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NAVIGATING THE COMPETITIVE LANDSCAPE: THE DRIVERS AND CONSEQUENCES OF COMPETITIVE AGGRESSIVENESS

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By defining strategy as a sequence of competitive actions carried out over time, I develop and test a dynamic process model of competitive interaction among firms. Results based on a sample of thousands of competitive actions carried out by rivals competing in 16 different industries over a seven-year period suggest that characteristics of firms' sequences of competitive actions account for differences in their relative performance. The findings also suggest that a firm's sequence of competitive actions is influenced by top management team heterogeneity, past performance, slack, and three important industry characteristics.

As they navigate the competitive landscape, firms often directly and aggressively challenge competitors in an effort to improve relative performance (Lumpkin & Dess, 1996; Miller, 1993). Indeed, in the context of head-to-head competition, firms fight for market share, with, for example, aggressive price and advertising competition (Vilcassim, Kadiyali, & Pradeep, 1999), innovation (Banbury & Mitchell, 1995), first-mover advantages and quick response to competitive challenges (Ferrier, Smith, & Grimm, 1999; Makadok, 1998), and competitive differentiation (Caves & Ghemawat, 1992) or with broad repertoires of such actions (Ferrier et al., 1999).

Although significant insights about the antecedents and consequences of head-to-head competition have been gleaned from research and contemporary thinking in competitive dynamics and game theory (Grimm & Smith, 1997), hypercompetition (D'Aveni, 1994), and multimarket competition (Chen, 1996; Gimeno & Woo, 1996), researchers in strategic management have yet to fully develop and test a dynamic *process* theory of competitive interaction. No strategy research to date has explicitly examined how and why the *sequential* patterns of competitive moves carried out between competing firms unfold over time and how such patterns relate to firm performance.

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Accordingly, in this study I attempted to advance understanding of how the process of competitive interaction occurs in strategic time—a journey characterized by complex choices made in the face of uncertainty (Harper, 1994; Ramaprasad & Stone, 1992)—by conceptualizing strategy as an aggressive sequence of competitive moves. Thus, the aim was to capture how competitive aggressiveness influences firm performance and how aggressiveness is influenced by several important internal and external forces and constraints.

THE ACTION-BASED VIEW OF HEAD-TO-HEAD RIVALRY

Schumpeter's (1950) theory of "creative destruction" aptly describes head-to-head rivalry between firms as "an incessant race to get or to keep ahead of one another" (Kirzner, 1973: 20). Especially in hypercompetitive markets, leading firms are relentlessly pursued by existing and unforeseen challengers that aggressively find new ways to satisfy customers (D'Aveni, 1994; Schumpeter, 1950). So, to stay ahead, leading firms must aggressively disrupt the routine pattern of rivalry "by creating new ways of doing things and new things to do" (Kirzner, 1973: 79).

Building on this view of aggressive competitive interaction, researchers in the competitive dynamics stream within strategic management research have recently developed theory and empirical methods centering on a fine-grained conceptualization of firm strategy as competitive action at four distinct levels of analysis (see Grimm & Smith, 1997; Smith, Grimm, & Gannon, 1992). First, this attention was focused on individual action-reaction dyads (Chen, Smith, & Grimm, 1992). This research has shown that the characteristics and expected payoffs of a competitive action are important predictors of competitive response (Grimm & Smith, 1997).

Second, this stream of research has demonstrated a link between action and performance by aggregating the characteristics and frequency of specific actions and responses over a finite time period—the action-year (Ferrier et al., 1999; Smith et al., 1992; Young, Smith, & Grimm, 1996) or action-month (Makadok, 1998). Research at this level of analysis has, for example, shown that the more actions a firm carries out and the greater the speed of execution, the better its profitability and market share.

Third, in this research strategy has recently been viewed as an entire repertoire of competitive actions carried out in a given year—a *repertoire-year* (Deephouse, 1999; Ferrier et al., 1999; Miller & Chen, 1994, 1996). Findings at this level of analysis suggest, for example, that firms that carry out a broad, complex repertoire of actions experience better profitability and market share than firms that carry out a narrow, simple repertoire.

Finally, the type and timing of competitive actions and their influence on performance have been examined within a moving window of observation (Bettis & Weeks, 1987; Lee, Smith, Grimm, & Schomberg, 2000). Firms that responded quickly to new product introductions, for example, were in fact found to have stock market returns superior to new product first movers.

In sum, the main lesson drawn from these research efforts is that aggressive competitive behavior is related to better organizational performance. Unfortunately, exploring competitive interaction at the levels of analysis discussed above cannot completely inform scholars as to the process of how a pattern of competitive moves impacts performance. This gap calls attention to the need for a level of analysis that explicitly explores strategy as it unfolds over time.

The next section defines the concept of a competitive attack, which is the basis for a new conceptual lens and level of analysis for explaining the dynamic process of competitive interaction, its influences, and its outcomes.

Strategy as a Sequence of Competitive Actions

The central focus of this study was to develop and test a process theory of competitive interaction. Accordingly, I adopted the view that a process theory "requires a story that narrates a sequence of events that unfolds as strategy changes over time. To study them requires the diagnosis of patterns in observable activities, events, or behaviors over time . . . using the chronological order of events as data" (Van de Ven, 1992: 170; see also Pettigrew, 1992). Yet, despite several writers having previously conceptualized strategy as a logically unified sequence of actions (Kirzner, 1973), patterns or consistencies in streams of behaviors (Mintzberg & Waters, 1985), a coordinated series of actions (MacCrimmon, 1993), or a simultaneous and sequential set of many actions (D'Aveni, 1994), research in strategic management has advanced little in terms of describing the process of strategy at this potentially important level of analysis.

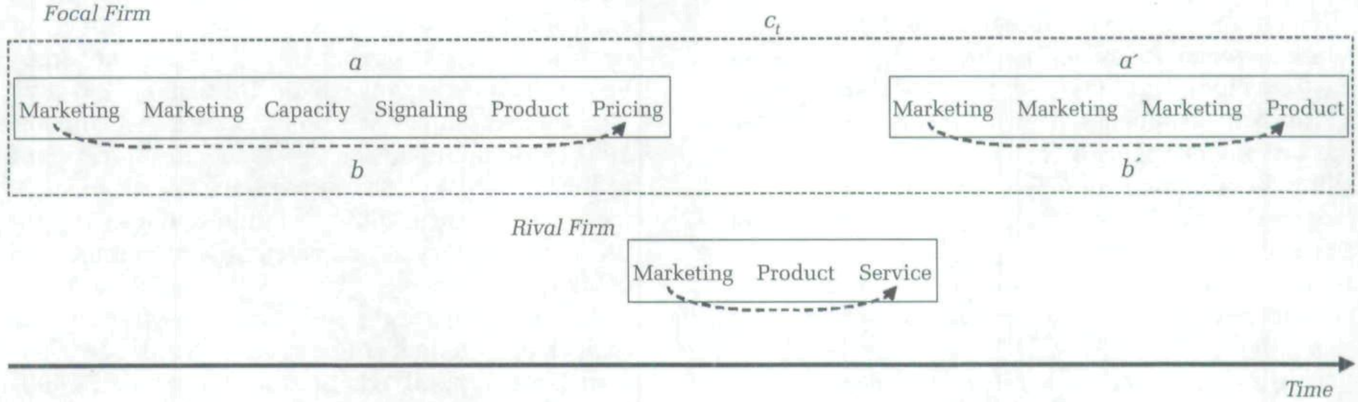
Accordingly, I defined a firm's *competitive attack* as an ordered, uninterrupted sequence of repeatable competitive action events (Abbott, 1990). This conceptualization of dynamic competitive strategy represents an important extension of prior research that emphasizes interdependence among rivals in terms of dyads of initiated actions and competitive responses (e.g., Chen et al., 1992; Smith et al., 1992). However, a competitive attack is shaped by the interplay of multiple competitive actions carried out by the attacking firm and perhaps punctuated by one or more competitive responses made by rivals. This definition also accounts for how the sequence of moves in each attack unfolds over time and the possibility that an intended sequence of actions might give way to an emergent sequence as rivals develop competitive responses.

Given that individual competitive actions comprise the basic building blocks for competitive attack, I define *competitive action events* as externally directed, specific, and observable competitive moves initiated by a firm to enhance its competitive position (Ferrier et al., 1999; Smith et al., 1992; Young et al., 1996). As will be discussed more fully below, I categorized action events into the following six categories: pricing actions, marketing actions, new product actions, capacity actions, service actions, and signaling actions.

