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It's Time for a Medical Research Revolution

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Consumers' Research is an independent educational organization whose mission is to increase the knowledge and understanding of issues, policies, products, and services of concern to consumers and to promote the freedom to act on that knowledge and understanding.

Consumers' Research believes that the cost, quality, availability, and variety of goods and services used or desired by American consumers—from both the private and public sectors—are improved by greater consumer knowledge and freedom.

Executive Director: Joseph Colangelo

Editor-in-Chief: Kyle Burgess

Art Director: Mike Costelloe

Staff Writers: David J. Weissman

John C. Meyer

Jillian Matlaga

Jacob Shercliffe

Matthew Clark

Jake Steele

Illustrations: Mike Costelloe

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Consumers' Research
1801 F St NW, Washington, DC 20006
202-898-0542



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Throwbacks

Products and Consumer Affairs Then and Now

International Travel

Is going to Europe on your bucket list? If so, you're not alone. In July 1974, Consumers' Research asked the question, "Are U.S. tourists spending their vacation in Europe?" The answer at the time was a definitive "no." The U.S. State Department had reported significant drops (19 percent) in passport applications in 1973 and there were reductions in international airline reservations across the board. Ticket prices had increased by as much as 23 percent from the year before, the cost of food and lodging abroad was perceived as expensive.

The story could not be more different today. The State Department reported a 9.6 percent increase in passport applications in 2015. International travel is at an all time high and Europe is by far the most popular overseas destination for Americans. According to the National Travel and Tourism Office, nearly 13 million Americans flew to Europe in 2015, with just under 5 million going to Asia. So, pack your bags because now more than ever, Americans are heading to Europe.

Reduce, Reuse, Recycle

Also in our July 1974 issue, CR wrote about how supermarkets were beginning to encourage shoppers to carry a convenient market basket or bring a paper shopping bag for reuse. Supermarket operators worried about shortages of brown paper bags, milk jugs, and egg cartons, so they began offering rewards, such as trading stamps, cash coupons, and even pennies for each bag returned for reuse. The transition to disposable plastics allayed these concerns and the rewards programs dissipated.

Today we are seeing a revitalization of the reusable bag movement, however it has evolved into one with an environmental focus. Stores across the country are offering discounts to consumers who supply their own reusable bags and companies are branding and selling totes made from recycled materials. Some cities are even taking punitive steps to curb the use of disposable plastic bags. New York and the District of Columbia have implemented plastic bag taxes of five cents per store-provided, non-reusable bag. San Jose, California has gone so far as to ban the use of plastic bags throughout the entire city since 2012.

Although these rules are more common in other countries than the United States, the culture of "bring your own bag" continues to grow and proliferate.

Fast Food Craze

An odd trend was starting to emerge at the start of 1975; more families were going out to eat at restaurants despite increasing food prices. At the time, we speculated that eating at restaurants was becoming a form of family entertainment. The top restaurants nationally in terms of sales were, in order: McDonalds, Kentucky Fried Chicken, International Dairy Queen, and Burger King. These franchises catered to an experience and could feed the whole family for cheap.

Fast food has since become ubiquitous. Last year, Americans spent nearly \$800 billion at restaurants alone. In the 1970s, 25 percent of all food spending was on food away from home; today that share is above 43 percent. The act of going out for dinner has become a pillar of American culture. In 2014, the top grossing restaurants list looked surprisingly similar to that of the 70s: McDonalds came in again at number one with \$35 billion in sales, followed by Starbucks, Subway, Burger King, and Wendy's. ◀



The *Virtually* New Reality

Jacob Shercliffe

In July, Pokémon Go took the world by storm. In the week after its release, the smartphone game gained more active users than Twitter. People spent twice as much time walking around catching Pokémon, as they did using Snapchat. The new game quickly became a cultural phenomenon and may provide insight in what the future holds in terms of augmented reality. With the recent release of the Google Pixel and the accompanying Google Daydream as well as a slew of other AR devices coming out for the holidays, AR may be primed for widespread adoption - finally.

The Technical Background of Augmented vs. Virtual Reality

Augmented reality is referred to as a “concept” or new reality. The best-known concept reality is virtual reality, which has been prominent in science fiction since the early 1980s, with roots in the “simulated reality” of the 1950s and 60s science fiction found in stories by prominent authors such as Philip K. Dick and Ray Bradbury. There are a few major concept realities: augmented reality, virtual reality, and mixed reality, with several key differences among the three.

Augmented reality (AR) is simply the reality we see, with supplemental virtual factors generated by a computing device. Imagine walking down the street, and your concept reality device (such as Google Glass) virtually displays reviews for a restaurant you pass by. Then a virtual cloud front approaches in the distance to notify you that a thunderstorm is coming, based upon local weather reports. Augmented reality is not unlike using a smartphone, but with optic displays and wearable technology for more seamless integration. Wearables have long been considered the future of the mobile market, with good AR seen as the Holy Grail. Augmented reality works in one of two ways. The first entails a location-based sensor that brings up relevant information based on the user’s GPS location. The other uses vision-based sensors to register information, based on QR codes or other visual indicators. When people spin around in circles trying to find a Pokémon in their surroundings, they are using an early form of augmented reality.

On the other end of the spectrum is virtual reality (VR). VR immerses users in an interactive computer simulation, building entirely new virtual environments for them to explore. Virtual reality replaces and augments sensory feedback to one or more of the senses in order to generate a realistic sensation of being inside a new room, standing on an alternate planet, or even venturing off to a different universe. “The Matrix” from the eponymous 1999 blockbuster film or “the Holodeck” from the Star Trek universe are both examples of virtual environments, although both are much more advanced than current VR technology. The key feature of virtual reality is that the user perceives they are somewhere else, doing something else. This is usually accomplished by means of a headset, such as the Oculus Rift, but the other senses can be incorporated too. Surround sound or haptic gloves, which give the sensory feedback of touch, can assist in immersing someone in the computer simulation. Researchers are working on integrating smells to amplify virtual spaces in order to make them more believable or realistic.

Finally, mixed reality (MR), or hybrid reality, is a combination of the virtual and augmented realities. MR projects three-dimensional images into real-world environments, where physical and digital objects coexist and interact in real time. Computers like those featured in the films Iron Man and Minority Report allow their users to manipulate digital objects and change them in real time. Although MR is a relatively new field, large technological advancements could bring us hybrid realities fairly soon.

How Far Away Are We From a Digitized Future?

Many new developments have come to the concept reality world in 2016. The question is: will consumers adopt the technology on a mass scale, or is it just another gadget with short-lived appeal?

It’s been an important few years for concept realities, but advancements were not achieved without first meeting a few bumps in the road. Early attempts at consumer-augmented reality were put forward by Alphabet Inc., with the Google Glass project, but failed to gain much traction

beyond the initial hype. Many barriers must be overcome before widespread adoption of augmented reality is achieved, but Pokémon Go's success highlights the appeal of this potentially multi-billion dollar market.

Virtual reality is a completely different story. Tech companies are rushing to be the first big name in VR. In a nine-month period, Google, Facebook, HTC, Sony, Microsoft, and Samsung either have released or will release VR headsets. VR has been present on the main stage at three major national conventions: the Consumer Electronics Show (CES), the Electronic Entertainment Expo (E3), and San Francisco Comic Con (SFCC).

Concept Reality Use Cases

Entertainment is the clearest application of concept realities, and may be the first to gain traction. New video games and other digital media are already capitalizing on virtual reality to offer novel experiences to their users. Immersive environments offer a new medium for movies and video games to explore. Millions of people could all attend the same interactive concert or travel around the world while remaining in the comfort of their homes. VR seems like a natural extension of the personal computers and gaming platforms that are omnipresent in American homes.

Other potential applications, however, are even more fascinating. VR offers new educational opportunities. Instead of sitting in a computer lab, teachers could transport their whole class to Africa for the day to study animals on the Sahara or take a tour of the solar system while flying through space. The limits of virtual reality rest only in the imaginations of VR users. Similar applications are possible with augmented reality as well. Students could take museum tours accompanied by a virtual tour guide, who describes the history of woolly mammoths or how soil erosion works. Walking audio tours have been around for years, but augmented reality creates the possibility for more interactive material and better control. These same modules could go into art exhibits and historical landmarks as well. Tourists could watch the landing at the beaches of Normandy while exploring the beaches in real life or march alongside civil rights activists as they make their way from Selma to Montgomery on foot.

VR could also break down traditional office environments. Businesses are already considering entirely new workplaces built around the use of new realities. For example, technology company NVIDIA is planning a VR-friendly headquarters, which allows its designers to work in virtual spaces. Instead of designing a building on a

piece of paper or a computer screen, architects could walk around in virtual space and interact with their blueprints. Similar technology would enable investors to see the status of a construction project in China or a potential homeowner to preview a house from the other side of the country.

In case of an emergency such as a fire or a natural disaster, augmented reality could survey a user's surroundings to warn emergency services of dangers in the area and guide firefighters through the safest route out of a disaster area. Heads-up displays offer the ability to record actions for later review, similar to a police body camera. The data gathered from such technologies could help improve logistics, safety, and productivity in almost any field.

Challenges/Obstacles

Usability

Despite the amazing potential of concept realities, there are still some significant roadblocks to achieving a technologically integrated future. The first comes from the technology itself. Many new reality devices are still too large for convenient personal use and are not powerful enough for sustained service. AR devices need to have consistent connectivity, day-long battery life, and high-capacity computing power. Furthermore, augmented reality must seamlessly integrate into everyday life before it can truly compete with the mobile market. The average consumer won't want to walk around wearing a headset that's wired to a fanny pack containing a five-pound battery. Furthermore, this new tech needs to deliver on its premium pricing. Unless Google Glass or its equivalent is proven to be significantly more helpful than a smart phone or smart watch, a real-time restaurant review incorporated into your visual field or a weather app that signals bad weather is coming with virtual storm clouds on the horizon probably isn't worth the \$1,000 investment to most consumers.

