



DESIGN INFORMED BY THE PANDEMIC  
COVID-19 BEST PRACTICES IN HUMAN-CENTERED DESIGN

HUGO



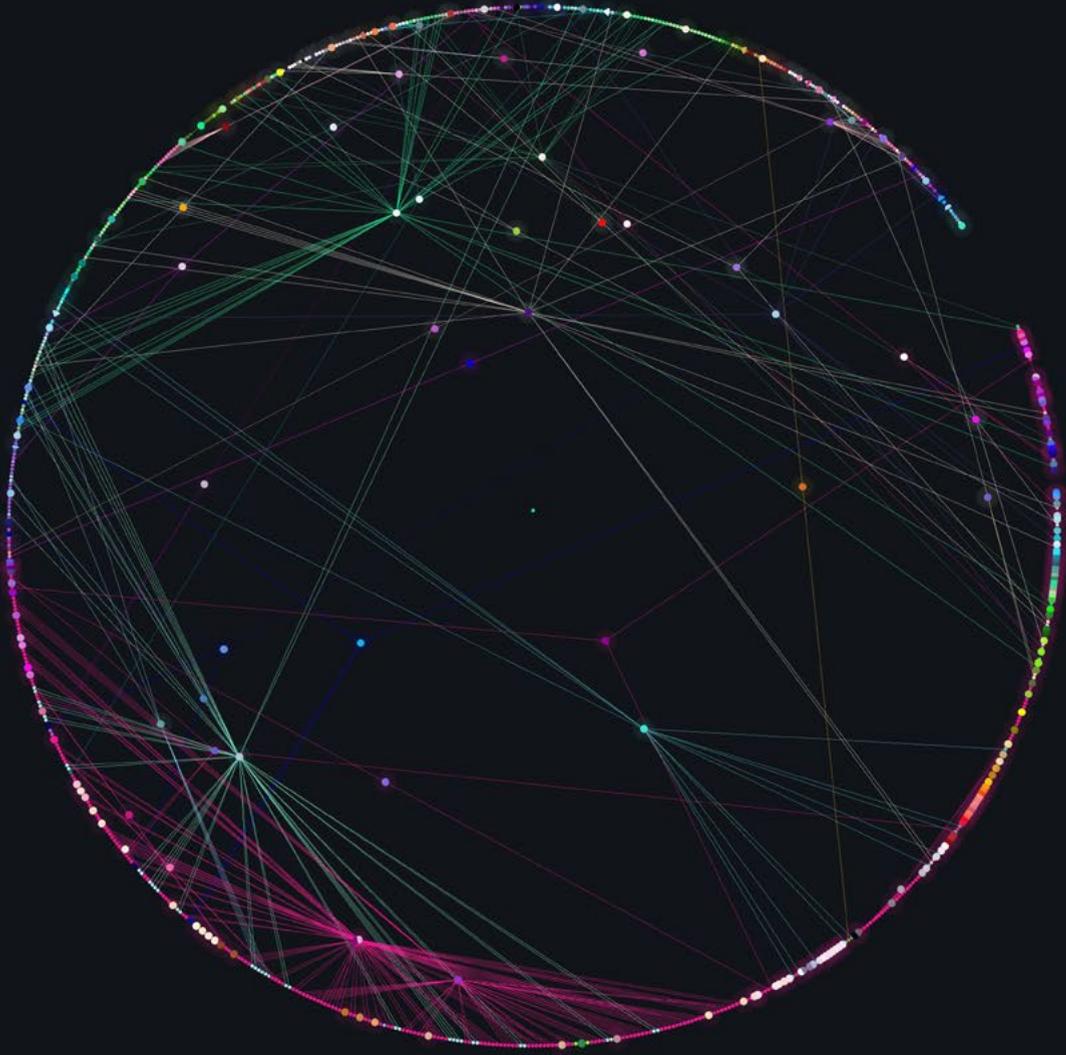
## For the majority of us, COVID-19 is the biggest global event of our lifetimes.

It has challenged us. It has changed our behaviors and altered our perspectives. We have lost our trust in public space, and at the same time, we have been introduced to healthier habits, gained more appreciation for the environment, and have realized a sudden desire to connect with others – as much and as often as possible.

There is a constant ringing in the air about what to expect from this “new normal” – our attitudes and behaviors are evolving at a rapid pace, forcing a hurried response from organizations and economies alike. The behaviors we build, and the technologies we adopt during this time are going to shape our lives in ways we can’t yet imagine. How will that affect the way we design, communicate,

build and create spaces that people feel confident coming back to? By diving deep into personal reactions, perceptions and ways individuals, families and social groups — all sources of creative innovation — hack new ways to live, we are learning how our built environment can successfully respond. We are preparing for so many changes, and we haven’t even begun.

This book is a guideline, a look into how architecture might evolve post-COVID-19, and a snapshot in time during an ongoing crisis. We are looking past the current pandemic, for long-term solutions that will drive healthier buildings – and happier occupants – far beyond the “new normal”.



# Letter from the Editor

## Technology is not the only thing that experiences exponential growth.

In our recent launch of The Curiosity Report, we shared a variety of emerging technologies and the human behaviors evolving with them. Little did we know that we would soon be experiencing a global pandemic that would serve as a catalyst for many of the technologies we discussed.

The coronavirus has disrupted systems and industries seemingly overnight. Across the world, we've all "gone home." We didn't just start working remotely, we started *living* remotely. Right now, digital connection is human connection. Our commutes went from highways to hallways, our dining tables became command stations, our spare room turned into the classroom, and our backyards became our vacation destinations.

Meanwhile, our healthcare facilities are overwhelmed. The unemployment rate is changing by the hour as our restaurants, small businesses, and large department stores alike shut their windows and lock their doors. Museums and amusement parks are moving into digital and virtual worlds, offering an escape as we stay indoors. We are washing our hands more. We are shaking hands less. And out of necessity, we are adapting to new technologies and ways of living. **But those technologies are moving quickly to adapt to our needs as well. It is true what they say – technologies and societies shape each other.**

Our firm has been working collaboratively – in cities around the world, and across each of our market sectors – to better understand the future of architecture in a world that's been disrupted by the coronavirus. Together we have created this report to learn from each other, and help our industry adapt as we adjust to certain changes in a post-pandemic world.

Previously, pandemics were studied in hindsight, with clearer vision and analysis; however, we are living in a world where technologies like AI and machine learning give us the ability to study its effect in the moment. As we experience this pandemic in real-time, we will analyze it, try to understand it, and derive new meaning from it. That being said, this report is not finished – it is a snapshot in time. It will evolve, as we continue to study, develop, and understand how our industry is changing (and ways it might even stay the same).

At some point, the "new normal" will just be normal. Working from home will be Tuesday and connecting with family members via Zoom will be a regular occurrence. Cooking at home will feel routine. And maintaining physical distance will seem customary. Some of these behaviors had already begun – they just got accelerated. And now more than ever, it's important to remember – it's not about getting "back" to normal; it's about creating a new one.

Let's create that together.

## HUGO



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Contributors

A roll of light-colored paper is mounted on a metal rod. The paper is partially unrolled, and a handwritten note is attached to the end. The note is written in black ink on a piece of white paper. The background is a plain, light-colored wall.

Don't

Panic!

# Human behavior is much harder to predict than technology.

Ask any behavioral economist. Humans are pretty well-known for their irrational behavior. Can't find toilet paper lately? Case in point. In fact, the field of Behavioral Economics was established to explore these irrational decisions and why they don't follow the predictions of traditional economic models.

**We are irrational creatures for a variety of reasons, one of them being that we are motivated by cognitive biases of which we are blissfully unaware.**<sup>1</sup> These cognitive biases distort the way we view the world and our perceived role in it. It explains why we tend to pay more attention to pieces of information that better support our idea over another.<sup>2</sup> Or why our memory is selective in the best of cases and almost entirely unreliable in the worst.<sup>2</sup>

When it comes to technological advances, however, we have the advantage of foresight. We're able to observe the trajectory of emerging technologies as

they're being developed (within reason, of course). We can research pending patent applications, attend industry events like the Consumer Electronics Show, see what venture capital firms are up to in Silicon Valley, and wait for promised deliverables like the proverbial flying car (which, by the way, might not be as far away as we thought).<sup>3</sup>

This isn't to say that advancements in technology are completely predictable. In fact, the scientific method is full of trial and error (just ask Thomas Edison; it took him 1,000 tries before he got the lightbulb to turn on).<sup>4</sup> Once in a while, an unexpected technology will even come along that turns us completely sideways – like Steve Jobs' announcement of the iPhone in 2007.<sup>5</sup> **But for the most part, the most unpredictable aspect of technology is how we decide to use it.** And as you can probably imagine, those possibilities are endless and full of complexities.

## Let me tell you a story about the spitting bucket.

If you walked into a 19<sup>th</sup> century hotel, you would more than likely see a series of spittoons, or “spitting buckets,” lining the floors of the central lobby. Spittoons were considered as common (and as necessary) as trash cans. These bowl-shaped vessels were designed to dispense “chew,” one of the most popular ways to consume tobacco at the time.<sup>6</sup> In fact, spitting was a generally accepted public practice, whether one chewed tobacco or not.

Spittoons would sit flat on the floor near doorways and hallways. This piece of technology was meant to be convenient and facilitate the human desire to spit. In theory, people were supposed to spit their chewed tobacco through the funnel at the top of the container but, in reality, it almost always ended up on the floor. Lovely, right?

**“Spitting is as old as baseball. Back in the 1800’s, players chewed tobacco to stimulate their saliva on the dusty field and then used the spit to moisten their gloves.”<sup>15</sup>**





human behavior



technology

The United States government even regulated where spitting was allowed. In 1917, a conference of health officials ordered that “an adequate supply of cuspidors shall be provided” in train cars.<sup>7</sup> But today, both the word “cuspidor” (meaning spittoon) and the object itself have virtually disappeared from the fabric of our lives.

This is not because the spittoon was an inherently flawed piece of technology. It’s because our behavior around spitting changed. And as COVID-19 makes its wave around the world, one thing is becoming very clear: certain human behaviors will be changing in response.

Like many changes that occur over time, elimination of the spittoon was gradual and influenced by a series of events. Most notably, by the early 1900’s, scientists had developed the modern study of hygiene. The works of Antonie Philips van Leeuwenhoek, Robert Koch, and Louis Pasteur made visible the microbial agents of disease.<sup>8</sup>

Around the same time, scientist Jean-Antoine Villemin proved that tuberculosis, which peaked significantly during both the Russian (1889) and Spanish (1918) flu spreads through saliva.<sup>9</sup> This discovery launched a series of public health campaigns to stop spitting in public in order to curtail the spread of infectious diseases.

“During World War I, the Red Cross sent out Army food boxes for prisoners of war which included either 4 packs of cigarettes, 4 packs of smoking tobacco, or 1 cut of chewing tobacco.”<sup>16</sup>

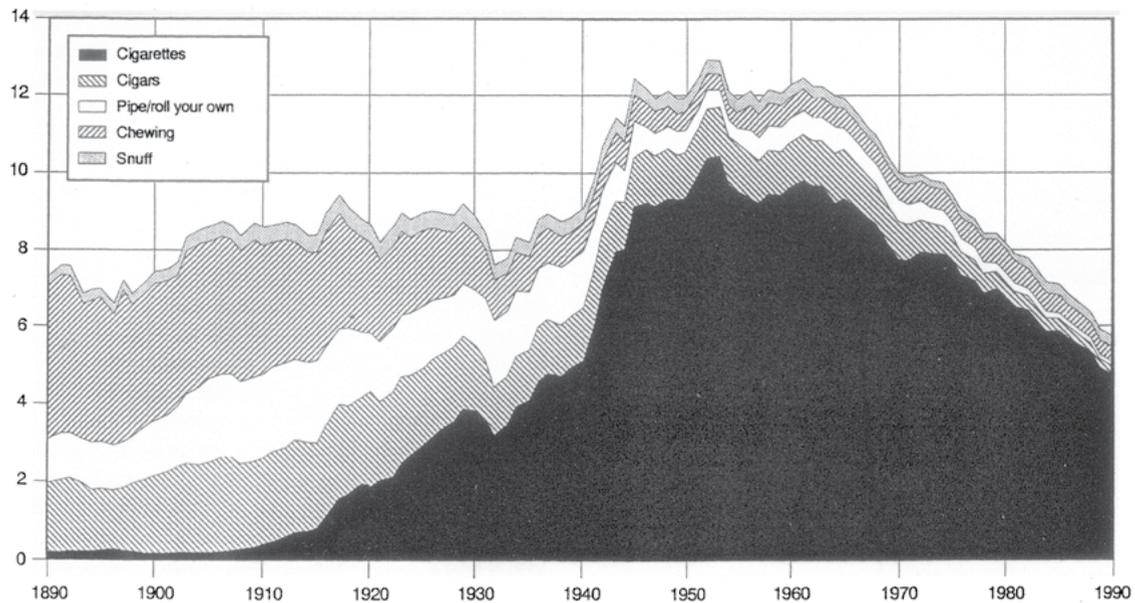


1920's Anti-spitting Poster

Additionally, our cities became more urbanized and congested, which means we became more aware of our own physical space and the areas where we might be inclined to spit.<sup>10</sup>

We also slowly transitioned our preference from chewing tobacco to smoking cigarettes. After WWII, many soldiers returned home with smoking tobacco, reducing the need for spittoons.<sup>6</sup>

And so, just like that, the spittoon disappears.



Trends in tobacco use in the United States during a period of one hundred years, reprinted from *Smokeless Tobacco and Health*, 1993. The ordinate is pounds of tobacco per adult per year.

## So, what does a spitting bucket have to do with architecture and design during a worldwide pandemic?

Similar to the spittoon, our behaviors have suddenly changed. Just a few months ago, we didn't think twice before going to the grocery store or touching an elevator button. As we look into the future of a post-COVID world, we might start to wonder what types of technologies and behaviors will emerge from this global pandemic.

Big historical events, like COVID-19, will more than likely be the catalyst for a wide range of technologies — gestural interfaces as we avoid high-touch surfaces, increased demand for 5G as we pull more data from home.

But we will have a harder time predicting what our human behaviors might be. Just ask the 1960's futurist who predicted the "office of the future" with fax machines, computers, and forward-looking

### DID YOU KNOW?

On April 23, 2020, Travis Scott performed a live concert in the Fortnite video game and 12 million people attended worldwide.<sup>11</sup>

technology products but forgot to include one major component: women in the workplace.<sup>12</sup>

**The hardest part for designers will be determining which of these behaviors are temporary and which ones are here to stay.** But hopefully we won't be hoarding toilet paper for the foreseeable future...

# How do big historical events, like COVID-19, impact human behaviors and our use of technology?

Scholars have long maintained that each era has unique spirit, nature, or climate that sets it apart from all other epochs.<sup>13</sup>

Big historical events often lead to shared cultural experiences that define generations for years to come, contributing to unique eras in history.

**Sometimes this is referred to as the zeitgeist, or the spirit of a generation or a period of time.**<sup>14</sup>

Some examples of this would be the free love and progressive movements of the 1960's or the Roaring Twenties.

**Origin of the word Zeitgeist**  
In German, zeit means time and geist means ghost or spirit.<sup>14</sup>

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## POST-CRISIS ANALYSIS

# and How We Have Adapted

By analyzing past pandemics, economic crises, or unforeseen events, we can gain valuable knowledge into the evolution of human behavior, technologies that emerged, and the systems that were developed, all in response to the event.

Technologies

Human Behaviors

Systems & Institutions

1854

## LONDON CHOLERA OUTBREAK ON BROAD STREET

How often does a map change the world? In the 1850s, cholera was believed to spread through "bad air," until Jon Snow mapped cholera deaths in Soho, London. By talking to local residents, Snow was able to identify the sources of the outbreak: a contaminated public water pump on Broad Street, demonstrating a link between cholera and contaminated drinking water.

Public Art through the Works Progress Administration

Movies & Radio for Entertainment

21<sup>st</sup> Amendment (End of Prohibition)

The New Deal

Mass Migrations

Agricultural Machinery

Public Health Act of 1875

Water Sanitation Practices

Reduced Crowding

The BCG Vaccine

American Thoracic Society

American Lung Association

Shorter Women's Dresses to Avoid Contamination

Healing Balconies

Self-Isolation

Nylon

Social Security Act

Increased Crime

Car Radio

Electric Razor

Frugality

Hoarding

Commercialization of Food Production

Data Journalism

Separate Land-Use Zoning to Protect from Industrial Pollution

Study of Epidemiology

Davidson Pneumothorax Apparatus

Red Cross Christmas Seal

Anti-Spitting Campaigns

Heliotherapy

The Baby Cage

Healthy Diet

Sanatorium (Fresh-Air Treatment)

1929

## THE GREAT DEPRESSION

When investors begin panic selling began on October 24, 1929, otherwise known as "Black Thursday," little did they it would mark the beginning of the Great Depression, a severe worldwide economic downturn. The Great Depression was the longest and most severe depression ever experienced by the industrialized Western world, sparking fundamental changes in economic institutions, macroeconomic policy, and economic theory.

1800

## TUBERCULOSIS

"Phthisis," "The White Plague," "Consumption," "The Captain of All These Men of Death" — for centuries tuberculosis plagued the world. It was not until the 1800s when the disease was formally identified, ultimately leading to the development of a vaccine by Albert Calmette and Jean-Marie Camille Guérin.

1939

## WWII

The instability created in Europe after the First World War (1914-18) set the stage for another international conflict. World War II broke out two decades later and would prove to be even more devastating. Over the next six years, the conflict would take more lives and destroy more land and property around the globe than any previous war, killing an estimated 45-60 million people.

Factory Assembly Line Production

Culture of Freeways & Driving

G.I. Bill of Rights

Streptomycin

Atomic Bomb

Sprawling Suburbs

End of Travel Restrictions between East & West Germany

European Management Forum becomes World Economic Forum

Increased Interest in Western Culture

Rapid Globalization marks New World Order

2001

## SEPTEMBER 11<sup>TH</sup>

On 9/11, militants associated with al-Qaeda hijacked four airplanes and carried out suicide attacks against the United States. Two planes flew into the World Trade Center in New York City, a third plane hit the Pentagon, and the fourth plane crashed in a field in Shanksville, Pennsylvania. Almost 3,000 people were killed that day, which triggered major U.S. initiatives to combat terrorism domestically and around the world.

Automobile Usage Increases

The War on Terror

The Patriot Act

Airport Security Line

Anti-Terrorism Advisory Councils

Arab Spring Uprisings

Economic Stimulus Act of 2008

35% of Population Delay Retirement Plans

American Recovery & Reinvestment Act of 2009

Millennials Delay the Purchasing of Homes

Occupy Wall Street Movement Gains Traction

Plastics

The Nuclear Family Unit

Nutrition Science

Post-war Optimism

United Nations

Anti-communism

Social Radicalism through Arts & Culture

Ability to Vote in East Germany

Berlin's Start-up and Tech Ecosystem

End of Cold War

Soviet Union Dismantled

Beginning of the Global Citizen

People Eat and Entertain at Home to Avoid Public Places

Transportation Security Administration

Phone & Web Surveillance

United States Department of Homeland Security

Military Drones

Household Spending Goes Down

Interest Rates Drop to Historic Lows

Beginning of the Gig Economy

Tech Start Ups Rise by 25%

Side Hustle Identity Emerges

2008

## THE GREAT RECESSION

The Great Recession was the longest recession since World War II. Beyond its duration, the Great Recession was notably severe in several respects. Home prices fell approximately 30%, the S&P 500 index fell 57% and the net worth of U.S. households and nonprofit organizations fell almost 15%.

1989

## FALL OF THE BERLIN WALL

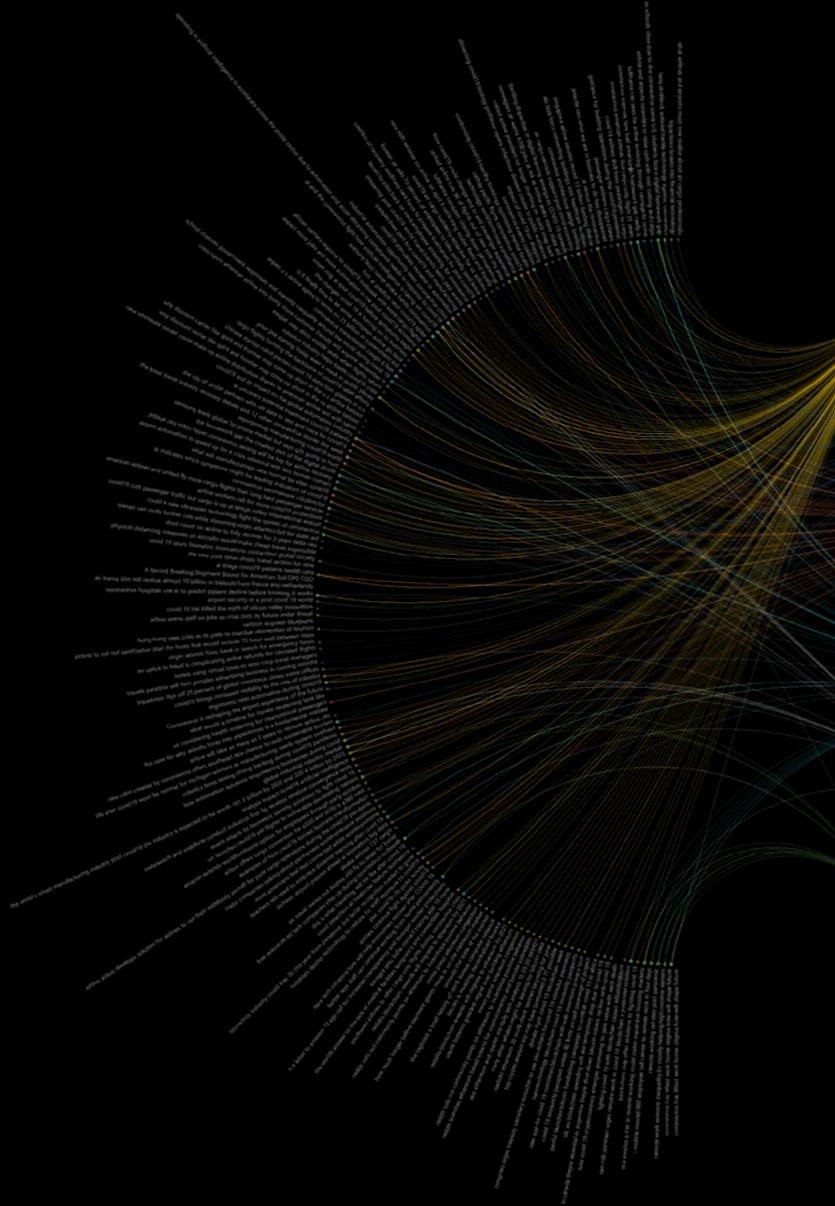
From 1961 to 1989, the Berlin Wall's concrete blockade physically and ideologically separated West Berlin from communist East Berlin. After 10,316 days of activism, the wall was "taken down" and East German citizens were able to pass through to the Western side.

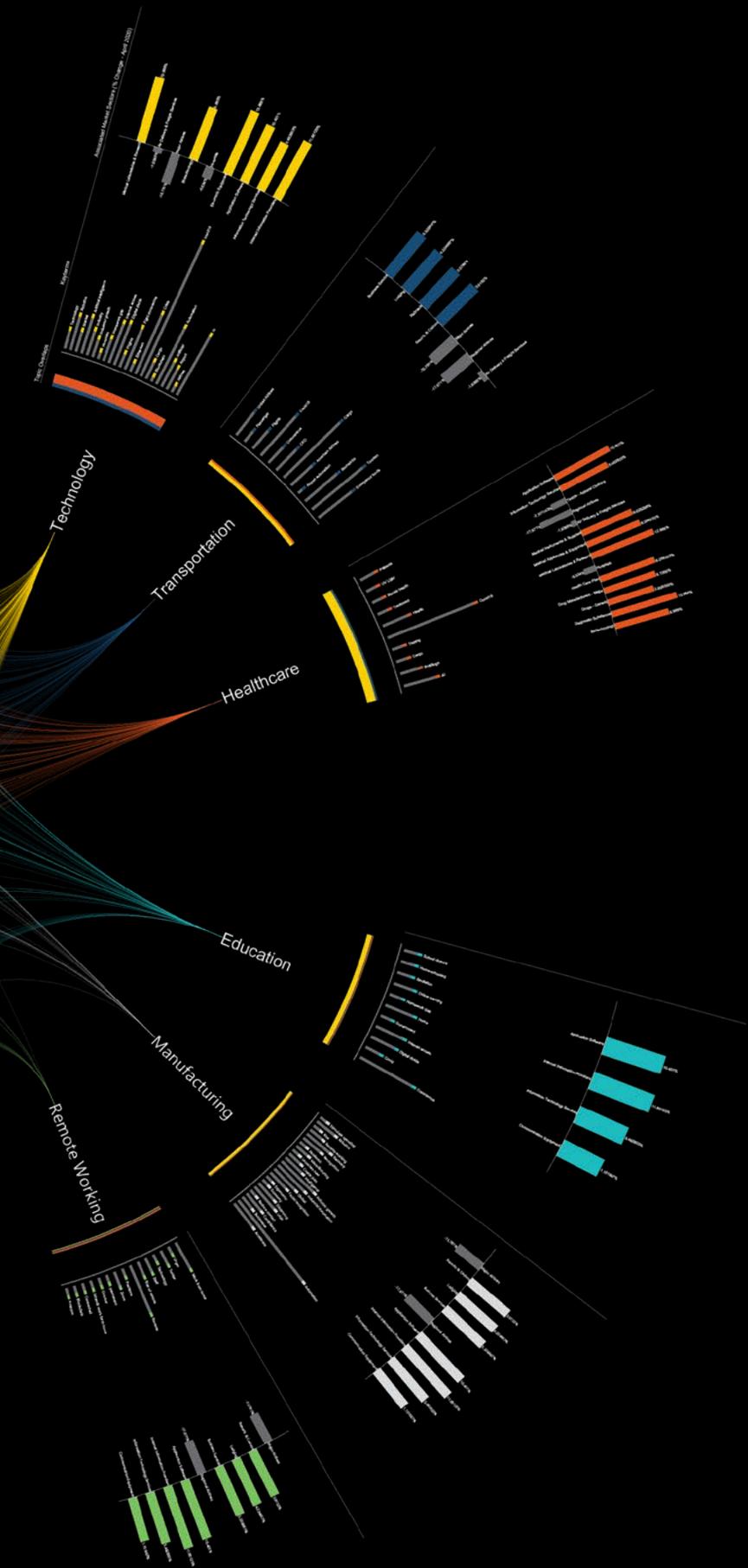
## INTRA-CRISIS ANALYSIS

# How To Decode The News

Today's new cycle is a living, breathing organism - evolving each day, perched and poised to take a story viral at any second. Especially now, the immediacy and chaotic nature of a continuous influx of news can be overwhelming and make it difficult to draw meaningful insights and connections.

Our goal is to help decode this chaos, analyzing the news cycle by mapping connections both between topics and to impacted industries in order to extrapolate meaning.





## LIVING DATA

# How We Adapted

News articles are fed into the visualization model (left) and through a framework of simple data mining, key words and phrases within the article titles and text are extracted and mapped to topics of interest. The extracted terminology is then searched for within market sector data from the S&P 500 resulting a list of potentially impacted industries. Each branch of this visualization contains a summarized graphic of terminology overlaps between topics, a hierarchical diagram of the most commonly found terms, and the percent change of impacted industries over the course of the COVID-19 pandemic.

**“If you think of anything that could come along and kill millions of people, pandemic is our greatest risk – in terms of a death toll, a pandemic would rival gigantic wars of the past.”**

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**BILL GATES, INTERVIEWED IN 2019<sup>5</sup>**

# COVID-19, Have You Heard of It?

On December 30, 2019, an artificial-intelligence company called BlueDot, which uses machine learning to monitor outbreaks of infectious diseases, alerted clients to an unusual bump in pneumonia-like cases in Wuhan, China. **It would be another nine days before the World Health Organization (WHO) officially flagged what we've all heard of by now: COVID-19.**<sup>8</sup>

## A Brief Introduction to Virology

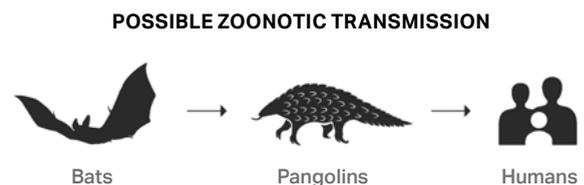
An estimated 1.5 million viruses exist in the world and, if the right circumstances align, any one of those could infect the human population. And this time, it seems they did. Prior to the first case of COVID-19, those who work in infectious diseases were preparing — and knew that a pandemic like this was inevitable.

While it's impossible to predict all the ways a virus can evolve, scientists and public officials have been studying the prospective impact of a pandemic. For a new disease to become a pandemic, it must find that delicate balance of contagiousness and deadliness. For example, Smallpox killed 30% of the its hosts — it terrorized humanity for thousands of years in the 20<sup>th</sup> century, killing hundreds of millions of people. Ebola was even deadlier, but far fewer people died from it in part because it's so deadly. People who are infected don't infect too many others because they get so sick, they stay home, and in most cases, don't survive self-quarantine.

## "Animal to Human Transmission"

A group called the EcoHealth Alliance has been scanning different regions in China for potential viruses and has repeatedly flagged diseases that could easily make the leap from animal to human. A few years ago, one strand of the coronavirus family, called RaTG13, was identified and categorized as low-risk to human populations. At the time, scientists didn't believe it was a clear and present danger. However, when scientists recently sequenced the genome behind the virus COVID-19, they found that it 96% identical to RaTG13.<sup>15</sup>

A similar kind of animal-to-human transmission happened in 1918 when a human (infected with the flu), and a bird (with the flu), met the same pig. The bird flu couldn't affect the human and human flu couldn't affect the bird. But those two viruses came together and collided with one of the pig's cells creating a new zoonotic virus — H1N1.<sup>14</sup> It is commonly believed that the COVID-19 virus originated in a bat, which then jumped to a pangolin, before jumping to a human.<sup>13</sup>

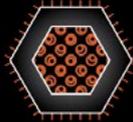


Source: CGTN

# Human Coronavirus Family



HCoV-OC43



HCoV-229E



HCoV-NL63



HCoV-HKU1



MERS-CoV



SARS-CoV



SARS-CoV-2

## COVID-19

The official name of the virus is **coronavirus disease 2019**, but it's been abbreviated to 2019-nCoV, or more recognizably, as COVID-19.<sup>4</sup> Like many diseases, COVID-19 spread quickly becoming the kind of pandemic we haven't seen in more than a century. Named after its crown-like spikes (*corona* means *crown* in Spanish), once inside the body, it locks onto proteins found outside of many human cells.

**CO + VI + D**  
corona virus disease

Formerly, this disease was referred to as "2019 novel coronavirus" or "2019-nCoV".<sup>4</sup>

COVID-19 is the youngest in a family of seven corona viruses known to infect humans.<sup>3</sup> Two previous coronavirus outbreaks, SARS-CoV in 2002 and MERS in 2012 — killed a total of 812

and 866 people, respectively. Just like COVID-19, SARS-CoV was transmitted from animal to human in a live animal market in China, and as is the case with any new zoonotic virus, there were no vaccines available.<sup>9</sup>

However, SARS-CoV would prove to be significantly less dangerous than its current counterpart, COVID-19. For one, SARS-CoV only spread when people were symptomatic (i.e. showing symptoms). This made it much easier to track, contain, and isolate infected individuals.

Additionally, SARS-CoV survivors gained a certain level of immunity and could not be re-infected. So, while SARS-CoV was technically much more deadly than COVID-19 (with a fatality rate of 34.3%) it was still spreading at a much lower rate. Note: viruses need a host to "survive" and, therefore, only spread if they don't kill their hosts immediately.<sup>9</sup>

With the current availability of tracking and testing, the estimated fatality rate for COVID-19 is 3.4%.<sup>9</sup>

## Sharing is *Not* Caring

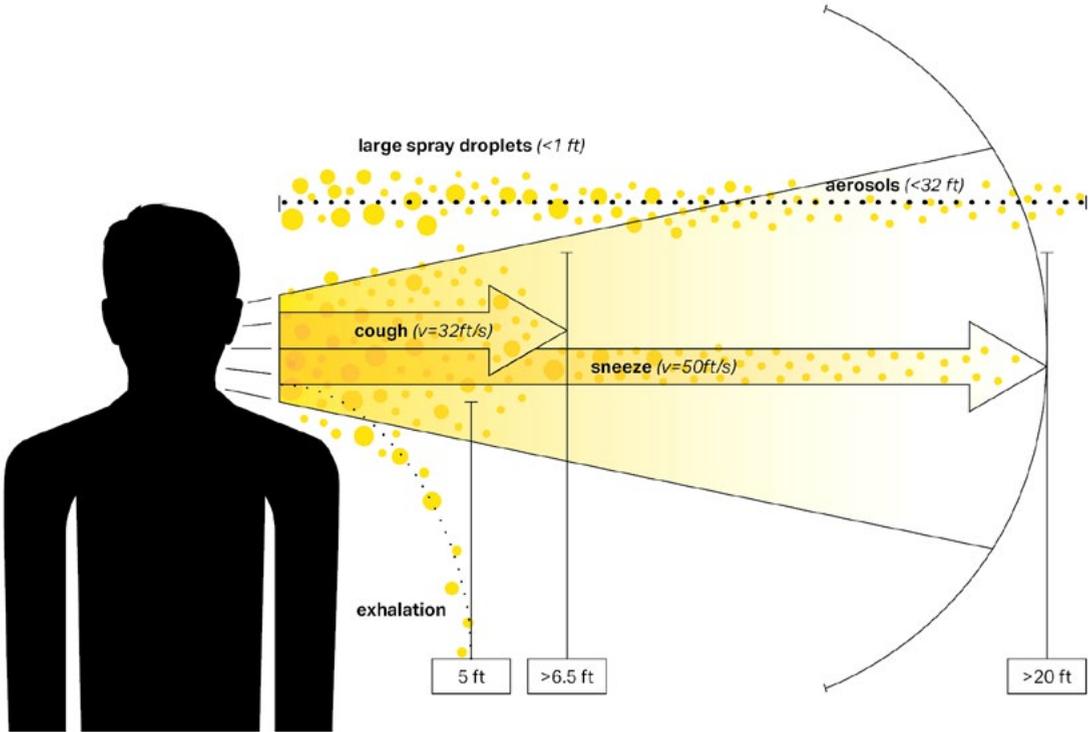
By now, symptoms of the virus are fairly well-known; however, we continue to learn about new symptoms as they surface. Among others, the most common and easy to identify are:

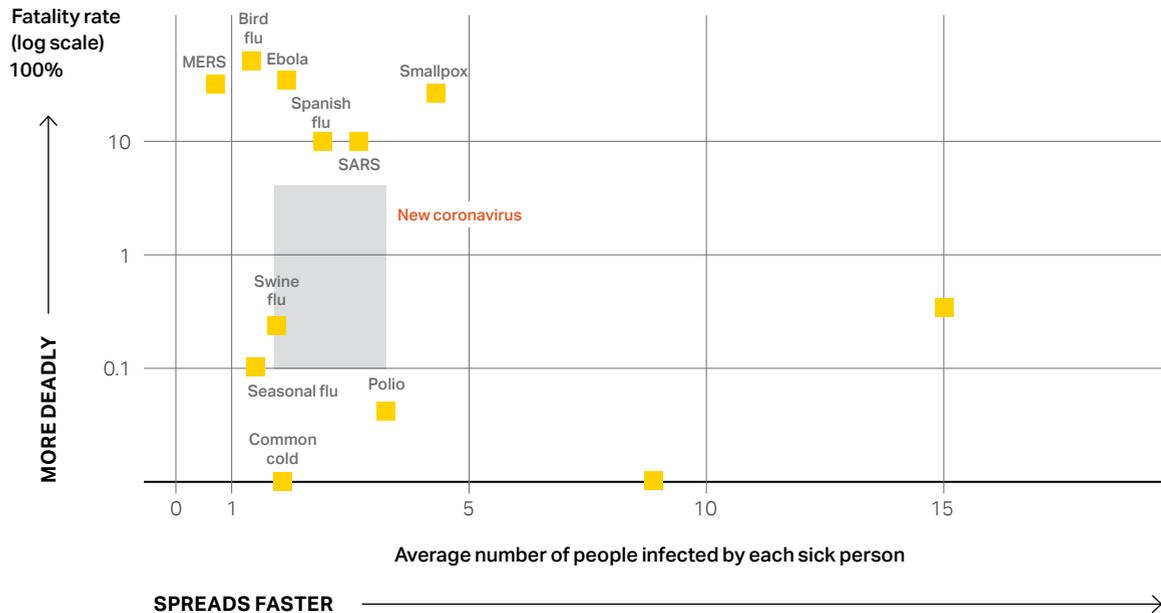
### Fever — Fatigue — Cough

Like many viruses, Coronavirus spreads through droplets when we sneeze, cough or speak, and it can infect us directly through our eyes, nose, and mouth. You can be infected and spread it without any symptoms, and in some cases, symptoms can even be mistaken for the ordinary flu. The virus itself is a self-assembled nanoparticle — its weakest link being the lipid (fatty) bilayer. When washing your hands, soap dissolves the fatty membrane and the virus disintegrates and “dies”.<sup>11</sup> In general, viruses can be active outside the body for hours, even days, which is why washing your hands after every transaction is very important. Especially when you consider that up to 80% of communicable diseases are transferred by touch.<sup>2</sup>



Check out how quickly the virus can spread in a restaurant when only one person is infected.





Average case-fatality rates and transmission numbers are shown. Estimates of case-fatality rates can vary. The preliminary estimates for the new coronavirus are shown in the gray region. Source: [New York Times](#)

COVID-19 joins the ranks with the world's most deadly diseases that are slow, silent, and commonly mistaken for other diseases. This coronavirus also has a long incubation period which means that infected individuals are more than likely spreading the disease before they even know they have it, which is why the number of cases increase on an exponential curve, doubling every several days.

Certain groups are especially at risk. In one U.S. sample,  $\frac{3}{4}$  of those who were hospitalized had at least one underlying health condition like lung disease, heart disease, or diabetes. Also, the risk of dying is clearly greater the older an infected person is.<sup>10</sup>

Cases amongst children have also been surfacing (mostly in the New York area where the highest number of cases currently exist). This "multisystem inflammatory syndrome" has currently shown up

in at least 150 New York children as a post-viral syndrome. This is not directly caused by the virus, but is more a response to the child's immune system.<sup>7</sup> Investigations into this strand of COVID-19 are still ongoing.

**In almost all countries where data is available, it also appears men are dying at a higher rate.<sup>6</sup>**

Scientists don't fully understand why, but this could be a result of various factors. Historically, women have a stronger adaptive immune system, which could be a contributing variable. However, human behavior may also play an important role – women have been 50% more likely than men to start using non-pharmaceutical protective behaviors during the pandemic, like wearing a face mask or avoiding public transit.<sup>12</sup> Interestingly enough, only 31% of men wash their hands with soap after using the restroom, while 15% don't wash their hands at all.<sup>1</sup>

# The Road to Recovery

The current antibiotics we have don't work on this coronavirus or any viruses. Antiviral drugs are difficult to develop and take time. Beating a virus requires immunity, and while the virus spreads through the population, some infected people die, while others survive. When enough people have developed immunity, there is no longer an uninfected host to which the virus can spread — a term we have come to know as “herd immunity.”

Herd immunity in relation to COVID-19 however, is not guaranteed, as other corona viruses do not achieve lifelong immunity. Waiting to achieve herd immunity in this case puts millions of lives in danger, with no assurance that it would work. When it comes to highly contagious, deadly viruses, creating a vaccine is crucial. Until you have a vaccine developed and distributed, you have limited options.

Dr. Anthony Fauci, a physician, immunologist, and current director of the National Institute of Allergy and Infectious Diseases (NIAID) — and now a household name — has mentioned that it could take a year to a year and a half to develop a viable vaccine. So, while the virus remains uncontained, the best thing that we can do to reduce the spread is to take a much more old-school approach.

Social distancing to avoid crowds and give the virus fewer opportunities to spread — also known as “quarantine” — has been a method of reducing viral spread for centuries. We see parallels between today's social distancing protocols, and those of the 1918 flu. At that time, St. Louis took immediate action when the flu was first detected, shutting down schools and public places, and asking people to minimize human to human contact. Philadelphia on the other hand didn't, and continued hosting a planned parade, which increased the death

rate significantly — it's much harder to save lives when everyone is infected at once, and healthcare systems are overwhelmed. However, St. Louis ended social distancing policies in November, when the flu seemed to be contained, only to see the death rate jump back up and the city quickly return to lock down mode.

This is a valuable lesson that we can learn and better understand for protocols today, as our government and congressmen are considering reopening our cities and repopulating our public beaches, restaurants, and offices. Slow and steady flattens the curve.

## Getting into Action

Across the globe today, healthcare facilities and staff are severely overwhelmed, as demands in response are rising while medical supplies are becoming scarce — all introducing a new world of makers ready and willing to create PPE for those on the frontlines. Makeshift drive-through testing facilities are popping up daily to meet the escalating needs of identifying the true levels of infection, introducing new methods of healthcare delivery and services that could go from temporary to permanent fixtures in our systems.

Once a virus becomes a pandemic all of human ingenuity is brought to bear to bring them down. We have learned to adapt our healthcare system's response, but what we need to do is prevent outbreaks like this from happening in the first place. We should've been more prepared, and yet at the same time, we've also never been more prepared.

This new virus was identified and within days the sequence was shared, and testing policies were put into place. Data scientists and strategists around the globe brought us information in real-time, keeping us informed about the infection rate and location on a daily, hourly, minute-by-minute basis,

bringing us into a world of information transparency. Post-COVID-19, the need for this information transparency will only increase, as we strive to know as much as possible about the buildings and public spaces we are walking into.

With the right mix of personal knowledge around maintaining healthy behaviors, and respect for

distancing guidelines, we can develop policies to minimize both the spread of the virus and the economic hardship of the pandemic. **The campaign against infectious disease can only succeed if the public cooperates and is knowledgeable.**

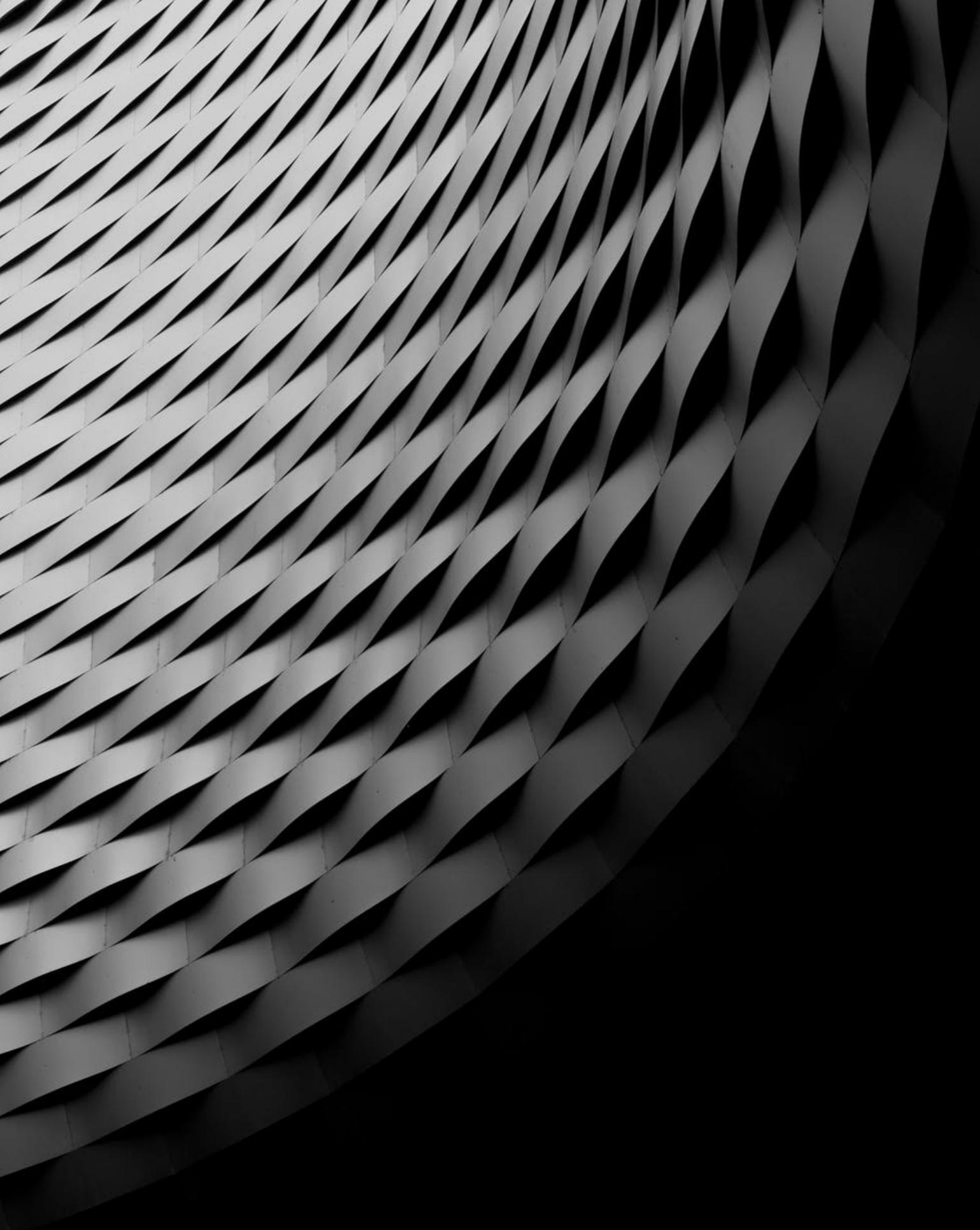
**So let's build that knowledge now.**

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Emerging technology, human behavior, and public health cannot be discussed in silos anymore. With any new system — or in this case, several systems combined — a common pidgin is developed, unfamiliar until it finds its way into everyday conversation. Several terms have taken on a new meaning as it pertains to our industry, and it's necessary to break down new mindsets about time and understand methods of intervention in project delivery.

# Time

Time is an interesting thing, particularly during a pandemic. Those on the frontline will remember this period much differently than those isolated at home, where days seem to blend together.

In fact, many researchers say, "These months will eventually become a blur for those of us isolating at home. This stretched out historical event isn't conducive to creating sharp, defined memories. Despite having conscious awareness of each moment now, a lot of it will slip away."<sup>1</sup>

As our governments prepare the world for re-entry, there has been a lot of discussion around short-term vs. long-term plans. While short-term might usually indicate a timeframe in the near future (let's say, 3-6 months) and long-term might extend beyond that, these concepts of time remain arbitrary if we don't consider the virus and vaccine availability.

"We do not offer a set date for reopening the economy; rather, we specify a minimum set of conditions to be satisfied before the economy of a given state can be reopened, and a path to reopening it once these conditions are met."

— Harvard Business Review (April 2020)<sup>2</sup>

With this in mind, a recovery timeline is no longer anchored by a certain number of days or a set of calendar months. Instead, a recovery timeline is now built around a set of public health conditions that must be met to ensure safety and impact.

**Pre-vaccine:** When we say short-term, we are more than likely referring to time as a "pre-vaccine state."

**Availability of testing:** When we say short-term, we are more than likely referring to a "pre-vaccine state" in which large percentages of the population have access to regular testing.

**Post-vaccine:** When we say long-term, we are more than likely referring to time as a "post-vaccine state."

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# Delivery

Our buildings and public spaces are about to change. Designing human-centered spaces with wellness in mind has been a luxury in some circumstances — but that will no longer be the case. The focus on health-oriented approaches will fundamentally transform how we design and deliver architecture. However, not every building will be able to make wholesale shifts, nor do they need to. Taking a layered approach to design delivery will instill confidence in users, bringing them back into the spaces we desperately want to keep designing, and keep designing for them.

## AVOIDANCE

Through thoughtful design and delivery of new construction post COVID-19, we have the opportunity to eliminate the introduction of the contaminant into the building space — a method to successfully avoid any instance of viral spread. In effect, this approach reduces the quantity of contaminants that can enter the indoor environment and establishes standards or methods to avoid high-risk situations that may require new buildings to incorporate touchless design strategies, recirculate outside air differently, decrease densities, or standardize ambient temperature and humidity levels.

## MITIGATION

When it is not possible to avoid or eliminate the risk, introducing controls that detect the contaminants prior to viral spread may be the next best solution. These controls include more active approaches intended to capture, kill, or flush away the contaminant, and could take shape in the form of monitoring technology added to an existing building system to gain better insight on current usage. It could even be as simple as introducing increased

filtration, ventilation, or UV lights into existing HVAC systems. Controls may also focus on management or decision-making processes. Keeping the same spatial size and layout but reducing the number of people that can access that particular space, or enacting “closed for cleaning” times to cut down on access, could be an example of adding controls.

## BEHAVIORAL CHANGE

Behavior change can refer to any transformation or modification of human behavior, or even a broad range of activities or environmental influences on the individual or larger community.<sup>1</sup> A user’s behavior with an environment can be influenced by placing obstacles in their path, like furniture, to keep them from acting differently in a space. On a larger scale, companies can make adjustments to certain policies, for example, decreasing required business travel and introducing flexible working schedules. Likewise, increased housekeeping protocols can change user’s perception and therefore, personal responsibility towards space. These can have incredibly different and direct influences on behavior and personal habit development.

One thing that the pandemic has taught us is that architecture cannot save the world — at least not on its own. It requires a layering of building systems and personal human responsibility for our environments to support our wellbeing. As the industry resumes, our relationships with the built environment will be different. And we will take an active role in that discussion.

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# Do You Speak COVID?

By now, we are all well aware what it means to “flatten the curve” or how to “keep a social distance,” however, this time is extremely impressionable, and there are some terms that will truly begin to define the language that we speak as we transition into life “post-COVID” (there’s one for ya). And while we may not be calling our children “quaranteens” in 2030<sup>6</sup>, we may still be referring to “quarantining” as a part of our seasonal language.

Certain terms are worth remembering — and it’s worth knowing, they’ve been here before, but sometimes in a much different form.

DID YOU KNOW?

In 1948, during the polio epidemic, a school teacher created Candyland for quarantined kids in polio wards.<sup>4</sup>

## CORONAVIRUS VS. COVID-19

### Coronavirus (*n.*)

A family of viruses, including other respiratory illnesses like SARS (severe acute respiratory syndrome). A coronavirus, also known as a CoV, is typically spread between animals and humans — an event known as zoonotic transfer — and they are named for the term “corona” — Latin for crown — which refers to the shape of the virus when observed microscopically.<sup>5</sup> The coronaviruses

themselves were first described as long ago as 1968 in a paper in *Nature*, but before 2020 few people had heard of the term beyond the scientists studying them.<sup>7</sup>

### COVID-19 (*n. Pathology*)

COVID-19 is the illness related to the current pandemic; the illness is caused by the virus SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2). CO-Corona, VI-Virus, D-Disease, 2019.<sup>5</sup>

### Community spread (*n.*)

The spread of a contagious disease in a geographic area in which there is no knowledge of how someone contracted the disease, and no known contact can be traced to other infected individuals.<sup>5</sup>

### Covidiot (*n.*)

A blend of COVID-19 and idiot, covidiot is a popular slang insult for someone who disregards healthy and safety guidelines about the novel coronavirus.<sup>1</sup>

### COVID-15 (*n.*)

For some, quarantining at home during COVID-19 may result in a less movement — and more snacking. COVID-15 is a riff on the numerals of COVID-19 and the freshman 15, an expression for the weight some people (are said to) gain during their first year of college.<sup>1</sup>

### Elbow bump (*n.*)

A form of greeting in which two people briefly touch elbows together. Along with a hand slap and high five, an elbow bump in its earliest manifestation

(1981) was a way of conveying celebratory pleasure to a teammate, rather than a means of avoiding hand-touching when greeting a friend, colleague, or stranger.<sup>7</sup>

### **Flatten the curve (v.)**

An attempt to create a more gradual uptick of cases, rather than a steep rise, in an effort to avoid overburdening the health care system all at once. It does not necessarily decrease the projected number of cases but spreads them out over time.<sup>5</sup>

### **Generation C (n.)**

Described as the Connected Generation (aka Gen C), although current circumstances are confusing this as the COVID-19 generation, inaccurately using this term to define babies born during the current COVID-19 pandemic. However, Gen C refers to a generation that is constantly connected to social media, the internet, and has more access to content than ever before.<sup>8</sup>

- The COVID-19 pandemic could affect young people's "core attitudes and values" in a way that it likely won't for older generations. It could change how this generation thinks about the future, the role of the government and educational opportunities, and is likely to introduce new norms they could ultimately benefit from, including shifts in online learning, physical work spaces, contactless payment, a vaccine, and other new technology.<sup>8</sup>
- Depending on the sacrifices Generation C will have to make coming of age during the coronavirus pandemic, it's possible their growth would mirror the Silent Generation, those who were born and came of age during the Great Depression.<sup>8</sup>

### **Herd immunity (n.)**

Occurs when a high percentage of the community is immune to a disease (through vaccination and/or

prior illness), making the spread of this disease from person to person unlikely.<sup>3</sup>

### **Infodemic (n.)**

A portmanteau word from information and epidemic) is the outpouring of often unsubstantiated media and online information relating to a crisis. The term was coined in 2003 for the SARS epidemic, but has also been used to describe the current proliferation of news around coronavirus.<sup>7</sup>

### **Quarantini (n.)**

A slang term for a cocktail people drink at home while under quarantine during — and because of — the COVID-19 pandemic. The term is a blend of quarantine and martini, a cocktail made with gin or vodka and dry vermouth, usually served with a green olive or a twist of lemon peel. The original quarantini referred to a martini-like cocktail mixed with vitamin C-based dietary supplements — a concoction that predates COVID-19.<sup>1</sup>

### **R0 (n.)**

Pronounced "R-naught," R0 represents the number of new infections estimated to stem from a single case. In other words, if R0 is 2.5, then one person with the disease is expected to infect, on average, 2.5 others. An R0 below 1 suggests that the number of cases is shrinking, possibly allowing societies to open back up. An R0 above 1 indicates that the number of cases is growing, perhaps necessitating renewed lockdowns or other measures. It can vary radically from place to place and day to day, pushed up or down by local conditions and human behavior.<sup>2</sup>

### **Self-isolation (n.)**

The act of separating oneself from others.<sup>5</sup> First recorded in 1834 and the term "self-isolating" recorded in 1841, it applied to countries which chose to detach themselves politically and economically from the rest of the world, but now is used to describe self-imposed isolation to prevent catching or transmitting an infectious disease.<sup>7</sup>

### **Self-quarantine (n.)**

The act of refraining from any contact with other individuals for a period of time — in the case of COVID-19, two weeks — to observe whether any symptoms of the disease will arise after potential exposure.<sup>5</sup>

### **Shelter-in-place (v.)**

Typically issued by local government, a shelter-in-place order asks residents to remain at home and only leave to perform duties deemed essential in an effort to slow transmission of and exposure to the virus.<sup>5</sup> Originally devised as an instruction for the public in 1976 in the event of a nuclear or terrorist attack, the phrase was a protocol instructing people to find a place of safety in the location they are occupying until the all clear is sounded.<sup>7</sup>

### **Social distancing (n., v.)**

The act of remaining physically apart in an effort to stem transmission of COVID-19. Social distancing can include a move to remote work, the cancellation of events, and remaining at least six feet away from other individuals.<sup>5</sup> First used in 1957, it was originally an attitude rather than a physical term, referring to an aloofness or deliberate attempt to distance oneself from others socially.<sup>7</sup>

### **Super-spreader (n.)**

A highly contagious individual who can spread an infectious disease to a large number of uninfected people through a network of contacts.<sup>5</sup>

### **Virtual happy hour (n.)**

A happy hour is generally used as a shorthand for “grabbing drinks” with colleagues or friends at the end of the workday. However, during this pandemic, people have been holding “virtual” happy hours over Zoom, FaceTime, Google Hangouts, and other video conferencing or chat applications. Also when someone might drink a quarantini or coronarita.<sup>1</sup>

### **WFH (n., v.)**

Shorthand for working from home which was first introduced in 1995 as a noun to refer to telecommuting, or doing their job from home rather than in the office, and was introduced as a verb in 2001.<sup>7</sup>

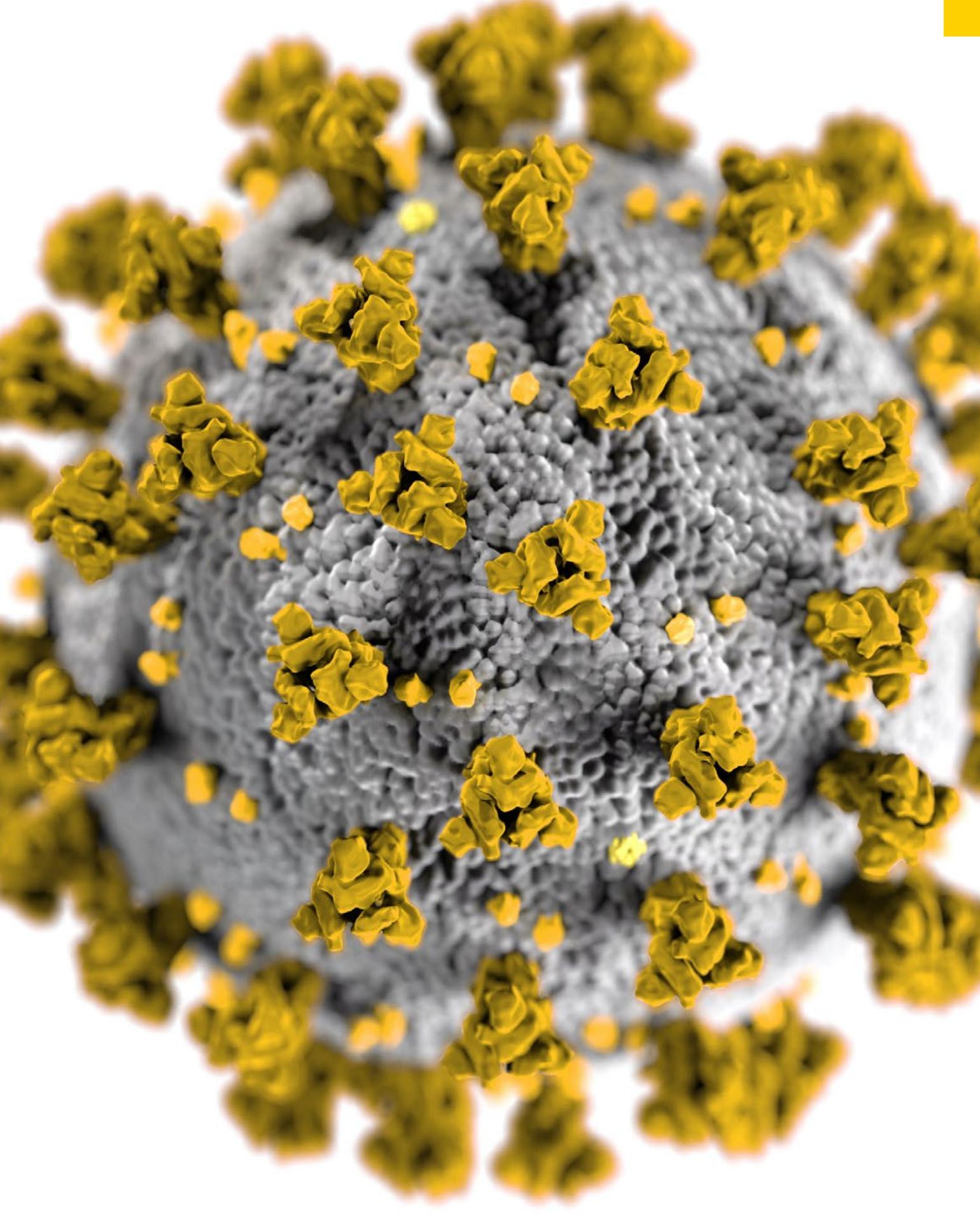
### **Zoom-bomb (v.)**

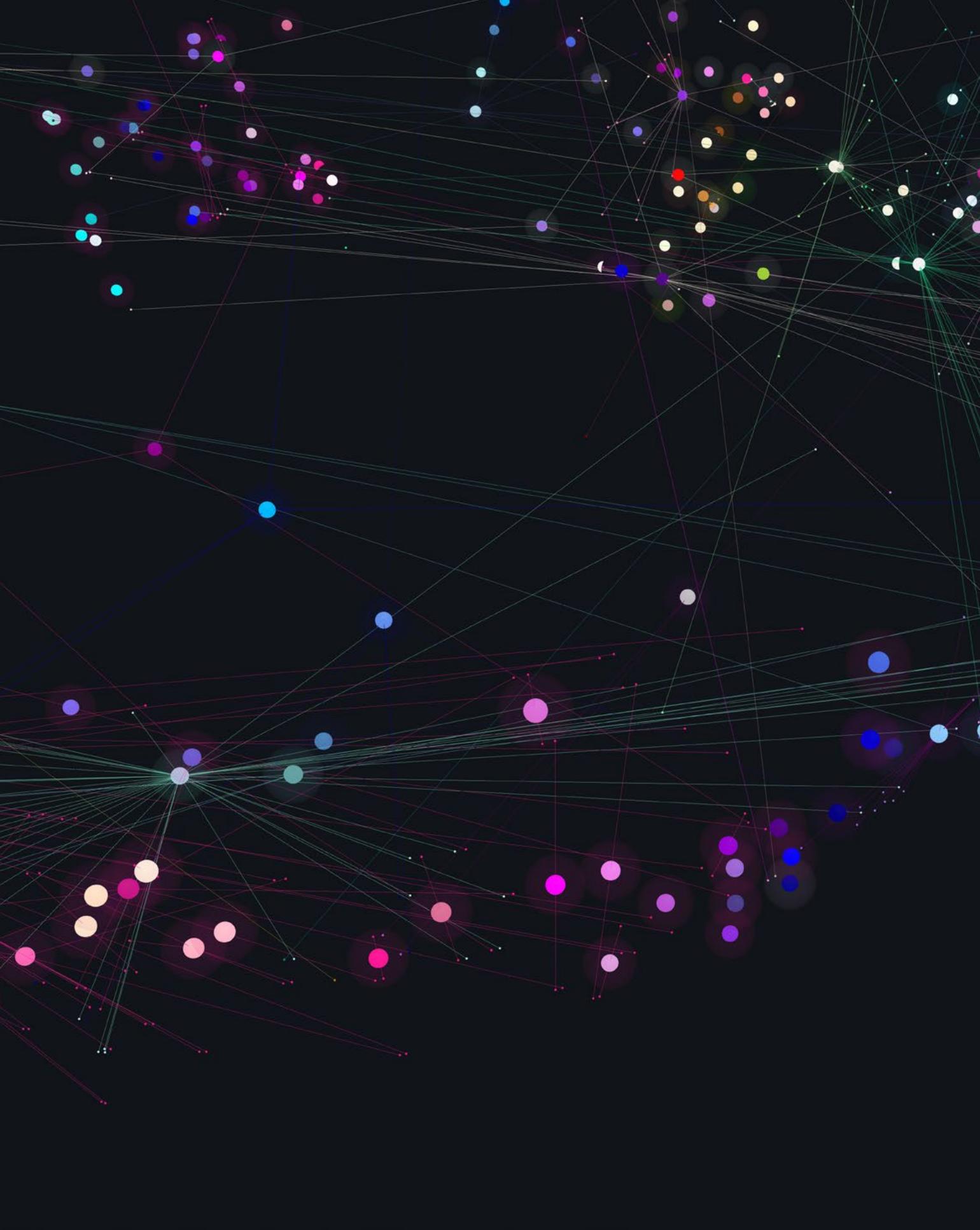
When uninvited guests enter into a virtual meeting with the intention to disrupt. Bombing, here, is based on photobombing, or when people ruin a photograph by appearing in the image without the photographer’s knowledge, often in some dramatic or comical way.<sup>1</sup>

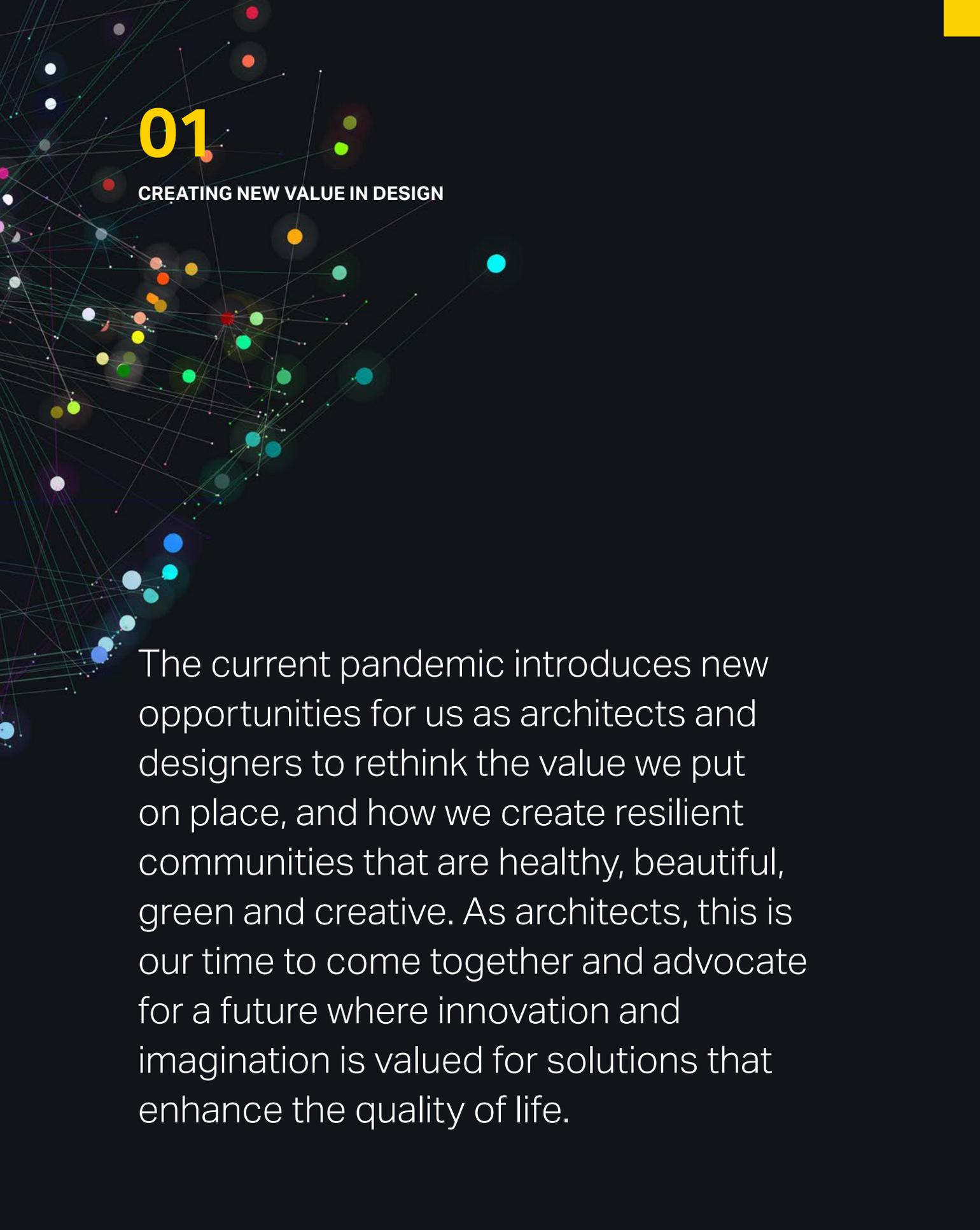
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A network diagram with colorful nodes and connecting lines on a dark background. The nodes are in various colors including yellow, orange, red, green, blue, and white. The lines are thin and grey, connecting the nodes in a complex web. The overall aesthetic is modern and digital.

# 01

## CREATING NEW VALUE IN DESIGN

The current pandemic introduces new opportunities for us as architects and designers to rethink the value we put on place, and how we create resilient communities that are healthy, beautiful, green and creative. As architects, this is our time to come together and advocate for a future where innovation and imagination is valued for solutions that enhance the quality of life.



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Dylan Wells





TO DO LIST:

- FIND CURE FOR COVID-19
- WASH DOG
- WASH HANDS
- ORDER GROCERY DELIVERY
- VIRTUAL YOGA @ 10

# Community and Culture

CAROLYN MULLIGAN AND JACQUELYN HUNTER

## Purpose + Culture

So, why should you want to go back to the office, and how can your tangible environment directly impact your social behavior, company culture, and community? The sense of place is more desirable now than ever!

How do we get people excited about coming back to the workplace? The desire for community is integral in our social human behavior. The physical space helps contribute to a company's sense of purpose and culture. Company culture can be defined as:

“...a set of shared values, goals, attitudes, and practices that characterize an organization. [It is] the shared ethos of an organization, the way people feel about the work they do, the values they believe in, where they see the company going and what they're doing to get there. A company's culture will be reflected in its dress code, business hours, office setup, employee benefits, turnover, hiring decisions, treatment of clients, client satisfaction, and every other aspect of operations.”<sup>1</sup>



Given that one third of the average American's life is spent at work, it stands to reason that individuals care about where and with whom they spend that time.

According to a 2019 Glassdoor global survey, "77% of adults would consider a company's culture before applying to an open position, and 56% prioritize company culture over salary."<sup>1</sup>

## The Office — A Magnetic Place For Community

There is one thing we know for certain; the COVID-19 pandemic has shifted many perspectives on what "going to work" really looks like. After being forced to exercise remote work avenues, we foresee a multitude of industries adopting this new digital platform into their standard practice. Although, some trades have mastered the skills of remote work integration into their workflow model, others are just learning of its pros and cons. There is no digital replacement for human to human physical interaction. "Innovation is at a premium for many companies today, with 75 percent of CEOs saying that innovation is at least as important as operational effectiveness for finding new sources of revenue that enable a company to grow."<sup>2</sup> As designers and architects, we hope to develop environments where dwellers thrive and find an eagerness driving them to immerse themselves within a space. Innovation does not often happen solo, many of the best solutions are supported when multiple people engage within a

tangible environment or social scene. By tapping into immersive design strategies, we can tailor an area to help spark interaction or even support focus.

Recently, within cross sector industries, such as co-working, higher education, and even residential multi-family, there has been a rise in forming "makerspaces." These communal settings are outfitted to support workshop style engagement, from studio art to woodworking to engineering, they provide an innovative space to encourage physical creations, whether individually or as a group. Ultimately, these makerspaces are finding themselves within office environments, as a way to cross-pollinate various departmental groups in hopes to inspire new inventive ideas. Planting amenities such as makerspaces within a workplace stimulates employee interaction and assists in enticing people to have a place to connect.

Additionally, adding strategic access to outdoor spaces can increase productivity and employee cognition levels – because who doesn't love to take a break with a walk in the park on a beautiful day? Weaving communal green spaces into workplace settings, has huge benefits. In fact, "an increasing body of evidence shows that the time people spend in urban green spaces promotes human connection, thereby enriching how we perceive the value of these spaces and each other."<sup>3</sup> The recent global shift to virtual work has allowed for flexibility with indoor to outdoor working environments, which is certainly appealing to the masses – which is why the "window" office or workstation, has long been considered prime real estate. By designing buildings with integrated courtyards, balconies or outdoor green spaces, and embedding technological infrastructure to support flexible outdoor work opportunities, employees may find fulfillment in the autonomy they once had while working remote.

# Designing For Autonomy

Throughout the pandemic-influenced shift to a variety of temporary remote work atmospheres, we have been able to gather insightful perspectives that could seamlessly translate into new workplace patterns. In a home setting, your space is personalized to reflect your design style, layout, and stocked with your favorite snacks, of course! The freedom to quickly adjust your surroundings based on the task at hand, light that lavender scented candle, or blare your instrumental playlist are all levels of customization that differentiate a standard workplace to an elevated, more desirable one that helps you focus. The future office will have even more hospitality influences.

