THE CONTRAST-INERTIA MODEL AND THE UPDATING OF
ATTRIBUTIONS IN PERFORMANCE EVALUATION

DISSERTATION

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By

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The two problems which motivate this research concern the role of managerial accounting information in performance evaluation. The first problem is that the processing of accounting information by individual managers may deviate from a normative (Bayesian) pattern. Second, managers' use of accounting information in performance appraisal may contribute to conflict between superiors and subordinates.

In this research, I applied the contrast-inertia model (C-IM) and attribution theory (AT) to predict how accounting information affects managers' beliefs about the causes for observed performance. The C-IM describes how new evidence is incorporated into opinions. Application of the C-IM leads to the prediction that information order may influence managers' opinions. Attribution theory is concerned with how people use information to assign causality, especially for success or failure. Together, the C-IM and AT imply that causal beliefs of superiors and subordinates diverge when they assimilate accounting information.
Three experiments were performed with manufacturing managers as subjects. Most of the subjects were middle-level production managers from Texas manufacturing plants. The subjects used accounting information in revising their beliefs about causes for performance problems. In the experiments, the manipulated factors were the order of information, subject role (superior or subordinate), and the position of different types of information. The experimental results were analyzed by repeated measures analyses of variance, in which the dependent variable was an opinion or the change in an opinion over a series of evidence items.

The experimental results indicate that the order of mixed positive and negative information affects beliefs in performance evaluation. For mixed evidence, there was significant divergence of opinions between superiors and subordinates. The results provide little evidence that superior and subordinate roles bias the belief updating process. The experiments show that belief revision in performance evaluation deviates from the normative standard, and that the use of accounting information may cause divergence of opinions between superiors and subordinates.
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CHAPTER 1

INTRODUCTION

In this research, I explore the updating of causal beliefs in performance evaluation. One of the major purposes of managerial accounting is to develop information which may be useful in performance appraisal [Harrison, West, and Reneau, 1988; Hopwood, 1974b; Otley, 1978; Waterhouse and Tiessen, 1978]. In these evaluations, superiors and subordinates may identify possible causes for outcomes and then integrate additional information into their causal beliefs [Brown, 1985]. This research involves three experiments in which managers update their causal attributions in performance evaluation cases. The remaining sections of this chapter detail the problems, the purposes, and the scope of the research, and the organization of this dissertation.

The Problems

Two main problems motivate this research. Both concern the role of managerial accounting information in managers' analyses of organizational subunit, subordinate, or personal performance [Brown, 1985]. The first research issue may be stated: How does the use of accounting
information in performance appraisal affect one manager's opinion? The problem is that the use of accounting information by an individual manager may deviate from an ideal or normative pattern.

In the performance evaluation process, superiors use accounting information to form opinions about subordinates' performance, and about causes for variances or other subunit performance problems and achievements. Superiors' opinions can affect the distribution of organizational rewards or punishments to their subordinates. Subordinates also may use accounting information to assess their own achievements, with potential impact on their motivation and sense of reward from their work [Birnberg, Frieze, and Shields, 1977; Kelley and Michela, 1980].

Managers may assimilate accounting information in a manner which deviates from normative models. One normative model for opinion revision is Bayes's theorem [Edwards, 1968; Einhorn and Hogarth, 1987; Libby, 1981]. According to Bayes's theorem, opinion formation or revision is influenced only by what information is available to a decision maker, and not by how the information is presented. Bayes's theorem has been recognized as a poor descriptive model for belief revision in many domains [Carlson and Dulany, 1988; Doherty, Mynatt, Tweney, and Schiavo, 1979; Peterson and Beach, 1967; Peterson, Schneider, and Miller, 1965; Pitz, Downing, and Reinhold, 1967]. The use of
accounting information in performance evaluation may be subject to the task effects which have been observed in other belief revisions. These effects include order effects and presentation and response mode effects [Ashton and Ashton, 1988a; Einhorn and Hogarth, 1987; Ruble and Feldman, 1976]. None of these task effects is predicted by the normative model. Such effects may increase the randomness or arbitrariness of the performance evaluation process, with unfavorable consequences for the managers and for the organization.

The second problem prompting this study is that the use of accounting information in performance evaluation may contribute to conflict or disagreement between subordinates and their superiors. The question may be phrased: How does the use of accounting information affect the relationship between the beliefs of subordinates and superiors?

An ideal or goal for the use of accounting information in performance appraisal is that such information should reconcile differences in opinions of superiors and subordinates. However, researchers have found that subordinates and superiors differ in their acquisition and use of information [Feldman, 1981; Harrison, West, and Reneau, 1988; Shields, Birnberg, and Frieze, 1981]. When individuals with disparate viewpoints are exposed to the same evidence, their opinions may diverge further [Lord, Ross, and Lepper, 1979]. The assimilation of accounting information in performance evaluation may increase stress for subordinates and friction between them and their superiors.

**Purposes of the Research**

The first purpose of this research is to apply the contrast-inertia model (C-IM) as a descriptive model for belief updating in performance evaluation situations. The C-IM was proposed by Einhorn and Hogarth [1985, 1987] as a descriptive model for revision of opinions upon the receipt of information. Einhorn and Hogarth [1985, 1987] assumed that belief updating occurs through a simple anchoring-and-adjustment strategy which places minimal demands on memory. The price for cognitive simplicity may be sensitivity to normatively irrelevant task characteristics. The model predicts that information order and response mode may
affect changes in opinions. The contrast-inertia model is discussed in detail in Chapter 2 of this dissertation.

The possible influence of information order and other task details has serious implications for those who prepare and use internal accounting reports. Experimental findings of procedural effects in the use of managerial accounting information could suggest a need for changes in the form of internal reports. Such findings might justify standardizing reports within a company, or suggest the order in which items should appear on reports to achieve specific results. There could also be implications about the frequency with which evaluations should occur. Experimental evidence of managers' nonnormative use of accounting information may influence the design of accounting systems in organizations.

The second purpose of the research is to use the contrast-inertia model and attribution theory (AT) to model the potential for conflict between superiors and subordinates in performance evaluation. The C-IM is a model for how bias affects opinion changes. Attribution theory (described in detail in Chapter 2) addresses how people assign causality for successes and failures, between the person involved (the actor) and the actor's environment [Kelley, 1973]. Attribution researchers have documented the tendency for subordinates and superiors to make different attributions for outcomes [Watson, 1982].
Subordinates tend to assign causality to something in the environment, while the superior attributes causal force to the subordinate. Attribution theory suggests that subordinates and superiors are likely to disagree about the extent or degree of the subordinate's control over outcomes. Such differences of opinion can be explained, at least in part, by motivational differences.

Attribution theory is a static model which has no provision for the evolution of causal opinions over time. In this research, the C-IM is integrated with AT, in an effort to develop a model for the updating of causal beliefs. The two models together imply that, if superiors and subordinates have divergent opinions about the cause for a problem, the assimilation of additional evidence may actually force their opinions further apart.

Attribution theory and the contrast-inertia model may explain part of the conflict between superiors and subordinates in performance evaluation. Stress or friction may result from an interaction between the participants' biases and information processing phenomena [Kelley and Michela, 1980]. An experimental finding of divergence of beliefs between superior and subordinate subjects might lead to methods to reduce conflict in actual evaluation situations. Findings of divergence would support a policy that evaluations should be made or reviewed by a third party. Training programs for evaluators could reduce
opinion discrepancies between performance evaluation participants [Feldman, 1981]. There may be increased recognition that superiors and subordinates view subordinates' performance differently, and that the measurement of performance is not unambiguous [Hopwood, 1974a].

Scope of the Research

This study includes three related experiments involving the updating of managers' causal beliefs. Subjects are manufacturing managers who have the responsibility for evaluating others' performance and who are themselves subject to such evaluation. The subjects were provided information which could be generated by a managerial accounting system. They used the information to update their beliefs in hypothesized attributions for performance. The changes in beliefs are compared, through statistical analysis, for superiors, subordinates, and control subjects who were assigned neither role.

Organization of the Dissertation

Chapter 2 of the dissertation is a literature review. It contains descriptions of the contrast-inertia model, attribution theory, and expectancy theory, which is a model for predicting motivation and effort. Some of the research performed within each model is summarized. The third chapter, the theoretical framework, specifies how AT and
the C-IM are interwoven for these experiments. Chapter 4 outlines the three experiments and the experimental hypotheses. The subject selection process, characteristics of subjects, and administration of the experiments are also described in the fourth chapter. Chapter 5 summarizes the data analysis and the experimental results. The final chapter outlines the contributions and limitations of this research and suggests possible future research.
In this chapter, I describe three psychological theories and some of the accounting research influenced by each of the theories. The early sections of the chapter contain descriptions of the contrast-inertia model, its constant and increasing inertia forms, and the contrast/surprise model, which was the original version of the model [Einhorn and Hogarth, 1985]. The experiments by Einhorn and Hogarth [1987] and others which have tested the contrast-inertia model are then summarized. The second model described is attribution theory. A discussion of patterns and biases in attributions is followed by a summary of accounting research utilizing attribution theory. Sections on expectancy theory precede a discussion of the linkages between expectancy theory and attribution theory. The final sections of the chapter describe the use of accounting information in performance evaluation and some performance evaluation research.

The Contrast-Inertia Model

The contrast-inertia model (C-IM) is a descriptive model proposed by Einhorn and Hogarth [1985, 1987] for
integrating new information with a current belief. The model is intended to be "general enough to be applied to many substantive domains," [Einhorn and Hogarth, 1987, p. 3]. It was originally proposed as the contrast/surprise model [Einhorn and Hogarth, 1985].

The normative model for the updating of belief in a hypothesis is Bayes's theorem. For many years researchers have compared subjects' belief revisions with normative Bayesian revision. Early researchers used probability revision tasks for which the correct change in belief could be calculated. Some of them found belief revision to be in the normatively correct direction but less extreme than predicted by Bayes's theorem, a phenomenon called conservatism [Edwards, 1968]. Other scientists questioned whether conservatism actually occurs. Pitz, Downing, and Reinhold [1967] concluded that their subjects' performance in probability revision tasks deviated from the optimal in ways more fundamental than conservatism. They suggested that subjects' performance was largely determined by normatively irrelevant task characteristics.

Einhorn [1976] wrote that Bayes's theorem has little to do with describing cognitive processes. It is extremely complex, especially for multiple data. Bayes's theorem is limited as a descriptive model for belief updating. It predicts no effect for the order of information, for presentation mode, or for response mode. Einhorn [1976]
concluded that such task details have a vital impact on judgment and decision making.

In developing the C-IM, Einhorn and Hogarth [1987] made three assumptions about how people revise their opinions. They assumed that subjects consider just one hypothesis at a time, an approach called pseudodiagnosticity [Doherty, Mynatt, Tweney, and Schiavo, 1979; Fischhoff and Beyth-Marom, 1983; Robinson and Hastie, 1985]. Potential alternative hypotheses do not influence the belief revision process.

Einhorn and Hogarth's [1987] second assumption was that information tends to be received sequentially [Anderson, 1981] and integrated with current belief by an anchoring-and-adjustment strategy. Finally, they assumed that there is a conflict between the forces of adaptation and inertia. Adaptation is sensitivity to new information. Inertia is the tendency to protect or maintain a current level of belief [Einhorn and Hogarth, 1987]. The force of adaptation is expected to be strong when a person has seen little evidence related to a hypothesis. The force of inertia generally increases as more evidence is received.

**Structure of the C-IM: The Constant Inertia Model**

Einhorn and Hogarth [1985, 1987] assumed that people encode information as positive or negative with respect to their single hypothesis, before they integrate it into
their current beliefs. The authors did not outline the nature of the encoding process. Negative evidence is thought to be incorporated with the anchor, or previous level of belief, using the discount model [Einhorn and Hogarth, 1987],

\[ S_k = S_{k-1} - w_k s(a_k) \]  

where

- \( S_k \) = strength of belief in a hypothesis or impression after \( k \) pieces of evidence; \( 0 \leq S_k \leq 1 \)
- \( S_{k-1} \) = the anchor or prior opinion. The initial belief is designated \( S_0 \).
- \( w_k \) = the adjustment weight for negative evidence
- \( s(a_k) \) = the subjective strength of the \( k \)th piece of evidence if it is negative; \( 0 \leq s(a_k) \leq 1 \).

According to the C-IM [Einhorn and Hogarth, 1987], positive evidence is integrated with the anchor by the accretion model,

\[ S_k = S_{k-1} + r_k s(b_k) \]  

where

- \( r_k \) = the adjustment weight for positive evidence
- \( s(b_k) \) = the subjective strength of the \( k \)th piece of evidence if it is positive; \( 0 \leq s(b_k) \leq 1 \).

Einhorn and Hogarth used the adjustment weights, \( r_k \) and \( w_k \), "to model the conflict between adaptation and inertia," [1987, p. 6]. They argued that a given piece of negative evidence causes a greater decrease of belief if the
previous anchor is high, as compared to low. Similarly, positive evidence strengthens belief more when the previous level of belief is low, rather than high. These contrast effects are modeled in the C-IM by making \( w_k \) proportional to \( S_{k-1} \) and \( r_k \) proportional to \( (1 - S_{k-1}) \),

\[
\begin{align*}
  w_k &= \alpha S_{k-1} \\
  r_k &= \beta (1 - S_{k-1})
\end{align*}
\]  

(3)  
(4)

where \( \alpha \) = sensitivity to negative evidence; \( 0 \leq \alpha \leq 1 \)

\( \beta \) = sensitivity to positive evidence; \( 0 \leq \beta \leq 1 \).

When equation (3) is incorporated into equation (1), the discount model becomes

\[
S_k = S_{k-1} - \alpha S_{k-1} s(a_k).
\]  

(5)

Combining equations (2) and (4) gives the accretion model for positive evidence,

\[
S_k = S_{k-1} + \beta (1 - S_{k-1}) s(b_k).
\]  

(6)

When \( \alpha (\beta) \) is equal to one, the subject is highly sensitive to negative (positive) evidence. If \( \alpha (\beta) \) equals zero, the individual's belief is not changed by negative (positive) evidence. Einhorn and Hogarth [1987] expected that, in the absence of prior information, both \( \alpha \) and \( \beta \) would be relatively high for an unbiased individual. As information accumulates, both parameters would decrease.

The model can accommodate subject bias; \( \beta \) need not equal \( \alpha \).

Einhorn and Hogarth [1987] defined the extreme cases, as shown in Table 1. If \( \alpha \) equals zero and \( \beta \) has a nonzero value, an individual is an advocate, or prone to
confirmation. If $\beta$ is zero and $\alpha$ is nonzero, the person is considered a skeptic, or tending toward disconfirmation. All intermediate values of $\alpha$ and $\beta$ are also possible.

---

**Table 1**

<table>
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<tr>
<th>$\alpha$</th>
<th>$\beta$</th>
<th>Description</th>
<th>$\beta = 1$</th>
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<tr>
<td>$\beta = 1$</td>
<td>Highly sensitive to both positive and negative evidence</td>
<td>$\beta = 0$</td>
<td>An advocate; sensitive to positive evidence alone</td>
<td></td>
</tr>
<tr>
<td>$\beta = 0$</td>
<td>A skeptic; sensitive only to negative evidence</td>
<td>$\alpha = 0$</td>
<td>Insensitive to both positive and negative evidence</td>
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**The Increasing Inertia Model**

Einhorn and Hogarth's [1987] C-IM model can be adapted to allow for serial position effects by adding exponents $\theta$ and $\lambda$ to equations (5) and (6) respectively,

Discount model: $S_k = S_{k-1} - \alpha^0 S_{k-1}s(a_k)$

Accretion model: $S_k = S_{k-1} + \beta^\lambda (1 - S_{k-1})s(b_k)$

where $\theta$ and $\lambda$ are both increasing functions of $k$. If $\theta$ and $\lambda$ increase with the number of pieces of evidence, the impact of evidence is reduced by placing it late in a series of items. As a result, the predicted serial position effect of the increasing inertia model is a force toward primacy.

When $\theta$ and $\lambda$ are both equal to 1, there are no serial position effects, and equations (7) and (8) are identical to the constant inertia form of the model. Einhorn and
Hogarth [1987] found little evidence for serial position effects in cognitively demanding tasks. In all following sections of this dissertation, any references to the C-IM include only the constant inertia form, unless specifically stated otherwise.

Predictions of the C-IM: Order Effects

The contrast-inertia model predicts no order effects for consistent positive or negative evidence. Appendix A presents mathematical proofs of the order effect predictions of the C-IM. If strong positive and weak positive evidence are presented to subjects, their final opinions would be independent of the order of presentation,

\[
S(\text{strong, weak}) = S(\text{weak, strong}).
\]

A similar result applies for negative information. Several other models for updating of beliefs, including Bayes's theorem, also predict no order effects for consistent information.

For evidence which is mixed (includes both positive and negative items), the C-IM predicts recency. Recency means that later evidence influences the position of final belief more than earlier information. The strength of ending belief when positive evidence is presented before negative evidence, \(S_{+, -}\), and the level of belief for the reverse order, \(S_{-, +}\), are not equal. Einhorn and Hogarth [1987] designated the difference in ending belief as \(D\).
D = S_{-,+} - S_{+, -}. \quad (10)

If there are recency effects, \( S_{-,+} \) is larger than \( S_{+, -} \), and \( D \) exceeds zero. A recency effect gives the characteristic fishtail pattern shown in Figure 1. Of seven belief revision models described by Einhorn and Hogarth [1985, 1987], only the C-IM predicts no order effects for consistent evidence and recency for mixed evidence. The preceding discussion of order effects assumes that both \( \alpha \) and \( \beta \) are greater than zero.\(^2\)

The Contrast/Surprise Model

In their 1985 paper, Einhorn and Hogarth called their belief updating model the contrast/surprise model (C/SM). Its implications and predictions are much the same as those for the C-IM. The forms of the discount and accretion equations of the C/SM are,

\[
S_k = S_{k-1}(1 - a_k \gamma)
\]

\[
S_k = S_{k-1} + (1 - S_{k-1})b_k \delta
\]

where

- \( a_k \) = the objective strength of negative evidence
- \( b_k \) = the objective strength of positive evidence
- \( \gamma \) = the attitude toward negative evidence; \( \gamma \geq 0 \)
- \( \delta \) = the attitude toward positive evidence; \( \delta \geq 0 \).

When \( \gamma \) and \( \delta \) are both greater than (less than) one, a person is both confirmation- and disconfirmation-avoiding (confirmation- and disconfirmation-seeking).
Figure 1
A Recency Effect

Recency:
$S(-,+) > S(+,-)$
Einhorn and Hogarth [1985] described response mode effects, which they omitted from the 1987 paper. There are two primary methods for eliciting judgments, step-by-step (SBS), which requires subjects to revise their beliefs after each piece of evidence, and end-of-sequence (EOS), in which subjects respond at the end of a series of items. The contrast feature of the C/SM implies that, if $\gamma$ and $\delta$ are both greater than one (the subject is both disconfirmation- and confirmation-avoiding), the EOS procedure will lead to more extreme belief revision than the SBS for consistent positive or negative evidence. This result is called a dilution effect for SBS processing. While the form of the C-IM differs slightly from the C/SM, the C-IM also predicts dilution for SBS processing, assuming that $\alpha$ and $\beta$ are not zero.

**Einhorn and Hogarth's Tests of the Contrast-Inertia Model**

Einhorn and Hogarth [1987] tested their model through its qualitative order effect predictions. They used this approach because its order predictions for consistent and mixed evidence are unique, out of the updating models they considered. Quantitative testing of the model would be very difficult. Such an approach would require that the strength of evidence and subjects' $\alpha$ and $\beta$ parameters be measured. Subjects are likely to disagree on the strength
of evidence, and their a and β values probably are not stable, either across contexts or across time within a single context.

Summaries of the designs and results of Einhorn and Hogarth's [1987] first five experiments are shown in Tables 2 and 3. The results for Experiments 1 and 2 show no effect on the change in judgment (the dependent variable) for the order of consistent positive or consistent negative evidence. In Experiment 2, there was dilution for EOS processing with three of the four scenarios, contrary to Einhorn and Hogarth's [1985] predictions for the C/SM and contrary to the C-IM as well. Experiments 3, 4, and 5 all tested the C-IM with mixed evidence. In each case, recency was found overall, consistent with the authors' predictions, although there was primacy for one scenario in Experiment 4.

Einhorn and Hogarth's [1987] Experiment 6 is a review of work done by Shanteau [1970], discussed below. Einhorn and Hogarth [1987] did two experiments, not reported in detail, in which they tried to reduce recency for mixed evidence by decreasing either a or β. They wrote these scenarios from the viewpoint of an advocate or a skeptic. In one of the experiments, they found recency for advocates and no order effect for skeptics, suggesting that they may have been successful in reducing β for the skeptic group.
Table 2

Summary of Einhorn and Hogarth’s Experiments 1-5

Subjects: Paid student volunteers

Factors:

4 Scenarios, each involving a hypothesized cause for a condition or an event; presented in a Latin square design

2 Response modes, SBS and EOS, within-subject

2 Orders of evidence, within-subject

Dependent Variable: The change in belief from the initial anchor to the final response

Table 3

Results from Einhorn and Hogarth's Experiments 1-5

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Evidence</th>
<th>ANOVA Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Consistent positive</td>
<td>No order effect; a significant main effect for scenarios</td>
</tr>
<tr>
<td>2</td>
<td>Consistent negative</td>
<td>No order effect; a significant main effect for response mode; response mode x scenario interaction</td>
</tr>
<tr>
<td>3</td>
<td>Mixed positive and negative</td>
<td>Recency, scenario main effect and response mode x scenario interaction were all significant</td>
</tr>
<tr>
<td>4,5</td>
<td>Mixed positive and negative</td>
<td>Recency effect, with one scenario showing primacy. Significant main effect for scenarios. Interaction effect for scenarios and response mode</td>
</tr>
</tbody>
</table>
Anderson [1981] found recency for SBS and primacy for EOS, and he attributed this difference to attention decrement for the EOS procedure. Einhorn and Hogarth [1987] attributed the effect to increasing inertia, for which attention decrement is one of several explanations. They did a series of experiments in which they tried to induce attention decrement. Results from the experiments were consistent with the constant inertia version of the C-IM. There was no primacy for mixed evidence.

In Einhorn and Hogarth's [1987] final experiment, they tried to manipulate $\alpha$ and $\beta$ by making different amounts of information available in the scenario stems. This manipulation was based on the assumption that both parameters should decline as the amount of prior information increases. Anderson's [1981] tasks which gave primacy for EOS were not cognitively demanding. Einhorn and Hogarth [1987] tried to make this experimental task simple, in an effort to induce primacy. They found that there was less belief revision when the stem included large amounts of prior information, implying that their manipulation of $\alpha$ and $\beta$ had been successful. However, a consequence of reduced sensitivity to evidence should be a reduction in recency, which did not occur. With no initial scenario at all and simple tasks, Einhorn and Hogarth [1987] did find recency for SBS and either no order effect or weak primacy for EOS, depending on the task they used.
Einhorn and Hogarth's [1987] Experiments 1-5 generally support the predictions of the C-IM. They found no order effects for consistent information and, in most cases, recency for mixed information. Their later experiments show the robustness of the constant inertia model; their efforts to induce increasing inertia were not successful. The authors reported some success in manipulating $a$ and $\beta$, but the apparent reductions in those parameters did not lead to the predicted reduction in recency.

Other Experiments Testing the C-IM or C/SM

Shanteau's [1970] purpose was to test an additive model for sequential decision making, using probability revision tasks. He assumed that a subject's response at serial position $n$, $R_n$, is a weighted sum of scale values of the evidence,

$$R_n = \sum_{i=1}^{n} w_i s_i \quad (13)$$

where

$w_i$ = a weight, assumed to depend on serial position:

$$\sum_{i=1}^{n} w_i = 1$$

$s_i$ = the scale value for the stimulus.

Shanteau [1970] used both SBS and EOS presentation. He calculated evidence weight values, $w_i$, at each serial position and found that the weights increased across serial positions, a recency effect. There was a less extreme reaction for SBS than for EOS, suggesting dilution for SBS
processing, as Einhorn and Hogarth [1985] predicted in their contrast/surprise model.

The accounting studies that applied the C-IM or C/SM are summarized in Table 4. Tubbs, Messier, and Knechel [1989] and Ashton and Ashton [1988a] both applied the C/SM to auditing tasks. The contrast/surprise model is appropriate in an auditing setting because auditing requires the sequential updating of belief based on probabilistic evidence. Tubbs, Messier, and Knechel [1989] used scenarios which they considered to be sufficiently rich in content to capture the complexity of auditors' judgment. Ashton and Ashton [1988a] preferred more abstract scenarios which might maximize the internal validity of their experiments.

Tubbs, Messier, and Knechel [1989] found some evidence for recency with consistent positive evidence, contrary to predictions of either the C/SM or the C-IM. Significant interactions for consistent negative evidence were not explained. For mixed evidence, there was a significant order by response mode interaction, with recency only for sequential processing. Anderson [1981] and Einhorn and Hogarth [1987] both found a similar reduction in recency with EOS processing, compared to their SBS results.

