primitive non-cortex mechanisms. These non-cortex mechanisms might be characterized as not under the direct control of the person, including conditioned responses and emotion- or affect-influenced responses to external stimuli. That is, these non-cortex processes would be characterized as "irrational" and autonomic or automatic in nature.

These three distinctively different modes of information processing are compared with the original labels placed on IMAAC₃ in Figure 7.1. The new label "systematic" would appear to concur with Chaiken's (1989) notion of "systematic" processing. The new label "heuristic" would also appear to concur with Chaiken's systematic-heuristic model, except for one important difference. The Chaiken model views "heuristic" processing as being less effortful
than "systematic" processing, whereas these labels as they are used in IMAAC\textsuperscript{3} allow "heuristic" processing to be just as effortful as "systematic" processing, since both can occur at the same extreme of the controlled-automatic continuum.

The IMAAC\textsubscript{3} Workload Operating Characteristic

Consider IMAAC\textsubscript{3} as drawn again in Figure 7.2. Recall that the structural axes of IMAAC\textsubscript{3} were associated with issue-relevant processing and task-relevant processing. Recall also that WHAM posits "work" to be constrained by time, quantity (ability to process), and force (willingness to exert cognitive effort). The structural axes of IMAAC\textsubscript{3}, then, are apparently associated with constraints on time and on an ability or willingness to engage in issue-relevant processing (x-axis) and on an ability or willingness to engage in task-relevant processing (y-axis). Note that the y-axis represents a "capacity"-related process. As more "capacity" is expended in the workload task, less "reserve" is available to perform the syntheses of new ideas, attitudes, etc. As the WHAM factors of T, Q, and F are affected by task demands and by the processing system of the individual, it might be possible to observe a "load curve" within the space of IMAAC\textsubscript{3}, or "IMAAC\textsubscript{3} Workload Operating Characteristic", passing through certain points (see Figure 7.2):
"AUTOMATIC"

- not under direct control of person
  - e.g., conditioned response, affect-influenced response
  - "irrational"

"SYSTEMATIC"

- under control of person
  - "objective"
  - rational

"HEURISTIC"

- under control of person
  - "subjective"
  - rational

FIGURE 7.1
IMAAC$_3$ PROCESSES
X AXIS: ability or willingness to engage issue–relevant processing
Y AXIS: ability or willingness to engage task–relevant processing

FIGURE 7.2
IMAAC3 WORKLOAD OPERATING CHARACTERISTIC
A) Under low workload, the person is expected to have the ability and motivation to effortfully process issue-relevant information.

B) Under moderately high workload, the person is expected to lose the ability to process effort-consuming information, but to still maintain motivation to attempt to make a "reasonable" decision based on other information.

C) Under very high workload, the person is expected to lose the ability to process any information, and therefore motivation as well, and be unable to attempt a reasonable decision.

D) Under some conditions, even the automatic system might not be equipped to aid processing, resulting in an outcome that cannot be predicted by this model.

Predictions Based on the IMAAC$_3$ WOC

The proposed Workload Operating Characteristic is specific only to the issue of mental workload, and the exact shape is assumed to be moderated by a number of factors. If the proposed IMAAC$_3$ Workload Operating Characteristic, based on the posits of DPM and ELM, is, cet. par., correct, then
the following outcome predictions can be made with regard to
a marketing communication at the illustrated points:

P(A): Greater recall of objective, message-relevant
information than subjective, message-irrelevant
information ("peripheral cues"); attitude change
based on objective information. Decision most
influenced by objective information.

P(B): Decreased recall of objective, message-relevant
information and increased recall of subjective
message-irrelevant information ("peripheral
cues"); attitude change based on subjective
information. Decision influenced more heavily by
subjective information.

P(C): Low recall of both objective and subjective
information; attitude change based on subjective
information. Decision most influenced by
affective aspects of subjective information, if
present, than objective information, influenced
by conditioned responses if an automatic
mechanism exists to react to stimuli that are
present, or approaches randomness.
P(D): Undefined by IMAAC$_3$, but possible: behavior does not follow ELM, is unpredictable. Decision is random.

Discussion

IMAAC$_3$ has been discussed in this chapter in the specific context of increases in mental workload. On the basis of the posits of DPM and ELM, a general Workload Operating Characteristic has been traced, leading to specific predictions regarding the effects of increases in mental workload on the processing outcomes of memory (learning) and attitude change. As workload increases, immediate decision outcomes can also be predicted based on the influence of the type of information that is used in various processing modes along the workload curve.

Note that increases in workload correspond to a rightward movement along the curve, but that this does not necessarily correspond to increases in information. Recall that results from the studies presented in Chapter V suggest that "information load" is apparently different from "mental workload". "Workload" is affected by such factors as time and the amount of effort that a person is willing to expend in the performance of a task; these variables can affect the location of a point along the Workload Operating Characteristic while the level of information remains constant. The results presented in Chapter V indicate that
decision performance can decrease with lesser amounts of information, suggesting an increase in mental workload, due, perhaps, to an increase in difficulty in comparing smaller amounts of information. Therefore, it seems possible that both increases and decreases in information could cause a rightward movement along the workload curve, both resulting in the same predictions with respect to memory and attitude change.

These propositions regarding the effects of different levels of mental workload on memory and attitude change will be tested in Study 3. These will remain as statements of proposition, rather than hypotheses, because the issues underlying these propositions are too complex; each proposition relies on a bundle of smaller assertions regarding the relationship of "information load" and "mental workload", the way that objective and subjective information is used, and so on.
CHAPTER VIII
PROTOCOL AND METHOD

Introduction

The initial "information overload" studies in marketing were concerned with the question, Is more better or worse? It seems intuitively obvious that there must exist some asymptotic limit in the amount of information that the processing system can use at any given moment, as argued so elegantly in Miller's (1956) "magical number seven" paper. This notion has found theoretical support in the "capacity" models (e.g., Kahneman 1973; Moray 1967) and empirical support in the marketing "information overload" studies (e.g., Malhotra 1982). Clearly, "more is worse" beyond a point, supported conceptually, theoretically, and empirically.

Although the observation that the mental processing system can "overload" is interesting, this observation is of limited value by itself. Several issues regarding the notion of "information load" remain to be answered. First, might less information also be worse before a certain point in some situations? As information load is decreased, might it be possible for people in some marketing situations to
experience greater difficulty in, say, comparing product information? If it is possible for lower amounts of information to sometimes make product comparisons more difficult, then it is possible for less information to sometimes result in greater mental workload. Since mental workload is a capacity-based construct, problems of processing reliability could be evidenced at low levels of information load as well as at high levels.

Related to the capacity issue is motivation. WHAM posits that work capacity is a function not only of the quantity of resource capacity, but of the force of effort exerted in the use of resources. The motivation to exert effort must vary in different situations, and even the difficulty of a task (e.g., too much information) might affect the motivation to exert effort (in either direction). If motivation can affect the amount of "work" that the processing system can perform at some instant in time, then motivation, like capacity to process some limited amount of information, could affect the point at which the processing system begins to exhibit problems of reliability. The factors of motivation and time, then, make the identification of some specific quantitative threshold of "overload" of limited value: any "overload" threshold that is identified in a particular study of information load is relative to some constant in time and motivation across subjects. That is, this quantitative value is alone of
little use beyond the observance of its existence.

Of greater interest in the present dissertation, then, are questions that are more qualitative in nature. In addition to the "is less worse" issue, one might ask, what happens to motivation as information load and mental workload change? Might information "underload", if not more confusing, lead to a decrease in motivation and effort, thereby affecting the capacity to do work? In addition to the effects of changes in workload on decision making reliability, what are the effects of changes in mental workload on attitudes and recall? Since marketing communications almost always contain subjective information (peripheral cues) in addition to objective information, what changes in the use of these qualitatively different types of information occur as mental workload changes?

**Study 3: Protocol**

**Objectives.** Study 3 was a between subjects design, conducted to:

1) Provide subjects with differing amounts of information.

2) Provide subjects with differing types of information, including objective and peripheral information.
3) Detect changes in mental workload (on several dimensions) as varying amounts of information are provided.

4) Detect differences in attitude toward objective and subjective objects of a communication as amounts of information and workload are varied.

5) Detect changes in recall of peripheral information as amounts of information and workload are varied (no measures of objective information recall were taken in this study).

**Stimuli.** Information load was varied in the pioneering "overload" studies by varying the number of products in the a choice set and by varying the number of features used to describe products; the response variable of interest was the probability (frequency) of correctly choosing a "best" product as information load increased. The present Study 3 varied "information load" by varying the number of products in a choice set, with a response variable of the frequency of "correct choice" in each cell as in the earlier studies. As in Prestudy 2, Study 3 was a between subjects design, with each subject in a cell of 4, 6, 8, 10, 12, 14, or 16 product alternatives in the choice set. Product descriptions were in the form of advertisements.
Unlike Prestudy 2, time was not varied; each subject was given exactly 2.5 minutes to read all information in the choice set, after which they were to immediately indicate a preference for a "best" product. Half of the subjects also received "peripheral" information in addition to the objective information. All product descriptions in each choice set were provided on two pages, half of the ads on each page, with the page ordering also manipulated. Study 3 was, then, a 7 (number of products in choice set) X 2 (peripheral information included or not included) X 2 (page ordering) between subjects design. The layout of these stimulus materials is illustrated in Figure 8.1. A detailed description of the stimulus materials is provided in Appendices A and B.

Subjects. Housing was chosen as the product class to use in this research since virtually everyone is familiar with the basic features of the product, yet few people have extensive experience in purchasing the product. Recall that IMAAC\textsubscript{3}, used in developing the propositions of Chapter VII, does not address the factor of expertise, requiring that an attempt must be made to control for this factor. Student respondents, then, were used in Study 3 since buying experience with this product class is likely to be highly homogeneous (i.e., almost non-existent) within this group. These subjects were shown ads for condominiums described with apartment features.
FIGURE 8.1

GENERAL LAYOUT OF WORKLOAD TASK
General procedure. The cover story implies that the business school is conducting a survey for employers who assist new recruits who must relocate. The respondents are asked to scan condominium listings from "selected pages" of a bogus real estate magazine of another unnamed city, where after two and a half minutes they should indicate the condominium that they would most like to visit if they had a limited amount of spare time while on a brief interview visit to the prospective employer's city. The listings are provided on two side-by-side pages (see Figure 8.1), with one set of listings under the heading of a sales agent pretested as a "neutral" cue and the other under the heading of an agent pretested as a "positive" cue see Appendix A for a more detailed discussion). Half of the subjects receive both the "objective/central" and "subjective/peripheral" information, while the other subjects are shown ads where the "peripheral" information has been blocked out.

An objectively superior listing is included under the sales agent of neutral credibility and attractiveness; an objectively second-best listing is included under the sales agent of positive credibility and attractiveness. Listings of lesser objective value are included in the remaining listings. All listings describe the same features (e.g., inclusion of specific appliances), including similar types of "filler" material (e.g., all reference "good location"), and all are the same number of lines and about the same
number of words in length. The objective value is varied by varying the kinds of appliances that are included (e.g., washer and dryer vs. washer and dryer hook-ups; dishwasher vs. sink disposal), by whether a garage or carport is included, and so on (see Appendix B for a more detailed discussion). Price, location (distance from work and shopping) and several other features are held constant (via a cover story which describes the criteria ostensibly used by the researcher to select these ads) so that products can be compared on specific objective features (see Appendix C).

Subjects are to immediately indicate their preferred listing at the end of 2.5 minutes, the folder containing the two pages of ads then being taken from them, and they then complete the workload survey that was developed in Prestudies 1 and 2. After the workload survey, subjects then complete several surveys designed to measure attitudes and recall, are asked several open-ended questions regarding their perceptions of the purpose of the study, are debriefed, and dismissed (see Appendix C). An "objective information only" session requires about 25 minutes to complete; a "peripheral information included" session requires about 35 minutes due to additional measures regarding the influence/use of the peripheral material.

General analysis. The response variable of interest in the "information load" studies was the percentage of subjects making a "correct choice" in each cell. The
performance curve traced across cells could be of a variety of shapes (cf., Malhotra, Jain, & Lagakos 1982), with Malhotra (1982) finding a decrease in "correct choice" at higher levels of information. It has been hypothesized for many years, however, that the performance curve could in some situations be of an inverted U-shape (e.g., Buck 1974). The results of Prestudy 2 (Chapter V), based on a larger sample size than the n=12 per cell of Malhotra and having a constraint on processing time, also appear to support the inverted U-shaped curve. One important issue of interest in Prestudy 3, then, is the shape of the performance curve in a study that attempts to heed the methodological concerns of Malhotra, Jain, & Lagakos 1982) and also attempts to use a more reasonable sample size than Malhotra (1982) for binary analysis.

The shape of the performance curve, however, provides only limited insight with regard to "mental workload". This performance curve only traces performance; it does not explain the underlying cause of performance changes. As found in Prestudy 2 (Chapter V), "workload" appears to consist of dimensions that include, at least, time, resource demands, and motivation to exert effort. A comparison of the performance curve with curves based on measures of the dimensions postulated in WHAM (discussed in Chapter V), then, is necessary to help explain causal effects on the shape of the workload operating characteristic that is based
on the propositions of IMAAC3 (discussed in Chapters VI and VIII). It is necessary, then, to take subjective measures in addition to the workload measures that were used in Prestudy 2.

Of great interest in this final study is the effect of changes in mental workload on attitude change. IMAAC3 proposes various outcomes with regard to the effects of mental workload on recall, attitude change, and choice behavior. In addition to measures of choice behavior, then, measures of recall and attitude change must be taken to test if IMAAC3 is a plausible model. Recall of specific products in the choice set will not be taken due to the length of the survey, but recall and attitudes toward each sales agent, as well as global attitudes toward each product, and are to be taken.

Specific Procedure

Subjects were run in groups of as large as (limited in size to) 14, with group sizes of around 10 or 12 as typical. Due to differences in the survey form, subjects in the "objective information only" and "peripheral" conditions could not be run in the same session. Subjects were run, however, in different conditions of workload (number of products in the choice) during the same session.

Workload choice task. The survey form was attached to the stimulus folder with a large paper clip that also held
the folder closed. Subjects were specifically asked not to open the folders when they were passed out. A more detailed discussion regarding the stimulus materials can be found in Appendix A, and a more detailed discussion regarding the survey instrument can be found in Appendix C.

On the back of each folder is information ostensibly describing the purpose of the survey. Subjects were given a few minutes to read this information, but were instructed by the experimenter not to open the folder until everyone had finished reading this information. The experimenter then briefly reviewed this information, noting that participants would be asked to choose the one condominium that they would most prefer to visit if on a brief employment interview to another unnamed city, and that all condominiums in these ads are about the same price, about the same driving time from the prospective employer, and about the same distance from shopping and entertainment. Subjects were further reminded that everyone in the room had a different set of ads with a different survey in some cases, so they should be very patient and understanding if some participants must take a bit longer than others to finish some sections in the survey. They were instructed that since some 56 different sets of advertisements were being assessed in this survey, it was decided to place a time limit of two and a half minutes on the reading of ads, regardless of which ad anyone in the room happened to receive.
Subjects were then asked to turn over their folders to view the cover page of the survey and asked to read the "main question of interest" at the bottom, which asked for a first and second preference. They were then told by the experimenter that the primary interest was in their first preference, but that since the most preferred property in such situations is sometimes unavailable, the researchers thought it a good idea to have them keep in mind a second "backup" preference as well. They were asked to put down their pencils and not to write anything while reading the ads, but to form their preferences and keep them in mind while reading so that they could quickly indicate their preference when the 2.5 minutes was up. They were then asked to remove the paper clips, place the survey form on their desk under the folder, and to open the folder and begin reading the ads. Reading was timed to exactly 2.5 minutes, after which subjects were asked to quickly indicate their preference while the experimenter collected their folders, and to continue on through the next two pages of the survey.

**Subjective measures of workload.** Subjects were instructed to complete the subjective workload measures on the next two pages, which was the list of descriptive words used in Prestudies 1 and 2. The experimenter indicated that this would take a few minutes and that they should quietly wait at the end of the two pages for everyone else in the
room to catch up before continuing. The time limit was in almost all cases held at exactly 4.5 minutes, but in some cases the time limit was cut to as short as 4:15 because it was clearly obvious to all participants that everyone in the room was finished, and extended to as long as 4:45 to allow some subjects to finish. If, as was the case in a few instances, a participant was not finished by 4:45, the group was informed that it is OK not to finish, but that the survey must move on to the next section to stay on schedule. Throughout the session, the experimenter attempted to minimize any appearance that the sections were being precisely timed, attempting rather to maintain an appearance of keeping everyone on the same section until all had caught up for the purpose of providing oral instruction when moving to a new section. Subjects were asked to turn to the next page in the survey.

Product attitude measures. Subjects were provided with a reduced representation of the side-by-side ads they had viewed with a box in each position where each product had been described. At the top of each side-by-side page in the mock-up of the condominium ads were the instructions:

Think about each of the condominiums that were shown on the LEFT (right) page. Place an X on the scales in each box below to indicate your impressions of that condominium. On the last line (4) in each box, indicate how confident you are in your ability to rate that condominium.
In each box that replaced each product description were four 5-point scales; anchored by:

1. worst—best
2. like—dislike
3. good—bad
4. no—yes

SURE?

Subjects were told that this page should take about three minutes, but that they should not turn to the next page until everyone had finished. The time limit on this page was in almost all cases held at exactly 3.25 minutes, but was in some cases cut to as short as 3:05 because it was obvious to all participants that everyone in the room had finished, and in some cases the time limit was extended to as long as 3:30 to allow some subjects to finish.

Subjects in the "central information only" condition, in which information regarding the agent was blocked out, then turned to the final page which contained several short answer questions. Subjects in the "peripheral" condition, in which the ads contained additional information regarding sales agents, next turned to three pages which attempted to assess the use of and influence of this agent information.

Agent attitude measures. Subjects were provided with a reduced representation of the side-by-side ads they had viewed, with instructions at the top of each page:
Think about the agent who was selling condominiums shown on the LEFT (right) page. What are your perceptions of this real estate agent? Place an X on each of the scales below to indicate your impressions of this agent.

Below the instructions at the top of each page was a list of 7-point scales, anchored by the words:

- attractive---unattractive
- clumsy/awkward---refined
- experienced---inexperienced
- honest/sincere---deceitful/shifty
- immature---mature
- confident---insecure
- lazy/slow---quick/responsive
- careful---reckless
- uncooperative---helpful
- likeable---unlikeable
- good listings---bad listings

Subjects were in all cases given exactly 2.0 minutes to complete this page.