Flexible work options are essential, giving people the choice to move around in efforts to practice social distancing. Molding space layouts to navigate end users into scenes supporting their desired task creates a novel interpretation of the “typical” office program. Architect David Dewane created a concept he calls the Eudaimonia Machine, which is “a precise work space layout based on Aristotle’s concept of eudaimonia — the epitome of human capability.”<sup>4</sup> Dewane’s scheme is a multipart floor plan that encourages employee interaction through various spaces with the intention of triggering different mental states. The layout incorporates an entry gallery, a social salon, a multi-person office, an archival library, and the chamber — a site for deep work.<sup>4</sup>

While these concepts have been evolving over the years, the recent COVID-19 pandemic has accelerated these thoughts from “amenity” to “necessity.” The future office program could become just as complex and varied – layered with more qualitative measures to reflect the desire for remote work, and the need for more integrated hospitality concepts.

We have already seen a focus on mental wellness in the workplace and a personal health resurgence over the last few years, and this human behavior is likely to see great acceleration post-pandemic. As designers and architects, our understanding of human behavioral norms influences the amenities and spaces needed in the workplace setting, and vice versa – spatial design has a direct influence on how humans interact, and what behaviors are encouraged. Imagine a typical conference room outfitted with a formal table, high-end finishes, and a traditional single seat at the head. Now envision the same room, equipped with comfortable sofas, laptop tables, playful lighting, and vibrant colors. One of these is much more “casual” and encourages more communal human interaction. With this example, it is obvious how – with the same people and tasks – design of the setting alone can influence and enable different types of conversations and behaviors.

And for that matter, what good is a golf simulator or ping pong table within an office, if the policy and culture does not support playful interface? Now that companies have experienced virtual management, trust and work ethic are pivotal to remote success. This concept also translates to standard work practice. Companies that fulfill this outlook will naturally adapt to the quickly changing pace of workplace expectations. By offering employees sociometric badges, we can track data in real time and “measure the amount of face-to-face interaction, conversational dynamics (e.g. turn taking patterns, tone of voice, etc.), physical proximity to other people, and physical activity levels using social signals derived from vocal features, body motion, and relative location,”<sup>5</sup> ultimately offering insightful figures to support new workplace design strategies, as well as, understand the evolution of social distancing within space in general.

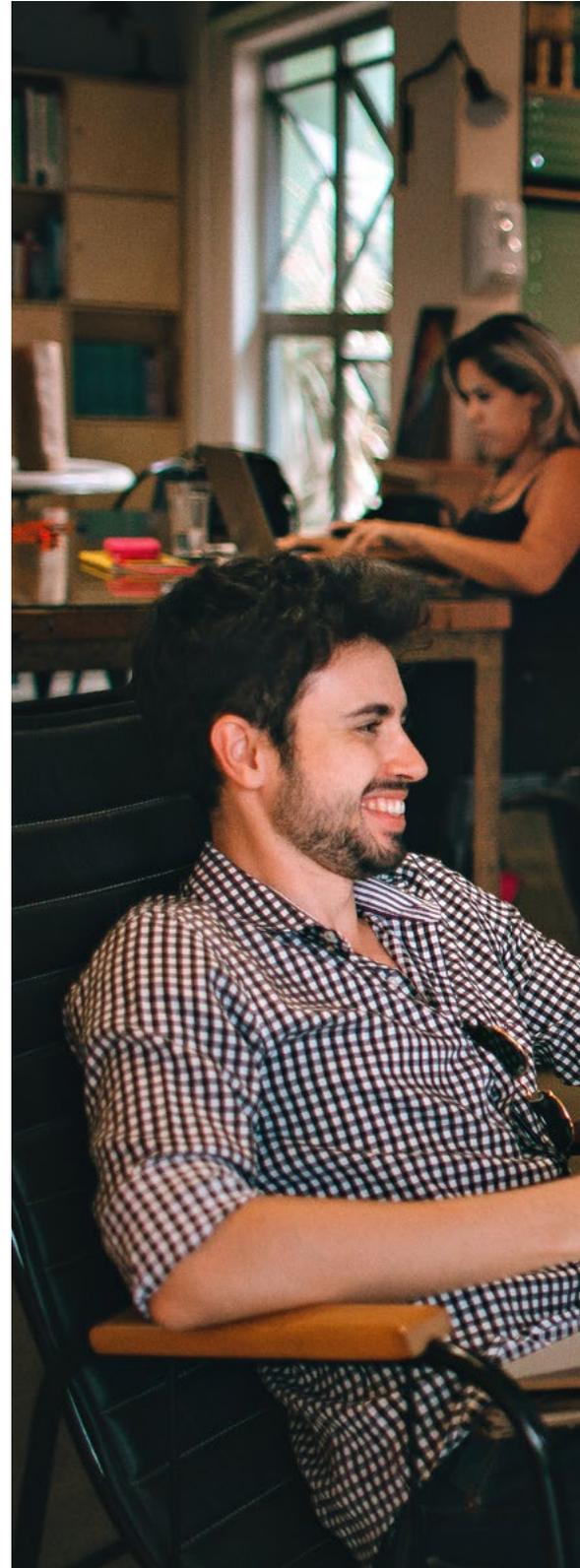
# Remember Places?

In this transitional time, stretched from humanity and skewed into an alternate reality, we as humans, manage to adapt. This adaptation will naturally shift into new growth and insightful perspectives. We must learn from the challenges we have faced and emerge as an evolved society. The importance and desire for place and connection is even more apparent. We are excited to translate these new understandings into the future of work!

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# Goodbye Extra Parking, Hello Office Amenities

ROBERT BIELAMOWICZ

## The Road

The roads seem a lot clearer these days. Zero congestion at peak hours per the Georgia Department of Transportation and clearer in late March by up to 50% in Houston over the same date one year earlier.<sup>1</sup> On a normal day, to most people, that would sound great, but these aren't normal days. There's been a sudden, massive migration toward work-from-home. There will be a rebound. People will return to the workplace. Traffic will re-intensify, but for now, clear roads lead to new energy for an older discussion.

While lesser traffic doesn't come from preferred circumstances, there are some benefits afforded by it - cleaner air, less time spent on commuting, less risk, less spent on gas, and less of a certain brand of stress. We're able to reallocate our time and energy typically spent on driving, waiting, competing, parking, and de-stressing on reat into other areas of life.

For a short time, we've lived with a hyper-focused lens on what we want and what we idealize as far as working life goes, including our commute, and very visibly, everything associated with our cars. Normally we exist within more linear dynamics. There are preferences and habits formed which once analyzed yield predictions and data points. This data informs mandates and associates to the return on investment for amenities that support

commuting choices, like parking. Mid-pandemic data show rates of commercial parking occupancy down 90% but low utilization has long plagued commercial parking.<sup>2</sup> We have a renewed chance to reflect on this aspect of commercial development within a wider spectrum of value.

There were trends in play, trends beyond just the sudden appearance of scooters. Until very recently, we were able to embrace them on less disruptive terms. Compare one year to the next and it might have seemed like not too much was different (OK, again, the scooters). Compare over the timescale of years and there was a picture emerging. Enough to propel conversation and projections within place-making and city-making of what values those projections held and reflected. We were in a position of choice and intention with respect to timelines and circumstances, so we thought. We're still in control, but circumstances have hit fast forward. As always, there's worth to be placed on agility - forethought, creativity, and action. It's logical that commuting by car will re-intensify as return to work progresses. To what extent people return, on what terms and how frequently remains to be seen. Some level of co-presence in the workspace will continue as a necessity, but it will be gauged on work habits that point to less overall physical occupancy of the workplace, a change that's likely to be permanent.<sup>3</sup> We're experiencing a trial - in more than one sense - a call to revisit and observe what we once predicted, what was already happening, and how it's all been

accelerated. Sudden reliance on working from home has been the acceleration of a “pre-COVID” trend that was judged to be worth pushing further, offering benefits beyond the present need for safety; benefits to worker satisfaction, retention and efficiency, and ultimately, measurable benefits to the bottom line.<sup>4</sup> A social disruption has made us realize where we could be headed. We’ll get there faster on open roads.

It’s reasonable to expect a variety of “post-COVID” changes to basic conditions of commercial development. As ever, predictions for any commercial market relate directly to rates-of-occupancy for a general workforce. Going forward, these will relate to emerging patterns of occupancies that reflect lesser densities and more preference towards flexible work-from-home policies.<sup>5</sup> We’re in discovery phase but occupancy patterns will settle as new norms emerge. One of the arenas this will play out in is parking. If we can assume parking occupancy will reduce with office occupancy, then we can extrapolate new norms based on what was already emerging.

## The Road Behind

The view out the windshield isn’t fully clear yet, but a look in the rear-view mirror tells us that what we’ll likely encounter comes as no surprise. Reduced commercial parking need has long been predicted as an outfall of emerging social, workplace, and transportation practices. We’ve been headed for emptier parking for some time now.

One indicator comes from looking at how we’ve assumed work-from-home within our daily norms. It’s a necessity right now but before this disruption, Work-From-Home (WFH) had elevated well past perk status. Per Global Workplace Analytics, WFH rates nearly tripled between 2005 and 2018 and as of 2016, according to the Gallup State of the American Workplace, over 40% of the workforce

was working from home with some frequency. The trend incorporated individual work as remote work with the workplace reserved for collaborative actions.<sup>6</sup> Desks were going vacant 50 to 60% of the time as of 2018, a practice boosted by simultaneous increases in tech capacity to support and propel it. Further incentivizing WFH practice has been a realization over time of financial and efficiencies, with data indicating significant bottom line and time savings benefits to both the individual and the business.<sup>7</sup> Demographic data indicates it’s likely to continue. As of 2017, incoming workforce generations were generally more interested in work flexibility than preceding generations.<sup>8</sup> Work-from-home has long since become a norm.

Not only have we been less-frequent office occupiers, we’ve been getting there by means other than our cars on an increasing basis. Wide-reaching technological and social trends are and have been changing the way we get around. These include the emergence of ride-sharing and autonomous vehicles as mass-movement options that diminish reliance on driver-driven personal vehicles. The efficiency, safety, and financial advantages experienced so far and foreseen as the trend develops, frame its status as a given.<sup>9</sup>

Ridesharing services like Uber and Lyft, have become highly visible players in the transit ecosystem. They’ve grown in proportion to a market that espouses a lesser desire for individual vehicle ownership. Though its impact on the general transit discussion has been visible and growing, it’s impact in terms of miles traveled is still only about 1%. Though growing, it’s braked by the need for a human driver. There’s economic incentive to eliminating the driver that make ride sharing companies prime developers of a next step – autonomous vehicles.<sup>10</sup>

An expected development of the autonomous vehicle market will further affect projections of

parking capacity. With automation, needs for parking space can be expected to diminish as parking dimensions between cars drop to just a few inches, meaning more cars parked in the same space. An expected lesser idleness among autonomous fleets also means fewer cars doing the same work, staying in motion for more of the time and, again, less need for parking space. If fully adopted, the estimated financial benefits of this trend to the public could amount to \$800 billion by 2030 in the United States alone, one-third of that estimated to be via re-purposing of redundant parking capacity to commercial and residential use.<sup>11</sup>

Accompanying the above disruptors is mass transit; rail and bus. Current mass transit ridership data show a downturn since the onset of the pandemic, 30 to 50% on the west coast as early as March 10.<sup>12</sup> Transit systems will need to emerge from the current downturn, responding in many of the same ways as other civic entities. There is robust existing infrastructure to support their re-start once pandemic events run their course and social distancing conditions stabilize. These include diminishment or elimination of touchpoints, more frequent cleaning, and more frequent service to diminish crowding.<sup>13</sup> While many transit agencies are cutting services in response to lesser demand, in Houston, rather than reducing service frequency, increases have been put in place for some bus routes to offer riders more space, a move that, if retained long-term, could end up making transit more convenient.<sup>14</sup> Additionally, as an essential service, financial losses incurred now may be offset by a bump in public transit stimulus funding. Transit is viewed as a good investment for federal bailout dollars and could see increased subsidies going forward to offset increased operating costs and boost its utilization post-covid.<sup>15</sup>

The laws of demand may dictate a reduction

in parking capacities, but there are other laws that apply to commercial development. These laws dictate how much parking must be built. Adjustments to municipally mandated minimums for parking have been undergoing change, reflecting what's economically feasible and justified against emerging market trends. Long a driver of parking ratios, cities have begun future-proofing development by exploring incentives to smarter construction and lesser parking minimums.<sup>16</sup> Municipalities, fixed as they are to location, can find themselves beholden to longer timeframes and interpretations of return on investment as opposed to private developers. Recognizing a trend toward reduced parking demand, municipalities are increasingly relaxing or eliminating minimums nationwide, recognizing the financial brake that such requirements can put on development for parking that will go unused in the longer term.<sup>17</sup> An unused resource is money lost. It's logical that diminishing revenue streams from parking will find their replacement in amenities that can be monetized in trend-consistent ways

It bears mention that, in addition to these trends and others, with reduced demand for vehicle storage, parking operators themselves are increasingly benefitting from emerging practices that optimize existing and new-build parking operation. Managing efficiencies are increasingly advantaged by improvements to real time car counting and occupancy tech.<sup>18</sup>

Clearly the current situation represents an extreme end of the scale, but it's one we've unknowingly been rehearsing for some time. Very much at its root and helping to propel it is the basic social reality that established and incoming generations place different values on car ownership. Reflections of these values in vehicle storage needs is a complex dynamic that will continue to develop and settle out over time. While an incoming generation places less

value on cars in general, this doesn't necessarily mean less preference for the single-owner, driver driven option. It does reflect a greater advantage taken by an incoming generation of connectivity, preference for flexibility, and the value of access to a wide range of transit possibilities.<sup>19</sup> Though time will tell, this is likely a long-term reality for the future of mobility.

It's reasonable to assume that the lessons of our present circumstance won't reverse the above trends from generalized patterns of long-term increase. It follows then that past demonstration of trends for reduced commercial parking demand will continue. A look back is a look forward.

## The Road Ahead

With a more transient population at the office, and with more diverse options to get there, it's foreseeable that commercial development dollars won't be as much devoted to parking as before. That begs a question; if there's not as much being paid out to build parking, does that part of a development dollar remain in the budget for a given development? If so, what do developers and tenants get in exchange? Optimistically, assuming retention of the whole dollar, there will be effort spent identifying how to invest what was formerly earmarked for parking on amenities; how to create alternative returns on a development dollar. Design responses to a trend for diminished parking will redirect resources formerly devoted to parking, to amenities that enhance support of emerging office practices.

Those responses will follow what emerges for the role of commercial space. Traditionally, its role has been the promotion of physical proximity as a means for producing results. This has and will continue to undergo change. Emerging workplace practice, aided by ongoing improvements to connectivity, makes proximity less primary

and makes the physical workplace a means for producing results by attracting and retaining talent.<sup>20</sup> Redirection of development resource to re-making collective space as a preferred environment will be critical to the future of commercial development itself.

The trend in office practice can be likened to being on a college campus; a place that offers a wide range of choices for the work environment and its accessory activities. This increasingly trends toward non-office spaces that are more collective and that act as touchdown for individual work and for informal meeting and collaboration, functioning more like hotel lobbies.<sup>21</sup> These include casual gathering spaces, cafes, lounges, outdoor spaces for individual work, and amenities like balconies and rooftop gardens.<sup>22</sup> There's emphasis on common accessibility so small companies have equal access to amenities typically within the domain of big companies.<sup>23</sup> Increased focus on personal spacing will promote imaginative uses of common space for once exclusively in-office activities.

Transit options mean increased arrival via rideshare, micro-mobility and autonomous vehicle. These correlate to lesser needs for vehicle storage and will potentially free up amenity space for drop-off. More focus will be placed on curbside arrival amenities, concessions, charge stations, wait spaces and building entry sequences as front door arrival becomes more of a norm.<sup>24</sup>

## EXISTING PARKING FACILITIES; POSSIBILITIES FOR ADAPTIVE REUSE

Future reductions in parking demand will not be abrupt to a point that parking facilities face near-term obsolescence. It will be helpful in general to envision scenarios that amenitize existing space to alternate uses.

Existing surface lots have long been a target for

redevelopment. These represent a lesser effort target for replacement of parking as demand for it falls. In developer's eyes, surface parking sites are attractive owing to lesser demolition effort and lesser general potential for hazardous materials or other unforeseens.<sup>25</sup>

Existing parking structures represent a different brand of blank slate for reuse. SCADpad explored the possibility of promoting community by the infill of underused parking deck infrastructure for micro-housing units. Arranged to create communal spaces, SCADpad was an experimental step toward sustainable re-occupation and conversion of what's expected to fall into increasing disuse.<sup>26</sup>

Existing parking deck form appears to dictate a lesser range of possibility for reuse. Imaginative solutions are possible. Low overhead clearances, sloping trays and structural loading capacities seem to preclude possibilities for widespread reuse outside of micro-housing or storage. That said, actual residential conversions, where existing deck designs make it possible, have been demonstrated as a valid possibility for adaptive reuse.<sup>27</sup> There may be a range of simpler uses that amenitize unused existing parking area. Lesser parking demands can free up area for rooftop gardens and outdoor recreation areas at existing deck top trays for instance. Overall, it's possible to imagine these reuses contributing to residential densities within existing commercial districts. These posit the potentials of commercial space development for civic roles.

## **NEW-BUILD PARKING DECKS; DESIGNED FOR TRANSITION**

New construction deck designs increasingly anticipate reduced parking needs over time and incorporate design features that anticipate conversion of parking space for other uses. Higher floor-to-floor heights, enhanced structural capacity

and incorporation of removeable ramps make possible their reuse for office, entertainment, food service and other uses. Isolating sloping trays structurally and locating them within inner bays of the deck make possible their future removal and the creation of interior atria for access to light and air for the level bays along the perimeter. Other prototypes include parking floors on lower levels with business or residential floors above. Uniform floor heights and structure for all floors make possible the conversion of lower floors from parking to other uses as parking demands flex over time.<sup>24</sup>

Whether new-build or through reuse, an expectation of lesser parking need can be planned for and advantaged to the ongoing vitality of commercial development. Shifts in development approach point to a philosophy of sustainability and renewal as collaborative and open communal amenities. These signal values pointing to an elevated future for commercial development as the rediscovery of civic space.

## **Conclusions**

If we anticipate our built environment as the embodiment of societal and human values, then much of what we build places immense value on mobility; individual and collective. These values have a way of trending and the built environment along with them. Trends are both signals of change and change itself. They develop over time. We exist within them constantly.

At one time the street was a place for a wider variety of transport and interaction. A city street photo from the early 20<sup>th</sup> century depicts a place of movement but also a common domain not given wholly over to cars. It's possible to imagine trends that swing toward more diversified norms for transit movement and transit storage; that re-invent our views of them and redirect resources to a new set of possibilities. These are possibilities that support healthy, humane

and resilient views of the future, for commercial space, for civic life, for sustainability, by the proportion of resources devoted to a spectrum of amenities including mobility. An optimistic outcome would see renewal in our return to commercial space and its continued evolution as a preferred environment, more sharply directed to individual and organizational needs. Many signs point to increasing value placed on collaborative capacities

and lesser reliance on default assumptions of working life. Within this shift there are resources to be freed and re-directed into offerings that are more relevant to emerging preferences. As ever, we are left with the value decisions of past generations, in the form and presence of what they built. An optimistic outlook foretells a conversion of those resources that brings the goals of the developer market closer to those of the civic realm.

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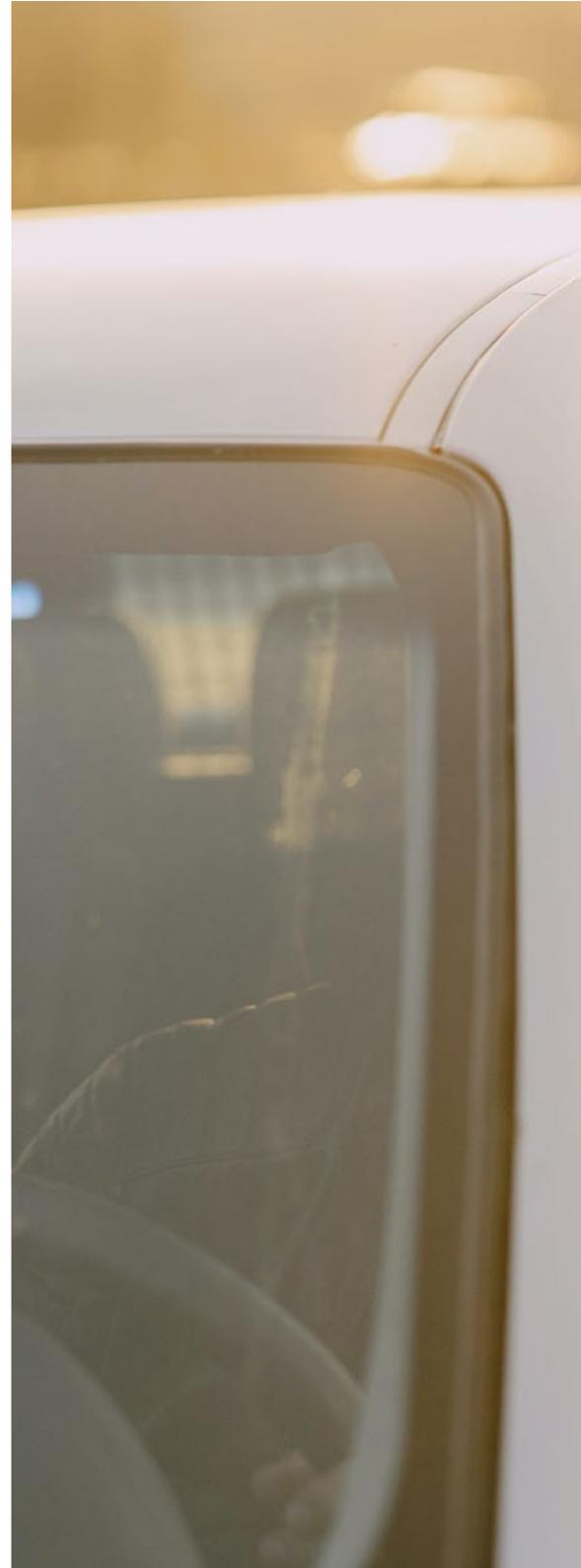
# Interruption and the New Patient Care Model

CHRIS GROSSNICKLAUS

As the coronavirus pandemic began to ripple through the country, health systems shifted their resources and supplies to mitigate the threat of the COVID-19 virus. Health systems and patients alike have put their routine care on pause amidst shelter-in-place orders while the country attempts to address current unknowns and rebuild disrupted supply chains. In the wake of this health crisis, the question remains — what changes are we seeing now that will impact how care is delivered in the future?

## Short-Term Impacts and Response

On March 18, 2020, the Centers for Medicare & Medicaid Services (CMS) released guidance to limit “non-essential adult elective surgery and medical and surgical procedures, including all dental procedures.”<sup>1</sup> States and healthcare systems quickly began postponing non-emergency





procedures as they developed plans to deal with the current and projected COVID-19 cases at their facility and within the region. The recommendations outline factors that should be considered for postponing elective surgeries, and non-essential medical, surgical, and dental procedures. Those factors include: patient risk factors, availability of beds, staff, and PPE, and the urgency of the procedure. These precautions will help providers to focus on addressing more urgent cases and preserve resources needed for the COVID-19 response.<sup>1</sup>

As a result of state orders and increased fear from patients, the number of visits to ambulatory practices declined nearly 60 percent in mid-March

## How Clinics Have Responded: New Protocols for Non-acute Care

- More extensive pre-screening-temperature checks and questionnaires
- Queueing in cars/just-in-time waiting/drive through visits with minor procedures done in patient's cars
- Expanded personal protection equipment for providers (and 3D printing of equipment)
- Universal masking - masks will be required at all times in clinics
- Limit on numbers of non-patient guests with restrictions based on age

and has remained low through mid-April according to a study on completed Researchers at Harvard University and Phreesia, a health care technology company.<sup>2</sup> Patients voluntarily cancelled their scheduled elective procedures as providers adjusted protocols and methods for treating both COVID-19 and non-COVID-19 patients.

However, people don't suddenly stop getting sick during a pandemic. Cancer continues to be diagnosed. Chronic conditions like diabetes still need regular attention. The need for episodic and chronic care requires providers to explore new protocols and alternative ways to provide treatment.

## Increased Virtual Care

Prior to the pandemic, the adoption of virtual care through telehealth visits, virtual check-ins, and e-visits have grown slowly. Key findings from the 2017 Closing the Telehealth Gap white paper showed that only 18% of consumers surveyed said they had used telehealth, while 82 percent had not.<sup>3</sup> Consumers who used telehealth, however, appreciated time savings and convenience (59 percent), faster service and shorter wait times to see the doctor (55 percent), and cost savings due to less travel (43 percent).<sup>3</sup>

With the lack of access to services and the patient uncertainty, the Centers for Medicare & Medicaid Services (CMS) broadened access to Medicare telehealth services so that beneficiaries can receive a wider range of services from their doctors without having to travel to a healthcare facility expands.<sup>4</sup>

CMS also added 85 telehealth services to the list of services covered by Medicare and emphasized that payment will be at the same rate as in-service care.<sup>5</sup> Previously, Medicare would only reimburse for telehealth if the services met certain requirements

and if the services were listed on Medicare's annual Covered Telehealth Services list. The visit would also need to be listed at a reduced rate compared to an in-person visit. The reimbursement model became a barrier to adoption from the provider's perspective.

During an April 14<sup>th</sup> webinar about COVID-19's Impact on Healthcare and Medical Office Real Estate, David Park, SVP of Construction at Novant Health, said that "the system averaged 1,000 telehealth visits a month pre-COVID and now is seeing 5,000 a week in light of the pandemic which has moved telemedicine 5 to 10 years into the future."<sup>6</sup>

While the short-term increases vary and need to be explored in the coming months, initial numbers from the Harvard University and Phreesia study indicate that nearly 30 percent of all visits in recent weeks at ambulatory practices surveyed are now provided via telemedicine.<sup>2</sup> However, findings from the study noted that the increase in telemedicine did not offset the loss of in-person visits.

## The Clinical Model in Transition

As the coronavirus disrupts the American health care system, primary care doctors and their patients are looking for new ways to provide and access care. Primary care practices are struggling financially as patient volumes decrease and patients are forgoing or missing out on needed routine care.<sup>7</sup>

In this transition period, healthcare providers will need to adjust to new ways of seeing patients. Motivated to regain volume, they will be forced to look at care in a new way.

## Towards a More Integrated Care Model

Like many industries, the traditional model of healthcare will be forced to reinvent itself in a post-COVID world as we define what our "new normal" will be. While new technologies have emerged out of this crisis to fill gaps in the system, patient behaviors change. Lessons learned from adjacent industries can influence a multi-modal, integrated care model.

### CHANGE IN THE CARE MODEL

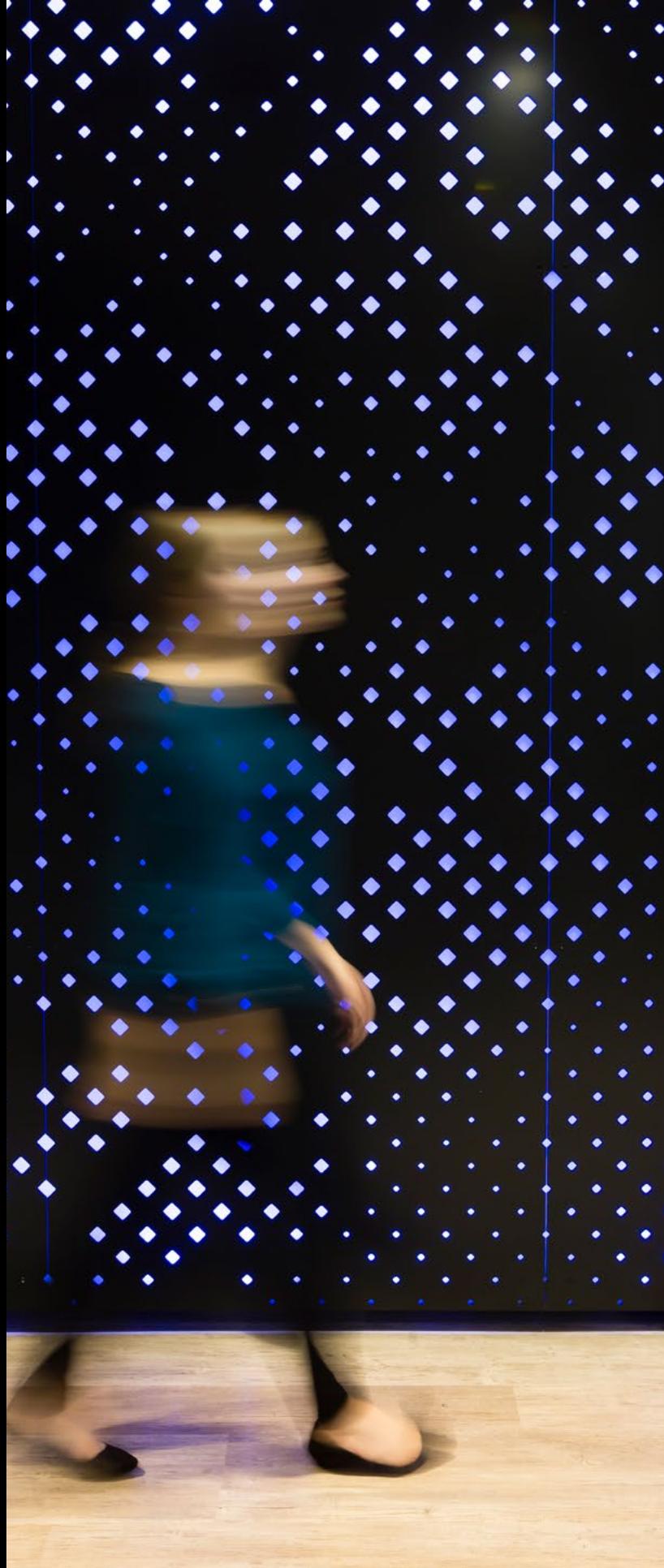
The current growth and adoption of telemedicine may signal that there will be an increased need – and demand – for virtual care as a result of COVID-19. The movement to care-at-home is also emerging as a preference for the future. These two combined will become parts of a new system that incorporates at-home testing, virtual visits, in-person visits and home care for a seamless care continuum. These changes could provide better access to care, efficiently allocate resources, and provide an overall better experience for patients and providers.

Like telemedicine, there are other technologies and systems that will accelerate in adoption as a result of the disruption we are experiencing. Important considerations to monitor:

- **In-home testing:** At-home test kits are currently being offered by many companies to test for COVID-19. Will this lead to more in-home testing to reduce trips to the doctor or lab? Everlywell, an online lab, already offers 30+ at-home kits — from fertility to food sensitivity tests.<sup>8</sup>
- **In-home diagnostics:** Currently, at-home devices include things like wireless blood

## Some examples of mid-range priority solutions include:

- The need for advanced infection control protocols and the incorporation of physical distancing
- Ways to care for COVID-19 patients at the same time as non-COVID-19 patients
- Aggressive screening and triage for patients and staff
- Ability to respond to surges in infected patients prior to a vaccine via a capacity plan
- Dedicated COVID-19 care locations and patient units
- Increased availability and access to virtual health



pressure cuffs, weighting scales, pulse oximeters, blood glucose meters, and spirometers. As developers further enter the healthcare space, will there be expanded in-home diagnostics?

- **Automated systems:** As transmission of the virus has increased the awareness of hygiene, we will see a proliferation and improvement of touchless systems. Some of the interventions will be low-tech, like more automatic entry doors, automatic handwashing faucets, and increased waterless hand-sanitizing systems that have typically been value engineered out of projects in the past. Other solutions will require increased technology to do virtual screening, on-line check-ins and contactless payments.
- **Home health care:** There have been examples of both active and passive monitoring at homes for chronic disease management and senior care.
  - Physiological Monitoring - telemonitoring devices can capture vital signs, weight, or

symptoms and report them to a remote provider or home health agency.

- Safety - sensors can detect changes in vitals like heart rate and temperature to provide alerts to providers. Motion and heat sensors can distinguish between heat that occurs during meal preparation and heat that builds up when a person turns on the stove and forgets about it.
- Social Interactions - Social interactions can be made through the active use of social networks and software that can assess self-perceived social connectedness. Passive sensor-based systems track the number of visitors, the amount of time spent inside and outside the home, and sedentary behavior.

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# Bringing Work Online

CHUCK BLACKFORD

It is called “an unprecedented pandemic” for a several reasons. However, at no other time in history have companies across the globe been more prepared to handle a pandemic, forcing our worldwide workforce to take advantage of an already growing global trend – working from home.

A trend that has only recently seen growing popularity amongst employers looking to retain talent, remote work has in the past been saddled with a bad reputation. From employers who worry that their workforce are too easily distracted at home, to managers who feel a loss of control when their staff members are not within eyesight, many companies didn't see remote work as a viable option for the majority of a company's workforce.

Over the past few years however, teleconferencing technologies have matured, employees are more connected through multiple devices, and businesses have seen the positives of flexible schedules outweigh many negatives, as reflected in their employees' increased health and productivity levels. However, this working style was previously nascent at Corgan – reserved almost exclusively to those who needed special accommodations. But like many other firms, working from home became a necessary reality for all employees in the span of a

few weeks, due to our need to reduce exposure and community spread of COVID-19.

## Preparation

Corgan's ability to respond to the COVID-19 pandemic stemmed from years of prior planning and preparation, and our ongoing digital transformation. Corgan has long had a commitment to the mobility of our workforce and has provided laptops with “always on” VPN connections for all employees long before it was commonplace in the AEC industry. As part of our business continuity and disaster recovery planning in recent years Corgan began moving many of the firm's production and corporate systems into cloud-hosted solutions like Autodesk BIM 360 for BIM projects, Microsoft Office 365, a cloud-based collaboration platform, as well as HR and Marketing platforms to ensure operations in the event of a loss of access or a loss of data in any of Corgan's physical office locations. In the months leading up to the pandemic, Corgan was in the process of upgrading its virtual desktop infrastructure (VDI) which allowed for an efficient response to address the needs of the firm that could not be moved to cloud solutions due to client requirements or technical reasons. Further, Corgan has placed a premium on network performance and bandwidth to support the demands of these approaches. This combination of mobility, cloud-based solutions, and VDI provided for a nearly seamless transition to working from home.



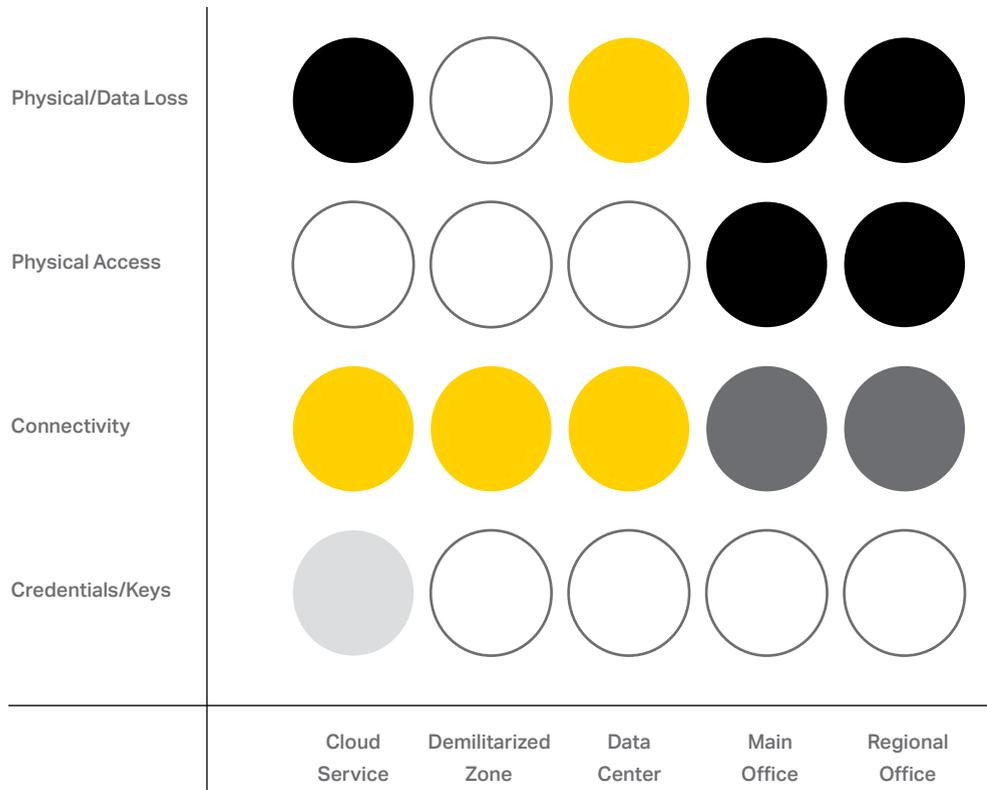


Figure 1: Business Continuity Impact Matrix

## Response

In early March 2020 when it became evident that Corgan would need to prepare to move all 700+ of its employees to work remotely, Corgan had prepared but not yet tested for this scenario. The initial approach was to conduct a rolling stress test of our transition plan to ensure all staff and projects were able to continue operations from home. However, the threat of COVID-19 brought the need to accelerate this plan dramatically. Corgan met this challenge by creating a transition plan using a data-driven decision-making and prioritization process. Corgan analyzed the timesheet data

of all employees to identify which projects had the highest concentration of effort and greatest number of team members not already working in the cloud. These high priority projects were then transitioned, staff were trained, and necessary licensing acquired in just two to three days. The remaining projects were transitioned less than a week later. By following the data and focusing on the largest projects first, Corgan was able to transition over 200 projects and associated team members to a cloud-based workflow while teams moved their office monitors and other needed hardware home.

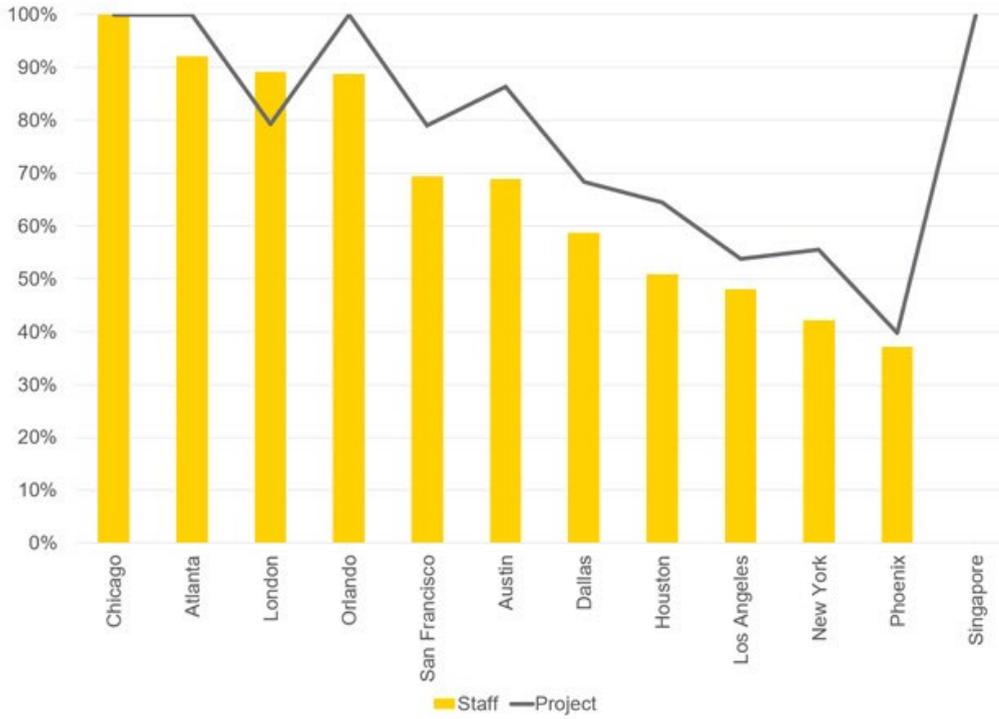


Figure 2: Cloud Based Projects by Location Prior to COVID-19 Pandemic

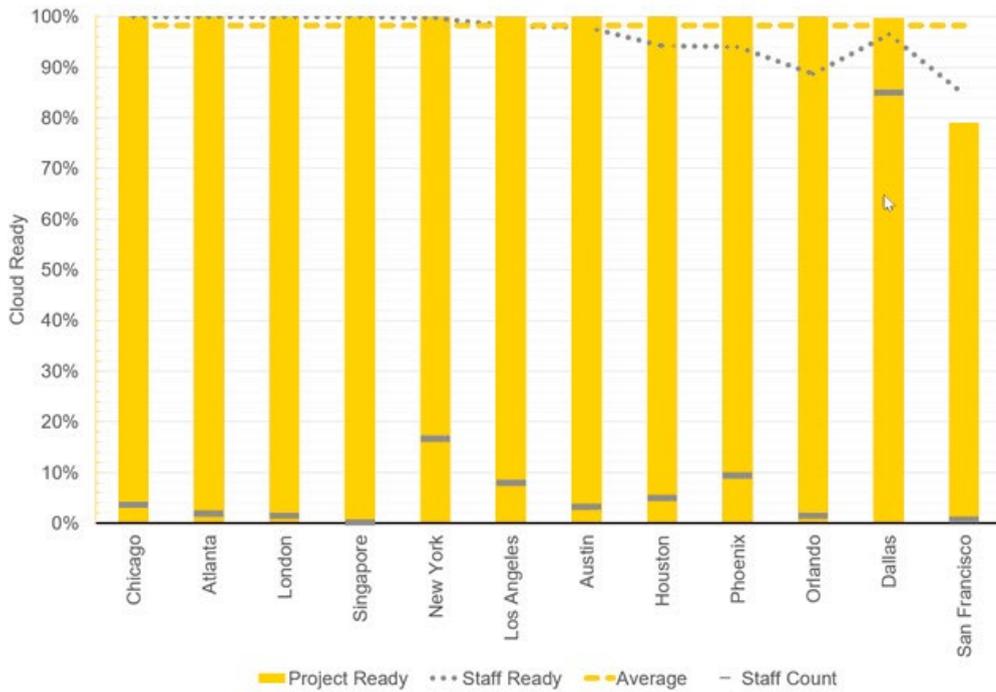


Figure 3: Cloud Based Projects By Location After Covid-19 Pandemic

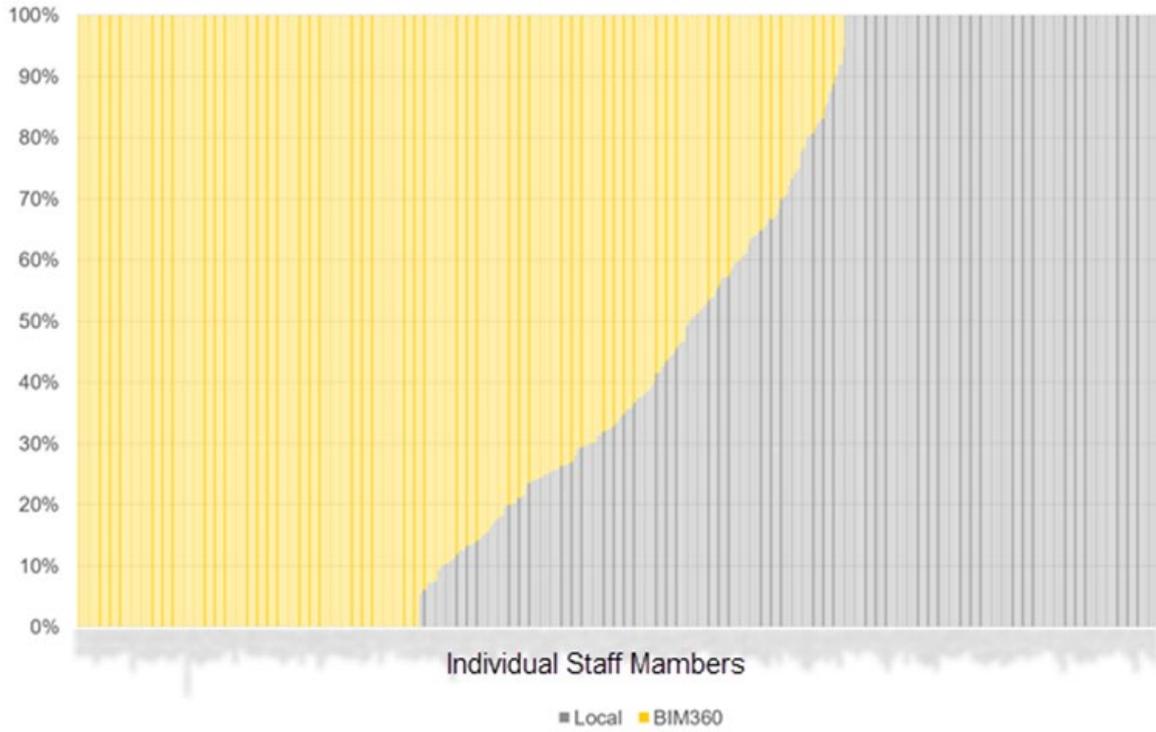


Figure 4: Cloud Enabled Production Staff And Projects Prior To Covid-19 Pandemic



Figure 5: Cloud Enabled Production Staff After Covid-19 Pandemic

Corgan's network infrastructure was prepared to support expansions necessary to meet the challenges as well. With existing gigabit speed MPLS connections between all offices and always-on VPN technology, Corgan was able to analyze bandwidth usage data to anticipate where the increased VPN load of external connections might be problematic. To alleviate demands on

bandwidth as the Internet suddenly was being asked to act as our local area network, Corgan implemented cloud-based firewall access points (Prisma in Fig. 6) in strategic locations to support the user population. This resulted in a net reduction of bandwidth usage despite more than doubling the number of users accessing the VPN.

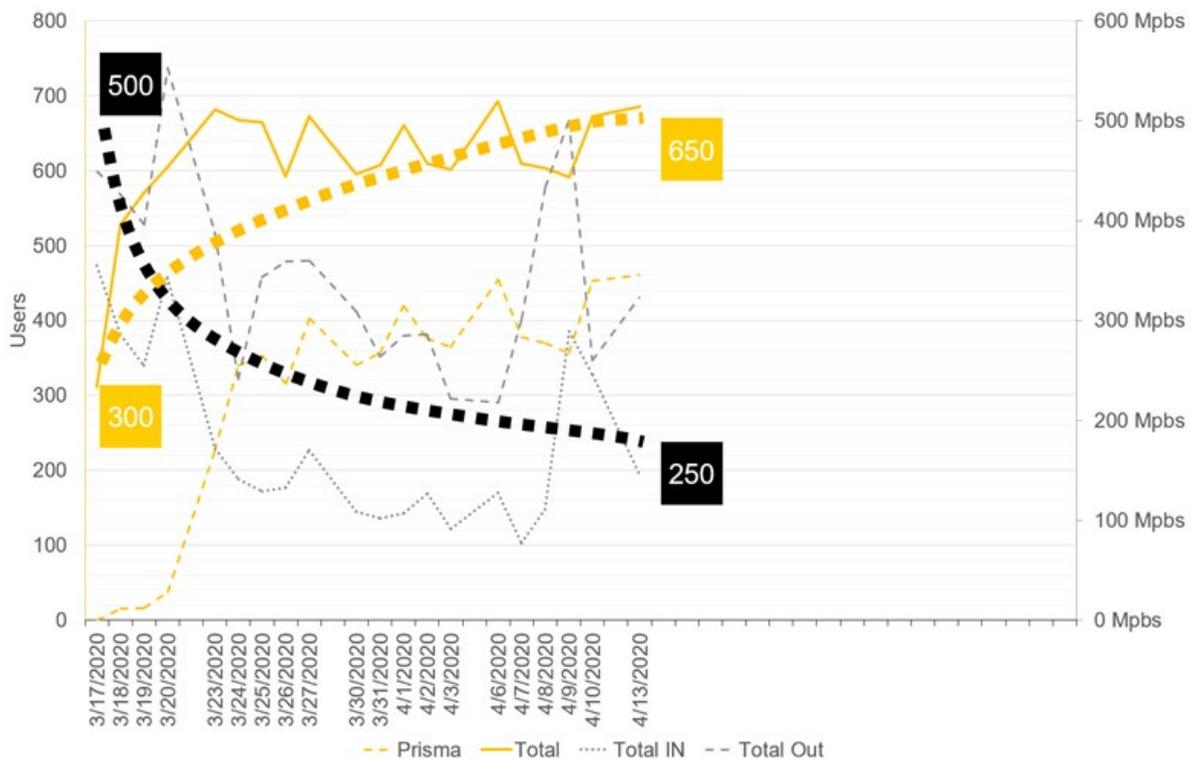


Figure 6: Bandwidth Utilization And Mitigation

## Reduction of In-Person Workflows

Corgan has leveraged reality capture, virtual reality, and augmented reality to continue to serve our client's needs despite difficulty in physical interaction. Corgan had prior experience developing Matterport scans to aid in reducing field visits for verification. This technology is now being used to further reduce field visits and the number of staff visiting our job sites. Corgan is exploring the use of virtual reality environments to share design experiences and integrated virtual workflows using headsets.

This will allow hardware to enhance our human senses with new workflows to support this mode of working. Additionally, collaboration tools utilizing virtual whiteboards and pin-up boards are replacing in-person meetings. The following stories illustrate success we have had in confronting the disruption caused by the COVID-19 pandemic.

## Digital Material Boards

Material boards are used to represent a project's physical properties as it transitions from concept to reality. These physical boards demonstrate to the client each of the materials that are being integrated into the final building design. The boards evoke sensorial feelings; the ability to see the paint, feel the touch of the furniture fabrics, and to understand the sense of calm brought out in a balanced color scheme. With design being such a collaborative process, the unveiling of a material palette is important. While we continue to social distance, we are developing ways to better share these experiences and allow them to remain as immersive as possible. We are using our modeling and visualization tools, such as Revit and Enscape, to produce virtual material boards with defined and

specific light experiences. Virtual reality headsets with live model sharing are then allowing for the review of these materials boards at a virtual table. This is allowing clients to see the materiality of their buildings in a new and dynamic way. Tools typically used within the firm by designers are now being used to bring client's and end users into the process.

## Live Interaction Through Technology

Corgan's interior designers are now leveraging online digital workspace collaboration tools like Mural to facilitate client visioning sessions during COVID-19 to replace in-person client project kick-off meetings, as one example. Corgan has also been staying in front of clients and maintaining their position as industry thought leaders by hosting live on-line webinars. Corgan has replaced internal meetings by using our video enabled phone system and Microsoft Teams for collaboration. These technologies have allowed Corgan to enhance traditional Friday Forum events with interactive online meetings which has helped to maintain morale and personal connections.

Implementing the firm-wide work-from-home strategy necessitated by COVID-19 was and continues to be a fast and furious time for everyone at Corgan, but prior planning and preparation has allowed for a seamless transition built on existing solutions, strategies and planning. This planning allowed Corgan to keep all of its commitments and meet all of its clients' schedules and expectations without disruption.



# Virtual Tours – Creating Value through 3D-Scanning

CHAD SPEAS AND CHUCK BLACKFORD

Across the globe, people are finding new ways to connect with loved ones and entertain themselves. However, others are struggling as gallery hopping, getting the thrill of an amusement park ride, and strolls through national parks are pastimes many tourists and residents alike appreciate, but cannot currently enjoy.

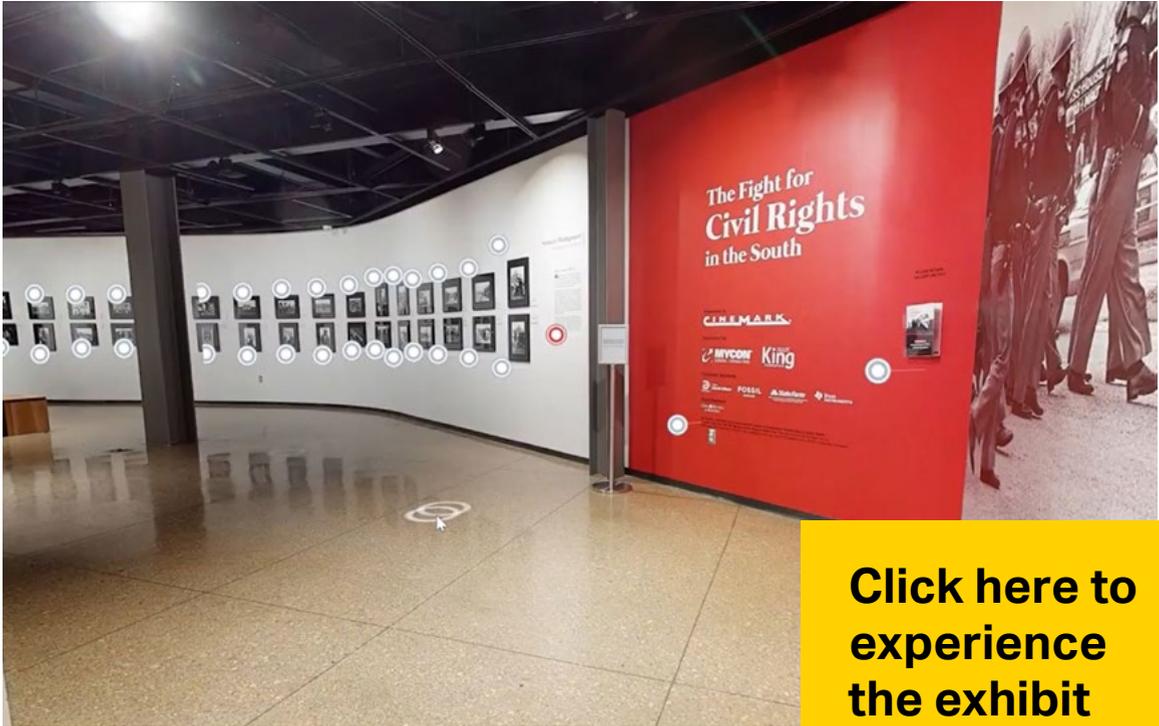
Ah, remember places? Innovators are hard at work, bringing these experiences to living rooms across the globe. Wineries across the U.S. are going online, offering virtual wine tastings; celebrity chefs are teaching people what and how to cook gourmet meals at home; musicians and performers have begun streaming performances online; and museums, national landmarks, theaters – even Disneyworld – have introduced new ways to experience their venues through free, virtual experiences.<sup>1</sup>

With the help of Corgan's MediaLab and Practice Technology Group, the Dallas Holocaust and Human Rights Museum now joins the Louvre in Paris, the Vatican in Rome and the Smithsonian in DC, among a host of galleries and museums worldwide that have gone online – offering new places to explore through virtual tours.

## How Corgan Helped

After their COVID-19 closure, the Dallas Holocaust and Human Rights Museum asked Corgan to assist with reality capture technology in a new and data rich way. The goal was to give their patrons a virtual experience of the museum's spaces and exhibits. This was especially important for the rotating exhibit hall.

Corgan took it upon themselves to use one of their Matterport reality capture cameras to scan each of these spaces in the museum. Much in the same way this technology is used to capture a building's condition during construction, the camera was used to provide an immersive 360-degree view of each space in three dimensions with contextual information overlaid within the virtual environment. The scans were then uploaded by the museum to the museum website so that patrons could continue



**Click here to  
experience  
the exhibit  
walkthrough**

or visit [www.dhhrm.org/  
exhibitions/current-special-  
exhibition-2/](http://www.dhhrm.org/exhibitions/current-special-exhibition-2/)

to experience the exhibits despite the inability to physically visit the building. As patrons virtually walk through the exhibit hall, clickable exhibit photos are presented allowing them to see a larger image of the piece – getting a true gallery experience.

The museum found the whole experience very positive and are now looking at ways to continue offering virtual exhibits to their customers. As for Corgan, we have found a new way to capture space easily, in a way that can significantly change the dialogue between our clients and designers. Virtual tours may be the spark, but that is only the beginning.

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Click or scan the QR code to watch a short video capturing the special day.





# Virtual Spaces and Digital Placemaking—From IRL to VR

CAROLYN MULLIGAN AND ALLISON BARRERA

Spaces are only as inspiring and attractive as the designers create them to be. Why stop at just the physical?

We are all familiar with the concept of video conferencing. Featuring a 2-dimensional (frequently grainy) video with lagging audio to boot, it may garner us a more personal conversation with remote meeting cohorts, but it often leaves something to be desired. Enter the fresher concept of “Virtual Workspaces.” In this new world of virtual and augmented reality, interactive 3D technology is increasingly weaving its way into our everyday workflow.



## Augmented Reality Workspaces: We're all in the Matrix

Companies like Rumii and Dataview VR have designed virtual workspaces where people can meet in virtual office environments, eliminating commutes to and from work, and removing collaboration barriers associated with global and remote working. Virtual reality conference rooms create a space where people can actually *interact* in 3D (unlike online conference call platforms), increasing employee engagement and productivity. Rumii's platform has its users create custom avatars to represent themselves once inside the virtual environment, although there are companies trying to use facial scanning software so that their avatars actually resemble employees.<sup>1</sup> The virtual workspace also provides customizable interfaces and room design, that can be changed per meeting and can allow for interaction with 3D models, charts, screensharing, etc. Dataview VR's platform for viewing data as a 3D dynamic component, versus 2D static charts, can revolutionize how businesses can interpret data in the future.<sup>2</sup>

Both experiences can put users on a more level playing field than traditional video conferencing. No one has distracting "coworkers", animals or

personal paraphernalia in the background. Poorly lit video occupants are a thing of the past. However, the thought of a fully submerged virtual workspace may be too radical for some users.

## Can We Get the Best of Both Worlds?

Think "VROOM". No, not like the truck speeding down the road – try "Virtual Robot Overlay for Online Meetings".<sup>3</sup> This technology could merge the physical space with the virtual by allowing avatars of remote workers to inhabit physical space with local occupants via video robot and digital overlays. Microsoft is pioneering a study on combining the existing technologies of AR workspaces and Telepresence robots in order to explore "immersive methods for humans to interact naturally in remote environments".<sup>3</sup>

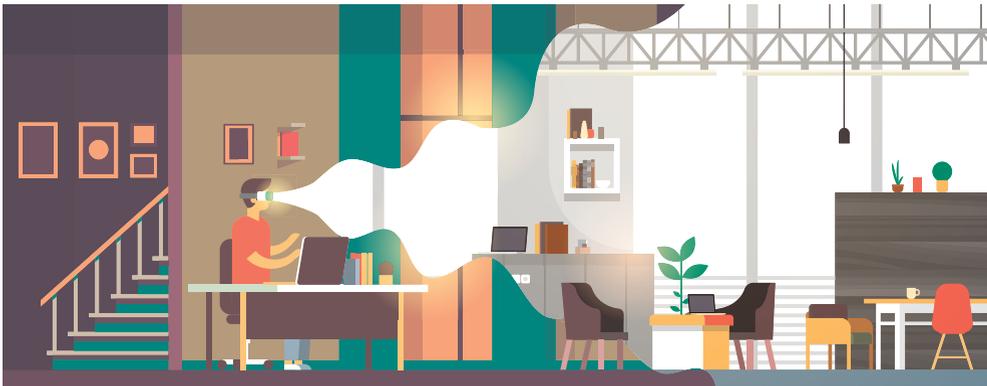
This approach requires both the remote user and the local user to wear VR equipment, albeit different Microsoft headsets to support the opposing functions, but enables the remote worker to interact in the physical, local environment. In reality, the local worker has a robot interacting and rolling around after them (think Phil Dunphy in Modern Family episode "American Skyper"); However, when wearing the VR headset, the local worker sees the avatar of their remote coworker.

# Designing Physical Spaces to Support Virtual Spaces

As commercial architects and interior designers, the limitations within which we design spaces (land, material properties, code etc.) can be removed when we think in 3D virtual spaces, expanding our design services and repertoire into the digital world. Digital meeting places can be customizable per team, client, employee, etc. based on their firm's brand guidelines or aesthetic preferences. Additionally, with these virtual conference rooms and workspaces comes the reality that people will need physical spaces with which to enter these virtual environments. "Commercial architecture" begins to encompass a wide array of spaces; basically, any space (coffee shop, living room, office, etc.) that people may use to engage with VR. How can architects design these spaces to promote long term physiological health, or "digital wellness", for people who are in VR environments for long periods of time, and will this be the next programmatic need for corporations who continue to need physical offices?

Conversely, in a merged AR and physical environment, we must consider new kinds of design factors to accommodate telepresence robots navigating the environment. What is the turning radius of the robot? What obstructions are in the built space that the robot may not be able to perceive, or are outside of its "viewing range?" How will it egress through a physical barrier, such as a door? A robotic coworker would bring new special considerations into play.

Whether it is technology similar to Dataview VR or Microsoft VROOM, it is undeniable that virtual reality will play a role in the future of commercial and workspace design. Conceptualizing these realities now will better prepare us for the technology savvy clients who will inevitably (and already do) approach us for a solution to these elements. As technology expands, we as architects and designers need to be as agile as the places and spaces we design. Technology is changing every day, but the buildings we design are not nearly so disposable and they must to be able to adapt to our ever-changing world.



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# An Emerging Typology – Residential Meets Office

CAROLYN MULLIGAN

In 1976, Nikolaus Pevsner wrote a fundamental book called “A History of Building Types”, cataloguing and defining existing buildings types as a means of discovering how architectural typologies change over time to reflect the character and politics of its society. This book was a first of its kind, spurring on the discussions and theories about type and typology that have saturated the discourse of architecture for decades.

The concept of ‘type’ essentially groups together objects of similar attributes, creating a realm within which architects can define their work. This results in the labeling of buildings as schools, museums, courthouses etc. **We are experiencing an interesting time in architecture, where the existing typologies of office, home, hospital, etc. are being challenged and questioned, and where our existing typologies are being asked to perform functions for which they were not previously conceived.**

Raphael Moneo’s essay *On Typology*, states that “the typological approach per se does not demand constant change” and the reason why certain building types have maintained stability, being reproduced with minimal variation, is not due to rigidity in the type itself, but rather,

that “stability in a society — stability reflected in activities, techniques, images — is mirrored also in architecture”.<sup>1</sup> **In other words, building typologies do not shift or change unless cultural changes in society necessitate it.**

What specific changing societal attitudes (or “instabilities”, to continue Moneo’s word choice) are igniting society’s desire to alter and push the boundaries created by ‘type’? The beginning of this 2020 decade has provided us with one of the biggest instabilities of all: the novel Coronavirus. The threat of this virus has quickly forced us into new habits, brought on us first and foremost by government mandated self-quarantining for the protection of ourselves, others, and our selfless frontline workers, with closures of all “non-essential businesses”.

# What behavioral changes have been created because of this pandemic, affecting how we live and work?

On a broad scale, there is an immediate fear of being in proximity to others, especially within indoor environments. We are all learning how easy this virus and others can spread between people within six feet of each other, making us hyper-conscious of the distance between ourselves and strangers — especially those of us who are aging or are living with pre-existing health conditions. In some cases, staying indoors and maintaining social distancing guidelines is not enough, as one case in China recently revealed. There, the non-filtered, recirculated indoor air caused several people to become infected.

We have recently discovered that people are more likely to feel comfortable being around others when they are outdoors, rather than in an enclosed environment, like an office building or entering someone's home. This comes as people are becoming increasingly more desperate for a face-to-face connection with others and with the outdoors, flocking to running trails, walking their dogs multiple times a day, and even social distancing on the beach. It is obvious that people are gaining a deeper appreciation for that connection with nature and outdoor environments, all the while craving human connection. For those that are not on the frontlines or are essential workers, being "stuck at home" has made many stir crazy, and has amplified the use of telecommunication tools such as Zoom, Google Hangout, Skype and others as reliable ways to create meaningful and safe human connections during these trying times.

We as designers are taking stock of this behavioral change and wondering: if both the desire to spend more time outdoors and the desire for deeper, more impactful human connection — be it virtual or face-to-face — continue to grow in a post-pandemic world, how might our home and work environments respond?

## Home

Have we spent too much of our lives indoors? Today, people in single-family homes across the U.S. — and in other countries as well — are signaling a behavioral shift by abandoning the privacy of their fenced off backyards or walled in living areas, and are choosing to spend more time playing in front yards and picnicking on porches. This shift reflects a desire to be a part of a neighborhood, a community, a network of friends and "second" families waving kind hellos to sidewalk strollers, spoiling each other's pets, and enjoying face-to-face conversations, while keeping the recommended distance, of course. Across the world, people are drinking wine and eating dinner on their patio chairs, and families are spending time playing in the grass with their toddlers. These little joys can be immensely impactful and enable us to move past the fact that we are in "self-isolation" or "quarantine" or even that we are "socially distancing". The desire to be "social" is still here, live and well.

People watching is the world's greatest pastime (think Parisian sidewalk cafes), and is finally making a resurgence in suburban, single family communities during this crisis. Front porch life has allowed neighborhoods to come alive — changing our pre-conceptions that privacy was desired in the first place — and has ignited an entirely new sense of community and belonging for suburban residents.

Similarly, with downtown dwellers, more people are spending more time outdoors jogging and walking

the streets than before the pandemic. Public sidewalks, parks and plazas are the urban dwellers' front lawn, and depending on the city, many downtown residents tend to have a slightly different outlook on their desire and ability to engage with their communities, due to the compact nature of the current multi-family housing model. Multifamily and affordable housing communities often have less opportunity for communal outdoor space — especially as the nation-wide closure of restaurants and public gathering spaces also includes shared club rooms, pool decks and resident gyms in apartment complexes.

Not all is lost. Residents of multi-family dwellings are finding increasingly creative ways to connect with neighbors. Recently, a political advocacy group called The Sunrise Movement created a People Dialer — a phone tree of sorts to reach out to community members and combat isolation. Tried and tested in the Bay area and Dallas, TX in March, dialers simply called and chatted with the next on their lists, providing a sense of community in times when randomly striking up a conversation with a neighbor is otherwise challenging.<sup>2</sup>

Additionally, as the now viral (no pun intended) Italian balcony videos have taught us, those that have direct lines of sight to other people's balconies have taken advantage of this design feature to achieve moments of connection with their immediate community. This behavioral shift towards increased community connection worldwide are examples of how people are determined to engage with others from the comfort of their own space, keeping a safe distance.

## Work

Behavioral shifts in our work environments, however, are highly varied and dependent on the type of work being performed. For the purposes of this discussion, we will focus on non-essential

businesses, where employees are able to work from home. Large, corporate companies and small, local businesses are being affected differently during this pandemic, with many small businesses being more susceptible to business loss, due to the fact that people cannot visit/shop their storefronts while in quarantine. Small business owners have resorted to online orders only, allowing customers to come to their actual homes to pick up online orders.

In addition to small businesses suffering, many self-employed free-lancers and entrepreneurs are choosing to cut overhead costs. Coworking spaces are suffering due to these cancelled leases, spurred by health concerns presented by a shared workspace and the additional cost of renting a desk outside of their home. Providing resilient workspaces for these free-lancers is extremely important, as the Bureau of Labor Statistics — prior to the recent pandemic — shows that self-employment in the U.S. was on course to see a 7.9% growth rate from 2016-2026.<sup>3</sup>

Many corporate employees are experiencing a transition to a work-from-home structure and are finding it is in fact possible to remain productive (childcare conflicts aside). CEOs are experiencing this in tandem with their employees, dislodging the taboo frequently associated with working from home. This massive forced social experiment will likely spur a trend in companies allowing for more flexibility in remote working in a post-pandemic world.

## We as designers are curious: is there a new live/work typology that will emerge?

It is important to note that the live/work typology is not a new idea or phenomenon, but has existed for

centuries — the predominant lifestyle worldwide, prior to the Industrial Revolution, when mass industrialization created a need for people to travel away from their homes to factories that housed large machinery for production.<sup>4</sup> The live/work “home above the shop” typology, where citizens are self-employed, has been a staple for economies in urban environments all over the globe. In comparison to other countries, however, the U.S. has relatively low self-employment rates, at 6.3% in 2018, compared to the United Kingdom with 15.1%, or even Italy with 22.9%.<sup>5</sup> Regulations and zoning requirements in cities like Dallas rarely accommodate or even acknowledge this form of living/working today. In fact, in many cities and neighborhoods in the U.S., it is illegal to sell goods from your home.

This current crisis has caused us to question whether or not the current zoning restrictions could evolve (or devolve) to better reflect this model, allowing communities to become resilient in times of pandemic. With 37% of the work force able to work from home, according to the National Bureau of Economic Research, a new work/home typology could re-define and create a new market type in many cities.<sup>6</sup>

## Our Study

In the years before Coronavirus and the COVID-19 pandemic, people rarely considered completely upending their behavioral working models. However, this current crisis has forced our working models to evolve. How can we design our home/work environments to capitalize on the *positive* behaviors – that have recently emerged due to the crisis — those that introduce more community, a better relationship with the outdoors, and healthier spatial design?

## MULTI-FAMILY

Imagine a live/work typology that is designed to accommodate the changing behaviors and evolving needs presented by the recent crisis. Can an individual unit be easily convertible and flexible to accommodate seasonal pandemic or economic changes? In the near future, there may be some seasons where the separation between home and office, reflecting the current typology, would remain intact. Other seasonal influences may introduce a flexible or full-time working from home model. Accommodating these changing circumstances (and ones have not yet been anticipated) could be a new standard of design that multifamily developers will need to provide to residents.

Individual units reflecting this flexibility should offer residents both a “public facing” entry — used for a home office, a pop-up shop, or a permanent retail storefront, granting direct access to a public staircase or sidewalk — and a “private” residential space. The public facing entry could also serve as a flex space to suit various needs, if there is no current need to work from home. These individual units can be master planned on a site to create resilient neighborhoods, activating streetscapes with these storefronts, and providing goods and services that neighbors can easily walk to from their own units.

The benefits from this type of unit model include<sup>7</sup>:

- 1 Heightens neighborhood activity, making communities livelier and expanding a sense of community much needed amongst residents. This is especially beneficial for residents that are self-quarantined, immunocompromised, or elderly that cannot leave their homes or must keep a safe distance from others.
- 2 Increases “eyes on the street” — the urban planning strategy that Jane Jacobs so

famously coined. This increases security by residents and neighbors self-policing their community spaces.<sup>8</sup> Among other things, allowing residents to work at home during this crisis has already seen a significant reduction in crime across the world.<sup>9</sup>

- 3 Stimulates local economy by supporting microbusinesses at a local scale, keeping more money in the hands of local communities and cities. This financial gain can in turn be spent on infrastructure that benefits citizens in those cities.
- 4 Sustainability in terms of cost efficiencies. Residents save on costs by paying only one monthly rent payment, instead of additional coworking leases, or parking leases at some urban offices.
- 5 Decreases commute times to work hubs, reducing pollution dramatically, saving costs associated with driving, and giving time back for families and personal wellness. Across the world, pollution levels have plummeted during this crisis, and offering more ways to keep people productive in at-home working solutions may be a global benefit.<sup>10</sup>
- 6 Offers flexibility to small business owners, especially those that have a separate storefront than their residence currently. Additionally, small business owners could continue to use their current leases as their main storefront for their mature products, while using their home workspace as a pop-up, testing viability for new products they wish to sell, without having to commit large amounts of money to design and retrofit a large retail space.
- 7 This public facing side can also be a client facing conference room for small business

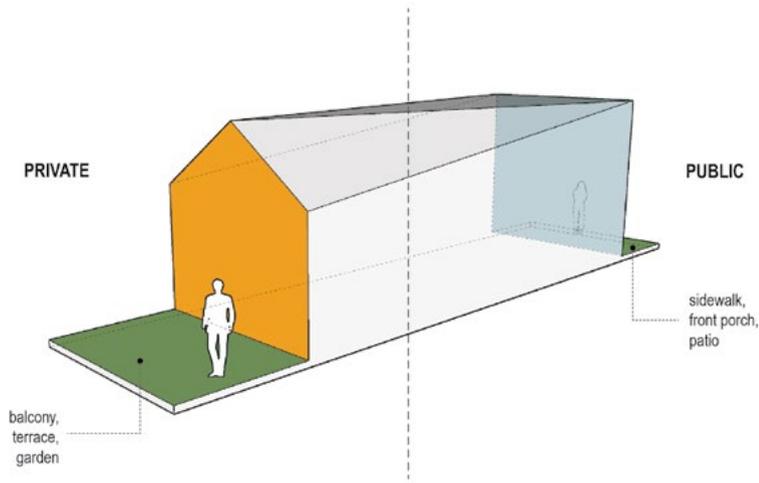
owners, where clients can come attend meetings in this space, without entering the owner's personal home.

