THE EFFECT OF DIFFERENT FORMS OF ACCOUNTING FEEDBACK, COST AGGREGATION AND PRICING KNOWLEDGE ON PROFITABILITY AND PROFIT ESTIMATION

DISSERTATION

Presented to the Graduate Council of the
University of North Texas in Partial
Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

David M. Smith
Denton, Texas

May, 1997

major Prof: DR. BRUCE KOCH

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Smith, David M., The effect of different forms of accounting feedback, cost aggregation and pricing knowledge on profitability and profit estimation. Doctor of Philosophy (Accounting), May 1997, 174 pp., 15 tables, 39 illustrations, references, 97 titles.

This study extends a research stream calling for further research regarding pricing and accounting feedback. Marketing executives rely heavily on accounting information for pricing decisions, yet criticize accounting feedback usefulness.

To address this criticism, this research integrates the cognitive psychology and accounting literature addressing feedback effectiveness with pricing research in the marketing discipline. The research extends the scope of previous accounting feedback studies by using a control group and comparing two proxies of subject task knowledge; years of pricing experience and a measure of the cognitive structure of pricing knowledge. In addition, this research manipulates task complexity by using two different accounting systems. These systems vary in the number of cost pools used in allocating overhead, resulting in differentially projected cost and profit information.

A total of 60 subjects participated in a computer laboratory experiment. These subjects were non-accountants with varying amounts of pricing knowledge. Subjects were randomly assigned to six experimental groups which varied by feedback type (no accounting feedback, outcome feedback only, or a combination of outcome and task properties feedback) and task complexity (high or low number of overhead cost pools). The subjects attempted to (1) maximize profits for a product during 15 rounds of pricing decisions, and (2) accurately estimate their profit for each round. The experimental results indicate no difference in performance between the three feedback types examined. However, increases in both subjects' pricing knowledge and the number of cost pools do influence feedback effectiveness.

This study suggests that the amount of the users' task knowledge may influence the effectiveness of current accounting reports. In addition, increasing the number of cost pools in accounting systems may be beneficial for all users.

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CHAPTER 1

INTRODUCTION

One of the important issues facing behavioral accounting researchers is the manner is which accounting information influences decision-making (Foster and Gupta 1994). This study addresses this issue by examining how accounting information influences individuals' pricing decisions. Specifically, the research examines how differing feedback conditions, pricing knowledge, and accounting system designs affect a series of pricing decisions.

A primary motivation for this research is a recent article suggesting that academicians have neglected the relationship between marketing and accounting (Foster and Gupta 1994). In their survey, the authors found marketing personnel ranked accounting as the most important *potential* source of information for pricing decisions. However, the same respondents evaluated their existing cost information as inadequate for pricing. This finding prompted the authors to call for more research on improving accounting's usefulness to pricing decision makers.

A second motivation for this study is to clarify the way in which accounting information provides feedback. Otley and Berry (1980) state that effective accounting feedback is crucial for control and improvement in the decision process. This is supported in a literature review by Luckett and Eggleton (1991), which showed little research addressing the way in which three different feedback types influenced the decision process[1]. Several studies have incorporated findings from cognitive psychology to suggest useful feedback types for accounting decision makers (Ashton 1981; Kessler and Ashton 1981; Hirst and Luckett 1987). However, the results are often contradictory.

Foster and Gupta's (1994) respondents used accounting information as feedback for evaluating the effectiveness of past pricing decisions and for suggesting future pricing changes. Managers used this feedback to monitor the impact of competition, the need for special pricing programs, and sales force efficiency. Thus, accounting provided information for both decision making and evaluation of past

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[1] Outcome feedback provides information on the actual outcome of the task. Task properties feedback the individual with information on how closely the cues used in decision making match the actual outcome. Cognitive feedback provides information on the decision strategy used by the individual.

actions. However, the way in which managers actually use accounting information is not known.

A third motivation of this study is examining how different accounting systems influence the pricing decision. While managers use accounting data for pricing (Foster and Gupta 1994; Govindarijan and Anthony 1983), the imprecision inherent in accounting data may mitigate its value as feedback for decision making.

Several studies have criticized accounting for providing inaccurate information (Kaplan 1984; Babad and Balachandran 1993). These studies note that different systems can produce widely varying cost numbers. This realization has helped spark the search for improved systems such as activity-based costing (Cooper 1988a; 1988b; 1989a; 1989b; and Kaplan 1984) and total cost management (Lewis 1991).

Despite these recent efforts, many academicians still believe that accounting falls short of providing pertinent information (Johnson 1988, 1992). Further, little evidence exists explaining how decision makers use cost data when pricing products. Research suggests that users' confidence in the reports, their knowledge about pricing, and the environmental complexity all play a role (Gupta and King 1994).

This study has several goals. First, this study hopes to explain some prior contradictory findings about the decision process by including neglected variables, such as subject knowledge and environmental complexity. Additionally, this study examines the role of feedback types in learning. Research suggests that more complex feedback types help decision makers' to learn at a faster rate (Hammond et al. 1977; Steinmann 1976).

A second goal of this research is to determine the interaction of feedback types with different types of accounting systems in use by decision makers. It is possible that changing the type of feedback from an accounting system may provide benefits equal to implementing a whole new accounting system.

A third goal is to examine if individuals with greater pricing knowledge can use this expertise to compensate for both feedback types and different accounting systems. Extant research suggests that prior subject knowledge is an important consideration in studies of feedback. However, relatively few accounting feedback studies have attempted to measure subject knowledge. Instead, experience has been used as a proxy for knowledge.

The second chapter of this dissertation reviews extant research on pricing, feedback, and task-knowledge research from the psychology and accounting literature. In addition, the chapter presents the pricing model used and the hypotheses. Chapter Three discusses the methodology of the experiment. Chapter Four presents the results of the experiment, and Chapter Five discusses the results. Finally, Appendices A and B, respectively, present the instructions to the subjects and an illustration of the test instrument.

CHAPTER 2

THEORY AND HYPOTHESES

Feedback Types and their Influence on Performance

Cognitive psychology literature has demonstrated that feedback can influence performance (Hammond and Summers 1972; Lindell 1976) and that feedback types differ in their effects (Castellan 1974; Schmitt et al. 1977; Steinmann 1976). Also, evidence suggests that price setters rely heavily on information (or feedback) from the accounting system when setting prices (Foster and Gupta 1994). The accounting system regularly provides feedback about past actions which they then use for future decisions. This information is crucial for both managing employees and achieving the company's financial goals (Otley and Berry 1980). Therefore, feedback has a potentially large impact on pricing decisions. Ilgen et al. (1979) suggest that decision makers receiving performance feedback advance through three stages. First, individuals form a perception about the feedback. Perception in this context refers to the individuals' interpretation of messages or meanings assigned to the messages. This perception affects responses and outcomes to the feedback, even if the perception is incorrect (Taylor et al. 1984; Erez 1977). For example, a manager who does not understand the variances shown on an accounting report may incorrectly conclude that they need take no action to improve performance.

Second, individuals decide whether to accept the feedback as meaningful. Acceptance depends largely on whether the recipient believes the feedback is an accurate measure of performance. Ilgen et al. (1979) notes that perception and acceptance are independent actions. For example, recipients can correctly perceive a message that indicates poor performance, but not accept the feedback because they believe the source is faulty.

Third, assuming the individual accepts the message, the message is compared against some personal standard. This comparison will result in at least one of three types of responses: cognitive, behavioral, and affective (Taylor et al. 1984). Cognitive responses consist of reevaluating expectancy beliefs about task achievement and changing individual's standards. Individuals faced with feedback about failing to meet a sales quota may decide that the quota is not obtainable and quit trying. Alternatively, they may evaluate the quota as obtainable and change their behavior instead. Behavioral responses include trying new strategies, altering the effort level, changing task persistence, and responding to the feedback system. This behavior can also alter an individual's feelings toward the feedback system. Affective responses relate to the individual's feelings or emotions about the feedback and the feedback system. Managers who view the feedback as unfair or biased can ignore the information which could impact future work performance.

An example of this three-stage process occurs in the Hilton et al. (1988) article where the subjects used information about demand functions to establish product prices. The subjects determined a tentative product price and received feedback on the estimated demand level and profit. The subjects had to understand the feedback mechanism and decide if changes in their actions were necessary. Since the experimental accounting system used produced variances between the projected and actual cost, subjects also had to decide if the feedback was accurate. If its reliability was accepted, subjects had to compare the results with a personal standard and decide (1) whether changes were necessary and (2) what changes were appropriate. Subjects may have decided the task was too difficult and given up. Conversely, the subjects may have decided to change their behavior by trying new pricing strategies or devoting more effort to the task. The research did not examine how the subjects affectively evaluated the feedback system itself.

Ilgen et al. (1979) suggest that a major factor in the recipient's perception and acceptance of a message is the source's credibility. Individuals attach more credibility to sources with high levels of expertise, trustworthiness, and reliability (Luckett and Eggleton 1991).[2] They suggest that when the source is the accounting system, a key factor is the predictability of the environment. Recipients consider feedback more credible in routine and predictable environments than those faced by managers in more turbulent circumstances (Hayes 1977). Therefore, managers in stable departments are more likely to accept and use accounting feedback (Luckett and Eggleton 1991). However, they note that the environment can be less important than the amount of trust between the report's users and the preparers. Managers often view the human accountant as a more desirable

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[2] Ilgen et al. (1979) found that several factors influenced credibility. However, expertise, trustworthiness, and reliability were most important when examining the relationship between source credibility and feedback acceptance. Expertise refers to the individual's belief in source's ability to provide a correct answer. Trustworthiness reflects the recipient's opinions about the intentions and motives of the feedback source.

feedback source than an impersonal accounting system (Argyris 1952).

In addition to source credibility, feedback also influences users' perceptions and behaviors. Feedback often describes task outcomes; it indicates success or failure in accomplishing a task. Taylor et al. (1984) notes that users often respond to this feedback type by changing behavior. This could include revising strategies or changing the direction of effort. However, these authors suggest that feedback is most effective when it suggests how to change specific behaviors. Therefore, feedback should be both directive and descriptive (Luckett and Eggleton 1991).

Brunswik's (1952, 1956) multiple-cue probability learning (MCPL) paradigm, also known as the lens-model, provides a framework for much of the research on feedback. Brunswik's primary interest was in how organisms adapted themselves to an unpredictable environment. Brunswik explored both the organism's cue usage and how the organism learned its environment's characteristics. The relationship between the organism, the environment, and the cues is shown in Figure 2.1. In this diagram, the information sources or cues are the variables X_1, X_2,...X_k. These cues have a

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Reliability of the source is defined as the source's specific relationship to the state of the true world. This true state, or criterion value, is designated Y_e. The relationship between the cues and the criterion value is the correlation, $r_{i,e}$, between X_i and Y_e. This value, $r_{i,e}$, is called the ecological validity of the *i*th cue, and the intercorrelations among cues are given by the r_{ij} values. For the subjects, their judgment is the value Y_s and the correlation of their judgments with the ith cue is $r_{i,s}$ or the utilization coefficient.

The MCPL paradigm facilitates examination of factors affecting performance. These include cue accuracy, extent of user reliance on cues, and the user's ability to use the information consistently (Hammond and Summers 1972). In Brunswik's model, individuals' relying completely on cues have their achievement limited by the cues' accuracy. Therefore, the more reliable the cues (or the accounting system), the more accurate the decision-maker's strategy. However, if the cues are unreliable, the decision maker may benefit by giving the cues relatively less weight or ignoring them altogether. Gupta and King (1994) examined this complete cue reliance in a study combining accounting and price setting. The authors found that price setters in

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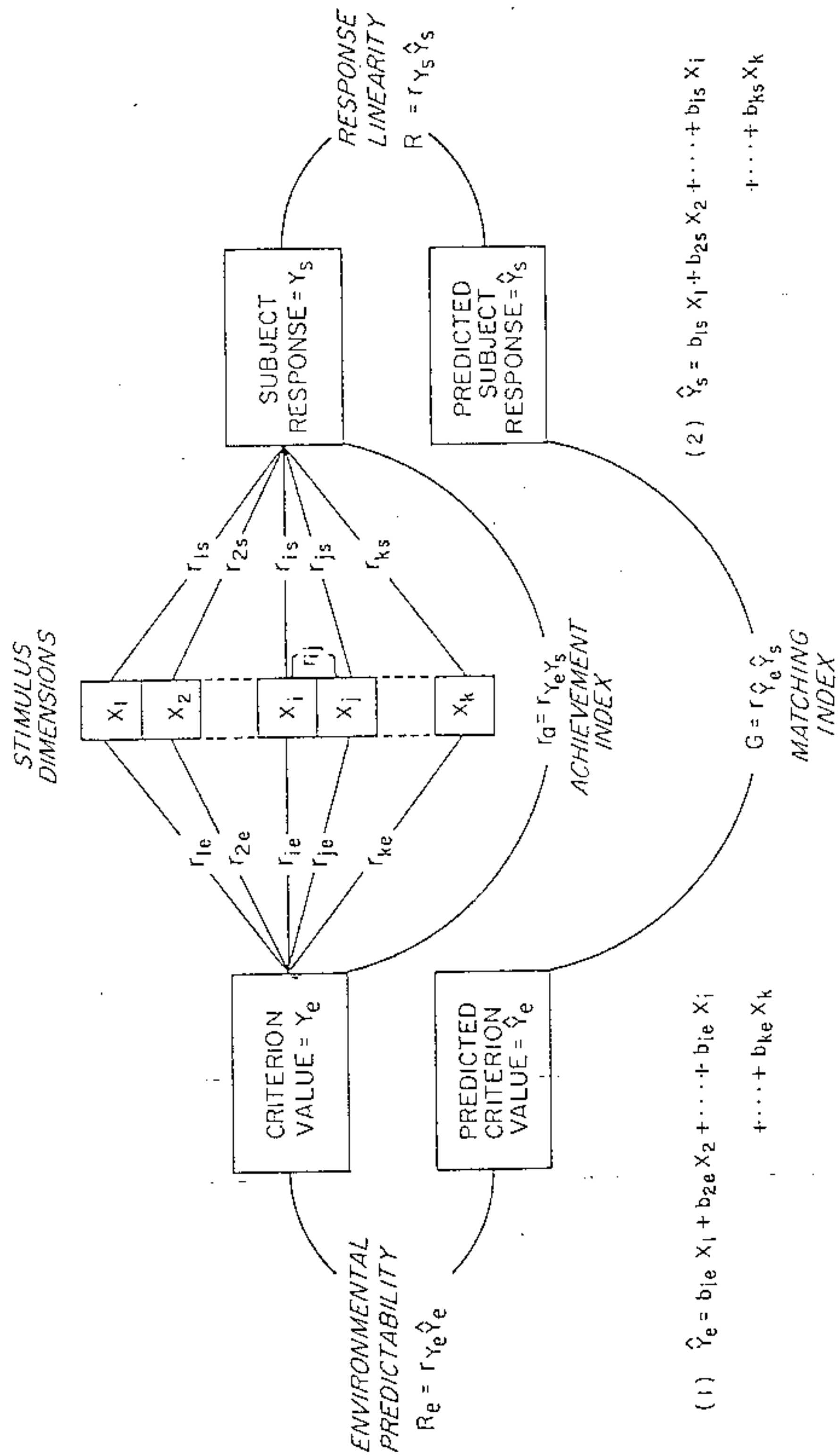
ability to deliver accurate feedback.

Figure 2.1 Diagram of Lens Model (Dudycha and Naylor 1966)



their experiment relied less on unreliable cues when making their pricing decisions and developed heuristics on how to modify the cues. Gupta and King interpreted this result as support for the theory that decision makers will react to cue reliability and attempt to "out-guess" inaccurate cues.

Using the lens-model equation, Hammond and Summers (1972) identified three general classes of feedback. These classes were outcome feedback, task properties feedback, and cognitive feedback. The authors defined outcome feedback (OF) as providing the correct response or answer to the subject after each trial. Outcome feedback is the most common form of accounting feedback and is similar to providing an accounting report reflecting the results of a prior pricing decision[3]. Task properties (TP) feedback (or feedforward [Steinmann 1976]) provides formal information

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[3] In the case of pricing decisions, the decision maker expects a certain outcome (e.g., unit sales, sales dollars, and profit) when setting a price. The accounting report will indicate how close the actual performance came to this *a priori* expectation. Therefore, the accounting report provides a form of the correct answer. In reality, price-setters never know the "correct price" to set. Thus, the accounting report acts as a surrogate for correct response.

about the task before the subject makes decisions. This could include providing information about the past reliability of the accounting system. Finally, cognitive feedback (CF) provides information about the judgment strategy used by the decision makers. This feedback allows the decision makers to make strategy changes by comparing their decision model with the formal properties of the task itself. While useful, CF feedback requires extensive knowledge of the relationship between the task and environment which is often difficult in practice.

Extensive research in this area has shown that three types of feedback have differentiated influences on performance. In general, both TP and CF have been shown to assist in task learning (Hammond et al. 1977) while OF is generally less effective than either TP or CF (Steinmann 1976). Further, OF can actually impede learning in certain situations. Hammond et al. (1973) attributed this finding to the misleading effects of the random error contained in the OF.

Researchers in cognitive psychology have concluded that the effectiveness of OF depends on certain task determinants (Steinmann 1976; Adelman 1981). These determinants include cue predictability (Slovic and Lichtenstein 1971), task complexity (Steinmann 1976), and task abstraction (Sniezek

1986; Adelman 1981). In addition, Hammond and Summers (1972) concluded that the subjects' performance was positively related to their task knowledge. Hammond and Summers (1972) showed that decision makers could not learn some complex tasks when they received only OF. They concluded that decision makers without sufficient experience or knowledge about the task were unable to use the OF effectively.

In addition to task knowledge, cue predictability also influences performance. Individuals relying completely on a cue set for decision making are limited by the accuracy of the cues. In the lens-model equation, cue predictability is the correlation between the cues and the criterion or the $r_{i,e}$. Therefore, if the correlation between the cues and the outcome is 0.9, subjects relying on the cues cannot achieve a higher achievement score than 0.9. However, the higher this correlation, the higher the subjects' achievement score because the cues' ability to predict the correct outcome is greater. Schmitt et al., (1976) found that as cue predictability improved from 0.63 to 0.89, the task performance of subjects using OF feedback improved significantly. However, subjects using TP or TP and OF performed significantly better than the other feedback groups. Higher cue predictability also improved the rate of learning over three trial blocks. York et al., (1987) had similar findings when comparing two groups with cue predictibilities of 0.78 and 0.37. Therefore, cue predictability can influence the effectiveness of feedback type on achievement and learning. It appears that OF results in significantly lower performance in low predictability tasks, but performance improves rapidly with increases in predictability. Further, TP feedback, both alone and in combination with OF, results in the highest performance in both high and low predictability tasks.

Thus, having accounting systems provide information on their reliability (TP) could help price setters to decide on how useful the cues are. This also suggests that different types of accounting feedback may be more appropriate in different situations. Decision makers in relatively stable environments might be able to use OF feedback whereas more complex environments may require a combination of OF and TP.

Task complexity also influences the effectiveness of feedback type. However, there are no studies which directly examine all three different feedback types together. Steinmann (1976) found no difference in achievement between TP and CF groups for three levels of complexity. However, Hammond (1971) concluded that CF was superior to TP in more complex tasks. For OF, Sheets and Miller (1978) found task performance was higher for linear (less complex) tasks than non-linear (more complex) sets. Sheets and Miller concluded that subjects start a task with a positive linear set and search for linearity first.

Luckett and Eggleton (1991) note that many of the tasks in MCPL research use abstract tasks. Therefore, decision makers have little or no real-world referents that could assist them in their task. Sniezek (1986) found that with OF, cue labels suggesting a statistical structure similar to the actual structure resulted in the highest achievement relative to neutral or incongruent labels. In both of Sniezek's experiments, subjects using abstract labels had lower results than subjects using either congruent or incongruent labels.

Adelman (1981) extended Sniezek's work by varying both cue labels and feedback type. Adelman grouped subjects into OF or CF groups who received either neutral, congruent, or incongruent cue labels. In the neutral groups, subjects receiving CF outperformed the OF subjects even with perfect task predictability. However, when subjects received either congruent or incongruent cue labels, there were no differences in achievement scores between the CF and OF groups. Adelman concluded that the labels themselves contained TP information which subjects were able to use when making their decisions. However, the subjects needed to have a reasonable level of knowledge about the nature of the task. These two papers suggest that OF can be effective when the labels typically relate to the task and the subject has some task knowledge. These findings provide support for using OF in accounting system reports because the cue labels relate to the task and users have varying levels of task knowledge.

In addition, Hammond and Summers (1972) stated that different feedback types have less differential impact on task performance for subjects with higher levels of task knowledge. Ashton (1981) noted there was little information on this issue but Kessler and Ashton (1981) did find evidence suggesting that task knowledge did minimize the impact of different feedback types.[4] Therefore, it appears that subjects with greater levels of task knowledge about pricing would be less affected by the different types of feedback. Thus, it may be beneficial for firms to offer more feedback to relatively inexperienced price setters until they have developed their task knowledge.

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[4] Kessler and Ashton provided MBA students with instructions on how to rate bonds. The authors found that the participants performed so well without feedback that providing them with information on past decisions did not result in large performance gains. This suggests that the participants had a relatively high level of task knowledge.

In summary, the cognitive psychology literature has extensively studied how feedback in general and specifically, different feedback types influence performance. Ilgen et al. (1979) have demonstrated that individual reaction to feedback depends on a person's reaction to the three stage model. Therefore, failure to correctly interpret the feedback or find it meaningful may prevent feedback from being effective. Further, even if the feedback is correctly interpreted the individual may not react to the feedback because they find the task too difficult. This reaction is highly dependent on how credible the individual finds the feedback source with higher credibility being positively linked to changes in behavior.

The research on feedback types indicates that outcome feedback can be detrimental to learning and performance. However, this finding is mitigated by factors such as task complexity, the level of task abstraction, and the subjects' knowledge of the task. Overall, feedback findings in both cognitive psychology and accounting have indicated that the combination of outcome and task properties feedback is more effective in enhancing performance than outcome feedback alone.

Elements in Price Setting

A review of the pricing literature suggests that businesses choose pricing approaches based on customer type. Rao (1984) notes that retail firms use consumer perceptions to a greater degree than industrial firms do when price setting. In contrast, industrial firms focus on costs and competition when pricing. This suggests that industrial firms rely more heavily on the costs provided by the accounting system for price setting relative to retail firms who also include customer perceptions. Because of this heavier reliance on the product costs provided by the accounting system, this study examines pricing within the context of industrial firms. Specifically, the research uses high-technology products with relatively short lives. These products offer benefits to the researcher because of extensive prior pricing research and these products are generally sold in a complex environment. This complexity highlights the advantages of the different feedback methods which a more routine or predictable environment may not expose.

Monroe (1990) has identified five factors that decision makers must consider when pricing products. These factors include demand considerations, costs, competitive factors, corporate profit and market objectives, and regulatory constraints. Unfortunately, these elements often work against each other and complicate pricing decisions. For example, competitive factors usually reduce the price ceiling while corporate profit objectives often require a higher price. Further, price itself also influences these factors. Thus, setting a high price may encourage competitors to enter the market and result in lower sales. Therefore, knowing the factors without specification of how they interact with pricing is not useful.

However, price setters can benefit from having a theory that identifies the relationships between the factors. Researchers have explicitly considered these factors in the economic theory of pricing. Hauser (1984) argues that economics provides marketing with both a theoretical framework for pricing and with suggestions for specific actions by managers. Therefore, Nagle (1984) stresses that price setters must first understand the economic environment before they can make effective decisions. Key elements in the environment include the demand function (Monroe 1990; Morris and Joyce 1988) and the level of competition (Hay 1976).

The demand function (price elasticity) measures how sensitive the quantity demanded by purchasers is to price changes. Nagle (1987) has identified major determinants for sensitivity including the availability of substitutes, the difficulty in gathering information on the product, and the total product cost. Additional research also indicates that price sensitivity can change over a product's life (Curry and Riesz 1988). In addition, competitors can influence price sensitivity. If there is little or no competition, the demand function is relatively inelastic. However, as competition increases, firms lower their prices to avoid being forced out of the market.

A firm can use price to influence the amount of competition by using spatial competition and uniquely positioning its product through a combination of price and features (Hay 1976). Hay found that firms can reduce future entrants into the market by positioning their products in such a way as to eliminate profitable market segments. In addition, firms with multiple product-lines can share costs across products, allowing them to exploit smaller segments profitably. Therefore, spatial competition can reduce the number of substitute products and keep prices relatively stable. Further, managers can price their product separately to different market segments and exploit different demand functions.[5] Nagle (1984) notes the most common forms of segmented pricing are product bundling (e.g., season tickets are cheaper than purchasing each ticket individually) and offering differing prices at different points in time or places of purchase.[6]

Therefore, economics has established a theoretical foundation for price setting and provided guidance for pricing in many situations. Managers can use price strategically and influence sales volume and revenue by knowing the demand function. Firms can create niches and limit competition by positioning themselves using the concepts in spatial competition. Further, within the constraints of government regulations, companies can use

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[5] This is a form of price discrimination because the same product is offered to different customers at different prices. However, price discrimination is not necessarily illegal. The Clayton Act (1914) and the Robinson-Patman Act (1936) generally require justification for charging different prices if the cost of providing the product or service is the same (Nagle 1987). Nagle notes that the firms often justify the different prices by arguing serving the different markets requires unique distribution channels with different cost structures. Monroe (1990) notes that the Sherman Anti-Trust Act of 1890 targets collusion in pricing by outlawing price-fixing (agreements among competitors), the exchange of price information, and price signaling. Predatory pricing (pricing below cost) is illegal if the intent is to restrict competition.

[6] An example is airlines pricing tickets differently for staying over a weekend versus weekday travel.

segmented pricing to achieve corporate growth and profitability goals.

While the economics literature has provided pricing strategies, several authors note these frameworks are highly abstracted and often examine the pricing decision at the firm rather than the product level (Robinson and Lakhani 1975; Morris and Della Bitta 1978; Nagle 1984; Nagle 1987; Monroe 1990). In an attempt to simplify the pricing decision, Monroe (1990) notes that firms have shifted to pricing strategies emphasizing costs. He suggests the shift is partly because firms have more control over costs than the other four elements in pricing. Managers can only indirectly influence demand and competition while governments impose regulatory constraints. Further, price setters may have no control over corporate objectives.

An article by Coe (1990) dramatically displays the magnitude of the shift to costing and profit objectives. In her survey of U.S. industrial firms, Coe found that pricing's strategic role as a support or core strategy dropped from 95% in 1982 to 22% in 1988. As a result, these firms shifted their preferences from competitive pricing and market penetration to cost-based pricing. Foster and Gupta (1994) also found this emphasis on costs when they found marketing managers rated accounting information as the most important factor in the pricing decision.

Costs in Price Setting

Costs indisputably play a primary role in price setting (Abel 1978; Govindarajan and Anthony 1983; Monroe 1990; Nagle 1987). This tenet contradicts economic theory, which suggests managers using supply and demand curves select the maximum profit (Govindarajan and Anthony 1983). These two authors note that managers rarely have sufficient information to estimate the demand curve. Further, managers do not have the resources to identify the profit-maximizing price. Instead, they select a satisficing price which meets corporate profit objectives. Several authors suggest that the rise in the use of markup pricing is due to its relative ease of use since demand curves are de-emphasized (Monroe 1990; Coe 1990; and Nagle 1987).

When considering costs for pricing, relevant costs include both the firm's manufacturing and marketing costs[7]. While manufacturing activities can be the primary cost, Foster and Gupta (1994) note that product managers are focusing more on customer retention. Therefore, they require

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[7] Manufacturing costs includes direct materials, direct labor, and manufacturing overhead (e.g., factory utilities, material handling, and purchasing).

information on the costs to service and maintain the customer. Examples of these marketing costs include warehousing, advertising, shipping, order processing, shelving and point-of-sale promotions, and commissions. Administrative costs can include upstream costs such as research and development and legal services (Horngren and Foster 1994).

After identifying important costs, price setters usually perform two steps (Nagle 1987; Govindarajan and Anthony 1983). First, they allocate costs to particular products. Second, they analyze how these identified costs change as the volume level of production varies. Monroe (1990) identifies several cost concepts for products including: direct costs, indirect traceable costs, and common costs. Direct costs are "incurred by and solely for a particular product, department, program, sales territory, or customer account" (Monroe 1990, pg. 144). Managers can objectively track indirect traceable costs to a particular product, unit, or customer, but the costs are spread across several products. Examples include maintenance and repairs or utilities (Monroe 1990). In contrast, individuals cannot objectively trace common costs to a product or segment. These costs could include administration costs or general expenses such as market research.[8] Allocating indirect and common costs is difficult because the products or processes share many costs. Therefore, price setters must have a reasonable allocation process when apportioning costs or the prices may be unrealistic (Nagle 1987).

Besides these general classifications, managers also classify costs according to their behavior as variable, mixed, or fixed (Monroe 1990).[9] Determining cost behavior is crucial for product pricing because costs (and profits) vary with production volume (Nagle 1987). In addition, research has shown that costs generally decrease over a product's life due to the experience curve (Parsons 1975; Liu and Hanssens 1981). Therefore, managers can set prices lower initially because long-term costs will decrease with production. Thus, price setters need information on both cost behaviors and how they should expect those behaviors to change over time and production volume.

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[8] These definitions are different from the traditional accounting terms because the marketing literature does not divide costs into product and period costs (Horngren and Foster 1994).

[9] These definitions are identical to the traditional accounting definitions used in cost accounting textbooks such as Horngren and Foster (1994). Variable costs will vary directly with the number of units produced while fixed costs remain constant for a certain time period or production level. Semi-variable costs include both variable and fixed cost elements (e.g., utility costs).

