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COMPETITIVE ATTACK, RETALIATION AND PERFORMANCE: AN EXPECTANCY-VALENCE FRAMEWORK

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This research examines how competitive attacks can best reduce the chances of retaliation. An expectancy–valence model is developed that views retaliation as a function of the subtlety of an attack: that is, its visibility, the difficulty rivals might have in responding to it in kind, and the importance or 'centrality' to rivals of the market under siege. Motivational theories suggest that all three *of these independent variables need to be in place in order to elicit a response—or conversely, that low visibility, substantial response difficulty, or minimal centrality would each by itself be enough to prevent retaliation. This notion was not supported.* Each one *of the independent variables could serve as the 'weak link of the chain,' increasing the chances of retaliation. However, as predicted by expectancy theory, these variables selectively demonstrated some interactions that compound the threat of retaliation. In combination, high visibility and low levels of difficulty were especially likely to evoke responses from rivals. Finally, there appears to be a real incentive to avoid retaliation given its negative associations with performance.*

INTRODUCTION

Business strategists are very much concerned with competitive rivalry: with the jockeying and maneuvering among competitors that takes the form of price cuts, advertising wars, and new product and service introductions. Michael Porter summarizes the essence of these dynamics as follows:

> Rivalry occurs because one or more competitors either feels the pressure or sees the opportunities to improve position. In most industries, competitive moves by one firm have noticeable effects on its competitors and thus may incite retaliation or efforts to counter the move; that is, firms are mutually interdependent. (1980: 17)

Unfortunately, the interplay between the actions of a strategist, the responses they provoke, and the ultimate performance implications of this interaction have barely begun to be explored empirically (e.g., Chen, Smith and Grimm, 1992; MacMillan, McCaffery and Van Wijk, 1985). This research represents a step in that direction. It seeks to identify just what it is about attack behavior that elicits or averts retaliatory responses, and it goes on to explore the performance implications of retaliation. These questions are important as they get to the heart of what makes for an effective competitive attack. We shall be using the expectancy–valence motivational framework developed by Atkinson (1964), Rotter (1954), and Vroom (1964) as a guide for modeling the nexus between strategic action and response.

Key words: Competitive strategy, competitive attack, competitive retaliation, expectancy-value models

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TWO MODES OF ATTACK

Thomas Schelling suggests that:

> the essence of a game of strategy is the dependence of each person's proper choice of action on what he expects the other to do . . . A strategic move is one that influences the other person's choice, in a manner favorable to oneself . . . One constrains the partner's choice by constraining one's own behavior (1960: 160).

And indeed, our central thesis is that attacking firms can best constrain their rivals and thereby achieve their own objectives by making nuanced and discreet moves that fail to elicit retaliation (Deutsch, 1969).

For competitive contexts in which no rival clearly dominates, a *subtle attack* strategy is expected, on average, to be far more effective than a *brute force strategy* (Fisher, 1964; Porter, 1980). The latter has firms trying to bulldoze their competitors, attacking with impunity to force rivals into submission. But such an obvious and threatening strategy is likely to prompt retaliatory responses that negate the potential advantage of the attacker (Deutsch, 1969). According to Porter:

> This pattern of action and reaction may not leave the initiating firm and the industry as a whole better off. If moves and countermoves escalate, then all firms in the industry may be worse off than before (1980: 17).

If a firm's actions represent a threat that is obvious, easy to match, and significant, its alert rivals will be motivated to counter that attack, and thus perhaps, to negate its potential benefits (Nelson and Winter, 1982).

In contrast, the subtle attack is much more likely to avoid retaliation and the escalating competition that impoverishes all competitors. Competitive moves that are covert, hard to respond to, and targeted towards peripheral areas of the market will be much more likely to create 'asymmetries' and thereby yield enduring rewards (Levitt, 1969; Shamsie, 1990). That is, they will be less apt to invite effective responses from agitated rivals and thus will minimize costly conflict. The legendary Chinese martial strategist Sun Tzu maintained that 'the expert [general] approaches his object indirectly. By selection of a devious and distant route he may march a thousand *li* [kilometers] without opposition and take his enemy unaware' (Griffith, 1963: 41). And as Liddell Hart argues, strategy 'has for its purpose the reduction of fighting to the slenderest possible proportions . . . The perfection of strategy would be . . . to produce a decision without any serious fighting' (1954: 338). Thus competitive moves that go unchallenged can be significant weapons in a strategist's arsenal (Chen and MacMillan, 1992).

A GENERAL MODEL

The superiority of subtle over brute force attack as a means of limiting retaliation can be derived from the well-known expectancy–valence model of motivation. Although this model has been used to understand individuals, we believe that it can also clarify the competitive behavior of organizations. It has the advantage identifying and systematically interrelating the various attributes of an attack to the proclivities of rivals to respond to it. In that sense, it provides a new framework for understanding competition.

According to the model there are two basic prerequisites that underlie the proclivity to respond to any threat: the subjective reward value or 'valence' of responding effectively, and the expectation or perceived probability that one is actually capable of performing in a way that will earn the reward (Atkinson, 1964; House, 1971; Vroom, 1964). The subtle attack will limit both these factors, thereby reducing the motivation to respond. These components of motivation will be examined in turn.

The motivation to retaliate will be greatest where the threat is significant. If potential responders feel that *something important is at stake*—that is, if they view the attack as potentially costly to them—they will have an incentive to counter it. In the language of the psychologists, the valence of the threat must be significant in order for it to prompt retaliation (Atkinson, 1964; Vroom, 1964). In a competitive context, the valence of a response is the reward expected from effectively neutralizing or nullifying an attack—hence, the more 'central' the object of the attack, the greater the valence to respond.

However, even if an attack puts much at stake, retaliation would still be unlikely unless potential respondents *are confident in their ability to mount an effective response*. They must believe they are capable of neutralizing the attack and thereby earning the commensurate rewards. This 'effort–reward expectancy' is central to expentancy–valence theory (Atkinson, 1964; Georgopoulos, Mahoney and Jones, 1957; House, 1971; Lawler and Porter, 1967; Locke, 1968; Vroom, 1964).[1]

Because a significant reward and the confidence that one's behavior will earn it are both prerequisites of response, most psychologists believe that these terms combine multiplicatively to determine the motivation to respond (House, 1971; Lawler, 1973; Vroom, 1964). Their argument is that without a sizeable reward, there will be less incentive to respond, even where strategists believe strongly in their ability to obtain the reward. Similarly, if parties feel they are unable to react effectively they may not respond even if the reward is high (House, 1971; Mitchell, 1974; Pinder, 1984).

