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The Curse of Innovation: Why Innovative New Products Fail

John T. Gourville

Why do innovative new products fail? The answer may lie in consumers’ inherent resistance to behavior change—a resistance that developers may neither anticipate nor plan for. What can managers do to minimize this resistance and promote adoption?

Report Summary

It’s hard for any new product to gain marketplace acceptance: Most studies estimate new product failure rates at 50% or more. But it’s particularly challenging if a product is highly innovative—a “really new product” that revolutionizes an existing product category or defines a new category. Although such products may suffer from a firm’s lack of resources, expertise, or commitment, even those that are well supported and that offer consumers significant gains over existing alternatives are far from certain to succeed.

However, many firms’ ultimate success or failure depends on the successful development and adoption of innovative products. How can managers increase the odds that innovative new products will succeed?

Author John Gourville offers a behavioral framework—called the “curse of innovation”—to explain such failures, starting with the simple fact that highly innovative new products tend to require consumers to change their behavior in some way. Consumers see these changes as losses, and due to “status quo bias,” these losses loom larger in consumers’ minds than do the benefits offered by the new innovation. Developers of new products, on the other hand, are biased in the other direction—they come to regard the product they are developing as the status quo, and they subsequently undervalue the losses consumers must experience to adopt the innovation, leading them to overestimate the likelihood of marketplace success.

Managers can help innovative new products to succeed in the marketplace by understanding the degree of behavior change the innovation requires and planning for it, anticipating the rate of product adoption and tailoring marketing efforts accordingly. Alternatively, the product itself can be tailored to minimize the behavior changes consumers will have to make. A firm can also seek subgroups of consumers who are not currently entrenched in any alternative or who greatly value the benefits of the innovative product.
Introduction

Innovation is critical to the long-term success of many firms. Products under development at any point in time represent potential sales long into the future, with firms that successfully introduce innovative new products more likely to flourish than those that fail at introducing such products (Cooper 2000; Gielen and Steenkamp 2004; Urban and Hauser 1993).

It is therefore not surprising that innovation has been studied in fields ranging from operations to marketing to entrepreneurship. Researchers have explored how best to structure firms to foster and leverage innovation (Christensen 1997; Tushman and O'Reilly 2002; Utterback 1994; Wheelwright and Clark 1992, 1995), how firms can best capture consumers’ current and future needs and wants (Griffin and Hauser 1993; Urban and Hauser 1993; von Hippel, Thomke, and Sonnack 1999), and the nature of the new product adoption process (Bass 1969; Moore 1999; Rogers 1995).

In spite of this research, new products fail to gain market acceptance at a stunning rate—reported to be from 40% to 90% across product categories (c.f. Cierpicki, Wright, and Sharp 2000; Griffin 1997). And highly innovative products—the focus of this paper—fail at a greater rate than less-innovative products (Cooper 2000; Golder and Tellis 1993; Urban and Hauser 1993). Recent examples include Webvan’s online grocery venture, the Segway scooter, and TiVo—all of which have struggled or failed in the marketplace.

After the fact, critics often dismiss such failures as “bad” concepts (Schnaars 1988; McMath and Forbes 1998). But if these products were so misguided, why was it not obvious before the fact? Many failed innovations are developed by industry insiders, garner well-seasoned financial support, and attract the imagination and/or praise of experts and consumers.

In this paper, we provide a theoretical explanation for innovative failure. We focus on highly innovative or “really new products” (Urban, Weinberg, and Hauser 1996)—those that revolutionize an existing product category or define a new category. For such products, we argue that the cause of marketplace failure is two-sided, with (1) consumers systematically undervaluing and (2) firms systematically overvaluing the innovation relative to what an objective analysis would suggest. We call this the “curse of innovation.” In doing so, we do not claim that the curse of innovation explains all innovation failures. However, we do argue that the phenomenon is robust and pervasive. And for firms unable to avoid it, it systematically increases the likelihood that their innovations will fail in the marketplace.

Our framework starts with a common trait among innovations—behavior change. Highly innovative products typically entail tradeoffs relative to the entrenched alternative—in short, they require consumers to change the way they do things (Moreau, Lehmann, and Markman 2001; Moore 1999; Rogers 1995). Customers adopting Webvan, for instance, obtain the convenience of not having to drive to the store, but they sacrifice some degree of control, e.g., strangers select their meats and vegetables. Those who adopt electric cars gain environmental friendliness but sacrifice driving range.

In turn, the two behavioral underpinnings for our framework are reference dependence and loss aversion (Tversky and Kahneman 1991). Reference dependence argues that consumers evaluate a multidimensional option, such as a new product, from a salient reference point. If the new product offers an improvement on a given attribute relative to that reference point, that improvement is viewed as a “gain.” If it falls short, that shortfall is viewed as a “loss.” In turn, loss aversion argues that any shortfall or loss has a far greater negative impact than a comparably sized gain has a positive impact. In other words, losses loom larger than gains.

The curse of innovation arises because consumers and developers employ different refer-
ence points. For consumers, we argue, the dominant reference point will almost always be the entrenched alternative—the product the innovation seeks to replace. Consumers assess online grocery shopping from the perspective of the highly familiar physical shopping trip. They assess electric cars from the perspective of the ubiquitous gasoline-powered car. Thus, obtaining the feature on which the innovation does better (e.g., convenience) feels like a gain, and giving up the feature on which the entrenched product does better (e.g., control) feels like a loss. Given loss aversion, the result is a systematic overvaluing of the entrenched alternative relative to the innovation.

In contrast, we propose that the most likely and most salient reference point for members of the firm will be the innovation itself. In our model, the developers of Webvan, Segway, and XM Radio, for instance, respectively come to view online shopping, personal transportation devices, and commercial-free satellite radio as the standard of comparison. Having invested time, money, and energy in the development of these products, such innovations are no longer viewed as possibilities but as realities. For developers, not having the features on which their innovation does better will feel like a shortcoming, or loss, and having the features on which the entrenched alternative does better will be nice to have, but not essential. The result is a systematic overvaluing of the innovation relative to the entrenched alternative.

This curse of innovation has at least two important implications. First, consumers will often reject innovations that, objectively, would make them better off. Second, developers will be at a loss to anticipate this rejection. The result will be an increased probability of market failure for the innovation.

The remainder of this paper is in several parts. Below we discuss new product failure rates and provide a brief overview of the relevant innovations literature. Second, we review the existing behavioral research on reference dependence and loss aversion. Third, we consider the special case of innovations, building a theoretical model of the consumer and the developer. Finally, we offer managerial solutions to the curse of innovation, suggesting strategies for gaining marketplace acceptance for highly innovative new products.