- 8 Addresses the need of the ever growing free-lance work force.<sup>11</sup>

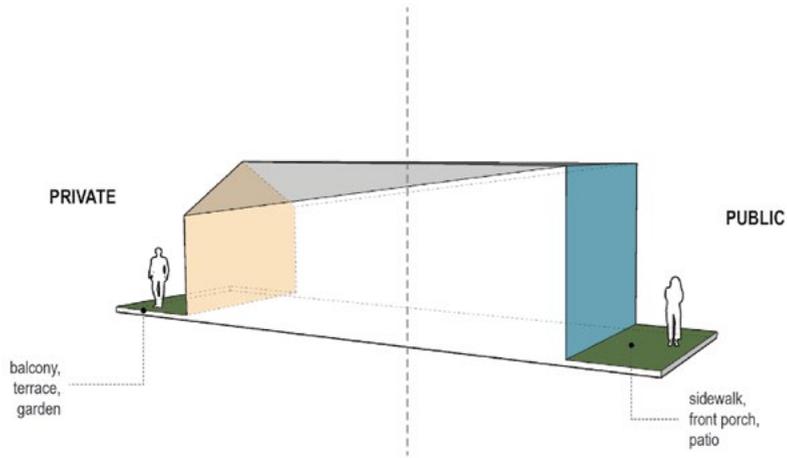
These individual units can be collectively arranged to maximize safe social interactions, during cyclical times when physical distancing is needed. The design and placement of seemingly mundane circulation elements such as staircases, corridors, are vital in determining the social factor of a complex. For low to mid-rise apartment complexes, front doors facing activity filled courtyards, allow people to know who their neighbors are when they come and go, and makes people feel comfortable talking to each other, versus the internal, long skinny hallways, where people put their heads down as they pass each other. Keeping circulation elements outdoors also add to healthier environments, as fresh air exchange dilutes virus particulates, providing less stress on building Owners to over "hospitalize" the space with complex HVAC systems and microbial surfaces.

## SINGLE FAMILY

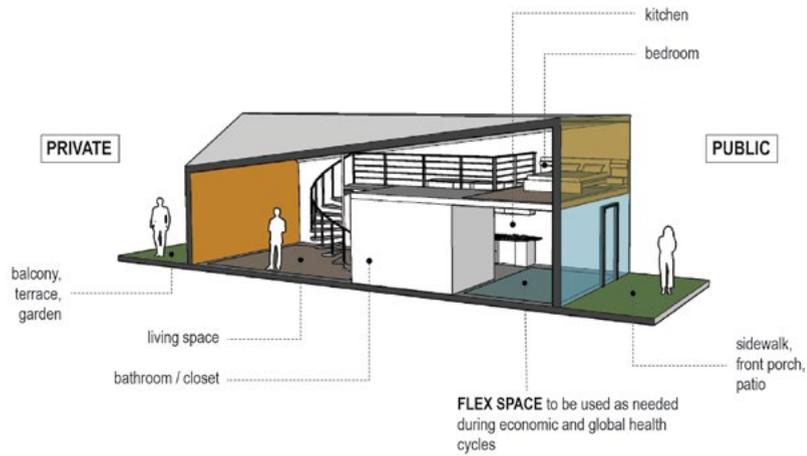
Accessory dwelling units have emerged in single family neighborhoods as people are demanding affordable housing due to nationwide housing shortages. Will this concept further expand, or will single family homeowners start building standalone home-office buildings in their backyards in preparation for future pandemics, as a way to separate their work and home life? Will residential designers and homebuilders start to include "public facing" areas at the front-facing side of new homes in masterplanned communities? Suburban communities could experience a never-before seen typology of urban resurgence — a fascinating development to the traditionally isolated and "get off my lawn" suburban mentality, adding vibrance to an otherwise routine street life.



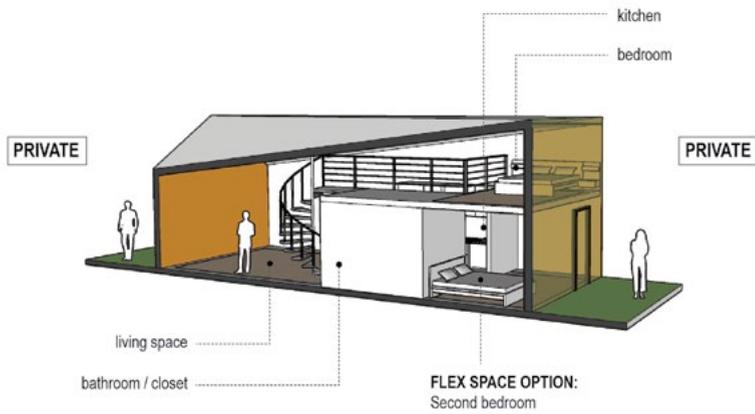
Individual Unit Configuration 1



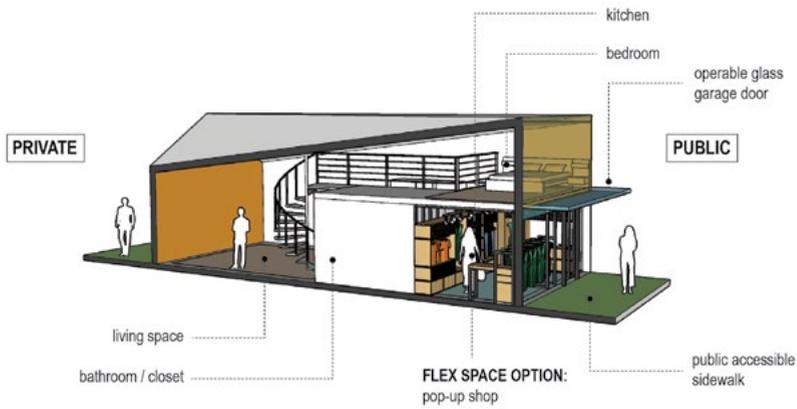
Individual Unit Configuration 2



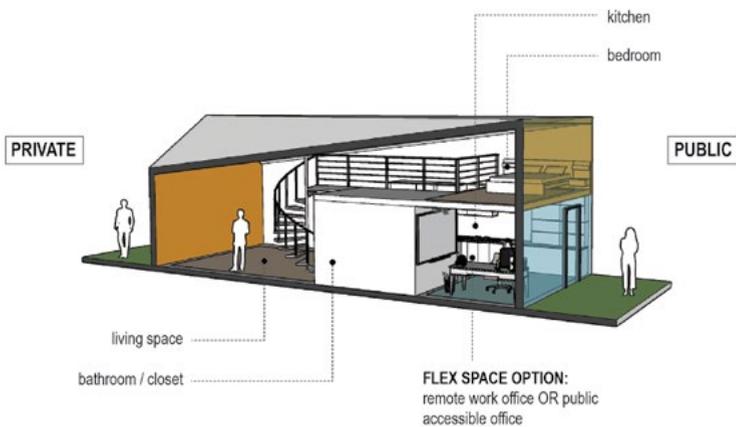
Individual Unit Configuration 3



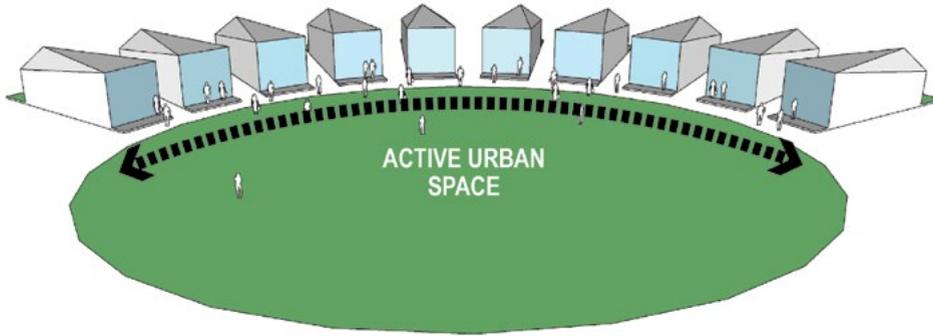
Individual Unit Configuration 4



Individual Unit Configuration 5



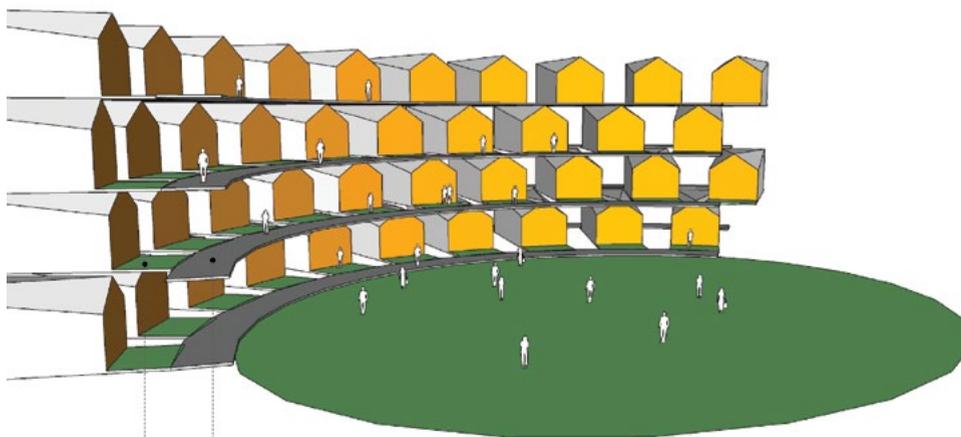
Individual Unit Configuration 6



**SINGLE FAMILY HOUSING**  
 Arranging the units so that the public areas face a shared area, activates the urban space and encourages street life.

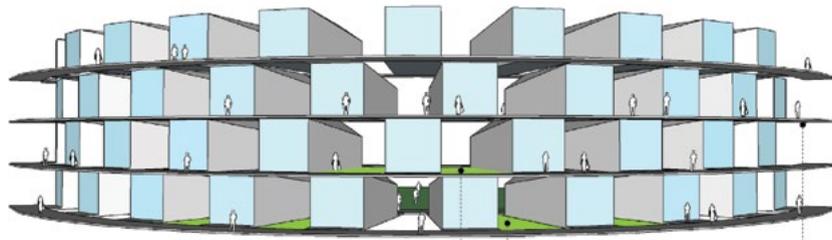


**SINGLE FAMILY HOUSING**  
 Arranging the units so that the private areas face a shared area, creates a sense of community with neighbors.



**MULTI-FAMILY FAMILY HOUSING**  
 Arranging the units so that the private areas face a shared area, creates a sense of community with neighbors.

connecting, exterior walkways  
 exterior balconies and front patios

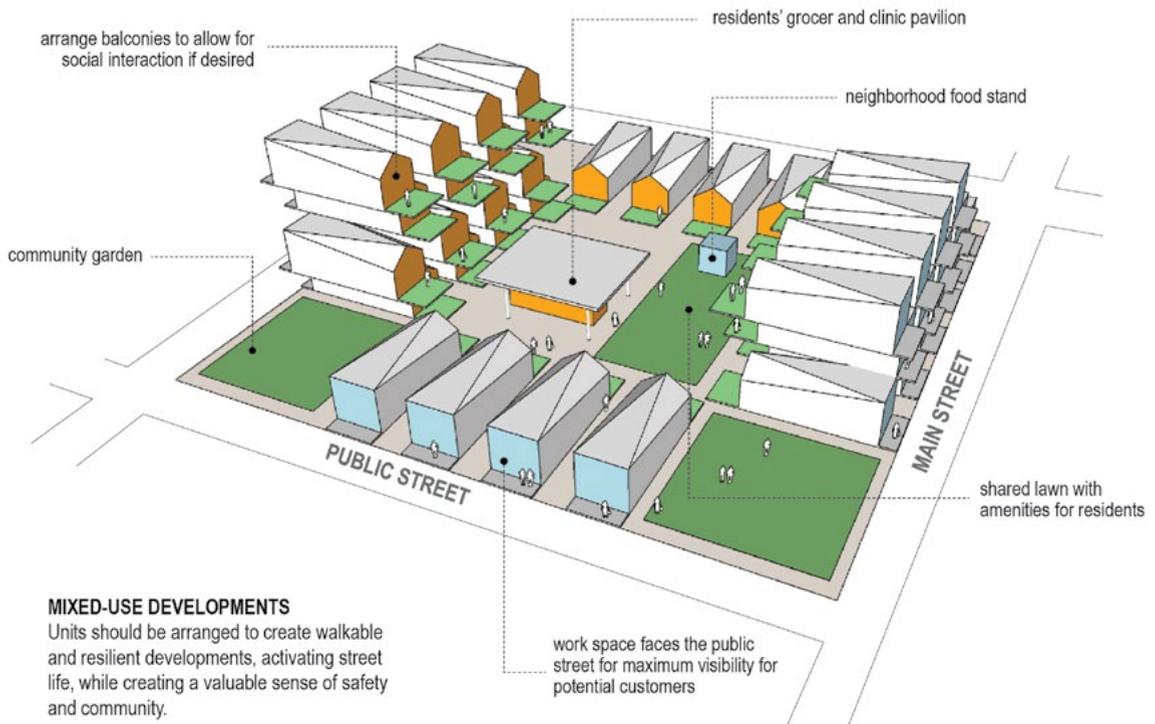


side gardens and private outdoor space for each unit

connecting, exterior walkways

**MULTI-FAMILY HOUSING**

Arranging the units so that the public areas face a public street, activates the urban space and encourages street life. Spaces between units can be designed with gardens etc.



**MIXED-USE DEVELOPMENTS**

Units should be arranged to create walkable and resilient developments, activating street life, while creating a valuable sense of safety and community.

Fueled by the spread of the virus, architects and designers alike are acutely aware of the ever-urgent societal needs for healthy spaces, resilient live / work strategies, as well as an integral community connection to restore a newly discovered quality of life. We are willing to rise to the challenge of designing spaces where individuals and communities can thrive, whether during a pandemic, ongoing climate crisis, or everyday life. We have an incredibly important job ahead of us, as our decisions today can have an incredible impact on generations to come.

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**"Our beds are empty two-thirds of the time. Our living rooms are empty seven-eighths of the time. Our office buildings are empty one half of the time. It's time we gave this some thought."**

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**BUCKMINSTER FULLER 1970, FROM BOOK: "I SEEM TO BE A VERB"**



# The Future of Productivity – How the Pandemic Exposed the Benefits of Telecommuting

JAN KANNAN OF CORGAN AND STUART SHELL OF BRANCHPATTERN

The practice of telecommuting or working from home has been around for several years now with nearly a quarter of the U.S. workforce having experienced working from home in some form or the other. With the onset of the COVID-19 pandemic, this number shot up to an unprecedented 62%, a with over 50% of businesses providing WFH options.<sup>6</sup> What's more: three out of five employees would like to continue to work from home even after the lockdown eases.<sup>6</sup> What is it about this bite of the proverbial apple that makes it alluring to all?

## Pros and Cons of WFH

**Consider this scenario** —The alarm rings at 5:00 AM. You snooze as long as you can, then jump out of the bed, wash and get ready for work. You wake up your kids, make breakfast, pack lunch, shepherd your children to the car, and roll out of your driveway to a road full of angry motorists fighting the morning rush hour. You make your way to your childrens' schools, make it to the freeway, get stuck behind a truck and move only a few inches for a couple of miles, missing every coordinated traffic light between your exit and your office. 20 minutes later, you pull into your office parking garage, drive around looking for a spot, and rush to the elevator

— your heart racing faster than an F-1 car at race. You make a beeline to your desk, put your bag down, turn on the computer and finally remember to breathe.

For an overwhelming 69% of people, in a survey done by Corgan's research group, Hugo, not having to commute and the reductions in expenses related to commuting are the top benefits of working from home (WFH). In other examples, employees engaged in work-from-home scenarios have also reported to have a higher sense of job satisfaction and work commitment.<sup>6</sup> The comfort of the environment — whether it is one's own dwelling place, a local coffee shop, or a sunny space in the park — is known to have positive

impacts as well. The sense of control over time and everyday schedule, as well as the ability to take care of small chunks of home-related work at a convenient time is an added benefit. As a result of the largely psychological impacts, studies show that productivity tends to be on the higher side when working from home. Employees make extra effort to remain connected and tuned with their employer.

However, there can be a downside. The most reported negative response to WFH is the lack of social interaction with colleagues, better known as social isolation. The total reliance on technology could be a setback, in some cases, introducing a sense of being 'on' all the time and an inability to switch off from work. From a manager's perspective, managing a team remotely requires a different set of skills and is reliant to a large extent on the team's ability to communicate effectively. For new employees, understanding the culture of the organization can be challenging. Additionally, workers in creative roles may feel the lack of spontaneous discussions or the synergy of designing solutions through unprompted collaborations more than others.

## The Human Nature of WFH

The interesting thing about WFH is the way it tends to humanize our coworking relationships. Anyone who has attended video meetings during this lockdown has more than likely been "welcomed" into their coworkers home, and should by now be used to seeing small children or pets of all kinds popping in and out of view. You're home — and that means play time. In the light of this pandemic, we have become increasingly aware that working from home across the globe means that pets, children, and elderly family members who need home care are left without the essential support of schools and caretakers. This may change with the passing of the pandemic or it may introduce new challenges and necessary

changes with prior caretaking arrangements. Providing the ability to work from home and the flexibility to rearrange hours so that such responsibilities may be addressed can be perceived as an empathetic approach on the employer's behalf. With the evolution of the workplace, visible empathy is now expected — a 2018 State of Workplace Empathy Study by Businessolver found that a whopping 96% of employees surveyed believed it was important for their employers to demonstrate empathy — showcasing that they are being listened to and that the employer genuinely cares about the wellbeing of their employees.<sup>5</sup> It shows that employers consider employees to be more than just resources. This goes a long way in building trust and leads to more loyal and trusting teams, with employees being at least 13 times more likely to remain longer in a high-trust culture.<sup>5</sup> Flexibility in the workplace can be great tool for attracting and retaining talent.

From an employee's perspective, the option of working from home is a perceived pathway to a better work-life balance, a term that has been in the buzz since the late 1970's. A recent survey by GoToMeeting shows that a healthy 60% of those surveyed said they were likely to accept a job with strong remote work culture.<sup>4</sup> Even more significant is the fact that employees are willing to take a pay cut for that flexibility.<sup>10</sup> Additionally, promoting telecommuting is also being considered at the national level as a way to build a better work-life balance, according to both the Fair Labor Standards Act<sup>2</sup> and Flexible Medical Leave Act.<sup>11</sup>

## Generational Preferences

Together, Gen-Xers and Millennials constitute nearly 70% of the workforce.<sup>3</sup> This number is only going to increase as more millennials join the workforce over the next few years with predictions that indicate the millennials alone will constitute the majority of

the workforce by 2025. Gen-Xers are highly tuned into the importance the work-life balance, having parents who are still in the workforce, and are more likely to prioritize making time to spend with their families.

Similarly, Millennials expect to have the workplace support their lifestyle outside their work life. Flexible working is among the top priorities for 79% of millennials when seeking a job.<sup>8</sup> The same survey also shows that, for respondents aged 25-44, over 40% say one of the biggest benefits of working remotely is the ability to start a family, or care for a family and/or pets.<sup>9</sup>

## What About Productivity?

We can look to research to see how remote working impacts employee. Many studies show that, while working remotely, relative job satisfaction increases and people tend to be more productive. Time is calculated differently, as employees tend to work at times that work best for them — building a preferred work schedule around when they are more relaxed, more focused and more motivated. This time also allows for energy breaks, such as a walk to a coffee shop, that restore imaginative thought. Additionally, these breaks allow for caregiving — whether it be to children, to elderly parents, or self-care for mental wellness — and in these instances, the employer always stands to gain. And in most cases, remote workers empowered with autonomy tend to perform better — in fact, two-thirds of managers who offer telecommuting flexibility report that employees who work from home are overall more productive than their counterparts.<sup>7</sup> This increase in productivity, again highlights big wins for employers, who, when offering at least part-time flexibility, collectively save \$44 billion each year.<sup>7</sup>

## Future of the Workplace

Working from home is not a new concept. Historically, working from home meant living and working in the same building — a concept familiar to even earlier colonial states. However, there have been several versions of the WFH we've come to know since the early 1990's, with a steady increase in the number of employees telecommuting since 2010. In a recent U.S. Census report, telecommuting has taken over the third most popular mode of commuting, in the place of public transport, with approximately 1 in 20 people telecommuting in America as of 2018.<sup>1</sup> This has given rise to many speculations about the future not having any office spaces. Perhaps that could come true sometime in the future, but the immediate future holds tight a spot for the collaborative working environment.

The pandemic lockdown has forcefully provided an opportunity to experiment with the option of working from home for many businesses. Some that believed WFH was not a possibility for them might now be able to either confirm that pre-conceived notion, or alternatively, have been pleasantly surprised at the ease of the transition. Other companies with some form of flexible working options already available prior to the shelter-in-place orders will hopefully help to better identify and solve any shortcomings, making WFH remain a viable alternative for those seeking more flexibility in supporting a life of wellness.

As governments ease the lockdown, businesses that have sustained with WFH may be able to continue to provide these options to employees, while taking measures to make the workplace safer for return. The choice of working from home is also an option that some employees prefer, as there remains a large contingent, rightfully so, of concerned citizens who prefer to continue

physical distancing or assisting with care taking at home. While the awareness of keeping a physical distance will remain heightened during pre-vaccine months, the choice to remain home might be only a luxury post-vaccine. In some cases, returning to the office is not a choice, and bringing employees back into the workplace in rotational phases may be the only pre-vaccine solution. In these scenarios, employers can control the number of people in the offices at any point by dividing the teams into groups and alternating on-site access and capacity, giving people the ability to continue keeping a safe, physical distance. Long term, this could have an impact on the way we deliver our designs, significantly altering the square-foot per employee ratio.

Remote working is a double-ended benefit that is not only advantageous to the employer but also to the employee and their ultimate wellbeing. Effective use is bound to have positive impact on the workforce while increasing job satisfaction and commitment to work. Employers need not worry about productivity decline but focus on supporting the remote workers to play to their potential.

This pandemic is not going to determine the future of the workplace. Rather, it serves to test and resolve technological maturity and our employees' ability to adapt to new and unprecedented situations that cause each of us to reflect. We did it, now what's next?

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# Working From Home – An Old Paradigm With New Meaning

SAMANTHA FLORES AND TANIA WHITE

Over the past few months, COVID-19 has forced much of the global workforce into a grand work-from-home (WFH) experiment — both creating challenges and highlighting opportunities for post-COVID-19 working environments along the way. The transition has been easier for some than others, but even before this pandemic, over 5 million U.S. employees were working from home at least half the time, and businesses were developing more robust WFH policies.<sup>5</sup> And while WFH has been around since the 90's, it might become a preferred method of work for some employees and employers alike — whether people were prepared for it or not.

Hodinkee. Image source: Corgan





Before this pandemic, remote working has been on the rise in the last decade, growing 173% since 2005.<sup>5</sup> It's popularity was already increasing as ⅔ of managers reported an overall increase in productivity from their remote working staff.<sup>5</sup> In fact, 86% of employees reported that they are most productive when they work remotely, in environments they can control – devoid of distractions like loud office spaces or inefficient meetings.<sup>5</sup> In addition to time saved, full-time telecommuters reportedly save more than \$4,000 each year by spending less on commuting, food, and professional clothing upkeep, in addition to receiving certain tax breaks.<sup>5</sup>

Employers have seen some benefits as well — so much so that in 2015, telecommuting saved all participating employers a combined \$44 billion that year. Likewise, employee satisfaction rises with the introduction of flexible work schedules, so turnover rates have fallen by 50%.<sup>5</sup> This may be why some companies across the U.S. — like Facebook — are making a 100% shift to a remote workforce. Meanwhile, today's transition has been easier for some than for others, in some cases leaving both employees and employers longing to be back in the office.

The situation we are all experiencing today is acutely different than what has been examined in the past few years, thanks to four factors: children, space, privacy and choice.<sup>1</sup> Additionally, there is an added stress of being in the center of a global pandemic that has changed our way of life. One Corgan employee, who is also in pursuance of a Master's degree, highlights this difference by sharing:

”

*“I have a mountain of homework to look forward to this weekend — articles to read, discussion questions to generate, a reflection paper to write,*

*preparation for leading a discussion next week, and a research project for computational modelling to work out. But for tonight, I'll be putting my sewing skills to work making fabric masks with filter pockets and nose bridge supports (hopefully) for my immediate and extended family. My 90-year-old Grandma asked me to make one for her- which breaks my heart that it's necessary, but it definitely highlights the importance of doing what I can to protect her and everyone else. I'll make a bunch and try to use fun fabric so it's not as sad” – Anonymous, WFH Diary Week 2*

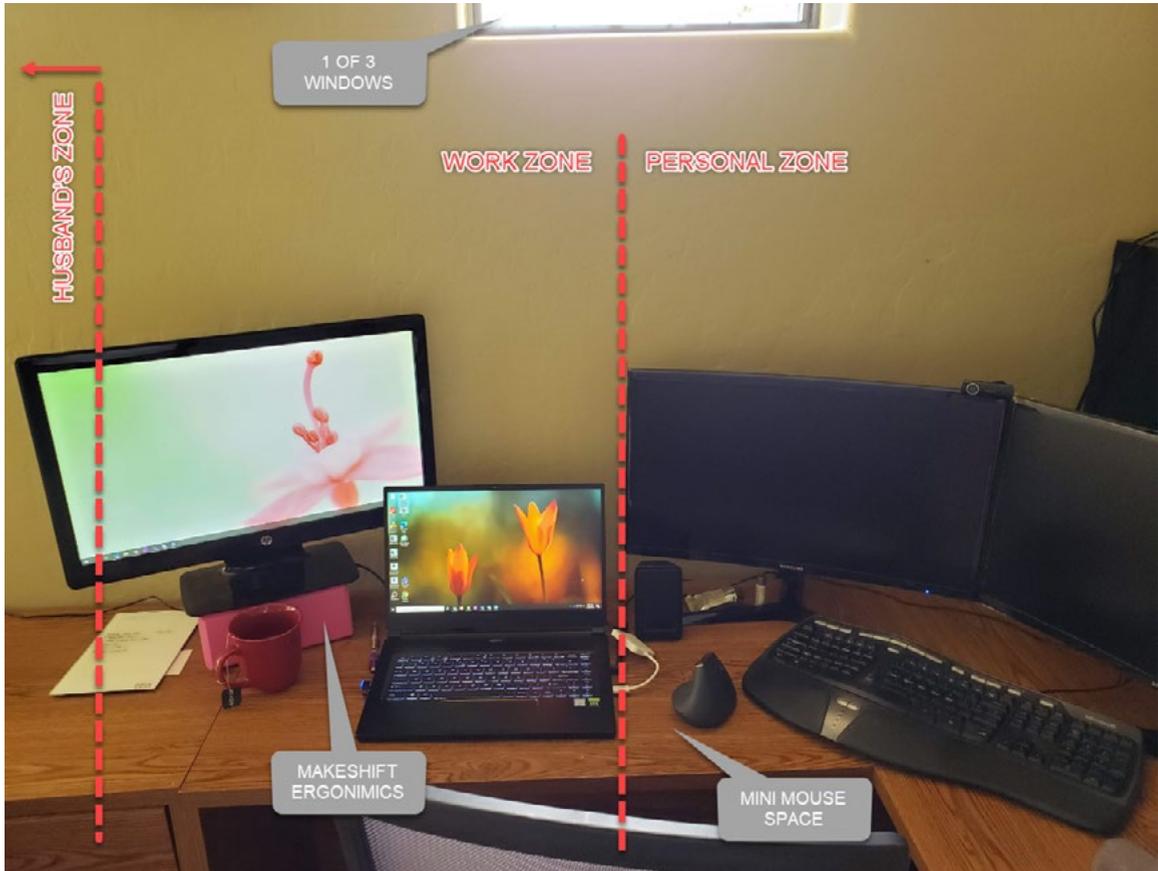
There is a balance happening right now, and while we recognize that these WFH conditions in most cases are not ideal — with kiddos popping on and off screen unannounced, fur-babies spontaneously interrupting, and significant others shouting “Let's circle back on that” from the other room — this is a time to examine all facets of working remotely today so that we can create evolved solutions around work flexibility for tomorrow.

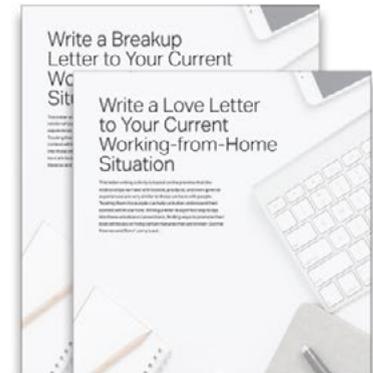
Hugo conducted a series of surveys to better understand how members at Corgan were — and are — adapting to the WFH environment. This was accomplished by two different types of primary data on participants' experiences:

## Quantitative Data

Reaching out to Corgan employees across all offices, we conducted three electronic surveys over the course of six weeks to capture data that reflects the needs of the WFH employee.

This data helps us to establish a general understanding of how routines have been altered, how communication styles have been adapted, and what other influences are affecting day-to-day working experiences.





Write a Love Letter or a Break-Up Letter to your WFH situation!



Develop an Empathy Map that focuses on your personal WFH experience



Create an Energy Map that tracks where your energy levels peak and fall

## Qualitative Data

By nature, qualitative data is descriptive. Users tend to describe phenomenon they observe, but that which is not wholly measurable — such as “reactions”, “feelings”, or “emotions.” To capture these emotions over the course of the same six week period, we asked 10 participants to log daily “WFH diaries”—expressing their emotions, noting frustrations and efficiency gains, and bringing us a little deeper into their thoughts.

We intentionally gave little structure to this study, to see what stream of consciousness would give us, and boy did each participant deliver! From tracking cat movement patterns, to sharing their daily Snack-O-Meter, each participant brought both deeply personal insights and much needed levity to their daily diary entries.

Our goal with this study was to understand the fundamental needs of Corgan employees during this time, capture their preferences, and gain a deeper understanding of their emotional response to this non-traditional WFH circumstance. All participants remained anonymous, so that deep, rich information could be captured without filtration.

Some major patterns did emerge, for example:

- 7 out of 10 diary participants had settled into a routine by week five
- The WFH experience was rated 4.03 in the 1<sup>st</sup> week, 4.11 in the 3<sup>rd</sup> week and 4.09 in the 6<sup>th</sup> week, showing high satisfaction among most of the firm

In addition, five major insights from both quantitative and qualitative studies emerged.

**KEY**

**Energy Levels:**  
**Low** - not motivated, moving slowly  
**Moderate** - getting work done, steady  
**High** - getting a lot of work done, killing it!

**Snacking:**  
**Light** - not snacking very much/ at all  
**Moderate** - snacking but not feeling bad about it  
**High** - starving all day, making multiple trips to the fridge

Example diary entry, emotional response key

# Write a Breakup Letter to Your Current Working-from-Home Situation

This letter writing activity is based on the premise that the relationships we have with brands, products, and even general experiences are very similar to those we have with people. Treating them like people can help us better understand their context within our lives. Writing a letter is a perfect way to tap into these emotional connections, finding ways to promote their best attributes or fixing certain features that are broken. Get the Kleenex and Ben n' Jerry's out...

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Anonymous | WFH Week 2 | 04.03.2020

I miss my favorite coffee shop. I miss collaborating with team members in the Skyline. I miss my desk. I miss all my places that tell me I am part of a larger community and the places which reinforce my identity as a professional with talent that brings value to others.

**Home is where my blessings of marriage and fatherhood are anchored.**  
It is 1,500sf of laughter, chaos, emotion and laundry.

**The Corgan headquarters is the hub of my life as an architect.**  
It fosters and facilitates my passion for good design. It is clean, ordered and open. There are ample supplies, big screens and a killer model shop. Large tables invite us to spread out trace paper and laptops, to sit around them and eat and laugh and make important decisions. I like to camp out in the phone rooms without making calls, chat with coworkers in the drive-thru booths and walk down the stairs to a spread of beverages, small talk and design inspiration on Friday afternoons.

**I love home.**  
**I miss Corgan.**

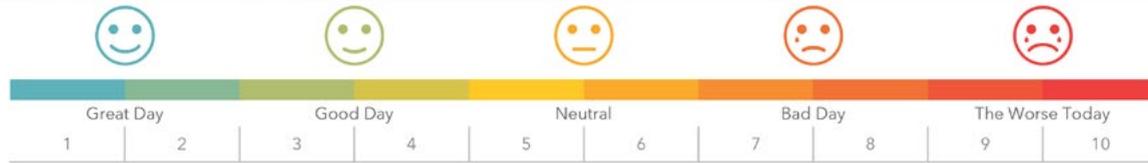
Now home is shared by Corgan and Corgan is shared by home and both look different. A lot different and I haven't figured out what to do about it. But I want to craft the change. I want to own this new world and not let it tell me how things must be.

But first I need to finish some RFIs.

Example diary entry using Hugo-provided worksheet

# Working from Home Diary

Use this scale to rate how I'm feeling.



DATE	What is working great today?	What could be better today?	What is not working at all?	What do I need for better support?	Rate My Day
3/27	I am enjoying working from home. The lack of distraction (open work environment) allows me to focus more and be more creative. I am also enjoying being able to manage my day better.	Nothing today. It has been a good Friday.	Everything is working well today.	No support needed today.	1
3/30	The ability to work from home: technology. Even though I did not bring my monitors from work, I can use the online portal in conjunction with my laptop.	I have had so many email interruptions and Skype message interruptions today. It is annoying. Less contact (email) from my boss. This is a different way to manage for some leaders - the tendency is to "over manage." That is emotionally draining. This work from home structure is showing the weak cracks in management skills.	Too many emails and Skype messages. I know we are working remotely, but not every thought has to be put in an email or Skyped!	<ul style="list-style-type: none"> <li>Set up weekly or agreed upon check in dates to alleviate the need to reach out and touch with email after email and Skype messages. It feels like big brother!</li> <li>Create awareness with leaders and managers of the fine line between remote management and micromanagement.</li> </ul>	7

Example diary entry, emotional response key

	1	2	3	4	5	6	7	8	9	10
Date	30-Mar	31-Mar	1-Apr	2-Apr	3-Apr	4-Apr	5-Apr	6-Apr	7-Apr	8-Apr
<b>Work Factors</b>										
<b>Task (hours)</b>										
Education Resarch	4	2	0	1	1			6	0	3
Architectural	0	0	0	0	0			2	4	0.5
Buisness Development	0	0	0	0	0			0	0	0
HUGO	2	4	4	1	7			0.5	0.5	0.5
Coordination	1	0	0	0	0			0	0.5	0
Meeting	0	1	0	0	1			1	0	0
Call	0	0	0	0	0			0	0	0
Corgan University	0	1	0	0	0			0	0	0
Webinar	0	0	0	3	0			0	0	0
Other	1	0	0	0	0			0	0	0
<b>Location (hours)</b>										
Desk	4	3	4	4	4			6	5	4
Lounge Chair	4	5	0	0	5			2	0	0
Other	0	0	0	0	0			0	0	0
<b>Hours Worked</b>	8	8	4	5	9			9.5	5	4
Overtime?	0	0	0	1	1			1.5	0	0
<b>Personal Habits</b>										
Sleep In	Y	Y	Y	N	Y			N	N	N
Yoga	Y	N	N	Y	N			N	N	N
Breakfast	N	Y	Y	Y	Y			Y	Y	Y
Lunch	Y	Y	Y	N	N			Y	Y	Y
Break for Dinner	Y	N	Y	Y	Y			Y	Y	Y
Go for a walk	N	Y	Y	Y	N			N	N	N
School / Homework (hours)	3	1	4	5	0	10	8	5	8	4.5
<b>Social Interaction (1-5)</b>										

Example diary entry, activity log

# Humanization through Culture

**“It’s interesting how this situation can remind you that we’re all humans. All of us in our homes, with the occasional pet or child interruption, wearing silly hats, and talking about how we’re adjusting and what our days look like now. It’s encouraging to hear people talk about how they’re getting outside and spending time with their families and adopting new habits, while shedding some old ones. It’ll be interesting to see what things look like when this is over.”** – ANONYMOUS, WFH DIARY WEEK 3

Like many other companies, Corganites witnessed this transition seemingly overnight. We’ve learned new ways of communicating with one another, which at times, have been stressful. We’ve adapted in ways we never thought we could. And as reflected in the employee survey responses, we may have developed a more humanized understanding for one another.



*“In a way, I feel more connected to my coworkers, seeing them “outside of work: and in their own homes” - Anonymous, WFH Diary Week 2*

Many of us have shared moments of vulnerability across our screens with coworkers and friends as we cope with the crisis. We’ve seen family pets walk across our laps during a conference call. We’ve heard children waking up from their naps. We’ve seen what kind of artwork hangs in our boss’ living room. This raw exposure of our lives during crisis could have one silver lining: a shift towards a deeper and more empathetic understanding for one another as coworkers.

Throughout the Work From Home surveys, Corganites shared their personal circumstances — taking care of an aging parent during shelter in place, having young children at home that need help with their school work, getting up at 5 AM to squeeze in some work before they swap “childcare” duties with a spouse, and the loneliness of living (and working) alone during a global pandemic. They expressed how much they miss their coworkers and the unexpected chats in the breakroom that spark ideas. And they’ve also introduced us to some of their new coworkers — spouses, children and fur babies included.

You might recall a BBC Skype interview that went viral in 2017 when professor, Robert E. Kelly’s two young children came waltzing into the room on live television. While this felt like an isolated incident at the time, it has possibly become part of our new normal. And with that, it might be something worth celebrating. We have managed to continue delivering our work for clients, but we have also learned a little bit more about each other.

“Zoom was providing us with more clues than ever before with which to figure out, or at least to imagine, what people might be doing in their more private lives — what they might really be like.”

– The New Yorker (April 2020)

# Introverted vs. Extroverted and “Social Serotonin”



*“What I am grateful for today is the spirit of Corganites! This pandemic seems to have bonded us closer together as a team and family. I am also meeting more of my fellow introverts who are loving working from home!” - Anonymous, WFH Diary Week 3*

The dichotomy of experiences is a range that exposes the introverts — those who are mostly enjoying the current WFH experiment — and the extrovert — those who, under the recommendation to stay home, are experiencing a slight struggle.

Take a look at competing viewpoints, and how one diary participant describes, the effects of losing Corgan’s in-person “social serotonin”:

## Introverted



*“I have noticed that people who are more extroverted may not be doing as well as those of us who are more on the introverted side. I get it! Some people need more stimulation and physical contact from others. How do we help them retain sanity in this pandemic? We currently have once-a-week happy hours. I think that helps people stay connected in a fun way. I can also tell that the introverts hate it!! LOL! Is there any way to please everybody?” - Anonymous, WFH Diary Week 1*

## Extroverted



*“I am without an audience, without a community, without the social happiness I depend on. I am a*

*worker bee without a hive...at this point, all things that ground me with a sense of ownership have been removed. Place, community, project, task. I am adrift. I know that this is not forever, we will recover, grow stronger, endure, be agile to the change. But on the molecular level, the level of me, as one, as one Corganite, I feel distant. Removed. - Anonymous, WFH Diary Week 1*



*Reaching a milestone during “work from home” doesn’t feel quite as special — there’s no team members to go to lunch with or celebrate with over cookies or generally feel that relief of tension wear off in mutual accomplishment. - Anonymous, WFH Diary Week 1*

Some naturally inclined introverts also described that while thoughtful managers are largely focused on everyone’s well-being, making sure to take stock in how others work will encourage participation without trepidation. This idea is interesting, as multiple people reported feeling smothered by others checking in constantly, calling meetings unnecessarily to do so. This sentiment tended to turn into appreciation in the second and third weeks, as the severity of the situation settled in.



*“This is the era of being an emotional leader.” - Anonymous, WFH Diary Week 2*



*“Work from home continues to be a positive experience — technology, collaboration, flexibility, etc. For some reason I feel closer to my co-workers as we go through this crisis. Times of challenge tends to bring out the best of people, we forget our differences and focus on the humanity of each other” - Anonymous, WFH Diary Week 3*

# Communication is Key

**“When I have meetings with the camera on, I have to make sure she [my wife] doesn’t walk into the kitchen (aka my new office) and do something silly in the background. We text each other with warnings like: stay away from the kitchen for the next hour!” – ANONYMOUS, E-SURVEY PARTICIPANT**

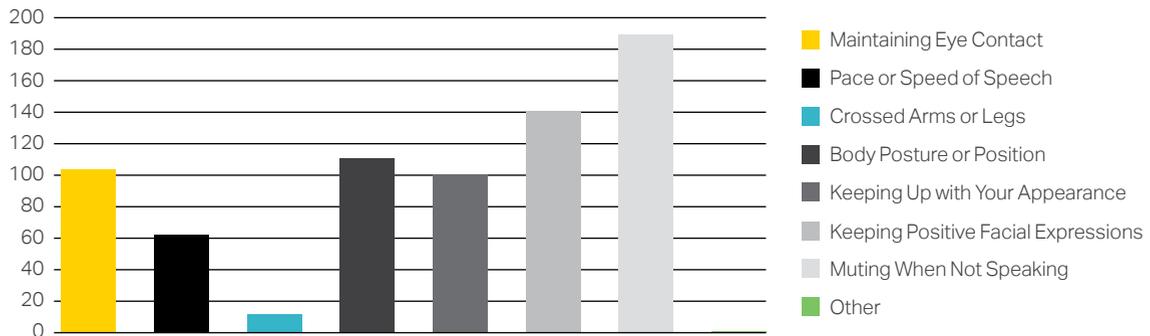
How often have you heard someone say that over 90% of communication is nonverbal? Researcher Albert Mehrabian is responsible for this percentage breakdown detailing the importance of nonverbal communication channels compared to verbal ones. So, when a majority of our communication “tools” are moved online, how does this impact the way we interact with coworkers?

Since there was not a lot of time to prepare employees for a fully remote operation, we wanted to better understand how Corganites were interacting with one another. The consensus is —

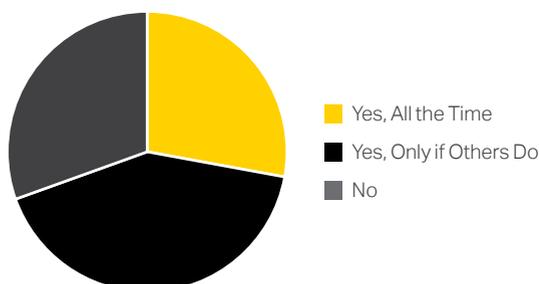
Corganites have a variety of different preferences when it comes to online communication.

We learned that some of us really appreciate the ability to hop on quick Skype calls throughout the day; others find it distracting and micromanaging. On average, the more Corganites that are on a call, the less likely we are to actively participate and the more likely we are to just listen. We’ve struggled to find replacements for certain activities, like sketching and brainstorming, that are done best in person. And a majority of us said that email was no longer our preferred method of contact when communicating internally.

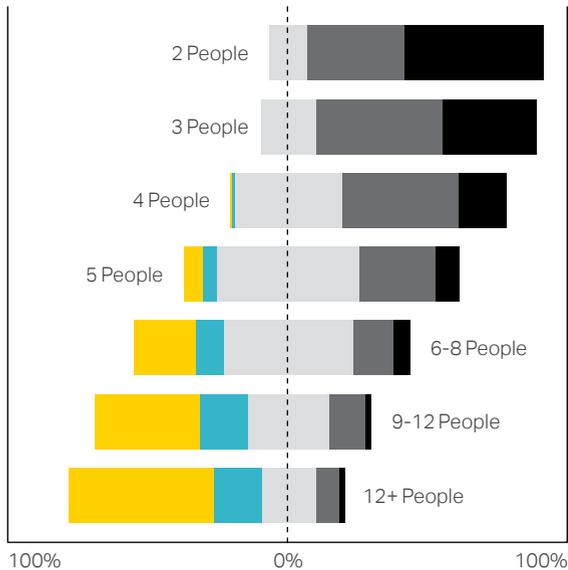
**Q:** 93% of communication is non-verbal (I see your eye-roll to that statistic). Since we are not in the same space together at the moment, some of these very important non-verbal cues may be missed. What are some ways you find yourself communicating non-verbally to your team over video call?



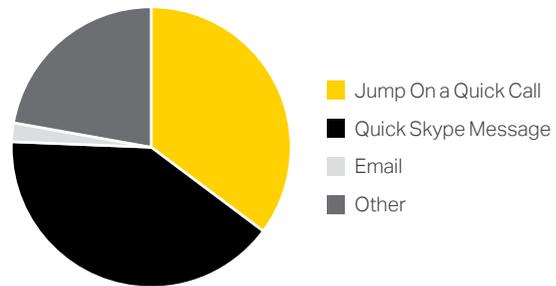
**Q:** Do you turn your camera on in the morning?



**Q:** We contribute to conversations differently when they are one-on-one calls versus a team-wide meeting with 20 people all trying to chime in at once. How much do you contribute to the call if there are...



**Q:** What is your preferred method of communication with your project teammates?



- Likely to Listen and Not Speak
- More Likely to Use the Chat Feature than Speak
- Balance Between Talking and Listening
- Likely to Participate in the Conversation
- Likely to Lead the Conversation



*"The best thing about working from home is that I am able to focus a lot more during long meetings and it's a lot easier to take meeting notes without as many distractions." - Anonymous, WFH Diary Week 1*



*"I have had so many email interruptions and Skype message interruptions today. It is annoying. Less contact (email) from my boss. Feels like Big Brother and micromanagement! This is a different way to manage for some leaders — the tendency is to 'over manage.' That is emotionally draining. This work from home structure is showing the weak cracks in management skills." - Anonymous, WFH Diary Week 1*



*"This isn't necessarily a WFH issue, but PMs who don't understand how long things take to complete. Made worse by WFH because he can't walk by my computer and see that I am diligently working on something. He just waits an hour and asks 'are you still working on this? Why isn't this done yet?' Really hope he doesn't just assume that I'm slacking off because I'm a millennial and working from home lacks supervision." - Anonymous, WFH Diary Week 1*

It is very important that we talk to our teammates about what works best for them. Try to understand your fellow Corganite's preferences. Establish virtual "drop-in" hours if you like. And reflect on how you communicate most effectively. Incorporating this reflection into your regular work life — during and after a pandemic crisis — is a healthy habit that we can continue to prioritize.

# Communication from Upper Management is Key for Culture and Solidarity

Several of our diary entries made one thing clear: our Wednesday line of communication was not only much needed, but something to look forward to:



*“An early afternoon address by our CEO puts a number of concerns at ease.” - Anonymous, WFH Diary Week 2*



*“This pandemic came upon us fast and furious and nobody was prepared for this new work situation. It also helps to have executives with compassion that recognize the “human” aspect of this transition. I have been so thankful for the ‘3-Pack’. That is what I call Steve, Lindsay and Scott.” - Anonymous, WFH Diary Week 2*



*“These Wednesday Calls —beit Scott Lindsay or Steve—are something to look forward to. I really enjoy the energy they bring, but more importantly, this is our time to ‘communicate’ directly with our leaders — something we don’t get to do usually but once a year. It’s incredible to be able to do this once a week. I realize this won’t continue post-WFH for many reasons, but boy wouldn’t that be awesome.” - Anonymous, WFH Diary Week 4*

Lastly, it’s safe to say we are all missing a bit of what our office culture can provide. Whether it’s chatting with our neighbors, celebrating a win with our teams, or simply missing the Wednesday donuts, our Corgan culture continues to pervade through today’s tough times.

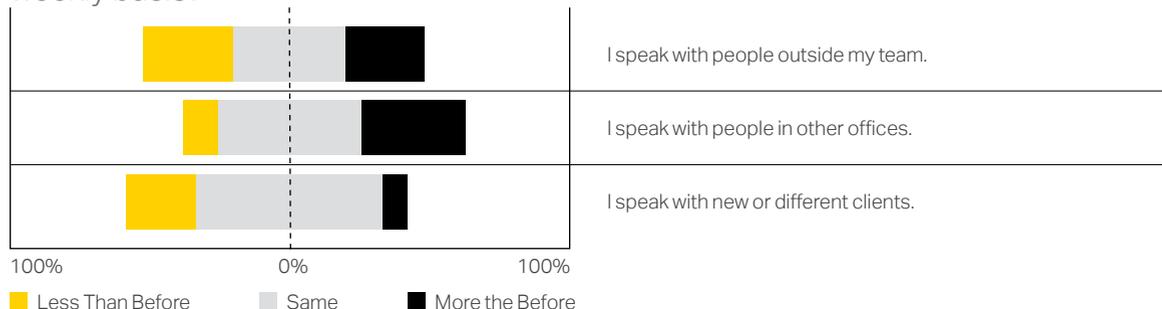


*“Today, I launched the education team’s new video chat series: ConnectED. The team was divided into groups of 9 people to Zoom with on a casual/ social level (9 because that’s what looks best on a screen before people start getting too small). It was **great**. We are now going to start doing this every week, randomly assigning people into groups of 9 with designated leaders. This is our attempt to be social and continue the spirit of Forum. Today’s theme: bring your pet to work day!” - Anonymous, WFH Diary Week 2*

## Communication Across Teams

People are enjoying working with team members who, in some cases, they have never worked with before. And in the case of these particular entries, some are working more between global offices than ever before. This odd time has brought our communications together in a more unified way. We are connecting and communicating in a very different way, and this study has shown us that we are not only humanizing an otherwise digital

**Q:** How has your communication with people from other offices changed, on a weekly basis?



experience, but we are also connecting more often across offices — removing “remote office” from our vocabulary.



“It’s been interesting to see our interaction with coworkers from other offices actually increase now that we’ve moved online.” - Anonymous, WFH Diary Week 3



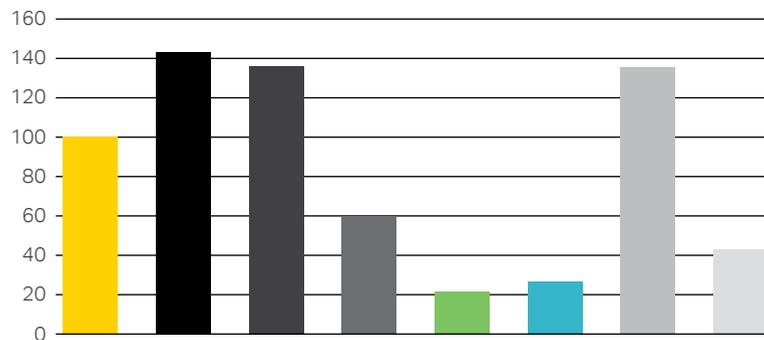
“Sometimes the distance and the physical separation can help people to be more open, authentic, and purposeful in their communications with others. Maybe removing the immediacy of in-person interactions can encourage greater openness, especially through a shared experience like this, if we can create space and opportunity for that to happen.” - Anonymous, WFH Diary Week 1



“We have been paired to another person in the New York team. It was great. I love that we get to team up with guys from the other offices.... It was awesome. I love that they are so knowledgeable on areas that we lack. I believe our London team needs more training on airport planning. It was great regardless to be able to learn from them. I would say its the most successful day out of all.” - Anonymous, WFH Diary Week 2

This ability has removed the barrier of technology, allowing us to understand that the value of telecommunication lies in connecting people across distances in an instant. As we continue to examine our meetings — noting which require in-person communication and which would suffice with a simple video call, people are re-examining the value placed on time to travel vs. face-to-face interaction.

**Q:** Virtual calls have connected us to each other in a variety of ways, both inside and outside of the office. How has this changed your opinion on face to face meetings that may require travel?



- I think people will be traveling far less to attend meetings within the same city as their office.
- I think people will be traveling far less to attend meetings outside the state where their office is located.
- I think people will put a higher value on face-to-face meetings and will travel more to attend meetings within the same city as their office.
- I think people will put a high value on face-to-face meetings and will travel more to attend meetings outside the same state as their office.
- I think people will put a higher value on face-to-face meetings and will travel more to attend meetings in another country.
- I think company travel policies will shift significantly.
- I think company travel policies will stay the same.
- I think people will be traveling far less to attend meetings outside the U.S.

# Communication

## Within a Team

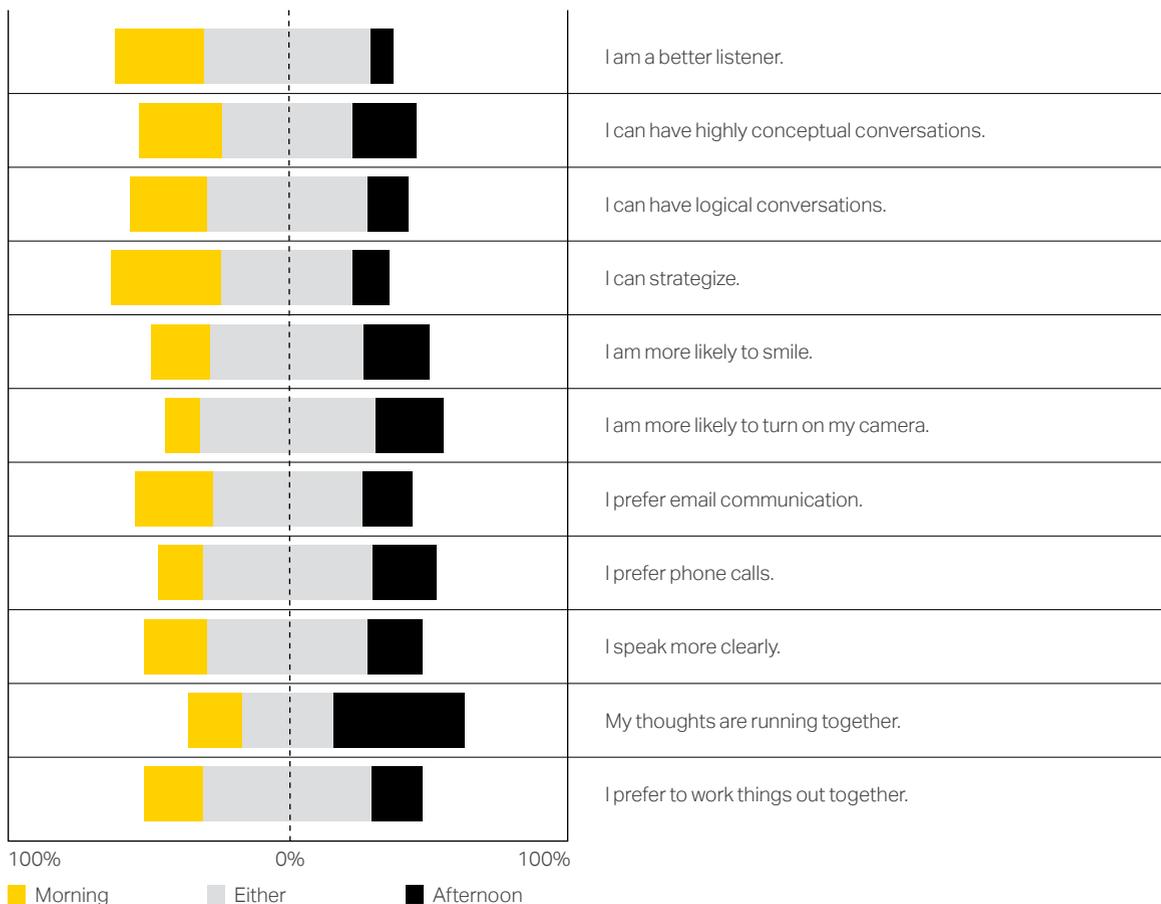
As we begin to introduce flexible work schedules or WFH options, it's important for our teams to communicate effectively. Throughout the study, sentiment about communication remained positive — with the occasional connectivity issue of course.

This sentiment only seemed to increase as people began learning more about each other's preferences and working styles. Knowing how other coworkers prefer to work — do they like to chat, get to the point, or create a debate? — can help keep anxieties low and motivation high.

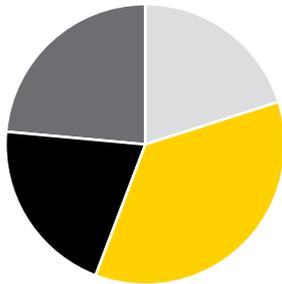
**Q:** While we have been working from home, how would you rate your overall ability to communicate effectively with your team or others?



**Q:** Communication happens in all forms, and is "best" at different times of the day. At what time of day do you feel you are able to communicate with your team most clearly?



**Q:** On a call with 5 people, which best describes you?



- Business Bob - Let's get to the point, I don't have all day.
- Wally the Wallflower - Just listening in, don't mind me.
- Busy Betty - I am tackling all sorts of tasks on this call.
- Chatty Kathy - I want to know about your day!



*"Now more than ever, it would be really useful for some senior project managers to learn Revit. I don't need their help in producing documents, but it would be really nice if the person running the meeting and the person driving the Revit model in the meeting were... the same person. It's cringey to hear 'hey [name] can you pan over here — hey [name] can you go back to that space — hey [name] can you zoom in' every 5 seconds on a call. These skills are very basic, and I firmly believe that people without any Revit experience could pick them up quickly. I think a good Corgan College class (mandatory for all PM's who don't know Revit) would be 'Revit for PM's and Presentations,' just to make meetings more efficient." - Anonymous, WFH Diary Week 4*



*"Deadlines: obviously this is always a stressful time, whether we're in the office or working remotely. But it feels more stressful when working remotely because my teammates aren't 5 feet away from me. It may seem trivial, but taking 2 minutes to type out a question (as opposed to taking 20 seconds to ask it verbally), adds a lot of time to your day." - Anonymous, WFH Diary Week 4*

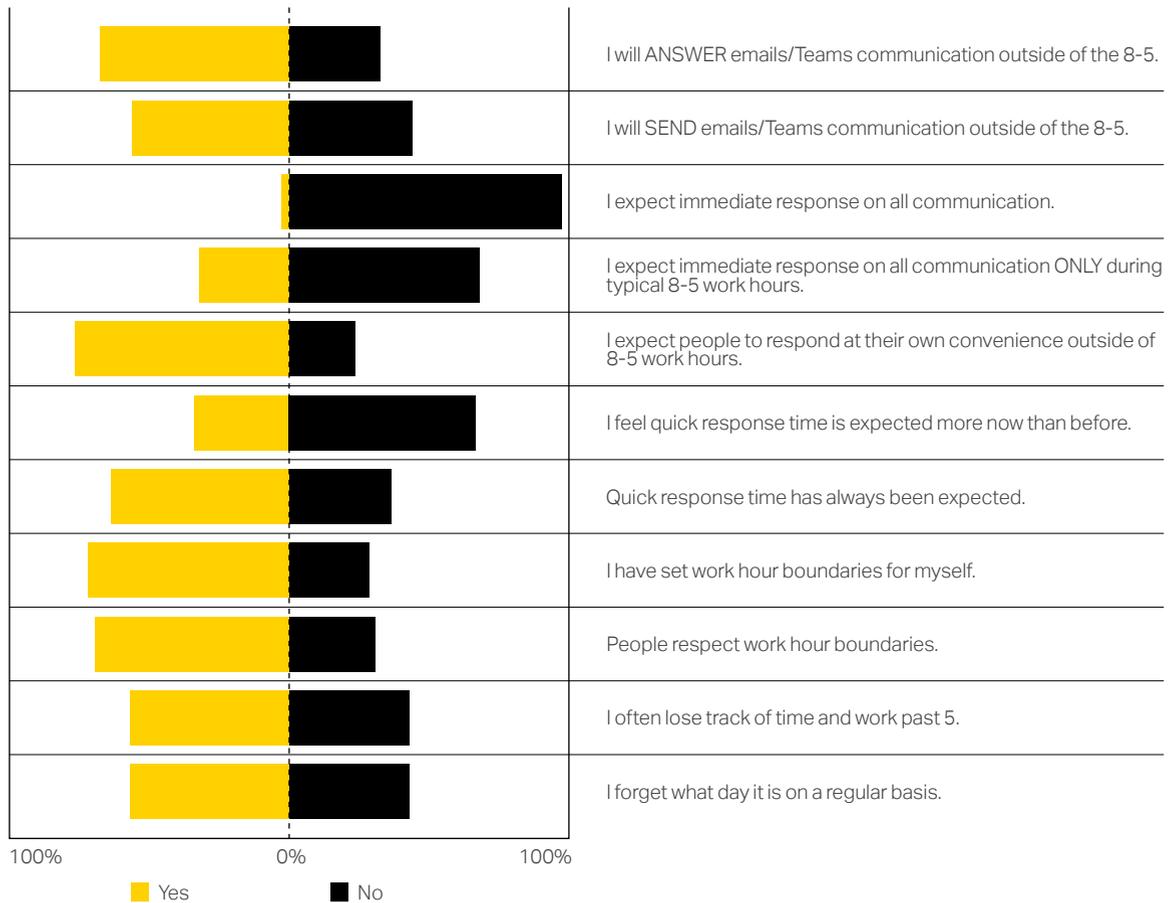


*"Sounds silly, but being able to send funny GIFs on teams really brightens the mood on a deadline day!" - Anonymous, WFH Diary Week 2*

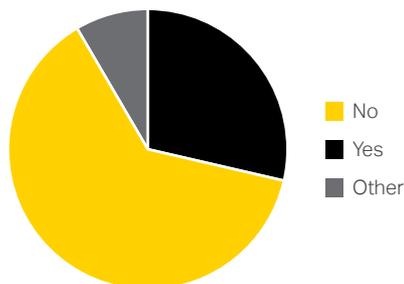
## Communicating with "New" Coworkers and Setting Boundaries

Setting time boundaries is not only important for physical and mental wellness (breaks are encouraged!), but is also an important way to communicate your availabilities with your team, as parenting schedules, connecting with friends and family, and other boundaries need to be respected as much as possible. As WFH becomes a lifestyle for some, using methods to communicate time boundaries – such as setting your out-of-office replies, blocking your calendar for necessary personal scheduling and adding a delay to emails – all become extremely important and effective in communicating and respecting others' boundaries.

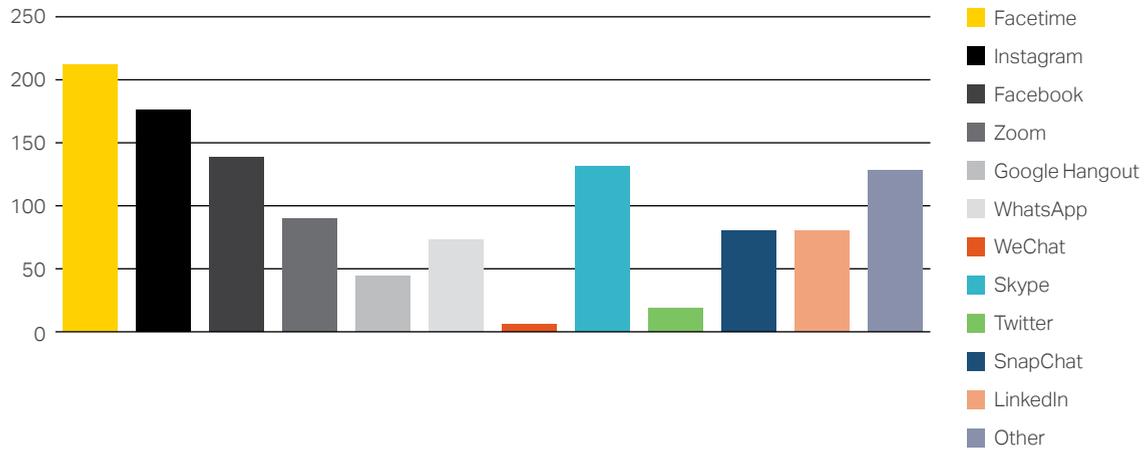
**Q:** Setting boundaries is important, but when we are working from home, time can run away from us very quickly. How has your tolerance for communication outside of the 8-5 workday changed? How has the expectation of response time changed?



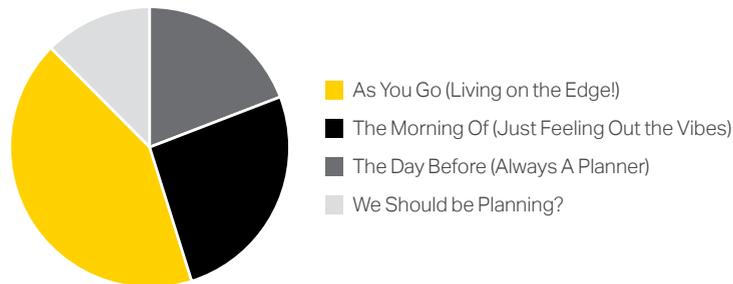
**Q:** Do you delay or schedule sending email messages in Outlook, in order to help others manage their boundaries/expectations?



**Q:** How are you socializing with friends and family?



**Q:** When do you find the time to coordinate routines with your new "coworkers"?



The biggest thing is coordinating calls with my wife. I also need to keep a squirt bottle at the ready to keep the kittens at bay.

**ANONYMOUS, E-SURVEY**

**PARTICIPANT**



# Losing the Commute

**“What I have learned this week is that this pandemic has made us all stand still. Look at what the result is – less pollution, less strain and drain on the earth’s resources, clearer air, ozone repair. OMG! If Corgan is serious about environmental impact and decreasing our environmental footprint, this work at home policy should become permanent. I am sure there will be many that want to return to long commutes, pollution and dirty air, but there is a subset who wants to positively contribute to reducing pollution and reducing our environmental footprint. I believe Corgan is a leader!” – ANONYMOUS, WFH DIARY WEEK 5**

Over the course of this six-week study, the majority of people reported high satisfaction with their working from home environments. We also found out that that may be because 68% have tossed that commute out the window and are choosing to catch a few more zzz’s in the morning.

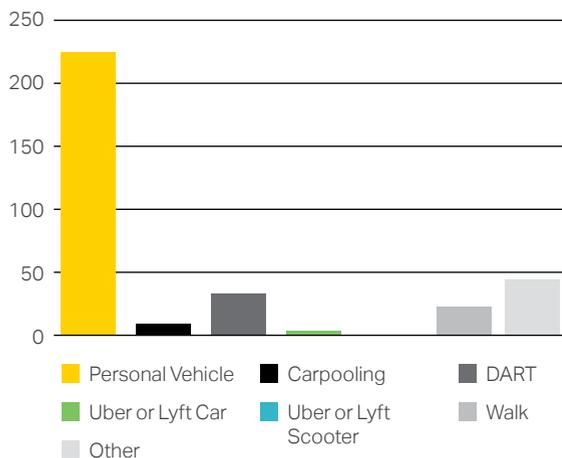
Could this also be why 70% of us are more productive, alert and energized in the morning?

“The morning is a critical time that can set the tone for the entire day” — says Namni Goel PhD — a biological psychologist and behavioral

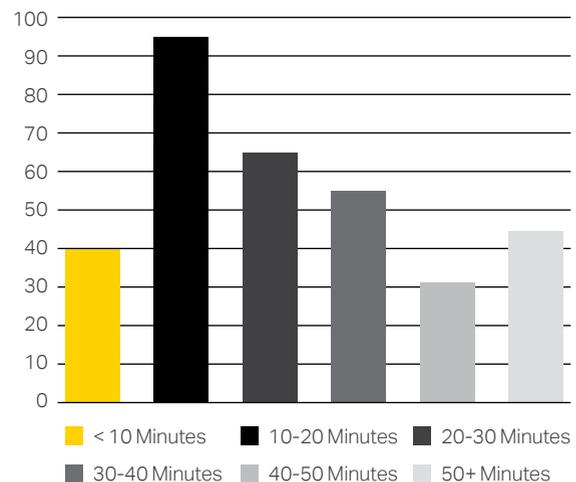
neuroscientist who specializes in sleep, circadian rhythms and their effect on human physiology.<sup>2</sup> Or could it be that people are able to scrap routines they think are unnecessary, in order to be more productive during the day?

Commutes can take a toll on the average person, and the benefits of removing this routine from our days extends beyond added productivity. Reducing stress, anxiety, and in some cases, improving cardiovascular health, removing the commute can give us back valuable time with our loved ones.

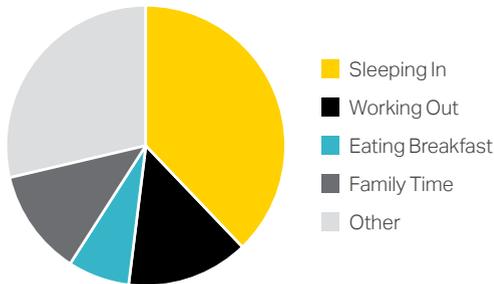
**Q:** How do you typically commute to work?



**Q:** How long does that commute typically take?



**Q:** How have you decided to use the extra time you have on your hands, now that you don't have to commute?



*"No commute means I get to be home when my kids wake up - LOVE THAT!" – Anonymous, e-survey participant*

*"I have time to eat breakfast now since I don't have to commute. I've also enjoyed being able to go outside for a few minutes at lunch or cook something quick." – Anonymous, e-survey participant*

*"I get to wake up at 7:45 instead of 6:00 AM! That's a positive for me." – Anonymous, e-survey participant*

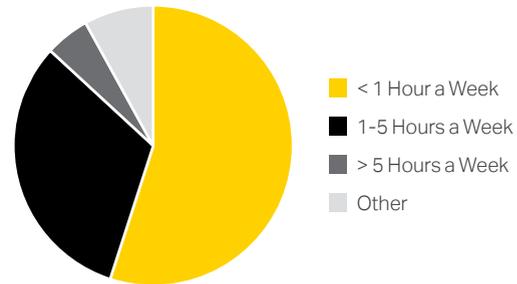
*"I have no commute and am able to easily work out during Lunch. Overall, I am able to actually work a bit more, and spend less time on meal preps/commuting etc." – Anonymous, e-survey participant*

*"I like that I can sleep in a half hour and not waste part of my day in traffic. I don't like the lack of social interaction." – Anonymous, e-survey participant*

*"Save 2 hours commuting to work. Valuable time to gained to walk dog get exercise." – Anonymous, e-survey participant*

*"No work life separation, working more hours now than before. My commute is great but dynamic exchange with people is compromised." – Anonymous, e-survey participant*

**Q:** How much time do you typically spend during working hours traveling to meetings?

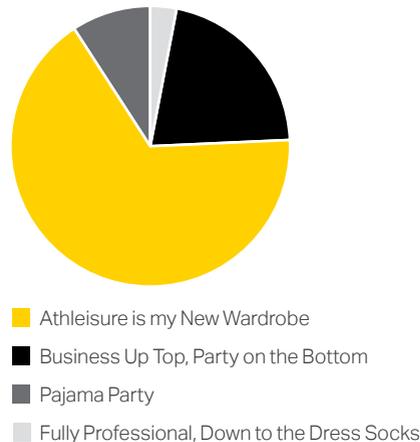


## WFH Equals Relaxed Attire

Overall, removing the commute has been one of the most positive responses. For some of us, removing the commute has allowed us to take more walks with our dogs, cook healthy meals, or take an at-home yoga course over lunch... and then just stay in those yoga pants. And wouldn't you know, comfy pants sure do make people happy while they work.

*"The ability to work without distraction. Being able to go out on my balcony and do morning exercises and then begin work without having to travel and get out of the house." – Anonymous, e-survey participant*

**Q:** Which best describes your work attire these days?



## Focus on Physical and Mental Health

**“Mr. Brightside” came on my Spotify playlist so I took an obligatory 3 minute and 42 second jump-around air guitar ‘dance’ break and freaked out two cats. Certainly, can’t do that in the office haha. I’m far too inhibited for that and people might think I’ve lost my marbles. Maybe I have, but sometimes it helps to let the crazy out for a few minutes.”** – ANONYMOUS, WFH DIARY WEEK 3

The importance of physical and mental wellness has sparked dialogue amongst experts in recent years. Long work hours combined with heightened awareness around mental health conditions like anxiety and depression have resulted in a much-needed conversation around healthy habits. This has become particularly important during a global pandemic, as we all try to manage our stress levels in a healthy way.

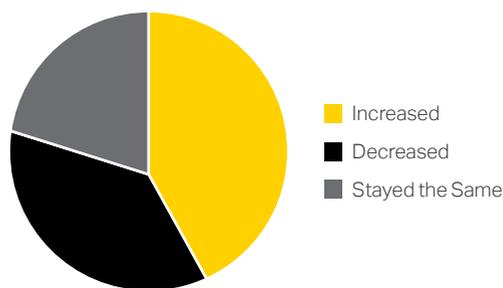
During the Work From Home Study, we asked Corganites how their routines have changed in light of the pandemic and a new work from home policy.

**The reality is, it’s impossible to separate these two events — a work from home policy was initiated because of a global pandemic.**

And while many aspects of this experience are extremely stressful and exhausting, like the unexpected loss of day-care or having to share a single space with a roommate while you conduct conference calls, we also learned that Corganites may be enjoying certain physical and mental aspects of remote work.

