ELIZABETH J. WILSON, GARY L. LILIEN, and DAVID T. WILSON*

The authors develop a contingency paradigm involving two situational factors (the nature of the buying task and the degree of perceived risk) to explain the predictive abilities of seven formal models of group choice and to see how the mechanism of buying center choice is affected by situational factors. In an empirical test of the models and the paradigm involving 104 procurement decisions made by buying centers, they found that the paradigm does significantly better than any single model in terms of predicting group choice. The contingency paradigm predicted accurately in 49% of the cases whereas the best alternative single model predicted correctly in only 20% of the cases. The results provide empirical support for several propositions in the organizational buying behavior literature.

Developing and Testing a Contingency Paradigm of Group Choice in Organizational Buying

The purchase of products and services by an organization may involve several and possibly many individuals: one or more engineers may develop specifications, a purchasing agent may screen and evaluate suppliers, a financial analyst may evaluate the financial impact of the purchase, and so on. How do individuals in organizational buying centers combine their preferences about alternative suppliers to reach a group choice? How do situational factors affect such decision making? Those questions motivate our research. Organizational buying theory (Robinson, Faris, and Wind 1967; Sheth 1973) offers clues about the effects of the buying task and perceived risk on group choice, but no empirical research has examined that topic.

To address our research questions, we use three general classes of group choice models proposed by Choffray and Lilien (1980). To examine situational effects of the buying task and perceived risk on group choice processes, we propose and empirically test a contingency framework. The buying task and perceived risk are included in the paradigm primarily because of their interest and importance to researchers; those factors have received theoretical and empirical attention in past studies of organizational buying behavior (Anderson, Chu, and Weitz 1987; Doyle, Woodside, and Michell 1979; Qualls and Puto 1989).

Buss (1981, p. 174) maintains that "the problem of predicting group preferences is not trivial" and notes that the mapping of individual preference structures into group utility functions has occupied decision theorists for the past two centuries. A central purpose of Buss' study was to "*determine the accuracy with which each hypothesized model predicts the group preferences.*" In our study, we build on the work of Buss and others (e.g., Steckel 1990) by developing a method to operationalize and test seven models of group choice.

Many of the modeling studies of group choice have been done in the area of social psychology (e.g., Davis 1973). In marketing, researchers of family decision making (e.g., Corfman and Lehmann 1987) have used a modeling approach to examine group choice. Our study is the first to test group choice models in an organizational buying context. In response to Johnston and Spek-

*Elizabeth J. Wilson is Assistant Professor of Marketing, Louisiana State University. Gary L. Lilien is Research Professor of Management Science and David T. Wilson is Professor of Marketing, Pennsylvania State University.

The authors thank the anonymous *JMR* reviewers, Arch G. Woodside, and Clifford C. Clogg for many helpful comments about the manuscript. Financial support was provided by Pennsylvania State University's Institute for the Study of Business Markets, the National Association of Purchasing Management, and the College of Business Administration, Louisiana State University.

Journal of Marketing Research
Vol. XXVIII (November 1991), 452–66

man's (1982) call for an integration of research findings from organizational buying, we draw on the work of Choffray and Lilien (1980) for the choice models and of Sheth (1973) for the situational factors included in the contingency paradigm.

We begin with a discussion of our contingency paradigm and the situational factors included. Next, we present the three classes of group choice models and illustrate each model with an example. Our hypotheses are stated, the methodology described, and our findings presented. We discuss our findings in terms of the predictive performance of the models. Our conclusions include recognition of the research limitations, directions for future research, and implications for theory and practice.

SITUATIONAL FACTORS AND A CONTINGENCY PARADIGM

Organizational buying is diverse and complex (Choffray and Lilien 1980); hence, a contingency approach may be an appropriate way to study buying center choice. Two situational factors, buying task and perceived risk, are included in our contingency paradigm.

Buying Task

Robinson, Faris, and Wind (1967) identified three "buyclasses" that are distinguished by the amount of familiarity buying center members have with a product. We include new task and modified rebuy as two levels of the buying task. New task purchases are those with which buying center members have little or no familiarity and the buying center has not faced the joint task previously. For the modified rebuy, the buying center has some familiarity with the decision but, because of new conditions (e.g., new suppliers, new technology, etc.), group activity is warranted. We do not include straight rebuy situations here because they are characterized by routinized response behavior (Robinson, Faris, and Wind 1967) and are not likely to involve group interaction (Patton, Puto, and King 1986).

Perceived Risk

Sheth's model includes perceived risk as ". . . the magnitude of adverse consequences felt by the decision maker if he makes a wrong choice, and the uncertainty under which he must decide" (Sheth 1973, p. 54). We use technical uncertainty and financial commitment as indicators of perceived risk for two reasons. First, they correspond to the two parts of Sheth's definition. Second, buying center members are generally able to make specific judgments about technical uncertainty and financial commitment; asking for specific judgments is a better measurement procedure than asking members to assess globally the amount of perceived risk in the buying decision (Silk and Kalwani 1982).

Technical uncertainty. Möller and Laaksonen (1986) and Lehmann and O'Shaughnessy (1974) recognize technical uncertainty as the chance that the product will not perform as expected, a particular concern in new task situations where there is no past experience in buying and product knowledge is very low. We incorporate technical uncertainty about the product at two levels (low and high).

Financial commitment. Financial commitment required in the buying decision corresponds to the first half of Sheth's definition of perceived risk—that is, it reflects the magnitude of the adverse consequences of a wrong choice. Several researchers have identified financial commitment as a factor in buying decisions (Lehmann and O'Shaughnessy 1974; Möller and Laaksonen 1986; Webster and Wind 1972). We specify two levels of financial commitment (low and high).

The Contingency Paradigm

Figure 1 summarizes our contingency paradigm. The models of group choice within the paradigm reflect our central thesis; that is, the buying task and perceived risk influence which group choice model is most likely to be used by a buying center in making organizational procurement decisions.

More instances of high versus low perceived risk are expected to occur in new task decisions than in modified rebuy decisions; that is, the buying task and perceived risk are nonorthogonal constructs (Anderson, Chu, and Weitz 1987). Modified rebuy situations high in both technical uncertainty and financial commitment are plausible but not likely to occur regularly because modified rebuys imply, by definition, that the buying center is familiar with the decision. More familiarity in buying means less uncertainty and therefore lower levels of perceived risk. (To reflect perceived risk, we view "uncertainty"

Figure 1
A CONTINGENCY PARADIGM OF SITUATIONAL FACTORS AND FORMAL MODELS OF GROUP CHOICE

BUYING TASK	PERCEIVED RISK: Low	PERCEIVED RISK: Moderate	PERCEIVED RISK: High
Modified Rebuy	Cell 1: Individual Decision Scheme [LTU and LFC]* Autocracy Model	Cell 2: No-Quota Decision Schemes [LTU and HFC or HTU and LFC] Weighted Probability Model Equiprobability Model Voting Model Preference Perturbation Model	Cell 3: No-Quota Decision Schemes [HTU and HFC] Weighted Probability Model Equiprobability Model Voting Model Preference Perturbation Model
New Task	Cell 4: Agreement Quota Decision Scheme [LTU and LFC] Majority Rule Model	Cell 5: Agreement Quota Decision Scheme [LTU and HFC or HTU and LFC] Majority Rule Model	Cell 6: Agreement Quota Decision Scheme [HTU and HFC] Unanimity Rule Model

* LTU: Low Technical Uncertainty HTU: High Technical Uncertainty
LFC: Low Financial Commitment HFC: High Financial Commitment

[a]In three-person groups, the differences between the voting and majority rule models are likely to be minimal.

as both technical uncertainty and financial commitment). In addition, new task situations low in both technical uncertainty and financial commitment may occur but probably not on a regular basis. New tasks imply more risk in the decision because the buying center is largely unfamiliar with the task and faces a greater level of uncertainty.

We now turn to a discussion of the models identified in the paradigm. A summary of the combinatorial process for each model is provided, along with a brief review of how the models have been used in other studies of group choice.