How Often Do New Products Fail?

Innovation has long been viewed as a path to long-term corporate success, with companies that successfully introduce innovative new products more likely to flourish than those that do not (Bayus, Erickson, and Jacobson 2003; Cooper 2000; Urban and Hauser 1993). But new product development often is a high-stakes endeavor. Gillette spent more than $700 million to develop the Mach 3 razor blade, pharmaceutical firms spend $500 million on average to get a drug approved in the United States, and a new car platform can cost in excess of $1 billion (Gielens and Steenkamp 2004). In turn, such products often drive future corporate revenues and profits. In 2003, for instance, more than half of Gillette’s $9.25 billion in revenues was generated by products introduced in the previous five years, with the Mach 3 family of razors accounting for over $1.5 billion of that revenue (Gillette Company 2004).

Unfortunately, the incidence of marketplace success for new products is strikingly low and shows no sign of improving (Booz, Allen and Hamilton 1982; Griffin 1997). For consumer packaged goods, for instance, the failure rate for new products is widely reported to be 70% to 90% (c.f. Broening 2005; Morris 1993; Turcsik 2002), with more than 30,000 products introduced to U.S. stores annually, but with very few remaining on store shelves for more than one year.

Other researchers place the failure rate of new products closer to 40% (Cierpicki, Wright, and Sharp 2000; Crawford 1979). In a broad survey of 383 firms involved in new product development, for instance, Griffin (1997) found that...
41% of all new product introductions were considered failures by their respective firms, a figure consistent with other survey-based studies (c.f. Booz, Allen and Hamilton 1982; Page 1993; Edgett, Shipley, and Forbes 1992).

We suggest, however, that such survey-based studies likely underestimate failure rates. First, in all the survey-based studies cited, the assessment of new product success was left to the surveyed firms, introducing a potential response bias. Second, the reported rates reflect only those firms that responded to the survey—2.7% of those sent the survey in the case of Griffin (1997)—introducing a potential sampling bias. Third, these figures include only fully commercialized products, eliminating products shelved prior to launch. Finally, these figures do not differentiate between highly innovative products, where one might expect higher failure rates, and far less innovative products. Thus, a 40% failure rate may be a conservative lower bound, with the true rate of failure for highly innovative products significantly higher.

Recent work on the first-mover advantage suggests this likely is the case. Contrary to the belief that product and market pioneers have long-lived market-share advantages (Robinson 1988; Robinson and Fornell 1985; Urban, Carter, Gaskin, and Mucha 1986), Golder and Tellis (1993; Tellis and Golder 1996) found the failure rate for “first movers” to be 47%. In categories ranging from disposable diapers to video games, they found that firms that pioneered a product category later withdrew from that category almost half of the time. Even this may be understated, however, as Golder and Tellis considered only product categories that eventually proved successful. If one included the fate of market pioneers in product categories that proved less successful (e.g., videophones), the failure rate of pioneers would almost certainly be higher.

In the end, one is left with a sobering view of new product introduction. While estimates vary from 40% to 90%, depending on the criteria used to define success and the stage at which products are included in the analysis, it is clear that new products fail at a significant rate.

Why Innovations Fail: Current Thinking

Current thinking identifies several potential causes for such failure. One potential cause is an irresolvable uncertainty in innovation adoption. According to this view, new product development is an intrinsically risky endeavor, with a certain rate of marketplace failure being inevitable and, in fact, necessary if one is to benefit from marketplace successes (Boulding, Morgan, and Staelin 1997). Thus, the high rate of marketplace failure merely reflects the cost of doing business. Investment banks and venture capital firms work under such a model, accepting the difficulty of predicting the eventual success of seemingly viable ventures and taking a portfolio approach across projects to diversify risk. Unfortunately, while a venture firm can diversify risk, the same cannot be said for the innovation developer, for whom failure can be devastating. Further, even if some optimal rate of marketplace failure exists for highly innovative new products, there is little to suggest what that rate might be.

Not content to accept the current rate of innovation failure, most other researchers place the blame for such failure in one of three places—the product, the consumer, or the developer.

Product-based causes of innovation failure

Rogers (1962, 1995) proposed looking to the innovations themselves to explain why some products succeed and others fail. Across decades of research, Rogers and his colleagues found that five product-based factors explain 49% to 87% of the variance in rates of adoption across innovative new products. These factors are:

- Relative advantage: the degree to which an innovation is perceived as economically or socially better than the product it replaces
- Compatibility: the degree to which an innovation is seen as consistent with existing values, experiences, and needs of potential
adopters

- Complexity: the degree to which the innovation is understood by the adopter
- Observability: the degree to which the impact of the innovation is visible to others
- Trialability: the degree to which an innovation may be experienced on a limited basis

Within these five factors, relative advantage has been widely viewed as the critical, if not always sufficient, condition for new product success (Moore 1999; Urban and Hauser 1993; Cooper 2000). As Cooper (2000) states, “It’s almost too obvious, but a dominant success factor is having . . . a superior product . . . that delivers unique benefits and better value to the customers” (p. 60). Urban and Hauser (1993) concur: “. . . products sell because consumers find them to be superior, of higher value, or distinctive” (p. 6). Simply, it is widely assumed that the single largest predictor of marketplace success for an innovative new product is the relative advantage of that innovation over the product it seeks to replace, as perceived by consumers in the marketplace. In turn, products that are more compatible, less complex, more observable, and easier to trial have a better chance of being adopted than those that aren’t.

Consumer-based causes of innovation failure

Other researchers argue that market failure of innovations can be explained by focusing on the intended consumers. Initially Rogers (1962, 1995), and then Moore (1999), for example, place potential innovation adopters into one of five categories—innovators, early adopters, early majority, late majority, and laggards—with one’s propensity to adopt decreasing as one moves from innovators to laggards. In Rogers’ framework, diffusion typically starts among innovators, gradually moves to early adopters, and so on. However, Moore (1999) argues that the needs of the early adopter and the needs of the early majority vary greatly, resulting in a “chasm” that firms have great difficulty overcoming. He states, “. . . the chasm represents the gulf between two distinct marketplaces for technology products—the first, an early market dominated by early adopters and insiders who are quick to appreciate the nature and benefits of the new development, and the second a mainstream market representing ‘the rest of us,’ people who want the benefits of new technology but who do not want to ‘experience’ it in all its gory details. The transition between these two markets is anything but smooth” (p. xiv).

Moore goes on to explain that many firms find initial success among innovators and early adopters but fail to attract the early majority in sufficient numbers to achieve long-term success.