Difficulties in Estimating Costs

Unfortunately, despite the importance of having accurate cost data, estimating costs is difficult. Managers face fluctuating price levels and changes in production volume. Further, managers cannot trace all costs directly to products. Instead, they are forced to allocate indirect and common costs, and the reliability of product costs depends on the allocation method used.[10] Also, managers debate including certain costs such as capacity and unexpected demand costs in the product cost (Banker and Hughes 1994).

When choosing an allocation method, decision makers must balance the costs of the technique with the benefits they expect to receive (Horngren and Foster 1994). The costs of the system increase with the number of bases or pools used and the cost of obtaining the necessary data. This

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[10] The purpose of this paper does not include evaluating differing allocation bases (e.g., activity-based costing systems versus traditional volume-based methods). Instead, this study explores how feedback on the relative reliability of projected costs and profits can affect product pricing. In addition, the marketing community has been aware of the value of accurate allocation bases before the development of activity-based costing. Foster and Gupta (1994) found that many retailers have been using systems similar to activity-based costing systems for more than thirty years. In addition, Longman and Schiff had already developed a distribution cost allocation method in 1955. Other examples include Schiff and Mellman (1962) who examined marketing cost allocation

means that system designers limit the number of allocation pools used (Babad and Balachandran 1993; Dopuch 1993). In addition, because allocation pools can not apportion costs perfectly, users have only imperfect estimates of future product costs (Dopuch 1993; Datar et al. 1993). Foster and Gupta (1994) found that price setters regularly criticized their accounting systems because of unreliable cost data due to inappropriate cost pools or poorly chosen allocation bases.

The accounting reports generally present this cost information in two different formats: full (also known as absorption) costing or variable costing. Evidence suggests that price setters prefer full costing data when making pricing decisions. Govindarajan and Anthony (1983) found that 83% of the industrial firms responding to their survey used full cost.[11] Foster and Gupta's (1994) survey also showed managers preferred full costing to variable costing

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systems and Schiff and Benninger (1963) who proposed bases similar to today's cost drivers for marketing expense.

[11] Full costing allocates both variable and fixed costs to products while variable costing does not include fixed costs. Thus, full costing results in a higher cost figure because more costs are included in the product. Govindarajan and Anthony suggest managers prefer full costing because it provides a better estimate of what "true" costs are than variable costing. In contrast, the economics literature suggests variable costing is the

when setting prices. Several authors have stated that price setters prefer full cost because using a higher cost figure lowers the possibility of underpricing the product and incurring a loss (Govindarajan and Anthony 1983; Monroe 1990).

Therefore, evidence suggests that decision makers see cost data as a key element in the pricing decision. However, managers have difficulty in obtaining accurate and reliable cost amounts from their accounting system. A majority of price setters use full costing because results in higher product costs and consequently higher product prices. Next, the study examines how different types of feedback can influence the price setting process.

Feedback in the Accounting Literature

Accounting academics have considered both feedback type and pricing in their work. However, they have not yet combined these two areas into one comprehensive study. Despite this, these articles provide a good theoretical foundation for this study.

Kessler and Ashton (1981) were among the first to replicate the psychological studies and show that both task properties feedback (TP) and cognitive feedback (CF)

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preferred costing method because it comes closer to the increase task performance. In this study, subjects predicted corporate bond ratings from financial ratios. The subjects received either TP or CF (the authors did not examine outcome feedback) and the results showed the group receiving TP performed as well as or better than the CF group. The authors concluded the TP was the preferred feedback because TP is less expensive to collect and easier to model than CF.

Ashton (1981) also examined TP and CF, but found neither type was effective in improving performance. However, he concluded this was due to a ceiling effect because of high achievement levels. Ashton's subjects made 60 pricing decisions using three different cues. The subjects varied by education level (accounting undergraduates, MBA students, or Ph.D. candidates) which proxied for the subjects' experience in making inferential judgments. While performance did not vary by feedback type, the Ph.D. subjects significantly outperformed both the undergraduates and the MBA students. This result suggests that subject experience could also influence performance.

Neither of these two studies examined outcome feedback (OF) because the early psychology literature suggested it had no effect or was detrimental to learning (Hammond et al.

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marginal cost definition used in price setting.

1973). Based on the research listed above, it appears that OF is not as useful as either TP or CF in improving task performance or learning (Castellan 1974; Lindell 1976). This is unfortunate because much of the information in accounting reports represents the outcomes of prior decisions.

However, researchers have looked at OF in several accounting contexts. Both Harrell (1977) and Luckett and Hirst (1989) examined the influence of OF on performance evaluations. Harrell examined the consistency of the performance evaluation decisions of Air Force officers when provided with either OF, TP, or both OF and TP. Harrell's (1977) results indicated that subjects receiving only OF did not change their evaluation procedures while TP subjects did. Further, the results indicated significantly higher consistency results from subjects receiving both TP and OF. However, this experiment did not include a no feedback control group.

Hirst and Luckett (1987) considered this issue in a paper using experienced auditors in an audit staff performance task. The authors found that the subjects' consistency improved when they had feedback, although there were no significant differences among the three feedback (OF, TP, and OF and TP) groups. The authors concluded that OF was as effective as TP in certain training situations and was easier and cheaper to obtain. However, they noted that subject experience, task predictability, and feedback source could moderate these findings.

Hoskin (1983) examined the role of feedback type when examining opportunity costs. His design used two groups (OF and both TP and OF) in an inventory-ordering task. The OF only group received a traditional income statement while the other group received the income statement and information concerning opportunity costs. The results showed the TP and OF group significantly outperformed the OF only group. However, the design did not include a TP only or a no feedback control group for comparison.

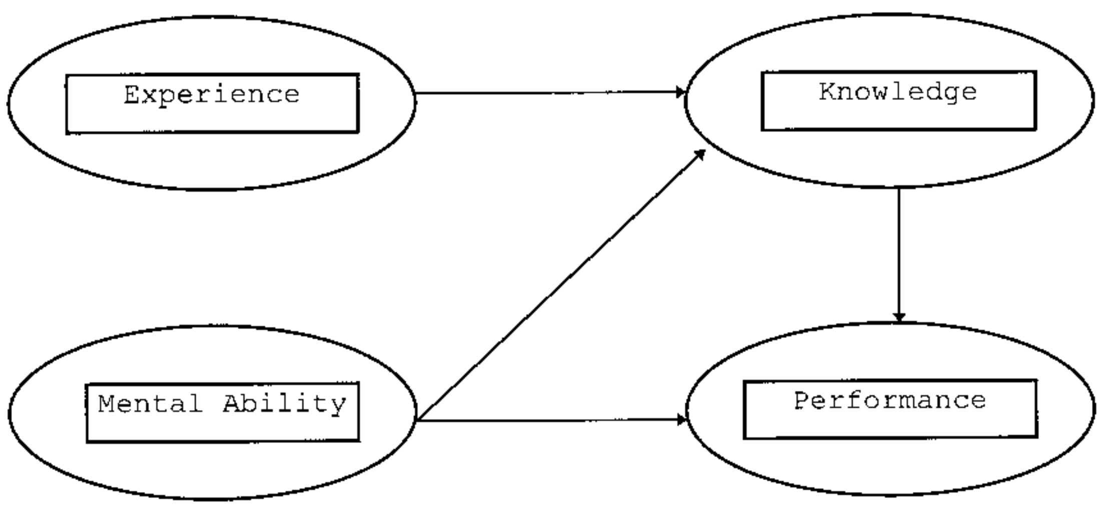
Like the psychology area, the accounting literature produces conflicting evidence on the value of OF. Subjects using OF alone can perform as well as subjects using other types of feedback in certain situations. However, data concerning when OF is most effective is limited. Further, even if OF is not as effective as TP or CF, Otley and Berry (1980) note that accounting control systems rely heavily on this data. Therefore, an accounting report without OF is unlikely. In addition, evidence indicates that OF has important motivational aspects. Cook's 1968 study of reporting frequency showed that groups receiving little feedback (annual reports) or no feedback at all expressed a high level of frustration with the experimental task. These groups also had lower performance scores, satisfaction, and interest in the task. The accounting literature also suggests a relationship between feedback and goal setting. Hirst and Lowy (1990) found that the combination of difficult goals and feedback resulted in higher performance.

Experience versus Expertise

Choo and Trotman noted in their 1991 study that much of the psychology and some of the accounting literature use the words experience and expertise interchangeably. While the two may be correlated in many situations, the two concepts are not necessarily equivalent. (Bonner and Lewis 1990; Ashton 1991) remarked that individuals with the same number of years of general experience could vary in their knowledge because of differences in their specific job situations or training. Their literature review noted that most prior studies examining expertise divided subjects into groups of experts based on years of experience or tenure-based titles. The authors stated that researchers should not assume that all persons at a given level of experience posses equal amounts of task-specific knowledge. Further, the authors implied that the subjects' ability and knowledge directly affect performance. Libby and Luft (1993) expanded this model by suggesting that knowledge is an intermediate variable. Performance (expertise) was actually determined by the subjects' knowledge and ability. This relationship is shown in Figure 2.2. This model suggests that using years of experience as a proxy for task knowledge is incomplete. Instead, a more direct measure of knowledge is required.

Bonner and Lewis' (1990) study contain several methods of measuring knowledge. These include having subjects answer multiple choice CPA exam questions, self-developed

Figure 2.2: Libby and Luft's Conceptual Model of the Determinants of Performance



problems, and problems from textbooks. An alternative method is to examine the knowledge structures of the subjects (Choo and Trotman 1991; Tubbs 1992). This research suggests that expert auditors (those with higher task-specific performance scores) have different knowledge structures relative to novices. Specifically, more experienced auditors grouped key ideas into a more tightly clustered group of ideas relative to inexperienced auditors. Further, the tighter the clusters, the higher the performance scores (Choo and Trotman 1991). Tubbs (1992) suggests that this clustering results from a greater understanding of the causal concepts involved between the principles.

The marketing research literature has also examined the differences between experience and expertise. Perkins (1993) examined the effects of experience and education on the organization of marketing knowledge. He found that increased experience and education led to a more highly categorized knowledge structure. The subjects with more detailed knowledge structures also performed significantly higher on a marketing term sorting task.

Perkins presented his subjects with 24 marketing terms representing four groups drawn from four chapters in a marketing textbook. The subjects grouped these marketing terms into associated categories. By counting the number of categories the subjects formed, Perkins examined the subjects' underlying knowledge structure. In addition, Perkins computed a "hit ratio" which measured how closely the subjects' term grouping matched the textbook's arrangement. Perkins noted that increased experience and education did lead to significantly higher knowledge of the marketing terms. However, his study did not test how effectively the subjects could actually use this information.

Pricing in the Accounting Literature

Accounting researchers have also examined the role of product costs in pricing. One stream of product pricing research examined the effects of different accounting methods on functional fixation. The functional fixation hypothesis suggests that users will continue to interpret accounting reports in the same way even after a change in accounting method (Ijiri et al. 1966).

Ashton (1976) used a product pricing scenario to test the functional fixation hypothesis. He had subjects price 30 new hypothetical products using information on demand elasticity, product cost (absorption or variable), and the competitions' speed in getting to market. After pricing the 30 products, Ashton informed the subjects that there was a change in accounting method from either variable to absorption or vice versa. In reality, Ashton did not manipulate either elasticity or competition. Instead, he manipulated the two accounting methods (including the product cost) and the amount of information on the potential effects while looking for evidence of functional fixation. His results supported functional fixation since the subjects ignored the potential effects of the switch in accounting methods. Several authors (Chang and Birnberg 1977; Swieringa et al. 1979; Dyckman et al. 1982; and Bloom et al. 1984) have extended and replicated Ashton's work.[12]

In another research stream, Dickhaut and Lere (1983) attempted to build a heuristic model on how individuals would use different accounting systems (variable and absorption costing) in an attempt to maximize profits. The authors noted that decision makers must often use unit costs provided by incomplete (or imperfect) accounting systems to maximize profit. This is because complete information on cost and revenue curves is either impossible to get or prohibitively costly. The results of their study indicated that under conditions of no measurement bias, the variable cost system would produce decisions identical to the ones obtained when complete information was available. However, under conditions of uncertainty or when there was a downward bias to the cost numbers, the absorption method produced decisions closer to the optimal decisions made with complete information. Since pricing is made in conditions of

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[12] The Bloom et al. (1984) article also included

uncertainty, the Dickhaut and Lere model offers support for using absorption costing when setting prices.

Lere (1986) extended the theory and Hilton et al. (1988) tested the Dickhaut/Lere theory using a product pricing scenario. Both Lere (1986) and Hilton et al. (1988) manipulated both the demand and the cost function and found weak support for the Lere heuristic. An interesting feature of the study was that subjects could set tentative prices and examine the effects of price change on unit demand, revenue, cost, and profits. Therefore, subjects received feedback which they could use for pricing decisions. Turner and Hilton (1989) extended the 1988 paper and found stronger support for the Dickhaut/Lere theory. In their experiment, subjects set production quantities instead of prices as in the 1988 paper.

Gupta and King (1994) used Turner and Hilton's (1989) methodology of having subjects select production quantities instead of prices. The 1994 study also examined accounting system reliability and task complexity in the experiment. Subjects selected a production quantity for three different products over 20 rounds. The computer presented the subjects with OF on the profits from their prior decisions. The

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information on competitor's cost information.

authors found evidence that subjects did not rely exclusively on the cost reports and made modifications to them. Subjects in all experimental conditions demonstrated learning with the highest learning rates in conditions of high accounting system reliability and lower task complexity.

Finally, Foster and Gupta (1994) did a survey which examined the relationship between marketing functions and cost accounting. The authors found significant gaps between the usefulness of existing accounting information and its potential value. Specifically, marketing personnel were found to rely heavily on cost data when making pricing decisions despite the criticisms the same decision makers made about the data's usefulness

The accounting literature has examined both feedback and product pricing. However, it has not combined these two areas into a comprehensive study. Much of the feedback research has followed the cognitive psychology literature by ignoring OF even though this feedback is an integral part of accounting reports. In addition, feedback research has not thoroughly considered the effects of accounting system variance or subject knowledge on performance despite indications that OF could be as effective as other feedback types in certain situations (Hirst and Luckett 1987). The lack of accounting research on OF is surprising given the importance of OF in accounting (Otley and Berry 1980; Cook 1968; Hirst and Lowy 1990).

The primary purpose of the past accounting product pricing research has been to examine accounting issues other than feedback. Ashton (1976) examined pricing when looking for evidence of functional fixation. Dickhaut and Lere (1983) examined feedback in a peripheral manner when examining subjects' pricing decisions when using absorption or variable costing. Foster and Gupta's (1994) article has demonstrated the importance of product costs in pricing decision. Therefore, this study attempts to fill this gap between the two research streams.

Overall, research results in both cognitive psychology and accounting on feedback types has suggested that outcome feedback may not be as useful as other feedback types or feedback combinations. However, the efficacy of outcome feedback may depend on factors such as cue reliability, subject knowledge, task complexity, and task abstraction. Accounting research suggests that outcome feedback is an integral part of many accounting reports and may have strong motivational value.

The research on pricing indicates that factors such as the demand function and the level of competition a product faces are key determinants for when individuals set prices. In addition, Monroe (1990) suggests that price setters see product costs as a major determinant when setting prices. Therefore, accounting can play a major role in the price setting function (Foster and Gupta 1994). However, accounting systems use different methods of allocating costs to products. Thus, different accounting systems can produce different product costs, prices, and ultimately, profit. As suggested above, accounting systems' feedback mechanism can also influence the price setting process.

HYPOTHESES

The pricing literature, along with related material in the cognitive psychology and accounting fields, provides a plausible explanation how feedback type, variance in the accounting feedback, and subject knowledge combine to influence pricing. In addition, the literature stream also suggests testable hypotheses to examine this issue.

Type of Feedback

While the feedback type literature has identified three types of feedback (outcome feedback, task properties feedback and cognitive feedback), not all types are germane to accounting or price setting. Otley and Berry (1980) state that outcome feedback (OF) is a key element of a management accounting system. Therefore, the possibility of subjects not receiving this type of feedback is remote. Foster and Gupta's (1994) article supports OF's importance by finding that marketing executives stressed the value of reliable and timely profitability reports. Thus, price setters will normally receive accounting reports (OF) on the prior period's decision.

Task properties feedback (TP) provides the decision maker with information about the validity of the feedback before the actual task. The literature suggests that TP is the most useful for learning a task. More specifically, TP could help subjects overcome errors introduced by accounting system variance or lack of experience relative to other feedback types. Therefore, this study also examined the affects of TP.

An alternative to OF is cognitive feedback (CF) which provides information on the correlation between the true state of the environment and the decision maker's strategy. However, the true state of the environment (e.g., actual demand function) is rarely known. Therefore, providing CF is generally not feasible, and was not included in this study.

While this study examines the value of feedback, researchers have criticized prior accounting feedback studies for not providing a no feedback control group

(Ashton 1981; Kessler and Ashton 1981; Hoskin 1983; Harrell 1977; and Luckett and Hirst 1989). This study uses a feedback group where subjects do not receive any accounting feedback on their pricing decisions. Instead, their feedback is limited to marketing feedback only (i.e., market share and number of actual units sold). The other groups receive this marketing information along with the appropriate accounting feedback. Thus, the hypotheses in this study compare three feedback conditions: (1) no accounting feedback (NAF), (2)outcome feedback (OF), and (3) a combination of outcome feedback and task properties feedback (OFTP). Both the psychology and accounting feedback literatures suggest that the combination of OF and TP is superior to OF alone (Hammond et al., 1973; Steinmann 1976; Castellan 1974; Lindell 1976; and Harrell 1977). This occurs because the OF does not explain the random error in the feedback that confuses the subjects. This leads to the following hypothesis:

H1A: The OFTP group will have higher performance compared to the OF only group.

However, price setters with OF only can learn about the system (and the cue predictability) by observing the difference between the predicted and actual product costs and income over a series of trials (Gupta and King 1994).

Therefore, the performance gap between the OF only and the OFTP subjects should decrease over the number of trials. This leads to the next hypothesis:

H1B: Over time, the difference in performance between subjects receiving OF only and OFTP will decrease.

Studies suggest that OF is beneficial if the cues are relatively accurate and subjects have a reasonable level of task knowledge (Sniezek 1986; Adelman 1981). The cues generated by the accounting system vary in reliability, but do have predictive value. Thus, subjects with OF should perform better than subjects receiving no accounting feedback (NAF). This leads to the next research hypothesis:

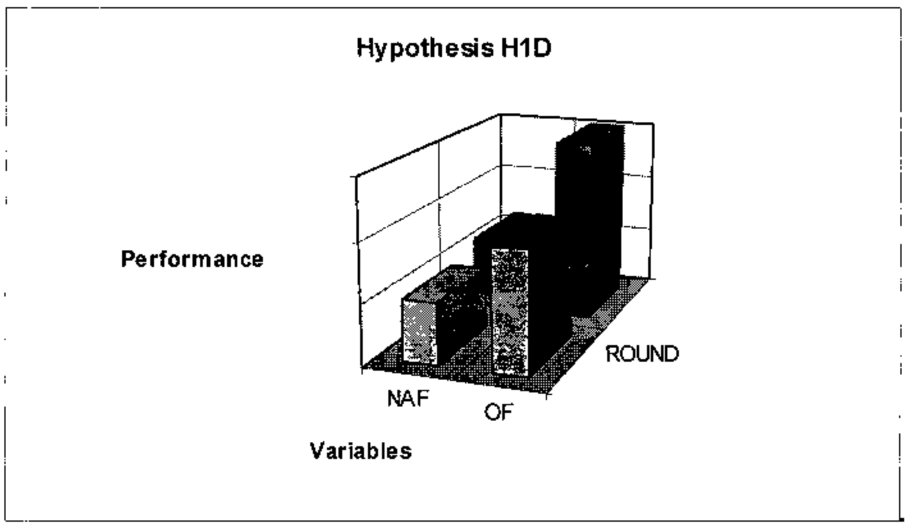
H1C: The OF feedback group will have greater performance than the NAF group.

Research suggests that feedback provides subjects with an opportunity to learn (Castellan 1974; Adelman 1981). Subjects in the OF group have accounting feedback that the NAF group lacks. Therefore, the NAF subjects should have less opportunity to learn over the course of the experiment relative to the OF group. This lack of improvement in performance for the NAF group results in the following hypothesis:

H1D: Over time, the difference in performance between subjects receiving outcome feedback and the NAF group should not decrease.

In order to clarify the meaning of some of the hypotheses, graphical representations of the hypotheses relating to changes in the variables over time are presented below.

Figure 2.3 Hypothesis H1D



Accounting System Aggregation

Rao (1984) notes that price is the only element of the marketing mix that generates revenues. In addition, firms can use pricing to influence demand and competition levels. However, managers must set the correct price to effectively control demand, competition, and ultimately, profits. Therefore, costs are not the only factor managers need to include in their pricing decision.

Price setters use cost information in order to avoid setting prices below the product's cost for extended periods. Therefore, managers' pricing decisions depend in part on the cost information provided by accounting (Foster and Gupta 1994). However, accounting systems must aggregate cost information and imperfectly allocate this information to different products. These calculations become less reliable as the accounting system aggregates more heterogeneous costs and allocates them to the product (Horngren and Foster 1994). This results in a greater variance of reported product cost. This variance is a direct result of greater cost aggregation. As more costs are aggregated, the common relationship they have with the product cost become more blurred. For example, combining rent cost on the factory with the factory's utilities combines two heterogeneous costs. Since these two cost types do not share a common relationship with the product cost, this cost pool can create a variance between the reported product cost and the actual factory cost.[13] Therefore, the variance occurs because greater aggregation of costs

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[13] The factory rent may be allocated based on square footage devoted to each product or to square footage used by each machine and then allocated to the products the machine work on. Utilities may vary dramatically due to weather

decreases the linkage between the actual costs and how the costs are estimated by the system. Thus, increases in cost aggregation should lead to less reliable cost data.

Therefore, as the reported product cost becomes less reliable, the price setter has greater difficulty in determining an appropriate minimum price "floor". As a result, price setters with less accurate systems may set higher prices to avoid pricing the product at a loss. These higher prices can result in several undesirable results. If the product is price-sensitive, the higher price may reduce demand. In addition, a higher price may encourage other companies to enter the market and increase competition which could lead to and lower profitability for a specific firm.

In addition, less reliable accounting systems may contain greater variances in their reported product costs. This increased variance in product costs makes determining a optimal price more difficult to determine because product cost and margins are less certain.

The increased variance means price setters are less likely to select the optimal price. This should result in lower profitability. Thus, accounting systems with less reliability (less cost pools) should result in both higher

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conditions which may have no relationship to the products prices and greater variances which leads to the following profitability hypothesis:

H2A: Subjects using a lower number of cost pools will have lower performance than subjects using a greater number of cost pools.

The feedback literature suggests the combination of OF and TP is superior to OF alone. Hammond et al. (1973) note that OF signals the decision maker if a strategy revision is necessary. Unfortunately, OF does not give the subject information on how to adjust the decision process. However, TP feedback provides the user with cue reliability information which allows the decision maker to evaluate cue usefulness.

In the low system reliability group, the subjects should find TP feedback useful in evaluating their reliance on the product cost reports. The subjects can offset the lower cue predictibilities from the weaker accounting system with the TP information. However, as the reliability increases, subjects should find less incremental benefit with TP because of the already high cue reliability. Therefore, increases in predictability should lead to a relative improvement in performance of subjects receiving OF

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themselves.

only compared to the combination of OF and TP which is tested in the next hypothesis:

H2B: As predictability increases, the performance of subjects receiving OF should increase relative to subjects receiving a combination of OF and TP.

However, the group receiving OF only should outperform those receiving no accounting feedback at a high reliability level. This leads to the following hypothesis:

H2C: As predictability increases, the subjects receiving OF should have higher performance than those receiving NAF.

In addition, we would expect that the group receiving more reliable accounting reports should learn more rapidly over the course of the experiment. This is illustrated in Figure 2.4 and leads to the following hypothesis:

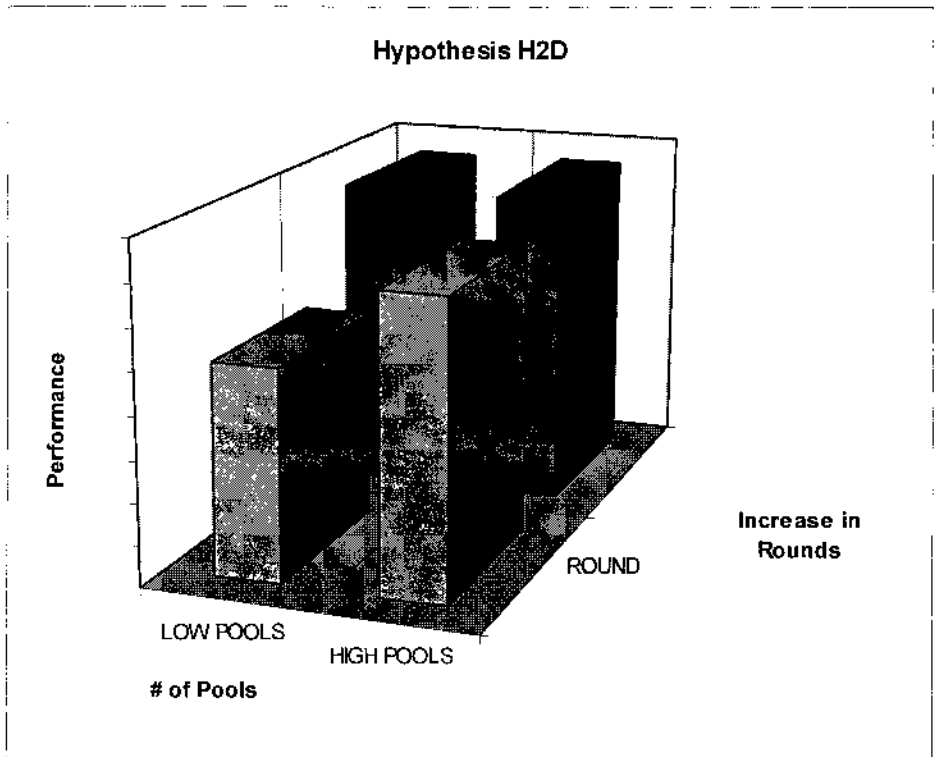
H2D: The subjects receiving higher reliability reports should show a greater learning effect during the experiment relative to those receiving lower reliability reports.

Task Knowledge

Research in both psychology and accounting suggest that task knowledge (expertise) is positively related to performance (Sniezek 1986, Ashton 1981). This leads to the following hypothesis:

H3A: Subjects with greater task knowledge will have higher performance than subjects with less task knowledge.

Figure 2.4 Hypothesis H2D



However, I would expect that the subjects with less task knowledge will learn during the course of the experiment. Therefore, the differences in performance between the high and low task knowledge subjects should decrease over time. This is stated as

H3B: The performance gap between subjects with greater and less task knowledge will decrease during the experiment.

Prior feedback findings also suggest that differences in feedback type effectiveness decline as task knowledge increases (Sniezek 1986; Adelman 1981). They note that subjects with greater task knowledge can use the available data more effectively than subjects with less knowledge but more precise feedback. This suggests an interaction effect between subject experience and feedback type. Specifically, the superiority of OFTP feedback over OF only to decrease as task knowledge increases. This suggests the following hypothesis:

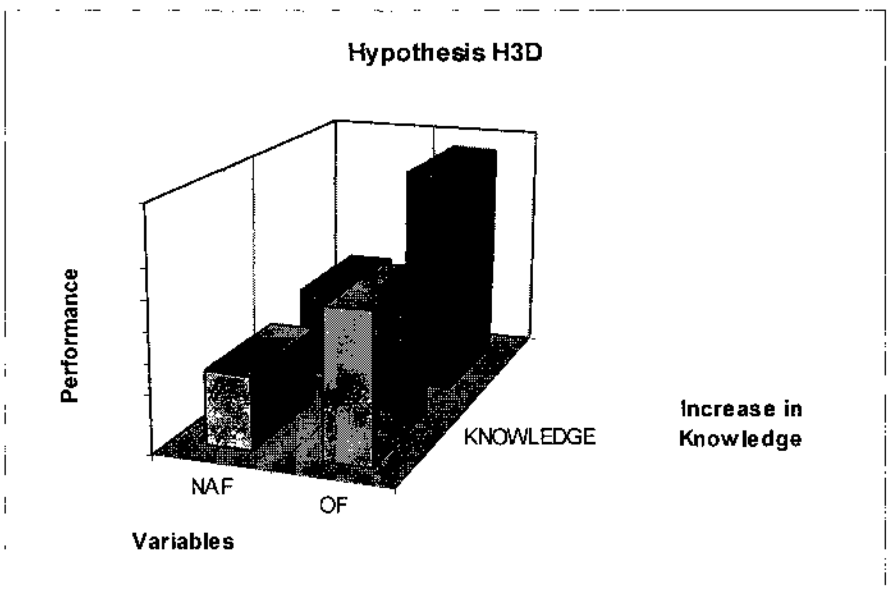
H3C: As task knowledge increases, the difference in performance between the OF only group and the OFTP group will decrease.

Research by Gupta and King (1994) suggests that subjects can improve their performance if they receive feedback. In addition, subjects with more price setting task knowledge should be able to use their experience more effectively than less experienced subjects. Therefore, as task knowledge increases, the performance of the group receiving OF should at least remain stable relative to the

NAF subjects. This is shown in Figure 2.5 and stated in the following hypothesis:

H3D: As task knowledge increases, the performance of those receiving only NAF will decrease relative to the OF group.