This is less of a problem for VR, because consoles don't have to be mobile. VR will also be able to find a clear user market, simply by adding new features to increase the enjoyment of video games, television, and movies. This immersion, however, needs to be impeccable. High definition displays are the standard in modern electronics. Without significant improvements to immersion rigs, customers will stick to watching movies and playing video games as they always have, but on a traditional high-definition or 4K television.

Design

Augmented reality needs to be “cool.” This may seem like a tangential concern, but it is a pertinent one. Aside from their utility, one big reason smartphones have been so widely adopted is that iPhones and other smartphones are attractive. The sleek, shiny body of the iPhone is just as much a fashion statement as it is a way to protect the device’s internal components. Dorky, unattractive camera glasses that are reminiscent of racquetball goggles are not going to appeal to everyday consumers. There is a reason people still walk or use bicycles for short trips, rather than riding a Segway. The once heralded “future of transportation” has been relegated to riding tours around cities, because most people would feel embarrassed to ride one on a day-to-day basis. Alternately, you can’t roam around a college campus for long without running into someone on a hoverboard – the Segway’s fun, trendy cousin.

Safety

A serious concern with AR is the safety of its users. There’s been no shortage of people walking into strangers or obstacles as they play Pokémon Go, or drivers getting into accidents while flinging virtual Poké balls. Browser windows that pop up while walking or driving could cause problems, as well. Virtual reality doesn’t have this issue, as users stay in one place, but it has its own unique set of drawbacks. Early testers of immersive rigs are getting motion sickness and headaches from sensory overload. Many users report that they can’t spend longer than 20 minutes playing a game before needing a break. For thousands of years, humans have learned to adapt and survive. Some virtual reality applications push users to ignore their survival instincts and engage in activities visually perceived as dangerous. Sometimes our minds and bodies won’t cooperate with these new experiences. Companies will surely work to address safety concerns, but that could delay new gear releases and increase prices.

Affordability

The final major hurdle comes in the form of price. One of the best-known augmented reality device is Google Glass. Google initially charged \$1,500 for the privilege of owning the device; a cheaper model was expected but has been cancelled. Alto Tech plans to offer their Cool Glass, a similar product, but with fewer features, for \$500. AR could very easily be the next Apple Watch – an interesting device with a few novel features, but at too high a price to appeal to all but the most technologically-minded.

Virtual reality is much closer to a viable product in the consumer market. With so many different devices entering the market at the same time, competition and bundling will ensure that early VR devices are available to those who

are interested. In addition, Google Cardboard provides a unique experience that consumers can try if they have a smartphone, potentially serving as an ambassador for other, more expensive gadgets in the concept reality space.

A Look Ahead

For the concept realities market to take off, we still need to see the development of a lot of new and intermediate technologies. However, given the rapid advance of consumer technology over the past few years, this shouldn’t be a problem. Rudimentary personal computers were only first showing up in homes in the late 1970s, and the first generation iPhone – with computing power many times that of the original PCs – came out in 2007. The cycle of technology is faster than ever, and there is already an arms race to make smaller, faster, and stronger parts for electronics.

If augmented reality can reach a lower price point and ensure unique user experiences, its rate of adoption is sure to escalate in the near future. It may be a different story for virtual reality. For now, the future of VR looks bright, but how far that future will progress is another issue. It will likely gain initial traction among more hardcore gamers and technologists, but may have little dissemination to the broader public until the quirks are worked out.

Many issues still need to be addressed in the concept realities market; of course, just ten years ago the smartphone sector faced many problems as well. Today, modern consumers can’t imagine daily life without their smartphones. These new realities have the potential to change the way we interact, all over again. The future may not be so far off after all. ◀

Retailers Can't Afford to Ignore Plus-Sized Women Any Longer

Jake Steele

To the frustration of millions of women, fashion retailers have failed to provide adequate plus-sized clothing options. According to a survey by retailer ModCloth, 65 percent of all women feel that the retail industry ignores needs of plus-sized women, while just 28 percent of women say larger sizes are included in the fashion community.

Additionally, 77 percent of plus-sized women agree that it's difficult to find well-fitting clothing, and 46 percent said that they never find well-fitting garments. This neglect of larger-sized clothing runs counter to demographic trends across the nation. More than two-thirds of American adults are overweight or obese, and obesity rates are trending upward. According to research from the Centers for Disease Control and Prevention's National Center for Health Statistics, the obesity rate for adult women was 40.4 percent in 2013-2014, compared to 35.3 percent in 2005-2003.

Though sizing often varies from brand to brand, most industry experts put the average size for women between a 14 and 16. The number of women who wear a size 16 is greater than the number of women who wear sizes 0, 2, and 4 combined, yet most retailers do not carry size 16 and above or only have very limited options in those sizes. According to Bloomberg, only 16 percent of dresses on JCPenney's website and 8.5 percent of dresses on Nordstrom's website are available in plus-sizes. In the spring, Nike.com carried only five plus-sized items, while UnderArmour carried three products in "extended sizes."

Though larger men also have difficulty finding clothing that fits, for a number of reasons, the problem is more pervasive in women's apparel. On a practical level, it is more difficult and expensive to produce larger sized clothing for women. Each individual has a unique figure, and these unique body types become more pronounced at higher sizes. This presents a design challenge, as simply making existing clothing designs larger will not flatter the variety of plus-sized female figures. In order to make clothes that fit right, designers must create more patterns, which is costly.

Snobbery within the fashion industry may play a part as well, due to a perception that plus-sized fashion diminishes brand value. When retailers do carry larger-sized clothing, they usually have a very limited selection hidden in the corner. For years, the fashion industry has essentially

trained the plus-sized segment to simply accept the limited options. As a result, retailers have experienced low sales in this segment, which discourages investment in plus-sized fashion. The industry is trapped in a vicious cycle: plus-sized women don't shop where their size is not available, and retailers don't carry larger sizes because plus-sized women don't buy their clothes.

However, market forces will likely change the equation. According to the NPD Group, the percentage of teenage girls purchasing plus-sized clothing has grown from 19 percent in 2012 to 34 percent in 2016, while the share in the junior-size category declined from 81 percent in 2012 to 74 percent in 2015. Plus-sized apparel, defined as size 14 and up, rose by 17 percent to \$20.4 billion in 2015, up from \$17.4 billion in 2013. This segment is growing rapidly, especially when compared to an increase in overall apparel sales of 7 percent, or just shy of half the growth seen by the plus-sized segment. According to Mariah Chase, CEO of plus-sized retailer Eloquii, 65 percent of women are considered plus-sized, yet plus-sized accounts for only about 17 percent of retail sales. As a result of this inconsistency, fashion retailers that specialize in plus-sized fashion, like Eloquii and ModCloth, are experiencing tremendous success and sales growth.

According to Modcloth co-founder Susan Koger:

"[S]ize 16 and above is our fastest growing category and, in 2014, sales in size 16 and above doubled year on year. We have found that styles in a full range of sizes sell around 20 percent more units and customers who buy sizes 16 and above place 20 percent more orders than the average consumer. These customers are also 66 percent more likely to spread positive feedback about their purchases on social media."

Some larger retailers are beginning to follow suit. Target launched a plus-sized line called AVA + VIV in 2015 in an attempt to grab market share in this category. JCPenney launched its first fashion brand for plus-sized women, Boutique +, in collaboration with "Project Runway" designers in April 2016. Plus-sized women want stylish and well-fitting apparel, but it just isn't available yet in most stores. As a whole, the retail industry is struggling. It may not be able to afford to ignore plus-sized women any longer. ◀

It's Time for a Medical Research Revolution

Jillian Matlaga

“What if I told you that the medical science discovered over the past century has been based on only half the population?” asks emergency medical doctor Alyson McGregor in her TED Talk, “Why Medicine Has Dangerous Side Effects for Women.” Modern medicine, although it can be life-saving and life-changing, has a significant flaw: it is developed mostly by men and for men – Caucasian men in particular. Healthcare researchers and professionals often do not allocate adequate representation to women in the healthcare research process, which has the potential to considerably affect their well-being. According to The Journal of the American Medical Association (JAMA) only one third of cardiovascular trial subjects are women – demonstrating just one of many examples where women are underrepresented or unrepresented entirely. Until the 1980s, healthcare professionals assumed the same medicine and dosage amounts were appropriate for both men and women and would be just as effective for both sexes in curing or preventing diseases. However, due to the discovery that biological, physiological, and metabolic distinctions (beyond reproductive differences) exist between the sexes, many healthcare professionals no longer default to such assumptions.

It is a commonly accepted scientific fact that men and women have different genetic compositions. One of the fundamental differences is within the cells – the building blocks of the body. According to the Institute of Medicine each cell has a sex. These cells, each containing 23 pairs of chromosomes including sex chromosomes, are responsible for determining gender. They are also responsible for many of the basic biological differences that make it imperative that women and men are treated distinctly, when it comes to medicine. When a new drug is created, it is necessary to look at the many factors that may determine how that medicine affects different people, such as cellular distinctions, gender, age, race, medical history, and environmental surroundings. By observing and analyzing the relevance of these factors, medical professionals are better able to determine which treatment is most appropriate for a specific's patient's needs.

Medical disparity is all around, from basic pain relievers to sophisticated cancer treatments. For example, the household medicine aspirin was originally only tested on

male cells, rather than segments or combinations of male and female cells. After further studies on cardiovascular disease, researchers discovered that when men take low-dose aspirin regularly it is typically beneficial to their heart health; however, aspirin therapy can be harmful to the heart health of certain segments of women. Noel Bairey Merz, Professor of Medicine at Cedars-Sinai Heart Institute, notes that there are many “diagnostic and therapeutic strategies, which had been developed in men, by men, for men - and they work pretty well for men.” However, what about the other half of the population? How has it become the norm that women are excluded from the healthcare research process? What about minorities?