Figure 1 depicts a series of competitive actions carried out between a focal firm and a focal rival over time, whereby the focal firm's total stream of competitive actions (c_t) carried out over the time panel is interrupted by a series of competitive actions carried out by the rival firm. Thus, according

[1] Alternatively, a competitive attack could be defined in terms of how of a series of actions carried out by a focal firm (independent of the rival's actions) are grouped or clustered together in time. More specifically, periods of inactivity would be punctuated by a competitive attack consisting of one or more temporally proximate competitive actions, and so on.

FIGURE 1
Attack Characteristics and Measures



to the definition above, the focal firm carries out two competitive attacks, labeled *"a"* and *"an',"* respectively. The next section discusses four important characteristics of a firm's competitive attack and how these dimensions relate to competitive aggressiveness.

The Dimensions of Competitive Attack

Prior research on competitive dynamics (e.g., Grimm & Smith, 1997), hypercompetition (e.g., D'Aveni, 1994), and Austrian economics (e.g., Kirzner, 1973) which focuses on competition as a process and on purposeful action, as well as research in other modes that explicitly account for sequences of events (e.g., Abbott, 1990; Sankoff & Kruskal, 1983), suggests that a sequence of competitive actions has the following dimensions: *volume,* defined as the number of action events that comprise the attack; *duration; complexity,* or the extent to which all possible types of action events are represented in the attack; and *unpredictability,* or within-firm variability in the sequence of action events occurring from one attack to the next.

Attack volume. The simplest dimension of a sequence of events is the total number of competitive action events that comprise each attack (Abbott, 1983, 1990). Figure 1 depicts two competitive attacks carried out by the focal firm. The first attack, *a,* consists of six uninterrupted action events and ends when the rival firm takes the initiative with an attack of its own. The focal firm resumes competitive interaction by engaging the rival firm with a second competitive attack, *a',* consisting of four action events. Prior research states that firms that carry out more actions per attack are competitively aggressive (D'Aveni, 1994; Ferrier et al., 1999; Young et al., 1996).

Prior research has explored firms' total competitive activity (e.g., Ferrier et al., 1999; Young et al., 1996); exploring attack volume represents a finer-grained approach to strategy, conceptualizing it as an aggressive sequential thrust of multiple initiated moves and competitive responses as they are carried out over time (D'Aveni, 1994). This concept also accounts for both periods of relative aggressiveness and periods of inactivity over time.

Attack duration. This dimension is defined as the time elapsed from the beginning to the end of a sequence of action events (Abbott, 1983; Ramaprasad & Stone, 1992). More specifically, Figure 1 depicts the duration of the focal firm's first attack as time path *b,* the number of days elapsed from the first marketing action to the pricing action. Similarly, the duration of the focal firm's second attack is depicted as the time path marked *b'*. Prior research has focused on the timing between individual competitive actions and responses (e.g., Smith et al., 1992); with attack duration, this study focused instead on the timing of a sustained series of multiple initiated actions. Firms that are able to initiate and sustain competitive attacks over longer, uninterrupted periods of time will be perceived as more aggressive (D'Aveni, 1994).

Attack complexity. This dimension is defined as the extent to which a sequence of actions is composed of actions of many different types (as opposed to a simple attack consisting of a few types). Figure 1 depicts the focal firm's first attack, *a,* as a complex attack consisting of action events representing five of the six different action categories. In contrast, the focal firm's second attack *(a')* is a simple one in which marketing actions comprise three of four total actions. Previous research indicates that firms carrying out more complex sequences of actions are more aggressive than firms carrying out a simpler sequences (D'Aveni, 1994; Ferrier et al., 1999; Miller & Chen, 1996). Indeed, this concept is similar to the simplicity/complexity of a firm's entire repertoire of competitive actions (Ferrier et al., 1999; Miller & Chen, 1996). However, attack complexity explicitly accounts for periods of relative complexity and simplicity of multiple actions over time.

Attack unpredictability. Every process model should specify some variation of sequential order (Van de Ven, 1992). Accordingly, I define attack unpredictability as the extent to which a firm's sequential order of competitive actions is dissimilar from one attack period to the next. For instance, as depicted in Figure 1, if the focal firm's first attack *(a)* is compared to its second attack *(a')*, then how the two sequences "match" in terms of their frequency and order of individual actions over time defines the degree of (dis)similariity between them. In the example, the two sequences of actions both have similar traits and show significant differences over time. Firms that purposefully carry out changes in sequences of actions create surprise and aggressively disrupt the status quo of competition within an industry (D'Aveni, 1994; Kirzner, 1973; MacCrimmon, 1993; O'Driscoll & Rizzo, 1985).

The next section describes a two-part model that accounts for the antecedents and consequences of aggressive competitive behavior.

A PROCESS MODEL OF COMPETITIVE AGGRESSIVENESS

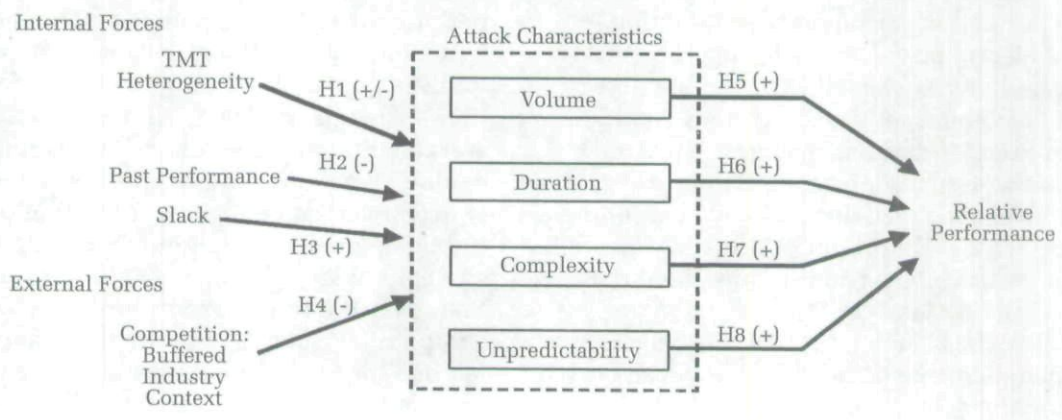
Process theorists argue that behavior is the result of a disruption in the equilibrium among a multitude or amalgam of opposing forces (Fombrun & Ginsberg, 1990; Ginsberg, 1988; Lewin, 1951; Pettigrew, 1992; Pettigrew & Whipp, 1993; Van de Ven, 1992). Consistent with this dynamic force field view of behavior, a process theory of strategy might suggest that dynamic competitive interaction "exists in a pluralistic world of colliding events, forces, or contradictory values" that influence how sequences of action events unfold over time (Van de Ven, 1992: 178).

Accordingly, I aimed to develop and test a process model of competitive interaction that describes how important organizational and industry characteristics give rise to both enabling and constraining forces that influence competitive aggressiveness and how this process influences relative firm performance (Fombrun & Ginsberg, 1990; Ginsberg, 1988; Pettigrew, 1992; Van de Ven, 1992). My two-part research model is summarized in Figure 2. The first part of this model consists of four hypothesis sets predicting that the dimensions of competitive aggressiveness—conceptualized as four characteristics of the pattern of a firm's competitive attack—are influenced by top management team heterogeneity, past performance, organizational slack, and industry context. The second part of this model consists of four hypotheses predicting that the characteristics of competitive attack (aggressiveness) influence relative performance.

Enabling and Constraining Forces

Research on learning, decision making, and organizational change implies three implicit, yet essential, influences on strategic action (Chen, 1996): factors that influence the awareness of the context and challenges stemming from competitive interdependence, factors that induce or impede the motivation to take action, and cognitive and resource-based factors that influence a firm's ability to take action. For the current research, I used these three implicit drivers of strategic action to motivate the initial hypotheses, which explain the internal and external influences of competitive aggressiveness.