Ashton and Ashton's [1988a] results indicate that auditors' belief revisions are systematically affected by normatively irrelevant properties of evidence, such as
<table>
<thead>
<tr>
<th>Research</th>
<th>Subjects</th>
<th>Design</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tubbs, Messier, and Knechel</td>
<td>Experienced auditors</td>
<td>$2^3$ factorial.</td>
<td>Order effect approached significance for positive evidence. Authors did not explain interaction effects. Mixed evidence gave recency for SBS, no order effects for EOS.</td>
</tr>
<tr>
<td>Ashton and Ashton</td>
<td>Students and experienced auditors</td>
<td>Between-subjects factors were response mode, evidence order, and assigned anchors. Scenarios were abstract.</td>
<td>Supported the contrast predictions of C-IM. No order effects for consistent information, recency for mixed evidence. Dilution for EOS processing. Auditors showed tendency for disconfirmation.</td>
</tr>
<tr>
<td>Reed, Pei, and Koch</td>
<td>State performance auditors</td>
<td>$2^3$ factorial.</td>
<td>Significant effect for order of information. Recency was driven by positive information. State auditors had confirmatory bias.</td>
</tr>
</tbody>
</table>

Table 4

Accounting Research Employing the C-IM or C/SM
order and presentation mode. Their findings support the contrast predictions of the C-IM and C/SM, that positive evidence increases small anchors more than large, and that negative evidence discounts large anchors more than small. The experiments also showed no significant order effects for consistent negative and positive evidence. Their results were achieved under conditions of strong experimenter demand.

Ashton and Ashton [1988a] tested for response mode effects with consistent positive and consistent negative evidence. They found dilution for simultaneous or EOS processing of evidence, contrary to the explicit predictions of the C/SM. Ashton and Ashton [1988a] concluded that the contradiction could be explained if their auditor subjects were prone to both confirmation and disconfirmation.

Ashton and Ashton [1988b] have extended their study of auditor judgment. They applied the contrast/surprise model to determine whether auditors are evidence-prone (both confirmation- and disconfirmation-prone). They also tried to determine whether, unlike many experimental subjects, auditors weigh evidence which would disconfirm a hypothesis more than confirmatory information. Ashton and Ashton [1988b] used auditor and nonauditor (business executive) subjects.
Because auditors showed dilution of response for the SBS response mode, Ashton and Ashton [1988b] concluded that auditors are evidence-prone. The dilution effect was significant at conventional levels in just two of four experimental tasks. Business executives had no consistent pattern of dilution and were described as evidence-neutral. The inference drawn by Ashton and Ashton [1988b] is that auditors may be more sensitive to negative evidence than other subjects, because of auditors' training and education. Their interpretation of the experimental results "is contingent on the descriptive appeal of the Einhorn-Hogarth model," [Ashton and Ashton, 1988b, p. 19].

Reed, Pei, and Koch [1988] applied the C-IM to belief revisions of state performance auditors. Analysis of variance (ANOVA) procedures showed a significant main effect for order of information and an interaction between the order and form of evidence. Recency effects could not be accounted for by order alone, because there was no contrast effect for negative evidence. Positive evidence had more impact on belief than did negative evidence; Ashton and Ashton [1988a] found opposite results for private sector auditors. Reed, Pei, and Koch [1988] examined serial position effects, which they considered to be order effects for different types of evidence. They found no significant serial position effects for three specific information types.
Summary of Research Using the C-IM

The papers described above generally have supported the order effect predictions of the C-IM. In most cases, there were no order effects for consistent evidence and recency for mixed evidence. Ashton and Ashton (1988a) supported the model's predictions of contrast effects. Einhorn and Hogarth [1987] and Tubbs, Messier, and Knechel [1989] both reported interactions which cannot readily be explained with the C-IM. Response mode effects were mixed. Shanteau [1970] found dilution for the sequential or SBS response mode, while Einhorn and Hogarth [1987] and Ashton and Ashton [1988a] found dilution for EOS processing. The experiments together show the strong impact of task characteristics on the updating of beliefs.

Attribution Theory

Attribution theory (AT) is concerned with how people interpret the causal bases of events [Kelley, 1973]. It is a "cognitive theory of perceived causality," [Harrison, West, and Reneau, 1988, p. 308]. Attributions may be social perceptions about others or self-perceptions. In Kelley's [1973] view, AT concerns naive psychology, or the causal attributions of the man in the street. The assignment of causality is an everyday event which is central to people's understanding of their environment [Heider, 1958]. The actions people take based on information are consistent
with the attributions they make from the same information [Kelley, 1973].

Since the C-IM was developed recently by one research group, it is a coherent, unified theory. Attribution theory has developed over a thirty year period, and contributions have been made by many psychologists [Heider, 1958; Jones and Nisbett, 1972; Weiner, 1974]. As a result, there is no single version of AT. According to Kelley [1973], attribution theory is a loose set of plausible principles, rather than a well-organized theory.

**Causal Attributions**

Kelley [1973] developed two models for how people assess causality, based on different amounts of information. When people base an attribution on a single observation, they would use the discounting principle. This principle requires that the role of a given cause in producing an effect be discounted if there are other potential causes. Kelley [1973] assumed that, for multiple observations of a particular effect, people use covariation between the effect and potential causes to determine the most likely cause. He believed that people use a naive version of the analysis of variance technique to select a cause for an event. The ANOVA model for causality has been used as a theoretical model in accounting research [Harrison, West, and Reneau, 1988].
Heider [1958] wrote that people perceive the result of an action to depend on two sets of conditions, factors within the person involved, and factors in the environment. In assigning causality, individuals may refer to the effective force (ff) of the person or the environment, action outcome, \( x = f(\text{ff person, ff environment}) \). (13) In Kelley's [1973] ANOVA model for attributions, he assumed that people use consensus, distinctiveness, and consistency information (Cs, D, and Ct, respectively) in making attributions to a person or to the environment. Consistency information tells how uniformly a person responds to a particular stimulus or task. Consensus reveals whether other people behave in the same way, and distinctiveness answers whether the person responds in the same manner to other stimuli [Read, 1987]. Specific combinations of consensus, consistency, and distinctiveness fit either person or environment attributions. Other combinations are ambiguous or suggest interactions between the person, the circumstances, and the stimulus.

**Internal and External Attributions**

An attribution to a person or actor is an internal attribution, while assignment of causality to something in the environment is an external attribution. The pattern of information for an internal attribution generally is stated
to be high Ct, low D, and low Cs [Arrington, Bailey, and Hopwood, 1985; Harrison, West, and Reneau, 1988; Liden and Mitchell, 1985]. Some researchers have assumed that the pattern for an external attribution is opposite that for an internal attribution, as shown in Table 5 [Arrington, Bailey, and Hopwood, 1985; Brown, 1984; Liden and Mitchell, 1985]. Harrison, West, and Reneau 1988] used high Ct, high D, and high Cs to encourage external attributions. McArthur [1972] assumed that this pattern of information should lead to a stimulus attribution, which is more specific than an external attribution.

Table 5

Patterns for Internal and External Attributions

<table>
<thead>
<tr>
<th>Factor</th>
<th>Expected Attribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consensus</td>
<td>Internal Low</td>
</tr>
<tr>
<td>Consistency</td>
<td>Internal High</td>
</tr>
<tr>
<td>Distinctiveness</td>
<td>Internal Low</td>
</tr>
<tr>
<td></td>
<td>External High</td>
</tr>
</tbody>
</table>

Position Effects in Attributions

The term "position effects" is used in this research to mean the dependency of levels of belief on the positions of consensus, consistency, and distinctiveness information in a sequence of evidence. Position effects are not the same as the serial position effects proposed by Einhorn and Hogarth [1987] for the increasing inertia version of the
C-IM. Serial position effects refer to positive and negative evidence and not to different types of evidence, such as Cs, Ct, and D.

There is empirical evidence of position effects for the three types of information used in attribution research. McArthur [1972] presented Cs, D, and Ct evidence to subjects to test their patterns of attributions to the person, the stimulus, and the circumstances. Her general finding was that Ct and D accounted for far more of the variance in attributions than did Cs information. Results for Orvis, Cunningham, and Kelley [1975] were similar. These results were interpreted as showing that Cs was less important to attributions than the other information sources. Researchers looked for psychological reasons for the lack of importance of Cs information. Ruble and Feldman [1976] suggested that the findings for Cs might be an order effect. Earlier researchers had always presented information in the order, Cs, D, Ct, allowing recency to contribute to the weakness of Cs evidence. Ruble and Feldman [1976] used different information orders, and they found the effect of Cs evidence was much lower when presented first than either second or third. When all possible information sequences were used, the three variables (Cs, Ct, and D) all accounted for about the same percentage of variance. The position of presentation seemed to affect Cs only [Ruble and Feldman, 1976].
Elements of Internal and External Attributions

Heider [1958] identified two components of a person's causal force, a power factor and a motivational factor. The power factor is often represented by the person's ability. The motivational factor refers to the person's intentions and efforts. Effective personal force requires that neither of these factors be zero. Heider [1958] described the important properties of the environment as task difficulty and opportunity or luck.

Weiner et al. [1972] assumed that people use the elements of ability (A), effort (E), task difficulty (T), and luck (L) to assign causality for a task outcome, O,

\[ O = f(A, E, T, L) \]  \hspace{1cm} (14)

These four elements have two basic dimensions (Table 6), the locus of control and stability. Ability and task difficulty have stable characteristics, while luck and effort are more transitory [Weiner, 1974].

<table>
<thead>
<tr>
<th>Stability</th>
<th>Locus of control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed</td>
<td>Internal Ability</td>
</tr>
<tr>
<td>Variable</td>
<td>External Task difficulty</td>
</tr>
</tbody>
</table>

The elements A, E, T, and L can be combined into an internality score, which has been used as a dependent variable in
attrition research [Arrington, Bailey, and Hopwood, 1985; Harrison, West, and Reneau, 1988],

\[ \text{Internality} = A + E - (T + L). \] (15)

Subjects assign points to each of the four elements. The higher the internality score is, the more internal is the attribution.

**Biases in Attributions**

Attribution researchers have found systematic patterns in the attributions people make. Jones and Nisbett [1972] identified a tendency for actors and observers to make different attributions for the actor's behavior. Actors tend to make external attributions, while observers attribute causality to the actor. Experiments have shown that observers make internal attributions based on slim evidence [Jones and Nisbett, 1972]. They assign causality to the actor even when the actor's behavior occurred under constraints. The tendency of the observer to make internal attributions on the basis of slight evidence is so well-established that it has been labeled the "fundamental attribution error," [Harvey, Town, and Yarkin, 1981].

Informational asymmetry may contribute to the actor-observer bias. Actors and observers have access to different information. Actors are more aware of their emotional states and intentions. They may respond to a more extended sequence of events than that available to the
observer. Jones and Nisbett [1972] argued that the same information is processed differently by the actor and the observer. Different aspects of the information are salient for the two individuals. The action itself is more important to the observer. Situational cues have greater relevance to the actor, who views his or her behavior as an appropriate response to the environment [Jones and Nisbett, 1972]. There are circumstances in which the actor-observer bias may not occur. The more observers see themselves as similar to actors, the more their attributions are likely to parallel those of actors [Harvey, Town, and Yarkin, 1981].

An additional bias referred to by Harrison, West, and Reneau [1988] is the self-serving bias. They suggested that actors tend to take credit (make internal attributions) for their successes, and avoid responsibility (make external attributions) for their failures. For successes, the self-serving bias would counter the effects of the actor-observer bias. For failures, the two biases both predict actors will make external attributions.

Other patterns have been found in attributions. The administrative level effect is the expectation that individuals administratively distant from the actor will be biased toward internal attributions [Brown, 1984]. Observers with previous task experience may make more external attributions than observers without such
experience. The more a negative outcome affects the perceiver's welfare, the more likely it is that he or she will make an internal assignment. Compared to failure, success is attributed more to the person [Kelley and Michela, 1980].

Updating Attributions

Einhorn and Hogarth [1986] proposed a model for the updating of causal attributions, based on Kelley's [1973] discounting principle. They wrote that the four key concepts in assessing causality are the causal field or context; cues to causality, such as temporal order, similarity of cause and effect, and covariation; a model for combining the causal field and the cues; and the discounting of the strength of an explanation because of the existence of plausible alternatives. The model implies an anchoring-and-adjustment strategy for the updating of causal beliefs. The approach is Bayesian in a sense that the C-IM is not: it considers the effects of multiple hypothesized causes.

Accounting Experiments Based on Attribution Theory

Arrington, Bailey, and Hopwood [1985] (ABH) employed attribution theory in an auditing setting, while Shields, Birnberg, and Frieze [1981] (SBF) and Harrison, West, and Reneau [1988] (HWR) both examined attributions in
performance evaluations. Arrington, Bailey, and Hopwood [1985] and HWR used professionals in their experiments, while SBF conducted a survey and an experiment using MBA students. The papers by ABH, SBF, and HWR are summarized in Table 7.

Attribution theory has often been employed in achievement situations, where the event to be explained is a success or failure. Each of the accounting studies mentioned above involve success or failure: an audit which ended in litigation, a large unfavorable variance, and acceptable or unacceptable levels of performance in a manufacturing plant. Harrison, West, and Reneau [1988] and ABH used the internality scale, equation (15), as their dependent variable. Shields, Birnberg, and Frieze [1981] used several related scales.

Arrington, Bailey, and Hopwood [1985] found that auditors and small business owners (SBO's) appear to use different models for appraising auditors' performance. The business owners assigned causality to the auditor if any one piece of information (consensus, consistency, or distinctiveness) supported an internal attribution. Auditors appeared to use a compensatory model, requiring two pieces of internal evidence before they made this attribution. The different attributions seemed to result from motivational and information processing differences between the subjects. The results may not be generalizable
Table 7
Attribution Experiments in Accounting

<table>
<thead>
<tr>
<th>Researchers</th>
<th>Subjects</th>
<th>Issue</th>
<th>Research Design</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harrison, West, and Reneau</td>
<td>Managers playing subordinate and superior roles</td>
<td>In a variance investigation, will the attributions of the superior be more internal than those of the subordinate?</td>
<td>Dependent variables: internality score and information-seeking pattern. Factors: level of information; role; scenarios</td>
<td>Attributions by superiors were more internal than those of subordinates. The role effect was significant for ability, task difficulty, and effort. Superior sought more internal information than subordinates.</td>
</tr>
<tr>
<td>Arrington, Bailey, and Hopwood</td>
<td>CPA's and small business owners, SBO's</td>
<td>Do CPA's and business owners use different models to evaluate auditors' performance?</td>
<td>Dependent variable, internality score. Factors: consistency, consensus, and distinctiveness of information; occupation; scenarios</td>
<td>Consensus information was more important to CPA's than to SBO's. CPA's used multiple cues in making attributions. SBO's used single cue.</td>
</tr>
<tr>
<td>Shields, Birnberg, and Frieze</td>
<td>MBA students playing roles of superior and subordinate</td>
<td>Do superior and subordinate have different views of the cause for a subordinate's performance?</td>
<td>Open-ended questionnaire elicited information subjects use to make attributions. Experiment with response scales for different facets of attributions</td>
<td>Subordinates and superiors sought similar information. Subordinates' attributions were more external than superiors'.</td>
</tr>
</tbody>
</table>
beyond the subjects employed because SBO's may not be good surrogates for some larger segment of the business community.

Shields, Birnberg, and Frieze [1981] and HWR both supported the existence of the actor-observer bias. The subjects playing the role of the subordinate made more external attributions than did those in the superior role. After making the attributions, SBF's two subject groups sought similar information. Harrison, West, and Reneau [1988] found that superiors sought information to substantiate internal hypotheses, and subordinates tried to confirm external hypotheses.

Expectancy Theory

Expectancy theory (ET) is discussed in this literature review chapter because it models part of the performance evaluation process. Expectancy theory is a cognitive theory of motivation originated by Vroom [1964]. It describes how individuals choose between different levels of performance on the job. Vroom [1964] referred to performance levels as first-level outcomes. The choice between these behaviors depends on the second-level outcomes to which they may lead. Second-level outcomes include bonuses, raises, promotions, and penalties, which are contingent on performance [Galbraith and Cummings, 1967]. The instrumentality of a first-level outcome for a
second-level outcome is the perceived correlation between them. An individual's preference for a job behavior is determined by its instrumentality for second-level outcomes, and by the valence or desirability of those second-level outcomes. Valences can be positive or negative. An individual's job effort also depends on the expectancy, or probability, that a given level of effort will lead to achievement of the first-level outcome, successful performance.

In research using ET, the dependent variable has generally been effort, performance, or some measure of motivation. Independent variables have included measures of valence, instrumentality, and expectancy. House's [1971] expectancy model also includes intrinsic valences of effort and job achievement,

\[ M = IV_a + P_1[IV_b + P_2 EV_i] \quad i = 1, \ldots, n \]  

(16)

where

\[ M = \text{motivation to work} \]

\[ IV_a = \text{the intrinsic valence of successfully performing a task} \]

\[ IV_b = \text{the intrinsic valence associated with goal-directed behavior} \]

\[ EV_i = \text{the extrinsic valence associated with the } i\text{th extrinsic reward which is contingent on work-goal accomplishment} \]
The expectancy that goal-directed behavior will lead to achieving the work goal

\[ P_1 = \text{the expectancy that goal-directed behavior will lead to achieving the work goal} \]

\[ P_{2i} = \text{the expectancy that work-goal accomplishment will lead to receiving the } i\text{th extrinsic reward.} \]

The addition of intrinsic valences to the model recognizes that part of the variance in motivation can be explained by rewards internal to the work itself [Vroom, 1964].

Expectancy theory assumes the rationality of individuals. Like classical economics, it assumes that people act to optimize expected valence or value [Ferris, 1977]. A valence is an expected utility. The model assumes that people have preferences between outcomes or states of nature, and that they can choose between acts the one with the strongest positive or weakest negative force.

Expectancy Theory and Accounting Research

The issues which have been explored using expectancy theory include the effect of alternative budget levels and reward structures on performance [Brownell, 1983; Rockness, 1977], the impact of performance evaluation on how CPA's distribute their time among job tasks [Jiambalvo, 1979], and the ability of an ET model to predict employee migration decisions in a CPA firm [Dillard, 1979].

Several accounting researchers have criticized the expectancy model. Rockness [1977] criticized ET models for not incorporating multiple levels of performance, which may
offer different intrinsic and extrinsic rewards. He proposed an expectancy model which allowed for alternative work levels. Jiambalvo [1979] wrote that ET models' lack of complexity limits their applicability in real organizations. Expectancy models predict overall job effort, ignoring the many dimensions of job effort. Jiambalvo [1979] looked at job performance along each of several dimensions which are used in performance evaluation. Ferris [1977] developed four different expectancy models, both additive and multiplicative, with motivation defined in different ways.

Attribution Theory and Expectancy Theory

Birnberg, Frieze, and Shields [1977] tied attribution theory and expectancy theory together, within the context of the control processes of organizations. According to these authors, the attribution process begins with an achievement behavior interpreted by the actor or observer as a success or failure. The person uses available information, such as the subjective probability of success in the task (an expectancy, from the prior period), to make a causal attribution for the outcome. After assigning causality, the individual may formulate the probability of success for the next period. The attribution process affects the setting of expectancy, \( P_1 \) in equation (16), for future levels of performance.
The setting of an expectancy for the next period may be modeled as an anchoring-and-adjustment strategy. The anchor is the expectancy for the current period. It is adjusted to take into account the most recent performance [McMahan, 1973]. An attribution to stable internal sources should lead to an expectancy for the next period which is similar to the actual accomplishment for the current period. An attribution to an unstable cause provides little information for the appropriate adjustment of $P_1$. By affecting expectancy, attributions may influence actors' levels of motivation and their performance for succeeding periods.

A second element of House's [1971] expectancy model is the actor's (subordinate's) estimate of the probability of receiving a reward from the observer (superior), $P_{2i}$. The reward received at the end of the current period and the subordinate's understanding of the superior's attributions are useful in assessing the probability of receiving reward $i$ in the next period, given successful performance. Attributions help to explain subordinates' responses to reward structures and to the evaluation process.

The four variables explicitly associated with attribution theory are ability, effort, task difficulty, and luck. They are all relevant to expectancy theory. Expectancy theory is sometimes used as a model for
predicting effort. In writing about attribution theory, Heider [1958] identified motivation, a key ET variable, as a part of a person's causal force. Ability and task difficulty both influence the expectancy that a given level of effort will lead to successful performance. Expectancy theory is a probabilistic model which allows for luck or chance, just as AT includes luck or other unstable attributions. Expectancy theory is primarily a motivational theory, concerned with the states of mind which precede actions. Attribution theory predicts the interpretations which follow actions. In any situation which includes a series of actions, the two theories overlap.

**Performance Evaluation**

The existence of superior-subordinate relationships in business organizations leads to the requirement of periodic reviews of the subordinate's performance [Harrison, West, and Reneau, 1988; Shields, Birnberg, and Frieze, 1981]. Performance evaluation is a part of the control function in organizations. Its purpose is to determine whether the performance of managers, employees, or organizational subunits has met expectations. Expected performance is defined in terms of making a specified contribution to achieving organizational goals set by the top management of the company. Performance appraisal is intended to motivate
performance which will achieve those organizational goals. Organizational rewards to both superiors and subordinates may depend on the evaluated or measured level of subordinates' achievement.

The individuals who are evaluated may participate in setting the standards against which they are judged [Brownell, 1982]. A manager's performance may be evaluated on the basis of both qualitative and quantitative factors. The qualitative factors may be leadership ability, enthusiasm, and job-related effort. Quantifiable factors include product quality, innovation, success in meeting schedules, and the ability to control costs or increase profits or return on investment [Kaplan and Atkinson, 1989]. Managerial accountants traditionally have measured the quantitative factors, especially those which can be expressed in financial terms [Hopwood, 1972; Otley, 1978]. Accountants have advocated that performance should be measured in terms of effectiveness and efficiency [Young, Shields, and Wolf, 1988].

The use of accounting information in performance evaluation may be the most important organizational function served by accounting, from the perspective of individual managers, because of the immediate and personal impact. The use of budgets in performance evaluation may have considerable impact on a manager's subsequent performance [Otley, 1978]. Budgetary information may be
the only quantitative representation of a manager's performance.

A simplified model for performance evaluation is shown in Figure 2. Evaluation must be based upon some standards or criteria for desirable performance (link 1 in Figure 2). The standards are assumed to be set consistent with organizational goals. Accountants may be involved in formulating quantitative standards and in measuring performance relative to those standards.

Two questions must be answered in reviewing a subordinate's performance. First, did the subordinate achieve the desired level of performance? Second, if performance departed from the standard, why? (link 3) [Harrison, West, and Reneau, 1988]. Determining the cause for a variance or other deviation from expected results can allow corrective action (link 6) and may influence the organizational reward received by the subordinate (link 7). If the cause for nonstandard performance is found to be uncorrectable, standards or expectations for future performance may be revised (link 4). The model allows for the causal determination step to be bypassed when results approximate expectations (links 2, 5, and 8). Consistent with expectancy theory, the model assumes that the subordinate may be motivated by extrinsic rewards and by the intrinsic rewards of performing well on the job (links 9, 10, and 11).
Figure 2

Performance Evaluation Model

Set standards < 2 Evaluate performance in comparison to standards 3 Determine cause for exceptions

Motivate subordinate performance 4

Make decisions about personnel and resource allocation 5 6

Reward performance < 7

References supporting each of the numbered links:

<table>
<thead>
<tr>
<th>Link</th>
<th>References</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Hopwood, 1974b; Jiambalvo, 1979; Wendelken and Inn, 1981</td>
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<td>2</td>
<td>Harrison, West, and Reneau, 1988</td>
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<td>Ansari, 1979; Wendelken and Inn, 1981</td>
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<td>Hopwood, 1974a; Jiambalvo, 1979</td>
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<td>9</td>
<td>Otley, 1978; House, 1971</td>
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<td>11</td>
<td>House, 1971</td>
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The model is a simplified representation of the appraisal process because it does not specify who sets performance standards, or how they are set. It assumes that standards can be set and that measurement in accordance with the standards is unambiguous. The model omits interdependencies between organizational subunits. The psychological mechanisms involved in the evaluation process are not specified.

**Performance Evaluation Dimensions**

Thompson [1967] described two dimensions of the environment in which performance evaluation occurs. Performance standards (standards of desirability) may range from crystallized to ambiguous, and knowledge of cause-and-effect relationships can be complete or incomplete. Standards may be ambiguous when they include multiple dimensions. As Hopwood [1974a] suggested, the meaning of the term "performance" can be highly variable. It may mean the precise specification of a single output, or can require a multi-dimensional perspective, with some dimensions more objective than others. Knowledge of cause-and-effect relationships will be incomplete in open systems, where causal actions can have multiple effects, some of which cannot be proven, and some of which may not even be known. The two dimensions combine to give four cells shown in Table 8 [Thompson, 1967].
Table 8
Dimensions of Performance Evaluation

<table>
<thead>
<tr>
<th>Beliefs about cause-effect relationships</th>
<th>Complete</th>
<th>Incomplete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standards of Desirability</td>
<td>Crystallized</td>
<td>Cell I</td>
</tr>
<tr>
<td></td>
<td>Ambiguous</td>
<td>Cell III</td>
</tr>
</tbody>
</table>

In cells I and II, theoretically, there should be little difficulty in developing assessment devices. In these cells, most currently-used managerial accounting assessment tools are appropriate [Hayes, 1977]. Cell II does involve uncertainty. The assignment of causality may introduce conflict between subordinate and superior. For companies in cells III and IV, assessment methods are contingent on the specific situations faced by organizational subunits [Hayes, 1977]. These assessments may require qualitative rather than quantitative information.

