

Risk Mitigating Factors in Design Parameters for Post COVID Architectural design

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ABSTRACT: For thousands of years, humans have looked to physical space to treat and cure sickness, just as Philip Lovell did. People have redesigned cities, infrastructure, architecture, and interiors all in the name of minimizing the risk of infectious disease. Meanwhile, enterprising businesspeople have capitalized on the fear of germs to sell products and services that supposedly stopped the rumored causes of illness. COVID-19, and no vaccines or cures to fight them, one of the most effective solutions is to go back to the physical: social distancing, quarantine, isolation, and, perhaps, adaptations to our cities, neighborhoods, and homes. After being cooped up indoors for months, might we all take a renewed interest in the value of parks and urban green space, as well as the public infrastructure of toilets, drinking fountains and, crucially, hand-washing facilities? Living in socially distanced self-isolation, with shops shuttered, offices abandoned and urban centres reduced to ghost towns, it's hard not to wonder what kind of lasting impact Covid-19 will have on our cities. We need to embrace a new tool kit of options that are more flexible, holistic and responsive. But also to help tackle urgent issues like climate change, terrorism, migration, social disconnection and inequality, community disintegration, housing shortages, traffic, pollution, sprawl and over-development — not to mention problems we haven't anticipated. Our architectural and urban planning systems, developed in a vastly different time, are long overdue to address many of these complex contemporary issues.

KEYWORDS: COVID-19, adaptation, urban green space, public infrastructure, responsive

I. INTRODUCTION

For thousands of years, humans have looked to physical space to treat and cure sickness. People have redesigned cities, infrastructure, architecture, and interiors all in the name of minimizing the risk of infectious disease. Meanwhile, enterprising businesspeople have capitalized on the fear of germs to sell products and services that supposedly stopped the rumored causes of illness (spoiler: they usually didn't work). It's only recently—with advancements in virology, bacteriology, epidemiology, and medicine mostly in the 19th and 20th centuries—that antibiotics and immunizations have been on the frontlines of infectious diseases. Now, with new diseases emerging, like COVID-19, and no vaccines or cures to fight them, one of the most effective solutions is to go back to the physical: social distancing, quarantine, isolation, and, perhaps, adaptations to our cities, neighbourhoods, and homes.

II. BEST PRACTICES FOR RESILIENCE

With travel limited, the local high street has come into its own: corner shops and bodegas are generally proving much better stocked than supermarkets. The pandemic has also made visible other changes that have been happening under the human noses. Vanstiphout says his friends who live in central Amsterdam have had a rude awakening. "Now that tourism has stopped and the Airbnbs are empty," he says, "they have discovered they have no neighbours. There is no neighbourhood. There is no city. If you subtract the tourists, there is nothing."

It was thought that disease could permeate through any structure in direct contact with the earth, so walls were sealed at the surface and buildings were increasingly coated, clad, plastered and varnished, forming an impregnable shield against this invisible enemy. Cracks were great causes of alarm – not only did they suggest structural fatigue, but also the possibility that deadly fumes might be released.

Carr's book charts a history of urban responses to public health crises, beginning with the work of landscape architect Frederick Law Olmsted, who worked as a sanitary officer during the American civil war, and went on to design New

York's Central Park and Boston's Emerald Necklace of parks, identifying "the occasional contemplation of natural scenes" as being "favourable to the health and vigour of men". After being cooped up indoors for months, might we all take a renewed interest in the value of parks and urban green space, as well as the public infrastructure of toilets, drinking fountains and, crucially, hand-washing facilities?

Furniture may change too. "Office desks have shrunk over the years, from 1.8m to 1.6m to now 1.4m and less, but I think we'll see a reversal of that, as people won't want to sit so close together." He imagines legislation might be introduced to mandate a minimum area per person in offices, as well as a reduction in maximum occupancy for lifts and larger lobbies to minimise overcrowding.

All of this could have a big knock-on effect on the skyline. "High-rise buildings would become more expensive to build and be less efficient which may reduce the economic attractiveness to developers of building tall – and super tall – towers both for offices and residential. ZHA's new HQ for the Bee'ah waste management company in Sharjah, UAE, has been designed around "contactless pathways", meaning employees will rarely have to touch a surface with their hands to navigate through the building. Lifts can be called from a smartphone, avoiding the need to press a button both outside and in, while office doors will open automatically using motion sensors and facial recognition.