FIGURE 2
General Research Model



TMT heterogeneity. Upper echelons and strategic decision making theory suggest that managerial cognition and experience influence three key managerial activities: problem sensing facilitated by greater awareness, interpretation and "enactment" of environmental cues and signals, and decision making that capably matches perceived problems with strategic solutions (Amason, 1996; Ban, Stimpert, & Huff, 1992; Cyert & March, 1963; Finkelstein & Hambrick, 1996; Hambrick & Mason, 1984; Kiesler & Sproull, 1982; Pettigrew & Whipp, 1993).

Top management team (TMT) demographic heterogeneity is widely viewed as a proxy for cognitive and experiential heterogeneity (Finkelstein & Hambrick, 1996). The composition of a TMT shapes the lenslike cognitive structure that defines its members' collective field of vision (Hambrick & Mason, 1984; Miller, 1993). By way of greater awareness in sensing strategic problems, heterogeneous teams can match complex competitive challenges and uncertain contexts with a requisite level of cognitive and experiential variety. Thus, heterogeneous top management teams are less likely to be constrained by selective awareness (Heiner, 1983), which may give rise to a commitment to the behavioral status quo (Hambrick, Geletkanycz, & Fredrickson, 1993) or inertia (Miller & Chen, 1994). By contrast, a homogeneous TMT's members share a common cognitive map and a consistent dominant logic (e.g., Duhaime & Schwenk, 1985; Prahalad & Bettis, 1986) that give rise to perceptual and cognitive constraints on aggressive competitive behavior and change.

Aside from being more aware, heterogeneous top management teams also possess greater ability to generate a more complex and unpredictable mix of alternatives for strategic action by way of comprehensive and conflictual decision-making techniques characterized by debate, devil's advocacy, and dialectical inquiry (Mitroff & Emshoff, 1979; Simons, Pelled, & Smith, 2000). As Wiersema and Bantel argued, such decision-making complexity gives rise to "diversity, novelty, and comprehensiveness in the set of recommended solutions" (1992: 96). Indeed, prior research suggests that TMT heterogeneity is associated with a greater likelihood of strategic change, flexibility, complexity, and aggressiveness (Hambrick et al., 1996; Lant, Milliken, & Batra, 1992; Wiersema & Bantel, 1992). By contrast, TMT homogeneity is a key source of strategic simplicity (Miller, 1993; Miller & Chen, 1996; Milliken & Lant, 1991) and inertia (Hambrick et al., 1993; Miller & Chen, 1994).

Recent research has demonstrated a link between TMT characteristics and strategic behavior at the action-reaction-dyad level of analysis (Hambrick, Cho, & Chen, 1996). However, I predict that TMT characteristics influence the characteristics of competitive attack as well. Therefore, I predict that TMT heterogeneity: (1) reflects a high level of cognitive and experiential breadth that influences a greater *awareness* facilitating complex and unpredictable competitive attacks and (2) increases the decision-making ability to make complex and unpredictable competitive attacks.

Hypothesis 1a. Top management team heterogeneity will be positively related to attack complexity.

Hypothesis 1b. Top management team heterogeneity will be positively related to attack unpredictability.

Despite its benefits, TMT heterogeneity reduces agreement-seeking behaviors and both social cohesion and informal communication in the context of strategic decision making (Knight et al., 1999; Simons et al., 2000; Smith, Smith, Olian, Sims, O'Bannon, & Scully, 1994). When faced with a competitive challenge, a heterogeneous top management team will likely vigorously and comprehensively debate various courses of action, owing to its members' diverse cognitive and experiential backgrounds (Simons et al., 2000). Consequently, decision-making speed and efficiency, as well as the firm's ability to affect strategic change, are likely to be diminished (Hambrick et al., 1996). Therefore, because of a greater likelihood for group conflict, I predict that heterogeneous teams will be less able to sustain a large series of competitive actions of significant duration.

Hypothesis 1c. Top management team heterogeneity will be negatively related to attack volume.

Hypothesis 1d. Top management team heterogeneity will be negatively related to attack duration.

Past performance. Despite the common use of performance as an outcome variable, the important issue for organizations is how past performance impacts preparedness and motivation for future action (Thompson, 1967). Indeed, theory and research within the organizational learning literature explains how attributions of the discrepancies between organizational goals and actual performance influence the likelihood of predictable behavior or strategic change (Heiner, 1983; Lant et al., 1992; Starbuck, 1983). For instance, success gives rise to complacency and a persistent reliance on well-learned organizational routines, thus inhibiting competitive action and strategic change (Lant et al., 1992; Miller, 1993; Miller & Chen, 1994). Indeed, managers attribute good past performance to their actions, thereby reinforcing current mental models and reducing motivation for change (Barr et al., 1992; Lant et al., 1992). Poor past performance, however, provides motivation for the reevaluation of current mental models and strategic change.

Thus, I predict that good past performance reduces a firm's motivation to compete aggressively, whereas firms experiencing poor performance will be motivated to compete aggressively.

Hypothesis 2a. Good past performance will be negatively related to attack volume.

Hypothesis 2b. Good past performance will be negatively related to attack duration.

Hypothesis 2c. Good past performance will be negatively related to attack complexity.

Hypothesis 2d. Good past performance will be negatively related to attack unpredictability.

Organizational slack. Organizational slack is defined as a buffer or cushion of actual or potential resources that may or may not be currently in use (Bourgeois, 1981). Indeed, slack gives a firm leeway in managing responses to competitive pressures and may be deployed wherever needed, permits the firm to experiment with strategic innovation (Cyert & March, 1963), and allows it to execute a greater number of competitive moves (Young et al., 1996). Low levels of slack, in comparison, inhibit the firm's ability to mobilize necessary resources and constrain strategic change and aggressiveness (Fombrun & Ginsberg, 1990; Pettigrew, 1992; Young et al., 1996). Accordingly, I predict that high levels of slack resources increase a firm's ability to initiate and sustain an aggressive pattern of competitive actions.

Hypothesis 3a. High levels of slack will be positively related to attack volume.

Hypothesis 3b. High levels of slack will be positively related to attack duration.

Hypothesis 3c. High levels of slack will be positively related to attack complexity.

Hypothesis 3d. High levels of slack will be positively related to attack unpredictability.

Competition-buffered industry environment. In prior research in strategic management, industry characteristics have been posited to influence the perceived intensity of competition within an industry, which in turn influences the strategic choices of firms within it (Dess & Beard, 1984; Keats & Hitt, 1988; Sutcliffe, 1994). Further, according to the structure-conduct-performance view within industrial economics, high levels of industry growth, barriers to entry, and industry concentration all buffer industry participants from intense competition (Scherer & Ross, 1990). Therefore, taken together, these important industry characteristics influence a firm's motivation to compete aggressively. I discuss each in turn.

First, industry growth is equated with munificence (Dess & Beard, 1984), which reduces the motivation to engage in aggressive competitive behavior. Managers interpret environmental munificence as a signal that their competitive strategies may be carried out in a predictable and simple fashion (Miller & Chen, 1996). This occurs because competition under conditions of munificence is less likely to provide feedback that disrupts managers' perceptions of causality between their own market actions and positive competitive outcomes (Harper, 1994; Lant et al., 1992). Slow growth, on the other hand, frequently gives rise to the more intense competition and lower profitability that motivate strategic aggressiveness and change (Fombrun & Ginsberg, 1990; Smith et al., 1992). Indeed, prior research suggests that firms in low-growth industries respond to competitive challenges more quickly (Smith et al., 1992).

Second, due to potential for oligopolistic coordination, a high level of industry concentration reduces intraindustry competition (see Scherer & Ross, 1990). In support of this connection, Young and colleagues (1996) found that higher levels of industry concentration resulted in fewer competitive moves among incumbent firms. Thus, a high level of industry concentration also reduces a firm's motivation to compete aggressively.

Third, industries characterized by high levels of capital intensity, innovation, and advertising, for example, experience less competitive pressure from potential entrants (Scherer & Ross, 1990). Barriers to entry were found to have a positive impact on industry performance principally because the intensity of competition among incumbents did not increase because of entry (Caves, Fortunato, & Ghemawat, 1984). Therefore, firms competing in industries characterized as having high barriers to entry are less motivated to compete aggressively.

In sum, I predict that firms competing in a competition-buffered industry environment—high levels of growth, concentration, and/or barriers to entry—will compete less aggressively.

Hypothesis 4a. A competition-buffered industry environment will be negatively related to attack volume.

Hypothesis 4b. A competition-buffered industry environment will be negatively related to attack duration.