Agent free recall. Subjects were provided with a reduced representation of the ads they had viewed, with boxes at the top of each page to represent blocks of information regarding the sales agents. At the top of this
page of the survey were instructions to fill in all the information they could recall about the agents. The experimenter commented upon turning to this page that the subjects were to spend exactly 2.5 minutes working on this page "whether or not you feel you need it". This comment was made to put at ease those subjects who had not used any of the peripheral information in reading the ads and would view this as an impossible or ridiculous task; more specifically, this comment was necessary to alleviate problems of some subjects commenting or giggling. In almost all cases, even subjects who initially looked surprised upon seeing this page did begin to write something within a minute or so.

Agent aided recall. Subjects were next provided with a list of 33 descriptors of peripheral information, some of which had appeared in the ad that they had viewed, and asked to check off those items that they thought they recognized from the ads. The instructions asked them to then go back and place an "L" next to those items that were on the left page ad, and an "R" next to those items that were on the right page ad. This page was given a strict 2.5-minute time limit.

Debriefing. The last page of the survey consisted of four open-ended questions:

1) What most caused you to like or dislike any of these houses?
2) What additional information would make the advertisements in The Housing Locator Monthly more useful to you?

3) In your own words, briefly describe what you believe to be the purpose of our survey.

4) Do you have any other suggestions that you would like to share?

Subjects were given enough time for all participants to finish and were then debriefed, thanked for their participation, and dismissed.

Analysis

Workload choice task. As in Prestudy 2, interest is in the shape of the performance curve. One reason for this interest is to assist in determining whether "more is better" or "more is worse" with respect to the effect of amount of information on the quality of choice behavior. Additionally, determining the location of an "overload" point, if one exists, is important as a point of comparison for subjective workload measures and for attitude and recall measures.

Since the response data are binary ("correct choice" or not), and since there are more than two conditions across which to compare the frequency or percentage of "correct choice", tests of differences between conditions cannot be performed using ANOVA or chi square methods (cf., Malhotra,
Lagakos, & Jain 1982). These can be compared using a logistic transformation (Aldrich & Nelson 1984; Green, Carmone, & Wachspress 1977; Malhotra et al. 1982).

The linear regression model, though placing no restrictions as to the values of the independent variables, assumes the dependent variable to be continuous. The dependent variable of the workload choice task, however, cannot take on more than two distinct values ("correct choice" or not), and an attempt to estimate the value of the dependent variable using the model, \( \sum b_k X_{ik} \), yields a value constrained between 0 and 1, although \( \sum b_k X_{ik} \) is not. That is, the regression model would yield a probability, \( P_i \), that the dependent variable would equal 1.

The upper limit, where \( P_i = 1 \), can be eliminated by converting this probability to an odds, \( P_i/(1-P_i) \). As \( P_i \) approaches 1, the denominator becomes very small, and the odds approaches infinity. The lower limit, where \( P_i = 0 \), can be eliminated by taking the natural logarithm of the odds, or \( \log_e[P_i/(1-P_i)] \). As \( P_i \) approaches 0, and therefore as the odds, \( P_i/(1-P_i) \), approaches 0, the log of the odds approaches negative infinity. This transformation, \( \log_e[P_i/(1-P_i)] \), is denoted as the "log odds", and can now take on any value between negative infinity and positive infinity.

In analyzing the present data, \( P_i \) is taken as a value of the percentage of respondents making the "correct
choice", or the number of respondents making the "correct choice" in cell\textsubscript{i} divided by the total number of respondents in cell\textsubscript{i}, where \( i = 2, 4, ..., 16 \) ads in the choice set. Green, Carmone, & Wachspress (1977) demonstrate a WLS method to estimate the parameters of the above model, which is very easy to program and use, but the present analysis will use MLE to maintain consistency with previous results reported by Malhotra. An MLE program that can be adapted in the present analysis is found in SAS Institute (1989).

Prior to analysis, the data must be adjusted for the effects of chance. The probability of obtaining a "correct choice" in the 4-ad condition is, by chance alone, 1/4, or 0.25. Consistent with the method used by Malhotra, the present analysis adjusted for the effects of chance using the correction:

\[
P_i = \frac{(P_{io} - P_{ic})}{(1 - P_{ic})}
\]

(eg. 8.1)

where:

- \( P_i \) = probability of "correct" choice adjusted for chance.
- \( P_{io} \) = uncorrected probability of "correct" choice.
- \( P_{ic} \) = probability of "correct" choice by chance alone.

The final model is, then,

\[
\log_e \left[ \frac{P_i}{(1-P_i)} \right] = \sum b_k X_{ik}
\]

(eg. 8.2)
where the response transformation is denoted as "log odds", $P_i$ is the probability (percentage) of choosing the objectively "best" product, $X_{ik}$ represents terms associated with the number of product alternatives in cell $i$, and the interpretation of the parameters $b_k$ is qualitatively the same as in a non-transformed linear regression model.

Subjective measures of workload. Study 3 uses the same workload measures that were used in Prestudy 2. Again, a factor analysis will be conducted to ensure that the same general factor structure is obtained in Study 3 as was obtained in Study 2. Of interest in Study 3, however, is using these dimensions as measures of the magnitude of each of the dimensions of workload. Changes in the magnitude of these measures across conditions can then be compared to changes in performance, perhaps providing some insight into the causal relationship between these dimensions and performance.

To do this, it is necessary to determine which words best discriminate between conditions. This can be accomplished by performing an ANOVA on each individual word across conditions. Words that best discriminate between conditions within each dimension will then be retained for use as a scale by taking the average scores of three or four words within each dimension across conditions. Although still somewhat crude, such measures are nonetheless an advancement over the measures of previous studies which
simply used single "agree-disagree" type statements that presumed unsubstantiated assumptions regarding the nature of workload.

**Product attitude measures.** Product attitude measures could be analyzed using ANOVA. Results of any sort of statistical test should, however, be viewed with caution since these are only 5-point scales (due to physical space constraints), creating problems in the interpretation of statistical results due to low resolution. Nonetheless, a simple plot of these values can provide for qualitative comparison with other measures.

There are two problematic issues inherent in this part of the survey, however. One is that each condition has a different number of products in the choice set; a comparison across conditions requires a different "n" for each condition, making a statistical test and interpretation difficult. One way to make comparisons is to use only those four products that appear across all conditions, or to use only the objectively "best" and "second best" products that appear across all conditions. A way that will be used in the final analysis is to use all alternatives that had been rated by the respondent, regardless of the number of alternatives in the choice set. This way, comparisons across conditions of "load" are not compared, but within-cell comparisons are made between the central and peripheral manipulations in each load condition.
Another issue is in how to interpret a non-response. This could be interpreted as a missing value, and therefore not included in analysis, thereby lowering the "n" by one for each missing value that is encountered and increasing the weight of the remaining values. However, many subjects were observed to "cherry pick", or hop around, when working on this part of the survey. Rather than work in serial fashion, top to bottom and left to right, subjects appeared to be choosing to first assess those alternatives in the choice set with which they felt the most confident. It is likely, then, that a non-response can be interpreted as a "0" on a five point scale with respect to certainty. It therefore seems most reasonable to interpret and analyze a non-response as "0" with respect to certainty, but as a missing value with respect to attitude measures.

Agent attitude measures. In pretesting, the agent attitude measures resulted in relatively parallel profiles in a between subjects test, each subject rating only a single agent without comparison, with the profiles separated by about 1.5 points. Given that the profiles were parallel, it is reasonable to collapse the individual scales into a single, global average. Of interest in Study 3, however, is not the average scores of each individual agent on each condition, but the magnitude of the difference between the attitude scores of the two agents under each condition. No difference implies that agent information was not being
used, and the magnitude of difference implies a magnitude of usage of this information.

Agent free recall. The use of agent free recall data will require coding by several independent judges. Exactly what sort of coding heuristic to use is not obvious; many subjects provided partial information that would be difficult to code. For example, many described the "neutral" agent as having a beard, or more globally as "ugly", while describing the "positive" agent as well dressed, or more globally as very "professional" looking. These subjects clearly formed a global picture or stereotype that differentiated between the two agents, but it is not clear how to interpret such comparisons for coding. These measures will therefore not presently be used in analysis if the aided recall measures yield interpretable results and insights.

Agent aided recall. The list of 33 descriptors contains a total of 14 correct items. The raw number of correctly identified items cannot be compared directly between subjects. In correctly choosing one of the 14 correct items from the total list of 33, the probability of a correct choice by chance alone is 14/33. This probability will increase as a greater number of choices is made. That is, there is a greater likelihood of obtaining at least one correct choice if two, three, or four items are checked on the list than if a single item is checked. Therefore, these
scores must be adjusted to account for guessing.

It might at first seem that this can be modelled based on the probability that some particular combination of "correct" and "incorrect" selections, \( E \), is obtained if some number of items, \( x \), is checked in total. That is, one might initially consider the question, If a selection of, say, three items is randomly made from the total list of 33 items, what is the probability that this selection consists of, say, 2 "correct" items and 1 "incorrect" item?

Note that of the 33 total items on the checklist, 14 are "correct" descriptors and 19 are "incorrect" items. The number of combinations of \( n \) things taken \( x \) at a time is represented by:

\[
\binom{n}{x} = \frac{n!}{x!(n-x)!}
\]  
(eq. 8.3)

Thus, \( \binom{n}{x} \) represents the number of different groups of size \( x \) that could be selected from a set of \( n \) objects when the order of selection is not considered relevant.

It is commonly shown in many books on probability that if \( k \) is the total number of ways in which the random selection can terminate and \( r \) is the number of ways that are favorable to event \( E \), then \( P(E) = \frac{r}{k} \). In answer to the question that was posed, then, the probability that a respondent could check two correct and one incorrect item is:
where:

\[ k = \binom{14}{2} \binom{19}{1} \]

and

\[ r = \binom{33}{3} \]

\[
\begin{align*}
\frac{14}{2} \binom{19}{1} &= \frac{(14)(13)}{(2)(1)} \frac{19}{1} \\
\frac{33}{3} &= \frac{(33)(32)}{(3)(2)(1)} \\
&= 0.3169
\end{align*}
\]

As desired, the probability of obtaining two correct items out of three random selections is greater than that of obtaining two correct items out of two selections:

\[
\begin{align*}
\frac{14}{2} &= \frac{(14)(13)}{(33)(32)} \\
&= 0.1723
\end{align*}
\]

and is less than the probability of obtaining two correct items out of four random selections:
However, the probability of obtaining two correct items out of a random selection of five items is:

$$\left( \begin{array}{c} 14 \\ 2 \\ 33 \\ 5 \end{array} \right) \left( \begin{array}{c} 19 \\ 2 \\ 33 \\ 4 \end{array} \right) = \frac{\left( \begin{array}{c} 14 \\ 2 \\ 3 \end{array} \right) \left( \begin{array}{c} 19 \\ 2 \end{array} \right)}{\left( \begin{array}{c} 33 \\ 3 \\ 5 \end{array} \right)} = 0.3803$$

(eq. 8.6)

=0.3803

The probability of obtaining two correct choices now begins to decrease as the number of items selected is increased because this model assumes that particular combinations of incorrect and correct items are of interest. One intuitively expects an increase in the likelihood of obtaining a correct item as the number of selections increases, and the number of incorrect items is not relevant, but only a consequence of the number of correct items obtained.
It is more appropriate, then, to consider the expected value of obtaining a correct item from some sample that is randomly selected from the full list of 33. More appropriate than the initial question, then, is, If a selection of three items is made randomly from the total list of 33 items, what is the expected number of correct items selected? Since there are 14 correct items in the full list of 33, one would expect that \((14/33)(3)=1.273\) correct items approximately would be selected. If 2 correct items were actually obtained, then the respondent would have obtained \((2/1.273)\) times what would have been expected if a random guess had been used in selecting items. This can then be used to weight responses:

\[
\left[ \frac{(\text{actual})}{(\text{expected})} \right] \text{actual} = \text{weighted value} \quad (\text{eq. 8.8})
\]

If six respondents each obtained two correct items, but made, respectively, the 2,3,4,5,6, and 10 total selections, the following weights would thus be obtained:

<table>
<thead>
<tr>
<th>total correct selections</th>
<th>total expected value</th>
<th>weighted value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2.848</td>
<td>4.717</td>
</tr>
<tr>
<td>2</td>
<td>1.273</td>
<td>3.142</td>
</tr>
<tr>
<td>2</td>
<td>1.697</td>
<td>2.382</td>
</tr>
<tr>
<td>2</td>
<td>2.121</td>
<td>1.886</td>
</tr>
<tr>
<td>2</td>
<td>2.545</td>
<td>1.572</td>
</tr>
<tr>
<td>2</td>
<td>4.242</td>
<td>0.943</td>
</tr>
</tbody>
</table>
Respondents who are more likely to be guessing now receive lower scores than respondents who are more likely to be indicating true recall.

Discussion

The pioneering "information overload" studies were interested in observing empirically whether or not people could become "overloaded" with too much product information, thereby exhibiting an increased probability of making product choice mistakes. The observation that people indeed can and do make such errors under increased informational loads is interesting, but of limited value. The final study in this dissertation is less interested in the quantitative observation of choice errors and more interested in the qualitative observation of what happens as an "overload" point is approached.

Of particular interest is the impact of "peripheral" information under differing conditions of "load". Might such information have a greater tendency to influence peoples' choices under conditions of greater "load"? Do people rely more on this information to simplify decision making under conditions of greater load, or might greater load provide them with less opportunity to observe and use peripheral information? Might these cues influence people in a more subtle manner, as a form of automatism, where these cues are not deliberately used by people yet might
still be influential in choice behavior? The role of "peripheral cues" under differing conditions of mental workload has heretofore never been considered. Study 3 is the first ever assessment of the relationship between mental workload, subjective information, and attitude change.
CHAPTER IX
RESULTS: GENERAL ASSESSMENT

Introduction

The pioneering studies of "information overload" in the marketing discipline were concerned with the everyday mistakes that consumers might make in the purchase of such mundane products as instant rice or peanut butter. These pioneering studies collectively suggest that prospective product purchasers have a higher probability of making an error in a choice decision if presented with too many product features or too many product alternatives. The focus of these pioneering studies was necessarily limited in that they were primarily concerned with verification of the "information overload" phenomenon.

Marketing practice presumes, however, that consumers attempt to make "reasonable" decisions, and if unable or unmotivated to fully consider the objective, relevant, central features of a message or marketing situation, will tend to give greater weight to the more subjective, less relevant "peripheral" features or situational cues. The conceptual and theoretical relationship between workload, effort, motivation, and the potential effects of "peripheral
cues" on product choice and attitudes has been outlined in previous chapters discussing the WHAM and IMAAC<sub>3</sub> models. A manipulation to test the plausibility of IMAAC<sub>3</sub> was discussed in the last chapter, and the present chapter outlines the results with respect to assessing the basic measures of Study 3 with regard to workload and "overload". Chapter X will further interpret this analysis in order to assess the plausibility of IMAAC<sub>3</sub> in light of these results.

**Workload Choice Task**

Frequency of preference for the objectively best alternative is graphically represented in Figures 9.1 and 9.2 after adjustment for the effects of chance (eq. 8.1). Of interest is the shape of the load curve as well as whether "load" was "significantly" varied. Note that "significance" in the "slope" terms of the LOGIT analysis will depend on which point is interpreted as representing the intercept, and there presently exists no concurrent test for differences between the individual points, as, say, a Tukey test in ANOVA. "Significance" in the present analysis will be used more to gauge a qualitative observation of results rather than as quantitative "proof" of any particular assertions that might be made. Also note that after a transformation such as LOGIT, the b-parameters can only be compared qualitatively with respect to direction and a ranking of magnitude; they cannot be compared
quantitatively as in the standard regression model.

Using a LOGIT model (eq. 8.2) with the intercept set at the overload "bump" of 12 ads, a "more is worse" finding is supported in the "central only" condition (Table 9.1), with 4, 6, and 8 alternatives producing higher performance (marginally significant positive b-parameters) than 12 alternatives, and 14 and 16 alternatives producing performance that is not significantly different from 12 alternatives. However, 10 alternatives produces results that, in exploratory research, could be considered marginally significant in the negative direction; that is, given the exploratory nature of the present research, these results could be viewed as indicating a dip at the 10-alternative point.

With the intercept again set at the overload bump of 12 ads in the peripheral condition, similar results are obtained (Table 9.2). Four, 6, and 8 alternatives produce results that are not significantly different from 12 alternatives. Although 14 and 16 alternatives produce results that are significantly lower than 12 alternatives, 10 alternatives also produces results that are significantly lower. That is, these results can also be interpreted as indicating a dip at the 10-alternative point.

When the central and peripheral conditions are analyzed together, where each condition, whether peripheral or central, is treated as an independent qualitative variable
(i.e., main effects analysis), with the intercept set at the overload bump of 12-alts peripheral, the same general results are obtained. This model, however, allows for the b-parameters to be rank-ordered to observe the effects of adding the peripheral information (Table 9.3, rank ordered by performance). Recall that these parameters cannot be compared quantitatively after transformation, but can be compared qualitatively. Table 9.3 is graphically illustrated in Figure 9.3.

Two noteworthy observations can be gained from the analysis represented graphically in Figure 9.3. First, the peripheral information does not appear to provide any advantage or disadvantage with regard to immediate choice behavior; it does not appear to create greater amounts of workload or to ease workload in any way that is observable in choice behavior (performance).

