vhb viewpoints

The Future of the

Autonomous World

April 2020

Innovation. Integration. Transformation.

Every day, a fully autonomous world inches closer to reality—and COVID-19 is only accelerating that pace, digitally transforming how we work, learn, shop, build, play, take care of our health, and more. The corresponding benefits of autonomy are boundless and will change life in ways that few have imagined.

What exactly is an autonomous world, and what does it mean for our day-to-day lives? While there is no definitive answer, one might think of it as a future when intelligent technology, operating without human participation, allows for new business models and operating systems in a more efficient society.

Changes are evident. In our daily lives, car remote ignition starters entered the market more than 15 years ago. Others, like Amazon's Alexa, were only introduced in 2014. Both technologies provided simple, yet significant, impact on our home environment.

Or, what about our transportation infrastructure? Just a few short years ago, consultants started to leverage drone technology for bridge inspections, as well as real-time, structural monitoring sensors to assess the condition of a bridge. This technology enhances inspection and monitoring of critical areas—helping to extend the lifetime of structures, and ultimately reduce operating costs and improve safety.

We will see this type of monitoring, data gathering, and analytics for all infrastructure in the future. Looking ahead, technology-driven advancements will be followed by an accelerating series of systemic adjustments. The paradigm shift will permeate communities, markets, and the built environment.

A fully autonomous world will impact how we

Live · Work · Play

Automation Integration

The autonomous world already impacts how we live, work, and play. Automation will continue to change our lives in ways that few have imagined, affecting communities, markets, and the built environment.

Transportation

Innovations, including connected and automated vehicles, adaptive signals, and mobility-as-a-service will help to decrease congestion and pollution and, ultimately, improve mobility and accessibility for all who travel.

Energy

Renewable energy, such as wind and solar power, are dependent on natural resources. Automation, including the use of artificial intelligence (AI), big data, and predictive modeling, can help assess energy requirements and mitigate conservation and storage challenges.

Healthcare

From wearable sensors to telemedicine to robotic surgery, detection, diagnosis, and medical treatment are made timelier and more convenient through the use of automation and virtual technology.

Construction

How we build, operate, and maintain critical infrastructure is made safer and more efficient by employing innovations such as drone technology, smart sensors, and robotics.

Retail

The rise of e-commerce has changed the way people shop. Online ordering, drone delivery, and big box repositioning have transformed the retail landscape, resulting in faster delivery and community-focused, mixed-use shopping destinations.

Smart Homes

The use of technology in our homes has automated everything from turning on the lights to ordering groceries to enforcing security. When daily tasks are automated, it frees up time for other, more enjoyable, activities.

Entertainment

High-speed broadband and data streaming have changed the way people watch movies, listen to music, read books, and play video games. Future advancements in technology will allow for entertainment to be enjoyed virtually anywhere, on any device, and in new ways.

Education

Online courses and digital learning have made education more accessible, flexible, and interactive. Audio and video technologies, online resources, and virtual reality are reshaping today's classroom and enhancing the learning experience.

Labor

Cobotics, where robots work alongside humans, will help to increase productivity and efficiency. Mundane and repetitious tasks, such as factory assembly and transcription, will be performed using automation, allowing humans to focus on innovation and creativity.

Live

With new technology, change accelerates. In the past, wide-scale changes to built environments took decades; now, they take just years.

Electricity, running water, and internet connections were slow to roll out. In fact, some rural American regions lacked indoor plumbing as recently as 1988. Compare that to the adoption of apps like Google Maps and Waze, which, in less than a decade, have forever transformed navigation. These days, new innovations are frequently introduced—even before we've fully acclimated to recent change.

Whether residing in an urban center, a suburb, or the newly coined **"surban or hipsturbia"**, the outlook on mobility and transportation is undergoing a major transformation.

For example, we are experiencing the decline of ownership—and the rise of the subscription economy for everyday needs. Car ownership is no longer a badge of achievement; to younger generations, it's a yoke of unnecessary costs and pollution. As newer generations continue to prefer experiences over possessions, and place a greater emphasis on sustainability, the subscription lifestyle grows in appeal, especially within the realm of mobility and transportation.

