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# Elevating Repositioning Costs: Strategy Dynamics and Competitive Interactions

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***Research summary***: *This article proposes an approach for modeling competitive interactions that incorporates the costs to firms of changing strategy. The costs associated with strategy modifications, which we term "repositioning costs," are particularly relevant to competitive interactions involving major changes to business strategies. Repositioning costs can critically affect competitive dynamics and, consequently, the implications of strategic interaction for strategic choice. While the literature broadly recognizes the importance of such costs, game-theoretic treatments of major strategic change, with very limited exceptions, have not addressed them meaningfully. We advocate greater recognition of repositioning costs and illustrate with two simple models how repositioning costs may facilitate differentiation and affect the value of a firm's capability to reduce repositioning costs through investments in flexibility.*

***Managerial summary***: *This article illustrates how the decision to make a strategic change is affected by both the cost to the firm of making the various strategy modifications, as well as the cost to its rivals of changing their strategies in response. These "repositioning costs" are important because they shape the responses each competitor would likely make to a move by the other competitor, and should be anticipated when considering an initial change to one's own strategy. The paper shows how repositioning costs can be used strategically to facilitate differentiation, and to assess the value of potential investments in flexibility.* 

## Introduction

Strategic change is daunting. To go "all in" requires a commitment to developing and integrating new capabilities across a firm's activity system and abandoning parts of the existing system that do not support or might actively undermine the strategic change. The costs associated with such change, what we term repositioning costs, affect the net value of the change through the immediate effect on the focal firm and the effects on the future moves and countermoves of the focal firm and its rivals. Repositioning costs are those "internal" costs incurred by the firm in order to transition from the status quo activity system to the new one. For example, the size of repositioning costs associated with a change to a decentralized, customer-focused business strategy could depend on how the firm's previous strategy had been implemented, the organizational costs associated with changing routines and culture, as well as the physical asset costs associated with the development of a supporting information technology infrastructure.

This paper constitutes an initial attempt to formalize the role of repositioning costs within analyses of competitive interactions. Our model applies to strategic choices that range from changes to a single activity (Porter, 1996) to changes that involve

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multiple activities that may accompany the repositioning of a firm's business strategy. While strategic interactions between firms have often been modeled as multi-period games, these treatments have mostly ignored the repositioning costs incurred by firms when making strategic changes. The introduction of these costs alters the competitive dynamics among firms, particularly when the costs are of the same order of magnitude as the differences in payoffs across the firms' choices. In this paper, we focus on two types of repositioning costs: distance-based and history/time-based costs. The former costs capture the "strategic distance" between previous strategy and the new strategy (e.g., the extent of the changes needed in the underlying activity systems of the firm to implement the new strategy), while the latter account for additional costs associated with the path a firm took to get to its previous strategy (e.g., costs increase with the time a firm had spent implementing the previous strategy because of deepening of routines). We illustrate the importance of these costs and their possible interaction through two simple game-theoretic models involving innovation and imitation choices. These models illustrate how, for a given repositioning cost structure, such costs can be strategically exploited (or avoided) to support improved payoff outcomes relative to a myopic benchmark. The competitive dynamics analysis also demonstrates, somewhat counterintuitively, that a firm facing a lower repositioning cost—one that is "more flexible"—may obtain lower payoffs than a firm facing a higher repositioning cost.

Our approach is primarily normative in that we focus on how firms may improve performance through the strategic use of repositioning costs. Rather than being a complete treatment of the strategic implications of repositioning costs on competitive dynamics, our models are meant to illustrate the competitive outcomes that might result from paying closer attention to these costs. As an example of how repositioning costs affect strategic dynamics consider the possible implications of an exclusive partner policy recently adopted by Mobileye, the technology leader in vision technologies used in advanced driver assistance systems (ADAS). (See Yoffie, 2015 for details.) Rather than selling its technologies directly to original equipment manufacturers (OEMs), Mobileye initially partnered with Tier 1 automotive suppliers such as TRW and Autoliv who, in turn, sold the OEMs integrated ADAS using Mobileye and non-Mobileye vision technologies. Mobileye subsequently instituted an exclusivity policy under which it would only work with Tier 1 suppliers who were not developing (or were no longer developing) non-Mobileye ADAS. While this policy change resulted in the loss of some partners (e.g., Autoliv), it led the remaining partners (e.g., TRW) to emphasize the development of complementary parts (i.e., non-camera technology) for a Mobileye-centered ADAS system while deemphasizing development of substitutes for Mobileye's vision technology. The success of automotive vision technologies depends on the technology's ability to accurately identify objects under varied driving conditions and accurate identification requires an object identification database that improves with extensive in-field use of the technology. Over time, then, the cost to a Mobileye current partner of repositioning itself to be a direct competitor of Mobileye is increasing, and, hence, Mobileye's policy change arguably benefits Mobileye by reducing the field of potential vision-technology competitors despite exploding ADAS demand.[1]

## Repositioning Costs and Strategic Interactions

Our starting point is Pankaj Ghemawat's (1991) theory of commitment as the essential element in identifying strategic choices. Ghemawat persuasively argues that a strategic choice is one that involves commitment and that committed choice creates the persistent pattern of action typically characterized as strategy.[2] Because strategic choice necessarily entails revising prior commitments, all such choices incur repositioning costs.