The second observation is that this performance-based "load" curve seems to generally follow what would be expected except at the 10 alternative points for both the central and peripheral conditions. That is, there appears to be a dip in the load curve about the vicinity of "overload", illustrated in general form in Figure 9.4. It is very unlikely that this dip is a function of the particular combination of ads. Recall that a dip and bump were also observed in the 1.5 and 2.5 minute conditions of Prestudy 2. This dip-bump curve shifted to the right with
FIGURE 9.1

PERFORMANCE IN CENTRAL CONDITION

Note: results adjusted for the effects of chance (eq. 8.1).
<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>b</th>
<th>STDERR</th>
<th>TRATIO</th>
<th>FREQ</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>intercept (12 alts)</td>
<td>-0.385</td>
<td>0.434</td>
<td>-0.886</td>
<td>10/22</td>
<td>ns</td>
</tr>
<tr>
<td>4 alternatives</td>
<td>1.771</td>
<td>0.707</td>
<td>2.502</td>
<td>17/20</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>6 alternatives</td>
<td>0.960</td>
<td>0.637</td>
<td>1.507</td>
<td>14/20</td>
<td>&gt;.10</td>
</tr>
<tr>
<td>8 alternatives</td>
<td>0.870</td>
<td>0.625</td>
<td>1.392</td>
<td>14/21</td>
<td>&gt;.10</td>
</tr>
<tr>
<td>10 alternatives</td>
<td>-0.758</td>
<td>0.661</td>
<td>-1.147</td>
<td>7/22</td>
<td>&gt;.15</td>
</tr>
<tr>
<td>14 alternatives</td>
<td>-0.392</td>
<td>0.632</td>
<td>-0.621</td>
<td>8/22</td>
<td>ns</td>
</tr>
<tr>
<td>16 alternatives</td>
<td>-0.430</td>
<td>0.651</td>
<td>-0.660</td>
<td>7/20</td>
<td>ns</td>
</tr>
</tbody>
</table>

Note: Freq. is original data; analysis adjusted for the effects of chance (eq 8.1). The b-parameters represent the results of a LOGIT transformation, and so are interpreted qualitatively, but not quantitatively, as in the regression model.
FIGURE 9.2

PERFORMANCE IN PERIPHERAL CONDITION

Note: results adjusted for the effects of chance (eq. 8.1)
### TABLE 9.2

**STUDY 3: PERFORMANCE IN PERIPHERAL CONDITION**

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>b</th>
<th>STDERR</th>
<th>TRATIO</th>
<th>FREQ</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>intercept (12 alts)</td>
<td>0.217</td>
<td>0.429</td>
<td>0.506</td>
<td>13/22</td>
<td>ns</td>
</tr>
<tr>
<td>4 alternatives</td>
<td>0.397</td>
<td>0.644</td>
<td>0.617</td>
<td>14/19</td>
<td>ns</td>
</tr>
<tr>
<td>6 alternatives</td>
<td>0.630</td>
<td>0.650</td>
<td>0.970</td>
<td>15/20</td>
<td>ns</td>
</tr>
<tr>
<td>8 alternatives</td>
<td>-0.273</td>
<td>0.620</td>
<td>-0.441</td>
<td>11/20</td>
<td>ns</td>
</tr>
<tr>
<td>10 alternatives</td>
<td>-0.866</td>
<td>0.621</td>
<td>-1.395</td>
<td>9/22</td>
<td>&gt;.10</td>
</tr>
<tr>
<td>14 alternatives</td>
<td>-1.065</td>
<td>0.650</td>
<td>-1.639</td>
<td>7/20</td>
<td>&gt;.10</td>
</tr>
<tr>
<td>16 alternatives</td>
<td>-1.300</td>
<td>0.670</td>
<td>-1.941</td>
<td>6/20</td>
<td>&gt;.05</td>
</tr>
</tbody>
</table>

Note: Freq. is original data; analysis adjusted for the effects of chance (eq 8.1). The b-parameters represent the results of a LOGIT transformation, and so are interpreted qualitatively, but not quantitatively, as in the regression model.
FIGURE 9.3
RANK ORDERED PERFORMANCE

Note: "C" denotes central condition, "P" denotes peripheral condition. "*" indicates performance that is at least marginally different from the intercept, set at 12 alternatives peripheral.
## TABLE 9.3

**STUDY 3: RANK ORDERED PERFORMANCE**

<table>
<thead>
<tr>
<th>RANK</th>
<th>#ALTS</th>
<th>COND</th>
<th>%CORRECT</th>
<th>b</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>C</td>
<td>.800</td>
<td>1.659</td>
<td>&gt;.10</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>P</td>
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Note: Freq. is original data; analysis adjusted for the effects of chance (eq 8.1). The b-parameters represent the results of a LOGIT transformation, and so are interpreted qualitatively, but not quantitatively, as in the regression model. "C"=central, "P"=peripheral.
FIGURE 9.4

LOAD CURVE SUGGESTED BY STUDY 3 RESULTS
increased time, even though identical ads were used. In the present Study 3, this dip-bump curve again shifted right, although identical ads were again used. Although this shift in these three different manipulations could be due to differences in such factors as effort, it cannot be due to the effects of particular combinations of ads, since identical combinations were used throughout these studies. This dip-bump curve is presumably related to the effects of "load".

Subjective Measures of Workload

The items of the workload survey were subjected to a factor analysis in the same manner as described in Chapter V regarding Prestudies 1 and 2. On the basis of a "scree" plot of eigenvalues (Figure 9.5), four or five factors should be retained. When four factors were retained, the loadings suggested the WHAM factors of "W", "Q", "F", and "T". When five factors were retained, the structure suggested two "F" factors in addition to the other three, with these factors interpretable as the two "motivation" factors of Prestudy 1.

An ANOVA was then performed on the workload survey items to determine which items best discriminate across the "load" conditions (Table 9.4). The "F" items of the four or five factor structure do not discriminate very well across conditions, so the simpler four factor structure was
retained, using a varimax rotation after an initial method of maximum likelihood (Table 9.5). On the basis of the F-ratios, four items were then retained from each factor:

"W": perceived performance:
  confident
  content
  satisfied
  successful

"Q": cognitive resource load:
  stressful
  demanding
  intense
  discouraging

"F": cognitive force:
  challenging
  leisurely
  mindless
  purposeful

"T": time load:
  frantic
  frenzied
  hectic
  rushed

The scores of these items were then summed and averaged within each factor (Tables 9.6, 9.7, & 9.8). The results are graphically illustrated in Figures 9.6, 9.7, and 9.8 for the "W", "Q", and "T" factors.

"F" is not plotted since none of these variables was found to be significant in discriminating across conditions in the ANOVA. The individual plots of the "F" variables do not maintain similar profiles, and an average across these variables results in an uninterestingly flat curve. Although the scores of these variables might be useful in assessing the relationship between performance and
differences between individual subjects, the present
dissertation is interested, in keeping with the earlier
studies of information load, in a more initial assessment of
factors that might generally relate to workload across
individuals.

The "W", "Q", and "T" plots follow what might be
expected without knowledge of the shape of the actual
performance curve. That is, with increases in information
quantity, perceived performance seems to follow a reasonably
straight curve downward, and perceptions of resource demands
and time constraints seem to follow a reasonably straight
curve upward. There are, however, no aberrations that
coincide with the dip-bump curve of actual performance.

One possible explanation as to why these curves do not
coincide with the load curve of actual performance is that
the perceptions that are measured in these subjective
measures might be guided more by the appearance of the task.
Shaffer & Hendrick (1971) found that subjects would and
could rate the apparent difficulty of a task without
actually performing the task. Subjects in that study had
been given a boring but demanding number circling task and
asked questions regarding the difficulty of the task, amount
of effort required, etc. The task required participants to
circle every three, every other 4, and every 7 preceded by a
6 in a long table of random numbers. Subjects who were
asked to rate the task without actually performing the task
were able to provide subjective measures of effort, frustration, and such, as well as subjects who had actually performed the task. It is possible that the subjective workload measures of the present study are also measures of perceptions rather than actual workload experienced.

Another explanation is that the subjective measures "Q" and "T" do indeed reflect changes in workload, and that the dip-bump performance curve itself does not directionally reflect changes in workload with regard to these factors. That is, changes in performance might not correspond in a linear manner with changes in workload on these factors. It is possible that subjects put forth greater effort right near the overload point, perhaps resulting in increased performance; Yeh & Wickens (1988) indeed report performance increases associated with increased subjective perceptions of workload. It is very possible that the "F" workload descriptors used here better reflect a motivation to exert effort due to the experimental setting (e.g., due to the justification for the experiment: cf., Shaffer & Hendrick 1971), rather than the amount of effort actually expended due to a particular workload condition. Perhaps the only way to obtain a useful measure of the expenditure of "effort" is through the use of more objective measures such as the secondary task technique (discussed in Chapter IV).
FIGURE 9.5

STUDY 3: SCREE PLOT OF EIGENVALUES, WORKLOAD SURVEY
## TABLE 9.4

### STUDY 3: ANOVA ON WORKLOAD DESCRIPTORS

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Note: "C" denotes central condition, "P" denotes peripheral condition.
FIGURE 9.6

"W": PERCEIVED PERFORMANCE
TABLE 9.7
MEANS OF WORKLOAD FACTOR "Q": COGNITIVE RESOURCE LOAD

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<td>3.284</td>
<td>1.296</td>
</tr>
<tr>
<td>12</td>
<td>P</td>
<td>21</td>
<td>3.155</td>
<td>1.364</td>
</tr>
<tr>
<td>14</td>
<td>P</td>
<td>20</td>
<td>2.875</td>
<td>0.968</td>
</tr>
<tr>
<td>16</td>
<td>P</td>
<td>20</td>
<td>3.413</td>
<td>1.336</td>
</tr>
</tbody>
</table>

Note: "C" denotes central condition, "P" denotes peripheral condition.
FIGURE 9.7

"O": COGNITIVE RESOURCES LOAD
### TABLE 9.8

**MEANS OF WORKLOAD FACTOR "T": TIME LOAD**

<table>
<thead>
<tr>
<th>#ALTS</th>
<th>COND</th>
<th>N</th>
<th>MEAN</th>
<th>STD DEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>C</td>
<td>18</td>
<td>2.528</td>
<td>0.962</td>
</tr>
<tr>
<td>6</td>
<td>C</td>
<td>20</td>
<td>2.914</td>
<td>1.394</td>
</tr>
<tr>
<td>8</td>
<td>C</td>
<td>21</td>
<td>3.190</td>
<td>1.180</td>
</tr>
<tr>
<td>10</td>
<td>C</td>
<td>22</td>
<td>3.534</td>
<td>1.597</td>
</tr>
<tr>
<td>12</td>
<td>C</td>
<td>22</td>
<td>3.852</td>
<td>1.607</td>
</tr>
<tr>
<td>14</td>
<td>C</td>
<td>21</td>
<td>4.464</td>
<td>1.379</td>
</tr>
<tr>
<td>16</td>
<td>C</td>
<td>20</td>
<td>3.788</td>
<td>1.173</td>
</tr>
<tr>
<td>4</td>
<td>P</td>
<td>19</td>
<td>2.776</td>
<td>1.274</td>
</tr>
<tr>
<td>6</td>
<td>P</td>
<td>20</td>
<td>3.213</td>
<td>1.139</td>
</tr>
<tr>
<td>8</td>
<td>P</td>
<td>20</td>
<td>3.238</td>
<td>1.523</td>
</tr>
<tr>
<td>10</td>
<td>P</td>
<td>22</td>
<td>4.125</td>
<td>1.554</td>
</tr>
<tr>
<td>12</td>
<td>P</td>
<td>21</td>
<td>3.310</td>
<td>1.518</td>
</tr>
<tr>
<td>14</td>
<td>P</td>
<td>20</td>
<td>3.763</td>
<td>1.420</td>
</tr>
<tr>
<td>16</td>
<td>P</td>
<td>20</td>
<td>4.238</td>
<td>1.561</td>
</tr>
</tbody>
</table>

Note: "C" denotes central condition, "P" denotes peripheral condition.
FIGURE 9.8

"T": TIME LOAD

mean perceived load

number of ads

central condition

peripheral condition
Product Attitude and Certainty Measures

The product attitude measures of worst-best, like-dislike, and good-bad were summed and averaged within each product, and were then summed and averaged within each of the two pages of ads for each subject. As discussed in Chapter VIII, all products that had been rated on a page were used, so that an average rating for the entire page under the listing agent is obtained (with missing values not retained). The results of the central and of the peripheral conditions are summarized in Figures 9.9 and 9.10. It appears that these measures detected a difference between the central and peripheral conditions only in the 4 alternative condition under only one of the agent headers. Since these measures were only five point scales, and since a different number of alternatives were rated across the different conditions, any interpretation or analysis of these measures is limited.

The "certainty" measures (sure? yes-no), where missing values were coded as zero, or "very uncertain" (see discussion in Chapter VIII), and then averaged for the entire page under the listing agent, are summarized in Figures 9.11 and 9.12. The certainty associated with making these ratings appears to decrease with an increase in information, in agreement with the ratings of perceived performance. This interpretation must be made with caution, however, since a different number of alternatives was rated
FIGURE 9.9

ATTITUDE TOWARD "MR" ALTERNATIVES
FIGURE 9.10

ATTITUDE TOWARD "SA" ALTERNATIVES
FIGURE 9.11

RATING CERTAINTY, CENTRAL CONDITION
FIGURE 9.12
RATING CERTAINTY, PERIPHERAL CONDITION
across conditions.

Note that these measures associated with the individual alternatives would likely be more useful on an assessment at the level of the individual subject, e.g., the relationship between an individual's choice and the liking and certainty associated with that choice in contrast with the other alternatives. Again, the present dissertation is more interested in an initial assessment of general differences across conditions of workload, in keeping with the earlier studies of load, and a further analysis of these measures is beyond the scope and focus of this dissertation.

Agent Attitude Measures

In pretesting, the profiles of the agent attitude scores had been found to be parallel between agents. These ad headers were tested in a between-subjects design, where each subject rated only one of the agents without comparison to another agent, resulting in profiles that were separated by about 1.5 points on the seven point scale. In Study 3, subjects instead rated both agents in side-by-side scales, so a principal components analysis was performed on the agent attitude measures of Study 3. The first two principal components clearly break between the descriptors of the two agents (Table 9.9), suggesting some degree of independence between these measures as they are used in Study 3.
The agent attitude measures (peripheral condition only) were then summed and averaged for each agent, summarized in Figure 9.13. The mean difference between the profiles for the two agents, presumably indicating the strength of the attitudes that were formed, is summarized in Figure 9.14. It appears that the magnitude of attitudes toward these cues is strongest at a moderate amount of information, but the direction of attitude (neutral cue vs. positive cue) in the alternative condition is, counter to intuition in absence of theory, in the wrong direction. The relationship of this curve to IMAAC will be further discussed and interpreted in Chapter X.

Agent Free Recall

As noted in Chapter VIII, these results would be difficult to code and analyze. Meaningful results were obtained from the aided recall measures. The free recall measures were therefore not coded or analyzed for the present research.

Agent Aided Recall

The mean number of items (weighted) correctly identified is summarized in Figure 9.15. The method of correcting aided recall for the effects of guessing was discussed in Chapter VIII (eq. 8.8). Interpretation of the shape of this curve is not obvious without assessing its
TABLE 9.9

STUDY 3: PRINCIPAL COMPONENT ANALYSIS OF AGENT ATTITUDE

<table>
<thead>
<tr>
<th>FACTOR1</th>
<th>FACTOR2</th>
<th>FACTOR3</th>
<th>FACTOR4</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA_EXPERIENCED</td>
<td>78 *</td>
<td>-14</td>
<td>7</td>
</tr>
<tr>
<td>SA_QUICK/RESPONSIVE</td>
<td>78 *</td>
<td>-30</td>
<td>-18</td>
</tr>
<tr>
<td>SA_CONFIDENT</td>
<td>77 *</td>
<td>-9</td>
<td>-22</td>
</tr>
<tr>
<td>SA_MATURE</td>
<td>75 *</td>
<td>-3</td>
<td>-18</td>
</tr>
<tr>
<td>SA_HELPFUL</td>
<td>75 *</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>SA_LIKEABLE</td>
<td>74 *</td>
<td>-15</td>
<td>15</td>
</tr>
<tr>
<td>SA_REFINED</td>
<td>73 *</td>
<td>-20</td>
<td>12</td>
</tr>
<tr>
<td>SA_CAREFUL</td>
<td>73 *</td>
<td>-24</td>
<td>-20</td>
</tr>
<tr>
<td>SA_HONEST</td>
<td>66 *</td>
<td>-9</td>
<td>24</td>
</tr>
<tr>
<td>SA_ATRACTIVE</td>
<td>64 *</td>
<td>-24</td>
<td>34</td>
</tr>
<tr>
<td>SA_GOOD LISTINGS</td>
<td>59 *</td>
<td>-7</td>
<td>15</td>
</tr>
<tr>
<td>MR_CONFIDENT</td>
<td>17</td>
<td>79 *</td>
<td>5</td>
</tr>
<tr>
<td>MR_CAREFUL</td>
<td>20</td>
<td>77 *</td>
<td>-3</td>
</tr>
<tr>
<td>MR_LIKEABLE</td>
<td>18</td>
<td>76 *</td>
<td>4</td>
</tr>
<tr>
<td>MR_EXPERIENCED</td>
<td>12</td>
<td>74 *</td>
<td>-32</td>
</tr>
<tr>
<td>MR_QUICK/RESPONSIVE</td>
<td>5</td>
<td>74 *</td>
<td>16</td>
</tr>
<tr>
<td>MR_REFINED</td>
<td>7</td>
<td>72 *</td>
<td>35</td>
</tr>
<tr>
<td>MR_HELPFUL</td>
<td>22</td>
<td>70 *</td>
<td>-30</td>
</tr>
<tr>
<td>MR_ATRACTIVE</td>
<td>3</td>
<td>66 *</td>
<td>45*</td>
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<td>64 *</td>
<td>21</td>
</tr>
<tr>
<td>MR_MATURE</td>
<td>25</td>
<td>58 *</td>
<td>-36</td>
</tr>
<tr>
<td>MR_GOOD LISTINGS</td>
<td>22</td>
<td>53 *</td>
<td>-30</td>
</tr>
</tbody>
</table>

(Values greater than 0.45 have been flagged by an ' * '.)

Note: "MR" refers to the "neutral cue" agent (Metro Realty) advertising alternatives with "MR" numbers, and "SA" refers to the "positive cue" agent (Stillman and Associates) advertising alternatives with "SA" numbers.
FIGURE 9.13

AGENT ATTITUDE

mean agent attitude

number of ads

ME agent — S A agent

4.03 4.24 4.22 4.53 4.55 4.58 4.61 4.63 4.64 4.68 4.69

4.09 4.24 4.22 4.53 4.55 4.58 4.61 4.63 4.64 4.68 4.69

196
FIGURE 9.14

AGENT ATTITUDE MAGNITUDE

Note: "Magnitude" is found by subtracting the mean attitude scores of the "neutral MR" agent from the "positive" "SA" agent, graphically illustrated as an absolute value (solid line; dashed line indicates actual value). A negative score indicates that the "SA" agent scored higher than the "MR" agent, whereas a positive score indicates that, contrary to the pretest results, the "SA" agent scored lower than the MR agent.
mean no. items recalled

number of ads

FIGURE 9.15

AGENT AIDED RECALL
relationship to IMAAC\textsubscript{3}; this will be further interpreted in Chapter X.

**Debriefing Survey**

A review of the debriefing questions indicates that nearly all subjects accepted the cover story throughout the session. A few subjects did indicate that they thought the true purpose of the housing survey was "to see how fast we can work" or "to see how well we can remember", but in almost all cases, subjects indicated that they thought the purpose was to find out what sorts of features students would like to see in condominiums or to test real estate ads for the best layout.

**Discussion**

**Workload and performance.** The results presented in this chapter do not alone provide a clear picture of what happens as workload is increased. Indeed, an ambiguous picture of workload appears if the various operational definitions of "load" are used. The subjective measures of workload and the certainty measures each provide a relatively smoothly increasing representation of "load". However, many studies of "information load" rely on performance measures as an indicator of load, and the results of Study 3 would appear to suggest that "load" does not steadily increase as more information is presented if
operationalized in performance measures. The dip-bump performance results of both Prestudy 2 and Study 3 seem counter-intuitive and do not follow the more smoothly increasing results of the subjective measures of "load". It is unfortunate that the "F" variables are unable to discriminate significant differences across conditions, and likely that a more objective method of measuring "effort" (e.g., the secondary task technique) would have to be utilized to explain this observation. Such a method would be very intrusive on this particular manipulation.