Performance Evaluation Research

Hopwood [1972] inspired a series of papers on the style of use of accounting data in performance evaluation. He believed that accounting data are necessarily incomplete measures of subordinate performance, and that there are no comprehensive measures. Accounting data measure outcomes. To the extent that outcomes are influenced by factors
outside a manager's control, accounting numbers give an inadequate image of the manager's performance. For a fair evaluation, the controllable component of reports should be identified, but such identification may be impossible. Hopwood [1972] believed that, since accounting numbers are incomplete performance measures, they should be used with discretion and flexibility in the appraisal process.

Hopwood [1972] suggested that there are three evaluation styles which make different use of accounting data,

1. Budget constrained style, in which evaluation is based mainly on the manager's ability to meet the budget on a short-term basis. Accounting data are interpreted literally or rigidly.

2. Profit conscious style, with subordinates evaluated on their ability to control long-run costs. Accounting data are used carefully and flexibly.

3. Nonaccounting style, in which the superior places little emphasis on accounting data.

Hopwood [1972] found that the budget constrained style was associated with more job-related tension and more dysfunctional behavior than either the profit conscious or the nonaccounting style.

strong interdependencies between subunits. Otley [1978] carried out a similar study in an organization with largely independent subunits. Such a company might be well-suited to the use of budgetary controls. Otley [1978] found that the budget constrained style was not associated with increased levels of job or budget tension in this company.

Hirst [1981, 1983] proposed that the adequacy of accounting performance measures may depend on the degree of task uncertainty for an organizational subunit. Accounting performance measures may be well-suited to situations of low task uncertainty, which to Hirst [1981] were situations of relatively complete knowledge of cause-and-effect relationships. For subunits performing nonroutine tasks, or exposed to outside influences, accounting numbers are incomplete measures of performance. Hirst [1981] found high reliance on accounting performance measures to reduce dysfunctional behavior in situations of low task uncertainty and to increase dysfunctional subordinate behavior where task uncertainty is high. Both Otley [1978] and Hirst [1981, 1983] found that the effect of reliance on accounting performance measures depends on organizational and technological characteristics.

Govindarajan [1984] found environmental uncertainty to have a significant moderating role between leadership evaluation style and measures of organizational effectiveness. Managers of successful subunits with low
environmental uncertainty tend to be evaluated using clearly defined formulas. In successful organizational subunits with high environmental uncertainty, evaluation is more subjective. The match between uncertainty and evaluation style is less precise for less successful subunits. Brownell [1982] found that high budget emphasis has a positive effect on performance, so long as budget participation is also high. The impact of supervisory appraisal style is moderated by budgetary participation.

The research by Hopwood [1972], Hirst [1981, 1983], Otley [1978], and Govindarajan [1984] suggests that superiors and subordinates may disagree over the extent to which quantitative accounting data should be utilized in the appraisal of performance. Under at least some organizational conditions, subordinates prefer that the senior manager not emphasize strict adherence to the budget. The use of budgetary data in a manner inconsistent with the organizational environment may be associated with an increase in dysfunctional subordinate behavior.

Another facet of performance appraisal which may increase conflict between superior and subordinate is the determination of controllability. One of the most widely-accepted tenets of managerial accounting is that a manager's performance should be evaluated by focusing on the aspects of performance over which he or she has control [Demski, 1976]. The controllability of costs and outcomes
cannot be objectively determined and may be a source of conflict between subordinates and senior managers [Shields, Birnberg, and Frieze, 1981].

As Hayes [1977] wrote, the use of managerial accounting information for performance evaluation is "a critical aspect of the decision-making function" in organizations [p. 22]. The retention, promotion, and reward of needed individuals are key factors in the success of an organization. Performance evaluation decisions play a vital role in these functions [Jiambalvo, Watson, and Baumler, 1983].

Performance evaluation is a sequential, ongoing process. Information is received over time, and formal evaluation occurs at intervals. Superiors have an evolving, developing impression of the subordinate's effort, ability, and overall performance. Knowledge of the subordinate's most recent performance affects the superior's understanding of the subordinate and of his or her task environment. Performance information may also influence subordinates' understanding of themselves. Performance appraisal occurs in an environment characterized by uncertainty. Generally, no one piece of evidence can prove or disprove an assertion about performance. Instead, opinions about the quality of performance are based on the cumulative weight of evidence received over a period of time.
This research applies the contrast-inertia model (C-IM) to the updating of attributions in performance evaluation. The work integrates the C-IM and attribution theory (AT), but does not explicitly include expectancy theory (ET), which was described in the literature review chapter. Sections of this chapter (1) contrast AT and ET and explain why ET does not influence the research design; (2) show the relevance and significance of AT to performance evaluation; (3) explain the rationale for integrating the C-IM and AT; and (4) describe the methods of combining the two models.

Expectancy Theory and Attribution Theory

Kelley and Michela [1980] proposed a general model for attribution research, shown in Figure 3.

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**Figure 3**

**Attribution Model**

<table>
<thead>
<tr>
<th>Antecedents</th>
<th>Attributions</th>
<th>Consequences</th>
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</thead>
<tbody>
<tr>
<td>Information</td>
<td>Perceived Causes</td>
<td>Behavior</td>
</tr>
<tr>
<td>Beliefs</td>
<td>Link 1</td>
<td>Affect</td>
</tr>
<tr>
<td>Motivation</td>
<td>Link 2</td>
<td>Expectancy</td>
</tr>
</tbody>
</table>
They divided attribution research into two broad categories. Some researchers have concentrated on the antecedents of attributions (Link 1), while others have studied the consequences of attributions (Link 2). There has been little overlap between the two areas of study. This research focuses on the role of information as an antecedent of causal attributions. Because the consequences of attributions are not examined, there is no direct connection to expectancies.

Two dimensions of attributions are the locus of control (internal or external) and stability (fixed or variable) [Weiner, 1974]. The dimension relevant to this research is the locus of control. Changes in expectancy are affected more by the dimension of stability. Attributions to fixed or stable causes are thought to influence expectancy differently than attributions to unstable causes [Valle and Frieze, 1976]. In this study there is no manipulation of the stability of attributions. Further research in accounting may address the consequences of attributions in performance evaluation as well as their antecedents.

**Attribution Theory and Performance Evaluation**

In attribution experiments, subjects are required to make attributions. Some researchers have questioned whether people engage in attributional behavior in everyday
Weiner [1985] found that spontaneous attributional thinking is particularly likely for unexpected occurrences, and for failure, as opposed to success. Unanticipated failure or failure of unexpected magnitude may motivate a search for causes.

People make attributions spontaneously when they perceive that they depend on others [Hastie, 1984]. In performance appraisal situations, subordinates and superiors are interdependent. Rewards to superiors may depend on the achievement of their subordinates. Subordinates' rewards depend directly on the opinions of their superiors. Attribution research supports the assumption underlying this research, that both subordinates and superiors make attributions for job-related outcomes, particularly for failures.

Management control systems are a rich area for the application of attribution theory [Birnberg, Frieze, and Shields, 1977]. The theory has most often been used in research about leadership [Liden and Mitchell, 1985]. Many AT writers [Jones and Nisbett, 1972; Kelley, 1973; Harvey, Town, and Yarkin, 1981; Brown, 1984] have included two roles in their research, an actor and an observer. In business contexts, actors and observers are usually subordinates and superiors, respectively. These roles frequently have been included in performance evaluation research [Harrison, West, and Reneau, 1988; Hirst, 1981,
An important element in performance evaluation is the determination of those outcomes for which an individual manager can be held responsible. Attributions may be made to persons at different levels within an organization or to circumstances beyond anyone's control. Different individuals within an organization may assign causality for events in different ways. For several years there has been increasing interest in examining the assessment of causality in performance evaluation [Shields, Birnberg, and Frieze, 1981].

The Contrast-Inertia Model and Attribution Theory

The contrast-inertia model and attribution theory may be combined to give a more complete model of performance evaluation than either model alone. The C-IM could be considered a process model, and AT is a descriptive model for the roles involved in performance evaluation.

The C-IM is a model for revising opinions about the truth of a hypothesis [Einhorn and Hogarth, 1987]. In the model, the nature and origin of the hypothesis are not specified. The possible influence of the source or development of the hypothesis on later belief changes

The initial attribution made in achievement situations is a tentative hypothesis of causes for specific behavior [Harrison, West, and Reneau, 1988]. The attribution may be to the person (actor) whose behavior is observed, to the stimulus or task, to the particular time or circumstances, or to any interaction of these factors [Kelley, 1973; Ross and Anderson, 1982]. Attribution theory may be simplified to include two classes of attributions: those made to the actor (internal attributions), and those to his or her environment (external attributions) [Heider, 1958].

Superiors may be motivated to make either internal or external attributions (see the section on attribution biases in the preceding chapter). Because of the widespread support for the actor-observer bias [Harrison, West, and Reneau, 1988; Jones and Nisbett, 1972], I assume that superiors generally make more internal attributions than subordinates. In the experiments, task hypotheses were assigned to subjects consistent with their roles. Subjects playing the role of subordinate updated their beliefs with respect to external hypotheses. Those assigned the superior role considered only internal hypotheses.

The C-IM as developed by Einhorn and Hogarth [1987] is a one-person model. If it were applied alone in a
performance evaluation experiment, only one role could be considered, presumably that of the superior. Performance evaluation research which does not include the subordinate's role and actions is incomplete [Birnberg, Frieze, and Shields, 1977]. Attribution theory can be applied to both self-perceptions and perceptions of another's behavior. Merging it with the C-IM allows simultaneous consideration of the changing beliefs of both superiors and subordinates.

Attribution theorists have recognized the need of an updating model for attributions [Kelley and Michela, 1980]. Harrison, West, and Reneau's [1988] subjects performed a static accounting task which required attribution formation but not belief revision. The authors suggested that the lack of revision was a limitation of their work which future research might address.

The updating of beliefs involves sequential processes for which a theoretical model is needed. Bayes's theorem has been used to model the attribution updating process [Ajzen and Fishbein, 1975]. Bayes's theorem may not be satisfactory as a descriptive model for updating attributions [Kelley and Michela, 1980]. The application of the theorem would be cognitively complex. In other belief updating research, Bayes's theorem has not adequately accounted for task and presentation mode effects [Doherty,
Einhorn and Hogarth [1986] published a discounting model for the updating of attributions (Chapter 2). Causal beliefs would be updated by discounting them for the strength of new, alternative explanations. This updating model requires complex calculations because it generally involves several causal hypotheses. There is no simple prediction for how new evidence affects the level of belief in one hypothesis. Einhorn and Hogarth's [1987] belief updating model, the contrast-inertia model, has been applied to causal hypotheses, but it has not previously been used for the updating of attributions for success or failure. A contribution of this research is the application of the C-IM to attributional hypotheses.

The Contrast-Inertia Model and Updating of Attributions

This study employs the constant inertia model. Subjects' sensitivities to positive and negative evidence are assumed constant for the duration of each task. With constant inertia, the C-IM predicts order effects (recency) for mixed positive and negative evidence and no order effects for consistent positive or negative evidence. These predictions suggest patterns which may occur in the updating of attributions.
The C-IM predicts contrast effects. Contrast effects mean that the magnitude of the adjustment to new evidence depends on the strength of the anchor. Contrast effects are not relevant to any of the experimental hypotheses for this research. The contrast/surprise model [Einhorn and Hogarth, 1985] includes response mode effects. The two response modes are simultaneous or end-of-sequence (EOS) and sequential or step-by-step (SBS). Response mode effects may be relevant to the use of managerial accounting information within organizations. The SBS experimental response mode is a reasonable representation of belief revision for a manager who receives frequent, detailed feedback from the operations of a department. The use of EOS responses may represent the belief revision process of managers who evaluate departments less frequently, on the basis of summarized information. This research applies the SBS response mode only. It does not test response mode effects.

If two individuals who have different strengths of belief in a hypothesis update their opinions for new information, their beliefs may converge or diverge. The change in their relative beliefs (convergence or divergence) depends on their sensitivities to positive and negative evidence [Einhorn and Hogarth, 1987]. If the two people have equal nonzero $\alpha$'s and equal nonzero $\beta$'s (sensitivity to negative and positive evidence,
respectively), their levels of belief will converge with the evaluation of new information. If the two persons' \( \alpha \) and \( \beta \) parameters differ asymmetrically, their beliefs will diverge with new evidence.

The issue of convergence or divergence of beliefs in these experiments is not concerned with a single hypothesis. Superior and subordinate subjects updated their beliefs with respect to opposite hypotheses, internal and external, respectively. Because the assigned task hypotheses were consistent with the actor-observer bias, both subordinates and superiors should have been advocates, with \( \beta \) greater than \( \alpha \). Individuals who are advocates may also be described as biased toward confirmation [Einhorn and Hogarth, 1978; Reed, Pei, and Koch, 1988]. With mixed evidence, both groups of subjects are predicted to strengthen their causal opinions, a divergence of opinions between superiors and subordinates. Divergence of beliefs also is predicted for consistent internal or external evidence.

Einhorn and Hogarth [1987] tried to manipulate subjects' \( \alpha \) and \( \beta \) parameters. They wanted subjects to act as advocates or skeptics. By assigning task hypotheses consistent with the actor-observer bias, I expected to create two advocate subject groups, similar to the manipulation Einhorn and Hogarth [1987] attempted. One result of decreasing \( \alpha \) or \( \beta \) is a reduction in order effects.
Information and Attributions

Attribution theory was instrumental in the selection of task hypotheses for these experiments. It also guided the choice of updating information. According to Weiner [1974], people use consensus, consistency, and distinctiveness information (Cs, Ct, and D, respectively) in making attributions. The updating information in these experiments is Cs, Ct, and D. All three information sources are relevant to a performance evaluation task.

In performance evaluation, consensus means the degree of similarity between the performance or results of different managers or responsibility centers. Within an organization, bad performance in many units (high consensus) suggests a company-wide cause. Low Cs (the performance in a department was worse than most) moves the attribution internal to the department and perhaps to its manager. The use of Cs information in the experiments is consistent with a tradition of making comparisons between organizational units in performance evaluation. Consensus evidence may be more available to the superior than either distinctiveness or consistency information [Brown, 1984].

Distinctiveness evidence compares a manager's performance on the task currently being examined to his or
her performance on other appraisal dimensions or tasks [Kelley and Michela, 1980]. The use of distinctiveness evidence in a performance evaluation experiment is consistent with the assertion that a manager should not be evaluated on any one dimension alone. Several dimensions are usually necessary to capture the quality of performance [Jiambalvo, Watson, and Baumler, 1983]. Consistency is the stability of a manager's performance over time. A superior who weighs consistency evidence compares performance in the current period with previous periods. Consistency information allows the evaluator to examine trends in performance.

Kelley [1973] wrote that different patterns of Cs, Ct, and D information suggest different attributions. If the three information sources are dichotomized into high and low levels, patterns for internal and external attributions can be stated (Table 5 in Chapter 2). The task hypotheses in this experiment make internal or external attributions for performance. Internal updating evidence (high Ct, low D, or low Cs) should be positive with respect to the internal hypothesis and negative for the external hypothesis. Opposite relationships apply for external updating information (low Ct, high D, or high Cs).

Position Effects in Attributions

In these experiments, there may be effects for the order in which internal and external evidence are
presented. There may also be position effects due to the positions of Cs, Ct, and D information. The experiments are designed to prevent position effects from confounding order effects. The experimental designs employ multiple combinations of source and sign of information, to allow tests for main effects of both position and order of information.

As described in the previous chapter, position effects have been found in the formation of attributions [Ruble and Feldman, 1976]. The C-IM does not account for position effects. The increasing inertia form of the model can be used to explain serial position effects, but it would not seem to account for Ruble and Feldman's [1976] results. They observed the position effect only for one information source, Cs, and the effect observed was recency. Increasing inertia could be invoked for a primacy effect across Cs, Ct, and D information. Ruble and Feldman's [1976] results indicate the need to avoid confounding of potential order effects by the position of information.

Summary

The formation and revision of causal beliefs are important in the evaluation of managerial performance. Both subordinate and senior managers are likely to assign causality for performance problems (or achievement) in the subordinate's domain of responsibility. Managers may apply
accounting information in forming or revising their opinions about the causes for performance outcomes.

The contrast-inertia model and attribution theory are integrated in this research to provide a model for the updating of causal opinions. According to attribution theory, superiors and subordinates make different attributions for the subordinate’s performance. Given the same information, the initial attribution of the superior will be more internal than that of the subordinate. This research is concerned, not with the formation of attributions, but with their revision. I assume that the actor-observer bias, which has been observed in attribution formation, will influence the belief revision processes of superiors and subordinates. The contrast-inertia model is used to describe how causal beliefs evolve as additional information is received. The C-IM describes how biases may influence opinion changes.

The combination of the contrast-inertia model and attribution theory leads to four testable predictions. The theoretical basis for each prediction is given in parentheses.

1. The actor-observer bias will be manifest in the initial strength of causal beliefs for subordinates and superiors (AT).
2. The causal opinions of superiors and subordinates will diverge as they receive new evidence, whether the evidence is internal, external, or mixed (AT and the C-IM).

3. Belief revision for subordinates and superiors will be nonnormative, or nonBayesian. For mixed evidence, the order effect of recency is expected. There will be no order effects for consistent internal or external evidence (C-IM).

4. The positions of different types of evidence (consensus, consistency, and distinctiveness) will not affect opinion revisions (C-IM).

Predictions 1 and 2 relate to superior and subordinate role effects or role bias. The second prediction is concerned with the relationship between the viewpoints of superiors and subordinates. The remaining predictions (3 and 4) concern the effects of procedural or task details on the opinions of individual managers. The four predictions form the basis of the experimental hypotheses in Chapter 4. The results related to these predictions are described in Chapter 5.
CHAPTER 4

METHODOLOGY

This chapter contains descriptions of the experimental design, the hypotheses, subject selection, subject characteristics, and experimental procedures. The first section of the chapter contains a brief discussion of the order effects, position effects, and the divergence of beliefs between subordinates and superiors which are examined in this research. The second part of the chapter analyzes the use of within-subject factors in factorial-design experiments. The third section supports the roles assigned to subjects in the experiments. The next parts of the chapter contain the experimental design and the scenarios (types of tasks) employed in the experiments. Each of the hypotheses is discussed and justified theoretically. The concluding segments of the chapter are subject selection, description of the subjects and their reactions to the experimental tasks, the experimental procedures, and the chapter summary.

Order, Position, and Divergence of Belief Effects

The central issue of this research is the adequacy of the contrast-inertia model (C-IM) as a descriptive theory
for the updating of attributions in performance evaluation. Einhorn and Hogarth [1987] predicted that order effects may occur during opinion revisions. The term "order effects" refers to different amounts of changes in beliefs, depending on the order of positive and negative (or weak and strong) updating evidence. My experiments test for the occurrence of order effects in performance evaluation tasks.

Attribution researchers have found that the information sources which are relevant to the attribution process are consensus (Cs), consistency (Ct), and distinctiveness (D) information. In this study, the term "position effects" means the sensitivity of belief to the sequence of Cs, Ct, and D information. There is empirical evidence that position effects occur in the formation of attributions [McArthur, 1972; Ruble and Feldman, 1976], but there have been no tests for such effects in the updating of attributional beliefs. These experiments test for position effects in the revision of beliefs about performance.

The C-IM and attribution theory (AT) together predict that the causal beliefs of subordinates and superiors are likely to diverge when they assimilate the same new information. This prediction depends on the two groups having different initial beliefs and on members of both groups being more sensitive to positive than negative
evidence. The experiments are designed to allow detection of divergence of beliefs.

**Within- and Between-Subjects Factors**

The three attribution revision experiments have complex factorial designs. Some of the variables could be between-subjects or within-subject factors. The use of within-subject factors has sometimes been criticized [Greenwald, 1976]. Each subject in such a design is exposed to several or all experimental treatments, risking contamination between treatments. Some subjects' responses may be determined by their interpretations of the manipulations they observe [Ashton and Ashton, 1988a]. Within-subject designs should be avoided if one treatment may still be effective when another begins.

Within-subject factors have potential advantages in experiments. Their application may increase the external validity of an experiment. In their normal daily activities, people often are exposed to multiple levels of a stimulus (multiple treatment levels). In an experiment which involves control groups, the use of within-subject factors allows subjects to serve as their own controls. Treatment differences are not confounded with subject differences, as they are with between-subjects factors. The result is an increase in the power of the design, compared to a between-subjects design with the same number
of observations [Greenwald, 1976]. Practical concerns in the design of an experiment include the total number of subjects needed and the number of tasks to be performed by each subject, which affects how long the experiment takes. Using between-subjects factors increases the total number of subjects. Relying on within-subject factors lengthens the experiment for each subject. A compromise may be reached with some factors between subjects and others within subjects.

Role Assignments

Subjects participated in three performance evaluation experiments. In part of Experiment 1, subjects took nonrole or observer positions. The remainder of Experiment 1 and all of Experiments 2 and 3 were performed in the role of superior or subordinate. The role/nonrole-manipulation was a within-subject factor, allowing subjects to act as their own controls. To prevent possible contamination of role effects between tasks, the role assignment (superior or subordinate) was handled as a between-subjects factor.

The experimental hypotheses can be tested by comparisons between superiors and subordinates, and between role task and nonrole task results. The employment of superior and subordinate roles is justified because both roles are essential to performance evaluation [Birnberg, Frieze, and Shields, 1977; Harrison, West, and Reneau, 1988]. The
superior and subordinate roles have been included in other attribution experiments [Harrison, West, and Reneau, 1988; Shields, Birnberg, and Frieze, 1981].

In these experiments, the superior and subordinate role assignments were expected to influence subjects' sensitivity to negative and positive evidence. Elicitation of the subjects' nonrole judgments allows evaluation of the success of the role assignment. The inclusion of nonrole tasks provides control groups for the role assignments. According to the C-IM, advocacy (confirmation bias) reduces recency effects for mixed positive and negative evidence [Einhorn and Hogarth, 1987]. A strong test of order effect predictions can only be achieved with subjects who are not expected to be biased.

There are no attribution experiments in the literature which have nonrole tasks and subordinate and superior role groups. Many attribution experiments have had nonrole or observer subjects [Feldman, Higgins, Karlovac, and Ruble, 1976; McArthur, 1972, 1976; Orvis, Cunningham, and Kelley, 1975; Tukey and Borgida, 1983]. In these experiments, subjects made attributions for others' behavior without assuming any role. The parallels between my use of nonrole subjects and earlier research are not exact. The earlier experiments had shorter and simpler tasks, and the tasks were not likely to stimulate strong subject involvement. The subjects in my experiments may have been prone to take
either a superior or a subordinate attitude toward the nonrole tasks, depending on which role is more important to them on the job. After the subjects completed the experiments, a manipulation check elicited their attitudes toward the nonrole tasks.

Regan and Totten [1975] performed an experiment which suggests that subjects may assume a role perspective, upon instructions from the experimenter. They gave different instructions to two groups of subjects. One group was instructed simply to observe an actor's behavior. The other group was told to empathize with the actor. Regan and Totten [1975] found that the empathizing subjects made less internal attributions; they adopted the actor's viewpoint. The manipulation was between subjects for Regan and Totten [1975]. I employed a within-subject manipulation in which subjects were asked to adopt the subordinate or superior role during the course of the experiment, rather than empathizing with one of the roles.

The Experimental Design

The design for Experiment 1 is summarized in Table 9. Appendix B contains alternate representations for the designs of all three experiments. In the first experiment, the task hypotheses for superior (subordinate) role subjects are internal (external), consistent with findings from previous attribution research [Harrison, West, and
### Table 9

**Experimental Design, Experiment 1**

**Between-subjects factors:**
- **A** Task hypothesis and role 2 levels, \( a = 2 \)
  - \( A_1 \) = Internal task hypothesis and superior role
  - \( A_2 \) = External task hypothesis and subordinate role
- **B** Order of information 2 levels, \( b = 2 \)
  - \( B_1 \) = Internal/external order of evidence
  - \( B_2 \) = External/internal order of evidence

**Within-subject factors:**
- **C** Nonrole/superior and nonrole/subordinate tasks 2 levels, \( c = 2 \)
  - \( C_1 \) = Nonrole assignment
  - \( C_2 \) = Role, superior or subordinate
- **D** Position of information 2 levels, \( d = 2 \)
  - \( D_1 \) = Position of information, \( C_t \) preceding \( C_s \)
  - \( D_2 \) = Position of information, \( C_s \) preceding \( C_t \)

The letter "G" represents specific combinations of the levels of the between-subjects factors, \( A \) and \( B \).
- \( G_1 = A_1 \) and \( B_1 \) = Superior, order 1 (Super1)
- \( G_2 = A_1 \) and \( B_2 \) = Superior, order 2 (Super2)
- \( G_3 = A_2 \) and \( B_1 \) = Subordinate, order 1 (Subor1)
- \( G_4 = A_2 \) and \( B_2 \) = Subordinate, order 2 (Subor2)

In the experimental design, the solid horizontal lines define groups of subjects, while the broken lines separate experimental tasks for a group of subjects. Because there are two between-subject factors, each at two levels, there are four experimental groups. Each group of subjects performed four separate tasks.