There is, however, another potential determinant of the proclivity to respond to an attack, and that is its visibility. Most models of human motivation seem to assume that in order to respond to a threat, one must first notice it (Kiesler and Sproul, 1982). Thus in a corporate setting, the more obvious an attack, the greater the likelihood that it will be countered.

To summarize, strategists might do well to eschew overt attacks in favor of subtle ones that: (a) minimize visibility, (b) minimize rivals' perceived ability to respond effectively, and (c) diminish the valence or value that rivals assign to effective retaliation. This recipe is not only in line with the thinking of most psychologists, but is also very consistent with the wisdom of military strategists such as Liddell Hart (1954), Sun Tsu and Mao Tse-Tung (Griffith, 1963), the counsel of political scientists such as Deutsch (1969) and Schelling (1960), and even the strategic prescriptions of business economists like Porter (1980).

CORPORATE ACTIONS AND RESPONSES

In order to make the transition from the motivational psychology of individuals to the behavior of corporations, it is necessary to imagine how expectancies and valence might surface in strategic competition. As we noted above, rivals will not be inclined to respond unless they are aware of an attack: hence *visibility* is a tacit precondition of the expectancy model. In a corporate setting, the expectancy that effort will lead to a positive outcome may be reflected by the perceived difficulty of engaging in retaliation—that is *the difficulty of responding*. Clearly, rivals are less likely to respond to an attack if they believe that they have a small chance of doing so effectively. The valence associated with an effective response is important as well. Attacks on a highly valued or *central* market will provoke response because retaliation may prevent or reverse a serious loss. In contrast, attacks on small or peripheral markets might only elicit the lethargy born of tiny rewards.

The research will therefore focus on the three factors that are expected to influence retaliation: attack visibility, response difficulty—our surrogate for expectancy, and attack centrality—our surrogate for reward valence. We will also argue

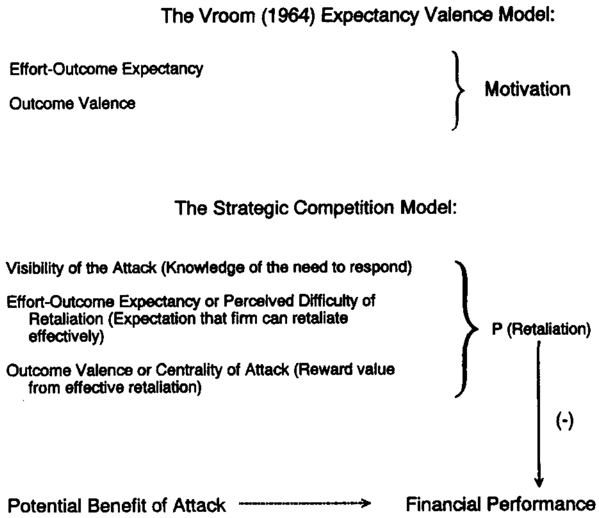

Figure 1. The general models

[1] More recently theorists have broken effort–reward expectancy into two components—the first is the expectation that effort will lead to effective performance; the second is the expectation that effective performance will be 'instrumental' in earning the reward (Lawler, 1973; Pinder, 1984; Wahba and House, 1974). This distinction produces a three-termed model often referred to as the VIE or valence–instrumentality–expectancy model. But as we are studying firms rather than individuals, effective performance is *by definition* that which will produce a valued outcome.

that retaliation will hurt financial performance. Figure 1 presents our general model.

Visibility of attack

The more visible a threat, the more likely it is that it will be detected and responded to (Deutsch, 1969, Deutsch and Krauss, 1960, Kiesler and Sproull, 1982). According to Sun Tzu one must conceal one's shape from the enemy: 'Subtle and insubstantial, the expert [general] leaves no trace; divinely mysterious, he is inaudible. Thus he is master of his enemy's fate.' (Griffith, 1963: 53, 97).

Some actions—such as price cuts in a price-sensitive market—may be so overt and visible as to invite an immediate response. To rivals these represent clear and widely heralded challenges. Other actions may be much more subtle, and therefore, far less likely to provoke retaliation. Competitors may not, for example, notice nuanced changes in a rival's services or still less uncover a private contract that a competitor has signed with a supplier. Indeed, these actions might never be announced or publicized. As Porter (1980: 96) argues, effective retaliation may be impeded when strategic moves are kept secret or 'introduced quietly away from competitors' centers of attention'.

Actions that are rather vague and do not apply very obviously to one particular business or target market may also go unnoticed by competitors and thus reduce the probability of response. For example, a general improvement in service may not be captured by the intelligence apparatus of competitors and so may not invite retaliation (Miller, 1990).

The publicity accorded to an attack might itself serve as an incentive for rivals to respond. If a competitor feels that everyone is watching it being assaulted, it may be especially motivated to show that it is not being passive, simply as a warning to others who might wish to attack it in the future. For example, a name-calling attack on a competitor is much more likely to attract press attention and provoke retaliation. Few rivals would feel they could afford to ignore so direct and public a challenge. Indeed, the greater the publicity associated with an attack, the greater the danger that defending firms' reputations will be damaged by not responding, thus encouraging further attacks both by the attacker *and by other competitors*. To prevent further attacks, the defending firms will often feel obliged to respond, even if such a decision does not make rational economic sense in the short run (Kreps, 1990; Weigelt and Camerer, 1988). To recap, if an action is visible in the marketplace, it will elicit responses from many of the competitors who are affected.

Hypothesis 1: The more visible the attack, the larger the number of retaliatory responses from the group of rivals being attacked.

Response difficulty

In a competitive situation, effort–performance expectancy will be reflected by the perceived ease of mounting appropriate retaliation. An action is more likely to evoke a response if it is easy to imitate, that is, if it can be countered simply, economically and without much organizational disruption (MacMillan, 1983; MacMillan *et al.*, 1985). Price changes can readily be matched by competitors because they require little in the way of special expertise, complex coordination, unsettling disruption, or major resources (Porter, 1980: 17).