Manipulation check: structural overload. "Overload" has been defined in engineering psychology as those points at which subjects are unable to complete the task. An important issue in the present study, given the large number of ads in the high "load" conditions, is whether or not subjects are even finishing the reading task. It was expected that some subjects would be unable to complete the reading task, which would indicate that "load" had been manipulated to a point beyond the abilities of the subjects. Since this was a counterbalanced design, in which half of the subjects received a folder in which the "best" product was advertised on the left page, and half received a folder in which the "best" product was on the right page, it is possible to compare choice behavior by page to see if there were any changes in the effects of ordering under high load conditions. Note that the per cell sample becomes very
small (as small as 5 in some cases) when ordering effects are considered across various other variables, so this dissertation can otherwise not attempt analyses at this level except to observe the potential effects on "structural overload", or the inability to complete the reading of the ads.

The results of the choice task in the central condition, split by which page of ads was on the left, are illustrated graphically in Figure 9.16. These results suggest that subjects might not be finishing the reading of ads, limiting the choice set to the left-most ads, enhancing the likelihood of choosing the "best" product if on the left and decreasing the likelihood if on the right.

A split of the product "certainty" measures by page also supports this contention. Mean certainty in the central condition is illustrated graphically in Figure 9.17, split by which page of ads was on the left, with missing values analyzed as a certainty of "0" as discussed in Chapter VIII. When the "MA" alternatives are presented on the left page, with the "SA" alternatives on the right, subjects tend to be more certain in the evaluation of MA alternatives over SA alternatives at the 12 alternative point and beyond. When the MA alternatives are presented on the right, with SA alternatives on the left, subjects tend to be more certain of the SA products beyond this "overload" point.
FIGURE 9.16
ORDER EFFECTS ON PERFORMANCE, CENTRAL CONDITION
FIGURE 9.17

ORDER EFFECTS ON CERTAINTY, CENTRAL CONDITION
Recall that subjects were observed to be "cherry picking" on this portion of the survey. That is, they tended not to rate these two pages in serial fashion, but to hop around across the two pages in the rating task, presumably first rating those alternatives with which they felt most certain or familiar. Therefore, these results are less likely to reflect an inability to complete the rating task and more likely to reflect an inability to complete the reading task. These results further suggest, then, that many subjects are not finishing the reading task.

Given that the choice and certainty measures suggest that many subjects are unable to finish the reading task at 14 and 16 alternatives, it seems reasonable to conclude in this exploratory work that there is a structural overload point about the point of 12 alternatives. Since cell sizes to analyze ordering effects would be very small, this dissertation cannot further explore these effects. Since many subjects would not have completed the reading task beyond the 12 alternative overload point, these ads will not be used in assessing IMAAC_3 in Chapter X.

Note that the 12 alternative point meets the definition of "overload" as it is defined in engineering psychology. That is, points beyond 12 alternatives meet the definition of "unable to complete the task". Regardless of choice, subjects exhibit a higher likelihood of being unable to complete the task beyond the 12 alternative point. This is
the point, then, that will be used as the "overload" or highest "workload" point in assessing IMAAC\textsubscript{3} in Chapter X. Of interest in assessing IMAAC\textsubscript{3} is what happens to attitude and choice behavior as mental workload approaches the overload point.
CHAPTER X

RESULTS: MAPPING ON IMAAC$_3$ SPACE

Introduction

An important difference between IMAAC$_3$ and earlier conceptualizations of "information load" is that IMAAC$_3$ considers the effects of "peripheral" information and considers the issue of attitude change in addition to the issue of product choice. Unlike earlier research, this dissertation attempts to differentiate between the notion of "information load" and the notion of "mental workload", where changes in "information load" might not correspond with changes in "mental workload", either in magnitude or, more importantly, in direction. Although specific hypotheses are not to be tested, the general plausibility of the propositions of IMAAC$_3$ are under scrutiny in Study 3.

Study 3 of this dissertation is the first ever test of the effects of "peripheral cues" under differing conditions of mental workload. Whether these cues would be more influential under conditions of low information load, where the subject is better able to consider and scrutinize the cues, or under conditions of high load, where the subject might be more subtly influenced by these cues or even use
them as a simplifying heuristic, is not intuitively obvious. It is even possible that cues are no more or less influential as a function of "load". The propositions of IMAAC₃ support the notion that subjective cues can be more influential as workload increases (regardless of the level of information load), with cues more likely to be used as simplifying heuristics at moderate levels of load, and to be more subtle (due to automatism) at higher levels of load.

If forced to provide at least one main hypothesis, this dissertation would propose that "peripheral cues" would become more influential on choice behavior as mental workload increases.

Review of the IMAAC₃ Workload Operating Characteristic

Recall that IMAAC₃ posits that as workload is increased, processing of information will tend to move from a "systematic" mode of processing toward a "heuristic" mode of processing, and toward an "automatic" mode of processing under conditions of excessive load. The Workload Operating Characteristic (WOC) that was proposed was graphically illustrated in Figures 7.1 and 7.2, reproduced in part in Figure 10.1, based on the following presumptions:

A) Under low workload, the person is expected to have the ability and motivation to effortfully process issue-relevant information.
"SYSTEMATIC" - under control of person - "objective" - rational

"AUTOMATIC" - not under direct control of person - e.g., conditioned response, affect-influenced response - "irrational"

"HEURISTIC" - under control of person - "subjective" - rational

FIGURE 10.1

IMAAC$_3$ WORKLOAD OPERATING CHARACTERISTIC
B) Under moderately high workload, the person is expected to lose some ability to process effort-consuming information, but to still maintain motivation to attempt to make a "reasonable" decision based on other more easily processed information (i.e., cues).

C) Under very high workload, the person is expected to lose the ability to process any information, and therefore motivation as well, and be unable to attempt a reasonable decision.

D) Under some conditions, even the automatic system might not be equipped to aid processing, resulting in an outcome that cannot be predicted by this model.

The above presumptions were followed by predictions that resulted in a workload operating curve. These predictions are modified in the present chapter in a way such that they can be related to the measures taken in Study 3, resulting in the following propositions regarding how the results of Study 3 might relate to the points along the proposed Workload Operating Characteristic:
P(A): Decision most influenced by objective information.

P(B): Greater use of subjective information, resulting in greater recall of subjective information and greater attitude change toward the object of the subjective information. Decision tending to be more influenced by the subjective information than at point A.

P(C): Less deliberate use of subjective information, resulting in lower recall of subjective information, but still some attitude change toward the object of the subjective information (due to automatism). Decision tending to be more influenced by the subjective information than at point A.

P(D): Points beyond "overload" are unpredictable.

Note that not all of the predictions of IMAAC₃ can be assessed in the present study, and that the above propositions were modified to make use of the measures of Study 3. For example, it did not seem possible to obtain useable measures of objective (product) recall in Study 3, and so a comparison of the results of Study 3 with IMAAC₃
necessarily focus more on changes regarding the subjective information as "load" is varied.

Recall that increases in workload correspond to a rightward movement along the curve, but that this does not necessarily correspond to increases in information. Therefore, the results of Study 3 are to be assessed as they fit IMAAC$_3$, rather than with respect to the quantitative ordering of the information load conditions.

**Overload and IMAAC$_3$**

Of interest throughout this dissertation is not the mere observance of some overload "redline" point, but in observing kinds of changes that occur in the outcomes of processing as load is increased toward "overload". Since this "redline" in the present study was defined as the point beyond which subjects exhibited a likelihood of not finishing the task, points beyond 12 alternatives will not be used in the present assessment. The 12 alternative point is taken to represent the highest point of mental workload, since the ordering effects for performance at points beyond indicated a likelihood that subjects did not complete the task, resulting in an incomplete balance of information. Additionally, the 12 alternative point and beyond showed an ordering effect for the certainty measure that also suggests an inability to complete the task starting around the 12 alternative point.
Mapping Study 3 Results on to IMAAC\textsubscript{3} Space

Recall that IMAAC\textsubscript{3} posits a space on two axes bounded by three dimensions. The Workload Operating Characteristic (WOC) within that space is predicted from theory on which the two axes are based: the Dual Process Model (DPM) for the y-axis and the Elaboration Likelihood Model (ELM) for the x-axis. That is, one axis relates to the ability or willingness to engage the general pool of cognitive resources, and the other relates to whether the more objective (central) or more subjective (peripheral) information tends to be used. Theory on which these axes are based predicts various outcomes with regard to information recall and attitude change.

Recall that the DPM posits that as more "controlled" processes are engaged, greater memory (recall) will result. The ELM posits that as a more "peripheral" processing route is engaged, an attitude change will tend more to be based on the "peripheral cues" of the situation. IMAAC\textsubscript{3} relates these continua in a way that allows a "controlled-automatic" dimension of the "peripheral" route.

In considering more specifically just how recall and attitude strength might map on the IMAAC\textsubscript{3} space, it becomes evident that this space as it is represented graphically on a flat sheet of paper is rather distorted in the sense of linearity. Recall that these axes are not orthogonal in the IMAAC\textsubscript{3} version and that all points below overload must fall
somewhere within the space of the three dimensions. A simple mapping on a standard flat sheet of paper, even with a grid parallel with the tilt of the "slippery axes", will result in points outside of the space bounded by the three dimensions; grids associated with these axes must account for the focal points at the three corners.

Additionally, points on these axes are likely not to be ordered in a linear fashion. Consider, for example, the "strength" of an attitude change that might be associated with movement along the x-axis (central-peripheral). Attitude change toward the subjective ("peripheral") objects of a communication are presumably associated with points on the "peripheral" side of the continuum, not the "central" side: i.e., to the right of the y-axis intersection. This is not to say that attitude change with regard to subjective objects can occur exclusively at points to the right of the y-axis, but rather that these will mostly be associated with that side of the axis. It therefore seems reasonable to think of this axis not in linear terms, but more in terms of a weighting, as in a logarithmic or exponential sort of scaling as represented in Figure 10.2. Now, any detection of "attitude strength" tends to be pushed graphically toward the peripheral end of the continuum when anchored to scores across extremes of workload.

The y-axis, or even any of the three space dimensions, would also seem to be non-linear in scaling. Recall of
FIGURE 10.2

SCALING THE IMAAC3 X-AXIS FOR AN ATTITUDE VARIABLE

FIGURE 10.3

SCALING THE IMAAC3 Y-AXIS FOR A RECALL VARIABLE
subjective information, associated with controlled processes, would presumably tend toward the controlled end of the continuum, below the intersection of the x-axis, as represented in Figure 10.3. Now, any detection of recall associated with subjective aspects of a communication tends to be pushed graphically toward the controlled end of the continuum when anchored to scores across extremes in workload.

Consider, then, placing these axes within the space bounded by the IMAAC₃ dimensions with a grid on which all points fall within these bounds as represented in Figure 10.4. Note that recall of peripheral information is primarily associated with the "peripheral" dimension of IMAAC₃ and therefore projects onto that dimension.

According to the general IMAAC model, the axes are "slippery", and exactly how they are positioned about the pivot points depends on the situation. Recall that the IMAAC₃ version assumes away an "expertise" component, resulting in a particular positioning of the axes. Given the conceptual nature of this model, an exact mathematical representation is not possible, and the positioning of the axes is arbitrary. The positioning used in the present research, however, should be taken as adequate for an exploration of the conceptual plausibility of the model. Additionally, the particular weighting (nonlinearity) of the scaling used on the axes is also arbitrary, but this
weighting fits the model conceptually, and is appropriate for exploration of the conceptual plausibility of the model.

Recall the mean attitude scores (magnitude of difference) and the mean recall scores from Figures 9.14 and 9.15, reproduced in Table 10.1. These plot on to the IMAAC<sub>3</sub> space as represented graphically in Figure 10.5. When a line is drawn through these points, a curve very similar to the proposed Workload Operating Characteristic is revealed. Note that the 4 alternative point is positioned on this workload curve at a higher position of workload than the six alternative position.

Interpretation of Results with Respect to IMAAC<sub>3</sub>

Influence of subjective information on choice. In comparing the results of Study 3 to IMAAC<sub>3</sub>, interest is not so much in the shape of the performance curve, but in the difference between performance in the central and peripheral conditions. IMAAC<sub>3</sub> posits that mental workload will have an effect on how subjective information is used in influencing product choice "mistakes". Figure 10.6a reproduces the general shape of the information load curve observed in Study 3, and Figure 10.6b graphically represents the loss experienced by the objectively "best" alternative after the introduction of the subjective information in the peripheral condition. This loss is derived by subtracting the results represented in Figure 9.2 from those represented in Figure
FIGURE 10.4

IMAAC$_3$ GRID ASSOCIATED WITH ATTITUDE AND RECALL VARIABLES
FIGURE 10.5

RESULTS PLOTTED ON IMAAC SPACE
### TABLE 10.1

**ATTITUDE AND RECALL SCORES (PERIPHERAL CONDITION)**

<table>
<thead>
<tr>
<th>#ALTS</th>
<th>ATD.</th>
<th>RECALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>.44</td>
<td>5.0</td>
</tr>
<tr>
<td>6</td>
<td>.04</td>
<td>2.8</td>
</tr>
<tr>
<td>8</td>
<td>1.23</td>
<td>4.4</td>
</tr>
<tr>
<td>10</td>
<td>.40</td>
<td>3.6</td>
</tr>
<tr>
<td>12</td>
<td>.46</td>
<td>.9</td>
</tr>
</tbody>
</table>
Figure 10.6
Comparison of results

- a) Performance Curve
- b) Loss of "Best" after peripheral info. added
- c) Loss of any MR after peripheral info. added
- d) Recall of subjective information
- e) Attitude magnitude
### TABLE 10.2

**FREQUENCY OF CHOICE BY PAGE**

<table>
<thead>
<tr>
<th>#ALTS</th>
<th>COND</th>
<th>MR</th>
<th>SA</th>
<th>N</th>
<th>LOSS OF MR</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>C</td>
<td>17</td>
<td>2</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>C</td>
<td>16</td>
<td>4</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>C</td>
<td>17</td>
<td>4</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>C</td>
<td>12</td>
<td>10</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>C</td>
<td>17</td>
<td>5</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>C</td>
<td>14</td>
<td>8</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>C</td>
<td>12</td>
<td>7</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>P</td>
<td>14</td>
<td>5</td>
<td>19</td>
<td>15.79% (loss)</td>
</tr>
<tr>
<td>6</td>
<td>P</td>
<td>17</td>
<td>3</td>
<td>20</td>
<td>-5.00 (gain)</td>
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<tr>
<td>8</td>
<td>P</td>
<td>12</td>
<td>8</td>
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<tr>
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<td>P</td>
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<td>P</td>
<td>13</td>
<td>7</td>
<td>20</td>
<td>-1.84</td>
</tr>
</tbody>
</table>

Note: "C" denotes central condition, "P" denotes peripheral condition. "Frequency" is frequency of choice where all choices are pooled as one of either the MR alternatives or one of the SA alternatives. "Loss" is change in the percentage of MR choices after the addition of the peripheral information, found by subtracting the percentage of choice in the central condition from the percentage of choice in the peripheral condition in each condition.
9.1. Figure 10.6c represents the loss in choice from any MR choice (to any SA choice) after the addition of the peripheral information (Table 10.2).

**Use of subjective information.** Recall of subjective information is reproduced in Figure 10.6d, and the magnitude, or strength, of attitude is reproduced in Figure 10.6e.

**Comparison of Results with the Propositions of IMAAC_3**

**P(A): low mental workload.** Note that the ordering of the information load conditions was changed in Figure 10.7 to make a graphic comparison between the results and the propositions of IMAAC_3. The 6 alternative point appears to best fit the proposed WOC closer to point A than the other alternatives. The addition of the subjective information in the peripheral condition does not result in a decrease in choice of the objectively "best" alternative. Attitude strength is low, and recall of the subjective information is lower than at the 4 and 8 alternative points.

**P(B): moderate mental workload.** The 4 and 8 alternative points appear to fit the WOC closer to point B. The addition of the subjective information in the peripheral condition did result in a decrease in choice of the objectively "best" alternative in both of these alternatives. Recall of the subjective information was highest at these two points, indicating that this
information was more likely to be used deliberately by subjects in these conditions than in others (heuristic processing mode). Attitude strength was highest at 8 alternatives, and moderate at 4 alternatives, again indicating that this information was more likely to be used by subjects in these conditions than those in the 6 alternative condition. As has been suggested in the dissertation by Buck (1974), it is reasonable to expect that a low amount of information can result in greater difficulty in making comparisons between alternatives, generating greater workload from the perspective of IMAAC_3.

**P(B/C): high mental workload.** The 10 alternative point appears to approach point C on the WOC. Attitude strength is still at a moderate level but decreasing, and recall of subjective information is also at a moderate level, but decreasing. Most noteworthy is that the addition of the subjective information did not result in a decrease in choice of the objectively "best" product, but rather enhanced choice behavior, contrary to the predictions of IMAAC_3.

**P(C): very high mental workload.** The 12 alternative point appears to fit the WOC at about point C. There is very low recall of subjective information, an indication that it was not being deliberately used by subjects. There is, however, an attitude strength that is about as strong as in the 10 and 4 alternative conditions, an indication that
the subjective information might have been used, but not at a heuristic level (i.e., more due to automatism). The addition of the subjective information did not result in a decrease in choice of the objectively "best" product, but rather enhanced choice behavior, in a direction consistent with attitude strength. MR choices in general, however, decreased when subjective information was added.

Discussion

IMAAC posits that subjective information will become a greater factor in information processing as workload is increased. According to IMAAC, this information will first tend to be used in a very active manner as simplifying heuristics at moderate levels of load, and will tend to be used in a less active, more subtle manner (due to automatism) at higher levels of load. A Workload Operating Characteristic was proposed, and the results of Study 3 appear to support this curve. It does indeed appear that at moderate levels of load, the subjective information is better recalled and the (subjective) attitude is stronger than at lower or higher levels of load; it appears that at the highest level of load, (subjective) attitude is as strong as at moderate levels, and stronger than at low levels, yet there is very little recall of the subjective information.
Support for IMAAC as an explanatory or predictive model is at this point, however, tenuous and tautological. The lowest point of "workload" as identified by IMAAC was 6 alternatives, yet the lowest point identified by subjective measures of the last chapter was 4 alternatives. Although it seems reasonable to expect that 6 alternatives in this particular manipulation could be more confusing and difficult than 4 alternatives (cf., Buck 1974), there is no evidence in this data in support or dissupport of this contention except for the trace of the curve on IMAAC. Unfortunately, the workload scale failed to detect any meaningful differences in effort expended, and more objective attempts at effort detection (e.g., secondary task technique) are likely to be too obtrusive (confounding) on this particular manipulation.

