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Using behavioral economics to accelerate consumer adoption

By Derek M. Pankratz, Philipp Willigmann, Sarah Kovar, and Jordan Sanders
Illustration by Traci Daberko

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Framing the future of mobility

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THE USER ADOPTION HURDLE

THE extended automotive industry is in the early stages of a potentially transformative evolution, one in which today's personally owned, driver-driven vehicles will likely travel alongside shared and self-driving cars. Incumbent players and new entrants are working hard to make that shift a reality, investing billions in developing autonomous driving systems and shared mobility platforms.[1] Governments at all levels are mulling over how to regulate a highly transformed transportation landscape, while also encouraging innovation. For many advocates of the future of mobility, the expected societal benefits of these changes are self-evident: less congestion, lower emissions, greater efficiency, lower costs, and—most compelling—saved lives.[2]

But even if we accept the advantages, the speed with which this future vision arrives likely hinges not only on technological and regulatory advances, but also on how quickly consumer expectations and behavior shift. How we get from point A to B is ultimately an individual, rather than a collective, choice that is influenced by a multitude of factors, from the obvious (cost, convenience) to the obscure (perceived prestige, peer pressure). Just because a new technology offers benefits "on paper" does not mean customers will ultimately embrace it. This is especially true with something as deeply ingrained in our individual and collective consciousness as the automobile. For many, owning and driving a car is a rite of passage and a symbol of freedom and prestige—reinforced by decades of advertising—and, in the United States at least, consumers may rebel against this perceived erosion of the American dream.

In this article, we explore how limitations in human cognition can lead us to delay or forego adopting a new technology (in this case, shared and autonomous vehicles), even if that technology provides demonstrable individual and collective benefits. While research in behavioral economics and social psychology has revealed deep and consistent biases that can lead to suboptimal choices, it has also uncovered ways to potentially overcome these mental limitations. By constructing choices and framing new mobility options in ways that encourage adoption, companies, governments, nonprofits, and others can help ensure that the future of mobility arrives sooner rather than later.

THE PROMISE OF THE FUTURE OF MOBILITY

A SERIES of converging trends, both technological and social, seem poised to dramatically reshape the ways that people and goods move about. In particular, the confluence of shared, on-demand transport via ridesharing and carsharing and the development of fully autonomous vehicles could transform the nature of mobility. The implications of this shift are potentially profound, affecting not only the automotive industry but also insurers, lenders, technology companies, telecom providers, energy suppliers, and governments at all levels.[3]

There could be a myriad of profound societal benefits as well. Traffic congestion could ease as autonomous vehicles safely follow one an-

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other, inches apart, and fluidly navigate intersections.[4] Electric powertrains coupled with lighter, more efficient cars promise to improve air quality and reduce energy consumption.[5] Autonomous vehicles could eliminate many of the roughly 90 percent of vehicle accidents caused by human error, which, in the United States, contributes to approximately 30,000 traffic deaths each year.[6] And shared self-driving cars could bring mobility to swaths of the population that are, today, effectively stranded, such as many elderly people.[7]

At the individual level, the future of mobility could mean many fewer white-knuckle commutes, which researchers have consistently found to be a "particularly unpleasant" part of our days based on measures of subjective happiness.[8] It means putting the time currently spent in transit (46 minutes *per day*, on average)[9] to better use. It means getting the vehicle you need when you need it, not having to choose between a pickup that has an empty bed most of the time or forcing a chest of drawers into a hatchback during your annual trip to the flea market. It means more affordable mobility; the cost per mile of traveling might decline by as much as two-thirds, based on Deloitte's analysis, as shared autonomous vehicles free drivers' time and reduce insurance and financing costs.[10] And it means no longer worrying about putting your teenage son or aging mother behind the wheel.

But even if the benefits of a world of shared self-driving cars seem self-evident, companies should not assume that consumers will reach a similar conclusion. In fact, a series of cognitive biases suggest that many people may be reluctant to relinquish their personally owned and driver-driven vehicles.