Developer-based causes of innovation failure

By far, the most common explanations for innovation failure hinge on the developer. In particular, some have argued that product failures arise from arrogance or incompetence among managers (c.f. Schnaars 1988; McMath and Forbes 1998), while others have attributed the high rate of failure to the overconfidence developers bring to their decisions (Fischhoff, Slovic, and Lichtenstein 1977; Mahajan 1992). Such pitfalls include the illusion of control and wishful thinking (Schultz and Braun 1998), where developers systematically overestimate the probability and speed of adoption of their innovations. They also include the “escalation of commitment”—the tendency to prolong or increase one’s efforts in the face of a losing product introduction (Boulding, Morgan, and Staelin 1997; Biyalagorsky, Boulding, and Staelin 2001). While such escalation might not increase the probability of new product failure, it certainly could increase the negative financial implications of that failure.

Collectively, these developer-based explanations for innovation failure most often cite some form of emotional or ego involvement. Schnaars (1988), for instance, argues that developers too often “. . . fall in love with the technology . . . and ignore the market the technology was intended to serve” (p. 9). Those espousing developer overconfidence would argue that developers tend to filter marketplace feedback through their existing faith in the innovation, discounting
that which challenges and overweighting that which supports that faith (Koriat, Lichtenstein, and Fischhoff 1980; Mahajan 1992). And those who point to an escalation of commitment argue that developers are trying to justify to themselves and to others that the previous decisions to develop and launch the innovation were sound (Boulding, Morgan, and Staelin 1997).

**Summary**

Based on the extant literature, we are left with diverse explanations for why innovative new products fail in the marketplace, attributing failure to the product, to consumers, or to the developing firm. We will offer a behavioral framework that links these three entities in a more unified fashion, but first we take a brief look at the underlying behavioral tendencies that drive this framework.

**Reference Dependence and Loss Aversion**

As Rogers (1995) argues, the relative advantage of an innovation over the product it looks to replace should be a significant determinant in new product adoption. Indeed, rational decision making suggests that the consumer should compare the utility of the innovation against that of the entrenched alternative and, if positive, adopt the innovation, and if not, reject it. But while relative advantage should play a critical role in the adoption of an innovation, Rogers (1995) and others (Cooper 2000; Urban and Hauser 1993) make it clear that it is the perceived relative advantage, not the actual relative advantage, that matters. Unfortunately, they largely leave unexplored the question of what drives perception. Reference dependence and loss aversion offer an answer. In particular, the work of Kahneman and Tversky (1979; Tversky and Kahneman 1991) suggests that consumers have an almost universal behavioral response to the opportunities they face, two characteristics of which are:

- **Reference Dependence:** The attractiveness of any alternative is assessed not by its objective utility but by its subjective value relative to some salient reference point. This reference point is often a person's current state of being. Improvements relative to this reference point are viewed as “gains,” and shortcomings are viewed as “losses.”
- **Loss Aversion:** Consumers do not treat comparably sized gains and losses the same. Rather, losses loom larger than gains. As a consequence, a loss has a greater negative impact than a similarly sized gain has a positive impact.

These behavioral tendencies have since been used to explain framing effects (Kahneman and Tversky 1984), the endowment effect (Thaler 1980), the status quo bias (Samuelson and Zeckhauser 1988), time-inconsistent preferences (Hoch and Loewenstein 1991), and asymmetric patterns of brand switching (Bronnenberg and Wathieu 1996; Hardie, Johnson, and Fader 1993).

**The endowment effect**

Perhaps the most revealing of these phenomena is the endowment effect (Kahneman, Knetsch, and Thaler 1991; Thaler 1980). Researchers have long noticed that individuals demand far more to give up a good than they are willing to pay to obtain that good. Thaler (1980) tied such behavior to reference dependence and loss aversion, arguing, “goods that are included in the individual’s endowment will be more highly valued than those not held in the endowment . . . this follows because removing a good from the endowment creates a loss while adding the same good . . . generates a gain” (p. 44).

In one well-replicated demonstration of the effect, Kahneman, Knetsch, and Thaler (1990) gave coffee mugs to one randomly chosen group of students. These students, the Sellers, were each asked to indicate whether they would be willing to sell their mug at each of a series of prices ranging from $0.25 to $9.25. Another group of students, the Choosers, were not given mugs, but at each of the same price points, they were asked to indicate whether they would
choose the mug or the specified amount of money. Objectively, the Sellers and the Choosers were in the same position—deciding between the mug and some amount of money. However, in one replicate of this study, the median valuation of the mug was $7.12 for the Sellers but only $3.12 for the Choosers. In another replicate, the respective median valuations were $7.00 and $3.50. The average seller, who was endowed with a mug, demanded two times more to give up a mug than the average Chooser was willing to spend to obtain it.

Analogous results were obtained by Loewenstein (1988), where the compensation demanded to delay the reception of a good ran two to four times the willingness to pay to speed up the reception of that good. And a survey of 1,500 residential customers of the Pacific Gas and Electric Company found that customers demanded three to four times more to endure a power outage than they were willing to pay to avoid such an outage (Hartman, Doane, and Woo 1991).

The status quo bias
One consequence of the endowment effect is the status quo bias (Samuelson and Zeckhauser 1988), “the strong tendency to remain at the status quo, because the disadvantages of leaving it loom larger than the advantages” (Kahneman, Knetsch, and Thaler 1991).

Examples of the status quo bias are plentiful (Hartman, Doane, and Woo 1991; Knetsch and Sinden 1984; Thaler 1980). Knetsch (1989), for instance, gave students in one group a choice between a coffee mug and a large bar of Swiss chocolate. Students in a second group received a coffee mug, but were each allowed to exchange their mug for a chocolate bar a short while later. Students in a third group were given the chocolate bar, and later allowed to exchange it for the mug. Of those in the choice condition, 56% chose the mug and 44% chose the chocolate bar, indicating a fairly even distribution of preferences across the two products. This suggests that about half of those originally given the mug should have traded for the chocolate bar, and half of those given the chocolate bar should have traded for the mug. This was not the case—only 11% of those given a mug opted to trade for a chocolate bar, and only 10% of those given a chocolate bar opted to trade for a mug.

In the lab, Samuelson and Zeckhauser (1988) found a similar tendency to stick with the status quo in domains ranging from investment decisions to automobiles to job choice. In their field research, they found evidence of the status quo bias in Harvard University employees’ choice of healthcare coverage and in their choice of TIAA/CREF retirement investments.

Generalizations
Several aspects of this research are worth noting. First, the effects of reference dependence and loss aversion are robust, with highly consistent results obtained across time, populations, and product categories. Repeatedly, individuals systematically overweight losses relative to gains.