The research and development process for pharmaceutical medicines has four key steps, these are: animal research, clinical trials, translating research into practice, and measuring effectiveness. Often, only male cells are used during the animal research phase, and if female cells are used, they are not identified as such. This initial phase serves as the foundation of the rest of the development process and if female cells are not included from the beginning, scientists will likely not be able to recognize gender differences throughout development phase. Similar to animal research, clinical trials “often fail to analyze and report results by sex,” and are not typically structured to examine gender differences in the safety and efficacy of trial discoveries, according to a report by the Mary Horrigan Connors Center for Women's Health & Gender Biology at Brigham and Women's Hospital. This structural failing makes it challenging to incorporate a significant amount of women into clinical trials and to examine the effects that a specific drug has on women. During the “translating research into practice” stage, gender differences are often ignored and not incorporated into clinical practice. Finally, when determining the effectiveness of medicine, results are not commonly reported by sex. Instead, all results are grouped together, implying that the medication influences all people the same way, irrespective of age, race, gender, and other key distinctions.

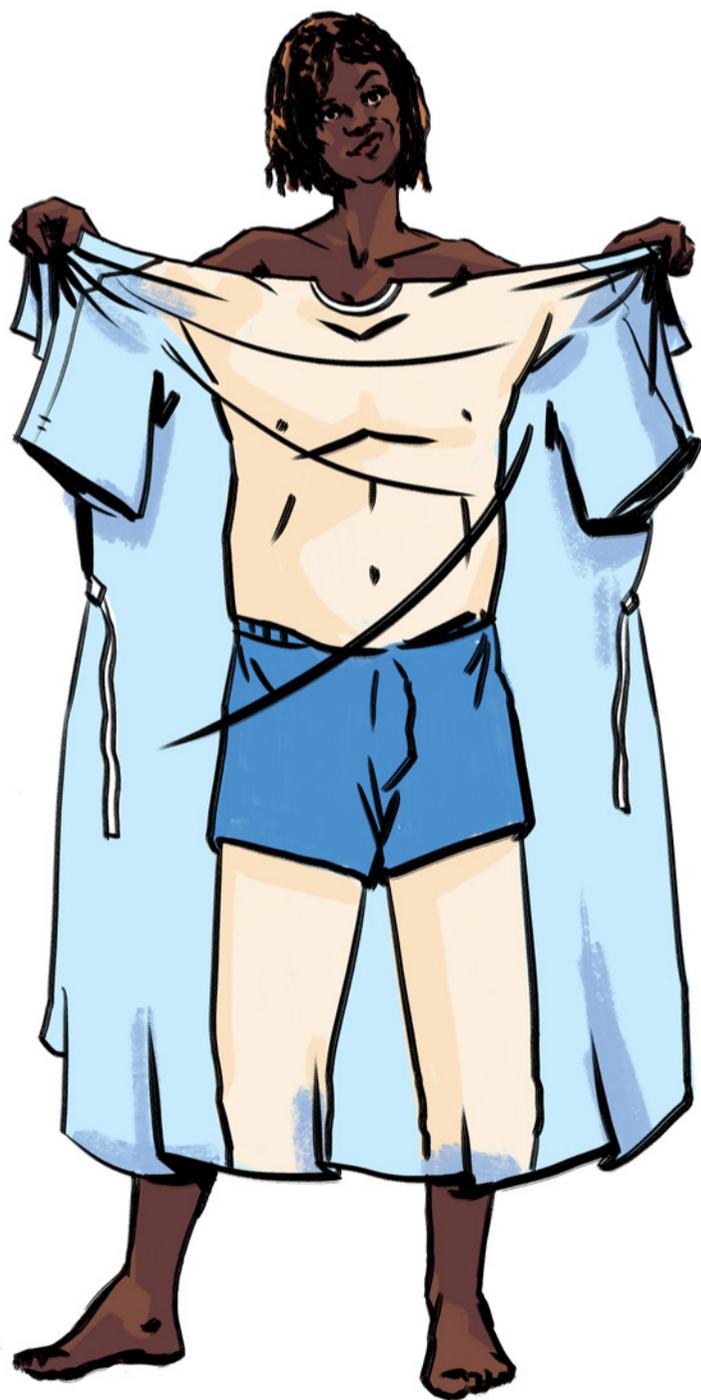
Advances in breast cancer treatment provide an example of the positive results that can come from prioritizing and funding valuable research that incorporates women in the drug development process. According to the National

Cancer Institute, death rates from breast cancer fell 1.9 percent on average each year from 2004-2013. “We’ve done the research. We have effective therapies now. Women are living longer than ever,” says Merz in regards to breast cancer treatment. Experts are confident that if healthcare professionals invest significant time in researching the fundamental differences between men and women, then medications for life-threatening illnesses, such as heart disease, will improve for men and women alike.

While men and women are vulnerable to many of the same diseases, women are sometimes subject to a higher level of risk. They are twice as likely to be affected by depression, three times as likely to experience migraines, and nine times as likely to suffer from lupus. However, it is not just women who are affected when their unique genetic composition is not properly studied or represented. Minorities, who are also at a higher risk of

having certain illnesses, suffer from a lack of segmented research. African Americans comprise 12 percent of the U.S. population and Hispanics make up 16 percent, yet only comprise five percent and one percent of clinical trial populations, respectively. This disparity leads to a lack of knowledge about the way drugs affect minorities and prevents doctors from properly treating minorities for a variety of severe diseases. Jonca Bull, Director of the Food and Drug Administration’s Office of Minority Health (OMH) said, “We know, for example, that African-Americans and Hispanics have higher rates of diabetes, HIV/AIDS, obesity and cardiovascular disease.” With life-threatening diseases influencing groups differently, it is time that healthcare professionals focus on developing appropriate treatments, medicines, and recommended doses for different patient groups.

“Research on these differences must become the norm if we are to achieve equity and, most important, to improve the health and well-being of women and men,” said Dr. Paula Johnson, an author of the Mary Horrigan Connors Center study. Women, men, and minorities alike could benefit from individualized healthcare. Although gender- and minority-specific research is not yet the norm, steps are slowly being taken to close the gap. Asking questions about the safety of prescribed medications, whether women and minorities participated in clinical trials, or if the prescriber has knowledge of the patient-specific indications of the medication, all start a conversation. Such conversations can change the way that scientists and healthcare professionals approach medicine and will positively affect all involved. ◀



The Regulatory Environment *Heats Up for the* Sharing Economy

David J. Weissman

Recent months have seen a spate of regulatory efforts aimed at the highest-profile members of the “sharing economy” – ridesharing services Uber and Lyft, and homesharing service Airbnb. New York Governor Andrew Cuomo signed a bill in October 2016 that banned short-term rentals of full dwellings in New York City, with fines of up to \$7,500 for violations. Austin, Texas passed a measure in December 2015 requiring fingerprint background checks on rideshare drivers, a method opposed not only by rideshare providers but also by the Austin-area Urban League and the Austin chapter of the NAACP.

These were only the most high-profile such actions this year; Anaheim, California banned all short-term rentals, owner-occupied or full-dwelling, in June 2016. Austin passed rules in March 2016 that established a 2022 sunset date for full-dwelling short-term rentals. This means, homeowners, commercial or private, will no longer be able to rent out whole homes for fewer than 30 days. Additionally, Denver instituted tough licensing requirements for homesharing rentals starting in July 2016.

It wasn't all bad news, however – in Philadelphia, where Uber and Lyft have not been strictly legal, they were allowed to operate *de facto* during a crisis with the city's public rail network in July 2016. Two months prior, Miami legally recognized the two ridesharing companies. In Boston, a federal judge ordered the mayor's office to amend its rules on transportation companies in March 2016 to give equal treatment to ridesharing companies that were previously not subject to the same rules as other ride-hailing services such as taxi companies.

The Unintended Consequences of Regulation

Taxis don't offer the convenience or efficiency of ridesharing apps, and they are often pricier. According to Business Insider, hailing an Uber is a better deal than hailing a taxi in 18 of the 21 cities reviewed, assuming a 5-mile ride at 30 mph with no idling in traffic and no tip. With the addition of a 20 percent tip on taxi rides, estimates showed Uber to be a better deal in all of the cities examined. CNBC estimated that Uber, Lyft, or Sidecar (now discontinued) offered cheaper alternatives to taxis in all 19 of the cities for which they found data.

Surge pricing can drive up the cost of ridesharing services, but tipping – not customary for ridesharing services – is also a factor in the total cost of a taxi. In addition, both Lyft and Uber offer lower-cost shared ride services that substantially bring down the amount billed, so long as riders don't mind sharing a car with others traveling along similar routes.

In less-dense cities such as Austin, finding a taxi on the street can be especially difficult and wait times for calling a cab are long. The University of California Transportation Center conducted a study of residents who used ridesharing and ride-hailing services in San Francisco; they found that 93 percent of respondents said they waited fewer than 10 minutes for a ridesharing car, but only 35 and 39 percent reported waiting fewer than 10 minutes for a taxi dispatch or street hail. The departure of Uber and Lyft should have been a godsend to taxi operators – they got what they wanted, and had the opportunity to dominate the market. However, after Uber and Lyft withdrew from the Austin-area market due to onerous regulation, demand for ridesharing services didn't wane and residents appeared unwilling or unable to go back to traditional taxis. It seems that the absence of the two major rideshare providers has instead created a transportation vacuum.

To that end, a host of black-market providers have been popping up in the city to serve this unmet demand. These are a mix of individual former drivers offering their services via Craigslist, Facebook groups specifically created to connect Austin-area rideshare riders and drivers, as well as smaller ridesharing services, such as Fare, Wingz, GetMe, Fasten, and RideAustin.