Following the positioning school of strategy (Porter, 1985, 1996), a firm's position is characterized by activities that the firm undertakes to create customer value. These activities are parts of

[1] This example exemplifies a class of situations in which the repositioning cost of one player is endogenously influenced by a rival's (or potential rival's) actions. Another example, described later in the article, involves Toyota licensing its hybrid powertrain to its automotive rivals. Strategic choices to outsource components of the value chain (e.g., IBM in the microcomputer industry) rather than maintain vertical control (e.g., Apple) may also involve such interactions, especially when some portions of the value chain involve inputs that exhibit network externalities that can be influenced by the actions of input suppliers.

[2] While choices that are typically more easily reversed (e.g., pricing) may be important, they are not, in this view, strategic. See Van den Steen (2016) for a view of strategy which argues that irreversibility makes a decision more important, though not necessarily, more strategic.

the value chain and may be traditional functional activities (e.g., R&D, manufacturing, marketing) or activities that operate across functions (e.g., human resources). We designate a firm's current configuration of resources and activities as its activity system.[3] Because competitive advantage is enhanced when these activities are reinforcing, a firm's competitive advantage derives, in part, from how its various activities relate to one another (Porter, 1996).[4] "Repositioning costs" refers to the path-dependent costs (Mintzberg & Waters, 1985; Siggelkow, 2002) associated with strategic changes to one or more of a firm's activities or to a firm's overall constellation of activities. The more tightly integrated the activity system and the greater the change, the higher the repositioning costs. Furthermore, significant changes to one's position means that reverting to a previous position may be costly. For example, the development of new capabilities may diminish pre-existing capabilities (Kogut & Zander, 1992; Levinthal & March, 1993) or remove the sustaining support of the previous activity system for those capabilities (e.g., King & Tucci, 2002; Tripsas, 1997).

Despite the importance of repositioning costs, there is a dearth of literature that examines the impact of repositioning costs on interactions involving changes to a firm's business strategy.[5] Even the work that straddles the boundary between applied game theory and strategy, while examining key features of competitive interactions, typically does not focus on changes to firms' business strategies. Ghemawat (1997), for example, uses game theory to discuss many business cases, while others have examined subjects such as dynamics between competitors (e.g., Esty & Ghemawat, 2002), competition between business models (Casadesus-Masanell & Ghemawat, 2006), competing complements (Casadesus-Masanell & Yoffie, 2007), strategic interactions in multi-sided platforms (Caillaud & Jullien, 2003; Evans, Hagiu, & Schmalensee, 2006), time-compression diseconomies (Pacheco-De-Almeida & Zemsky, 2007), and friction costs (Chatain & Zemsky, 2011).[6] The best example of strategy-oriented work incorporating repositioning costs is Makadok and Ross (2013) that shows how such costs endogenously lead to markets characterized by product differentiation. Their important paper explores repositioning costs in a static rather than a dynamic context.[7]

## Distance and History/ Time-Based Repositioning Costs

We develop our repositioning cost ideas through a simple three-period model. To provide context for that model, we briefly discuss two nonexclusive bases for categorizing repositioning costs: (a) *distance* and (b) *history and time-based* costs. These costs represent the internal costs to the firm of performing those actions needed to change its activity system.

**Distance-based repositioning costs** reflect the focal firm's "origin" (the initial activity system from which the firm is moving) and "destination" (the activity system to which the firm is moving). Repositioning costs increase with the "distance" between these two "points." For example, repositioning costs could reflect changes in the capabilities required to execute the origin versus destination activity systems, difficulties in migrating from the initial system to the destination system (e.g., difficulties in

[3] Ghemawat (1991) notes that many define strategy as a broad pattern of behavior that persists over time. Activity systems have the characteristic of generating such patterns.

[4] This perspective of the activity system that is configured to best deliver value also corresponds closely to the concept of business models (Casadesus-Masanell & Ricart, 2010).

[5] A voluminous literature does exist, primarily in economics, which explores the varied mechanisms through which commitment operates and includes topics such as entry, pricing, and capacity expansions. See, e.g., Sutton (1991) which describes two-stage strategic interaction models that involve first-stage investment (e.g., entry, advertising, R&D) followed by second-stage market competition. We employ the same methodology as this research, but our approach emphasizes the exploration of general repositioning cost structures, rather than specific costs that firms incur as part of commitments that are consistent with a firm's current business strategy.

[6] Pacheco-de-Almeida and Zemsky (2007) formalize the notion that "the faster a firm develops a resource, the greater the cost." Despite the similarity between speed-based costs and repositioning costs, the former are not necessarily incurred when transitioning from one activity system to another (although that could be involved). Chatain and Zemsky (2011) formalize "friction" costs in industry value chains that prevent some transactions and, thereby, destroy potential value. Friction costs differ from repositioning costs, which are incurred when firms undertake strategic change. See also Chen and MacMillan (1992) which explicitly addressed the fact that both "attackers" and "defenders" suffered "implementation costs" when they changed their strategic actions.