Second, these effects are almost instantaneous. In the space of a single class period, Knetsch (1989) and Kahneman, Knetsch, and Thaler (1991) were able to shift a subject’s status quo to include a coffee mug or a chocolate bar. Third, these effects seem to intensify over time (Strahilevitz and Loewenstein 1998). While Kahneman, Knetsch, and Thaler (1991) found the magnitude of loss aversion to be about two when a student was endowed with a coffee mug for a short while, the magnitude of loss aversion appears to increase to about four when individuals possess a good for any length of time (Hartman, Doane, and Woo 1991; Strahilevitz and Loewenstein 1998). For the purposes of our framework, we will assume the magnitude for loss aversion to be about three.

Third, individuals seem oblivious to the systematic and significant impact of these effects, even to the point of defensiveness (Samuelson and Zeckhauser 1988; Van Boven, Dunning, and Loewenstein 2000). As Samuelson and Zeckhauser (1988) report, “In the debriefing discussions following the experiments, subjects
expressed surprise at the existence of the [status quo] bias. Most were readily persuaded of the aggregate pattern of the behavior . . . but seemed unaware (and slightly skeptical) that they personally would fall prey to this bias” (p. 9).

Modeling Innovation Adoption

We now use loss aversion and reference dependence to explain the market failure of innovative new products. In particular, we offer a conceptual framework that has three components. First, highly innovative products, by their nature, often demand tradeoffs or behavior change on the part of consumers. One gives up (i.e., loses) certain benefits to obtain (i.e., gain) other, presumably greater, benefits. Second, consumers will evaluate an innovation from the perspective of the entrenched alternative. Given loss aversion, this implies consumers will see far less value in an innovation relative to the entrenched alternative than an objective analysis would suggest. Third, developers will tend to evaluate the relative merits of their innovation from the perspective of that innovation. Again, given loss aversion, developers will see far more value in the innovation relative to the entrenched alternative than an objective analysis would suggest.

These three components are captured in Figure 1. If there exists an entrenched alternative, \( x \), characterized on two dimensions by \( x_1 \) and \( x_2 \), and there exists an innovation, \( y \), characterized on the same two dimensions by \( y_1 \) and \( y_2 \), then the tradeoffs or “degree of behavioral change” required in the adoption of the innovation is captured by the gains (e.g., \( y_2 - x_2 \)) and losses (e.g., \( x_1 - y_1 \)) inherent in moving from \( x \) to \( y \). For simplicity, let us assume that these two options offer comparable net benefits such that a consumer not initially endowed with either alternative would be indifferent between the entrenched alternative and the innovation, as reflected in the dotted indifference line passing through the two options.

However, in our framework, the consumer and the developer are endowed. Moreover, they are differentially endowed. Consider the consumer who is naturally endowed with the entrenched alternative. Their valuation of any option in this product space is captured by an indifference curve kinked at \( x \), reflecting loss aversion with respect to \( x \). Specifically, options that fall above and to the left of \( x \) involve a gain on dimension 2, but a more heavily weighted loss on dimension 1, resulting in the steep indifference curve shown. At the same time, options that fall below and to the right of \( x \) involve a gain on dimension 1, but a more heavily weighted loss on dimension 2, resulting in the flat indifference curve in this region. The result is the kinked indifference curve shown (for a more detailed discussion of this argument, see the Appendix).

Now consider the developer who, we argue, tends to be endowed with their innovation. The result is a similarly kinked indifference curve, but now with the inflection point at \( y \), reflecting loss aversion relative to their innovation.
Therefore, whereas the entrenched alternative and the innovation offer comparable economic benefits to an objective, unendowed individual, the consumer will view the entrenched alternative as far superior to the innovation, and the developer will view the innovation as far superior to the entrenched alternative. We now explore these three components more closely.

Behavior change inherent in an innovation
Researchers have long differentiated between less-innovative and more-innovative products, variously categorizing less-innovative products as continuous or sustaining, and more-innovative products as discontinuous, breakthrough, or “new to the world” (Moore 1999; Rogers 1995; Urban, Weinberg, and Hauser 1996). However defined, the former typically represent incremental improvements upon existing products, while the latter tend to revolutionize existing product categories or define new product categories (Urban, Weinberg, and Hauser 1996). Not surprisingly, research suggests that the failure rate for more-innovative products is significantly greater than for less-innovative products (Golder and Tellis 1993; Urban and Hauser 1993).

The first important factor in our framework is the behavior change inherent in such an innovation. Highly innovative products often require consumers to change the way they do things (Moore 1999; Moreau, Lehmann, and Markman 2001; Rogers 1995). More precisely, the adoption of a highly innovative new product often involves tradeoffs, i.e., gaining highly desirable product features not previously available and losing certain other product features that are particular to the entrenched alternative. This could involve benefits, where new benefits are obtained, but some old benefits are sacrificed. With Webvan, for instance, consumers gain the convenience of not having to leave home to buy groceries, but they sacrifice anonymity and the ability to cherry-pick the best cuts of meat. It could also involve costs, with reduction or elimination of some costs inherent in the entrenched alternative, but new costs incurred with the innovation. For instance, Webvan eliminates travel time, but consumers must wait for delivery of the groceries. As reflected in Table 1, many highly innovative products have this gain-versus-loss dynamic.

The perspective of the consumer
The second component of our framework is the consumers’ valuation of the innovation relative to the entrenched alternative. How should such a valuation take place? One might expect a consumer to compare the economic utility of the innovation against that of the entrenched alternative and, if positive, adopt the innovation. If traditionally recognized switching costs are a concern, such as learning or transaction costs, they can be incorporated into this analysis. And if risk aversion or uncertainty is an issue, it too can be incorporated into the model. In the end, one should have an incentive to adopt any new product that offers a net economic benefit relative to the entrenched alternative.

But reference dependence and loss aversion preclude such an analysis. We suggest that the vast majority of consumers are endowed with the entrenched alternative and, as a result, assess an innovation in terms of gains and losses relative to that entrenched alternative. Surely, a lifetime of driving a gasoline-powered car, listening to AM/FM radio, and shopping at the local A&P Supermarket will lead the typical consumer to view these familiar options as the status quo. As such, the benefits sacrificed in switching to the innovation will loom larger than the benefits

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<td>Home delivery</td>
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<td>Satellite radio</td>
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</table>
gained. Indeed, if we assume that the impact of a loss outweighs a comparably sized gain by a factor of three, as research suggests it might (Hartman, Doane, and Woo 1991; Kahneman, Knetsch, and Thaler 1991; Strahilevitz and Loewenstein 1998), the benefits sacrificed will dominate the benefits received, and any new costs will loom larger than the old costs now being avoided—also by a factor of three. The result is the indifference curve kinked at $x$ in Figure 1.