Many Corganites are taking advantage of mental breaks throughout the day – savoring a slow cup of coffee and a yoga session before checking emails, making a healthy snack or going for a quick walk outside with their dog. Some people reported getting a little bit more sleep than usual or squeezing in an extra 5 minutes with their families during a lunch break.

**Q:** Has your physical activity during the day decreased, increased, or stayed the same?







*"As I am slowly getting into a routine working from home, I realized I am going to be pretty sad when working from home isn't a part of my work life. During lunch today, I was able to do a 30 minute online yoga class, eat lunch AND fold an entire load of laundry. All within an hour...I feel like I have much more time for myself and I am not exhausted at the end of the day, like I am when I come home from work. That specifically has been a big eye opener for me. My energy levels are much higher at 5 PM to do things around the house, cook, work out, walk my dog etc. Probably because I am not extending the same amount of social energy as I would at the office (also because I am working out in the middle of the day, gaining more energy). This will be dearly missed." – Anonymous, WFH Diary Week 1*



*"I take a shorter lunch break and then take a break around 4 PM to go outside for a walk with my elderly mother (89+) when she is at her most productive." – Anonymous e-survey participant*



*"My step count is nothing short of embarrassing — less than 1,000 during the work day! Overall, definitely not moving enough during the course of the work day — I am used to so many location changes in my typical day. I am able to get out and walk or exercise in the evenings – but hard to make up for it during the day." – Anonymous, WFH Diary Week 1*

But not everyone is sharing these experiences, as they reported higher levels of stress and anxiety as they cope with, not only a major work-life transition but the ramifications of a global crisis.



*"The workday ends with no new assignments. My escape is only 12 feet away. And it's not an escape.*

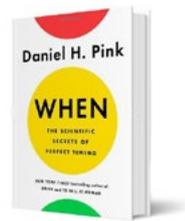
*It is looming. Present, but not present."*

*- Anonymous, WFH Diary Week 1*

These observations surface how important it is to take care of your families and yourself. Check in on your loved ones. Chat with your coworkers. This is a time when communication may be less frequent, but necessary, nevertheless.

## Chronotypes and Working to Optimize our Mental Wellness

Most of us identify with a certain chronotype — a personality trait identified by a person's circadian typology — which can help to understand our own individual differences in activity and alertness in the morning and evening. Knowing and respecting your chronotype can help you sleep better, communicate more effectively, and know exactly when to exercise, socialize and tackle logical or creative tasks.



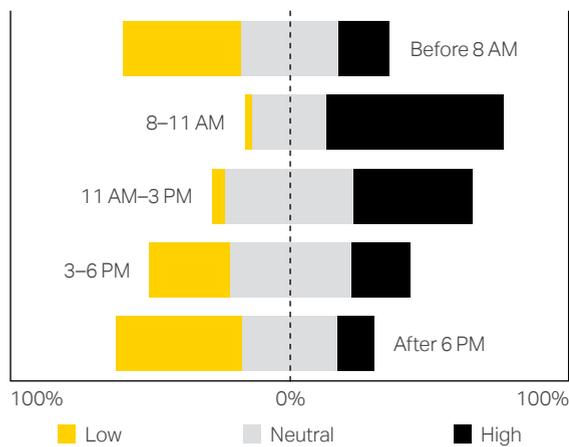
Determine your chronotype and peak cognitive schedule by reading "When: The Scientific Secrets of Perfect Timing" by Daniel H. Pink.

77% of Corganites reportedly prefer to have logical and strategic conversations in the morning, while 58% are more excited about group conversations when they happen in the afternoon. This is important in successfully shaping good working relationships and personal boundaries for mental wellness. Knowing when you are at your best for specific tasks gives you the ability to work more efficiently, according to Daniel H. Pink, author of "When: The Scientific Secrets of Perfect Timing".<sup>4</sup>Time of day influences emotional tone of conversations, and by extension, your ability to communicate with each other.

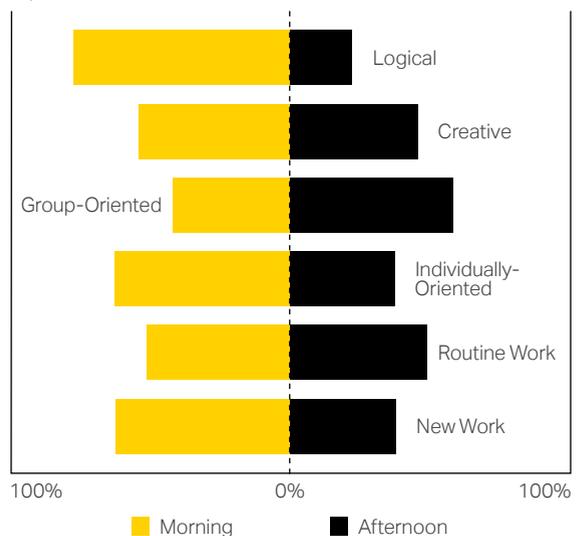


70% of people feel most productive in the morning hours

**Q:** Now that you have a new norm, what time do you find your energy hits its peak?



**Q:** At what time do you prefer to tackle specific tasks?



## Taking Time to Enjoy the Outdoors



*"I now have 'adult recess' where I intentionally go outside, get some fresh air and enjoy soaking up a little vitamin D. I feel positive about it and it has allowed me to continue centering my gratitude and staying optimistic in such different times that we're experiencing." – Anonymous e-survey participant*

One basic understanding we have all gained during the COVID-19 outbreak: there is a definite need to get outdoors and smell the roses. Connecting with outdoor environments is becoming increasingly more evident for mental restoration, and for those living in multi-family apartment buildings, it is absolutely necessary. One diary entry could not have said this better:



*"I think what I really want to see on that day when we all go back is a different world. A world operating in balance with nature, a world where respect and compassion guide our society, and a world where life is moving at a more humane pace. I think we have been out of touch with what it really means to be a human being for far too long and I believe that's really at the root of so many of the problems we're facing. We're not some superior being, totally removed from the natural world we came from.*



*As I've studied the human system in greater detail and looked to build a link between our humanness and the built environment, the most salient and ironic conclusion I've drawn is that all we're really trying to do when we're talking about designing healthy and effective buildings is essentially just recreating elements of nature. And it's strange that those findings are as eye-opening and surprising as they can be. What that says to me is we've lost our connection to ourselves and to the natural world*

*that we are (or should be) very much a part of, and the answer to so many of our questions is painfully simple- we need to rebuild our connection to nature. I think we're getting a little taste now of how quickly nature can and will rebound in our absence, and it's clear that nature doesn't need us. In fact, nature would benefit tremendously from our absence. But we so desperately need nature for our survival as a species, and for our physical, psychological, and emotional health. – Anonymous, WFH Diary Week 4*

And other entries support this thought as well:



*"What I have learned this week is that this pandemic has made us all stand still. Look at what the result is — less pollution, less strain and drain on the earth's resources, clearer air, ozone repair. OMG! If Corgan is serious about environmental impact and decreasing our environmental footprint, this work at home policy should become permanent. I am sure there will be many that want to return to long commutes, pollution and dirty air, but there is a subset who wants to positively contribute to reducing pollution and reducing our environmental footprint. I believe Corgan is a leader!" – Anonymous, WFH Diary Week 5*



*"The bright spot in all of this for me has been the reports about significant improvement in air quality in China, India, and LA, clear blue canals in Venice, the earth literally shaking less, and bears frolicking at Yosemite. I set up my hammock during lunch today and I could hear birds chirping and singing all over the neighborhood without the sounds of cars and traffic drowning it out. There are people out walking at every hour of the day...I think it's a good thing that we've had to stop. It's good for the planet to have the chance it so desperately needs to breathe and to heal, and it's good for us as human beings to reevaluate our lives and our impact on the world around us." – Anonymous, WFH Diary Week 4*



Additionally, bringing the outdoors in – in anyway possible – will be great for supporting mental health and well-being:



*"I put a plant next to my workspace today, and I kid you not, I think that it really changed my attitude towards working in this room. Since WFH, and transitioning out guest room into an office, I have been working so much that it makes me dread coming into this room. Just adding the one plant makes me love this space and not dread working in it!". – Anonymous, WFH Diary Week 5*

## Knowing how to Manage Various Stressors

With each of these insights, we see a balance – an introvert to an extrovert, a night owl to a morning lark. This variety in employees is what makes us unique, share various viewpoints, and continue to innovate with and challenge each other. That being said, for every person that has been enjoying long walks in the park with their dog to relieve stress, there is someone else who is managing time and balancing multiple schedules – a level of stress that may be almost removed in a post-pandemic WFH scenario.



*"Balancing children and being their substitute teacher with school closed is a negative stress. Also feeling some self-imposed stress to be even more responsive to clients.*



*The ability to be more flexible and gaining time back that's usually being used for traveling to/from work are positives. Overall, the positives are outweighing the negatives." – Anonymous e-survey participant*

## Whether in the Office or at Home, Ergonomics are Important

Whether you are in the office or are WFH, sitting behind a desk or on the couch can be really exhausting for the body and mind. Having proper ergonomic support is essential to a productive working environment and can ensure your mental wellness in addition to your healthiness – both playing vital roles in your ability to produce quality work.



*"Also, my kitchen work set up is not the most ideal ergonomically. I have my arms and both screens and work chair, but the counter height is not ideal." – Anonymous e-survey participant*



*"Ergonomics of the new space. I have to work in my living room table on a dining chair so overall my posture is suffering." – Anonymous e-survey participant*



*"By the afternoon my 'desk' (ie kitchen island) starts to hurt my back." – Anonymous e-survey participant*

# Routines – Balance, Flexibility, and Breaks

**“From the kitchen with coffee in hand, I return to my bedroom to answer my emails from my tablet, then get ready, get my purse, refill my coffee, and walk across the hall (about 5 feet) to my office, and log onto my computer. It’s very important that I take my purse with me; it symbolizes that I am at work. When I log off at night, I take my purse back to my bedroom. I am off work.”**

– ANONYMOUS E-SURVEY PARTICIPANT

When working from the office, your workspace is determined for you. But when working from home, Corganites have the freedom to create a workspace and a routine that works for them and their families. In some cases, this simply means getting more shut eye than before. In others, this means cutting out unnecessary routines that are time busters. Corganites have developed their own unique systems that blend their working style with their daily needs.

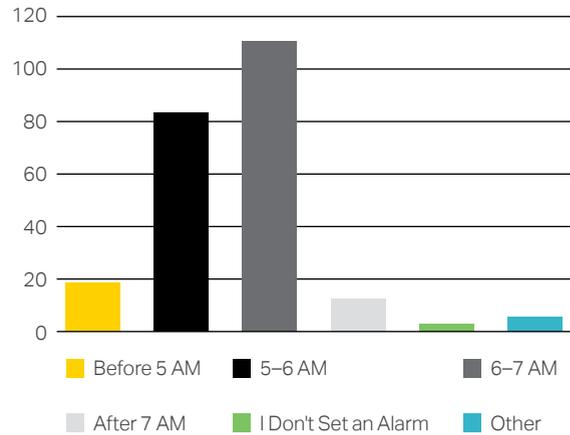
Routines are great and learning to develop new ones can take time. Even when there is no office building to go to, building a routine for yourself sets a tone for the day, and helps to create value in the time that we spend on both our work and our personal lives.



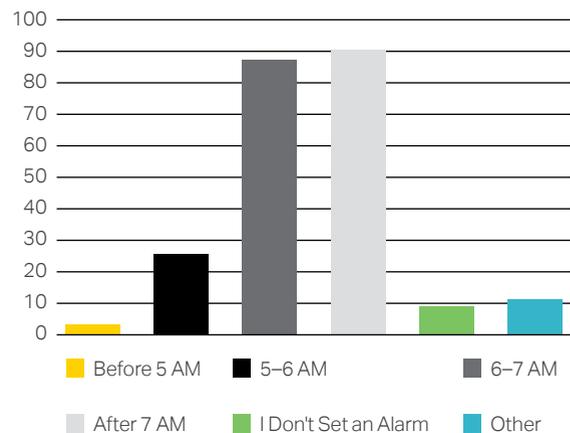
*“I can wake up later than usual because I do not have a commute and can no longer go to outside workout studios. I enjoy waking up later but I like having a routine so that has been difficult.”*

– Anonymous e-survey participant

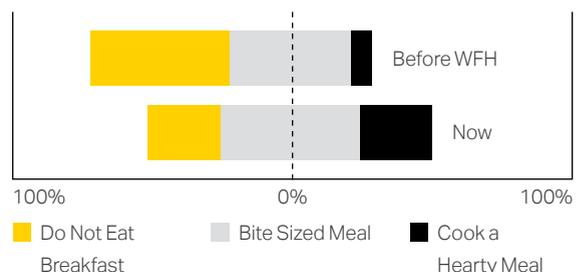
**Q:** On a normal day, when would your alarm usually ring?



**Q:** Now that you are #WFH4L, what time do you set your morning alarm?



**Q:** How has your breakfast routine changed, since you started working from home?



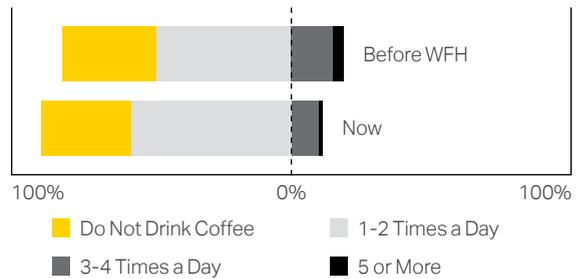


*"Overall, it's been easier to implement healthy habits. I have been taking time in the morning before logging in and during lunch to do yoga or take a walk which has been a nice way to get some exercise. It's also been easier to have a more well-balanced and substantial diet." – Anonymous e-survey participant*

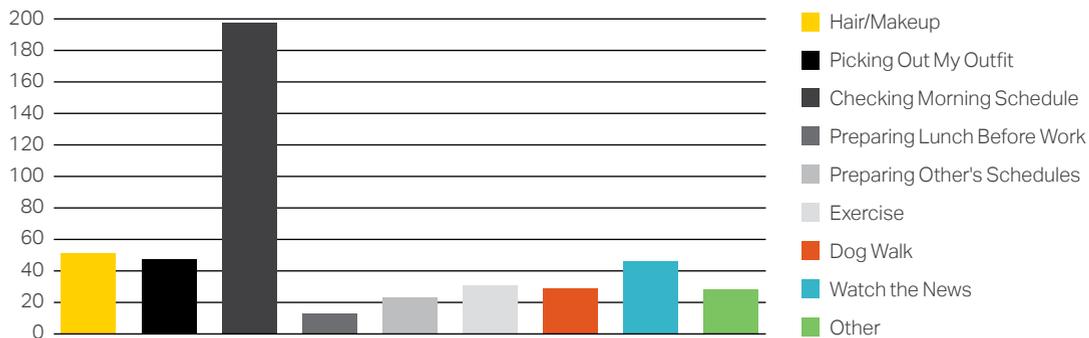


*"I drink my coffee in the mornings and it's a time when life feels "slower" – Anonymous, WFH Diary Week 1*

**Q:** How many times a day are you filling up your coffee mug (or doing a coffee run)?



**Q:** What part of your morning prep routine has stayed the same?



*"I can sleep later in the morning! The best part of working from home is not having to allocate 2-3 hours per day getting dressed (hair, makeup, picking out an outfit) and commuting. I have used this extra time to exercise more, cook and get caught up on chores around the house I never had time for." – Anonymous e-survey participant*



*"This morning I sat down at my normal dining room table "desk" seat and just wasn't feeling it (I'm pretty sore from a workout yesterday), so I love that I was able to switch to the couch. The flexibility in seating has been the best part of WFH! I am able to get more work done when I am comfortable." – Anonymous, WFH Diary Week 1*

Some Corganites have developed a dedicated workstation that they can work from each day, while others reported the use of different areas throughout their homes to accommodate specific tasks and workflows. While some reported a newfound freedom and work-life balance, others said they are having a hard time knowing when to turn off because the lines between work and home have become too blurred.



*"I'm working on the couch today, which is perfect for catching up on emails and doing non-Revit work. It's a nice reward for the hard deadline work, sitting upright at the table the rest of the week." – Anonymous, WFH Diary Week 2*

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“Couch in the morning for calls and table in the afternoon for more focused work (I’m seeing a trend here...)” – Anonymous, WFH Diary Week 3

While COVID-19 has been disruptive in many ways, it also is accelerating certain trends and behaviors that have slowly been growing on the horizon. Working from home and personalized flexibility are two trends that have been developing over the last decade. This portion of the survey reinforces how important it is to offer personalized options — whether remote or in the office — that exercise flexibility and autonomy.

## Business Hours Don't Have to be the 9-5

Some people are naturally working within their chronotypes without even knowing it. We have some reported that they are blocking out “Heads Down” time in the mornings to tackle specific logical work, while keeping their afternoons open for collaborative conversation. Others are creating their schedules around the needs of their family members. Some are enjoying the flexibility that building their own schedules affords them, others need more structure. This is a great example of how different people work best — some need the structure that an office setting can bring, others are just fine with autonomy.

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“I love scheduling my workday and being free to do that.” – Anonymous, WFH Diary Week 1

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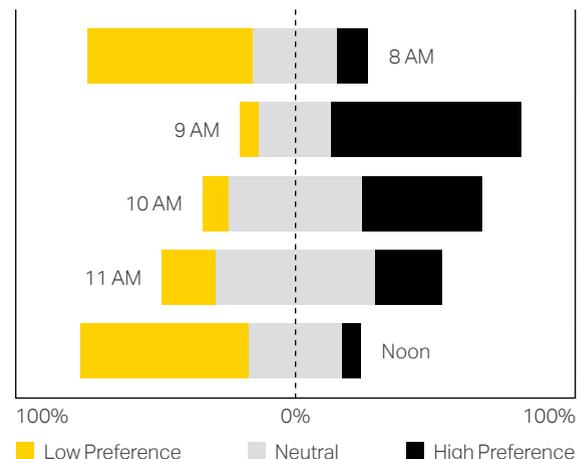
“There was no notion that 5 o’clock had passed, no indication that the typical day had ended. I realized that my ‘Work-adium’ rhythm is far less based on the clock itself, and more so on the shift of the office energy that happens at 5 o’clock. The

rustling of people around you packing up their things and discussing evening plans changes the mood in the office environment and it’s something that is fed upon. It either announces the end of the day allowing you the chance to mentally wrap everything up and find a natural stopping point. Or it can be an added accelerant into focus. That catalyst puts everything into hyperdrive to get your work done and find the sweet mental release. At home, that is gone. I am but one person in the same quiet kitchen, lost in work and distant from the clock with only plans of dinner to pull me away and change my scene.” – Anonymous, WFH Diary Week 1

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“Understanding that I have to plan in some time during the week to do things with him [her son] that he wants to do during the day. I will have to work over the weekend to be prepared for Monday, that was something I worked hard to mitigate previously — so that typically my weekends could be focused on family and downtime. Shifting that thinking has been challenging.” – Anonymous, WFH Diary Week 1

**Q:** When you are putting your schedule together for the next day, what is the earliest you prefer to schedule your first call?







## Breaks are **Good**



*"I think it's important for all of us to show ourselves and each other kindness and understanding right now, and always. Of course, we need to push ourselves to stay focused and motivated, but sometimes I do need to remind myself of everything I'm trying to carry and not be so demanding of perfection from myself all the time." – Anonymous, WFH Diary Week 6*

Many of us do our best to perform at our highest levels 24/7, taking on all tasks that are asked of us, and rarely stepping away from our desks (lunch al-desko anyone?). Breaks are a good thing — but 38% of American employees don't feel encouraged to even step away from lunch.<sup>3</sup> This "work hard all the time" mentality isn't healthy.

Regular breaks can help improve cognition levels, productivity on tasks, and overall job satisfaction. And one of the most productive breaks to take? According to Daniel H. Pink, author of *When: The Scientific Secrets of Perfect Timing*<sup>4</sup>, watching a funny dog video is one of the best breaks to take, in order to restore productivity levels. So, take a break!



*"Today actually marks one week since I started working from home and has honestly been one of the hardest. Balancing the work from home plus the school from home is no joke. The big learning today from other days is that I had a call from 12-1. Every other day — I have had a break to have lunch with my family, check in with my son's progress and make a plan together for the afternoon. That didn't happen today, and it made for a tough afternoon. Lesson learned — planned breaks are good." – Anonymous, WFH Diary Week 1*

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“Today I took a couple hours in the afternoon for some mental health and it helped so much! I went outside, laid in a field and didn’t check email for the rest of the day.” – Anonymous, WFH Diary Week 1

“Our family has a pretty good schedule going, by the end of the week we are ready for the weekend. Beautiful day and we were able to get out and do a family bike ride around 4:00 PM. Also made time to catch up with a few friends on Thursday evening and Friday evening – always good to connect.”

– Anonymous, WFH Diary Week 1

## Distractions – Good and Bad

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“I had the ‘cha-cha slide’ stuck in my head for the better part of two days. Where that came from, I have no idea, but it was ridiculous, and I think that could be an indication that I need to wash my brain... it’s getting weird in there.” – Anonymous, WFH Diary Week 2

Distractions in the office are typically seen as a negative — but they actually can provide a much-needed mental escape from our routines, our work, our stress and our anxiety. They remind us that we have a choice on how we want to spend our time. The trick is to use distractions in an uplifting way, finding rejuvenation in them instead of letting them detach you from the reality of the situation completely. Right now, some are living in the moment and seeing value in these distractions. Others still hold the mentality that distractions are bad. Let’s break that habit.

”

“Sometimes it’s nice to have a task that requires less phonological loop involvement (a component of

working memory that deals with language-based information — reading, writing, listening, talking, etc.) so I can listen to some music that has words in it and jam for a little bit.” – Anonymous, WFH Diary Week 2

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“My sister is here visiting from our parents’ house because she can’t get anything done with our mom talking. She is working on her undergraduate thesis while I work on door schedules. It’s so nice to have someone working next to me, even if it isn’t Corgan related... feels more motivating. Feeling more motivated today than usual. I think it helps that [she] is here. – Anonymous, WFH Diary Week 2

Less stress with traffic and lots of people. I enjoy the quiet that I get from working remotely. The open workspaces reduce my productivity with all the interruptions and “out loud” interactions.”

– Anonymous e-survey participant

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“I am able to work in a focused way for longer. I have far fewer distractions than when in the office, and it’s a positive change for my workday.” – Anonymous e-survey participant

## Key Takeaways

We are in this together — that is very apparent. But we are working in an unprecedented time, and as is evident from this study, working from home can be beneficial and welcoming for some, while also overwhelming and stress-inducing for others. There is no one-size-fits-all solution — we are all unique people with different needs! As we give more attention to the importance of work-life balance, with insight and understanding, we will better position ourselves to decide and act holistically on what is best for a person’s whole self, not just their work product.



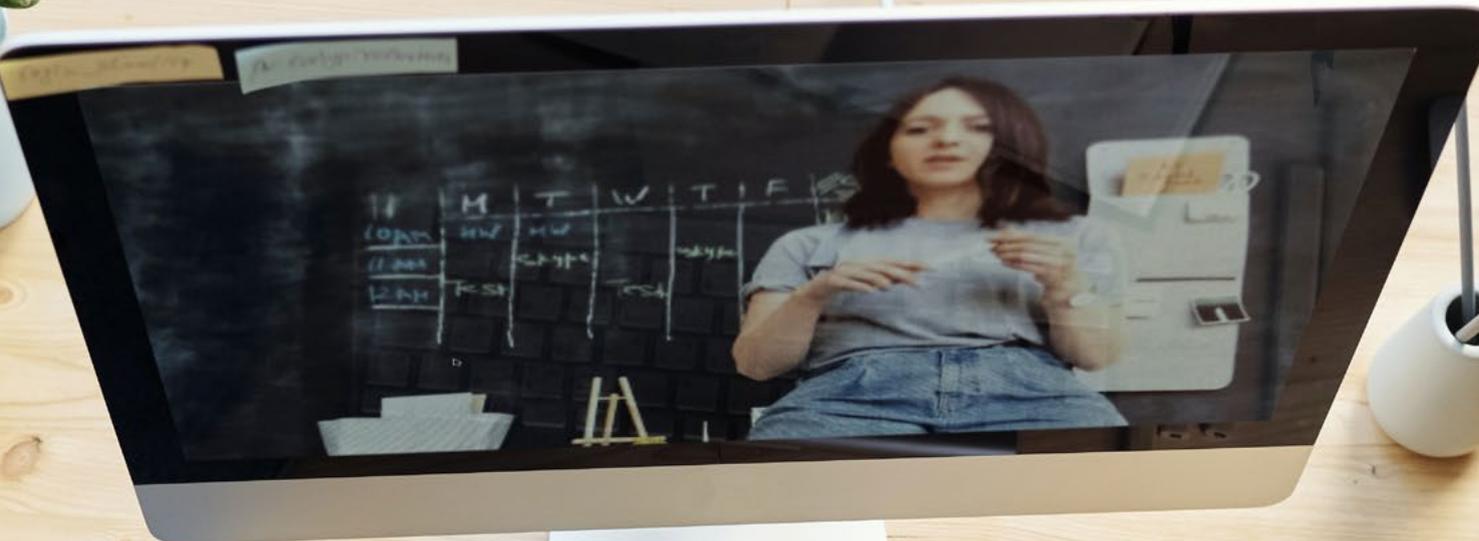
Creating new meaning in work-life flexibility will humanize our decision-making moving forward—de-parenting, de-gendering, and de-ageing the perception of a flexible worker. In all of this we have learned that it doesn't necessarily get easier – we just get stronger and more resilient.

*“Keeping anxiety at bay. Most of everything feels normal, workflow is normal, just doing it all in a different location. But every now and then it hits me, and I think WHOA this is actually happening in the world. I can't believe we're living in this.”*  
– Anonymous e-survey participant

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# Silver Linings – Lessons to Carry into the Future of Education

CHLOE HOSID

Sometimes it takes a big change or a paradigm shift to see ourselves and the world around us with clear eyes and an open mind; to lift the haze of normalcy and routine to reveal the truth of what really matters. Somewhere in the space between what was and what will be, there's an opportunity for reflection where we can decide what we want to carry with us into the future and what we need to leave behind.

A pause, and in this case, a "Great Pause," to take a breath, re-center ourselves and re-prioritize our connections, our communities, and our health and wellbeing. Right now, we are in that space — anxiously hovering in the threshold between the world as we knew it and our post-COVID future, and there are valuable lessons we are learning during this quarantine era that have the capacity to improve our lives moving forward if we let them.

Through this experience, we've seen the true value of our schools, colleges, and universities and all that they bring to our students and to our communities. We have a new appreciation for our educators, for shared learning experiences, and for all of the irreplaceable resources a school provides to support students' health, wellbeing, and success as they build meaningful knowledge and skills, and develop on a social and emotional level. While it's been a strange and challenging time, some of the adaptations that have been made in response to this pandemic may still have a place in schools and

classrooms in a post-COVID world. The importance of creativity and flexibility, the value of human connection, and a new perspective on our education system are all valuable COVID-19 insights to take with us to improve learning and education in the future.

## Creativity and Flexibility

Students and teachers are engaging with learning in new and unexpected ways: shifting online, retooling assignments, and adapting learning experiences to work for at-home learning environments. Simply echoing the activities and procedures that were planned for person-to-person teaching is not an effective approach to facilitating learning online, and for many hands-on and context-dependent learning experiences (like lab or field work or the performing arts), doing so may not even be possible. Making a successful transition to learning online and from home has required teachers,

professors, administrators, students, and parents to be creative and flexible in their approach to education. The innovative solutions that have come out of this effort should not be abandoned upon our return to 'normalcy'.

Incredible examples of this creative problem-solving are all over the web and popping up in our newsfeeds, highlighting the true power of ingenuity during a time of great adversity. Shifting lesson plans and assignments to respond to and embrace the challenges and opportunities of this time, rather than simply ignoring them, enhances learning and integrates 'context' as a tool for building meaningful learning experiences that take on new relevance as a result.<sup>1</sup> A great example of this comes from an urban agriculture course at NYU.<sup>2</sup> Students would typically harvest crops at an on-campus Urban Farm Lab, but instead were tasked with cultivating plants from vegetable scraps and creating a self-sustaining garden at home- effectively bringing the core purpose of the lesson into the home learning environment and providing students with skills and resources to carry with them beyond the spring semester.<sup>2</sup> Capitalizing on readily available technologies, an engineering professor at Pennsylvania State University, armed with a greenscreen and a sense of humor, used themed backgrounds and costumes to engage his students from a distance and bring some levity to his online classes.<sup>2</sup> With a little creativity, something as simple as a greenscreen can become a teaching tool to incorporate digital media, creating a flexible and unique teaching environment to support learning and student engagement, even from a distance.

Channeling this same creative energy and flexibility towards the challenges that lie ahead can help to inform a new approach to education, and even stimulate new ideas for the design and adaptation of physical spaces for learning, post-COVID. By looking at these unusual circumstances as a

challenge that is pushing us to adapt, rather than a threat to learning as we know it, the inherent stress educators and students are feeling in this experience can become constructive fuel for creativity and flexibility during this in-between time now, and in the new learning typologies we'll see in our post-COVID classrooms.<sup>3</sup>

## The Value of Human Connection

During this period of social distancing, one thing that's been made abundantly clear is that humans are social creatures. We value meaningful interactions and quality time with the people we care about, and so much of what brings color and richness to our everyday lives are the connections we share with our families, our friends, our coworkers, and our classmates. And while we know now more than ever that nothing can really replace the feeling of actually being together in the immediate sense, we are fortunate that we happen to live in a time in which technologies and video communication platforms are abundantly available to help us safely bridge the gap. Physically distancing from others reminds us of the importance of staying connected and has pushed all of us to be more deliberate and creative in our efforts to do so. Through the many Zoom calls we're having for work, for school, and for fun, we've caught a rare glimpse into the real lives of the people we know- their kids, their pets, and their quirky living room artwork all coming into focus for the first time, reminding us that we're all humans with lives outside of our schools and offices. Through this experience, we're gaining a holistic picture of ourselves and of each other, underscoring the importance of prioritizing empathy and balance in our lives- a lesson to hold onto as we look to return to schools and offices in the coming months.

In the context of education, it's difficult to imagine a future without in-person collaboration and interaction. We know how valuable and critical those experiences are for learning and for social and emotional development, so safely translating those fundamental experiences to post-COVID education will need to be a priority at all levels- from elementary to higher education. Technology will continue to be a necessary mediator for safe social interaction as we navigate online learning, blended learning models, and staggered schedules so that students can stay connected both in the classroom and at home. Our schools and classrooms will need to accommodate technologies that can effectively support these activities.

Following such an intensely difficult experience, many students and teachers will be navigating a return to school while trying to cope with mental health challenges and concerns about their physical health.<sup>4</sup> Recognizing the implications of this added weight makes it all the more important that we carry the heightened consideration for psychological wellbeing and the emphasis on human connection we've had during this time with us, even after we're no longer so reliant on Zoom calls to maintain our connections. Taking steps to accommodate and support health and wellbeing within the school community through strategies like Social and Emotional Learning (SEL) and Resilience Training can help to create a safe space for learning, growth, and connection.<sup>4,5</sup> Emotion and social connection are such a deeply important part of learning<sup>6</sup>, and these affective factors need to be kept front of mind as we transition into our post-COVID future.

## A New Perspective on Our Education System

One interesting aspect of the changes we've experienced in recent weeks is that there is a

distinct line between 'then' and 'now'. Students were in classrooms as usual one day and learning from home the next. As strange as that adjustment has been, it provides us with an unusual opportunity to reflect on our education system; allowing us to "weed out" the things that are not necessary to meet student needs and campus goals, and shifting the focus to strengthening the systems and services that really matter and bring so much value to our students.

We know that not every student has the same access to resources- be it technology, family support, or food security- and this pandemic has brought to light just how important it is to find creative ways to prioritize equity in our school system.<sup>7</sup> The 'homework gap' and the 'digital divide'<sup>8,9,10</sup> are two of the challenges that have been intensified during this time, requiring districts to respond with empathy and ingenuity. A great example of targeted, creative accommodations for students in need comes from the Austin Independent School District. Here, school busses are being equipped with WiFi and deployed as mobile wireless hotspots, allowing students with limited internet access to stay connected and continue their education during extended school closures.<sup>11</sup>

Students and teachers have undergone a significant transition to online and at-home learning over the past two months. Ideally, this time at home has allowed students to personalize their learning environment and understand their needs and how they like to engage with their education. 'Home' has provided students with the agency and the comfortability they need to really take charge of their learning experiences. As our schools prepare for yet another transition to what promises to be a new, blended learning model in the fall semester<sup>12</sup>, embracing the benefits of 'home' in the classroom can support students' wellbeing and academic

growth when they return to their campuses. This transition will vary between regions, communities, and even for individual students, as schools will need to provide their students with the best possible chance for success despite the challenges of their unique circumstances. While there will not be a one-size-fits-all solution, this time can also provide the education system with an opportunity to allow students more choice in their scheduling and learning model, contributing to a greater integration of personalized learning in education.

The lessons to be learned from an event like this pandemic are numerous, yet difficult to identify

while we are still in the throes of this challenging moment in history. The impacts of this event on our lives will be widespread, and the way we approach education at our schools and universities will undoubtedly be different as a result of this. If we can draw meaningful insights from the adaptations we've made during this time, we can enhance learning for our students in the future. Creativity and flexibility, the value of human connection, and gaining a new perspective on our education system are just a few lessons we can take with us into our post-COVID future.

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IMAGINE. DISCOVER. LEARN. **CREATE.**

# Five Keys to a Successful Home Learning Environment

CHLOE HOSID

The world as we know it has changed substantially and dramatically in response to the threat of COVID-19. Education is no exception. We've closed classrooms and moved learning into our homes and online. Students are learning in their bedrooms, at the kitchen table, on the floor, and in their backyards — we're all making it work, but is there a way to make it better?

How can you translate the benefits of a well-designed classroom into your at-home learning environment? The benefits of an optimized learning environment tailored to your student's needs extends beyond finishing the school year at home and can offer the space your child needs for homework, studying, or exploring extra-curricular opportunities over the summer — a foundation for success for many years to come. Here are five guiding principles from architects in Corgan's Education Studio for creating the best home learning environment with your child:

## 1. Flexibility

If there's one thing that has become abundantly clear in recent weeks, it's that things change, and they can change quickly. The importance of flexibility is a fundamental truth in education. A well-designed, effective learning environment must support the individual student and accommodate a range of teaching and learning methods for

different types of content and tasks while also responding to ever-evolving technologies and sociocultural priorities. From facilitating more focused and reflective activities to hands-on projects and group-based explorations, spaces must harmoniously evolve throughout the day and the year to accommodate the full spectrum of learning experiences.

Lean into your child's natural creativity, be open to changing things up, and emphasize multi-functionality. Spaces in your home may be activated in new ways if your student feels empowered to choose their learning space based on their task. Your staircase could function as theater style seating for your child to share what they've learned or to host a family TED Talks series, a blanket fort study nook in your student's bedroom could be a prime spot for focused, reflective work or reading, and your backyard could become an outdoor nature lab. Ryan Connell, Vice President and Studio Design Director, recommends keeping an open mind. "By

now, I think most families have settled into some kind of normal at home, but I think it's good to keep checking in with our kids and ask what's working well and what could be better. They are instinctively curious, so just try to be flexible and follow their lead. This is a rare chance for kids to shape their learning environment, so let them."

## 2. Restorative Spaces

While many students come to school with anxiety, depression, and stress under normal circumstances, current world events exacerbate these challenges and introduce new frustrations and emotions for everyone — underscoring the need for restorative spaces in our schools and our homes. Research in cognitive science and psychology has highlighted the benefits of exposure to nature for health and wellbeing. Attention Restoration Theory<sup>1</sup> posits that natural environments provide a restorative reprieve from cognitive demands by engaging the mind passively through fascination to relieve attention fatigue. Through design elements that inspire fascination, we can bring meaningful richness and sensory experience into the learning environment. Stress Reduction Theory<sup>2</sup> states that exposure to nature can reduce stress responses and accelerate psychological and physiological recovery. Taken together, this research highlights the potential for exposure to nature and experiences of fascination to positively contribute to human health and wellbeing, especially during times of stress and uncertainty.

To bring these elements into your home, focus on connecting with nature and creating space to move and to decompress. Find a quiet spot in your home for a cozy nook that feels safe and relaxing where your child can go when they need to unwind. Lay

Rodriguez Middle School. Image source: Corgan





out a blanket or set up a hammock outside on a nice day and take learning into the outdoors. If you don't have a yard, consider adding some plants to a sunny corner to create an indoor 'greenhouse' — a great opportunity for learning too! Dedicate space for movement and exercise by rearranging furniture and making space to roll out a yoga mat or have a mid-afternoon dance party to help your child decompress. Making room for restoration in your home will support your children's holistic wellbeing and help them to perform at their best, now and in the future.

### 3. Individualized Spaces

We know that every student comes to the classroom with their own unique set of strengths, passions, challenges, and experiences that shape the way they learn.

Effective learning environments must provide students with the support and the tools they need to learn in a way that works for them. This is a challenging proposition in shared learning spaces. However, as we shift to learning from home, and with the potential for a new, blended learning model (a mix between online learning and person-to-person experiences) in the coming months, children have the unique opportunity to shape their learning environment to align with their needs and their goals. Allowing children to meaningfully contribute to the identity and functionality of their space provides them with a sense of ownership and responsibility that can increase engagement and improve learning outcomes.<sup>3</sup> Balancing complexity, stimulation, focus, and ease can help to keep the space interesting and comfortable, while limiting distraction and allowing your student to select the appropriate setting for their work.

Interestingly, 'home' is a feeling we often try to evoke in learning spaces to encourage students

to feel relaxed and free to be creative. This means your child's at-home learning environment has already taken steps in the right direction! To take it to the next level, we encourage you to talk with your children about what they need in their learning space — you can use the visioning questions in the following section as a guide. Reflecting on their needs can help your children to determine the best location(s) in the house for them to learn and work on various tasks and activities. Allow them to thoughtfully co-create their space with you or on their own so that they feel empowered to engage with their learning in a way that works for them.

### 4. Active Learning

Learning is not a purely cerebral process, but one that engages the body and the tools and technologies that are available in the learning environment.

Allowing students to move and actively experiment within the physical, digital, natural, and social world reinforces learning with meaningful and memorable experiences.<sup>4</sup> With virtual learning representing a significant part of your child's education, it's important to inject 'real world' learning into their day and to engage with technology in a way that inspires your child to create, explore, and solve problems, rather than passively consume digital media.<sup>5</sup> Drawing from the Blended Learning model, online learning can offer self-paced learning opportunities to develop familiarity and understanding, while person-to-person experiences can dive deeper for exploring concepts, applying new knowledge, and building creative and critical thinking skills.

To create an active learning environment at home, take advantage of the infrastructure you already have in place. For instance, your kitchen is a ready-made laboratory for learning about science, health, and problem-solving through cooking and experimentation. Designating a space with

a work surface where your child feels free to get a little messy and be creative can serve as an at-home makerspace. Gather some craft supplies and materials like boxes and other recyclables and organize a resource cabinet or cubby so that supplies are always within arm's reach to experiment, prototype, and explore new ideas. These hands-on experiences can help to nurture your children's natural curiosity and inspire them to pursue their passions.

## 5. Collaboration

Modern learning environments focus heavily on creating spaces for students to come together, work collaboratively, and use their interactions to reinforce understanding, communication skills, and a sense of community.<sup>6</sup>

For example, mixed grade level "houses" with a centralized collaboration space can effortlessly connect students with their peers to encourage

empathy and meaningful interaction. The challenges of the time require us to adapt and to think about collaboration in a different way in order to translate the benefits of constructive interaction to virtual and at-home learning environments.

To support your child's ability to interact with peers and teachers, set up a designated space for conference calls so they can engage as naturally as possible and without interruption. Providing access to power, strong Wi-Fi, an appropriate background, sound mitigation (closing a door or a secluded location), easy access to class materials, and a work surface to take notes prepares your child for successful digital collaboration. You can also find creative ways to establish a sense of community within your home. An intentional, shared workspace invites anyone in your household to work independently together, to engage in shared learning experiences through hands-on projects and discussions, or just to have lunch!

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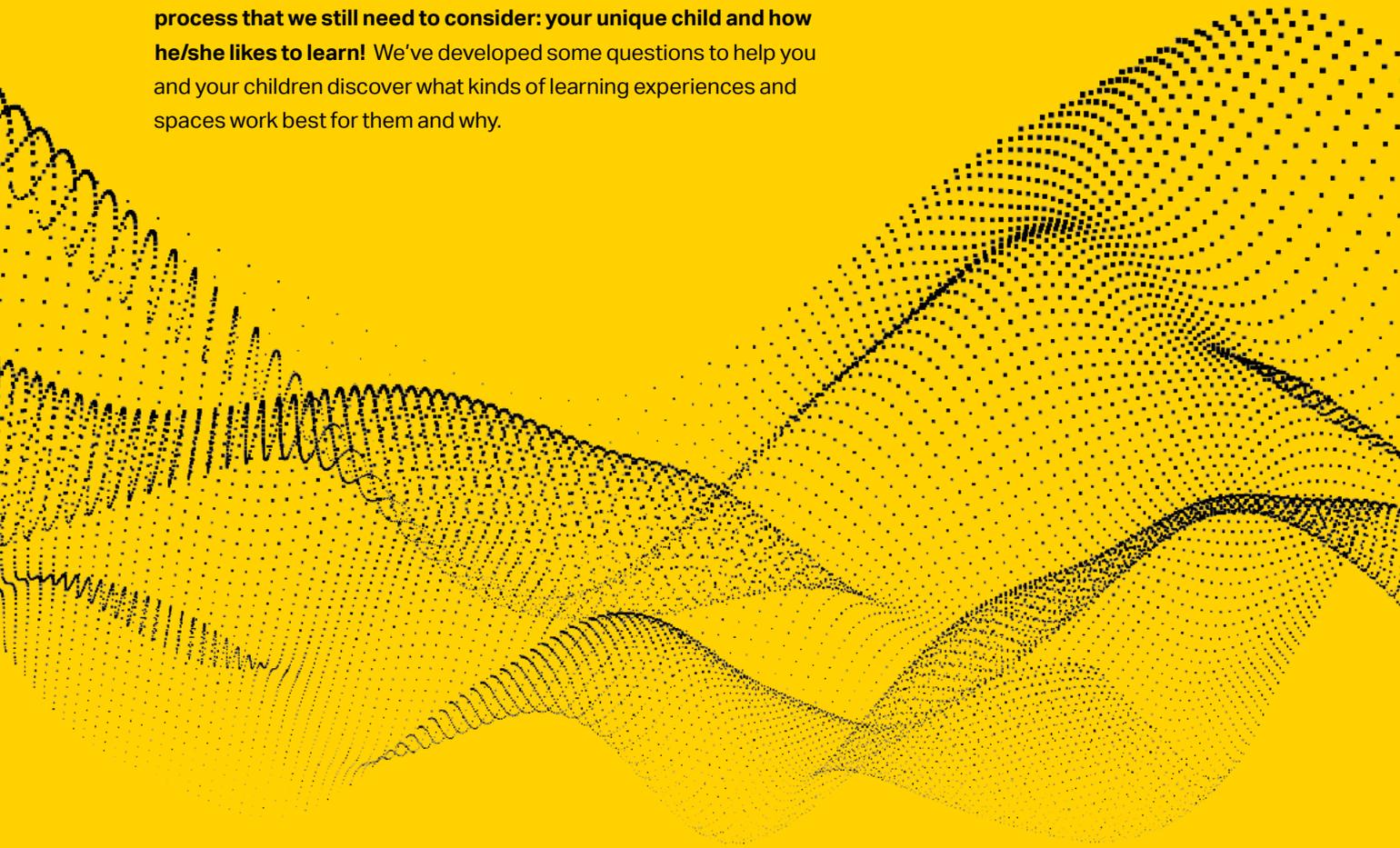
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## Let's talk about you.

You've learned about five guiding principles for the design of high-quality learning spaces and how you can translate these insights into your home to create the best at-home learning environment for your child. We know that the benefits of reflecting on your experiences so far and taking the time to work through a design visioning process with your child can positively contribute to your child's learning, both during this time and in the future.

**However, there's another very important layer to this visioning process that we still need to consider: your unique child and how he/she likes to learn!** We've developed some questions to help you and your children discover what kinds of learning experiences and spaces work best for them and why.



# How do you like to learn?

## CHECK ALL THE BOXES THAT APPLY

Fill these questions out digitally by clicking the check boxes and typing in the lines provided, or print this out and fill it out by hand.

**When I'm working on a reflective task like reading, studying, taking an exam, or writing, I need to:**

- Have some structure in my environment to help me focus
- Relax and settle in somewhere cozy
- Go to a space where I can be alone
- Find a spot that gives me energy
- Keep my space quiet and peaceful
- Discuss what I'm working on with others
- Get comfortable and find a place where I can lounge or spread out
- Focus on what I'm working on with no distractions
- Have opportunities to move around or look around to clear my head



### REFLECTION

This means that when my task is focused or reflective, it helps me to:

# How do you like to learn?

## CHECK ALL THE BOXES THAT APPLY

Fill these questions out digitally by clicking the check boxes and typing in the lines provided, or print this out and fill it out by hand.

**When I'm working on a problem-based task (like math), or something I find challenging, I need to:**

- Be somewhere quiet by myself
- Work independently, but with other people around me
- Collaborate with my peers or with my teacher
- Be comfortable (on my bed or in a comfy chair)
- Sit somewhere with a flat surface so I can work
- Write or draw out my thinking process to solve the problem
- Use physical tools/manipulatives to help me figure things out
- Have someone help me think things through



### REFLECTION

This means that when I'm doing a problem-based task, it works best for me to:

**If I'm meeting or with my teacher or my class virtually, or working through a lesson online, I like to:**

- ❑ Have a quiet space where I can go to be alone
- ❑ Make sure I can take notes or write things down
- ❑ Get settled in somewhere I feel comfortable
- ❑ Have an organized background behind me while we're talking
- ❑ Go where the wind takes me- I can work wherever!
- ❑ Have the supplies I need close by for easy access
- ❑ Speak and play the audio without background noise



#### **REFLECTION**

This means that when I am meeting with my class online, I need:

# How do you like to learn?

## CHECK ALL THE BOXES THAT APPLY

Fill these questions out digitally by clicking the check boxes and typing in the lines provided, or print this out and fill it out by hand.

### If I'm working on a school project or doing something creative, I like to:

- Have my own space to focus alone
- Work somewhere that helps me feel inspired, energized, and engaged
- Do some research to see how other people have solved the problem (in a book or online)
- Think through my whole idea and write out a plan before I begin
- Work with my peers and/or my teacher to collaborate or brainstorm together
- Test out my ideas with prototypes and mock-ups and see how things work
- Spread out with lots of space to see everything I'm working on at once
- Have easy access to technology while I'm working
- Feel free to get a little messy while I'm working
- Keep my space and my resources organized and neat



### REFLECTION

This means that when I'm working on a project or doing something creative, I need my space to:

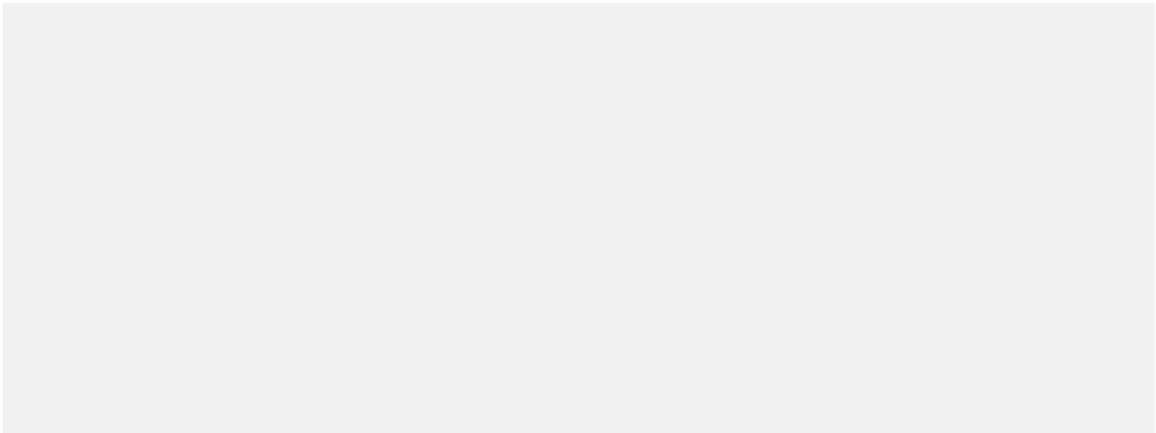
**In general, I like my learning space to be:**

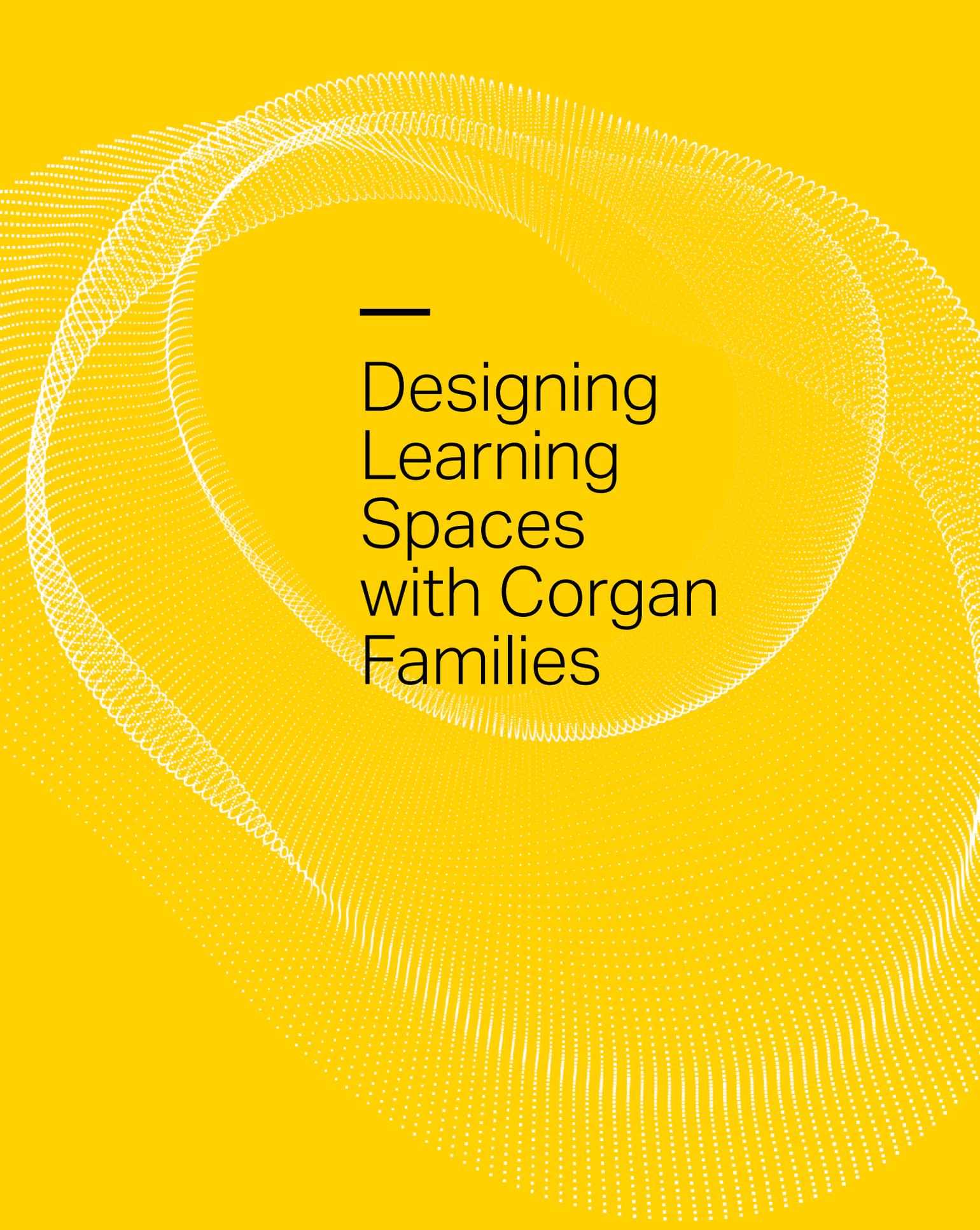
- Quiet and calm
- Active and around other people
- Structured and in my own space
- Set up so I can work easily with technology
- Free for me to get a little messy
- Wherever and whatever I need it to be
- Outside!
- Always changing depending on what I'm working on
- Organized and neat

**REFLECTION**

This means that the best learning environment for me is:

**DRAW YOUR IDEAL  
LEARNING SPACE BELOW:**





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Designing  
Learning  
Spaces  
with Corgan  
Families

# Mellard Household



## WHAT DOES YOUR CHILD'S LEARNING WORKSPACE(S) LOOK LIKE AND WHY?

When developing my daughter's workspace, I showed her examples to get feedback. Several were cluttered and had **"too much going on"** so we kept the walls simple and limited the supplies to one bench. She located her desk close to her supply area so she could reach them without getting up. She opened the French door to act as a wall so her space would **"feel like a home and help her concentrate better."**

She uses her workspace for calendar time, phonics, and interacting with her teacher, and the dining table for math and journaling. When reading alone, she likes the couch and when reading with a parent, she likes to be on her bed. For crafts, we move her workspace table into her room.

## WHAT ADVICE DO YOU HAVE FOR PARENTS AND STUDENTS AS THEY CREATE THEIR AT-HOME LEARNING ENVIRONMENT?

Have a visioning session with your child, and get as many options and ideas in front of them as possible. Allowing them to craft their own space in new ways can bolster their engagement in learning.

## WHAT PERSONAL CHALLENGES OR FUNNY EXPERIENCES HAVE YOU HAD WITH THE TRANSITION TO A HOME-SCHOOL ENVIRONMENT?

I want to drop everything and say yes each time my kids ask me to play with them. I'm grateful that I can interact with them at various times during the day but am tired of saying "I can't right now, daddy's working."

# Connell Household



## WHAT DOES YOUR CHILD'S LEARNING WORKSPACE(S) LOOK LIKE AND WHY?

We have a small house, so their learning workspace is pretty much anywhere they want to be, aside from Daddy's office (aka bedroom). I mean this literally — **we have photos of them in almost every square inch in and around the house, including the swingset.** They attend a Montessori school, so our approach has been geared toward keeping true to that method as much as possible, and giving them the freedom and responsibility to do their works where they are comfortable.

They have a "checkboard" wall where the schedule and jobs for the day are posted, same as they would at school, but the jobs are different (making lunch, bathing the dog, folding laundry, sweeping the deck....)

The dining room table is the hub of activity. This is where they are most comfortable for heads-down individual work, and it's where they spend probably half of their work block. It's a glorious mess during the day so part of their transition from "school" to home is cleaning up, just as they are expected to pick up and organize their classroom materials.



dining room table is the hub of activity

cubby bench houses  
books and materials



We have a cubby bench that usually houses games and puzzles, but for now that's where their books and materials go. That's really the only physical adjustment we've made — I wouldn't say I've designed their space, just adapted it.

Sometimes work is done at the bar, or outside on the back deck, or on the front porch, or on the sofa. They seem to find the sofa or their beds when they have video chats, but otherwise they stick to harder surfaces... even the floor.

#### WHAT ADVICE DO YOU HAVE FOR PARENTS AND STUDENTS AS THEY CREATE THEIR AT-HOME LEARNING ENVIRONMENT?

By now I think most families have settled into some kind of normal at home, but I think it's a good to keep checking in with our kids and ask what's working well and what could be better. They are instinctively curious, so just try to be flexible and follow their lead. This is a rare chance for kids to shape their learning environment, so let them. I need a defined space and separation from home to focus, so that's how I've set up my workspace. **My kids don't need or want that — they fidget, they sprawl across the floor, they move around. It energizes them. I built a desk into their bedroom years ago, and I've been amazed at how little they've used it for school work.**



#### WHAT PERSONAL CHALLENGES OR FUNNY EXPERIENCES HAVE YOU HAD WITH THE TRANSITION TO A HOME-SCHOOL ENVIRONMENT?

The hardest part for our kids has been the physical separation from friends and family. Video chats definitely help; our oldest has a school-issued laptop for connecting with her teachers and doing app-based works, and they also have old iPhones for 1-on-1 visits with friends. We also have a "Guest Lecture Series" where we ask a family member to each lead them in a virtual lesson on something they have expertise in, which has been a fun way for them to see family and learn something about what their relatives do/did for a living. Another challenge has been that they don't have access to their Montessori classroom materials, so we've had to get creative in finding hands-on activities, and we just look for any opportunity to safely get out of the house. Nature walks. Bike rides. A friend texted that his neighbor was having a large tree planted, so we took a field trip to watch how it's done and turned it into a lesson.



# Stutsman Household

## WHAT DOES YOUR CHILD'S LEARNING WORKSPACE(S) LOOK LIKE AND WHY?

My middle schooler's workspace has not changed at all since moving to eLearning. This is his computer set up in his room that he now uses for school work. For the most part, he focuses on school work during the day, but does sometimes allow himself "breaks" when his friends want to play online games. My husband and I both work from home now, so we are really hands off, and allow him to self-monitor his own pace. He really enjoys this freedom and responsibility. The picture shows him attending his fine arts elective, band, at 9:00 at night. He is watching a pre-recorded video of his instructor playing a scale, which really helps him as a beginner band student. Once he watches the video, he moves away from his desk and plays his instrument while I record him so he can load his video for a grade.



child self-monitors his own pace throughout the day ↗

## WHAT ADVICE DO YOU HAVE FOR PARENTS AND STUDENTS AS THEY CREATE THEIR AT-HOME LEARNING ENVIRONMENT?

Be flexible! Learning can happen anywhere! My youngest child downloaded the conferencing app on his phone so he can chat with his small group and teachers on the go. He chooses where to sit throughout the house and still get the same level of engagement. Don't stress too much or push for your kids to do all the extra activities available. Sometimes they just need a mental break in the middle of the day, and eLearning enables them to do that.

## WHAT PERSONAL CHALLENGES OR FUNNY EXPERIENCES HAVE YOU HAD WITH THE TRANSITION TO A HOME-SCHOOL ENVIRONMENT?

One of my kids realized he had a conference with his teachers that started in less than 5 minutes. He had to scramble to find real clothes, and brush his hair to jump on the call!

*Added bonus: I wash a lot less socks these days.*

# Rodriguez Household



## WHAT DOES YOUR CHILD'S LEARNING WORKSPACE(S) LOOK LIKE AND WHY?

Laptop for online classroom, a second screen for assignment work, and a table for writing assignments.

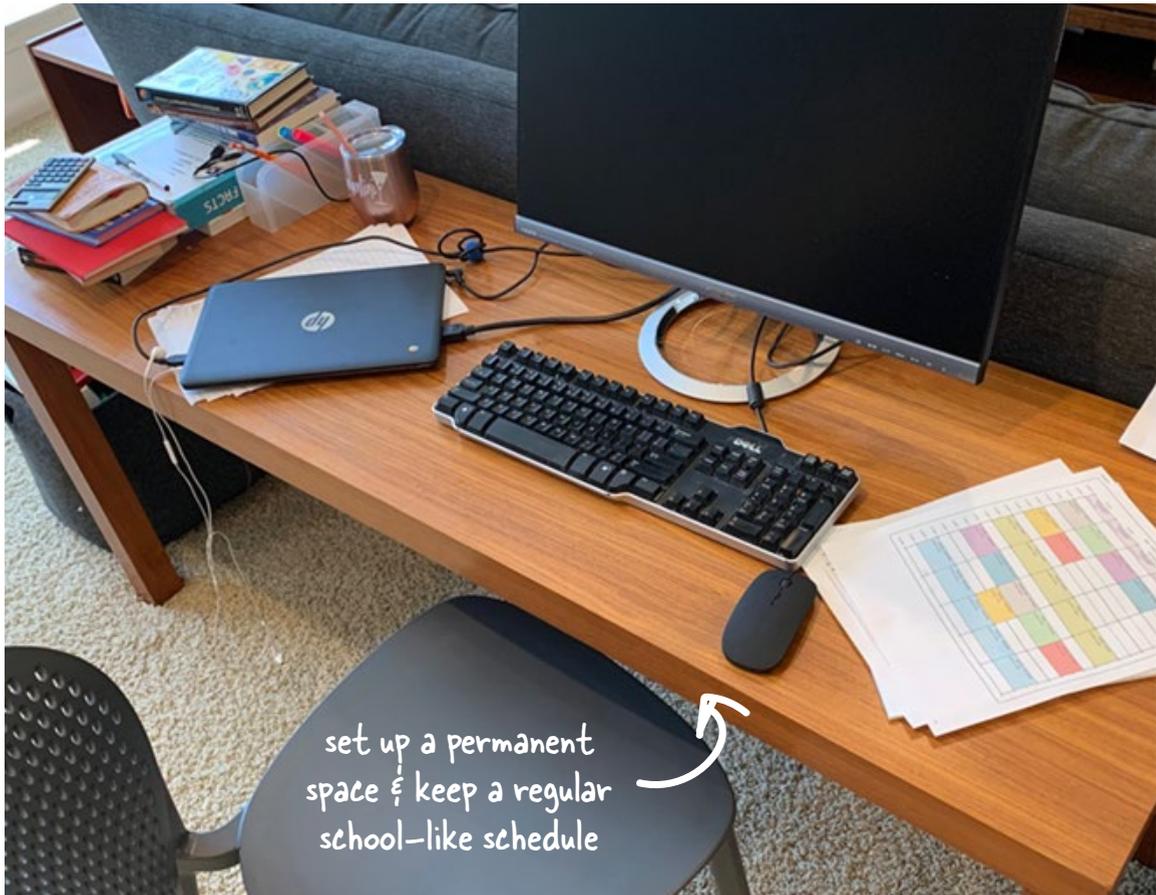
## WHAT ADVICE DO YOU HAVE FOR PARENTS AND STUDENTS AS THEY CREATE THEIR AT-HOME LEARNING ENVIRONMENT?

Set up a workstation that is easy for your child to use, and keep the station where you can keep an eye on them.

## WHAT PERSONAL CHALLENGES OR FUNNY EXPERIENCES HAVE YOU HAD WITH THE TRANSITION TO A HOME-SCHOOL ENVIRONMENT?

It's been hard to balance all the school assignments and navigating all the different websites. Finding the rhythm for a work schedule and breaking up the day with breaks and stops to keep Diego's focus is one of the hardest parts.

# Efrussy Household



## WHAT DOES YOUR CHILD'S LEARNING WORKSPACE(S) LOOK LIKE AND WHY?

My son (7<sup>th</sup> grade) is working on the console table behind our sofa. He has a school-issued Chromebook, and we got him a large monitor. It is away from our office, as we are on the phone almost constantly.

My daughter (2<sup>nd</sup> grade) works mainly on our dining room table. Her schoolwork is less rigorous, and she usually completes her assignments in an hour or two in the morning.

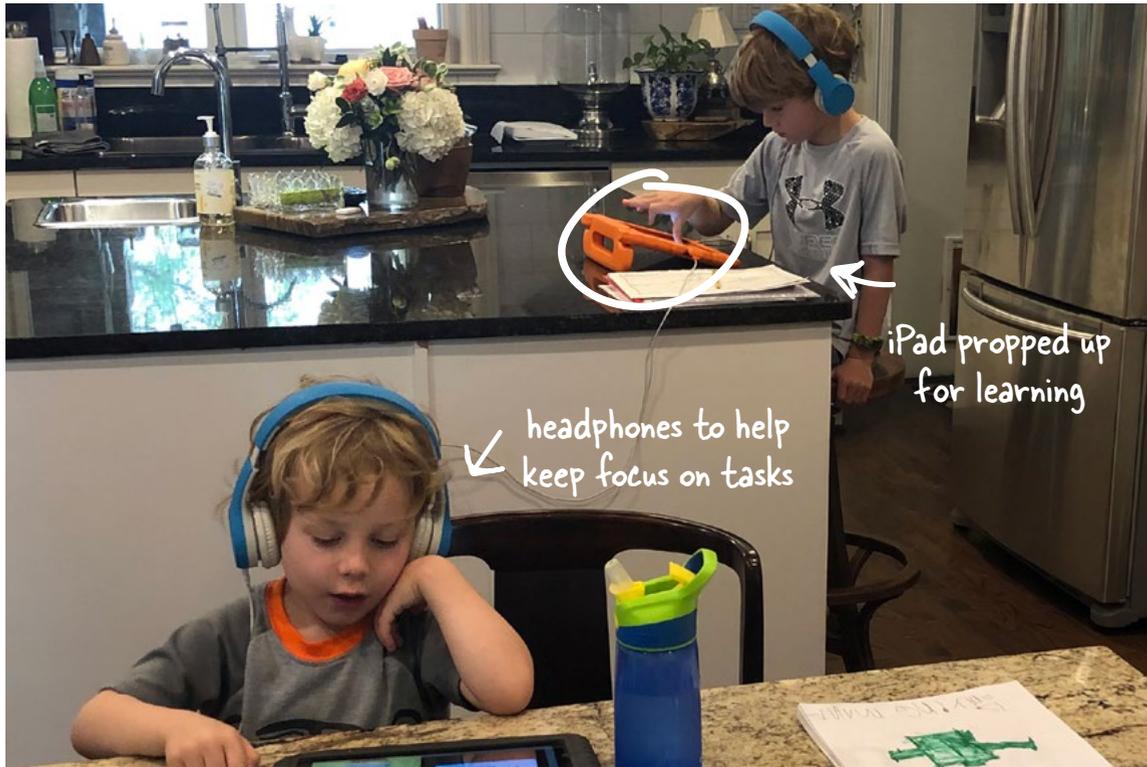
## WHAT ADVICE DO YOU HAVE FOR PARENTS AND STUDENTS AS THEY CREATE THEIR AT-HOME LEARNING ENVIRONMENT?

Set up a permanent space and keep a regular school-like schedule, with lunch and recess. **The more "normal" or routine you can make this, the better your chance of success.** My kids are older and fairly self-sufficient and self-organizing, so we have it easier than many!

## WHAT PERSONAL CHALLENGES OR FUNNY EXPERIENCES HAVE YOU HAD WITH THE TRANSITION TO A HOME-SCHOOL ENVIRONMENT?

Seeing my 12-year-old on his headset during online meetings... like an adult. I thought he would have a few more years of innocence before he had to experience the drudgery of conference calls!

# Vessels Household



## WHAT DOES YOUR CHILD'S LEARNING WORKSPACE(S) LOOK LIKE AND WHY?

Primarily the kitchen table and the island. **Dual height and various sight lines are key; this keeps each child focused on tasks.** Also access to power is so important — the majority of at-home schooling is on the iPad or laptop. They wear headphones that surround their ears — this is vital.

We have case protectors on the iPads. They typically angle prop the iPads up for learning.

For Zoom calls, we separate the kids into different rooms with doors. They have to be away from one another and from us. The sound transfers all over the space. The kids like to lay down on their stomachs during Zoom calls. I find them transitioning down during the call to get close to the iPad and then write assignments, etc. on the floor.

## WHAT ADVICE DO YOU HAVE FOR PARENTS AND STUDENTS AS THEY CREATE THEIR AT-HOME LEARNING ENVIRONMENT?

Schedule is key — a consistent schedule is a huge factor in our kids' lives.

An ideal space for them would be small sit-stand desks with power. They need to wiggle and adjust their posture all day. If we could convert our living room into an 'open office' concept space with desks adjacent to one another yet separate the sight lines — this would be perfect. We would also prefer making small break out rooms for their conference calls. These spaces would be located so that it is quick access from the main learning space with a clear view from mom to the kids. Also the break-out space needs comfy seating with a space to write and access to power.

## WHAT PERSONAL CHALLENGES OR FUNNY EXPERIENCES HAVE YOU HAD WITH THE TRANSITION TO A HOME-SCHOOL ENVIRONMENT?

Teaching kids conference call etiquette and not taking the iPad to the restroom with them. We caught one kid with tablet in hand on the way to the restroom.

As a parent, it would be great to schedule calls for 45 minutes so I can have 5-10 minutes to restart or check on them then 5 minutes for myself to prepare for the next call. Currently, calls are stacked back to back on the calendar which leaves little time to transition from one call to the next and/or time to check on kids to transition them from thing to thing.

# **Our homes have become a surrogate environment for so many of our normal activities, requiring us to reinterpret our everyday functions so that we can safely learn, work, and support one another from home.**

The lessons learned provide huge benefits, not only in navigating these uncertain times, but also for continued academic and extracurricular success moving forward. Taking the time to have a focused conversation with your children about how they learn and what they need from their learning space can help them make the most out of their learning from home experience. Developing spatial

solutions that are conducive to learning, studying, and doing homework can support positive learning outcomes and academic growth. Additionally, increasing your children's awareness of how they think, what they need to succeed, and how they prefer to engage with their education can instill long-lasting, positive attitudes towards learning.





# Seeing New Value in 3D-Printing

DYLAN WELLS

Makerspaces, Fab Labs, hackerspaces, DIYers... These are all very familiar terms today. They are evocative of a new movement of consumer-driven fabrication, a movement that encourages the “every day, ordinary person” to express themselves through the art of making.

In the past, certain methods of fabrication were only available in professional factories and workshops. For example, to get a custom design made out of plastic, an individual would likely consult an injection molding company with a factory who would take the intended design, use a Computer Numerical Control (CNC) machine to mill out a negative mold of the desired part, and then inject plastic into it with an industrial injection molding machine. Not only was this an expensive and time-consuming endeavor, but it also removed the individual from the manufacturing process, which created a separation between consumer and producer.

Within the last two decades however, we have seen a dramatic increase in digital fabrication – several industrial machines and technologies have been scaled down to the consumer (or desktop) level. With these new machines and processes, methods of fabrication are now more accessible and affordable

to the average consumer, and we are seeing a rise in self-made entrepreneurial product design and fabrication. **This has led to a distributed fabrication network where the consumer is the producer.**

## How Did We Get Here?

A brief look through the past few centuries reveals key moments where there have been advancements in technology. In the 18<sup>th</sup> and 19<sup>th</sup> centuries, the industrial revolution(s) gave way to new technologies in the form of machine-driven manufacturing methods and mass production factory environments. In the late 20<sup>th</sup> century, computer-driven platforms and technologies gave way to the internet, and to entirely new digital environments and workflows that sparked a “digital revolution.” Now in the 21<sup>st</sup> century, with the digital revolution thriving, we are seeing a merge between the new digitally saturated individualized culture, and the former industrial craftsmanship of the past. We are now in an age “...where the dominant economic players no longer come from the fields of Energy or Industry, but the famous GAFA (Google, Apple, Facebook, Amazon) in Western countries and BAT (Baidu, Alibaba, Tencent) in China. This revolution is of the same magnitude as the industrial revolutions of the nineteenth century, or the invention of printing at the beginning of the Renaissance — but over a much faster timeframe. And this is only the beginning.”<sup>1</sup> One way this revolution has been embodied is through the advancements of digital fabrication.

## Digital Fabrication

Digital fabrication is the integration of contemporary digital 3D modeling software and physical machine-driven manufacturing processes. This idea covers a broad spectrum ranging from (but not limited to) 3D printers, CNC

machines, 3D modeling programs, Computer Aided Manufacturing (CAM) software, 3D print slicers, laser cutters, plasma cutters, robotics, etc. With the development of this technology, both the commercial and consumer markets have been heavily impacted.