Figure 2.5 Hypothesis H3D



The Relationship between Experience and Knowledge

The expertise literature in both accounting and marketing acknowledge that experience alone does not necessarily lead to expertise or task knowledge. Libby and Luft's (1993) model suggests that both experience and mental ability are prerequisites for knowledge. Therefore, using experience as alone as a proxy for knowledge should produce different results relative to a measure of knowledge structure. Specifically, I would expect to see a stronger relationship between a measure of knowledge structure and performance than between pricing experience and performance. This leads to the following fourth group of hypotheses.

H4A: The measure of knowledge structure will have a stronger relationship with performance than the measure of the subjects' pricing experience.

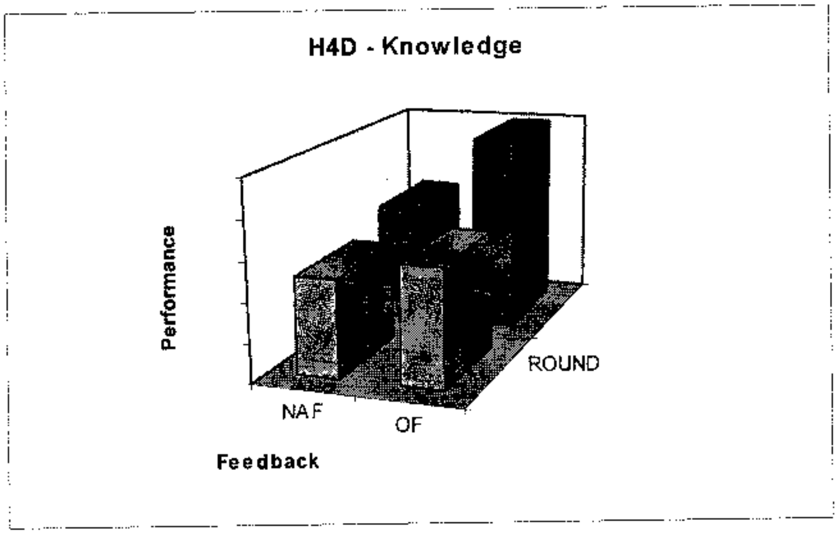
H4B: Over time, subjects with lesser knowledge or experience should increase their performance relative to subjects with greater knowledge or experience. This increase in performance will be greater for the knowledge structure measure than the experience measure.

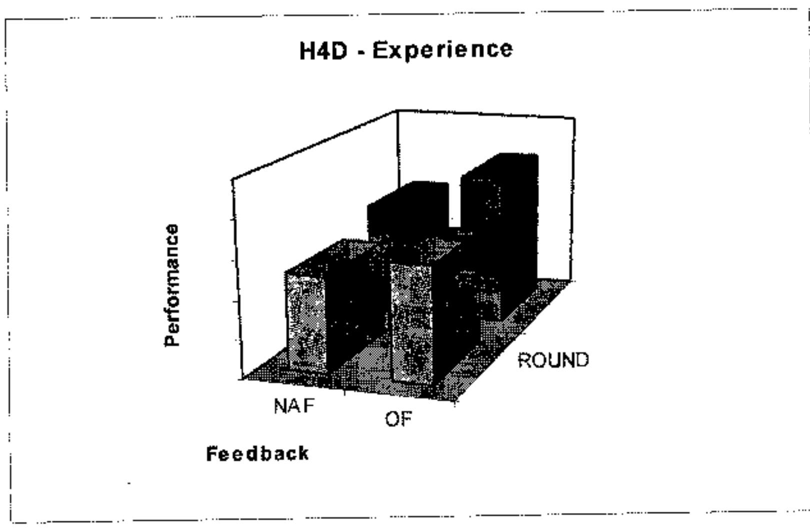
H4C: As knowledge or experience increases, the difference in performance between the OF only group and the OFTP group will decrease. This decrease will be greater for the knowledge structure measure than the experience measure.

H4D: As knowledge or experience increases, the performance of those receiving only NAF will decrease relative to the OF group. This decrease will be greater for the knowledge structure measure than the experience measure.

The relationships suggested in hypotheses H4D is shown in Figure 2.6 below:

Figure 2.6 Hypothesis H4D





MODEL

This section presents the model used for testing the hypotheses. Since the research design has both cross-sectional and repeated-measures, data a hierarchical regression model set up for panel data is appropriate. This model allows the researcher to examine the influence of time (represented by rounds) on the variables. The model is presented in Equation 2.1 below.

Equation 2.1

$$\begin{aligned} ROUNDSCR = {} & \beta_1 OFTP + \beta_2 NAF + \beta_3 POOLS + \beta_4 TASKKNOW + \\ & \beta_5 ROUND + \beta_6 OFTP*ROUND + \beta_7 NAF*ROUND + \\ & \beta_8 POOLS*ROUND + \beta_9 OFTP*POOLS + \beta_{10} NAF*POOLS \\ & \beta_{11} TASKKNOW*ROUND + \beta_{12} OFTP*TASKKNOW + \\ & \beta_{13} NAF*TASKKNOW + \beta_{14} DEMAND + \beta_{15} COMPETE + \\ & \beta_{16} CPRICE + \beta_{17} PRICE + \varepsilon \end{aligned}$$

where:

ROUNDSCR	=	The actual profit earned by the particular product for each round.
OFTP	=	Coded 1,0 where 1 represents subjects receiving the combination of OF and TP.
NAF	=	Coded 1,0 where 1 represents subjects receiving no accounting feedback.
POOLS	=	A variable coded as one for higher number of cost pools and zero for the lower number of pools.
TASKKNOW	=	The natural log of the subject's knowledge or pricing experience.
ROUND	=	A variable representing the pricing round where ROUND = 1, 2,..., 15.
DEMAND	=	The actual demand function for the product for the round.

COMPETE	=	The actual amount of competition for the product for the round.
CPRICE	=	The average price of competing products.
PRICE	=	The product's price for that round.

The model examines both profitability and the ability of the subjects to correctly estimate this profitability from the cues provided in the experiment. Prior accounting studies on pricing have concentrated primarily on the link between accounting costs and profitability (Gupta and King 1994; Hilton et al. 1988). While this link is important (Foster and Gupta 1994), these authors also suggest that the ability to forecast profits is also essential. Therefore, the dependent variable (ROUNDSCR) is a combination of profit attained and accuracy in profit prediction. Specifically, the performance score is the actual profit less the error, where the error is computed as the difference between the actual and estimated profit.

Since actual accounting reports inherently include outcome feedback, this feedback type is the most realistic and will be used as the control group. The model will examine if the combination of OF and TP will result in significantly greater performance relative to receiving OF only. In addition, the model will compare no accounting feedback with OF to determine if OF improves performance. This test has been neglected in prior accounting feedback studies. The model uses dummy-coded variables representing these two different feedback types (OF and TP and no accounting feedback) allowing a direct comparison with those subjects receiving only outcome feedback.

In addition to feedback type, the model also examines how the number of cost pools influences performance. The variable for the number of pools is represented by a dummy variable coded 0/1 where the codes represent one and eight cost pools respectively. The literature suggests that a greater number of cost pools will result in a higher cue reliability (Babad and Balachandran 1993).

The model uses a proxy for task knowledge similar to the approach used by Perkins (1993) in the marketing area. Subjects sorted 24 marketing terms with pre-determined correct groupings. The number of correct classifications is then used to measure task knowledge. This is consistent with accounting literature, which prefers a more direct measure of pricing measure relative to years of experience or some other proxy (Bonner 1990; Bonner and Pennington 1991). Similar to this research stream, the measure of task knowledge (number of correct answers) is transformed into a natural log.[14]

The marketing literature is rich in pricing models for different industries. This model is based on articles examining new products and the high technology industry. Articles on pricing new products include Dockner and Jorgensen (1988) and Horsky and Nelson (1992). The high technology industry is covered by Grunewald and Vernon (1988) and Yoon (1991). The authors all note the importance of elasticities and competition in their models and suggest how these functions will change over the product life cycle. Therefore, the model includes variables representing the product's demand and the competition level. Competition is proxied using two variables; competitor's price and market share (Dockner and Jorgensen 1988; Horsky and Nelson 1992; and Grunewald and Vernon 1988).

Another consideration is the dynamic nature of the pricing decision. Prior decisions influence the future parameters. For example, if a decision maker initially sets

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[14] The cognitive psychology literature suggests that the rate of learning can be described by a logarithmic function (the learning curve). According to Frensch and Sternberg (1989), practice is related to performance through a logarithmic function where gains in performance quality become smaller and smaller with increased practice.

a price too high, this will increase future competition and the demand function while lowering product volume (and increasing product costs) (Besanko and Winston 1990; Fodor 1987; Kijewski and Yoon 1990). To control for these prior decisions, the model includes the price set by each subject. This variable proxies for the total cost effect and the availability of substitute information that Nagle (1987) suggest can influence the demand function.

CHAPTER 3

METHODOLOGY

Experimental Design

Each subject priced a product for fifteen rounds. The design of the experiment required measurement of subject performance on three types of feedback conditions, two types of subjects and two types of accounting systems. Accordingly, the design is a 3 x 2 x 2 design. The three independent variables are feedback type (no accounting feedback, outcome feedback, and the combination of outcome and task properties feedback), knowledge (novices and experts), and number of cost pools (high-low) which are all between-subjects variables. The research design is shown in Table 3.1. In addition, since the research design has both cross-sectional and repeated-measures data a hierarchical regression model set up for panel data is appropriate. This model allows the researcher to examine the influence of time (represented by rounds) on the variables.

Subjects

Subjects were 22 individuals who had completed at least a Bachelor's degree and were working full-time (professionals) and 38 students in senior and graduate marketing courses at the University of North Texas (students). The subjects were drawn from these two different populations to insure differences in both pricing experience and knowledge. Each subject's pricing experience was elicited with a series of demographic questions about their academic and professional background. These questions established the number of marketing courses taken and years of pricing experience in different industries. The variable for years of pricing experience served as a proxy for pricing knowledge.

Table 3.1 The design of the experiment.

	Feedback Type					
	No Accounting Feedback		Outcome Feedback		Outcome and Task Properties Feedback	
Cost Pools	Low	High	Low	High	Low	High
Students N = 38	n = 7	n = 7	n = 6	n = 6	n = 6	n = 6
Professionals N = 22	n = 4	n = 3	n = 3	n = 4	n = 4	n = 4

However, both the marketing (Perkins 1993) and the accounting (Bonner 1990) literatures note that years of experience are not always a satisfactory proxy for knowledge. Therefore, subjects also completed a sorting task of 24 marketing terms (Appendix B Figure 23) similar to

Perkins (1993). The score of this sorting task was used to classify the subjects according to their marketing knowledge with a higher score corresponding to greater knowledge. None of the subjects had any actual accounting experience. The student group had a theoretical background in pricing and limited experience, whereas the professional group had both a theoretical background and actual pricing experience.[15] The fourth set of hypotheses makes predictions about years of experience compared to the more direct measure of knowledge obtained through the sorting task. The subjects with pricing experience came from a wide range of industries which are detailed in Table 3.2.

Tasks

Task Description

During the experiment, the subjects used a personal computer to display the cues and enter their decisions. The computer ran a custom designed program for Windows 3.1 and the subjects used both a mouse and the keyboard for input.

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[15] Approximately 12 of the students reported having some pricing experience, primarily in the retail industry. However, they reported pricing under supervision whereas the professionals reported full responsibility for pricing.

Table 3.2 Breakdown of Subjects' Pricing Experience by Industry Type.

Industry Type	Number of Professionals with Experience
Manufacturing: High-Tech Consumer Goods	0
Manufacturing: High-Tech Industrial Goods	1
Manufacturing: Other	8
Wholesale Distribution	3
Service Industries:	6
Other (Oil and Gas, Not-for-Profit, etc.)	1
Retail Sales	9

The use of a computer insured a consistent approach to the presentation of the cues, as well as unobtrusive collection of all data entered by the subject. Further, the computer allowed each subject to work at an individual pace, and quickly showed the appropriate feedback based on the subject's decision. Depending on subject availability, data was collected either at their place of employment or in the researcher's office. In all cases, the researcher was present to answer any questions the subjects had during the course of the experiment.

The experimental steps for each subject are described below in Table 3.3. Subjects were provided with a description of the experiment (Appendix A) which they read. The researcher then explained key points about the experiment with them using a print out of the relevant computer screens (Figures 3.1 and 3.2).

Table 3.3 Description of Experimental Steps

Step	Description
1.	Read Instructions
2.	Researcher reviews instructions with the subject
3.	Subject works tutorial, including a brief demonstration of working with the mouse. Researcher monitors the progress of each subject and is available for questions.
4.	Researcher discusses the results of the tutorial with each subject and answers any questions.
5.	Subject takes 13-question quiz on covering key points of the experiment
6.	Subjects set price and estimate profits for the fifteen round experimental task.
7.	Subjects perform sorting task tutorial
8.	Subjects sort 24 marketing terms to establish a proxy for marketing knowledge.
9.	Subjects weight each cue received based on how much they relied on them.
10.	Subjects provide information on the their number of years pricing experience in different industries.
11.	Subjects report their education level and the number of courses completed in both accounting and marketing.
12.	Subjects provide information on their age. This completed the experiment.
13.	All subjects are informed of the results of the experiment by mail. Those subjects receiving compensation are paid at that time.

Tutorial

After the instructions, each subject started the program by reading through a brief tutorial demonstrating how to use a mouse to read and input information. Following the mouse tutorial, the subjects started a 3-round tutorial section. The purpose of the tutorial was to demonstrate how they should interact with the computer. The tutorial screens were identical to actual experimental screens except the tutorial included additional written instructions.[16] Subjects were encouraged to ask any questions they had during this time period and the researcher asked if they required any assistance at least once during the tutorial. After the subjects had completed the three-round tutorial, a results screen (Appendix B, Figure 9) appeared and the subjects required a password to proceed. The researcher reviewed the tutorial results with each subject. This review was to insure that each subject understood the scoring procedure, answer any questions a subject had, and determine if the subject understood the correct procedure.

Quiz

Following the review, the subjects had a 13-question, true/false quiz about key points in the experiment. The quiz served as a manipulation check on the subjects' understanding of the instructions. The subjects used a mouse to select their answer and were immediately provided with the correct answer (Appendix B, Figure 10). Following the questions, a screen showed the subjects their correct score

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[16] The participants received the appropriate type of feedback for their experimental group. The actual cues were generated using identical formulas for all experimental groups. Therefore, none of the participants received additional information about the experiment.

on the quiz.[17] Therefore, even if a correct answer was chosen incorrectly, the subjects received feedback on why each answer was correct.

Pricing and Profit Estimation Task

Immediately after the quiz results screen, the subjects started the first round of the actual experiment. Subjects followed a procedure identical to the tutorial, in which they received external marketing information and adjusted the price (Figure 3.1). Following the price-setting, the subjects estimated the actual total profit for that round (Figure 3.2). Following the profit estimation, the subjects received the appropriate feedback for their group. After viewing the feedback, the subjects returned to the pricing screen, from which they started the next round.

Figure 3.1 provided subjects with information on market share percentage, average competitor's price for an equivalent profit, projected unit volume at different prices, and projected per unit costs at different volumes. Subjects were able to use the mouse to change the price per unit as often as they wished. As the price changed, the unit volume and per unit cost information automatically updated

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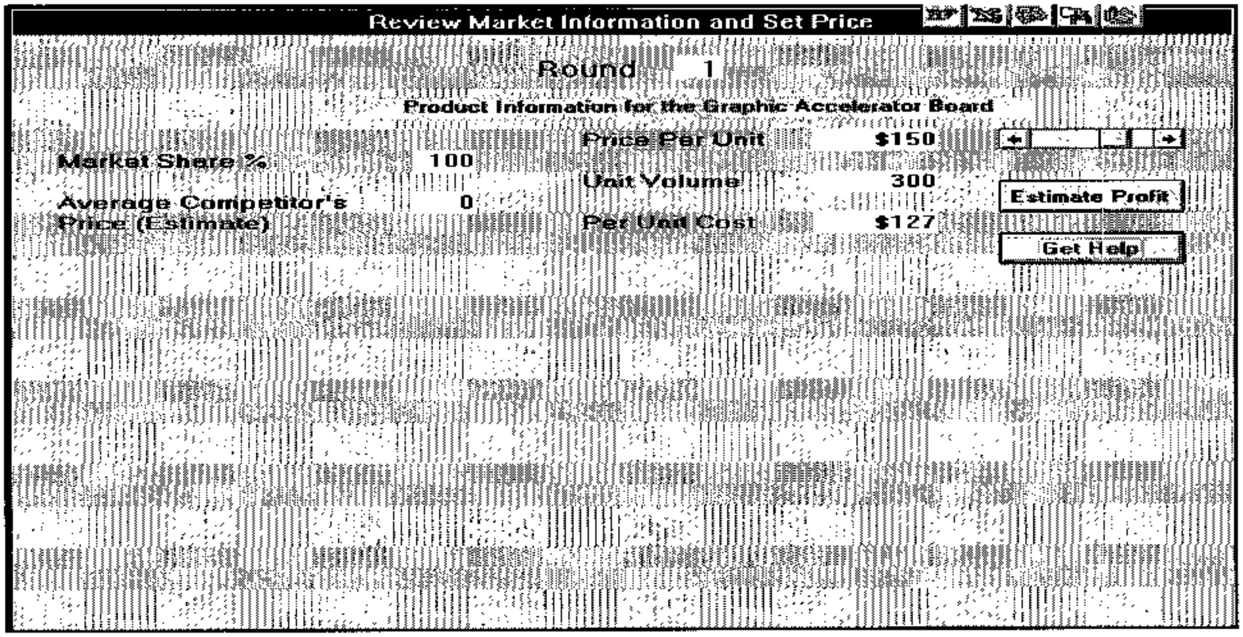
[17] The questions and the correct responses are shown in Appendix B, Table 1.

Figure 3.1 Screen subjects saw when setting price.



to show the price effects. Since the research focused on the accounting system, the unit volume cue was made highly reliable with a seeded random error of plus or minus three percent.[18] The per unit cost amount was calculated using the appropriate accounting system for the subject (high or low number of cost pools).

The market share percentage number was updated at the beginning of each round. Market share fluctuated depending on how the subjects priced their product relative to the average competitor's price. While the competitors' price

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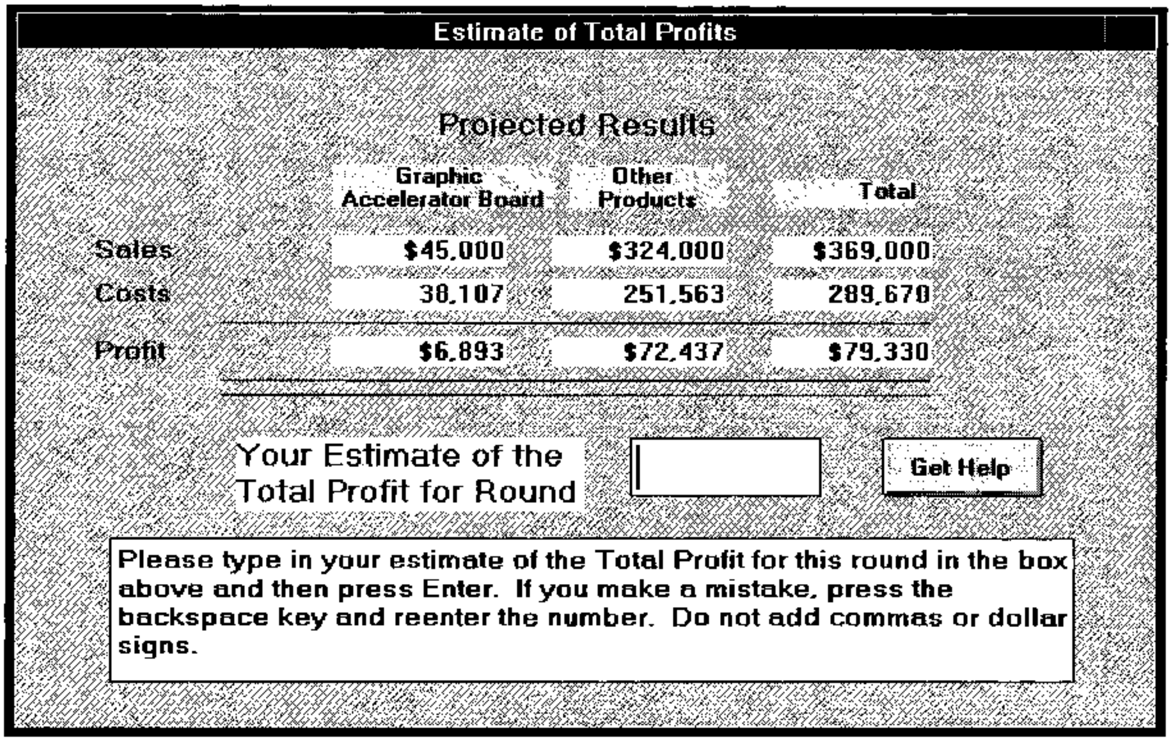
[18] The error was randomized, but was the same percentage for all participants. The participants were informed that the cue should be considered reliable.

Figure 3.2 Screen subjects saw when estimating profit.



decreased each round, it was the same for all subjects for each round.

The subjects used the keyboard to enter their profit estimation and had already obtained feedback about their past performance for the OF and OFTP groups (Figures 3.4 and 3.5).[19] The no accounting feedback (NAF) group received feedback on the actual units sold in each round (Figure 3.3).

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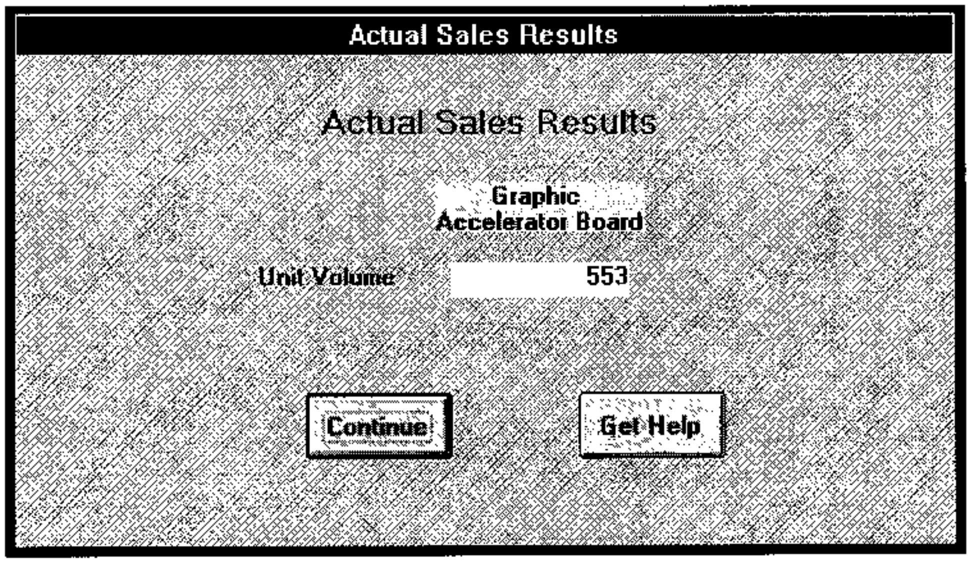
[19] The participants received feedback about prior results for rounds two through fifteen.

Figure 3.3 Feedback screen for subjects receiving no accounting feedback.

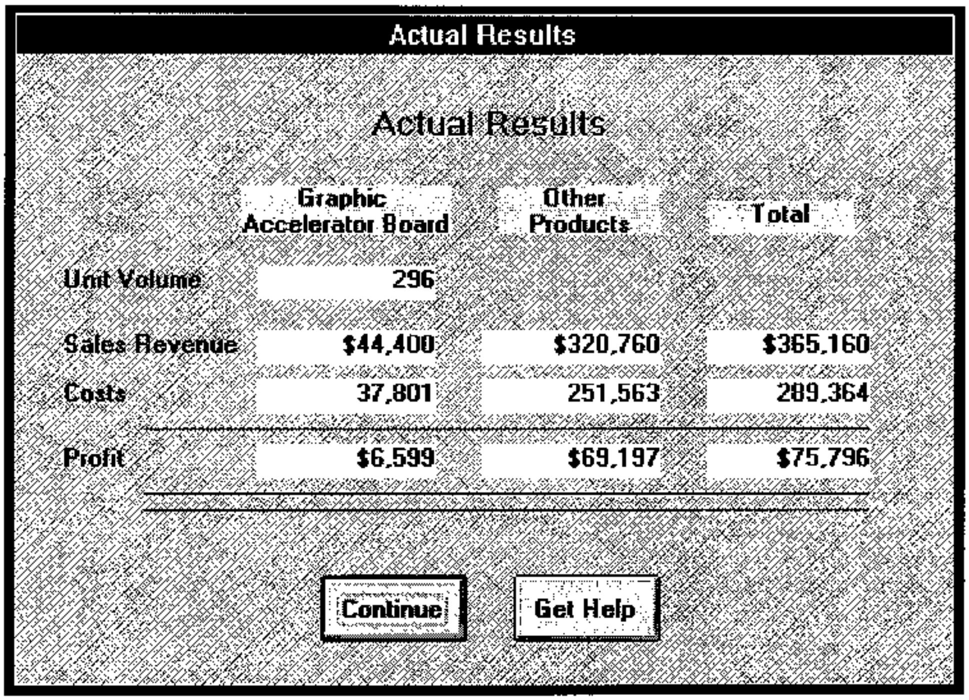


This control group had only the accounting system's estimate of profits and did not receive any information on cue reliability. The other groups received more feedback and these reports are shown in Figures 3.4 and 3.5 below. Note that the subjects who viewed Figure 3.5 also saw Figure 3.4. This continued for 15 rounds at which point subjects were shown a results screen summarizing their performance for each round and presenting their total score.

Sorting Task

After the pricing task, the subjects performed a sorting task which served as a proxy for their task knowledge. The subjects first went through a tutorial where they were shown how to sort terms by placing them on a nine-cell grid (Appendix B, Figures 18-21). The six tutorial

Figure 3.4 Feedback screen seen by subjects receiving outcome feedback.



terms, which were for automobiles, were chosen for their ease of understanding for sorting categories as well as being neutral to the actual sorting task.[20]

Following the sorting tutorial, the subjects were given 24 marketing terms.[21] The computer screen (Appendix B,

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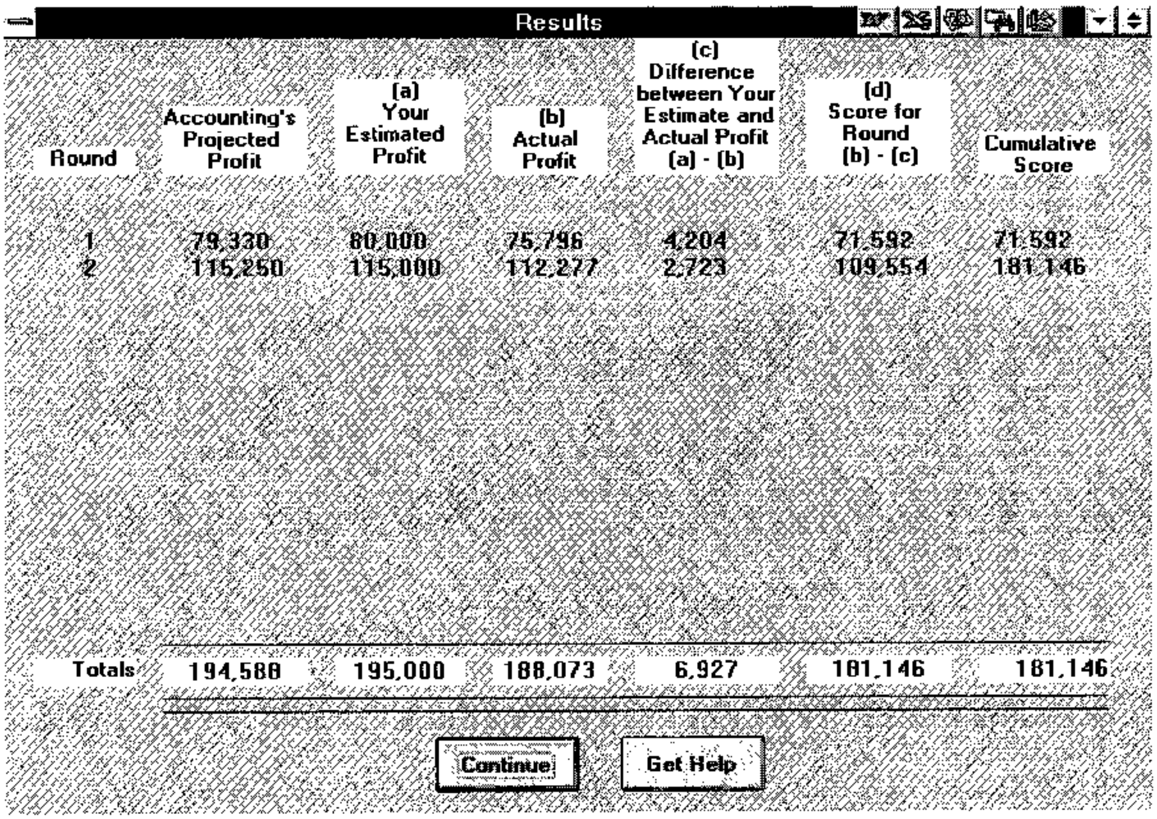
[20] The six terms were Cadillac, Chevrolet, Ferrari, Ford, Honda, and Rolls Royce.