In contrast, attacks that develop new products or processes may be much harder to implement. They are less likely to elicit responses in kind as these would require considerable managerial and financial resources. They might also involve complex coordination among many departments or external constituencies, disruption of existing systems, relocation of personnel, and a high chance of costly error.

Porter (1985: 531) notes that rivals will be reluctant to respond to complex attacks that subtly differentiate a product (see also Porter, 1980 and Scherer, 1980). Here difficulty of response is caused by a scarcity of expertise or design talent. According to Scherer (1980: 388) 'Any fool can match a price cut, but counteracting a clever advertising gambit is far from easy.' Indeed, the resource based view of the firm suggests the strategic importance of idiosyncratic assets and skills that are difficult for rivals to imitate (Amit and Shoemaker, 1993; Barney, 1991; Lippman and Rumelt, 1982; Prahald and Hamel, 1990; Wernerfelt, 1984).

Hypothesis 2: The more difficult it is to *respond to an attack, the smaller the number of retaliatory responses.*

Centrality of attack

The valence or expected pay-off associated with effective retaliation will be very much a function of the *centrality* of the attack—that is, the extent to which it pertains to markets that are especially large, valued by, or vital to potential responders. Where a firm attempts to capture a rival's major market, it is more likely to trigger a response; the competitor might experience significant losses (negative pay-offs) if it failed to do so.

In business, as in war, tactics based on forays into neglected or hitherto unprized territory may have their rewards. However, full frontal attacks on much-treasured property will meet with great resistance unless there is a tremendous discrepancy between the strengths of the combatants (Deutsch, 1969; Deutsch and Krauss, 1960; Fisher, 1964).

As Porter (1985: 532) notes: a firm 'may not retaliate if its commitment . . . is directed to other industries,' or for that matter, other target markets within the same industry. Thus by launching attacks upon markets that are not highly prized by rivals a strategic actor may be able to preclude retaliation long enough to gain a valuable foothold (Fisher, 1964). Indeed, this has been a strategy favored by some Japanese multinationals who first broached peripheral 'low end' motorcycle, appliance and toy markets before moving into the mainstream (Hamel and Prahalad, 1990).

In short, if an action simultaneously threatens a major proportion of several competitors' markets, it would be expected to provoke many responses.

Hypothesis 3: The greater the centrality of the markets attacked, the greater the number of retaliatory responses.

The multiplicative relationship

As suggested earlier, expectancy valence theory predicts a multiplicative relationship between expectancy and valence—in this case perceived response difficulty and attack centrality (Pinder, 1984; Vroom, 1964). Visibility was also expected to increase the chance of retaliation and hence the number of responses from affected competitors, and thus must constitute another term in the model.

The products of visibility and centrality, visibility and difficulty, and difficulty and centrality will be significantly related to the number of retaliatory responses, as will the product of all three terms.

Hypothesis 4: The first order and second order products of response ease (the inverse of response difficulty), attack visibility, and attack centrality will be positively correlated with the number of responses.

In the psychological literature, expectancy models of motivation predict responses using only the product of valence and expectancy (Georgopoulos *et al.*, 1957; House, 1971; Vroom, 1964). Psychologists reason that high expectancies will not motivate a response unless there is a valued pay-off, nor will a valued pay-off induce action without a high expectancy. In other words, the main motivational effects of expectancy or valence alone will not be significant. Response to an attack would occur only if the attack is visible, easy to respond to *and* levelled against a central market. Conversely, an attack might meet with little opposition if only it negates *any one* of these three conditions.

In the context of corporate competition, however, firms almost always have some information and retaliatory ability *vis à vis* one another and some expected pay-off from responding to each other. In other words, it will be rare for null expectancies to cancel out entirely the influence of a pay-off; moreover, pay-offs will rarely be so low as to completely nullify the motivational effect of positive expectancy (Stahl and Harrell, 1981).[2] These tendencies can restrict the potential magnitude of the interaction effect.

In short, we see the expectancy model as a framework that can help to identify factors that trigger retaliation to an attack; it should also reveal important interactions among these factors. We do not, however, expect a strict version of

[2] Indeed, the same conditions may apply to individual motivation, and perhaps that is why many psychologists have had such a hard time empirically confirming their multiplicative models (Arnold, 1981, 1982; Landy and Becker, 1987; Stahl and Harrell, 1981; Zedeck, 1977).

the model to apply—one, that is, that posits null main effects and determinative interaction effects.

ATTACK, RETALIATION AND PERFORMANCE

The consequences of a competitive action for an attacker depend at least in part on the number of responses that action provokes. The initiating firm's profit may be adversely affected if its attack triggers intense counter-actions from a large number of competitors. Mansfield (1968) and Nelson and Winter (1982) claim that an initiator's competitive advantage decreases as more competitors enter the fray. Conversely, as long as the number of competitive responses to an action remains small, the initiating firm will continue to enjoy its quasi-monopolistic status (MacMillan *et al.*, 1985; Mansfield, 1968; Porter, 1980).

Responses may not only neutralize an action's benefits, they may also create the need for further actions. For example, if a firm advertises in order to gain market share and rivals respond in kind the attacker would have to advertise even more to preserve his share (Comanor and Wilson, 1974; Nelson and Winter, 1982; Schmalensee, 1972). Costs go up and profitability shrinks; or alternatively, sales do not increase enough to compensate for the rise in expenses (Porter, 1980, 1985; Scherer, 1980; Shamsie, 1990).

Hypothesis 5: The extent to which a firm's actions will provoke retaliation will be negatively related to performance.

Since performance may also be influenced by the scale of the potential benefit to the attacker represented by a particular action, for example, the number of customers involved, it is necessary to control for this benefit when examining the relationship between the extent to which a firm's actions will provoke retaliation (the response ratio) and performance.

METHOD

Sample

The sample consisted of 32 major U.S. airlines. This industry was chosen because of its well-established competitiveness and its rather distinct boundary. It also contains a clearly identifiable set of competitors about whom there is abundant public information. Because our hypotheses all pertain to the business rather than corporate level of strategy, it is also appropriate that all our airlines are single or dominant business firms according to the definition of Rumelt (1974).