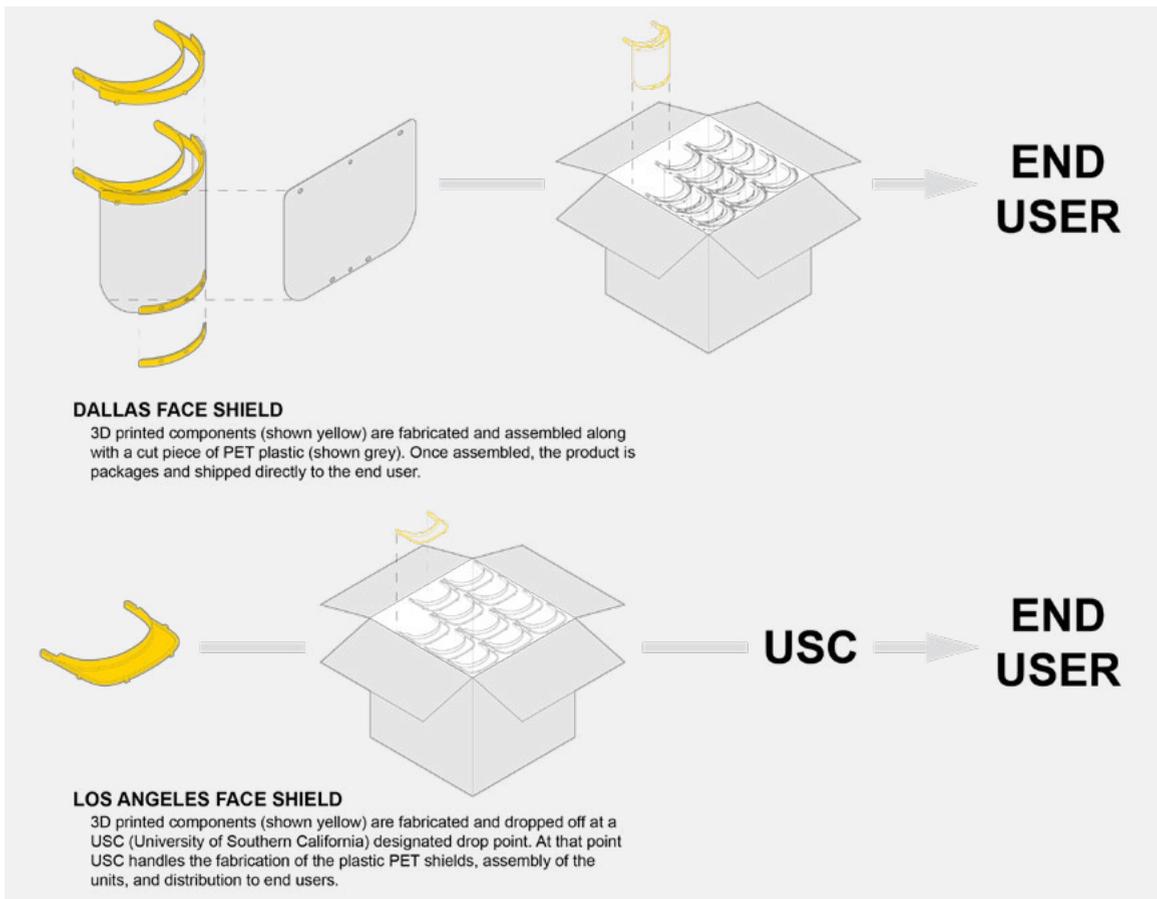
At the industrial level, this technology gave way to more precise fabrication methodologies. Fabricators were able to digitally create and coordinate designs, and then physically produce repeatable objects with very small tolerances using computer-driven machinery. Architectural and engineering universities and firms were able to train students and staff on how to best integrate and leverage software and machinery within their design processes via computational design, prototyping, and 1:1 fabrication. At the consumer level, new-age desktop machines that perform basic level industrial tasks at an affordable cost have given individuals the ability to design and produce personalized objects from the comfort of their homes, garages, or individual shops.

This push for consumer-driven desktop manufacturing machines has been the catalyst for the creation of large open-source communities and forums such as Thingiverse.com, Myminifactory.com, and Prusaprinters.org – digital communities where 3D models, machine enhancements, user experiences, best practices, and strategies are shared and refined. Through the sharing and accessibility of this technology, “digital fabrication is opening the doors of manufacturing to almost everyone and increasing the possibility for goods to be produced locally by people themselves or local makers. It also enables small agile companies to move into areas of production that were previously the exclusive domain of large corporations.”<sup>2</sup>

# Responsive Manufacturing

This new open-source DIY digital fabrication network has been emphasized greatly amidst the global COVID-19 pandemic. With the vast increase in demand for healthcare personal protective equipment (PPE) that the virus caused, large manufacturers and distributors hit a bottleneck in their abilities to fabricate and meet supply demands. This led to worldwide healthcare facility shortages, in which healthcare workers were forced to ration or even go without PPE during their shifts. Not only did this place healthcare workers themselves in danger, but also their patients, families, and friends.

In response to the growing need for PPE production, individuals within the digital fabrication realm took it upon themselves to 3D model and fabricate PPE that could be mass distributed to both fabricators for production, as well as healthcare workers for use. How was this possible? Due to the increase in availability of digital fabrication machines and software, open-source 3D model sharing, and the connectivity of the internet, large companies and individuals alike were able to come together and produce thousands of 3D printed PPE for healthcare facilities. Much like the response of US factory assembly lines during WWII – transitioning from making consumer products to frontline necessities – today’s response has been an extraordinary moment for makers to work together and make a difference to save the lives of frontline healthcare workers.



In support of this movement and the societal need, Corgan utilized their digital fabrication resources to work alongside other firms and individuals to aid in the production of 3D printed PPE. To accomplish this, the first step was to source a 3D model from the community that had been tested and approved for use. To do this, there were two 3D printed face shield models that were used for PPE production: one designed by Prusa<sup>3</sup>, and one designed by Budmen.<sup>4</sup>

Once these models were sourced, the next step was establishing a connection with a healthcare facility that was in need. To do this, Corgan's healthcare sector and employees reached out to clients and contacts within their areas to determine which facilities were running low and willing to accept 3D printed PPE. Two clients were identified – Village Healthcare Partners in Dallas, TX, and the University of Southern California in Los Angeles, CA. Once identified, Corgan's Dallas Shop and Los Angeles office used 3D printers in both locations to produce 50 face shields for Dallas and 75 face shields for Los Angeles.

This use of multi-site fabrication has not only highlighted the strengths of the distributed fabrication network that the digital fabrication community has created, but also exposed how these networks could be used to come together and provide aid to surrounding communities in times of crisis.

## What Have We Learned?

This pandemic has revealed many areas of success and areas of needed growth worldwide. Regarding digital fabrication, there have been a few areas of growth that will need to be addressed in the future to best utilize this resource. For example, through this pandemic, it was seen that companies (for the most part) are not setup for spontaneous manufacturing

and distribution. Non-manufacturing companies like architecture firms, engineering firms, etc. that may have resources like 3D printers in-house do not currently have insurance plans to legally cover them for mass-manufacturing, since this is a more recent endeavor. On the other hand, certain healthcare establishments hit roadblocks within their own legal/insurance systems concerning the acceptance of DIY manufactured healthcare PPE. We are optimistic that this pandemic will cause a change in these systems that leverages the strengths of this new distributed manufacturing network.

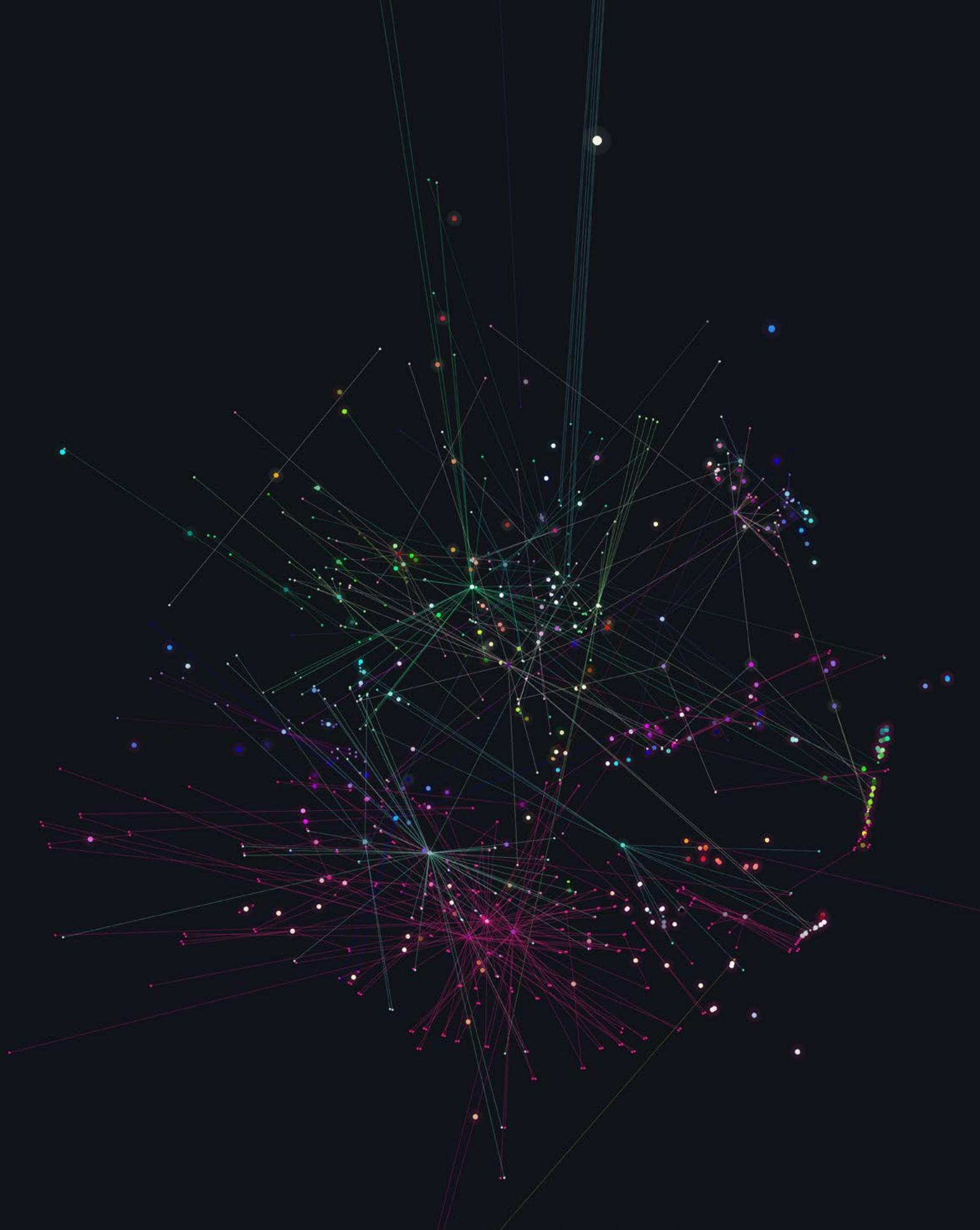
Though there are areas still needing growth, digital fabrication has shown many strengths and successes during this time, highlighting resource availability and inter-connected information sharing. **Through the willingness of individuals and firms to dedicate their time and resources, a large-scale collective volunteering effort led to thousands of frontline workers getting the support they needed.** In addition, this effort has revealed the strength in numbers and collaborative design. By openly sharing digital files, successes and failures, and coordinating distribution efforts, teams comprised of people with different backgrounds and professions came together to support those in need during this worldwide crisis.

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# 02

## DESIGNING TRUST

We are looking ahead to a continually evolving definition of what it means to be and feel safe — anticipating the next invisible threat while preserving and even amplifying a more human, personal experience. Design has the potential to embrace today's societal shifts both on account of this pandemic and before it, offering spaces that restore our sense of stability and community.



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# How Do We Go Back into Public Spaces and Feel Safe?

ALEXANDRA MARKEY AND STACEY BRIMMER

Imagine that after months of social distancing, worrying about the future, and frantically checking the news for COVID-19 updates, restrictions are finally being lifted. It's been announced your office is reopening next week. How do you feel? A little scared, perhaps?<sup>1</sup>

In order for employees to feel safe returning to the office, trust is essential. Workers must have confidence their employers are taking the right measures to protect them from getting sick. So far, businesses are off to a good start. According to the [Edelman Trust Barometer](#), 62% of people trust their employer to take responsible action with the coronavirus outbreak.<sup>2</sup> However, this confidence will be tested as employees begin returning to work en masse, viewing their office environments through new pandemic-tinted glasses.

Toyota North American Headquarters. Image source: Corgan



Signage designed by Corgan

What does a safe, healthy office look like post-COVID? Since this is new territory for the workplace, we should look to healthcare design for the answers. This knowledge can guide us in understanding the best practices for reducing the spread of germs and building trust in the environment.

## Seeing is Believing

When it comes to hospital design, studies show that when a sink is within visual distance of a patient, staff are more likely to wash their hands<sup>3</sup> and patients are more likely to rate their experiences as better.<sup>4</sup> Keeping health and wellbeing at the forefront will be key for workplaces now as well. Even if employers are following all the recommended protocols, it doesn't matter if people can't see it. These safety measures should

be visible to provide reassurance that responsible precautions are being taken.

With this in mind, consider locating handwashing sinks and hand sanitizer stations in visible areas. While it may be tempting to conceal these items, seeing others washing their hands can increase the perception of cleanliness. Moreover, this visual reminder can encourage good behavior when it comes to handwashing, helping to create a culture of hygiene.

Where safety measures are not visible, signage can help. For example, many buildings are upgrading their HVAC systems to reduce the spread of germs, yet these features are concealed within the ceiling. In these cases, consider adding signage. For example, "This room is equipped with a clean [air disinfection unit](#) located in the ductwork."

## Perception is Reality

For a recent hospital renovation, Corgan was called in to fix a problem caused by the previous architects' material choices. The showers in the patient rooms were clad in a mottled taupe ceramic tile, mimicking the appearance of limestone. Even though the showers were being cleaned regularly, patients kept complaining their showers were dirty. Eventually, the hospital realized it was the tile pattern itself causing the floors to look soiled.

The perception of cleanliness should also be considered in the post-COVID workplace. Avoid finishes that have speckles, splotches or appear worn looking.<sup>5</sup> Glossy materials are also perceived as cleaner, although this may not be reality. (This explains the abundance of polished LVT floors found in hospitals.) When it comes to actually reducing the spread of germs, non-porous materials and seamless designs are the most important considerations, paired with the proper cleaning protocols.<sup>6</sup>

## Taking Control

Many hospitals are now encouraging patients and visitors to take an active role in reducing the spread of infection.<sup>4</sup> Infection control centers are being incorporated at many public waiting areas with the goal of empowering visitors to help reduce hospital infections. These [freestanding units](#) typically include hand sanitizer, masks, tissues and poster displays for health-related instructions.

Offices can use a similar strategy to promote employee participation in keeping the workplace healthy. In addition to providing visible sanitation stations, graphics and signage can be incorporated to educate staff on health-related building etiquette. Some of these may include:

- "Please note: Only X number of persons in the room at once"
- "Wash your hands with soap and water for at least 20 seconds"
- "Please use the floor markers as guidance for remaining 6 feet apart"
- "Sanitation stations this way"

Keep in mind, the goal of these signs is to educate and empower staff, not to scare them. Some companies are marketing signage packages with words like "STOP" or images that promote fear. In response to this, Corgan is developing a social distancing package designed to foster trust. Paige Terrell, director of Branded Environments, describes it this way. **"Our approach is a spirit of calm, and even welcome, and informative in nature."**

## Sharing is Caring

Transparency is another important factor in building trust.<sup>7</sup> According to a global study by EY, 59% of employees feel that open, transparent communication promotes trust.<sup>8</sup> This seems more apparent now than ever as employers are stepping up their communication in response to the COVID-19 crisis. This high level of communication will need to continue as employees return to work.

So what does transparency look like within the workplace? One important measure will be transparency in cleaning procedures as these are ramped up to keep workers safe. Restroom cleaning logs have been around for some time but consider displaying these more prominently to reassure employees facilities are being cleaned frequently. This concept may be extended to desks as well, particularly in offices using a desk sharing model. For these situations, new methods will need to be developed. For instance, flip cards may be provided at each desk indicating if the surface has been disinfected (green) or requires cleaning (red)

# Communication is Key — Signage and Information Transparency

STUART SHELL OF BRANCHPATTERN

Direct communication to building occupants is an under-utilized strategy in the designer's toolkit. This is because knowledge about a building system or policy changes the occupants experience of the facility. For example, when hospital patients were provided information about the noises in the hallway, they are significantly more satisfied with the acoustic quality of the room – an effect similar in size to other interventions such as adding a background noise system.<sup>1</sup>

Signage in buildings will be a pillar of our post-pandemic approach to resilience. Effectively designed signage offers several benefits.

- Invite occupants to practice their agency and decision-making.
- Reinforce pro-social behavior, such as norms of interaction and sanctions.
- Generate trust by transparently sharing information about system operation, such as ventilation and cleaning policies.
- Build a sense of shared purpose and identity for user groups.

Signage can also backfire, creating the opposite effect as those listed above. For example, a sign telling occupants to wear masks and maintain a 6-foot distance functions very differently than one with a picture of a person wearing a mask, distanced from others. This is because the first sign applies a mandate to occupants that may not fit, whereas the second approach provides a guideline that can be considered and adapted by occupants.

Similarly, a sign that reports a building has been certified as safe per OSHA may belittle occupants who are unsure what that means. Instead, a sign could show occupants a bar scale that indicates the real-time CO<sub>2</sub> levels for the building, with "insufficient ventilation (2000 ppm)" and "excellent ventilation (600 ppm)" for anchors. This type of sign empowers the occupant with real information and invites them to decide if they feel safe inhabiting the facility. The time in hours since high-touch surfaces were last cleaned also be displayed through dynamic signage located nearby the surfaces in question.

Building occupants are the best resource for designing a signage strategy. Through interactions with infectious disease experts, it's possible to identify the primary concerns for user groups and tailor signage that honestly addresses the perceived risks. This interaction can identify indigenous theories about health in the built environment and inform an evidence-based strategy.

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For more high-tech methods, check out "Digital Twin" in Section 3 to learn how a digital twin can provide occupants with complete information transparency.

## Ambient Wellness

Besides responding to immediate coronavirus concerns, employers can build trust by investing in employees' long long-term health and well-being. Whether or not businesses decide to pursue WELL Building Certification, these strategies are designed to advance the overall health and wellness of building occupants by focusing on concepts such as enhanced air quality, healthy nourishment, opportunities for physical activity, and access to nature.<sup>9</sup>

Some of these concepts have been clearly demonstrated to improve both physical and psychological health within a hospital setting. For instance, views of nature and/or plants within patient rooms have shown a wide range of benefits across many studies. These include lower blood pressure and heart rates, reductions in pain medication, faster recovery times, as well as improved emotional and cognitive health.<sup>10</sup> All of these are benefits which would be valued in a post-COVID workplace.

## A Two-Way Street

At the end of the day, trust goes both ways. While businesses can build trust using the methods described above, the responsibility does not fall solely on employers. Workers too will need to be active participants in maintaining a clean, healthy environment. They will need to be diligent in practicing good hygiene while at work and staying

home when they are sick. Each person plays an important role in protecting the larger group. Yet working together, employers and employees can make an impact in creating a safe, healthy workplace.

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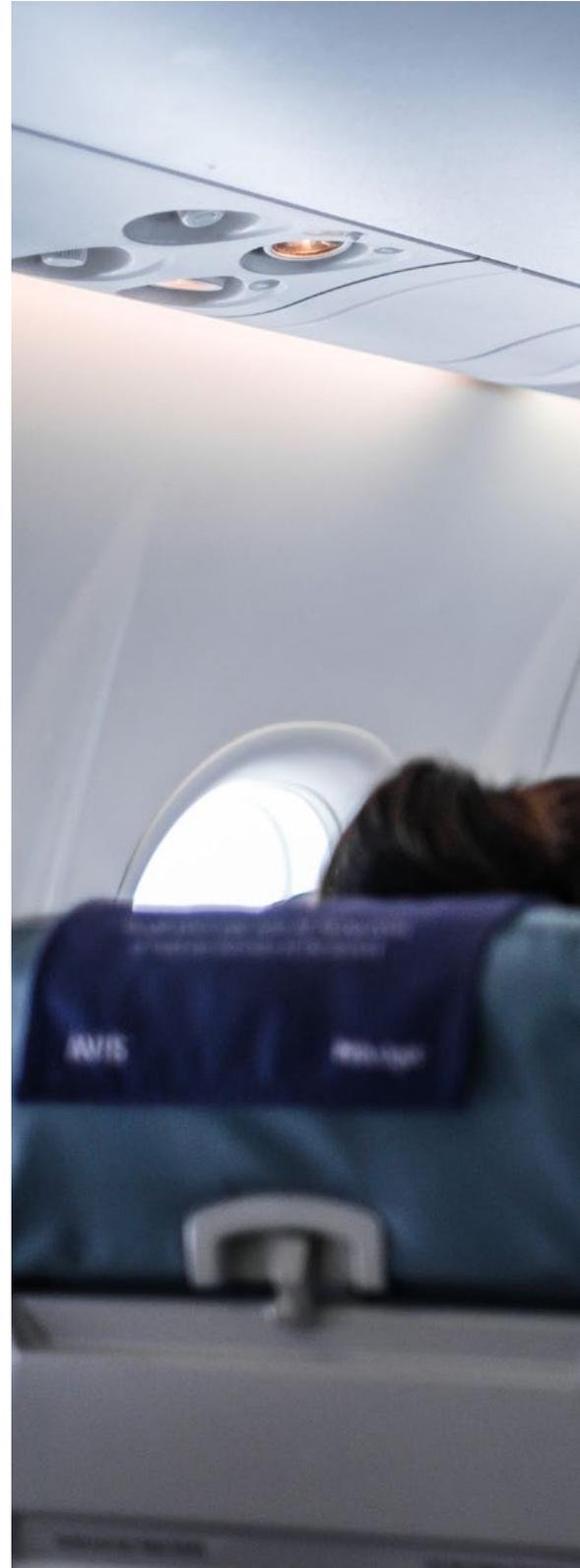
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# Sterilizing the Aircraft — Health Safety vs. Turnaround Time

TALLEEN KHIRWADKAR

While the current state of commercial travel has dropped significantly due to this unexpected pandemic, the desire to travel will not remain dormant forever. This outbreak will undoubtedly change how passengers think – and likewise how airports and airlines enact visible safety measures in the future. Bringing passengers back into a safe travel environment requires changes to the physical space, the psychological message, and the routines of the airport and airline staff.

As we begin to understand how travel can resume, it is imperative for airlines to win back passengers' trust so that they can safely return to the skies. Airlines must take active measures to safeguard the passenger health, which would require changes to aircraft cleaning process, passenger boarding and deboarding, and gate lounge design. The challenge is in implementing these measures without impacting scheduled operations.





Certain short-term measures would prevent the spread of the coronavirus by incorporating enhanced cleaning and sterilization schedules. Other long-term architectural adjustments would safeguard passengers from such threats in the future.

## Short-term Measures

During the COVID-19 pandemic, aircraft load factors have dropped down from 85%-90% to below 20%. This dramatic drop in load factor has allowed airlines to implement social distancing measures in the aircraft as well as gate lounges. The reduction in number of passengers boarding the aircraft decreases the required number of seats in a gate lounge, which can be removed from the gate lounge area to create distance between seated passengers as they wait.

In addition to social distancing, sterilizing the aircraft cabin is a critical step in gaining public trust. Airlines are implementing various cleaning measures to sterilize the aircraft. Typically, these cleaning measures are applied at three different times:<sup>1</sup>

- **During aircraft turn**  
These cleans are generally light cleans with a focus on galley areas, lavatory cleanliness and trash removal from the cabin and passenger areas. This is very straightforward cleaning, and takes around 10 minutes.
- **Overnight**  
This clean is performed on aircraft that have flown all their routes for the day and are to remain overnight. It focuses on enhanced cleaning of areas in and around seats, while continuing to clean the galley and lavatory areas. This type of cleaning may take up to an hour or longer.<sup>2</sup>

- **When aircraft is serviced outside of regular operations**

This clean, also known as “deep clean,” includes removal of aircraft seats and many surfaces to expose the inner workings of the seat, compartments, cabinets and storage areas. Some airlines have specialized equipment that helps with a deep clean. This clean can take up to several hours.<sup>5</sup>

To enhance the cleaning of aircraft cabin during the turn, following cleaning methods are being applied:

- **Electrostatic Fogging**  
The aircraft is covered by the fog before cleaning crew members board the plane and physically clean each surface. Fogging kills any potential germs or pathogens. It has been introduced by the four largest carriers in the United States.<sup>3</sup>
- **HEPA Filters**  
Most modern aircraft have been equipped with high efficiency particulate air (HEPA) filters, which according to the Centers for Disease Control and Prevention (CDC), HEPA filters capture 99.9% of particles 0.1–0.3 micrometers in diameter, and cabin air generally passes through the filters 20-30 times per hour.<sup>4</sup>
- **UV Light**  
There are three types of ultraviolet light: UV-A, UV-B and UV-C. UV-C light is most damaging and is known to kill viruses in air-borne droplets. A UV-C-emitting cleaning machine called GermFalcon<sup>®</sup> is a food cart-sized robotic tool that is pushed down the aisle of the plane. It emits UV-C light onto aircraft seats and cabin surfaces and can clean a typical narrow body aircraft in approximately three minutes.



Figure 1: Electrostatic Fogging; Photo Courtesy of Delta Air Lines



Figure 2: UV-C Emitting Cleaning Machine - GermFalcon; Photo Courtesy of Dimer UVC Innovations

# Long-term Measures

As passengers return to the skies and load factors return to pre-COVID-19 levels, the time it takes to complete boarding will increase accordingly, but sufficient time must be left for cleaning aircraft cabin before passengers board. At the same time, to safeguard health, opportunities must be provided for passengers to maintain social distance while in the gate lounge. Alternative gate lounge design and the use of biometric technology will expedite the boarding process.

- **Distributed Boarding Layouts**

Alternative gate lounge design with low-density seating allows sufficient distance between passengers. Figure 2 shows an example of an existing typical gate lounge. Alternative layouts are provided below. Figure 3 provides

low-density seating and queueing areas, in addition to giving departing passengers the opportunity to board through a different door than arriving for passengers — maintaining some level of potential containment. Lastly, Figure 4 provides distributed seating, eliminates boarding queues, and distributes passenger boarding through multiple doors.

- **Biometric Self Boarding Process**

The self-boarding process allows passengers to board the aircraft by using biometric technology. This expedites the boarding process, maximizes time available for aircraft cleaning, reduces airline staffing and creates a touchless process. Delta, American Airlines, and JetBlue have begun using this process on select international departures in the U.S.

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Figure 3: Typical Gate Lounge Today  
Image Source: Corgan

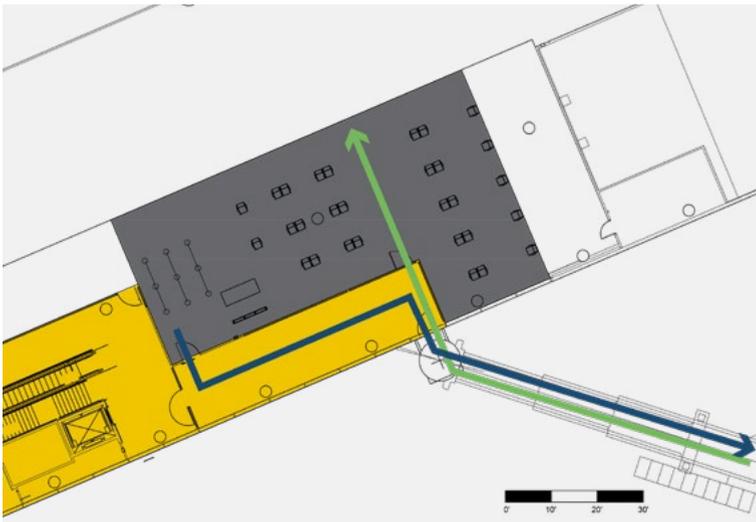


Figure 4: Future Gate Lounges - Option 1  
Image Source: Corgan



Figure 5: Future Gate Lounges - Option 2  
Image Source: Corgan

# Trust Through Design

JANA SKIDMORE

"Trust is the new currency of our interdependent, collaborative world."  
- Steven M. Covey<sup>1</sup>

## Collaboration

As a design firm that wants to remain agile and ready to help our clients in the face of a global pandemic, we knew that supporting healthcare workers in their response to COVID-19 was a natural and immediate priority. We also knew there was a greater need for innovation on the horizon: collaborating with healthcare systems on their emergency response plans — but this time, well in advance.

We are no strangers to pandemics. Our human histories have been plagued for disease for millennia. A survivor, who recently reflected on her experience during the 1918 Spanish Flu, had a clear message: "Be aware."<sup>2</sup> Her charge carried an inherent warning, but also a call for preparedness.

Various public health officials and scientists have warned us of the potential impact a pandemic would (not could) have. And these emergency situations are not reserved solely for pandemics. Climate change has introduced a world of more severe and more frequent natural disasters that disrupt our ways of living in similar ways.<sup>3</sup>

By its very definition, being prepared is to be properly expectant, organized and equipped.<sup>4</sup>

And this is the aim of the Centers for Medicare and Medicaid Services (CMS) requirement for healthcare providers to maintain an Emergency Preparedness plan. Successful adoption of these requirements enables providers to better anticipate and plan for needs, rapidly respond, integrate with local emergency management agencies, and rapidly recover.<sup>5</sup>

Collaborating with providers in advance of an event would build stronger trust, fueling more innovative and resilient solutions. Trust is built through relationship. And trust is key to visionary design.

**"Trust each other again and again. When the trust level gets high enough, people transcend apparent limits, discovering new and awesome abilities of which they were previously unaware." - David Armistead<sup>6</sup>**

So, how do we incorporate emergency preparedness into our design practice? Fortunately, there are some existing models and frameworks that help us better understand the processes and roles required to co-create emergency plans with clients.



# Emergency Management

While COVID-19 will have a protracted impact, history suggests that the next event could be any myriad of disasters; hurricane, tornado, earthquake, flooding, fire, bombing, mass shooting, etc. Actively engaging in community Emergency Management could lead to inventive, life-saving ideas.

An understanding of the Emergency Management Process can help guide engagement and is broken into four phases.<sup>7</sup>

- **Mitigation** – risk assessment and planning
- **Preparedness** – roles, simulation, and communication
- **Response** – event action and logistics
- **Recovery** – lessons learned and continuous improvement

# Design Thinking

Design Thinking is an iterative process which seeks to understand user-needs and redefine problems in a way that might not be instantly apparent. This human-centered approach to problem solving is primarily focused on building a deeper sense of empathy for the end-user and what types of solutions they might need.<sup>8</sup>

The iterative nature of the Emergency Management Process is evocative of the Design Thinking Process. Combining the Design Thinking approach with Emergency Management highlights where opportunities exist for both enhanced preparedness and design.

## Emergency Management      Design Thinking

<b>Mitigation</b>	Ideation: Identify issues and generate ideas
<b>Preparedness</b>	Prototyping: Design mock-ups
<b>Response</b>	Test: Test the design
<b>Recovery</b>	Improve: Incorporate test results to improve design

# Event Management

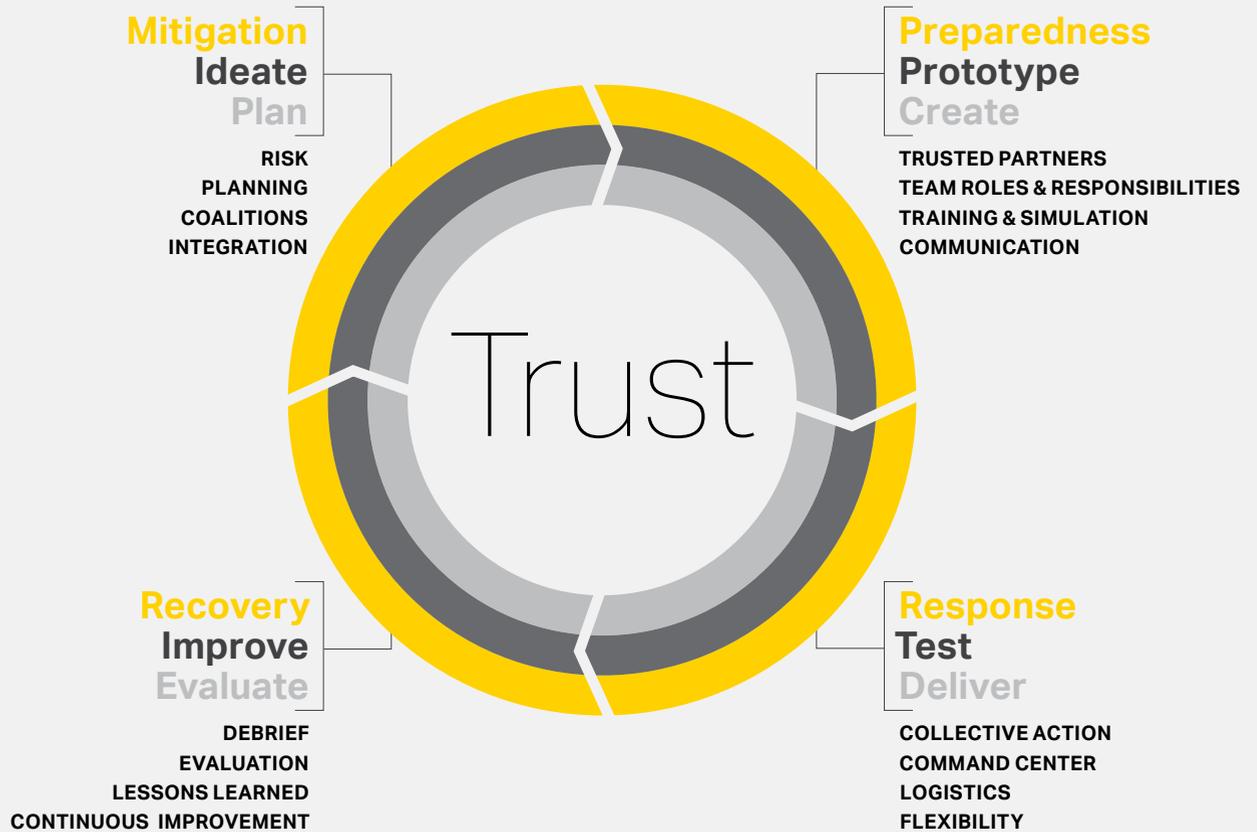
In addition to collaborating with healthcare providers, trust can be further enhanced through forging partnerships with other experts. Recognizing the critical role of event logistics in Emergency Management, and partnering with Event Management professionals, could elevate preparedness and execution tactics.

Curiously, the Event Management Process likewise echoes similar processes as Emergency Management and Design Thinking.

## Emergency Management      Event Management

<b>Mitigation</b>	Plan: Identify objectives, develop vision
<b>Preparedness</b>	Creat: Contracts, staffing, comprehensive plan
<b>Response</b>	Deliver: Execution and logistics
<b>Recovery</b>	Evaluate: Metrics and lessons learned

Integrating Emergency Management, Design Thinking, and Event Management gives rise to new framework for solving problems related to disaster preparedness. The compelling syndication engenders trust and provokes inventive ideas, collectively focused on one goal — saving lives.



**“No astronaut launches through space with their fingers crossed. That’s not how we deal with risk. What I learned from 21 years as an astronaut, is that the more you know, the less you fear.”**

*Former Colonel & Commander, NASA & CSA, Chris Hadfield<sup>9</sup>*

## Mitigation

Mitigation strategy can be broken down into three major components: risk, planning and coalitions.

### RISK

As our communities are launched into disasters, we must likewise prepare for and deal with risk through emergency planning. Within the Emergency Management framework, the formative stage of planning is where mitigation strategies are developed. Design Thinking lends the practice of talking to users directly, ideating around their needs and seeking out solutions that human-centered in nature.

Healthcare providers are required to develop an Emergency Plan that is based on a Risk Assessment and incorporates an all hazards approach. This approach identifies hazards and develops emergency preparedness for natural, man-made, and or facility emergencies. In addition to an all hazards approach, the Emergency Plan must also develop facility-based protocols specific to its geographical region, community, facility, and patient population.<sup>10</sup> The Risk Assessment enables the facility to plan and identify in advance essential functions and who is responsible in a crisis.<sup>11</sup>

“Emergency managers use creative and innovative approaches in solving disaster challenges. A principal role of the emergency manager is the assessment of vulnerability and risk and the development of corresponding strategies that could be used to reduce or eliminate risk.”<sup>12</sup>

### PLANNING

Joining healthcare providers in the process of assessing risks offers insight into what their planned and potential needs may be in a disaster. These insights allow for design ideas to be generated in advance, seeking solutions that can withstand anticipated hazards. Participating in emergency planning with providers, design interventions can be realized that might otherwise be missed.

Following the terrorist attacks of 9/11, public health and medical leaders became concerned about the low level of preparedness and, in 2002, the Hospital Preparedness Program (HPP) was created to address the gaps in hospital preparedness.<sup>13</sup> Initially the program was focused on providing leadership and funding for individual healthcare organizations in their preparedness efforts.

### COALITIONS

As HPP matured, it began to perceive that the need for greater preparedness would require healthcare organizations to coordinate together and began promoting partnerships.<sup>14</sup> However, in the wake of the second costliest storm in U.S. history, Hurricane Sandy revealed that solid emergency preparedness was far from a reality.<sup>15</sup> In response, HPP formalized the Health Care Coalition (HCC) program in 2012.<sup>16</sup>

HPP encourages diverse organizations to work together through health care coalitions (HCCs) to make sure their communities are ready to respond during emergencies.<sup>17</sup> The Emergency Plan for a healthcare organization must also address how

the facility would coordinate with other healthcare facilities, as well as the whole community, during an emergency or disaster.<sup>10</sup>

As designers we have a rich opportunity to engage in HCC's and contribute solutions developed through a design thinking process. Community-based coalitions join public health agencies, emergency medical services (EMS), private non-healthcare partners, and others in a common objective: minimize loss of life, suffering, and other serious adverse impacts on society.<sup>15</sup>

The Southwest Texas Regional Advisory Council illustrates the far-reaching impact a coalition can have. In an effort to increase situational awareness at hospitals and enhance the ability of Texas hospitals to communicate with each other during disasters, they created tracking boards. In September 2010, the coalition was contacted, learning that New Zealand was in search of a Mass Casualty Incident tracking board following an earthquake. Within four hours of the request, MCI transport tracking boards were installed and functional in New Zealand.<sup>18</sup>

## Preparedness

“By failing to prepare, you are preparing to fail.” - Benjamin Franklin<sup>19</sup>

Preparedness is the premise for success in Emergency Management. Collaborative efforts between experts and organizations in the public, private and non-profit sectors are needed to promote disaster prevention and preparedness.<sup>20</sup> Preparedness can be achieved through these four mechanisms: trusted partners, team roles and responsibilities, training and simulation, and communication.

## TRUSTED PARTNERS

FEMA emphasizes the importance of collaboration in its outline of emergency management principles. We must commit to ensuring that we have done everything possible to identify all potential players in a disaster event and work to involve them in every aspect of planning and preparedness for a disaster event. Having achieved this broad involvement, we must constantly work to maintain and sustain the real human contact necessary to make the system work in a disaster scenario.

Our involvement with our “partners” must be based on a sincere desire to listen to and incorporate their concerns and ideas into our planning and preparedness efforts. This element is probably the most critical because it is this sincere interest that engenders trust, cooperation and understanding and allows us to truly have a “team” approach to protecting our communities in times of disaster.<sup>20</sup>

## TEAM ROLES AND RESPONSIBILITIES

Identifying roles and responsibilities is a key aspect in emergency preparedness planning. By becoming a trusted partner, designers have an opportunity to be integrated and privy to the emergency operations plan. Visibility strengthens alliance among members.

Event professionals, Eventbrite, share their expertise from millions of business and entertainment events. Knowing who on your team will be responsible for what months in advance is vital as everything comes together in the planning stage. Make sure you've designated a point person for even the seemingly small things. What might seem like a small task now can become a huge problem if you don't have a coverage plan when everyone's bandwidth is maxed out.<sup>21</sup>

## TRAINING AND SIMULATION

Training and exercises are required and they must emphasize vulnerability, reduction, and capacity building, not just compliance. Emergency management is progressive and not just reactive in orientation.<sup>20</sup>

Both Full-Scale Exercises and Table-Top Exercises are required.

- **A full-scale exercise** is an operations-based exercise that involves multiple agencies, jurisdictions, and disciplines performing functional and operational activities in a mock simulation.
- **A tabletop exercise** is a discussion-based exercise that involves senior staff, elected or appointed officials, and other key decision-making personnel in a group discussion centered on a hypothetical scenario.<sup>22</sup>

Design Thinking brings prototyping to the table as a powerful tool for gaining clarity and comparing processes with desired outcomes during training and simulation. Iterative prototyping will highlight opportunities and fuel program improvements. Prototyping helps us “pick apart our assumptions, see where we’ve made progress, and where we’ve failed.”<sup>23</sup>

## COMMUNICATION

As a tactical component of planning and response, the ability to establish communication with other entities is the leading indicator of the success or failure of an Emergency Operations Plan. Emergency communications protocols should be well-defined for all staff and regional partners.<sup>24</sup>

Understanding the communications protocols will enable designers to effectively integrate into the appropriate channels, optimizing accessibility and

interconnectedness. Additionally, “Clear, accurate and timely communication is necessary to ensure informed decision-making, effective collaboration and cooperation, and public awareness and trust.”<sup>24</sup>

Specifically within healthcare, “Preparing the nation’s private health care system to collaboratively plan for and respond to emergencies takes coordination, innovation, and continued diligence,”<sup>25</sup> but, when done effectively, can save lives.

## Response

“Emergency preparedness is a team sport.” - Eric Whitaker<sup>26</sup>

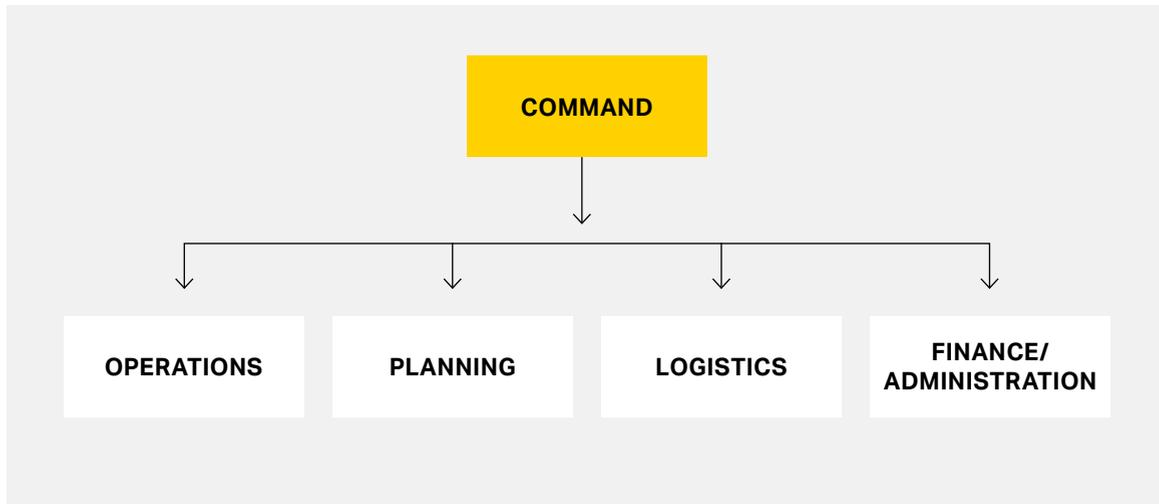
Confusion and chaos are commonly experienced by the hospital at the onset of a medical disaster. However, these negative effects can be minimized if management responds quickly with structure and a focused direction of activities.<sup>27</sup> Effective response boils down to four major components: collective action, activated command center, logistics and flexibility.

## COLLECTIVE ACTION

The relationships forged through collaboration must now be relied upon to execute action plans. “In environments of high uncertainty, inter-personal trust is essential,” if collective action is required.<sup>14</sup>

## AN ACTIVATED COMMAND CENTER

“A well-functioning command-and-control system is essential for effective hospital emergency management operations” during a time of crisis.<sup>28</sup> Defined responsibilities and clear reporting channels help unify responders.<sup>27</sup> Pre-established communication channels will link designers to the command center through logistics, positioning them to be a powerful and known resource, ready for critical action. The investment in collaboration is now realized.



## LOGISTICS

Powering 3 million business and entertainment events in a year, event management organization, Eventbrite, has vast experience in logistics. “When the rubber hits the road, you’ll need to keep an eye on a lot of things at once. Your ability to quickly respond — and make in-the-moment decisions to manage resources — is essential to your success.”<sup>21</sup>

Eventbrite pro-tips emphasize that a thorough on-site logistics strategy begins many months before an event. Even though it is called on-site logistics, this strategy requires a great deal of off-site work. A successful strategy will identify requirements, designate resources, and define execution. We have to expect the unexpected.<sup>21</sup>

## FLEXIBILITY

The unexpected nature of events, planned or emergent, requires flexibility. Great event organizers are masters of planning for the unexpected. Build flexibility into your logistics with clear communication and escalation paths.<sup>29</sup> **Though nothing ever goes exactly according to plan, with a well-built strategy, you’ll be flexible enough to meet unexpected challenges as they arise.**<sup>21</sup>

The most dramatic phase of emergency management is response. The emergency manager must be flexible enough to suggest variations in tactics or procedures and adapt quickly to a rapidly changing and frequently unclear situation. The emphasis is on creative problem solving based on the event and not on rigid adherence to pre-existing plans.<sup>20</sup>

With agility as part of our design thinking DNA, we are well suited to support emergency response efforts – providing immediate solutions, as well as leading a vision to recovery.

## Recovery

“If we shake hands before a disaster, we won’t have to point fingers afterwards.” - FEMA<sup>20</sup>

Transitioning into the Recovery phase after an event can place a further strain on the system. Responders may face burn out, organizations are focused on continuity of operations, and communities are seeking to resume a sense of normalcy. Resiliency is advanced by the





very relationships that have been forged through collaboration and commitment. In the wake of a disaster, it's important to process recovery through debrief, evaluation, a documentation of lessons learned, and identifying areas for continuous improvement.

## **DEBRIEF**

Emergency managers create and sustain broad and sincere relationships among individuals and organizations to encourage trust, advocate a team atmosphere, build consensus, and facilitate communication.<sup>20</sup> Drawing upon the culture of respect and credibility, transparent dialog is vital for debriefing. Uninhibited feedback will lead to greater insights, refined judgement, and enhanced preparedness.

## **EVALUATION**

Response organizations coordinate to develop an after-action report (ARR) which documents gaps in planning, resources, and skills. Correspondingly, an improvement plan (IP) is developed identifying means for addressing identified gaps. Successful programs depend on integrating findings into the next planning cycle.<sup>30</sup>

## **LESSONS LEARNED**

Event management organizations are adept at post-event evaluation. "Lessons learned are based on the true-life experience of an event and often come from working with and solving real world problems."

Two vastly different disasters, Hurricane Sandy and the Joplin Tornado, resulted in the same lesson learned: the location of evacuation equipment is critical. During Sandy, one facility's evacuation sleds and chairs were stored in the basement and had to be carted to an upper floor which, after power was lost, meant transporting them up many flights of stairs.<sup>31</sup> Staff at the Joplin hospital advise:

store evacuation equipment where you will need it (e.g. in storage areas on patient units.)<sup>24</sup>

In Hurricane Sandy, one facility reported all food stores were destroyed by basement flooding.<sup>24</sup>

Seemingly mundane, the location of equipment and supplies, as evidenced in these events, can have life-saving implications during a disaster. Another lesson also learned through both Hurricane Sandy and the Joplin tornado, is the need to take care of staff. Some staff suffered the loss of their own homes in Hurricane Sandy and had to shelter at hospitals or stations. Similarly, in the aftermath of the Joplin tornado, food and sleeping logistics for staff were a challenge.<sup>24</sup>

These lessons learned are examples of issues that could be mitigated through design thinking interventions. Rolling this intel into subsequent planning efforts could refine preparedness

strategies. In the poignant words of Max Mayfield, Director National Hurricane Center, "Preparation through education is less costly than learning through tragedy."<sup>32</sup>

## CONTINUOUS IMPROVEMENT

Emergency managers value continuous improvement.<sup>20</sup> In disaster situations, the one factor that is consistently credited with improving the performance of a community is the degree to which there is an open and cooperative relationship among those individuals and agencies involved.<sup>20</sup>

With a commitment to improving lives and strengthening communities, there is a rich opportunity to provide vision and leadership through design thinking. The collaborative foundation of trusted partnerships could elevate preparedness and promote resilience.

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# Over Capacity

HARVEY MUDHAR, JT JACOBS, AND CAMERON LASSITER

While the demand for online services surges, the impact caused some services to reduce content quality to ensure a consistent supply could be sustained.

Aligned with business 'temporarily' shifting to a work-from-home environment and adapting to new forms of communication apps, may pose businesses to re-evaluate their structure and offer a long-term work-from-home option to offset company overheads and carbon footprint. This increases demand to data center companies to maximise built in capacity and contingencies to the maximum, working to ensure uptime while highlighting the importance of data centers in meeting society's evolving requirements<sup>6</sup>.

Alternatively, data center companies could adopt a modular prefabricated data center units or data center racks as short to medium term solutions to mitigate demand and risk severity, as an alternative to constructing data center projects. This would support an upturn in meeting supply and demand by actively benefiting common constraints in delivery and construction. Typically, these pre-packaged units are inclusive of rack cooling and racks and can be especially effective at an enterprise or edge computing scale where smaller scale solutions are needed at a specific site. These units will typically require a separate module for electrical backup and a separate module or building for office functions.





They also require a utility yard with equipment including backup generators, transformers, and switchgear. Examples of premanufactured modules include Dell and Vertiv's modular solutions.

One solution for impacting areas with low fiber infrastructure, such as India or Africa, would be to tap into the soon-to-be-complete Starlink network. Starlink just launched its last batch of satellites needed for basic operation in April 2020. It is expected to go into beta operation in July 2020 and basic operation for northern latitude countries in October 2020. Global coverage is anticipated for 2021. With global coverage in place, modular solutions would only be limited by proximity to a power source rather than needing costly fiber infrastructure put in place.

Regular uptake on data center maintenance to monitor, manage, and minimize failure would be difficult to prevent or delay during a lockdown. To allow essential personnel to maintain uptime and availability, measures are needed to protect against illness and sustain essential service maintenance while extreme access measurements may be introduced — such as remote building management systems in reducing foot traffic.<sup>1</sup> IT equipment will be more fully utilized (virtual machines, processing etc.), and available mechanical and electrical equipment operating near planned maximums.

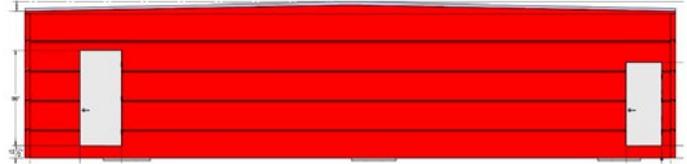
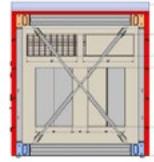
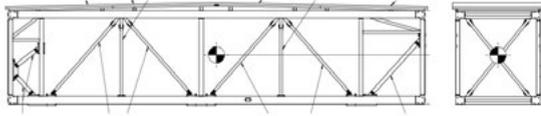
Remote working methods and reduced access to data centers have been deployed by some of the largest data center operators. Granting essential access to employees and customers comes with a requirement to follow specialized training and control measures. Common foot-traffic routes and touched surface areas are targeted for disinfecting, while screening measures are implemented to assess temperature, travel history, and any signs of symptoms. In Singapore and Hong Kong, certain

data centers implement a business continuity plan in preparedness of a pandemic by offering accommodation food, emergency generator, and spare parts. Adapting similar methods may safeguard the operation of future data centers by establishing a proactive approach rather than a reactive approach.<sup>5</sup> Data centers adopting a virtual method in approving and commissioning of testing and certificates use live streaming cameras and wireless sensors to manage sites remotely, with on-site tasks completed by a small group with safe distancing measures.

Sign-off and handover of a data center development during this situation is still viable and more intuitive as it “ended up providing us far more recorded data than we have had with traditional processes”.<sup>7</sup> This may prove to be a new measure in how we carry out tasks where previously high number of personnel involvements is required.

The supply chain for equipment has the potential to become a major issue for building a fully functional data center as it has in other electronics and manufacturing industries. Developing PPE protocols and procedures for factory workers and designing with open specifications are two potential solutions.<sup>2</sup>

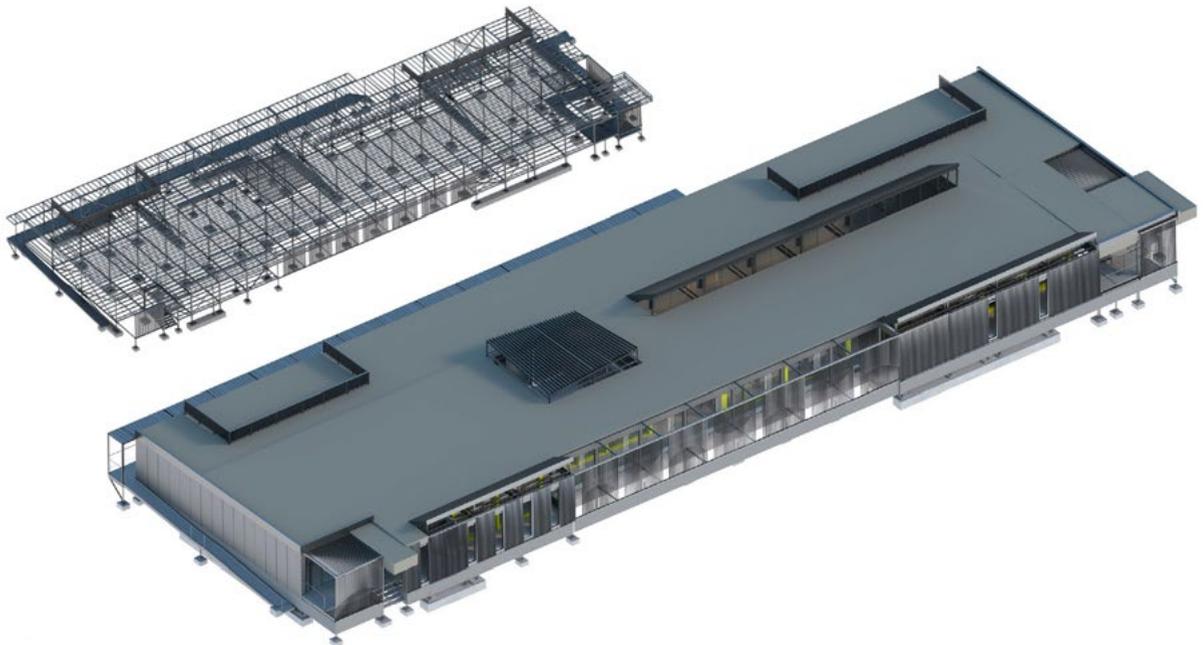
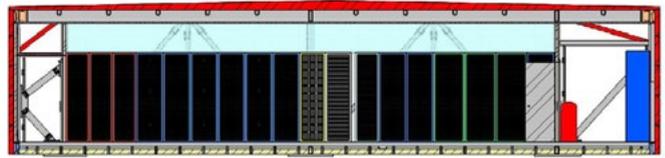
Support spaces or offices connected to data centers may be adjusted to minimize coworking and employee interaction. A limitation of flow between different areas could introduce a laboratory-style decontamination phase prior to entry. Automated measures could be incorporated within a smart building, such as calling an elevator using a smart phone or linking doors to facial recognition to allow entry to an office or conference room, to minimize employee surface interaction, ultimately push towards creating a contactless approach to buildings.<sup>9</sup>



## ROGERS DATA CENTER

**Office Building** Owen Sound, ON  
**1 Unit** Completed  
**Owner** Rogers Communication Inc.  
**Developer** 5th Essential  
**Design Builder** Z Modular®  
**GC** CRSC Data Centre Experts

Recently completed, this project quickly and affordably expanded the client's data center capacity while offering easy scalability for future needs.



Images Courtesy of Z Modular

## Mission Critical as Critical Infrastructure

Data centers will be adding/reacting to COVID-19 to add cloud capacity, while adding edge computing and reduction of latency in a more diverse realm. Governments will begin to recognize data centers and data processing as a kind of essential utility, regulations may begin to roll out regarding protection of facilities, procedures for national crises.

Data center construction will see a substantial rise. The industry may seek further commoditization of data center assets as already constrained resources in design and construction are further tested by a growing market.

Expect more modularized solutions to be explored for speed to market, reduced cost or labor. Data centers may also seek out technologies that more fully utilize mechanical and electrical capacity, like large scale adoption of RISC or MIPS processing, which might allow higher compute density per watt of power. Business will evaluate their cloud strategy and shift the IT landscape, possibly reducing IT workforces within private companies.

## Rapid Deployment for Uninterrupted Access

Adjustments to what the industry expects will be the 'new normal,' with higher demand for cloud services and constraints at the 'last mile'.

End users will continue the push towards a 'thin client' model of computing, with ever-improving access to the cloud and the robustness of cloud application offerings. Connectivity will become increasingly important to daily work activities.

Half of the world's population lives along near a coast, and off-shore data storage capsules offer opportunities for rapid deployment of infrastructure that capitalizes on the ocean for cooling and electricity generators. Two companies who have come up with water-based data center solutions include Microsoft's submerged Natick and Nautilus' floating barges.<sup>4</sup>

Some companies may re-evaluate their risk profile and consider increased resiliency in their systems designs (moving from Tier III back to Tier IV).

With the rollout of 5G underway, the biggest focus on connectivity will be with fiber infrastructure, which will become even more essential but eliminate connectivity issues at point-of-use for most people. 5G opens the market for further milestones in technological advancements, particularly autonomous driving.

Liquid cooling parts to replace air cooled parts such as servers and chip which tend to overheat. Google released chips required to be submerged in liquid to cool off. Offshore (Microsoft Project Natick) data centers can be a possible alternative, however a submerged data center could cause sea level warming and maintenance constraints. The collaborative efforts by Nordic DC and DigiPlex to create a heat reuse system to convert excess heat loss into local residential heating system. A future closed-loop data center may pave the way for a more green data center model!

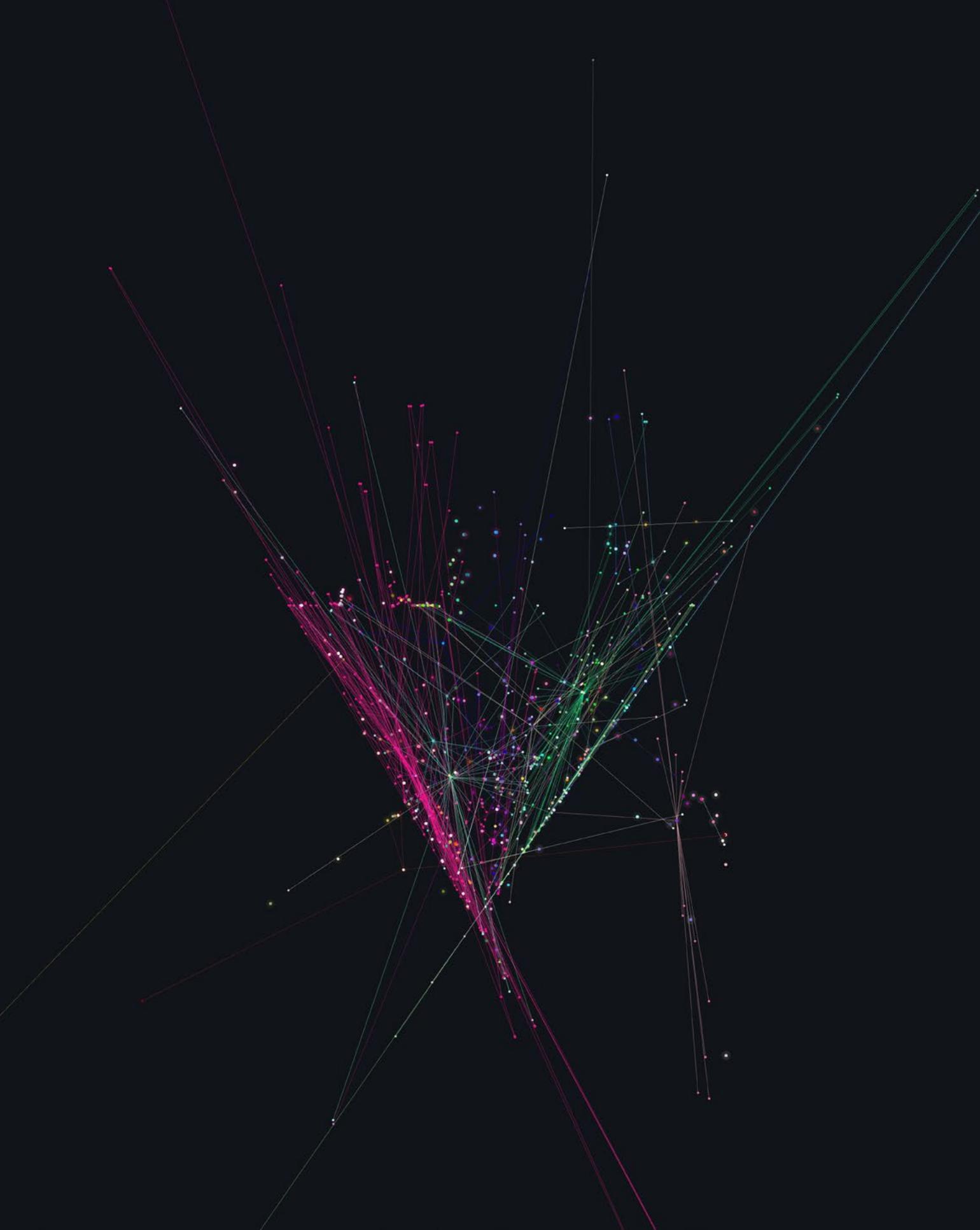
Another land-based solution at the hyperscale is the incorporation of modular building blocks that can be assembled rapidly onsite. Components would have pre-assembled walls, furnishings, and equipment. The construction industry found significant cost savings in this approach by reducing the time in the field which is expensive and focusing labor in large buildings where labor is cheaper, and the controlled

environment makes modules faster and easier to construct. A limiting factor with modular design is the dimension restraints brought on by transportation. A modular building could be used for a hyperscale air cooled solution preferred by most cloud providers today, or a smaller liquid cooled solution that some in the industry are aiming towards using in the future.

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# 03

## CROWD CONTROL

Before COVID-19, our day-to-day interactions had already begun evolving toward an increasingly seamless world. Lessons learned from the pandemic not only challenge us to reconsider social norms but also demand that responsibly designed spaces support our new best practices — minimizing touchpoints and providing options that maintain the humanity within our experiences while at the same time, mitigating the risks of person-to-person contact.



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# Bridge to the New Normal

**CHEYNE BROWN AND ROBERT BIELAMOWEICZ**

The transition from the office to working from home was abrupt and disruptive. When people come back to the workplace, individual mindsets, rules of engagement, and operations will have changed. How can end users, building owners, brokers, and developers begin to prepare for the future? We set out to collect ideas and answer this question as a starting point for conversation with existing and potential clients.

## **THE UNKNOWN FACTORS**

At the time of collecting this knowledge, many factors are still developing. Scientific discovery and metrics are in the news daily. Policies are evolving to attempt to balance between curbing the spread of Covid-19 and the staggering impact it has had on the economy. With no vaccine in place, the extent, timing and duration of the virus's impact are unknown and even the most advanced predicative models show a wide range of outcomes.





# Top 5 Considerations

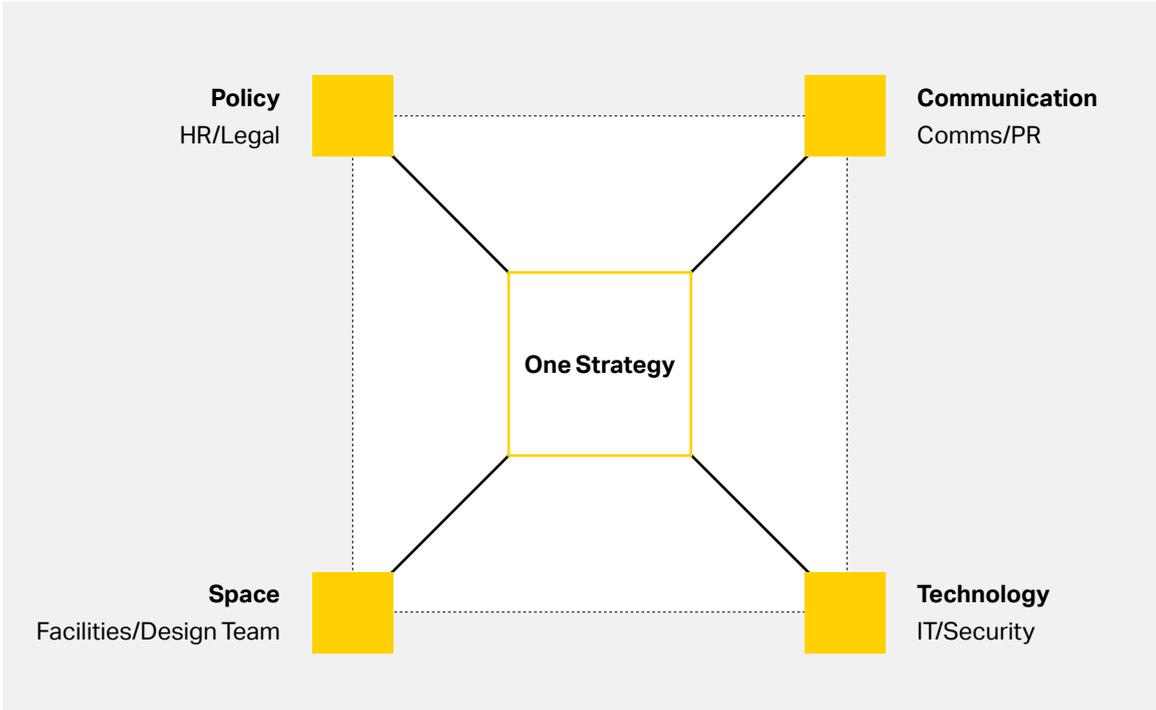
While office buildings sit empty is the ideal time to make modifications to the space to prepare for the inevitable return to the office. Teams should be formed to develop a transition strategy for who comes back to the office, how to make people feel safe, how to support health and wellness, and the modifications that need to be made now to enable the return to the workplace. To be successful, that strategy needs to be a unified approach that brings together a diverse team to tackle the problem and then sets forth a clear action plan.

With so many questions and unknown factors, it can cause confusion and paralysis, not knowing where to begin with so little concrete information. We have gathered ideas from thought leaders across the firm and we have broken the ideas down into five main areas of consideration.

## BUILDING INFRASTRUCTURE

Arguably, one of the most straightforward places to start is with **analyzing building infrastructure**. Evaluate building systems for both performance and future adaptability to emerging technologies.

- Complete maintenance and renovation projects in high use or difficult to access areas.
- Improve IT systems to support higher technology use.
- Improve AV systems to support increased video conferencing.
- Improve HVAC systems for better air quality through filtration, ventilation, condensation management, and allergen removal. Zoning can be changed to isolate areas from each other to reduce possible cross contamination.
- Improve light quality, including access to daylight, to better support the health and wellness.



## OPERATIONAL MODIFICATIONS

From an operational standpoint, limiting the number of people in the space is one of the best ways of supporting the social distancing measures that will be in place when people return to the office.

- Control building access and entry points, including service entrances. This could be through separating “in” and “out” points, restricting visitors, staggering start times and initiating counting measures.
- Limit the number of people in confined spaces, such as elevators and restrooms. Consider posting occupancy limits and adding occupancy sensors.
- Establish fully functioning neighborhoods with all required support spaces to separate tenants, departments, or teams from each other.
- Create clear paths of travel and one-way circulation as much as possible.

Touch points are locations where people have frequent contact, such as door handles and elevator buttons. Understanding and controlling touch points can not only help protect people from virus transmission but will also help alleviate the newfound anxiety that comes along with that interaction.

- Conduct journey mapping to understand common paths that people travel and the high touch points along the way.
- Eliminate touch points as much as possible by converting to hands free use. Automatic doors and motion sensors, doors on hold opens, and touchless fixtures are readily available products. Elevators can be addressed through destination elevators, voice activated elevators, or by providing an operator to open doors and push buttons.

- Provide hand washing or sanitization at touch points that can't be eliminated.

It is quickly becoming socially acceptable to wear personal protection equipment. This shift is extending to practices in buildings, too, where providing protective measures can support health by both avoiding introducing contaminants into a building and helping limit their transmission after people enter.

- Conduct temperature checks at entrances, including employee, staff and services entrances.
- Once testing becomes more readily available, conduct testing on site. This could occur outside the building as a walk up or drive up testing center prior to entering the parking garage and building.
- Modify mail room and train staff to safely process and deliver packages.
- Develop a strategy for managing local delivery services, including food services like Grub Hub and Uber Eats.
- Provide masks, face shields and other personal protection equipment. This could be a branded element that adds some culture or fun and encourages use.

## WORKPLACE ENABLEMENT

New planning guidelines and product development are racing to the market at hyper speed to try to offer a prescriptive solution. We know that designing places where people work requires a thorough understanding of the parameters, the culture and needs of the organization and the solution will likely look different for each client and each space. Through thoughtful planning, we can support work on a transitional basis while long term solutions are still being developed.

**Personal work areas**, such as offices and workstations, are a particularly high area of concern. This is space people can't avoid and may not be able to control.

- In open office areas, review workstation layout, orientation and spacing. In dense layouts, the simplest way to ensure distancing requirements is to occupy every other seat for greater separation.
- Provide protective shields or stacker panels for extra separation.
- At assigned work areas, enhance cleaning protocols and desk sanitization. A clean desk policy removes clutter, allowing the janitorial staff access to clean and disinfect surfaces.
- At unassigned work areas, focus on the high touch elements. Cleaning protocols may already be in place to sanitize between users, so consider assigning a keyboard and mouse to each user that can be stored in a locker or taken with them after each use.
- For locker storage, provided dedicated lockers instead of shared or disinfect after each use.

**Fully functioning neighborhoods** break a floor plate down into multiple separate work environments to localize access and reduce cross over between departments or teams.

- Restrict access by neighborhood through signage or key card access.
- Provide all necessary support spaces within the neighborhood to insulate each team.
- Plan a clear path of travel with direct access to each neighborhood.

- Modify circulation for one-way travel where possible. Simple arrow signage can inform people on the best path of travel to avoid congestion.

**Shared spaces** support collaboration and build community, but often come with a higher density occupancy. With increased awareness of proximity to other people, shared spaces will need to be evaluated for use, furniture, power and technology requirements.

- Consider repurposing large amenity spaces and multi-purpose spaces to support increased distancing requirements. Shared conference centers and break rooms can become individual touch down spaces.
- Reduce occupancy of medium and large meeting rooms by removing the number of available chairs. Support meeting room restrictions by disabling or placing limitations on room scheduling systems.
- Convert huddle rooms and other small meeting spaces to individual use.

**Food and beverage service** is an amenity that people have come to expect in an office space. Whether it is a full-service cafeteria or a satellite coffee bar, safety measures will need to be put into place to reduce the potential for contamination and make people feel comfortable using these services.

- Provide touchless beverage and ice dispensers, including water and coffee.
- Suspend self-serve options like salad bars where control is difficult to maintain.
- Close dining areas or reduce occupancy to support social distancing requirements.

- Offer take-out options that are either prepared by trained culinary staff or pre-packaged.
- Support online ordering and no touch payment.

## CLEANLINESS

Cleanliness is one of the best tools in prevention of illness and infection. Common in healthcare and medical environments, structured protocols and a **rigorous approach to cleaning** is having a heavy influence on the workplace.

- Evaluate number and size of sinks to support the increase in both hand washing and cleaning protocols. Placing sinks in visible locations helps reinforce the behavior.
- Consider cleanable and anti-microbial surfaces. This does not mean that all finishes should be removed and thrown in a landfill, but rather that materials that are commonly used in healthcare environments may become more mainstream in office and other spaces.
- Determine a strategy for trash collection. If located in a centralized area, there are fewer locations for potentially contaminated materials to be collected. If locations are distributed, fewer people interact with a single collection site, reducing the chances for contamination. Touchless solutions are ideal regardless of the approach.
- Separate janitor's closets into clean and dirty rooms, similar to common practices in healthcare and hospitality spaces.
- Supplement building janitorial program with additional staff and training.
- Provide easily accessible cleaning products to enable users to do more incremental cleaning.

- Provide cleaning status notifications as a visible indication that a space is clean and safe to use. This could be used for any space type from desks to restrooms and could be as simple as a sticker or color code system.

## MENTAL AND PHYSICAL WELLNESS

A frequent topic of conversation even before Covid-19, mental and physical wellness has stepped into the spotlight. Wellness programs have been used as a practical tool to reduce absenteeism and improve the quality of life for occupants, but also as a recruiting and marketing tool, **demonstrating a company's commitment to its people**. In this time of high stress and fear, it is even more important to keep wellness top of mind.