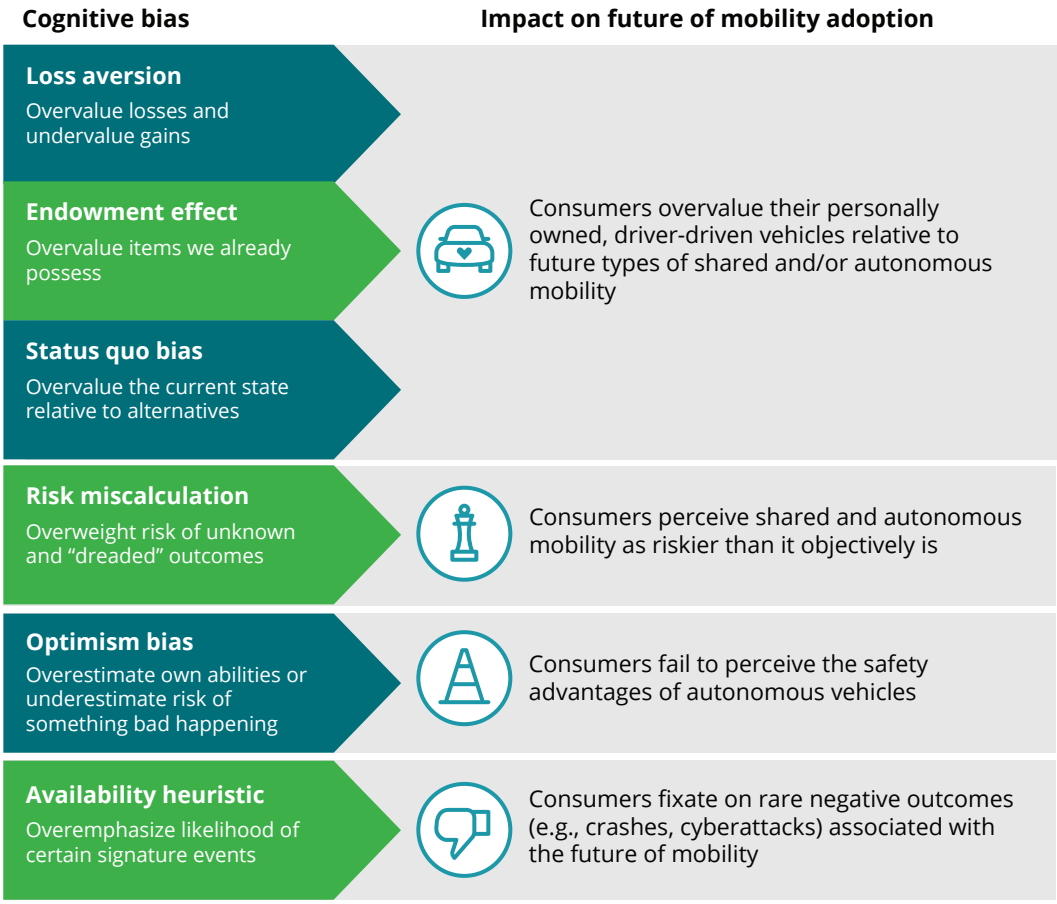
PUMPING THE BRAKES: THE COGNITIVE BIASES THAT COULD SLOW THE FUTURE OF MOBILITY

FOR decades, psychologists and economists have documented the ways in which human decision making departs from classic assumptions of rational, cost-benefit calculation.[11] In countless studies, in the lab and in real-life situations, we have been shown to exhibit a reliable set of biases that shape the choices we make—including choices about how we move from point A to point B.[12] Here, we explore just a handful of salient biases that could lead customers to balk at adopting the future of mobility's technological and service innovations (see figure 1 for a summary).

Gains and losses: Loss aversion, endowment effects, and the status quo bias

The fear of losses typically looms larger than the anticipation of perceived gains, causing us to overweight what we might give up relative to the potential improvements created by some new choice.[13] This creates a gap between our "willingness to pay" and "willingness to accept" and can, for example, lead sellers to demand

Figure 1. Summary of select biases and their effects



Source: Deloitte analysis.