Additionally, the effects of the subjective information on choice behavior at the 10 alternative point, just prior to the "redline", was in the wrong direction from what would be expected from the direction of attitude change. It could be possible that extreme levels of load are motivating subjects to put forth greater effort into making an objective decision. That the performance curve does bump up at the "redline" point in both the central and peripheral conditions is evidence that subjects might indeed be putting forth greater effort as the redline point is approached. Again, however, the subjective workload measures failed to
detect any meaningful differences in effort across conditions.

Nonetheless, IMAAC$_3$ does appear to be a plausible model in absence of any other. IMAAC$_3$ is the first ever attempt to integrate theory of attention with theory of attitude change in a way to make predictions about choice behavior. Although the predictions regarding attitude change and recall of subjective information under varying conditions of load appear to hold, predictions regarding the effect of subjective information on choice behavior under high load conditions does not hold. A more sensitive means of measuring effort is needed to further explore this model at the high and low load ends.
CHAPTER XI
SUMMARY, CONCLUSIONS, AND IMPLICATIONS

Introduction

The issue of consumer mental workload is clearly deserving of attention. Research on this topic in consumer psychology and in marketing, however, has advanced little beyond the state of verifying that a phenomenon of "information overload" can exist. Of interest in the present dissertation was not so much the observance of a "redline" phenomenon, but the observation of what happens in the processing system as "mental workload" changes.

The previous work of Jacoby in consumer psychology and of Malhotra in marketing was very influential in the present work. Jacoby and his colleagues appear to have taken a process approach to the issue of "load", considering such issues as how less information might cause greater confusion, or wondering how graphical information might affect processing. Indeed, the Jacoby school found results suggesting that less information can cause greater "load" (e.g., Buck 1974), a conceptually confusing notion when viewed in terms of "information" load. Malhotra, on the other hand, appears to have taken an outcome approach to the
issue of "load", focusing almost exclusively on decision outcomes. The Malhotra school more closely parallels the approach used in engineering psychology, where the processing system is viewed in a machine-like manner as a system that makes mistakes when overloaded. Indeed, this school of thought has found that too many inputs can lead to what is viewed as "dysfunctional" output behavior.

The present dissertation was motivated, in part, by an attempt to integrate these different approaches to processing system behavior. The "redline" approach of Malhotra was used in Prestudies 1 and 2 to discover that this redline point in performance reliability can shift due to at least one variable other than information quantity—time. The process approach of the Jacoby school was used in Study 3 to observe underlying changes in the processing system that might lead to problems of performance reliability as well as lead to outcomes other than immediate decisions—attitude changes.

Much like the original dissertation of Malhotra (1979), "Consumer Information Seeking and Information Processing: An Alternative Theoretical Framework and some Empirical Investigations," the present dissertation was observational in nature, proposing two theoretical frameworks, WHAM and IMAAC\textsubscript{3}, on the broader issue of "mental workload", and presenting the results of some empirical investigations conducted to explore the conceptual plausibility of these
frameworks. The present exploration of the broader issue of "mental workload" was conducted from the perspective of building upon the earlier Malhotra work. The objectives of the present dissertation, as stated in Chapter I, were:

1) To integrate relevant theoretical development and empirical findings from the areas of marketing, of engineering psychology and mental workload, and of social psychology and persuasion.

2) To explore the underlying structure of "mental workload" in an attempt to define this notion conceptually, theoretically, and operationally.

3) To develop a conceptual, theoretical, and operational framework that helps to explain how consumer information is processed under conditions of low, moderate, and high mental workload.

The Underlying Structure of Mental Workload

Time. The results of Prestudy 2 implicate "information load" as a time-less notion as it relates to Miller's "magical number seven". Irrespective of time, there does appear to exist some asymptotic limit in the ability of the processing system to handle some quantity of information. It appears, however, that the notion of "mental workload"
necessarily requires the dimension of time, whereas the notion of "information load" is apparently a special case of the broader notion of mental workload that requires that time is specifically not a constraining factor, as was the case in the Malhotra study. The "redline" of "overload" shifted in the present research when time was constrained and manipulated in Prestudy 2.

**Effort.** Curiously, this "redline" point again shifted in Study 3, from the 10 alternative point of the 2.5 minute condition in Prestudy 2 to the 12 alternative point in Study 3, also a 2.5 minute condition using the same stimulus materials. In all cases, however, the "bump" at this "redline" point was preceded by a dip. A possible explanation for the dip-bump signature of "overload" is that subjects in this particular manipulation put forth a greater amount of effort near the point of overload. It is possible that subjects in Study 3 felt more overwhelmed by that task than the task of Prestudy 2.

The survey booklet of Prestudy 2 merely consisted of the "choice" question and the workload survey on 8-1/2 x 11 inch paper, and subjects were requested to quickly peruse the survey material prior to commencing with the reading task. The survey booklet of Study 3 was relatively thick and on 8-1/2 x 14 inch paper, and subjects were prohibited from looking through the survey booklet. The results of Shaffer & Hendrick (1971) suggest that subjects will make
judgements regarding the difficulty and effort requirements of a task, and the results of Bryan & Locke (1967) suggest that subjects will adjust their effort to conform to the apparent requirements of a task. Perhaps this could affect the alteration in the location of the dip-bump signature, and even be the cause of the dip-bump signature. "Effort" appears to be a tenuous measure in the present research, however.

Workload dimensions. The Workload Human Analogy Model (WHAM) posits that workload is associated with three primary dimensions, resource requirements (a quantity), effort (a force), and time. A factor analysis of the workload survey appears to concur with these primary dimensions when "load" is varied. Measures associated with the "quantity" and "time" dimensions do appear to reflect different "information load" conditions. This cannot be said for the "effort" dimension, however.

In retrospect, it seems likely that the measures of the workload survey do not reflect actual use of the processing system, but better reflect subjects' perceptions. Again, the results of Shaffer & Hendrick (1971) suggest that similar results might be obtained even if subjects did not actually complete the task, but merely imagined completing the task. This would be true regardless of the format, as if, say, subjects were asked in sentence form, "how hard did you work to complete this survey", as in the Shaffer &
Hendrick study.

It appears, then, that subjective measures of "effort", and perhaps even of the quantitative (resource) demands on the processing system might be limited in usefulness, and that the only useful way to detect actual expenditures of the processing system is via more obtrusive means, such as the secondary task technique and physiological measures (reviewed briefly in Chapter IV). Nonetheless, the factor results from the subjective workload survey do concur with WHAM, suggesting the primary dimensions of workload, at least as perceived by the subjects themselves.

Overload

In the "information overload" studies of earlier researchers, "overload" was assumed to occur at a point at which subjects exhibited a "significant" drop in choice behavior. "Significance" does not necessarily mean that some redline point of sudden change can be found, however. Any line that decreases at a constant rate (i.e., is a straight but sloped line) will possess some point which is "significantly" different from the starting point in a statistical sense, regardless of any lack of aberrations along the smooth but sloped line. "Significance", then, could not alone define "overload", although this is the method used in the earlier "overload" studies.
In engineering psychology, "overload" is taken to occur when the operator (subject) is unable to complete the task. This is how "overload" was defined in Study 3 of the present research, in contrast with the operationalization previously used in marketing studies of information load. In the present research, the point at which performance began to vary as a result of changes in the ordering of the alternatives in the choice set was taken as the "overload" point. That is, changes in aggregate performance due to ordering were taken as an indication of an increased likelihood of not completing the reading task. A subjective measure of "certainty" also suggested an "overload" point due to a split in this measure with regard to ordering effects. This operationalization of "overload", then, provided a point of reference for the range of load in observing the shape of the load curve and on the use of "peripheral cues" by subjects as "overload" was approached.

The Shape of a "Load Curve"

The dip-bump signature about the "overload" point in performance was unexpected, and initially viewed as an indication that there was some sort of flaw in the stimulus materials or in the manipulation. In viewing the performance results of the 1.5 minute condition of Prestudy 1, the performance curve appears as an inverted-U, as if there exists a point which exhibits a peak in performance.
It becomes evident in observing the results of the 2.5 minute condition of Prestudy 2 and the results of Study 3 that this is not a peak, but a bump about the point of ultimate "overload".

The results previously reported by Malhotra and by Jacoby also appear to exhibit this dip-bump signature about the overload point. A limitation with these earlier studies is that the number of subjects per cell is very small, requiring large differences to achieve "significance" in a statistical sense; the present study raised this to 20 per cell. Note that a change in response by a single subject makes a difference of over 8% in the result when only 12 subjects per cell are used. Additionally, the resolution of these studies was rather large; the increment of information increase between each successive cell was relatively large, with Jacoby varying "load" in steps of 4, 8, 12, or 16 alternatives in the instant rice and prepared dinners studies, and Malhotra varying "load" in steps of 5, 10, 15, 20, and 25 alternatives. The resolution of the present research was twice as great, additionally providing a greater number of steps across which load was varied.

These issues all present limitations in interpreting the "significance" of the results of Malhotra and of Malhotra's reanalysis of Jacoby's results. The data of Jacoby, Speller, & Berning (1974) and of Malhotra (1979, 1982) are reproduced in Tables 11.1 and 11.2 after
adjustment for the effects of chance (eq. 8.8). In the Malhotra study, when five features are used to describe each alternative in the choice set, a bump in performance is apparent at 15 and 20 alternatives (82% "correct choice"), preceded by a dip at 10 alternatives (54% "correct choice"). At the level of 10 features, a bump at the 15 alternative point (73%) is preceded by a dip at the 10 alternative point (44%). The 15 feature level and above was taken by Malhotra to be beyond "overload", and it appears that the "bump" might have shifted left at this point. Malhotra's analysis took the 10 alternative point as an indication of the "overload" threshold in a main effects analysis which essentially aggregated across all levels of features; no recognition was made of the bump that occurred past this point when the data were disaggregated to view results below the point of "overload" on the feature factor. The data of Jacoby and his colleagues also appears to have a signature not unlike that of the present research. It would be interesting to have had additional data for points between those used in these two studies.

A comparison between the Malhotra results and those of the present Study 3 is graphically illustrated in Figure 11.1. Note that the Malhotra study was a true "information load" study since time was not constrained; the present Study 3 was a "workload" study since time was constrained. Recall that "overload" was defined in Study 3 by the point
Table 11.1

Performance Results of Malhotra (1979)

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<td></td>
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Note: Total number in each cell is 12. Numbers represent the percentage of subjects making a "correct choice" after adjustment for chance (eq. 8.8); numbers in parentheses are original (raw) frequency of subjects making a "correct choice" (out of 12) in that cell.
Table 11.2

PERFORMANCE RESULTS OF JACOBY ET AL. (1974)

**instant rice data**

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<td>122(5)</td>
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**prepared dinners data**

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<td>44(7)</td>
</tr>
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<td>16</td>
<td>78(10)</td>
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Note: Total number in each cell is 12. Numbers represent the percentage of subjects making a "correct choice" after adjustment for chance (eq. 8.8); numbers in parentheses are original (raw) frequency of subjects making a "correct choice" (out of 12) in that cell.
FIGURE 11.1
COMPARISON OF STUDY 3 AND MALHOTRA RESULTS

- Malhotra, 5 features
- Malhotra, 10 features
- Study 3, central cond.
at which respondents began to exhibit an increased probability of not finishing the task in the constrained time, with "overload" occurring beyond the 12 alternative point. The results of Study 3 are therefore shown with aggregated counterbalanced results, which dip after the 12 alternative point, as well as with the results of the "left page" condition (from Figure 9.16), in which the objectively "best" product is included within the set of ads that subjects are likely to have read.

For comparison in Figure 11.1, the Study 3 results that are plotted are those of the central condition only, since the Malhotra study did not include peripheral information. The Malhotra results that are plotted are only those of the 5 feature and the 10 feature conditions. Study 3 uses between 5 and 11 features, depending on what should appropriately be considered to constitute the unit of a feature (see Table B.1 and associated discussion in Appendix B). Therefore, the plot of Study 3 results against the 5 and the 10 feature conditions of Malhotra is an "apples to apples" comparison below the point of "structural overload", except for the effects that a time constraint might have on "effort" expenditure below the structural overload point.

The dip-bump performance signature observed in the present research appears to be entirely consistent with that of the previous research of Jacoby and of Malhotra when these are not confounded with the factor of feature level.
Indeed, the Malhotra data hardly show evidence of "overload" at and beyond the 10 alternative level when disaggregated, as he concluded from his aggregated LOGIT analysis, but seem instead to exhibit a dip in performance prior to a peak. Unfortunately, it is still unclear exactly why such a shape in the performance curve should occur. It is has been speculated here that this signature might be due to an increase in effort by subjects near the threshold of "overload". That is, people might have the ability to recognize when the task requires "extra effort" (cf., Bryan & Locke 1967; Yeh & Wickens 1988), thereby exhibiting a "burst" of effort near the "overload" threshold.

However, there are no measures from the Malhotra or Jacoby studies nor from the present research that can confirm or deny this potential explanation. The apparent "effort" and "resource" measures of the present study presumably do not detect the actual expenditure of processing resources, and some more obtrusive means, such as the RT-probe or physiological techniques, is necessary to further explore this issue.

Load and Attitude Change

Of ultimate interest in the line of research initiated by this dissertation is the effect of "load" on the use of "peripheral cues". An initial consideration in the proposal of IMAAC was that the agent cues as used in this research
could function to increase the choice probability of the second best product above the choice probability of the first best product under conditions of high load. According to IMAAC₃, cues should play a larger role in the processing of information as processing approaches "overload", and it was thought that this would have a strong influence on choice behavior. The recall and attitude results of Study 3 suggest that IMAAC₃ is a plausible model, and that cues are apparently used to a greater extent as load is increased. However, these cues do not seem to direct choice behavior toward a specific product. That is, in this manipulation, increases in load did not cause an increase (in the peripheral vs. central condition) in choice of the second best alternative sold by the more credible and attractive sales agent.

The test used in this manipulation was a very rigorous test of the influence of cues, however. The instructions received by subjects were intended to imply that these cues are not relevant to the choice task. So, although cues might be more likely to be considered under higher conditions of load, they apparently have only minimal effects on choice behavior when the objective of the task does not require the use of cues. It is still possible that cues would affect choice behavior under conditions when cues are considered more relevant to the task.
In a typical manipulation used in assessing the ELM, for example, the credibility of the source of a communication might be considered important by the reader when the task deals with an issue with which the reader is unfamiliar, thereby influencing the attitudes and perhaps the choices made by the reader. Similarly, the instructions of the present study could be framed such that the agent might be a more important aspect of the choice process (e.g., by increasing the personal "involvement" of the subject, or by using a less familiar product), and it still seems possible that the agent could affect choice behavior toward specific products under conditions of high load.

Nonetheless, the present results suggest that "peripheral cues" are actively used under conditions of moderate load, and might be more passively used under conditions of very high load. Even if these cues do not have a strong effect on immediate choice behavior in this particular manipulation, these cues may well have some effect on the behavior of a consumer if they affect attitudes. Exactly how increases in mental workload affect attitude change processes is at least as important as any immediate decision outcome of the effects of mental workload. The engagement of qualitatively different modes of processing might result in very different levels of attitude persistence and resistance to counter-arguments (cf., Haugtvedt 1989; Haugtvedt & Strathman 1990); i.e., the
delayed effects on future decisions or post-purchase satisfaction might be very different, depending on the mode of processing. Such issues await further research.

Although the IMAAC$_3$ model proposed in this dissertation appears to be conceptually plausible, it is only a starting point. As a starting point, however, the propositions of this model and the results obtained in Study 3 provide insights that extend beyond the independent notions of "central-peripheral" and "controlled-automatic" processing. IMAAC$_3$ appears to be useful as a conceptual framework to deal with the complex real-world issues raised by the classic "Four Levels" involvement/attention model of Greenwald & Leavitt (1984). The Workload Operating Characteristic of IMAAC$_3$ provides a process approach grounded in reasonably well understood theories that could, perhaps, assist in answering the questions posed by Greenwald & Leavitt.

Future Research

Although the studies conducted as part of this dissertation provide insights with regard to the nature of consumer mental workload, they still leave a number of important issues unresolved. The focus of the final study in this dissertation was on the effects of differing levels of mental workload on recall and attitude change with respect to situational cues. It was initially expected that
an increase in recall and attitude change with respect to these cues would be accompanied by an influence on choice behavior as load increased. That is, it seems possible that people's choices could be affected by cues as the choice task is performed under higher "load". At an aggregate level, this does not appear to be the case in this particular manipulation.

The present manipulation was a very rigorous test of this potential effect, however. The instructions provided to subjects tended to downplay the role of cues in the decision task. That is, subjects were to choose the one most preferred alternative in the choice set, which is probably not the way that people in the actual situation of the cover story would make a choice. Since the product is not being purchased, but merely being visited, someone in the actual situation would likely place some weight on the sales agent as an objective attribute. The agent might indeed function, for example, as someone on whom the prospective purchaser might have to rely to show other listings outside of the choice set. Future research could manipulate the cover story or instructions to test for the influence of cues under differing conditions of load in different situations.

Of more immediate interest, however, is the issue of "effort" and "motivation" in this line of research. Three observations of the present research cannot be fully
explained without a better understanding and measure of the "effort" construct. First, the performance curve (called a "load curve" by Malhotra) was observed to shift in the different studies of the research reported here. The performance curve shifted when load was changed on the dimension of time in Prestudy 2. The curve again shifted when the 2.5 minute condition of Prestudy was replicated in Study 3, but with a much longer survey booklet. Although a plausible explanation would appear to be that differences in motivation and effort influenced the location of the load curve, a better indicator of these constructs is necessary to test for this explanation.

Secondly, performance in all three of these manipulations appears to increase in the neighborhood of the "overload" threshold. Again, this is presumably due to the realization by subjects in conditions at the threshold that the task requires an increase in "effort". A valid and reliable indicator of motivation and effort is required to test for this explanation, however.

Thirdly, the "load" curve that is suggested by cue recall and attitude measures, as implied by the Workload Operating Characteristic of IMAAC₃, does not match the performance curve at the lower end. The Workload Operating Characteristic that is traced by the data of Study 3 suggests that 4 alternatives in this particular manipulation results in greater workload than 6 alternatives. Again, a
valid and reliable indicator of motivation and effort is required before it is possible to assert that 6 alternatives is indeed less "work" than 4 alternatives.

Studies related to these observations and to the issue of "motivation" and "effort" have been initiated. Study 3 is being replicated to see if the same performance signature is obtained. Although the cell sizes of Study 3 were larger than those the Jacoby and Malhotra studies, they were still somewhat small for binary analysis. If the replication obtains the same results as those of Study 3, the data can be pooled, doubling the cell sizes and increasing the confidence in the observation of the load signature. This pooling would additionally allow a further disaggregation of the data to observe the effects of ordering, which currently results in cell sizes that are too small to be meaningful.

In conjunction with this replication, two other post-dissertation studies are being conducted. One study is designed to specifically not manipulate workload, with interest being in the relationship between the personality variable "need for cognition" and subjective measures of motivation and effort. The other study is designed to observe the effects of changes in the "justification" of an experiment (via the cover story) on subjects' answers to a survey and on subjective measures of motivation and effort.