The focus of this paper is the competitive action/response dyad, the fundamental building block of competitive interaction. In order to study competition at this level this research selected each and every competitive move reported between 1979 and 1986 in *Aviation Daily*. Methods of 'structured content analysis' were used to identify and classify these moves (see Miller and Friesen, 1984; Jauch, Osborn, and Martin, 1980; Harrigan, 1980). *Aviation Daily* is widely known in the industry as the publication that provides by far the most comprehensive and reliable information on airline competitive actions. As the journal aims to report airlines' announcements and objective actions as they occur, it suffers very little from the distortions of post hoc rationalization.

Identification of attack actions and retaliatory responses

The first author undertook an extensive 8-year review of every issue of *Aviation Daily* to discover all the following kinds of competitive moves: price cuts, promotional activities, product line or service changes, distribution channel alterations, market expansions, vertical integration, mergers and acquisitions, and strategic alliances. All these actions were listed by Levine (1987) as being the fundamental modes of competition in the U.S. domestic airline industry. They also were included in the work of strategy content researchers such as Hatten, Schendel and Cooper (1978), Khandwalla (1981), Porter (1980, 1985), and Scherer (1980). This study incorporated all market moves as reported in *Aviation Daily* that airlines took against each other in these categories. All internal moves—such as organizational restructuring—were excluded from this study as they do not pertain to our hypotheses and are beyond the scope of this research. Also excluded from this study were moves such as route exits and price increases which, strictly speaking, do not constitute competitive attacks.

It was essential for the purposes of this study to distinguish the competitive actions that met with responses. To accomplish that, we identified all entries in *Aviation Daily* that were responses by searching for the following key words: 'in responding to,' 'following,' 'match,' 'under pressure of,' 'reacting to,' and so on. For example, *Aviation Daily* reported that 'United Airlines and Frontier responded to Continental's 35% price cuts' (February 17, 1984). Continental's price cut is considered an action and United and Frontier's a response. If no further report appeared in *Aviation Daily* indicating a change, the execution plan announced was assumed to be valid. An action was excluded if its execution was later reported to have been canceled.

Much care was taken in tracing streams of actions and responses back to the initial action. First, raters read all *Aviation Daily* issues in chronological order from January 1, 1979 to December 31, 1986 to find all market moves. Second, using the above keywords, raters first identified responses and then worked back from December 1986 to January 1979 to find the report of the initial action. This method was able to trace each and every initial action and all the responses to it.

The total sample of this study consisted of 780 actions and 222 responses in kind. These were classified by the first author and by three Ph.D. students in the field of business strategy into the 14 generic action and response types presented in the left column of Appendix 1. The 14 types of actions were deemed by prior researchers to be the major modes of competition in the US domestic airline industry (Chen, Smith and Grimm, 1992; Levine, 1987).

In order to further verify the classification of actions into the 14 types, we conducted an extensive survey of airline executives and industry experts (see Appendix 2 and the section that follows on Measurement). A sample of 106 executives from the airline industry were asked to classify 7 of the most ambiguous sample moves that we could find into one of our generic categories. The executives classified the moves into the same categories as the researchers 82 per cent of the time.

Data source reliability

In order to investigate the overall accuracy, comprehensiveness and managerial usage of *Aviation Daily* as a source of information about competition in the airline industry, we conducted another survey of airline executives. The results of this survey, given in full in Appendix 3, indicate that 85 percent of the respondents rated *Aviation Daily* very comprehensive or totally comprehensive as a source of airline competitive activity; and only 8 percent of the respondents rated the reportage of the journal as less than reliable.

To further establish the accuracy of the information published in *Aviation Daily*, a random subsample of 20 moves was drawn, of which 17 (85%) were found and confirmed in their details by other major business publications and newspapers. It is normal that *Aviation Daily* would be more exhaustive in its reporting of airline competitive exchanges as it is a more specialized industry periodical.

Measurement

In order to test our hypotheses, it was necessary to have each of the 14 types of actions scored along the scales we used to assess attack visibility, response difficulty and attack centrality.

Visibility of attack

Visibility of attack was assessed using an extensive questionnaire survey that was mailed to 430 very senior airline executives and experts; 176 usable responses were received (41%) after two follow-up mailings. The sample was drawn primarily from the *World Aviation Directory* and is described fully in Appendix 2. Complete confidentiality was assured to all respondents. We could detect no statistically significant differences between respondents and nonrespondents in years of experience in the industry and company, management level, age, functional background, education level and the size of their firms (p values of the differences exceeded 0.27 in all cases).

Three scales were used to assess how visible each type of attack might be to rivals. The first two scales were derived from the questionnaires and were thus the same for each action of a given type; the third was an objective measure and varied for each individual action. First, respondents were asked about the amount of industry publicity associated with each move.

Second, respondents were requested to estimate the likelihood that this type of attack would be publicly announced by top management. The questionnaire asked each respondent to rate on a 5-point scale both aspects of visibility for each of 14 sample moves. To obtain a third, more objective measure of visibility, we counted the *number of lines of print* in *Aviation Daily* associated with each move. The visibility of each of the moves is reported in Appendix 1. The three scales were standardized and then averaged. The Cronbach Alpha for visibility was 0.62; Appendix 1 reports the intercorrelations among the visibility scales.

Difficulty of response

Response difficulty is the ease with which a competitor can respond in kind to an attack. This was assessed using five scales: the estimated financial expense of making a move; the degree of disruption of staff and systems; the amount of relocation of staff or equipment required; the need for complex coordination among different functional departments; and the overall perceived difficulty of making the move. The first four scales were completed by the respondents to the questionnaire using the 5-point scale described above, and ratings were equal for all actions within a type. As a double check on the representativeness of these four scales we also derived an overall difficulty scale for each of the 14 moves. All these moves were assessed along a 5-point scale by both authors. The correlations among these raters' scores were extremely high ($r = 0.85$, $p = 0.001$) and the scores themselves as well as the intercorrelation matrix are reported in Appendix 1. The Cronbach Alpha for the 5 scale Response Difficulty measure was 0.95.