Because of the bureaucracy, time, and expense often associated with large-scale infrastructure projects to address mobility needs, car subscription services, transportation network companies, and autonomous vehicles have stepped in to fill the void between convenience and sustainability.

You need a car next Tuesday? One can arrive at your front door.

Today, you may need a two-passenger vehicle for work, but on Saturday, you need a minivan for the hockey team.

These needs can all be accomplished with ease. Sign-up for what you want when you want it. And, cancel when you're done...all within a few clicks from your mobile device.

Major automakers across the globe expect to roll out full fleets of self-driving cars in the early 2020s. These vehicles will have across-the-board impact, removing barriers to affordable personal transportation for economically disadvantaged families, the elderly, and the disabled. The democratization of transportation opens up Live, Work, and Play opportunities that were previously inaccessible.

Overall advancements will astonish. With real-time big data analysis and **computer-programmed mobility planning** on the horizon, peak-hour congestion on streets and highways can be mitigated, if not totally avoided. Days become more productive, and roadways safer.

But by no means will the adoption of autonomous vehicles follow one straight line.

As is characteristic for innovation, safety concerns abound, reminding us that, when first introduced, people resisted seat belts, air bags, and high-speed trains.

In this case, the safety advantages of autonomous vehicles are difficult to ignore, but—following past patterns—adoption will most likely continue to be gradual.

Within a defined set of criteria, computers react quicker—and make more accurate decisions, especially amidst the wide variety of road and weather conditions. In contrast, people are limited by their five senses, plus intuitive sensibilities that aren't always accurate.

Real-time predictive modeling and road sensors can reroute cars away from congested and accident-prone areas, such as flooded streets, downed electrical wires, and schools letting out streams of students at the end of each day. Human beings can source this information, too—but not as broadly or efficiently.

When thinking of autonomy, many limit it to just vehicles. However, autonomy is so much more. In the next five to 10 years, changes and transformations will include:

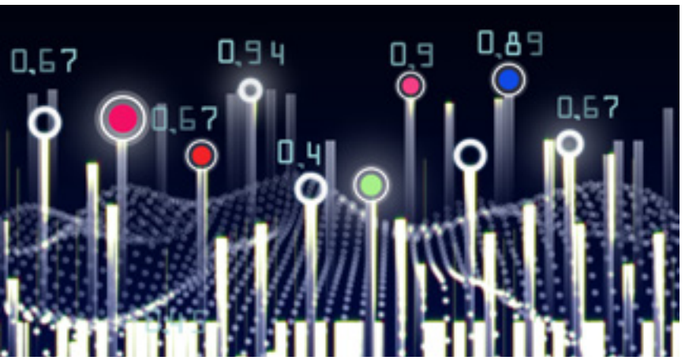
Disaster-Resistant Infrastructure

Bridges that rise with sea levels, stronger and more protective building materials, and other technical innovations can endure and even predict natural disasters. These will become increasingly important for sustaining future generations, especially as natural disasters (flooding, drought, wildfires) continue to accelerate.

The Hood Canal Floating Bridge in Washington State connects Puget Sound with the Olympic Peninsula

Accident-Resistant Systems

With computers now collecting massive data around the occurrence of accidents under varying conditions, predictive modeling will help usher in preventive measures—and facilitate a better response. This extends to ambulance dispatch, hospital readiness, and the aforementioned real-time rerouting for accident avoidance. Our autonomous world will enable proactivity around the delivery of care: when and where needed.



Cybersecurity + Domestic Safety and Defense

As technology becomes more complex, threats to our information security grow more sophisticated. Proactive measures—such as automating scans, sensors, and updates—can help better secure our living (worshipping, learning, studying, and other) environments.

Dubai's smart mapping includes real-time street-level data

Real-Time Data + Sensors

Through digitally streamed data and sensors, the possibilities are limitless. The autonomous world can help the visually impaired navigate using WeWalk, a "smart cane" that leverages real-time and GPS data.

Toyota is building "Woven City" the world's first truly smart city. On 175 acres at the base of Mt. Fuji, residents, businesses, recreational facilities, and infrastructure will be entirely linked and integrated through data, sensors, and communication tactics. Within, the autonomous Toyota e-Palette will facilitate transportation, deliveries, and mobile retail: one of the myriad applications of autonomy, robotics, and AI.