A factor of interest across the three studies is the subjective measures of motivation and effort by subjects who
had previously seen the measures. In the second and third studies, some of the participants, obtained from a common student subject pool, would have seen the effort measures in one of the previous studies. Subjects who have experience in completing subjective measures might provide different responses than those who do not. SWAT (eg., Reid et al. 1981), discussed in Chapter V, has been in use with military pilots who are intimately familiar with SWAT as a measurement task, and SWAT appears to exhibit good reliability in the situation of experienced respondents. The three post-dissertation studies are being conducted as a series to observe, in part, if subjective measures of effort and motivation in consumer studies can become more sensitive with practice on the part of the subject.

Although the conduct of the dissertation study has resulted in greater insight and clarification regarding processes and outcomes that might be associated with the various workload related constructs such as attention, elaboration, or mental effort, the detection and measure of these remains elusive. Quoted earlier, Titchener's (1908, Ch.5) observation is continued:

"It is true that the discovery of attention did not result in any immediate triumph of experimental method. It was something like the discovery of a hornet's nest: the first touch brought out a swarm of instant problems. . .

"The discovery of a reliable measure of attention would appear to be one of the most important problems that await solution by experimental psychology in the future."
APPENDIX A

PRETESTING OF PERIPHERAL CUES

Introduction

An important objective of Study 3 was to assess the effect of subjective information, or peripheral cues, in the context of changes in mental workload with regard to the objective information of a communication. In order to assess the effects of these cues, some insights must first be gained with regard to the subjective perceptions of a sample of the population under test. That is, the general magnitude and direction of attitudes that these cues elicit from people within a particular population must be known prior to using these cues in an experimental manipulation.

Pretesting of the cues that were used in the present research was done in two steps. First, appropriate photographs of sales agents and appropriate descriptive material were initially selected by asking subjects to rank order several alternatives of both photographs and of separate descriptors. Photographs that tested as most separated in the attitudes expressed toward the agent in the picture (by mean rank) were chosen for consideration in the final set. The descriptors were also rank ordered, and
potential descriptors were chosen on the basis of a separation in the mean ranks as well as a conjoint analysis of attributes within each descriptor.

In the second step of this pretesting, the most "positive" agent photograph was paired with the most "positive" descriptor, and the least "positive" agent photograph was paired with the least "positive" descriptor. A sample of subjects was then asked to express an attitude regarding one of the agents (photograph and descriptor), without comparison to the other agent. The attitude profile of the two agents was then compared, and found to be reasonably parallel between these agents. The ad headers (cues) used in the final stimulus material, then, were known to elicit positive attitudes toward one header and slightly negative attitudes toward the other.

Pretesting of Photographs

Photographs of actual real estate agents were clipped from a local real estate catalog that is distributed free in local retail stores. In initially considering what sort of agent to use, pictures were hand drawn of a middle aged, conservative looking male agent, and of a younger, cocky looking male agent. Two agents from the initial set of photographs were chosen due to resemblance to the hand drawn pictures, labeled as "E" and "D" in Figure A.1. Two other male agents were chosen from the set as representing a very
"professional" look and as representing a very "unprofessional" look, labeled as "C" and "B" in Figure A.1. A fifth male agent was chosen as potentially ambiguous looking with regard to such traits.

Student subjects (n=42) in an undergraduate business class were then asked to rank order these five photographs on 10 dimensions, as shown in Figure A.1. The age range across all of these subjects was 20-23 years, with 20 females and 22 males. In coding for analysis, rank values were assigned such that "most matches this description" was assigned a value of 1, and "least matches this description" was assigned a value of 5. That is, if an individual subject ranked the agents on attractiveness as C, D, A, E, B, then agent "C" was scored a value of 1, "D" a value of 2, and so on, for that individual subject.

The rank sums and rounded average ranks for each of the five photographs on each of the ten dimensions is shown in Table A.1 and summarized more graphically in Figure A.2. In order to ensure that there were no substantial differences between male and female respondents, these results were also broken down by gender, shown in Tables A.2 and A.3.

Interestingly, agents "D" and "E", initially chosen on the middle-aged researcher's perceptions as "negative" and "positive" real estate agents, would not be especially good cues to use in experiments utilizing 20-23 year old college undergraduates. Agents "B" and "C" appear to consistently
Below are several sets of words which describe desirable and undesirable characteristics of real estate agents. In each set, choose the agent who most seems to match the description. Then choose the agent who least seems to match the description. Finally, fill in the three middle blanks so that the agents are ordered in a manner from "most matches this description" to "least matches this description". Thank you for your time.

1) attractive

2) unrefined, clumsy, awkward

3) trustworthy, honest, sincere

4) lazy, slow

5) experienced, knowledgeable

6) reckless, uncooperative

7) confident

8) deceitful, shifty

9) professional

10) immature

Are you: FEMALE MALE Age:

FIGURE A.1

AGENT PHOTOGRAPHS RATING TASK

Note: Page is reduced in size.
TABLE A.1

STIMULUS PHOTOGRAPH RANKING, ALL SUBJECTS

RANK SUMS

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<thead>
<tr>
<th>ITEM</th>
<th>A</th>
<th>B</th>
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<th>D</th>
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AVERAGE RANKS

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In coding, rank values were assigned such that "most matches this description" was assigned a value of 1, and "least matches this description" was assigned a value of 5. "Rank sums" is the sum of these ranks, and "average ranks" is the nearest integer to the average of these ranks (n=42).
### TABLE A.2

**STIMULUS PHOTOGRAPH RANKING, MALE SUBJECTS**

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**AVERAGE RANKS**

In coding, rank values were assigned such that "most matches this description" was assigned a value of 1, and "least matches this description" was assigned a value of 5. "Rank sums" is the sum of these ranks, and "average ranks" is the nearest integer to the average of these ranks (n=22).
TABLE A.3
STIMULUS PHOTOGRAPH RANKING, FEMALE SUBJECTS

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AVERAGE RANKS

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In coding, rank values were assigned such that "most matches this description" was assigned a value of 1, and "least matches this description" was assigned a value of 5. "Rank sums" is the sum of these ranks, and "average ranks" is the nearest integer to the average of these ranks (n=20).
Below are several sets of words which describe desirable and undesirable characteristics of real estate agents. In each set, choose the agent who most seems to match the description. Then choose the agent who least seems match the description. Finally, fill in the three middle blanks so that the agents are ordered in a manner from "most matches this description" to "least matches this description". Thank you for your time.

1) attractive
   MOST matches this description: D, A, E, B
   LEAST matches this description: C, B

2) unrefined, clumsy, awkward
   MOST matches this description: C, A, B
   LEAST matches this description: E

3) trustworthy, honest, sincere
   MOST matches this description: E, A, B
   LEAST matches this description: C

4) lazy, slow
   MOST matches this description: B, E, A, D
   LEAST matches this description: C

5) experienced, knowledgeable
   MOST matches this description: C, A, B
   LEAST matches this description: E

6) reckless, uncooperative
   MOST matches this description: B, D, A
   LEAST matches this description: E

7) confident
   MOST matches this description: C, D
   LEAST matches this description: A, B

8) deceitful, shifty
   MOST matches this description: B, D, A
   LEAST matches this description: C

9) professional
   MOST matches this description: C, A
   LEAST matches this description: B, D

10) immature
    MOST matches this description: D, A
    LEAST matches this description: B, C, E

Are you: FEMALE MALE    Age: __________

FIGURE A.2

RESULTS OF AGENT PHOTOGRAPHS RATING TASK

Note: Page is reduced in size.
represent extremes in the rankings on this particular subject population (young middle-class undergraduate business majors at a large midwestern university), except on the "maturity" dimension.

Pretesting of Agent Descriptors

Like the agent photographs, descriptions of agent credentials were taken from actual real estate advertisements in the same booklet from which the photographs were taken. Three general attributes appeared to be described often and to be relevant to creating "credibility" as stimulus cues to business undergraduates: sales levels (e.g., member of the $20 million roundtable), credentials (e.g., number of years' experience or certification by a professional organization), and level of education (e.g., MBA). Descriptors based on these three general attributes were then created from descriptors of actual ads, except that certification or accreditation was altered to reflect a non-existent professional organization.

These agent descriptions were assembled into a conjoint task with three attributes at three levels. The attributes and levels are listed in Table A.4. The same student subjects who had ranked the photographs were asked in the same session to also rank the descriptors shown in Figure A.3. Although 42 surveys were returned on the photograph ranking task, only 41 surveys were returned on the
descriptor ranking task.

The results of a conjoint analysis on these descriptor rankings are listed in Table A.4. The attribute importance weights are all reasonably high, indicating that these are a reasonable choice of attributes to use in the stimulus materials with this sample of undergraduate business majors. To gain further insights into how best to create agent descriptors to use as stimulus materials, the ranks were summed and averaged for each set of descriptors, shown in Figure A.3. The descriptions used in the final stimulus materials were assembled from the insights provided by these two methods.

A conjoint simulation was then run on three agents: Agent A is a member of the $20 MM club, has a professional certification, and has an MBA from a prestigious school. Agent B has won an office sales award, has 20 years' of experience, and has a BA degree from a community college. Agent C provides free maps, a buyer's guide, and offers a notary service (i.e., advertises no credentials). In this simulation on the results from this sample, Agent A would obtain 95% of the business, Agent B would obtain 5%, and Agent C would obtain none. This simulation suggests that the credentials of Agent A would be very influential in the choice task of Study 3 if subjects were to rely solely on these cues.
### TABLE A.4

**RESULTS OF CONJOINT ANALYSIS**

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<th>LEVEL</th>
<th>IMPORTANCE</th>
<th>WEIGHT</th>
<th>UTILITY</th>
</tr>
</thead>
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<tr>
<td>Education</td>
<td>MBA, prestigious school</td>
<td>48%</td>
<td>1.15</td>
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<tr>
<td></td>
<td>BA, community college</td>
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<td></td>
<td>None: filler material</td>
<td></td>
<td>-1.11</td>
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<td>Sales</td>
<td>$20 MM Roundtable</td>
<td>33%</td>
<td>1.15</td>
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<td>-0.60</td>
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REAL ESTATE AGENT SURVEY

Below are several sets of descriptions taken from a local real estate magazine. If you received a job offer in a distant city and were considering the purchase of a condominium, which of the following real estate agents would you most prefer to visit first? Which agent would you least prefer to visit?

In the box next to the agent you would most prefer to visit first, write "1". In the box next to the agent you would least prefer to visit, write "9". Then go back and look for the second best, then the second worst, and so on, until all agents are ordered from "best" to "worst" using the numbers 1 through 9. Thank you for your time.

Note: Page is reduced in size. Numbers in boxes represent rank sum averages.
Interestingly, the worst-ranked set described the agent as having provided "real estate service since 1971", and the best-ranked set described the agent as having "over two decades of real estate service". These responses were collected in April 1991, meaning that both agents should be perceived as having about the same amount of experience. This could be a function of the relatively lower importance ascribed to this attribute, or could instead be a factor lowering the apparent importance weighting of this factor in analysis. When questioned about this anomaly, an undergrad research assistant pointed out that the year 1971 was about the time when typical undergrad students had been born. The explanation that was given regarding why the year "1971" might elicit a different response than "two decades" has since been forgotten, but this curious observation, along with the choice of photographs that differed from those initially chosen by the middle aged researcher, does emphasize the need to pretest stimulus materials when used on any particular sample.

Pretesting of Final Stimulus Headers

From the tests of photographs and the insights gained from the testing of the discriptor material, headers for the stimulus ads were assembled as shown in Figures A.4 and A.5. The attitude descriptors that had been used on the photograph ranking task were modified for use in examining
attitudes expressed toward the final headers, resulting in bipolar seven point scales. Undergraduate business students \( n=46 \) were asked to express their perceptions regarding the agents pictured in these headers in a between subjects manner. That is, each respondent received only one of these headers to rate, without comparison to the other header, for a total of 23 subjects per cell.

The results of this survey are shown in Tables A.5 and A.6, where the seven point scale is anchored by values of -3 to +3. The resulting profile of each agent is graphically compared in Figure A.6. The profiles of the "neutral" agent and the "positive" agent appear to be reasonably parallel and separated for the purposes of their use as cues, and therefore considered as acceptable cues for the present research. These headers were therefore deemed as appropriate stimulus cues for the population of typical undergraduate students. The agents pictured in the photographs were then contacted and the nature of the remainder of the study was explained, and written permission was obtained to use their photographs with the bogus descriptors.
CALL NUMBER ONE!

- Quality real estate service since 1971
- Alumnus, Branfield Tech
- S.W. office listing leader
- Balloons for the kids (while they last)!

Harold Berkermer

MÉTRO REALTY
1845 Eleventh St.
Office: 872-6287
Eves. : 493-2136

What are your perceptions of this real estate agent? Place an X on each of the scales below to indicate your initial impressions of this agent.

attractive __:____:____:____:____:____:____ unattractive

clumsy/awkward __:____:____:____:____:____:____ refined

experienced __:____:____:____:____:____:____ inexperienced

honest/sincere __:____:____:____:____:____:____ deceitful/shifty

immature __:____:____:____:____:____:____ mature

confident __:____:____:____:____:____:____ insecure

lazy/slow __:____:____:____:____:____:____ quick/responsive

careful __:____:____:____:____:____:____ reckless

uncooperative __:____:____:____:____:____:____ helpful

FIGURE A.4
SURVEY OF NEUTRAL AGENT HEADER

Note: Page is reduced in size.
What are your perceptions of this real estate agent? Place an X on each of the scales below to indicate your initial impressions of this agent.

- attractive ___:____:____:____:____:____:____:____:____ unattractive
- clumsy/awkward ___:____:____:____:____:____:____:____:____ refined
- experienced ___:____:____:____:____:____:____:____:____ inexperenced
- honest/sincere ___:____:____:____:____:____:____:____:____ deceitful/shifty
- immature ___:____:____:____:____:____:____:____:____ mature
- confident ___:____:____:____:____:____:____:____:____ insecure
- lazy/slow ___:____:____:____:____:____:____:____:____ quick/responsive
- careful ___:____:____:____:____:____:____:____:____ reckless
- uncooperative ___:____:____:____:____:____:____:____:____ helpful

FIGURE A.5
SURVEY OF POSITIVE AGENT HEADER

Note: Page is reduced in size.
### TABLE A.5

**FINAL HEADER ATTITUDES, NEUTRAL HEADER**

<table>
<thead>
<tr>
<th>DESCRIPTOR</th>
<th>MEAN</th>
<th>STD.DEV.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attractiveness</td>
<td>-1.261</td>
<td>1.214</td>
</tr>
<tr>
<td>Refinement</td>
<td>-1.261</td>
<td>1.367</td>
</tr>
<tr>
<td>Experience</td>
<td>0.739</td>
<td>1.287</td>
</tr>
<tr>
<td>Honesty</td>
<td>-0.348</td>
<td>1.369</td>
</tr>
<tr>
<td>Maturity</td>
<td>-0.043</td>
<td>1.296</td>
</tr>
<tr>
<td>Confidence</td>
<td>0.304</td>
<td>1.063</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>-0.696</td>
<td>1.146</td>
</tr>
<tr>
<td>Carefulness</td>
<td>-0.261</td>
<td>1.287</td>
</tr>
<tr>
<td>Helpfulness</td>
<td>0.130</td>
<td>1.217</td>
</tr>
</tbody>
</table>

### TABLE A.6

**FINAL HEADER ATTITUDES, POSITIVE HEADER**

<table>
<thead>
<tr>
<th>DESCRIPTOR</th>
<th>MEAN</th>
<th>STD.DEV.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attractiveness</td>
<td>0.217</td>
<td>1.085</td>
</tr>
<tr>
<td>Refinement</td>
<td>0.636</td>
<td>1.329</td>
</tr>
<tr>
<td>Experience</td>
<td>1.870</td>
<td>0.920</td>
</tr>
<tr>
<td>Honesty</td>
<td>0.826</td>
<td>1.403</td>
</tr>
<tr>
<td>Maturity</td>
<td>1.652</td>
<td>0.982</td>
</tr>
<tr>
<td>Confidence</td>
<td>1.913</td>
<td>1.125</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>1.304</td>
<td>0.974</td>
</tr>
<tr>
<td>Carefulness</td>
<td>0.870</td>
<td>1.217</td>
</tr>
<tr>
<td>Helpfulness</td>
<td>1.391</td>
<td>1.234</td>
</tr>
</tbody>
</table>
Note: "*" denotes items in which the anchors have been reversed. These results reflect a between subjects comparison, where each subject rated only a single header without comparison to the opposing header.
APPENDIX B

DEVELOPMENT OF PRODUCT ALTERNATIVES

Introduction

Very careful consideration had to be given to generating the product alternatives used in this research, since these are associated with issues of "workload", "attention", and such, both actual and perceived. Although construction of the choice set might seem like a trivial problem, a number of issues had to be considered when generating the product alternatives used in each choice set. Because the present research is the study of processes involving attention, information load, mental workload, and such, the construction of the ads used in this research is much more critical than would be the case in most other consumer research, and is therefore described in much greater detail than would otherwise be required.

Since this is part of a workload task, it was necessary to ensure as best as possible that each increment in "information load" via the addition of any additional pair of alternative products was about the same, and that each alternative within the additional pair was as nearly the same as possible. Each ad had to not only be about the same
with respect to amount of information, but also had to be as near as possible the same with respect to number of words. Additionally, all ads had to provide the same graphic appearance, since this could affect the attention given to particular alternatives, requiring that these be the same with respect to number of lines, to the length of the last line, and even to the placement of the product name within the description. Finally, one alternative on each page had to clearly be "better" than the other alternatives, with one of those two as clearly the "first best" alternative.

Careful consideration had to be given, then, to exactly what information was provided, how each alternative was to differ from the others, and specifically how the statements describing the features of each alternative were physically constructed. This was performed in several steps. Appropriate features had to be chosen such that they could be described at various levels which differed objectively in value. Sentences had to be constructed such that the statement itself did not add value to a feature or attract undue attention, yet described various features with different wording. Sentences then had to be assembled into the various alternative descriptions such that the final description of each product was about the same in length and graphic appearance as all other descriptions. Finally, each ad had to look "real" when completed, i.e., the stimuli had to exhibit face validity to participants in the research.
Features

Recall that condominiums were to be described with apartment features. Although apartment features were chosen in part because these should be most salient to college undergraduate students, apartment features are also especially useful in the present choice task because many of these features can be easily compared on objective terms. An apartment that is equipped with a refrigerator, stove, washer, and dryer is of greater objective value, cet. par., than one which does not have these features. Note that the cover story explained that these alternatives were all about the same with respect to price, and with respect to distance from the prospective employer, shopping, and entertainment.