FORMAL MODELS OF GROUP CHOICE

Choffray and Lilien (1980) proposed seven formal models to describe how buying center members might make supplier choice decisions. Those models, as examined in our study, are most useful as paramorphic representations of group choice because they represent what might happen in group choice rather than what groups actually set out to do. We categorize them into three general classes based on the social decision scheme invoked. First, buying center members may use a *no-quota scheme* (weighted probability, equiprobability, voting, and preference perturbation models), whereby group discussion precedes choice without specification of a minimum number of group members who must agree on a supplier alternative. Second, a more structured decision may entail the use of an *agreement quota scheme,* whereby group members act as though they use a prespecified agreement quota. Before any decision making occurs, group members either decide or are told what the agreement quota will be (e.g., simple majority, two-thirds majority, unanimity, etc). Third, a single member of the buying center may make the supplier choice autocratically in an *individual decision scheme*.

Each model starts with individual preferences and provides a probabilistic prediction of buying center choice. A good way to understand the models is through a simple numerical example that we use throughout the article. We next provide the background for our example and describe each model. The mathematical details of the models are given in the Appendix.

Background for Example

Assume that a three-person buying center is responsible for selecting vendors for industrial valves. Buying center members eliminate any suppliers that do not meet *a priori* expectations (Sheth 1973) and then divide the available business so that each acceptable supplier gets a "share of business." The buying center members' allocations of share of business among competing vendors represent preference data. The models we describe interpret the preference data as the shares of business vendors are predicted to receive from the buying center. Assume we have the evaluations from individual members of the buying center in Table 1A.

In addition to the share-of-business data in Table 1A, we need the relative importance of buying center members to estimate two of the models (weighted probability and autocracy). Members rate themselves and others on a 100-point constant sum scale to reflect the relative importance of each buying center member. The importance weights are decision-specific to avoid measurement problems (Silk and Kalwani 1982). Assume the three buying center members provide importance weights as shown in Table 1B.

Table 1

SAMPLE DATA FOR A BUYING CENTER DECISION

A. PREFERENCE DATA

Vendor	*Engineer*	*Production manager*	*Buyer*
1	0	10	0
2	0	0	0
3	20	40	50
4	35	20	25
5	0	0	25
6	0	30	0
7	45	0	0
8	0	0	0
9	0	0	0
	100	100	100

B. IMPORTANCE WEIGHT DATA

	Stated relative importance of			
	Engineer	*Production manager*	*Buyer*	*Total*
Rater				
Engineer	50	25	25	100
Production manager	40	40	20	100
Buyer	70	20	10	100
Estimated importance weights[a]	57	17	26	100

[a]By the procedure of Choffray and Lilien (1980, p. 195–197).

We modified the importance weights via a procedure suggested by Choffray and Lilien (1980, p. 195–197) to correct for self-report bias (Silk and Kalwani 1982). The procedure discards each rater's self-report and uses only the ratio of the other ratings to estimate a set of importance weights. In our example, the production manager provides only the information that the relative importance of the engineer is two times (40/20) that of the buyer. The data from the production manager and the buyer are used to estimate the relative importance of the engineer, and so on. By a least squares procedure, we used the four equations (one from each rater plus the sum constraint) to estimate the three unknowns (the importance weights) in Table 1B.

No-Quota Models of Group Choice

Weighted probability model. In the weighted probability model, one assumes that the buying center is likely to adopt a given vendor-product alternative in proportion to each buying center member's preferences about the vendors and his or her relative importance in the decision. To estimate the choice probabilities for this model, consider the preference data and importance weights of the buying center in Table 2A. Vendor 1 is predicted to

Table 2
PREDICTED PROBABILITIES OF CHOICE FOR EACH MODEL
(estimated with sample data)

A. WEIGHTED PROBABILITY MODEL

Vendor	*Engineer × importance*	+	*Manager × importance*	+	*Buyer × importance*	=	*Predicted probability distribution of group choice*
1	(0 × .57)	+	(10 × .17)	+	(0 × .26)	=	1.70
2	(0 × .57)	+	(0 × .17)	+	(0 × .26)	=	0.00
3	(20 × .57)	+	(40 × .17)	+	(50 × .26)	=	31.20
4	(35 × .57)	+	(20 × .17)	+	(25 × .26)	=	29.85
5	(0 × .57)	+	(0 × .17)	+	(25 × .26)	=	6.50
6	(0 × .57)	+	(30 × .17)	+	(0 × .26)	=	5.10
7	(45 × .57)	+	(0 × .17)	+	(0 × .26)	=	25.65
8	(0 × .57)	+	(0 × .17)	+	(0 × .26)	=	0.00
9	(0 × .57)	+	(0 × .17)	+	(0 × .26)	=	0.00
Total	100		100		100		100.00

B. EQUIPROBABILITY MODEL

Vendor	*Engineer × importance*	+	*Manager × importance*	+	*Buyer × importance*	=	*Predicted probability distribution of group choice*
1	(0 × .33)	+	(10 × .33)	+	(0 × .33)	=	3.33
2	(0 × .33)	+	(0 × .33)	+	(0 × .33)	+	0.00
3	(20 × .33)	+	(40 × .33)	+	(50 × .33)	=	36.30
4	(35 × .33)	+	(20 × .33)	+	(25 × .33)	=	26.40
5	(0 × .33)	+	(0 × .33)	+	(25 × .33)	=	8.25
6	(0 × .33)	+	(30 × .33)	+	(0 × .33)	=	9.90
7	(45 × .33)	+	(0 × .33)	+	(0 × .33)	=	14.85
8	(0 × .33)	+	(0 × .33)	+	(0 × .33)	=	0.00
9	(0 × .33)	+	(0 × .33)	+	(0 × .33)	=	0.00
Total	100		100		100		100.00

C. VOTING MODEL[a]

Vendor	*Engineer*	*Production manager*	*Buyer*	*Predicted probability distribution of group choice*
1	0	10	0	2.71
2	0	0	0	0.00
3	20	40	50	42.67
4	35	20	25	28.17
5	0	0	25	7.08
6	0	30	0	8.13
7	45	0	0	11.25
8	0	0	0	0.00
9	0	0	0	0.00
Total	100	100	100	100.00

D. PREFERENCE PERTURBATION MODEL[a]

Vendor	*Engineer*	*Production manager*	*Buyer*	*Predicted probability distribution of group choice*
1	0	10	0	5.87
2	0	0	0	4.83
3	20	40	50	41.07
4	35	20	25	18.25
5	0	0	25	6.31
6	0	30	0	6.84
7	45	0	0	7.14
8	0	0	0	4.83
9	0	0	0	4.83
Total	100	100	100	100.00

E. MAJORITY RULE MODEL[a]

Vendor	*Engineer*	*Production manager*	*Buyer*	*Predicted probability distribution of group choice*
1	0	10	0	0.00
2	0	0	0	0.00
3	20	40	50	63.49
4	35	20	25	36.51
5	0	0	25	0.00
6	0	30	0	0.00
7	45	0	0	0.00
8	0	0	0	0.00
9	0	0	0	0.00
Total	100	100	100	100.00

F. UNANIMITY MODEL[a]

Vendor	*Engineer*	*Production manager*	*Buyer*	*Predicted probability distribution of group choice*
1	0	10	0	0.00
2	0	0	0	0.00
3	20	40	50	70.00
4	35	20	25	30.00
5	0	0	25	0.00
6	0	30	0	0.00
7	45	0	0	0.00
8	0	0	0	0.00
9	0	0	0	0.00
Total	100	100	100	100.00

G. AUTOCRACY MODEL

Vendor	*Engineer × importance*	+	*Manager × importance*	+	*Buyer importance*	=	*Predicted probability distribution of group choice*
1	(0 × 1.0)	+	(10 × 0.0)	+	(0 × 0.0)	=	0
2	(0 × 1.0)	+	(0 × 0.0)	+	(0 × 0.0)	=	0
3	(20 × 1.0)	+	(40 × 0.0)	+	(50 × 0.0)	=	20
4	(35 × 1.0)	+	(20 × 0.0)	+	(25 × 0.0)	=	35
5	(0 × 1.0)	+	(0 × 0.0)	+	(25 × 0.0)	=	0
6	(0 × 1.0)	+	(30 × 0.0)	+	(0 × 0.0)	=	0
7	(45 × 1.0)	+	(0 × 0.0)	+	(0 × 0.0)	=	45
8	(0 × 1.0)	+	(0 × 0.0)	+	(0 × 0.0)	=	0
9	(0 × 1.0)	+	(0 × 0.0)	+	(0 × 0.0)	=	0
Total	100		100		100		100

[a]Complete details available from the authors.

receive 1.7% of the available business, vendor 2 is predicted to receive 0% of available business, vendor 3 is predicted to receive 31.2%, and so on.