[7] Makadok and Ross's model of product differentiation involves two firms that simultaneously choose their respective positions, then, given those positions, simultaneously choose price. The model is static because it does not explore how positioning choices unfold over time.

changing current operations and unwinding related commitments), or costs to reconfiguring one or more activities. Such costs directly map onto the classic considerations of commitment (e.g., capacity additions, long-term contracts) and, when modeled, a distance-based repositioning cost function includes both the destination action as well as the origin action as arguments.[8]

The idea that a change's difficulty corresponds to its distance is a core tenet in strategic management. Resources are less productive as their uses increasingly diverge from their core uses (Montgomery & Wernerfelt, 1988). Firms are arguably much more effective at local search (e.g., identifying improvements closely related to their current activities) than distant search (Nelson & Winter, 1982), organizational learning tends to be very local and myopic (Levinthal & March, 1993), and movements in technological space are increasingly difficult with distance (e.g., Stuart & Podolny, 1996).

**History and time-based repositioning costs** reflect a firm's history that precedes its immediate origin. This cost category has roots in the strategic change literature. Sosa (2012), for example, advocates understanding firms' differential R&D productivities based on their different "pre-histories." Generally, a firm's prior experiences alter the internal costs to changing its activity systems. As such, two firms with the same immediate origin and destination activity system (the same "distances") may have different repositioning costs due to their different histories.[9]

From a modeling perspective, history-based repositioning cost functions take as their arguments the firm's actions prior to the previous period (e.g., accounting for a path-dependence of two or more periods) as well as the origin and destination actions and states. Such costs are rarely accounted for in the payoffs in typical multi-period games, except when history can be summarized with a single statistic such as "experience." Accounting for history-based repositioning costs requires that such costs be a function of either the relevant history or a set of history-related summary statistics.

Time-based repositioning costs are a class of history-based costs that reflect a firm's increasing inertia to change the longer it has occupied a given position. Costs within this category reflect, for example, the development and embeddedness of routines over time (Nelson & Winter, 1982), the fact that learning may increase competence for "local" actions while decreasing competence for "distant" actions (Levinthal & March, 1993), the acquisition of position-specific resources and capabilities over time (Barney, 1991; Teece, Pisano, & Shuen, 1997), the development of core rigidities (Leonard-Barton, 1992), and the development of organizational relationships. Furthermore, expediting the repositioning from the origin to the destination (compressing the move on the time dimension) increases the overall cost of the move (Pacheco-De-Almeida & Zemsky, 2007).

As the degree of change increases (e.g., change involves increasing numbers of activities) and it becomes more consequential, the precise mechanism associated with commitment costs becomes harder to identify. But ignoring such costs because they cannot be precisely quantified is both unwise and unnecessary. A fruitful path to better understand higher-level strategy dynamics, perhaps combining empirical and theoretical work, would entail exploring general structures of repositioning costs. Along these lines Marx and Hsu (2015) present an intriguing framework in which firms commercialize their technologies through a strategy that includes changes in positioning along with an awareness of the associated repositioning cost.

With this background, we now describe our repositioning cost models. The models are implemented as two closely-related numerical examples that illustrate some key implications of repositioning costs for strategic dynamics and for assessing the value of a firm's "flexibility," i.e., its ability to change its activities at low costs.

## Repositioning Costs and Strategic Interaction: The Base Model

Our base model consists of an interaction between an incumbent innovator (henceforth, "innovator") and an entrant-follower (henceforth, "follower") which considers its strategic position with respect to the innovator's market. The innovator develops and introduces a new generation of product in each period and chooses to offer either generous or stingy

[8] Arguably, distance-based repositioning costs are implicitly embedded in the payoffs. It is often unclear, however, whether modelers developing such payoffs account for repositioning costs.

[9] The path dependency of repositioning costs is a key difference from NK model landscapes (Levinthal, 1997) that treat firms as searching for better performance positions.

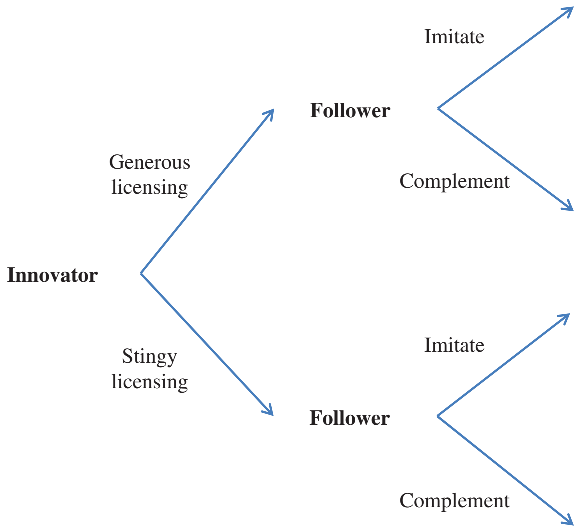


*Figure 1.* Sequence of moves in each period.

licensing terms to a follower. The follower can imitate the innovation (and implicitly reject the license) or it can focus on being an effective complementor (or merely a producer rather than a developer of the underlying technology) and accept the license. One example of such an interaction involved Toyota (the "innovator" in our model) which offered licenses to portions of its innovative hybrid automobile powertrain to several competitors (the "follower"). Through its licensing practices, Toyota reduced the licensees' incentives to imitate that generation of hybrid technology.