In other words, if $V(\text{Innovation})$ captures the perceived value of the innovation, $y$, for a neutral or unendowed consumer, and $V(\text{Innovation} \mid \text{Entrenched})$ captures the perceived value of that same innovation, $y$, conditional on being endowed with the entrenched alternative, $x$, then

$$V(\text{Innovation} \mid \text{Entrenched}) < V(\text{Innovation}).$$

In other words, given the behavior change inherent in a highly innovative new product, the valuation of that innovation will be far lower for a consumer currently endowed with the entrenched alternative than for the neutral or unendowed consumer.

This is captured graphically in Figure 2. If we again assume the innovation, $y$, and the entrenched alternative, $x$, offer comparable utility to the unendowed or objective consumer, reflected by the dotted indifference curve, the endowed consumer will overvalue $x$ relative to $y$ by the amount $\alpha$. Further, while any innovation falling within the shaded area would offer an objective improvement over the entrenched alternative, the endowed consumer would reject that innovation as a less attractive offering than the existing option. It is helpful to note that the perceived shortfall of the innovation, $\alpha$, will monotonically increase with the amount of behavior change required of potential adopters, i.e., the greater the tradeoffs as graphically measured by the diagonal distance between $x$ and $y$, the greater the undervaluation of the innovation on the part of consumers.

The perspective of the developer

The third component of our framework is the developer’s valuation of the innovation. In contrast to consumers, who come to view the entrenched alternative as the status quo, we argue that developers come to view the innovation as the relevant standard of reference, resulting in an indifference curve kinked at the innovation, $y$, as shown in Figure 1.

Behavioral research on adaptation (e.g., Helson 1964) and endowment (e.g., Thaler 1980; Kahneman, Knetsch, and Thaler 1990) suggests that developers, as individuals who have conceptualized, developed, and internally marketed their new-to-the-world product over a period of many months, if not years, will come to view their innovation as the status quo. If a subject’s reference point can shift to include a chocolate bar (Kahneman, Knetsch, and Thaler 1990), the color of a car (Samuelson and Zeckhauser 1988), or a bag of potato chips (Hoch and Loewenstein 1991) in as little as a few moments, a developer’s reference point can shift to include an innovation they have labored over for an extended time.
period. Thus, the management team at Webvan would come to view online grocery shopping as the option of choice, and the engineers behind Segway almost certainly would come to view personal transportation devices as a reality. We give these individuals names like “visionaries,” “product champions,” and “believers,” suggesting that they envision and believe in a world the average consumer has yet to embrace.

Several problems arise from this “developer’s perspective.” First, in the same way that the typical consumer overvalues the entrenched alternative due to loss aversion, developers come to overvalue their innovations due to loss aversion. If \( \alpha \) in Figure 2 represents the perceived shortfall of the innovation for the typical consumer, then \( \beta \) in Figure 3 represents the perceived superiority of the innovation for the typical developer. In particular, while an unendowed assessment would find the existing alternative, \( x \), and the innovation, \( y \), to be objectively comparable, the developer will perceive the innovation to be superior to any alternative falling within the shaded area. Further, the magnitude of this perceived superiority, \( \beta \), again will monotonically increase with degree of behavior change.

Alternatively, if \( V(Innovation) \) again captures the perceived value of the innovation, \( y \), for a neutral or unendowed consumer and \( V(Innovation | Innovation) \) now captures the perceived value of that same innovation conditional on being endowed with the innovation, then

\[
V(Innovation) < V(Innovation | Innovation),
\]

with the developer valuing the innovation more than an objective, unendowed assessment would suggest is reasonable.

Second, developers are not likely to realize that their valuation of the innovation differs from that of the consumer. Just as researchers have found subjects unaware of the effects of endowment on preferences (Samuelson and Zeckhauser 1988; Van Boven, Dunning, and Loewenstein 2000), even to the point of defensiveness, so we would expect developers to be unaware of the impact of endowment on themselves or the consumers they seek to serve.

Research on “the curse of knowledge” supports this view (Birch and Bloom 2003; Camerer, Loewenstein, and Weber 1989; Kelley and Jacoby 1996), finding that people have difficulty recalling their state of mind when they were naive. As noted by Heath (2003), “… once people know some piece of information, they find it hard to imagine what it was like before they knew it” (p. 26). In one vivid demonstration of the phenomenon (Newton 1990), a researcher presented one group of subjects, the Tappers, with 25 well-known songs and asked them to tap out the rhythm of each song. As they did so, other subjects, the Listeners, were asked to identify the song based on the taps. When the Tappers were asked to predict the percentage of songs Listeners would be able to identify, the mean prediction was 50%. In reality, Listeners were able to identify only about
3% of the songs correctly, with the remaining songs coming across as nothing more than a series of random taps.

More broadly, when predicting the judgments and choices of others, the curse of knowledge suggests that we are unable to ignore what we believe to be true. Thus, we overestimate the probability that others will solve a puzzle once we know the answer to that puzzle (Kelley and Jacoby 1996; Nickerson, Baddeley, and Freeman 1987), we overestimate the likelihood that others will find a hidden item once we know the location of that item (Birch and Bloom 2003), we overestimate a person’s ability to classify a statement as sarcastic once we know it to be sarcastic (Keysar 1994), and we expect a person to be better at predicting a company’s earnings if we know what those earnings are (Camerer, Loewenstein, and Weber 1989). In the current context, the curse of knowledge implies that developers will expect others to see the value in their innovations that they themselves see.

One might argue that a simple solution to this dilemma is to ask consumers what they want—i.e., to actively obtain the consumers’ perspective. Unfortunately, for highly innovative products, such advice might fall short, because “... while marketing research is usually good to find the preferences for existing products, it is not very good to determine the potential for completely new products” (Goldenberg 2003, p. 40). Similarly, a founder of one highly successful high-tech company argued that successful innovation stems from anticipating consumer needs rather than responding to consumer wants or demands (Lassiter 1998). And in the case of truly disruptive innovations, Christensen (1997) argues, “... blindly following the maxim that good managers should keep close to their customers can sometimes be a fatal mistake” (p. 4).

At the very least, the issue of whether and when developers should listen to consumers is still in question (Zhou, Yim, and Tse 2005).

The integrated view

The extant literature identifies a host of explanations for new product failure—linking failure to inherent qualities of the product, to the consumer, or to the developer. We build upon these three entities, but argue that it is the interplay among them that greatly and systematically impacts innovation adoption. Structurally, the “curse of innovation” can be captured as

\[ \text{V(Innovation | Entrenched) < V(Innovation) < V(Innovation | Innovation)} \]

with \( \text{V(Innovation)} \) capturing the objective, unendowed assessment of the innovation, \( \text{V(Innovation | Entrenched)} \) capturing the assessment of that same innovation by a consumer currently endowed with the entrenched alternative, and \( \text{V(Innovation | Innovation)} \) capturing the assessment of that innovation by a developer psychologically endowed with the innovation.