Hypothesis 4c. A competition-buffered industry environment will be negatively related to attack complexity.

Hypothesis 4d. A competition-buffered industry environment will be negatively related to attack unpredictability.

The Consequences of Competitive Aggressiveness

As firms navigate the competitive landscape, "There are many possible actions that could be undertaken. Not only is that number probably quite large, but more importantly, the particular combination of such actions will affect the consequences of the decision maker's choice. A still further element of complexity emerges when we realize that the 'order' of such actions also matters" (O'Driscoll & Rizzo, 1985: 30). Indeed, competing in strategic time (Ramaprasad & Stone, 1992)—especially in competition-intense industries—places a significant cognitive and decision-making burden on rivals to sense, predict, and react to an aggressive, complex, and unpredictable series of competitive actions carried out by attacking firms.

In the context of competitive interaction, the strategic decision making and organizational learning literatures help explain this relationship between an attacker's level of competitive aggressiveness and a rival's speed of competitive response. In particular, when confronted with a less aggressive, a simple, or a familiar competitive challenge, rivals quickly learn how to respond to the attack using rigidly structured yet highly efficient and simple problem-solving mechanisms and decision-making processes (Heiner, 1983; Levinthal & March, 1993). However, higher levels of focal firm competitive aggressiveness, complexity, and/or uncertainty will likely require rivals to engage in greater levels of decision comprehensiveness and complexity in an effort to conceive of and carry out an appropriate competitive response (e.g., Lumpkin & Dess, 1995; Simons et al., 1999). The likely consequence is a slower competitive response.

Indeed, drawing from theory and research within competitive dynamics (e.g., Ferrier et al., 1999; Smith et al., 1992) and the Austrian and hypercompetition views (e.g., D'Aveni, 1994; Harper, 1994; Kirzner, 1973), a key principle in dynamic competitive interaction is to move quickly and aggressively to preemptively beat rivals to the punch, an action that also slows their ability to respond (D'Aveni, 1994; Miller, 1983; Smith et al., 1992). Much of this research suggests that firms that carry out more actions and respond to competitive challenges more quickly experience better performance (Ferrier et al., 1999; Lee et al., 2000; Young et al., 1996). Further, firms experience better performance when they carry out complex (Ferrier et al., 1999; Miller & Chen, 1996) or unpredictable strategies (D'Aveni, 1994; MacCrimmon, 1993). Therefore, I posit that the following four characteristics of a firm's competitive attack influence the rate at which rivals are capable of responding, and hence, the attacking firm's ability to improve its relative performance.

Attack volume. According to the Austrian view, performance equilibrium among rivals is achieved only when all competitive activity ceases (Schumpeter, 1950). However, once firms are induced or motivated to take action, performance disequilibrium occurs. Firms that carry out more actions than rivals will be exploiting more opportunities, closing off the potential for action on the part of the rivals.

Indeed, prior research suggests that aggressive firms experience higher profitability (Young et al., 1996) and gains in market share (Ferrier et al., 1999) than less aggressive firms. However, whereas these studies focused on total competitive activity carried out in a given year, the current research accounts for the dynamic interchange among rivals in the context of punch-counterpunch competitive interaction (D'Aveni, 1994). Hence, firms that carry out competitive attacks that, on average, consist of a greater number of competitive actions (irrespective of the types of actions) are more likely to overwhelm rivals and delay their ability to launch counterattacks (D'Aveni, 1994).

Hypothesis 5. Attack volume will be positively related to relative performance.

Attack duration. When firms carry out competitive attacks consisting of many competitive moves in rapid succession (again, irrespective of action type) without eliciting a response from rivals, the attacks are likely to be of longer average duration. Further, as a firm's cumulative competitive activity increases, it creates internal organizational assets in the form of action repertoires, routines, and knowledge on how to compete, which increases decision-making efficiency and the ability to sustain competitive attacks (Nelson & Winter, 1982; Pettigrew & Whipp, 1993; Young et al., 1996). Consequently, rivals can become stunned or confused as they become less sure about which actions to respond to and what the attacker is likely to do next (D'Aveni, 1994; Kirzner, 1973). This uncertainty slows their response, thereby favoring the attacker.

Hypothesis 6. Attack duration will be positively related to relative performance.

Attack complexity. Austrian economists envisioned that competitive aggressiveness is, in part, the ability to carry out a *range* of competitive actions (Kirzner, 1973; Schumpeter, 1950). More specifically, purposeful action comprised of a "constellation of product qualities, styles, sizes, color, packagings, and so on, changes systematically under the influence of market forces set in motion" by firms in pursuit of new customers (Kirzner, 1973: 115). Firms that carry out a complex sequence of actions consisting of a wide range of action types are more aggressive, attacking rivals on multiple fronts, thereby causing a delay in competitive response (D'Aveni, 1994).

Indeed, prior research suggests that firms that carry out a complex (as opposed to simple) repertoire of competitive actions experience high levels of performance (Ferrier et al., 1999; Miller & Chen, 1996). However, because these recent studies conceptualized strategic complexity/simplicity as the repertoire of actions carried out by a firm over an entire year, they could not explicitly account for the rivals' decision-making speed and subsequent speed of competitive response as the attack is carried out in strategic time. As viewed from a rival's perspective, its delay in responding to a complex attack is proportional to its level of decision-making complexity when the focal firm's attack includes more and more new competitive actions of different varieties. From the attacking firm's perspective, the longer it can delay the rival's response, the better its performance.

The relationship between a focal firm's attack complexity and a rival firm's delay in responding will increase at an increasing rate. This curvilinear relationship might occur because rivals are capable of quickly sensing and reacting to simple competitive attacks, thereby countering the focal firm's ability to improve its performance. However, as attack complexity increases, it becomes increasingly difficult for rivals to unravel it and respond—so that their response delay at high levels of attack complexity is significantly longer than their response delay at intermediate levels of attack complexity. Therefore, I predict a positive, curvilinear relationship between attack complexity and relative performance:

[2] Increasing levels of attack complexity stem from not only adding actions of different types to a given competitive attack, it is also likely to add to the total number of actions in the attack. Thus, attack complexity doubly influences rivals' speed of competitive response.

Hypothesis 7. The relationship between attack complexity and relative performance will increase at an increasing rate.

Attack unpredictability. If strategic behaviors are viewed as a spectrum, rigidly following plans, rules of thumb, and routines is at one end, and purposefully developing emergent, experimental, and, hence, disruptive competitive behavior is at the other end (Kirzner, 1973; Mintzberg & Waters, 1985; Nelson & Winter, 1982). Aggressive firms surprise rivals by making changes in strategy to avoid being predictable (D'Aveni, 1994; MacCrimmon, 1993). Therefore, firms that carry out unpredictable sequences of competitive moves disrupt the routine pattern of rivalry, thereby delaying competitive responses (D' Aveni, 1994).

Using logic similar to that for the curvilinear relationship between attack complexity and performance, I argue that the relationship between a focal firm's attack unpredictability and a rival's response delay increases at an increasing rate. This curvilinear relationship might occur because at low levels of attack unpredictability rivals are capable of quickly sensing and reacting to routine or familiar competitive attacks. However, as the level of the focal firm's attack unpredictability increases, rivals have increasingly greater difficulty establishing a link between the attacker's prior sequence of actions, the current sequence of actions, and performance outcomes (D'Aveni, 1994). Therefore, they are likely to slow their competitive responses. Therefore, I predict a positive curvilinear relationship between attack unpredictability and relative firm performance:

Hypothesis 8. The relationship between attack unpredictability and relative performance will increase at an increasing rate.

The foregoing hypotheses and the concept of competitive attack directly account for the competitive behaviors of both attacking firms and their rivals. A matched-pairs research design was ideal for examining such head-to-head rivalry.

METHODS

Ginsberg (1988) argued that an effective way to develop large-sample multivariate research designs to explore strategic processes is through content analysis of published histories about firms. Because the strategies of the largest, market-leading firms are likely to be the most observable (Fombrun & Shanley, 1990), I first drew a sample of *Fortune* 500 firms that were ranked first or second in an industry, defined by four-digit Standard Industrial

Code (SIC) classification, in terms of U.S. market share during the period 1987–93. Second, among all candidate firm-pairs, only those that are classified as single- or dominant-business firms were selected because firms confined to a particular industry are keenly aware of competitors in the markets on which they are highly dependent (Chen, 1996). Third, firm-pairs that were not consistent across each of the seven years of the study were eliminated. I cross-validated the resultant firm-pairs using the industry rankings list of *Ward's Business Directory*. Thus, I included only pairs of relatively nondiversified U.S. firms in the sample to be certain that their competitive actions were carried out to improve their positions in their primary industries. This matched-pairs sampling process yielded a final research sample based on a pooled seven-year cross-section of the two largest single-business firms in 16 different industries and consisting of 224 observations with focal firm-year as the unit of analysis.