## Base Model

The interaction is modeled as a three-period game. Each period consists of a sequence in which the innovator chooses which license to offer (generous or stingy) and then the follower chooses either to imitate or to complement. The sequence of moves in each period is captured by Figure 1.

Each player's net payoff for each period consists of the market payoff for the player minus any repositioning costs incurred that period.[10] The per period *market* payoffs to these actions are as shown in Table 1.

Table 1
Market Payoffs for Base Model

| | | INNOVATOR | |
|---|---|---|---|
| | | Generous licensing | Stingy licensing |
| FOLLOWER | Imitate | 2, 2 | 2, 2 |
| | Complement | 3.5, 1.5 | 0, 5 |

When the follower chooses imitation, the payoffs do not vary by licensing choice because imitation entails the rejection of the license. Complement payoffs depend on licensing terms with generous terms favoring the follower and stingy terms favoring the innovator. The complement payoffs reflect the improved joint profits available to the two firms when they do not directly compete. All choices are observable by each player.

Within this setting, the follower's choices are modeled as involving possible repositioning costs because the activity systems supporting imitation versus complementarity are different. In contrast, the innovator's choices are not modeled as involving repositioning costs because the choice of licensing terms does not entail major changes to that firm's activity system. This asymmetric structure has the benefit of making it easier to develop and understand the underlying intuition.[11]

More specifically, distance-based costs $\kappa_d$ are incurred whenever the follower changes its activity system. If more than two choices were modeled, distance-based costs could vary depending on the origin and destination of the repositioning. History and time-based costs (henceforth, time-based costs) increase the longer a firm engages in the same activity system because, for example, it takes time to implement (commit to) a new activity system.

[10] A modest game-theory literature (e.g., Caruana & Einav, 2008; Lipman & Wang, 2000) addresses the effect of switching costs in repeated games. Lipman and Wang analyze a finite-repeated game with switching costs with particular attention to how switching costs affect the equilibria of a repeated prisoner's dilemma game, while Caruana and Einav explore a model with endogenous timing of commitments where the cost of switching a commitment increases over time. These papers provide a start on the theoretical foundation for further explorations of the type we advocate.

[11] The labels "generous" and "stingy" licensing each represent a bundle of actions that an innovator might undertake. For example, the generous "bundle" might include not only generous licensing terms for some key technology, but also greater amenability to knowledge sharing, openness and collaboration towards the follower, and building trust and a cooperative relationship. In contrast, the stingy "bundle" might be characterized as more narrowly "transactional," with extractive licensing terms and the absence of any openness or knowledge sharing between the two firms. The key characteristic of the example is that the cost to the innovator of moving between its two options is much lower than the cost for the follower.

Here, time-based repositioning costs, $\kappa_t$, which are incremental to any distance-based costs, are incurred only when changing from an action that had been chosen in *both* of the two previous periods. For expositional simplicity, it is assumed that the follower enters in the first period, so there are no choice-specific first-period repositioning costs. Therefore, distance-based costs can be incurred beginning in the second period and time-based costs only in the third period. Because these costs depend on the action history, they are separate from the market payoffs given in the market payoff matrix. The equilibrium path of play is displayed in Figure 2. The complete extensive-form game tree is available in the on-line Appendix S1.

Each firm is assumed to exercise foresight and to maximize the three-period undiscounted sum of the market payoffs minus repositioning costs. As is standard in the analysis of noncooperative games, we look for Nash equilibrium strategies. Within this context, each firm's strategy choice constitutes a best response to the other firm's strategy choice. Given the structure of the game, solving the game through backward induction is straightforward.

## Analysis and Interpretation

As a benchmark, consider a situation with no repositioning costs, i.e., $\kappa_d = \kappa_t = 0$. In that setting, the innovator and follower are each assured a payoff of at least 2 per period by pursuing "stingy licensing" and "imitate," respectively, in each period. The innovator's challenge is to increase profits by inducing the follower to choose "complement" when the innovator chooses "stingy licensing." But this outcome is precluded because whenever the innovator offers the stingy license, the follower responds with imitation.

Let us now consider a different competitive outcome that would arise if non-zero repositioning costs were involved. Suppose repositioning costs fall in the ranges $\kappa_d + \kappa_t \geq 2$ and $0.5 \leq \kappa_d \leq 4$. The innovator, through generous licensing terms, can induce the follower to choose "complement" in the first two periods. After two successive periods as a complementor, the follower would incur a time-based repositioning cost if it switches to imitation. Therefore, in period three, the innovator switches to stingy license and the follower remains with complement. Relative to the no-repositioning cost benchmark, this "differentiation" equilibrium results in innovator payoffs of 8 instead of 6, while the follower receives 7 instead of 6.[12] See Figure 2.