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Distance communication could bring major change to cities and suburbs. The time savings of not commuting from home, the increased familiarity with telemedicine and distance learning, the convenience of online shopping and the cultural connection of online entertainment (virtual museum visits, livestreams of concerts, recorded theater) — these all could change our long-term habits, dramatically cutting traffic, sprawl and pollution.

These kinds of techniques will likely become standard in hospitals after the pandemic, but might they expand to wherever people congregate, like homes, offices, factories, warehouses and schools? They could save lives where occupants don't have a choice about social distance: prisons, homeless shelters and refugee facilities. Perhaps they could be complemented by germ-resistant strategies like antimicrobial polymer surfaces, copper alloy surfaces (which naturally kill germs and viruses) and flexible spatial designs to accommodate social distancing.

While trapped at home during quarantine, expect more people to embrace the Healthy Building Movement, an approach to improving health through strategies like greater natural light, improved ventilation, fewer toxic substances and the incorporation of plants and other natural materials. Think skylights, large windows, rooftop terraces, balconies and courtyards. Spaces for exercise and meditation could become standard along with home offices.

III. NEW NORMAL CONSTRUCTION

As the pandemic has grown, the most pressing need in architecture has been speed: the quick creation of emergency facilities like hospitals, quarantine centers, testing sites and temporary lodgings. That demand has prompted an overwhelming response, much of it employing techniques outside the mainstream. A good example is modular construction — prefabricating standardized components in a factory, then assembling them quickly on site. It's long been touted as a fast, flexible, less wasteful alternative to traditional building. The normal time to build a hospital is well over two years, but in February builders in Wuhan, China, the pandemic's epicenter, used modular construction for two hospitals — the 1,000-bed Huoshenshan facility and the 1,600-bed Leishenshan Hospital — in about two weeks. The structures, created by thousands of workers and filled with advanced medical infrastructure, consist of prefabricated panels placed into steel skeletons above concrete foundations.

"The question is, how do we draw lessons from this pandemic to design houses, office buildings and cities in a way which makes us more resilient to future pandemics, while also being more people-friendly?"

Temperature sensors and facial recognition could detect a symptomatic worker in the building, triggering a series of physical changes. The heating and cooling system could immediately change to create a negative pressure environment in the zone where the illness was detected, preventing air that maybe contaminated from getting to another area of the building. Meanwhile, the glass panels on the building façade could instantly open to let fresh air into unaffected spaces. Those within the building continue their day, comforted by the fact that they're safe where they are. The same technology can be used to regulate temperature and humidity to keep people comfortable under regular, illness-free conditions,

improving energy efficiency and operating costs. What might be motivated initially for safety reasons could enhance wellness, not just avoid illness.

Manufacturers of flooring products are exploring LED lights embedded in surfaces like basketball courts to help coaches walk through plays in real-time. The LED lights let athletes know where to stand relative to one another for set plays. It's not a stretch to consider integrating this technology into flooring in retail, restaurants and offices to provide visual cues where people should stand safely away from others.

Building facades can be designed to self-darken and to automatically circulate fresh air when the weather is good. For example, in a new building we're designing outside of Washington DC, the glass skin will have integral technology that darkens the panels based on the path of the sun, eliminating the need for shades or blinds. PNC Tower in Pittsburgh, one of the greenest tall buildings in North America, is designed with a breathable double skin made of glass panels and embedded with sensors that will track optimal weather conditions and open the panels to allow fresh air inside.

Is this an architecture of a future age or the emerging recipe of design ingredients for a more immediate new normal? The good news is that the technology and building components needed to create this new normal already exist. The problem is that many have been implemented separate from one another instead of designed as one cohesive architectural solution. Current building products, sensor and AI technologies, and design strategies pulled together from different industries can bring us a new architecture type for a post-pandemic society that is safe and healthy while continuing to celebrate the human experience.

The challenge is that many strategies have been implemented separate from one another instead of designed as one cohesive architectural solution. That's what needs to happen now.

We are seeing sparks of this innovation in several areas already.