Centrality of attack

Centrality of attack reflects the degree to which the markets of a given competitor are threatened by an action. It captures the direct threat of an action to rivals in the markets under attack. Of course, an action has a distinct effect on every competitor, depending on the importance to that competitor of the affected market.

Airlines affected by each action were first identified as those which provided service to at least one of the sample airports affected by the action. These airports were the 37 major hubs identified by the Department of Transportation. The centrality of an action was taken as the proportion of annual passengers affected. Of course, centrality varies among actions even for the same airline in the same year when different airports are affected. It also varies among competitors with a different mix of business. An aggregate index for each action was obtained by averaging the centrality measures for each affected airline. All data were drawn from the *Airport Activities Statistics of Certified Route Carriers*, published annually by the Department of Transportation.

Number of responses. For testing Hypotheses 1 to 4, which are couched at the level of the action/response dyad, the response variable is simply the number of responses evoked by an action. It is defined as the total number of competitors who actually respond to an action, and was determined by counting the number of airlines that responded to an action as reported in *Aviation Daily*.

Response ratio. Because Hypothesis 5 concerns the impact of retaliation on organizational performance, analysis is at the firm level. Financial performance is, of course, reported not by action but by company, by year. To obtain a matching response ratio, we summed all the competitive responses directed towards the actions of a given firm in a given year, and expressed this as a proportion of the total number of actions made by that firm in that year.

Performance

Financial performance was assessed using the three most widely accepted measures in the airline industry (Bailey and Williams, 1988; Smith *et al.*, 1991). These included total operating revenue per revenue passenger mile (RPM), operating profit per RPM and profit margin. To complement these measures we also used Standard and Poor's published stock ratings for each airline for each year. The stock ratings could be obtained only for 112 of the 168 observations.

These performance variables were used in lieu of return on assets which tends to vary a great deal because of the many extraordinary items affecting assets and nonoperating profits (e.g., tax rebates, changes and differences in depreciation and asset valuation methods, and nonrecurring income and expense items).

Potential benefit of the attack

The potential benefit of the attack was measured by the number of attackers' passengers affected by the action. This was aggregated for all the actions made by a given attacker in a given year.

FINDINGS

Correlational and multiple regression (OLS) analyses were run in order to test each of the five hypotheses. The correlations are presented in Table 1, the multiple regressions in Table 2. In order to remove multicollinearity of the interaction terms with their components, the interactions were calculated as the product of the *standardized* component terms (Southwood, 1978; Smith and Sasaki, 1979). The maximum correlation of an interaction term with its components was only 0.42, the average correlation was 0.13. Given the expected negative impact of response difficulty on the proportion of responses, that variable was subtracted from zero in calculating the interactions. Table 2 shows the results of the main effects and interaction terms.

The determinants of strategic response

The main effects: Hypotheses 1 to 3

It is clear from Tables 1 and 2 that Hypotheses 1 to 3 are well supported. Table 1 shows that visibility of attack and centrality correlate positively with the number of responses, whereas difficulty of response correlates negatively with responses. The more visible and central an attack and the easier it is to respond to, the greater the number of responses. These results are borne out by Equation 1 of Table 2 that regresses the number of responses against visibility, centrality, and difficulty (ease) of response. The overall regression and all three main effects attain significance at beyond the 0.01 level in the predicted direction. This was true for both the correlational and the multiple regression analyses.

The interaction effects: Hypothesis 4

Equations 2 to 4 of Table 2 reveal that two of the three first-order interaction effects were significant in the predicted direction. The visibility × difficulty and centrality × difficulty terms attained significance at the 0.03 and 0.05 levels, respectively. The partial F statistics that result from adding these interaction terms to Equation 1 were significant only at beyond the 0.10 level. Given the substantial sample size, these findings represent only weak support for expectancy theory.

In order to determine whether the two significant first order interaction terms contributed jointly to the variance explained, we calculated the effect of adding both of them simultaneously to the main

Table 1. Descriptive statistics and Pearson correlations

	Mean	S.D.	Correlations		
			Number of responses	Visibility	Centrality
Number of responses	0.26	0.86			
Attack visibility	2.60	0.47	0.17***		
Attack centrality	0.32	0.27	0.17***	0.06*	
Response difficulty	2.55	0.65	−0.20***	0.39***	−0.23***

*, **, *** indicate that the Pearson correlation coefficients are significant at beyond the 0.05, 0.01 and 0.001 levels respectively (N = 850).

Table 2. Multiple regression analyses of number of responses on attack characteristics

Equation constant	1	2	3	4	5
B	−0.214	0.284	0.270	0.259	0.275
Std error	0.187	0.031	0.030	0.031	0.034
t	−1.142	9.078	8.889	8.360	8.179
p value	0.254	0.000	0.000	0.000	0.000
Visibility					
B	0.514	0.252	0.254	0.267	0.264
Std error	0.070	0.033	0.035	0.036	0.036
Std beta	0.267	0.277	0.280	0.296	0.291
t	7.340	7.545	7.232	7.461	7.297
p value	0.000	0.000	0.000	0.000	0.000
Centrality					
B	0.284	0.102	0.079	0.065	0.091
Std error	0.113	0.034	0.031	0.032	0.037
Std beta	0.088	0.115	0.086	0.074	0.102
t	2.515	2.984	2.420	2.073	2.429
p value	0.006	0.001	0.008	0.019	0.007
Difficulty (sign reversed)					
B	0.377	0.207	0.239	0.237	0.211
Std error	0.052	0.040	0.035	0.035	0.040
Std beta	0.272	0.228	0.263	0.261	0.233
t	7.219	5.196	6.669	6.856	5.244
p value	0.000	0.000	0.000	0.000	0.000
Visibility × Centrality					
B			−0.020		
Std error			0.028		
Std beta			−0.028		
t			−0.709		
p value			0.240		
Visibility × difficulty					
B		0.039			0.030
Std error		0.020			0.024
Std beta		0.081			0.064
t		1.903			1.265
p value		0.029			0.103
Centrality × difficulty					
B				0.050	0.026
Std error				0.030	0.036
Std beta				0.064	0.033
t				1.633	0.723
p value				0.051	0.235
R-square	0.114	0.118	0.114	0.117	0.119
(adjusted)	(0.110)	(0.113)	(0.110)	(0.112)	(0.113)
df	3,776	4,775	4,775	4,775	5,774
F	33.21	25.93	25.02	25.63	20.84
p value	0.000	0.000	0.000	0.000	0.000
Partial F of interaction		3.34	0.46	2.95	2.24
p value of interaction		0.10	NS	0.10	0.10

effects of Equation 1 (see Equation 5). The incremental variance explained by these interactions resulted in an F statistic of 2.24, and a p value of about 0.10. The multiplicative model derived from expectancy theory does explain variance over and above that accounted for by the additive main effects, but only very modestly so.