The weighted probability model represents a linear combination of individual members' preferences and influence abilities. Similar model forms have been suggested by March (1966) and used by Shiflett (1979) to model small-group productivity. In marketing, the weighted probability model has received research attention in studies of family decision-making research. Corfman and Lehmann (1987) incorporated a version of the weighted probability model into their research and found that an unweighted linear model predicted family choice better than a weighted model. Kriewall (1980) and Krishnamurthi (1981) also used weighted linear models in family decision studies.

Steckel, Lehmann, and Corfman (1988) examined the weighted probability model in dyadic decision making using sparse data. Weights were modeled as a function of "opinion leadership" and "severity of disappointment." Likelihood ratio tests showed that the full model had a large chi square value but was statistically significant because of the correspondingly large degrees of freedom. All nested model tests were significant.

Equiprobability model. In the equiprobability model, all decision participants are assumed to have equal weight—for a three-person group, each participant would be assigned a weight of one-third. Results in Table 2B indicate that vendor 1 is predicted to receive 3.33% of the available business, vendor 3 is predicted to receive 36.3%, and so on. Results for all models shown in Table 2 can be interpreted similarly.

Voting model. In the voting model, the probability that the group will choose a vendor alternative is the likelihood that the vendor alternative will be the choice of the largest number of buying center members (that is, voting = plurality). For this model, we use an equiprobability rule as the secondary decision scheme to resolve ties among alternatives in the decision in order to be consistent with the original statement of the models. The predicted probability of group choice according to the voting model is shown in Table 2C; where the calculations are complex, complete computational details are available from the authors for this model and for several of the ones that follow.

Preference perturbation model. The assumption in the preference perturbation model is that a buying center will choose the alternative that perturbs individual preferences least. Each buying center member is assumed to have a preference ordering across vendor alternatives; that is, one individual may prefer B to A to C whereas another may prefer C to B to A. Here, for A to be the selected supplier, it must move up one place (from second choice to first choice) for the first individual and two places (from third to first) for the other individual. Likelihood-of-selection probabilities or "share-of-business" estimates are related inversely to the sum of the preference shifts (one for the first participant plus two for the other participant or three for A to be selected in this case). The predicted distribution of group choice for the preference perturbation model is shown in Table 2D.

Two models were found that reflect a choice process similar to that of the preference perturbation model. Davis et al. (1970, p. 181) refer to an "equal distance compromise model" as one in which "neither member necessarily 'wins' but rather that the outcome of discussion yields a decision for an alternative between the two positions." The chosen alternative is likely to be each group member's second choice. Though the equal distance compromise model embodies the same spirit as the preference perturbation model, computationally the two are distinct. Corfman and Gupta (1990) note that the preference perturbation model is more similar to the "city block distance model" of Kemeny and Snell (1962) than to social decision schemes. Both models produce consensus rankings and the preference perturbation model can be viewed as a truncated version of the city block distance model.

Agreement Quota Models of Group Choice

Majority rule model. This model's assumption is that to be accepted by a firm, a vendor alternative must be the choice of a specified number (quota) of participants involved in the decision—for example, two persons in a three-person buying center. The tie-breaking rule for the majority rule model is of interest here because the majority rule and voting models offer similar predictions in the case of three-person groups. Again, to be consistent with Choffray and Lilien's (1980) original exposition, we use a secondary scheme that rejects ties in the majority rule model. That is, equally preferred alternatives (tied) are thrown out. Table 2E contains the predicted distribution of group choice for the majority rule model.

Unanimity model. The unanimity model is a special case of the majority rule model; all buying center members must agree on the selected vendor alternatives. Probability of choice for a supplier is then the likelihood that the group will be in agreement about those suppliers that will receive some share of the available business. For this model, the buying center does not necessarily agree on the specific shares that the suppliers will be awarded.

In our example, vendors 3 and 4 were the only suppliers that received share of business points from all three members of the buying center. Because more than one vendor received points from all three members, the choice probabilities are estimated by computing the relative preference for each vendor alternative within the set of vendors that have unanimously been awarded a nonzero share of business. The predicted probability distribution for the unanimity model is shown in Table 2F.

Davis (1973) recognizes the unanimity model as a social decision scheme; however, the empirical work on this model tends to be done in more normatively focused studies. Such studies commonly examine the quality of the group solution and group members' satisfaction with the decision (e.g., Mannix, Thompson, and Bazerman 1989).

An Individual Decision Model of Group Choice

Autocracy model. The motivation for the autocracy model is that in some cases a single member of the buying center may be designated as the decision maker. In terms of the importance weights we computed previously, the individual with the highest importance weight becomes the autocrat and the preferences of the autocrat become the preferences of the group. The estimation of this model is shown in Table 2G.

Social decision scheme research usually does not include an autocratic model because that model does not imply group interaction. Einhorn, Hogarth, and Klempner (1977) considered a model comparable to the autocracy model. "Assume . . . the group is able to identify its best member with certainty. . . . In such a situation, a sensible strategy would clearly be to give all the weight to the 'best' judgment and none to the remaining $N - 1$ members" (p. 160–161).

Alternatives

One might consider alternatives to the models described here or a mixture of those models. Laughlin and Earley (1982) point out that social decision schemes should be viewed as complementary, rather than competing, approaches to understanding group choice. The models we consider seem to provide a reasonable range of alternative mechanisms for how a group might allocate requirements among vendors. Next, we present formal hypotheses and rationales for the placement of the models in the contingency paradigm as shown in Figure 1.

HYPOTHESES

Our primary hypothesis explores the general appropriateness of the contingency paradigm. Our research question is: Does one type of decision model adequately predict buying center choice across all contingencies? To test it, we propose an alternate approach that affords greater predictive ability than any single model—that is, the contingency paradigm. In testing the primary hypothesis in that way, we provide a critical test with strong inference (Platt 1964) because alternate models are tested against each other rather than against a null hypothesis.

H_1: Contingency Paradigm

> H_1: Our described contingency paradigm affords greater predictive ability than any single group choice model across situations.

Rationale. Organizational buying decisions are usually diverse and complex (Choffray and Lilien 1980; Sheth 1973; Webster and Wind 1972), and are influenced by the buying task and perceived risk (Anderson, Chu, and Weitz 1987). It is unlikely that one type of decision process (or rule to combine individual preferences into a group preference) will be the best predictor of choice in all situations.

HP_1–HP_6: Placement of Models Within the Contingency Paradigm

To justify the anticipated best-fitting models within each cell of the contingency paradigm, we propose a set of "paradigm hypotheses" (HP_1–HP_6).

> HP_1 cell 1: Autocracy model. When the buying task is a *modified rebuy and perceived risk is low,* the autocracy model is the best predictor of buying center choice.

Rationale. Patton, Puto, and King (1986) found that individuals, not groups, tend to make low risk, modified rebuy decisions. In buying a product requiring low financial commitment with low technical uncertainty, buying center members may rely on the judgments of the member with the greatest expertise to make the decision. Patchen (1974) has shown that users (who are likely to have high levels of expertise about the product) tend to be highly influential in low risk situations.

> HP_2 cell 2: No-quota models. When the buying task is a *modified rebuy and perceived risk levels are moderate,* no-quota models of group choice are the best predictors of buying center choice.

Rationale. No-quota models are likely to be better predictors in this cell than the autocracy model because the level of risk is in the moderate range and buying center members have some familiarity with the decision. Moderate risk may require group participation rather than a one-person decision (Patton, Puto, and King 1986), but is not likely to require the extensive deliberations that may be needed to reach an agreement quota (Choffray and Lilien 1980).

In social psychology, Davis (1982, p. 44) found that a plurality (voting) decision scheme was an acceptable predictor of choice in tasks of moderate uncertainty. In addition, Davis (1973, p. 108) reported that in studies of group risk shift, the equiprobability model is a good predictor of choice. Davis, Hoppe, and Hornseth (1968) found that a plurality model tended to be a good predictor of choice in group decision making under conditions of risk. Uncertainty, as used in those studies, corresponds most closely to the "technical uncertainty" component of risk as defined previously.