In Beijing, we're nearing completion on twin towers in the central business district that integrate facial recognition technology into the lobby security kiosks. Employees of the businesses in the building will be let through to elevators that will open without touching a surface.

Modernist furniture reflected these concerns as well. As the architectural historian Paul Overy writes in *Light, Air, and Openness*, dust lodged in decorative features was "an enemy of hygiene to be eradicated at all costs." Minimalist designs replaced carved wood and upholstery, where bacilli-containing dust could linger and become vectors of disease. Instead, designers used lightweight, washable materials in streamlined forms. Michael Thonet used bentwood and cane, Aalto used bent plywood, and Marcel Breuer and Mies van der Rohe used tubular steel. Easily moved for cleaning, this furniture deprived dust and insects of hiding places in the dark.

By jettisoning decoration and disavowing clutter, these designers fought against dust and grime that could nestle in dusky corners. By the dawn of the 20th century, it was known that dried tuberculosis-carrying droplets could survive and remain infectious in household dust. The popular English catchphrase "30 years in the dark but 30 seconds in the sun" reinforced public awareness of this fact as well as the medicinal potency of sunlight.

The influence of these principles on architectural modernism crystallized in Alvar Aalto's Paimio Sanatorium in Finland, built in 1933. The clinical aesthetic of the sanatorium achieved full expression in this monument to health, a landmark of international modernism. He conceived of the entire building as a medical instrument. Aalto bridged inside and outside with sunning balconies on each floor and a rooftop sun deck where healthier patients could bask. Windowed rooms offered sweeping views of the forest outside, while walking trails led patients through the landscape. Terraces, balconies, and flat roofs are common elements in modernist architecture, even in climates less suited to luxuriating outdoors. Beyond their aesthetic appeal, these features embodied modernist preoccupations with the healing effects of light, air, and nature. Influential California modernist Richard Neutra, whose father died of the influenza in 1920, was obsessed with making sunlight and natural ventilation available in every habitable space. In his Corona school in Los Angeles, built in 1935, Neutra used telescoping glass walls to fluidly connect each classroom with the gardens outside. These architectural features—terraces, flat roofs, and precisely designed interiors and furniture—served the pursuit of a therapeutic lifestyle, even as they expressed the design theories of functionality and rationality that are identified with modernism.

First, in the case of an emergency due to an epidemic or pandemic disease, a city is confronted with large-scale needs in supplies, medical spaces and cemeteries.

Second, designing places of living in the future should not only take into account functional spaces for individual and collective needs, but should also protect health, as humans spend more and more of their time isolated in built spaces.

3.1. Residential Architecture

When millions of people are isolated and working from home, what features should a home have? When people can't travel, what is the role of the hotels? When crowds are not allowed at public spaces, how cities and public spaces change? In terms of health centres and interior design, what are the hygienic architectural details of the pandemic reality?

Pandemic Architecture Competition attempts to open up a dialogue and create a think tank, looking for ideas from the architectural and design community about the future of the living, the workspace, the public space and the tourism industry. Urbanists, architects, designers, students, artists, performers and authors are invited to submit their ideas on Pandemic Architecture. Values will change, our lives and habits will change, and our homes will also change under that influence. With that in mind, here are seven predictions for the changes that might occur.

Houses not apartments

High-rise buildings were designed to organise as many people as possible in one place. Health and hygiene were not a consideration. In times of pandemic, it is necessary to reduce contact with everything that is used in multi-storey buildings: elevator, elevator buttons, door handles, surfaces and, above all, neighbours.

After forced self-isolation on different floors above the ground, often without a balcony or terrace, we will all desperately want to have a house. It can be small, but with a courtyard and a terrace where you can have coffee in the morning.

Throughout time, the primary function of the house has been safety. Initially, it served as a hiding place from bad weather and predatory animals. Then, tall stone fortresses were built to prevent the enemy getting in. Today, people need a house that can effectively provide social isolation.

More than an escape from routine and urban chaos, the house now offers a retreat from viruses and infections. Urbanisation takes a step back as we relocate to small villages and city suburbs.

No open-plan

For survivalists – those constantly training to survive a coming apocalypse — there was already a trend for fortified buildings. But now we can expect that trend to become more widespread.