Dubai's Road and Transportation Authority is co-developing smart mapping, with real-time street-level data, including environmental data and congestion, and intelligent links between cars, traffic lights, and sensors on roads and sidewalks.

Work

Today's workplace differs radically from that of 2010—and even 2015. Apps like Slack, collaboration platforms like Google Drive, efficiency-increasing factory robots: all have amplified our real-time interconnectivity—and woven them into the very fabric of our work. Companies now see automation as a means of boosting quality, efficiency, accuracy, worker satisfaction, and global competitiveness.

While efficiencies created by automation and technology will eliminate some jobs, history shows that new jobs are always generated. According to Daniel Susskind, author and economic scholar at Oxford University, predictions of "technological unemployment" don't materialize. Instead, new jobs arise that we could never had imagined. Moving forward, the very shape of how we **work** may be in for a paradigm change.

Automation's benefits for how and where we execute work are numerous and include:

- Replacing repetitive tasks
- Minimizing manual processes
- Performing formula-based work
- Enabling workers to focus on the strategic, creative, and interpersonal aspects of their work—while streamlining processes.

For the A/E/C industry, and how we deliver and execute, we have seen several benefits from autonomy, such as how CAD/CAM and BIM have made it more time efficient to design everything built, while enabling more detail, faster modifications, and stronger outcomes.

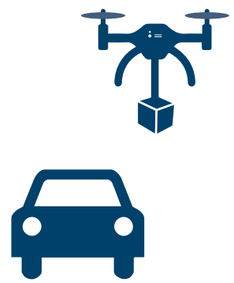
The impact of autonomy on the workplace will reach every industry. Detailed to the right are just a few ways autonomy will change how we work.

Workplace Flexibility

Autonomy places greater flexibility into the hands of employers and employees about where they work. While remote work is increasingly common, with reduced traffic thanks to autonomous vehicles (see **Live** section, above) workers may be more inclined to come to the workplace for in-person collaboration. If that's the case, will companies still need acres of parking lots to accommodate their workforce? Can this land be repurposed for other uses, such as at-work recreation for better work-life balance? Download VHB's Technology-Focused Tips to Boost Work Remote Productivity to learn more.

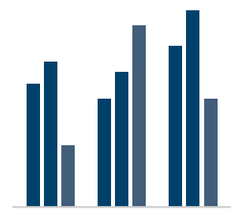
Cobotics

The specter of being ousted or replaced is of understandable concern to workers in every industry. Instead, beyond factories, where robots have been used since the 1960s, humans will find themselves working alongside robots to perform tasks more efficiently—and with greater productivity for all. These machines will become ubiquitous in areas brimming with repetitive manual labor, such as construction and agriculture. The benefits of cobots are clear—particularly in any industry or environment in which the risk for human injury dominates, such as energy. Finally, cobots are often better equipped to perform quality assurance inspections, on everything from welded pipe seams to secured scaffolding.



Transactions

Total business models will change, too. For example, the shift from conventional to self-driving vehicles requires a change in how these cars are serviced, repaired, and refueled. Corner gas stations and highway rest stops will need to evolve to accommodate more sustainable forms of energy; alternatively, they may recede and, eventually, disappear. The day may soon come when a sensor can notify you that your car is running low on energy—and summon the nearest automated refueling robot. In retail, robots may soon deliver your BOPIS (buy online, pickup in store) orders directly to your self-driving car.



Stronger Organizational Data + Insights

Automation technology such as automatic data capture, collection, and visualizations will be able to track performance metrics more reliably for deeper and more accessible insights. How we get to and from work, what we do once we are there, and how we can enhance the entire work experience will be up for evaluation.

Play

With newfound time freed up for daily activities, there's greater potential for enriching life. It won't just be more time to do more—in many cases, it will be greater physical access to experiences and an expanded array of things to enjoy.

As connectivity and augmented reality (AR) have enabled interactive play for people from all over the world, AR can transform play on a larger scale. For example, AI-equipped robot referees may eliminate any instance of home court bias from professional sports down to the club level. E-arenas will bring e-gaming to a live format, with pro e-gamers gaining celebrity status.