- Offer healthy, immunity boosting foods in the form of pre-packaged offerings with emphasis on fresh fruits and vegetables.
- Encourage physical activity through fitness programs and incentives.
- Provide access to the outdoors, including furniture that supports both leisure time and work. This is especially important as people have become accustomed to open windows with fresh air and the ability to step outside at will during their time working from home.
- Offer healthcare support on site. This could be virtual or an in-person clinic and could offer education, health checks, testing and protective equipment.
- Reinforce policies that encourage people to stay at home if they are sick.
- Increase and clarify flexible work arrangements, including work from home and personal time off policies. Personal complexities, such as childcare or elderly care, may still be challenges even after people return to the office.

As the gradual shift back to the office occurs, **providing transitional support** will be important to encourage safety without stoking fear.

- Identify key people to act as leaders or captains to help navigate the transition. Arm those leaders with knowledge and tools to be able to educate and support others.
- Establish a fixed location, like a help desk, where information and materials can be found.
- Create a welcome back package with essential tools and communications. This kit can be branded to reflect the company culture.
- Establish behavioral training and authentic, appropriate language. Educate people on how to tell someone they are standing too close or they should cough into their elbow.

A thoughtful **change management plan** aligns a company's policies, spaces, technology and communications.

- Maintain the frequency and transparency of communications. With the abrupt shift to working from home and high rate of change, people have become accustomed to receiving regular updates on company policy.
- Make the invisible known. Share additional wellness measures and cleaning protocols that have been put into place to keep people safe and healthy. Increase awareness of high touch surfaces and social distance recommendations.
- Establish and communicate safety plans and health alerts should a user become sick.







# Campus Health and Advancement in Response to COVID-19 – a Phased Approach

BOB ERICKSON, CARINA CLARK, TODD LEHMENKULER, JOHN MEDCALF, ERIC THOMSON, JARED BLISS, SAMANTHA FLORES OF CORGAN, AND STUART SHELL OF BRANCHPATTERN

Over the course of one month, we watched as one school district after another locked their doors for the remainder of the 2019-2020 school year, as a method to reduce community spread of the Coronavirus. Nationwide, a reported 124,000 U.S. public and private schools have been impacted by school closures, which has affected at least 55.1 million students.<sup>1</sup>

This sudden jolt to our education system will certainly have a lasting impact. Without warning or choice, we became at-home educators while adapting to the new normal of balancing our own careers from home. Having our children at home has been a powerful reminder of how dependent we are on schools for our own personal success at work, the success of our familial institutions, and the full and attentive education of our children.

It is too early to define what the future educational environment will look like long-term. At a minimum, we can anticipate seismic shifts in both the regulatory environment and the implementation of technology for learning environments. As we evolve past the current “reactive” state and the pandemic mentality subsides, we must now begin to look to the future and plan for the upcoming school year of 2020-2021, and beyond. The challenge, however, is that this crisis is evolving daily, and the certainty of our educational future is still unknown. However,

several possible scenarios are likely to present themselves as we look toward this coming August and the new school year.

## Scenario 01: Schools Remain Completely Closed

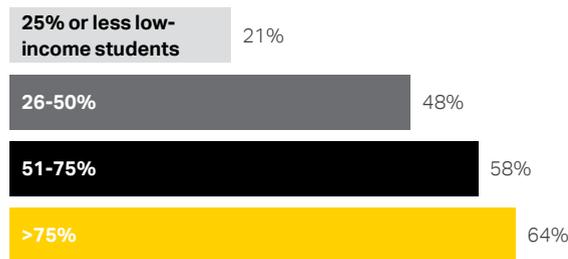
History repeats itself. Previous pandemics such as the Spanish Flu in 1918, enacted school closures for American schools, showing success in reducing viral spread to communities when schools closed earlier and for a longer period of time. School closures tend to be one of the more useful tactics in preventing viral spread, simply because it fits into natural human behavior — we are familiar and comfortable with schools periodically closing for summer, fall, winter, and spring breaks, because we have learned how to adapt to these seasonal shifts.<sup>2</sup>

But today's closures are a much more delicate situation than in 1918, as it is more common today for both parents to have steady careers outside the home environment.<sup>2</sup> If we as a country decide to remain in the current status of full closure, we must better prepare to teach and learn remotely with the aid of technology. This possibility is a challenge for many reasons. According to Education Week,

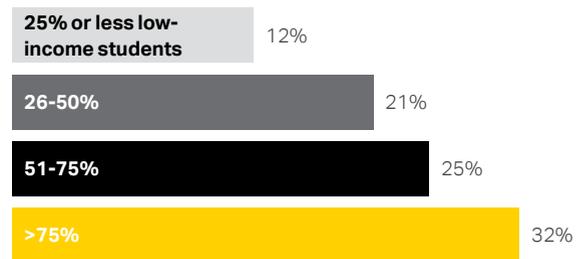
*"Two of the biggest hurdles to moving America's schools online have been an inadequate number of digital devices for students and millions of families' lack of high-speed internet at home. These gaps in basic technology access are particularly stark along socioeconomic lines: In districts with the lowest percentages of students from low-income families, just 1 in 5 leaders reported in late March that a lack of basic technology is a "major" problem, compared with nearly two-thirds of leaders in districts where the highest percentages of students are from low-income families".<sup>3</sup>*

Even in suburban communities, where it is typical to see higher ratings in education systems, we are barely seeing the ability to provide remote learning to half the student population, rising only to 62%.<sup>2</sup> As we have seen in recent decades, technology will continue to reshape school facilities and individual learning spaces. For this to succeed, we must address home internet access for all — a project currently being led by the private sector. Equitable internet access and emergent norms of digital citizenship are fundamental to the success of students as they navigate a new educational paradigm. This is not the scenario Ivan Illich imagined in his polemic work *Deschooling Society*<sup>4</sup>, yet many of those progressive educational ideals are becoming reality.

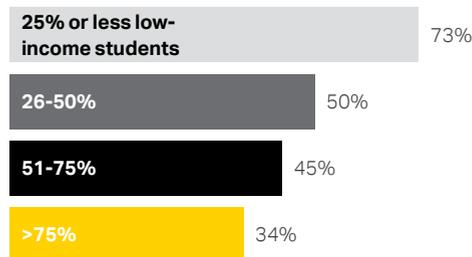
Now, as we are amid this pandemic and are made acutely aware of the disparities — not only between school districts, but even within them — we should continue to advocate for access to high-speed internet, extend the reach of broadband, and "close



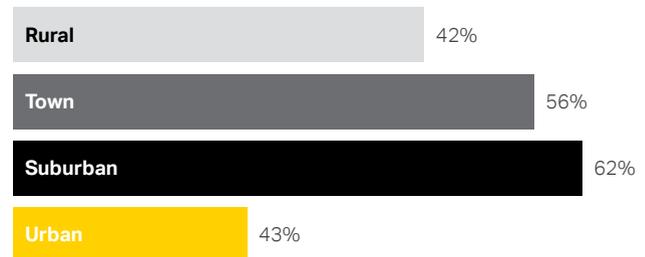
Percentage of district leaders who said students' lack of technology access is a major challenge to teaching during coronavirus-related closures



Percentage of teachers who said their students were essentially "truant" during coronavirus-related closures



Percentage of district leaders who said they were able to provide online learning opportunities to all students during coronavirus-related closures.



Source: EdWeek Research Center

the 'Homework Gap' so we connect millions of children who desperately need to get online for school".<sup>2</sup>

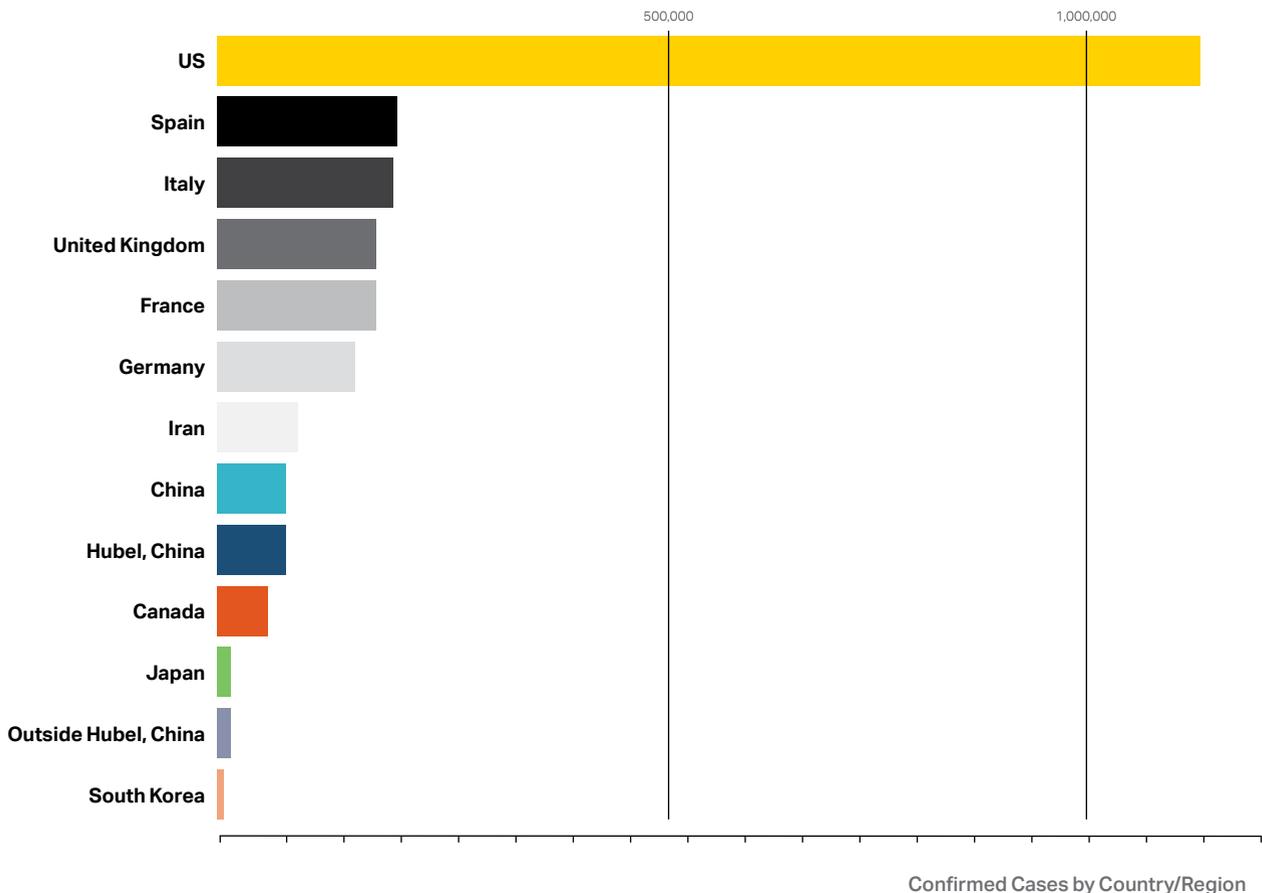
While this scenario is very much needed and may see accelerated adoption due in part to the recent pandemic response, it is very unlikely that in the span of 2.5 months, every school across the U.S. will have the access to technology needed to support continuous school closures. Nonetheless, solutions like this, where teachers and students engage in virtual only classes, activities and events, are considered by the CDC as "low-risk" situations, and are very viable routes for education pre-vaccine.

## Scenario 02: Schools Completely Re-open

Understanding this is likely not the last time we will face a pandemic or rapid viral spread, we must

realize that typical pre-COVID-19 lifestyles, spatial requirements and capacity within all building types will change as a result — especially educational facilities. The manner in which we design buildings, and the attention we pay to the health and wellness of the indoor environment, will gain momentum for the unforeseeable future, if not forever.

According to medical professionals, reopening in August for the upcoming school year would mean that we would likely be reopening pre-vaccine. In an interview on the Today Show on April 30th, 2020, Dr. Anthony Fauci, M.D., and the current director of the National Institute of Allergy and Infectious Diseases (NIAID), mentioned that a vaccine for the novel coronavirus might be ready for use in January 2021.<sup>5</sup> This comes as the U.S. is leading in number of cases reported each day, and in total number of cases globally.



Classroom scenarios as we have known them pre-pandemic — with full-sized in-person activities and shared materials between students — are classified by the CDC as “high-risk”, as students continue to mix between classes and different activities. In the coming months and years, attention to resilience and infectious disease will reshape the regulations that school administrators must navigate. Considering current classroom capacities and the potential inability to maintain social distancing guidelines, reopening educational facilities as they are today with no spatial, scheduling, or ventilation modifications may not be possible in a pre-vaccine scenario.

## Scenario 03: Schools Re-open in a “Hybrid” Model

A hybrid approach using a strategic and appropriate mix of both remote learning and in-classroom interaction is most likely to be adopted as a near-term, pre-vaccine solution. Considered by the CDC as “more risk” — or in some cases the “hybrid” approach — small, in-person classes can be held separately, with students and teachers maintaining social distance and not mixing with each other in between classes. However, we must first educate ourselves and the students in acceptable and appropriate interactions within this delicate environment, provide a new standard of personal and building cleanliness, and find ways to reduce our school population at any one-time to maintain distancing requirements.

We must now look toward what physical and behavioral modifications will be required for any school to re-open in the future. Looking at potential immediate, intermediate, and long-term responses, we can begin to identify what topics and ideas are needed in four important categories: planning and design, administrative, facility & site maintenance,

and technology — improving the NEEDS of every school to re-open and to re-populate with students and staff moving forward.

### PHASE I: IMMEDIATE RESPONSE

*(60-day timeline/June-August 2020)*

Solutions for Phase I: Immediate Response are based on what we currently know now through the CDC and accredited agencies. Evaluations and strategies to combat COVID-19 are changing daily. Until we know the new permanent solutions in design and environmental cleanliness, resolutions proposed during this phase are temporary solutions that can be incorporated immediately in planning and design, as well as nursing operations. The administrative changes proposed reside mainly with incorporating new policies, procedures and behavioral modifications on how building occupants use and behave in the space around them. Such as recommending that both staff and students wear masks to school, and to self-quarantine at home when necessary. Facility maintenance focuses on products and cleaning methods that are known to work today. These cleaning methodologies are expected to be updated as new discoveries are found in how to mitigate and/or eliminate the coronavirus from our surfaces and building environments.

One of the most visible shifts we may see in pre-vaccine classrooms, however, is the response to social distancing. We know that students (like working adults) prefer more personal space. Student outcomes are generally better if they have more floor area, too. Social distancing to reduce infections is further support for larger classrooms, smaller class sizes, or both. These will give more space for students to manage their personal space — one of the greatest affordances available. Some flexibility in how students are physically present, for example, sitting on the floor, in a chair, or standing, is also an exercise in executive functioning that supports the learning process.

Some pre-vaccine modifications that can be enacted immediately are:

- Incorporate sanitation stations at all campus entry points, as well as both exits and entries to restrooms and classrooms
- Screen for illness before leaving Home
- Arrive at school wearing required PPE apparel
- Incorporate legislated nursing and healthcare operation protocols
- Develop contact tracing protocols
- Reduce class sizes through various schedule modifications
- Policies and procedures in learning how to use and behave in school spaces
- Introduce school wayfinding and COVID-19 response signage
- Set enhanced procedures for ongoing building maintenance and cleaning

Technologies suggested in Phase I are mainly procedural processes, that are provided and tracked manually until there are more wide-spread technology advances available and affordable across all platforms to all schools. These newly required technology capabilities are expected to be available in the next 1-2 years during Phase II: Intermediate Response.

While it is our responsibility to build healthy environments that support the wellbeing of the occupants, it will never be possible to completely assure all occupants are 100% free from being exposed to an unknown virus. However, through heightened measures in our personal behaviors, along with new set standards of cleanliness in our interior environments, we can minimize exposure to COVID-19. This phase provides measures that

are available now, to upgrade building standards to a level that we as a society feel confident to occupy these environments without fear of illness.

## **PHASE II: INTERMEDIATE RESPONSE.**

*(12 - 24-month timeline/August 2020 – August 2022):*

During Phase II: Intermediate Response, we look at what can be preplanned and incorporated to mitigate risk in our existing schools, while simultaneously allowing the practice of educating others to flourish. This phase will begin to incorporate permanent changes to the existing indoor environment, including building renovations and systematic changes, as well as signaling behavior changes to students, staff, parents and community.

As information regarding COVID-19 continues to develop, we will learn how to design more permanent solutions that can be incorporated into our existing educational facilities. In addition to nursing and healthcare operational upgrades, other suggested adjustments in the learning environment have surfaced, such as:

- Stagger student groups arrivals/departures
- Alternate day schedules by grade level, allowing each grade to make use of all classrooms throughout the school on their given day
- Introduce food service to those cafeterias that may currently be self-serve
  - This reduces the amount of hands that may be touching a single-wrapped self-serve product
  - Monitor queuing lines to maintain social distance by adding a brightly colored signifier on the floor.
  - Consider serving individual meals in classrooms

Many other aspects will influence the variations on this hybrid approach. As schools change, we will see corresponding changes in households and in the workforce. Rapid technological advancement could potentially allow for remote school attendance, including off-site locations, part-day sessions, and entirely home-based education — which would support staggering attendance schedules. Employers will react to these changes in a way that best suits their needs, with many businesses entertaining the idea for a more flexible home/office arrangement, enabling parents to monitor and supervise their children at home on the necessary days. Parents may be given an educational “menu” of different attendance opportunities available for their child that best fits their work schedule or the desire of their family.

Additionally, leveraging already growing advancements in educational technology and tools, such as Virtual Reality (VR) lessons, could create better connectivity and allow students to engage in remote interaction with larger groups. Using VR as an educational tool has in recent years proven to be a successful tool in creating deeper memory recall for the lessons learned.<sup>6</sup> This could also improve the current remote teaching model, where teachers can now create lessons that are engaging and students are learning by doing. Lastly, VR solutions do not have to be a drain on an already tight educational budget — Google cardboard leverages a person’s iPhone, and the headset itself can cost as low as \$10.<sup>7</sup> Consider the value gained, when students can use this device to learn in a virtual space together during times of isolation.

### PHASE III: LONG TERM RESPONSE

*(24 month & beyond timeline/August 2022+)*

Without a cure for COVID-19 and the many future uncertainties, the long term physical & philosophical design changes in buildings are currently in question. Our behavioral norms, and therefore the

buildings in which we inhabit, will change, but to what degree is simply unknown.

When we think about the ecosystem of a school, the classroom serves as a home base for students and teachers. Classrooms strive to provide the right context for learning with a safe, engaging backdrop for curriculum and social interaction that are most associated with student achievement. In the wake of COVID-19, and in the interest of mitigating against future pandemics, the physical environment of the classroom may change significantly.

Mechanical systems serving schools impact air quality, an invisible feature of classrooms that will become increasingly important for resilient design. When feasible, operable windows are a proven intervention in classrooms that can be integrated with HVAC operation. Regardless of window design, ductwork must still deliver adequate fresh air to the classrooms. Equipment should also provide filtration and comfortable temperature and humidity. For example, a common design for classrooms with 25 students is to provide outdoor air at the rate of 15 cfm per person and MERV 7 air filters. A sick child who coughs in the room creates a risk of infection for other occupants. Increasing the ventilation to 25 cfm per person reduces the estimated number of children infected by two. Providing MERV 13 filters instead of MERV 7 has a similar effect. **These estimates are based on the happè calculator developed by BranchPattern, using research on Influenza A.**

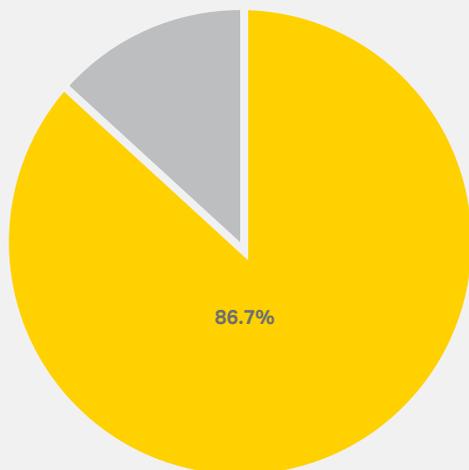
Recent research highlights another powerful reason for schools to increase outdoor air rates: cognitive functioning. Increasing from 15 to 25 cfm could increase strategic thinking skills by 22%.<sup>8</sup> This is also an estimate generated by the happè calculator.

In a more visible approach, new designs may incorporate the “neighborhood approach”,

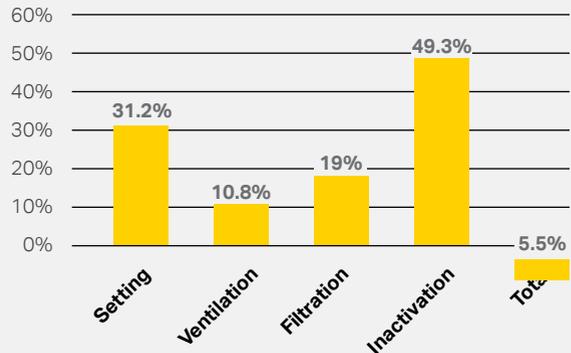
## RISK OF INFECTION CALCULATOR

INPUTS	
Number of Children	25
Number of Employees/Adults (18+)	5
Weighted Average Salary of Employees	\$72,000
Room Height (m)	2.74
Room Area (m <sup>2</sup> )	70.2
Number of Rooms per Facility	15
Relative Humidity	30%
Air Changes per Hour (ACH <sub>R</sub> )	2.5
Filter Type	MERV 13
Design RH	40%

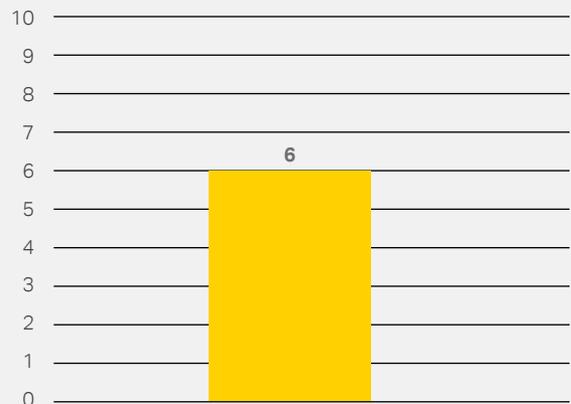
## DESIGN AEROSOL FLU PARTICLE REMOVAL TOTAL EFFICIENCY



## CHILD PROBABILITY OF INFECTION (INFLUENZA A)



## DECREASE IN ESTIMATED NUMBER OF FLU INFECTIONS VIA AEROSOL TRANSMISSION



### Decrease in Children Infected / Flu Season

These estimates are based on the Health and Productivity Performance Estimator (happē) calculator developed by BranchPattern. This calculator uses selected research as a basis for quantifying the human impact that results from changes to indoor environmental quality. Understanding that designers and building operators are struggling to choose between technologies that improve air quality, BranchPattern's team recently added a Risk of Infection Calculator to the tool. The web version that is being released in June 2020 will allow a user to optimize several strategies for improving IAQ based on existing research into viral (Influenza A) transmission.

Figure: Outputs from BranchPattern's happē calculator using an example elementary school design provided by Corgan.

offering direct access to food, water, bathrooms, and cleaning areas, which been best practice in early learning environments for decades. Spaces for older learners continue to borrow this type of integrated pedagogical principles from Montessori, Reggio Emilia, and Waldorf philosophies. Adding sinks to classrooms for learners of all ages is a courteous gesture towards our whole selves — especially when we are in rooms for more than an hour. Sinks also offer the best cleaning intervention in the form handwashing. A transition area in the classroom is also an invitation to adjust personal garb and protective gear for the space occupants are entering.

While it is too early in this pandemic to definitively describe what the future educational environment will look like long-term, there will be a raised baseline standard, likely at the Federal level, to provide a new set of requirements for all buildings. If well-designed, these standards will make access to quality schools more equitable, lessening the disparity across geography and socioeconomic

status. Requirements for buildings may be implemented and reinforced through building code requirements. Certain heightened requirements will target the entire facility, and, in some cases, the classroom environment will completely transform to comply with new cleanliness and distancing requirements. State authorities may also increasingly require performance-based measures that demonstrate indoor air quality and proper HVAC operation. When these systems and policy changes work together in symphony, there is a strong chance we will be able safeguard the health of indoor learning spaces.

Our educational institutions are in most cases the foundation for a person's character, confidence, and identity as a part of a larger societal whole — an identity that has been completely upended due to current circumstances. However, we are a resilient breed, and will find a way to adapt. Our schools will not be closed forever, but we must consider the health, safety and equitable access to every student before we can reopen.

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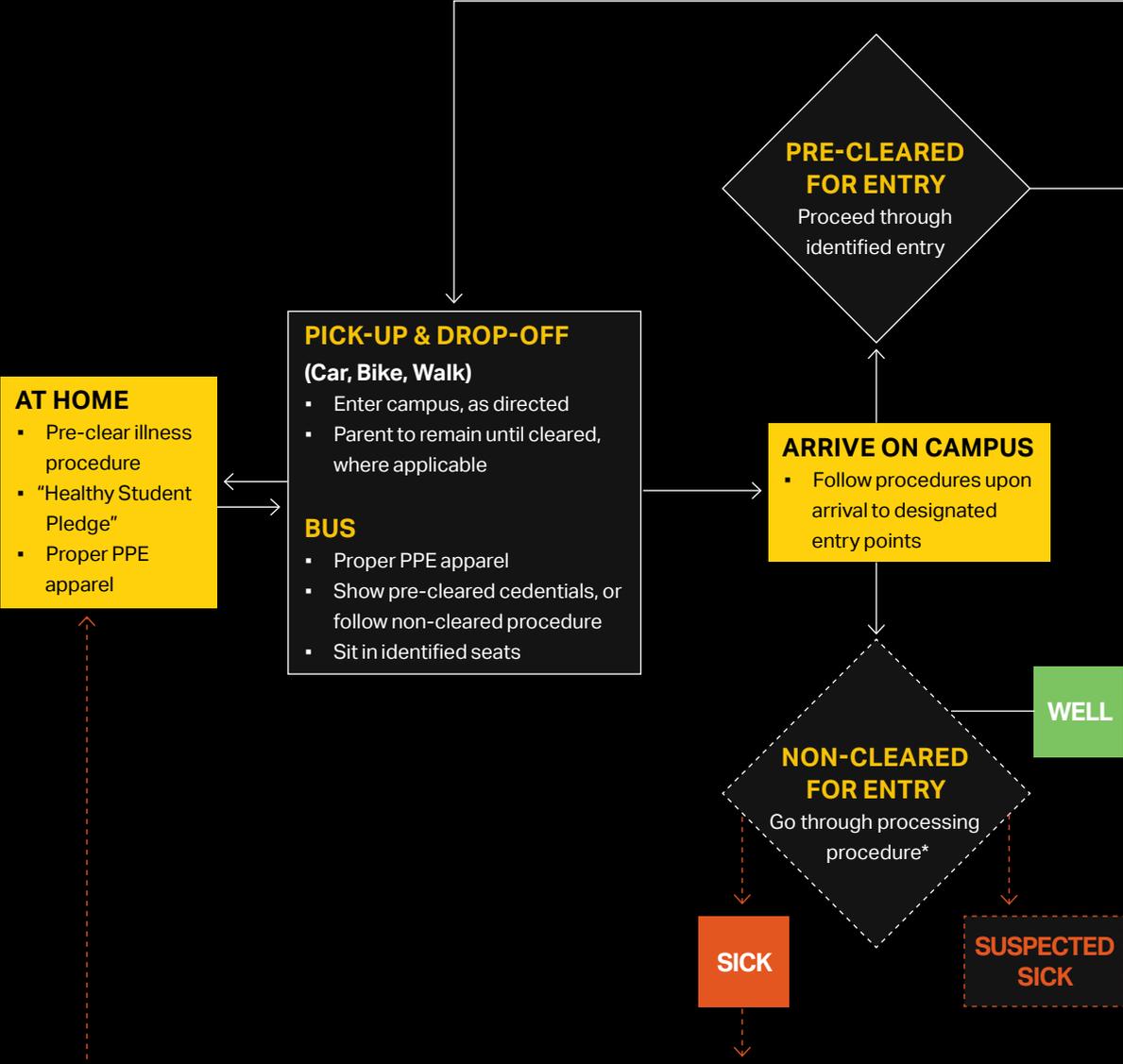
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# Educational Facilities

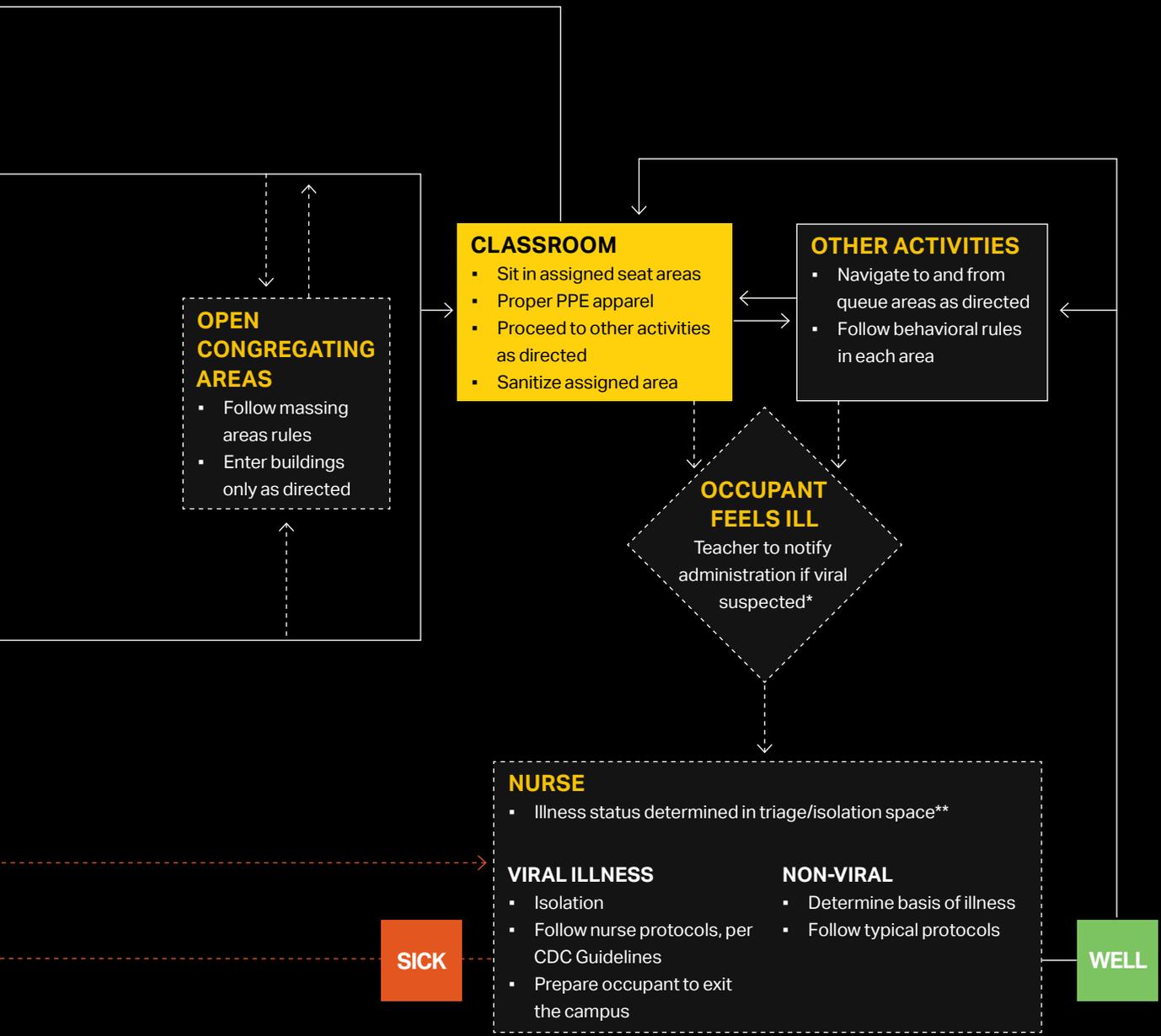
## Daily Journey, COVID-19 and Beyond

This journey takes a glance at probable tasks and decisions that would be part of a daily routine as occupants utilize any educational facility in the current and post-COVID-19 life. This list of procedures and protocols will change as new discoveries are made and guidelines are mandated per our governing authorities.



\* Under current CDC identification protocol (Example: MIS-C (Multisystem Inflammatory Syndrome in Children Associated with COVID-19))

\*\* Triage area can be temporary conversion of spaces (cafeteria, gym, etc.) until a permanent space is created





# Behavioral Reinforcement in Terminal Environments

SHELLY NICHOLS OF CORGAN AND STUART SHELL OF BRANCHPATTERN

When considering designing space for the sole purpose of infectious disease control, the airport terminal environment is not the ideal solution that comes to mind. This is because terminals — and particularly the airside concourse — are deceptively complex in function and operation, accommodating overlapping programs that change in intensity and size over the course of a day, all in a single space. Food service, retail, restrooms, and boarding of the aircraft are established programmatic airside elements, while other behavioral activities — such as waiting, childcare, conducting office work, and occasionally sleeping — are not specifically indicated as programmatic spatial requirements, but are behavioral activities that typically occur within the terminal environment. These activities should be taken into consideration as we begin to understand how to manage viral spread and reduce its impact.

Managing the spread of disease is easier when larger spatial divide between people can be achieved, and where there is not eating and toileting — such is not always the case in the airport. Gate lounge dwellers tend to wait for long periods of time for their flight in the seating provided, while others are constantly moving from one waiting area to the next, checking out the provided amenities, or making purchases in nearby retail or food and

beverage location prior to boarding. Each of these transactions is a scenario that supports increased viral spread. These interactions are opportunities where people share more than a boarding pass with each other. And while we want to continue to encourage enjoying the customer experience that we have been developing as an industry for many decades, we also need to seriously consider some straightforward concepts that might help lower the risk of infection in terminals.

Compartmentalization can reduce the number of people within a breathing zone is a clear path to fewer infections. This could mean creating purpose-built spaces with controlled air zones for TSA screening, or even doors and windows to separate shops, restaurants, and the food court from the concourse. This concept could also introduce U.S. domestic airports to enclosed call-to-gate lounge scenarios for boarding, mimicking similar operations in Changi and Heathrow. Each of these zones could be treated by separate HVAC equipment, with pressure held negative to circulation spaces for better filtration where people are more likely to be congregating. If this type of programmatic overhaul were achieved, the concourse may function more like a walkway, separated for one-way traffic. This scenario may encourage “waiting” to happen in other locations

throughout the terminal, introducing a staggered call-to-gate scenario that allows people to be alerted in the event of their specific boarding time, reducing large crowds at the boarding gate and spilling into the concourse. To achieve this, a certain level of trust in operations would need to be established, so that people abide by any personal notifications regarding call-to-gate and boarding times.

Other behavioral reinforcement strategies can help manage the density throughout the terminal, such as a smart gate assignment, which would help avoid crowded collisions in the event that adjacent gates are boarding. Of course, delays occur, and some crowding may be inevitable. However, anxiety around flying tends to be a strong influencer in crowding behavior in airports. Providing useful information at the right time can help alleviate the fear of missing a flight or getting the middle seat in unassigned airline boarding operations. In this particular instance, information transparency is key. Contrary to popular belief and healthy skepticism, 87% of consumers are willing to share data in exchange for a uniquely personalized experience.<sup>1</sup> As the post-pandemic mindset makes way for universal biometric screening methods, it will only be a matter of time before we see a biometrically enabled airside infrastructure that caters to passengers in a more humanizing way from personal navigation to specific gates, to real-time information around boarding procedures, minimizing congestion points.

Leveraging existing infrastructure we are already attuned to acknowledging for this personalized information is key, using biometric facial recognition throughout concourse information displays to inform passengers of their own personalized journey. IBM, Delta Air Lines, and Misapplied Sciences recently launched Parallel Reality, a new display that lets many different people see personalized travel updates on the same screen,

simultaneously. However, each person can only view information relative to their personal journey -and no one else's — minimizing anxiety and confusion typically experienced when looking through lengthy lists of flight updates. When combined with location technology and sensors, content can be instantaneously updated and follow people throughout 3-dimensional space.<sup>2</sup>

This behavioral reinforcement of consistent messaging creates less dependency on gate lounge announcements. Limiting or eliminating boarding announcements and TSA messages can reduce anxiety for travelers, through Silent Airport policies. This initiative aims to remove terminal-wide PA announcements, noise pollution from adjacent concessions, and boarding gate calls (among others). This reduction in sometimes mentally and physically draining noise has in some cases been replaced with unique sound designs that highlight bird songs and the sound of rustling leaves. Soundscapes for each space can match the needs of occupants, and with compartmentalization for air quality, this acoustic separation is possible. Environmental changes such as adjusting the lighting levels and music in some parts of the terminal could encourage passengers to space out when crowding, and can also be enjoyable sensations to weary travelers — mimicking some of the variety in outdoor habitat.

However, one of the most influential uses of behavioral reinforcement for social distancing and intuitive zoning is through furniture design and layout. Gate lounge furniture is a powerful signal to occupants of normative behavior. The spacing and shape of furnishings may be adjustable or automatic to optimize the terminal for public health, and is a useful tool for identifying where the physical environment is misaligned with passenger goals. Today, airports – and specifically gate lounges — have a responsibility to address the current pandemic and protect the travelling population

most susceptible to viral spread. In response to COVID-19, the airport gate lounge is about to undergo yet another evolution, one that balances the volumes of passengers moving through the space with the desire to respect social distancing recommendations. Our recent case study examines potential furniture modifications that can accommodate this balance.

## How Does Social Distancing Impact Gate Lounge Design?

Current gate lounge design focuses on maximizing the square footage to provide seating for as many passengers as possible. IATA ADRM 11 advises that: “Ample seating should be provided for waiting passengers. Different seating types and arrangements can be implemented to reflect different qualities and user needs. Seating can be provided as individual seating, group seating, cluster seating or casual seating.”<sup>3</sup>

As it relates to spacing of furniture, six feet is the recommendation from face to face of seating offerings, however, this often results in a less than desirable seat count. Therefore, seating typically ranges from 4-6 feet apart. While this design may meet code requirements and be beneficial for airlines, in times of social distancing, passengers will want to have the ability to maintain larger distances than a typical gate lounge is designed.

With the outbreak of COVID-19, we must now re-assess the way we think about furniture placement, materiality of surfaces, and ways to encourage desired distancing or grouping of passengers. A typical gate lounge consists of tight rows of seating across the leased space and sometimes tables or work areas, similar to the

representative gate lounge layout shown below, where defined circulation paths range from 4ft – 6ft. The groupings of beam seating and cluster seating create an efficient layout with seating for 124 passengers. While this maximizes passenger count, our study shows that the consideration of proper social distancing requires a more creative approach.

## Short-Term Adaptive Components — How We Can Help Today

Furniture has the innate ability to influence human behavior, and can have an incredible impact on the way passengers interact within a space. In the current climate, furniture should be designed to support social distancing, create personal zones, be well-maintained and cleaned frequently to support the health of passengers.

### SOCIAL DISTANCING

While social distancing in some areas of the airport proves challenging, it is human nature to distance oneself in a hold lounge, typically using more than one seat by placing carry-on luggage or other personal items in the seat adjacent. This is known as “Seat Spoilage” — a phenomenon airports typically try to mitigate. Because that seat is “reserved,” other passengers are convinced to look elsewhere. Likewise, passengers often prefer not to sit directly adjacent to another and will leave intermediate seats empty. While this would typically be a concern for the airport, in times of social distancing this works to everyone’s benefit.

In the short term a few modifications can be made to encourage people to maintain their distance. Many beam seats are modular systems with the option to switch seats to tables creating more distance between passengers, often reaching the minimum requirement of 3-feet between people. Alternatively, using a system to signal to passengers preferable



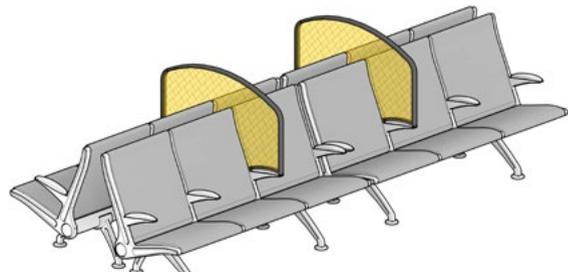
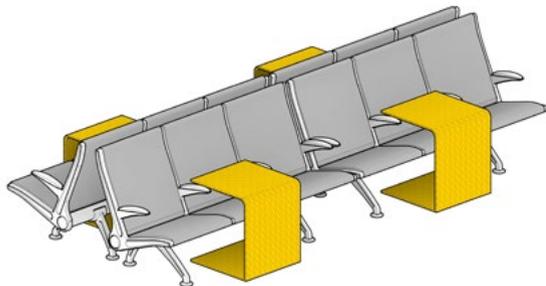
Figure 1: A typical gate lounge showing 124 available seats with 21 utilized during times of social distancing.

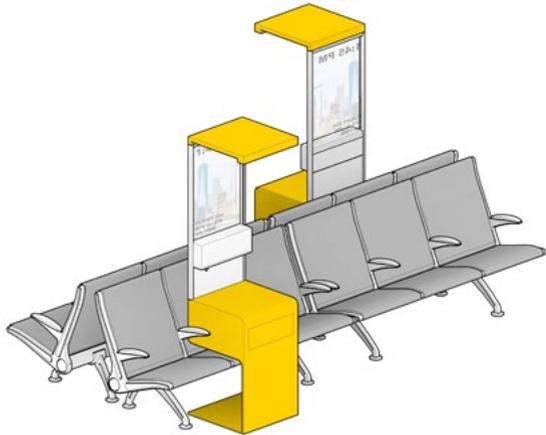
seating, such as seat covers, is a cost-effective option which eases concerns over adequate spacing during times of social distancing.

### PERSONAL ZONES

In recent years there has been a shift in the way gate lounges are designed. Each type of passenger—whether business flyer, a vacationing family or a retired tourist — has a seating preference. By designing for each type of traveler, seating can be personalized to meet their needs. In the short-term, defining specific zones is important as people consider their personal space to be directly linked to their health and limiting the spread of disease.

A mediation that could be made to most furniture types in gate lounge application is an additional panel system. As seen in other commercial applications, a plexiglass panel can be used to limit or redirect the airborne droplets through coughing or sneezing, as well as aerosols created while talking, potentially reducing opportunities to spread the virus. A modification to existing beam seating, or lounge seating of a plexiglass or similar safety panel can protect passengers from potential contamination. This modification serves as a physical barrier and ease individuals fears while traveling.





## CLEANING

The most effective way to prevent the spread of disease and other threats is a meticulously clean airport. This is critical in gate lounges, where people

have a more personal interaction and physical contact with the space. Increasing cleaning frequency in these spaces would ease passenger concerns. Additionally, providing information transparency to passengers by identifying the time of last cleaning, and what level of cleaning occurred, would again be beneficial in easing the mind of the passengers – further encouraging proper usage of the gate lounge.

In addition, anti-bacterial gel stations can be temporarily installed at times of seasonal flu. The sanitation station could dock over a seat, providing a needed amenity as well as personal space to the surrounding seats, and would perform similarly to the modular seat to table configuration for the beam seating.



Figure 2: Beam seating with a wider armrest and larger spacing at the Corgan designed Phoenix Sky Harbor International Airport Terminal 3. Photo Courtesy of Kevin Korczyk

# The Long-Term Impact – The Evolution Of The Gate Lounge

Standard beam seating will be improved to provide adequate personal space through the use of privacy panels, incorporation of side tables between chairs or through wider armrests. In the recently opened Terminal 3 at Phoenix Sky Harbor International Airport, designed by Corgan, gate lounge seating already incorporates wider arm rests and purposefully introduces more space to combat Seat Spoilage. In times of pandemic, this solution can also give passengers more personal space and help them visually define boundaries, ultimately resulting in better seat utilization and a more efficient airport.

**The future of gate lounge design consists of passenger focused amenities that provide a hospitality like space with additional room for passengers to socially distance themselves.**

To maintain seat count, a variety of seating will be provided based of the type of passenger it serves. Personal booths can provide for a dense seating option for the business traveler or solo traveler as long as it is coupled with appropriate protocols for cleaning such as UVC Lighting. Family or Group Pods can be incorporated for passengers who are comfortable sitting together. Exploration of furniture types that redirects where passengers face can also be a simple way to create a newly valued sense of personal space and privacy, while a spacious charging bar with a view to the runway meets CDC guidelines for public spaces. With these considerations in mind, our investigation nears the seat count of the traditional plan with features that benefit the health of passengers.

**The combination of cleaning protocols and sanitizing technology will be integrated to provide a health-forward approach.** Moving forward, airport operators will incorporate sanitation protocols similar to healthcare facilities to ensure the cleanliness of the gate lounges. Incorporating anti-microbial surfaces and UVC Lighting will be done not only as a safety precaution but also to reinforce the passenger’s perception of sanitation. The combination of high-tech solutions with traditional cleaning methods will work in tandem so that future passengers can be assured of a clean, safe airport that puts their health first.

As transportation hubs, airport terminals present a challenge for public health. What makes them so wonderful to experience — all those overlapping functions — is also what makes them overwhelming and anxiety-inducing for many. The path towards a safer, saner travel experience begins with better and separation of functions within a terminal. While not as efficient and exciting for some travelers, at least as many will welcome the accommodation.

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The future of holdroom design consists of passenger focused amenities that provide for hospitality while also accommodating for additional room for passengers to define personal boundary.

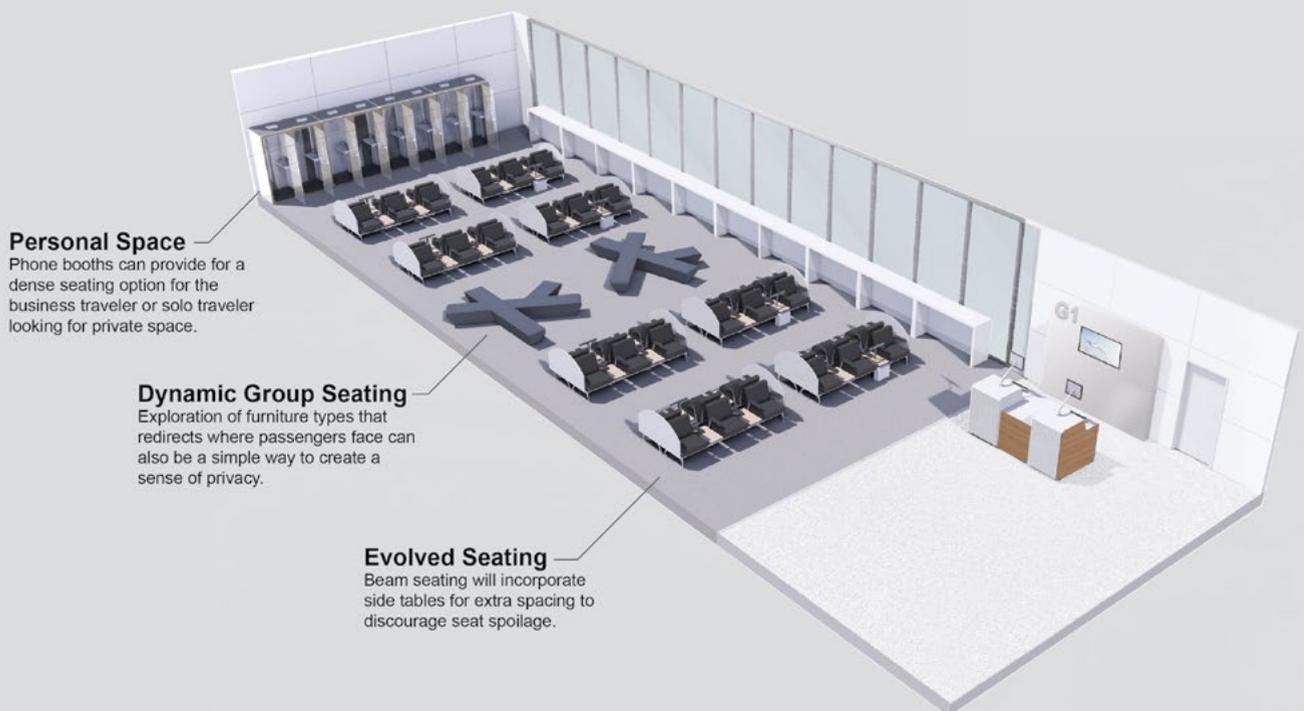


Figure 3: The incorporation of passenger focused amenities in a gate lounge layout.

# Schools – Open for Business

CHLOE HOSID, ANGIE STUTSMAN, AND JASON MELLARD

Schools are rich environments for study, collaboration, identity formation, and social and emotional development. They are second homes, social hubs, community centers, and most of all, epicenters of learning. Due to COVID-19, students and educators had to adapt quickly to a remote learning model. As attention turns to this upcoming school year, how can schools maintain or even enhance learning and connection on campus in unique ways while adhering to the CDC guidelines for social distancing?

Messaging is important. There will be much anticipation for what this year will bring, and schools can acknowledge that while the new school year won't be business as usual, it can be something uniquely their own if students, parents, staff and the community all take ownership of this opportunity. An invitation to collaborate and an assurance of safety and security should be the primary messages, not merely a list of regulations.

Each portion of the school day will be affected, from arrival to departure. Cars may arrive at staggered times to minimize student density and allow time for screening if required. Busses will be at a lower capacity and additional school entrances can be opened to avoid overcrowding at the front door. While students should avoid congregating prior to start of class, creative ways can be developed to provide comradery and a common identity.

## Schools Within a School

Our schools are places for students to grow- to interact broadly with their peers and their teachers and to explore themselves and the world around them. Their 'domain' within the school becomes larger and more diverse as students progress, providing them with more and more opportunities to delve into their passions and interests with age. One challenge in the time ahead of us will be to adapt the structure of the school environment so that students are provided with these important opportunities as much as possible while prioritizing their health and safety.

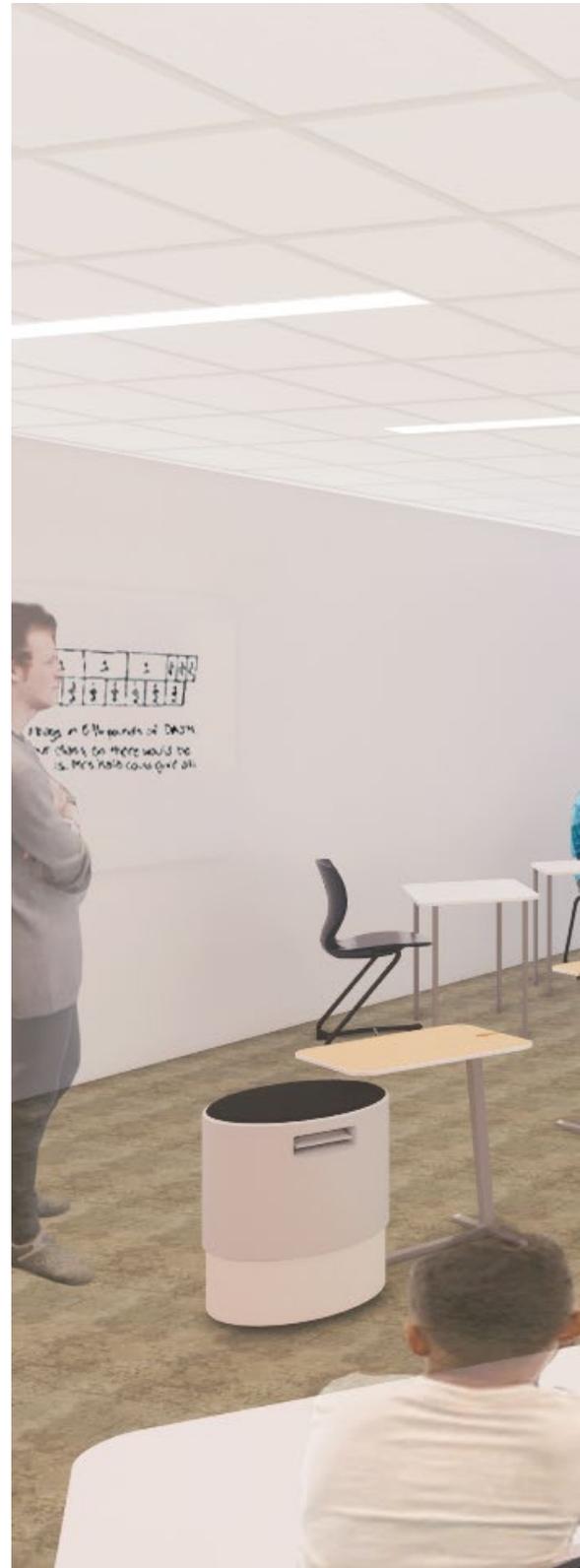
Per the CDC guidelines, schools should "Ensure that student and staff groupings are as static as possible by having the same group of children stay with the same staff (all day for young children, and as much



as possible for older children).”<sup>1</sup> For elementary schools, this requirement aligns very closely with their existing model. Groups of students stay together with the same group of students and their teacher in one classroom for the majority of the day- effectively minimizing the number of other people each student and each teacher comes into contact with during their day. This becomes more challenging for middle school and high school where students move between classrooms to learn with different groups of students with different teachers for each of their classes.

Taking a cue for the elementary school ‘house’ model, smaller groups of students on similar academic tracks could be clustered together as a learning community in one classroom or in a smaller, more controlled area of the larger school building with a few classrooms dedicated to facilitating their community’s education. This model could control and reduce the size of each student’s network of contact while fostering a sense of community and connection within the larger school environment. Here, teachers and students can take advantage of the personalized learning opportunities offered by online learning as well as methods described in the Universal Design for Learning framework<sup>2</sup> to ensure each student has the resources they need to guide their own learning while being both supported and appropriately challenged. Rather than having relatively large groups of students travelling between classrooms within the learning community, teachers can move between rooms to teach different subjects, and students can eat in their classrooms to create a feeling of ‘home’.

16-18 students in a classroom can interact with remote students via video monitors inside the classroom. Remote students can view from home, or an adjacent space in the school building.





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Calculate each expression  
if:  $x=3, y=-8, z=4$   
 $x-y = \frac{3-(-8)}{3+(-11)}$   
 $2xy \cdot x = \frac{2(3)(-8) \cdot 3}{4(-8)(-11)}$

## Expanding and Dissolving Classroom Walls

For a standard 700 square foot classroom, 16-18 desks can be accommodated while maintaining six feet of separation between students. Introducing clear dividers between adjacent desks can increase that number but would be an added expense and may be acoustically distributive.

Schools that seek to safely bring as many students as possible to campus can adapt distance learning to occur within the school walls. Libraries, lecture halls or collaboration spaces adjacent to classrooms can serve as “overflow seating” with students viewing a live feed of the instructor on a projector or their individual devices. A staff person supervising several classroom segments could monitor engagement. In any live distance learning scenario, students will benefit from continuous two-way exchanges with the instructor and their classmates. Virtual whiteboards, student polling,

and monitored chat can be engaging methods of connecting with the entire class or facilitating group projects.

For blended learning models where half of the students are receiving instruction in the classroom at one time, with their classmates learning online from home, the reduced student to teacher ratio creates a learning environment that most students have not experienced before. This small-group atmosphere can invite more discussion and opportunity for each student to showcase their work. Additional room is available for learning tools like mobile markerboards and flexible furnishings, creating a vibrant and safe learning environment for students to engage with their education in ways they haven’t been able to in a traditional thirty-student class.

Another way to dissolve the actual walls of the classroom is to leave the classroom all together. Make-shift classrooms that leverage the exterior playground, sports field, or lawn provide room to spread out. With more space outside, the entire



class of students could be together while staying apart. The students and teachers would benefit from the natural light and fresh air, and more of the campus can be activated for learning.

## Shared Spaces

Shared spaces are an integral part of our schools. These are the spaces where students gather to socialize, collaborate, and decompress. How do we adapt these spaces so that students receive as many of the same benefits as possible while maintaining safe distancing and necessary sanitation precautions? We know that the challenges of this time will require creative adaptations, both spatially and behaviorally, in order to ensure safety while minimizing the interruption of meaningful experiences.

For dining, if eating in the classroom is not practical, tables can be sectioned off so that students remain six feet apart. A brightly colored signifier on the floor can help to monitor the queuing lines to maintain social distancing. Expanding the number and types of spaces that can be utilized for necessary functions like serving breakfast and lunch can help to alleviate the strain of density of use on school facilities. Eating areas can be dispersed throughout the campus in casual, small settings previously not open for lunch periods, and allowing students to eat lunch outdoors can introduce more space for physical distancing and give students an opportunity to get some fresh air.

Once class is dismissed, staggering passing periods could help to maintain order in the hallways and reduce the number of students in this highly trafficked shared space at any given time. Defining a clear directional flow can maximize the space available in corridors, allowing students to maintain a safe distance from one another while moving efficiently and without crowding. Creative (but not always practical) physical distancing strategies in

communities and schools around the world have been popping up to encourage safe distancing in public spaces. Residents in a city in India are being asked to use umbrellas when walking outside in public areas in order to maintain a minimum safe distance, students in China made their own social distancing hats, and the Willow Creek School in Montana employed Styrofoam pool noodles for staff to spot check student separation.<sup>3</sup> All of these strategies paint an interesting picture of public spaces in our near future, but by responding to these challenges and stipulations with a playful sense of ingenuity and a deep concern for the health of our communities, our schools can remain safe spaces for learning, even during times of great uncertainty.

## Experience-Based Learning

When it comes to elective classes and more experience-based learning, social distancing adaptations will have to be more creative. Band, choir and orchestra can reduce density by splitting up classes by instrument or vocal range or by creating smaller ensembles. Practices and performances that utilize multiple rooms at a time could bring the entire ensemble together virtually, just as we've seen with student musicians and professional symphonies all around the world, collaborating and playing music together from a distance.<sup>4</sup>

In experience-based, hands on learning environments where students tend to share materials and resources, reducing the number of students per class can ensure that every student has access to their own designated equipment. In between classes, equipment and hands can be sanitized to limit the spread of illness between groups of students. For some classes, it may be possible to adapt learning experiences to at-home

learning environments in order to provide students with meaningful learning experiences within the framework of a blended or online learning model. Focusing on core learning goals while adapting to the resources available to students outside of formal learning environments can nurture students' curiosity and passion both in the classroom and outside of it when they are learning online or from home.

With some creative thinking, Physical Education can be successful without any physical contact. Shadow tag is a fun and interactive way for students to socialize and exercise at a safe distance by touching shadows rather than physically tagging another person.<sup>5,6</sup> Engaging more extensively with outdoor spaces to allow students to safely exercise outside, focusing on activities that require minimal or no shared equipment, or playing games or sports that don't allow students to touch equipment or each other with their hands (like a coronavirus

version of the all-familiar "the ground is lava" game). Restorative physical activities like yoga and meditation can also be utilized in student's classrooms to provide constructive outlets for dealing with stress and fatigue.

Navigating uncharted territory like this global pandemic requires teamwork, tenacity and a sense of adventure. In these challenging and uncertain times, it is important to remember that we are all in this together. If we can focus on keeping core purposes front of mind, we can embrace these new constraints and allow them to challenge us to develop creative solutions to support student engagement, wellbeing, and success. Responding to this crisis with empathy, creativity, and determination will allow us to make the most out of the resources we have available and support the best possible outcomes for our schools' staff, students, and communities.

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E Gates



# Queue Management

JOE CONTI

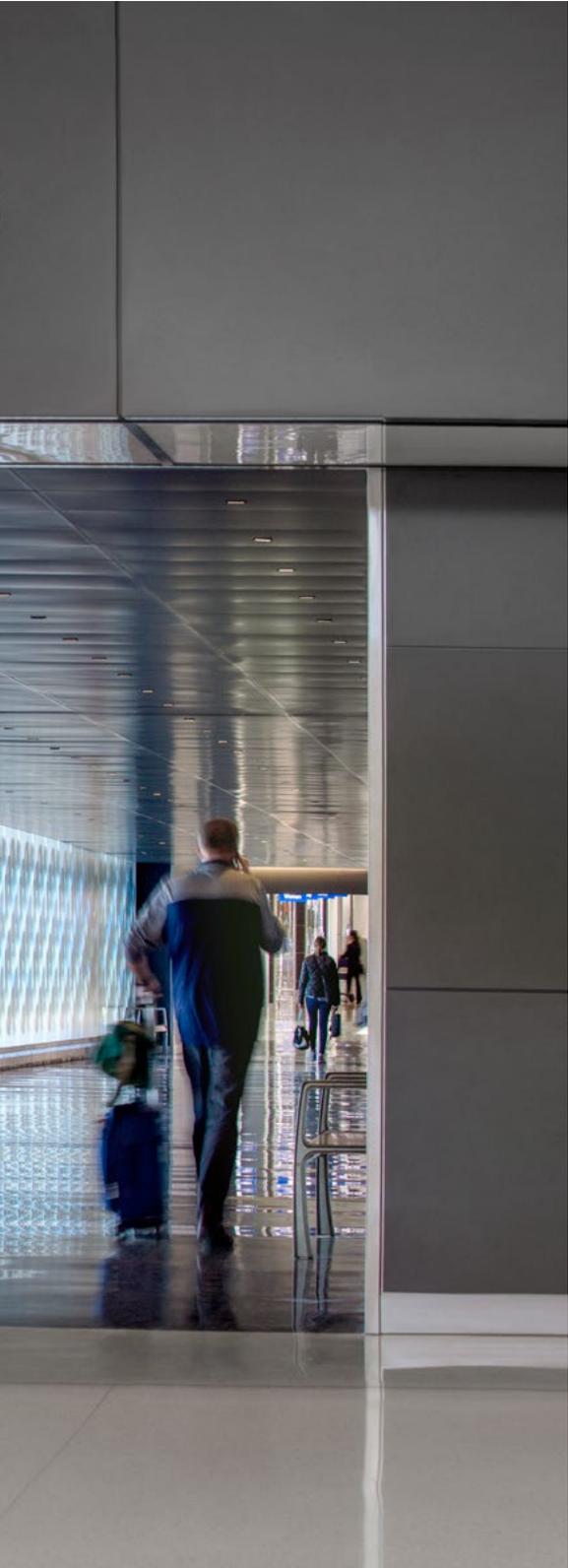
Inherent in the passenger journey at airports is the use of queues. In fact, a part of the programming and planning of airports is the expectation that there will be an allowable amount of time waiting in queue. As the passenger experience evolves, we must understand how this process may change—and with the sweeping pandemic altering our perception of valuable personal space, queuing standards may see rapid transformation. When implementing the queuing process into the design, the analysis is broken down into two aspects of process: The amount of space that we allocate per person in queue and the processing time it takes to get passengers through the task.

## How Much Space Should We Allocate for Passengers in Queue?

Current guidance provided to the industry via IATA Airport Development Reference Manual, ACRP Report 25 and even relevant building codes — both local and far reaching — have previously set the standard for queuing design.

A review of the of the 2018 International Building Code gives us guidance regarding queuing design based on the Occupant Load.<sup>1</sup> Occupant Load assigns a maximum floor area allowance per occupant based on the different functions of space within the terminal. Areas designated

PHX Terminal 3 Modernization. Photo courtesy of Bill Timmerman



for queueing may fall into a few different occupant load factors, depending on function of the space, including 'Airport Terminal Waiting Areas,' which gives a load factor of 15 gross ft<sup>2</sup> per person, or, more accurate for queueing, 'Assembly Standing Space' which assigns a 5 net ft<sup>2</sup> per person. The code books represent minimum amounts allowed by law and are used in determining maximum capacity of passengers. Using minimum guidelines typically translates into a lower Level of Service (LOS) based on IATA standings and therefore is typically not used for programming and design.

IATA ADRM 11<sup>2</sup> provides space recommendations that are more accurate for design purposes. These allocations are defined based off of an LOS matrix ranging from Sub-Optimum to Over-Design. Space allocation varies per function, however, queues are defined as being a minimum of 4 feet (1.2 m) wide. In areas of large queueing, such as the Security Checkpoint and Immigration or Emigration Passport Control, space allocations are 10.8 to 12.9 ft<sup>2</sup> (1.0 to 1.2 m).

To slow the spread of COVID-19, many health professionals including the Center for Disease Controls (CDC), have recommended the practice of 'social distancing.'<sup>3</sup> Through this practice, it is recommended to keep approximately six feet distance from one another — particularly in mass gathering situations such as the environment experienced in an airport. Using the six feet spacing recommendation, however, calls for approximately three times greater personal space needs than the IATA recommendations.

SPACE ALLOCATIONS FOR QUEUEING	
2018 International Building Code	5 ft <sup>2</sup>
IATA ADRM 11	10.8 – 12.9 ft <sup>2</sup>
CDC Social Distancing Recommendation	28.3 ft <sup>2</sup>

# Who Does It the Best?

Waiting in line is not unique to airports. All aspects of human life involve waiting in line, whether it be at the grocery store, health care facilities or at theme parks. What methods of queueing do other industries and businesses utilize and what can we learn from their reaction to the COVID-19 Crisis?

## THE GROCERY STORE

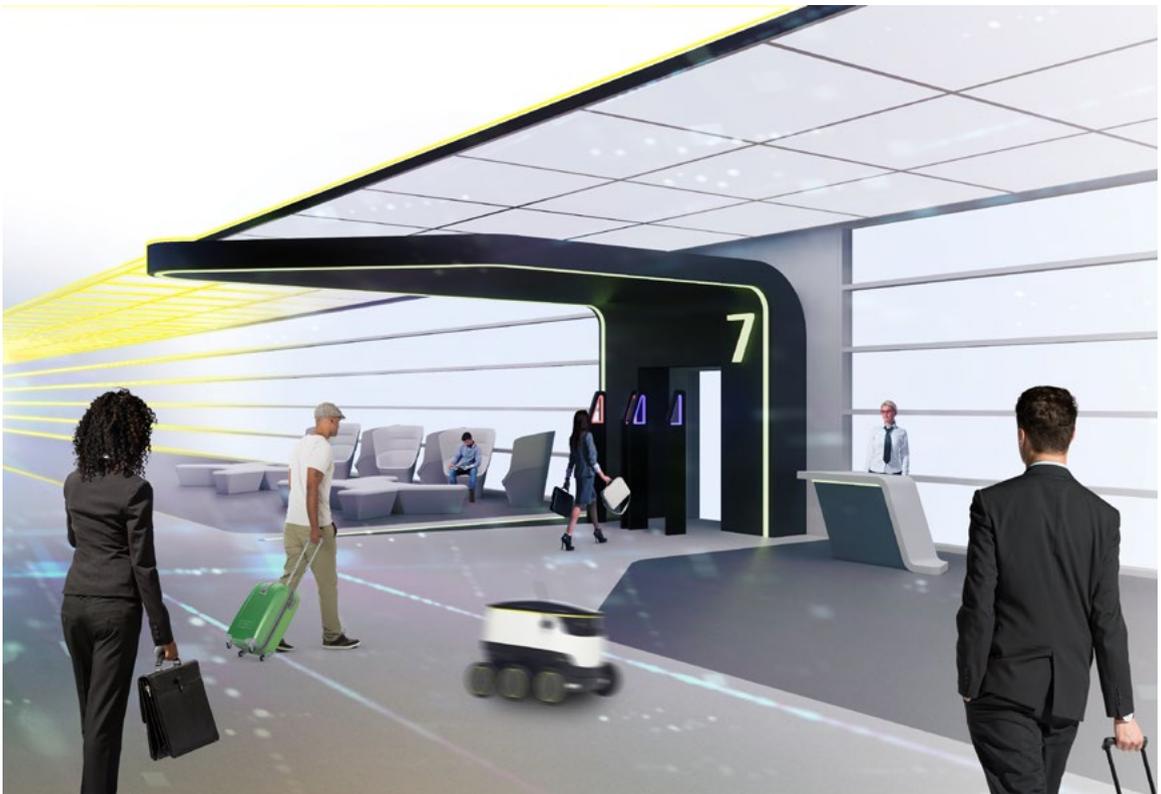
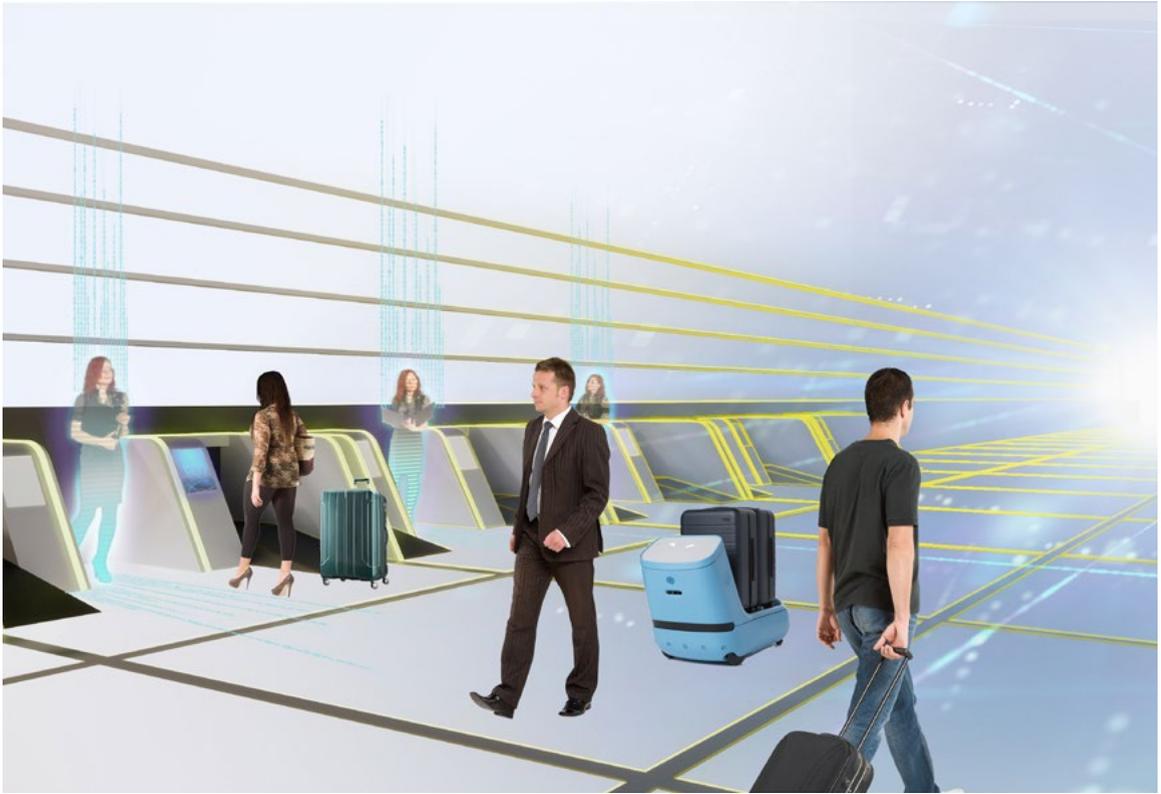
Many grocery stores utilize a system where each point-of-sale station has an independent queueing lane. This results in a large area required for queueing; however, it is generally regarded as a slower, lower level of service. Additionally, the ability of the process to flex to delays in processing is lower.

As an alternative, some retailers, have started to utilize multiple point-of-sale stations with a single queueing lane serving all. This will result in a centralized, more dense queueing location that would allow for delays in processing at a single point-of-sale to not affect the overall processing time for those in queue — a method that is currently used in US airports today.

## HEATH CARE FACILITIES AND RESTAURANTS

To address long wait times and possible spread of disease, many healthcare and urgent care facilities utilize an online system to register patients and allow them to wait at home prior to arriving at the facility. This gives ownership of the process to the patients, reducing their wait time in the facility.

Likewise, restaurants use similar "no wait" mobile queueing – alerting the user to arrive at the restaurant 5 minutes prior to seating. This reduces the crowd, and creates a just-in-time arrival time that equates to a higher level of hospitality and more personalized service.



## THEME PARKS

Theme parks — most notably the Walt Disney family of theme parks — have been utilizing a virtual queue for over twenty years with the use of systems such as Fast Pass. Disney's Fast Pass is a service that allows you to reserve access to attractions in advance either by using a mobile app or one of their Fast Pass Kiosks located throughout the park.<sup>4</sup>

Like the healthcare virtual queuing systems, the result of fast pass systems is the ownership of experience by the customer. Guests can eat, shop, and explore instead of waiting in line, which increases user satisfaction. As an added bonus, you're spending money — making Disney a beneficiary of that heightened customer experience as well.