This framework leaves us with at least two compelling phenomena. First, consumers often will reject innovations that an objective analysis suggests would make them better off. Second, developers often will be at a loss to anticipate this rejection. Indeed, we have developers, who irrationally overvalue their innovation, predicting the behavior of consumers, who irrationally undervalue that same innovation. In light of such dynamics, perhaps it’s no surprise that innovative new products so often fail to gain marketplace acceptance.

The Moderating Role of Behavior Change

To this point, an underlying assumption driving our theoretical framework has been that highly innovative products demand behavior change on the part of consumers and developers. We now relax this assumption and argue that it is critically important to differentiate between product change and behavior change, two concepts often linked in the literature (c.f. Moore 1999; Rogers 1995; Urban, Weinberg, and Hauser 1996).
Product innovation versus behavior change
Toward this end, we simultaneously capture the “degree of product innovation” and “degree of behavior change” inherent in any innovation, as shown in Figure 4.

First, researchers have noted that innovations vary in their “degree of innovativeness,” or the change in the underlying technology, with lower levels of change characterized as incremental innovation and higher levels of change being characterized as radical innovation (c.f. Wheelwright and Clark 1992). When it comes to highly innovative goods, firms can create value for consumers by radically changing the way the product or process works. While the internal combustion engine converts gasoline to energy, a fuel cell converts hydrogen to energy, virtually eliminating toxic pollutants. While film cameras capture analog images, digital cameras capture 0’s and 1’s, greatly increasing the ease of editing pictures. And while FM radio employs transmission towers, XM Radio employs orbiting satellites, resulting in coast-to-coast reception. These innovations create great value by changing the workings of the underlying product—the greater the product change, the greater the potential for a breakthrough product. As a result, firms often strive for radical product change, as reflected in the horizontal arrow in Figure 4.

Second, innovations often necessitate behavioral change or tradeoffs of the person doing the adopting. Individuals must change how they refuel their car, how they develop pictures, and how they listen to the radio. As we have argued, these behavioral changes drive the “curse of innovation,” which leads those who have accepted or embraced the innovation, such as developers, insiders, and investors, to see more value in an innovative product than an objective assessment would suggest. It also leads those who have yet to encounter the innovation, such as the typical consumer, to see less value than an objective assessment would suggest.

Critically, however, highly innovative products need not demand significant behavior change, as has often been assumed. Rather, some innovations are easily integrated into current customer behavior and require minimal tradeoffs. For instance, while we would argue that a pure-electric vehicle (e.g., GM’s EV1) and a hybrid-electric vehicle (e.g., Toyota’s Prius) both entail a very high “degree of product innovation,” we also would argue that a pure-electric vehicle requires significantly greater behavioral change (e.g., recharging the car, limiting driving distance) than a hybrid-electric vehicle, which looks and feels very much like any other car on the road.6

More broadly, the magnitude of the tradeoffs inherent in an innovation moderates the curse of innovation. When minimal behavioral tradeoffs are required, consumer and developer should have much the same perspective on the relative merits of an innovation. But when significant behavioral tradeoffs are required, the consumer and developer should hold significantly different perspectives on the merits of that innovation. Thus, firms would benefit from minimizing behavior change, as reflected in the downward arrow in Figure 4.
Managerial Implications

Having painted a rather bleak picture of likely innovation adoption, we now offer a set of strategies for managing and enhancing that adoption. To start, managers must understand where their innovations currently fall in the 2 (product change) x 2 (behavior change) matrix just outlined, for each cell has distinct implications for the likelihood and timing of product adoption. We capture these four cells in Figure 5 and describe them as follows:

- **Tinkering**—limited technological improvements over the entrenched alternative and little to no required behavior change. Examples would include toothbrushes with angled heads, cars whose gasoline engines improve mileage by 5%, and enhancements of well-known foods (e.g., Double Stuf Oreo cookies). Adoption is likely, but the benefits to the consumer and the firm tend to be limited. Most new products fall into this cell (Booz, Allen and Hamilton 1982).

- **Death**—small technological improvements over the entrenched alternative, but requiring significant behavior change. The Dvorak keyboard, touted to (modestly) increase typing speed over the QWERTY keyboard, but at tremendous behavior change, falls into this cell. Adoption is highly unlikely.

- **Long Haul**—great technological change and great behavior change. Many highly innovative products we now take for granted, such as the telephone and the automobile, fall into this cell. Current examples might include satellite radio and TiVo, which are only beginning to gain critical mass. Adoption here will be quite gradual—the objective benefits are great, but resistance to change is equally great.

- **Home Run**—great technological change and limited behavior change. A good example is Google. By changing its search engine’s underlying search algorithm without changing the familiar user interface, Google was able to quickly attract users by offering far superior results. Holding all else constant, adoption should be rapid in this cell.

Having assessed the product changes and behavior changes inherent in an innovation, firms are left with the question of what to do with that assessment. Two broad sets of strategies emerge: (1) accepting and managing the underlying resistance to change and (2) proactively minimizing that resistance.

**Accepting resistance to change**

For many highly innovative new products, behavior change may be unavoidable. The telephone changed how we interacted with others, the automobile changed how we dealt with distance, and the personal computer changed the way we measured work productivity. For these technologies, behavior change was inevitable, forcing firms to accept and manage the resulting consumer resistance.

**Manage for the Long Haul.** Perhaps the simplest strategy for dealing with consumer resistance is for the firm to accept that resistance and brace for the slow adoption that is inherent in the “long haul.” Moore’s (1999) serial recommendations of “crossing the chasm,” “building a beachhead,” and gradually gaining traction with the early majority apply here. To be successful with such a strategy, however, a firm must anticipate a drawn-out adoption process and manage accordingly.
Consider the case of TiVo. Both DVD players and TiVo hit the market in the late 1990s. Yet, while 80 million DVD players have been purchased in the United States through early 2005, only about 3 million TiVo units have been purchased. At one level, this is curious, for while both devices are highly innovative, the incremental value of a DVD player may be less than that of TiVo. In particular, a DVD player performs many of the same functions a VCR already performs reasonably well (e.g., playing rented media), whereas a TiVo device performs functions that the VCR performs poorly (e.g., recording) or not at all (e.g., pausing live television). Yet, given consumers’ comfort with devices that play rented media and employ CD-like disks, a DVD player fits seamlessly into the everyday behavior of most consumers. In contrast, TiVo, with its “pause live TV” and its “proactive recording of shows it thinks viewers will like” alters the way viewers think about and watch television. The net result is that very little behavior change is required to adopt a DVD player, but significant behavior change is required to appreciate and adopt a TiVo.