We include both combinations of the situational factors in cell 2 of the paradigm. High financial commitment combined with low technical uncertainty is not intended to be any more or less risky than low financial commitment combined with high technical uncertainty.

> HP_3 cell 3: No-quota models. When the buying task is a *modified rebuy and perceived risk levels are high,* no-quota models of group choice are the best predictors of buying center choice.

Rationale. When a modified rebuy decision entails high financial commitment and high technical uncertainty, we consider perceived risk to be relatively high. We assume perceived risk in modified rebuys to be "handled risk" whereas perceived risk in new task situations is "inherent risk" (Bettman 1973). We assume, on the basis of Bettman's work, that handled risk is less risky (i.e., threatening) than inherent risk. Handled risk implies that buying center members may be choosing a vendor from an "evoked set" and hence have some information to use in making a final choice. Conversely, risk in new task situations is likely to be inherent risk because no information is assumed to be known by the buying center.

Because the buying task is a rebuy decision, use of an agreement quota may not be necessary; given the familiarity about the decision, buying center members may not feel compelled to "spread the decision risk" (Corfman and Gupta 1990) according to a pre-set quota. Group participation, rather than an autocratic process, is likely to occur because the level of perceived risk is relatively high (Patton, Puto, and King 1986).

> HP_4 cell 4: Agreement quota model—majority rule. When the buying task is a *new task and perceived risk is low*, an agreement quota model (the majority rule model) is used by the buying center in making a group choice.

Rationale. In studies of risk shift, the majority rule model has been found to be a good predictor of choice in low uncertainty tasks (Davis 1982). Laughlin and Earley (1982) found that for judgmental tasks (no clear right or wrong answer for the decision), the majority rule model tended to predict group choice best when risk shifts were relatively small.

The distinguishing factor between this cell and cell 3 is the difference in the nature of risk. Because this situation is a new task, risk is now characterized as inherent. In comparison with modified rebuys, new tasks are more risky (threatening) for buying center members because there is no familiarity with the buying decision (Robinson, Faris, and Wind 1967). Group decision making (rather than individual choice) is likely to be necessary. Buying centers may use an agreement quota to ensure that risk is spread among a majority of group members. Because the level of inherent risk is low, the consequences of an unsatisfactory decision may not necessarily be of significant monetary value, but could be problematic if buying center members must take time to "re-do" the decision. Note, however, that this combination of situational factors (new task, low risk) may not occur often in reality.

> HP_5 cell 5: Agreement quota model—majority rule. When the buying task is a *new task and perceived risk is moderate*, an agreement quota model (the majority rule model) is used by the buying center in making a group choice.

Rationale. Laughlin and Earley (1982) found that a majority rule was the best predictor of group choice in comparison with other models in decisions in the midrange of a high–low risk continuum. Castore, Peterson, and Goodrich (1971) studied two modifications of the majority rule model in a study of the risk shift. Generally the majority model form outpredicted a least squares (LS) estimate of the most likely group decision. "Such an LS estimate is the same type as that provided by the mean of the individual choices, except that it is for one of the specific alternatives available to the group" (Castore, Peterson, and Goodrich 1971, p. 488).

In a new task situation, perceived risk is characterized as inherent at a moderate level; hence, an agreement quota decision rule is likely to encourage buying center members to discuss vendor alternatives in a cooperative, problem-solving manner in order to reach the agreement quota (Choffray and Lilien 1980; Sheth 1973). A majority rule model allows members to share the responsibility of the decision outcome but does not necessarily require unanimity because perceived risk is in the moderate range.

We expect the majority rule model to be the best predictor of choice in two cases in which buying center members want to have some consensus in order to share the responsibility of the decision outcome. These situations represent both combinations of technical uncertainty and financial commitment.

> HP_6 cell 6: Agreement quota model—unanimity rule. When the buying task is a *new task and perceived risk is high*, an agreement quota model (the unanimity model, specifically) is used by the buying center in making a group choice.

Rationale. Buying center members may want to be in complete agreement about decisions that involve the highest level of perceived risk in the new task situation (Wilson 1971). Requiring unanimity among buying center members maximizes the amount of decision "responsibility spreading." Buying center members are likely to search for information and discuss vendor alternatives extensively to obtain an "integrative solution"—the only solution that all members would prefer (Mannix, Thompson, and Bazerman 1989).

Kohli (1989, p. 60) found that though some might expect an expert to dominate the decision in high risk situations, the buying center "members do not care for expertise any more or less in high risk situations." Hence, in high risk situations, members are likely to work together as a group rather than rely on a single member, even if he or she is an expert.

METHOD

We constructed 22 buying decisions for office products and manufacturing items that are purchased and used by a wide range of organizations across industries. Personal computers, copiers, telephone systems, warehouse vehicles, chemicals, and valves are some examples of products used as the basis of the decision tasks. We chose these and other products to form a pool of decisions that buying centers in a variety of firms would be able to evaluate. Each product was described in terms of price, quality, delivery, and service-maintenance because those attributes are most often critical across a range of industrial products (Lilien and Wong 1984). Figure 2 is an example of the buying decision for valves.

Participants

Participants were members of buying centers in organizations. To recruit subjects, the first author met with the purchasing manager to identify people participating in buying processes. The purchasing manager identified three to five products that potential subjects had procured during the past year or were likely to procure during the coming year. The first author developed questionnaire sets, customized for each set of subjects, based on the relevant products. She then telephoned potential subjects to verify the appropriateness of the relevant products and to arrange a time to meet at the company location.

Participating organizations ranged in size from small local firms (<50 employees) to large multinational corporations. Sampled firms were taken from the membership of Penn State's Institute for the Study of Business Markets and from the membership of the National Association of Purchasing Management. In 24 of the 32 sets of subjects (75%), members reported working together as true buying centers in making organizational buying decisions in their firms. The remaining eight

Figure 2
EXAMPLE BUYING DECISION FOR INDUSTRIAL VALVES

Decision Context: Your company needs to consider vendors for awarding annual purchase agreements. The contract to supply the annual requirement of valves may be awarded to one or several of the vendors described below.

	F ____ pts.	B ____ pts.	N ____ pts.
Price Discount (per thousand units):	12%	7%	3%
Delivery Lead Time Required:	Immediate	3 days	10 days
Dependability of Supply (in-house rating):	A	A	A
Failure Rate (per 1000 hrs. of use):	6%	3%	10%

	T ____ pts.	A ____ pts.	S ____ pts.
Price Discount (per thousand units):	3%	12%	7%
Delivery Lead Time Required:	Immediate	3 days	10 days
Dependability of Supply (in-house rating):	B	B	B
Failure Rate (per 1000 hrs. of use):	3%	10%	6%

	R ____ pts.	P ____ pts.	J ____ pts.
Price Discount (per thousand units):	7%	3%	12%
Delivery Lead Time Required:	Immediate	3 days	10 days
Dependability of Supply (in-house rating):	A+	A+	A+
Failure Rate (per 1000 hrs. of use):	10%	6%	3%

groups were *ad hoc;* members all reported having had experience with the products evaluated but not in participating with one another in making purchase decisions prior to the study. The members of the *ad hoc* groups were selected for the study with the understanding that they might work together on buying decisions in the future.

Twenty-four (75%) of the buying centers were three-person groups and eight were two-person groups. Buying center members were most often from different functional areas of the organization. The naturally occurring buying centers involved people who met face-to-face to discuss supplier choice decisions.