The core intuition underlying the differentiation equilibrium is that time-based repositioning costs can induce the innovator to sacrifice early profits to lock its rival into the option (activity system) that the innovator wants the rival to play later in the interaction. Distance-based repositioning costs are also critical. If $\kappa_d < 0.5$, the follower would deviate from the equilibrium by choosing imitate, rather than complement, in the second period. Such a "take-the-money-and-run" choice sacrifices 3.5, returning instead $2 - \kappa_d$ in the second period, but confers a third-period payoff of 2 rather than 0 by avoiding the time-based cost lock-in to complement. Finally, these choices are optimal for each firm, even when both correctly anticipate their rival's actions.[13]

The base model illustrates how, by introducing various forms of commitment and lock-in, repositioning costs change the dynamics of competition. Numerous examples exist of firms that take advantage of lock-in associated with continued investment in an existing technology. The Mobileye example in the introduction appears to be one. Other examples involve challenger firms exploiting entrenched activity systems. For example, Pepsi successfully challenged Coca-Cola in the 1930s with a 12 ounce bottle because Coca-Cola's bottlers

[12] The equilibrium strategies depend on the follower's historical choices, the innovator's current period choices, and the repositioning costs. Here we focus on the "differentiation" equilibrium. In describing the strategies, history is designated in braces as appropriate and choices are abbreviated G for generous licensing, S for stingy licensing, I for imitate, and C for complement and are subscripted to indicate the period. For $\kappa_d + \kappa_t \geq 2$ and $0.5 \leq \kappa_d \leq 4$, the innovator's equilibrium strategy in the "differentiation" equilibrium is: $G_1$; if $\{I_1\}$ then $S_2$; if $\{C_1\}$ then $G_2$; if $[\{I_1,I_2\}$ or $\{C_1,C_2\}$or $\{I_1,C_2\}$ or $\{C_1,I_2\}]$, then $S_3$. The follower's equilibrium strategy is: if $[G_1]$, then $C_1$, if $[S_1]$, then $I_1$; if $[\{C_1\}, G_2]$, then $C_2$, if $[\{C_1\},S_2, \kappa_d < 4]$,then $I_2$, else $C_2$; if $[\{I_1\}, G_2, \kappa_d \leq 0.75]$,then $C_2$, else $I_2$; if $[\{I_1\},S_2,]$,then $I_2$; if $\{C_1,C_2\}$ or $\{I_1,C_2\}, G_3]$,then $C_3$; if $[\{I_1,I_2\}, G_3]$,then $I_3$; if $[\{C_1,I_2\}, G_3, \kappa_d > 1.5]$,then $I_3$, else $C_3$; if $[\{I_1,I_2\}$ or $\{C_1,I_2\}, S_3]$, then $I_3$; if $[\{C_1,C_2\}, S_3]$, then $C_3$; if $[\{I_1, C_2\}, S_3, \kappa_d \geq 2]$, then $C_3$, else $I_3$. For $\kappa_d$ and $\kappa_t$ outside the ranges, in all periods the innovator plays S and the follower responds with I.

[13] The intuition emerging from this numerical example obtains across a wide range of payoff values. Consider a similarly structured game in which the innovator makes take-it-or-leave-it offers to the follower and the innovator has complete flexibility regarding the contracts it offers in each period. The attendant repositioning costs also lead to an equilibrium outcome in which the follower receives a larger share of its revenue in the first two periods and the innovator receives a larger share of its revenues in the final period.



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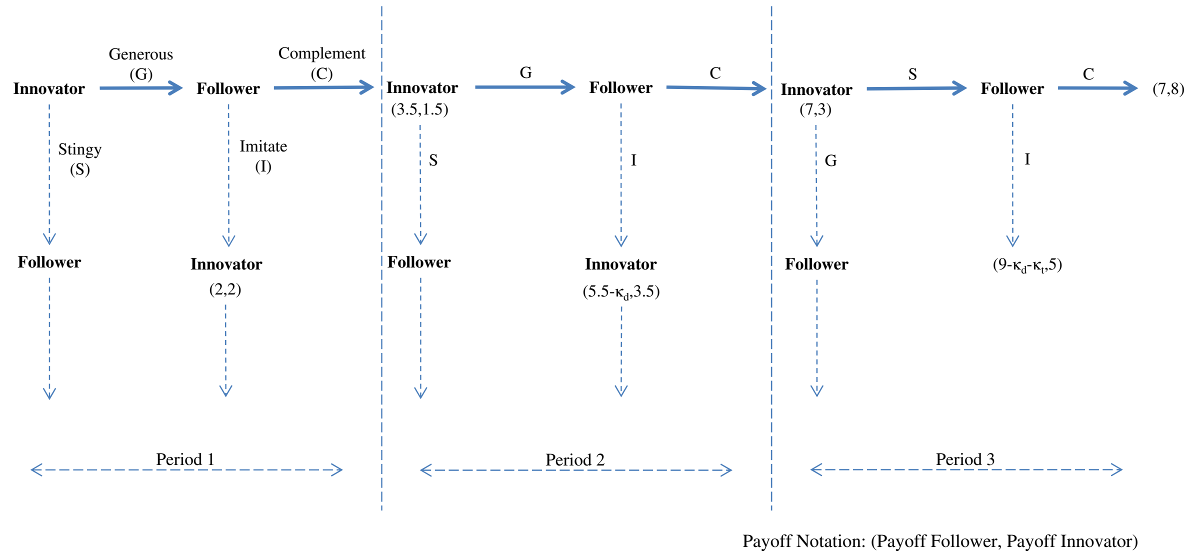