[21] This is a similar methodology used by Perkins (1993). Perkins selected six terms from 4 chapters of Kotler's 4th edition marketing textbook. I used 12 of Perkin's 24 terms

Figures 22-23) instructed them to group the terms according to relatedness and not include any terms they did not

Figure 3.5 Feedback screen seen by subjects receiving both outcome and task properties feedback.



understand. Following Perkin's (1993) methodology, the total number of correct answers for each subject was determined.[22]

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and then selected 12 other terms from Kotler's two chapters on pricing.

[22] Perkins compared his score to self-reported measures on marketing education and marketing experience and found a significant correlation between the three measures. The score in the current study also correlated with marketing education and pricing experience.

The natural log of the number of correct answers was used in the model similar to research in the expertise literature. This sorting task proxied for the each subject's task knowledge. Similar to Perkins, the terms included general marketing terms. In addition, 12 of the terms related specifically to product pricing. As discussed in the Results chapter, those with more marketing experience, greater age, and pricing experience had a higher score on the sorting task.

Cue Ranking

Subjects then provided information regarding how much they relied on the cues they received during the pricing experiment (Appendix B, Figure 24). This information was not used directly in the current study, but will be used in future research.

Pricing Experience and Demographics

After rating the cues, the subjects provided information on their approximate number of years pricing in various industries (Appendix B, Figure 25). This information served as a manipulation check on the task knowledge score on the sorting task. The subjects then advanced a screen and provided information on their education level achieved and entered the number of accounting and marketing courses they had completed (Appendix B, Figure 26). This information also served to check the task sorting proxy. These three proxies were compared to the score on the term sorting task. A positive relationship between these proxies and the term sorting task would give extra credibility to the proxy for task knowledge (Perkins 1993; Bonner and Pennington 1991).

The subjects then indicated their approximate age (Appendix B, Figure 27) and rated the task on four factors: (1) how interesting the task was, (2) how well the tutorial prepared them for the experiment, (3) how realistic the task was, and (4) how clear the instructions were (Appendix B, Figure 28).

Subject Incentives

As in prior experiments, the subjects had a chance to earn cash, contingent upon performance (Hilton, et al. 1988; Gupta and King 1994).[23] In this study, the selection of a compensation scheme was made more difficult because of the two different populations: students and professionals.

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[23] The Hilton, et al. (1988) experiment guaranteed a minimum payment of $5.00 and provided participants with a chance to earn up to $30.00 for approximately 75 minutes of their time. Gupta and King (1994) used a tutorial in their training and paid their participants $0.30 for each correct answer. The average payment was $2.90 out of a possible $3.00. In addition, participants received compensation based on their performance and earned an average of $23.80 for two hours work. Thus, the average pay was approximately $26.70. Compensation for students

Research has shown that there is no difference in the affects of course credit and monetary incentives on willingness to participate in an experiment (Korn and Hogan 1992). In addition, cash lotteries have been shown to be an effective substitute for a small cash awards (Balakrishnan et al. 1992; Gajray et al. 1990). In an attempt to equalize the incentives for the two groups, students were offered one percent extra credit in their marketing class for participating, as well as an opportunity to win cash based on performance. The top performer in each of the six experimental groups was selected and then one was randomly picked to receive a $200.00 cash prize and two were selected to win $100.00 prizes. The professionals had a total cash incentive pool of $600.00. As in the student group, the top performer from each of the six experimental groups was selected and a lottery used to randomly pick a $300.00 winner and two $150.00 winners.

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could also include extra credit points to minimize out-of-pocket costs.

CHAPTER 4

RESULTS

Test of Hypotheses Sets One Through Three

The results of the test of the model are shown below. For the test of the first three hypotheses, the variable TASKKNOW represents the natural log of the subjects' sorting score. Due to the high degree of multicollinearity, the model was run as a two-stage hierarchical regression. The Pearson correlations and their p values are shown below in Table 4.1. where the p values are: .05 = * .01 = ** .001 = ***

Table 4.1 Correlations of Model Variables

	OFTP	NAF	POOLS	TASKKNOW	ROUND	TP_RND	NAF_RND
OFTP	1.0000						
NAF	-0.5095***	1.0000					
POOLS	-0.0050	-0.0384	1.0000				
HITS	-0.0215	-0.1251***	-0.0913**	1.0000			
ROUND	-0.0015	-0.0061	0.0121	-0.0008	1.0000		
TP_RND	0.8357***	-0.4258***	-0.0034	-0.0196	0.3154***	1.0000	
NAF_RND	-0.4251***	0.8343***	-0.0253	-0.1045**	0.3162***	-0.3552***	1.0000
POOL_RND	-0.0075	-0.0304	0.8019***	-0.0725*	0.4277***	0.1250***	0.1081**
TP_POOL	0.6223***	-0.3171***	0.4477***	-0.0619	0.0001	0.5211***	-0.2645***
NAF_POOL	-0.3064***	0.6013***	0.4439***	-0.2134***	0.0060	-0.2560***	0.5108***
HIT_RND	-0.0123	-0.0645	-0.0330	0.4753***	0.8411***	0.2534***	0.2013***
TP_HITS	0.9562***	-0.4872***	-0.0270	0.1168***	-0.0025	0.7981***	-0.4065***
NAF_HITS	-0.4651***	0.9128***	-0.0974**	0.1564***	-0.0056	-0.3886***	0.7614***

Table Continued

	OFTP	NAF	POOLS	TASKKNOW	ROUND	TP_RND	NAF_RND
DEMAND	-0.0166	0.0322	-0.0042	0.0353	-0.4270***	-0.1421***	-0.1028**
COMPETE	-0.0012	0.0431	-0.0288	0.0258	-0.5458***	-0.1673***	-0.1270***
CPRICE	-0.0000	-0.0042	-0.0123	0.0002	0.1378***	0.0436	0.0447
PRICE	-0.0057	-0.0203	0.0169	0.0044	-0.7550***	-0.2378***	-0.2695***

	POOL_RND	TP_POOL	NAF_POOL	TK_RND	TP_TK	NAF_TK	DEMAND
POOL_RND	1.0000						
TP_POOL	0.3545***	1.0000					
NAF_POOL	0.3565***	-0.1907***	1.0000				
HIT_RND	0.3156***	-0.0301	-0.0960**	1.0000			
TP_HITS	-0.0255	0.5649***	-0.2930***	0.0531	1.0000		
NAF_HITS	-0.0766*	-0.2894***	0.4637***	0.0693*	-0.4447***	1.0000	
DEMAND	-0.2015***	0.0239	0.0683*	-0.3385***	0.0089	0.0202	1.0000
COMPETE	-0.2738***	0.0297	0.0719*	-0.4379***	0.0311	0.0187	0.6152***
CPRICE	0.0553	-0.0058	-0.0099	0.1161***	0.0009	-0.0053	0.3452***
PRICE	-0.2958***	-0.0079	-0.0282	-0.6434***	-0.0122	-0.0134	0.0651

	COMPETE	CPRICE	PRICE
COMPETE	1.0000		
CPRICE	-0.1547***	1.0000	
PRICE	0.4163***	-0.2088***	1.0000

The first stage of the model included only tests of significance for the main effects and the results are shown in Table 4.2. This table shows the results of both an ordinary least squares model without group dummy variables and the random effects model. The first model (Panel A) has an F-test of 64.60 with a p-value of .001. The random effects model (Panel B) shows that all of the main effects are highly significant ($p < .001$) with the exception OF the variables TASKKNOW, OFTP, NAF, and ROUND. The R-squared for the random effects model was 0.3988. This suggests that there was little difference in subject performance based on task knowledge, accounting system type, or feedback type.

Table 4.2 Panel A - First Stage of the Model Test

Unconditional ANOVA (No regressors)

Source	Variation	Deg. Free.	Mean Square
Between	0.187499E+12	59.	0.317795E+10
Residual	0.290580E+12	808.	0.359629E+09
Total	0.478079E+12	867.	0.551417E+09

OLS Without Group Dummy Variables

Ordinary least squares regression.		Dep. Variable =	ROUNDSCR
Observations =	868	Weights =	ONE
Mean of LHS =	0.6997007E+05	Std.Dev of LHS =	0.2348228E+05
StdDev of residuals=	0.1822452E+05	Sum of squares =	0.2849703E+12
R-squared =	0.4039263E+00	Adjusted R-squared=	0.3976738E+00
F[9, 858] =	0.6460216E+02	Prob value	0.3217295E-13
Log-likelihood =	-0.9742144E+04	Restr.(á=0) Log-l =	-0.9966692E+04
Amemiya Pr. Criter.=	0.2247038E+02	Akaike Info.Crit. =	0.3359596E+09

ANOVA Source	Variation	Degrees of Freedom	Mean Square
Regression	0.1931087E+12	9.	0.2145652E+11
Residual	0.2849703E+12	858.	0.3321332E+09
Total	0.4780789E+12	867.	0.5514175E+09

N[0,1] used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob|t|òx	Mean of X	Std.Dev.of X
TASKKNOW	1980.8	1109.	1.785	0.07419	1.8707	0.56888
POOLS	10441.	1249.	8.360	0.00000	0.48963	0.50018
OFTP	2443.7	1538.	1.588	0.11219	0.33180	0.47113
NAF	725.50	1541.	0.471	0.63784	0.34332	0.47509
ROUND	482.33	279.3	1.727	0.08422	8.0058	4.2938
DEMAND	11.132	3.018	3.689	0.00023	592.30	377.79
COMPETE	93.818	33.51	2.800	0.00512	60.015	30.030
CPRICE	223.36	23.90	9.346	0.00000	112.49	32.925
PRICE	628.42	62.37	10.076	0.00000	122.23	17.963
Constant	-57931.	0.1000E+05	-5.792	0.00000		

There were a total of 900 observations (60 subjects times 15 rounds). However, a number of the subjects committed significant errors when entering the profit estimates. These errors could have been due to not understanding the instructions or simple fatigue during the course of the experiment. A total of 32 observations were excluded from the analysis which were all observations outside of plus or minus three standard deviations from the mean profit estimation error.

Table 4.2 Panel B - First Stage of the Model Test

```
Random Effects Model: v(i,t) = e(i,t) + u(i)
2 estimates of Var[u] + Q * Var[e]
Based on      Means              OLS
       0.74347E+08      0.30966E+09
(Used  Means.  Q  =     0.0712)
Estimates:  Var[e]                =  0.277537E+09
            Var[u]                =  0.545963E+08
            Corr[v(i,t),v(i,s)] =  0.164381
Lagrange Multiplier Test vs. Model (3) =      583.34619
( 1 df, prob value = 0.000000)
Estd. Autocorrelation of e(i,t)     0.000168
Reestimated using GLS coefficients:
Estimates:  Var[e]                =  0.178746E+09
            Var[u]                =  0.295668E+09
            Sum of Squares           0.287421E+12
            R-squared                0.398800E+00
N[0,1] used for significance levels.
```

Variable	Coefficient	Std. Error	t-ratio	Prob|t|òx	Mean of X	Std.Dev.of X
TASKKNOW	1615.0	2003.	0.806	0.42003	1.8707	0.56888
POOLS	8842.2	2238.	3.951	0.00008	0.48963	0.50018
OFTP	1416.1	2770.	0.511	0.60917	0.33180	0.47113
NAF	-334.03	2765.	-0.121	0.90383	0.34332	0.47509
ROUND	398.99	269.3	1.482	0.13845	8.0058	4.2938
DEMAND	10.611	2.866	3.702	0.00021	592.30	377.79
COMPETE	127.99	35.56	3.599	0.00032	60.015	30.030
CPRICE	213.49	22.05	9.684	0.00000	112.49	32.925
PRICE	562.21	63.93	8.794	0.00000	122.23	17.963
Constant	-48513.	0.1060E+05	-4.576	0.00000		

The second stage of the regression included both the main effects and the interaction terms. The results are shown below in Table 4.3. The results of Table 4.3 illustrate the suppression effects due to the multicollinearity of the variables. For the second model, the F-test is highly significant at 36.34 (p-value < .001) (Panel A). The interactions are not significant at the .05 level with three exceptions. These include the

Table 4.3 Panel A - Second Stage of the Model Test

Unconditional ANOVA (No regressors)

Source	Variation	Deg. Free.	Mean Square
Between	0.187499E+12	59.	0.317795E+10
Residual	0.290580E+12	808.	0.359629E+09
Total	0.478079E+12	867.	0.551417E+09

OLS Without Group Dummy Variables

Ordinary least squares regression.		Dep. Variable =	ROUNDSCR
Observations =	868	Weights =	ONE
Mean of LHS =	0.6997007E+05	Std.Dev of LHS =	0.2348228E+05
StdDev of residuals=	0.1804729E+05	Sum of squares =	0.2768489E+12
R-squared =	0.4209139E+00	Adjusted R-squared=	0.4093322E+00
F[17, 850] =	0.3634295E+02	Prob value	0.3217295E-13
Log-likelihood =	-0.9729596E+04	Restr.(á=0) Log-l =	-0.9966692E+04
Amemiya Pr. Criter.=	0.2245990E+02	Akaike Info.Crit. =	0.3324588E+09

ANOVA Source	Variation	Degrees of Freedom	Mean Square
Regression	0.2012301E+12	17.	0.1183706E+11
Residual	0.2768489E+12	850.	0.3257045E+09
Total	0.4780789E+12	867.	0.5514175E+09

N[0,1] used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob|t|òx	Mean of X	Std.Dev.of X
TASKKNOW	10220.	2817.	3.628	0.00029	1.8707	0.56888
POOLS	14491.	3186.	4.548	0.00001	0.48963	0.50018
OFTP	27285.	6840.	3.989	0.00007	0.33180	0.47113
NAF	23978.	6065.	3.954	0.00008	0.34332	0.47509
ROUND	1275.1	634.0	2.011	0.04430	8.0058	4.2938
DEMAND	10.957	2.998	3.655	0.00026	592.30	377.79
COMPETE	104.26	33.82	3.083	0.00205	60.015	30.030
CPRICE	224.56	23.70	9.475	0.00000	112.49	32.925
PRICE	612.77	62.20	9.852	0.00000	122.23	17.963
TP_TK	-11882.	3025.	-3.928	0.00009	0.61493	0.91313
NAF_TK	-8797.3	2571.	-3.422	0.00062	0.60848	0.92249
TP_RND	-45.214	353.7	-0.128	0.89828	2.6532	4.5082
NAF_RND	-584.70	355.8	-1.643	0.10029	2.7362	4.5383
POOL_RND	-322.25	288.0	-1.119	0.26315	3.9459	5.0269
TP_POOL	-3194.6	3106.	-1.028	0.30375	0.16129	0.36801
TK_RND	-234.83	256.3	-0.916	0.35949	14.974	9.5381
NAF_POOL	-3336.2	3125.	-1.068	0.28566	0.15899	0.36587
Constant	-76431.	0.1116E+05	-6.848	0.00000		

interaction of OFTP and HITS, NAF and HITS, and NAF and ROUND in Panel B. In addition, the results show a significant score for the Lagrange Multiplier Test ($p < .01$) which would support the use of the random effects model. The results also indicate a very low autocorrelation of -.018645. Table 4.4 below shows the actual and predicted

Table 4.3 Panel B - Second Stage of the Model Test

```
Random Effects Model: v(i,t) = e(i,t) + u(i)
2 estimates of Var[u] + Q * Var[e]
Based on      Means            OLS
       0.47237E+08      0.35640E+09
(Used  Means.  Q  =     0.0712)
Estimates:  Var[e]              =  0.299803E+09
            Var[u]              =  0.259019E+08
            Corr[v(i,t),v(i,s)] =  0.079526
Lagrange Multiplier Test vs. Model (3) =     554.86555
( 1 df, prob value = 0.000000)
Estd. Autocorrelation of e(i,t)    -0.018645
Reestimated using GLS coefficients:
Estimates:  Var[e]              =  0.177440E+09
            Var[u]              =  0.342204E+09
            Sum of Squares         0.278031E+12
            R-squared              0.418442E+00
N[0,1] used for significance levels.
```

Variable	Coefficient	Std. Error	t-ratio	Prob|t|òx	Mean of X	Std.Dev.of X
TASKKNOW	10693.	3431.	3.117	0.00183	1.8707	0.56888
POOLS	14089.	3868.	3.642	0.00027	0.48963	0.50018
OFTP	29004.	9415.	3.081	0.00207	0.33180	0.47113
NAF	26290.	8225.	3.196	0.00139	0.34332	0.47509
ROUND	1385.9	612.5	2.263	0.02366	8.0058	4.2938
DEMAND	10.401	2.958	3.517	0.00044	592.30	377.79
COMPETE	130.23	35.75	3.642	0.00027	60.015	30.030
CPRICE	218.92	22.89	9.565	0.00000	112.49	32.925
PRICE	563.81	64.74	8.709	0.00000	122.23	17.963
TP_TK	-12276.	4390.	-2.796	0.00517	0.61493	0.91313
NAF_TK	-9323.3	3717.	-2.508	0.01213	0.60848	0.92249
TP_RND	-151.86	339.7	-0.447	0.65480	2.6532	4.5082
NAF_RND	-742.09	341.9	-2.170	0.02997	2.7362	4.5383
POOL_RND	-281.59	276.7	-1.018	0.30875	3.9459	5.0269
TP_POOL	-4620.3	4462.	-1.036	0.30040	0.16129	0.36801
TK_RND	-292.17	246.5	-1.185	0.23586	14.974	9.5381
NAF_POOL	-4766.7	4473.	-1.066	0.28654	0.15899	0.36587
Constant	-72125.	0.1193E+05	-6.044	0.00000		

coefficient signs, the standard error, the t-ratio and the resulting p value for each variable.

Tests of the First Set of Hypotheses

The first set of hypotheses related to the effects the different feedback type had on performance. Hypothesis H1A suggests that subjects receiving the OFTP combination would

Table 4.4 Test of Hypotheses

Variable	Co-Effi-cient	Model Stage	Expected Sign	Testing Hypotheses	Actual Co-efficient/ Std. Error	t-ratio/ p value
Constant	β_0	1	?	--	-48,513 10,600	-4.576 .0001
OFTP	β_1	1	+	H1A	1,416.1 2,770	0.511 .6092
NAF	β_2	1	-	H1C	-334.03 2,765	-0.121 .9038
POOLS*	β_3	1	+	H2A	8,842.2 2,238	3.951 .001
TASKKNOW	β_4	1	+	H3A	1,615 2,003	.806 .420
ROUND	β_5	1	+	--	398.99 269.3	1.482 .1385
OFTP*ROUND	β_6	2	-	H1B	-151.86 339.7	-.447 .6548
NAF*ROUND*	β_7	2	0 or -	H1D	-742.09 341.9	-2.170 .0299
POOLS*ROUND	β_8	2	-	H2D	-281.59 276.7	-1.018 .3088
OFTP*POOLS	β_9	2	-	H2B	-4,620.3 4,462	-1.036 .3004
NAF*POOLS	β_{10}	2	-	H2C	-4,766.7 4,473	-1.066 .2865
TASKKNOW*ROUND	β_{11}	2	-	H3B	-292.17 246.5	-1.185 .2359
OFTP*TASKKNOW*	β_{12}	2	-	H3C	-12,276 4,390	-2.796 .0052
NAF*TASKKNOW*	β_{13}	2	-	H3D	-9,323.3 3,717	-2.508 .0121
DEMAND*	β_{14}	1	?	--	10.61 2.866	3.702 .001
COMPETE*	β_{15}	1	?	--	127.99 35.56	3.599 .001
CPRICE*	β_{16}	1	?	--	213.49 22.05	9.684 .001
PRICE*	β_{17}	1	?	--	562.21 63.93	8.794 .001

* p value < .05

outperform those receiving only OF. This was not supported at the $p < .05$ level. The coefficient β_6 tested hypothesis H1B which examines if subjects receiving OF only could improve their performance relative to the OFTP subjects over the course of the task. This hypothesis was not supported ($p > .10$) indicating that there was no change in the relative performance of these two groups. This result could be due to the lack of significance shown by the OFTP feedback condition as tested in H1A. Therefore, there may have been little room for improvement by the OF feedback group over the course of the experiment.

Whether those subjects in the OF group can outperform those receiving NAF is examined in hypothesis H1C. This hypothesis was rejected as the results showed that the NAF subjects did not perform significantly ($p > .10$) worse than did the subject receiving outcome feedback. However, coefficient β_7 supported hypothesis H1D ($p < .05$), which suggested that subjects receiving OF had a higher rate of learning over the course of the experiment that the NAF subjects. Therefore, the subjects receiving OF learned quicker than subjects receiving only NAF.

For the first set of hypotheses, there was no significant difference between subjects receiving outcome feedback and the other two feedback conditions. There was no significant change in the rate of learning between subjects receiving OF and OFTP. However, subjects receiving outcome feedback on accounting did improve over time relative to subjects receiving no accounting feedback.

Tests of the Second Set of Hypotheses

The second set of hypotheses examines the effects the amount of aggregation of the accounting data had on the subjects' performance. Hypothesis H2A suggests subjects using the accounting system with the greater number of pools would outperform the other group. This hypothesis was supported ($p < .01$) and indicates that performance increased with a greater number of pools used in allocating overhead. This implies that excessive cost pool aggregation can degrade decision making performance.

Hypothesis H2B examined if the subjects receiving OF could increase their performance relative to subjects receiving OFTP as the number of cost pools increased. This hypothesis is not supported ($p > .05$) which indicates a higher number of cost pools did not make a significant difference in performance between the OF and OFTP groups. Once again, this result could be due to the lack of a main effect difference between the two groups.

In hypothesis H2C, subjects receiving OF could not significantly ($p > .05$) increase their performance relative to subjects receiving NAF as the number of cost pools increased. Hypotheses H2D examined if a greater number of cost pools would increase the learning effect over the course of the experiment. This hypothesis was not supported

($p > .05$). The results from the second set of hypotheses indicate that the number of cost pools was not able to overcome feedback conditions nor did it affect subjects' ability to learn over time. However, as the number of cost pools used to allocate overhead increased, so did the subjects' task performance. Once again, the lack of significant difference between the feedback conditions could account for the lack of significance in relative performance of the OF group.

Tests of the Third Set of Hypotheses

The third set of hypotheses examined how the subjects' marketing knowledge, as measured by the sorting task, could effect their performance. Hypothesis H3A was not supported ($p > .10$) suggesting that prior marketing knowledge did not influence the subjects' overall performance. This unexpected result could be due to the relatively high performance by all subjects. Therefore, subjects' task knowledge may have not been able to play a significant factor.

Hypothesis H3B examined whether subjects with less marketing task knowledge could learn over the course of the experiment. However, this hypothesis was not supported ($p > .10$) indicating that those with greater marketing knowledge maintained a higher relative performance throughout the experiment.

The influence of feedback and task knowledge on performance was examined with hypotheses H3C and H3D. Both hypotheses were supported. Hypothesis H3C ($p < .01$) showed that subjects with relatively higher task knowledge could effectively use OF and improve their performance relative to subjects receiving OFTP. Hypothesis H3D ($p < .05$) showed that subjects with greater task knowledge could use outcome feedback successfully and improve their performance relative to subjects receiving no accounting feedback. This supports the view that task knowledge must be considered when evaluating the effectiveness of different feedback types.

Descriptive Statistics and Manipulation Check

Table 4.5 presents variable means and standard deviations for the subjects when divided by professionals and students.

Table 4.5 Descriptive Statistics for Professionals and Students

	Professionals		Students	
N	22		38	
Variable	Mean	Std. Dev.	Mean.	Std. Dev.
Experimental Condition				
NAF	.3182	.4767	.3684	.4889
OF	.3182	.4767	.3158	.4711
OFTP	.3636	.4924	.3158	.4711
POOLS	.5000	.5118	.5000	.5067
Demographics				
ACCT	3.909	2.741	2.053	1.012
AGE	37.5	10.24	22.19	3.17
EDUCATE	16.68	1.644	15.05	.462
EXPER	7.227	9.957	3.211	4.101
MRKT	5.455	4.647	4.737	3.599

	Professionals		Students	
Key Results				
CLEAR	6.227	1.110	6.342	1.236
DEMAND	210.4	172.3	290.7	188.9
ERROR	4,611	20,050	7,744	24,280
TASKKNOW	2.092	.4731	1.742	.5823
INTEREST	5.273	1.723	5.658	1.4
PRICE	110.4	4.776	107.6	7.058
QUIZSCOR	10.95	.8439	10.32	1.668
REALIST	4.318	1.701	4.5	1.555
ROUNDSCR	73,477	21,785	67,922	24,204
TOTSCORE	1,071,164	242,266	932,886	335,108
TUTORIAL	5.773	1.378	5.737	1.389

Variable labels denote the following:

NAF = The percentage of subjects in the No Accounting Feedback group.

OF = The percentage of subjects in the Outcome Feedback only group.

OFTP = The percentage of subjects in the Outcome and Task Properties Feedback group.

POOLS = The percentage of the subjects in either the high or low aggregation pool where high aggregation = 1.

ACCT = The number of accounting courses taken.

AGE = Age in years.

EDUCATE = The number of years of schooling where 16 equals graduation with a bachelor's degree.

EXPER = Number of years of self-reported pricing experience.

MRKT = The number of marketing courses taken.

CLEAR = How clear the instructions for the experiment were.

DEMAND = The demand in units for each round during the experiment.

ERROR = The average error (difference between actual and estimated profit) per round.

TASKKNOW = The natural log of the number of marketing terms correctly matched.

INTEREST = How interesting the subjects found the experiment.

PRICE = The average price set by each subject during the experiment.

QUIZSCOR = Number of quiz questions answered correctly by each subject (out of 13).

REALIST = How realistic the subjects found the experimental task.

ROUNDSCR = The average score for each round.

TOTSCORE = Total Performance score for the experimental task.

TUTORIAL = How useful the subjects found the tutorial in helping them complete the experimental task.

In addition, Table 4.6 below shows the same variables when the subjects are divided into experts and novices. The number of correct sorting matches was used to determine expertise where the top 50 percent of the subjects are classified as experts.

Table 4.6 Descriptive Statistics for Experts and Novices when Experts Professionals and Students

	Experts		Novices	
N	30		30	
Variable	Mean	Std. Dev.	Mean.	Std. Dev.
Experimental Condition				
NAF	.3000	.4661	.4000	.4983
OF	.4000	.4983	.2333	.4302
OFTP	.3000	.4661	.3667	.4901
POOLS	.4000	.4983	.6000	.4983
Demographics				
ACCT	3.000	2.117	2.467	1.943
AGE	27.32	10.585	26.67	8.72
EDUCATE	16.433	2.029	16.233	1.942
EXPER	4.767	7.519	5.600	6.891
MRKT	4.833	3.949	5.167	4.094
Key Results				
CLEAR	6.3	1.291	6.3	1.088
DEMAND	280.7	53.92	286.8	55.64
ERROR	9,705	24,020	2,657	18,100
TASKKNOW	2.313	.3282	1.428	.3757
INTEREST	5.567	1.478	5.467	1.592
PRICE	122.6	17.21	121.8	18.7
QUIZSCOR	10.57	1.569	10.53	1.297
REALIST	4.100	1.470	4.738	1.658
ROUNDSCR	67,960	23,940	71,970	22,820
TOTSCORE	1,034,000	203,000	1,035,000	288,400
TUTORIAL	5.9	13.48	5.6	1.404

I performed a series of manipulation checks using two-sample T-tests to support the premise that the two populations (professionals and students) had the assumed differences in pricing experience and educational background and that both groups did not differ in ability to complete the experimental task. Table 4.7 below shows the comparisons between the professionals and students on the manipulation checks. The tests show that the professionals scored significantly higher on accounting courses, age, pricing experience, and performance on the pricing sorting task. This would be expected, given the differences between the two populations. The tests also reveal that there was no significant differences between the quiz scores or their overall rating of the effectiveness of experimental task. This suggests that the subjects' understanding of the experimental task was equivalent.

Table 4.7 Two-Sample (Professionals/Students) T-tests of the Manipulative Checks

Variable	Professionals' Mean	Students' Mean	p-value
Demographics			
Number of Accounting courses	3.91	2.05	.0004
Age in years	37.50	22.19	.0000
Years of Education	16.68	15.05	.0001
Pricing Experience	7.227	3.211	.0321
Marketing courses	5.455	4.737	.5365
Experimental			

Variable	Professionals' Mean	Students' Mean	p-value
Task			
Taskknow	2.092	1.742	.0143
QuizScor	10.95	10.32	.1049
Rating	21.59	22.24	.5707

I also performed the same manipulation checks when the subjects were divided into experts and novices based on their performance on the sorting task. Once again, those subjects scoring in the upper 50 percent were classified as experts.[24] These results are shown in Table 4.8 below.

Table 4.8 Two-Sample (Experts/Novices) t-tests of the Manipulative Checks

Variable	Experts' Mean	Novices' Mean	p-value
Demographics			
Number of Accounting courses	3.00	2.467	.3136
Age in years	27.32	26.67	.7350
Years of Education	16.433	16.233	.6979
Pricing Experience	4.767	5.600	.6562
Marketing courses	4.833	5.167	.7494
Experimental Task			
Taskknow	2.313	1.428	.0001
QuizScor	10.57	10.53	.9686
Rating	21.87	22.13	.7958

[24] Libby and Tan in their 1994 study defined experts as those scoring the top 20 percent of the participants. Using this definition of expertise rather than the top 50 percent did not change the results of the t-tests.

The manipulation checks shown above indicate that the two subject groups do not significantly differ in terms of pricing experience, age, or education.

In addition to the manipulation checks above, the correlation between the accounting systems' estimated profit and the actual profit was also examined. These correlations were .8829 and .6432 for the high and low number of cost pools respectively. This results provide evidence suggesting that the two different cost systems acted as designed. Therefore, the subjects with the higher number of cost pools received cues that were much closer to the actual profits compared to the other group. Further, these correlations are similar to prior research in the area (Schmitt et al., 1976).