The black market for transportation illustrates a few things: there is still consumer demand for these services, taxis have not or cannot picked up the slack, and consumer preferences support services that are even less regulated than the ones the city sought to maim. It's unlikely the raft of new apps that have quickly moved in will be as efficient and reliable as Uber or Lyft. New entrants probably won't have the same extensive resources as Uber or Lyft, and they will lack the tested algorithms and customer interfaces of the established players. Even though arranging a ride through Craigslist, Facebook

groups, or newer apps may not be as dependable as using Uber or Lyft, consumers in this market continue to choose these alternatives over taxis, which is telling.

It is important to note that even though Uber, Lyft, or Airbnb may be technically illegal in a city or municipality, some riders, drivers, and hosts in these areas still utilize their services regardless. This is why you can find Airbnb listings in Anaheim, California even though the city banned all short-term rentals in June 2016, or why underground ridesharing services continue to be offered in Austin despite the city's laws. Such activities can result in strict law enforcement, including fines for operators, such as the aforementioned \$7,500 penalty in New York for violating the state's restriction on short-term rentals of entire dwellings.

Where Things Stand For Ride And Homesharing Nationally

The table below is a summary of the current regulatory status of the ride and homesharing economy in 18 U.S. cities across the country, representing multiple regions and ranging from small cities such as Santa Monica, California (population: 92,472) to New York City (population: 8.4 million). The cities chosen also represent a range of regulatory environments and responses to ride and homesharing services – from Las Vegas, where ridesharing was legally recognized in the Fall of 2015 and Airbnb is legal (though both entities have minor legal restrictions), to Houston, where Uber has threatened to pull out of the market due to heavy regulations and non-hosted stays via Airbnb are not permitted.

Why The Opposition?

Regulation affecting Airbnb has often been more stringent than that of Lyft and Uber – six cities shown in the table above have bans on short-term or whole residence rentals, versus only two markets that have total ridesharing bans or from which ridesharing companies have left due to cumbersome regulation. In both cases, established operators staunchly oppose the new entrants – taxi drivers and companies in the case of Uber and Lyft, hotels in that of Airbnb. They oppose the threat to their businesses from cheaper, more convenient and sometimes more cost-effective competitors – and because the new players are often not subject to the same set of rules and regulations municipalities have imposed on legacy service providers.

In his book *Permissionless Innovation*, Adam Thierer of the Mercatus Center posits that:

“The best solution, however, is not to punish new innovations by simply rolling old regulatory regimes onto new technologies and sectors. The better alternative is to level the playing field by ‘deregulating down’ to

put everyone on equal footing, not by ‘regulating up’ to achieve parity. Policymakers should relax old rules on incumbents as new entrants and new technologies challenge the status quo.”

It is clear that the impact on legacy companies from the new entrants has been tangible. In the case of Lyft and Uber, taxi companies and drivers continue to oppose them vociferously, even in cities where they have been legalized, such as Washington, D.C. Paris saw riots in January 2016 from taxi drivers who resisted the new entrants. Fortunately, U.S. cities have been spared the ugliest retaliations against the two companies. The value of “medallions,” which give New York City cabbies the right to operate, has fallen precipitously in recent years, even as “yellow cab” as an institution has proven resistant to the challenge posed by ridesharing.

Taxes collected from hotels in New York City dropped or remained flat from late 2015 through early 2016, according to a report released by New York's publicly funded, non-partisan Independent Budget Office in May 2016. Many blame Airbnb for this decline.

Revenue from hotel occupancy taxes dropped 4 percent from October 2015 through March 2016, and sales taxes collected from hotel stays fell 1.3 percent during early 2016 – making the hotel sales tax the only New York City sales tax revenue to drop during that period (the rest rose by 4.4 percent).

The argument of regulators against Airbnb is that property owners renting out rooms or residences for short-term stays takes long-term rentals off the market – it reduces the “housing stock.” A report commissioned by the city of San Francisco asserts that Airbnb took 925 to 1,960 units off the market in 2014. There is also criticism that a few “power brokers” dominate Airbnb's rental markets – but according to the company, this is not the case. David Hantman, head of global public policy for Airbnb, said, “It's important to remember that almost 90 percent of our hosts have only one listing and it's the home they live in.”

According to a press release from Airbnb, 16,000 hosts (comprising nearly 13 percent of hosts from ten of the largest cities in the country) reported that their supplemental income helped them avoid eviction or foreclosure. Half of all hosts say this income has helped them afford to stay in their homes, and more than half say it has helped them make ends meet.

Based on Airbnb's estimates, it would seem that most users who list their properties on Airbnb are not real-estate magnates trying to rake in nightly rates while diminishing the housing stock at the detriment of long-term housing seekers. They are middle-class residents looking to supplement their income. In addition, centering the debate on the housing stock may ignore

Regulation Affecting the Sharing Economy

	City	Ridesharing – Uber & Lyft	Home-sharing – Airbnb
Legal, with few regulations	Anaheim, CA	No significant roadblocks.	All short-term rentals banned in June 2016.
Heavy regulation	Atlanta, GA	Legal with some fees and other requirements, regulated statewide as of July 2015 .	Effectively illegal; hosted and non-hosted stays as well as short-term rentals restricted.
Some regulation	Austin, TX	Uber and Lyft pulled out of market after passage of onerous regulations.	Significant licensing requirements passed March 2016, including a 2022 date for total ban on short-term rentals.
Illegal or have left the market due to onerous regulations	Boston, MA	Legal; city ordered by a federal judge to amend rules on ridesharing in March 2016.	Landlords must register with the city, licensing fees and inspection requirements apply.
	Houston, TX	Uber has threatened to pull out of the city due to regulations similar to those in Austin. Other rules include cap on market entrants, licensing requirements and taxes.	Non-hosted stays effectively illegal, hosted stays only allowed in commercially zoned areas. Landlords may not rent more than 10 rooms in one dwelling, any more than 10 and the dwelling is categorized as a hotel. Resident-owner occupied homes with no more than 10 rooms for rent are considered a bed and breakfast.
	Denver, CO	Colorado first state to recognize ridesharing companies as legitimate. Fully legal since June 2014.	Heavily regulated; renting out second homes to short-term renters is banned; owners who rent out all or part of their first home obliged to go through licensing and tax requirements .
	Kansas City, MO	City currently accepting public comment on a rule that would modify current regulations – including removing the 30-day orientation period, during which drivers can operate without a permit. Uber previously backed a failed state bill that would have overridden local regulations for a statewide standard.	Proposed rules would require property owners to get a \$596 permit that would be good for two years and impose minimum residency requirements for prospective landlords.
	Las Vegas, NV	Banned until Fall 2015; now permitted but drivers cannot pick up at McCarran airport terminal (must pick up in parking garage instead).	Legal, but with licensing requirements and other restrictions.
	Miami, FL	Illegal until May 2016, now permitted.	Stays in Miami proper are limited to certain zoning districts; nearby Miami Beach has banned all rentals for less than six months and instituted fines of up to \$20,000.

Source: The R Street Institute's Roomscore 2016 and Ridescore 2015 reports as well as various media entities in the cities in question.

City	Ridesharing – Uber & Lyft	Home-sharing – Airbnb
New Orleans, LA	Ridesharing legalized in 2015, drivers allowed to pick up passengers from the airport in April 2016.	Short-term rentals are currently still illegal, but the city has considered rules that would legalize them with extensive restrictions.
New York, NY	No significant roadblocks to legality; taxis still dominate the market .	Heavily restricted; no listings for entire dwellings for terms under 30 days permitted. Significant enforcement efforts exist.
Philadelphia, PA	Illegal; Uber allowed to operate de facto amid SEPTA crisis in July 2016.	Legal with minor restrictions.
Portland, OR	Illegal until April 2015.	Legal but with onerous restrictions including licensing and inspection and a requirement that certain types of short-term rentals get explicit approval from zoning board.
Raleigh, NC	No significant roadblocks.	Effectively illegal; a proposal that would have permitted residents to rent out up to two rooms of their residence (but not a whole house) failed in June 2015 when the city council vote split 4-4.
San Francisco, CA	Legal, ridesharing companies are regulated statewide. Restrictions exist, such as a limit on the number of entrants as well as taxes levied on operators. However, efforts to apply more regulations do occur .	Hosts required to register with the city (Airbnb is currently fighting this); SF voters defeated an even more onerous proposal in November 2015. SF city council is also attempting to hold Airbnb responsible for hosts not complying with registration rules, Airbnb also fighting this .
Santa Monica, CA	No significant regulations.	Owners must be present for duration of the stay, must attain a business license, and pay a 14 percent occupancy tax to the city.
Seattle, WA	Statewide regulation is relatively light, however municipalities are allowed to make their own rules. Seattle in particular has imposed multiple licensing requirements and a knowledge test similar to that given to taxi drivers. Legal fight currently unfolding over a law that would allow drivers to unionize .	Short-term rentals are legal, operators must get a license and have semi-regular inspections.
Washington, D.C.	Technically illegal until Spring 2015, now legal (although there is continuing opposition from taxi operators).	Short-term rentals not illegal, however, renting out more than two bedrooms per unit is not permitted.

other causes of increasing rents and decreasing availability – strict zoning and permitting requirements. For example, rules such as Washington, D.C.’s height restriction for buildings limits the number of units that can be built to accommodate housing demand. Cities such as San Francisco, New York, and Washington, D.C. have been experiencing very high rents for decades before Airbnb came along. A study by the Mercatus Center at George Mason University entitled, “How Land Use Regulation Undermines Affordable Housing,” stated, “Land-use regulations may then be an important factor in the skyrocketing housing costs in some of America’s largest cities.” The study pointed to minimum lot sizes, parking requirements, zoning requirements for low-income housing set-asides, and urban growth boundaries as all being potential drivers for higher housing prices.

Moving Forward – A Multi-City Regulatory Framework?