The Source and Categorization of Competitive Actions

Following the procedure used in a recent study (Ferrier et al., 1999), I used structured content analysis to categorize news headlines from *F&S Predicasts* about each firm into competitive action events of different types. On the basis of my definition of competitive action events described above, I developed a list of keywords related to action categories similar to that used in prior studies of competitive dynamics (e.g., Bettis & Weeks, 1987; Gimeno & Woo, 1996; Smith et al., 1992; Young et al., 1996) and strategic change (e.g., Lant et al., 1992). Using these keywords, two academic experts not involved with the original keyword generation process separately coded a representative sample ($n = 300$) of news headlines into the following six categories: pricing actions, marketing actions, new product actions, capacity-related actions, service actions, and overt signaling actions. This categorization approach yielded a value of 0.91 on Perrault and Leigh's (1989) index of reliability, which indicates a high degree of reliability.

Characteristics of Competitive Attack

Applying my definition of competitive attack, I arranged all the actions for each *pair* of firms chronologically for each year of the study. In so doing, I was able to identify each uninterrupted sequence of competitive actions for each firm as a distinct competitive attack, as depicted by attacks *a* and *a′* in Figure 1. Then I developed the following measures of the dimensions of competitive attack using sequence analysis techniques and variations of other measures from recent research in competitive dynamics.

Attack volume. This was measured as the average number of competitive action events composing each of a focal firm's competitive attacks in a given year. As depicted in Figure 1, this measure represents the annual average of the focal firm's first attack *(a)* consisting of six action events, and the firm's second competitive attack *(a′)*, consisting of four action events, and so on. Higher attack volume scores indicate that a firm typically carries out attacks comprised of many actions. This measure is similar to that used in prior research (e.g., Ferrier et al., 1999; Young et al., 1996). However, consistent with the definition of competitive attack, it accounts for periods of relative competitive activity/inactivity, whereby the attacking firm may carry out many actions early in a given year and fewer actions later in the year.

Attack duration. As depicted by the time spans *b* and *b′* in Figure 1, the duration of a particular competitive attack is measured as the number of days elapsed from the first action in a given attack to the last action of the attack (Abbott, 1983; Ramaprasad & Stone, 1992). For the analyses, I calculated attack duration as the average duration of all a firm's competitive attacks carried out in a given year—for example, the average of both time spans labeled in Figure 1. High attack duration scores indicate that firms typically sustain competitive attacks against rivals, and low scores indicate that firms typically carry out only short bursts of competitive activity.

Attack complexity. To measure the extent to which a firm's competitive attack consists of a broad range (as compared to a narrow range) of different action types, I used Ferrier et al.'s (1999) Herfindahl-type index of competitive simplicity. This measure accounts for the weighted diversity among all six action types. However, in contrast to measures in prior research, my measure of attack complexity/simplicity accounts for periods of relative competitive complexity/simplicity within a given year as the competing firms' actions unfold over time.

I first calculated the ratio of actions in each of the six action categories to total actions. Then, to account for the weighted distribution of actions carried out across categories, I squared each proportion. Finally, I summed these squared proportions to arrive at the measure for attack complexity. As depicted in Figure 1, the complex attack *(a)* consists of five of the six possible action types. By contrast, the simple attack *(a')* consists mainly of marketing actions. For the analyses, I calculated the annual average of attack complexity. Firms with low scores carry out competitive attacks that typically consist of a broad range of action types; high scores indicate that a firm typically carries out competitive attacks with just a few action types.

Attack unpredictability. Following prior research using sequence analysis techniques, I used optimal matching analysis to measure the extent to which a firm's sequence of actions carried out in a given time period was or was not similar to that carried out in the preceding time period (see Abbott, 1990; Sabherwal & Robey, 1993; Sankoff & Kruskal, 1983). Optimal matching calculates the distance between any two action sequences by accounting for the costs of the insertions, deletions, and substitutions among all action types (known as INDEL costs) needed to transform one action sequence to exactly match another (Sankoff & Kruskal, 1983). For example, in order to transform attack *a* to exactly match attack *a'*, several insertions, deletions, and substitutions are needed. After accounting for the first two marketing actions and the one product action that already match, a capacity action would need to be substituted for a marketing action, one signaling action would need to be inserted prior to the product action, and a price action would be inserted at the end of the action sequence.

INDEL costs represent "pairwise" differences across all six action categories based on how each action differs from the others (Sankoff & Kruskal, 1983). For instance, substituting a new plant construction (capacity action) in one sequence for a new advertising slogan (marketing action) in another sequence would entail a greater cost. Therefore, I established a matrix of INDEL costs across all action types according to several characteristics of each type of competitive action developed in prior research (see Chen et al., 1992; Smith et al., 1992). The Appendix gives details on this matrix. Once the INDEL matrix was established, I used the optimal matching procedure to calculate the (dis)similarity between the focal firm's entire sequence of competitive actions (see c_t in Figure 1) carried out in year t and that carried out in year $t-1$. For this within-firm measure of sequence (dis)similarity, a high optimal matching score indicates that the firm is strategically unpredictable; a low score indicates that the firm's entire sequence of competitive actions changes little from year to year (that is, it is predictable).

Forces Influencing Competitive Aggressiveness

Top management team heterogeneity. Here, I adopted the basic methodological approach used by Wiersema and Bantel (1992) to develop a composite measure of top management team heterogeneity. I defined the top management team as those individuals at the highest level of management—the chairman, vice chairmen, CEO, president, and chief financial and operating officers (CFO and COO)—as well as the next highest level identified in the *Dun & Bradstreet Reference Book of Corporate Managements* (1987–93 volumes). This source provided sufficient demographic data on each TMT member for me to calculate three common measures of team heterogeneity: educational background heterogeneity, functional background heterogeneity, and industry tenure heterogeneity.

To calculate TMT educational heterogeneity, I applied Blau's (1977) index of heterogeneity to six different degree categories: business, science, liberal arts, engineering, law, and other. High scores suggest that a top management team is educationally diverse. I also used Blau's index to calculate functional background heterogeneity, categorizing functional experience as engineering/R&D, finance/accounting, legal, human resources management, manufacturing, logistics, purchasing, public relations, and general management. High scores indicate that a team is composed of members with different functional backgrounds. To calculate industry heterogeneity, I used a coefficient of variation, defined as the standard deviation divided by the mean for the team's years of experience in the focal industry (Wiersema & Bantel, 1992). High scores indicate that a team's members are diverse with respect to their experience in the focal industry.

Because TMT heterogeneity can be considered as a meta-construct that is manifested along a number of different, yet correlated, dimensions (Amason, Shrader & Thomson, 1997), I calculated a parsimonious composite heterogeneity index, the sum of the three standardized individual heterogeneity measures noted above. Consistent with the individual TMT measures, high scores for this composite indicate that a top management team possesses, overall, a diverse set of experiences, cognitive perspectives, and backgrounds.

Past performance. Consistent with other studies that have used past performance as a predictor variable (e.g., Lant et al., 1992; Wiersema & Bantel, 1992), I used each company's annual return on assets (ROA; lagged one year) for each year of the time panel.

Organizational slack. I measured unabsorbed slack using the quick ratio, the ratio of current assets less inventory to current liabilities (Smith et al., 1992).

Barriers to entry. Because different industries are likely to have different entry barrier characteristics, I used a composite measure of each industry's barriers to entry. This was calculated as the sum of the year-by-year pooled industry means for investments in R&D, selling activities, and total assets (Ferrier et al., 1999; Young et al., 1996). This composite measure is a parsimonious way to capture average barriers to entry and has been used in prior empirical research examining competitive behavior across multiple industries (Caves et al., 1984).

Industry growth. For the present research, I calculated a simple growth rate for each industry-year (year *t*) as the percentage change in industry gross sales between the study and the previous year (year *t*-1) for each four-digit SIC industry.