Expectancy theorists often estimate second order or three-way interaction effects to test an entire or 'saturated' model (Arnold, 1982). This model did not explain significantly more variance than Equation 5. This may be due to the nonsignificance of one of the first order interactions as well as the inherent instability of second order terms and the collinearity they engender (Cohen and Cohen, 1983; Draper and Smith, 1985; Smith and Sasaki, 1979).

In summary, the results for two of the three first order interaction terms are mildly supportive of expectancy theory. Difficulty modestly compounds the effects of both visibility and centrality; although the latter two variables do not interact.

Gate vs. chain models of retaliation

It is instructive to develop this analysis further by comparing what we will call a *gate* vs. a *chain* model of retaliation. The strictest version of the expectancy–valence model can be likened to a series of gates, each of which must be open in order for retaliation to occur. The gates in our case might be labeled visibility of attack, difficulty of response, and centrality of attack. The expectancy–valence reasoning suggests that unless all the gates are open and the attack is visible, easy to reply to, *and* central, there will be no response. Thus attackers need only to shut one gate to avoid retaliation and increase profitability.[3]

In contrast, the *chain* model proposes that an attacker will be as vulnerable as 'the weakest link in the chain' of his attack: be it high visibility, high centrality, *or* low difficulty. Here, one weakness alone would be enough to elicit retaliation.

We wished to compare these *chain* and *gate* models directly and to examine with greater discrimination the joint effects among the three independent variables. The models may best be operationalized by a set of gates or thresholds, each suggesting a binary value that reflects the capacity to induce retaliation.[4] An analysis of variance approach was used in which eight cells ($2 \times 2 \times 2$) were formed by bifurcating each of the three independent variables according to their median scores. Bifurcation ensured an adequate sample size in each cell of the contingency table. Table 3 shows that we may safely reject the null hypothesis that response rates were randomly distributed among the eight cells (F statistic = 12.22, d.f. 7,772, p value = 0.000). This is consistent with the results of Table 2.

More importantly, *post hoc* Sheffe pairwise comparison tests indicated that two of the cells showed dramatically higher response levels than virtually all other cells ($p < 0.05$ in 10 of the 12 comparisons). Both of these cells have high values of visibility and low values of difficulty. But all cells showing only a single one of these qualities respond at or below the mean response level. It seems then that high visibility and ease of responding in kind *in combination* produce by far the strongest likelihood of retaliation from rivals, a much greater likelihood than we would expect simply from summing the main effects.

Although the significant main effects of the regression analyses favored the chain model, Table 3 shows some situational support for a modified *two-gate* model. Particular combinations among the independent variables are especially likely to induce retaliation. When the gates of visibility and difficulty are both open, far more than twice as much damage is done than if either gate alone is open.

Impact of responses upon performance: Hypothesis 5

We predicted that the response ratio would have a negative impact on financial performance. This

[3] The original multiplicative hypothesis was predicated on the assumption of the expectancy–valence or gate model that there can be no response to an attack without some modicum of visibility *and* centrality *and* ease. It may, however, have been very tough to test this assertion among our firms because none of these factors was ever so absent as to completely remove the incentive to respond. That is, among regularly interacting, non-monopolistic competitors, actions are only very rarely entirely invisible, irrelevant or impossible to respond to.

[4] It would have been useful to derive these threshold values simultaneously, using an approach like maximum likelihood estimation. Unfortunately, various mathematical and statistical difficulties usually render problems such as these intractable (Hill, 1963; Nakamura, 1991).

Table 3. Average response ratios under different combinations of the independent variables

Cells			Number of attacks	Mean number of responses per attack
Vis	Dif	Cent		
H	H	H	88	0.136
H	H	L	110	0.064
H	L	L	67	0.687*
H	L	H	119	0.773*
L	H	H	35	0.000
L	L	H	158	0.335
L	H	L	151	0.013
L	L	L	52	0.115
Total			780	0.280
F Statistic 12.22, df 7,772, *p* value = 0.0000				

* A Scheffe test indicates that the two cells in question differ significantly from all other cells at the 0.05 level. The only 2 exceptions in 12 comparisons are that the HLL cell does not differ significantly from the LLL or LLH cells. Nor do the HLL or HLH cells differ from one another.

was borne out by the partial correlations between the response ratio and the performance measures, which control for the potential benefit of an action, that is, the number of attacker's customers affected. As shown by Table 4, revenue per revenue passenger mile (RPM), operating profit per RPM, profit margin and Standard and Poor's stock ratings are all significantly but negatively correlated with the proportion of responses. These correlations are consistently significant, which is especially encouraging as performance is a function of many diverse factors such as a firm's route structure, regional economic conditions, price wars, labor unrest, and so on.

In order to establish the robustness of our findings we performed a factor analysis of the four performance variables. A one factor solution was selected based on the scree test and the traditional eigenvalue cutoff criterion of 1.0. This factor accounted for 57.2 percent of the variance in the performance data and had an eigenvalue of 2.29. The loadings for the variables were as follows: 0.67 for revenue per RPM, 0.94 for operating profit per RPM, 0.76 for profit margin, and 0.61 for the S & P stock rating.

Table 4 reveals that the correlation between the performance factor and the response ratio was significant in the predicted direction at beyond the 0.01 level when controlling for the average number of affected passengers. Hypothesis 5 was confirmed.

DISCUSSION

Our central thesis was that *subtle* attacks would provoke fewer responses than more visible, more central, and more easily imitated volleys. This was confirmed. Hypotheses 1 to 3 were supported and they show that all three aspects of subtlety—visibility, difficulty and centrality—bear the expected relationships to response. Two of the expectancy–valence interactions of Hypothesis 4 materialized, but only very weakly. However, the more fine grained analysis indicated that in combination, low levels of difficulty and high levels of visibility were especially likely to elicit retaliation. And Hypothesis 5 was borne out as well, suggesting a consistently negative relationship between profitability and the response ratio.