Additionally, Disney benefits operationally as well. While the Fast Pass systems won't increase the total potential throughput of an attraction, it can help with resource scheduling. Allocating the time that someone can enter a ride allows you to spread the demand out for the ride across the day, reducing peak demands and resulting queues.

## Temporary Solutions And Long-Term Recommendations

Designing facilities to meet the current social distancing recommendations from the CDC is not feasible as an industry standard long-term. There will need to be a balance of solutions that can address temporary social distancing requirements during times of need, such as seasonal flus, and working towards a long-term solution that negates the needs of queues all together.

## TEMPORARY SOLUTIONS IN TIMES OF SOCIAL DISTANCING

Queueing lines will be inevitable in an airport until we can reduce processing times at congestion points of the passenger journey. In order to address times where society will be more inclined to socially distance themselves, the airport should provide temporary solutions to mitigate the negative aspects of queueing.

- Reduce the number of passengers that can enter a queue to maintain social distance requirements.
- Delineate waiting positions for passengers while in queue.
- Provide safety measures such as masks and hand sanitation as an amenity for passengers.
- Frequently clean the touchpoints within queues.
- Provide segregated security screening opportunities for those passengers

## LONG-TERM QUEUEING SOLUTIONS

In the long-term, airports will look towards trying to reduce the need for queues all together. While the primary focus on this will be through improved processing functions, there can be solutions to address the human behavior in how we deal with high congestion areas.

**Introduce virtual queueing, similar to those in use at theme parks and healthcare facilities.** Airports can take advantage of the resource allocation by providing specific times to passengers for when they can enter high congestion areas like security checkpoints. As a result, additional area on the non-secure landside would be required to be designated by the airport to allow for passengers to disperse while awaiting their appropriate appointment times.  
**Assign passengers to designated queues based**

**on the anticipated processing time of that person.**

If a passenger has no carry-on luggage, they should be able to be processed through security much faster than a family with multiple carry-on bags. Similar to opt-in programs like TSA Precheck and Global Entry, if we can identify passengers who can be processed quickly, that will reduce time in line for the passenger as well as overall spatial queue requirements.

**Decentralize processing elements to disperse passengers and introduce accountability in the process.**

The current trend is for high processing areas to be centralized to take advantage of consolidated operations. As a result, large scale processing blocks are created with large, dense queues in front to serve them. By distributing checkpoints and passport control, passengers will be able to journey through the process without being led through one single consolidated point and as a result, can avoid congregating with large numbers of the passenger population in a confined area. While multiple processing blocks will require more space and more manpower than the consolidated methodology, recent research suggests that the single queue processing elements may work more efficiently, due to the impact that accountability has on the human behavior of successfully running that processing element.<sup>5</sup>

Emerging technologies have every opportunity to enhance the queue experience and shorten the wait times. Biometric solutions such as facial recognition could not only identify known travelers, but sort them into different lines based on their personal security screening processing speed — an aggregate created from each visit to the airport. Additionally, introducing other elements, such as no-divestment screening, may prove to reduce wait times. DFW Airport has studied a combination of these technologies to understand the overall effect of queueing and wait times. The result was a substantial reduction in wait times, pax frustration and a reduction of touch points during the screening process.

The debate for facial recognition security methods as a transition into touchless processing has been an ongoing conversation, even prior to COVID-19. Airports in the future may consider offering lanes that accommodate passengers that are willing to use facial recognition as a way to maintain their personal safety and health by moving seamlessly through a queue, while simultaneously offering traditional identification methods for those who prefer, requiring slightly longer wait times within the queuing process.

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# Security and Low Touch Processes

LUKE BROHMER

Occupant health is paramount, especially now in a post COVID workplace. The built environment must respond and shift to better combat infectious diseases. As most of the factors involved with a stable and healthy space are not clearly visible, this is easier said than done. Therefore, the charge is to make the invisible, visible.

## Journey Mapping

To begin, first consider the art of journey mapping. Tracking an individual's path to a specific location and subsequent interactions in space can identify touchpoints, transactions, and overall level of risk. The approach will vary by context, whether a dense urban city center or spacious suburban business park. Managing this perception of personal risk lends to a more robust energy and sense of wellness by the occupants.

**Locations** bring many factors for consideration solely based on the contextual density. An urban city center per se has a much higher risk factor than the suburban business park. Means of **mobility** (public transit, personal vehicle, rideshare, walking) all vary in exposure and add to complexities of an individual's journey to the workplace. **Building access** is the entrance and front door into the workplace. Vestibules, lobbies, reception and waiting areas are spaces that funnel in individuals and provide direction to specific areas. High volume points of congestion can be expected at vertical circulation elements like stairs and elevators. From

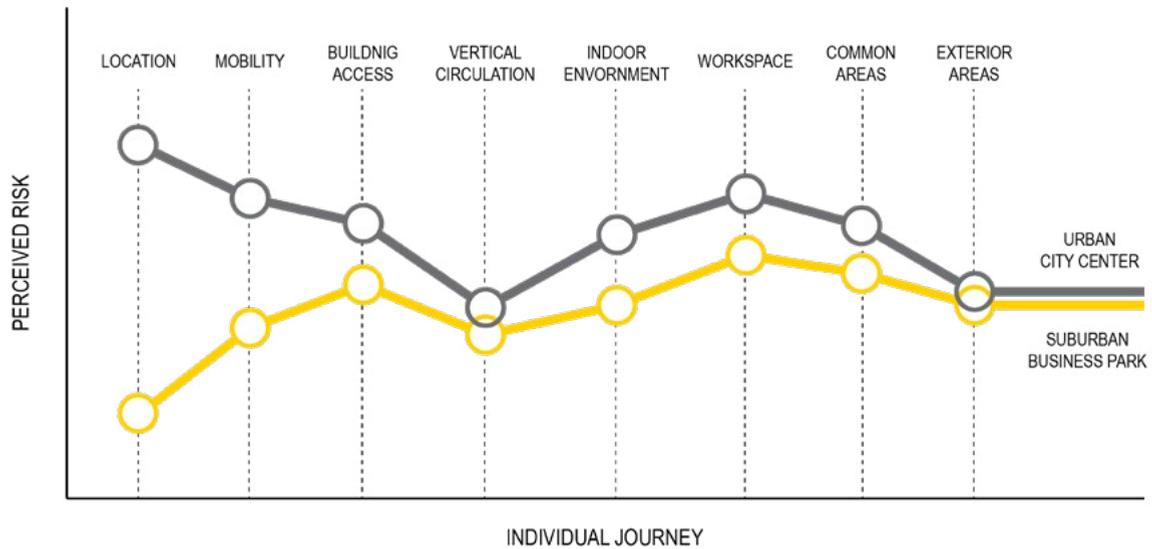
HVAC systems to cleaning protocols, means of circulation and PPE, the overall **indoor environment**

will pose a crucial factor in sustaining long-term health for an individual. Within the **workspace**, specific needs for daily function target meeting spaces and shared open office. This environment is where the individual spends most of their time while in the building. Other considerations include **common areas** like restrooms, break areas, cafeteria or kitchen, which may be brief touchpoints but are high communal areas for all inhabitants. **Exterior areas**, such as courtyards, terraces or shared greenspace, give moments of reprieve and provide fresh air and new views.<sup>1</sup>

## Building Access

As the first line of defense, monitoring health prior to entering the building — via app monitoring, distributed health checks, or building screening — is vital for overall safety and wellbeing of building occupants. Whether retrofitting existing spaces or shifting design to plan new construction, various solutions can be implemented to achieve a higher level of cleanliness and human care.

Primary entrance doors can be adapted with card reader activation, or biometric access points. Through badging, fob scanning, or facial recognition, the secure entry process becomes



a hands-free operation. For new construction, entry sequences could consider wider vestibule designs to accommodate automatic sliding doors. Removing the need for touching door handles at these high-volume locations greatly reduces health risks and transmission of contaminants.

Introducing pathogen sensors within vestibules facilitates microbial detection and enables constant monitoring. Reporting pollutants can help “control and prevent outbreaks of harmful airborne contaminants.”<sup>2</sup> These sensors use cloud-based platforms for monitoring, which allow building owners to constantly inform users of unit status and automate alerts in the event of a hazardous event.<sup>2</sup> Additionally, disinfectant vestibules or air curtains can help increase air exchange, remove collected particles and increase overall quality of indoor environments.

On an individual level, occupant temperature readings can be monitored daily via personal thermometers. Products from Kinsa Health, use simple ergonomic devices to capture temperature readings in 8 seconds and create data logs via

bluetooth connection to a smart phone app.<sup>3</sup> This allows occupants to self-check their personal health and selectively share data with their employer to ensure they personally are staying safe, while also verifying they are clear to enter a building.

## Security Monitoring

As building owners and tenants begin transitioning back to the office, protocols will be set in place to ensure social distancing requirements are met. Enforcing these guidelines is most important for employee health.

To help in this effort, a clear monitoring system should be established to create a baseline and track security measures moving forward. Companies, like Yanzi, bring smart building technology to life with their GPS based platform. Using a network of plug-n-play sensors, devices are placed throughout the building. From desk specific sensors to conference rooms and amenity areas, the web of connected nodes forms various data points that collectively can ensure protocols are practiced and employee health is kept top of mind.<sup>4</sup>

Three key areas of data collection are set as a layered defense approach:

- 1 Occupancy** – Monitoring space habitation helps enforce occupancy limits for conference rooms and social distancing standards in open office seating. As spaces are modified over time, occupants can see the effectiveness of room layout, design, or furniture orientation. Additionally, companies can gauge the efficacy rate of the space they inhabit.
- 2 Utilization** – Real time data allows tracking of the most used spaces and under-utilized areas. This could aid in setting building maintenance and cleaning schedules to boost overall sanitation. Conversely, if a space is seeing higher utilization, management would be alerted of the areas that need to be cleaned more frequently or reconsidered for safer and better functional use.
- 3 Comfort** – Each sensor collects Co<sub>2</sub>, temperature, humidity, light, noise and pressure levels over daily usage within their residing space (open office, conference

rooms and amenities). Performance snapshots on a case by case basis will accurately display readings against standard comfort levels.

Consider that achieving optimal levels of Co<sub>2</sub> can aid to overall health, increased productivity of employees, can be linked to reduced sick days, and most importantly, increase cognitive function of the respective occupants. Studies show that increased Co<sub>2</sub> impacts decision-making performance, reducing one's ability to take initiative and think strategically.<sup>5</sup> Building systems can then be updated to provide better levels in the required spaces to achieve an optimal health environment on a variety of levels.

During the initial timeframe of re-entry, businesses will need to be agile in how they respond to the issues at hand both from their employees and within their building. A focus on wellness is paramount in providing the peace of mind for people to return to work. Monitoring in this nature gives accurate, real time data that can quickly and effectively transfer to protocol modifications. Such practices ensure safety of inhabits, build the best environment for overall wellness and benefit the bottom line of a company.

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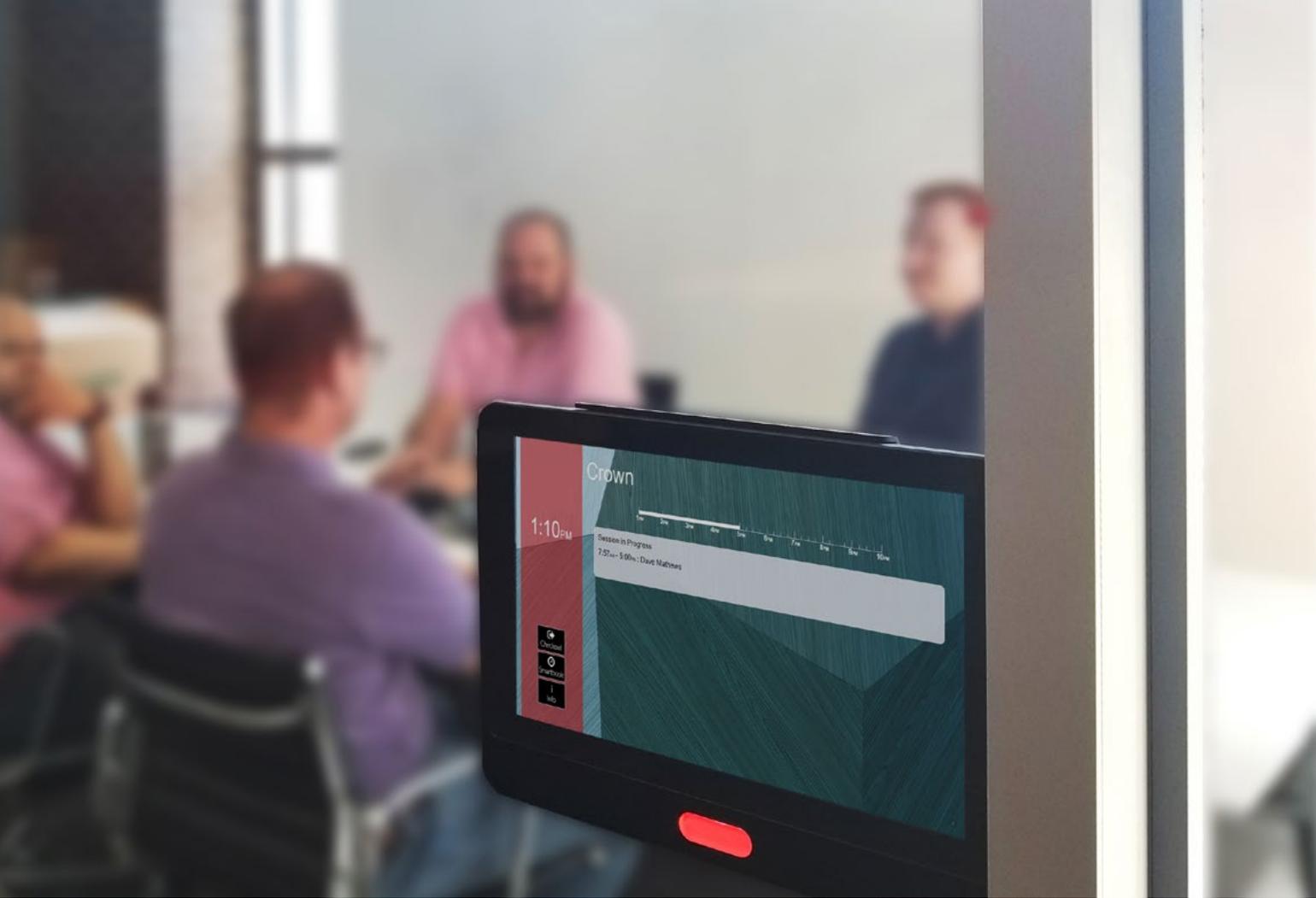


# Evolutionary Technologies Will Transform High Touch Surfaces

**LUKE BROHMER**

Smart Building concepts are not a new trend, yet the COVID-19 pandemic has brought these evolutionary technologies to the forefront of the built environment. Responses to the current events must begin to reconsider the social norms and new best practices set forth in the spaces we inhabit. When paired appropriately, technology can serve to increase awareness and provide vital information to building owners and tenants alike on when and how the building is performing and being used.

As companies ready for re-entry, a renewed focus on minimizing touchpoints can be achieved through implementation of advanced technology. These strategies can provide alternate options to daily engagement while maintaining the human interaction and reducing the risk of person-to-person contact.



## Gestural Interaction

Embracing technology is now commonplace with most companies enacting work from home policies. As the transition back to the office begins, integration of touchless processes with the workplace will help to provide seamless connection throughout the building and reduce the spread of germs.

Within the typical workplace, conference rooms can be high volume spaces that confine and expose occupants to many high touch surfaces. In addition to the conference room door — typically a pull or a push operation — scheduling systems should integrate no-touch interfaces that leverage check-in from personal computers, smart phone taps or even facial recognition devices at the conference room for an impromptu booking.

Likewise, video conferencing, screen-sharing and overall communication can be reimaged through AV equipment updates to allow personal devices to share content. Introducing digital whiteboards into conference rooms can be a great way to continue collaborative communications, while keeping social distancing in mind. By leveraging their own devices, each person in the room can draw, add text, or create shapes that are visualized on a shared screen. This keeps the interaction and collaboration that whiteboards provide when developing solutions, however it reduces the use of shared surfaces, such as the markers, eraser, or whiteboard itself.

Communal areas, like break rooms or kitchens, should provide motion sensor fixtures to dispense ice, water or coffee. Moving interaction with devices to a simple wave of the hand, will drastically reduce the transmission of bacteria and simplify the cleaning procedures in these public use spaces.

Lastly, new hand sanitizing stations should operate in a hands-free fashion without the need for the dispenser pump. These designs can be gesturally activated, and could possibly be designed into wall tile solutions, furniture modules, and personal desk compartments.

## VOICE-ACTIVATED ELEVATORS

Even with encouraging individuals to use stairwells for circulating between levels, elevator travel is still necessary and in high demand at most establishments. Studies have shown that “elevator buttons harbor 22% more bacteria than toilet seats.”<sup>1</sup> To reduce this risk, elevator manufacturers have created new products that are responding to these issues.



Kone's DX Class elevator offers a platform that has more tech friendly services and less high-touch surfaces, like voice-activated controls. Through voice commands, a cab could be beckoned to a passenger for a hands-free elevator approach.<sup>2</sup> Leveraging their People Flow Intelligence platform, a range of flexible design solutions can be used to accommodate changing building needs. Destination and access controls are retrieved through smart phone applications and proximity readers. Additionally, building management can monitor equipment use, required repairs and seamlessly communicate necessary information updates to occupants in real time.<sup>3</sup>

Mitsubishi Electric's new elevator system also utilizes voice recognition controls. These controls are activated when occupants are within 30 centimeters of the sensor. Primarily focused on aiding wheelchair occupants, these technology upgrades can comfort and better assist differently-abled occupants and visitors, enabling them to function safely in the buildings Corgan designs.<sup>4</sup>



## DIGITAL TWIN

Digital building twins are an incredible way to manage the communication between buildings and their occupants, as they are simply a digital representation of the built environment. By replicating a physical building, various systems or scenarios can be tested in the digital space to see the affecting outcomes. How will upgrading an HVAC system perform with filtration, fresh air intake and outside air exchange? What rate of reoccupation should be considered for the building? How much density is appropriate for the space while maintaining standard social distancing practices? Using digital twin model simulation, data can reveal optimized solutions for peak efficiency of buildings and create multiple what-if scenarios.

In an increasingly data rich environment, digital twin technology can serve as a prototype for upgrading systems and establishing best practices before any physical version is even built. Once the suitable actions are selected for implementation, sensors within the built environment can feed live data back to the twin, verifying the systems or protocols in place. This also aids with future building operation maintenance planning.<sup>5</sup>

Implementing these technologies sooner than later is recommended in order to get ahead of the future influx of occupants. What better time to retrofit existing spaces, than during a period of quarantine while a building is uninhabited? Building readiness will lend to individual willingness. Occupancy is not the end goal, but a first step to establishing an environment for work and life to begin again in community.

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# Dual Purpose – Retrofitting Offices for Healthcare Facilities

CAROLYN MULLIGAN

How can office buildings serve the greater good now and in the future?

By now, we have all seen the overwhelming burden that has been placed on our healthcare system as a result of the coronavirus. Many hospitals are running out of room for patients, resorting to using hallways for locating hospital beds. The videos shared on the news showing the inside conditions of these hospitals have been haunting. Cities like Denver and Dallas, among others, have committed their convention centers to serve as overflow hospitals for COVID-19 patients, answering the cry of help of hospital and government officials to help relieve the stress on hospital system.<sup>6,11</sup>

Where, then, do all non-COVID-19 patients go when needing hospital or routine care, to ensure that they too don't contract the virus, further adding to the crisis? In addition to convention centers, university dormitories, hotels, and schools are being retrofitted to accommodate these patients.<sup>1,5,8,9</sup>

It begs the question, does an existing office environment also lead itself to be transformed and retrofitted in times of crisis, such as the one we are living through now? Or is there a new model of the Medical Office, that can infill currently vacant commercial spaces in multi-tenant buildings across the U.S.?

In addition to the current crisis, data indicates that Baby Boomers, those born between 1946–1964 after WWII, make up about 16% of the U.S.'s population, over 52 million people. The number of citizens over 65 has increased tremendously, from 3.1 million in 1900 to 35 million in 2000.<sup>12</sup> Because of this growth, the need for doctors and nurses, as well as demand for medical office space to accommodate the large numbers of aging population will increase dramatically.<sup>10</sup> Baby boomers are the second largest generation by population (millennials are the largest), so this demand will not be permanent. Is there a way to accommodate this ebb and flow of medical facility needs through the decades? Can office developers and owners take proactive steps in the design of their spaces that allow contribution to the greater good in times of need, without sacrificing viability?

We will look at how office space can answer society's call for health facilities and services through two lenses, our current crisis as well as future needs.



**"All these trends are forcing building teams and their clients to consider new styles of non-hospital facilities aimed at attracting patients, improving wellness, and saving money. Increasingly, healthcare organizations want to create 'medical homes' that foster ongoing relationships and offer a competitive edge."**

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JULIE HIGGINBOTHAM, SENIOR EDITOR OF BUILDING DESIGN+CONSTRUCTION

# Why office, versus any other market type?

- 1 According to CBRE, 13% of national commercial property is vacant (as of 2019), a staggering percentage.<sup>2</sup> What if we infilled these spaces with primary care offices, or other healthcare services? Can a Wellness Office be a new typology, giving employees access to both healthy buildings and healthcare, while providing opportunities for the healthcare industry to sustainably accommodate future healthcare growth?
  - **Current Crisis:** Infilling these vacancies around cities, in urban and suburban communities, can help decentralize hospital care, being closer and more accessible to where people live. The coronavirus pandemic has further highlighted the inequity of healthcare access in cities around the U.S.
  - **Future Needs:** If people working in multi-tenant office buildings can easily take a simple elevator ride to see their wellness or health care provider, without it being a hassle or having to wait in waiting rooms for hours, they will likely spend more time focusing on their healthcare. This is good for employers, who lose significant dollars when employees miss work due to health issues, as well as provide a steady stream of income for healthcare providers. Corporations already bring in biometric screening companies to their offices to perform wellness checks for their employees, often having high participation rates since employees don't have to leave their office. Healthy employees equals overall cost savings for companies.<sup>3</sup>
- 2 Office building infrastructure already accommodates multiple needs of MOBs and hospitals. Many office buildings already have service elevators that are designed to accommodate stretcher in case of emergencies, as well as generators, UPS power, and fire truck/EMS access. Electrical panels would possibly need to be upsized depending on the type of medical equipment needed.
  - **Current Crisis:** Service elevators already separate back of house functions from view, allowing for a separation of "non-contagious patients/delivery routes" and "contagious patients/delivery routes" through a building. Current hospitals and clinics don't have different elevators for different types of patients, creating risk for contamination for those attending routine check-ups.
  - **Future Needs:** Having abilities to transport those in stretchers in case of emergencies is a crucial part of any medical facility that can be served by commercial service areas.
- 3 The modern office floorplan configuration calls for building perimeters to be largely populated with windows or designed with floor to ceiling glass, providing daylight and view to the outdoors for employees. Typical office buildings are designed around a 5-foot grid system that accommodates any variation of office or conference room on the exterior along the windows.
  - **Current crisis:** Compared to convention centers trade rooms that are often dark and cavernous, offices may be better

suited as emergency hospital bed overflow areas, as natural daylight and exposure to nature has been scientifically proven to help in patient recovery. Temporary walls can be set up along the building perimeter to create exam rooms or place beds. Separating patients on several floors could also help with patient care, keeping people with like illnesses or conditions together, consolidating equipment and staffing needs etc. If these companies are designed with hard surfaces (as most of them are or will be transitioning this way), then doing a post-occupancy deep clean of the space would not be difficult.

- **Future Needs:** Medical office buildings and hospitals are extremely cost-conscious building types. If codes and regulations could be rethought to allow health care and wellness providers to rent tenant spaces within commercial buildings along with other typical corporate companies, then we will have opened up an entirely new tenant market for commercial developers and buildings owners to lease their spaces to. This means more investments can be made in shared amenities, like lobbies, elevators and mechanical and electrical systems with the added revenue.

Some additional commercial building upgrades for consideration are providing electrical panels required for supporting medical equipment, making sure the building structural loads can support needed medical equipment, as well as providing ducted return air pathways from all healthcare rooms. All return air for exam rooms etc., are required by code to be ducted to help contain the spread of germs, whereas commercial offices typically route return air through

above ceiling plenum space. While these upgrades could be costly, because of COVID-19 developers and building owners are beginning to understand the value of upgrading their office HVAC systems to mimic those of healthcare facilities, in order to keep their employees safe and help them feel comfortable returning back to work. This now may not be a hard sell after all.

4 In a typical hospital, only 15% of people who enter the building are actually patients.<sup>4</sup> That means the remaining 85%, employees or visitors, would benefit from similar amenities or facilities as traditional office employees. Commercial office buildings are already designed with many of the shared amenities needed in medical facilities and MOBs, such as covered drop offs, ADA push buttons at doors, large lobbies with admin stations, security check points and in some scenarios, coffee shops, fitness centers or cafeterias. Public facing items like coffee shops can even be enjoyed by patients as well.

- **Current Crisis:** Large, first floor lobbies could be converted to pre-screening areas, limiting the number of people that are allowed into other areas of the building, or on elevators, if contagious. Many offices already require security clearances to get past the lobby. These could serve as nurse stations or info desk points, creating a barrier from those delivering supplies and those that are sick.
- **Future needs:** Capitalize on the lobby space that is rarely utilized. Visitors of all kinds can utilize the coffee station in the lobby, allowing the experience to feel more hospitable, less hospital waiting room. No one likes waiting in a dark patient room

with no windows anyways. Doors would need to be converted to having automatic doors. While ADA push buttons work to provide accessible access, automatic doors provide the ultimate functionality for all users. Sharing security and admin check points consolidates services and duplicate functions for all tenants, saving money and space.

The coronavirus has forced developers, architects and building owners to re-look at our previous notions of what healthy spaces are. While the conversion or adaptive re-use of office spaces

into medical office space has traditionally been seen as a rare and potentially costly endeavor, because of new best practices brought on by COVID, the two typologies will start to function more similarly than ever before. Attracting employees, improving wellness, and reducing inefficiencies of cost are among the shared values between these two building types and markets. While upgrades to building systems may be necessary, at the end of the day, healthy employees are more cost effective than unhealthy ones. Treating patients and office employees like regular people in safe and welcoming facilities, not hyper sterile environments, goes a long way for overall wellbeing.

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# Transforming Schools into Temporary Hospital Centers for Non-COVID-19 Patients

CARINA CLARK, ERIC THOMSON, BOB ERICKSON, AND JARED BLISS

## Introduction

With the growing number of COVID-19 cases in the U.S., the demand for hospital beds is also increasing—creating shortages for hospitals and healthcare centers. From parking lots and parks to convention centers and military shifts, unconventional spaces across the country have been tapped to provide the space and resources to treat the tidal wave of COVID-19 patients. Less considered, however, is the ripple effect on non-COVID-19 patients. What is the impact to patients needing care for the flu or a routine wellness visit? How must facilities respond to continue to meet the needs of these patients that are now displaced because of the unprecedented crisis?

As elementary and middle schools sit empty, Corgan tapped our internal research and development team and engaged partners Henderson Engineers and Rider Levett Bucknall to explore the potential of converting these facilities into Temporary Hospital Centers (THCs) to serve the highest needs of the community during this critical time. This case study explores the compatibilities of K-8 facilities and the unique needs of THCs to alleviate the pressure on hospitals and care for non-COVID-19 patients.

*In March 2020, the U.S. Army Corps of Engineers published a document on the use of [Alternative Care Sites \(ACS\)](#) which stated that an ACS “is a facility that’s temporarily converted for healthcare use during a public health emergency to reduce the burden on hospitals and established medical facilities.” Throughout this case study, the phrase “Temporary Hospital Center” is used as a more specific type of an ACS.*

**THIS CASE STUDY WILL ASSESS WHY K-8 FACILITIES COULD BE TRANSFORMED FOR NON-COVID-19 TEMPORARY HOSPITAL CENTERS, USING URBAN AND SUBURBAN SCHOOL SYSTEMS FOR RESEARCH TO BE IMPLEMENTED IN U.S. SCHOOLS.**

Phoenix has  
**1-2 schools**  
per square mile

New York City has  
**8-9 schools**  
per square mile

Transforming closed schools to help non-COVID-19 patients could reach

**2,000–5,000**  
people per community in Phoenix

**16,000–22,500**  
people per community in New York City

*As of April 21, 2020, Phoenix has about 525 schools<sup>1</sup>, while New York City has about 2,600 schools<sup>2</sup>—all of which are closed due to COVID-19. By utilizing closed schools, 2,000–2,500 people per square mile can be reached.*

## Why Schools?

Mostly empty, U.S. schools present an opportunity to find new life for currently underutilized assets. Schools are often at the core of the community fabric — well-situated, highly localized, and connected to a network of transit channels in any metro or rural area. Without the investment of costly renovation, quick adaptations can retrofit these spaces to alleviate the burden on primary hospitals while providing dedicated, safer spaces to care for those not infected by the virus. From changes to furniture and equipment to disposable flooring and filtration upgrades, cost-effective and timely modifications take advantage of the several compatibilities of school design.

As part of the research done in preparation for this case study, the number of people a temporary hospital center could treat in their local community was taken into consideration. At the time of print, the urgency to also review a highly impacted area, New York City, to determine viability was paramount. These numbers show an estimated reach of community members who could get access to a healthcare facility without the concerns of being near contagious COVID-19 patients in urban and suburban areas.

Schools offer an abundance of advantages for a quick transition to Temporary Hospital Centers, such as:

- **Infrastructure:** While the power and Wi-Fi needs for Healthcare requirements are going to be specific to each community, most schools in general have adequate power and Wi-Fi to accommodate high demands and needs. If additional electrical power is needed, it can be easily supplemented with added mobile generators to provide a required redundant resource.
- **Room sizing and zoning configuration:** Schools typically have 20-30 classrooms at 800-900 SF per class, which can be quartered-off to serve multiple patient beds and other identified needs, such as triage rooms, geriatric care, gastrology, urology, ENT, obstetrics, gynecology, minor emergency rooms, etc. Many schools separate into wings that are each mechanically zoned, which is favorable when in need of a clean environment.
- **Campus assets and amenities:** School grounds can be used for triage tents to increase the level of care. Parts of the school, such as gymnasiums and libraries, could be utilized as daycare units for the healthcare workers. Kitchens and cafeterias can be used for food prep to feed all occupants, as well as a place to store local food deliveries.
- **Traffic and flow patterns:** District bus systems can be used for transporting healthcare staff and patients to and from designated areas. Schools are designed to accommodate drop-off and pick-up traffic, material delivery, and food preparation.
- **Community connection:** Neighborhood schools connect with the local community and keep long-distance travel and congested roads to a minimum.



Looking at the types of spaces at an average elementary or middle school, we can make some assumptions for the number of patients we can comfortably fit in each space:

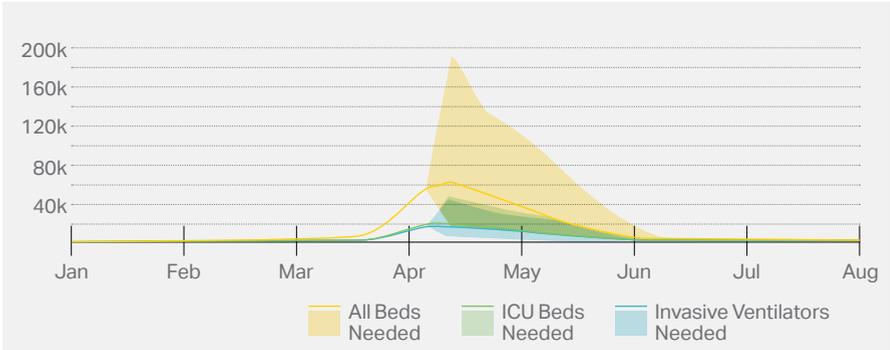
Healthcare Space Type	Size (in SF)	Room Size								Courts 4,700	Football Field		Gym 7,600	Caf. 4,175
		150	200	650	700	750	800	850	900		49,500	86,400		
Exam Room	80 SF	1	2	8	8	9	10	10	11	58	618	1,092	95	52
Intake	80 SF	1	2	8	8	9	10	10	11	58	618	1,092	95	52
Outpatient	120 SF	1	1	5	5	6	6	7	7	39	412	728	63	34
Pop-Up Tents	73.5 SF									63	673	1,189		
Treatment	100 SF	1	2	6	7	7	8	8	9	47	495	874	76	41
Triage	80 SF	1	2	8	8	9	10	10	11	58	618	1,092	95	52

## Why Non-COVID-19 Patients?

**Hospital beds are in high demand:** According to the AIA, "there is an unprecedented need for the adaptive reuse of buildings to serve in a surge capacity for medical screening, triage, and patient care".<sup>3</sup> At the time of this print, the United States was still in need of patient beds by over 58,000.<sup>4</sup> While the virus ushers in an unprecedent volume of patients on an already strained healthcare system, the opportunity to divert some of the burden to an alternative system or

setting provides our infrastructure the added support it needs manage this crisis. Focusing on how to treat those not directly infected with COVID-19 offers a more realistic solution as these cases are often less complex, more routine, and without the unknown variables and risks associated with the virus. The systems and infrastructures needed to care for these other patients can be more swiftly and efficiently deployed with the least disruption to ad hoc venues.

## Healthcare Needs Projection<sup>5</sup>



The Association for the Health Care Environment has estimated about 40 to 45 minutes of cleaning for a typical patient room, depending on size, number of surfaces, degrees of isolation, and other factors.<sup>6</sup> The number of patients per room may be larger and lead to a varying number of regular cleanings per patient.

Non-COVID-19 patients including those visiting THCs for the common cold, sprained ankles, or allergic rashes for instance, place a lesser burden on the space than required in containing the spread of an unknown and highly contagious virus. Rather, routine cleaning and decontamination of these spaces in hospital settings is comparatively faster and less intensive. Restricting care to non-COVID-19 patients makes for a more manageable turnover process of the THC to its original purpose as a school and preparing it for occupancy.

Dedicating THCs to serving those without the virus not only reserves primary hospital resources for COVID-19 patients it also reduces the risk of exposure to otherwise healthy patients and staff. Local schools can provide the continued care communities need while also offering a safer space that can minimize the spread of the virus.

## Operational Concept

With the average elementary school designed to be 84,700 square feet, teams have a wide variety of uses for alternate care sites.<sup>7</sup> The substantial and diverse floor plans of schools are ideal for transforming into a temporary hospital center due to each community's needs differing. This study suggests how common school spaces can be best utilized for different healthcare functions, including:

- Inpatient Care
- Outpatient Care
- Screening/Testing
- Mobile Services

## Site Preparation

Any required modifications must be both quick to implement and restore to maximize the time available after closing the temporary hospital center and prior to reopening the school. Additionally, the school should be left in a better state as a result of the physical improvements for healthcare use and the improvement of sanitation and air filtration systems.

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‡ On April 13, 2020, all Corgan employees were asked to participate in a survey assessing how parents felt about their child/ren's school being used as a temporary hospital center. The survey consisted of 13 questions and took approximately 1 minute to complete.

# Recommended Uses for Common School Spaces

		ART ROOM	BUS LANE	CAFETERIA	CHEMISTRY	CLASSROOM	COURTS	FIELDS	GYM	HOME EC	LIBRARY	LOCKER ROOM	MUSIC ROOM	PARKING LOT	RECEIVING	THEATER
Admin	Telemed			■		■	■	■	■	■	■					■
	Admin Work			■	■	■	■		■	■	■		■			■
COVID-19	Drive-Through Testing		■											■		
	Patient Waiting		■											■		
Imaging	Mobile MRI		■				■							■	■	
	Mobile X-Ray		■			■	■		■		■		■	■	■	■
Patient Space	Exam	■		■	■	■	■	■	■				■			■
	Intake	■		■	■	■	■	■	■				■			■
	Outpatient	■		■	■	■	■	■	■				■			■
	Pop-Up Tents						■	■						■		
	Triage	■		■	■	■	■	■	■		■		■			■
	Surgery															
	Physical Therapy								■							
Storage	Classroom	■		■	■	■	■	■	■	■	■		■			■
	Clean Supply	■		■	■	■			■		■		■			■
	Soiled Supply	■		■	■	■			■		■		■			■
	Hospital Equipment	■		■	■	■	■	■	■	■	■		■	■		■
	Truck-Based Generators		■				■	■						■		
Support	Break Room	■		■	■	■	■	■	■		■		■			
	Helipad						■									
	Lab	■		■	■		■		■							
	Pharmacy										■					
	Decontamination				■		■	■		■		■		■		
	Personal Washing/Hygiene											■				

## FURNITURE REMOVAL & STORAGE

School furniture will require temporary storage. Furniture can be stored in temporary onsite containers or in unutilized school rooms.

## DIVIDER, WALL, AND HEADWALL SYSTEMS

Multiple patient treatment spaces can be created within existing classrooms, gyms, and cafeteriums by utilizing portable divider systems in conjunction with mobile headwall systems to provide needed power and medical gas outlets. Pre-manufactured wall systems not only integrate into the existing wall system but also offer a higher degree of privacy, with options for doors and ceilings as well. These systems should be self-supporting to minimize the impact on any of the school facilities.

## WAYFINDING (SITE & BUILDING SIGNAGE)

Temporary signage will be necessary to direct traffic to/from and within the school site. These signs can be attached to existing signs to make a rapid transition to a temporary hospital center and back to a school.

## EQUIPMENT & SUPPLIES

Government agencies or private institutions operating the temporary hospital center would need to bring necessary medical equipment and supplies to function. The procurement of new medical furniture and equipment as required by the operating entity can be coordinated with vendors, such as Goodman's Interior Structures or Stryker Medical.

## MECHANICAL

**Heating and cooling** requirements for temporary hospital centers would be met by most school mechanical systems. The design population density in classrooms, libraries, gymnasiums, and other multi-occupant spaces in a typical K-12 school will, in most cases, result in enough cooling capacity to meet space loads required for healthcare patient treatment spaces. Additional required cooling systems would need to be evaluated on a space-by-space basis.

**Ventilation** in healthcare occupancies is measured in terms of air changes per hour (ACH), or the number of times per hour the full volume of air in the space is exchanged with fresh air from the HVAC system. A typical classroom designed to ASHRAE 62.1 or IMC ventilation requirements will most likely have between 2 and 3 ACH of outdoor air, depending on ventilation system design. This will satisfy the required 2 ACH of outdoor air ventilation applicable to nearly all patient care space types, which would be appropriate for a temporary hospital center.



The high volume of a gymnasium will result in lower air changes per hour based on the existing airflows when compared with a classroom with lower ceilings. To maintain required ACH in gymnasiums retrofitted as patient spaces, temporary tents with recirculation ventilation equipment would be needed.

**Humidity control** requirements for healthcare spaces will be met by typical school HVAC systems. In most cases, the population density for patient spaces will be lower than that of the original multi-occupant space design. This should limit the humidity in the area to within acceptable levels, provided humidity added by ventilation air is addressed.

**Air filtration** requirements for inpatient healthcare spaces would require an additional MERV14 filter bank, added downstream of the typical air handler unit in schools. The supply ductwork would be intercepted, and temporary ductwork would be routed to a temporary filter housing. This would most likely require a booster fan to overcome the additional system pressure drop. This upgrade

would leave the school with a healthier HVAC system if the existing system can be modified to support it.

Outpatient healthcare spaces and support function filtration requirements (alignment with MERV 7 rating) would be met with the typical existing air handling systems in schools.

**Exhaust air** required for spaces such as triage, laboratories, and soiled holding could be added to existing school spaces. Air exhausted by temporary fans could be routed out to temporary louvers installed in nearby windows or other minimally invasive locations. If appropriate exhaust discharge locations away from populated areas and outside air intakes are not readily available, exhausted air could be routed through a MERV 17-rated-HEPA filter before discharge.

Testing and balancing of the existing air systems could be used to adjust supply and return airflow to existing spaces for healthcare space types, which are required to be positively or negatively pressurized.

## ELECTRICAL

The existing electrical system should be sufficient for supporting standard power needs. However, modifications will be required to connect an emergency power source. Typical elementary and middle schools do not have an emergency generator — an emergency generator on a flatbed or a pad with a skid mounted tank will be required. Fuel supply will be needed to maintain the continuous operation of the generator for 24 hours before refueling.

## PLUMBING

Existing facilities should be sufficient for supporting the needs of the temporary hospital center. Elementary school bathroom fixtures may not be suitable for staff, due to the smaller sizing and lower installed height of fixtures. Restroom trailers could be brought onsite and connected to the grade cleanouts or sewer manholes. Lavatory and sink faucet aerators should be converted into laminar flow aerators.





## MEDICAL GAS

Many temporary medical response facilities require a medical gas and suction infrastructure response. A solution requiring medical gas will be specialized in the nature of the temporary and rapid implementation required. Two possible approaches in providing gasses and suction include:

- 1 Providing gas and suction equipment in one centralized location and routing temporary distribution lines through the facility.
- 2 Supplying individual bottle and suction machines directly at the bedside.

By utilizing a centralized solution, users have the convenience of providing bulk oxygen supply in larger tanks set up in a temporary yard or a container solution. These would be paired with machinery for suction. Manufacturers of these prefabricated units can quickly deliver units — however, amidst a widespread emergency, the availability of such units may be limited. Builders of each temporary hospital center can create a secure mini yard with the tanks and devices separately. Distribution lines from a yard would run to care rooms through a network of hoses along walls, ceilings, or even over rooftops and into the place of treatment.

Alternatively, individual-use oxygen or medical gas tanks and suction machines can be supplied and brought to the bedside. This strategy would reduce the time spent building a hose distribution network around the site and have a lower converted impact on the facility. However, this approach requires procuring a large number of devices, in addition to resources to replenish smaller tanks as they run out of capacity. A point-of-use strategy may also present a safety benefit by avoiding temporary lines being routed in many directions, and a redundancy benefit should equipment fail or require unexpected downtime.

Hybrid approaches could be tailored to the needs of the specific site or type of care provided.

# Considerations For Schools Post-COVID-19

The following should be considered at schools following the COVID-19 pandemic:

## SAFETY UPGRADES

- Separate entrances for sick and well students to use when entering the nursing area should be considered for any new builds or renovations, allowing for a separation of contagious and non-contagious students or staff.
- School nursing unit design should be more "robust" to handle and isolate infectious students.

## MAINTENANCE NEEDS

- Mechanical systems should have upgraded controls and filtration to reduce the potential for cross-contamination.
- Rented student equipment should be "assigned" to students to be used for the entire day and include a full cleaning at the end of the day to reduce microorganism growth.

## PARENT INTEGRATION

Providing parents with the technology to ensure students aren't sick before entering the campus to reduce the potential for the spread of illnesses. Innovative technology has emerged, including wearable thermometers.

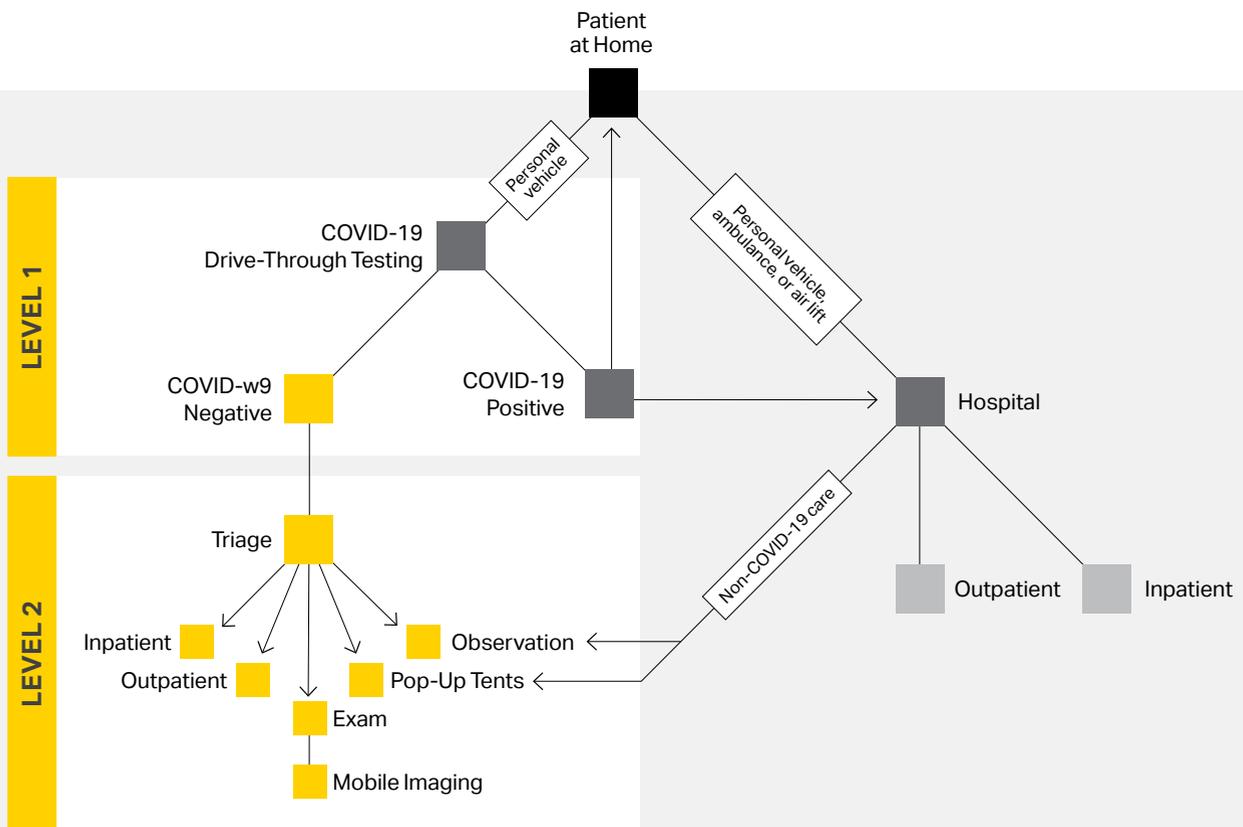


# Patient Flow

Schools should utilize two levels in regard to patient flow.

**Level 1** is the initial arrival of any patient to the campus to be tested for COVID-19 before moving forward. Only if the patient tests negative are they moved into the temporary healthcare center for treatment. Level 1 allows for more testing sites to be made available to the community and helps ensure patients being treated in the temporary hospital center are not infected with the COVID-19 virus.

**Level 2** is treatment. Once a potential patient has tested negative for COVID-19, they move to triage to determine their ailment and where they should be moved inside the temporary hospital center. After triage, the patient moves to an exam (for further examination or phlebotomy), or a patient treatment area (observation, inpatient, outpatient) whether in classrooms, gyms, or pop-up tents on campus grounds. As an added service to the patients on a temporary hospital center, mobile imaging units (x-ray or MRI) could be stored and utilized on site. Additionally, local hospitals could bring in COVID-free patients via ambulance or helicopter.



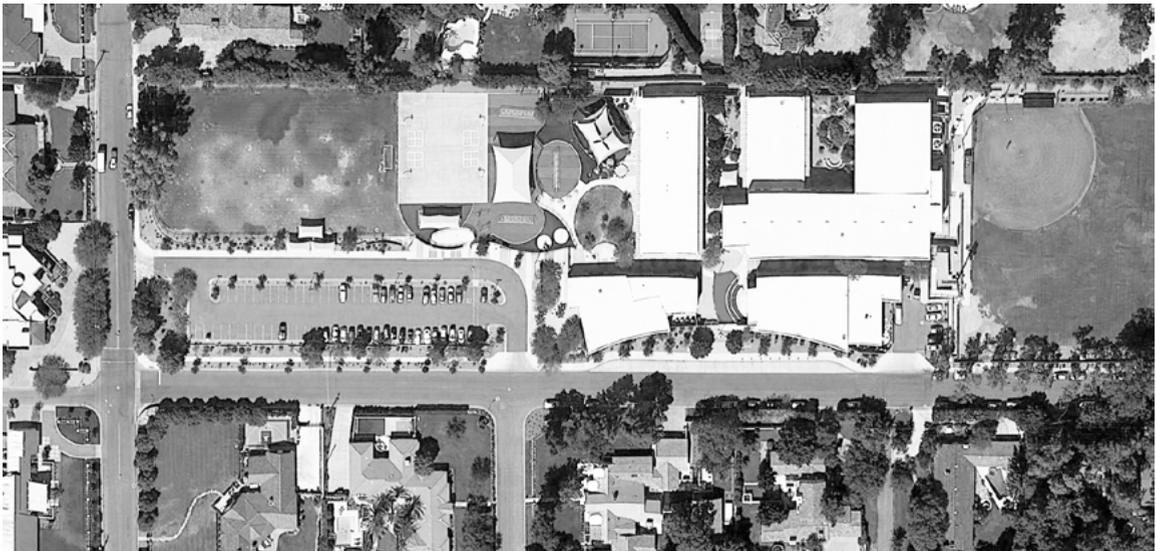
# Case Study

This case study utilizes an elementary/middle school to represent all possible facilities available in a typical elementary school and middle school. These schools are ideal due to their location in every town and state across the United States, in both metropolitan and rural areas.

Elementary schools are more abundant and equally distributed across school districts and the towns they serve. They are better positioned to provide a similarly disbursed surrounding service to the predominant healthcare provider in each area. Each school can relieve local hospitals to allow hospitals to focus all attention toward patients with COVID-19. Neighborhood elementary schools offer the added benefit of optimal spaces for daycare services for healthcare staff working on-site. In addition to reducing vehicular road traffic, which allows patients to stay in their community to get the care they need, it also provides opportunities for neighbors to volunteer their services. These facilities are significant assets, currently empty and available to serve their specific community's needs.

## SITE HIGHLIGHTS:

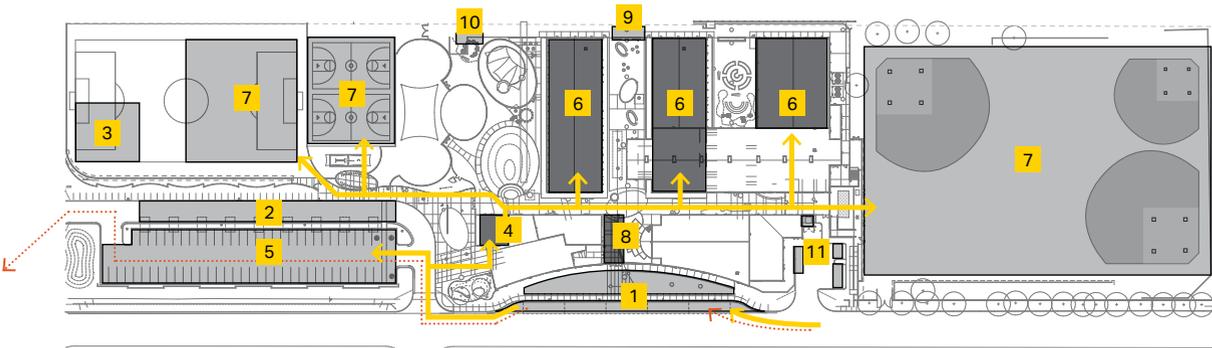
- 369,029 square footage campus
  - Two basketball courts
  - One football/track field
  - Multiple baseball fields
  - In/out bus lane drop-off
  - In/out parking
  
- Facility highlights
  - All classrooms contain a handwashing sink
  - Shared classrooms with connected restrooms available



# The Site

The bus lane serves as a COVID-19 testing site. Once a patient has been cleared as *negative for COVID-19*, they enter the campus through the school nurse's office converted to the triage space, and travel to other areas of the campus.

This particular site suggests that even a small campus can house a spot for a helipad to land or ambulances to arrive, transporting patients from hospitals that may have been overcrowded with COVID-19 cases.



- |                                |  |                              |   |
|--------------------------------|--|------------------------------|---|
|                                |  | ← COVID positive route       | ← COVID negative route                        |
| <b>1</b> Drive-Through Testing | <b>4</b> Triage  | <b>7</b> Pop-Up Tents        | <b>10</b> Transformer                         |
| <b>2</b> Emergency Vehicles    | <b>5</b> Waiting Area  | <b>8</b> Mobile Imaging      | <b>11</b> Receiving, Trash, Hazmat Collection |
| <b>3</b> Helipad Landing Zone  | <b>6</b> Treatment Area<br><i>Inpatient, Outpatient, Observation, Exam</i> | <b>9</b> Temporary Generator |   |

Numerous other arrangements would work on this site. Some alternatives include:

- Utilizing outdoor fields as container storage for classroom furniture, fixtures, and equipment while the school is in use as a temporary hospital center.
- Converting small, specialized classrooms into single-patient rooms.

# The Campus

This case study involves a two-story school — the second floor is considered only as a convenient location to store classroom furniture and equipment while the school is a temporary hospital center. It is possible, however, that since there an elevator nearby, all classrooms, technology rooms, and music rooms on the second floor could be converted to more patient space. For security purposes, this case contains all patient areas to the ground floor.

This plan utilizes the chemistry and art rooms as lab space, which can be easily accessed from patient treatment and exam areas. The cafetorium is proposed to house a break area for healthcare staff, while also allowing for additional lab overflow if needed. The stage could quickly be converted to an administration area for the temporary hospital center and allows for a quick access to the press briefing center outside.



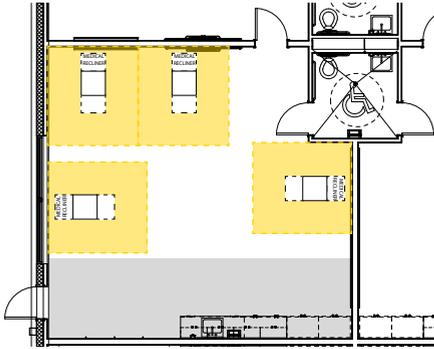
# 3-4

Patients

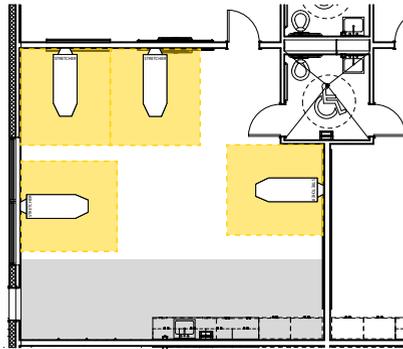
## Layouts

### Typical Classroom Layout

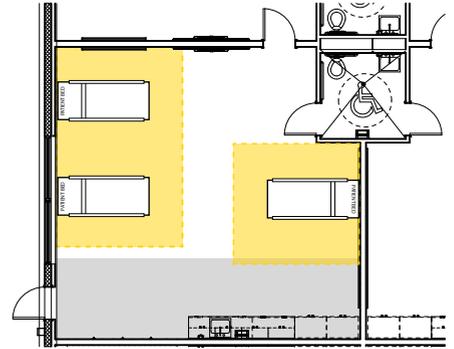
This typical classroom includes a restroom with hand-washing facilities.



*Recliner chairs (Phlebotomy)*



*Stretchers*



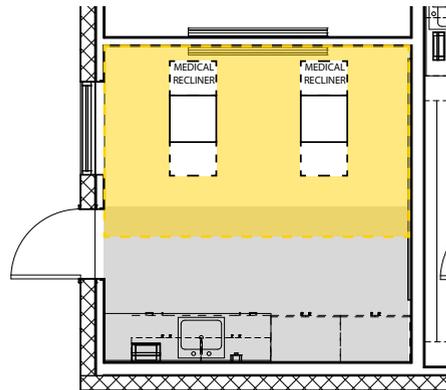
*Patient beds*

# 1-2

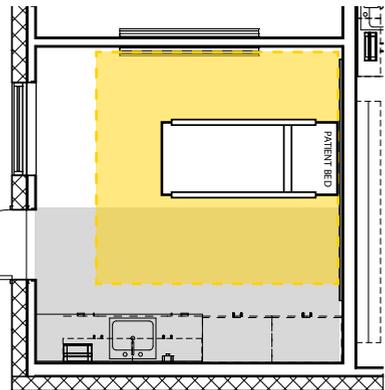
Patients

### Specialty Classroom or Office Layout

Patients can be examined or have their blood drawn in a smaller specialized classroom. These rooms can also be converted to single-occupancy patient rooms if needed.



*Recliner chairs (Phlebotomy)*



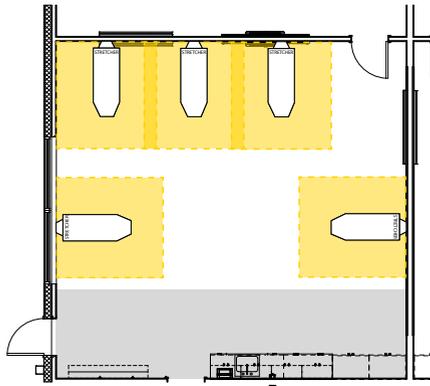
*Stretchers (exam)*

# 4-5

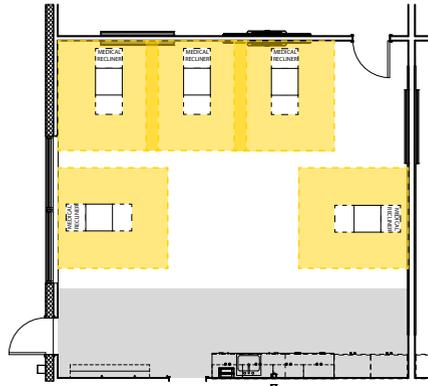
Patients

## Classroom Type II Layout

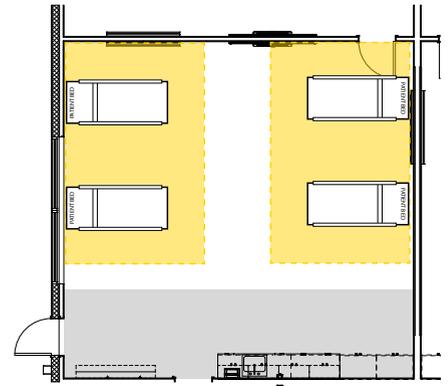
Slightly larger than a typical classroom, this space type does not include a restroom or dedicated hand-washing facilities. Depending on the care needed, an additional patient could comfortably fit into this size classroom.



*Stretchers*



*Recliner chairs (Phlebotomy)*



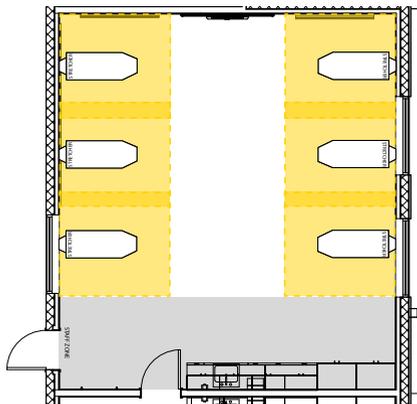
*Patient Beds*

# 4-6

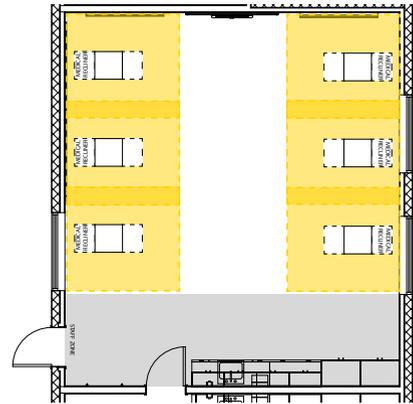
Patients

## Classroom Type III Layout

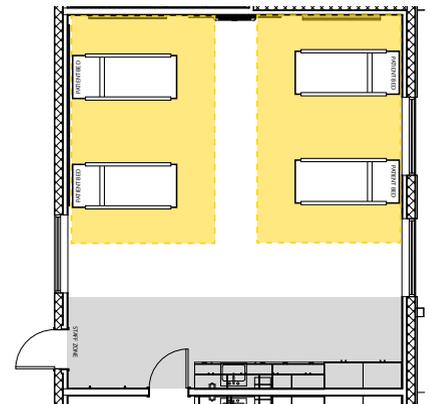
The largest of classroom types, this space allows for the most patients per room while still meeting standard space requirements for staff and patients.



*Stretchers*



*Recliner chairs (Phlebotomy)*



*Patient Beds*

# 48+

Patients

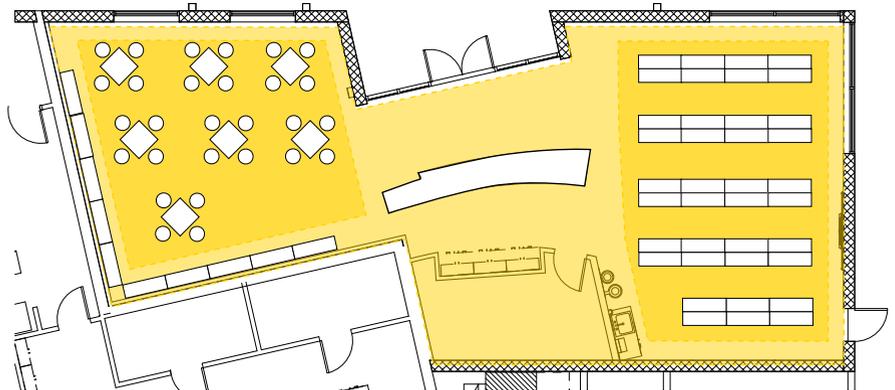
## Gymnasium

A large, open space, gymnasiums allow for a large number of patients. This example shows 48 patients, but due to the range in size of school gymnasiums, additional patients could be treated as locations vary.



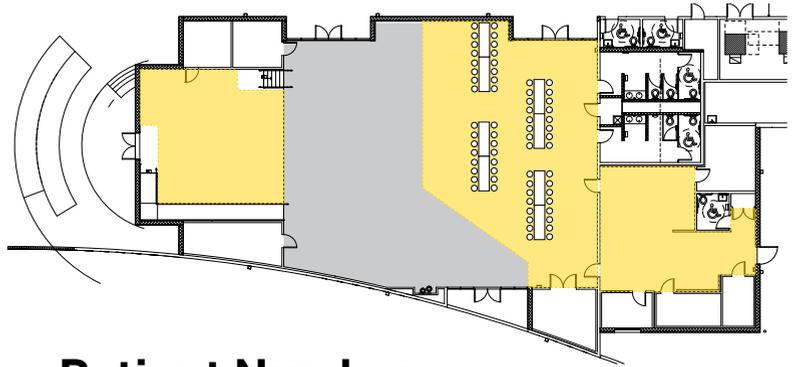
## Library

A library can be used as a temporary pharmacy with reconverted shelving space for storage and reading tables for work surfaces.



## Cafetorium

Staff can utilize half of the cafetorium as a break room, with access to the kitchen (assuming the other half was used for lab overflow). It is likely that the the entire space would be utilized as a kitchen and open to the community.



# 1,894

Estimated maximum patients treated on this campus at one time

# 195

square feet needed per patient in this high-density situation.

## Patient Numbers

Based on the proposed case study, this elementary/middle school can support up to 170 patients in this elementary/middle school at one time.

- 5-6 triage spaces can be utilized to support ten exam rooms for 1-2 patients, allowing for up to 26 patients to be triaged and examined.
- Classrooms can provide treatment for 16 patient treatment pods allowing for 3-6 patients in each room. This case study allows up to 96 patients to be treated at one time.
- Should outdoor spaces be utilized, an additional 1,724 patients could be treated on a single campus. This includes areas such as baseball fields (1,189 patients), football fields (409 patients), and basketball courts (126 patients).
- This case study has shown that a patient can be treated for every 195 square feet of this campus. This number is specific to this case study in a high-density situation — other schools looking to use this as a model may vary.

In comparing the potential reach of community members in the Phoenix area (2,000-2,500 patients per square mile), this case study could aid in the care for almost all of the community around this school if the local hospital is too full of patients being treated for COVID-19. While not every member of a community may be in need of a non-COVID temporary hospital center, this case study provides a path to meet a need that is currently not being met.

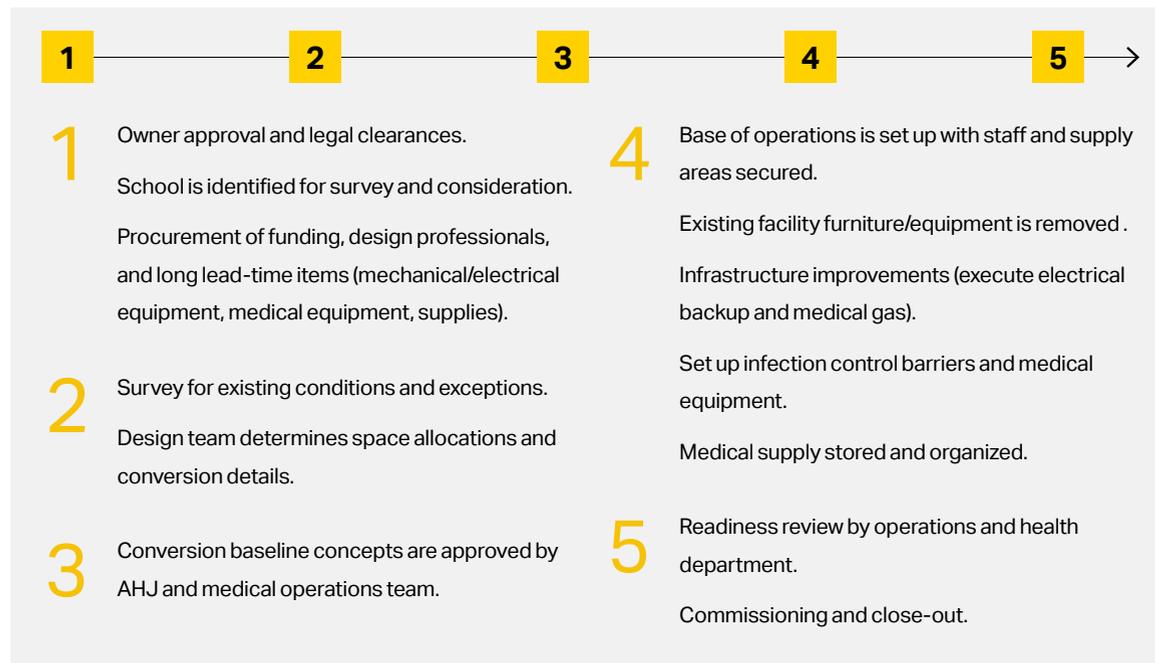
# Timeline

The timeline below shows an aggressive schedule accounting for the basic steps to set up a facility, though some set up will have specific challenges that can cause these times to change. Organizers are encouraged to work with local authorities from the beginning to speed up the process and avoid challenges.

Time at the beginning is needed to assess the facility and move supplies and equipment out of the facility, to make way for the change. Operators should be ready with agreed-upon levels of readiness, with an understanding of fast-tracking from the authority having jurisdiction and local health department.

Facilities can open  
in as little as

14.5  
days



A phased approach could be utilized in order to allow initial patients to be tested and treated quicker than waiting until the entire facility can take on non-COVID-19 patients at full capacity.

**PHASE 1**  
Drive-through testing  
  
Outdoor pop-up treatment areas

**PHASE 2**  
Indoor gym space converted

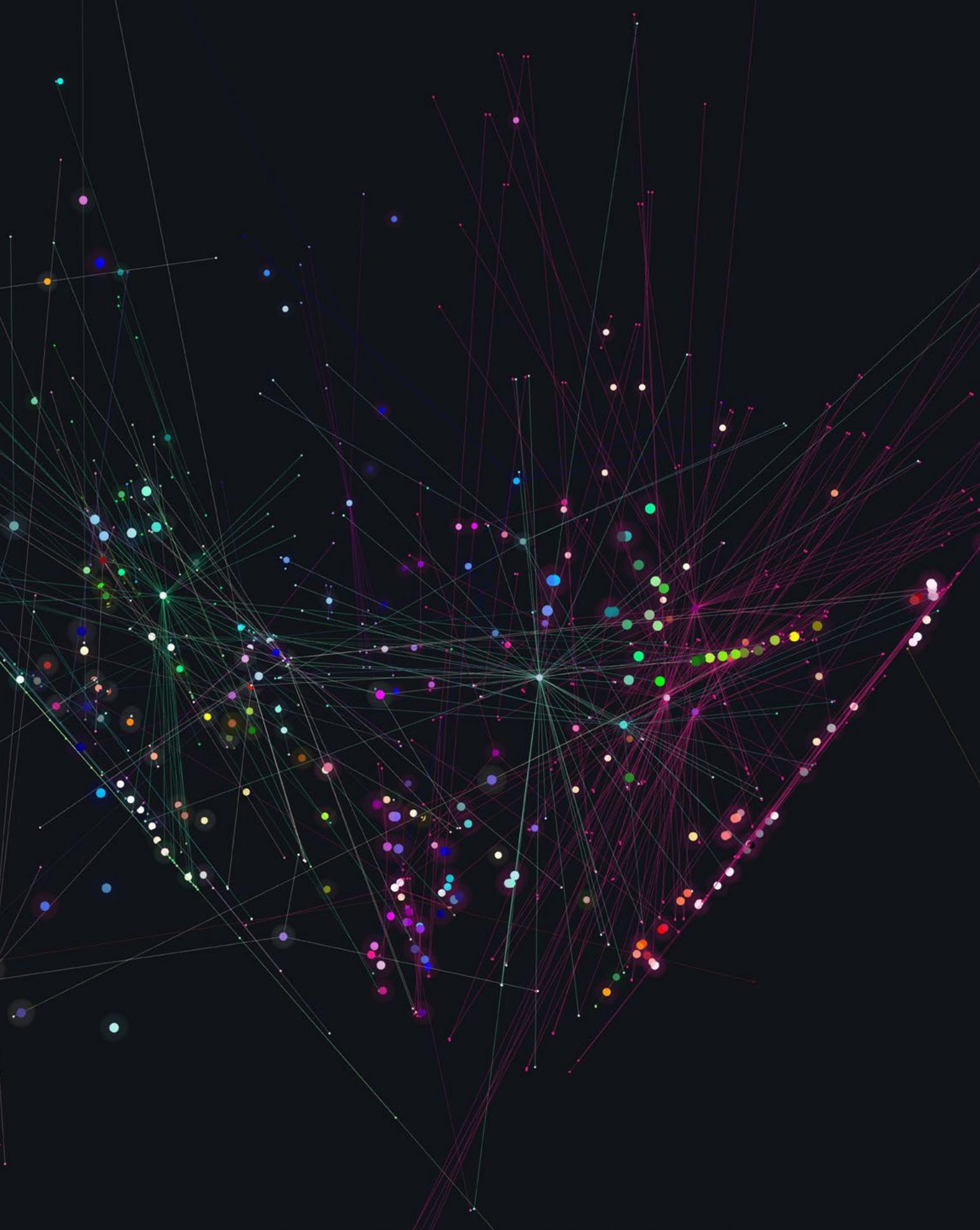
**PHASE 3**  
Classrooms converted

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# 04

## FOCUSING ON HEALTH

From well-ventilated buildings, to infrastructure that encourages sanitation habits, the design of our cities and buildings have always been shaped by disease. Today, our heightened awareness about disease transmission is strengthening our focus on how human-centered, empathetic design can anticipate evolving user expectations and introduce health-oriented design interventions.

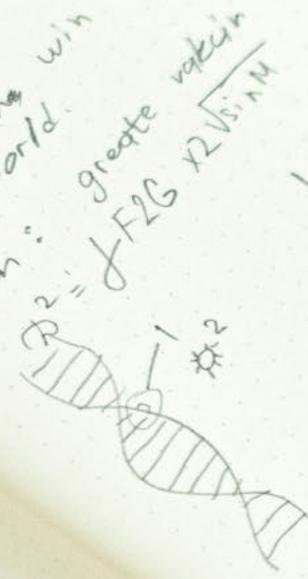


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COVID 19

how I can win coronavirus  
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Coronavirus

# Deciphering the Language of Anti

CARINA CLARK

For years, the A&E industry has been slowly infected by new and exciting terminology like “antibacterial” to aid in infection control — especially in hospitals where the potential of catching an Hospital Acquired Infection (HAI) is more prominent. As the coronavirus overflows into every realm of our daily lives, it’s essential to take the time to understand some of these keywords and particular phrases, but most importantly, validate them with peer-reviewed research.

To start from the very beginning, we first need to define the soul of these “anti-” terms.