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higher prices when faced with a nominal loss. For example, during a down market when real estate prices fell below what many had paid for their homes, home sellers in Boston asked 35 percent more than the expected market value; that gap shrank to just 12 percent as the market recovered.[14] In short, to induce a switch, the expected gains from new goods or services must overwhelm the (overvalued) anticipated losses from relinquishing what we already have. Perhaps unsurprisingly, having an emotional attachment to the goods in question exacerbates loss aversion (see sidebar, "Culture and the car").[15]

In related findings, researchers demonstrated that we have a strong preference for what we already own—even if it came to us entirely by chance.[16] In a canonical experiment, students were "endowed" with either a coffee mug or a

chocolate bar, and then given the opportunity to trade for the item they were not assigned. In the end, 89 percent of those given a mug kept it, while just 10 percent of those with chocolate bars opted to trade for a mug; in a control group endowed with neither item, 56 percent chose the mug.[17]

Finally, because we tend to overvalue current benefits and undervalue potential gains, we also strongly favor the option already in place relative to alternatives. When asked to select from an array of choices, study participants more frequently opt for the one framed as the current state;[18] outside the lab, this phenomenon has been linked to the reluctance of employees to adopt new information technology systems,[19] individuals' tolerance of electrical service outages,[20] patients' preferences for existing cancer screening options,[21] and more.

Taken together, these cognitive biases can be a powerful force for inertia. While many consumers are likely to take advantage of multiple types of transportation, the most ambitious realization of the future of mobility envisions at least some foregoing personally owned, driver-driven cars in favor of on-demand autonomous vehicles. That means surrendering all of the real or perceived advantages that we derive from the car sitting in the garage—*our* car—in favor of some lesser-known alternative. And while all new products and services are likely to face the headwinds posed by loss aversion, endowment effects, and status quo bias, the future of mobility's shared autonomous vehicles could prove particularly susceptible. Unlike many consumer choices, moving from owned to shared mobility is not a simple like-for-like trade of one tangible product for another, comparable one. Instead, we are replacing a durable product with an intangible service, which implies that the substitution of carsharing and ridesharing for car ownership may be more muted or take longer to materialize than early studies have suggested.[22]

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The dreaded unknown: Evaluating risk

We are generally quite poor at accurately assessing risk, at least as it has been traditionally defined by economics. Rather than gauging the potential losses some incident might cause, and discounting them by the likelihood of that event actually occurring (forming an expected value), most non-experts' perceptions of risk are impacted by other characteristics. Researchers have mapped these characteristics onto two dimensions of a possible event:

CULTURE AND THE CAR

For many, cars and other modes of transport are not only conveyances. They represent something more fundamental about individual and collective identities. We purchase hybrids not only for fuel economy, but to signal to others that we are environmentally conscious. We buy a luxury sedan not just for the leather interior, but as a sign that years of hard work have paid off. Because vehicles are often so much more than just a collection of steel and rubber, *how* the car is embedded in the broader society could prove to be just as powerful a hindrance to the future of the mobility as any individual cognitive bias.

The hurdle may be highest in the United States. The automobile is deeply rooted in American culture: It is a symbol of individual freedom, personal expression, and aspiration.[23] With over 250 million cars in operation (more than one per licensed driver), 88 percent of households own at least one car, nearly the highest among any country polled (Italy leads the list at 89 percent).[24] Underscoring the car's resilience in the American psyche, as the United States underwent an economic recession between 2006 and 2009, the proportion of Americans who viewed cars as necessities declined only slightly (from 91 percent to 86 percent), while responses for items such as air conditioning (70 percent to 55 percent) and clothes dryers (83 percent to 59 percent) dipped precipitously.[25] The car's symbolism has been reinforced and extended through decades of marketing that has helped cement the automobile in American culture. Three of the ten largest advertisers in the United States by spend in 2015 were automakers.[26] In the United States, the means (the personal automobile) and the end (personal mobility) have been deeply intertwined.