*Figure 2*. Equilibrium path of play, if $\kappa_d + \kappa_t \geq 2$ and $0.5 \leq \kappa_d \leq 4$, with cumulative payoffs.
The payoffs indicated here are cumulative payoffs along the path of play up to that point. They must not be used as the basis for a backward induction solution.

were invested in Coke's original six and one half ounce bottles (Yoffie & Kwak, 2001, p. 81) which, in turn, increased the costs of a Coke response. Ideally, strategists should recognize that repositioning costs are frictions that impact competitive dynamics and can be exploited to a firm's advantage.[14]

More generally, the strategic dynamics illustrated in this base model suggest some broad forces that may be operating in an industry. For example, one interpretation of the follower-innovator example is that repositioning costs (and the dynamics they produce) facilitate strategies that increase differentiation amongst rivals in a market. In the base model example, the distribution of profits is inter-temporal: the follower (now complementor) is the initial beneficiary of the dynamic, while innovator benefits in the later periods.[15]

Finally, the example illuminates certain conditions under which repositioning costs are most likely to matter. One important dimension is the size of repositioning costs relative to the differences across market payoffs. When repositioning costs are relatively large, e.g., $\kappa_d > 4$ in the example, repositioning is so costly that repositioning never occurs. Such settings are consistent with schools of thought that view major strategic change as extremely costly or even impossible (e.g., Hannan & Freeman, 1977).[16] When repositioning costs are relatively small (e.g., most price changes), dynamic strategic interaction may be important, but repositioning costs play a minor role. Those settings typically involve interactions that would be classified as tactical rather than strategic. Thus, repositioning costs seem most critical for strategic interactions falling within the middle of the range where the costs are similar in magnitude to at least some of the differences among the market payoffs. Such settings would involve, for example, changes and realignments of activity systems, or major changes to product lines or to geographies served.

[14] Another example of exploiting time-based costs allegedly occurred when Unocal represented to key parties that it "lacked, or would not assert, patent rights concerning automobile emissions research results" but then it asserted such rights after standards were adopted that depended on Unocal's intellectual property. *In the Matter of Union Oil Company of California*, FTC Docket no. 9305, 2005, p. 1.

[15] The differentiation equilibrium we explore is robust in that differentiation is self-reinforcing and does not require a commitment instrument such as a long-term contract. Where long-term contracts are legally acceptable and do not suffer from specification, monitoring, and enforcement problems (e.g., environments without considerable uncertainty and asymmetric information), they could also be used to achieve differentiation.

[16] Within this context, competitive interactions would be less strategic, e.g., with the relevant repositioning cost deriving from commitments involving changes to activity system elements rather than changes to the activity system itself.



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## Flexibility and Repositioning Costs

In this article we examine the dynamic implications of an exogenous repositioning cost structure but do not allow the incurred repositioning costs to be endogenous to firm actions. Nonetheless, by comparing the implications of different repositioning costs on outcomes, one can gain some intuition regarding the value of firm actions that serve to lower repositioning costs. In this section we use this approach to briefly explore the costs and benefits of flexibility, that is, of having a capability that results in a *lower* repositioning cost structure.[17]

The base example is dynamic in that player actions may change over time, but it is also static because the payoffs remain constant throughout. Therefore, it is not ideal for assessing the full value of flexibility. In this variation, we maintain the base model's structure and payoffs except in the third period when payoffs acquire new values (state A) with probability p and maintain the previous values (state B) with probability 1-p and these states are known before each player makes its third-period choice.[18] Allowing for a state in which the environment changes provides a channel through which flexibility has value, all other things being held constant. The only difference between those states is that the complement payoffs to the innovator in state A are greater than in state B (Table 2).

To the extent that a firm's flexibility lowers the levels of repositioning costs, our analysis suggests that acquiring such flexibility can affect the competitive interactions.[19] Consider first the base example ($p=0$) and suppose that the follower firm's flexibility has reduced its repositioning costs from $\kappa_d = 1$ and $\kappa_t = 2$ to $\kappa_d + \kappa_t < 2$. This repositioning-cost reduction eliminates the possibility that repositioning costs can "lock" the follower into a third-period complement choice, thereby undercutting the differentiation equilibrium and leading to lower payoffs for both firms. Here, the attractiveness of flexibility as modeled in lower repositioning costs capability partially depends on the strategic interplay. Flexibility is not always beneficial.