Industry concentration. I used a Herfindahl index for industry concentration for each four-digit SIC industry for each year over the seven-year time panel.

Data used in these organizational and industry context measures were collected from COMPUSTAT and *Ward's Business Directory.*

Relative Performance

Market share gain. For the current research, the central unit of analysis was competitive attack, whereby firms carry out competitive actions to improve their competitive positions. Market share gain is both a key organizational objective and a measure of standing vis-à-vis competitors that managers often believe to be associated with higher profits (Armstrong & Collopy, 1996; Song, DiBenedetto, & Zhao, 1999). However, although in some previous research high market share has been associated with higher profits—owing to economies of scale, market power, and reputational advantages (Anderson & Zeithaml, 1984)—it is important to note that pursuing market share is not always related to higher profits. Indeed, firms with a competitor orientation, those that increase market share at all costs, were less profitable than firms with stronger profit objectives (Armstrong & Collopy, 1996).

Following several other recent market share studies, I calculated market share gain as the positive year-to-year change in the percentage of total sales in the focal firm's primary industry that its own sales represent (e.g., Ferrier et al., 1999; Gimeno & Woo, 1996; Makadok, 1998). This measure also accounts for market share erosion, measured as the negative annual change in market share. Data for this measure were collected from COMPUSTAT and *Ward's Business Directory.*

Control Variables

Attack heterogeneity. To control for the possibility that strategic dissimilarity between rivals is related to market share changes (Caves & Ghemawat, 1992; Gimeno & Woo, 1996), I included a control variable for attack heterogeneity. The optimal matching technique described above is used to measure the degree of (dis)similarity between the attacks carried out by a focal firm and those of the matched rival (Sankoff & Kruskal, 1983). High scores indicate that the focal firm and rival are strategically heterogeneous with regard their sequences of competitive actions, whereas low scores suggest that both firms carry out similar action sequences.

Other control variables predicting market share gain. Recent research has shown that market share erosion (the opposite of gain) is a function of the relative competitive activity between firms (Ferrier et al., 1999). Therefore, because the measures for relative competitive activity are conceptually and empirically similar to several of my dimensions of competitive attack in the present study, I included three key measures as control variables: (1) the difference in the total competitive activity of the focal firm and rival firm, (2) the difference in the simplicity/complexity of their entire repertoires of actions, and (3) the difference in the timing with which the focal firm and rival firm responded to each other's actions (see Ferrier et al. [1999: 378–379] for details about these measures).

Table 1 reports the descriptive statistics and correlations among the variables included in the analysis.

Analysis

To test the hypotheses regarding the internal and external influences of competitive attack, I separately regressed each of the four attack characteristics variables on the focal firm's level of TMT heterogeneity (Hypotheses 1a–1d), past performance (Hypotheses 2a–2d), slack (Hypotheses 3a–3d), and the three industry context variables (Hypotheses 4a–4d). These models also include attack heterogeneity as a control. To test the hypotheses relating to

[3] For the attack duration model 2, I also included the focal firm's attack volume as a control. I am grateful to an anonymous reviewer for recommending this important control.

TABLE 1
Descriptive Statistics and Pearson Correlation Coefficients[a]

Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Market share gain	−0.00	0.02														
2. Attack volume	15.90	22.10	.12*													
3. Attack duration	43.30	107.10	.15**	.05												
4. Attack complexity	0.27	0.21	.04	.15*	−.07											
5. Attack unpredictability	0.50	0.18	−.04	−.13*	−.09	.09										
6. Attack heterogeneity	0.56	0.19	−.01	.04	.05	−.05	.10									
7. TMT heterogeneity	0.03	1.87	.01	−.00	−.09	.10	−.03	.05								
8. Past performance[b]	0.07	0.11	.08	.08	−.10	.04	−.05	.07	.07							
9. Unabsorbed slack	1.05	0.76	.06	.21***	.09	−.19**	−.09	.05	.02	.20**						
10. Barriers to entry	3,369.00	4,199.90	−.08	−.18**	.01	.18**	−.07	−.06	−.16**	−.06	−.24***					
11. Industry growth	0.20	0.29	.02	.01	−.02	.02	−.09	.02	.01	.05	.09	−.03				
12. Industry concentration	0.19	0.14	−.08	.01	−.04	.23***	−.07	−.11	.04	−.07	−.11	.19	.14*			
13. Total competitive activity	1.88	22.02	.05	.30***	−.02	.09	.09	.13	.07	.04	.11	.04	−.02	−.05		
14. Action repertoire simplicity	−0.03	0.26	−.05	−.02	−.06	−.02	−.14	−.17**	.03	.00	−.00	.05	−.08	.03	−.01	
15. Action timing	−6.48	110.88	−.12*	−.39***	−.17**	−.16**	.03	.00	.07	.15**	.05	−.27***	.08	−.11	−.01	.18**

[a] $n = 224$.
[b] Measured as ROA.
* $p < .05$
** $p < .01$
*** $p < .001$

how competitive attack influences relative performance (market share gain), I included both the linear terms (for Hypotheses 5 and 6) and the quadratic terms (for Hypotheses 7 and 8) for the competitive attack variables, along with the firm and industry controls, in a single quadratic model. Since these data are a cross-sectional time series, I used the PROC MIXED regression technique found in SAS, which allowed me to model the linear regression error term into separate components: (1) the first-order autoregressive function (AR1), (2) random firm-level factors, and (3) and random error (Wolfinger, Tobias, & Sall, 1991). When this procedure is used, the regression coefficients used to test the hypotheses are less likely to exhibit bias stemming from serial correlation and/or random firm-specific factors. I report the covariance parameter estimates for both firm random error and serial correlation in Tables 2 and 3.

RESULTS

Table 2 summarizes the regression results for the drivers of competitive aggressiveness. In general, the first hypothesis set posits that TMT heterogeneity impacts important characteristics of a firm's pattern of competitive attack. Overall, this set was moderately well supported, as two of its four variants were supported. Hypothesis 1a predicts that top management team heterogeneity will be positively related to attack complexity. Indeed, as indicated in model 3 of Table 2, the coefficient for TMT heterogeneity was positive and significant ($b = 0.01$, $p < .05$).[4] TMT heterogeneity was also negatively related to attack duration ($b = -0.05$, $p < .10$), thus providing support for Hypothesis 1d. Hypotheses 1b and 1c were not supported, as the coefficients for team heterogeneity were not significant in either model 1 or model 4.

Collectively, the second set of hypothesis variants predict that good past performance will be negatively related to each of the four dimensions of competitive attack. This hypothesis was only partially supported, as past performance was negatively related to only attack duration ($b = -0.06$, $p < .05$).

Hypotheses 3a–3d predict that slack will be positively related to the four dimensions of competitive attack. This prediction was also moderately supported. In particular, slack was positively related to attack volume ($b = 2.82$, $p < .01$), thus providing support for Hypothesis 3a. Hypothesis 3b was also supported, as the coefficient for the relationship between slack and attack duration was positive and significant ($b = 0.17$, $p < .10$).

[4] Although not reported, the results from supplemental analysis that included the three individual TMT measures were consistent with those reported in Tables 3 and 4 for at least two out of three of these individual measures.