Data Collection and Analysis Procedures

Each buying center worked on an average of 3.25 decisions. For each decision, buying center members first worked individually to award the share-of-business points to the vendor alternative(s) they preferred (phase I, or the individual phase of the data collection). Individuals then rated themselves and other participants on a constant sum scale in terms of their relative importance (i.e., expertise) in each decision.[1]

Next, buying center members worked together to evaluate the same decisions as a group (phase G, or the group phase of the data collection). They discussed the nine vendor alternatives to reach agreement on which vendors would be eliminated and how share-of-business points would be allocated. The group task yielded nine group preference scores, one for each of the nine vendor alternatives, that could be compared with the nine (estimated) share-of-business scores that each group choice model produced.[2]

After the group decisions, members of each buying center (collectively) classified the decision on three situational variables: (1) as a rebuy or new task purchase, (2) as a low or high financial commitment purchase, and (3) as low or high in technical uncertainty. All buying centers reached agreement about an appropriate classification with little difficulty. Respondents then completed a 10-item questionnaire designed to assess *post hoc* reactions to the study, along with open-ended questions about their past buying behavior. Finally, half of

[1]A constant sum measure of relative expertise was used as an indicator of relative importance because research findings (Kohli 1989) indicate that expertise is a significant dimension of influence in buying center decision making. We refer to the weights in the weighted probability model and autocracy model as corresponding to relative importance to be consistent with Choffray and Lilien's (1980) original exposition of the models.

[2]The differences in predicted distributions of choice between the majority rule model and the voting model are minimal in our study (see Table 2C and E) because our buying centers tended to be three-person rather than larger groups. With three-person groups, there is always a pre-set agreement quota (two members) and the difference between the voting and majority rule models is simply in how the groups resolve ties (voting randomizes tie votes whereas the majority rule rejects ties).

the buying centers completed an alternate form of their first decision as a reliability and cross-validity check.

To determine the predictive accuracy of each model, we ran seven chi square goodness-of-fit[3] tests, one for each model, whereby a model's predicted preference score distribution was compared with the group's preference score distribution. If the preference score distribution of a model is close to the group distribution, a small chi square value (<15.5, 8 d.f., $p < .05$) will result and we can conclude that the model is a relatively good predictor of the group evaluation. We then ranked each model so that the model with the lowest chi square statistic (best fit) was ranked 1 and the model with the highest statistic (worst fit) was ranked 7. We used this ranking information to test our hypotheses.

Reliability and Validity

To ensure consistency and stability of our data (Churchill 1979; Peter 1979), we conducted reliability, cross-validity, and ecological validity checks. Using an alternate-form decision, we examined reliability via a "coefficient of equivalence" (Parker and Srinivasan 1976) to note the correlation between rankings of vendor attributes across administrations. We calculated coefficients of equivalence for individual and group decision evaluations. The average correlation between forms was $r = .55$ ($p < .01$).

Though statistically significant, this result is lower than expected, possibly because the buying center members evaluated the alternate form after having made a group decision in a similar task previously in the data collection session. As the alternate form always corresponded to the first decision, some learning about the task may have occurred that introduced error. Given the complexities of the decision tasks, we believe the levels of the coefficients are reasonable.

In a cross-validity check, a regression-based procedure described by Wind and Spitz (1976) was used to compute preference rankings for vendor alternatives between the original and alternate forms and vice versa. The average correlation of rankings over all cross-validity observations was $r = .49$ ($p < .05$), indicating that the preference ratings of vendors have a reasonable level of stability given the complexity of the decision tasks and the effect of learning during the decision evaluations.

Respondents' reactions to the study showed evidence of ecological validity. For example, mean scores on a 7-point scale (1 = strongly disagree, 7 = strongly agree) indicate that respondents found the buying decision tasks to be realistic (mean = 5.4, SD = 1.01) and similar to other decisions in which they had been involved (mean = 5.1, SD = 1.3).

FINDINGS

We test the appropriateness of our paradigm by comparing the ranking of the model(s) hypothesized to be the best predictor of group choice with that of the model(s) that actually fit best in each cell of the paradigm. Participants' responses about the levels of the situational factors provided the information needed to determine which group choice model should best describe buying center choice according to our contingency model. That evaluation provided the following sample of decisions.

Paradigm cell	*Group choice model predicted by contingency model*	*Number of decisions*
1	Autocracy model	17
2	No-quota models–moderate risk	43
3	No-quota models–high risk	9
4	Agreement quota–majority rule–low risk	3
5	Agreement quota–majority rule–moderate risk	19
6	Agreement quota–unanimity rule	13
	Total	104

The number of observations in cells 3 and 4 is small. Few cases were characterized as modified rebuys with high risk or new task buys with low risk. This finding supports our contention that perceived risk and the buying task are not independent dimensions.

The findings in Table 3 provide support for H_1. The contingency paradigm chose the model that best predicted buying center choice in 49% of decisions,[4] which is significantly greater than the proportion of first-place fit rankings for the best single model across situations ($Z = 4.4$, $p < .01$). The best models across situations are the preference perturbation and majority rule models; each has predictions ranked first in fit in 20% of the decisions.

In addition to the first place rankings, the percentage of observations in the top three fit ranks is highest for the contingency paradigm (82%) versus the best single model (the voting model at 67%). In other words, in 82% of decisions, the model expected by the paradigm to fit the group choice best was ranked in either first, second, or third place. Chi square tests on the frequency distributions of rankings for the contingency paradigm versus each model also indicate significant differences in predictive performance.

[3]A chi square goodness-of-fit test was used here to note the fit of a model's predictions to the actual group choice. This test is not the traditional "Pearson" chi square test because our distribution of expected values is fixed rather than estimated (Bishop, Fienberg, and Holland 1975).

[4]In cells 2 and 3, any one of four no-quota models is expected to be an accurate predictor of buying center choice; thus, the paradigm has an advantage here over any single model. To tabulate the results for the contingency paradigm in Table 4, we took the highest ranking of any of the four models in the 43 cases classified as modified rebuy, moderate risk decisions and in the nine cases classified as modified rebuy, high risk decisions.

Table 3

GOODNESS-OF-FIT RANKINGS FOR THE CONTINGENCY PARADIGM AND ALL MODELS OF GROUP CHOICE (H_1)

	Contingency paradigm	*Autocracy*	*Weighted probability*	*Equiprobability*	*Voting*	*Preference perturbation*	*Majority*	*Unanimity*
Rank								
1st	51	19	7	17	17	21	21	10
2nd	23	8	25	14	23	7	12	12
3rd	11	3	19	23	30	14	12	4
4th	5	5	23	23	26	15	10	7
5th	6	16	18	15	7	20	14	14
6th	7	28	9	8	1	21	16	26
7th	1	24	3	4	0	6	19	31
Total	104	104	104	104	104	104	104	104
Percentage of cases ranked first in fit	49	18	7	16	16	20	20	10
Percentage of cases in top three ranks	82	29	49	52	67	42	43	25
Chi square test for ranking frequency distribution of contingency paradigm in comparison with the distribution for each model								
X^2		147.56	303.96	101.90	133.13	110.03	82.21	238.50
p		.001	.001	.001	.001	.001	.001	.001

Findings for Cell-By-Cell Analysis

The results of the cell-by-cell analysis support the overall results for the contingency paradigm. In cell 1 the autocracy model is ranked first in fit in 47% of decisions and is in the top three fit ranks in 76% of decisions. These proportions for the autocracy model, shown in Table 4, are greater than those for any other model and HP_1 is supported.

In cell 1, the weighted probability model is second in predictive ability (65%) behind the autocracy model (76%) when the top three fit ranks are considered. Possibly the weighted probability model predicts well here because it is related to the autocracy model. Buying center members may give a proportionately greater weight, but not the total weight, to the most important (expert) buying center member in modified rebuy situations of low perceived risk.

In cell 2, two situational combinations of technical uncertainty and financial commitment are grouped together. We neither expected nor found any substantial differences between the predictive abilities of the no-quota models in these cells. This finding lends support for our decision to group the combinations of situational factors. The no-quota models of group choice have good fit to the actual buying decisions, as shown in Table 4. When only the first place rankings are considered, HP_2 is supported for the preference perturbation model and voting model. Because the autocracy model has a greater proportion of observations ranked first (19%) than the equiprobability model and more than the weighted probability model, HP_2 is partially supported for these models.

Additional support for HP_2 is found in our less stringent evaluation of the top three fit ranks. All of the no-quota models have better predictive ability than other models. The majority rule model is the next best predictor of choice after the no-quota models, with 33% of observations in the top three fit ranks. The voting model, rather than the majority rule model, may have predicted choice better in this cell because of the equiprobability tie-breaking scheme.