- Number of subjects per group = \( n \)
- Total number of subjects = \( abn = 4n \) (\( a = b = 2 \))
- Number of tasks/subject = \( cd = 4 \) for Experiment 1
- Total number of observations = \( abcdn = 16n \)
Reneau, 1988; Jones and Nisbett, 1972]. In Experiment 1, there are two between-subjects factors which divide the subject pool into four groups. Two groups have internal task hypotheses, Super1 and Super2 (superior, order 1 and superior, order 2). For the two other groups, Subor1 and Subor2 (subordinate, order 1 and subordinate, order 2), the task hypotheses are external. There are both internal and external updating cues in the first experiment.

In Experiments 2 and 3 (summarized in Table 10), there are two between-subjects factors, each at two levels: task hypothesis/role, and order of information. The only within-subject factor, position of information, also occurs at two levels. In Experiment 2, the updating evidence is consistent and external. The experimental evidence should be viewed as positive by subordinate subjects and as negative by superior subjects. Evidence from Experiment 3 is entirely internal. Experiments 2 and 3 do not include the nonrole assignment.

The second and third experiments each involve two tasks for every subject. Together, the three experiments give eight updating tasks per subject. The two nonrole tasks from Experiment 1 were performed in random order before any of the role tasks, to prevent contamination from the role adoption. The role assigned was always consistent with the task hypothesis. The subordinate role was paired with the external hypothesis, and the superior role was
Table 10
Experimental Design, Experiments 2 and 3

Between-subjects factors:
A Task hypothesis and role 2 levels, a = 2
   A₁ = Internal task hypothesis and superior role
   A₂ = External task hypothesis and subordinate role
B Order of information 2 levels, b = 2
   B₁ = Strong/weak order of evidence
   B₂ = Weak/strong order of evidence

Within-subject factor:
C Position of information 2 levels, c = 2
   C₁ = Position of information, D preceding Cs
   C₂ = Position of information, Cs preceding D

Representation of the Design for Experiments 2 and 3

Super1   Subor1
G₁C₁ | G₁C₂
   G₁C₁ | G₁C₂

Super2   Subor2
G₂C₁ | G₂C₂
   G₂C₁ | G₂C₂

The design is the same for the two experiments. The direction of evidence (internal or external) and the scenarios differ between Experiments 2 and 3. The letter "G" represents combinations of the levels of factors A and B.

Because there are two between-subject factors, each at two levels, there are four groups for each experiment. Every subject did two tasks in Experiment 2 and two in Experiment 3. The role assigned in Experiment 1 (superior or subordinate) is retained in Experiments 2 and 3.

Number of subjects per group = n
Total number of subjects = abn = 4n  (a = b = 2)
Number of tasks/subject = c = 2 for Experiment 2 and 2
   for Experiment 3.
Total number of observations/experiment = abcn = 8n
matched with the internal hypothesis. Once a subject received a role assignment, the same role was maintained throughout the rest of the experiment. The six role tasks (two each from Experiments 1, 2, and 3) were performed in random order following the nonrole tasks.

Experimental Scenarios

In the three experiments, three different scenarios were used to increase the generalizability of results. The actual scenarios and instructions to the subjects are shown in Appendix C. In Experiment 1, subjects evaluated performance in terms of the control of costs. The scenario involves an unfavorable labor variance. The two scenarios in the second and third experiments pertain to failures to meet a production schedule and to achieve acceptable product quality. By including diversified scenarios, the experiments cover three potential dimensions for performance evaluation [Kaplan and Atkinson, 1989].

Table 11 contains two sample scenarios, from Experiments 2 and 3. The two scenarios are subordinate and superior role tasks, respectively. The role assignments are made in the brief instructions preceding each task. The role is reinforced by the use of personal pronouns in the body of each scenario (for example, "You are the manager," "your superior," or "your subordinate"). The superior tasks include a statement that the superior's compensation and job
Table 11

Experimental Scenarios

Experiment 2, Subor2: Task Z

Instructions: In this task, please imagine that you are the subordinate whose performance is to be evaluated by a superior.

You are the manager of a production department in a large manufacturing plant and have held that position for almost one year. Your superior, M. Warner, recently transferred here from a similar position at another plant. This month, your department failed to finish on time an order for an important customer. Company managers are concerned that the customer may be lost to a competitor. An investigation into the causes of the failure to meet the job deadline has been ordered, to prevent such problems in the future. Your superior, Warner, is responsible for the investigation.

State your initial estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the failure to meet the order deadline was due to factors other than your management of the department.

Probability estimate

Experiment 3, Super2: Task AB

Instructions: In this task, please imagine that you are the superior, and that you are evaluating one of your subordinates.

Chris Smith, your subordinate, is the manager of a production department in a large manufacturing plant. Smith has managed the department for several months, and you recently transferred to your current responsibilities from a similar position in another part of the company. Questions have been raised about the quality of work being done in the department. An important customer reported product defects traceable to the department. Company managers are concerned that they may lose this customer or other customers. They have ordered an investigation into possible causes of the low product quality. As Smith's superior, you are in charge of the investigation. Your compensation and job rating may be influenced by the performance of Smith's department.

State your initial estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the poor product quality was related to Smith's management of the department.

Probability estimate
rating may be affected by results from the subordinate's department. The statement is part of the superior role manipulation. Its purpose is to emphasize that the superior has an important stake in performance evaluation. For the nonrole tasks, subjects are asked to adopt the viewpoint of an outsider to the performance evaluation situation. In the nonrole scenarios, names are given for both superiors and subordinates, and no pronouns are used for either person (Appendix C).

In the scenarios, the names given for superiors and subordinates are intended to avoid any biased responses for race or gender [Wendelken and Inn, 1981]. The last names are all simple and familiar throughout this country (Smith, Warner, Wilson). In a few cases, first names which can be either male or female are used. In most of the scenarios, no first names are given, only initials. There are no pronouns which would indicate the gender of the superior or subordinate.

In all the experimental scenarios, the subordinate has managed the department for several months or more. The subordinate's experience is long enough that a meaningful pattern of consistency of results could have developed. Although the superiors in the scenarios have managerial experience similar to their current responsibilities, they came to their current positions recently. The superiors are all described as new to their jobs, so that they might
reasonably rely on accounting information in evaluating the subordinate. Managers who have held their positions for some time may place less reliance on accounting information in performance evaluation [Hopwood, 1972].

After reading the scenario, subjects stated their levels of belief in the task hypotheses. They responded with numbers from 0 to 100. A response of 100 means that the participant was completely certain that the given statement is true (see Table 11 or Appendix C). An answer of 0 indicated complete certainty that the statement is false. A value of 50 means that the individual was equally uncertain whether the statement is true or false. Similar response scales were used by Einhorn and Hogarth [1987] and Reed, Pei, and Koch [1988].

Each scenario is followed by three or four pieces of updating information. The updating items are consistency, consensus, and distinctiveness evidence. The experimental design allows testing for some effects of the position of Ct, Cs, and D. The experiments do not include all possible arrangements of the information types. To include all arrangements in this research would make the experimental designs more complex and would require large numbers of subjects. In Experiment 1, the effects of Cs and Ct positions are tested. The position of distinctiveness is not manipulated. In Experiments 2 and 3, Cs and D are tested. Consensus evidence is tested in all the
experiments because existing empirical results have shown that there may be position effects for Cs [Ruble and Feldman, 1976]. Some position effects, including possible interactions between the three forms of information, may escape detection in these experiments.

Hypotheses

The experimental hypotheses may be divided into four groups,

1. Hypotheses of bias or role effects for superiors and subordinates

2. Predictions about order effects in the use of managerial accounting information

3. Propositions about divergence of beliefs between superiors and subordinates

4. Hypotheses concerning position effects

The discussion of the experimental hypotheses is organized by these four categories. All hypotheses are presented in the null form.

Role Effects Hypotheses

In these experiments, subordinates (superiors) were assigned external (internal) task hypotheses. In Experiment 1, the subjects formed judgments from a nonrole perspective, and then performed duplicate tasks as either superior or subordinate. In each task, the subjects read
the scenario and stated their levels of belief with respect to the causal hypothesis before reading the updating cues. The first experimental hypotheses concern the initial levels of belief and role bias for superiors and subordinates.

\[ \text{H}01\text{A}: \text{A superior's role in performance evaluation will not influence his or her initial strength of belief in an internal attribution.} \]

\[ \text{H}01\text{B}: \text{A subordinate's role in performance evaluation will not influence his or her initial strength of belief in an external attribution.} \]

The expected effect is that the superior (subordinate) role increases the belief in the internal (external) attribution, compared to the same person without the role involvement. These hypotheses are tested by comparing the initial belief \( (S_0 \text{ from Experiment 1}) \) for superiors and subordinates to their nonrole beliefs.

There is empirical and theoretical justification for the above hypotheses. Harrison, West, and Reneau [1988] did an attribution experiment with a scenario involving an unfavorable variance, similar to the scenarios in Experiment 1. They found that superior subjects made significantly more internal attributions than did subordinates, based on rather minimal information. Their results support the prediction that the role assignments strengthen beliefs in causal hypotheses which are consistent with the roles. One of the theoretical bases for the actor-observer bias, that there are motivational differences between the
actor and the observer, also supports $H_{01A}$ and $H_{01B}$ [Jones and Nisbett, 1972]. Superiors and subordinates may identify strongly with causal statements consistent with their own interests.

Role attitudes may influence the assimilation of information consistent with or in opposition to causal opinions.

$H_{02A}$: For evidence consistent with a causal hypothesis, the superior role will not affect the amount of belief change.

$H_{02B}$: For evidence consistent with a causal hypothesis, the subordinate role will not affect the amount of belief change.

$H_{03A}$: For evidence contrary to a causal hypothesis, the superior role will not affect the amount of belief change.

$H_{03B}$: For evidence contrary to a causal hypothesis, the subordinate role will not affect the amount of belief change.

These hypotheses are tested using the change in belief after two items of consistent evidence from Experiment 1, $S_2 - S_0$ ($S_2$ is the level of belief after two evidence items). The alternate hypotheses for $H_{02A}$ and $H_{02B}$ assume that role assignment may increase $\beta$, the sensitivity to confirmatory evidence. The alternate hypotheses for $H_{03A}$ and $H_{03B}$ depend on role assignment decreasing the sensitivity to negative evidence, or the $\gamma$ parameter.

Attribution research has shown that subordinates and superiors interpret information differently, as if they were biased [Harrison, West and Reneau, 1988]. This research may
show whether superiors and subordinates are biased relative to nonrole subjects. If there is a finding of bias, the research may also determine whether the bias results from the assimilation of positive or negative evidence or both.

Order Effects Hypotheses

Einhorn and Hogarth [1987] predicted that there will be order effects in the updating of opinions, given mixed evidence.

$H_{04}$: There will be no order effects with mixed evidence.

Recency effects may be stronger for nonrole tasks than for role tasks. If superiors and subordinates are strongly confirmation-prone, no order effects are anticipated. Recency effects are tested through an analysis of variance using only the nonrole tasks. The C-IM predicts the fishtail pattern of recency, which is discussed in Chapter 2 and shown in Figure 1.

Einhorn and Hogarth [1987] expected no order effects for consistent positive (negative) evidence. In this research, the evidence described as internal or external may be positive or negative, depending on the task hypothesis.

$H_{05A}$: For superiors, there will be order effects for consistent internal (external) evidence.

$H_{05B}$: For subordinates, there will be order effects for consistent external (internal) evidence.
The second and third experiments manipulate the strength of external and internal evidence. These hypotheses are tested by a repeated-measures analysis of variance. A finding of no effect for the order of consistent information supports expectations. Order effects for consistent evidence cannot be tested for nonrole subjects since there are no nonrole tasks in Experiments 2 and 3.

The order effect of recency for mixed evidence may be reduced for subordinate and superior subjects, compared to the nonrole tasks.

**H₀₆A**: The superior role will not reduce the tendency for order effects (recency), compared to a nonrole perspective.

**H₀₆B**: The subordinate role will not reduce the tendency for order effects (recency), compared to a nonrole perspective.

These hypotheses relate to both order effects and role effects. Hypotheses 6A and 6B are tested by comparing role subjects' responses with their nonrole belief changes from Experiment 1. The tests involve repeated measures analyses of variance on the internal and external attribution subjects. If role involvement decreases sensitivity to negative evidence, it should also decrease recency effects for mixed evidence, compared to nonrole tasks [Einhorn and Hogarth, 1987].

For both the superior and subordinate role groups, β is expected to be greater than α. For nonrole tasks, the α and β values should be approximately equal [Einhorn and
Hogarth, 1987]. If the preceding conditions are met, the belief change for mixed evidence with a role assignment would be more positive than with no role involvement.

\( H_{07A} \): For mixed evidence, the superior role will not affect the amount of belief change, compared to a nonrole viewpoint.

\( H_{07B} \): For mixed evidence, the subordinate role will not affect the amount of belief change, compared to a nonrole viewpoint.

In Experiment 1, these hypotheses are tested by analysis of variance for each hypothesis type, internal or external. The dependent variable is the change in belief after four pieces of evidence. The effect of interest is a main effect for role assignment versus nonrole assignment.

**Belief Divergence Hypotheses**

The integration of the contrast-inertia model and attribution theory leads to the prediction that the opinions of superiors and subordinates diverge when they update their causal beliefs.

\( H_{08} \): The beliefs of superiors and subordinates will not diverge when they assimilate the same mixed evidence into their opinions.

The actor-observer bias supports the expectation that both groups are biased toward their task hypotheses. For the subordinate group, external evidence is positive, while to the superior group, internal evidence is positive. For both groups there should be greater sensitivity to positive than to negative evidence. Lord, Ross, and Lepper [1979]
found that the positions of groups with opposite beliefs move further apart when they receive evidence which gives partial support to both viewpoints.

The eighth hypothesis is tested in two ways, both using data from Experiment 1. The first method of testing assumes that the strengths of internal and external evidence are approximately equal. If this assumption is met, both role groups should increase their beliefs in their opposite hypotheses, from the same mixed evidence. The hypothesis is tested by determining whether the mean belief change for each group is significantly different from zero. An increase in both levels of belief indicates divergence of viewpoints.

If there is a pronounced disparity in the strength of positive and negative evidence, there could be a belief decrease for one of the groups. The second method of testing the hypothesis does not require equal strength for internal and external evidence. If the mean effect of mixed evidence on the subordinate and the superior subjects together is an increase in the level of belief, their opinions have diverged. The hypothesis is tested by determining whether the mean change in belief over the evidence sequence is greater than zero for the combined groups.

Divergence of beliefs is also expected for consistent internal and external evidence. The effects are tested with data from Experiments 2 and 3.
H₀⁹A: The beliefs of superiors and subordinates will not diverge when they assimilate the same consistent external evidence into their opinions.

H₀⁹B: The beliefs of superiors and subordinates will not diverge when they assimilate the same consistent internal evidence into their opinions.

Divergence of beliefs implies a mean increase in belief for the two groups as a whole. The hypotheses are tested by examining the mean impact of external (internal) evidence on the level of belief for all subjects, both superiors and subordinates.

Position Effects Hypotheses

The three experiments manipulate the order and position of information. The C-IM includes no provision for different types of information, such as Cs, Ct, and D.

H₀¹⁰A: There will be position effects with consistent internal evidence.

H₀¹⁰B: There will be position effects with consistent external evidence.

H₀¹⁰C: There will be position effects with mixed internal and external evidence.

In the experiments, position of information is a within-subject factor. The repeated measures analyses of variance, using the amount of belief change from each experimental task as the dependent variable, test for the main effect of position. The result that belief changes are not affected by position would support expectations.
Subject Selection

The companies involved in these experiments were chosen in a nonrandom manner. All the companies are in manufacturing, and most are located in north central Texas. Of the 64 manager participants, there are 55 from Texas. The experimental participants come from a range of industries, shown in Table 12. Some industries, such as electronics and plastics, are overrepresented in the sample, compared to U.S. manufacturing as a whole [U.S. Department of Commerce, Bureau of the Census, 1987]. Several industries, such as textiles, apparel, lumber and wood products, printing and publishing, chemicals, and petroleum refining, are not included in the sample. The generalizability of the experimental results may be reduced

<table>
<thead>
<tr>
<th>Industry</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronics</td>
<td>13</td>
<td>20.3</td>
</tr>
<tr>
<td>Fiberglass/plastics</td>
<td>11</td>
<td>17.2</td>
</tr>
<tr>
<td>Oilfield/drilling</td>
<td>10</td>
<td>15.6</td>
</tr>
<tr>
<td>equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Truck manufacture</td>
<td>9</td>
<td>14.1</td>
</tr>
<tr>
<td>Steel manufacture</td>
<td>7</td>
<td>10.9</td>
</tr>
<tr>
<td>Abrasives</td>
<td>5</td>
<td>7.8</td>
</tr>
<tr>
<td>Automotive</td>
<td>4</td>
<td>6.3</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
<td>2</td>
<td>3.1</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>4.7</td>
</tr>
<tr>
<td>Total</td>
<td>64</td>
<td>100.0</td>
</tr>
</tbody>
</table>
by the geographic limitations of the sample and by the
distribution of subjects among industries.

Within the participating companies, selection of
individual subjects was nonrandom. For each company, a
high level manager who works in or near the manufacturing
plant selected the specific individuals whom they asked to
perform the experiments. These managers include plant
managers, controllers, senior managers in charge of
manufacturing at the plant level or company level, a
marketing vice president, and a plant personnel director.
Part of the sample was acquired in a different manner.
Members of a managerial consulting firm in Dallas agreed to
find potential subjects among the managers who attended
their seminars during March, 1989. The seminar partici-
pants came from companies in different parts of the
country. One partner in the consulting firm distributed
about twenty experimental instruments, from which seven
responses were received.

The managers and managerial consultant who chose the
experimental participants agreed to apply my criteria in
making the selections. The first criterion for the
subjects is experience in evaluating others as well as
being evaluated by their own superiors. This criterion is
necessary because the experiments require each subject to
imagine that he or she is the superior or subordinate in a
series of performance evaluation tasks. Managers who occupy both roles in actual appraisal situations should be comfortable in either experimental role. Some of the demographic information elicited from subjects allows the determination of how well this criterion was met. The subjects' performance evaluation roles are shown in Table 13. More than 90 percent of the subjects evaluate others and are also evaluated. The subjects indicated that both appraisal roles are important to them in their jobs (Table 18, later in this chapter). The requirement that participants both evaluate and be evaluated was met.

A second criterion is that subjects be professional managers who are directly involved in manufacturing. This requirement is imposed because the experimental scenarios involve manufacturing performance. Subjects were asked for their current work position titles, and their answers are summarized in Table 14. Job titles are extremely variable.
between companies. For example, the title "production manager" includes those who are unit managers, manufacturing managers, general foremen, and other titles. From the job titles, the subjects as a group appear to be closely involved with production in manufacturing companies.

Table 14

<table>
<thead>
<tr>
<th>Job Title</th>
<th>No.</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production manager</td>
<td>42</td>
<td>65.6</td>
</tr>
<tr>
<td>Production engineer</td>
<td>5</td>
<td>7.8</td>
</tr>
<tr>
<td>Plant manager, assistant plant manager</td>
<td>3</td>
<td>4.7</td>
</tr>
<tr>
<td>Quality control manager</td>
<td>4</td>
<td>6.3</td>
</tr>
<tr>
<td>Packaging or materials manager</td>
<td>5</td>
<td>7.8</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>7.8</td>
</tr>
<tr>
<td>Total</td>
<td>64</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Description of Subjects

Table 15 summarizes the experimental participants' gender and years of experience as manufacturing managers.

Table 15

<table>
<thead>
<tr>
<th>Subject Characteristics</th>
<th>Super1</th>
<th>Super2</th>
<th>Subor1</th>
<th>Subor2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male subjects</td>
<td>14</td>
<td>18</td>
<td>13</td>
<td>16</td>
<td>61</td>
</tr>
<tr>
<td>Female subjects</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Total subjects</td>
<td>15</td>
<td>18</td>
<td>15</td>
<td>16</td>
<td>64</td>
</tr>
<tr>
<td>Avg. managerial experience (yrs.)</td>
<td>9.5</td>
<td>10.8</td>
<td>14.6</td>
<td>11.6</td>
<td>11.5</td>
</tr>
</tbody>
</table>
The sample is predominantly male: 61 of 64 participants (95%) are men. In U.S. manufacturing of durable goods, about 8% of the managers are women [U.S. Equal Employment Opportunity Commission, 1984]. While most manufacturing managers in this country are male, women managers are slightly underrepresented in my study. The mean length of managerial experience ranges from 9.5 years for the Super1 group to 14.6 years for Subor1. The variation in experience among the four groups is not statistically significant. For a one way analysis of variance, F is 1.52 (p = .22).

The level of education for the subject pool as a whole is shown in Table 16. Using the seven point rating scale

<table>
<thead>
<tr>
<th>Level of Education</th>
<th>Number of Subjects</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Less than high school</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>2. High school</td>
<td>7</td>
<td>10.9</td>
</tr>
<tr>
<td>3. Some college</td>
<td>18</td>
<td>28.1</td>
</tr>
<tr>
<td>4. Bachelor's degree</td>
<td>19</td>
<td>29.7</td>
</tr>
<tr>
<td>5. Some graduate study</td>
<td>13</td>
<td>20.3</td>
</tr>
<tr>
<td>6. Master's degree</td>
<td>6</td>
<td>9.4</td>
</tr>
<tr>
<td>7. Beyond master's degree</td>
<td>1</td>
<td>1.9</td>
</tr>
<tr>
<td>Total</td>
<td>64</td>
<td>100.0</td>
</tr>
</tbody>
</table>

in Table 16, the mean levels of education for the four experimental groups are Super1, 4.4; Super2, 3.7; Subor1, 3.9; and Subor2, 3.9. The differences are not significant
by a Kruskal-Wallis test \( (p = .30) \). Kruskal-Wallis is used since the responses are ordinal data. The group Superl has less managerial experience and more education than the other groups, but the differences may be attributed to chance. Subjects were randomly assigned to the four groups.

Most of the experimental participants work in nonunion companies. The statistics for plant union membership are in Table 17. Of the 64 participants, 54 (84 percent) work in plants where none of the direct labor employees are union members. For another 5 percent of subjects, plant

<table>
<thead>
<tr>
<th>Union Membership</th>
<th>Number of Responses</th>
<th>Percent of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>54</td>
<td>84.4</td>
</tr>
<tr>
<td>1-10%</td>
<td>3</td>
<td>4.7</td>
</tr>
<tr>
<td>10-49%</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>50-99%</td>
<td>3</td>
<td>4.7</td>
</tr>
<tr>
<td>100%</td>
<td>3</td>
<td>4.7</td>
</tr>
<tr>
<td>Total</td>
<td>64</td>
<td>100.1</td>
</tr>
</tbody>
</table>

Table 17

Percentage of Union Membership in Subjects' Companies

union membership is low. Among U.S. manufacturing workers, 24 percent are members of labor unions [U.S. Commerce Department, Bureau of the Census, 1987]. The lack of union involvement in the subjects' plants may limit the external validity of my results. One experimental scenario involves the responsibility for a labor variance. In companies with high union membership, production managers' ability to
control labor variances may be lower than in nonunion companies.

The subject sample in this research is a convenience sample. In several respects, it is not representative of all U.S. manufacturing managers. My sample has too few women and too many managers from nonunion plants to be typical of U.S. manufacturing. Most of the participants are from Texas. Several important industries are omitted from the sample, and others are overrepresented. Limitations of the sample must be considered in drawing conclusions from this research.

**Performance Evaluation Dimensions**

Subjects were asked for their opinions about the importance of labor variances, maintaining product quality, and meeting production schedules in the evaluation of managers in their companies (Table 18). The three experimental scenarios involve these three performance evaluation issues. The subjects believed that labor variances are less important in performance appraisal than the other two dimensions. The importance of the three aspects of performance is

product quality > production schedule > labor variances

A Friedman test shows that each of the differences is significant. The importance of each of the three items is significantly different from the others (p < .02).
Table 18

Mean Responses to Performance Appraisal Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>The ability to evaluate others' performance is important in my job.</td>
<td>1.36&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Others' formal evaluations of my performance are important to my success with this company.</td>
<td>1.56</td>
</tr>
<tr>
<td>Labor variances are important in evaluating performance in this company.</td>
<td>2.08</td>
</tr>
<tr>
<td>Maintaining product quality is important to a manager's success in this company.</td>
<td>1.20</td>
</tr>
<tr>
<td>Ability to meet a production schedule is important to a manager's success in this company.</td>
<td>1.42</td>
</tr>
<tr>
<td>Production department managers in this company have a significant degree of control over labor variances.</td>
<td>2.25</td>
</tr>
<tr>
<td>Production department managers in this company have a significant degree of control over product quality.</td>
<td>1.81</td>
</tr>
<tr>
<td>Production department managers in this company have a significant degree of control over the department's ability to meet production deadlines.</td>
<td>1.89</td>
</tr>
</tbody>
</table>

<sup>a</sup> The possible responses were:
1. I agree strongly
2. I agree
3. I neither agree nor disagree
4. I disagree
5. I disagree strongly
In a series of related questions, subjects were asked whether production managers have a significant degree of control over labor variances, the meeting of production schedules, and product quality maintenance. The mean responses for the entire subject pool are given in Table 18. Subjects indicated that managers have significantly less control (Friedman test, p < .02) over labor variances than either of the other two issues, which do not differ significantly from each other. Subjects' acceptance of an internal attribution for labor variances is questionable, if they believe that the variances are beyond the control of production managers. The labor variance scenario is used in Experiment 1.