Tests of the Fourth Set of Hypotheses

The fourth set of hypotheses examined if using pricing experience as a proxy for knowledge would affect the results of the model. The same procedures were used for these models as described when testing the first three sets of hypotheses with one exception. In this case, the natural log of the number of years of pricing experience was used as the TASKKNOW variable instead of the natural log of the subjects' sorting scores. The first stage of the hierarchical regression is shown below in Table 4.9. This table shows the results of both an ordinary least squares model without group dummy variables and the random effects model.

Table 4.9 Panel A - First Stage of the Model Test for the Fourth Set of Hypotheses

Unconditional ANOVA (No regressors)

Source	Variation	Deg. Free.	Mean Square
Between	0.187499E+12	59.	0.317795E+10
Residual	0.290580E+12	808.	0.359629E+09
Total	0.478079E+12	867.	0.551417E+09

OLS Without Group Dummy Variables

Ordinary least squares regression. Dep. Variable = ROUNDSCR
Observations = 868 Weights = ONE
Mean of LHS = 0.6997007E+05 Std.Dev of LHS = 0.2348228E+05
StdDev of residuals= 0.1791550E+05 Sum of squares = 0.2753881E+12
R-squared = 0.4239695E+00 Adjusted R-squared= 0.4179272E+00
F[9, 858] = 0.7016716E+02 Prob value 0.3217295E-13
Log-likelihood = -0.9727299E+04 Restr.(á=0) Log-l = -0.9966692E+04
Amemiya Pr. Criter.= 0.2243617E+02 Akaike Info.Crit. = 0.3246629E+09

ANOVA Source	Variation	Degrees of Freedom	Mean Square
Regression	0.2026909E+12	9.	0.2252121E+11
Residual	0.2753881E+12	858.	0.3209651E+09
Total	0.4780789E+12	867.	0.5514175E+09

N[0,1] used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob|t|òx	Mean of X	Std.Dev.of X
LOGEXP	3474.8	603.5	5.758	0.00000	1.3454	1.0394
ACCURACY	9737.0	1224.	7.954	0.00000	0.48963	0.50018
OFTP	3583.7	1525.	2.351	0.01874	0.33180	0.47113
NAF	-80.591	1496.	-0.054	0.95704	0.34332	0.47509
ROUND	402.05	275.0	1.462	0.14368	8.0058	4.2938
DEMAND	11.002	2.965	3.711	0.00021	592.30	377.79
COMPETE	96.893	32.95	2.941	0.00327	60.015	30.030
CPRICE	220.87	23.49	9.403	0.00000	112.49	32.925
PRICE	599.17	61.54	9.736	0.00000	122.23	17.963
Constant	-54266.	9629.	-5.636	0.00000		

Table 4.9 Panel B - First Stage of the Model Test for the Fourth Set of Hypotheses

Random Effects Model: v(i,t) = e(i,t) + u(i)
2 estimates of Var[u] + Q * Var[e]
Based on Means OLS
0.71961E+08 0.28020E+09
(Used Means. Q = 0.0712)
Estimates: Var[e] = 0.268081E+09
Var[u] = 0.528838E+08
Corr[v(i,t),v(i,s)] = 0.164765
Lagrange Multiplier Test vs. Model (3) = 580.78986

Table Continued

```
( 1 df, prob value = 0.000000)
Estd. Autocorrelation of e(i,t)    0.000904
Reestimated using GLS coefficients:
Estimates:  Var[e]              =  0.178674E+09
            Var[u]              =  0.262906E+09
            Sum of Squares         0.278154E+12
            R-squared              0.418185E+00
N[0,1] used for significance levels.
```

Variable	Coefficient	Std. Error	t-ratio	Prob|t|≥x	Mean of X	Std.Dev.of X
LOGEXP	4502.8	1077.	4.183	0.00003	1.3454	1.0394
ACCURACY	8205.9	2194.	3.740	0.00018	0.48963	0.50018
OFTP	3089.7	2748.	1.124	0.26095	0.33180	0.47113
NAF	-1063.4	2686.	-0.396	0.69212	0.34332	0.47509
ROUND	364.25	264.8	1.376	0.16895	8.0058	4.2938
DEMAND	10.524	2.817	3.736	0.00019	592.30	377.79
COMPETE	129.82	34.96	3.714	0.00020	60.015	30.030
CPRICE	212.50	21.67	9.808	0.00000	112.49	32.925
PRICE	549.54	62.92	8.734	0.00000	122.23	17.963
Constant	-49590.	9709.	-5.107	0.00000		

The first model has an F-test of 70.16 with a p-value of .0001. The random effects model shows that all of the main effects are highly significant ($p < .001$) with the exception of the variables OFTP, NAF, and ROUND. The R-squared for the random effects model was 0.4101. This suggests that there was little difference in subject performance based on accounting system type or feedback type.

The second stage of the regression included both the main effects and the interaction terms. The results are shown below in Table 4.10.

The results of Table 4.10 illustrate the suppression effects due to the multicollinearity of the variables. For the second run, the F-test is highly significant at 41.06

Table 4.10 Panel A - Second Stage of the Model Examining the Fourth Set of Hypotheses

Unconditional ANOVA (No regressors)

Source	Variation	Deg. Free.	Mean Square
Between	0.187499E+12	59.	0.317795E+10
Residual	0.290580E+12	808.	0.359629E+09
Total	0.478079E+12	867.	0.551417E+09

OLS Without Group Dummy Variables

Ordinary least squares regression.		Dep. Variable =	ROUNDSCR
Observations =	868	Weights =	ONE
Mean of LHS =	0.6997007E+05	Std.Dev of LHS =	0.2348228E+05
StdDev of residuals=	0.1780573E+05	Sum of squares =	0.2698044E+12
R-squared =	0.4356489E+00	Adjusted R-squared=	0.4250383E+00
F[16, 851] =	0.4105791E+02	Prob value	0.3217295E-13
Log-likelihood =	-0.9718409E+04	Restr.(á=0) Log-l =	-0.9966692E+04
Amemiya Pr. Criter.=	0.2243182E+02	Akaike Info.Crit. =	0.3232533E+09

ANOVA Source	Variation	Degrees of Freedom	Mean Square
Regression	0.2082746E+12	16.	0.1301716E+11
Residual	0.2698044E+12	851.	0.3170439E+09
Total	0.4780789E+12	867.	0.5514175E+09

N[0,1] used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob|t|òx	Mean of X	Std.Dev.of X
LOGEXP	6611.9	1457.	4.539	0.00001	1.3454	1.0394
ACCURACY	11828.	2720.	4.349	0.00001	0.48963	0.50018
OFTP	10093.	3848.	2.623	0.00872	0.33180	0.47113
NAF	10414.	3819.	2.727	0.00640	0.34332	0.47509
ROUND	784.92	416.4	1.885	0.05941	8.0058	4.2938
DEMAND	10.191	2.962	3.440	0.00058	592.30	377.79
COMPETE	95.840	32.87	2.916	0.00355	60.015	30.030
CPRICE	224.47	23.39	9.597	0.00000	112.49	32.925
PRICE	589.61	61.57	9.576	0.00000	122.23	17.963
TP_HITS	-4631.0	1458.	-3.176	0.00149	0.34314	0.72902
NAF_HITS	-4096.5	1440.	-2.846	0.00443	0.52835	0.91198
TP_RND	-60.153	351.8	-0.171	0.86425	2.6532	4.5082
NAF_RND	-547.23	346.0	-1.581	0.11378	2.7362	4.5383
ACC_RND	-276.74	283.7	-0.975	0.32932	3.9459	5.0269
TP_ACC	-354.28	2585.	-0.137	0.89099	0.16129	0.36801
HIT_RND	-77.636	139.2	-0.558	0.57701	10.759	11.101
Constant	-59638.	9987.	-5.972	0.00000		

Table 4.10 Panel B - Second Stage of the Model Examining the Fourth Set of Hypotheses

Random Effects Model: v(i,t) = e(i,t) + u(i)
2 estimates of Var[u] + Q * Var[e]

Based on	Means	OLS
	0.51352E+08	0.32659E+09

(Used Means. Q = 0.0712)

Estimates:	Var[e] =	0.286048E+09
	Var[u] =	0.309960E+08
	Corr[v(i,t),v(i,s)] =	0.097766

Table Continued

```
Lagrange Multiplier Test vs. Model (3) =      536.40801
( 1 df, prob value = 0.000000)
Estd. Autocorrelation of e(i,t)   -0.013916
Reestimated using GLS coefficients:
Estimates:  Var[e]               =  0.177724E+09
            Var[u]               =  0.308406E+09
            Sum of Squares          0.271720E+12
            R-squared               0.431642E+00
N[0,1] used for significance levels.
```

Variable	Coefficient	Std. Error	t-ratio	Prob|t|òx	Mean of X	Std.Dev.of X
LOGEXP	6956.8	1771.	3.928	0.00009	1.3454	1.0394
ACCURACY	10599.	3137.	3.379	0.00073	0.48963	0.50018
OFTP	10026.	4814.	2.082	0.03730	0.33180	0.47113
NAF	9461.2	4757.	1.989	0.04669	0.34332	0.47509
ROUND	846.58	402.7	2.102	0.03554	8.0058	4.2938
DEMAND	10.119	2.897	3.493	0.00048	592.30	377.79
COMPETE	123.89	34.95	3.544	0.00039	60.015	30.030
CPRICE	217.00	22.38	9.698	0.00000	112.49	32.925
PRICE	553.06	63.63	8.692	0.00000	122.23	17.963
TP_EXP	-3965.5	2218.	-1.788	0.07375	0.34314	0.72902
NAF_EXP	-3184.7	2179.	-1.462	0.14387	0.52835	0.91198
TP_RND	-162.29	334.5	-0.485	0.62760	2.6532	4.5082
NAF_RND	-692.92	329.2	-2.105	0.03528	2.7362	4.5383
ACC_RND	-232.66	269.9	-0.862	0.38869	3.9459	5.0269
TP_ACC	-1079.2	3934.	-0.274	0.78382	0.16129	0.36801
EXP_RND	-79.710	132.4	-0.602	0.54725	10.759	11.101
Constant	-56670.	0.1019E+05	-5.559	0.00000		

(p-value < .001). None of the interactions using experience are significant at the .05 level. Table 4.11 compares the two different models for the fourth set of hypotheses.

The fourth set of hypotheses is examined by comparing the results of two different models. The first model used the natural log of the sorting task score as a proxy for knowledge. The second model used the natural log of the subjects' years of pricing experience as the knowledge proxy. Table 4.11 below compares the affect each coefficient had on the dependent variable of subject performance. This comparison does not represent a direct test of the hypotheses. Instead, by comparing the t-test results for

Table 4.11 Test Results for the Fourth Set of Hypotheses

Variable	Model	Testing Hypotheses	Actual Co-efficient/ Std. Error	t-ratio/ p value
TASKKNOW	1	H4A	1,615 2,003	.806 .420
LOGEXP*	2	H4A	3474.8 603.5	5.758 .0001
TASKKNOW*ROUND	1	H4B	-292.17 246.5	-1.185 .2359
LOGEXP*ROUND	2	H4B	-79.71 132.4	-0.602 -.5474
OFTP*TASKKNOW*	1	H4C	-12,276 4,390	-2.796 .0052
OFTP*LOGEXP	2	H4C	-3965.5 2218	-1.788 .0738
NAF*TASKKNOW*	1	H4D	-9,323.3 3,717	-2.508 .0121
NAF*LOGEXP	2	H4D	-3,184.7 2,179	-1.462 .1439
*p value < .05				

each relevant variable, I am providing indirect evidence for each hypothesis.

I posited that the natural log of the sorting task score (measure of knowledge) would have a stronger affect on performance than the subjects' pricing experience. However, comparing the t-tests and p-values of the two coefficients above would indicate that the log of experience had a greater relationship relative to the sorting score (t-test of 5.75 versus 0.806). Therefore, hypothesis H4A is not supported.

In hypothesis H4B, subjects with lower values for the sorting task or pricing task were not able to learn more during the course of the experiment. Therefore, this hypothesis was not supported. Further, since each variable's coefficient was not significantly different from zero, no suggestion about relative affect on performance can be made.

It was hypothesized that subjects receiving OF would show greater learning effects relative to subjects receiving OFTP. This hypothesis received support for the sorting task proxy (t-test of 2.796), but not for the pricing experience proxy. This result provides support for the sorting task proxy as a more accurate measure of the knowledge construct. Therefore, hypothesis H4C has received support.

Finally, hypothesis H4D suggested that subjects with greater knowledge and receiving OF would perform better than subjects receiving NAF. The sorting task proxy was significant (t-test of -2.508) while the pricing experience proxy was insignificant (t-test of -1.452). Similar to hypothesis H4C, this result provides support for sorting task as being a more effective measure of knowledge than years of pricing experience.

Overall, no clear pattern about the relative effectiveness of the two proxies for knowledge appears. Hypothesis H4A would suggest that pricing experience has a stronger relationship with performance than does the sorting task proxy. This relationship was reversed in hypotheses H4C and H4D where the sorting task proxy showed significant t-test scores and the years of pricing proxy was insignificant. Hypothesis H4C was inconclusive as neither proxy showed a statistically significant relationship with subject performance.

CHAPTER 5

DISCUSSION

The use of human subjects involves risks that are intrinsic to experimental research. The subjects may have been influenced by factors unrelated to the goal of the study. However, the study was designed to control for as many of these factors as possible. For example, the study used random assignment to groups and the development of a clear tutorial. Regardless, the results of any single experimental study must be interpreted with caution.

The study employed numerous manipulation checks to ensure the subjects had a wide range of experience. The subjects were drawn from two populations groups; students who were relative novices to actual pricing and professionals with pricing experience. The professionals significantly ($p < .05$) outscored the students on all demographic variables with the exception of number of marketing courses taken. This would indicate that formal marketing education was not a significant factor in this experiment. The professionals did average almost two more accounting courses than the students which may have helped account for their average 1.6 years of extra education. Therefore, the professionals had significantly higher demographic results in education and pricing experience which would provide support for their significantly higher ($p < .05$) task knowledge score on the sorting task. Both subject groups did relatively well on the tutorial quiz (the professionals and students scored 84% and 79.4% correct respectively) which would indicate both groups adequately understood the instructions. The similar quiz results could also indicate that the subjects' had equivalent task motivation.

Discussion of the Sorting Task Proxy

Despite the success of the manipulation checks, the main effects generally did not act as hypothesized. Only the amount of cost pool aggregation (POOLS) was significant when examining performance. The other hypothesized main effects of OFTP, NAF, TASKKNOW, and ROUND were not significant when using the natural log of the sorting task as a measure of knowledge. In particular, the lack of a significant main effect performance difference between subjects receiving no accounting feedback (NAF) and accounting outcome feedback (OF) was unexpected. Informal observations of the subjects suggested that many of those receiving outcome feedback did not record the feedback as the experiment progressed.

Therefore, these subjects evidently attempted to outguess the profit estimate provided by the computer which could account for their lower score.

In contrast, subjects receiving no accounting feedback may have exerted relatively more cognitive effort on the pricing portion of the task relative to the outcome feedback group. In addition, the NAF subjects often chose the profit estimate provided by the program which reduced their errors and could explain their superior performance. These findings cast doubt on the effectiveness of many types of accounting reports that exclusively use outcome feedback and supports Foster and Gupta's (1994) findings that current accounting reports are inadequate in the marketing area.

Also unexpected was the lack of superiority of the subjects receiving the combination of outcome and task properties feedback (OFTP) relative to OF. This could be due the design of the task. Since the subjects all performed relatively well, the task may have been too easy for the advantages of OFTP to become apparent.

Also, the subjects demonstrated relatively little learning during the experimental task. The main effect ROUND was insignificant which could also provide support that the task may have been too easy. This relatively high achievement level could account for the lack of a significant interaction of OFTP with ROUND. An alternative explanation could be that subjects did not have enough time for learning to occur. The main effects model suggests no difference in overall performance between subjects receiving NAF or OF. However, the interaction of ROUND and NAF was significant. Thus, over time, subjects receiving OF were able to significantly outperform ($p < .05$) subjects receiving only NAF. This might indicate that OF does provide feedback value and there was sufficient time for learning relative to the NAF group. Alternatively, subjects in the NAF group may have reached their performance ceilings.

In addition, task knowledge did not directly influence performance or learning over time. This could provide support that the task was too easy or that the task was as equally unfamiliar to all subjects. Also, the proxy used for task knowledge may have not been adequately specified, but the t-tests of the demographics is consistent with the significantly higher task knowledge scores of the professionals. Task knowledge did significantly assist subjects receiving OF only. The subjects with both higher task knowledge and OF significantly outperformed subjects receiving either OFTP and NAF. This is consistent with the research literature and indicates that subjects need a greater understanding of the task to effectively use OF.

In addition, the influence of the number of cost pools on performance was limited. The main effect was highly significant, but the cost pools variable did not significantly interact with any of the feedback types or task knowledge. These findings suggest that the format of the accounting report is less important that the structure of the accounting system itself. Thus, a greater number of cost pools may help make the type of feedback provided by the accounting report less relevant.

Discussion of the Years of Pricing Experience Proxy

An alternative method of proxying pricing knowledge in this study was to use the natural log of the number of years of pricing experience. Bonner (1990) and Bonner and Lewis (1990) suggest that pricing experience does not correspond directly with task knowledge. Therefore, the fourth set of hypotheses predicted that the sorting task proxy should outperform the pricing experience variable.

However, results of the second model are not conclusive. The log of years of pricing experience has a statistically significant relationship with performance while the sorting task proxy did not. Conversely, only the sorting task proxy was significant when interacting with feedback type. These findings would support the sorting task proxy as superior to years of experience.

Discussion of Possible Ceiling Effects

Another potential cause for the failed hypotheses is the possibility of a ceiling effect. Ashton (1981) found no significant difference between feedback types because of the relatively high performance demonstrated by all feedback types. In the current study, subjects were able to perform relatively well regardless of feedback type or task knowledge. Therefore, based on the lack of performance differences in the subjects, the task may have not been difficult enough.

This ceiling effect would have reduced the variance among the subjects' performance and help explain why a number of the hypotheses were not supported. If the task was too easy, the feedback type would be largely irrelevant. Subjects receiving NAF could rely on the computer's estimate and perform at approximately the same level as subjects receiving OF. Likewise, subjects receiving OF would be able to perform at approximately the same level as subjects receiving OFTP.

The subjects' high performance would also explain why relatively little learning was observed and the variable ROUND was insignificant. The relative ease of the task from the beginning would have precluded an increase in performance throughout the experiment. Only one hypothesis

(H1D) which examined the interaction of NAF and ROUND was significant.

The ceiling effect would also explain the weak performance of the sorting proxy for task knowledge. As a main effect, the coefficient had the correct sign, but the p value was insignificant. In addition, a ceiling effect would have made interpretation of the fourth set of hypotheses more difficult since there would have been little opportunity for any differences between knowledge and experience to appear.

Limitations

To the extent that the study did not support the hypotheses, it could be because of flaws in the research design, misspecification of the model, or faulty theory development. The experimental task had subjects price a high-technology item. Since virtually none of the subjects had prior experience in a high-technology industry, the experimental task may have been inappropriate. This would have influenced the task knowledge variables. In addition, while the sorting task was based on prior research by Perkins (1993), several modifications were made to the list of terms which may have introduced noise into the sorting task proxy. Virtually all of the demographic data was elicited directly from the subjects and could have contained errors.

A number of the subjects commented that the profit forecast provided by the computer was inaccurate regardless of the type of accounting system used. Therefore, certain subjects may have simply guessed or expended relatively little cognitive effort which would affect their performance scores. This anecdotal evidence is supported by the subjects' evaluation of the experiment. Subjects found the experiment relatively interesting (5.52 out of 7), but scored its realism much lower (4.43 out of 7).

A further consideration was subject motivation. Drawing subjects from two different populations (students and professionals) suggested that different incentive schemes were necessary to equalize motivation. However, this decision introduces the possibility that the subjects had differing motivational levels.

Conclusion

To the extent that the hypotheses of the study were supported, those subjects with higher task knowledge were shown to have exhibited greater task performance, particularly in using OF. Among the implications of this finding is the idea that any future work on feedback needs to consider task knowledge. Using outcome feedback may be appropriate with those with greater task knowledge, but relative novices in an area may benefit from more complete feedback types such as OFTP.

Of interest to both the cognitive psychology and the accounting feedback literatures is the assumed general superiority of the combination of outcome and task properties feedback over outcome feedback has not been replicated. This has strong implications for accounting report design in both the workplace and accounting education.

It appears that the feedback design of accounting reports is of less concern that the underlying method of allocating costs through the number of cost pools. This study's results show that individuals with higher task knowledge were able to use their knowledge to compensate for feedback type. However, individuals with relatively little task knowledge may still benefit from OFTP. Therefore, relative novices using accounting reports providing only OF may need additional supervision or training to effectively use the OF reports.

Further, OFTP may be the preferred feedback type for accounting education. Many of the difficulties in gathering the task properties feedback could be overcome in a classroom environment with its generally simpler problems relative to the business place. As students gain experience, the amount of task properties feedback can be reduced until students receive the more realistic OF accounting reports.

This study does not provide support for the clear superiority of a direct measure of task knowledge compared to years of experience. This may suggest that the years of experience proxy may be useful when measuring task knowledge directly is difficult.

Extensions

Several extensions are possible with this research. First, while only several of the hypotheses are supported, the coefficients all have the correct sign. This suggests that gathering additional subjects may boost the power of the model since there were relatively few subjects within each cell. In addition, using subjects with a background in the high-technology area would also boost the model's effectiveness.

Second, the task could be modified to eliminate the ceiling effect discussed above and new data gathered. This could also increase the power of the model in describing the data. The task could be made more complex in a number of ways. One possibility could be to provide only intermittent feedback about the financial results. Another approach could be providing less information about the competitors' price. This lack of information would require subjects to rely more on their knowledge of the product life-cycle and pricing strategies. Third, more information on the accounting system could be provided. Providing information about the conditions affecting the system's estimating power may improve the task properties component of the feedback. This could be done by informing subjects that as relative percentage of graphic accelerator boards increases, the system is more or less likely to be biased.

In addition to the tests performed in this study, further work could be done comparing the subjects' self-score on reported cue usage with analysis of what cues they actually relied on. This could also be examined for changes over the course of the experiment.

APPENDIX A

WRITTEN EXPERIMENTAL MATERIALS

Instructions for student subjects receiving the combination of Outcome Feedback and Task Properties Feedback

Subject Number: A-###

Instructions

Thank you for participating in this study! If you follow these instructions carefully, you can earn up to $200.00.

This study about decision making is being conducted by Dave Smith of the University of North Texas. It should take approximately 90 minutes to complete the entire task. All individual results will be held in strictest confidence and the results will be disclosed in summarized form only. If you have any questions about this study, please contact Dave Smith at (817) 565-3172. Please note that your participation is strictly voluntary. If you do not wish to participate, please return your booklet now or at any point during the task.

All aspects of this study will use computer terminals. Special skills are not required, and the instructions that follow will provide all the information you need. Be sure to ask any questions that you have during the instruction period and ask for assistance, if needed, once seated at the computer terminal. The task you are involved in is exactly as described in these instructions.

Today's Activities:

- An overview of these instructions.
- Computer training.
- Review of Key Concepts
- A quiz based on these instructions.
- Actual research task and a questionnaire.

Keep these instructions handy throughout the task. Feel free to use these sheets for writing any notes or calculations.

There are three prizes: the top prize is $200.00 and there are two second prizes of $100.00 each. These prizes will go to the three individuals with the top scores. Once everyone has had a chance to participate in this research, I will determine the winners and mail out the checks. Please write your mailing address in the space below:

For the professional subjects, the prize information above was changed to $300.00 and $150.00 respectively.

Name: ____
Address: ____
City: ______________________ State: _________ Zip Code: ____________

Summary of Research Task

You are a **product manager** and must develop a sales forecast for one product.

You use information provided by the computer for two tasks:

- **Setting a price** which maximizes your total profits for the entire task of 15 rounds (each round represents one month).
- **Accurately Estimating your actual profits** for each round.

The computer provides **reports** at both the **beginning** and the **end** of each round:

- The **first report** gives information needed for the **sales forecast**. The price you set and the actual demand for the product will determine your profit for the period.
- The **second report** shows the **actual financial results** for that period.
- The **final report** shows your score and how **accurate** your forecast and the sales forecast were in predicting the actual results.

You will have a **tutorial** allowing you three trial runs to demonstrate the process. The trial runs are merely exercises and do not reflect the environment or parameters of the actual task.

As you go through the tutorial, you will become more familiar with how the accounting system is affected by your decisions.

For subjects receiving only no accounting feedback, the section above was changed to:

- The **first report** gives information needed for the **sales forecast**. The price you set and the actual demand for the product will determine your profit for the period.
- The **second report** shows the **actual** for that period.

For subject receiving only outcome feedback, the section above was changed to:

- The **first report** gives information needed for the **sales forecast**. The price you set and the actual demand for the product will determine your profit for the period.
- The **second report** shows the **actual financial results** for that period.

Description of Company, Product, and Reports

Company

The key points about the company and your role are:

- You are a **product manager** at world-wide manufacturer of electronic components.
- You must **maximize profitability** over the product's entire life-cycle.
- You must **accurately estimate** total profits for each round.
- Marketing provides you with reliable **information** about the product's **market share** and your **estimated unit sales volume**.

You will use a program integrating this information into your **sales forecast**. **Product**

The key points about the product and your role are:

- You price a **single** product — a **graphic accelerator board** used in personal computers.
- The board is initially used by **high-end users** and later adopted by more conventional users. The boards typically have a **product life** of about **two years**.
- The total market starts out relatively **small, expands rapidly,** and then starts to **decline** as new technology creates better products.
- Your company currently **holds a technological edge** over its competition. However, your **competition will catch up** in several rounds.
- This product is part of an **entire product line**, which you **do not price** during the study.
- Your sales forecast is for **one sales region in the U.S.** and you use only **one channel of distribution**.

Reports

The key points about the reports and your role are:

- Your forecast report presents information on the **Market Share Percentage, Average Competitors' Price, Estimated Unit Sales and Per Unit Cost**.
- The **Per Unit Cost** is a "**full-cost**" estimate and include up-stream, manufacturing, and down-stream costs.
- Increases in the **number of units** sold will result in a **lower per unit cost**. This occurs because of two reasons. First, the **fixed costs** are spread over more units. Second, you **learn how to produce more efficiently** as you produce more units.
- The second report presents information about **actual sales** and **financial results** at the end of the round.
- At the end of each round you will receive a report showing your score and how **accurate** your forecast and the sales forecast were in predicting the actual results.

Goal

The key points about the goal and your role are:

Goal 1: Maximize the Total Profits for the Entire Study.

Goal 2: Accurately predict the Actual Profits for Each Round.

Please **do not discuss the study** with others — it will give them a better chance at the $200.00 prize!

How Your Score is Determined

In the study you want to accomplish two goals. First, you want to maximize your total profits for the entire study. In addition, you wish to make accurate estimates of each round's ACTUAL total profit. The difference between your forecasted profits and the actual profits will be subtracted from your actual profits to determine your score.

For example, assume you estimated profits for round 1 of $11,000 and the actual profits were $10,000. Your score for the first round would be 9,000. This is determined by starting with the actual profit of $10,000 and subtracting the $1,000 difference between your estimate and the actual profits. The computer will track your score and show you the results at the end of the last round. In the second round, you estimated profits as $12,000 and the actual profits were $12,500. Your score for the second round would be 12,000. This is determined by starting with the actual profit of $12,500 and subtracting the $500 difference between your estimate and the actual profits. DO NOT try and catch up for errors in prior rounds. You want to try **and ESTIMATE EACH ROUND AS ACCURATELY AS POSSIBLE.**

After the Study

Because this study is being run over a period of several weeks, **please DO NOT DISCUSS DETAILS** of it with others. If they have yet not participated in the study, this could give them an unfair advantage over you! Once all subjects have completed the study, I will compare your score with others of your group. The top scores will be eligible for a cash prize. I will mail everyone a report informing them of the experimental results. This will be hopefully in late-June or early July.

Getting Started

At this point, if you do not have any questions, please enter your subject number (located on the top right-hand corner of the first page) in the computer and proceed with the task. You will go through a brief tutorial and then have a chance to go through several trial runs on the computer. These trial runs are merely illustrations and do not reflect the actual parameters of the task.

Once you have completed the tutorial, you will take a short quiz which focuses on key points of the task. Please feel free to use these notes at any time during the quiz or while you work on the task. Following the quiz, you will perform the actual task. Upon completing the task, you will be asked several questions about your background and marketing knowledge.

Please, do not hesitate to ask any questions at any point before or during the task. Good luck!

NOTES

(Please use this sheet for any calculations or notes you would like to make)

Debriefing instructions for student subjects received at the end of the experimental task.

If You Have Questions Later

If you are receiving extra credit for your participation, I will contact your instructor on May 8th and confirm your participation in the experiment.

If you have any questions about this study, please contact Dave Smith at (817) 565-3172. Remember, your participation is strictly voluntary. If you do not wish to participate, please contact me and I will remove you from the sample.

There are three prizes: the top prize is $200.00 and there are two second prizes of $100.00 each. These prizes will go to the three individuals with the top scores. Any ties will be determined by a drawing.

Once everyone has had a chance to participate in this research, I will determine the three winners and mail out the checks. I will also mail everyone a report informing them of the experimental results. This will be hopefully in late-June or early July.

Debriefing instructions for professional subjects received at the end of the experimental task.

If You Have Questions Later

If you have any questions about this study, please contact Dave Smith at (417) 625-3012. Remember, your participation is strictly voluntary. If you do not wish to participate, please contact me and I will remove you from the sample.