Though the autocracy model has a better fit than the equiprobability model and weighted probability models in the first place rankings, the autocracy model does not do well when we review the top three ranks. Only 26% of decisions are ranked from 1 to 3 in fit for the autocracy model whereas 72% of decisions are ranked from 5 to 7. The majority rule and unanimity models were not expected to predict choice accurately in these cells and they did not, as shown in Table 4. Hence, the no-quota models are generally better predictors of buying center choice than alternative models and we find partial support for HP_2.

HP_3 is supported for the equiprobability model and partially for the other no-quota models. In modified rebuy situations with high perceived risk, the equiprobability model has the greatest proportion of first-place predictions (44%) and the other no-quota models have 11% of decisions ranked as first in fit; these models are tied with the majority rule and autocracy models. When the top three fit ranks are considered, the no-quota models have better predictive ability. The equiprobability model has 88% of decisions in the top three fit ranks followed by the voting model (77%), weighted probability model (66%), and preference perturbation model (22%). The autocracy model also has 22% of decisions ranked in the top three fit ranks.

Results in cell 4 do not lend themselves to a formal hypothesis test because of the small sample of obser-

Table 4

SUMMARY OF HYPOTHESIS TESTING RESULTS IN THE CELL-BY-CELL ANALYSIS

Model/hypothesis	*Percentage of observations ranked 1st in fit*	*Percentage of observations ranked 1st in fit for best alternate model*	*Percentage of observations in top three fit ranks*	*Percentage of observations in top three fit ranks for best alternate model*
HP_1: individual decision scheme				
Autocracy	47	>23 majority	76	>65 weighted probability
HP_1 is supported				
HP_2: compromise decision schemes				
Preference perturbation	33	>19 autocracy	60	>33 majority
Voting	21	>19 autocracy	63	>33 majority
Equiprobability	12	<19 autocracy	56	>33 majority
Weighted probability	5	<19 autocracy	53	>33 majority
HP_2 is supported for preference perturbation model and voting model; partially supported for equiprobability model and weighted probability model				
HP_3: compromise decision schemes				
Equiprobability	44	>11 majority, autocracy	88	>22 autocracy
Voting	11	=11 majority, autocracy	77	>22 autocracy
Preference perturbation	11	=11 majority, autocracy	22	=22 autocracy
Weighted probability	11	=11 majority, autocracy	66	>22 autocracy
HP_3 is partially supported				
HP_4: agreement quota scheme				
Majority	33%	<66% equiprobability	66%	<100% voting
HP_4 is not testable because of the small number of observations				
HP_5: agreement quota scheme				
Majority	37	>26 voting	70	<79 voting
HP_5 is partially supported				
HP_6: agreement quota scheme				
Unanimity	15	<31 majority	39	<53 voting
HP_6 is not supported				

vations. The equiprobability model is the best predictor for two of the observations and the majority rule model is the best predictor for the third. A lack of complete support for HP_3 and HP_4 is not particularly detrimental to our test of the contingency paradigm. The small sizes of cells 3 and 4 afford additional evidence that the buying task and perceived risk are not completely independent dimensions of organizational buying. One can infer that these particular situations are not likely to occur often in practice and it may not be worthwhile to focus substantial research attention on such cases.

HP_5 is partially supported. No substantial differences were expected or found in the predictive ability of the majority rule model in the two technical uncertainty/financial commitment situations included in cell 5. The majority rule model has the highest proportion of first-place fit rankings in comparison with the other models. The best alternate model in first-place rankings is the voting model, which is not surprising because the majority and voting models generate similar predictions for small groups. The difference between these two models is in the secondary scheme used to handle ties (equiprobability rule for the voting model and a "no ties get business" for the majority model). HP_5 is partially supported by consideration of the top three fit ranks; the voting model has more decisions ranked from 1 to 3 in this cell than the majority rule model (79% vs. 70%).

HP_6 is not supported, as shown in Table 4. The majority rule model has 31% of decisions ranked first in fit in this cell and the equiprobability model has 23% versus 15% each for the unanimity model, autocracy model, and voting model. When the top three fit ranks are considered, the voting model and majority rule model have 53% and 46% of decisions, respectively, in the top three fit ranks in comparison with 39% for the unanimity model.

We tested the robustness of the results to size of organizations and naturally occurring versus *ad hoc* groups. In all cases, the results were consistent with those just described (details are available from the authors).

Finally, we examined a "posterior paradigm" based on our findings in Table 4. This data-driven paradigm has slightly better predictive accuracy than our prior paradigm when the first-place and top-three-ranks criteria are applied. By the first-place criterion, our posterior paradigm has the equiprobability model in cell 4 and the majority model in cell 6 (models in other cells remain the same). The model hypothesized to be the best predictor of group choice is ranked first in fit in 58% of decisions, in comparison with 49% for our prior paradigm (see Table 3). When the top three ranks are considered, the posterior paradigm places the voting model in cells 4, 5, and 6. The model hypothesized to be the best predictor of group choice is ranked either first, second, or third in fit in 88% of decisions, which is slightly better than the percentage for the prior paradigm (82%).

DISCUSSION

Our findings indicate that a contingency approach is generally appropriate in studying buying center choice. For example, no single model predicted choice best across situations, and buying center choice processes seem dependent on the situation (as defined by the buying task and perceived risk). Consistent with the findings of Patton, Puto, and King (1986), individual decision making is likely to occur in organizational buying when the task is a modified rebuy and perceived risk is low. Modified rebuys of higher risk and new tasks seem to require group interaction. This finding supports conclusions of Spekman and Stern (1979, p. 60), who maintain "the greater the uncertainty and the concomitant need for greater information, the more likely it is that . . . joint participation in decision making will be emphasized."

The weighted probability model, frequently cited in marketing studies of group choice, does not seem to be an appropriate model for predicting group choice according to our findings. In cells 2 and 3, where we hypothesize that this model would be a good predictor of choice, it does not perform well by the first-in-fit criterion. The weighted probability model has relatively better predictive ability for the top three fit ranks in cells 2 and 3. One reason for the poor predictive accuracy may be the weighting component of the model form. Our use of a single construct, expertise, to represent influence in the buying decision may not have provided a complete test of the weighted probability model. Corfman and Lehmann (1987), Steckel, Lehmann, and Corfman (1988), and Kohli (1989) provide evidence that influence may be a function of several variables, not just expertise.

The good predictive performance of the equiprobability model in modified rebuy situations of relatively high risk may be due to the "participative" nature of that model. It is possible that in modified rebuys of relatively high risk, group members all want to have a voice in the decision.

The voting model appears to be quite robust; it predicts choice well in modified rebuy situations (as hypothesized) and in new task situations (not hypothesized). Because the differences between the voting and majority rule models are minimal in three-person groups, those models have similar predictive ability in the new task cells of the paradigm.

Our results for the majority rule model may seem inconsistent with those of the social psychology literature. This difference may be due to our use of small, two- to three-person groups. Small groups allow only a plurality form of majority rule rather than more complex majority forms that may emerge in tests with large groups.

The unanimity model may not have predicted buying center choice well in our study because of its characterization as a "total agreement" decision rule. That type of decision scheme may not reflect buying center behavior in many organizations in the United States, but it may apply in other cultures. Our results support Choffray and Lilien's (1980) contention that the unanimity model may reflect a "management by consensus" process practiced by Japanese organizations. The unanimity model may have predicted poorly because it is difficult to induce "real world," high risk conditions for subjects participating in buying center experiments. In addition, the predictive ability of the majority rule model could have been similarly affected in the higher risk, new task cells.

Note, however, that we do register use of an agreement quota in new task, high risk situations. For example, in cell 6, the majority rule model is the best predictor of choice in terms of the first-place rankings and is second in predictive accuracy behind the voting model when the top three ranks are considered. Thus, group choice in high risk, new task situations seems to involve risk spreading in the form of partial, but not total, agreement among buying center members.

The lack of independence between the buying task and perceived risk may account for our findings in the new task cells of the paradigm. In new task situations, the buying center is unfamiliar with the decision; hence, use of a majority rule model forces the spreading of decision responsibility among buying center members. It follows that in modified rebuy situations, buying center members are somewhat more familiar with the decision and feel less need to spread the decision responsibility among themselves through use of a pre-set agreement quota. The no-quota models do allow for responsibility spreading but may achieve it to a lesser degree because no specific agreement quota must be met.