TABLE 2
Regression Results: Determinants of the Structural Characteristics of Competitive Attack[a]

	Model 1: Attack Volume[b]		Model 2: Attack Duration		Model 3: Attack Complexity		Model 4: Attack Unpredictability	
Variable	*b*	s.e.	*b*	s.e.	*b*	s.e.	*b*	s.e.
TMT heterogeneity	−0.01	0.02	−0.05	0.04†	0.01	0.01*	0.00	0.00
Past performance	0.04	0.55	−0.06	0.02*	0.15	0.29	−0.00	0.00
Unabsorbed slack	2.82	0.98**	0.17	0.09†	−0.02	0.02	−0.02	0.01
Barriers to entry[b]	−0.19	0.12*	−0.00	0.08	−0.02	0.02	−0.03	0.01*
Industry growth	0.01	0.14	−0.46	0.44	−0.00	0.07	−0.14	0.08*
Industry concentration	−0.14	0.51	0.04	0.59	−0.30	0.16*	−0.14	0.10†
Attack heterogeneity	0.06	0.13	0.41	0.37	0.05	0.07	0.12	0.06*
Attack volume[b]			0.02	0.09†				
Intercept	0.48	0.22	−0.20	0.32	0.27	0.07	0.55	0.05
Model 2 log likelihood[c]	−306.0***		−673.9***		−108.0***		−76.0***	
Estimate of firm random error	1.01***		0.04		0.01**		0.00	
AR (1)	.54***		.10†		.24**		−.06	

[a] One-tailed tests were used, which are directionally predicted in the hypotheses. $n = 224$.
[b] Variable was standardized prior to analysis.
[c] Significance levels for −2 log likelihoods were obtained by comparing values to those obtained from a nested model containing only a constant.
† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

Hypotheses 4a–4d predict that a competition-buffered industry context will diminish firms' motivation to compete aggressively. This hypothesis was also supported, as three of the four of the attack characteristics were predicted by one or more of the industry influences, yet the industry variables did not exhibit a uniform influence across each of the attack variables. As predicted, high barriers to entry were negatively related to attack volume ($b = -0.19$, $p < .05$) and attack unpredictability ($b = -0.03$, $p < .05$). Consistent with expectations, industry concentration was negatively related to both attack complexity ($b = -0.30$, $p < .05$) and attack unpredictability ($b = -0.14$, $p < .10$). However, high levels of industry growth were negatively related only to attack unpredictability ($b = -0.14$, $p < .05$).

Table 3 reports the results of mixed regression analyses testing Hypotheses 5 through 8, which predict that the characteristics of a firm's pattern of attack will impact the firm's gain/loss of market share. Hypothesis 5 was supported, as the coefficient for attack volume (model 5) is positive and significant ($b = 0.15$, $p < .05$). Thus, firms that carry out a high number of actions per attack experience a gain in market share.

Hypothesis 6 predicts that the longer a firm sustains a competitive attack on rivals, the greater its gain in market share. This hypothesis is also supported, with a positive and significant coefficient for attack duration ($b = 0.13$, $p < .05$).

Hypothesis 7 predicts that the relationship between attack complexity and performance will increase at an increasing rate. This hypothesis was not fully supported, as attack complexity exhibited a U-shaped relationship with market share gain. Although the quadratic term in model 6 was in the direction predicted ($b = 1.43$, $p < .10$), the linear term was not ($b = -1.61$, $p < .05$).

Attack unpredictability also had a U-shaped relationship with market share gain. As reported in the quadratic model, model 6, the coefficients for the linear ($b = -2.28$, $p < .05$) and squared ($b = 2.44$, $p < .05$) terms for attack unpredictability were significant. However, the linear term was in the direction opposite prediction. Thus, Hypothesis 8 was not fully supported.

DISCUSSION AND CONCLUSIONS

This study examined the process of competitive interaction at the sequence level of analysis, conceptualized as the unfolding of a series of competitive moves rivals carry out against one another in their efforts to improve their performance vis-à-vis one another. Broadly speaking, the results support

TABLE 3
Regression Results: Market Share Gain on Dimensions of Competitive Attack[a]

Variable	Linear Model 5		Quadratic Model 6	
	b	s.e.	*b*	s.e.
Attack volume[b]	0.15	0.09*	0.17	0.10*
Attack duration[b]	0.13	0.06*	0.12	0.07*
Attack complexity	0.29	0.43	−1.61	1.01*
Attack complexity squared			1.43	0.91†
Attack unpredictability	−0.16	0.36	−2.28	1.46*
Attack unpredictability squared			2.44	1.45*
Attack heterogeneity	0.21	0.37	−0.11	0.37
TMT heterogeneity	−0.01	0.05	−0.01	0.05
Past performance	0.70	0.79	0.38	0.81
Unabsorbed slack	−2.28	1.05*	−2.16	1.05*
Barriers to entry[b]	−0.18	0.11	−0.18	0.11*
Industry growth	0.03	0.42	−0.02	0.42
Industry concentration	−0.38	0.74	−0.27	0.74
Total competitive activity	0.00	0.00	0.00	0.00
Action repertoire simplicity	−0.27	0.20†	−0.40	0.03†
Action timing	−0.00	0.00**	−0.02	0.01**
Intercept	0.69	0.43	0.90	0.50
Model −2 log likelihood[c]	−630.0***		622.3***	
Change in −2 log likelihood[d]			7.7**	
Estimate of firm random error	.18†		.18†	
AR(1)	.20*		.20†	

[a] One-tailed tests were used, which are directionally predicted in the hypotheses. $n = 224$.
[b] Variable was standardized prior to analysis.
[c] Significance levels for −2 log likelihoods were obtained by comparing values to those obtained from a nested model containing only a constant.
[d] Change tested as chi-square with two additional degrees of freedom from quadratic terms.
† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

the hypercompetition view (D'Aveni, 1994) that suggests that relative performance is linked to sustaining a high level of competitive aggressiveness. My core findings suggest that by exploring the determinants and consequences of the process of competitive interaction, researchers and practitioners may be able to obtain a better understanding of the key internal and external factors that facilitate or constrain competitive aggressiveness. As such, these findings make several important contributions to research and theory in competitive dynamics, the upper echelons view of decision making, and dynamic organizational learning.

The Influences of Competitive Attack

The most complex findings relate to the drivers of dynamic competitive behavior. As expected, my results suggest that competitive aggressiveness and adaptation are influenced by a top management team's ability to scan and interpret signals from the competitive environment. As a consequence of a rich information-processing capability, a heterogeneous TMT may be less likely to be lulled into complacency stemming from good past performance or a competition-buffered industry environment. Furthermore, because of diverse cognitive and experiential backgrounds, heterogeneous top teams are better equipped to carry out a complex sequence of competitive moves than homogeneous top teams. However, this facility apparently comes at the expense of decision-making speed. While a complex series of actions, for example, is being contemplated and carried out, managers are less capable of sustaining competitive attacks of significant duration.

These findings suggest that the relationship between TMT heterogeneity, decision making, and specific dimensions of competitive strategy is indeed more complex than first imagined. For instance, TMT heterogeneity did not relate uniformly as predicted across all measures of competitive aggressiveness. Top management team heterogeneity was not related to attack unpredictability. It could be that a heterogeneous team indeed has the information-processing capability to perceive the need for and subsequently develop complex strategies in the strategic planning process. However, the TMT may not be very good at simulating randomness and unpredictability (Attneave, 1959). As Levinthal and March (1993) argued, randomness requires exploration behaviors, yet sustaining exploration is difficult because as learning progresses under conditions of uncertainty, managers tend to adopt and exploit heuristics, routines, and rules of thumb that are attributed to organizational success (Lant et al., 1992) and tend to become predictable (Heiner, 1983). Perhaps factors other than TMT demographic heterogeneity influence strategic learning and unpredictability. Recent research on strategic decision making, for example, suggests that top team heterogeneity reduces important group processes, such as agreement-seeking behaviors, a diminishment that, in turn, reduces strategic consensus (Knight et al., 1999). Hence, heterogeneous TMTs might have difficulty in agreeing on how to be unpredictable.

My findings provide moderate support for Ginsberg's (1988) assertion that past performance and slack resources can create both pressures for and resistance to competitive aggressiveness and change. I found that good past performance breeds complacent behavior, thereby reducing a firm's motivation to sustain competitive attacks for a significant duration. Also, high levels of slack provide the resources required for competitive aggressiveness. Future studies could perhaps employ fine-gained approaches that more directly address the extent to which decision makers are influenced by the enabling and constraining forces resulting from success and failure.

I predicted that industry context would also influence competitive aggressiveness, with an industry's protection from competitive pressures constraining managers' motivation to carry out a series of aggressive competitive attacks. My findings for barriers to entry, industry concentration and, to a lesser extent, industry growth conformed to expectations and were somewhat consistent with the structure-conduct-performance paradigm of strategic behavior. More specifically, industry structure is a key driver of the intensity of competition among major players.