Table 2
Market Payoffs for Variation Model

| | | INNOVATOR | |
|---|---|---|---|
| State A (probability $p$) | | Generous licensing | Stingy licensing |
| FOLLOWER | Imitate | 2, 2 | 2, 2 |
| | Complement | 3.5, 3 | 0, 6.5 |
| | | INNOVATOR | |
| State B (probability $1-p$) | | Generous licensing | Stingy licensing |
| FOLLOWER | Imitate | 2, 2 | 2, 2 |
| | Complement | 3.5, 1.5 | 0, 5 |

To better understand how flexibility affects strategic outcomes, we first consider how a potential change in the underlying market environment (i.e., $p \neq 0$) affects the strategic interaction for a given set of repositioning costs and then examine how equilibrium outcomes change with smaller repositioning costs. We simplify the analysis by initially holding $\kappa_d = 0$. As described earlier, no differentiation equilibrium exists in this part of the parameter space when $p=0$. When $\kappa_t$ is also zero and thus there are no repositioning costs, as uncertainty rises from $p=0$, the innovator offers a stingy license in the first two periods and the follower imitates in those periods. In the third period the innovator offers a generous license if state A occurs (probability p) which is met by a complement response by the follower, and a stingy license if state B occurs (probability 1-p) which is met by an imitate response by the follower.

However, when $\kappa_t \geq 1.5$ and $p \geq 0.5$, a "flexible-follower" equilibrium emerges in which the innovator offers stingy licensing in the first period (the follower responds with imitation), generous licensing in the second period (complement response), and generous licensing under state A (complement response) and stingy licensing under

[17] Flexibility may sometimes be a feature of an underlying dynamic capability (Helfat, 1997; Teece et al., 1997), e.g., adoption of organizational processes that enable a firm to more easily reconfigure its organizational processes (Eisenhardt & Martin, 2000).

[18] Uncertainty is introduced only in the third period for simplicity. Since time-based repositioning costs only apply in the third period, the introduction of the uncertainty in the third period is the minimum change required from the base model to obtain interesting results.

[19] Note that we are interested in how the competitive dynamics in a game with uncertainty changes when a "flexibility" capability lowers the repositioning costs of the follower. We are not exploring the follower's "meta" choice on whether or not to deploy such a "flexibility" capability, which is an analysis beyond the scope of the present paper.

state B (imitate response) in the third period.[20] The core intuition is that the innovator wants to maintain an option to exploit state A which offers superior payoffs when the follower chooses "complement." But when $\kappa_t$ is large, time-based repositioning costs—generated if the follower "imitates" in both of the first two periods—prevents the follower from choosing complement in response to generous licensing offered by the innovator in the third period. To avoid $\kappa_t$, the innovator induces the follower to switch from imitate to complement in the second period by switching its action from "stingy" to "generous licensing." This switch by the innovator is an investment in the option to exploit the more favorable payoffs should state A obtain in the future. The flexible-follower equilibrium outcome contrasts with the differentiation equilibrium of the base example in which the innovator induces rather than discourages the creation of time-based repositioning costs.[21]

With this intuition, we now reexamine the implications of flexibility with the continued assumption that flexibility reduces distance and/or time-based repositioning costs. If, for example, $\kappa_d = 0.2$, $\kappa_t = 1.5$, and $p = 0.75$, then the flexible-follower equilibrium results. But suppose an improvement in flexibility lowers $\kappa_t$ below 1.5. Then, no "generous" offer by the innovator is needed to preserve its preferred option should state A occur. Hence, the follower's expected payoffs decline as the innovator will choose "stingy licensing" instead of "generous licensing" in the second period.

Note, however, that if $\kappa_d$ were positive (instead of assumed to be zero), say 0.2, and flexibility reduced $\kappa_d$ to 0, then the expected payoff improvement to the follower is 0.25 which consists of 0.2 savings in the period-two switch from imitate to complement and a probability of further savings from a third-period switch from complement back to imitate. More generally, because $\kappa_d$ is incurred for every change in action (activity system), the sufficient conditions for improved flexibility regarding $\kappa_d$ to increase the follower's payoffs are (a) the change does not alter the equilibrium path and (b) the original equilibrium path involves at least one activity system change by the follower. When improved flexibility changes the equilibrium path, as when $\kappa_t$ drops below 1.5 in the example, the payoff effect can operate in either direction. Thus, flexibility that allows a firm to lower the cost of changes to its activity systems may affect its payoffs from a subsequent strategic interaction either positively or negatively, as was seen in this case with the follower.

## Discussion

This paper's core argument is that repositioning costs should be central to analyses of strategic dynamics whenever the relative cost of repositioning is of a similar magnitude to the payoff differences across choices. Despite a general recognition regarding repositioning costs' importance, very few systematic examinations of interactions involving major strategic change incorporate such costs.[22] Two potential explanations for this absence are a bias towards more precise mechanisms and a concern that the complexity of strategic change reduces the value of assessing strategic interaction given the level of rationality and foresight typically assumed in game-theoretic analyses.