**Experimental Procedure**

In most cases, the experimental instruments, in random order, were sent or delivered to the managers who had selected the experimental subjects. These managers distributed the instruments to the participants. The instruments were in individual, stamped, addressed envelopes. When the participants completed the experiments, they mailed them to me. A total of 87 instruments were distributed, of which 64 were returned, for a response rate of 74 percent. Many of the unreturned experiments were distributed by the managerial consulting firm referred to above. Administration of the experiments
by mail results in weaker experimental controls than administration in person. The reduced control is a limitation of the research.  

Summary  

This research involves three experiments with complex factorial designs. In the experiments, subjects performed attribution updating tasks in either the superior or the subordinate role. There are also experimental tasks in which no role was suggested to the subjects. The experiments are designed to test hypotheses about how individual managers use managerial accounting information. Other hypotheses concern how the use of managerial accounting information affects the relative beliefs of superiors and subordinates. The experiments were administered to manufacturing managers who are actively involved with performance appraisal. The results of the data analyses are reported in the next chapter.
CHAPTER 5

EXPERIMENTAL RESULTS

This chapter outlines the statistical analysis of the experimental data. Results are summarized for role effects, order effects, divergence of beliefs between superiors and subordinates, and position effects. Certain manipulation checks which were performed to examine the internal validity of the experiments are discussed. The implications of the manipulation checks for the experimental results are considered. A chapter summary concludes the chapter.

Data Analysis

The experimental hypotheses were discussed in detail in Chapter 4 and are listed together in Table 19. The hypotheses can be divided into four groups, based on the broad issues with which they are concerned. The first group of hypotheses pertain to the existence of bias on the part of superiors and subordinates involved in performance evaluation. To provide evidence of bias, superiors and subordinates must be compared with a control, the nonrole assignment. The hypotheses about role bias or role effects are 1A, 1B, 2A, 2B, 3A, and 3B.
Table 19
Experimental Hypotheses

**Role Effects Hypotheses**

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H_{01A}</td>
<td>A superior's role in performance evaluation will not influence his or her initial strength of belief in an internal attribution.</td>
</tr>
<tr>
<td>H_{01B}</td>
<td>A subordinate's role in performance evaluation will not influence his or her initial strength of belief in an external attribution.</td>
</tr>
<tr>
<td>H_{02A}</td>
<td>For evidence consistent with a causal hypothesis, the superior role will not affect the amount of belief change.</td>
</tr>
<tr>
<td>H_{02B}</td>
<td>For evidence consistent with a causal hypothesis, the subordinate role will not affect the amount of belief change.</td>
</tr>
<tr>
<td>H_{03A}</td>
<td>For evidence contrary to a causal hypothesis, the superior role will not affect the amount of belief change.</td>
</tr>
<tr>
<td>H_{03B}</td>
<td>For evidence contrary to a causal hypothesis, the subordinate role will not affect the amount of belief change.</td>
</tr>
</tbody>
</table>

**Order Effects Hypotheses**

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H_{04}</td>
<td>There will be no order effects with mixed evidence.</td>
</tr>
<tr>
<td>H_{05A}</td>
<td>For superiors, there will be order effects for consistent internal (external) evidence.</td>
</tr>
<tr>
<td>H_{05B}</td>
<td>For subordinates, there will be order effects for consistent internal (external) evidence.</td>
</tr>
<tr>
<td>H_{06A}</td>
<td>The superior role will not reduce the tendency for order effects (recency), compared to a nonrole perspective.</td>
</tr>
<tr>
<td>H_{06B}</td>
<td>The subordinate role will not reduce the tendency for order effects (recency), compared to a nonrole perspective.</td>
</tr>
</tbody>
</table>
Table 19, Continued

Experimental Hypotheses

\( H_{07A} \): For mixed evidence, the superior role will not affect the amount of belief change, compared to a nonrole viewpoint.

\( H_{07B} \): For mixed evidence, the subordinate role will not affect the amount of belief change, compared to a nonrole viewpoint.

Divergence of Beliefs Hypotheses

\( H_{08} \): The beliefs of superiors and subordinates will not diverge when they assimilate the same mixed evidence into their opinions.

\( H_{09A} \): The beliefs of superiors and subordinates will not diverge when they assimilate the same consistent external evidence into their opinions.

\( H_{09B} \): The beliefs of superiors and subordinates will not diverge when they assimilate the same consistent internal evidence into their opinions.

Position Effects Hypotheses

\( H_{010A} \): There will be position effects with consistent internal evidence.

\( H_{010B} \): There will be position effects with consistent external evidence.

\( H_{010C} \): There will be position effects with mixed internal and external evidence.
The second category of hypotheses concerns the order effects predicted by Einhorn and Hogarth [1987] in the contrast-inertia model (C-IM). The order effects hypotheses are 4, 5A, and 5B. Hypotheses 6A, 6B, 7A, and 7B relate to both order and role effects. The third category is divergence of beliefs between the superior and the subordinate in the performance appraisal process, postulated in hypotheses 8, 9A, and 9B. The final category is the position effects hypotheses, 10A, 10B, and 10C.

All the experimental hypotheses are tested with repeated measures analyses of variance, a total of 24 ANOVAs. There are multiple analyses for some hypotheses, and some analyses test two or more of the experimental hypotheses. The dependent variables, factors, and experimental data used are summarized in Table 20.

The numbers of subjects in the four experimental groups were not equal. There were 15 for the superior, order 1 group (Super1) and for the subordinate, order 1 group (Subor1). The group superior, order 2 (Super2) had 18 subjects, and there were 16 participants in subordinate, order 2 (Subor2). For analyses involving two or more groups, the number of observations in each cell is 15. Observations were deleted at random to reach that cell size. The results of the analyses are shown in Appendix D and are discussed in this chapter, organized by the four categories of experimental hypotheses.
Table 20

Analyses of Variance

<table>
<thead>
<tr>
<th>No. Tested</th>
<th>Factors</th>
<th>Expt.</th>
<th>Expt. Tasks</th>
<th>Subject Group</th>
<th>DV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1B</td>
<td>1A</td>
<td>Role/nonrole(W) Task(W)</td>
<td>AEJN</td>
<td>Super1</td>
<td>S0</td>
</tr>
<tr>
<td>2</td>
<td>1A</td>
<td>Role/nonrole(W) Task(W)</td>
<td>BFKP</td>
<td>Super2</td>
<td>S0</td>
</tr>
<tr>
<td>3</td>
<td>1A</td>
<td>Group(B) Role/nonrole(W) Task(W)</td>
<td>AEJN</td>
<td>Super1</td>
<td>S0</td>
</tr>
<tr>
<td>4</td>
<td>1B</td>
<td>Role/nonrole(W) Task(W)</td>
<td>CGLQ</td>
<td>Subor1</td>
<td>S0</td>
</tr>
<tr>
<td>5</td>
<td>1B</td>
<td>Role/nonrole(W) Task(W)</td>
<td>DHMR</td>
<td>Subor2</td>
<td>S0</td>
</tr>
<tr>
<td>6</td>
<td>1B</td>
<td>Group(B) Role/nonrole(W) Task(W)</td>
<td>CGLQ</td>
<td>Subor1</td>
<td>S0</td>
</tr>
</tbody>
</table>

*aExplanation of abbreviations and symbols:
DV = dependent variable
S0 = initial belief, after the scenario only
S2, S3, S4 = opinion after 2, 3, or 4 cues
W = within-subject factor
B = between-subjects factor
Order = the order of internal and external or weak and strong evidence
Position = the position of Cs, Ct, and D evidence
The factors of "Task" and "Group" are used for two similar tasks or two similar groups, when no effect is expected for the factor. "Role/nonrole" means that similar tasks were done in the superior or subordinate role and also without a role assignment. The term "Role" alone is used to distinguish between the superior and subordinate roles.

The numbers assigned to the analyses of variance in this table are used throughout the chapter to distinguish the various procedures performed.

The experimental hypotheses are listed in Table 19 in this chapter.

The experiment numbers and the letters used to designate separate experimental tasks are shown in Appendix B.
### Table 20, Continued

**Analyses of Variance**

<table>
<thead>
<tr>
<th>No. Tested</th>
<th>Factors</th>
<th>Expt. Tasks</th>
<th>Subject Group</th>
<th>DV</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>2A</td>
<td>Role/nonrole(W) Position(W)</td>
<td>AEJN</td>
<td>Super1</td>
</tr>
<tr>
<td>8</td>
<td>2B</td>
<td>Role/nonrole(W) Position(W)</td>
<td>DHMR</td>
<td>Subor2</td>
</tr>
<tr>
<td>9</td>
<td>3A</td>
<td>Role/nonrole(W) Position(W)</td>
<td>BFKP</td>
<td>Super2</td>
</tr>
<tr>
<td>10</td>
<td>3B</td>
<td>Role/nonrole(W) Position(W)</td>
<td>CGLQ</td>
<td>Subor1</td>
</tr>
<tr>
<td>11</td>
<td>4</td>
<td>Order(B) Position(W)</td>
<td>ABEF</td>
<td>Super1</td>
</tr>
<tr>
<td>12</td>
<td>4</td>
<td>Order(B) Position(W)</td>
<td>CDGH</td>
<td>Subor1</td>
</tr>
<tr>
<td>13</td>
<td>4</td>
<td>Order(B) Hypothesis(B) Position(W)</td>
<td>ABCD</td>
<td>Super1</td>
</tr>
<tr>
<td>14</td>
<td>4, 8</td>
<td>Order(B) Position(W)</td>
<td>JKNP</td>
<td>Super1</td>
</tr>
<tr>
<td>15</td>
<td>4, 8</td>
<td>Order(B) Position(W)</td>
<td>LMQR</td>
<td>Subor1</td>
</tr>
<tr>
<td>16</td>
<td>4, 8</td>
<td>Order(B) Role(B) Position(W)</td>
<td>JKNP</td>
<td>Super1</td>
</tr>
<tr>
<td>17</td>
<td>5A</td>
<td>Order(B) Position(W)</td>
<td>STWX</td>
<td>Super1</td>
</tr>
<tr>
<td>18</td>
<td>5A</td>
<td>Order(B) Position(W)</td>
<td>AA AB AE AF</td>
<td>Super1</td>
</tr>
<tr>
<td>19</td>
<td>5B</td>
<td>Order(B) Position(W)</td>
<td>UVYZ</td>
<td>Subor1</td>
</tr>
</tbody>
</table>
Table 20, Continued

Analyses of Variance

<table>
<thead>
<tr>
<th>No. Tested</th>
<th>Factors</th>
<th>Expt.</th>
<th>Tasks</th>
<th>Subject Group</th>
<th>DV</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 5B</td>
<td>Order(B)</td>
<td>3</td>
<td>AC AD</td>
<td>Subor1</td>
<td>S₀-S₃</td>
</tr>
<tr>
<td>10A</td>
<td>Position(W)</td>
<td></td>
<td>AG AH</td>
<td>Subor2</td>
<td></td>
</tr>
<tr>
<td>21 6A</td>
<td>Order(B)</td>
<td>1</td>
<td>ABEF</td>
<td>Super1</td>
<td>S₄-S₀</td>
</tr>
<tr>
<td>7A</td>
<td>Role/nonrole(W)</td>
<td></td>
<td>JKNP</td>
<td>Super2</td>
<td></td>
</tr>
<tr>
<td>22 6B</td>
<td>Order(B)</td>
<td>1</td>
<td>CDGH</td>
<td>Subor1</td>
<td>S₄-S₀</td>
</tr>
<tr>
<td>7B</td>
<td>Role/nonrole(W)</td>
<td></td>
<td>LMQR</td>
<td>Subor2</td>
<td></td>
</tr>
<tr>
<td>23 9A</td>
<td>Order(B)</td>
<td>2</td>
<td>STUV</td>
<td>Super1</td>
<td>S₃-S₀</td>
</tr>
<tr>
<td>10B</td>
<td>Role(B)</td>
<td></td>
<td>WXYZ</td>
<td>Super2</td>
<td></td>
</tr>
<tr>
<td>24 9B</td>
<td>Order(B)</td>
<td>3</td>
<td>AA AB</td>
<td>Super1</td>
<td>S₃-S₀</td>
</tr>
<tr>
<td>10A</td>
<td>Role(B)</td>
<td></td>
<td>AC AD</td>
<td>Super2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Position(W)</td>
<td></td>
<td>AE AF</td>
<td>Subor1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AG AH</td>
<td>Subor2</td>
<td></td>
</tr>
</tbody>
</table>
Experimental Results: Role Effects and Evidence of Bias

Attribution theorists assert that superiors and subordinates have different perspectives on the causality for the subordinate's behavior. The viewpoints and opinion changes of both superiors and subordinates may differ from those of an uninvolved observer. In Experiment 1, every subject performed two nonrole tasks, followed by two tasks in an assigned role (superior or subordinate). Each subject thereby served as his or her own nonrole control. All the tests for superior and subordinate bias are part of Experiment 1; there are no nonrole tasks in Experiments 2 and 3.

Hypotheses 1A and 1B are concerned with the initial level of belief, after reading just the scenario from Experiment 1. The dependent variable is $S_0$, the initial stated belief. I hypothesize that role bias results in superiors showing stronger belief in an internal hypothesis than they would if not involved in the performance evaluation. Hypothesis 1A is tested for the group Super1 alone, for the group Super2, and for the two groups together (Table 21). For all the superior subjects together, the mean stated belief in the internal attribution is significantly stronger than the nonrole belief (the ASSI effect for Analysis 3, $F = 7.17$, $p = .012$). The group x assignment interaction is not significant at the .05 level (Appendix D). Nevertheless, the significant assignment
Hypothesis: 1A  
**Expected Results:**  
**Observed Results:**

Hypothesis: 1B  
**Expected Results:**  
**Observed Results:**

Hypothesis: 2A  
**Expected Results:**  
**Observed Results:**

Hypothesis: 2B  
**Expected Results:**  
**Observed Results:**

Hypothesis: 3A  
**Expected Results:**  
**Observed Results:**

Hypothesis: 3B  
**Expected Results:**  
**Observed Results:**

Table 21  
Summary of Role Effects

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Expected Results</th>
<th>Observed Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>Significant main effect for role assignment (ASSI)</td>
<td>Significance for all superior subjects together ($F=7.17$, $p=.012$) and for the group Super1 ($F=6.08$, $p=.027$)</td>
</tr>
<tr>
<td>1B</td>
<td>Significant main effect for role assignment (ASSI)</td>
<td>No results approach significance See Analyses 4, 5, and 6 in Appendix D</td>
</tr>
<tr>
<td>2A</td>
<td>Significant main effect for role assignment (ASSI)</td>
<td>ASSI $F=0.00$ $p=.995$</td>
</tr>
<tr>
<td>2B</td>
<td>Significant main effect for role assignment (ASSI)</td>
<td>ASSI $F=.94$ $p=.349$</td>
</tr>
<tr>
<td>3A</td>
<td>Significant main effect for role assignment (ASSI)</td>
<td>ASSI $F=.07$ $p=.799$</td>
</tr>
<tr>
<td>3B</td>
<td>Significant main effect for role assignment (ASSI)</td>
<td>ASSI $F=.11$ $p=.746$</td>
</tr>
</tbody>
</table>
effect for all the superior subjects results primarily from the effect for the group Super1. The role effect is a strengthening of the initial belief for the superior role tasks.

Analyses 4 through 6 test hypothesis 1B, that subordinates have a stronger initial belief in an external attribution than if they were not involved in the performance evaluation. Hypothesis 1B is not supported by any of the analyses. For subordinate subjects, there is no evidence of a role effect or role bias in the initial attributional beliefs.6

Hypotheses 2A through 3B concern bias or role effects in the updating or revision of attributions. I assume that superior subjects are biased toward confirming an internal attribution. Similarly, subordinate subjects would have a confirmatory bias for an external attribution-[Harrison, West, and Reneau, 1988]. In the C-IM, the $\alpha$ parameter measures sensitivity toward negative or disconfirming evidence. The parameter $\beta$ measures sensitivity to positive or confirmatory evidence. The role effect for superiors and subordinates might increase their $\beta$ values and/or decrease $\alpha$, compared to nonrole viewpoints. The sensitivity to positive evidence should exceed the sensitivity to negative evidence, with detectable effects on opinion changes [Einhorn and Hogarth, 1987].
Superior and subordinate subjects' sensitivity to confirming and disconfirming evidence are tested using belief changes over the first two evidence items from Experiment 1 (see the design for Experiment 1 in Appendix B). The groups Super1 and Subor2 received confirmatory evidence (internal and external, respectively). The groups Super2 and Subor1 should have perceived their evidence as disconfirmatory. A significant effect for assignment (role versus nonrole) is expected in each case. The anticipated effect is a greater belief increase (smaller belief decrease) with confirmatory (disconfirmatory) evidence for superior or subordinate role tasks than for nonrole tasks. In the four analyses performed (analyses 7 through 10 in Table 21), the assignment effect does not reach significance.

The results of the analyses for superior-and subordinate bias provide limited support for such effects. There is some evidence for bias in the initial level of belief, \( S_0 \). Superior subjects more strongly support an internal attribution than do the same individuals with no role assignment. There is no evidence for bias in the belief revision process. The results thus far do not support the notion that the roles of superior and subordinate influence sensitivity to positive or negative information in performance appraisal.
Experimental Results: Order Effects

Einhorn and Hogarth [1987] predicted the order effect of recency for mixed positive and negative evidence, and no order effect for consistently positive or negative evidence. Order effects are important to this research because they would increase the arbitrariness of the performance evaluation process. The experimental designs enable testing of order effect predictions.

Order effects for mixed evidence are tested with nonrole tasks from Experiment 1 (Table 22). The nonrole tasks allow the strongest tests for order effects from mixed evidence. Role effects for superiors and subordinates are predicted to reduce the level of $\alpha$. As either $\alpha$ or $\beta$ decreases, order effects for mixed evidence should diminish. The dependent variable in the analyses is $S_4 - S_0$, or the change in belief over the series of updating items. The results from analyses 11 and 12 (nonrole tasks, internal and external task hypotheses, respectively) show that the main effect for order is not significant ($p = .223$ and .681, respectively). In ANOVA 13, both hypothesis types are included, and the predicted effect is a significant interaction between hypothesis type and order of evidence. The interaction is not significant ($p = .290$). The nonrole task results fail to support predictions of recency for mixed evidence.
Table 22
Summary of Order Effects Results

<table>
<thead>
<tr>
<th>Hypothesis: 4</th>
<th>Expected Results:</th>
<th>Observed Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyses: 11-13</td>
<td>Significant order effect (recency) for nonrole tasks</td>
<td>Order effects not significant (see Appendix D)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hypothesis: 5A</th>
<th>Expected Results:</th>
<th>Observed Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyses: 17, 18</td>
<td>No significant order effects for consistent external or internal evidence</td>
<td>Order not significant (p=.479 and .827 for external and internal information)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hypothesis: 5B</th>
<th>Expected Results:</th>
<th>Observed Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyses: 19, 20</td>
<td>No significant order effects for consistent external or internal evidence</td>
<td>External evidence: p=.125 Internal evidence: p=.181</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hypothesis: 6A</th>
<th>Expected Results:</th>
<th>Observed Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis: 21</td>
<td>Significant interaction between order and role/nonrole assignment (reduction in recency for role tasks)</td>
<td>ORDER x ASSI not significant, p=.532</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hypothesis: 6B</th>
<th>Expected Results:</th>
<th>Observed Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis: 22</td>
<td>Significant interaction between order and role/nonrole assignment (reduction in recency for role tasks)</td>
<td>ORDER x ASSI not significant, p=.362</td>
</tr>
</tbody>
</table>
Table 22, Continued

Summary of Order Effects Results

**Hypothesis: 7A**

**Expected Results:** Significant effect for role/nonrole (ASSI). Role assignment should increase the amount of belief change

**Observed Results:** ASSI, F=.03, p=.864

**Hypothesis: 7B**

**Expected Results:** Significant effect for role/nonrole (ASSI). Role assignment should increase the amount of belief change

**Observed Results:** ASSI, F=1.28, p=.267
In analysis 16, order effects are tested for superior and subordinate role subjects, using their responses to Experiment 1. The relevant effect is an interaction between role and order. The interaction is significant ($F = 9.59$, $p = .003$). For separate ANOVAs performed on superior and subordinate role results (analyses 14 and 15), the main effects for order are significant (superior role subjects, $F = 5.20$, $p = .030$; subordinate participants, $F = 4.06$, $p = .054$).

Order effects for consistent evidence are tested with evidence from Experiments 2 and 3. The dependent variable is the difference between $S_3$ and $S_0$, the change in belief over the series of evidence items. For the superior role, the updating evidence from Experiment 2 is negative, and the cues in Experiment 3 are positive. The reverse relationship applies for subordinate subjects. As reported in Table 22, the order effects for ANOVAs 17 through 20 are not significant. In analyses 23 and 24, the absence of significant interactions between role and order indicates that there are no order effects for consistent internal or external evidence (Appendix D). Einhorn and Hogarth's [1987] prediction of no order effects for consistent evidence is supported.

The experimental hypotheses 6A and 6B involve both order effects and role effects. I predicted that the order effect would be reduced for role tasks, compared to nonrole
tasks. The reasoning behind this prediction is that role involvement would reduce subjects' \( a \) values, leading to smaller order effects. The postulated effect is tested separately for superior and subordinate subjects, in analyses 21 and 22, using data from Experiment 1. The expected result is a significant interaction between order and role assignment. Role assignment means the superior/nonrole or subordinate/nonrole difference. For both subordinate and superior groups, the interaction is not significant (\( p = .362 \) and \( .532 \), respectively). Role assignment appears to have no significant influence on order effects.\(^8\)

Since the assignment by order interactions are not significant, the main effect for role assignment can be examined, hypotheses 7A and 7B. The expected effect is a greater belief increase with mixed evidence for role tasks than for nonrole tasks. This role effect could result from either increased sensitivity to positive evidence or decreased sensitivity to negative information. The role/nonrole assignment effect is not significant for superiors and subordinates in analyses 21 and 22 (\( p = .864 \) and \( .267 \), respectively). The results provide no evidence that the superior and subordinate roles increase the \( \beta \) to \( a \) ratio (cause relatively greater sensitivity toward positive evidence than negative information).
One of Hogarth and Einhorn's [1989] strongest predictions in the C-IM is that order effects will be observed for mixed evidence. The model also includes the prediction of reduced order effects for biased subjects, who seek either to confirm or to disconfirm a hypothesis. In these performance evaluation tasks, stronger recency effects are expected for subjects taking a nonrole approach, than for role tasks. The opposite effect occurred: recency is significant only for role tasks. A partial interpretation for this finding is an absence of bias (either confirmatory or disconfirmatory) in the performance evaluation participants. The expected lack of order effects for consistent evidence is observed.

**Experimental Results: Divergence of Beliefs**

Divergence of beliefs between superiors and subordinates is predicted for both mixed and consistent evidence. Divergence of opinions over a series of evidence items could suggest, for example, increased conflict over the course of a variance investigation. For mixed evidence (hypothesis 8), divergence of beliefs can be tested in two ways. First, I used the CONSTANT effect to test for an increase in beliefs for superiors and subordinates separately. The ANOVA program automatically calculates the $F$ value for the CONSTANT effect, and this $F$ value indicates whether the overall mean is significantly different from
### Table 23

Summary of Results for Divergence of Beliefs Hypotheses

<table>
<thead>
<tr>
<th>Hypothesis: 8</th>
<th>Analyses: 14-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected Results:</td>
<td>Increase in belief for subordinates</td>
</tr>
<tr>
<td></td>
<td>Increase in belief for superiors</td>
</tr>
<tr>
<td></td>
<td>Increase in belief for the two groups together (in each case, CONSTANT effect would be significant)</td>
</tr>
<tr>
<td>Observed Results:</td>
<td>Subordinates: CONSTANT, F=4.40, p=.045</td>
</tr>
<tr>
<td></td>
<td>Superiors: CONSTANT, F=13.89, p=.001</td>
</tr>
<tr>
<td></td>
<td>Superiors and subordinates together: CONSTANT, F=17.04, p=.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hypothesis: 9A</th>
<th>Analysis: 23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected Results:</td>
<td>Increase in beliefs for superiors and subordinates together for external information (significant CONSTANT effect)</td>
</tr>
<tr>
<td>Observed Results:</td>
<td>CONSTANT, F=.10, p=.749</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hypothesis: 9B</th>
<th>Analysis: 24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected Results:</td>
<td>Increase in beliefs for superiors and subordinates together for internal information (significant CONSTANT effect)</td>
</tr>
<tr>
<td>Observed Results:</td>
<td>CONSTANT, F=1.86, p=.178</td>
</tr>
</tbody>
</table>
zero [Norusis, 1988]. From analysis 14, the effect for superior subjects is highly significant ($F = 13.89$, $p = .001$, in Table 23). Their level of belief did increase over the evidence series. The CONSTANT effect is also significant for subordinates (analysis 15, $F = 4.40$, $p = .045$). The significant increase in beliefs for each group alone indicates divergence of beliefs for mixed evidence. In analysis 16, the CONSTANT effect is significant ($F=17.04$, $p=.000$) for superiors and subordinates together. Given that the two groups were assigned opposite task hypotheses, an overall belief increase implies belief divergence.