The Outcomes of Competitive Attack

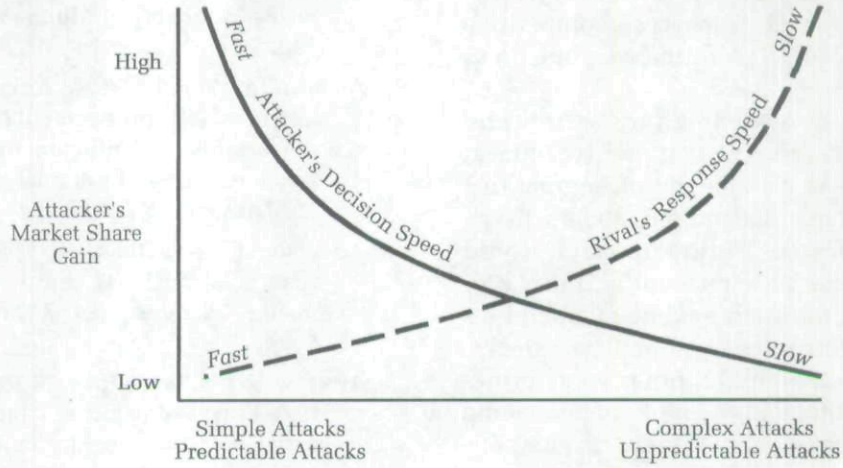
The results relating to the link between two of the four measures of competitive attack and performance conformed to expectations. More specifically, attack volume and attack duration contributed to market share gains. This is line with the findings of studies at other levels of analysis. For instance, prior studies have shown when firms carry out more total actions than rivals do over the course of an entire year, they enjoy higher profits (Young et al., 1996) and market share gains (Ferrier et al., 1999). However, my results relating to both attack volume and attack duration provide unique variance above and beyond the control variables in terms of predicting market share gain.

My findings also suggest that the relationships between both attack complexity and unpredictability and performance are perhaps more complex that previously imagined. More specifically, both exhibited ∪-shaped relationships with market share gain. These results stand in contrast to the findings of some previous studies in which strategic complexity/simplicity (e.g., Ferrier et al., 1999; Miller & Chen, 1996) and change (e.g., Miller & Chen, 1994) were related to performance in a linear fashion. Indeed, it is interesting to note that neither attack complexity nor attack unpredictability were significant in linear model 5 reported in Table 3.

I predicted that both attack complexity and attack unpredictability would be related to market share gains at an increasing rate. Indeed, beyond some intermediate range of both variables, this would appear to be the case, therefore providing partial support for Hypotheses 7 and 8. However, the results suggest that an attacking firm also benefits (in terms of market share gains) at *low* levels of both attack complexity and attack unpredictability. This finding suggests a trade-off among underlying competing forces that gives rise to a more complex relationship between these important characteristics of a firm's competitive attack and performance.

Indeed, in putting forth Hypotheses 7 and 8, I reasoned that attack complexity and attack unpredictability influence the rate at which rivals are able to learn how to untangle and respond to an initiating firm's competitive attack. This curvilinear relationship is depicted by the dashed curve in Figure 3. However, it is possible that the relationship between a focal firm's attack complexity and its own decision and implementation speed decreases at a decreasing rate, as depicted by the solid curve in Figure 3. This curvilinear relationship might occur because, at low levels of attack complexity and attack unpredictability, the focal firm's top management team can quickly conceive of, decide on, and implement attacks that consist of very few different competitive action types carried out in a predictable manner. However, as the levels of attack complexity and unpredictability increase, greater levels of decision comprehensiveness and complexity are likely to be required (Lumpkin &

FIGURE 3
Competitive Attack, Focal Firm Decision Speed, Rival Response Speed, and Market Share Gains



Dess, 1995; Simons et al., 1999), a process that which incrementally reduces decision-making and implementation speed.

Therefore, consistent with a process theory in which behavior is viewed as resulting from opposing forces (e.g., Lewin, 1951; Van de Ven, 1992), the relationship between a focal firm's level of attack complexity, for example, and its speed of implementation mirrors that between this complexity and the rival's speed of competitive response. Then, implicitly summing the focal firm's implementation speed (increases performance) and the rival's response speed (reduces performance) across all levels of attack complexity might explain the U-shaped relationship with market share gain (see Figure 3). A similar set of mirrored relationships may occur for attack unpredictability.

These findings, although unexpected, highlight the importance of how attack complexity and attack unpredictability each gives rise to potentially competing dual effects of an attacker's implementation speed *and* a rival's response speed. Simply put, a simple or predictable attack, on the one hand, enhances relative performance, owing to rapid implementation. Yet rivals can respond more quickly to simple attacks, thereby suppressing the attacker's ability to improve relative performance. On the other hand, a complex or unpredictable attack reduces implementation speed, thus suppressing its ability to improve performance. Yet complexity slows competitive response, thereby enhancing the attacker's performance.

Competitive Interaction as a Sequence of Actions

As the title of this article suggests, how firms strive to improve relative performance should indeed be a crucial concern among strategy researchers and practitioners. However, prior research in competitive dynamics has not taken full account of the process of competitive interaction in strategic time. First, the action-reaction dyad view of strategy is based on "Markov chains," a structure that implies "that the likelihood that an event occurs is conditional only on the immediate predecessor event" and ignores "the possibility that events occuring 'earlier' in the sequence stream can predict the likelihood of an event" (Abbott, 1990: 383). Second, although the action year, repertoire, and moving window levels of analysis can indeed facilitate a clear historical understanding of competitive outcomes, they too cannot explain the pattern of competitive actions carried out over time.

These criticisms highlight the contribution of examining the process of dynamic competitive interaction as a sequence of competitive actions, the level that arguably best represents competitive interaction as a process. Indeed, my findings provide valuable insight as to how the characteristics of sequences of actions (for both competing firms) as they unfold over time are strong predictors of performance.

Some Limitations and Further Avenues for Research

This research is not without limitations. First, given my definition of competitive action, I excluded firms' *internal* actions (such as using new information systems, reorganizing, and shifting to lean manufacturing) from the analysis because such actions were beyond the scope of the study and are largely unobservable to industry participants. Nevertheless, some writers have argued that competitive behavior is a function of a firm's resource profile (e.g., Grimm & Smith, 1997). In future research, the sequential link between developing internal actions and resources, competitive behavior, and external performance outcomes could be examined.

Second, my findings relate to a very narrow and specific conceptualization of competitive attack, which was defined as a sequence of competitive moves that is uninterrupted or punctuated by rivals' competitive moves. Future research could fruitfully explore how new conceptualizations of competitive interaction, such as time-clustered (as opposed to rival-interrupted) competitive attacks, impact performance. Relatedly, other ways of defining competitive interaction could enable testing the relationship between nonaggregated competitive actions and more temporally proximate performance measures (stock prices, for example), to the sequence of actions as they unfold over time (e.g., Lee et al., 2000).

Third, since I examined the process of competitive interaction over multiple industries, my findings have broad generalizabilty. However, because the methodology for collecting competitive actions is critically dependent on the newsworthiness of the firms in the sample, I tested the hypotheses using only the two largest firms in each industry. Future research could examine sequential competitive interaction in a systemic manner among all firms competing in a given industry.

Fourth, sequential competitive behavior could also be influenced by other internal and/or external factors. Future research could fruitfully explore other cognitive or competitive constraints on strategic choice, such as the level of managerial discretion (Hambrick et al., 1993) or how a firm is embedded in a network of multimarket competitive and/or cooperative relationships (Gimeno & Woo, 1996).

In sum, the central unit of analysis for this research was an action sequence. Indeed, other areas of strategic management research, such as longitudinal studies of the patterns of acquisition, innovation, multimarket competition, strategic alliance, international entry, and the behavior of strategic groups, may benefit from adopting a level of analysis that captures the sequence of these events.

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APPENDIX

Cost Matrix

To establish the INDEL cost matrix below, two academic experts separately ranked the six different action types according to the following characteristics: action irreversibility, action magnitude, scope and nature of implementation requirement, response time, and response likelihood. Then, pairwise "costs" were established on a five-point scale, which was subsequently transformed to a 0.0 to 1.0 scale. For instance, the costs of substituting a marketing action for a pricing action is rather small (cost = .20) as compared to that of substituting a marketing action for a capacity-related action (cost = .80). Similarly, since the type and scope of resources needed to implementing a capacity-related action are different from those needed to introduce a new product, the cost of substituting either a capacity action for a new product introduction are quite high (cost = .80). Pairwise INDEL costs for other action types were assigned intermediate values, as shown in Table A1:

TABLE A1
Action Substitution Costs

Action	Marketing	Product	Capacity	Service	Signaling
Pricing	.20	.60	.80	.40	.20
Marketing		.60	.80	.40	.40
Product			.80	.40	.80
Capacity				.80	.80
Service					.40

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