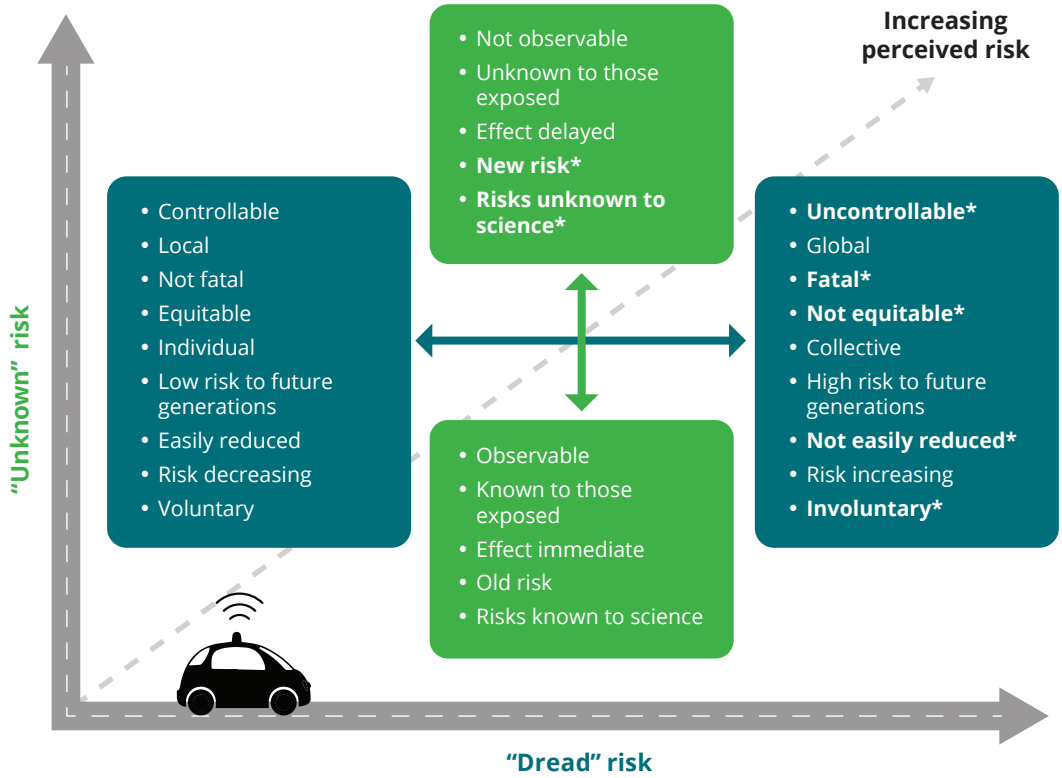
But the car's place in the collective consciousness varies widely across the globe. For example, household vehicle ownership in sub-Saharan Africa ranges from 31 percent in South Africa to just 3 percent in Uganda.[27] In India, where only 6 percent of households own a vehicle, consumers prefer cheaper vehicles and are less willing to pay for upgrades or customization—an indicator not only of economic conditions but also social perceptions that a vehicle is a form of transportation, nothing more.[28] Of course, ownership rates are only one indicator of the car's role in a particular culture. Taxes and other policies have made owning a vehicle extremely expensive in Singapore, contributing to just 15 percent of the country owning a vehicle. However, making cars unaffordable has actually made them more desirable to consumers and has elevated the car as a status symbol. As a result, even though Singapore is greatly expanding its subway system, public transportation has struggled to be seen as an attractive alternative to a car.[29]

While difficult to quantify, these cultural differences could have profound implications for the adoption of new types of mobility. All else equal, we might expect quicker uptake in countries with less established car cultures. Of course, all else is rarely equal, and the places where the car is mostly deeply entrenched are also likely to be those with the resources to move most quickly toward the future of mobility. Thankfully for those advocating for shared and autonomous vehicles, cultural attitudes are far from immutable, and early signs suggest the car's hold on the collective imagination—at least in the United States—may be easing. Fewer teens are obtaining driver's licenses,[30] and even car enthusiasts recognize that, "instead of customizing their ride, [young adults] customize their phones with covers and apps . . . You express yourself through your phone, whereas lately, cars have become more like appliances, with 100,000-mile warranties."[31]

the degree to which the risk is *unknown*, and the degree to which it instills dread.[32] New categories of events whose impacts are delayed, unobserved, or unknown to those affected create a heightened sense of risk; new and poorly understood technologies often rate highly on this dimension.[33] Even more influential to the perceived riskiness of an event is the degree to which it is perceived as beyond control, lethal, indiscriminate, involuntary, irreducible, and likely to impact future generations.