Although commitment is central to game-theoretic analyses in industrial organization economics (see, e.g., Saloner, Shepard, & Podolny, 2005), with the important exception of the value-based approaches based in cooperative game theory, the vast majority of this work applies to tactical and intermediate-level strategic interactions rather than to interactions involving major strategic

[20] Equilibrium strategies that support this outcome (with $\kappa_d = 0$, $\kappa_t \geq 1.5$ and $p \geq .5$) are specified with the same notation as in the description of the base example equilibrium in footnote 12. For the innovator: $S_1$; if $[\{I_1\}]$, then $G_2$, if $[\{C_1\}, (K_t - 1.5)/K_t \leq p$ and $K_t \geq 2]$, then $G_2$, else $S_2$ ;if [state A, $\{C_1, C_2\}$, $\kappa_t \geq 2\}$, then $S_3$, else $G_3$, if [state A, $\{I_1, I_2\}$, $\kappa_t \leq 1.5]$, then $G_3$, else $S_3$; if [state A, $\{I_1, C_2\}$ or $\{C_1, I_2\}$], then $G_3$; if [state B], then $S_3$. For the follower: if $[G_1]$, then $C_1$; if $[S_1]$, then $I_1$; if $[\{I_1\}, G_2]$, then $C_2$, if $[\{I_1\}, S_2]$ or $[\{C_1\}, S_2]$, then $I_2$; if $[\{C_1\}, G_2, (\kappa_t - 1.5) > p\kappa_t]$, then $I_2$, else $C_2$; if $[\{I_1, I_2\}, G_{3,}\ \kappa_t > 1.5]$, then $I_{3,}$ else $C_3$; if $[\{I_1, I_2\}, S_3]$, then $I_3$; if $[\{C_1, C_2,\}, G_3]$, then $C_3$; if $[\{C_1, C_2\}, S_3, \kappa_t < 2\}$, then $I_3$, else $C_3$; if $[\{I_1, C_2\}, G_3]$, then $C_3$; if $[\{I_1, C_2\}, S_3]$, then $I_3$; if $[\{C_1, I_2\}, G_3]$, then $C_3$; if $[\{C_1, I_2\}, S_3]$, then $I_3$.

[21] With $p = .75$, relative to myopic single-period maximizing choice by the innovator, the equilibrium results in innovator expected payoffs of 6.25 versus 6 and follower payoffs of 8.625 versus 6.

[22] The literature on major strategic change has not, of course, ignored the fact that the performance of a firm depends on the actions of other actors. The notions of competitive advantage, competitive position, and valuable resources are understood relative to the competition. But while acknowledging that the actions of the other actors impact a focal firm's performance, most of the literature treats these outside factors as parameters in a decision problem, over which the strategist optimizes.




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changes.[23] One reason for the dearth of such analyses is that the richness characterizing a change to a firm's activity system cannot be captured easily in the precisely-specified mechanisms favored by analytic modelers. In this paper, we propose a way out of this quandary by focusing on general classes of repositioning cost structures rather than on precise mechanisms, an approach that we hope will be adopted by other scholars. But this is only a first foray into these cost structures, it is by no means intended to be a comprehensive treatment of the matter. Much further work remains to be done, and we hope that the two models illustrate the fertility of this approach.

With regard to the concern about the value of insights derived from game-theoretic models that assume high levels of rationality and foresight, it is important to recognize that the mechanisms underlying competitive dynamics models do not always require that rationality and foresight be exercised by all players. In the model examples discussed above, both equilibrium outcomes only require that the innovators have foresight and rationality. In the base model the equilibrium will still obtain if the follower merely reacts with its best myopic choice because the follower would then choose "complement" in response to a generous license in the first two periods after which repositioning costs would prevent the myopic follower from changing to "imitate" in the third period. Foresight is, however, required of the innovator who must initiate strategic moves predicated on this strategic interaction insight. If the innovator lacks such insight, imitation, rather than differentiation, results.

## Conclusion

This paper argues that repositioning costs are fundamental to strategic change and, therefore, that such costs are especially important in strategic interactions involving possible shifts in a firm's activity system, i.e., its business strategy. The inherent complexity of such shifts, however, renders difficult the identification of specific change mechanisms. We propose focusing, in the first instance, on general repositioning cost structures (such as distance and history and time-based structures) that can be developed from the organizational and strategy literatures and hope that the analysis of repositioning costs developed here constitutes a useful step in that direction.

[23] Unlike most work in non-cooperative game theory, the value-based approach developed from cooperative game theory (Brandenburger & Stuart, 1996) is directly applied to strategic change. This research stream includes an elegant framework that integrates value creation, value capture and competition. The framework focuses on the bargaining power of the various actors and, most crucially, how that is determined by the unique value they contribute to the system. While this approach is powerful, work in this tradition does not focus on repositioning costs associated with changes in strategy.

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## Supporting Information

**Additional supporting information may be found in the online version of this article:**

**Appendix S1.** Game tree and equilibrium analysis.