Several local apartment shopper's guides were consulted for insights regarding appropriate features to use in these ad descriptions. A number of features were commonly described, such as the availability of appliances, hook-ups for appliances if not provided, availability of patios, availability of exercise and party facilities, and so on. The resultant list of these commonly mentioned features was then limited to the most "generic" of items. For example, a weight room might be of great interest to some people, but a jogging trail might be of greater interest to others, while some people might perceive no value in either. Such items might serve to attract the attention of particular subjects, being the primary reason for a choice, and were therefore
eliminated from consideration as features for use in describing the various alternatives.

Each alternative was ultimately described with respect to five features, some of which were described by several attributes (e.g., appliances within the feature "kitchen"). These features were varied in value, including a virtual absence of the feature. The various alternatives and features are outlined in Table B.1. Note that the levels of the features were slightly decreased as additional alternatives were added to the choice set; this was to ensure that the addition of particular alternatives did not themselves decrease the likelihood of choice of alternatives already in the choice set. That is, it was important that any decrease in choice of any particular alternative could be attributed to changes in amount of information, rather than the specific information that was added.

Product Names

A pool of names was compiled from names actually used in the local apartment shopper's guide. In most cases, names consisted of two parts, a noun (e.g., "Hills") and a descriptor (e.g., "Whispering"). Existing local two-word apartment names were used, being split and reassembled, thereby decreasing the likelihood of using any name that actually existed locally. Final names are listed in Table B.2.
### TABLE B.1

**FEATURES DESCRIBING THE ALTERNATIVES**

<table>
<thead>
<tr>
<th>First Choice</th>
<th>Second Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. kitchen</strong></td>
<td><strong>1. kitchen</strong></td>
</tr>
<tr>
<td>- self-cleaning range</td>
<td>- color-coord. range</td>
</tr>
<tr>
<td>- frost-free refrigerator</td>
<td>- refrigerator</td>
</tr>
<tr>
<td>- dishwasher</td>
<td>- disposal</td>
</tr>
<tr>
<td><strong>2. washer and dryer</strong></td>
<td><strong>2. washer/dryer hook-ups</strong></td>
</tr>
<tr>
<td>- utility room</td>
<td>- utility room</td>
</tr>
<tr>
<td><strong>3. fully-screened/covered patio</strong></td>
<td><strong>3. open patio</strong></td>
</tr>
<tr>
<td>- gas grill</td>
<td>- gas grill hook-ups</td>
</tr>
<tr>
<td><strong>4. garage</strong></td>
<td><strong>4. carport</strong></td>
</tr>
<tr>
<td><strong>5. club house</strong></td>
<td><strong>5. party house</strong></td>
</tr>
<tr>
<td>- kitchen appliances</td>
<td>- microwave oven</td>
</tr>
<tr>
<td>- dining tables</td>
<td>- ping-pong table</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lesser Choice, 4 Alts.</th>
<th>Lesser Choice, 6 Alts.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. kitchen</strong></td>
<td><strong>1. kitchen</strong></td>
</tr>
<tr>
<td>- range</td>
<td>- range</td>
</tr>
<tr>
<td>- refrigerator</td>
<td>- refrigerator</td>
</tr>
<tr>
<td><strong>2. washer/dryer hook-ups</strong></td>
<td><strong>2. washer/dryer hook-ups</strong></td>
</tr>
<tr>
<td><strong>3. open patio</strong></td>
<td><strong>3. open patio</strong></td>
</tr>
<tr>
<td><strong>4. carports available</strong></td>
<td><strong>4. ample parking</strong></td>
</tr>
<tr>
<td><strong>5. picnic shelter</strong></td>
<td><strong>5. picnic shelter</strong></td>
</tr>
<tr>
<td>- picnic table</td>
<td>- picnic table</td>
</tr>
</tbody>
</table>
Table B.1 (continued).

**Lesser Choice, 8 Alts.**

1. kitchen
   - range
   - refrigerator
2. washer/dryer hook-ups
3. open patio
4. ample parking
5. lawn area for entertaining

**Lesser Choice, 10 Alts.**

1. kitchen
   - range exhaust fan
   - no-wax floors
2. washer/dryer hook-ups
3. nice view
4. ample parking
5. nice place for entertainment

**Lesser Choice, 12 Alts.**

1. kitchen
   - range exhaust fan
2. space available for washer/dryer
3. nice view
4. ample parking
5. nice place for entertaining.

**Lesser Choice, 14 Alts.**

1. kitchen
   - designer-styled cabinets
2. laundry facility conveniently located
3. nice view
4. easy access to parking
5. nice place to visit

**Lesser Choice, 16 Alts.**

1. kitchen
   - easy to decorate
2. central laundry facilities
3. moderate view
4. designed with parking in mind
5. convenient to local entertainment
TABLE B.2
LENGTH ORDERED LIST OF APARTMENT NAMES

Cedar Run
Tall Oaks
Park Ridge
Briar Bluff
Walnut Grove
Channing Way
Oxford Villa
Heather Wood
Meadow Green
Laurel Cliffs
Oakwood Hills
Willow's Edge
Rosewood Glen
Whispering Tree
Foxhound Estates
First and Last Sentences

The first sentence was designed to make vague reference to a constant (irrelevant) dimension, location, for all alternatives; the last sentence was designed to make vague reference to "good living" for all alternatives. First and last sentences referenced the product by name, with an attempt made to balance the location (beginning, middle, end) of the name within the sentence. In all cases, "self referencing" was carefully avoided, since this could attract additional attention, result in more "effortful" processing, or result in a change in the way information is encoded (Klein & Kihlstrom 1986). For example, a sentence would be worded "... has everything that could be expected" rather than "... has everything you would expect". Sentences were initially compiled from actual apartment advertisements; many of the sentences eventually used in the stimulus ads were statements that had actually been used in "real" ads. First and last sentences that were initially constructed are listed in Tables B.3 and B.4.

Sentences Describing Features

Sentences containing product features were designed so as not to add value to the feature. Again, many of these statements were compiled from actual advertisements. The initial lists of statements describing product features are listed in Tables B.5, B.6, B.7, and B.8.
Final Assembly of Alternative Product Descriptors

Sentences describing each of the features were combined such that each product alternative was described in about 50-55 words and was eight and one-half lines in length, except that the last two alternatives added were one line shorter. After these were all assembled and located in pairs on two opposing pages, ads were modified to ensure that pages were relatively consistent with respect to number of ads in which a name started an ad or finished an ad, with respect to the length of the last line, and so on.

After all ads were assembled with headers, they were copied and pasted into file folders for final use. Each subject was provided with a set of the Metro Realty, or "MR" ads, on one page of the open folder, and a set of the Stillman & Associates, or "SA" ads on the opposing page of the open folder. That is, the two sets of ads were viewed side-by-side when the folder was opened. The ads were sealed with clear plastic to ensure that subjects could not write on the ads, that ads would not get smudged in usage, etc., since these factors could affect the attention paid to particular ads. Additionally, this plastic served to reinforce instructions that subjects set down their pencils and not write during the reading task. A partial set of ads used in all information load conditions is included at the end of this appendix (Figure B.1).
TABLE B.3

LENGTH ORDERED FIRST SENTENCE LIST

<table>
<thead>
<tr>
<th>Sentence</th>
<th>Location Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>The prime location of ____ makes life easier.</td>
<td></td>
</tr>
<tr>
<td>____ is just a hop and a skip from everything.</td>
<td></td>
</tr>
<tr>
<td>Terrific location of ____ has convenience in mind.</td>
<td></td>
</tr>
<tr>
<td>____ appeals to common sense with a superb location.</td>
<td></td>
</tr>
<tr>
<td>Ideally located ____ condo is right where it's needed.</td>
<td></td>
</tr>
<tr>
<td>Fabulous location puts ____ in the middle of everything.</td>
<td></td>
</tr>
<tr>
<td>Everything and more is close by in this ____ condominium.</td>
<td></td>
</tr>
<tr>
<td>Perfect location makes ____ an advantageous place to live.</td>
<td></td>
</tr>
<tr>
<td>The perfect match of convenience and location is all at ____</td>
<td></td>
</tr>
<tr>
<td>Close to it all at ____ with easy access to all that one needs.</td>
<td></td>
</tr>
<tr>
<td>Extraordinary location gives the edge to this beautiful ____ condo.</td>
<td></td>
</tr>
<tr>
<td>____ is ideally situated in the center of style and convenience.</td>
<td></td>
</tr>
<tr>
<td>This ____ condo provides the necessary mobile edge with a superb location.</td>
<td></td>
</tr>
<tr>
<td>Fantastic is the only way to describe the location of this ____ condominium.</td>
<td></td>
</tr>
<tr>
<td>The contemporary location of this ____ condominium makes today's living easy.</td>
<td></td>
</tr>
<tr>
<td>Outstanding ____ condominium is just a stone's throw away from the heart of Metro activity.</td>
<td></td>
</tr>
</tbody>
</table>
TABLE B.4.
LENGTH ORDERED LAST SENTENCE LIST

___ has it all.
___ is everything come true.
Beauty and convenience are here at ___.
Living at the fullest is the name for ___.
For the kind of living everyone wants at ___.
At the leading edge of today's lifestyles is ___.
___ is a natural choice for a great place to live.
___ offers the perfect balance of top-notch living.
Everything that could be expected is waiting at ___.
All the comforts and conveniences are awaiting at ___.
___ is sure to satisfy the need for convenience and style.
___ satisfies the demand for true comfort and convenience.
Unique is the best way to describe this condominium at ___.
Unequaled in design, ___ is the contemporary lifestyle of today.
___ fulfills the desire for modern convenience and contemporary living.

This ___ condominium is for those who understand and appreciate great living.
TABLE B.5

LENGTH ORDERED KITCHEN SENTENCES

| The stylish kitchen features ____.
| The spacious kitchen features ____.
| The show case kitchen includes ____.
| ____ complement the beautiful kitchen.
| The tastefully designed kitchen includes ____.
| Included in the state-of-the-art kitchen are ____.
| ____ accent the kitchen that words can't describe.
| ____ are included in the decorator-styled kitchen.
| ____ give the kitchen the convenience everyone wants.
| ____ provide all the convenience needed in the kitchen.
| ____ are evidence to the special attention to the kitchen.

**Designer-styled cabinets** accent the tastefully styled and decorated kitchen. (14 alts.)

The decorator kitchen features modern **easy-clean laminated composite cabinets**. (14 alts.)

This designer condo features a beautiful **easy-to-decorate kitchen**. (16 alts.)

Kitchen is supplemented by outstanding **decor, style, and color coordination**. (16 alts.)
#1. The utility room, complete with washer and dryer, provides easy access to the garage.

#2. The carport is accessible through the utility room, which includes complete washer and dryer hookups.

(4) 1. Complete with washer/dryer hookups; carport available in some units.

2. A carport can be added to some units. Washer and dryer connections are included.

(6) 1. Easy hook-ups for washer and dryer. Ample parking space.

2. Lots of parking space; full washer and dryer connections.

(8) 1. Washer/dryer connections can be added. Lots of parking space.

2. Hook-ups for washer and dryer can be added. Ample parking.

(10)1. Space for washer and dryer equipment. Adequate parking.


(12)1. Ample space for washer and dryer. No parking problems.

2. Enough space for washer/dryer. Hassle free parking.

(14)1. Conveniently located laundry facility. Easy access to parking.


(16)1. Central laundry facility. Convenient parking has easy access.

2. Parking was part of the design plan. Conveniently located laundry facility.
TABLE B.7

PATIO SENTENCES

#1. Covered and screened patio with gas grill.
#2. Gas grill connections compliment the open patio.

(4) 1. Beautiful open patio.
    2. Open patio is just lovely.

(6) 1. Open patio is included.
    2. Open patio with a view.

(8) 1. Patio can be added.
    2. Adequate space for patio addition.

(10) 1. Large rear window view.
    2. Beautiful back room view.

(12) 1. Terrific view.
    2. Nice view.

(14) 1. Good view.
    2. Good view.

(16) 1. Reasonable view.
    2. Adequate view.
**TABLE B.8**

**ENTERTAINMENT SENTENCES**

1. Entertain in the resident clubhouse, complete with modern kitchen appliances and dining tables.

2. Relax with guests in the resident partyhouse complete with microwave oven and ping-pong table.

(4) 1. Relax with guests at the resident picnic shelter, complete with picnic tables.

2. Entertain in the resident picnic shelter complete with picnic tables.

(6) 1. Take visitors to the resident gazebo with picnic table.

2. Resident gazebo with picnic table for entertaining.

(8) 1. Beautiful lawn area for outdoor entertaining.

2. Relax with visitors in the beautiful outdoor commons area.

(10) 1. A great place to entertain.

2. A nice place to bring guests.

(12) 1. Terrific for entertaining.

2. A place guests will enjoy.

(14) 1. Nice place for guests to visit.

2. Visitors will like this condo.

(16) 1. Convenient to local entertainment for guests.

2. Near to nice places to take visitors.
FIGURE B.1

SET OF FINAL CHOICE SETS USED IN ALL CONDITIONS

Note: Examples of stimulus materials shown on the following pages are reduced in size, the original size of each page being 8.5 by 11 inches. Some ads on the following pages are shown with the peripheral information, denoted as the "peripheral condition"; some ads are shown with the peripheral information blocked out, denoted as the "central condition". There were a total of 28 different conditions, 7 (number of ads in the choice set) X 2 (peripheral or central condition) X 2 (MR ads on left page or SA ads on left page). Furthermore, each folder was duplicated as an "A" or "B" folder as a potential comparison in case one folder was later found to have been marked in by subjects, for a total of 56 folders in use throughout the experimental run. No stray marks were found in any folders.
Figure B.1 (continued)

51 (March 1991)  Condo: Price Range K / Area C-3 on map  THE HOUSING LOCATOR MONTHLY

CALL NUMBER ONE!

* Quality real estate service since 1971
* Alumnus, Branfield Tech
* S.W. office listing leader
* Balloons for the kids (while they last)!

Harold Berkermer

METRO REALTY
1845 Eleventh St.
Office: 872-6287
Eves.: 493-2136

MR #12
Park Ridge is just a hop and a skip from everything. The showcase kitchen includes range and refrigerator. Complete with washer/dryer hook-ups; carport available in some units. Relax with guests at the resident picnic shelter, complete with picnic tables. Beautiful open patio. This Park Ridge condominium is for those who appreciate great living.

MR #87
Terrific Cedar Run location. Stylish kitchen features self-cleaning range, frost-free fridge, and dishwasher. Utility room includes washer and dryer, provides easy access to garage. Entertain in resident clubhouse, complete with modern kitchen appliances and dining tables. Covered and screened patio with gas grill. Cedar Run is everything come true.
MR #72
Ideally located Oxford Villa is right where it's needed for outstanding convenience. Featured in the designer kitchen are range and refrigerator. Loads of parking space; complete washer and dryer connections. Take visitors to the resident gazebo with picnic table. Terrific open patio is included. Find beauty and convenience at Oxford Villa.

MR #12
Park Ridge is just a hop and a skip from everything. The showcase kitchen includes range and refrigerator. Complete with washer/dryer hook-ups; carport available in some units. Relax with guests at the resident picnic shelter, complete with picnic tables. Beautiful open patio. This Park Ridge condominium is for those who appreciate great living.

MR #87
Terrific Cedar Run location. Stylish kitchen features self-cleaning range, frost-free fridge, and dishwasher. Utility room includes washer and dryer, provides easy access to garage. Entertain in resident clubhouse, complete with modern kitchen appliances and dining tables. Covered and screened patio with gas grill. Cedar Run is everything come true.
### EXPECT THE BEST!

<table>
<thead>
<tr>
<th>Condo: Price Range K/ Area C-3 on map</th>
<th>THE HOUSING LOCATOR MONTHLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael Stilman, CRA</td>
<td></td>
</tr>
</tbody>
</table>

- **SA #62**  
  Channing Way appeals to common sense with a superb location. Range and refrigerator complement the beautiful kitchen. A carport can be added to some units. Washer and dryer connections are included. Entertain at the resident picnic shelter complete with picnic tables. Open patio is just lovely. Channing Way is a great place to live.

- **SA #64**  
  Prime Tall Oaks location. Designer kitchen includes color-coordinated range, refrigerator, and disposal. Convenient carport access through utility room featuring washer and dryer hook-ups. Relax with guests in resident party house complete with microwave and ping pong table. Gas grill connections complement the open patio. Tall Oaks has it all.

- **SA #24**  
  Fabulous location puts Heather Wood in the middle of everything for superb access. The tastefully designed kitchen includes range and refrigerator. Easy hook-ups for washer and dryer. Ample parking space. Resident gazebo with picnic table for entertaining. Open patio with a view. For the kind of living everyone wants at Heather Wood.

- **SA #25**  
  Perfect location makes Laurel Cliffs an advantageous place to live. Range and refrigerator accent the kitchen that words can't describe. Hook-ups for washer and dryer can be added. Ample parking. Relax with visitors in the beautiful outdoor commons area. Adequate space for patio addition. Living the fullest at Laurel Cliffs.
Figure B.1 (continued)

51 (March 1991) Condo: Price Range K Area C-3 on map THE HOUSING LOCATOR MONTHLY

MR #27
Close to It all at Oakwood Hills with easy access to everything anyone ever needs. Range exhaust fan and no-wax floors are included in the decorator-styled kitchen. Adequate space for washer/dryer. Adequate parking. A great place to entertain. Large rear window view. Demand for true comfort and convenience is satisfied at Oakwood Hills.

MR #12
Park Ridge is just a hop and a skip from everything. The showcase kitchen includes range and refrigerator. Complete with washer/dryer hook-ups; carport available in some units. Relax with guests at the resident picnic shelter, complete with picnic tables. Beautiful open patio. This Park Ridge condominium is for those who appreciate great living.

MR #16
Everything and more is close and convenient in this Meadow Green condominium. Included in the state-of-the-art kitchen are range and refrigerator. Washer/dryer connections can be added. Lots of parking space. Beautiful lawn area for outdoor entertaining. Patio can be added. At the leading edge of today's lifestyles is Meadow Green.

MR #87
Terrific Cedar Run location. Stylish kitchen features self-cleaning range, frost-free fridge, and dishwasher. Utility room includes washer and dryer, provides easy access to garage. Entertain in resident clubhouse, complete with modern kitchen appliances and dining tables. Covered and screened patio with gas grill. Cedar Run is everything come true.

MR #72
Ideally located Oxford Villa is right where it's needed for outstanding convenience. Featured in the designer kitchen are range and refrigerator. Loads of parking space; complete washer and dryer connections. Take visitors to the resident gazebo with picnic table. Terrific open patio is included. Find beauty and convenience at Oxford Villa.
Figure B.1 (continued)

51 (March 1991) Condo: Price Range K / Area C-3 on map THE HOUSING LOCATOR MONTHLY

CALL NUMBER ONE!

* Quality real estate service since 1971
* Alumnus, Branfield Tech
* S.W. office listing leader
* Balloons for the kids (while they last)!