Figure 2 identifies a number of traits contributing to perceived riskiness, and it highlights those that seem likely to be particularly applicable to self-driving cars.[34] When first introduced, the risk posed by autonomous vehicles may be relatively unknown to the buying public, and regardless of the testing done by regulators or carmakers, the underlying technology of a self-driving car will likely remain mysterious to the average consumer. As important, the very nature of an autonomous vehicle makes

Figure 2. Characteristics affecting perceived risk



* Likely characteristic of self-driving cars

Source: Adapted from Paul Slovic, "Perception of risk," *Science* 236, no. 4799 (1987), pp. 280–285.

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it fundamentally uncontrollable (by the passenger, at least), which means customers are likely to see riding in them as particularly risky. And for many, the consequences of a mishap—bluntly, a crash—are likely to be perceived as quite serious, even fatal, exacerbating the sense of "dread" associated with stepping into a self-driving vehicle.

Even as consumers may perceive self-driving cars as much riskier than they objectively are, they are also likely to downplay the risks inherent in their own driving. In studies about driving, respondents persistently demonstrated *optimism bias*, the tendency to overestimate their own abilities or underestimate the probability that something bad could happen to them. In fact, most drivers routinely believe they are safer and at lower risk of being involved in an accident than the average driver, meaning they are also less likely to be compelled to adopt an autonomous vehicle for safety reasons, regardless of the statistics.[35]

> The perception of risk is often socially and psychologically constructed.

These examples underscore the fact that the perception of risk is often socially and psychologically constructed.[36] Despite the statistics on the safety and reliability of shared and autonomous mobility, the bar for consumers' acceptance could be higher than many advocates appreciate, at least until they gain greater exposure and experience over time.

The availability heuristic

Exacerbating these risk-based biases is our tendency to overemphasize the likelihood of certain events. When handicapping the chances of a difficult-to-estimate or complicated outcome, a person may employ a mental shortcut (or *heuristic*) to simplify the problem. One such shortcut, the *availability heuristic*, comes into play whenever someone "estimates frequency or probability by the ease with which instances or associations could be brought to mind."[37] That means that particularly salient and easy-to-recall examples can have an outsized impact on how we judge the likelihood of future events.[38] For example, in a classic demonstration, researchers exposed participants to short fictional accounts of a single death from a specific cause. Compared to a control group, those who had read these stories provided higher estimates of the number of annual fatalities the hazard caused, and also reported being significantly more worried about their personal risk.[39] After witnessing or reading about a car accident, we think getting in an accident ourselves is more likely. After watching a movie about nuclear war, the chances of a real nuclear war seem greater.[40] Events that are easier to visualize—like a car crash—also tend to more readily come to mind when we estimate risk.[41]

For consumers contemplating transportation options, the availability heuristic could lead them to balk at new mobility choices since the most familiar and salient examples are likely to be those reflecting negative experiences. For instance, when choosing between using ridesharing to get to work or driving a personal vehicle, a commuter might focus on the few occasions when he was inconvenienced by ridesharing (by a long wait for his vehicle, for example) or a story of someone being harassed by a driver rather than the majority of instances when shared mobility was fast, convenient, and inexpensive. He may then overestimate the odds of being put out today, a prompt to go with the "safe choice" of driving his own car.

More dramatically in the case of autonomous cars, consumers could focus on the rare instances of cyberattacks or system failures leading to a crash, underemphasizing the much greater odds of being involved in an accident in a human-controlled car. Media coverage of such events, especially in the early stages of autonomous vehicle rollout, seems likely to only exacerbate this bias.[42]

The choice of personal mobility is a complex one, and this discussion only begins the exploration of the myriad factors at play; indeed, we have not yet exhausted the potential set of cognitive biases that could factor in. And it is certainly possible that some psychological factors

THE PERILS OF PERSONALIZED MOBILITY

Today's automotive industry has come a long way since Henry Ford famously said, "Any customer can have a car painted any colour [sic] that he wants so long as it is black."[43] Consumers now enjoy an impressive array of choices, with a plethora of models, powertrains, colors, and interior and exterior options to select from. And as vehicles increasingly become on-demand technology platforms, the opportunities for customization will likely only increase. Customers may be able to "order" the exact type of vehicle they need for a specific trip, loaded with a tailored selection of entertainment and informational options.