One of the most interesting developments in the sharing economy regulation saga this year was the news in June 2016 that mayors of ten or more global cities were coordinating on drafting rules for services such as Airbnb and Uber. Representatives of some of these cities met for the first time in May 2016 in Amsterdam. Paris representatives had called for a first publication of guidelines by October 2016, but the project has not yet come to fruition.

Companies currently have to navigate a patchwork of regulations, which isn’t good for them or their customers or partners. On the surface, coordinated rules might seem like a good thing. Wiley Norvell, spokesman for New York mayor Bill de Blasio’s deputy for housing and economic development, said, “Having the 20 or 30 biggest urban markets of the world all operating under entirely different rules doesn’t do much good for anyone.” Norvell continued, “We want consumers and tourists to have some consistency, city to city.”

However, this push for coordinated rules could have negative consequences for consumer choice. If cities hostile to Uber or Airbnb are leading the conversation, then it could mean limiting market access in cities that are relatively friendly to new services or don’t have much in the way of regulation yet, or where such services have yet to gain much of a foothold. These sharing economy companies are well out of their infancy and startup phase; they are now major economic forces. As their stature has increased, so has the scrutiny from regulators and legacy providers alike. The future of these companies, and the sharing economy in general, may well be decided in the coming months. ◀

Rapid Rise of Prepaid Cards Draws Regulatory Attention

Jake Steele

Prepaid cards, which include general-purpose reloadable cards, payroll cards, gift cards, campus cards, healthcare cards, award or incentive cards, disaster relief cards, and government benefit disbursement cards, are an increasingly popular payment instrument in the United States. As opposed to traditional credit and debit cards that are backed by a line of credit or a bank account, open loop prepaid cards derive their value from deposits to the issuer before they are used. Prepaid cards can be either open-loop or closed-loop. Open-loop cards can be used to make payments anywhere the major payment network (e.g. Visa or MasterCard) on the front of the card is accepted. Closed-loop cards are accepted at a specific retailer (e.g. Starbucks Rewards™) or related group of retailers such as a franchise network (e.g. Gap gift cards, which can be used at any of the Gap Inc. brand stores including Gap, Old Navy, Banana Republic, and Athleta). These cards offer an alternative to credit and debit cards that is cost-effective and accessible. Prepaid cards are commonly used by banked and unbanked consumers to manage their money, by employers to distribute payroll, and by government agencies to distribute benefits.

According to the 2013 Federal Reserve Payments Study, the number of prepaid card payments increased by 3.3 billion to a total of 9.2 billion from 2009 to 2012, amounting to a 15.8% annual increase. Specifically, general purpose reloadable (GPR) cards are the fastest growing payment instrument in the United States. The number of payments using GPR cards increased 33.5% annually in the span of 2009 to 2012 from 1.3 billion transactions to 3.1 billion. GPR cards especially appeal to the 9 million (7%) of U.S. households that are unbanked and 24.5 million (20%) that are underbanked, whether by choice or because no bank will allow them to open an account. The 2015 FDIC National Survey of Unbanked and Underbanked Households found that 37.8% of these unbanked consumers cited not having enough money as their main reason for not having a bank account, 10.9% cited that they do not trust banks, and 9.4% are unbanked mainly because account fees are too high.

GPR cards offer essential services traditionally limited to bank accounts, including ATM withdrawals; direct transfers, direct deposits, and cash or check deposits; online account management and bill pay; and payment

with major card networks such as Visa, MasterCard, Discover, or American Express. GPR cards are purchased most often by consumers from retail locations, but are also distributed by employers and government agencies. These cards can often be reloaded electronically or at thousands of retail locations across the U.S.

According to the 2013 Prepaid Card Experiment, a 1,056-consumer study conducted by the Federal Reserve Bank of Boston, 27% of U.S. consumers have some type of GPR card. 24% of banked U.S. adults, as defined by having a checking account, own a GPR card, and 45% of unbanked consumers have one. This amounts to 4.8% of U.S. adults who possess a GPR card and do not have a checking account. Among U.S. adults with incomes below \$25,000, 49% have used a GPR card, which is a significantly higher rate (over 20% more) than other income groups. According to Phoenix Marketing International's Consumer Payments Monitor, 45% of Millennials, 35% of Generation X, 18% of Baby Boomers, and 4% of the Greatest Generation own a GPR card. The Phoenix 2013 survey defined Millennials as ages 18–32, Generation Xers as ages 33–48, Baby Boomers as ages 49–67, and the Greatest Generation as age 68 or older. The study found age to be a more significant factor than income in determining GPR card usage rates, as a majority of Millennials with incomes over \$100,000 own a GPR card. The Federal Reserve Bank of Philadelphia conducted a study called "Millennials with Money," exploring this phenomenon. They found that 96% of Millennials with incomes of \$100,000 or more used prepaid cards in August 2014.

Unbanked customers are significantly more likely than those who are banked to receive payments through prepaid cards. Of those consumers without a checking account, 33% received income via a prepaid card compared to 9% of consumers who have a checking account. Those without a checking account made proportionately more payments with a prepaid card than those with a checking account. Prepaid card accounts that receive periodic direct deposits from the government or an employer remain active longer and are used more intensively than those purchased from a retailer.

Some consumers are using GPR cards in place of checking accounts, yet GPR cards do not currently have the same

federal consumer protections. Currently, issuers are not required to limit a cardholder's liability for unauthorized use, or offer provisional credit for disputed transactions, or disclose all cardholder fees prior to acquisition, though many issuers provide these protections. Depending on how cardholder accounts are set up, some consumers do not have FDIC protection. It may be difficult for consumers to tell if they are protected as a result of the lack of standardized disclosure. Additionally, GPR cards can include a wide range of fees varying from company to company that are often not clearly and concisely disclosed. Possible fees, which vary by card product, can include charges for account activation, monthly account maintenance, point of sale transaction, bill payment, cash withdrawal, balance inquiry, adding funds to the card, receiving a printed statement, customer service requests, card replacement, inactivity, declined transaction, refund of remaining card balance, shortage/overdraft, and account advances. Critics argue that the lack of a standard format to compare fees and protections against fraud and disputed transactions makes it difficult for consumers to determine the best card for their needs.

In response, the Consumer Financial Protection Bureau (CFPB) finalized new rules on October 5, 2016 to regulate the prepaid card industry that become effective on October 1, 2017. In addition to general purpose reloadable cards, these regulations will cover mobile wallets, person-to-person payment products such as Venmo and Square Cash, and other electronic prepaid accounts that can store funds. The new rules extend protections from Regulation E, which applies the Electronic Fund Transfer Act, and Regulation Z, which applies the Truth in Lending Act, to all prepaid accounts other than limited exceptions for a handful of products such as certain healthcare cards, gift cards, and disaster relief cards.

The rules will require financial institutions to provide short form and long form disclosures with uniform format and content. The short form will contain standardized fee disclosures for all prepaid accounts even if the fees are \$0 or irrelevant to that particular program, information about additional fees that may be charged specific to that program, and finally information regarding FDIC deposit or NCUA share insurance eligibility and overdraft features. The long form disclosure will comprehensively set forth all of the prepaid account's fees.

The rules also extend provisions regarding consumers' rights to see account information. As the CFPB specifies, financial institutions must make available: a consumer's account balance, through a readily available telephone line, at least 12 months of transaction history electronically, and written transaction history in response to an oral or written request that covers the 24 months preceding the date the financial institution receives the request. For all prepaid accounts, the Bureau proposes to require financial institutions to disclose monthly and annual summary totals of all fees imposed on a prepaid account, when providing a periodic statement or electronic or written account history.

Additionally, the measure extends error resolution and limited liability provisions that currently exist for credit and debit cards to prepaid accounts that offer overdraft protection. The proposed rules limit consumer liability for unauthorized transfers, provided that they give timely notice. Companies cannot charge more than \$50 for lost or stolen debit cards if the customer files a report within two days.

The new rules extend credit card rules and disclosure requirements to prepaid account issuers offering overdraft services under Regulation Z. Under the new rules, the issuer must obtain consent before adding overdraft services, and must wait at least 30 days after the user registers for an account before adding these features. Consumers would receive periodic statements not more often than once a month and have at least three weeks to repay debt from overdraft service or credit feature. Also, the measure prevents the issuer from setting up electronic fund transfers to immediately take incoming deposits to repay and replenish credit lines. In response to concerns about "force pay" transactions – cases in which the card issuer is required to process a transaction even though there are insufficient funds to cover that transaction – the final rule clarified: "a prepaid card is not a credit card when the prepaid card accesses credit that is incidental to certain transactions in the form of a negative balance on the asset account where the prepaid account issuer generally is not charging credit-related fees for the credit." Some commenters on the proposed rule were concerned that such a requirement would mean that a prepaid debit card would be treated as a de facto credit card.

Though the new regulations serve to increase transparency and provide limitation of liability protections, they may have harmful unintended consequences. Critics of the CFPB rules argue that the rules are too broad and will limit access to essential banking services, such as overdraft, for those most underserved. Brad Fauss, President and CEO of the Network Branded Prepaid Card Association (NBPCA), stated in a press release that "the CFPB has dismissed many of our serious concerns and moved forward with a rule that will harm the very consumers it aims to protect. Instead of fostering financial innovation and inclusion, the CFPB's rule will ultimately limit access to an essential mainstream consumer product that helps millions of Americans participate in the digital economy, affordably manage funds, and safely hold money." These rules extend to a wide range of prepaid card types outside of GPR cards, and the increased cost of compliance may price out some non-reloadable products. Along with the increased costs, the short implementation timeline likely will not be met by some providers. While it is important to protect consumers from fraud and hidden fees, regulators must be careful not to undermine what makes these new payment instruments so attractive. ◀

What the Apple vs. FBI Encryption Battle Could Mean for Consumers

David J. Weissman

Multiple media outlets are suing the Federal Bureau of Investigation (FBI) over its refusal to disclose information on the cracking of the iPhone 5C belonging to Syed Rizwan Farook, who together with his wife carried out a shooting in San Bernardino, California. USA Today, Vice, and the Associated Press alleged that the FBI was concealing even basic information about the alleged third-party contractor who provided the tool, including not just the identity of that contractor but the amount paid as well. They are making this suit on Freedom of Information Act (FOIA) grounds.