CONCLUSION

The buying task and perceived risk situational factors affect the types of choice schemes used by buying centers making group decisions. Our findings provide empirical support for inclusion of these two situational factors in global models of organizational buying (Robinson, Faris, and Wind 1967; Sheth 1973; Webster and Wind 1972). Paradigms proposed in future research should incorporate other contingent factors that may improve predictive ability beyond the levels achieved here.

Limitations and Future Research

Our research has several limitations. We use one construct, expertise, to represent relative influence. Possibly other factors may lead to possession of dominant influence (e.g., formal authority, resource control, referent power, access to information, etc.). In future studies, subjects should be asked for their perceptions of relative influence both before and after group decision tasks; or, constructs identified as determinants of influence should be measured so that influence can be modeled.

The selection of the autocrat for the autocracy model was based on the importance (expertise) weights as specified by Choffray and Lilien (1980). Possibly selection of an autocrat is based on different factors. An alternate approach would be to ask buying center members, "Who would be most likely to be given responsibility for the decision if it must be made by only one person?"

A true group decision is a dynamic process, which we model by using static preference data. The models studied here, in their current form, are static and do not incorporate change. This limitation is problematic for all of the models and the unanimity model in particular. In a true group choice setting, prediscussion preferences of group members may differ, but may be resolved after a group discussion that leads to a unanimous choice.

Our use of small buying centers minimizes the differences between the voting and majority rule models to the differences between their secondary decision schemes. In future studies, larger buying centers should be examined to discriminate between the predictive abilities of those models.

Future research might incorporate "decision quality" to learn whether the choice models that are predicted and supported in our paradigm yield the best solutions. Decision-making processes from other nations (e.g., Japan) should be examined to note any cultural differences that might affect group choice. We tested the models and paradigm within the context of modified rebuy and new task decisions. The autocracy model, a good predictor of choice in low risk, modified rebuy situations, might also be accurate in straight rebuy decisions because they also tend to be characterized by low levels of risk. Straight rebuys should be included for testing in future research. Finally, the structure and operationalization of the contingency paradigm here is a first step and should be refined through further empirical and theoretical studies.

Implications for Theory and Practice

Our results provide general empirical support for some aspects of organizational buying theory. In particular, our results support Sheth's (1973) model of situational influences on buying decisions and show that Choffray and Lilien's (1980) models of group choice are useful tools. By partially integrating those two theories, we have attempted to provide insight about group choice as it occurs within the buying center.

The contingency paradigm can be used, in a general sense, by purchasing managers. By determining the nature of the situation, they can place a buying decision in a cell of the paradigm to determine the group choice model likely to be used. Purchasing managers and others involved in buying centers may be able to gain normative insight about the types of decision rules that are most often used to make supplier choice decisions. Until we know more about the quality of such decisions, though, we cannot offer more specific recommendations for purchasing strategy. Marketers can improve selling strategies if they understand how the buying center responds to the vendor selection task. For example, a group decision process that reflects the majority rule model is likely to require marketers to gain the support of more persons in the buying center than would be needed for other decision processes.

Weitz (1981) notes that universal propositions about selling effectiveness often are not enough to explain sales behavior. He calls for the investigation of "more complex propositions in which circumstances of the sales situation moderate the relationship between the salesperson behavior and effectiveness" (p. 100). Though our research examines the other side of the phenomenon (buying center behavior), Weitz's contention is important and relevant to buying center research. By examining the effects of situational factors on buying center choice processes, our results provide a step toward developing the more complex propositions that may improve our understanding of how buying centers make purchase decisions.

APPENDIX
ANALYTIC STRUCTURE OF MODELS OF GROUP INTERACTION

In the *weighted probability model,* the assumption is that the group, as a whole, is likely to adopt a given alternative, say a_j in the choice set A, proportionally to the relative importance to the members who choose it. Let

$P_G(a_j; A)$ = probability that the group chooses a_j, $j = 1, \ldots, k$ alternatives,

and

w_i = relative importance, on the average, of decision participant i, $i = 1, \ldots, r$ in the choice process.

Hence:

$$\sum_{i=1}^{r} w_i = 1.$$

Then the weighted probability model postulates that

$$\text{(A1)} \qquad P_G(a_j; A) = \sum_{i=1}^{r} w_i P_i(a_j; A), \quad j = 1, \ldots, k.$$

The *equiprobability model* takes form A1 with $w_i = 1/r$ for all i.

The *voting model* states that the probability that the group will choose alternative a_j is equal to the probability that a_j is selected by the *largest number* of decision participants. Let

$$X_{ij} = \begin{cases} 1 & \text{if individual } i \text{ chooses } a_j \\ 0 & \text{otherwise} \end{cases}.$$

Then

$$\Pr(X_{ij} = 1) = P_i(a_j; A).$$

Let

$$Z_j = \sum_{i=1}^{r} X_{ij};$$

then

$$\text{(A2)} \qquad P_G(a_j; A) = \Pr[Z_j = \max(Z_k)].$$

In the *preference perturbation model*, the assumption is that if a group does not reach unanimous agreement, it is most likely to choose the alternative that "perturbs" individual preference structures least. Let:

θ_{iw} = event that individual i has preference ordering w, $i = 1, \ldots, r$; $w = 1, \ldots, k!$, where a preference ordering means, e.g., $a_1 \gg a_2 \gg a_3$ and $\gg$ means "is preferred to,"

λ_μ = set of preference orderings across decision participants = $\{\theta_{1w_1}, \theta_{2w_2}, \ldots, \theta_{rw_r}\}$ where $w_i = 1, \ldots, k!$ for $i = 1, \ldots, r$ and, hence, $\mu = 1, \ldots, rk!$;

$Q(a_j|\lambda_\mu)$ = "perturbation" associated with the set of preference orderings λ_μ; i.e., the sum of the number of preference shifts that are required to make option a_j the first choice of all decision participants.

To see how Q evolves, consider a two-person, three-product decision, with

$$\lambda_\mu = (\theta_{1,w_1}, \theta_{2,w_2}) = [a_0 \gg a_1 \gg a_2; a_2 \gg a_0 \gg a_1].$$

Here $Q(a_0|\lambda_\mu) = 1$, $Q(a_1|\lambda_\mu) = 3$, and $Q(a_2|\lambda_\mu) = 2$ (i.e., a_0 must move from second to first choice for participant 2 to give $Q(a_0|\lambda_\mu) = 1$; a_1 must move from second to first for participant 1 *and* move from third to first for participant 2 for $Q(a_1|\lambda_\mu) = 3$, and so on).

Assuming that individual preference distributions are mutually independent,

$$\text{(A3)} \qquad \Pr(\lambda_\mu) = \Pr(\theta_{1,w_1}, \theta_{2,w_2}, \ldots, \theta_{r,w_r}) = \prod_{i=1}^{r} \Pr(\theta_{i,w_i}), \quad \mu = 1, \ldots, rk!,$$

where the $\{i, w_i\}$ are suitably mapped to the appropriate μ. The model postulates that the ratio of probability of group choice equals the ratio of needed preference perturbation to achieve first preference within the group:

$$\text{(A4)} \qquad \frac{P_G(a_j|\lambda_\mu)}{P_G(a_e|\lambda_\mu)} = \frac{Q(a_e|\lambda_\mu)}{Q(a_j|\lambda_\mu)}.$$

Moreover, if $Q(a_e|\lambda_\mu) = 0$, then $P_G(a_e|\lambda_\mu) = 1$ and $P_G(a_j|\lambda_\mu) = 0$ for $j \neq e$ (this is a case of unanimous first preference).

As the total number of possible preference shifts is fixed, these conditional probabilities are uniquely determined. Hence,the unconditional probabilities of group choice are given by

$$\text{(A5)} \qquad P_G(a_j; A) = \sum_{w} P_G(a_j|\lambda_\mu) \cdot \Pr[\lambda_\mu].$$

The *majority rule model* is a special case of the voting model when a quota (say 50% or more) of the group is required to agree for an alternative to be chosen. Formally, we have

$$\text{(A6)} \qquad P_G(a_j; A) = \Pr[Z_j = \max(Z_k)|Z_k > r/2].$$

The *unanimity model* is another special case of the voting model with

$$\text{(A7)} \qquad P_G(a_j; A) = \Pr[Z_j = \max(Z_k)|Z_k = r].$$

The *autocracy model* uses the most influential decision participant's preferences as those of the group:

$$\text{(A8)} \qquad P_G(a_j; A) = P_{i^*}(a_j; A),$$

where i^* is the index representing that individual for whom $w_{i^*} = \max_i(w_i)$.