While it may seem obvious that being offered greater flexibility and personalization would be valuable to consumers, it's been shown that offering too many choices can backfire. Psychologists have gathered evidence that suggests that increasing levels of choice can contribute to anxiety, confusion, and an inability to choose.[44] For example, researchers presented shoppers entering a grocery store with an assortment of jams and provided a coupon toward purchase. Some were shown 24 varieties, others just 6. Nearly one in three who were shown the smaller number ended up purchasing one of the jams, while just 3 percent of those who saw the larger display did so.[45] In other experiments, participants reported being less satisfied with their ultimate choices when confronted with a large number of options.[46]

While additional research has softened some of these findings and added important mitigating factors,[47] mobility players should still be wary of an approach that assumes more is always better.[48]

could work in favor of adopting shared autonomous mobility. For example, many people are likely to have directly experienced a car accident or know someone who has, prompting an availability heuristic that leads them to overestimate the risk of conventional human-driven vehicles. Despite those mitigating factors, as a new and poorly understood technology that challenges the status quo, it seems likely that a future of ridesharing, carsharing, and self-driving cars could face significant (some might say irrational) resistance from consumers. While unlikely to stop the powerful converging forces propelling the future of mobility, such psychological factors could slow the pace of adoption. Fortunately, consumer attitudes remain inchoate,[49] providing future of mobility evangelists a window to shape perceptions and spur adoption. The next section explores how companies, governments, and others might craft messages to overcome these cognitive biases.

STEPPING ON THE GAS: OVERCOMING PSYCHOLOGICAL BARRIERS TO THE FUTURE OF MOBILITY

THE significant investments being made by companies and the public sector in the future of mobility could be undermined without a careful and thorough consideration of how consumers might perceive and adopt these new technologies and services. This goes beyond marketing, surveys, and focus groups, and requires crafting a strategy informed by the deep-seated patterns of human

Figure 3. Summary of popular behavioral economics concepts

Outcomes valuation	Calculation bias	Timing elements	Environmental influences	Choice architecture
• Loss aversion • Mental accounting • Prospect theory • Certainty/ possible • Status quo bias • Sunk cost fallacy • Zero price effect	• Affect heuristic • Anchoring • Availability • Halo effect • Optimism bias • Representative	• Empathy gap • Hedonic adaptation • Hindsight bias • Peak-end rule • Diversification bias • Present bias • Projection bias • Time discounting	• Game theory • Herd behavior • Commitment • Inequity aversion • Reciprocity • Social proof • Salience • Priming	• Decoy effect • Default options • Choice overload • Framing effect • Partitioning

These five dimensions may work in tandem

Source: Timothy Murphy and Mark Cotteleer, *Behavioral strategy to combat choice overload*, Deloitte University Press, December 10, 2015, http://dupress.deloitte.com/dup-us-en/focus/behavioral-economics/strategy-choice-overload-framework.html.

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cognition. Here we have highlighted a handful of the lessons from behavioral economics that can be used to "nudge" consumers and help overcome cognitive barriers to adoption.[50] Depending on an actor's aspirations and location within the mobility ecosystem, much more will likely be needed to maximize the chances of success. Deloitte's taxonomy and managerial framework offer one way to think through the relevant biases and possible responses (see figure 3).[51]

Most of the interventions highlighted here fall under the category of manipulating someone's *choice architecture*; that is, the way a choice is presented or framed.[52] It asks, "Can we influence behavior by how we organize choice?," and captures the variety of concepts that demonstrate our ability to influence decisions with the layout of alternatives.[53] Here we offer a few steps that leaders can take to enhance the probability of accelerated adoption.

- **Recast losses as foregone gains and gains as foregone losses.**[54] Because losses are typically overvalued relative to gains, advocates might stress what a consumer would miss by, for example, not choosing an autonomous vehicle, such as free time during their commute. Similarly, negative framing can also be effective.[55] So instead of promoting that "Buying a driverless car saves lives," advocates might consider a variation of "Not buying a driverless car costs lives."