Looking at our real experience, films about the end of the world no longer seem to be so fantastic. The desire to prepare your home for natural or man-made hazards is no longer surprising. There will not only be a garage near the house, but also a hopper, or at least a fortified "minus" floor with a pantry for food and water.

We'll also be saying goodbye to one of the main trends of recent years: open-plan spaces, with the entrance, living room, dining space and kitchen united. In the aftermath of the pandemic, the entrance area will be separated so that we can leave our shoes, clothing and belongings on the street, rather than carry dirt into the living quarters.

Power and water

The buildings of the future will be proud and independent, with their own water supply and heating. Geothermal wells are gaining popularity already. In addition to water, they can partially provide a home with heating.

There will be several other sources of heating to have as a safety net: a stove, a fireplace, a solid fuel boiler, a fuel generator, solar panels. Autonomous mini-stations generating alternative power will become a reality. The goal will be independence from the outside world, minimising risks in the case of a full shutdown.

Home as the new office

During quarantine, most are forced to work from home. There will be people who will, on the first day after the quarantine, race to meet colleagues and drink that office coffee. But there will be those who will not want to return to the office.

More attention will be given to the arrangement of the workplace at home. Spatial organisation will change, with the place to work at home no longer a desk with a parody of an office chair and a lamp, slotted somewhere in the corner of the living room or under the stairs. Now it will be a completely separate room with large windows, blackout curtains and comfortable furniture. It will be technically equipped and sound-insulated.

In response, offices will make more effort to win us back. Everything that the top companies have will become commonplace.

Urban farming goes global

It used to be trendy to start small gardens near homes or on balconies, but now it will be a boom. As our grandparents told us, gardening is calming. It is proven that physical interaction with living plants is good for our mental health.

Growing what you eat is pleasant and gives you some freedom from your daily routine, particularly during self-isolation. Quarantine is perhaps the best time to get to know more about indoor gardens – how to grow plants from seeds and create a food ration, even if you live in a multi-storey building. In addition to producing food, indoor gardens can provide oxygen. The trend in phytowalls has been around for many years, but we have not explored the full potential it offers for interior design.

Going deeper is also an option, like in the recent Guy Ritchie film *Gentlemen*, where marijuana is produced in underground plantations. You could develop an underground basement with a garden, mini cheese factory or a winery. Of course, you need extra equipment here: artificial lighting, water and air filtration, soil fertiliser. But it would be worth it for fresh tomatoes.

Rejection of mass industry

People around the world was struck by photos revealing a new sky over China. After two months of forced abandonment of mass production, they could finally breathe fresh air.

1. State of Art Technology

In addition, governments will have to maintain local manufacturers to restore economic performance. Once you leave export and import, you will no longer be such frivolous cosmopolitans. Wash your hands, stay at home and let's create a new worthy life that the planet will no longer want to lose. Imagine walking through the front vestibule of your office building where heat-sensing cameras scan your body temperature. It registers in the normal range and a green light flash. The front doors open without a touch. As you walk towards the security kiosk, facial recognition technology recognizes that it's you and knows, based on the calendar access you have granted, that you have a meeting today on the 15th floor, and signals an elevator. The elevator doors open and an LED light embedded in the elevator floor tells you where you should stand as it whisks you to your meeting. When you approach the 15th-floor meeting room, sensors cue the exterior glass walls to darken, the lights to dim, and the other attendees to appear virtually on the large screens that line the wall.

After the meeting, you head to your desk, again through elevators that recognize you and know what floor you sit on. Sensors in the ceiling know that it's you. They set the desk to the correct height, adjust the lights, and turn on the heads-up display that is your work interface. Your virtual assistant greets you, reads through the morning messages and restructures the day around the urgent client matter that just came up. There's no disruption to your coworker standing at their desk six feet away on the other side of a privacy screen, since the sound direction system above means you hear only what is coming from your digital interface.

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Another potential change, one that's somewhat paradoxical in this germophobic time: With social distancing dominating our lives, it's becoming clearer how much we crave human contact and community interaction. Yes, we'll all be nervous to socialize for a while, but when this pandemic is over, the call for connection will be that much greater.