How is this knowledge helpful? To optimally market a product, a firm must accurately anticipate the likely rate of product adoption. If a firm anticipates slow adoption and experiences rapid adoption, an opportunity is missed, and competitors have a chance to gain market share. If a firm anticipates rapid adoption and actually experiences slow adoption, however, the firm risks burning through its financial resources too quickly. We would argue that this is what TiVo has done, spending well over $500 million to quickly build and market a product that may very well be a “long haul” innovation.

The 10X Improvement. Alternatively, a firm could strive for the brute-force method of fostering adoption by making the innovation’s relative benefits so great that they overcome any overweighting of potential losses. The spirit of such a strategy is captured by Intel’s Andy Grove, who argues that, to be rapidly and widely adopted, a new product has to offer a tenfold improvement over the incumbent alternative (Grove 2003). This is evident in medicine, where angioplasties offer an order-of-magnitude improvement over bypass surgeries and where MRIs offer a similar improvement over traditional X-rays. In such cases, by making the relative benefits of the innovation overwhelmingly, the tradeoff favors the innovation over the entrenched alternative, even given the overweighting of losses relative to gains.

Eliminate the Old. Finally, in light of anticipated consumer resistance, a firm can try to eliminate the incumbent alternative. In few places would the logic of elimination have been more compelling than in the United States Mint’s handling of the dollar coin. After the marketplace failure of the Susan B. Anthony dollar coin in 1979, the U.S. Mint reasoned that the Anthony dollar looked and felt too much like the Washington quarter to succeed. Twenty years later, in 1998, it released the gold-toned, smooth-rimmed Sacagawea dollar coin. Once again, the result was disappointing—while over 1.3 billion Sacagawea dollar coins have been minted, only a fraction are in active circulation. At the same time, the U.S. Mint has steadfastly refused to withdraw the dollar bill from circulation. As a result, consumers continue to favor the dollar bill, with its 18-month life span, as opposed to the dollar coin, with its 30-year life span.

To appreciate how things might have been different, one merely needs look north. In 1987, the Canadian Mint introduced a gold-colored dollar coin—the “loonie.” Unlike the United States Mint, however, the Canadian Mint removed the one-dollar bill from circulation. Nine years later, it did the same with the two-dollar bill, introducing the “toonie.” Today, both coins are well accepted and widely used units of currency throughout the country.

Admittedly, many firms do not have the option of “eliminating the old,” for they do not control access to the entrenched alternative. However, regulatory agencies can and do play a significant role in this regard. With automobiles, for
instance, groups such as the California Air Resource Board and the U.S. Environmental Protection Agency can foster the adoption of highly innovative vehicles by legislatively restricting or taxing the sale of more traditional gasoline-powered cars. Similarly, health maintenance organizations (HMOs) and Medicare have some control over the adoption of drugs and medical procedures through their powers of reimbursement. While not explicitly “eliminating the old,” such influences can have a remarkably similar effect.

Minimizing resistance to change

For other firms, the “long haul” is decidedly unattractive, innovations that offer tenfold improvements are rare, and there is little ability to restrict the entrenched alternative, highlighting the need for minimizing, as opposed to accepting, consumer resistance.

Make It Behaviorally Compatible. The first option a firm can pursue is to proactively manage the behavior change required of an innovation. In particular, a firm could reduce or eliminate the behavior change required of consumers and, in doing so, try to move from “long haul” to “home run.”

Such a strategy is now playing out with hybrid electric vehicles (HEVs), such as the Toyota Prius, Ford Hybrid Escape, and Honda Hybrid Civic. In contrast to the long-pursued electric car, which limits both driving range and power and requires recharging at night, an HEV provides a driver with both a traditional internal combustion engine and an innovative, self-charging electric engine, rendering a consumer experience virtually identical to that of a gasoline-only car. These vehicles boost gas mileage by as much as 100%, yet few benefits are sacrificed, and only limited costs are incurred. While demand is still building for such vehicles, the hybrid electric vehicle is the first alternative-fuel technology to truly gain traction among the driving public and automobile makers, with Toyota expecting to sell over 100,000 of its hybrid Prius models in 2005 (Dawson 2004; Koerner 2005). Conversely, American manufacturers are now being criticized for the timidity with which they have developed such vehicles (Dawson 2004; Kerwin 2003).

This strategy of minimizing behavior change has not been lost on others in the auto industry. In January 2005, for instance, BMW announced that it was developing a fuel-cell vehicle with a small gasoline engine (Port 2005). Should the fuel-cell engine run out of hydrogen fuel, a driver needs merely to switch over to the gasoline engine. As a result, the car will offer all of the benefits of cleaner-burning hydrogen without requiring drivers to alter driving behavior when refueling stations are unavailable. The vehicle’s design suggests that BMW understands the importance of minimizing behavior change and is purposefully developing a product that seeks to do just that.

Seek Out the Unendowed. Alternatively, a firm could seek out consumers who are not currently endowed with any alternative. The snowboard industry has been adept in this strategy, capturing individuals who have yet to establish themselves as skiers. To date, the result has been a noticeable age delineation between snowboarders and skiers. Those under 20 years old are much more likely to snowboard than ski, and those over 35 are much more likely to ski than snowboard.

One hundred years ago, seeking out the unendowed was the masterstroke of George Eastman (Tedlow 2001; Utterback 1994). Rather than target professional photographers and serious amateurs with his first Kodak camera in 1888 and then his Kodak Brownie camera in 1900, he marketed his innovations to first-time buyers. In doing so, he was encouraging new behavior among nonusers rather than trying to change entrenched behavior among existing users. While the former was a challenge, the latter proved virtually impossible. In fact, professional photographers and serious amateur photographers came to resent Eastman’s cameras, largely because they offered a set of bene-
fits they had learned to live without (e.g., ease of use, convenience) and sacrificed a set of benefits that had become part of their status quo (e.g., exclusivity, prestige).

**Find Believers.** Finally, a firm can always seek out consumers that either greatly value the benefits to be gained or lightly value the benefits to be given up. Such a strategy is captured in Christensen’s concept of a “disruptive technology,” where a technology initially gains traction in a small segment of the marketplace (Christensen 1997). In the case of fuel-cell vehicles, for instance, a firm quite obviously could target consumers who are environmentally conscious. Less obviously, it could target consumers for whom access to a central refueling station is not overly restrictive. Consider the island community of Bermuda, where an entire day’s travel might take a car owner no more than 10 miles from the center of town. In such a place, a broad network of gas stations may be valued far less and emission-free transportation far more than in geographically dispersed locales, making the subsequent tradeoff attractive even after consumers’ biased assessment of gains and losses. Not surprisingly, for many of these same reasons, the island nation of Iceland is at the forefront of developing a fuel-cell society.