The observed divergence of beliefs with mixed evidence cannot be attributed solely to superior/subordinate role effects. In the nonrole tasks (tasks A through H, Appendix B), there is also some evidence for belief divergence. For the groups Super1 and Super2, the belief increase is significant (analysis 11, Appendix D; for the CONSTANT effect, $F=9.12$, $p=.005$). The belief change for the nonrole tasks is not significantly different from zero for the groups Subor1 and Subor2 (analysis 12, Appendix D). For all the nonrole tasks combined, there is an increase in beliefs which approaches significance (analysis 13, $F=3.93$, $p=.062$). This divergence of beliefs for opposite task hypotheses may be explained by assuming that the subjects
as a group were biased toward confirming the task hypotheses, even when there was no role assignment.

For consistent evidence, divergence of beliefs is tested in analyses 23 and 24. In Experiment 2, beliefs of superiors should decrease and those of subordinates should increase. The opposite changes are expected for Experiment 3. These expectations are confirmed by highly significant role effects in both analyses. Divergence of beliefs for consistent evidence can only be tested for the two groups together. The dependent variable is $S_3 - S_0$. With both internal and external evidence, the CONSTANT effect is not significant ($p = .178$ and $.660$, respectively). For the two groups, there is not a significant increase in beliefs. There is no evidence for divergence with consistent information. The divergence of beliefs phenomenon could require a strong contrast between evidence items, as with mixed evidence. The lack of significant divergence of beliefs with consistent evidence may be a symptom of a lack of role effect or role bias.

**Experimental Results: Position Effects**

Attribution researchers have found that the position of presentation of Cs, Ct, or D evidence affects its impact. Consensus evidence is particularly sensitive to position effects [Ruble and Feldman, 1976]. The design of Experiment 1 allows comparisons of the effects of Cs and Ct.
Experiments 2 and 3 permit examination of the effects of Cs and D. No position effects are predicted because the C-IM contains no direct provision for different types of evidence.

Hypothesis 10A (position effects for consistent internal evidence) is tested by analyses 18, 20, and 24. In the first and third analyses, the position effect approaches conventional levels of significance (Table 24, \( p = .104 \) and \( .107 \), respectively). Position effects with consistent external evidence are tested by ANOVAs 17, 19, and 23. The effect is not significant in any analysis (Appendix D). The results give little indication of position effects with consistent evidence.

Position effects for mixed evidence are tested in ANOVAs 11, 12, and 13 for the nonrole tasks from Experiment 1, and in ANOVAs 14, 15, and 16 for the role tasks. The position effect is significant in only one of the six analyses (Analysis 12, nonrole tasks, external task hypothesis, \( F = 6.29, p = .018 \)). Position effects range from highly significant in one isolated case to far from significant in several cases. Position x order interactions in analyses 14 through 16 also indicate that position of information can affect belief revision (Appendix D).
Table 24

Summary of Results for Position Effects

<table>
<thead>
<tr>
<th>Hypothesis: 10A</th>
<th>Expected Results:</th>
<th>Observed Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Analyses: 18, 20, 24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Main effect for POSITION not significant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Superior subjects (Analysis 18) $F=2.78$, $p=.107$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Superiors and subordinates together (Analysis 24) $F=2.73$, $p=.104$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hypothesis: 10B</th>
<th>Expected Results:</th>
<th>Observed Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Analyses: 17, 19, 23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Main effect for POSITION not significant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In each case, POSITION does not approach significance (see Appendix D)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hypothesis: 10C</th>
<th>Expected Results:</th>
<th>Observed Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Analyses: 11-16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Main effect for POSITION not significant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analysis 12, external task hypothesis, nonrole tasks: $F=6.29$, $p=.018$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In all other cases, POSITION effect was not significant with mixed evidence</td>
</tr>
</tbody>
</table>
Summary of Experimental Results

There is no more than limited evidence indicating role bias in these experiments. Bias may manifest itself either in the initial level of belief or in patterns of belief changes. Superior subjects' initial beliefs in internal attributions are stronger than the nonrole beliefs. The same effect does not extend to subordinate role subjects.

Predictions about subjects' $\alpha$ and $\beta$ levels can be used to model how bias would influence belief changes. For both superior and subordinate subjects, $\beta$ was expected to exceed $\beta$, implying a tendency toward confirmation. The results of tests of hypotheses 2A through 3B give no support for role adoption affecting the value of either $\alpha$ or $\beta$. If role adoption decreases, there should be a parallel reduction in recency effects for role tasks, compared to nonrole tasks. In fact, for mixed evidence, recency effects are significant when there is a role assignment, and not significant without the assignment. The results imply that role adoption does not decrease the sensitivity to negative evidence. This interpretation depends on the descriptive accuracy of the contrast-inertia model. Einhorn and Hogarth [1987] did report results in which they believed they had successfully reduced the level of $\alpha$ or $\beta$, and they did not observe the expected reduction in recency. Another example in these experiments where role effects are not observed is in testing hypotheses 8A.
and 8B. The role assignment does not increase the amount of belief change over the series of mixed evidence, which would be expected if $\beta$ exceeds $\gamma$.

The experiments partially support the order effect predictions of the C-IM. There is significant recency for superior and subordinate tasks with mixed evidence, but no significant effect for the nonrole tasks. In Experiments 2 and 3, there are no significant order effects with consistent evidence. A significant position effect occurs in just one instance; its importance is difficult to determine.

Divergence of beliefs between subordinates and superiors is predicted for all types of evidence, mixed, internal, and external. Significant divergence of beliefs is found only for mixed evidence. The results imply that belief updating processes do not inevitably increase a difference of opinions between superiors and subordinates. At the same time, the lack of a significant effect implies that assimilation of evidence does not cause convergence of the viewpoints of subordinates and superiors.

**Manipulation Checks**

In Experiment 1, all subjects performed two tasks from the viewpoint of the superior or subordinate, and two without a role assignment. The acceptance of the role assignment is critical to most of the experimental
hypotheses (all except 4, 5A, 5B, 10A, 10B, and 10C). The nonrole tasks are meant to encourage a neutral viewpoint. To check the success of the nonrole/role manipulation, subjects were asked their viewpoints on the nonrole tasks (Table 25). The desired response is that they approached

Table 25

Viewpoint on Nonrole Tasks

<table>
<thead>
<tr>
<th></th>
<th>Superior</th>
<th>Subordinate</th>
<th>Neither</th>
</tr>
</thead>
<tbody>
<tr>
<td>Super1</td>
<td>6</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Super2</td>
<td>5</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Subor1</td>
<td>7</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Subor2</td>
<td>6</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>6</td>
<td>34</td>
</tr>
</tbody>
</table>

the tasks from the perspective of neither the superior nor the subordinate. Only 34 of 64 (53 percent) gave that response. Of the remaining subjects, 24 indicated that they approached the nonrole tasks as if they were superiors.

The subject responses to the nonrole manipulation check call into question the success of the nonrole/role manipulation overall and specifically the success of the subordinate role assignment. Of the 31 subordinate role subjects, 13 (42 percent) stated that they performed the nonrole tasks from the viewpoint of the superior. Even though most subjects said that they both evaluate and are evaluated (Table 13, Chapter 4), their perspective on the evaluation process may be more that of the evaluator. Many
of the subjects probably spend a significant amount of time evaluating the work of others, formally or informally.

After the subjects completed the experimental tasks, they rated the strength and direction of the updating cues, as a manipulation check (Appendix C). Instructions on the manipulation checks are to rate evidence as positive or negative in reference to a given hypothesis. For the superior role, the hypothesis states that the cause of a problem is due to how well the manager manages the department. A majority of the superior role subjects responded to the manipulation checks in the direction opposite to expectations. Items which should have been negative or external with respect to the internal hypothesis were rated as positive. I believe that the problem is attributable to the manipulation check procedures and not to the experiments. When the superior subjects did the experimental tasks, the belief changes for the updating cues had the sign opposite to expectations only 86 times out of 924 belief revisions (9.3 percent). In performing the manipulation checks, superior subjects seemed to rate the cues as positive or negative (favorable or unfavorable) with respect to a subordinate, rather than with respect to the given internal hypothesis.

Because the superiors' responses to the manipulation checks do not seem reasonable, the assessment of the updating evidence is based on the responses of subordinate
Table 26

Perceived Direction and Strength of Updating Cues

<table>
<thead>
<tr>
<th>Cue</th>
<th>Subjects' Level of Response Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experiment 1:</strong></td>
<td></td>
</tr>
<tr>
<td>Department material variance was very small last month, ( D_e )</td>
<td>(+44.7) ( p &lt; .005^b )</td>
</tr>
<tr>
<td>Department overhead costs were higher than budgeted, ( D_i )</td>
<td>(-10.8) ( p &lt; .25 )</td>
</tr>
<tr>
<td>Department labor variance was small for several months before last month, ( C_{te} )</td>
<td>(+56.5) ( p &lt; .005 )</td>
</tr>
<tr>
<td>Department labor variance was large and unfavorable several times recently, ( C_{ti} )</td>
<td>(-57.3) ( p &lt; .005 )</td>
</tr>
<tr>
<td>Several other departments had large, unfavorable labor variances, ( C_{se} )</td>
<td>(+29.3) ( p &lt; .025 )</td>
</tr>
<tr>
<td>Other departments had much smaller labor variances, ( C_{si} )</td>
<td>(-42.9) ( p &lt; .005 )</td>
</tr>
<tr>
<td><strong>Experiment 2:</strong></td>
<td></td>
</tr>
<tr>
<td>This is the first important order deadline which has been missed, ( C_{te} )</td>
<td>(+59.4) ( p &lt; .005 )</td>
</tr>
<tr>
<td>The department's use of materials has been acceptable on all orders, ( D_{e,s} )</td>
<td>(+57.5) ( p &lt; .005 )</td>
</tr>
<tr>
<td>The department's use of materials has been acceptable on most orders, ( D_{e,w} )</td>
<td>(+35.6) ( p &lt; .005 )</td>
</tr>
<tr>
<td>Other department managers have frequently missed order deadlines, ( C_{se,s} )</td>
<td>(+40.5) ( p &lt; .005 )</td>
</tr>
</tbody>
</table>

The cues shown here have been shortened slightly. The complete cues are in Appendix C. The symbols (\( D_e \), et cetera) are defined in Appendix B. A "significance" means significantly different from zero, as measured by a \( t \) test.
Table 26, Continued

Perceived Direction and Strength of Updating Cues

<table>
<thead>
<tr>
<th>Cue</th>
<th>Subjects' Response</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment 2, Continued:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other department managers have occasionally missed order deadlines,</td>
<td>+12.3</td>
<td>p &lt; .25</td>
</tr>
<tr>
<td>Cs_e,w</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experiment 3:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>There have been other complaints about the department's product</td>
<td>-43.9</td>
<td>p &lt; .005</td>
</tr>
<tr>
<td>quality, Ct_i</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The amount of scrap was much higher than expected Di_s</td>
<td>-31.0</td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>The amount of scrap was higher than expected, Di_w</td>
<td>-17.6</td>
<td>p &lt; .25</td>
</tr>
<tr>
<td>There have been no complaints about the product quality of other</td>
<td>-12.9</td>
<td>p &lt; .25</td>
</tr>
<tr>
<td>departments, Cs_i,s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>There have been few complaints about the product quality of other</td>
<td>-8.0</td>
<td>p &lt; .4</td>
</tr>
<tr>
<td>departments, Cs_i,w</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
subjects only. The manipulation check findings are contained in Table 26. The direction (positive or negative) of every cue for all three experiments is as intended. From Experiment 1, the only apparent problem is that the strength of one updating item (the second cue in Table 26) is not significantly different from zero. Subjects did not perceive the item to be strongly negative or internal. There is a similar problem for the fifth cue shown for Experiment 2. Its mean response is positive or external, but not significantly different from zero. For Experiment 3, three items are close to zero. Also, the $C_{i,s}$ cue was meant to be stronger (more negative or internal) than $D_{i,w}$. The two items do not differ significantly.

Experimental Results and Manipulation Checks

The participants' reported attitudes toward the nonrole tasks cast doubt on the viability of the role manipulation, particularly on the subordinate role assignment. The conclusion that nonrole tasks were performed (by a large minority of subjects) with the viewpoint of the superior can account for some of the observed results. However, the reported attitudes lead to some predictions which did not materialize.

If the nonrole tasks are dominated by a superior bias, the assignment (ASSI) effect in analyses 1 through 3
(groups Super1 and Super2) should not be significant. The ASSI significance in analyses 1 and 3 implies that the superior role assignment is at least partially successful. For subordinate subjects, the effect (in analyses 4 through 6) of performing nonrole tasks with a superior outlook cannot be predicted.\(^{10}\) The ASSI effect is not significant for the groups Subor1 and Subor2 (Table 21).

If the subordinate subjects had the viewpoint of superiors, there are predictable effects on belief updating. Under those circumstances, I would expect \( a \) to be greater than \( b \) for an external task hypothesis (the subjects should be disconfirmation prone). The subordinate subjects' level of belief might decrease with mixed evidence. For superior and subordinate groups together, there would be a convergence of beliefs for mixed information. Instead, subordinates and superiors strengthened their beliefs with mixed evidence, and there was a significant divergence of beliefs.

**Consequences of Updating Cue Strengths**

Table 26 reports the subordinate subjects' evaluations of the direction and strength of each of the updating cues for the experiments. In Experiment 1, there was one internal item rated as not significantly different from zero. The recency effect for mixed evidence is expected to be greatest when both negative and positive items are
strong [Einhorn and Hogarth, 1987]. For Experiment 1, the order effects were significant for role subjects but not for the nonrole tasks. The effect for the nonrole tasks could be related to weak evidence. Experiments 2 and 3 would have provided a better test of the order effect predictions of the C-IM if some of the cues had been stronger.

Certain relationships between strengths of cues were needed in the experiments. For example, from Experiment 1, the cues $C_s$ and $C_t$ should be of similar strength. Subjects perceived the $C_t$ cue to be stronger than the $C_s$ item. A failure to achieve the desired relationships between cues could contribute to apparent position effects or to interactions between position and order. Out of twelve tests for position effects, only one was significant at $p$ less than .10. Interactions between order and position were examined in analyses 11 through 24. The order x position or role x order x position interactions are significant only in analyses 14, 15, and 16 (Appendix D). The form of the interaction in each case is a stronger recency effect when information is presented in the order $C_s..C_t$ than for the reverse order. In the manipulation checks for Experiment 1, the consistency cues were both perceived as stronger than the consensus cues. Recency (with the stronger cue presented later) may have contributed to the significant order x position interactions.
Summary

In the experiments, virtually all the significant results involved mixed evidence. Significant divergence of beliefs occurred for mixed evidence. The divergence of opinions for mixed evidence suggests that there was a reduction in $\alpha$ for one or both groups. Two other experimental findings indicate that $\alpha$ was not affected by role assignment. First, there was no reduction in recency for order tasks, compared to nonrole tasks. When $\alpha$ is small, recency for mixed evidence should be reduced.

The second result which suggests that $\alpha$ values were not affected is the lack of divergence of beliefs for consistent evidence. If $\alpha$ levels were low for both subordinates and superiors, divergence should also be observed for consistent evidence. The nonsignificant divergence effect for consistent evidence may be related to the weakness of some of the updating cues. With stronger evidence, the divergence effect might be significant. An alternative explanation is that the divergence effect requires a sharp or dramatic change in evidence, as with the mixed evidence used in belief updating experiments.
CHAPTER 6

SUMMARY AND CONCLUSIONS

Research into the use of accounting information in performance evaluation may make contributions both to accounting practice and to the development of the academic accounting literature. The first two sections of the chapter describe the potential contributions of this study. Like other behavioral research, the conclusions from these experiments are subject to limitations of generalizability. Threats to both external and internal validity are outlined, followed by suggestions for future research. Finally, this study is summarized.

Contributions to Practice

The contrast-inertia model (C-IM) may describe deviations from normative behavior in the revision of beliefs about performance. The research supports the existence of order effects in belief revisions. With the availability of a good descriptive model for the belief updating process, managerial accounting systems and reports may be designed to minimize order effects and other task effects [Harrison, West, and Reneau, 1988]. Performance evaluation
might approach more closely the Bayesian ideal for opinion changes.

There are both organizational costs and personal costs from order effects and other procedural or task effects associated with the use of information. The effect of information order on the superior's opinion may be used as an example. Order effects increase the "noise" or arbitrariness of the performance evaluation process. The illustration of order effects in Figure 4 assumes the existence of two items of performance information of equal strength, one positive and one negative. If the items are received in the (-,+)) order, the superior may allow unacceptable performance to continue. If the superior responds to the items in the (+,-) order, the subordinate may have to account for unfavorable outcomes (which would be ignored with the reverse order) and may suffer reduced compensation and increased stress. With either information order, the superior's evaluation is more extreme than the normative or Bayesian ideal.

Performance evaluation research may change how performance appraisal occurs in organizations. Training programs for evaluators have been shown to reduce certain evaluative errors or bias, such as the halo effect, stringency, and central tendency [Feldman, 1981]. The order effects and divergence of beliefs for mixed evidence which were found in this research may be controllable through training and
Figure 3
Bayesian and Nonnormative Belief Revision

A = ending opinion for (-,+) order
B = ending opinion for (+,-) order
C = normative Bayesian belief revision
changes in evaluation procedures. For organizations which try to increase trust between their members, the study of how accounting information is used in performance evaluation may be particularly important. To the extent that the C-IM models undesirable behavior in actual organizations, it may be helpful in preventing such phenomena.

The C-IM and attribution theory (AT) together predict that divergence of beliefs between superiors and subordinates occurs during performance appraisals. Divergence of beliefs was actually observed for mixed evidence. The two models appear to account for some of the friction between superiors and subordinates. Companies may undertake safeguards to reduce such opinion discrepancies or to control the consequences. Some companies might choose to allow more self evaluation and less evaluation by superiors. The results of these and other experiments [Harrison, West, and Reneau, 1988; Shields, Birnberg, and Frieze, 1981] support policies of performance review by an independent third party. Some organizations might respond to experimental results by using a more formula-based evaluation process. Such an approach would avoid order effects, but formulas may fail to capture performance in numerous companies and many jobs.

The results of this study do not indicate that there are unique effects in managers' use of accounting information. According to the C-IM, order and other task
effects may occur in a wide range of situations. In these experiments, there was evidence for divergence of beliefs in both role and nonrole tasks. The results from this research suggest that the same kinds of information processing phenomena which have been observed in other kinds of tasks may present particular problems, which have not been adequately studied, in performance evaluation.

Contributions to Academic Research

This study furthers the tradition of research into how accounting information is used in performance evaluation [Brownell, 1982; Hirst, 1981, 1983; Hopwood, 1972; Otley, 1978]. It may be considered an extension of the research published by Harrison, West, and Reneau [1988]. They established that superior and subordinate subjects make different attributions for unfavorable variances. Their study involved a static task, rather than an updating task. I assumed that superiors and subordinates do make different attributions, and had them perform an updating or belief revision task. At issue was how attributions evolve, not how they are originally made.

This study was the first to apply the contrast-inertia model to a managerial accounting task. Several researchers have used the C-IM for expert judgment tasks in auditing [Asare, 1989; Ashton and Ashton, 1988a, 1988b; Reed, Pei, and Koch, 1988; Tubbs, Messier, and Knechel, 1989], but it
had not been applied in other accounting areas. The results further support the order effect predictions of the C-IM.

An important contribution of this research is the integration of the C-IM and attribution theory in an area where both are relevant. There are several questions about belief revision which are not addressed by the C-IM. Among these are, Where does a person's initial hypothesis come from? A second question is, How do people identify information as positive or negative? In this study, these questions are answered by attribution theory. The task hypotheses which were assigned to superior and subordinate subjects were consistent with attribution research precedent. Expectations about the sign of evidence (positive or negative) come from earlier attribution research. Attribution theory describes the causal assumptions managers usually make. Integrating AT and the C-IM allows predictions of how causal beliefs evolve as new information is received.

Limitations of the Research

For this study, there are threats to both internal and external validity. The internal threats are (1) the possible failure of role adoption, or the absence of significant differences between the role and the nonrole tasks; (2) the conditions of administration of the
experiments; and (3) the perceived strength of the updating evidence. The assumptions and simplifications which were made in designing these experiments limit the generalizability of the results. The limitations on external validity relate to (1) the assumed characteristics of the organizations involved in the experimental tasks; (2) the characteristics of the subjects used in the experiments; (3) the form in which information was presented to subjects in the experiments; and (4) the differences between the experimental task requirements and actual evaluation task requirements.

**Threats to Internal Validity**

The first threat to internal validity is the possible failure of the role manipulation in Experiment 1. Subjects performed two tasks in which they were to take the position of an uninvolved observer. Most of the subjects indicated that they both evaluate others and are evaluated by their superiors. However, in a manipulation check (Table 25), many of the subjects wrote that their attitude toward the nonrole tasks was that of the superior (37.5 percent) or the subordinate (9.4 percent). Comparisons between role and nonrole task results may not capture any true role effects. Most of the predicted differences between role and nonrole tasks are not statistically significant. The lack of significance may be due to the subjects' lack of a
neutral attitude toward the nonrole tasks. As described in Chapter 5, problems with the role assignments cannot account for all the observed results.

The method of administration of most of the experiments (by mail) poses a threat to internal validity. The managers who chose the experimental participants could have selected individuals who did not meet the specified criteria. The demographic information elicited from subjects suggests that this problem was avoided. Subjects may not have followed the experimental instructions. The failure to follow directions (especially the requirement that completed answers not be altered) could increase the statistical significance of results.

Because I was not present when the participants performed the experiments, I do not know how much time they spent. The amount of time taken measures how carefully they did the experiment. Some subjects gave identical responses to five or more sequential elicitations, suggesting that they simply wrote down numbers without reading the updating information. Another factor relates to the order in which the subjects performed the experimental tasks. If any subjects did the parts of the instrument out of order, the nonrole tasks (which were supposed to be done first) could be contaminated by role effects. Assuming that all subjects did the nonrole tasks first, any significant differences between role and nonrole tasks may be due either to the role
assignment or to the sequencing of the tasks (a practice effect).

Order effects for consistent evidence and position effects for all kinds of evidence were predicted not to be significant. The absence of significant effects (except for one position effect) may be due to the descriptive accuracy of the theoretical models. The lack of significant results might also be attributable to the strength of some updating cues. Some items which were meant to be internal or external were perceived as not significantly different from zero. The relative strengths of some cues, particularly in Experiments 2 and 3, were not as intended. As a result of problems with the strength of evidence, the tests of order, position, and divergence of beliefs effects were not as powerful as they might have been.

Organizational and Subject Characteristics

The organizational and subject characteristics which were assumed in designing the experiments limit the generalizability of the results. I assumed that the level of performance within an organization can be assessed unambiguously. In the experimental scenarios, there was no ambiguity about the failure to meet standards or expectations. Accounting tools for performance evaluation are mainly quantitative financial data [Hayes, 1977]. Performance was assumed to be adequately captured by such
data. This assumption excludes cells III and IV of Thompson's [1967] characterization of organizations, shown in Chapter 2 of this proposal. Cells III and IV are those organizations in which standards are ambiguous. I have assumed that performance is well-defined, and the only unresolved issue is causality for performance. The experiments are most consistent with those organizations in Thompson's cell II.

There are further limitations on the organizations to which the results might be generalizable. All subjects work for manufacturing firms in the for-profit sector of the economy. The scenarios are restricted to manufacturing failures. Nothing can be inferred about attributions for success or in nonmanufacturing or nonprofit organizations. The existence of the actor-observer bias, which is assumed in this proposal, depends on an organization having a clearly-defined hierarchical structure. Results may not extend to companies with less traditional structures.

Subjects were selected from manufacturing firms, primarily in the Dallas-Fort Worth area. Most of the managers in the sample work in nonunion plants. Women manufacturing managers are underrepresented. The use of a nonrandom sample, chosen from a small number of firms within a single geographic area, and with characteristics not typical of manufacturing companies as a group, limits the external validity of the findings.
Information Characteristics

Some of the assumptions and choices made to implement the experiments reduce the generalizability of the results. Consensus, consistency, and distinctiveness information were dichotomized into two levels, high and low. People can perceive and use more gradients of information. Much of the information in performance reports is continuous and not restricted to two levels. The cues or updating evidence in these experiments are qualitative summaries of the information which may appear in performance reports. Managers who receive such reports on the job have to extract the significant information, evaluate, and summarize it themselves. Judgments may depend on the degree of decomposition of the stimuli presented to decision makers [Einhorn, 1976]. Findings of order or position effects in experiments with separate, well-defined cues need not imply that such effects occur in actual decision environments.

In these experiments, subjects were assigned their causal viewpoints. Managers evaluating performance on the job may develop their own causal hypotheses, explicitly or implicitly. The initial items of evidence they receive may be crucial to hypothesis formation. Assigned experimental hypotheses may not carry the same level of commitment as the hypotheses managers develop themselves [Asch, 1946; Nisbett and Ross, 1980]. For self-developed hypotheses,
there may be a strong primacy effect. The reported results of recency for mixed evidence and no order effects for consistent evidence [Ashton and Ashton, 1988a; Einhorn and Hogarth, 1987; Tubbs, Messier, and Knechel, 1989] may be experimental artifacts. Hogarth and Einhorn [1989] recognized that their model only applies in cases where people change their beliefs in an existing hypothesis. If superiors in performance appraisal start with the hypothesis that current performance will resemble the performance for the previous period, there could be recency effects in the amount of opinion revision.