The suit raised concerns as to the fact that the tool allowed the FBI to exploit “a serious undisclosed security vulnerability... in one of the most popular consumer products in the world.” It also raised doubts as to the reliability of the unknown contractor, calling into question their security measures and whether it would act only in the public interest. In addition, the plaintiffs are seeking information about the transparency of expenditure of public funds.

In March 2016, officials at the FBI successfully unlocked the iPhone 5C of Farook, marking the end of a month-long saga in which the FBI submitted a court order to attempt to compel Apple to comply. Apple refused, with CEO Tim Cook writing a letter to the public informing the world why he would not comply. FBI Director James Comey fired back in response to Apple’s concerns.

The initial order, issued by Judge Sheri Pym, of the Federal District Court for the District of Central California called for Apple to: 1) provide “reasonable technical assistance,” including uploading software to the iPhone that would enable the FBI to bypass the auto-erase function on the iPhone (which executes upon more than 10 incorrect password entry attempts), and 2) allow officials to submit potential passcodes to the device electronically (in order to crack it and gain access).

Apple Defies Court Order

Hours after the order, Cook posted his response. In it, he called the FBI’s demand “an overreach by the U.S. government.”

He alleged that the judge essentially ordered Apple to build special, all-new software that would work as a skeleton key or a universal “unlocker,” capable of bypassing the device’s security and allowing law enforcement access to the data inside. Cook said that Apple does not have such a capability, nor would they want to create it, for security and privacy reasons.

He called the potential “backdoor” into iPhone security, “...something we simply do not have, and something we consider too dangerous to create.”

He continued, “The FBI may use different words to describe this tool, but make no mistake: Building a version of iOS that bypasses security in this way would undeniably create a backdoor. And while the government may argue that its use would be limited to this case, there is no way to guarantee such control.”

Cook stated that Apple has cooperated with the authorities on multiple occasions in the past, complying with search warrants and subpoenas and making Apple engineers available as advisors to the FBI. But, he believes this latest request goes beyond what they have asked for in the past, and is a dangerous precedent which would open the door to further government collection of data as well as compromise their devices’ security.

Cook tempered his criticism by adding, “We are challenging the FBI’s demands with the deepest respect for American democracy and a love of our country. We believe it would be in the best interest of everyone to step back and consider the implications.”

The FBI Responds to Apple’s Concerns

Comey’s reply to Cook’s letter came several days later. He exhorted the American public to, “take a deep breath and stop saying the world is ending, but instead use that breath to talk to each other.”

In response to Cook’s worry that giving the FBI this workaround would create what he called “a dangerous precedent,” Comey stated:

“The San Bernardino litigation isn’t about trying to set a precedent or send any kind of message... We simply want the chance, with a search warrant, to try to guess the terrorist’s passcode without the phone essentially self-destructing and without it taking a decade to guess correctly. That’s it. We don’t want to break anyone’s encryption or set a master key loose on the land.”

Comey continued, “It is about the victims and justice. Fourteen people were slaughtered and many more had their lives and bodies ruined. We owe them a thorough and professional investigation under law. That’s what this is. The American people should expect nothing less from the FBI.”

Apple’s Rebuttal

The morning after Comey’s statement, Cook offered a rebuttal. In an email to Apple employees, he stood by his conviction that complying with the order would be damaging to privacy, and he reiterated the company’s stance regarding the attacks:

“As individuals and as a company, we have no tolerance or sympathy for terrorists. When they commit unspeakable acts like the tragic attacks in San Bernardino, we work to help the authorities pursue justice for the victims. And that’s exactly what we did. This case is about much more than a single phone or a single investigation, so when we received the government’s order we knew we had to speak out. At stake is the data security of hundreds of millions of law-abiding people, and setting a dangerous precedent that threatens everyone’s civil liberties.”

Reminiscent of Comey’s admonition to “talk to each other,” Cook summarized his arguments by saying, “Our country has always been strongest when we come together.”

The FBI Finds Its Backdoor

Just as abruptly as the story began, it seemed to end. The FBI announced they had successfully unlocked Farook’s iPhone, and withdrew their legal complaint against Apple. The Bureau has declined to inform Apple of the method they used to break the encryption – despite Apple’s requests that it does so. The only information the FBI has released to the public is that the method or device was purchased from the private sector for \$1.3 million and only has limited applications. Due to the lack of transparency on this issue, it cannot be known for sure that the Bureau is being forthright, nor can the exact method the Bureau used to gain access to Farook’s iPhone be known unless the FBI chooses to disclose this information.

Government security agencies regularly purchase exploits to gain backdoor access to consumer software – and rarely do they inform the private companies of their vulnerabilities.

Other Cases Set a Precedent

This exchange between Apple and the FBI was the most high-profile in recent months, but there have been other instances of the government requesting backdoor access to devices or data. In February 2016, a federal judge denied the Department of Justice’s request for a court order that would have compelled Apple to bypass the security on a phone belonging to the criminal defendant in a drug case.

In that instance, Magistrate Judge James Orenstein found that the federal government failed to establish that the All Writs Act (the 1789 law that the FBI invoked in its fight for access to Farook’s iPhone) permits the action the DOJ sought, or that “discretionary factors” important in the case weighed in favor of granting the motion.

Orenstein continued to outline those “discretionary factors” – the rules for interpreting the All Writs Act’s text, specifically.

One reason Orenstein gave for denying the court order was that Congress has considered legislation that would give the DOJ the relief it sought, but it has not adopted it. In addition, he pointed to applicable case law for the All Writs Act, which he said highlights three important factors in deciding whether to issue an order under the Act: “the closeness of Apple’s relationship to the underlying criminal conduct and government investigation; the burden the requested order would impose on Apple; and the necessity of imposing such a burden on Apple.”

A similar case stems from a December 2013 New York district court judge’s issuance of a warrant to compel Microsoft to turn over emails stored in an overseas server in Dublin, Ireland. *Microsoft Corporation v. United States of America* (known colloquially as the “Microsoft Ireland” case, in part to distinguish it from the antitrust case against Microsoft that has a similar name) invoked the issue of whether a domestic search warrant can compel American companies to produce data stored in servers outside the United States.

The eventual decision, reached in July 2016, hinged on whether the basis the government used for its search warrant – the Stored Communications Act – applied outside of the U.S. The appeals court ruled that it did not, and Microsoft did not have to turn those emails over to the federal government.

Impact for Consumers

If the FBI used a hardware method – in other words, if they physically took apart Farook’s iPhone to gain access to the data – then that does not necessarily mean harm to consumers on a mass scale.

However, if the Bureau gained access using a software exploit of some kind – such as a virus – this would indicate that there are potential vulnerabilities in consumers’ iPhones that government information could help resolve.

According to tech news site The Verge, even if an FBI software exploit method was only applicable to the iPhone 5C or even just specific to the device in question (using the serial number of that device) then it could still present a security liability:

“But while the precise software proposed by the FBI can’t be used to unlock other phones, it can still be useful to thieves. If the code fell into the wrong hands, it could potentially be reverse-engineered into a generic version, removing the code that ties the attack to a specific phone. That reverse-engineered version would still need Apple’s signature before it could be installed — something thieves are not likely to have — but that signature system would be the only thing protecting a stolen iPhone and the information inside it.”

The government asking tech companies to provide backdoors that would circumvent their own encryption is a move that could materially harm consumer privacy. There is risk of such a backdoor falling into the wrong hands, and that would be disastrous for consumers – millions of iPhone users, for example.

In the next few years, requests such as this may become even more common, and the way companies and law enforcement agencies handle these situations will have immense consequences not just for the tech industry, but for consumers as well. ◀

Cutting the Cord: Pay-Television vs. Digital Streaming

Matthew Clark

Television entertainment has been a staple in American homes since the 1950s. With the advent of cable television, a handful of channels evolved into hundreds of options spanning across a myriad of genres. For decades, cable and satellite subscriptions were essential to receiving breaking news, live entertainment, and primetime programming. In recent years, however, consumers have been straying away from the growing costs and lack of flexibility of traditional paid programming and pursuing alternative viewing methods.

Why Are Consumers Cutting The Cord?

According to Nielsen, approximately 99 million American households subscribed to pay-television on a monthly basis in the fourth quarter of 2015, representing roughly 78 percent of all U.S. households. These subscription numbers currently sit slightly below all-time highs. However, according to a 2015 survey conducted by Pew Research, one out of seven adults admitted to “cutting the cord” by cancelling pricey cable or satellite subscriptions and opting for alternate sources of video entertainment. With the average pay-TV bill in the United States hovering around \$99 per month, consumers may be seeking cheaper ways to watch their favorite programs. In the second quarter of 2016 alone, major television providers lost a net 665,000 subscribers.

According to The New York Times, television providers have failed to attract Millennials, who comprise a major demographic of growing importance. The Times asserts that while still living with their parents (or others), only 11 percent of Millennials do not have cable and use Internet or broadcast television to watch programming. Once Millennials live on their own, twice as many opt to watch television programming via the Internet or broadcast television, rather than paying for a cable subscription – 20 percent for those with children in the home and 25 percent for those without children in their home. With cheaper, higher quality content readily available online, the traditional cable packages subscribed to by their parents don’t appear to hold the same appeal for Millennials.

In addition to growing monthly fees, subscribers may find cable and satellite packages overwhelming. The average pay-television consumer has access to approximately 200 channels, but only watches about 17 of them. The desire for customization and lower fees has paved the way for a new industry of online streaming services.

What Are The Alternatives?