There are three prizes: the top prize is $300.00 and there are two second prizes of $150.00 each. These prizes will go to the three individuals with the top scores. Any ties will be determined by a drawing.

Once everyone has had a chance to participate in this research, I will determine the three winners and mail out the checks. I will also mail everyone a report informing them of the experimental results. This will be hopefully in late-November or early December.

Results letter received by all non-winning subjects. Winners received a similar letter which stated the amount of prize money won.

Date

FirstName~ LastName~
Address~
City~ Zip~

Dear FirstName~:

I wanted to thank you again for participating in my dissertation experiment. Your donation of time and effort has helped move this project forward. I plan on completing the dissertation this Fall and writing an article for publication in the near future.

I also wanted to give you an idea of what my research is about. I am interested in how your pricing and profit-estimation decisions are influenced by the type of accounting system, the way the information is presented, and your marketing knowledge. The results so far not surprisingly indicate that those receiving the "better" information do a superior job in pricing and profit-estimation. However, what is interesting is that those of you receiving the less desirable information are able to learn over time and match the first group's performance over the last few rounds. I will perform the same experiment using individuals in the marketing field and see if I get similar results.

Because of the different accounting systems and information used, I do not think it is fair to compare the scores of people in different groups. Instead, I compared your scores with those who received the same information you did. The top score in each group was then eligible for one of the three cash prizes. These prizes were then awarded randomly to the pool of top scores. While everyone did a great job, I am afraid you did not win a cash prize. If you were going to receive extra credit, I have contacted your instructor and told them you are eligible for the credit.

If you have any questions, I can be reached at (817) 565-3172 through July 27th. After that date, please call (817) 565-3170 if you need to contact me for any reason. Once again, thank you for helping me out on my dissertation. I hope you found the experiment interesting and will consider helping out another needy doctoral student in the future if you have the opportunity.

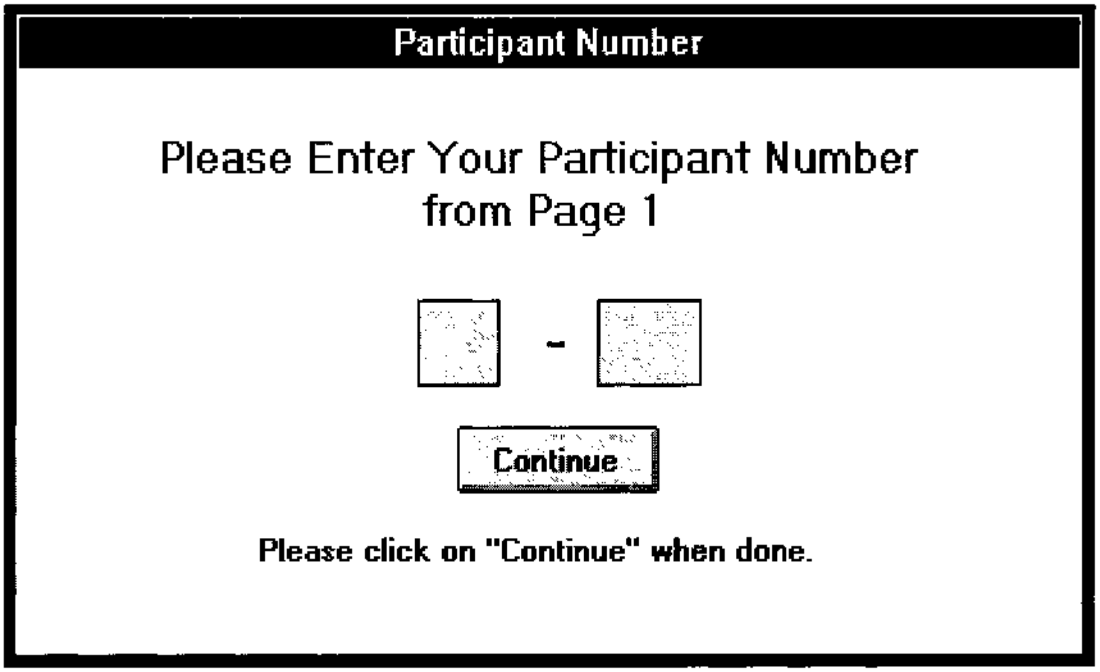
Good luck in your future endeavors,

David M. Smith

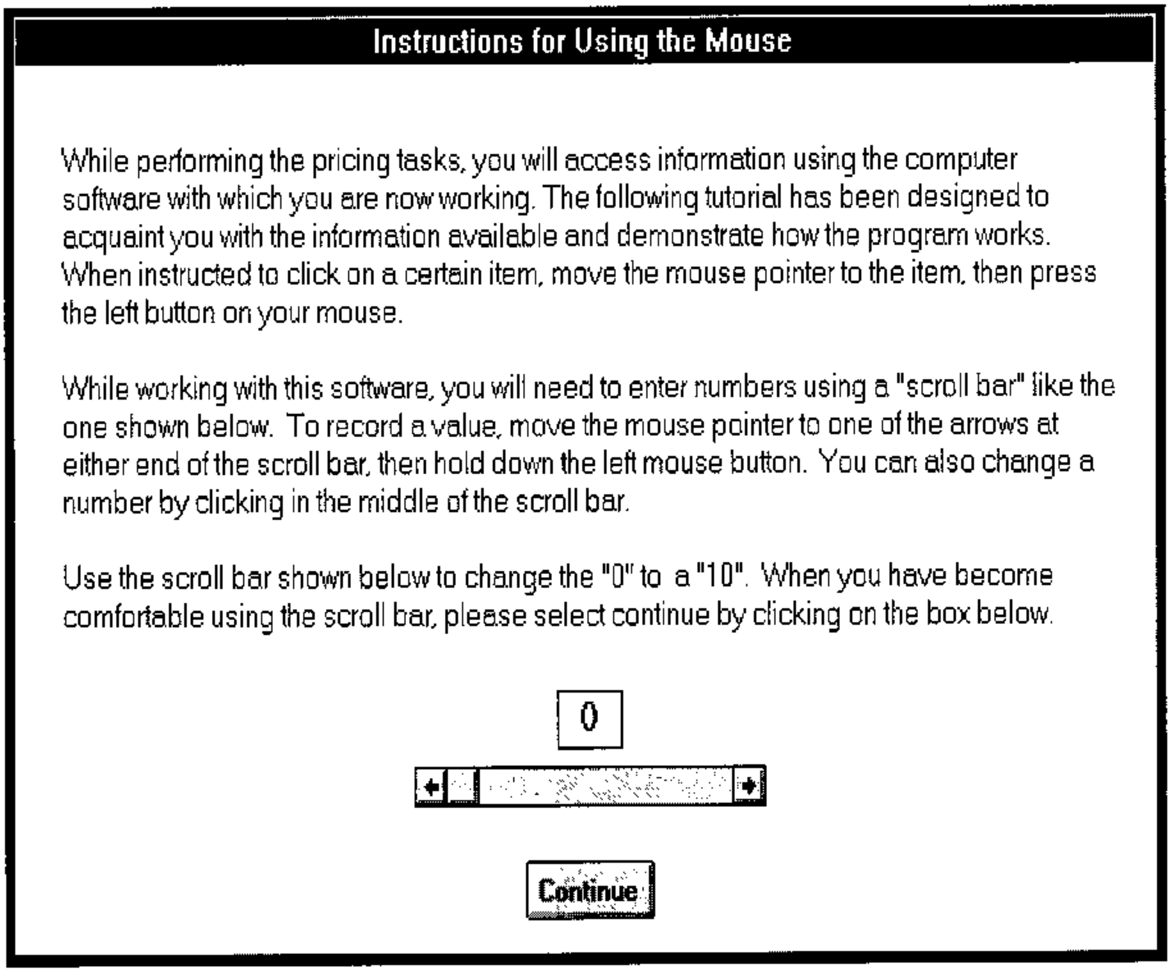
APPENDIX B

COMPUTER EXPERIMENTAL MATERIALS

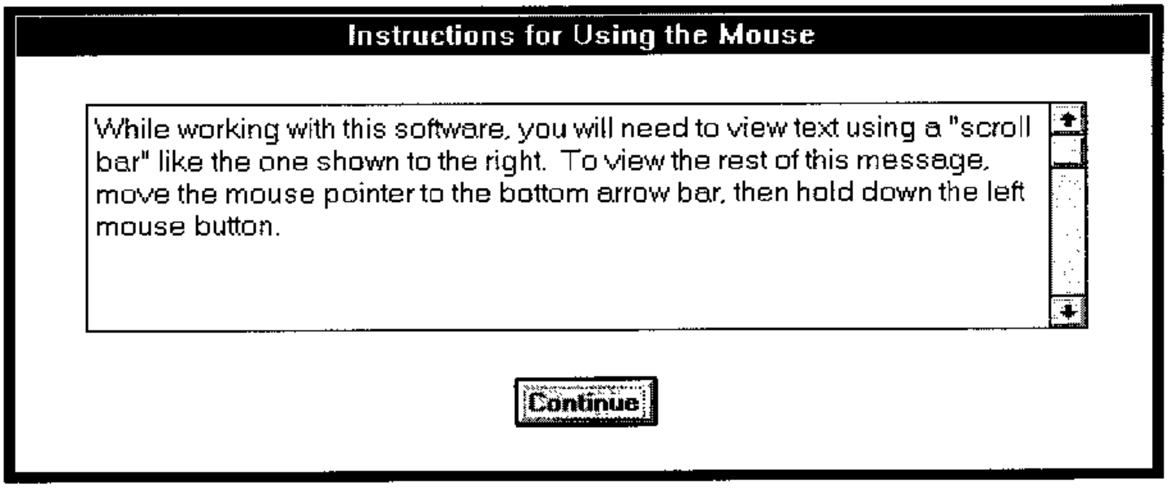
Appendix B Figure 1. The initial screen viewed by subjects.

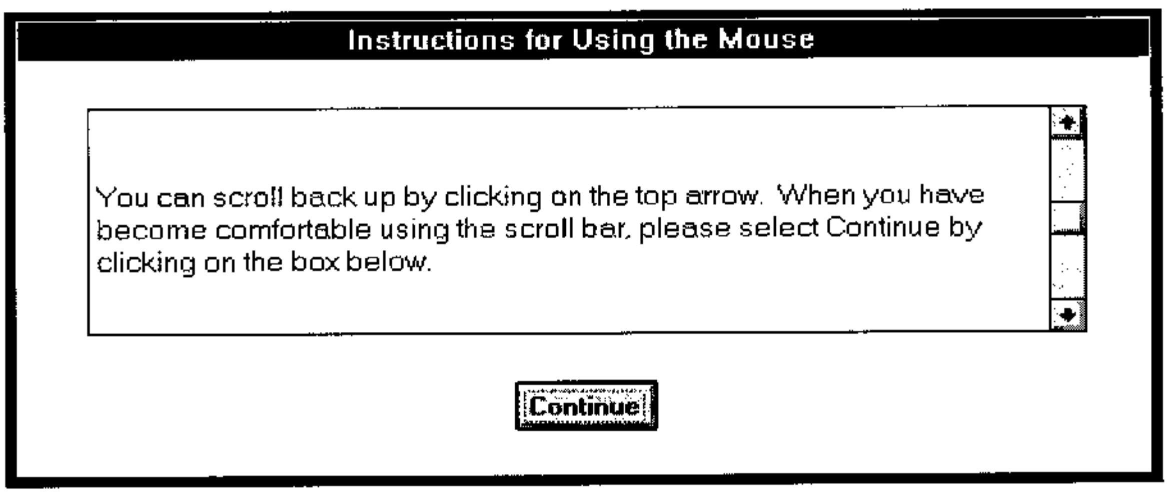


Appendix B Figure 2 The first screen demonstrating the use of the mouse.

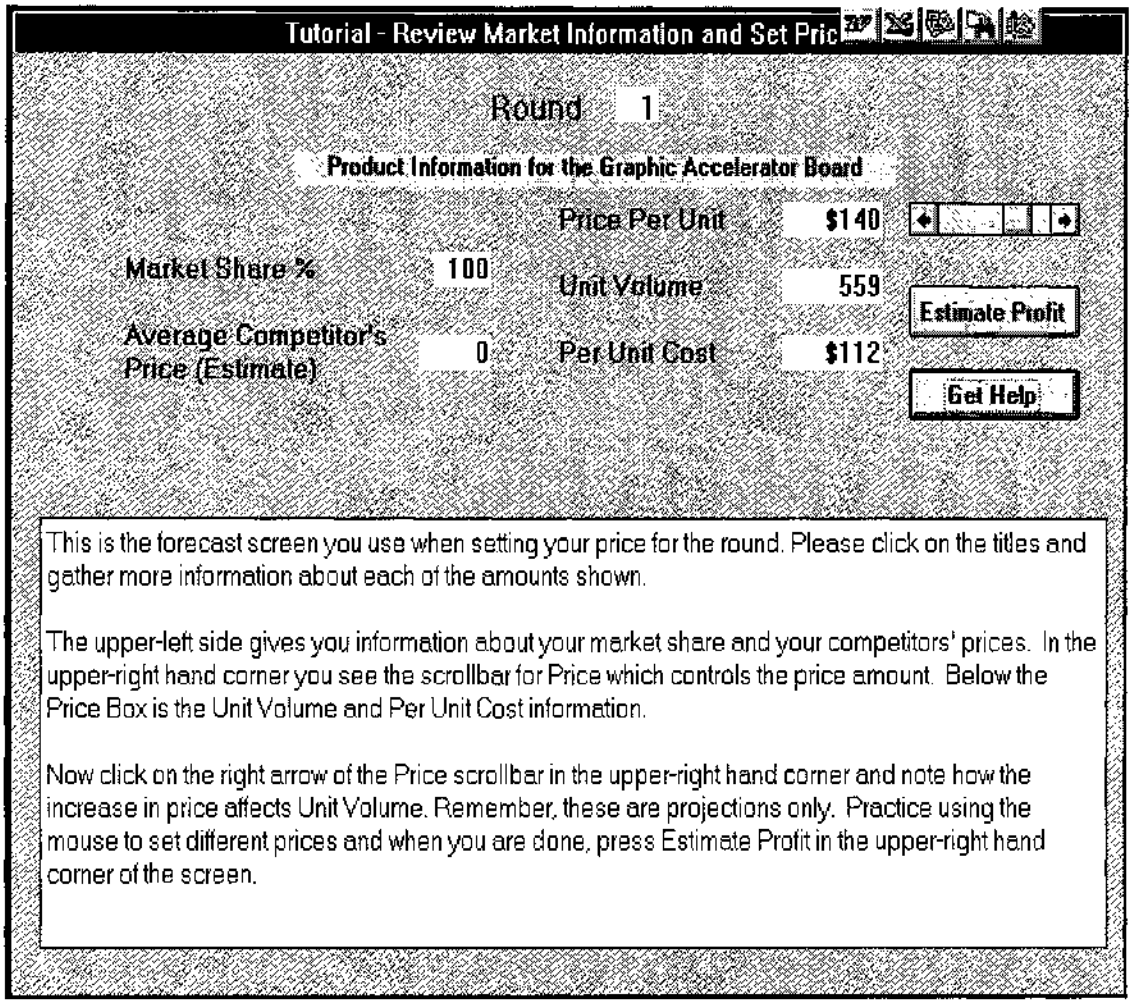


Appendix B Figure 3 The second screen demonstrating the use of the mouse.

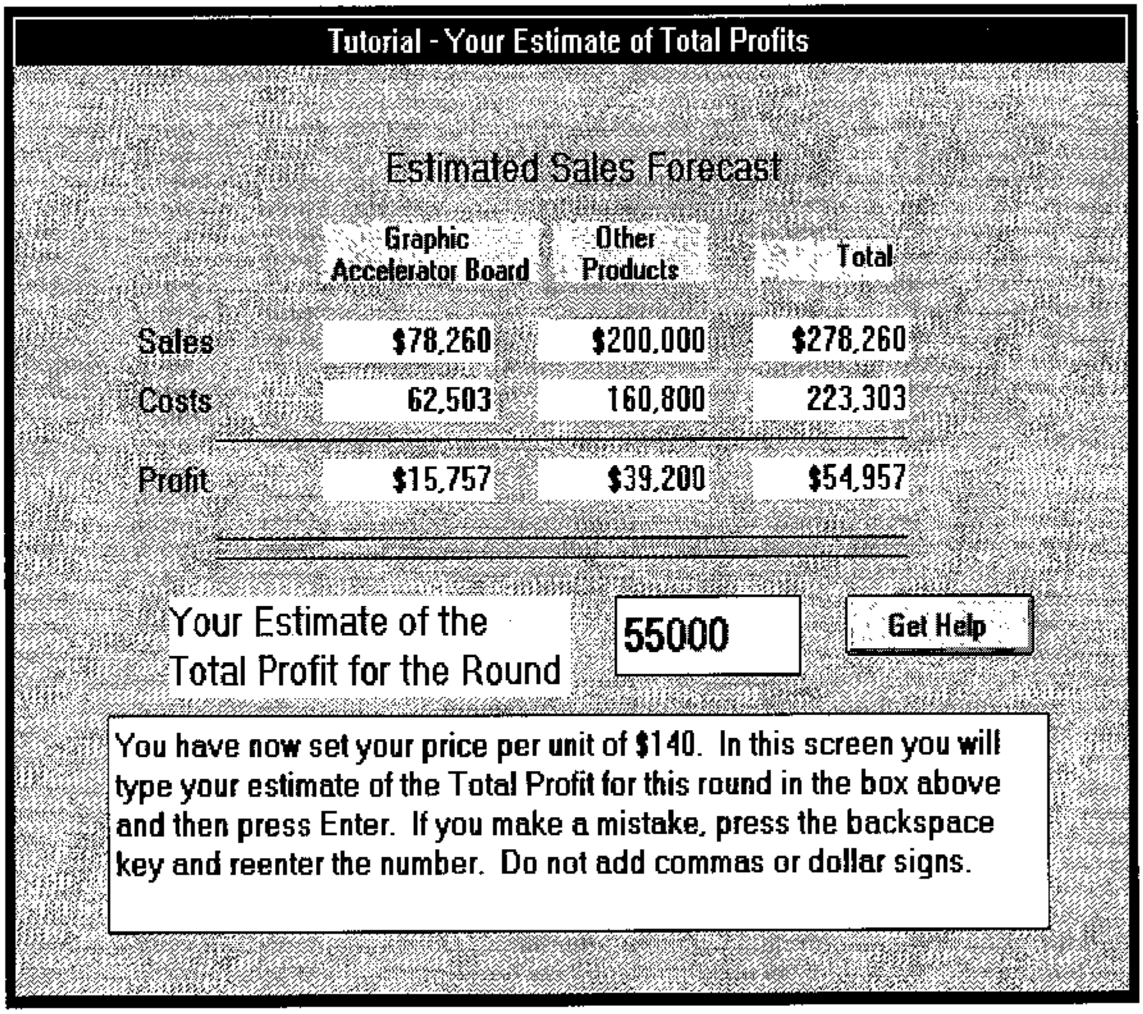




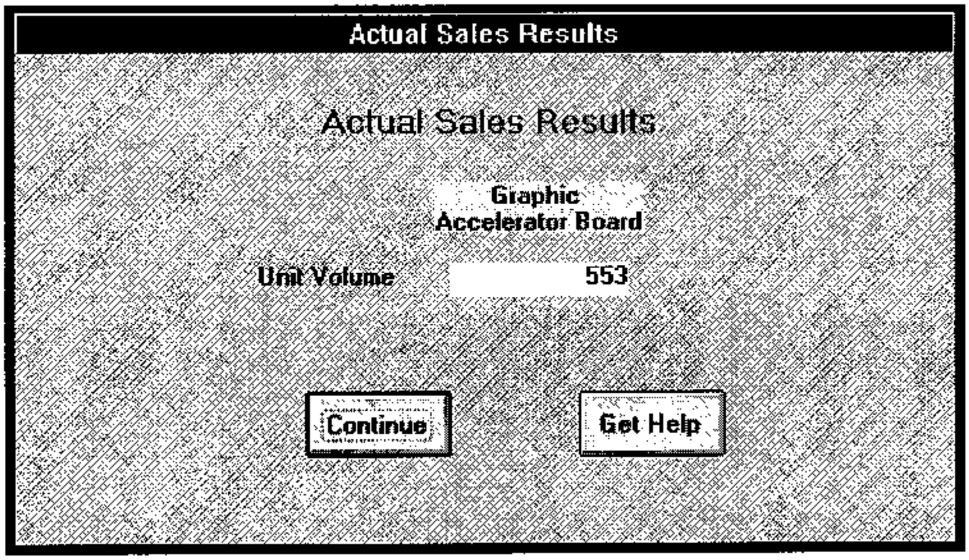
Appendix B Figure 4 First screen of the tutorial - Price Setting.



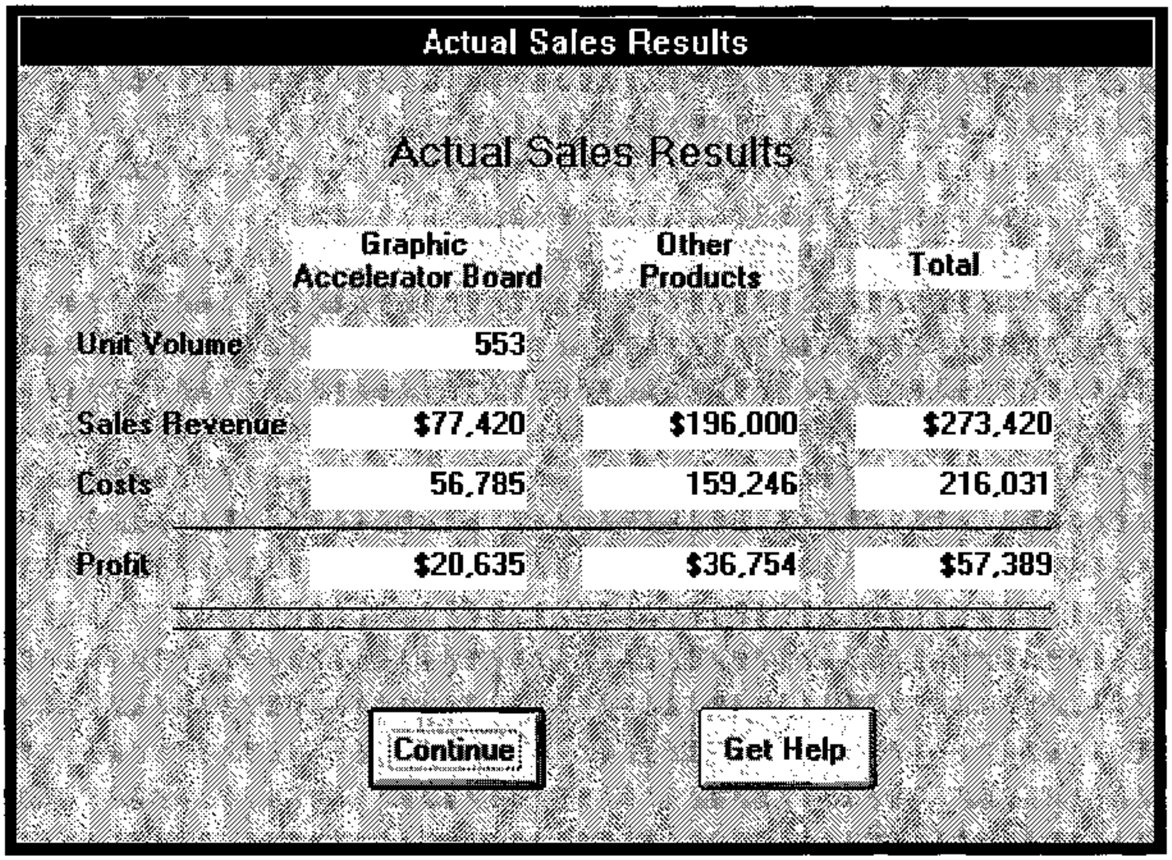
Appendix B Figure 5 Second screen of the tutorial - Profit Estimation.



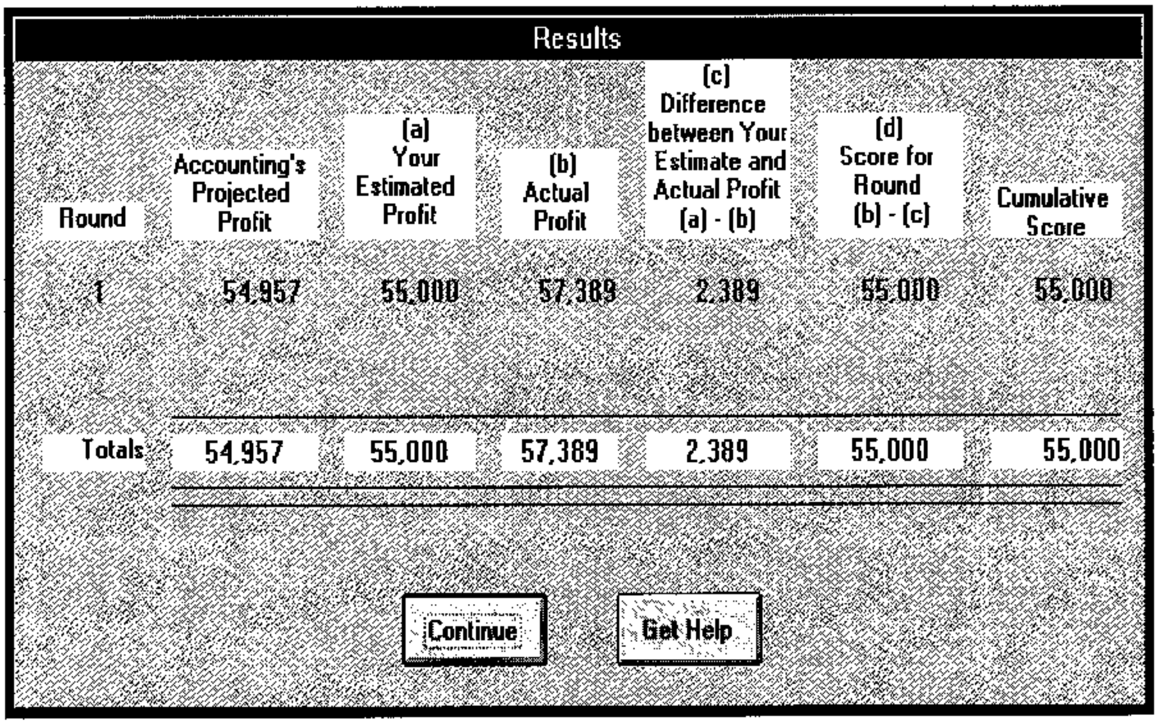
Appendix B Figure 6 Feedback screen shown at the end of each tutorial round to subjects receiving no accounting information.



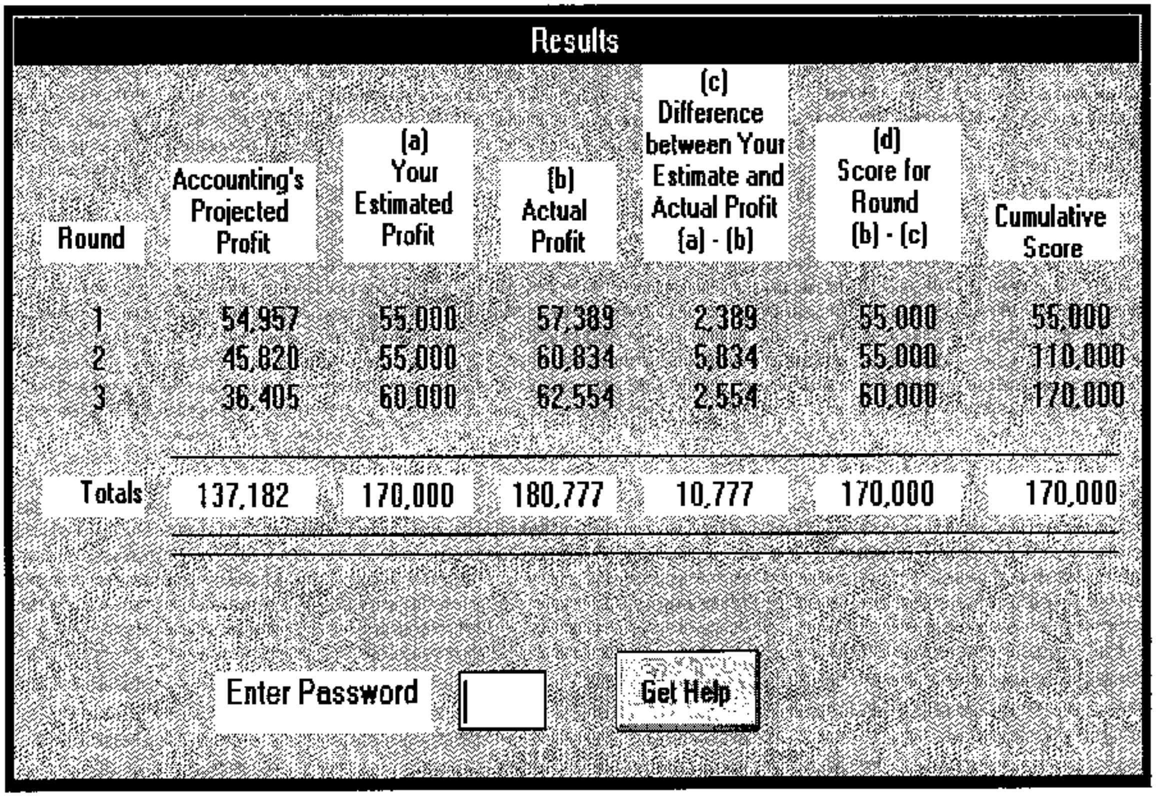
Appendix B Figure 7 Feedback screen shown at the end of each tutorial round to subjects receiving either outcome feedback or the combination of outcome and task properties feedback.