Although the results for Hypothesis 4 show some merits in using expectancy theory to

Table 4. Response ratio and financial performance

	M	S.D.	Partial correlations[1]				
			Response ratio	1	2	3	4
1. Revenue/RPM	0.16	0.16	−0.17*	1.00			
2. Profit/RPM	0.00	0.02	−0.33***	0.66***	1.00		
3. Profit margin	−0.01	0.14	−0.30***	0.17**	0.68***	1.00	
4. S & P rating	4.61	1.23	−0.23**	0.19**	0.40***	0.37***	1.00
5. Performance factor			−0.34***	0.67***	0.94***	0.76***	0.61***

[1] Correlations control for the average number of attacker's passengers affected by that year's actions.
*, **, *** indicate that the Pearson correlation coefficients are significant at beyond the 0.10, 0.05, and 0.01 levels respectively. The minimum sample size is 112.

model competitive attack and response, important adjustments seem necessary to adapt this motivational framework to the corporate setting. Expectancy theorists generally assume that main effects will not be very significant once interaction terms are added to a model. This was not true in this research. Indeed, the main effects were far stronger than the interaction effects. Visibility, centrality, and difficulty each played important roles in evoking responses from rivals.

These significant main effects warn against concluding that any organization is safe from retaliation unless its attacks are visible *and* easy to reply to *and* central. Such a strict interpretation of expectancy theory is rarely supported even in the study of individual behavior (Arnold, 1981; Landy and Becker, 1987). And in a corporate setting, close rivals almost always have some degree of awareness of each other, some ability to respond to threats, and some pain from an attack. The positive values of all these dimensions prevent them from nullifying each other when multiplied. Thus the interaction terms are deprived of some of the power that they might occasionally have in the realm of individual motivation.

The contingency cells of Table 3 qualify the expectancy–valence framework by examining just which combinations and alignments of the independent variables compound the degree of retaliation. They reveal that an attack whose action is *both* highly visible and easy to emulate is especially likely to evoke a response from rivals. Hence, it is not a question of whether there are interactions among the variables that provoke response but one of *which* combinations are most important. In short, aspects of both the *chain* and the *gate* model apply. Any weak links in the chain appear to contribute to the chances of retaliation. However, certain 'key' combinations of open gates are far more likely to provoke responses than any of their individual components would indicate.

CONCLUSION

A friend of one of the authors is a gifted mathematician, but only a very average chess player. When asked about his shaky chess he cited cybernetics expert Norbert Weiner, saying 'A mathematician is as strong as his most brilliant move, a chess player only as good as his weakest one.' In this respect competitive strategy is perhaps more like chess than mathematics.

Our research suggests that in order to succeed organizations must avoid being retaliated against. And this in turn requires that their attacks be subtle enough along all three components of the expectancy–valence model to minimize rivals' incentives to respond, while at the same time being sufficiently potent to produce significant benefits. Stealth, complexity and obliqueness may all be required to make an attack sufficiently subtle to succeed. To fail along any one of these dimensions—to have just one weak link in the *chain*—increases the chances of retaliation. But, true to the *gate* model, to have the two 'open gates' of high visibility and ease of responding in kind, multiplies the likelihood of a rival's response. Paradoxically, it may be that the attacks that have the greatest potential pay-offs are the most likely to be visible.

Of course, our study is a preliminary one that derives rather sweeping generalizations on the basis of only a single industry. Subsequent investigators might therefore attempt to extend this research by looking into the conditions and contexts under which these findings best apply. When, for example, is visibility more important than centrality in provoking retaliation, what are the performance implications of the response ratio in different environments? One would like to see this research extended to industries other than airlines to establish the scope and the robustness of the results.

To make a more general methodological point, it seems that one of the best ways to become informed about competition is to study the individual actions of firms in an industry and to then track the responses these elicit from competitors. It is at this level that actual rivalry takes place; that is where decision makers enact their strategies, defend their reputations, and signal their commitments via their actions, responses, or passivity. Although such studies are extremely costly and time consuming, as we can attest, there are simply no substitutes for disclosing the complex interactions among rival organizations.

Finally, we would like to see more research that attempts to relate well-known frameworks or models from psychology, economics, and sociology to the study of corporate competitive behavior. For example, the game theoretic framework may be especially useful for studying competitive interactions (Kreps, 1990) as it models dynamically the interplay among rivals.[5] The more senior social sciences can provide fertile notions for a new discipline that is informed by far too little theory. Obviously there are hazards associated with any interdisciplinary approach, and much will have to be done to adapt micro frameworks to a macro environment. Indeed, that was true of this research. However, the benefits of breaching the boundaries may well exceed the costs.

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[5] This point is perhaps best illustrated by David Kreps' (1990) discussion of the limitations of game theory in modeling competitive interaction. One limitation is that multiple equilibria are common in game theory models, and there is often no satisfactory way to choose among them. Second, achieving an equilibrium solution generally requires strong assumptions about players' objectives and tendencies, whereas players can quite rationally take a very different course of action that would not lead to an equilibrium. Finally, and perhaps most importantly, many examples of competitive interaction are too rich and full of possible moves and countermoves to be modeled by game theory, which requires very precise and somewhat simplified characterizations of strategy. As an example, Kreps cites the deregulated US domestic air-transport business of the current study: 'In this fairly complex situation, players (rival firms) were unclear about what others would do, how they would behave, and what were their motivations. Each individual firm could try to make assessments of what others would do and chose accordingly optimal responses, but it would have been rather a surprise if the behavior so engendered resembled the equilibrium of any game theoretic model that didn't begin with that behavior and then construct the model around it' (1990: p.138).