Popular video streaming services – such as Netflix, Hulu, and Amazon Prime – offer consumers the advantage of watching familiar and original television programs not bound by network timeslots or excessive commercials. As a result of the creation of critically acclaimed, original series such as House of Cards and Stranger Things, primetime programming may be losing its appeal among younger viewers. In addition to much greater freedom of choice, the cost of using these services is far cheaper than an average cable or satellite package.

Subscriptions with Netflix and Hulu each start at \$7.99 per month and offer thousands of movies, documentaries, and television shows to choose from. Amazon Prime, a deluxe membership with online retailer Amazon.com, offers the same benefits plus other advantages (such as free two-day shipping on many items, as well as the Amazon Music service and unlimited Prime Reading) for \$99 per year.

Netflix boasts approximately 77 million subscribers around the globe, with about 47 million of those viewers living in the United States. Hulu has just over 12 million U.S. subscribers, and 43 million Americans enjoy Amazon Prime’s instant video service. These services can be accessed through any Internet-enabled device, including computers, tablets, mobile phones, video game consoles, and smart televisions.

Additionally, as the popularity of on-demand video has grown, a new market of streaming hardware has developed. Apple TV, Roku, Amazon Fire, and Google Chromecast are all devices that can enable a variety of different streaming services through an Internet connection and at a relatively low, one-time cost to consumers.

The Attraction Of Cable Television

A drawback of digital streaming, however, is the inability to view programs immediately as they air on network television. On Netflix, for example, entire seasons of programs are typically released in bulk a few months after they air on TV. Hulu employs a similar strategy, but more programs are sometimes available sooner than they are on Netflix. For example, Comedy Central has an exclusive deal with Hulu to show its popular animated comedy series South Park. Cable and satellite subscriptions still offer the opportunity to view programs in real time without a months-long wait. Additionally, television shows available through one streaming service are often excluded from others.

Moreover, while some consumers seek customization of their television stations, others take advantage of the ability to channel surf. This allows viewers to switch programs easily without having to revert back to a menu and “start from the beginning,” as is the case when streaming.

An additional downside of digital video streaming is its lack of live news and sporting event coverage. Popular services such as Netflix, Hulu, and Amazon Prime do not offer the option to watch sports or breaking news at all, let alone in real time.

Moreover, for consumers in more remote areas without reliable Internet access, dropping their cable or satellite TV subscriptions in favor of an Internet-dependent service may not be a viable option.

How Are Networks Adapting?

In order to better compete against the advantages of Internet streaming over traditional cable and satellite packages, networks have begun striking deals with outside services to retain viewership. Internet-delivered network television is attracting an increasingly large audience, with major players including HBO and Showtime.

HBO and Showtime, premium networks dependent on pay-TV subscriptions, could lose out as consumers cut the cord. As a result of this impending threat, they now enable Internet log-ins for live or on-demand streaming of their content, without the need for a cable subscription. HBO Now – HBO’s premium on-demand streaming application – costs \$15 per month and had over 800,000 subscribers as of April 2016.

Following the trend of successful network streaming, basic stations such as CBS, NBC, and ABC also have begun giving consumers the option of next-day viewing without creating an account. To avoid a decline in ratings from cord cutting, other major networks have partnered with outlets like Sling TV. Other major cable networks such as FX and ESPN are offering websites where content can be

viewed immediately after it airs, with some older seasons available as well. Similar apps exist for the alternative streaming hardware such as Amazon Fire TV.

Sling TV is a platform owned by Dish Network and offers a highly customizable selection of live television, available without a cable subscription. Using an Internet-enabled device, Sling TV grants access to a limited selection of live programming. A monthly fee of \$20 allows the viewing of 16 channels, including ESPN, TNT, TBS, CNN, Disney Channel, and Food Network. According to Statista, the platform had 600,000 subscribers as of February 2016.

Defying Industry Trends

During the final three-month period of 2015 when the entire pay-TV industry saw subscription losses, Comcast – the world’s largest cable provider – posted its best quarter in nine years.

While the rest of the industry lost 665,000 subscribers in the second quarter of 2016, Comcast added 53,000 subscribers and saw cable revenue growth of 6.7 percent to \$12.2 billion, according to The Wall Street Journal. Market Realist reported that amid an industry-wide loss in subscriptions, Comcast added 90,000 new video subscribers from April 2015 to April 2016. Although these numbers are unique compared to industry trends, a case can be made against their value as a predictor of the pay-TV market.

Major telecommunications providers such as Comcast use a business model known as bundling. Bundling involves combining two or three services together – typically cable, phone, and Internet – in one packaged deal for consumers. Because of the way the companies structure these packages, subscribing to all three services is sometimes cheaper than signing up for just one or two. Consumers who subscribe to Comcast’s high-speed Internet service may have no interest in cable or phone service; however, if purchased as a bundle, they may actually save money, whether they use those additional or undesired services or not. Comcast’s cable subscriptions may be on the rise, but consumers purchasing bundled services may be inflating those numbers.

Furthermore, some of Comcast’s recent success can likely be attributed to the implementation of its X1 set-top box, which replaces traditional cable boxes and serves as the company’s video on-demand service. The platform offers subscribers customization and Internet browsing through certain applications while allowing them to search across live television, on-demand programs, and DVR recordings. The rollout of the X1 was bolstered by a partnership with NBC to broadcast the 2016 Olympics in Rio de Janeiro, as the platform was used by 40 percent of Comcast’s video customers at that time. The company plans to grow X1 users by another 10 percent before the end of the year.

Due to Comcast's large market share in the industry as well as cable companies' control over how cable content is delivered to their customers, similar and arguably more innovative or desirable set-top boxes developed by (cable and non-cable) rivals have not been as successful. However, the FCC's proposed set-top box rule may end Comcast's domination over set-top box selection. While Comcast currently has a stranglehold on the technology, it has potentially laid the framework for cable packages that include live streaming, offering consumers the best of both worlds.

Cable Isn't Going Anywhere... Yet

The number of cord cutters has remained relatively steady over the past few years, and won't yet be cause for panic among cable providers. Subscription losses in 2015, which numbered in the hundreds of thousands, still only represented 0.6 percent of all households. That number is predicted to reach 0.8 percent by the end of 2016. Perhaps in response to the recent lower numbers across the pay-TV industry, providers and networks alike are responding to the call for more consumer choice in the form of on-demand streaming.

Continued adaptation will be the key for television providers and cable networks, moving forward. Consumers are seeking more freedom, and corporations and networks will have to be willing to come up with solutions that attract and retain subscribers. A hybrid of services, as seen with Dish Network's Sling TV "skinny bundle" and Comcast's Internet-enabled set-top box, may be enough to bring customers back to cable and satellite television.

While streaming services such as Netflix, Hulu, and Amazon Prime may pose a temporary threat to major pay-TV providers, the vast majority of streamers still pay for traditional cable. The pay-television industry remains strong for now, but in order to keep consumers satisfied with their pricey subscriptions, a combination of cable and satellite services with digital streaming may be inevitable. ◀



History of Hydrogen Fuel Cells and the Current State of the Market

David J. Weissman

The use of hydrogen as energy has fascinated people for years. In 1839 Sir William Grove built the first fuel cell – just 39 years after Alessandro Volta invented the battery. This was also the same year that the photovoltaic effect was discovered; however, like fuel cells, automakers have only begun taking solar power seriously as an vehicular power source in the past five to ten years. Fuel cells are essentially a battery that can be refilled rather than recharged, and can run on fuels other than hydrogen, provided they contain hydrogen – this includes natural gas, methane, and alcohols such as ethanol.

According to a report entitled, “State of the States: Fuel Cells in America 2015,” commissioned by the Department of Energy (DOE) and authored by the Fuel Cell & Hydrogen Energy Association (FCHEA), global annual fuel cell sales in 2014 totaled \$2.2 billion. Per a fact sheet put out by the Environmental and Energy Study Institute (EESI), this is an increase from \$1.3 billion in 2013, with sales predicted to reach \$3 billion by 2020. U.S. manufacturers currently dominate this market, as 140 megawatt of the 180 megawatt worth of fuel cells installed in 2014 shipped from American suppliers. Stationary fuel cells are a large driver of this growth; South Korea and the U.S. have the largest share of stationary fuel cell systems, while Japan has the most residential fuel cells installed. Growth in Western Europe is also pronounced, as that region strives to reduce its carbon emissions.

Advantages

Using hydrogen fuel cells for power has a number of potential advantages. According to the DOE/FCHEA report, fuel cells have very low or zero emissions, are quiet and reliable (unlike combustion engines, fuel cells have no moving parts), they are efficient and flexible in where they can be used, and use very little water in their operation, among other benefits. The report goes on to laud fuel cells’ scalability, in that they can meet power needs ranging from a few watts to multi-megawatts. They can be used to provide primary or backup power, and are compatible with solar, wind, batteries and other renewable and conventional energy technologies. Hydrogen-powered cars represent one of the most often-cited applications of fuel cell technology, and one that excites many people.

Fuel cells used in vehicles can be refueled in 3-5 minutes, which is much faster than recharging the batteries in EVs, which can take several hours. Batteries can only be recharged a limited number of times before they need to be completely replaced, and that count can be severely reduced by supercharging, which shortens charge time from several hours to a more manageable half hour.

Fuel cells do not emit pollution when run on pure hydrogen, however emissions can vary depending on how that hydrogen is extracted and stored. A 2005 joint study by General Motors Corporation, Argonne National Laboratory, and Air Improvement Resource, Inc. researchers estimated that emissions of fuel cell electric vehicles running on renewable hydrogen were almost 100 percent lower than those of conventional gasoline vehicles. That same study estimated that when running on hydrogen extracted from natural gas (the most common source) fuel cells’ greenhouse gas emissions are about 50 percent lower than that of combustion engines.