**Summary and Conclusions**

By many estimates, new products fail to gain marketplace acceptance at least half the time, with highly innovative new products failing more often than that. Surely, these products fail for a host of reasons. Some are offered by firms that lack the expertise, resources, or commitment to see the product through to success, while others lack an objective net benefit, offering too few benefits for too great a cost. But even when supported by well-intentioned firms and even when offering objective improvements over existing alternatives, the success of an innovative new product is far from certain.

In this paper, we have offered a behavioral framework to help explain such failures. This framework begins with the behavior change inherent in many an innovation and the resulting biases that such changes bring about in both consumers and developers. Given that the psychological valuation of any alternative is prone to loss aversion from a salient reference point, we argue that both consumers and developers are biased in assessing the relative benefits of any innovation that entails behavior change. As a result, consumers fail to see the value that developers perceive, and developers fail to see consumers’ hesitancy to adopt. This is the “curse of innovation.”

In turn, we have recommended strategies for dealing with this curse, ranging from acceptance of behavior change to the proactive minimization of that change. In the end, understanding the tradeoffs a product requires of both consumers and developers and the biases such tradeoffs induce is necessary if a developing firm is to improve its chances at marketplace success.

**Appendix**

Consider two alternatives, $x$ and $y$, that differ on two dimensions, as reflected in Figure A. Loss aversion implies that an individual who is indifferent between $x$ and $y$ at reference point $t$ will prefer $x$ from reference point $t'$ and $y$ from reference point $t''$ (Bronnenberg and Wathieu 1996; Hardie, Johnson, and Fader 1993; Tversky and Kahneman 1991). To see this, first consider reference point $t$. Relative to $t$, $x$ and $y$ offer gains on both dimensions. And given the person’s indifference between $x$ and $y$ when at reference point $t$ (i.e., $U_t(x) = U_t(y)$), his valuation of an increase in dimension 1 should be approximately equal to his valuation of an increase in dimension 2. For argument’s sake, assume the tradeoff is 1:1.

Now consider reference point $t'$. Relative to $t'$, alternative $x$ offers a gain on both dimensions, while alternative $y$ offers a gain on dimension 2, but a loss on dimension 1. With losses looming larger than gains, this implies that the person will prefer $x$ to $y$ when at reference point $t'$ (i.e., $U_{t'}(x) > U_{t'}(y)$). Similarly, relative to $t''$, alternative $y$ offers a gain on both dimensions, while alternative $x$ offers a gain and a loss. Again, with losses looming larger than gains, this implies a preference for $y$ over $x$ from reference point $t''$ (i.e., $U_{t''}(x) < U_{t''}(y)$).
With several simplifying assumptions, this framework can be axiomatized as an additive utility model with constant loss aversion (see Tversky and Kahneman 1991). Specifically, if an alternative \( x \) is defined on two attributes, \( x_1 \) and \( x_2 \), then the utility function relative to reference point \( r \) can be written as

\[
U_t(x) = u_t(x_1) + u_t(x_2)
\]

with

\[
u_t(x) = \begin{cases} 
    u(x_j) - u(r_j) & \text{if } x_j \geq r_j \\
    \lambda_j [u(x_j) - u(r_j)] & \text{if } x_j < r_j
\end{cases}
\]

where \( \lambda_1 \) and \( \lambda_2 \) are the coefficients of loss aversion for attributes \( x_1 \) and \( x_2 \). If no loss aversion exists, then \( \lambda_1 = \lambda_2 = 1 \) and the above formulation collapses to a standard additive utility model. This results in a series of parallel indifference curves, as reflected on the left side of Figure B. In this case, losses and gains are weighted equally, and one’s assessment of an alternative is independent of one’s reference point, \( r \).

However, if loss aversion is relevant, then \( \lambda_1 > 1 \) and \( \lambda_2 > 1 \), and the reference point from which any alternative is evaluated matters greatly. Consider the case where losses outweigh gains by three to one (i.e., \( \lambda_1 = \lambda_2 = 3 \)), as research suggests is often the case (Hartman, Doane, and Woo 1991; Kahneman, Knetsch, and Thaler 1990; Loewenstein 1988). We now are left with the set of indifference curves on the right side of Figure B. Relative to one’s reference point \( r \), one can divide a two-attribute space into four quadrants. The upper right quadrant represents improvements on both dimensions relative to \( r \), while the lower left represents losses on both dimensions relative to \( r \). As such, the indifference curves in both quadrants reflect an even tradeoff on the two dimensions.

In contrast, relative to \( r \), the upper left and lower right quadrants represent a gain on one dimension and a loss on the second relative to \( r \). Specifically, an individual at reference point \( r \) would require a three-unit increase on dimension 2 to compensate for a one-unit decrease on dimension 1. In contrast, this same individual would require a three-
unit increase in dimension 1 to compensate for a one-unit decrease in dimension 2. The result is a series of kinked indifference curves, reflecting loss aversion and reference dependence.

Notes

1. Later in this paper, we consider the moderating role of “degree of behavior change” on innovation adoption.

2. By “objectively,” we refer to the utility maximizing choice one would make if not subject either to reference dependence or to loss aversion. Alternatively, one can think of the “objectively” best choice as the choice one would make if not currently endowed with any alternative, even after controlling for switching costs.

3. Yet, by one estimate, only about 35% of new products that enter product development are ever commercialized (Booz, Allen and Hamilton 1982).

4. If the magnitude of loss aversion is about two, it means that losses outweigh comparably sized gains by about 2 to 1.

5. We chose two dimensions for simplicity, but the frame-work can easily be applied to any number of dimensions without loss of generality.

6. In fact, one could argue that the hybrid electric vehicle represents a greater degree of product innovation. While the pure-electric vehicle has a single engine, the hybrid vehicle has two engines—one electric and one gasoline—with added technology to draw power from one or both of the engines as driving conditions change.

7. One might argue that the dollar coin has failed not because of “gains and losses,” but because it offers little value to consumers. Yet consider the following thought experiment: Would you prefer a quarter coin to a “quarter bill”? If not, why is the dollar bill preferable to the dollar coin, but the quarter coin preferable to the quarter bill? Our answer is that we have grown used to both the dollar bill and quarter coin, and to give up either would be viewed as a loss.

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