Harold Berkermer

METRO REALTY
1845 Eleventh St.
Office: 872-6287
Eves.: 493-2135

MR #27
Close to it all at Oakwood Hills with easy access to everything anyone ever needs. Range exhaust fan and no-wax floors are included in the decorator-styled kitchen. Adequate space for washer/dryer. Adequate parking. A great place to entertain. Large rear window view. Demand for true comfort and convenience is satisfied at Oakwood Hills.

MR #12
Park Ridge is just a hop and a skip from everything. The showcase kitchen includes range and refrigerator. Complete with washer/dryer hook-ups; carport available in some units. Relax with guests at the resident picnic shelter, complete with picnic tables. Beautiful open patio. This Park Ridge condominium is for those who appreciate great living.

MR #16
Everything and more is close and convenient in this Meadow Green condominium. Included in the state-of-the-art kitchen are range and refrigerator. Washer/dryer connections can be added. Lots of parking space. Beautiful lawn area for outdoor entertaining. Patio can be added. At the leading edge of today's lifestyles is Meadow Green.

MR #87
Terrific Cedar Run location. Stylish kitchen features self-cleaning range, frost-free fridge, and dishwasher. Utility room includes washer and dryer, provides easy access to garage. Entertain in resident clubhouse, complete with modern kitchen appliances and dining tables. Covered and screened patio with gas grill. Cedar Run is everything come true.

MR #72
Ideally located Oxford Villa is right where it's needed for outstanding convenience. Featured in the designer kitchen are range and refrigerator. Loads of parking space; complete washer and dryer connections. Take visitors to the resident gazebo with picnic table. Terrific open patio is included. Find beauty and convenience at Oxford Villa.

MR #79
The perfect match of convenience and location is all at Briar Bluff. Kitchen is supplemented by outstanding decor, style, and color. Central laundry facility. Convenient parking has easy access. Convenient to local entertainment for guests. Adequate view. Unequaled in design, the contemporary lifestyle of today is found at Briar Bluff.
Figure B.1 (continued)

51 (March 1991) Condo: Price Range $K/Area C-3 on map THE HOUSING LOCATOR MONTHLY

MR #77
The contemporary location of this Walnut Grove condominium makes today's living easy. Designer-styled cabinets accent the tastefully decorated kitchen. Conveniently located laundry facility. Easy access to parking. Visitors will like this condo. Good view. Walnut Grove is sure to satisfy the need for convenience and style.

MR #27
Close to it all at Oakwood Hills with easy access to everything anyone ever needs. Range exhaust fan and no-wax floors are included in the decorator-styled kitchen. Adequate space for washer/dryer. Adequate parking. A great place to entertain. Large rear window view. Demand for true comfort and convenience is satisfied at Oakwood Hills.

MR #12
Park Ridge is just a hop and a skip from everything. The showcase kitchen includes range and refrigerator. Complete with washer/dryer hook-ups; carport available in some units. Relax with guests at the resident picnic shelter, complete with picnic tables. Beautiful open patio. This Park Ridge condominium is for those who appreciate great living.

MR #79
The perfect match of convenience and location is all at Briar Bluff. Kitchen is supplemented by outstanding decor, style, and color. Central laundry facility. Convenient parking has easy access. Convenient to local entertainment for guests. Adequate view. Unequaled in design, the contemporary lifestyle of today is found at Briar Bluff.

MR #16
Everything and more is close and convenient in this Meadow Green condominium. Included in the state-of-the-art kitchen are range and refrigerator. Washer/dryer connections can be added. Lots of parking space. Beautiful lawn area for outdoor entertaining. Patio can be added. At the leading edge of today's lifestyles is Meadow Green.

MR #87
Terrific Cedar Run location. Stylish kitchen features self-cleaning range, frost-free fridge, and dishwasher. Utility room includes washer and dryer, provides easy access to garage. Entertain in resident clubhouse, complete with modern kitchen appliances and dining tables. Covered and screened patio with gas grill. Cedar Run is everything come true.

MR #72
Ideally located Oxford Villa is right where it's needed for outstanding convenience. Featured in the designer kitchen are range and refrigerator. Loads of parking space; complete washer and dryer connections. Take visitors to the resident gazebo with picnic table. Terrific open patio is included. Find beauty and convenience at Oxford Villa.
<table>
<thead>
<tr>
<th>Condo</th>
<th>Location</th>
<th>Property Features</th>
<th>Price Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA #58</td>
<td>An extraordinary location gives the edge to this beautiful Whispering Tree condo. The decorator kitchen features modern easy-clean laminated composite cabinets. Designed with parking in mind. Centrally located laundry facility. A nice place for guests to visit. Good view. Whispering Tree fulfills the desire for contemporary living.</td>
<td></td>
<td>K/Area C-3</td>
</tr>
<tr>
<td>SA #69</td>
<td>Stratford Court is ideally situated in the center of style and convenience. This designer condo features a beautiful easy-to-decorate kitchen. Parking was part of the design plan. Convenient laundry facility. Near to nice places to take visitors. Reasonable view. Unique is the best way to describe this great condominium at Stratford Court.</td>
<td></td>
<td>Area C-3</td>
</tr>
<tr>
<td>SA #62</td>
<td>Channing Way appeals to common sense with a superb location. Range and refrigerator complement the beautiful kitchen. A carport can be added to some units. Washer and dryer connections are included. Entertain at the resident picnic shelter complete with picnic tables. Open patio is just lovely. Channing Way is a great place to live.</td>
<td></td>
<td>K/Area C-3</td>
</tr>
<tr>
<td>SA #34</td>
<td>Fabulous location puts Heather Wood in the middle of everything for superb access. The tastefully designed kitchen includes range and refrigerator. Easy hook-ups for washer and dryer. Ample parking space. Resident gazebo with picnic table for entertaining. Open patio with a view. For the kind of living everyone wants at Heather Wood.</td>
<td></td>
<td>Area C-3</td>
</tr>
<tr>
<td>SA #52</td>
<td>Outstanding Foxhound Estates condominium is just a stone's throw away from the heart of Metro activity. Range exhaust fan is evidence of the special attention afforded the kitchen. Ample space for washer and dryer. No parking problems. A place guests will enjoy. Nice view. Foxhound Estates offers the perfect balance.</td>
<td></td>
<td>Area C-3</td>
</tr>
<tr>
<td>SA #64</td>
<td>Prime Tall Oaks location. Designer kitchen includes color-coordinated range, refrigerator, and disposal. Convenient carport access through utility room featuring washer and dryer hook-ups. Relax with guests in resident partyhouse complete with microwave and ping pong table. Gas grill connections complement the open patio. Tall Oaks has it all.</td>
<td></td>
<td>Area C-3</td>
</tr>
<tr>
<td>SA #35</td>
<td>Perfect location makes Laurel Cliffs an advantageous place to live. Range and refrigerator accent the kitchen that words can't describe. Hook-ups for washer and dryer can be added. Ample parking. Relax with visitors in the beautiful outdoor commons area. Adequate space for patio addition. Living the fullest at Laurel Cliffs.</td>
<td></td>
<td>Area C-3</td>
</tr>
</tbody>
</table>
APPENDIX C

FINAL SURVEY INSTRUMENT

Introduction

The survey instrument of Prestudy 2 and the final Study 3 was used in three versions. Study 3 used different versions for the peripheral and central conditions, the peripheral version requiring additional measures related to the "peripheral" information. Prestudy 2 was only interested in choice behavior and subjective measures of workload, and therefore only consisted of instructions, space to indicate a product choice, and the subjective workload survey. Study 3 additionally was interested in how the subjective information was being used under differing conditions of load, and therefore included recall and attitude strength measures associated with the subjective information. Product attitude measures were also added to Study 3.

Background information ostensibly describing the nature of the study, affixed to the back of the stimulus folder, is reproduced (reduced) in Figure C.1. The survey instrument used in Study 3 was printed on 8.5 X 14 inch paper, so is reduced substantially as it is reproduced in Figure C.2.
The survey instrument used in Prestudy 2 was printed on 8.5 X 11 inch paper, but otherwise consisted of the same information and instructions as is included in the survey instrument shown in Figure C.2 for those portions relevant to Prestudy 2.

Note that there were seven different printed versions for each of the central and peripheral conditions of Study 3 due to the different numbers of alternatives listed in the stimulus folders of these conditions. The survey reproduced in Figure C.2 is only one of these (12 alternative condition). Since this was a 7 (number of alternatives in the choice set) X 2 (peripheral or central condition) X 2 (MR products on left page or SA products on left page) design, the various survey instruments were constructed such that there were a total 14 separate forms, coded as 28 different forms (the two ordering conditions used the same form, but had to be reverse coded with respect to the order of ads to which the answers referred).

Although the central and peripheral conditions had to be conducted in separate sessions in Study 3 due to differences in the survey forms, the various "load" conditions were mixed within sessions. A prearranged sequence was ordered such that no session would be dominated by low or high load conditions or by ordering conditions. In most cases, sessions were larger than 10 subjects, and many reached the maximum of 14, so that it is very unlikely
that the sample of subjects attending the sessions could confound the results of the various conditions. A more detailed discussion regarding the conduct of the sessions can be found in Chapter 8.
Some employers provide a housing locator service to employees who must relocate due to a job transfer. Additionally, some employers provide a locator service to new employees who must relocate to accept a new job offer.

We are attempting to assess the kinds of features that people would want to see when shopping for a condominium in an unfamiliar city. Two pages of condominium listings have been selected from the Housing Locator Monthly of a large midwestern city. We would like you to choose the one condominium that you would most prefer to see if you had a limited amount of spare time during a brief visit to that city.

Some comments on these listings:

We have chosen these two pages from the Housing Locator Monthly for the following reasons:

1) All listings on these pages are about the same price (within a range of about 10%).

2) All listings on these pages are about the same driving distance from the employer (about 15 minutes).

3) All are only minutes away from shopping and entertainment.

In other words, the condominiums listed on these selected pages are all about the same with regard to price and location. Again, we would like you to choose the condominium that you would most like to see if you were on a brief visit to the employer's city. We also need your opinions regarding the general format used by this listing service.

You will only have minutes to look over these two pages, after which we will ask you some questions regarding this listing service. Please do not mark on these pages! Remember, we are mostly interested in the one condominium you would most like to see if you were on a tight schedule while visiting the employer's city.

STOP

DO NOT CONTINUE UNTIL INSTRUCTED

FIGURE C.1

INSTRUCTIONS DESCRIBING THE NATURE OF THE STUDY

Note: Page is reduced in size.
FIGURE C.2

SAMPLE SURVEY INSTRUMENT, PERIPHERAL, 12 ALTS.

Note: Pages are reduced in size.
Figure C.2 (continued)

* Folder: PRB

**HOUSING LOCATOR SURVEY**

The purpose of this survey is to gain an understanding of how people use information provided in real estate advertisements. Your responses will be used only as part of a statistical average and your individual answers will remain anonymous. We hope that you will find it interesting.

Note that we are attempting to assess more than one advertisement and that not everyone in the room has the same advertisement to evaluate. Some of these may take longer to evaluate than others.

Please provide the following information:

Name ___________________________ I.D. number ___________________________

LAST, FIRST

Date ___________________________ Time ___________________________

You will be given a folder which contains advertisements for condominiums. **DO NOT OPEN THE FOLDER UNTIL INSTRUCTED.** When you receive your folder, read the instructions on the back, but please wait for further instructions.

**STOP HERE**

**DO NOT CONTINUE UNTIL INSTRUCTED**

**WHICH CONDO WOULD YOU MOST WANT TO SEE?**

If you had only enough time to visit one of these condominiums while on a brief visit to the employer's city, which one of these would you MOST prefer to visit? You may leave your folder open, but you MUST make a choice immediately.

#

Which condominium would be your second preference if your first preference was unavailable?

#

**STOP**

**DO NOT CONTINUE UNTIL INSTRUCTED**
Figure C.2 (continued)

HOW WELL DO THESE WORDS DESCRIBE YOUR PERFORMANCE?
How do you feel about the choices you have just made? Place an "X" on the line next to each word to indicate how well that word describes your feelings about your performance in making these choices.

CONFIDENT not well extremely well
CONTENT not well extremely well
DISPLEASED not well extremely well
SATISFIED not well extremely well
SUCCESSFUL not well extremely well
UNCERTAIN not well extremely well

HOW WELL DO THESE WORDS DESCRIBE THIS SURVEY?
How well do the words below describe the condominium survey that you have just completed? Place an "X" on the line next to each word to indicate how well that word describes the survey.

AGGRAVATING not well extremely well
ANNOYING not well extremely well
BORING not well extremely well
CAPTIVATING not well extremely well
CHALLENGING not well extremely well
COMPLEX not well extremely well
CONFUSING not well extremely well
DEMANDING not well extremely well
DIFFICULT not well extremely well
DISCOURAGING not well extremely well
DRAINING not well extremely well
EASY not well extremely well
EFFORTFUL not well extremely well
ENJOYABLE not well extremely well
EXACTING not well extremely well
EXHAUSTING not well extremely well
FRANTIC not well extremely well
FRETFUL not well extremely well

please continue on the next page
Figure C.2 (continued)

How well do these words describe this survey?

<table>
<thead>
<tr>
<th>Word</th>
<th>Scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frenzied</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Frustrating</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Hectic</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Important</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Impossible</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Intense</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Interesting</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Inviting</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Irritating</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Laborious</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Lengthy</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Leisurely</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Mundane</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Miserable</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Monotonous</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Motivating</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Mundane</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Miserable</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Pleasurable</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Purposeful</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Quick</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Rushed</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Simple</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Stressful</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Tedious</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Threatening</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Time-consuming</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Tiresome</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Unnecessary</td>
<td>not well</td>
<td>extremely well</td>
</tr>
<tr>
<td>Worthwhile</td>
<td>not well</td>
<td>extremely well</td>
</tr>
</tbody>
</table>

STOP

Do not continue until instructed.
HOW DO YOU FEEL ABOUT THESE CONDOMINIUMS?

Think about each of the condominiums that were shown on the LEFT page. Place an X on the scales in each box below to indicate your impressions of that condominium. On the last line (4) in each box, indicate how confident you are in your ability to rate that condominium.

1. worst ________ best
2. like _______ dislike
3. good ________ bad
SURE? no _____ yes
4. no ________ yes

(Left page)

Think about each of the condominiums that were shown on the RIGHT page. Place an X on the scales in each box below to indicate your impressions of that condominium. On the last line (4) in each box, indicate how confident you are in your ability to rate that condominium.

1. worst ________ best
2. like _______ dislike
3. good ________ bad
SURE? no _____ yes
4. no ________ yes

(Right page)
HOW DO YOU FEEL ABOUT THESE AGENTS?

Think about the agent who was selling condominiums shown on the LEFT page. What are your perceptions of this real estate agent? Place an X on each of the scales below to indicate your impressions of this agent.

- attractive __:__:__:__:__ unattractive
- clumsy/awkward __:__:__:__:__ refined
- inexperienced __:__:__:__:__ inexperienced
- honest/sincere __:__:__:__:__ deceitful/shifty
- immature __:__:__:__:__ mature
- confident __:__:__:__:__ insecure
- lazy/slow __:__:__:__:__ quick/responsive
- careful __:__:__:__:__ reckless
- uncooperative __:__:__:__:__ helpful
- likeable __:__:__:__:__ unlikeable
- good listings __:__:__:__:__ bad listings

Think about the agent who was selling condominiums shown on the RIGHT page. What are your perceptions of this real estate agent? Place an X on each of the scales below to indicate your impressions of this agent.

- attractive __:__:__:__:__ unattractive
- clumsy/awkward __:__:__:__:__ refined
- inexperienced __:__:__:__:__ inexperienced
- honest/sincere __:__:__:__:__ deceitful/shifty
- immature __:__:__:__:__ mature
- confident __:__:__:__:__ insecure
- lazy/slow __:__:__:__:__ quick/responsive
- careful __:__:__:__:__ reckless
- uncooperative __:__:__:__:__ helpful
- likeable __:__:__:__:__ unlikeable
- good listings __:__:__:__:__ bad listings

Figure C.2 (continued)
We are now interested in what you can remember about each of the agents who advertised the condominiums you have just seen. In the boxes on each ad below, write all that you can remember regarding the ad on that page. If you can remember only part of the information (e.g., only a first name), that is OK. Just write whatever you can remember. If you cannot fit all of the information in the appropriate box, use the space below and draw an arrow to indicate where it should go.

In the space below, describe how the agent looks.
Figure C.2 (continued)

We are now interested in what information you can recall about the agents who advertised in this locator service. On the line next to each item below, check off those items that you think you recognize. Then go back and place an "L" next to those items that were on the left page ad, and place an "R" next to those items that were on the right page ad.

___ Free notary service!
___ S.W. office listing leader
___ 24-hr. answering machine
___ 1945 Eleventh St.
___ Special interest information
___ MBA (Stanford, 1967)
___ Accredited by the National Board of Realtors
___ Harold Berkermer
___ Maps available
___ Car Phone: 479-0163
___ John Farley, CLP
___ Member, 25 Million Dollar Roundtable
___ Quality real estate service since 1971
___ $22 million sales leader
___ Michael Stillman, CRA
___ 9451 Fairfield Way
___ Consistent communication
___ George Cromwell
___ Balloons for the kids (while they last!)
___ Information packets available
___ Trustee, Metro Area Board of Realtors
___ Alumnus, Branfield Tech
___ Graduate of Leland College
___ Serving your real estate needs for 25 years
___ 100% Club in North Area Office
___ Over two decades of real estate service
___ 2737 Brandenberg Drive
___ Professional approach
___ MBA (Wharton)
___ Free Housing Buyer's Guide
___ Eves: 493-2136
___ Most-Buyer's Award - NW office
___ Certified, Real Estate Appraiser's Association

STOP

DO NOT CONTINUE UNTIL INSTRUCTED
Figure C.2 (continued)

Please take a few moments to tell us about your impressions of The Housing Locator Monthly:

1) What most caused you to like or dislike any of these houses?

2) What additional information would make the advertisements in The Housing Locator Monthly more useful to you?

3) In your own words, briefly describe what you believe to be the purpose of our survey.

4) Do you have any other suggestions that you would like to share?
LIST OF REFERENCES


Cacioppo, John T., Beverly S. Marshall-Goodell, Louis G. Tassinary, & Richard E. Petty (in review), "Rudimentary Determinants of Attitudes: Classical Conditioning is More Effective When Prior Knowledge About Attitude Stimulus is Low Than High."


Hirst, William, Elizabeth E. Spelke, Celia Reaves, George Caharack, & Ulric Neisser (1980), "Dividing Attention Without Alternation or Automaticity," Journal of Experimental Psychology: General, 109, 98-117.


Miller, George A. (1956), "The Magical Number Seven, Plus or Minus Two: Some Limits on our Capacity for Processing Information," Psychological Review, 63(2), 81-97.