- **Aggregate the costs and risks.** To overcome potentially skewed perceptions of loss and risk, consider expanding the relevant timeframe or pooling the costs. For example, study participants who were presented with the overall probability of being involved in an accident over a 50-year time period were more likely to support additional safety regulations vs. those provided the relatively small probability of having an accident on a single trip.[56] Similarly, proponents of shared and autonomous mobility could emphasize the average time lost in an entire year to commuting (31 days for so-called "mega-commuters"), rather than the few minutes that accrue every day.[57] Companies are already employing these techniques in other fields. Users of Nest connected thermostats receive a monthly "home report" that begins not with individual results but with the number of kilowatt-hours *all* users in the United States and Canada have collectively saved.[58]

- **Create social proofs.** We often look to the behavior of others for clues as to the correct course of action. Such "social proofs" can serve as powerful motivators, and messaging that invokes peers is often effective in changing behavior. This is particularly true when consumers are confronting a product they are ambivalent or uncertain about.[59] To that end, companies might stress how many people have used ridesharing or rid-

The future of mobility still lies ahead of us; it is foreshadowed, not foregone.

den safely in a semi-autonomous vehicle. Such messages could be particularly effective when localized, focusing on people "like you" or in your neighborhood. Well-publicized pilot efforts in various cities, like those being undertaken in Pittsburgh, Boston, Nevada, and elsewhere, could also provide important examples.[60] Returning to Nest users, the company also sends individuals "kudos" or "leafs" when their energy consumption is lower relative to others using the thermostats.[61]

- **Set default options.** Creating pre-selected options can have a powerful effect on what we ultimately choose.[62] Users of Uber's popular app often find the UberPool (ridesharing) option pre-selected, effectively "nudging" them toward that option.[63] In the future, it may be possible to access a range of transportation options through a single application on a mobile device. To encourage uptake, service providers can make shared or autonomous mobility the default option. Likewise, automakers and dealers might make fully autonomous vehicles a "standard" feature, only reverting to limited autonomy at the customer's request.[64]

- **Make autonomy a peripheral, rather than a core, feature.** In a similar vein, research suggests that any new innovation is more readily accepted by consumers when it is packaged as an add-on to an existing, familiar item, rather than as a change to the central form and function of a product. In a study of car "autopilot" technology, survey respondents were presented with one of three scenarios: an integrated self-driving system that is the only way to control the vehicle; an integrated system that also had the option of human control; and a vehicle with a plug-in accessory that offered self-driving capabilities. Those presented with the latter condition (add-on option) were two to three times more likely to sign up for a test drive.[65] For automakers, that could mean creating "plug-and-play" autonomous capabilities, putting fully autonomous capabilities in vehicles that look and feel like today's cars (for example, with steering wheels and pedals that may never be used), or making autonomous control "standard" with human control an "option."

Shared mobility and autonomous vehicles offer many potential benefits, and while important developments emerge near-daily, the

future of mobility still lies ahead of us; it is foreshadowed, not foregone. How and how quickly that future emerges is likely to depend not only on the merits of the technological solutions that emerge, but also on how well key players understand and address consumers' cognitive biases—and failure to do so could put those future benefits in jeopardy. This article illustrated just a handful of the potential risks and opportunities, and hopes to begin a broader discussion about how the future of mobility can impact individuals and the broader society.

Technology adoption is typically characterized by an S-shaped distribution: Relatively few "early adopters" initially use the new technology, followed by a rapid proliferation until a point of saturation is approached and adoption rates taper off. The speed of adoption can vary dramatically. It took 25 years for the telephone to reach 10 percent of American households, and just five years for the tablet to do the same.[66] By understanding and attending to consumers' cognitive biases and the special role the automobile plays in American and other cultures, companies, governments, and others at the leading edge of changes in the mobility ecosystem can help ensure that the adoption of shared mobility and autonomous vehicles more closely resembles a "skinny S." **DR**

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Endnotes

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10. Scott Corwin et al., *The future of mobility: What's next?*

11. For more about how cognitive biases affect business decisions, see Deloitte's full corpus of work on behavioral economics and management at http://dupress.com/collection/behavioral-insights/.

12. For overviews see, for example, Timothy Murphy and Mark J. Cotteleer, *Behavioral strategy to combat choice overload*, Deloitte University Press, December 10, 2015, http://dupress.com/articles/behavioral-strategy-choice-overload-framework/?coll=11936; Sendhil Mullainathan and Richard H. Thaler, *Behavioral economics*, no. w7948, National Bureau of Economic Research, 2000; and Daniel Kahneman, "Maps of bounded rationality: Psychology for behavioral economics," *American Economic Review* 93, no. 5 (2003): pp. 1,449–1,475.

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