Appendix B Figure 8 Feedback screen shown at the end of each tutorial round to subjects receiving only task properties feedback.



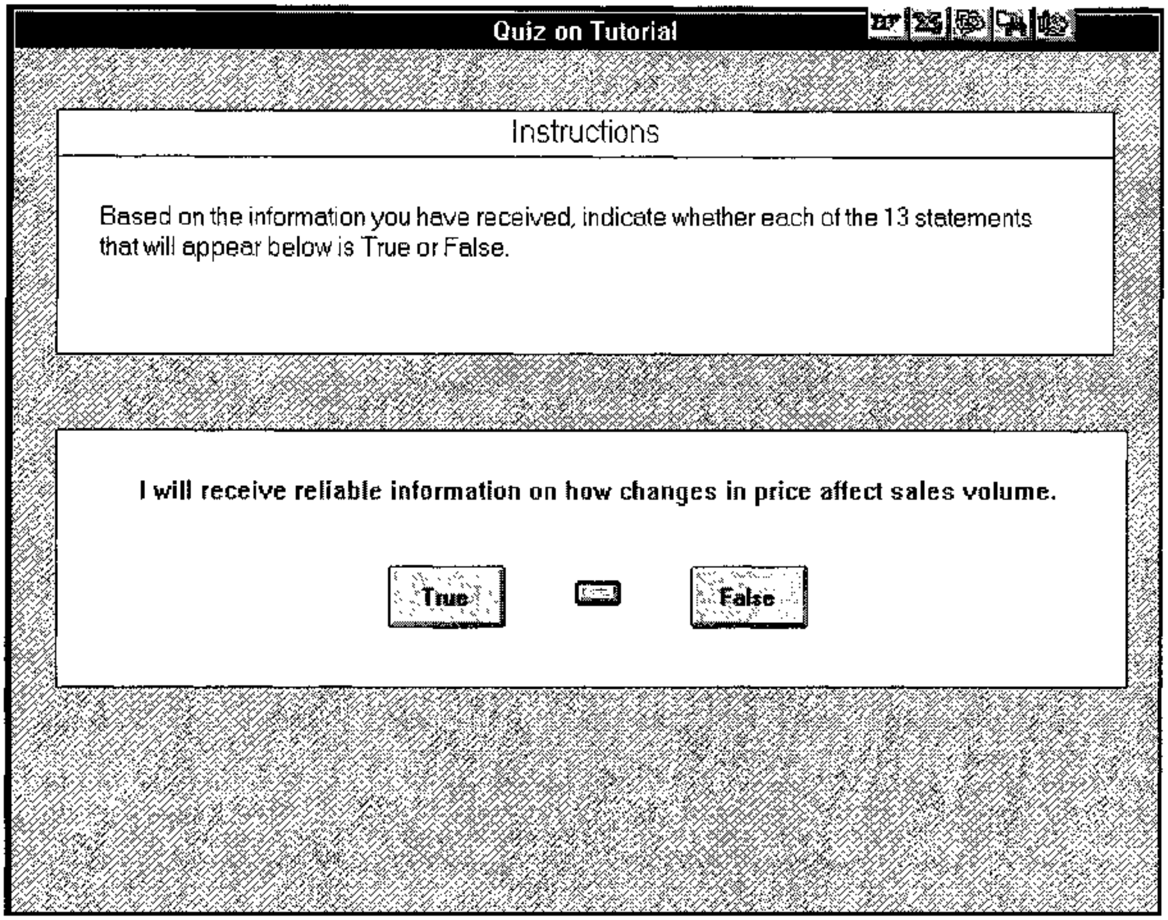
Appendix B Figure 9 Final feedback screen shown at the end of the tutorial to all subjects.



Results

Round	Accounting's Projected Profit	(a) Your Estimated Profit	(b) Actual Profit	(c) Difference between Your Estimate and Actual Profit (a) - (b)	(d) Score for Round (b) - (c)	Cumulative Score
1	54,957	55,000	57,389	2,389	55,000	55,000
2	45,820	55,000	60,834	5,834	55,000	110,000
3	36,405	60,000	62,554	2,554	60,000	170,000
Totals	137,182	170,000	180,777	10,777	170,000	170,000

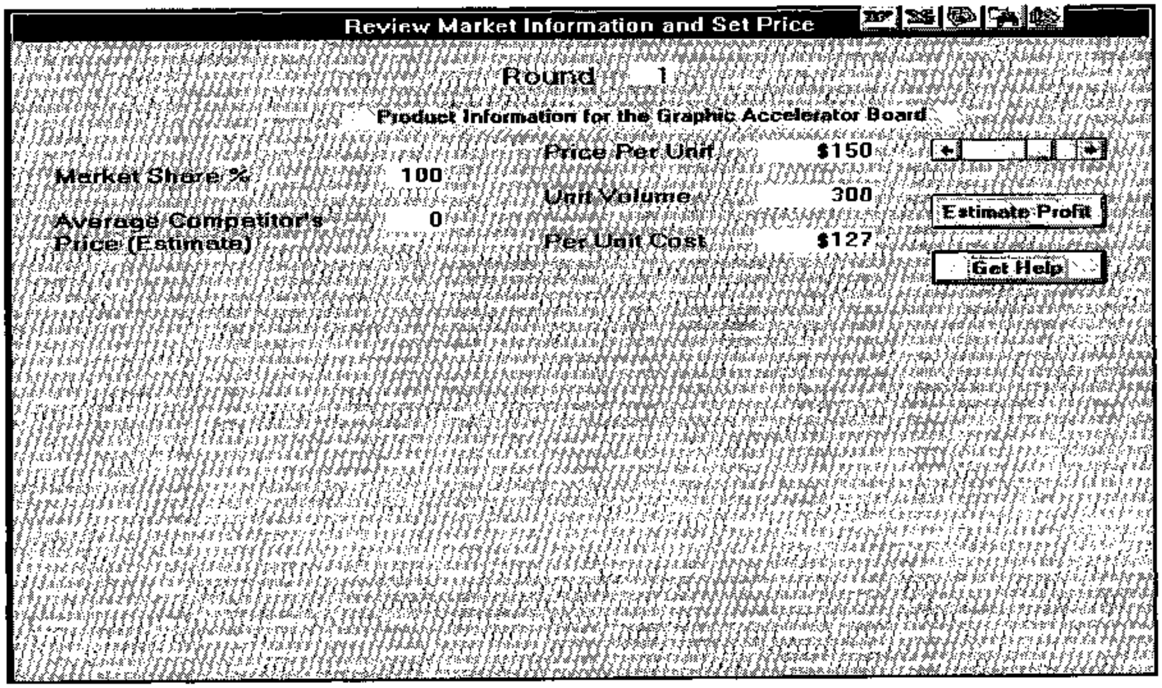
Appendix B Figure 10 First screen of the quiz administered to all subjects after completing the tutorial.



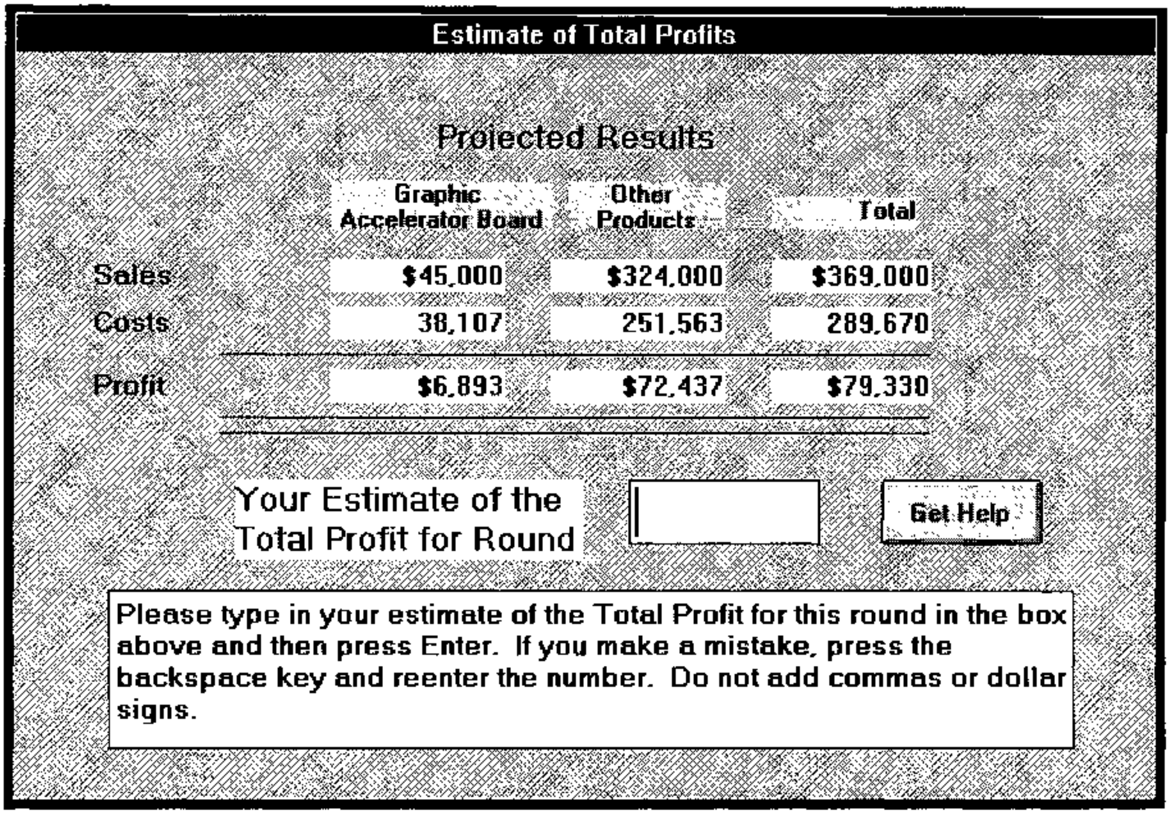
Appendix B Table 1 Listing of all quiz questions and the correct answers.

Quiz Question	Correct Answer
I will receive reliable information on how changes in price affect sales volume.	True
I am to assume the role of a product manager and make a series of sales forecasts.	True
The graphic accelerator board has a predicted life-cycle of approximately 2 years. "	True
Pricing my boards lower than my competition will increase my market share and future sales volume.	True
The graphic accelerator boards are initially used by conventional computer users.	False
At the beginning of the task, my competition has a technological advantage over my product.	True
The Cost Number for the graphic accelerator board represents only manufacturing costs.	False
Changes in Volume Sold will result in different per unit costs for the graphic accelerator board.	True
The costs of the graphic accelerator board will decrease as product volume increases over time.	True
My goal for the study is to maximize both my total profits and my accuracy in estimating these total profits.	True
For this study, I will set prices for more than one product.	False
My sales forecasts are for the entire worldwide market.	False
Maximizing my profit on each round will give me the highest total profit.	False

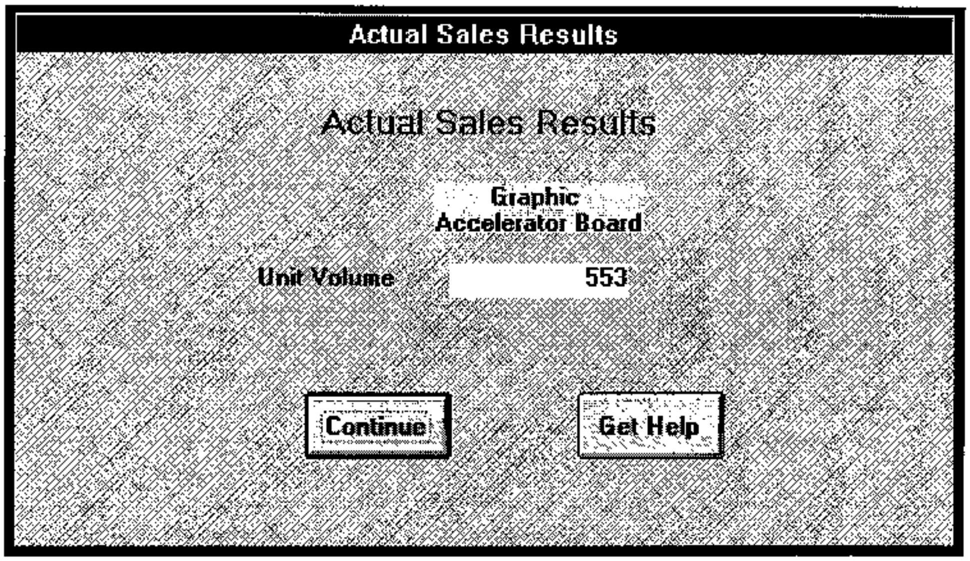
Appendix B Figure 11 First screen viewed by all subjects when setting the price for the actual experiment.



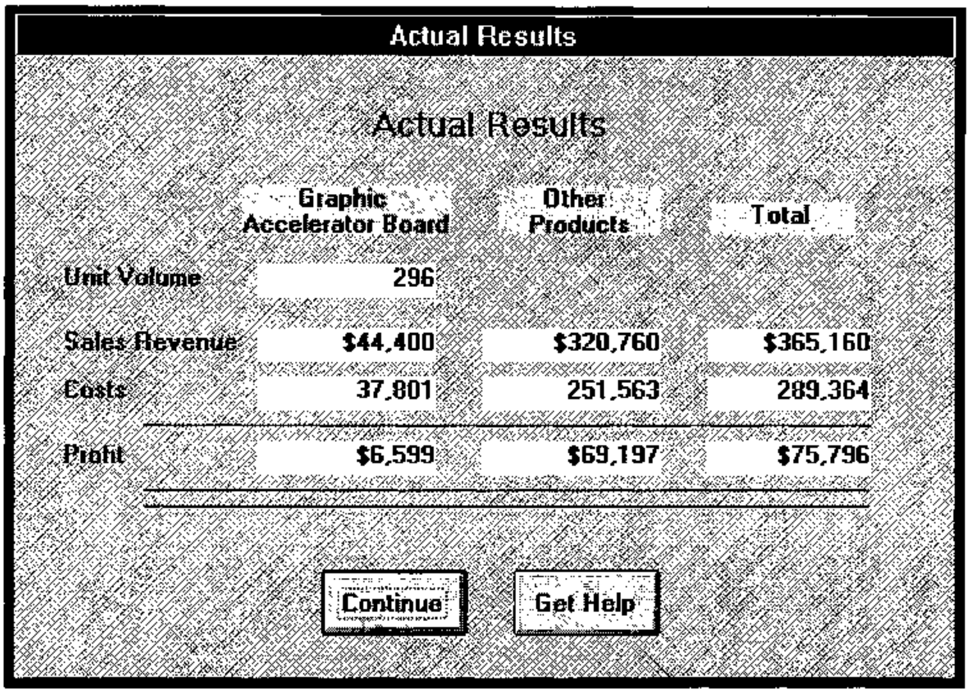
Appendix B Figure 12 Screen viewed by all subjects when estimating total profit for the actual experiment.



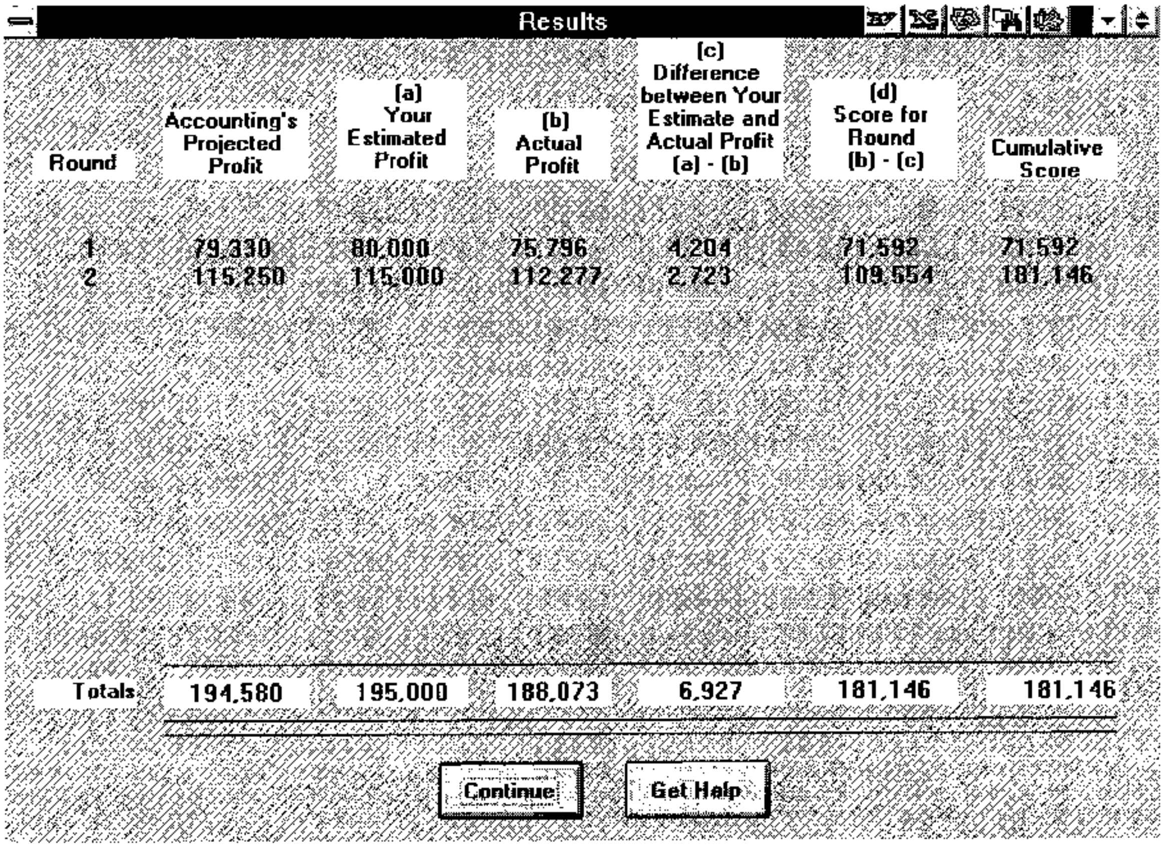
Appendix B Figure 13 Feedback screen shown at end of each round to subjects receiving no accounting information.



Appendix B Figure 14 Feedback screen shown at end of each round to subjects receiving either outcome feedback or the combination of outcome and task properties feedback.



Appendix B Figure 15 Feedback screen seen by subjects receiving both outcome and task properties feedback.



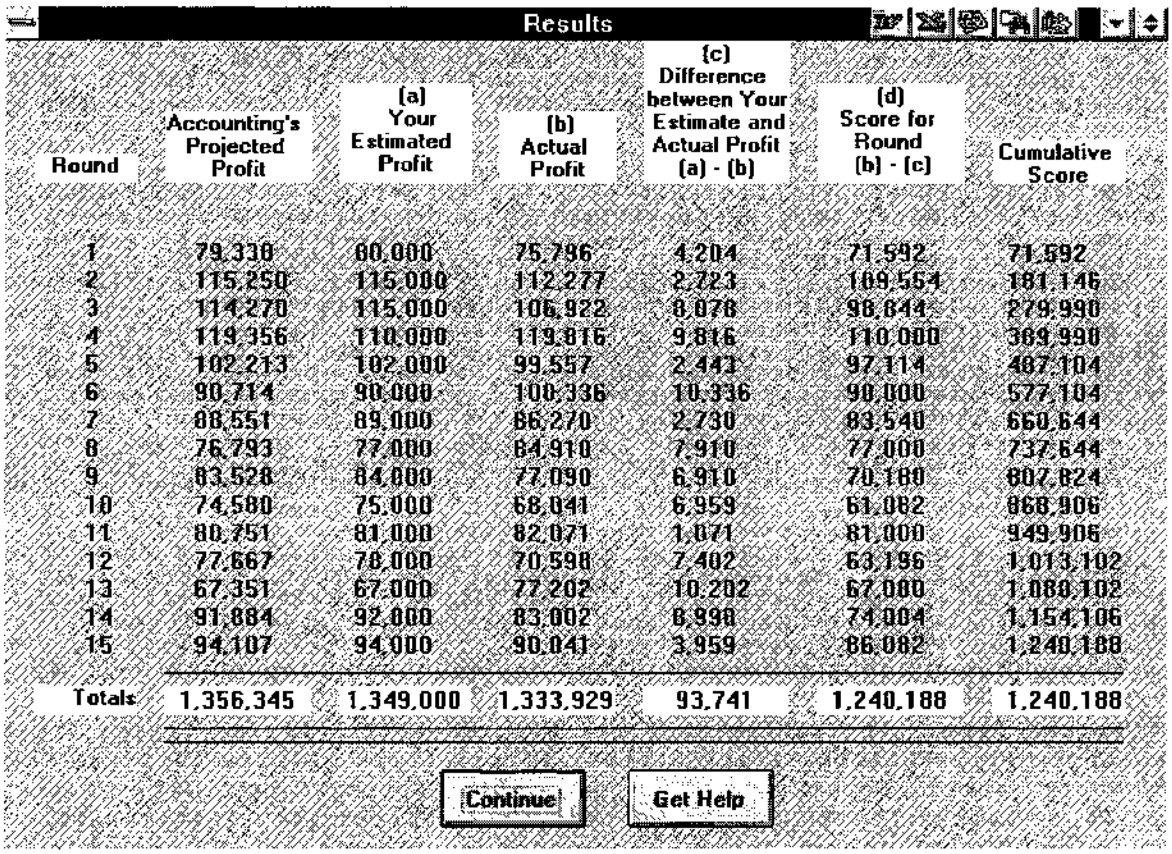
Results

Round	Accounting's Projected Profit	(a) Your Estimated Profit	(b) Actual Profit	(c) Difference between Your Estimate and Actual Profit (a) - (b)	(d) Score for Round (b) - (c)	Cumulative Score
1	79,330	80,000	75,796	4,204	71,592	71,592
2	115,250	115,000	112,277	2,723	109,554	181,146
Totals	194,580	195,000	188,073	6,927	181,146	181,146

Continue

Get Help

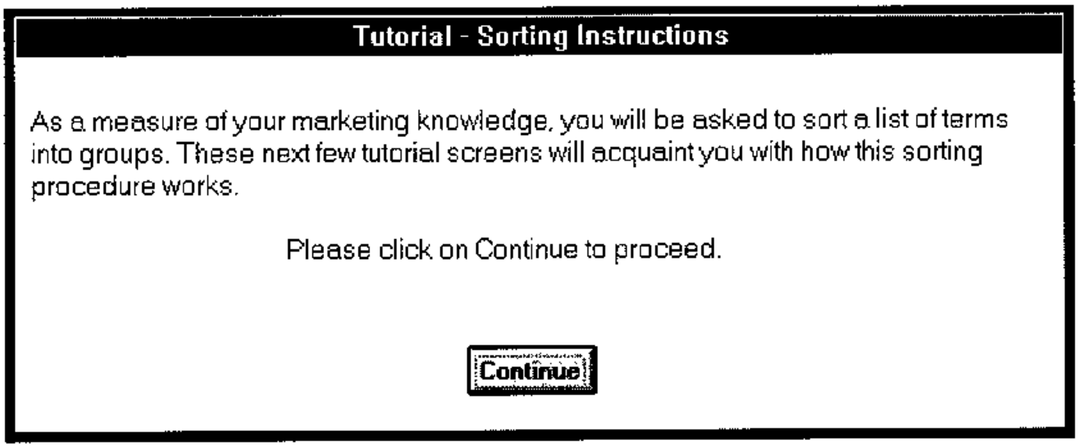
Appendix B Figure 16 Example of the feedback screen shown at end of the experiment to all subjects.



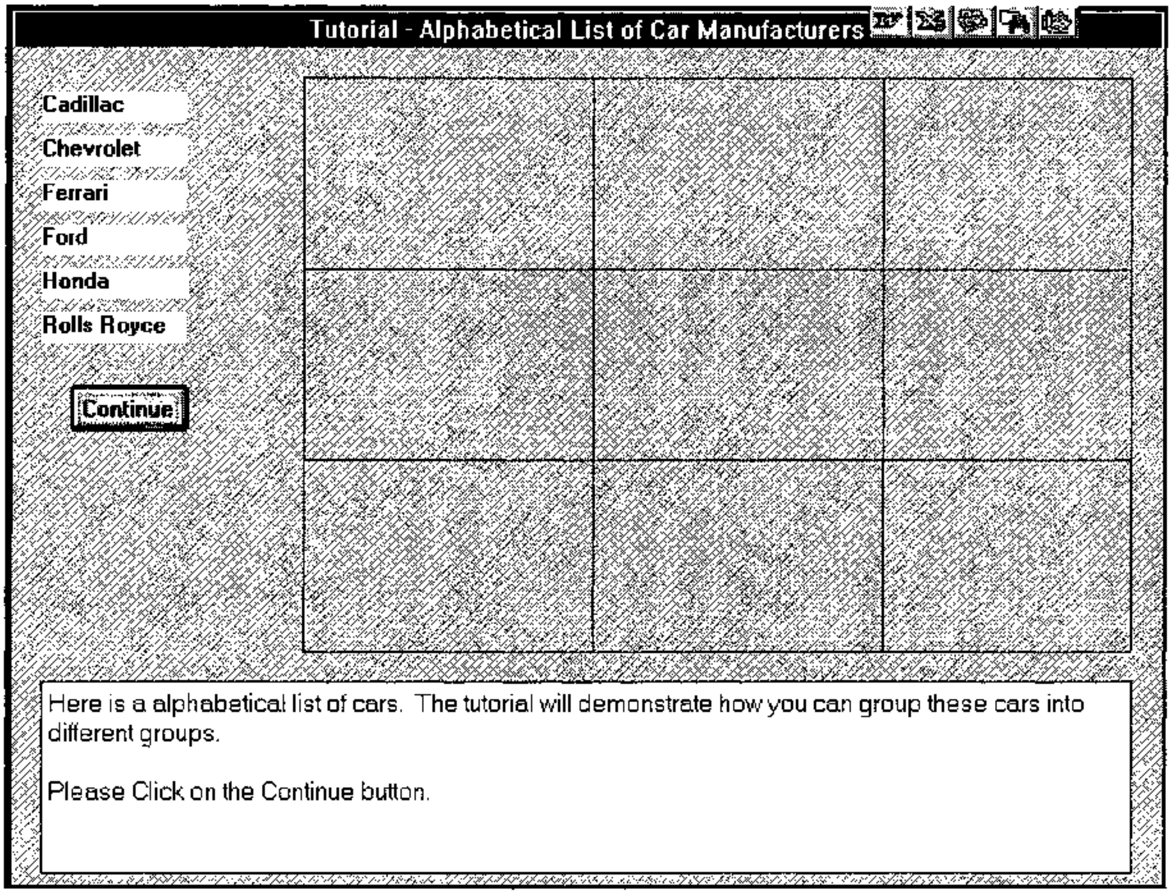
Results

Round	Accounting's Projected Profit	(a) Your Estimated Profit	(b) Actual Profit	(c) Difference between Your Estimate and Actual Profit (a) - (b)	(d) Score for Round (b) - (c)	Cumulative Score
1	79,330	80,000	75,796	4,204	71,592	71,592
2	115,250	115,000	112,277	2,723	109,554	181,146
3	114,270	115,000	106,922	8,078	98,844	279,990
4	119,356	110,000	119,816	9,816	110,000	389,990
5	102,213	102,000	99,557	2,443	97,114	487,104
6	90,714	90,000	100,336	10,336	90,000	577,104
7	88,551	89,000	86,270	2,730	83,540	660,644
8	76,793	77,000	84,910	7,910	77,000	737,644
9	83,528	84,000	77,090	6,910	70,180	807,824
10	74,580	75,000	68,041	6,959	61,082	868,906
11	80,751	81,000	82,071	1,071	81,000	949,906
12	77,667	78,000	70,598	7,402	63,196	1,013,102
13	67,351	67,000	77,202	10,202	67,000	1,080,102
14	91,884	92,000	83,002	8,998	74,004	1,154,106
15	94,107	94,000	90,041	3,959	86,082	1,240,188
Totals	1,356,345	1,349,000	1,333,929	93,741	1,240,188	1,240,188

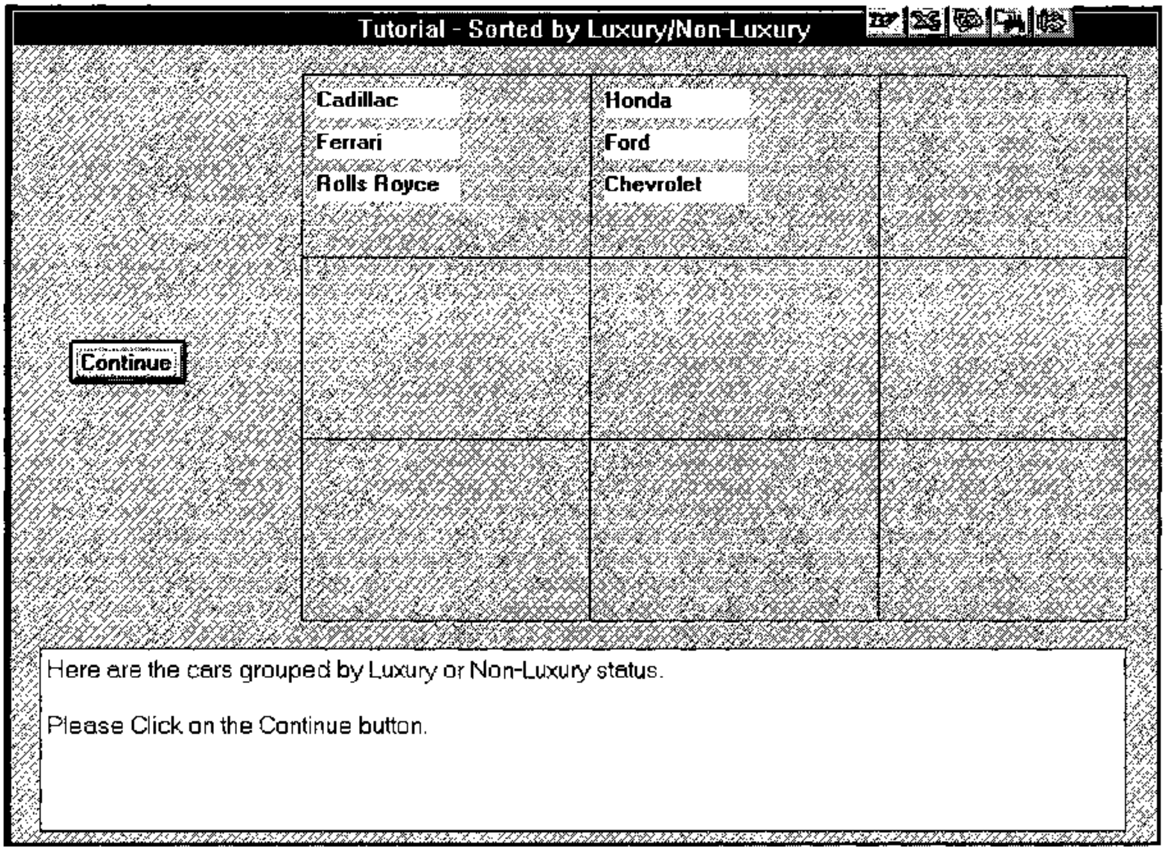
Appendix B Figure 17 Instruction screen for sorting task tutorial.