## “Anti-” Terminology

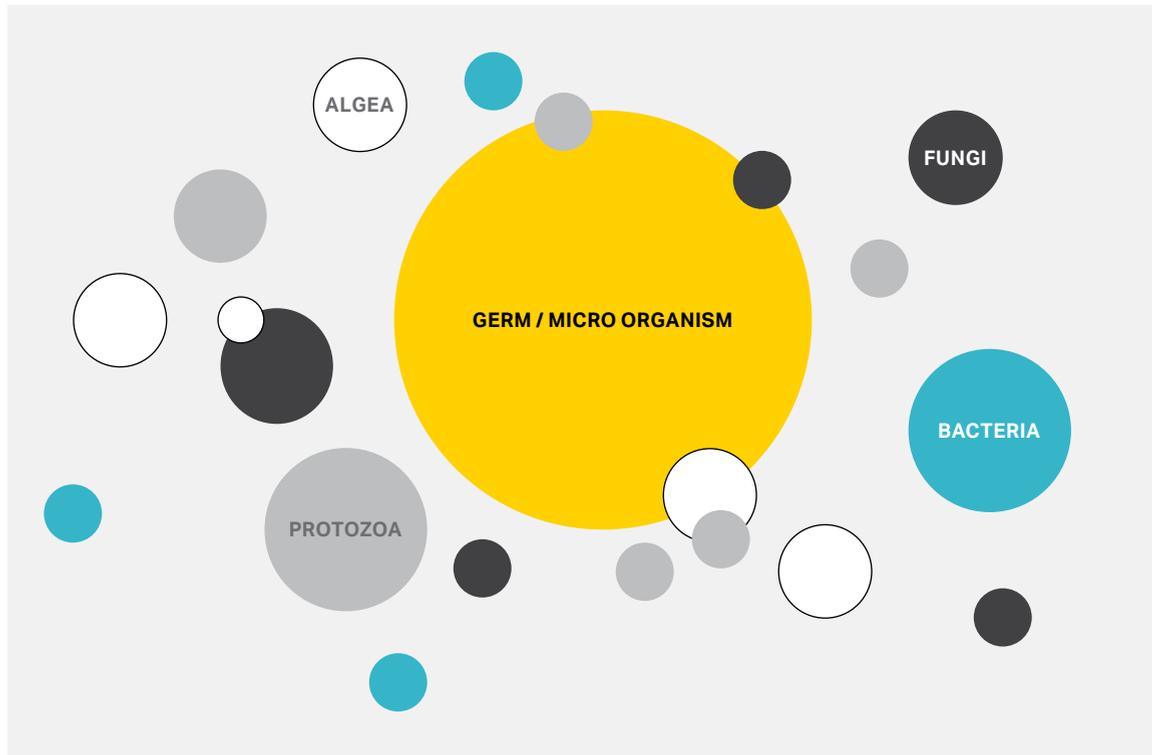
We have all heard of the word: **germ**. Germs are bad; germs make you sick, and so on. But transitioning from the common term “germ” to the scientific name “microorganism,” we find that there are more to these germs than meet the eye. In fact, a **microorganism** is an umbrella term for things like algae, fungi, bacteria, and protozoa, which all these have the ability to cause disease.<sup>1</sup>

But, hold on. Many resources out there will also classify viruses as a microorganism, and to understand the anti- terms, we need to understand the difference between microorganisms and viruses.<sup>1</sup>

Let’s make this simple and strictly keep to bacteria and viruses. **Bacteria** are single-celled organisms that can be found in numerous places like soil, water

sources, and even inside your body.<sup>2</sup> In fact, when you compare the number of cells in our bodies to cells of the microorganisms living within our bodies, the microbes beat us by ten-fold! So, yes, many types of bacteria are dangerous and the cause of many diseases, like pneumonia, but, there are cases where bacteria can be an added benefit — like in the process of turning curdling milk into yogurt.<sup>3</sup>

Now, viruses are a little different. Not only are **viruses** typically smaller than bacteria, but they are also dependent on a host.<sup>4</sup> Remember when we stated where bacteria could be found? Soil and water are static environments, not a living creature (yes, they can also survive in a living thing, but the key difference is the non-living environment here). A virus must survive on, or in, a living host in order to not only endure their own life cycle, but to latch on to the cells of its host in order to reproduce.<sup>4</sup> **It is with this simple difference that many microbiologists do not classify a virus as a microorganism.** This fundamental difference is vital for the next stage in understanding the “anti-” world.



## Anti-terminology

We are going to once again start from a macro-to-micro scale in defining these terms from microorganisms to bacteria.

The term **antimicrobial** is a fantastic word for manufactures to use as it seems to cover all the bases. Based on the “-microbial” part of the name, it’s clear that this term is specifically focused on the microorganisms mentioned earlier. The critical piece of information to note here is that antimicrobials “work at a cellular level to continually disrupt and prevent the growth of microorganisms by creating an inhospitable environment...” until they eventually die out.<sup>5</sup>

Similarly, **antibacterial** is commonly used more specifically to inhibit the growth of bacteria, but not necessarily other types of microorganisms like

algae, fungi, or protozoa. Hopefully, at this point, there is a clear pattern here: antimicrobials and antibacterial simply slow the growth until the point of death but do not immediately kill.

To eliminate germs more quickly, you can use a common technique referred to as being biocidal. A **biocide** is a mixture or substance that has “the intention of destroying, deterring, or rendering harmless, any harmful organism by any means other than mere physical or mechanical action.”<sup>6</sup> Not only do these do better at destroying, but it must also kill the cell within a specific time and within defined conditions to be qualified as a “biocide.”

Realizing that this might sound like an amazing substance to use and be on the lookout for, (especially in post-COVID scenarios), it’s important to note that biocides have been known carcinogens and endocrine-disrupting at least 30% of the time.

At this time, it's crucial to point out that many of these terms and techniques are considered **pesticides** – especially those related to a product applied or infused to an object – and are regulated by the U.S. Environmental Protection Agency (EPA)<sup>7</sup>. There are products out there, like bleach, that are actually considered both a pesticide (to disinfect surfaces), as well as a cleaner (to whiten laundry), so it is essential to not only follow all directions of using these products but to understand its effectiveness against germs.

## What this means for the Coronavirus

By now, you should hopefully understand some anti-terms and how they can affect microorganisms and bacteria specifically. **As a reminder from earlier terminology, viruses (like the novel coronavirus) are not the same as bacteria; therefore, antibacterial solutions will have no**

**impact on inhibiting the growth or destroying viruses.** In fact, there is evidence to indicate that some antibacterial agents, or washing products like antibacterial soaps, may even cause more harm than good.<sup>8</sup>

But, wait, what about anti-viral? Yes, **antiviral** methods exist and they do suppress reproduction ability, which inadvertently inhibits the growth and eventually kills a virus.<sup>9</sup> Antiviral drugs were used mostly during the AIDS pandemic;<sup>4</sup> **however, much of what is available as an antiviral is a drug, rather than an environmental aerosol or surface.**

So, in terms of the Coronavirus pandemic, there is still much to be studied. But in the meantime, it is best to follow suggestions of the Centers for Disease Control and Prevention (CDC) by working to avoid exposure and use EPA-registered household disinfectants.<sup>10</sup>

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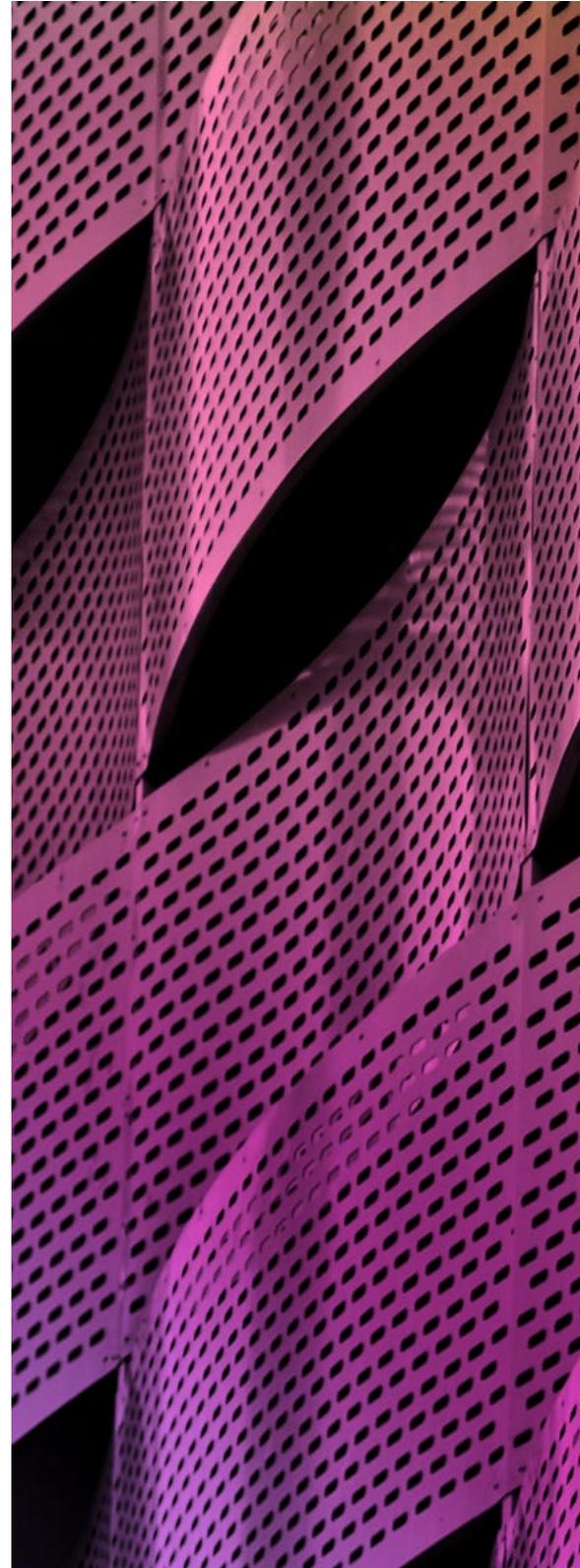
# Future Material Technologies

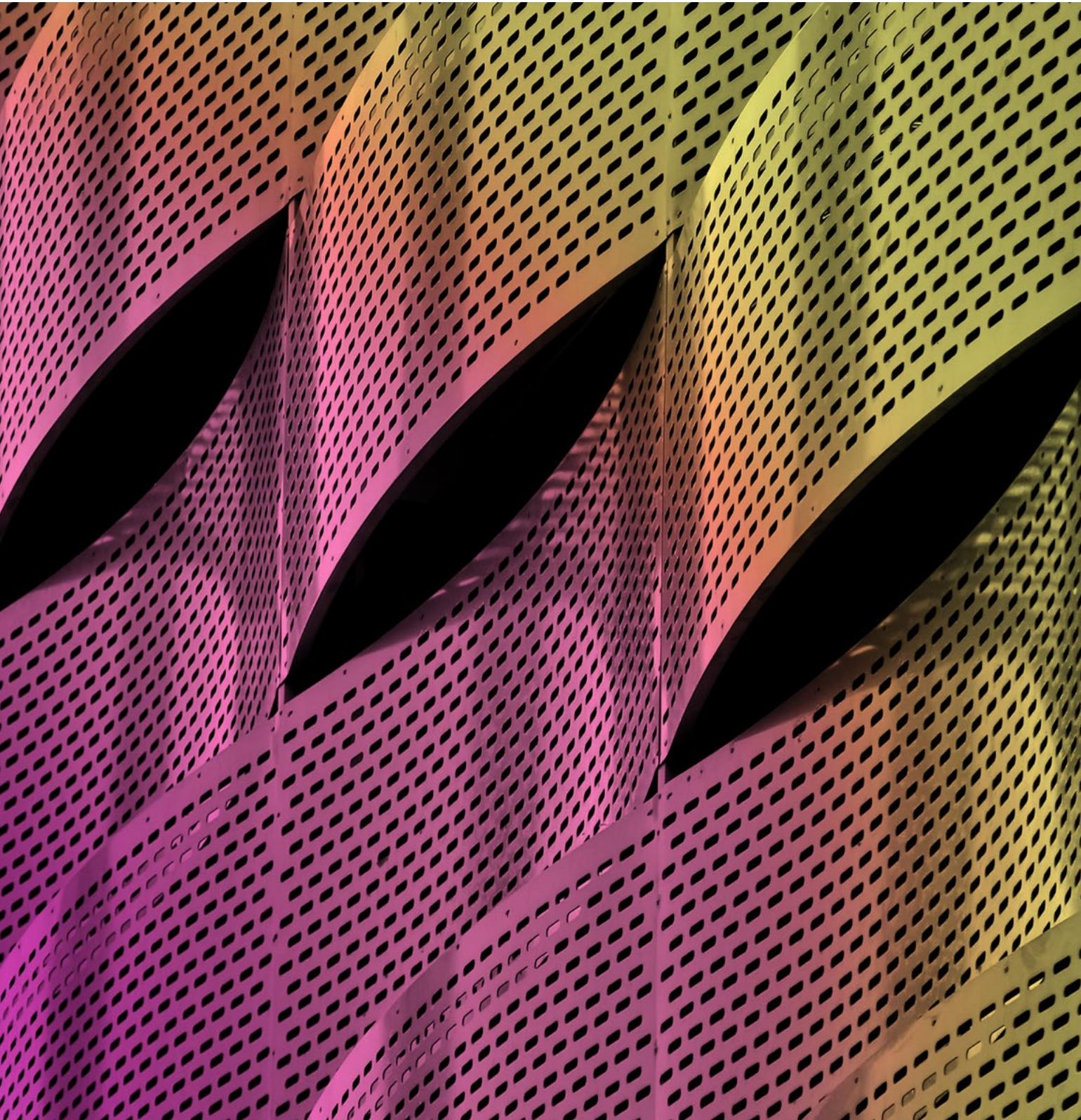
STACEY BRIMMER AND CARINA CLARK

As a society in the middle of a pandemic, we are suddenly exploring new ways to clean surfaces and filter our air through what may at one point been considered science-fiction. Who knew that waving light over a surface, or passing through a portal could reduce microbe loads? Or that we could use aerosolized hydrogen peroxide to clean every inch of space? This seems to be the future of hygiene, *right?*

The Center for Disease Control and Prevention has created a Hierarchy of Controls, pictured below.<sup>1</sup> As you can see from the inverted pyramid, PPE & changing the way people work (i.e. masks and social distancing) are typically the least effective.

But what if the spaces where we lived, worked, and healed naturally protected us from the dangers of the microscopic world? How could design of the future impact our survival for tomorrow? In this article, we will review several already available methods and products to get us to that point, followed by some futuristic hypothesis that designers and scientists are beginning to consider.





# Available Now

## METAL

It may be a surprise to some, but metals have been used for centuries due to their antimicrobial properties.<sup>2</sup> It is essential to understand, however, that not every metal is created equally. Some have shown great success in protecting humans from a world we cannot see with our naked eye, while others indicate a realm of possibilities with a nasty and potentially dangerous side effect.

### Silver

One metal used in products like privacy curtains is Silver-ion. Silver is an interesting metal in that it “can pose a problem if it is ingested in high quantities,” and there haven’t been studies looking at the long-term effect of exposure to silver (i.e. the daily touching of curtains).<sup>3</sup> But, the thing silver does have going for it is its ability to penetrate the inside of bacteria. Recent studies have even shown that metal nanoparticles, particularly AgNPs, can be effective agents against a number of types of virus.<sup>4</sup>



To learn more about the silver-ion infused privacy curtain, visit [www.arc-com.com/crypton](http://www.arc-com.com/crypton)

### Copper

Another metal to consider is one that has caught the attention of many researchers and medical professionals in recent years: copper. Copper is “registered with the EPA as a public-health antimicrobial product because of its proven ability to kill bacteria.”<sup>5</sup> Studies, like those done at Sentara Healthcare, show remarkable decreases in bacteria loads when using copper, preventing many Hospital Acquired Infections (HAIs). In certain cases, copper has decreased rate of infection by 78%.<sup>5</sup>

The benefits of using copper as a non-invasive anti-bacterial design tool is that it can kill the bacteria

through three main pathways: rusting, microbial cellular toxicity, and free radicals.<sup>6</sup> To put it simply:

- 1 Oxidizing copper atoms weaken the bacteria’s cell wall pulling it apart until the bacteria dies
- 2 As the bacteria’s cell walls are broken down, copper ions storm inside the hole of the wall and into the cell itself
- 3 Once inside, the copper really starts to get all Bill Nye, The Science Guy. As the copper oxidizes, it releases hydrogen and oxygen atoms (aka. oxygen hydroxide) and forces instability as it’s unpaired electrons try to find a match, pulling and ripping electrons from other atoms, inadvertently rupturing the cell membrane and killing the bacteria

Not only have we used this heavy metal for thousands of years to house our drinking water and cater our meals, it is also a metal found naturally in our bodies. We absorb it through ordinary food, like chocolate, without repercussions.<sup>7</sup> Note: Corgan does not endorse the ingestion of copper or copper-like materials.



To learn more about how copper can act as a great, natural antimicrobial, and to see how scientists are using ways to infuse copper in building materials like solid surface, visit [www.eoscu.com](http://www.eoscu.com)

### Silver and Ruthenium

This next metal is less of a direct application and more of a coating solution. In 2019, the International Space Station tested a coated surface for a toilet door using silver and ruthenium to see how bacteria would react to this type of mixture. After six months of tests, no bacteria was discovered. It was only

at the end of the experiment were a total of 12 strains of bacteria were found to be surviving on the surface.<sup>8</sup>

Scientists have found that this mixture of silver and ruthenium (which has been known to reduce bacteria loads by 30%) can show an outstanding 80% fewer bacteria strains than a control.

According to microbiologist, Elisabeth Grohmann, this coating not only kills bacteria, but yeasts, fungi, and even viruses. Like many surfaces, much of what is believed to be the cause of bacteria growth is the lack of proper cleaning, leaving dust particles, debris, and even dead cells create a protective surface between the fallen microbes and the active coating.<sup>9</sup>



To learn more about this space-aged coating visit [www.alliedbioscience.com/surface-wise](http://www.alliedbioscience.com/surface-wise)

## Biomimicry

Biomimicry is a fantastic technique in that it looks to nature for inspiration. Our planet has evolved to develop its own means of protection against unwanted threats and looking to these methods could prove to be a reliable source for, not only, reducing bacteria but also limiting its ability to evolve and become a superbug.

Rather than introducing antibiotics that microbes can become resistant to, or using heavy metals, that could be more dangerous to people than the bacteria itself, some companies are using biomimicry to influence a **surface pattern**-based approach to deter bacteria.

In 2002, Dr. Anthony Brennan was working on a product for the U.S. Navy to help reduce the friction of boats in the water when he looked to marine life already free from barnacles and algae; what he noticed was the lack of any growth on the skin

of sharks. **By taking the simple diamond shape scales, or the “dermal denticles” – a key feature to the success of the shark’s skin - scientists were able to create the first antimicrobial physical surface modification to inhibit the growth of bacteria.**<sup>10</sup>

The reason this method works so well is due to the pattern itself. Because of the size and placement of the patterns, the bacteria’s cell walls are bent out of shape. Additionally, with the reduced ability for the bacteria to latch on the surface securely (because of the gaps of the pattern), it causes more energy for the bacteria to try to find another place to secure to leading it to die before significant reproduction can take place.<sup>11</sup> The added benefit to this type of material is its adhesive backing that can be applied to a wide range of surfaces in our most contaminated spaces (i.e., public restrooms, hospitals, childcare, etc.) or even integrated into devices, like catheters.<sup>10</sup>



To learn more about Sharklet Technologies visit [www.sharklet.com](http://www.sharklet.com)

**Hydrophilic coatings** also work in much the same way that hydro-phobic coatings do. Currently, there are silica-based coatings in the ophthalmic and HVAC markets that, due to their optical clarity, could be applied to architectural glass, resin, metal or other materials providing an improved cleaning surface.



To learn more about these hydrophilic coatings, visit [www.lotusleafcoatings.com](http://www.lotusleafcoatings.com)

## Mechanical

Not every material needs to have a coated application to protect it from bacteria; some common material manufacturers are looking to

the use of **ions** to prevent bacteria growth on their products.

A Norwegian flooring manufacture and textile coatings manufacturer are utilizing its surface materials to force bacteria cells to be attracted to the surface covered in microscopic cones, or teeth. As the bacterial cells come near the surface, the cell wall is partially neutralized by  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  ions, leaving the remaining negatively charged cell walls to pull towards the positively charged floor. As the bacteria reaches the surface, its membrane is disrupted and inadvertently kills the bacteria.<sup>12</sup> Imagine a future of surfaces like these where your biggest concern is clearing away the bio-load for more microbes to be attracted and punctured! For more information on the use of a biocidal flooring product, visit [www.bolidt.com/en/home](http://www.bolidt.com/en/home). For more information on Applied Textiles use of antimicrobial fabric coatings, make sure to visit [www.applied-textiles.com/environments/healthcare](http://www.applied-textiles.com/environments/healthcare).



Watch Bolidt's video on how the flooring works to kill the bacteria.



Also watch their video on how the fabric works as well.

## Future Possibilities from the past

What if the best material to protect us from harmful germs are not yet on the market? Doesn't seem too crazy, right? What if we took the time to look at things from our past, to help us in the future? Technology is forever evolving. As we increase our understanding of how these surface materials impact our health, we need to look to a variety of markets for possible surface application materials.

Several exciting opportunities surround the expansion of nanotechnology.

### METAL

One type of coating to consider is **photocatalytic titanium-dioxide**. This coating works by creating a free electron when exposed to UV light, such as sunlight. The electrons then combine with oxygen to produce superoxide radicals that deteriorate organic compounds.<sup>13</sup> Some of the best versions of this coating employ a dopamine-encapsulated silver-doped titanium dioxide molecule.<sup>14</sup> As previously mentioned, the introduction of heavy metals can be contentious based on lack of information on their impact for absorption. One compromise to this may be to seek the use of these coatings on only low/no-touch surfaces such as ceilings, light and HVAC fixtures, undersides or components of furniture and equipment and or flooring depending on the space.

### BIOMIMICRY

Yes, there are many inspirations from nature already out there (some even mentioned here). It's fair to suggest that maybe not everything has been explored from what mother nature has to offer. In recent years, there has been much discussion about looking to the natural world for inspiration, like the Sharklet technology mentioned above.

Take, for instance, the **lotus leaf**. Even though the lotus plant typically lives in muddy environments, the leaves tend to remain dirt-free without using detergent or expending energy. From a microscopic level, the lotus leaf contains a roughened surface through its creation of epicuticular wax crystals. This surface forces water droplets to condense into small spheres where dirt is more likely to be attracted to it, rather than the leaf's surface. As low vibrations happen, the water droplets shake off the leaf, making it easier to not only clean bacteria off the surface but also helps deal with the challenge

of biofilm, which is the growth of organisms on the dead bodies of its comrades that were killed by anti-biotic coatings.<sup>15</sup>

Due to the structure of the surface, there is no micro-organism or viral attachment, which means a simple rinse with water can remove any material on the surface.<sup>16</sup> **Just imagine if you go beyond the Sharklet technology mentioned earlier and use the hydrophobic inspiration of the lotus leaf – glass, painted walls, and even textiles could act as their own self-cleaning surface, which could reduce the need for costly labor and harmful cleaning detergents.**<sup>17</sup>

The use of natural wood in healthcare environments has always been a struggle. **Wood**, is a natural food source of many fungal and bacterial organisms<sup>18</sup> and the current coatings often used, namely urethane, degrade heavily with the use of disinfectant cleaners creating a ripe opportunity for micro-organisms to flourish.<sup>19</sup> Recent studies into a new coating that combines a one-step solvothermal method and a nanoimprint lithography method using silicon dioxide, created a super-hydrophobic surface that was both mechanically stable, water resistant and highly thermostable.<sup>20</sup> Further testing would need to be done to see how this coating reacted to typical hospital cleaners/disinfectants. Pending the results, it would be a wonderful opportunity to confidently bring wood into the healthcare environment (through architecture and furniture) without concerns for long-term infection control or specialized cleaning methods.

Another look into biomimicry brought forth the research of **mechano-bactericidal surfaces**, similar to those found on insects.<sup>20</sup> When the surface itself is responsible for the killing of the bacteria, it helps combat drug resistant strains of bacteria and biofilms.<sup>15</sup> There is a new technology in which lasers are used to create a nano-textured

surface (spikes, LIPSS, or nano-pillars). These textured surfaces were shown to reduce bacterial retention by up to 99.8% for *E. coli* and 84.7% for *S. aureus*.<sup>21</sup> While much of the studies have been carried out on metallic surfaces, expansion of this technology to other hard surfaces has great potential to create passive anti-microbial opportunities.

## ...and beyond

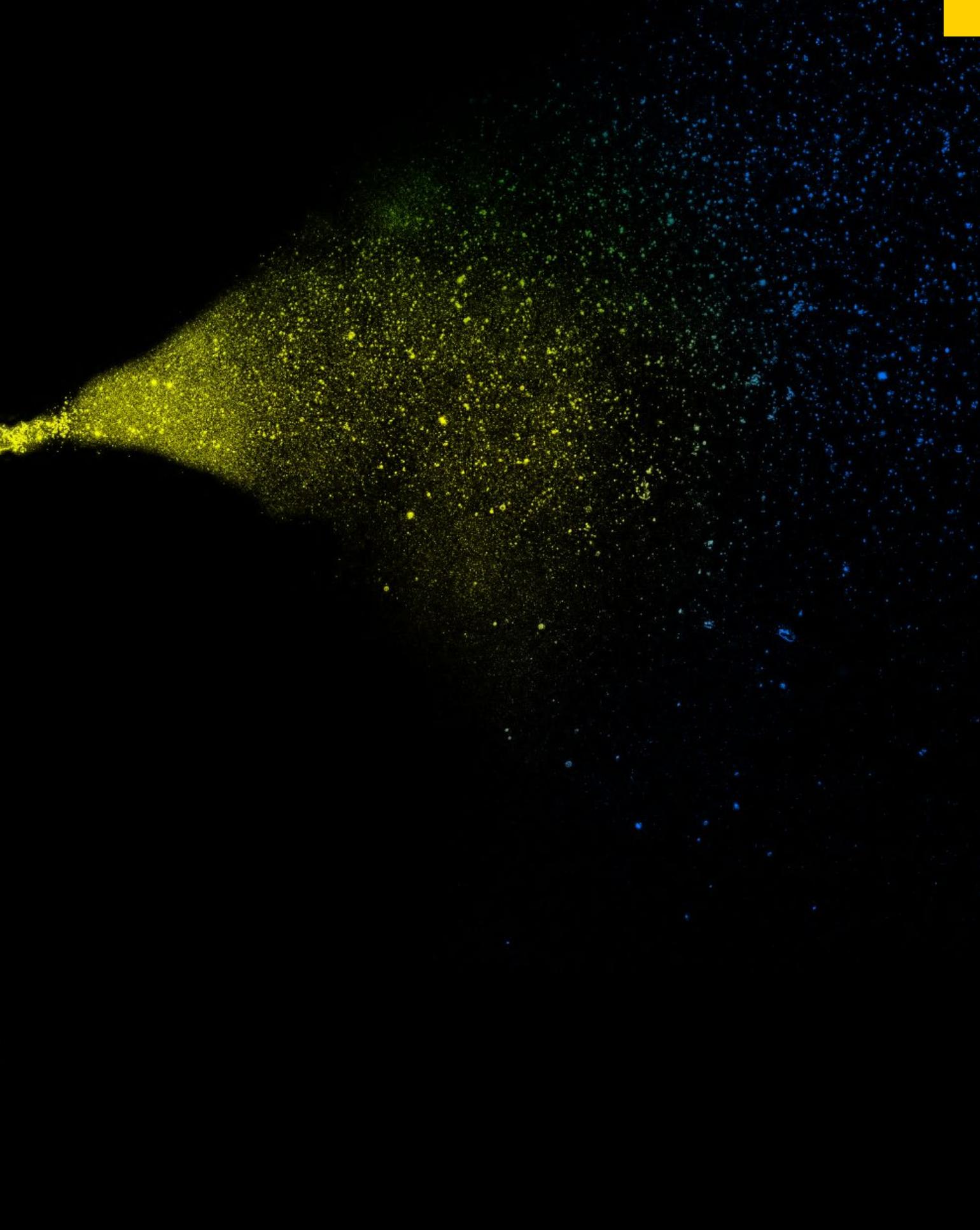
It's clear that science is taking a great leap in the world. But what we are doing is not enough. To reiterate once more, cleaning and disinfecting are fantastic ways to help mitigate a problem, but, when your kitchen sink is overflowing, you don't grab your mop to fix the problem, you fix the leak – stop the source.

**Imagine, if you will, what it would be like in the future for a patient room to utilize the acoustic ceiling tiles as a way to filter out the particles, like the return duct of an HVAC unit. Picture your home, built with 100% mold-free gypsum board that will not have to worry about health reactions post flooding.** By exploring more ways to integrate hazard-free materials, we will be able to enhance the livelihood of all people throughout a variety of different spaces and design strategies.

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pera™ 



# pera: A Case Study in Developing Better Hand Sanitation Habits

SAMANTHA FLORES, TANIA WHITE, BRANDON CARMICHAEL, ALEXANDRA AYRES, ROBBIE GOODE, AND THOMAS LUSK

Since 2020 has begun, we are all now acutely aware how often we are touching surfaces, our faces, different products. We have all washed our hands to the tune of “Happy Birthday” so many times that there are permanent red marks on our knuckles and around our ring fingers.

Hand washing and enhanced hygiene has been identified as one of the most effective ways to prevent and slow the rapidly increasing spread of COVID-19. Yet before this pandemic, handwashing habits across the world were subpar — in fact, a study conducted by Michigan State University recorded that, on average, only 5% of people properly wash their hands long enough to kill infection-causing germs. The same study revealed that 15% of men and 7% of women don't wash their hands after using the restroom, and if the sink is visibly dirty, men and women alike will skip hand washing altogether. Additionally, 71% of women will wash their hands after they sneeze or cough, compared to only 48% of men.

This information can be mindblowing, when paired with the fact that the average person comes into contact with 300 surfaces every 30 minutes — and with up to 80% of communicable diseases, such as COVID-19, transferable by touch<sup>1</sup>, it's no wonder why our handwashing habits have been brought to attention.

**While the CDC recommends cleaning your hands with soap and water whenever possible, and as often as possible, there are times when access to water and soap is simply not available.<sup>2</sup>**

Currently, an increase in sales for pocket sanitizers points to our awareness and willingness to participate in CDC recommendations, but hand sanitizers are effective when used *consistently*, and these single-use plastic dispensers are not always readily available after every transaction, and they prevent us from being environmentally responsible.

With these obstacles in mind, Hugo conducted a two-week design sprint to accelerate the establishment of new behavioral norms in hand washing by reimagining the personal hand sanitizer

dispenser. **pera** is a personal, refillable hand sanitizing wearable designed to replace single-use plastic pocket sanitizers, provide a new sense of safety in the public realm, and most importantly, build better sanitizing habits in people of all ages, within all communities.

The **pera** (personal. effective. refillable. accessible) is easy to use. With one simple, circular motion, the gesture-activated device sprays a controlled 0.1mL of liquid sanitizer in an instant from a central ring of atomizers, onto the opposite hand. The device itself can hold up to 10mL, which equates to 100 sprays.

Once empty, **pera** is easily refilled in seconds at any refilling station — accessible in both interior and exterior applications. In one movement, the user connects the small, centralized copper gauge to the refilling station, receiving a haptic feedback alert when refilling is complete. This station infrastructure allows quick refilling of the device, without touch. A play on the public water fountain, the hand sanitizer refilling station is meant to be a public amenity accessible to all communities, helping to reduce viral transmission by offering sanitizer right at our fingertips (or wrists) at all times.

This universal access to hand sanitizers has been vital in reducing viral spread in schools. A previous study revealed that consistently using hand

sanitizer in schools cut absences due to illness by 26% and reduced confirmed cases of illness from the highly contagious influenza A virus by 52%.<sup>3</sup>

However, it is still best to use soap and water when available. To continue to encourage healthy habits, **pera** is also activated by the handwashing motion, displaying a 20 second light timer for handwashing consistency. A similar haptic alert is sent once optimum wash time has been reached.

In an effort for complete information transparency — and also because we love competing against our own previous stats – the wearer can track daily handwashing goals and monitor body temperature via the **pera** app, continuing to keep a pulse (no pun intended) on their daily habits. With permission, GPS allows the device to send health-based alerts regarding viral outbreaks or other potential concerns in the wearer’s vicinity.

Thoughtfully designed with accessibility in mind, **pera** is meant to be distributed at a low cost to all communities — helping to create better hand sanitizing habits for all.



[Check out perawear.com](https://perawear.com)  
to learn more

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Polypropylene with Embedded  
Copper-Oxide Nanoparticles

Copper Housing

Refilling Piston

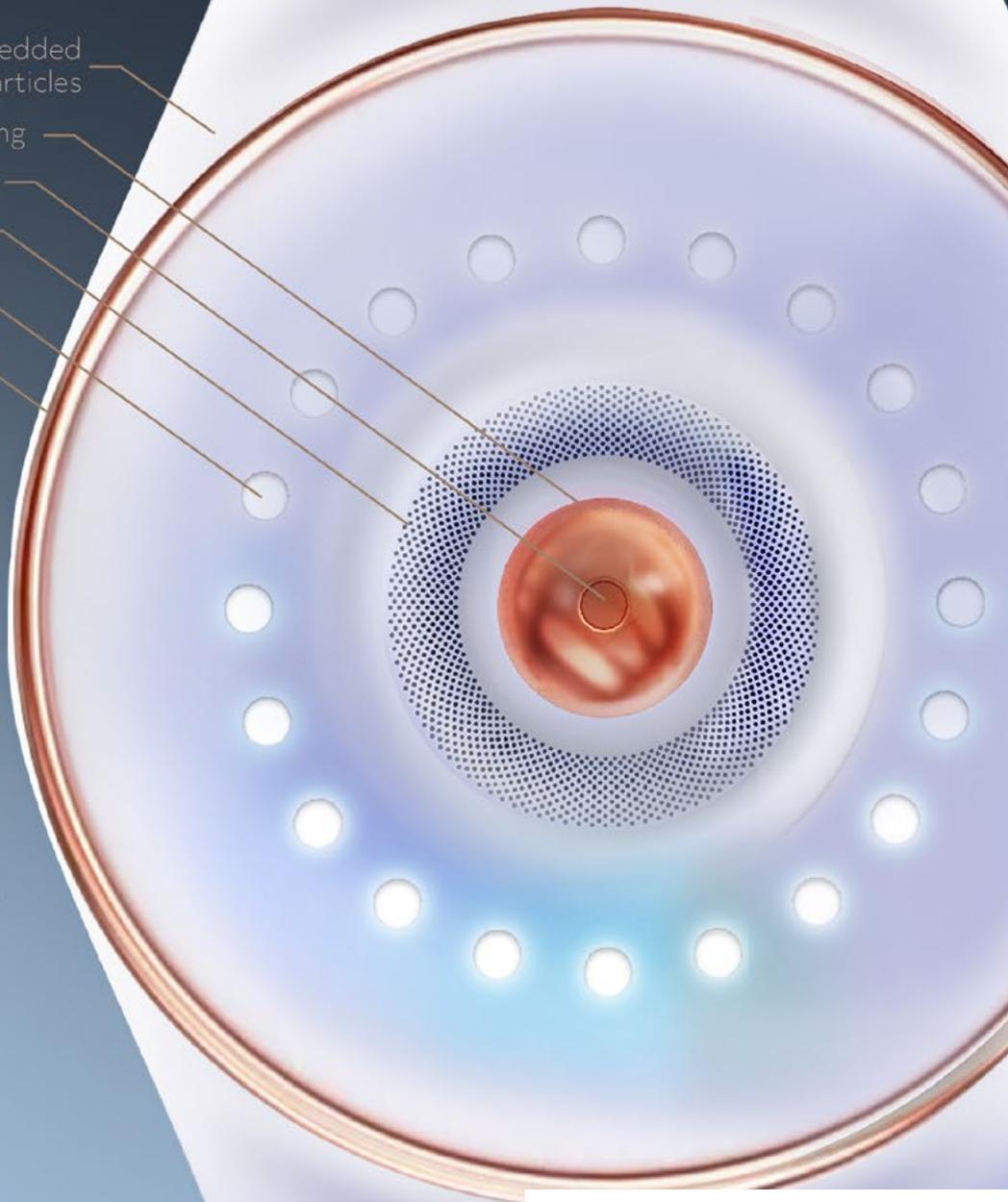
Gesture Activated

Atomizer

Illuminated Hand-

Washing Timer

Copper Detailing



**On average, you  
come into contact  
with 300 surfaces  
every 30 minutes,  
exposing you to  
840,000 germs.**

- Source: All Portable Sinks

# Health Screening at High Volumes

ALAN RICHARDS

We have purposefully built a world that is globally interconnected — and with that connection, we have become especially vulnerable to the quick spread of viruses and other contagions while also making it more and more difficult to implement the solutions needed to contain these threats once they are exposed.

In response, countries across the globe have imposed sweeping travel bans, and U.S. domestic travel advisories are evolving just as quickly, to try and minimize the rapidly increasing spread of COVID-19, and some policies are beginning to institute screening at ports of entry.

It just isn't that simple. A major challenge for health screening at airports in the current pandemic is the incubation period of the virus infection. COVID-19 is particularly challenging because patients may have no signs or symptoms during their transit through airports and are, in most cases, unaware that they have contracted the virus, becoming highly contagious.

Designing for an invisible enemy that has the potential to quickly and quietly threaten the safety and security of our modern world has prompted airports and others to investigate potential

implications to the built environment and how different methods to detect and respond to viral threats can help reduce further transmission.

## Lessons Learned From the Sars Outbreak in 2003

The 2002-2004 outbreak of severe acute respiratory syndrome (SARS) affected 26 countries and resulted in more than 8,000 cases. Once human to human transmission was established, the disease spread from southern China to Hong Kong, Taipei, Singapore, Hanoi and Toronto, Canada. SARS was caused by a strand of the coronavirus that is very closely related to Coronavirus, and as a result of the 2003 outbreak, many of the current guidelines for health screening at airports were established. An International Civil Aviation Organization (ICAO) meeting held in June 2003, including the World Health Organization (WHO), International Air Transport Association (IATA) and Civil Aviation Authority of Singapore (CAAS), created guidelines and recommendations for a sequence of eight protective measures for screening departing passengers, and similar measures for arriving passengers who had originated from a place identified as high risk for virus contagion.<sup>1</sup>



The recommended protective measures for **departing passengers** include:

- A questionnaire established by the WHO to occur before (and no later than) check-in. The questions are as follows:
  - Have you travelled to the hotspot area in the last 2 weeks?
  - Do you have a fever?
  - Do you feel unwell?
- A reliable method to measure passengers' temperature, to occur before passengers and crew reach the secure airside area
- If either of the measures in 1 or 2 raise alerts, the passenger should be isolated and evaluated by a healthcare professional
- A passenger who is coughing is given a face mask
- If secondary screening indicates that a passenger is possibly a SARS case, they are given a medical examination and assessment
- If the medical practitioner determines the passenger is well, the person is released
- If the medical practitioner determines the passenger has SARS, the person is taken to a dedicated SARS hospital
- If the medical practitioner determines the passenger does not have SARS, but is ill, the passenger's voyage continues with the usual IATA procedures

The recommended protective measures for **arriving passengers** include:

- Arriving passengers coming from affected areas would be required to complete

questionnaires during the flight or immediately on disembarkation.

- Positive responses would lead to secondary screening. Passengers will be required to provide contact information.
- Temperature screening is accomplished as early as possible after disembarkation, before passengers are divided into transit and arriving passengers and always before immigration controls.

A significant question about the effectiveness of these screening measures arose from the experience in Canada. In response to the SARS outbreak, Canada instituted intensive inbound and outbound screening. No SARS cases were detected but it was later discovered through tracing transmissions that five SARS patients had entered Canada through Toronto airport – none of which were exhibiting signs or symptoms during transit. At the time, CAN\$7.5M was invested in airport screening measures.<sup>2</sup> A WHO report concluded that available screening measures were not effective to detecting SARS. "It is generally considered that entry screening offers little benefit, while requiring considerable resources". The WHO recommended that investments should instead be used to strengthen infection control measures at hotspots and focus on public education.<sup>3</sup>

## Screening Methodologies

There currently is no adopted standard for health screening at airports. It is widely acknowledged that health screening is not perfect, especially as COVID-19 infected passengers can be asymptomatic but can still spread the disease. However, the screening will provide reassurance to passengers who are resuming flying after the pandemic recedes. In general, screening protocols

consist of three components; Pre-Departure Screening, Health Checks at the Airport and Protocols During Flight.

Additional staffing will be required, including trained medical staff. Those staff will require office space, examination rooms for secondary screening and isolation/waiting rooms. Passengers who fail the initial screening will go to secondary screening and, depending on the result, may be restricted from flying, be put in a quarantine facility until further tests are done or be taken to a designated hospital.

### **PRE-DEPARTURE SCREENING**

In the long term, screening passengers before they travel and before they arrive at the airport may be the preferred solution. A certificate of health can be issued off-site based on health testing and screening. This method will avoid additional queuing at the airport and scanning the certificate could potentially be incorporated into a self-service kiosk.

### **HEALTH CHECKS AT THE AIRPORT**

Technology solutions are becoming available to incorporate medical screening functions into self-service kiosks. Etihad is trialing such a system that can measure the temperature, heart rate and respiration rate of passengers using the check in kiosks.<sup>4</sup> Additionally, several thermal screening technology products are available and in use today, are very unobtrusive, and are unlikely to cause significant additional queuing or delays. However, trained staff will be needed, to operate the system and interpret the results. Systems that incorporate cameras are safer for operators, as screening from a distance is safer than reading someone's temperature up close. Possible locations for such systems would be within the security check point for departures or the sterile corridor for arriving passengers.

Other at-airport screening methods, such as blood tests for departing passengers, are currently being deployed and tested. For example, passengers on a recent Emirates flight from Dubai to Tunisia were given a blood test at the airport. Results were available in 10 minutes, and non-affected passengers were given an all-clear certificate. This allowed passengers to travel to countries that require some proof of good health.<sup>5</sup>

While this screening method is new, it is uncertain how accurate the results are. There is also a concern about the invasive blood test and whether the airline is the right organization to be doing this screening.

### **HEALTH MEASURES AT THE AIRPORT AND DURING THE FLIGHT**

Some countries and airlines are mandating that passengers wear face masks on flights, during airport screening and at any time when people crowd together.<sup>6</sup>

## **Quarantine Facilities for Arriving Passengers**

If a passenger becomes ill during an inbound flight and is suspected to be suffering from the virus, it may be necessary to remove the individual on arrival to a quarantine location. It may also be necessary to quarantine passengers seated in the immediate vicinity of a patient including passengers seated in the same row of up to two rows in front of behind, or possibly all passengers and crew on the aircraft. However, keeping passengers and crew on board the aircraft or in the gate area for any extended period is not desirable.

A quarantine space is needed where health evaluations can be performed, and surveys and contact information can be completed and collected. This space could either be in the airport,

in which case the passengers could possibly be transported in the aircraft, or if the quarantine space is off airport property, buses will be required for transportation.

Typically, these 'Q Stations' have facilities to accommodate one or two patients and 4 – 10 staff members. To understand what would be required to provide a larger quarantine space, the ACRP did a study in 2008 "Quarantine Facilities for Arriving Passengers – Identification of Planning Needs and Costs".<sup>7</sup> The report analyzed requirements to accommodate 200 travelers for 2 weeks, considering the needs for space, supplies, facilities, operations such as catering, security and cleaning. They found that approximately 4,000 SF would be needed, and the cost would be around \$250,000.

Currently, the CDC operates a quarantine facility at 19 different airports in the U.S. — out of 19,700 airports in the U.S. 5,170 of these airports are open to the general public and 503 of them serve commercial flights.<sup>8</sup> If we continue to see a rise in privatized aviation for leisure and business travel, as has been the case during the current pandemic, then the number of 'Q Stations' will need to expand not only to more commercial airports, but smaller public airports as well.

The opportunity to stop the next pandemic is now. Introducing quarantine facilities where possible, paired with a series of other maintenance response measures and updated building systems within the airport environment will be critical for the aviation industry to mitigate the spread of viral outbreaks.

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# Health Card



**123** SYS  
mmHg

**81** DIA  
mmHg

**67** PUL  
/min



# The Touchless Restroom

SCOTT GORENC AND AMANDA ANDERSON

Restroom facilities have always played a significant role in the satisfaction ratings of airports. In many cases, as passengers deplane their first stop will be the restroom. Literally, the first impression of not only the airport, but the city, will be the passenger's restroom experience.

When it comes to the design of the restroom facilities within airports, the focus has been primarily on sizing the facilities appropriately and ease of cleaning and maintenance. The COVID-19 Pandemic has reinforced our attention on the necessity to wash your hands and maintain good hygiene. Therefore, the design of restroom facilities moving forward will be focused on improving sanitation protocols via data analytics and redefining the restroom experience.

## Data Analytics and Improving Sanitation Protocols

Technology is being integrated into restrooms as a way to empower passengers and raise awareness. First, data analytics are being integrated into restrooms via occupancy sensors that tracks the restroom use. This is both helpful in providing real time feedback to the passengers on restroom availability but also as an operational tool for scheduling appropriate cleanings.<sup>1</sup> These sensors

go beyond just passenger occupancy. Sensors are indicated at supply points, alerting operations when toilet paper, paper towels or soap is low.

Additionally, passenger feedback is integral in giving the users an elevated sense of ownership in the process. Feedback loops have been used for a while in airport restrooms either through a physical touchpoint such as a happy face and sad face button or more ideally, a cloud-based interface such as a QR code. In between regular cleanings, situations may arise that need immediate attention. Giving passengers a direct connection to the airport to make the airport aware of a cleaning issue will be vital for travel post COVID-19.

## Sight and Smell

Passengers experience a restroom three ways. First, passengers see the facilities noting how well-lit they are, how clean the facilities are, and the condition of the amenities. Second, passengers smell the facilities noting how well ventilated the space is. Finally, passengers interact with

the facilities. In order to achieve the touchless experience that will meet the passenger's expectations post COVID-19, a restroom must first meet expectations in the first two categories.

To meet **sight** expectations:

- Select finishes that will accentuate how clean the restroom is. Selecting finishes to hide grime will immediately fault the restroom's perception.
- Select finishes that are antimicrobial and that can handle constant cleaning and frequent use.
- Implement a lighting plan that is bright and doesn't hide facilities in shadows.

To meet **smell** expectations:

- Exhaust the facilities properly
- Don't allow stagnant water on surfaces within restrooms
- Ultimately restrooms must smell clean

## Achieving a Touchless Restroom

A touchless restroom experience is one which a passenger interacts with the most minimal number of touchpoints possible. Hand sanitizer should be provided at multiple locations throughout the facility, primarily after known touchpoints.

Entry into the restroom facilities should be done through a hallway as opposed to a door. Once within the restroom ample flows need to be provided so that passengers can circulate around each other at appropriate distances. If space is available, dedicated entries and exits minimize cross flow of passengers. An additional benefit to multiple entries is the benefit to close half the restroom for cleaning and maintenance while keeping the other half open for use.

Entry into a restroom stall is largely still an experience that involves contact with door handles and latches. In order to mitigate the risk of transmission of disease via direct contact, alternative methods could be considered. For example, a stall door could have an opener integrated that keeps the door open when unoccupied, then passengers would only have to close the door. Another solution for consideration is the use of an arm bar opener on doors so that passengers could push or pull a door via their forearm. Automatic openers and closers are another consideration, however, compliance with the Americans with Disability Act would need to be ensured.

Once in the stall, passengers should have ample space to store luggage, with heavy duty coat hooks for purses, back packs and coats so that they don't have to rest on the floor. As has always been standard, ample toilet paper should be available. Hand sanitizer should be considered within the stall. Toilets should be equipped with automatic flushers that are calibrated appropriately. At the sink, faucets, soap, hand sanitizer and paper towel dispensers can all be done via sensors without touch. Ideally, soap and hand sanitizer dispensers would be located about waste bins to minimize drippings. Individual sinks are preferable to trough sinks not only to encourage social distancing, but also to minimize surface area for cleaning and maintenance.

The amenities throughout the restroom facility must include thoughtful consideration as to the sanitary environment that must be maintained. For example, certain fixtures can be made touchless via sensors such as toilets, faucets or paper towel dispensers. Others, however, may not be improved when made touchless. For example, the use of hand dryers has come into question with some research pointing out that the recirculation of air by hand dryers can

actually help distribute the spread of microbes.<sup>2</sup> Furthermore, paper towels have been identified as being more hygienic, which is why you come across paper towels in healthcare settings.<sup>3</sup>

## Cleanliness as a Differentiator

In order to implement an elevated experience within restrooms in an airport, it will require more space and upgraded operational protocols for cleaning. Certain businesses, such as Buc-ee's, a gas station and travel center based out of Texas, have taken advantage of clean restrooms as a differentiator in providing elevated customer service. Their website even boasts that they have the "world's cleanest restrooms."<sup>4</sup> Design features such as full walled

partitions between toilets and urinals provides a sense of privacy. Additionally, the facilities provide an ample amount of space without people crowding around touchpoints such as sinks. The key to Buc-ee's success, however, is round the clock cleaning.<sup>5</sup>

Clean restrooms represent comfort to passengers. Traveling through an airport can cause anxiety, and a clean restroom provides peace of mind. A key component of this will be public awareness. Airports will need to work to not only make passengers aware of the protocols being implemented in response to seasonal flus or COVID-19, but they will also need to see those protocols in action. Similar to the successes of Buc-ee's, a full-time attendant cleaning in the restrooms is a demonstration of the value placed on cleanliness in a restroom facility.

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# Mental Health of the Caregiver

TAMMY TESTA AND TANIA WHITE

As the pandemic places a significant strain on our healthcare system, healthcare workers are experiencing unfounded levels of stress and trauma. Certain parts of the country, like New York and New Orleans, have experienced devastating outbreaks with overwhelmed emergency rooms, reduced medical supplies, long working hours, high fatality rates and the ensuing emotional trauma.

**"I broke down and cried today. I cried of exhaustion, of defeat. Because after 4 years of being an ER nurse, I suddenly feel like I know nothing."**

– Registered Nurse, United States (2020)<sup>1</sup>

While these health providers are being called superheroes in strength, in reality, they are not superhuman and suffer as 'mere mortals.' Even outside of pandemic times, research studies underscore the importance of a positive working environment for nurses' well-being, highlighting the fact that stress caused by caring for patients can result in negative health implications for nurses.<sup>2</sup>

Beyond the individual resulting effects, the fear of an entire 'generation of burnt out medical professionals' will be an even longer battle to overcome. As COVID-19 piles additional and unprecedented pressure on medical workers (who were already under considerable strain due staff shortages among other issues) the result may lead to anger and resentment that linger after the crisis, potentially causing some to leave the profession for good.

Leading professors from the University of Surrey and University of Southampton have released new evidence-based guidance on supporting nurses' psychological wellbeing during the crisis and after. They said they feared that, without action to protect staff involved in the coronavirus pandemic, a "generation of burnt out nurses" could be left in its wake.<sup>1</sup>





# MeMoment pod

In partnership with the Framery, Corgan has developed a flexible “soundproof” pod for use in healthcare facilities that meets the requirements for a respite space. The pod interior will accommodate a range of activities for one employee and is geared for a 15-minute rejuvenation break.

## **BENEFITS INCLUDE:**

- A moment for caregivers to refresh
- Emotional pause and release
- A space for mindfulness and reflection

## **ACTIVITIES INCLUDE:**

- Meditation
- Audio or written journals
- Private, personal pep talk
- Music and refreshing imagery

## How Can Architects Respond to This?

As we design working environments for healthcare professionals during and after the pandemic, it will be important to consider how the built environment contributes to their overall wellness and mental health.

Spaces like respite rooms and outdoor areas that feature ample vegetation and natural lighting can serve as areas for medical staff to reflect and gather themselves during times of stress.

Other wellness solutions might include staff locker rooms with showers that allow employees to clean and change out of their scrubs without the risk of transmitting an infectious disease into their cars and homes. Or conscious sound design that addresses alarm fatigue from various medical devices in a hospital setting.<sup>3</sup>

The coronavirus has spurred an urgent conversation around the infinite surfaces we touch throughout

"It's an experience I would compare to a world war."

– Registered Nurse, Italy (2020)<sup>1</sup>

our day. From door handles, to elevators and stair rails, the world is now, more than ever, aware of the many ways we interact with the built environment. However, our mental health is also impacted by the buildings we live and work in. This is prompting an important conversation that is not just limited to mitigating physical touch, but is also prioritizing the way healthcare spaces can improve the mental health of our healthcare workers.

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# Indoor Air Quality

STUART SHELL AND PETE JEFFERSON OF BRANCHPATTERN

By now, we have all become familiar with social distancing protocols, washing our hands as often as possible, and wearing PPE in public spaces — all in an effort to mitigate the spread of Coronavirus. What is less well-known, however, is that in addition to our personal efforts, our interior building environments can actively help us stay healthy and safe while being in a public setting.

Because COVID-19 can be transmitted through the air by droplets, strategies that address air quality in buildings can help limit the spread of the virus. Ventilation rates, air cleaners, and humidity are emerging as key considerations for HVAC operation. Research on COVID-19 is ongoing, so following recommendations are based on other viruses such as SARS-CoV-2 and Influenza A.

## Ventilation

The age-old adage for indoor air quality is “dilution is the solution.” While certainly not the only solution, bringing in outdoor air into the interior building environment is generally helpful. This is

Kubota North American Headquarters. Image source: Corgan





because outdoor air is generally much cleaner than indoor air, so it has a net positive effect on contaminant concentrations, including droplets in the air. Buildings with natural ventilation or operable windows can offer superior air quality and, when well-designed, move particulate out of the breathing zone very effectively. One caveat with ventilation is that sometimes there are contaminants in outdoor air that necessitate filtration.

## Air Cleaners

Particle filters are standard in mechanical equipment – by forcing the air through filter media they remove suspended particulate matter. Because filters are located in the HVAC system, they generally will not intercept the large droplets most associated with the spread of COVID-19. These large droplets will fall out of the air in minutes, not making it into the ductwork. Researchers are learning that COVID-19 can also be spread by small droplet nuclei which are small enough to remain suspended in air for hours. While MERV 8 filters are common practice for recirculated air, to effectively remove droplet nuclei MERV 13 or MERV 16 are required. Very high-performance filters, called HEPA, can remove even more fine particulate

and may be appropriate for high-risk spaces. Another way to clean air is with ultraviolet light. Like sunlight, radiation at the UV-C spectrum has the effect of penetrating into cells and interrupting their RNA. UV-C has traditionally been used to control mold growth at cooling coils in mechanical equipment, where water is likely to condense on coils. Evidence supports broader use of UV-C in ductwork to clean the airstream and as ambient lamps in the upper portion of rooms. Generally, designers avoid exposing occupants to UV-C light although this is also an emerging area of research.

There are other air cleaners that may be considered for managing infectious disease. Bi-polar ionization, also called plasma filters and corona discharge utilize an energy field to react with organic compounds in the airstream. New technology may reduce or eliminate the ozone released by these cleaners, although their efficacy in improving occupant outcomes remains to be seen. Activated carbon filters are commonly used to address odors and can adsorb gasses from the airstream that other filters cannot. These are likely less relevant to addressing transmission of disease than particle filters and UV-C.



# UV Light and Germicidal Irradiation

ALEJANDRO IBANEZ

Ultraviolet light is electromagnetic radiation that can be broken down into three spectrums: UV-A light, similar to a black light, UV-B light, which is light that causes sunburns after prolonged exposure and UV-C light which is extremely harmful, but is absorbed by the Earth's atmosphere.<sup>1</sup> While in some cases harmful, UV-C ultraviolet light has been an established method of eradicating airborne or aerosolized microbial disease transmission, and Far UV-C light in certain doses is not harmful to humans.<sup>7</sup>

One disinfection method using Ultraviolet Germicidal Irradiation (UVGI) has the ability to harness UV-C light, disrupting bacteria or viruses from reproducing, inactivating its infectious nature. This technology has been used since the 1940s as a sterilization method within healthcare facilities. However, during the 1990s the technology was applied to cleaning the internal components of HVAC systems. Some large public spaces, such as Los Angeles International Airport, currently utilize the technology in existing HVAC systems, noting improvements in not only the Indoor Environmental Quality (IEQ) but also in maintenance operations and energy efficiency.<sup>2</sup>

UVGI has been used in different industries across the world for various decades. In addition to air

stream and HVAC sterilization, UV-C Light has been used for surface disinfection in healthcare and educational facilities through the use of fixed or portable in-room UV-C fixtures.<sup>3</sup> Other industries have also benefited from UVGI technology, including water treatment plants, waste management plants, food & beverage factories, and other businesses where sanitizing tools and equipment are essential.

## Current Limitations to Mass Adoption

UVGI Technology has been proven to be effective in the high sanitation capabilities regarding sterilization of air streams and HVAC systems, and does not corrode materials as other disinfectant products might. Additionally, the technology is time and cost effective because of the reduction of operational and maintenance impacts to the systems.

However, UV-C Light is harmful to humans and can cause damage not only to skin but also to your eyes and therefore, proper safety precautions need to be followed when working with UV-C Light. Furthermore, when being utilized to sanitize surfaces, the technology should be paired with a backup disinfecting methodology because of low penetration power, distance constraints, and inadequate sterilization due to some crevices or porous surfaces. Finally, up-front costs and continuous power supply are other elements to consider.

Emerging technologies, such as Far UV-C, promises to be effective on killing pathogens while being safe to humans due to the particular wavelength that Far UV-C resides in.<sup>4</sup> This opens the spectrum for public use of UV disinfection technologies, similar to air stream sterilization, and can be used in occupied settings such as airport terminals.

# Incorporating Uvgi Technology into Terminal Design

Both unoccupied and occupied spaces within airports would benefit from the use of Far UV-C cleaning methods, improving overall sanitation, and instilling confidence in passengers that the spaces they are moving through are being well maintained.

## Unoccupied Spaces

UVGI technology could be, and is being, used today in unoccupied spaces. Not only has UVGI technology integrated into the LAX HVAC Systems, but UV-C lamps have been installed in security checkpoint storage and hand luggage trays, luggage trolley and wheelchair storage in Cagliari Airport, Italy.<sup>5</sup>

## Occupied Spaces

Far UV-C will be a paradigm shift on lighting and architectural design once fully tested in long periods of time, approved by agencies and ultimately mass

produced. This UV light technology, which research shows to be safe to humans, could be implemented terminal wide, and used when occupancy in those spaces is low. This new opportunity would help to eradicate pathogens from air and surfaces at large scale and if combined with other disinfection strategies could prove to be extremely successful. Boeing developed a bathroom prototype for their airplanes in 2016, where Far UV-C lights turn on if the room is unoccupied.<sup>6</sup> Automated Robots circulate through airports public and private spaces for disinfection as currently done in Hong Kong airport.<sup>7</sup> Other areas that are periodically unoccupied that could take advantage of Far UV-C lamps include jet bridges, lockers for employees, restroom amenities, baggage handling systems, and elevators.

In the coming years, we will see a whole host of investigations in to Far UV-C lighting products, as we navigate this new normal and balance the need to effectively and efficiently sterilize our spaces, while remaining vigilant to keep the health and safety of our building occupants top of mind.

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## Humidity and Temperature

Commonly considered for comfort, both humidity and temperature limit the risk associated with COVID-19. Relative humidity ranging from 40-60% reduces the risk of infection. This is pertinent during the winter when humidity levels are often 10-20%. Temperatures outside the comfort range add stress to occupants, exacerbating the impact of illness and weakening the immune system.

## Design Considerations

When designing or renovating a facility there are broader opportunities to impact the spread of disease. The first principle of indoor air quality is to remove the source of contaminants from the space. When it comes to humans as contaminants, this is a policy discussion. Organizations can mandate that would-be occupants with symptoms stay home or implement a testing protocol for entry.

In planning spaces, consider the number of occupants who need to share the same breathing zone. Separating spaces within a building is helpful — such as adding a door between a hallway and media center in a school, or enclosing restaurants within a concourse. Based on their use, this can help limit the spread of disease. This basic strategy of compartmentalization allows for better control of bio-contaminants through zone filtration and pressurization. Spaces likely to have contaminants can be negatively pressurized to protect occupants in the adjacent zones, similar to a patient room in a hospital.

Within the breathing zone there are different strategies for providing clean, comfortable air. The most common approach is called mixing, where air is blown into the space from above with enough

velocity to create turbulence and create acceptable air quality in all parts of the room. Alternatively, displacement ventilation provides conditioned air near the floor at low velocity. This promotes stratification within the space with contaminants rising to the top of the room with the warmer 'dirty' air. There are many advantages to displacement ventilation, including reduced risk of infection due to less mixing of air.

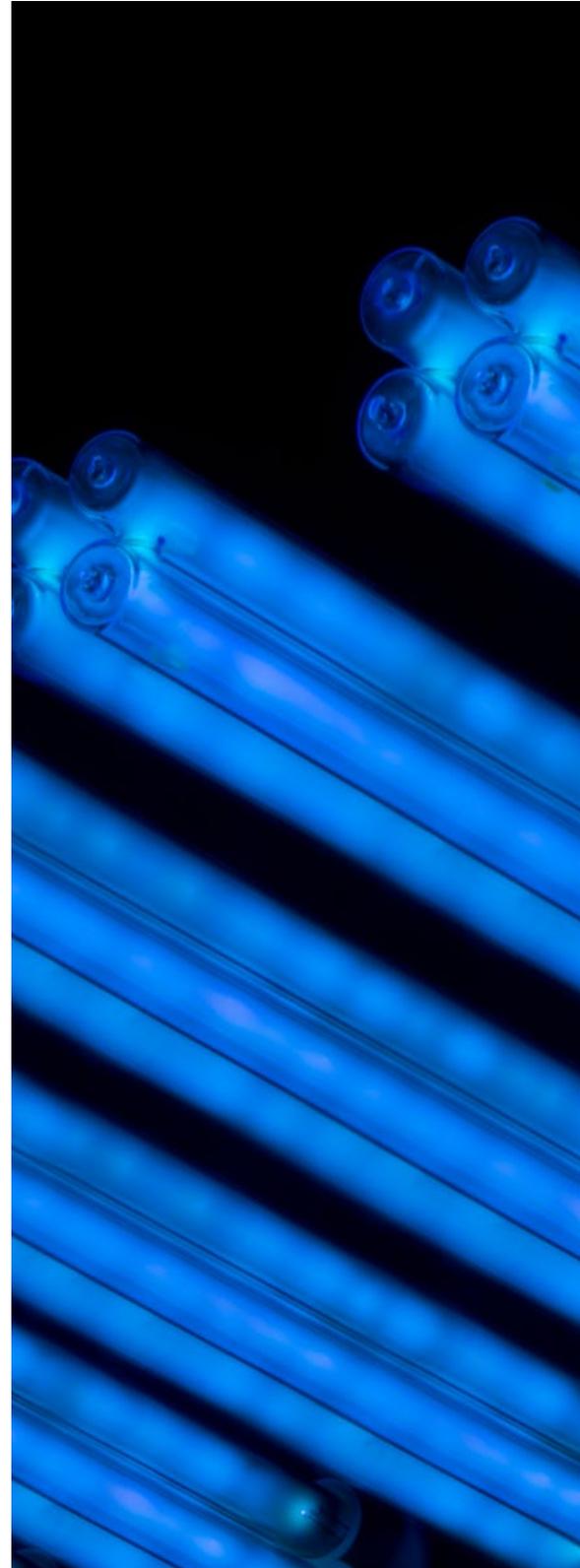
A final design consideration relates to central air handling equipment. In most buildings, central fans pull air from many rooms simultaneously in a combined return, condition and clean the air, and then supply it back to the same rooms. Typically, some outdoor air is also added by this central air handler. This is an efficient system but also leads to mixing of air between zones — an additional risk as described above. Alternatives to this typical system provide the conditioning and filtering of air with smaller fans for each zone. Then a central outdoor air system (DOAS) provides the fresh air required to each space without using any combined return ductwork. In DOAS systems it's possible to avoid mixing air from different zones — at the same time providing greater control of the outdoor air provided to each room.

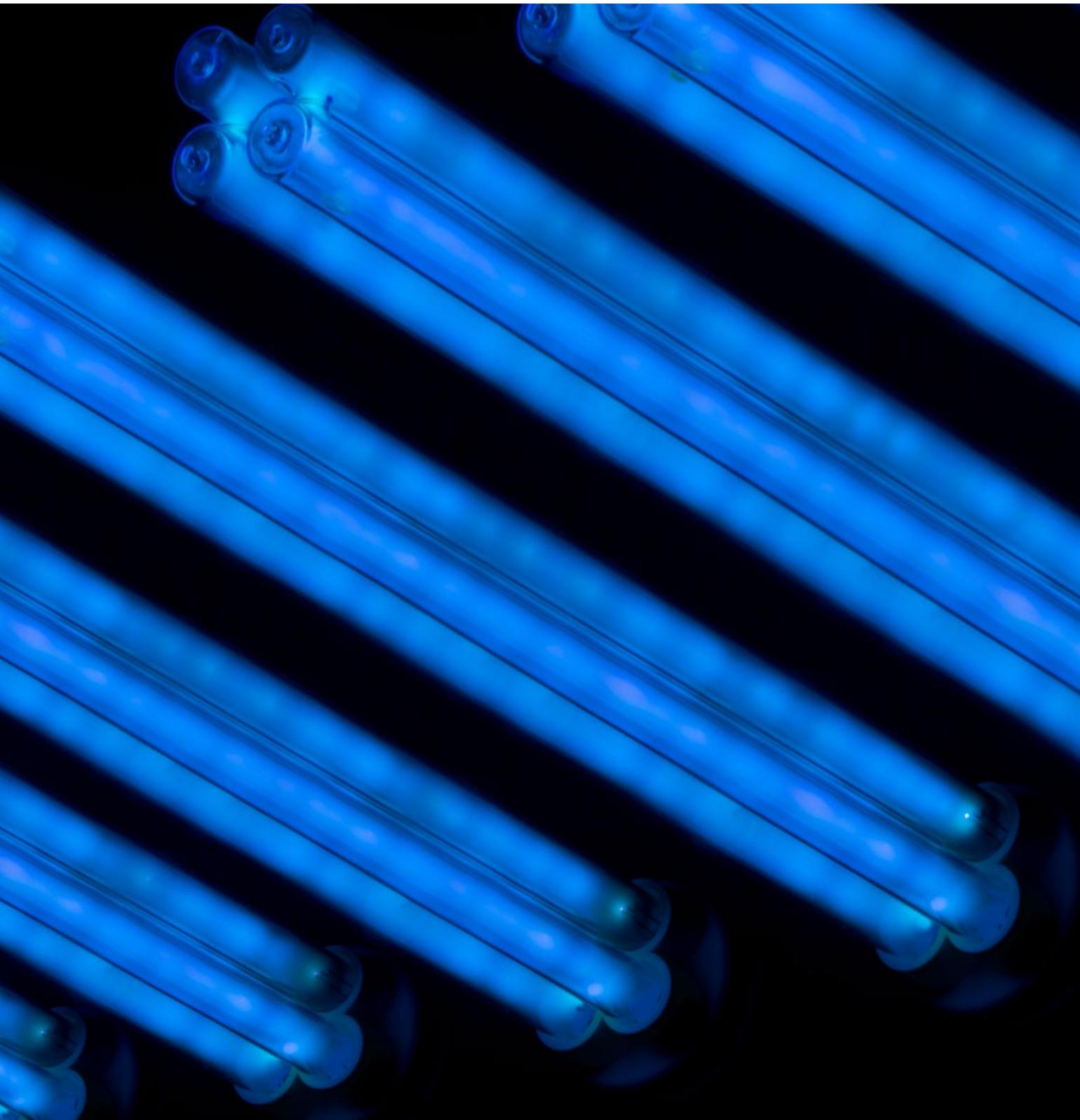
## Transparency

Mechanical system design and operation is fundamental to indoor air quality. However, they can be frustrating for occupants because they often are hidden, confusing, and difficult to control. Transparency about air quality is fundamental to gaining the confidence occupants desire. One example of this trend is the real-time air quality program RESET. Originally from China, the standard provides thresholds for air quality performance related to particulate matter, CO<sub>2</sub>, humidity, and temperature. The standard also specifies cloud-based reporting requirements for transparency and standards for selecting and deploying air quality

monitors in the space. In addition to addressing infection risks in spaces, the standard safeguards the conditions for wellness.

The design, construction, and facility maintenance industries can deliver superior indoor air quality with technology that is available now. A more resilient community will emerge from an evidence-based approach to selecting air quality strategies. Greater occupant awareness of how indoor air quality is achieved — especially ventilation — will support wellness and a connection to natural systems, while designs that are more responsive in real time can also offer energy savings. The flexibility and competence to better control indoor air conditions will help us more rapidly and efficiently respond to the next public health emergency.







## **One important factor that must be kept in mind is openness. Our world is transitioning, we are adapting, and we will continue on.**

It's true — schools may never revert fully back to the same model, working in the office may be a bygone era for some, and doorstep delivery might just make grocery stores (or at least the way we know them today) a thing of the past.

However, we should take comfort in the fact that the virus didn't force us into this lifestyle — we were already headed in this direction.

The world is changing fast. **Let's change with it.**



# Our Contributors

This report, this collection of shared ideas, has been created through a collaboration across multiple teams at Corgan; a group of busy bees actively cross-pollinating to share with you how evolving user behavior and emerging technologies are shaping each other throughout our practice. **Thank you** to all of those involved for your incredible insight, expertise, and passion to help us better understand how our industry can play a role in shaping safe and healthy environments, and support our well-being.

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# Our Network of Collaborators

We are pioneers for our clients, which means that we are always looking for the best product, design, or solution for any challenge. Now, more than ever, it is very important for us to continually cultivate our network of experienced and dedicated partners, collaborating with a network of specialists and industry experts to gain a well-rounded understanding of how the built environment will operate post-pandemic. Incorporating Industrial hygienists, behavioralists, IEQ experts, engineers, and manufacturers into our workshop sessions not only educates and inspires us, but also encourages collaboration towards novel solutions, providing every opportunity to gain better knowledge of what is to come.



## **Chandran Achutan, PhD, CIH**

Chandran Achutan, a Certified Industrial Hygienist and Associate Professor at the University of Nebraska Medical Center (UNMC) examines how different environments evaluate and control occupational and environmental exposures to a variety of potentially harmful airborne health initiatives within the architectural environment. He currently focuses his investigations into respirators and the UV light used to cleanse them, in addition to others. However, as an industrial hygienist, he also examines a variety of issues that pertain to the health of occupants, including occupational noise exposures and hearing loss, air pollution, dust and pesticide exposures among farm workers, heat stress, physical and chemical environmental exposures, environmental tobacco smoke exposure, global health, and occupational stress.

Chandran previously worked at the Center for Disease Control and Prevention (CDC) and the National Institute for Occupational Safety and Health (NIOSH). He has been an incredible addition to the team, and we have been happy for his insights on this topic as it has been evolving.



## BranchPattern

Indoor Environmental Quality (IEQ) encompasses the conditions inside a building—air quality, lighting, thermal conditions, ergonomics — and their effects on occupants or residents. Branchpattern is an IEQ consultancy who believes that true sustainability sits at the intersection of human experience and environmental stewardship. Their research looks to find a deeper understanding between natural systems, patterns found in nature, and human behavior by learning from the natural sciences and incorporating those insights into the built environment. BranchPattern also studies the interplay between social life and physical surroundings, which has been found to satisfy the end-users' psychological and physical needs, and when applied appropriately to the built environment, helps to reduce the ecological footprint of buildings. BranchPattern has been a very essential partner, and has helped us explore solutions holistically with the end-user always in mind.



## Henderson Engineers

Henderson Engineers is a full-service building systems engineering design and facility consulting firm – using a holistic approach to design facilities that put people first, lead with innovation, and partner through the entire life of the building. They provide a wide array of design services — acoustics, architectural lighting, audio-visual, broadcast, code consulting, electrical, fire and life safety, mechanical, plumbing, security, and technology — all under one roof. Henderson Engineers shared great insight during a tough and uncertain time, and we are thankful to have had them on this team.



## Rider Levett Bucknall

With a network that covers the globe and a heritage spanning over two centuries, Rider Levett Bucknall is a leading independent consultancy firm in cost management and quantity surveying, project management and advisory services. RLB's dedication to the value, quality and sustainability of the built environment shines through their unbiased, expert advice for all aspects of the feasibility, cost, and timing of major construction projects.

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