REFERENCES

Anderson, Erin, Wujin Chu, and Barton Weitz (1987), "Industrial Purchasing: An Empirical Exploration of the Buyclass Framework," *Journal of Marketing*, 51 (July), 71–86.

Bettman, James R. (1973), "Perceived Risk and Its Components," *Journal of Marketing Research*, 10 (May), 184–90.

Bishop, Yvonne, Stephen Fienberg, and Paul Holland (1975), *Discrete Multivariate Analysis: Theory and Practice*. Cambridge, MA: The MIT Press.

Buss, W. C. (1981), "A Comparison of the Predictive Performance of Group-Preference Models," in *AMA Educators' Conference Proceedings*, Series 47, Ken Bernhardt, ed. Chicago: American Marketing Association, 174–7.

Castore, Carl H., Kevin Peterson, and Thomas A. Goodrich (1971), "Risky Shift: Social Value or Social Choice? An Alternative Model," *Journal of Personality and Social Psychology*, 20 (3), 487–94.

Choffray, Jean-Marie and Gary L. Lilien (1980), *Marketing Planning for New Industrial Products*. New York: John Wiley & Sons, Inc.

Churchill, Gilbert A., Jr. (1979), "A Paradigm for Developing Better Measures of Marketing Constructs," *Journal of Marketing Research*, 16 (February), 64–73.

Corfman, Kim P. and Sunil Gupta (1990), "Mathematical Models of Group Choice," working paper, New York University.

——— and Donald R. Lehmann (1987), "Models of Comparative Group Decision-Making and Relative Influence," *Journal of Consumer Research*, 14 (June), 1–13.

Davis, James H. (1973), "Group Decision and Social Interaction," *Psychological Review*, 80 (March), 97–125.

——— (1982), "Social Interaction as a Combinatorial Process in Group Decision," in *Group Decision Making*, Hermann Brandstatter, James Davis, and Gisela Stocker-Kreichgauer, eds. London: Academic Press, Inc., 27–58.

———, Jerry L. Cohen, John Hornik, and A. Kent Rissman (1970), "Dyadic Decision as a Function of the Frequency Distributions Describing the Preferences of Members' Constituencies," *Journal of Personality and Social Psychology*, 26 (2), 178–95.

———, R. A. Hoppe, and John P. Hornseth (1968), "Risk-Taking: Task, Response Pattern and Grouping," *Organizational Behavior and Human Performance*, 3, 124–42.

Doyle, Peter, Arch G. Woodside, and Paul Michell (1979), "Organizations Buying in New Task and Modified Rebuy Situations," *Industrial Marketing Management*, 8, 7–11.

Einhorn, Hillel, Robin Hogarth, and Eric Klempner (1977), "Quality of Group Judgement," *Psychological Bulletin*, 84 (1), 158–72.

Johnston, Wesley J. and Robert E. Spekman (1982), "Industrial Buying Behavior: A Need for an Integrative Approach," *Journal of Business Research*, 10, 135–45.

Kemeny, J. G. and L. J. Snell (1962), "Preference Ranking: An Axiomatic Approach," in *Mathematical Models in the Social Sciences*, J. G. Kemeny and L. J. Snell, eds. New York: Ginn Publishing Company, 9–23.

Kohli, Ajay (1989), "Determinants of Influence in Organizational Buying: A Contingency Approach," *Journal of Marketing*, 53 (July), 50–65.

Kriewall, Mary Ann Odegaard (1980), "Modeling Multi-Person Decision Processes on a Major Consumption Decision," unpublished dissertation, Stanford University.

Krishnamurthi, Lakshman (1981), "Modeling Joint Decision Making Through Relative Influence," unpublished dissertation, Stanford University.

Laughlin, Patrick R. and P. Christopher Earley (1982), "Social Combination Models, Persuasive Arguments Theory, Social Comparison Theory, and Choice Shift," *Journal of Personality and Social Psychology*, 42 (2), 273–80.

Lehmann, Donald and John O'Shaughnessy (1974), "Difference in Attribute Importance for Different Industrial Products," *Journal of Marketing*, 38 (April), 36–42.

Lilien, Gary L. and M. Anthony Wong (1984), "An Exploratory Investigation of Structure of the Buying Center in the Metalworking Industry," *Journal of Marketing Research*, 21 (February), 1–11.

Mannix, Elizabeth A., Leigh L. Thompson, and Max H. Bazerman (1989), "Negotiation in Small Groups," *Journal of Applied Psychology*, 74 (3), 508–17.

March, J. G. (1966), "The Power of Power," in *Varieties of Political Theory*, D. Easton, ed. Englewood Cliffs, NJ: Prentice-Hall, Inc., 39–70.

Möller, Kristian and Martti Laaksonen (1986), "Situational Dimensions and Decision Criteria in Industrial Buying," in *Advances in Business Marketing*, Vol. 1, Arch G. Woodside, ed. Greenwich, CT: JAI Press, Inc.

Parker, Barnett and V. Srinivasan (1976), "A Consumer Preference Approach to the Planning of Rural Primary Health-Care Facilities," *Operations Research*, 24 (September–October), 991–1025.

Patchen, Martin (1974), "The Locus and Basis of Influence in Organizational Decisions," *Organizational Behavior and Human Performance*, 11, 195–221.

Patton, W. E., Christopher P. Puto, and Ronald H. King (1986), "Which Buying Decisions Are Made by Individuals and Not by Groups," *Industrial Marketing Management*, 15, 129–38.

Peter, J. Paul (1979), "Reliability: A Review of Psychometric Basics and Recent Marketing Practices," *Journal of Marketing Research*, 16 (February), 6–17.

Platt, John (1964), "Strong Inference," *Science*, 146, 347–53.

Qualls, William J. and Christopher P. Puto (1989), "Organizational Climate and Decision Framing: An Integrated Approach to Analyzing Industrial Buying Decisions," *Journal of Marketing Research*, 26 (May), 179–92.

Robinson, Patrick, Charles W. Faris, and Yoram Wind (1967), *Industrial Buying and Creative Marketing*. Boston: Allyn and Bacon.

Sheth, Jagdish (1973), "A Model of Industrial Buyer Behavior," *Journal of Marketing*, 37 (October), 50–6.

Shiflett, S. (1979), "Toward a General Model of Small Group Productivity," *Psychological Bulletin*, 86, 69–79.

Silk, Alvin and Manohar U. Kalwani (1982), "Measuring Influence in Organizational Purchase Decisions," *Journal of Marketing Research*, 19 (May), 165–81.

Spekman, Robert E. and Louis W. Stern (1979), "Environmental Uncertainty and Buying Group Structure: An Empirical Investigation," *Journal of Marketing*, 43 (Spring), 54–64.

Steckel, Joel H. (1990), "Committee Decision Making in Organizations: An Experimental Test of the Core," *Decision Sciences*, 21 (Winter), 204–15.

———, Donald R. Lehmann, and Kim P. Corfman (1988), "Estimating Probabilistic Choice Models From Sparse Data: A Method and an Application to Groups," *Psychological Bulletin*, 103 (1), 131–9.

Webster, Fredrick E. and Yoram Wind (1972), "A General Model for Understanding Organizational Buying Behavior," *Journal of Marketing*, 36 (April), 12–19.

Weitz, Barton A. (1981), "Effectiveness in Sales Interactions: A Contingency Framework," *Journal of Marketing*, 45 (Winter), 85–103.

Wilson, David T. (1971), "Industrial Buyers' Decision-Making Styles," *Journal of Marketing Research*, 8 (November), 433–6.

Wind, Yoram and Lawrence K. Spitz (1976), "Analytical Approach to Marketing Decisions in Health-Care Organizations," *Operations Research*, 24 (September–October), 973–90.

Reprint No. JMR284106