The sequential anchoring-and-adjustment strategy assumed as part of the C-IM is a limitation of the model. In such a sequential approach, an item of information is assumed to be received and completely assimilated before another updating cue is received. A more realistic picture would allow a continuous inflow of information, with different items of information overlapping or even indistinguishable. In such an environment, the effects of separate items could not be isolated. There would be interactions between evidence bits before or during the assimilation process.

The experiments did not incorporate superiors' leadership styles or interactions between leadership style and the use of accounting information [Hopwood, 1972]. The study is concerned only with those items of information
which superiors and subordinates have in common. According to attribution theory, the superior-subordinate relationship is characterized by informational asymmetry. The subordinate may have more detailed knowledge about the production environment, while the superior may have greater access to formal information channels. The effects of information asymmetry on subordinate stress and differences of opinion between superiors and subordinates are not examined in this study.

**Experimental Task Requirements**

Other C-IM experiments have used both the end-of-sequence (EOS) and step-by-step (SBS) response modes [Ashton and Ashton, 1988a; Einhorn and Hogarth, 1987; Tubbs, Messier, and Knechel, 1989]. In this research, SBS alone was used. This response mode requires explicit statement of the level of belief after every evidence item. The EOS response mode could more closely resemble managers' performance evaluation behavior. The step-by-step response mode was employed because some of the hypotheses could not be tested with an EOS response mode. Future research may employ EOS belief revision in a performance evaluation task.

These experiments involved revision of belief by subjects. The subjects were not required to take any actions on the basis of their beliefs. There were neither
costs nor benefits to the participants. Einhorn and Hogarth [1981] wrote that judgment and choice (belief and action) are not synonymous. Making a choice requires greater commitment than making a judgment. Taking action reduces future freedom to choose, in a way that forming an opinion does not. In actual performance evaluation situations, there are choices to be made and costs and benefits to the organization as well as the individuals involved. Meaningful costs and benefits are not easily built into behavioral experiments.

In the experiments, the task hypotheses are concerned with the subordinate's responsibility for a performance problem. Both superiors and subordinates were expected to revise their beliefs about the subordinate's causal role. In performance appraisal, new information may change the superior's understanding of the subordinate's task environment as well as, or instead of, the evaluation of the subordinate. The experimental instrument tells nothing about the environment in which the performance problem occurred.

When there are performance problems, the cause may lie outside the subordinate, or there may be multiple necessary causes. A labor efficiency variance could result from low-quality materials, changes in technology, or labor turnover caused by factors external to the production department. These experiments focus on the performance role of the
subordinate. The two task hypotheses in each experiment had to be opposites (Table 11 or Appendix C), so that comparisons could be made between superiors and subordinates. The updating evidence in the experiments could have been consistent with or contrary to a specific alternative hypothesis. Use of updating evidence pointing to another hypothesis would not fit very well with the contrast-inertia model, which assumes that people consider one hypothesis at a time. The updating evidence used in the experiments was not intended to be overwhelmingly positive or negative, as evidence related to another hypothesis might be. Instead, the evidence was meant to require interpretation by the experimental participants.

All behavioral experiments involve simplification, or abstraction from reality. Performance appraisal in organizations is a complex activity with behavioral and motivational implications. The external validity of relatively abstract experiments, such as these, is always subject to question. Experiments can have one important source of external validity, process generality [Wendelken and Inn, 1981]. To the extent that the experiments capture the cognitive processes of performance appraisal, they contribute to a theoretical understanding of behavior in organizations. The intent of this research is to identify basic phenomena (order effects and divergence of beliefs) which may occur in actual performance evaluations.
Suggestions for Future Research

Attribution theory and the C-IM could be integrated by methods other than that used here. An experiment might be designed using an internality response scale,

Internality = Ability + Effort - (Task difficulty + Luck)

where subjects would divide a given number of points between the four terms in the equation. Arrington, Bailey, and Hopwood [1985] and Harrison, West, and Reneau [1988] used the internality response scale in attribution research. In a belief updating experiment with the internality scale, subjects would be making their own attributions. Their viewpoints might change from internal to external, for example, if convincing external evidence were presented. A finding that subjects still show order effects with this response scale would offer powerful support for the C-IM.

In these experiments, superior and subordinate subjects were given opposite hypotheses. Both groups were expected to be advocates for their positions. An experiment could be designed in which different subjects are assigned the roles and then are given the same hypothesis, an internal hypothesis, for example. People generally are considered to be confirmation prone. This suggested experimental manipulation should create one group of confirmation-prone subjects (superiors), and a second group (subordinates) who are disconfirmation-prone. The two
groups should have different $\alpha$ and $\beta$ values. When updating evidence is presented to them, their levels of belief in the internal hypothesis should diverge, as predicted by Einhorn and Hogarth [1987].

The contrast predictions of the C-IM have been tested only by Ashton and Ashton [1988a]. An experiment might be designed to test the sensitivity of the contrast effect to the use of the probability response scale. The experiment would use probabilities and a response scale without end bounds, such as an odds elicitation. The use of different response scales might establish whether the contrast effect is a genuine behavioral phenomenon, or an artifact of the response scale [Ashton and Ashton, 1988a].

Einhorn and Hogarth [1985] concluded that step-by-step and end-of-sequence response elicitations influence opinion changes. Some friction between levels of management may be related to different frequencies of reporting of operating results to managers, and different levels of information aggregation. An experiment might use the SBS and EOS response modes as a proxy for different frequencies of reporting and levels of aggregation. The SBS mode would be used for frequent, less aggregated reports to low level managers. The EOS response mode would represent the less frequent, more aggregated reports to higher level managers. If differences in ending opinions resulted, a potential source of conflict would have been identified.
Future research might examine attribution updating in companies which do not have traditionally hierarchical structures. In such companies, the actor-observer bias could not be assumed. There might also be research in nonproduction departments of manufacturing companies or in service organizations. Biases in the use of accounting data may be countered by less formal appraisal techniques. A field study might examine the updating of beliefs with formal and informal information sources. Many accounting issues related to performance evaluation remain to be addressed.

Summary

The first problem considered in this research is nonnormative belief revision by individual managers. The contrast-inertia model was applied to make predictions about the patterns of belief revision in performance evaluation. The experimental results support the existence of order effects for mixed information. There is also limited evidence for position effects in belief revision. As predicted, there are no order effects for consistent (positive or negative) evidence. The contrast-inertia model may be useful in predicting and perhaps preventing nonnormative belief revision by managers.

The second problem motivating this research is the existence of role bias or divergence of beliefs between
superiors and subordinates in performance evaluation. The experimental results provide little support for role bias in the assimilation of accounting information. The absence of bias results may have occurred because the subjects' attitudes toward information are unbiased. There are two additional explanations for the lack of bias. First, the nonrole tasks (which served as a control for the role assignments) may not have reflected an uninvolved, neutral attitude. The experiments may not provide a true measure of role attitudes. The second potential explanation is that the C-IM may not adequately describe bias effects.

The integration of attribution theory and the contrast-inertia model leads to the prediction that the opinions of superiors and subordinates diverge as they assimilate new information in performance evaluation. Divergence of beliefs was predicted for mixed evidence and for consistent internal or external information. Significant divergence of beliefs is observed for mixed evidence only. In the experiments, nonnormative effects occur for mixed evidence almost exclusively. Since performance appraisal is likely to be based on both positive and negative evidence, the results may be significant in organizational evaluations.
NOTES

The belief updating model has been revised a second time [Hogarth and Einhorn, 1989]. The model is now called the belief-adjustment model. In this revision, the authors discuss the encoding process. Information is identified as positive or negative by comparing it to a reference point, which could be the previous anchor or a constant, such as zero. The model has been revised to consider the effects of the number of evidence items and the complexity of each item. For the experiments I designed (a short series of complex evidence items, and a presumed constant reference point) the form and predictions of the model are still as shown in Chapter 2.

1If either parameter is zero, the model predicts no order effects. For example, if $a$ is zero, negative evidence has no impact on an individual's beliefs. When mixed evidence is presented in the $(-,+)$ order, the negative evidence leaves the initial level of belief unchanged. The impact of positive evidence is the same as when it is presented first. Exposure to mixed evidence could only strengthen beliefs, by an amount which is independent of the order of presentation.
As a simple example, two pieces of evidence might be presented as \( C_{s_i}C_{t_e} \) and \( C_{t_e}C_{s_i} \), where the subscripts \( i \) and \( e \) represent "internal" and "external." If these two orders of presentation gave different final levels of belief, the observed effect could be due to the order of internal and external evidence or to the position of \( C_s \) and \( C_t \) information.

Because the subjects used in the experiments were professionals, the number of participants that could reasonably be acquired was limited. As a result, not all arrangements of information types could be tested.

Administration of the experiments in person would have been preferable to the procedure actually used, administration by mail. The absentee administration was necessary to get enough participants. Managers of most of the companies would have been reluctant to cooperate with administration in person. The managers who did the experiment could not have taken time away from their jobs. Administration by mail reduced the disruption of the normal work routine.

Because subjects did the experiments on their own, there is no assurance that they followed the experimental instructions. A failure to follow certain instructions could affect the results. The directions request that the
experiment be completed in a single sitting. If subjects did not complete the experiment at one time, work-related events and mood changes could affect the relationships between their responses on different parts of the experiment. Another instruction is that, once a response had been made, it should not be changed. As subjects proceeded through the experimental instrument, they may have developed opinions about the experimental manipulations or the purposes of the experiments. If they changed any of their responses to reflect these opinions, it could affect the significance of the results. To the extent that the subjects correctly understood the experimental manipulations, significance would increase. Subjects did appear to understand the experimental instructions. All instruments which were returned to me were complete and usable.

In ANOVAs 1 and 5, the TASK variable is significant. Each subject performed two nonrole tasks and two in the role assignment. A significant TASK effect means that the subjects gave different initial responses for the two nonrole tasks (or for the two role tasks). For example, in the group Super1, about 40 percent of the responses were higher for task E than for Task A. The scenarios for Experiment 1 were written to be comparable, but with minor wording differences (see Tasks A and E in Appendix C). Some groups of subjects may have reacted to the wording
variations. The scenarios were varied slightly to maintain subjects' interest in the tasks. The variations also reduce surface similarities between tasks and may help to disguise the experimental manipulations.

There is a higher order interaction. The role x order x position interaction is significant. The interaction between role and order is much stronger for the Cs..Ct positioning of cues than for Ct..Cs. In analyses 14 and 15, for the significant order x position interactions, the order effects are stronger for the Cs..Ct sequence than for Ct..Cs. The interactions are discussed in the "Experimental Results and Manipulation Checks" section of the chapter.

With mixed evidence, the recency effect is significant for role tasks only, contrary to predictions. The lack of significance for nonrole tasks may be due to experimental procedures. Subjects performed the nonrole tasks first, before any of the role tasks. The purpose for this procedure was to prevent role beliefs from contaminating the nonrole tasks. The stronger order effects for role tasks may be due to practice at the updating tasks. An alternative explanation is that the role assignment increases subjects' interest in the experiments, and
increases their $a$ and $\beta$ values. According to the C-IM, recency effects are strongest when both $a$ and $\beta$ are large.

If subjects approached the nonrole tasks and the role tasks in essentially the same way, the recency effects with mixed evidence should not differ between the role and nonrole tasks. I had predicted reduced recency for the role tasks, an effect which is not observed. I also expected the total belief change for mixed evidence to be more positive for role tasks than for nonrole tasks. The amount of belief change does not differ significantly between role and nonrole tasks. The lack of significant support for Hypotheses 6A, 6B, 7A and 7B (Table 22) could be accounted for by a failure of the role assignments.

If subordinate subjects performed nonrole tasks as if they were superiors and then adopted the subordinate viewpoint, the ASSI effect should be highly significant. If the superior role dominated all their tasks, the ASSI effect would not be significant.

To the extent that the assumption is not met in the subjects' companies, there is also a threat to the internal validity of the experiments.
APPENDIX A

PROOFS OF THE ORDER EFFECT PREDICTIONS
OF THE CONTRAST-INERTIA MODEL
Order Effect Predictions for Negative Evidence

The contrast-inertia model predicts no order effects for consistent positive or negative evidence. The model assumes that negative evidence is incorporated into an existing belief through the use of the discount model, which may be stated,

$$S_k = S_{k-1} - \alpha S_{k-1}s(a_k)$$

where $S_k$ = the level of belief in a hypothesis after $k$ pieces of evidence

$S_{k-1}$ = the belief after $k-1$ pieces of evidence;

the anchor for the $k$th updating

$s(a_k)$ = the subjective appraisal of the strength of the $k$th piece of evidence, when it is negative

$\alpha$ = a person's sensitivity to negative evidence;

assumed to be constant over a short sequence of evidence.

The discount model may be rearranged,

$$S_k = S_{k-1}[1 - \alpha s(a_k)].$$

For $k = 2$:

$$S_2 = S_1[1 - \alpha s(a_2)]$$

$$S_1 = S_0[1 - \alpha s(a_1)],$$

where $S_0$ = the initial level of belief, before any updating evidence is received. Substituting equation (4) into equation (3),
The result achieved in equation (5) does not depend on the order in which the two pieces of evidence are received and evaluated. Because multiplication is commutative, \( S_2 \), the ending level of belief, is not affected by the order of information processing. This result can be generalized for values of \( k \) greater than two [Einhorn and Hogarth, 1987].

**Order Effect Predictions for Positive Evidence**

Einhorn and Hogarth [1987] assumed that positive evidence is incorporated into opinions through the accretion model,

\[
S_k = S_{k-1} + \beta (1 - S_{k-1})s(b_k)
\]

where \( \beta \) = the person's sensitivity to positive evidence

\( s(b_k) \) = the subjective strength of the \( k \)th piece of evidence, when it is positive.

Equation (6) can be rearranged,

\[
S_k = S_{k-1}[1 - \beta s(b_k)] + \beta s(b_k).
\]

Applying equation (7) when \( k = 2 \) gives the following results:

\[
S_2 = S_1[1 - \beta s(b_2)] + \beta s(b_2)
\]

\[
S_1 = S_0[1 - \beta s(b_1)] + \beta s(b_1).
\]

Substituting (9) into (8),

\[
S_2 = [S_0 - \beta s(b_1)][1 - \beta s(b_2)] + \beta s(b_2)
\]

\[
= S_0 + \beta (1 - S_0)[s(b_1) + s(b_2) - \beta s(b_1)s(b_2)].
\]

Since both addition and multiplication are commutative, the
order of information evaluation does not affect either the ending level of belief or the amount of change in belief for consistent positive evidence [Einhorn and Hogarth, 1987].

**Order Effects for Mixed Positive and Negative Evidence**

The contrast-inertia model predicts that there will be the order effect of recency for mixed positive and negative evidence. The ending level of belief will be higher when information is presented in the order (negative, positive) than when it is given to subjects in the reverse order. For mixed evidence, Einhorn and Hogarth [1987] assumed that people use the discount model, equation (1), for negative evidence, and the accretion model, equation (6), for positive evidence. When evidence is presented in the (+,-) order,

\[ S_{2-} = S_1 - a S_1 s(a) \]  

(11)

where \( s(a) \) = the subjective strength of the single piece of negative information.

The level of belief after the first item of evidence may be computed,

\[ S_1 = S_0 + \beta (1 - S_0) s(b) \]  

(12)

where \( s(b) \) = the subjective strength of the positive evidence.

Incorporating equation (12) into equation (11) gives equation (13),
\[ S_{2+} = S_0 + \beta s(b) - \beta S_0 s(b) - \alpha S_0 s(a) - \alpha \beta S_0 s(a)s(b) \]
\[ + \alpha \beta S_0 s(a)s(b). \]  

(13)

When evidence is presented in the \((-,+\)) order,
\[ S_{2-} = S_1 + \beta(1 - S_1)s(b) \]
\[ S_1 = S_0 - \alpha S_0 s(a) \]  

(14)

(15)

Substituting equation (15) into (14),
\[ S_{2-} = S_0 - \alpha S_0 s(a) + \beta s(b) - \beta S_0 s(b) + \alpha \beta S_0 s(a)s(b). \]  

(16)

When equation (12) is subtracted from equation (15), the result is
\[ S_{2-} - S_{2+} = \alpha \beta s(a)s(b). \]  

(17)

The ending level of belief is dependent on the order in which positive and negative cues are integrated into the opinion. Assuming that both \( \alpha \) and \( \beta \) are greater than zero, the order effect of recency is predicted. The final level of belief and the amount of belief change over a sequence of evidence are greater when positive evidence is presented after negative information, than for the reverse order. This recency effect is expected to be strongest when both positive and negative updating cues are perceived to be strong, and when a person is highly sensitive to both positive and negative evidence.
APPENDIX B

EXPERIMENTAL DESIGNS
Table 27  
Experimental Design, Experiment 1

Subject Pool

<table>
<thead>
<tr>
<th>Internal Task Hypothesis</th>
<th>External Task Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Super1 Order 1</strong></td>
<td><strong>Super2 Order 2</strong></td>
</tr>
<tr>
<td><strong>Task 1:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Task A</strong></td>
<td><strong>Task B</strong></td>
</tr>
<tr>
<td>Nonrole</td>
<td>Nonrole</td>
</tr>
<tr>
<td>Evidence:</td>
<td>Evidence:</td>
</tr>
<tr>
<td>Ct_i D_i, Csi D_e</td>
<td>Cte D_e, Ct_i D_i</td>
</tr>
<tr>
<td><strong>Task 2:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Task E</strong></td>
<td><strong>Task F</strong></td>
</tr>
<tr>
<td>Nonrole</td>
<td>Nonrole</td>
</tr>
<tr>
<td>Evidence:</td>
<td>Evidence:</td>
</tr>
<tr>
<td>Cs_i D_i, Cte D_e</td>
<td>Cs_i D_i, Ct_i D_i</td>
</tr>
<tr>
<td><strong>Task 3:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Task J</strong></td>
<td><strong>Task K</strong></td>
</tr>
<tr>
<td>Role: Superior</td>
<td>Role: Superior</td>
</tr>
<tr>
<td>Evidence:</td>
<td>Evidence:</td>
</tr>
<tr>
<td>Ct_i D_i, Csi D_e</td>
<td>Cte D_e, Ct_i D_i</td>
</tr>
<tr>
<td><strong>Task 4:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Task N</strong></td>
<td><strong>Task P</strong></td>
</tr>
<tr>
<td>Role: Superior</td>
<td>Role: Superior</td>
</tr>
<tr>
<td>Evidence:</td>
<td>Evidence:</td>
</tr>
<tr>
<td>Cs_i D_i, Cte D_e</td>
<td>Cs_i D_i, Cte D_e</td>
</tr>
</tbody>
</table>

There are two between-subject factors, each at two levels (the type of task hypotheses and the evidence order), splitting the subject pool into four groups. The four groups are designated Super1 (superior, order 1), Super2 (superior, order 2), Subor1 (subordinate, order 1), and Subor2 (subordinate, order 2). The two within-subject factors are position of information and the role/nonrole assignment. Each separate experimental task is assigned a letter designation, as shown. For an explanation of the abbreviations used, see Table 28.
Table 28
Experimental Design, Experiments 2 and 3

Subject Pool

<table>
<thead>
<tr>
<th>Internal Task</th>
<th>Hypothesis</th>
<th>Superior Role</th>
<th>External Task</th>
<th>Hypothesis</th>
<th>Subordinate Role</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Super1</strong></td>
<td></td>
<td></td>
<td><strong>Super2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Order 1</strong></td>
<td></td>
<td></td>
<td><strong>Order 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expt. 2</td>
<td></td>
<td></td>
<td>Expt. 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Task 1</strong>:</td>
<td>Task S</td>
<td>Evidence:</td>
<td><strong>Task AA</strong></td>
<td>Task AB</td>
<td>Evidence:</td>
</tr>
<tr>
<td>Order 1</td>
<td></td>
<td>$D_{e,s}$ $C_{t,e}$</td>
<td><strong>Task AB</strong></td>
<td>Evidence:</td>
<td>$D_{i,w}$ $C_{t,i}$</td>
</tr>
<tr>
<td>Evidence:</td>
<td></td>
<td>$C_{s_{e,w}}$</td>
<td><strong>Task AC</strong></td>
<td>Evidence:</td>
<td>$C_{s_{i,w}}$</td>
</tr>
<tr>
<td><strong>Task 2</strong>:</td>
<td>Task W</td>
<td>Evidence:</td>
<td><strong>Task AD</strong></td>
<td>Evidence:</td>
<td></td>
</tr>
<tr>
<td>Order 1</td>
<td></td>
<td>$C_{s_{e,s}}$ $C_{t,e}$</td>
<td><strong>Task AC</strong></td>
<td>Evidence:</td>
<td></td>
</tr>
<tr>
<td>Evidence:</td>
<td></td>
<td>$D_{e,w}$ $C_{t,e}$</td>
<td><strong>Task AH</strong></td>
<td>Evidence:</td>
<td></td>
</tr>
<tr>
<td>Order 2</td>
<td></td>
<td></td>
<td><strong>Task AH</strong></td>
<td>Evidence:</td>
<td></td>
</tr>
</tbody>
</table>

In Experiments 2 and 3, there are two between-subjects factors, hypothesis type and information order, dividing the subjects into four groups. The only within-subject factor is the position of evidence.

Interpretation of abbreviations:
- $C_t =$ consistency
- $C_s =$ consensus
- $D =$ distinctiveness
- $i =$ internal evidence
- $e =$ external evidence
- $w =$ weak evidence
- $s =$ strong evidence
APPENDIX C

EXPERIMENTAL INSTRUMENT AND INSTRUCTIONS
Experimental Instructions

In this experiment, you will be asked to state your judgment in several performance evaluation situations. Since you are being asked for your opinions, there are no right or wrong answers. For each situation or task, you will state your estimate of the likelihood that a certain statement is true. After receiving additional information, you will make new estimates of the probability that the same statement is true. In each case, state your estimate on a scale from 0 to 100, where 0 means that you are certain the statement is not true. A value of 100 means that you are certain the statement is true. A value of 50 means that you are equally uncertain whether the statement is true or false. An example of a completed judgment task is shown on the back of this page.

The amount of time needed to complete the experiment is estimated to be 30 minutes. Please work carefully and at your own pace. The entire experiment should be done in one sitting. Read and complete each page in order, completing the front and then the back of the page. If you need to turn back to an earlier page to reread part of the experiment, you may do so, but please do not change any of your previous responses. Your responses will be kept confidential. Please do not put your name on any part of the experiment. Your participation in this experiment is
totally voluntary, and you may cease participation at any
time without penalty. Thank you for your cooperation.

Example judgment task:

Initial information: Nora's apple pie won a blue
ribbon at the county fair.
State your estimate, from 0 to 100, of the
probability that the following statement is true:
Nora won the prize because of her cooking skill.
   Probability estimate 80
(The probability estimate of 80 means that the
respondent believed that the statement was more
likely to be true than false.)

Updating information: Nora's cousin was one of the
judges for the pie-baking contest.
Now, state your estimate, from 0 to 100, of the
probability that the following statement is true:
Nora won the prize because of her cooking skill.
   Probability estimate 40
(Because of the new information, the respondent
now thinks that the statement is more likely to be
false than true.)

(Any information shown in brackets,{}, is for explanatory
purposes and did not appear on the experimental instruments
which were administered to subjects. This version of the
instrument was administered to superior subjects, order 1,
Super1, or group G1 in Tables 9 and 10, in Chapter 4.
The changes for other groups of subjects are given in
brackets elsewhere in this instrument. The other groups
are subordinate, order 1 (Subor1), Superior, order 2
(Super2), and subordinate, order 2 (Subor2).}
Instructions: In this task, please adopt the viewpoint of an outsider to the performance evaluation situation.

A.C. Anthony is the manager of a production department in a large manufacturing plant and has held that position for about one year. Anthony's superior, B. Todd, recently transferred from similar responsibilities elsewhere in the company. Department managers in the plant are evaluated on the basis of variances for materials and labor usage. Last month's performance report shows labor costs which were higher than the standard for the department's output. The labor efficiency (usage) variance was unfavorable and large enough that company policy requires an investigation of possible causes for the variance. Anthony's superior, Todd, is responsible for the investigation.

State your initial estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the unfavorable labor efficiency variance was related to A.C. Anthony's management of the department.

Probability estimate ________
Task A, Page 2

The labor efficiency variance has been large and unfavorable several times since Anthony has managed the department. \( \{Ct_i\} \)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the unfavorable labor efficiency variance was related to A.C. Anthony's management of the department.

Probability estimate ________

Task A, Page 3

In Anthony's department, last month's actual overhead costs were significantly higher than budgeted amounts.

\( \{D_i\} \)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the unfavorable labor efficiency variance was related to A.C. Anthony's management of the department.

Probability estimate ________

Task A, Page 4

Several other department managers in the plant had large unfavorable labor efficiency variances last month.

\( \{Cs_e\} \)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the unfavorable labor efficiency variance was related to A.C. Anthony's management of the department.

Probability estimate ________

(For all tasks, the scenario and each of the updating cues were on separate pages.