Travel will also change. Flights will likely be quicker, hotel stays shorter, and hospitality services delivered via corobots. The expanding amenities that come with autonomous touring vehicles will forever alter the definition of a vacation.

Advanced technology also brings rich options closer to home. For example, Big Snow at the American Dream Mall in New Jersey bills itself as "North America's first and only indoor, real-snow, year-round ski and snow resort." The skiway offers a life experience to anyone without means or weather conditions to make their way to a real ski resort.

Or, picture a ride around Gotham City narrated by Alfred, Batman's butler. You're in an autonomous SUV, being fed with sensory and haptic (3D touch) feedback, immersed in sound and light, watching a massive screen. With its immersive concept car, Warner Bros. is blurring entertainment and transportation. Pair this technology with models from the subscription economy previously discussed, and your trip to your vacation spot becomes an event in itself.

Additionally, climate change and global warming are having considerable impacts not only on how we live and work, but also play. Global warming impacts many of our most beloved vacation areas—decreased snow in the mountains; depleted coral reefs; increased marine pollution; and burgeoning fire, drought, and floods.

Alongside innovative flood barriers, autonomous transport, and clean buildings, creating/preserving/restoring entire environments may be on the horizon—with technology that can automatically collect, recycle, and repurpose our resources.

Applications of the autonomous world into **Play** also cross into how we **Live** and **Work**. Video game simulation has always exceeded real life technologies. Some of the best 3D models of cities like New York exist solely in video games. These sophisticated renderings can now be applied to uses outside of gaming, especially to infrastructure and real estate, and creating computer modeling of what-if scenarios.

The effects of the autonomous world are fluid, as easily seen just through transportation, which not only affects how we Live, but also affects our Work and Play. Similarly, autonomous security, safety, and sustainability impact components of Live, Work and Play.

Challenges

While the promise of autonomy looms large, there are challenges that can delay implementation, such as:

Government Decision-Making

At present, local, state, and federal laws and regulations aren't keeping pace with the speed of change. Private companies are driving innovation faster than the governments can currently regulate, endorse, or match.

Cybersecurity

Along with the growth in interconnectivity and data comes a requisite (and hopefully temporary) loss of privacy: machines will simply know more about people's movements and other data. Every project requires built-in failsafes to protect data integrity, privacy, and security—and ward against cyberattacks.

People

With the increasing penetration of technologies like these, we have newfound capacity to focus on people: on the personal relationships and meaningful connections that form the very fabric of our lives, workplaces, communities, recreational activities, and more. The prefix 'auto' connotates 'self', but our goals should always include finding ways to bring people together efficiently and harmoniously, not to isolate.

Global Governance

The race for autonomy and AI superiority is on. Some will harness it for good, but others may have more subversive objectives. It is vitally important that companies and countries work together to develop standards and norms for the application of this rapidly evolving technology.

Conclusion

Economies of scale across interconnected industries will facilitate the application of autonomous innovations in the built environment. As this new world speeds towards us, it's time to look ahead, free our creativity to solve problems, invent new solutions, and grab onto promising possibilities.

At VHB, maintaining the status quo is not an option. Our innovative thinking leads to creative and practical solutions.

We work along the leading edge of technology and innovation in the built environment, constantly applying innovative ways to help our clients and their communities.

VHB's passionate team of engineers, scientists, planners and designers continually look for innovative ways to improve mobility, enhance our communities, and promote economic vitality.

We aspire to build a sustainable, resilient, and innovative environment—optimizing **Live**, **Work**, and **Play** for current and future generations.

We look forward to embracing a fully autonomous world and the opportunities it presents for our firm, our clients, and our communities. VHB's technology team can help your organization navigate the new autonomous world.

Connect

with our thought leaders to share insights on the future of the autonomous world.

Steve Anderson, GISP
Director, Applied Technologies
sanderson@vhb.com

Mike McArdle
Chief Development Officer
mmcardle@vhb.com

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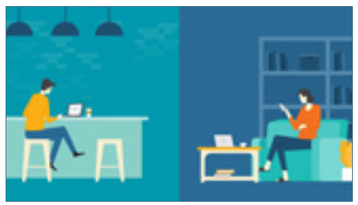

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