In a 2016 University of Michigan study, researchers noted that there are two ways of producing hydrogen energy, which both use electricity from the grid. One is a chemical process involving fossil fuels called steam reformation; the other uses electricity to split water into hydrogen and oxygen and is called electrolysis. These have varying environmental impacts. The study estimated the average greenhouse gas (GHG) emissions for electric vehicles to be lower than emissions from both internal combustion and hydrogen fuel cell vehicles. According to the study, the average well-to-wheels emissions for electric vehicles is 214 g/mi, fuel cells emit 260 to 364 g/mi (depending on whether the fuel used is gaseous or liquid hydrogen) and internal combustion engines have average emissions of 356 g/mi to 409 g/mi, depending on the type of fuel injection system used.

Fuel cells are more energy-efficient than combustion engines, have more energy density than a battery of a similar size. According to a fact sheet published by the EESI, a fuel cell-equipped electric car could generate enough energy to power a typical U.S. household for two days, something a standard battery could not do. Fuel cell systems are also considerably lighter than the comparable battery systems, even when the storage support system for the hydrogen is taken into account.

Fuel cell vehicles have longer range than electric, with an average of 289 miles vs. 110 miles on a single charge or fill-up. Internal combustion, however, beats both of those with an average of 418 miles. While average economy is better for electric vehicles than fuel-cell powered vehicles (105.2 mpge vs. 58.5 mpge), both are more efficient than internal combustion engines, which have an average of 23.3 mpg.

Current consumer applications of hydrogen are still fairly limited, but have considerable potential. According to the EESI, portable fuel cell systems can be used to recharge or directly power consumer electronics such as laptops or smartphones. In addition, hydrogen fuel cell-powered vehicles have a number of advantages over gas- or electric-powered vehicles.

While consumer use of hydrogen energy is not yet widespread, industrial and corporate use is common and gaining traction. According to the DOE/FCHEA report, Apple, Google, Coca-Cola, and other Fortune 500 companies have adopted fuel cell technology. Walmart uses fuel cells to power 2,800 of the company's forklifts at multiple warehouses. Stationary fuel cells generate power for 44 Walmart and Sam's Club retail stores in California and Connecticut.

Food service company Sysco utilizes a fleet of 800 fuel cell-powered forklifts at seven warehouses. AT&T uses stationary fuel cells to power almost two-dozen data and call centers, and as backup power for hundreds of cell phone towers.

Disadvantages

So, if hydrogen fuel cells present all these amazing benefits, why haven't they taken over the energy field?

Hydrogen cars present great promise; yet, as of 2016 there were only two fuel-cell electric vehicles (FCEVs) available on the market: the Toyota Mirai and the Hyundai Tucson. A third, the Honda FCX Clarity, was produced starting in 2008 but was discontinued in 2014. These vehicles are and were much more expensive than conventional alternatives – the Mirai has an MSRP of \$57,500 before any government incentives, compared with \$24,685 for a conventional-hybrid Prius. In addition, those vehicles have only been offered to customers residing in certain areas of California, due to the lack of significant refueling infrastructure in much of the country.

The problem of the lack of fueling infrastructure is something of a "chicken-or-egg" conundrum, as without a large quantity of FCEVs on the road, it is not a practical investment to build hydrogen-fueling stations. However, mass adoption of FCEVs will not occur without a significant fueling infrastructure. Unlike with battery-powered EVs, consumers won't be able to refuel FCEVs at home. An approach similar to what Tesla has adopted – selling EVs while installing Tesla-branded supercharger stations across the country to power those EVs – may be a way forward.

Of course, at the advent of gasoline-powered vehicles, there was no national infrastructure of gas stations (or any interstate or other large paved road network, for that matter). If early proponents of gas-powered cars had allowed themselves to be dissuaded by those roadblocks, then passengers might still be riding horses and taking steam trains in order to get to where they need to go. One other obstacle to mass adoption is the cost of production. Many fuel cells are made using platinum, which is expensive and rare. According to the EESI, however, the quantity of platinum needed has fallen dramatically in recent years, and ongoing research and development will further reduce this requirement. In addition, not all types of fuel cells require expensive catalysts such as platinum.

While hydrogen is the most abundant element in the universe, it does not exist in a pure state on Earth and must be derived from water or from hydrocarbons. This process is energy-intensive and sometimes done through the use of fossil fuels; however, its impact can be mitigated by the use of renewable energy sources, such as solar or nuclear energy, in lieu of fossil fuels. Currently, the more environmentally damaging method of extracting hydrogen from hydrocarbons such as methane (a fossil fuel) is more commonplace. The U.S. already produces a large quantity of hydrogen – 3 billion cubic feet per day, or 9 million metric tons a year. This is enough to power to 36-41 million FCEVs.

Even once the hurdle of producing hydrogen is overcome, it will still be difficult to store. It is the lightest element on the periodic table, meaning it must be heavily compressed in order to fit into a fuel cell or other container. Storing hydrogen as a gas requires high-pressure fiber-composite tanks; storing it as a liquid, meanwhile, means it must be kept incredibly cold. One potential solution is to store hydrogen as a component of a hydrocarbon such as alcohol, and release it in an FCEV with an onboard reformer. This emits some pollution, but substantially less than that of a combustion-based engine, according to a fact sheet produced by the Union of Concerned Scientists.

Conclusion

Hydrogen energy presents unique opportunities to diversify the energy portfolio of the United States, and some interesting applications for consumers, in particular the promise of alternative-fuel vehicles that could solve some of the drawbacks of electric vehicles.

Hydrogen fuel cell technology faces some concrete technological challenges and barriers to adoption, however, as has happened with a myriad of technologies ranging from the original gasoline-powered cars to personal computers, research and development and technological progress eventually lead to solutions to those problems. ◀

The Too

“Precautionary Principle”

Joe Colangelo

The race to bring autonomous automobiles to consumers is well underway. On August 18, Uber and Volvo announced plans to “develop base vehicles that will be able to incorporate the latest developments in AD [autonomous driving] technologies.” Ford intends to have self-driving cars available for ride-sharing in 2021, working with four start-up companies and expanding its presence in Silicon Valley to meet that goal. On August 26, Google announced the hiring of a former Airbnb executive to head its autonomous vehicle group. Google’s self-driving cars are currently being tested in four U.S. cities and have logged 1.5 million miles. For months now, General Motors has partnered with ride-sharing trailblazer Lyft in what they’re calling “a long-term strategic alliance to create an integrated network of on-demand autonomous vehicles.” And, though not without incident, consumer-owned Teslas have been zooming around the country in a limited self-driving mode.

While there are still a few miles to travel on the technological path, if there is anything that could delay the arrival of self-driving cars, it’s not technological capability – it’s premature, excessive regulation. Of course, it’s important that driverless cars are safe, and maintaining a low-risk environment for consumers is the primary charge of the regulatory bodies weighing in on this development. However, at this point in the testing process regulators may be susceptible to overreacting to possible safety concerns. State and federal authorities may, in response to the early but solvable problems that come with any new technology, set up roadblocks that impede the technology’s development.

There is a timeframe in a product or technology’s lifespan when regulators can be especially damaging to innovation. Consider recent regulations that prohibit drones, even commercial ones, from flying beyond the line of sight of their operators. This premature regulation has stifled one of the most promising new industries in our country, pushing companies like Amazon to locate their cutting-edge research facilities outside of the United States and depriving consumers of many of the benefits of this technology. Again, safety is a vital concern; however, there ought to be a reasonable middle ground between minor precautions and draconian rules that preclude progress.

The precautionary principle, a decision-making model, is a helpful way of understanding this issue. The principle states that if the risks of a decision are unknown, the least harmful path should be taken. This means that policymakers and regulators, in the absence of firm science, have a responsibility to protect the public from harm. While well-intentioned, this “do no harm” idea often translates into regulatory prohibitions of new technologies that appear dangerous on the surface, but when assessed in full context can be a boon to society. Taken to its extreme, the precautionary principle, which advocates minimizing risks without any consideration of the costs, would lead to a 25 mph speed limit on freeways or the prohibition of driving altogether.

One might be tempted to say that, since the “science is out” on the future of self-driving cars, regulators should apply the brakes to this new technology. However, that would be overlooking what we know about the alternative to driverless cars – when we take into account the dangers of driving, regulators’ application of the precautionary principle becomes straightforward: 32,675 Americans were killed driving in 2014. One-third of those deaths were due to drunk driving, and another 10 percent were due to distracted driving. We may not know exactly how safe self-driving cars will be, but we do know exactly how unsafe the practice of people driving themselves is.

In the case of driverless cars, the clear dangers relate to their reliability in adverse conditions and their ability to avoid accidents without harming other people, including pedestrians. These dangers tempt regulators into controlling the technology and, in the process, stifling growth before we can get a clear perception of the benefits, and before consumers can balance the risks with the advantages.

The obvious benefits of driverless cars can be simply understood and appreciated. With self-driving cars, commutes can become productive or relaxing, and the pain of traffic is alleviated. However, the secondary benefits of driverless cars may not be so readily observed. Research from Morgan Stanley shows that cars are utilized (driven) just 4 percent of the time. A study from Columbia University showed that an autonomous taxi fleet of 9,000

cars could replace today's surface transportation on Manhattan, with riders waiting an average of 36 seconds for rides that cost \$0.50 a mile or less. Shared driverless cars have the potential to drastically reduce the \$9,000 annual cost of automobiles – consumers' second-largest expense after rent or mortgage.

Driverless cars could physically transform the way people live in communities. The ability to sleep or work on one's commute could allow people to move further from transit centers without increasing the cost or time of their commutes, drastically reshaping communities throughout the world and reducing the cost of living. Companies like Google, Volvo, and Uber do not have a monopoly on driverless vehicles, and as they get more refined, more companies will invest in autonomous technology and software. This competitive landscape is terrific for the American consumer, who will benefit from increased efficiency and decreased cost.

Assuming, of course, regulators allow the innovators to innovate.