Abbreviations:

\( Cs = \) consensus \hspace{1cm} \( Ct = \) consistency
\( D = \) distinctiveness \hspace{1cm} \( i = \) internal
\( e = \) external \hspace{1cm} \( s = \) strong
\( w = \) weak)
Materials variances in Anthony's department were very small last month. \( \{D_e\} \)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the unfavorable labor efficiency variance was related to A.C. Anthony's management of the department.

Probability estimate ________

(The same updating cues, in the same order, were used for Subor1 subjects. For Super2 and Subor2, the updating evidence was:

1. The labor efficiency variance for ___'s department had been small for several months before last month. \( \{C_{t_e} \} \)
2. Materials variances in ___'s department were very small last month. \( \{D_e\} \)
3. Last month, all other departments in the plant had much smaller labor efficiency variances than ___'s department. \( \{Cs_i\} \)
4. In ___'s department, last month's actual overhead costs were significantly higher than budgeted amounts. \( \{D_i\} \)
Task E, Page 1

Instructions: In this task, please adopt the viewpoint of an outsider to the performance evaluation situation.

Lynn Harris was selected several months ago to manage one of the production departments of a large manufacturer. Harris's superior, D. Banks, just transferred from a similar position in another plant. Harris's performance is evaluated on the basis of material and labor variances. For last month, labor costs were well above the standard for the department's output. The labor efficiency (usage) variance was large and unfavorable. Company policy requires an investigation to determine the cause for the variance.

Harris's superior, Banks, is in charge of the investigation.

State your initial estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the unfavorable labor efficiency variance was related to Lynn Harris's management of the department.

Probability estimate

(This scenario is nearly identical to Task A and to the other tasks used in Experiment 1. The names used for the superior and the subordinate were different in each scenario. In the nonrole scenarios (Tasks A - H, Appendix B), names were given for both the superior and the subordinate.)
Last month, all other departments in the plant had much smaller labor efficiency variances than Harris's department. \( \{C_s_i\} \)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:
The cause of the unfavorable labor efficiency variance was related to Lynn Harris's management of the department.

Probability estimate __________

In Harris's department, last month's actual overhead costs were significantly higher than budgeted amounts. \( \{D_i\} \)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:
The cause of the unfavorable labor efficiency variance was related to Lynn Harris's management of the department.

Probability estimate __________

The labor efficiency variance for Harris's department had been small for several months before last month. \( \{C_t_e\} \)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:
The cause of the unfavorable labor efficiency variance was related to Lynn Harris's management of the department.

Probability estimate __________
Task _E_, Page 5

Materials variances in Harris's department were very small last month. (D_e)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the unfavorable labor efficiency variance was related to Lynn Harris's management of the department.

Probability estimate ________

(The same updating cues were used for Subor1. The updating cues for Super2 and Subor2 were:

1. Several other department managers in the plant had large unfavorable labor efficiency variances last month. (C_{s_e})

2. Materials variances in __'s department were very small last month. (D_{e})

3. The labor efficiency variance has been large and unfavorable several times since ___ has managed the department. (C_{t_j})

4. In ___'s department, last month's actual overhead costs were significantly higher than budgeted amounts. (D_{j})
Task J, Page 1.

Instructions: In this task, please imagine that you are the superior, and that you are evaluating one of your subordinates.

R.J. Williams, your subordinate, is the manager of a production department in a large manufacturing plant and has held that position for about one year. You were recently transferred to the plant from a similar position elsewhere. You are to evaluate Williams's performance on the basis of variances for materials and labor usage. Last month's performance report shows that labor costs were significantly above the standard for the department's output. The labor efficiency (usage) variance was unfavorable and large enough that company policy requires an investigation of possible causes for the variance. As Williams's superior, you are responsible for the investigation. Operating results from Williams's department may affect your compensation and job rating.

State your initial estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the unfavorable labor efficiency variance was related to R.J. Williams's management of the department.

Probability estimate _________

(This task is the same as Task A, except that subjects were asked to assume the role of superior. In A, they were to respond as observers.)
The labor efficiency variance has been large and unfavorable several times since Williams has managed the department. \(C_t^i\)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:
The cause of the unfavorable labor efficiency variance was related to R.J. Williams's management of the department.

Probability estimate ______

In Williams's department, last month's actual overhead costs were significantly higher than budgeted amounts. \(D_j\)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:
The cause of the unfavorable labor efficiency variance was related to R.J. Williams's management of the department.

Probability estimate ______

Several other department managers in the plant had large unfavorable labor efficiency variances last month. \(C_{se}\)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:
The cause of the unfavorable labor efficiency variance was related to R.J. Williams's management of the department.

Probability estimate ______
Task J, Page 5

Materials variances in Williams's department were very small last month. \(D_e\)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the unfavorable labor efficiency variance was related to R.J. Williams's management of the department.

Probability estimate ______

(The updating evidence for this task is identical to that for task A. For subjects Super2 and Subor2, the updating cues are shown on page 167 of this appendix.)
Task N, Page 1

Instructions: In this task, please imagine that you are the superior, and that you are evaluating one of your subordinates.

Lee Young, your subordinate, has managed a production department in a large manufacturing firm for several months. You just transferred into this plant from a similar position in a different facility. Young's performance is evaluated on the basis of materials and labor variances. Last month's performance report shows labor costs which were significantly above standard. The labor efficiency (usage) variance was large and unfavorable. Company policy requires an investigation to determine the cause for the variance. As Young's superior, you are in charge of the investigation. Your compensation and job rating may be influenced by results from Young's department.

State your initial estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the unfavorable labor efficiency variance was related to Lee Young's management of the department.

Probability estimate

(This task is analogous to Task E, except that the subject was assigned the superior role here.)
Last month, all other departments in the plant had much smaller labor efficiency variances than Young's department. (Cs1)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the unfavorable labor efficiency variance was related to Lee Young's management of the department.

Probability estimate

In Young's department, last month's actual overhead costs were significantly higher than budgeted amounts. (D1)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the unfavorable labor efficiency variance was related to Lee Young's management of the department.

Probability estimate

The labor efficiency variance in Young's department had been small for several months before last month. (Ct6)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the unfavorable labor efficiency variance was related to Lee Young's management of the department.

Probability estimate
Materials variances in Young's department were very small last month. \( \{D_e\} \)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the unfavorable labor efficiency variance was related to Lee Young's management of the department.

Probability estimate

\( \{\text{Task N is identical to E, except for role assignment. The cues for Super2 and Subor2 are shown on page 170.}\} \)
Instructions: In this task, please imagine that you are the superior, and that you are evaluating one of your subordinates.

L.L. Andrews, your subordinate, is the manager of a production department in a large manufacturing plant and has held that position for almost a year. You were recently transferred to your current position from a similar position at another plant. This month, Andrews's department failed to finish on time an order for an important customer. Company managers are concerned that the customer may be lost to a competitor. An investigation into the cause of the failure to meet the job deadline has been ordered, to prevent such problems in the future. As Andrews's superior, you are responsible for the investigation. Your compensation and job evaluation may be influenced by the performance of Andrews's department.

State your initial estimate, from 0 to 100, of the probability that the following statement is true:
The cause of the failure to meet the order deadline was related to Andrews's management of the department.

Probability estimate _____

(This task is part of Experiment 2 and includes external updating evidence only. Since the evidence is consistently external, the strength of evidence was manipulated, to allow tests for order effects.)
Task S, Page 2

Recently, the use of materials in Andrews's department has been acceptable on all orders. (D_e,s)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:
   The cause of the failure to meet the order deadline was related to Andrews's management of the department.

Probability estimate ________

Task S, Page 3

Since Andrews started managing the department, this is the first important order deadline that has been missed. (C_t_e)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:
   The cause of the failure to meet the order deadline was related to Andrews's management of the department.

Probability estimate ________

Task S, Page 4

Other department managers have occasionally failed to meet deadlines on large orders. (C_s_e,w)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:
   The cause of the failure to meet the order deadline was related to Andrews's management of the department.

Probability estimate ________

(The same updating cues were used for Subor1 subjects. For Super2 and Subor2, the updating evidence was:
1. Recently, ___'s department's use of materials has been within acceptable limits on most orders.
2. Since ___ started managing the department, this is the first important order deadline that has been missed.
3. Other department managers in the plant have frequently failed to meet order deadlines.)
Instructions: In this task, please imagine that you are the superior, and that you are evaluating one of your subordinates.

B.K. Collins, your subordinate, is the manager of a production department in a large manufacturing plant and has held that position for more than a year. You were recently transferred to your current position from a similar position elsewhere in the company. This month, Collins's department failed to complete on time an order for an important customer. Company managers are concerned that the customer may be lost to a competitor. An investigation into the causes of the failure to meet the job deadline has been ordered. As Collins's superior, you are responsible for the investigation. Your compensation and job evaluation may be influenced by the performance of Collins's department.

State your initial estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the failure to meet the order deadline was related to Collins's management of the department.

Probability estimate ________

(Task W is part of Experiment 2 and involves external updating evidence. The positions of D and Cs cues are reversed, compared to Task S.)
Other department managers in the plant have frequently failed to meet order deadlines. \( (C_{S_e}, s) \)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the failure to meet the order deadline was related to Collins's management of the department.

Probability estimate

Since Collins started managing the department, this is the first important order deadline that has been missed. \( (C_{t_e}) \)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the failure to meet the order deadline was related to Collins's management of the department.

Probability estimate

Recently, the use of materials in Collins's department has been within acceptable limits on most orders. \( (D_{e,w}) \)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the failure to meet the order deadline was related to Collins's management of the department.

Probability estimate

(The updating cues for order 2 were:
1. Other department managers have occasionally failed to meet deadlines on large orders.
2. Since ___ started managing the department, this is the first important order deadline that has been missed.
3. Recently, ___'s department's use of materials has been acceptable on all orders.)
Instructions: In this task, please imagine that you are the superior, and that you are evaluating one of your subordinates.

M. Block, your subordinate, is the manager of a production department in a large manufacturing plant. Block has managed the department for several months, and you recently transferred to your current responsibilities from a similar position in another part of the company. Questions have been raised about the quality of work being done in the department. An important customer reported product defects traceable to the department. Company managers are concerned that they may lose this customer or other customers. They have ordered an investigation into possible causes of the low product quality. As Block's superior, you are in charge of the investigation. Your compensation and job rating may be influenced by the performance of Block's department.

State your initial estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the poor product quality was related to Block's management of the department.

Probability estimate __________

(This task is part of Experiment 3. All the updating cues were meant to suggest internal attributions.)
The amount of scrap and waste material from Block's department was much higher than expected last month.

Now, state your estimate, from 0 to 100, of the probability that the following statement is true: The cause of the poor product quality was related to Block's management of the department.

Probability estimate ________

Since Block began managing the department, there have been other complaints about the department's product quality. (Ct_i)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true: The cause of the poor product quality was related to Block's management of the department.

Probability estimate ________

Recently, there have been few complaints about the product quality of other departments in the plant. (C_{i,w})

Now, state your estimate, from 0 to 100, of the probability that the following statement is true: The cause of the poor product quality was related to Block's management of the department.

Probability estimate ________

(The updating cues for order 2 were:
  1. The amount of scrap and waste material from ___'s department was higher than expected last month.
  2. Since ___ began managing the department, there have been other complaints about the department's product quality.
  3. Recently, there have been no complaints about the product quality of any other department in the plant.)
Task AE, Page 1

Instructions: In this task, please imagine that you are the superior, and that you are evaluating one of your subordinates.

Chris Tyler, your subordinate, is the manager of a production department in a large manufacturing plant. Tyler has managed the department for several months, and you recently transferred to your current responsibilities from a similar position in another part of the company. Questions have been raised about the quality of work being done in Tyler's department. An important customer reported product defects traceable to the department. Company managers are concerned that they may lose this customer or other customers. They have ordered an investigation into possible causes of the low product quality. As Tyler's superior, you are in charge of the investigation. Your compensation and job rating may be influenced by the performance of Tyler's department.

State your initial estimate, from 0 to 100, of the probability that the following statement is true: The cause of the poor product quality was related to Tyler's management of the department.

Probability estimate

(This task is part of Experiment 3. It differs from Task AA in the positions of the Cs and D cues.)
Recently, there have been no complaints about the product quality of any other department in the plant. \(\{C_{s_i}, s\}\)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the poor product quality was related to Tyler's management of the department.

Probability estimate ________

Since Tyler began managing the department, there have been other complaints about its product quality. \(\{C_{t_i}\}\)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the poor product quality was related to Tyler's management of the department.

Probability estimate ________

The amount of scrap and waste material from Tyler's department was higher than expected last month. \(\{D_{i,w}\}\)

Now, state your estimate, from 0 to 100, of the probability that the following statement is true:

The cause of the poor product quality was related to Tyler's management of the department.

Probability estimate ________

{The updating cues for Super2 and Subor2 subjects were:
1. Recently, there have been few complaints about the product quality of other departments in the plant.
2. Since ___ began managing the department, there have been other complaints about product quality.
3. The amount of scrap and waste material from ___'s department was much higher than expected last month.}
In a task which involved an unfavorable labor efficiency variance, the hypothesis which you considered was, *The cause of the variance was related to Anthony's management of the department*. Please rate the strength of each of the following pieces of evidence, and also check whether it is positive or negative with respect to the underlined hypothesis.

1. Materials variances in Anthony's department were very small last month.
   - This item is positive
   - This item is negative
   - Strength of evidence: Very weak to Very strong
   - 0 to 100

2. In Anthony's department, last month's actual overhead costs were significantly higher than budgeted amounts.
   - This item is positive
   - This item is negative
   - Strength of evidence: Very weak to Very strong
   - 0 to 100

3. The labor efficiency variance for Anthony's department has been large and unfavorable several times since Anthony has managed the department.
   - This item is positive
   - This item is negative
   - Strength of evidence: Very weak to Very strong
   - 0 to 100

4. Several other department managers in the same plant had large unfavorable labor efficiency variances last month.
   - This item is positive
   - This item is negative
   - Strength of evidence: Very weak to Very strong
   - 0 to 100

In the task where an order had not been completed on time for an important customer, the hypothesis you considered was, *The cause of the failure to meet the deadline was related to Andrews's management of the department*. Please rate the strength of each of the following pieces of evidence, and also check whether it is positive or negative with respect to the underlined hypothesis.

1. Other department managers have occasionally failed to meet deadlines on large orders.
   - This item is positive
   - This item is negative
   - Strength of evidence: Very weak to Very strong
   - 0 to 100
2. Recently, in Andrews's department, the use of materials has been acceptable on all orders.
   This item is positive
   Strength of evidence:
   or negative
   Very weak
   Very strong
   0.........................100

3. Since Andrews started managing the department, this is the first important order deadline that has been missed.
   This item is positive
   Strength of evidence:
   or negative
   Very weak
   Very strong
   0.........................100

In the case in which Block's department had failed to maintain acceptable product quality, the hypothesis you examined was, The cause of the low product quality was related to Block's management of the department. Please rate the strength of each of the following pieces of evidence, and also check whether it is positive or negative with respect to the underlined hypothesis.

1. Recently, there have been few complaints about the product quality of other departments in the plant.
   This item is positive
   Strength of evidence:
   or negative
   Very weak
   Very strong
   0.........................100

2. The amount of scrap and waste material from Block's department was much higher than expected last month.
   This item is positive
   Strength of evidence:
   or negative
   Very weak
   Very strong
   0.........................100

3. Since Block began managing the department, there have been other complaints about the department's product quality.
   This item is positive
   Strength of evidence:
   or negative
   Very weak
   Very strong
   0.........................100

(Every item or cue used in the experiments was included in the manipulation check for at least two of the four experimental groups. The items shown here were given to the groups Superl and Suborl. For subordinate subjects, the underlined hypothesis was, "The cause of (the specified problem) was due to factors other than the manager's management of the department.")
(Demographic information)
1. How many years of managerial experience with manufacturing companies do you have? ________________
2. What is your current work position title? ________________
3. What is the industry of the company you work for? ________________
4. What kinds of products are you most often associated with? ________________

On items 5-7, please check the correct response.
5. Sex: M___ F___

6. Level of education completed:
   ___ Less than high school
   ___ High school
   ___ Some college
   ___ Completed college with a bachelor's degree
   ___ Some graduate study
   ___ Master's degree
   ___ Beyond a master's degree

7. Which of the following is part of your job?
   ___ I evaluate subordinates on a regular basis
   ___ I am evaluated by superiors on a regular basis.
   ___ I evaluate subordinates and I am evaluated by superiors, both on a regular basis
   ___ None of the above is true of my job

On questions 8-16, please circle the response that best expresses your opinion.
8. The ability to evaluate others' performance is important in my job.
   I agree strongly ___ I agree ___ I neither agree nor disagree ___ I disagree strongly ___ I disagree

9. Others' formal evaluations of my performance are important to my success with this company.
   I agree strongly ___ I agree ___ I neither agree nor disagree ___ I disagree strongly ___ I disagree

10. Labor variances are important in evaluating performance in this company.
    I agree strongly ___ I agree ___ I neither agree nor disagree ___ I disagree strongly ___ I disagree
11. Maintaining product quality is important to a manager's success in this company.
I agree
strongly agree
I neither
agree nor
disagree
I disagree
strongly disagree

12. Ability to meet a production schedule is important to a manager's success in this company.
I agree
strongly agree
I neither
agree nor
disagree
I disagree
strongly disagree

13. Production department managers in this company have a significant degree of control over labor variances.
I agree
strongly agree
I neither
agree nor
disagree
I disagree
strongly disagree

14. Production department managers in this company have a significant degree of control over product quality.
I agree
strongly agree
I neither
agree nor
disagree
I disagree
strongly disagree

15. Production department managers in this company have a significant degree of control over the department's ability to meet production deadlines.
I agree
strongly agree
I neither
agree nor
disagree
I disagree
strongly disagree

16. In the first two tasks in this experiment, you were asked to assume that you were an outsider to the performance evaluation described in the task. When you express your opinion in these tasks, did you look at the information from the viewpoint of:
1. the superior
2. the subordinate
3. neither the superior nor the subordinate

17. Approximately what percentage of production (direct labor) workers in your plant are members of labor unions?
APPENDIX D

ANALYSES OF VARIANCE RESULTS
### Table 29
Expected and Observed Results

<table>
<thead>
<tr>
<th>No.</th>
<th>Expected Results</th>
<th>Observed Results&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Significant main effect for role/nonrole (ASSI)</td>
<td>ASSI: $F=6.08$ $p=.027$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TASK: $F=8.40$ $p=.012$</td>
</tr>
<tr>
<td>2</td>
<td>Significant main effect for ASSI</td>
<td>ASSI not significant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ASSI: $F=.82$ $p=.377$</td>
</tr>
<tr>
<td>3</td>
<td>Significant main effect for ASSI</td>
<td>GROUPxASSI: $F=3.05$ $p=.092$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ASSI: $F=7.17$ $p=.012$</td>
</tr>
<tr>
<td>4</td>
<td>Significant main effect for ASSI</td>
<td>No significant effects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ASSI: $F=.26$ $p=.621$</td>
</tr>
<tr>
<td>5</td>
<td>Significant main effect for ASSI</td>
<td>ASSI: $F=.63$ $p=.530$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TASK: $F=4.87$ $p=.043$</td>
</tr>
<tr>
<td>6</td>
<td>Significant main effect for ASSI</td>
<td>No significant main effects. ASSI: $F=.63$ $p=.434$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GROUPxTASK $F=3.56$ $p=.069$</td>
</tr>
</tbody>
</table>

<sup>a</sup> The numbers identifying the analyses are those which are assigned in Table 20 in Chapter 5.

<sup>b</sup> All main effects and interactions which approach statistical significance are listed in this table, except for the CONSTANT effect. The CONSTANT effect, which is used to determine whether the overall mean is significantly different from zero, is omitted when it is relatively meaningless.
Expected Results

Significant ASSI effect

Observed Results

ASSI: $F=0.00$ $p=0.995$

Effect for Cs and Ct position: $F=4.49$ $p=0.053$

ASSIxTASK: $F=2.05$ $p=0.174$

ASSI: $F=0.94$ $p=0.349$

Effect for Cs and Ct position: $F=2.40$ $p=0.140$

ASSI: $F=0.07$ $p=0.799$

ASSI: $F=0.11$ $p=0.746$

Significant ASSI effect

Significant ORDER effect

No POSITION effect

Significant ORDER effect

No effect for POSITION

Significant interaction between hypothesis type (HYPOTH) and ORDER

No POSITION effect

$(S_4-S_0)>0$

Significant ORDER effect

No significant effect for POSITION of information

ORDER: $F=5.20$ $p=0.030$

POSITION: $F=0.02$ $p=0.889$

ORDERxPOSITION: $F=6.23$ $p=0.019$
<table>
<thead>
<tr>
<th>No.</th>
<th>Expected Results</th>
<th>Observed Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$(S_4-S_0)&gt;0$</td>
<td></td>
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<tr>
<td>15</td>
<td>Significant ORDER effect</td>
<td>$\text{CONSTANT: } F=4.40 \ p=.045$</td>
</tr>
<tr>
<td></td>
<td>No effect for POSITION</td>
<td>$\text{ORDER: } F=4.06 \ p=.054$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$\text{POSITION: } F=.00 \ p=.955$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$\text{ORDERxPOSITION: } F=4.05 \ p=.054$</td>
</tr>
<tr>
<td>16</td>
<td>$(S_4-S_0)&gt;0$</td>
<td>$\text{CONSTANT: } F=17.04 \ p=.000$</td>
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<td></td>
<td>No POSITION effect</td>
<td>$\text{POSITION: } F=.50 \ p=.483$</td>
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<tr>
<td></td>
<td>Significant ROLEX ORDER interaction</td>
<td>$\text{ROLExORDER: } F=9.59 \ p=.003$</td>
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<td></td>
<td>$\text{ROLExORDERxPOSITION: } F=5.42 \ p=.023$</td>
</tr>
<tr>
<td>17</td>
<td>No ORDER effect</td>
<td>$\text{ORDER: } F=.52 \ p=.479$</td>
</tr>
<tr>
<td></td>
<td>No POSITION effect</td>
<td>$\text{POSITION: } F=.53 \ p=.473$</td>
</tr>
<tr>
<td>18</td>
<td>No ORDER effect</td>
<td>$\text{ORDER: } F=.05 \ p=.827$</td>
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<tr>
<td></td>
<td>No POSITION effect</td>
<td>$\text{POSITION: } F=2.78 \ p=.107$</td>
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<tr>
<td></td>
<td></td>
<td>$\text{ORDERxPOSITION: } F=2.08 \ p=.161$</td>
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<tr>
<td>19</td>
<td>No ORDER effect for consistent external evidence</td>
<td>$\text{ORDER: } F=2.50 \ p=.125$</td>
</tr>
<tr>
<td></td>
<td>No POSITION effect</td>
<td>$\text{POSITION: } F=.25 \ p=.618$</td>
</tr>
<tr>
<td>20</td>
<td>No ORDER effect for consistent internal evidence</td>
<td>$\text{ORDER: } F=1.88 \ p=.181$</td>
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<tr>
<td></td>
<td>No POSITION effect</td>
<td>$\text{POSITION: } F=1.10 \ p=.304$</td>
</tr>
<tr>
<td>No.</td>
<td>Expected Results</td>
<td>Observed Results</td>
</tr>
<tr>
<td>-----</td>
<td>----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>21</td>
<td>Significant interaction between role/nonrole (ASSI) and ORDER</td>
<td>ORDERxASSI: $F = .40$, $p = .532$</td>
</tr>
<tr>
<td></td>
<td>ASSI effect significant</td>
<td>ASSI: $F = .03$, $p = .864$</td>
</tr>
<tr>
<td></td>
<td>No effect for POSITION</td>
<td>POSITION: $F = .18$, $p = .864$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ORDER: $F = 4.35$, $p = .046$</td>
</tr>
<tr>
<td>22</td>
<td>ORDERxASSI interaction</td>
<td>ORDERxASSI: $F = .86$, $p = .362$</td>
</tr>
<tr>
<td></td>
<td>ASSI effect significant</td>
<td>ASSI: $F = 1.28$, $p = .267$</td>
</tr>
<tr>
<td></td>
<td>No POSITION effect</td>
<td>POSITION: $F = 4.01$, $p = .055$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ASSIxPOSITION: $F = 2.70$, $p = .111$</td>
</tr>
<tr>
<td>23</td>
<td>$(S_3-S_0) &gt; 0$</td>
<td>CONSTANT: $F = .10$, $p = .749$</td>
</tr>
<tr>
<td></td>
<td>POSITION not significant</td>
<td>POSITION: $F = .66$, $p = .420$</td>
</tr>
<tr>
<td></td>
<td>ROLExORDER not significant</td>
<td>ROLExORDER: $F = .24$, $p = .624$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ROLE: $F = 46.14$, $p = .000$</td>
</tr>
<tr>
<td>24</td>
<td>$(S_3-S_0) &gt; 0$</td>
<td>CONSTANT: $F = 1.86$, $p = .178$</td>
</tr>
<tr>
<td></td>
<td>POSITION not significant</td>
<td>POSITION: $F = 2.73$, $p = .104$</td>
</tr>
<tr>
<td></td>
<td>ROLExORDER not significant</td>
<td>ROLExORDER: $F = 1.28$, $p = .263$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ROLE: $F = 58.64$, $p = .000$</td>
</tr>
</tbody>
</table>


Norusis, M., SPSS/PC+ Advanced Statistics V2.0 (Chicago, IL: SPSS Inc., 1988).