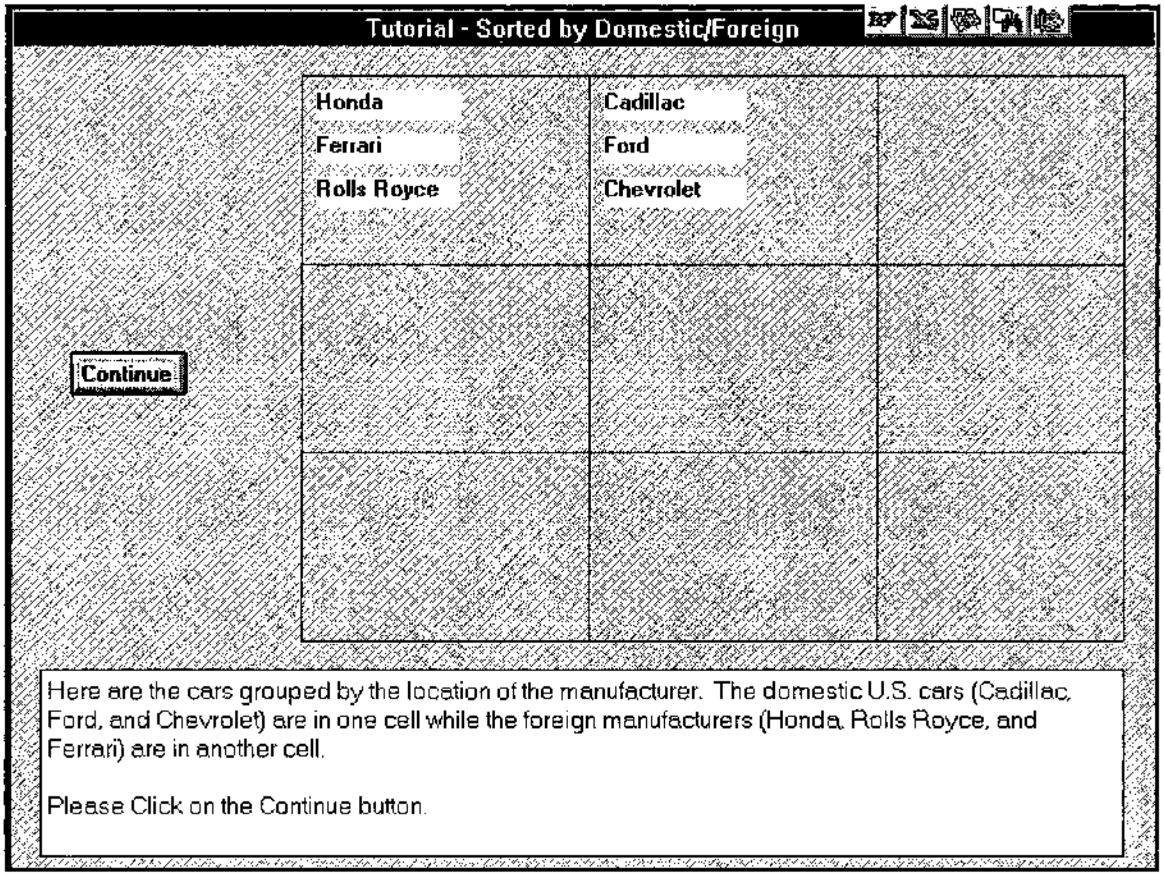
Appendix B Figure 18 First screen of sorting tutorial.



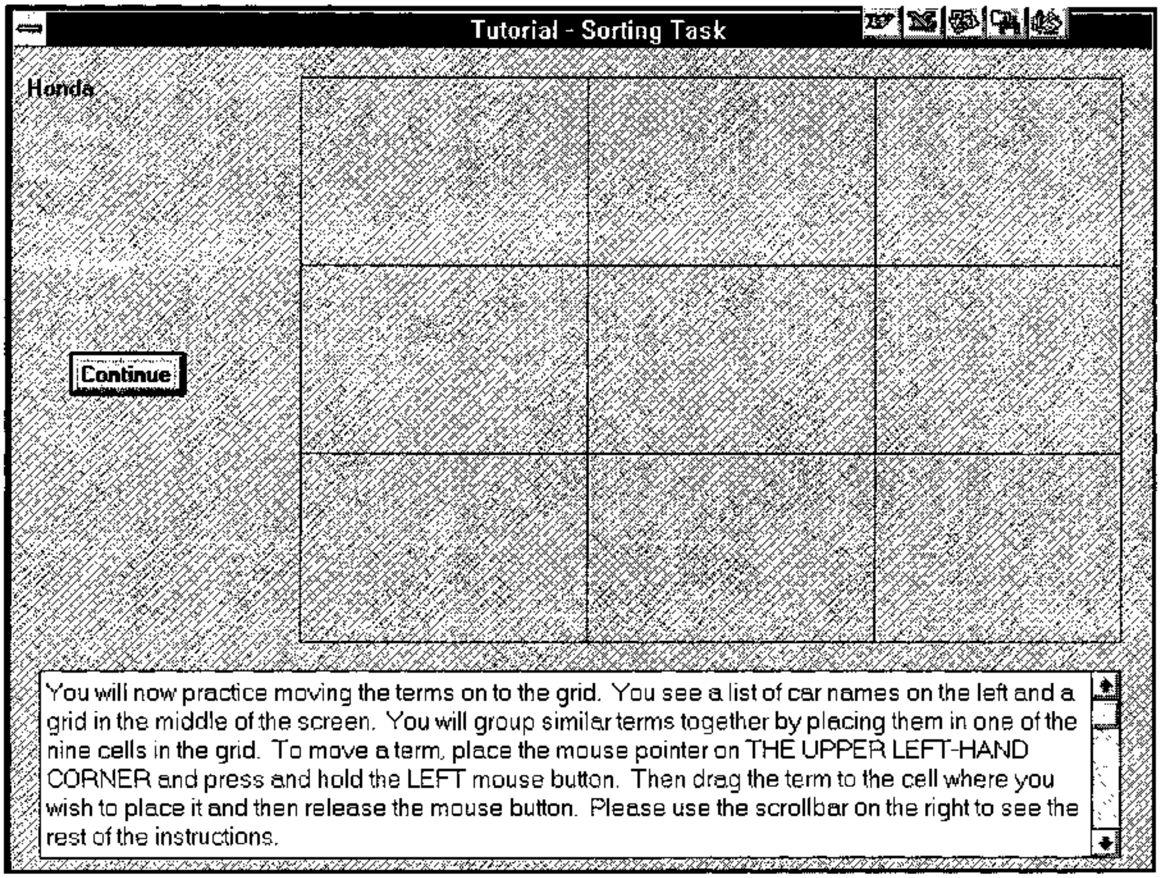
Appendix B Figure 19 Second screen of sorting tutorial.



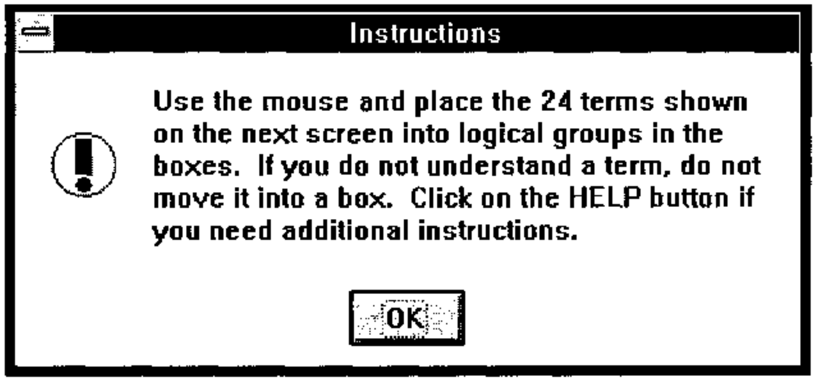
Appendix B Figure 20 Third screen of sorting tutorial.



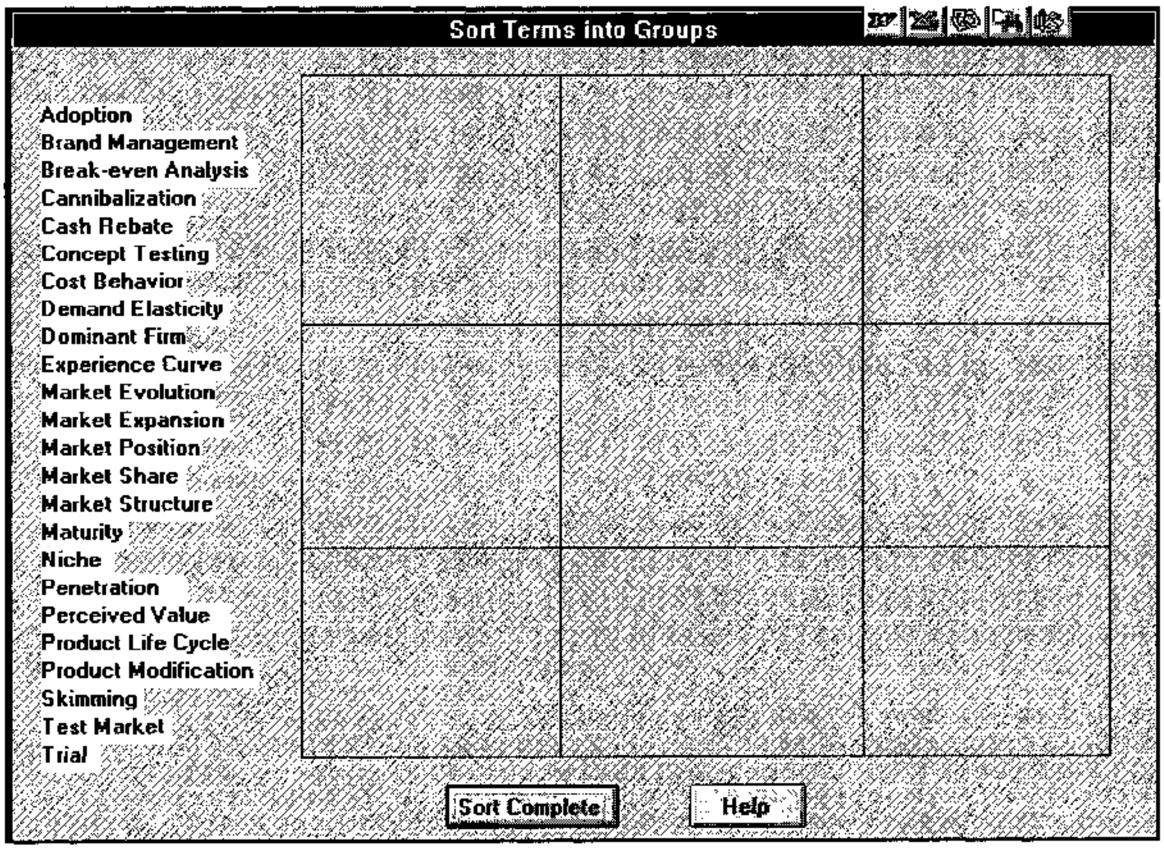
Appendix B Figure 21 Fourth screen of sorting tutorial.



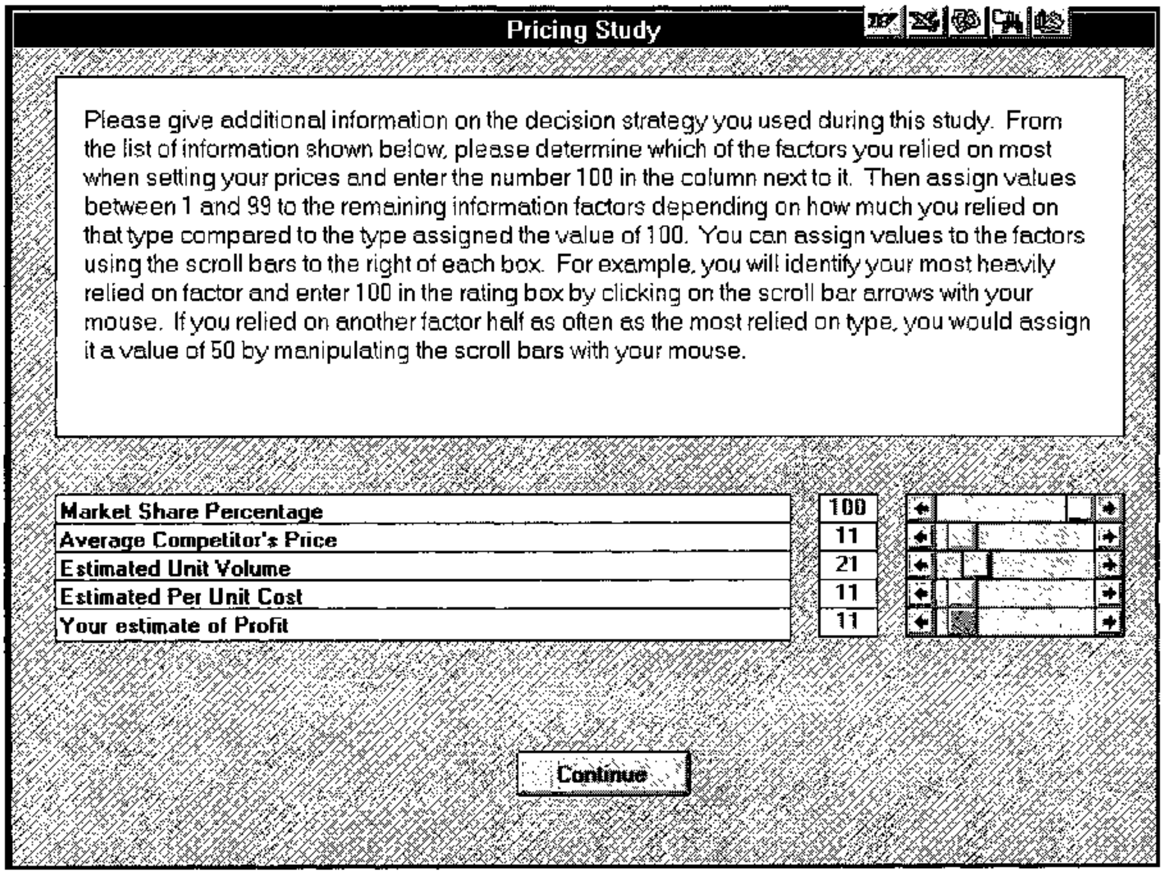
Appendix B Figure 22 Instructions for actual sorting task.



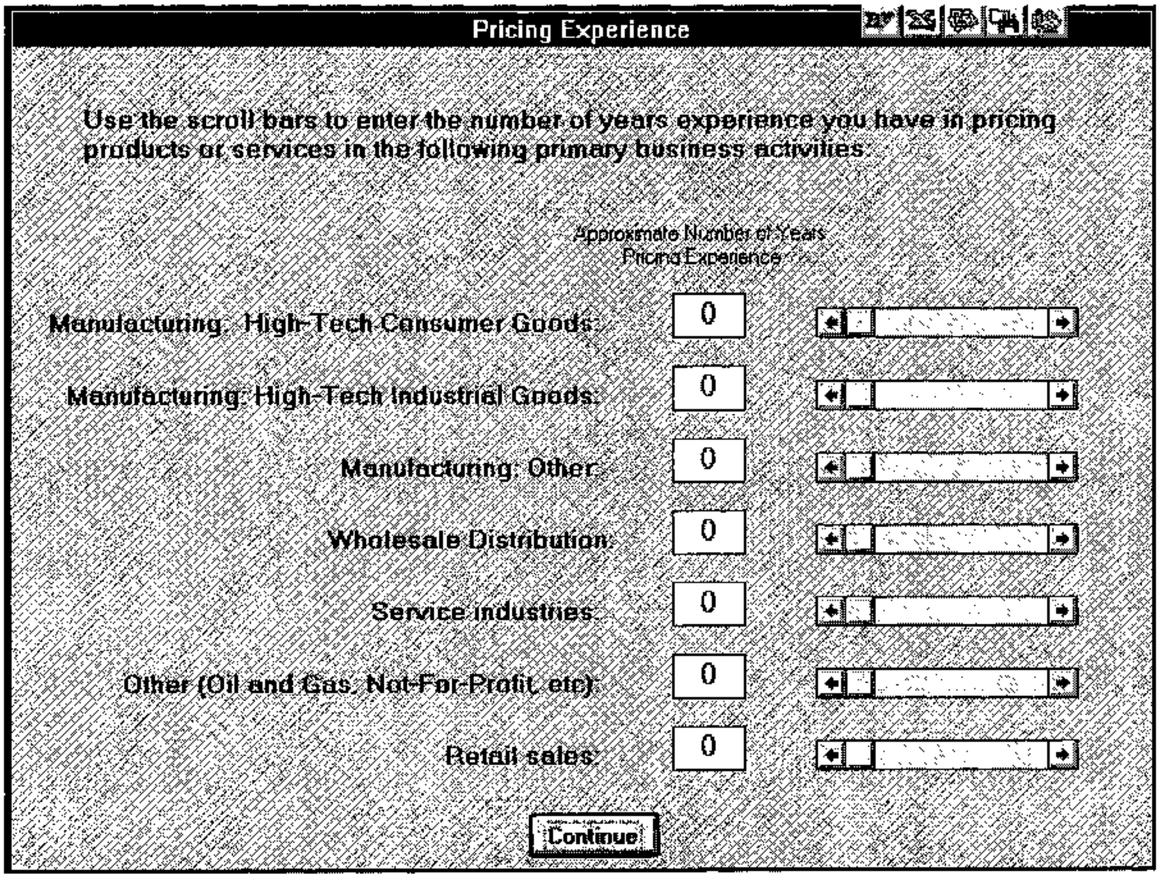
Appendix B Figure 23 Screen viewed by subjects during sorting task.



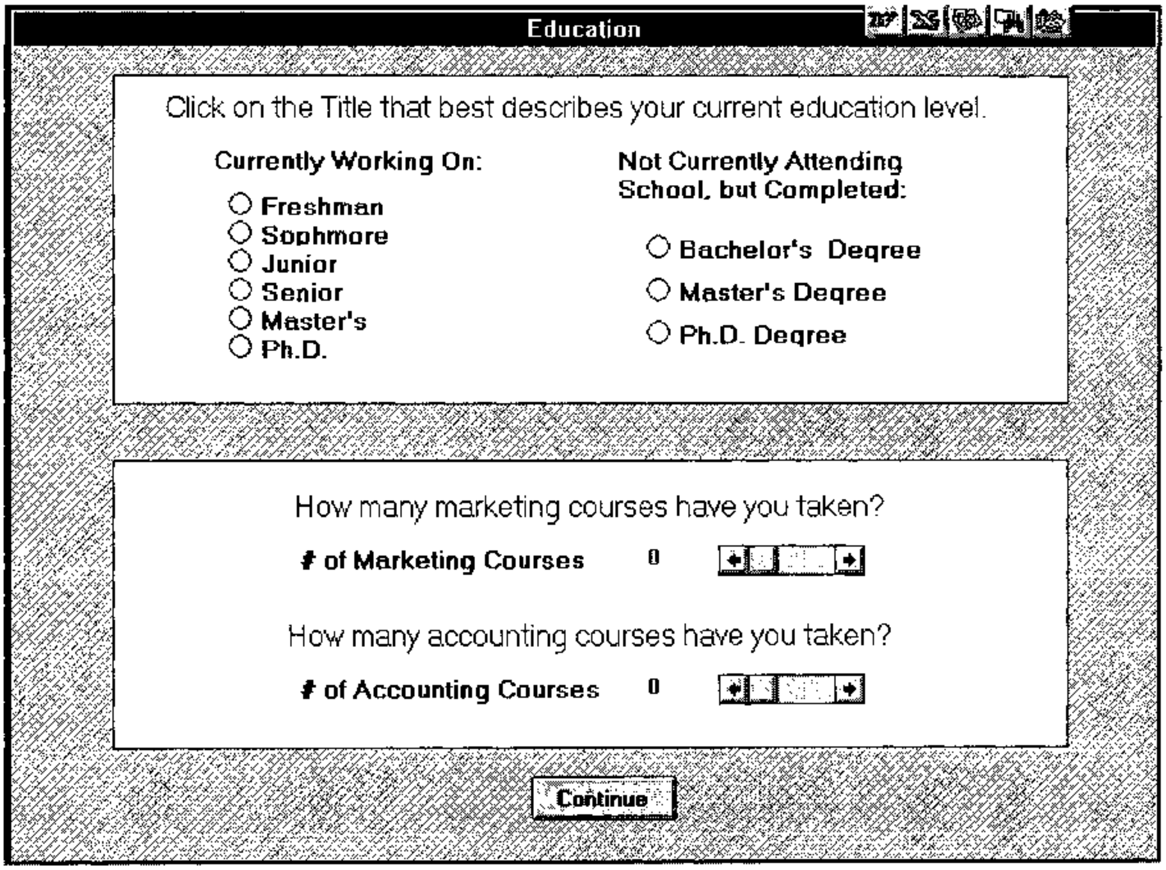
Appendix B Figure 24 Screen viewed by subjects when self-reporting on relative weights placed on cue usage.



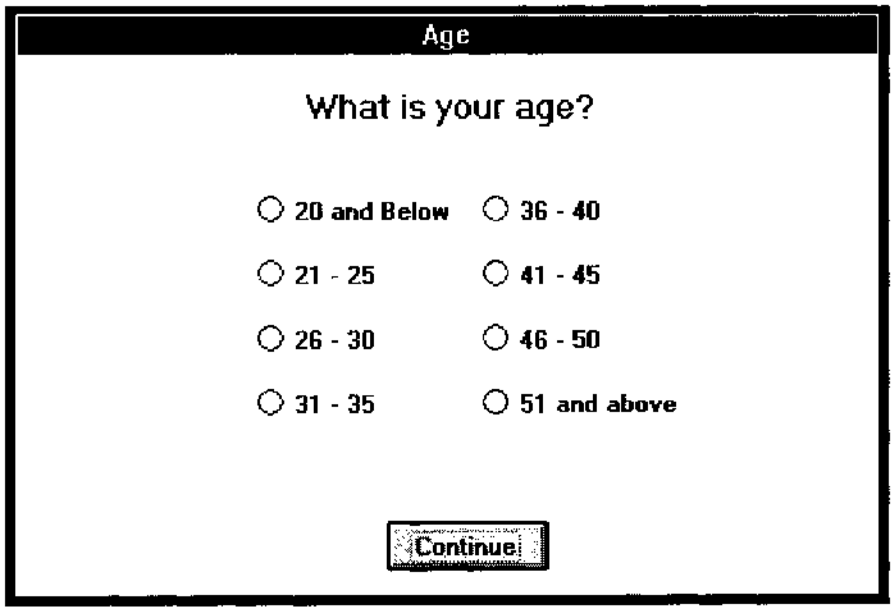
Appendix B Figure 25 Screen viewed by subjects when self-reporting on years of pricing experience in different industries.



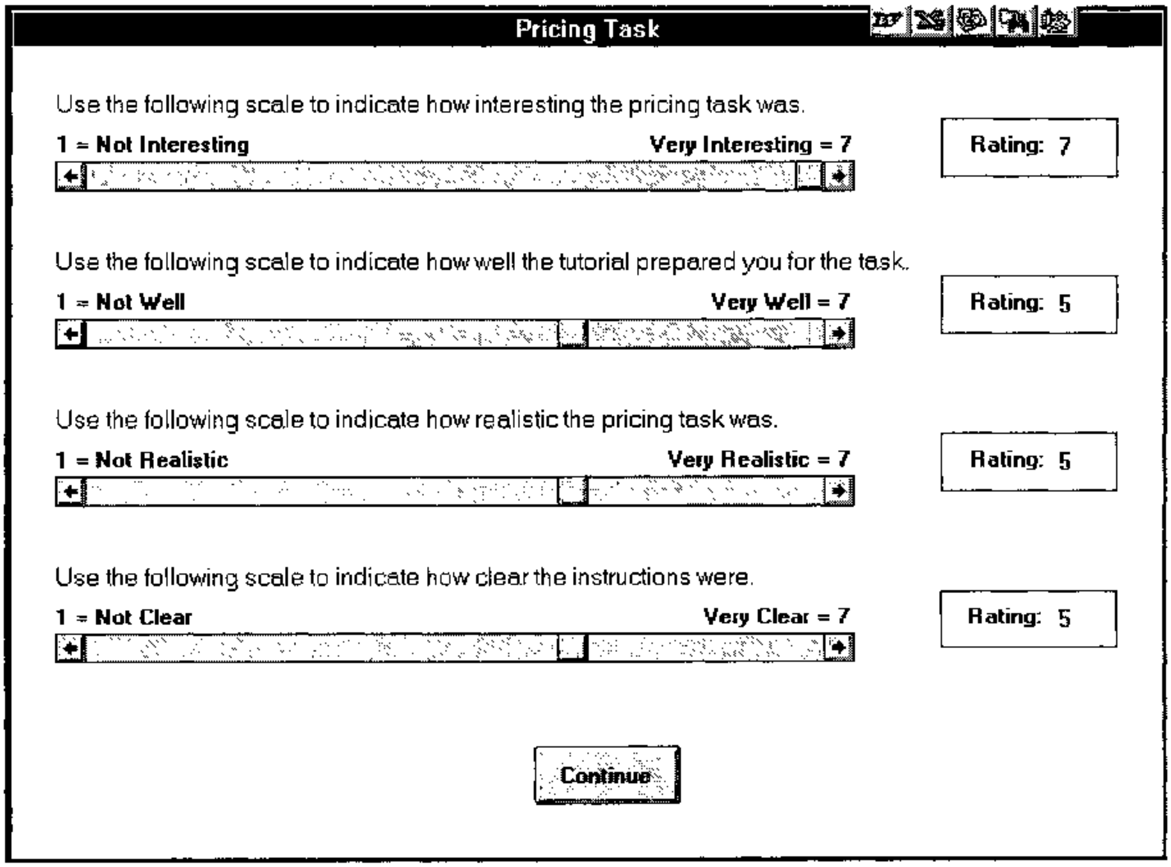
Appendix B Figure 26 Screen viewed by subjects when self-reporting on education level and the numbers of courses taken in marketing and accounting.



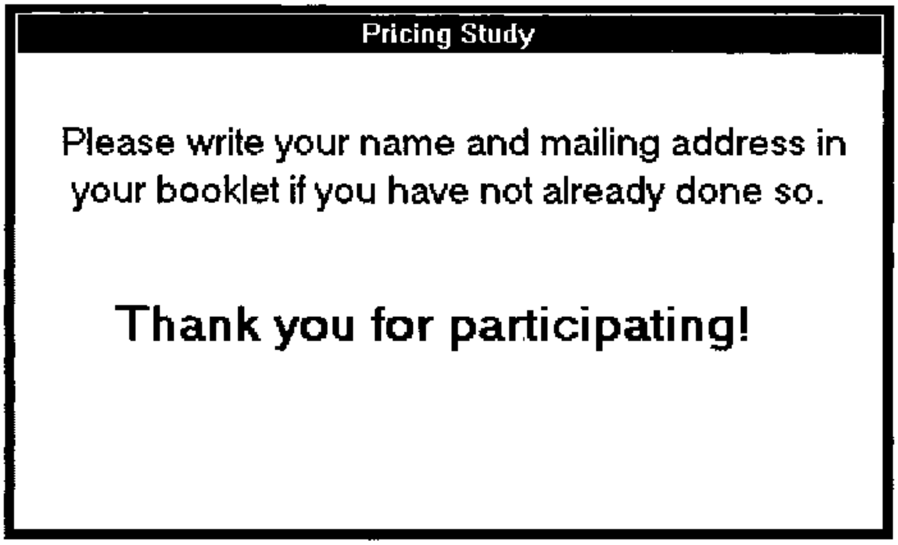
Appendix B Figure 27 Screen viewed by subjects when self-reporting on age category.



Appendix B Figure 28 Screen viewed by subjects when evaluating experiment.



Appendix B Figure 29 Final screen viewed subjects.



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