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APPENDIX 1: TYPES OF COMPETITIVE MOVES AND ITEMS USED TO ASSESS VISIBILITY AND RESPONSE DIFFICULTY

I. Mean scores by types of competitive moves

Types of competitive moves	Items used to assess visibility and response difficulty[a]									
	Visibility				Response difficulty					
	Amount of industry publicity the move would receive (Q)	Likelihood that this action will be publicly announced by top management (Q)	Actual number of lines devoted to the move by *Aviation Daily* (D)	Mean visibility scores across items[b]	Amount of financial investment required for implementation (Q)	Degree of disruption of staff, systems and/or procedure caused by implementation (Q)	Extent to which relocation of staff and/or equipment would be required (Q)	Degree of interdepartmental coordination required for implementation (Q)	Authors' overall assessment (Q)	Mean response difficulty scores across items
Price cut	4.29	4.26	9.43	3.11	2.80	2.29	1.29	2.82	1	2.04
Promotion	2.42	3.41	8.37	2.17	2.12	1.90	1.12	2.41	2	1.91
Service improvement	2.38	3.59	11.65	2.31	2.39	1.91	1.18	2.86	2	2.07
Increase in commission rate for travel agents	3.41	2.89	8.87	2.34	2.24	1.95	1.20	2.48	2	1.97
Feeder alliance with a commuter airline	3.50	3.98	13.75	2.87	2.47	2.86	2.37	3.64	4	3.07
Merger and acquisition	4.90	4.81	30.42	4.07	4.64	4.58	4.49	4.88	5	4.72
Co-promotion with non-airlines	2.41	3.28	6.45	2.07	1.71	1.85	1.21	2.16	2	1.79
Increase in daily departures	2.95	3.87	10.92	2.57	3.01	2.55	2.90	3.26	3	2.94
Entry into a new route	2.94	3.75	8.37	2.46	2.75	2.52	2.72	3.23	4	3.04
Decrease in daily departures	2.66	2.32	10.25	1.94	1.90	2.51	2.84	3.06	2	2.46
New service	2.38	3.59	13.41	2.36	2.39	1.91	1.18	2.86	2	2.27
Cooperation with another airline	3.50	3.98	11.88	2.82	2.47	2.86	2.37	3.64	4	3.07
Frequent Flyer Programs	2.42	3.41	12.10	2.27	2.12	1.90	1.12	2.41	3	2.11
Hub creation and major expansion	4.39	4.61	18.24	3.50	4.15	3.74	4.19	4.48	5	4.31

[a] Each of these questionnaire items measuring visibility and response difficulty is rated by each respondent on a 5-point scale (1 indicating very low, 5 indicating very high) for the 14 types of competitive moves listed in the left column.
[b] To be comparable with other items, number of lines in *Aviation Daily* is converted to a 5-point scale.

Q: Questionnaire dimension
D: Information taken from *Aviation Daily*

II. Intercorrelation among items

	1	2	4	5	6	7
Visibility						
1. Industry publicity						
2. Top management announcement	0.73***					
3. Number of lines in *Aviation Daily*	0.21***	0.18***				
Response difficulty						
4. Financial investment						
5. Disruption of staff and systems			0.89***			
6. Relocation of staff and equipment			0.76***	0.86***		
7. Interdepartmental coordination			0.88***	0.96***	0.89***	
8. Authors' overall assessment			0.43***	0.62***	0.81***	0.71***

$N = 780$
* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$

APPENDIX 2: SELECTED CHARACTERISTICS OF SURVEY RESPONDENTS AND SAMPLING METHOD

Group	Title	Average length of industry experience (by years)	Number of respondents
Major airlines	Senior VPs or above	25	44
Regional airlines	CEOs or presidents	24	34
Travel agents	CEOs or presidents	27	20
Aircraft manufacturers	Seniors VPs or above	28	6
Consultants		32	36
Security analyst		21	16
Government officers	Managers	15	4
Academics	Professors & researchers	N/A	16
		26	176

The list of survey subjects was compiled from several directories, mainly the Winter 1989 edition of *World Aviation Directory* (*WAD*). The executives and experts selected include the following eight categories: (1) Senior VPs or above (excluding CEOs) of all major airlines with annual operating revenues greater than $100 million; (2) CEOs or presidents of all regional airlines listed in *WAD*; (3) airline consultants listed in *WAD*; (4) security analysts who follow the industry listed in the 1989 edition of *Nelson's Directory of Investment Research* and the October 1989 edition of *Institutional Investor*; (5) CEOs or presidents for the top 65 travel agents, in terms of sales revenues, in the USA (annual sales revenues greater than $20 million); (6) Senior VPs or presidents (excluding CEOs) of Boeing and McDonnell Douglas; (7) senior managers of the Federal Aviation Administration; and (8) Business professors and researchers from the authors' institutions with expertise in competitive strategy.

A total of 430 questionnaires was distributed. One hundred and seventy-six were returned (a response rate of 41%).

A supplementary survey to confirm the validity of the authors' classification of types of sample moves was completed by 106 of the 176 participants of the study (a response rate of 77%).

APPENDIX 3: SURVEY ON *AVIATION DAILY**

Frequency of reading Respondents were asked to answer the following question using a 5-point scale: 'How often do you read *Aviation Daily*?' (1) every day (60.7%), (2) at least twice a week (16.1%), (3) once a week (8.9%), (4) once a month (1.8%), (5) not at all (12.5%). The mean is 1.89 and the standard deviation 1.38.

Significance Respondents were asked to answer the following question using a 5-point scale: 'To what extent do you think that airlines rely on *Aviation Daily* in obtaining industry information?' (1) none (0%), (2) limited (18.5%), (3) moderate (35.2%), (4) substantial (40.7%), (5) very substantial (5.6%). The mean is 3.33 and the standard deviation is 0.847.

Comprehensiveness Respondents were asked to answer the following question using a 5-point scale: 'How comprehensive is *Aviation Daily*'s coverage of competitive information of the industry?' (1) not at all comprehensive (0%), (2) not very comprehensive (3.8%), (3) moderately comprehensive (9.4%), (4) very comprehensive (50.9%), (5) totally comprehensive (35.8%). The mean is 3.189 and the standard deviation is 0.761.

Reliability Respondents were asked to answer the following question using a 5-point scale: 'In general, how reliable is the information that you read in *Aviation Daily*?' (1) totally unreliable (0%), (2) not very reliable (7.8%), (3) moderately reliable (41.2%), (4) very reliable (47.1%), (5) totally reliable (3.9%). The mean is 3.47 and the standard deviation is 0.703.

* Total number of respondents is 57, with a response rate of 45%.