2. Design of public spaces

For their work on the David H. Koch Center for Cancer Care at Memorial Sloan Kettering Cancer Center in New York, Ohayon's team at ICRAVE worked to eliminate the traditional waiting area by creating alternative “waiting nooks” scattered around the building and relying on RFID technology to track and alert patients. “This lets patients be somewhere else in the building—the yoga library or somewhere watching a lecture—instead of sitting around on the same floor with other ill people,” says Ohayon. If architects and designers help people start to think of public spaces more like home and less like someone else’s space, they’ll be more vested in treating it right. In a 2016 presentation to SXSW, architect Dan Meis predicated the death of the modern stadium and proposed sustainable alternatives to the future of spectator sport.

Restrooms with doors in public spaces were already on the way out, points out Craig Scully, partner and chief engineer at Fort Wayne, Indiana, firm Design Collaborative, but are likely to be eliminated wherever possible. Designers will increasingly call on antibacterial fabrics and finishes, including those that already exist—like copper—and those that will inevitably be developed. “If five years ago I had a conversation with a convention center about implementing those materials, they might not want to spend the money, but today that’s likely to be a totally different story,” says Scully. Within hotels, Karp also predicts self-cleaning bathrooms as well as pod rooms—smaller modular spaces that can be sealed off from other guests while also offering the ability to be quickly torn down and disinfected.

Certain construction elements already standard in health care may find application in other public spaces, such as reducing the number of flat surfaces where germs can sit, and installing ventilation systems that allow for removing potentially contaminated air from any given area. But health care design will very likely get an upgrade, too. “The biggest thing to come to light during this is the inability for hospitals to accommodate the number of sick people,” says Scully. “So you might see, from design perspective, an ability to make a normal patient room more flexible to increase capacity or be easily converted into an ICU.” Boston dermatologist Ranella Hirsch, M.D., points out that many existing hospitals, especially in non-urban areas, aren’t a match for modern ailments. “A prime example is the emergency department, by design almost always the first point of entry to a facility and a core flaw in an infectious situation,” she says. “The ER is meant for staging and triage, and always has a place designed for waiting, which is precisely where you want to avoid having highly contagious people.”

Future senior living projects, like this one by firm Amenta Emma, are likely to feature hands-free lighting, curtains, and temperature controls.

So, look for self-cleaning bathrooms to proliferate in public spaces. Watch for anti-bacterial surfaces and anti-microbial fabrics in every hotel, restaurant, museum, gallery, and shopping centre. Many people who shift to working from home will likely continue to do so after the pandemic subsides. Not only because they have concerns about viral outbreaks occurring again, but many will find the adjustment desirable. Why commute or pay exorbitant urban rent when you can perform tasks carelessly gripping the handles of an exercise bike or vigorously lifting weights in a gym facility? No amount of assurance on cleanliness from proprietors will be enough for many people and home fitness is the most sensible alternative. As shared recreation and fitness changes, these needs will come inside the home as well. Will you want to swim in a public pool or hot tub this time next year the way people conceive of and use primary living spaces. Just like large, shared public buildings, homes need fewer buttons, handles, doors, levers, and other points of tactile contact. But they also need multipurpose sleep, work, relaxation, and entertainment areas. Picture heated floors tied to voice-operated thermostats. And smart screen walls that take you from a serene forest for your morning yoga session through to your afternoon data analysis visuals and an evening movie to help you unwind. Are we suggesting that you’ll be talking to your walls? The desire for safety, sanitation, and less contact with people will naturally dovetail to even more shopping online and home delivery. Residential architects and interior designers who can address home security with a view to package safety will find more interest in their work.

While social distancing would seem to be a necessary, if (hopefully) temporary, action, it’s reasonable to think that concerns about future viruses might encourage architects to design with an eye toward open spaces that enable and encourage people to spread out. Karp wonders if smaller, more expensive hotels will necessarily replace larger ones,

even if the model proves less accessible and less profitable. But Rami el Samahy cautions his colleagues against relying too heavily on that sort of mindset: “Giving up on urbanity and density is the wrong solution—after all, we still have a planet to save.” Meis puts it another way. “I don’t think we’ll ever get to the point where we completely avoid public gathering, and it is the magic of sports and concerts, at least, to have that common experience,” he says. “But in all settings, this experience has illustrated that it really is a very tiny world and we are all very connected. We just may have to become a bit less physically so, wherever possible.”

Early in the piece, writer Derek Thompson notes that the shopping habits being formed this spring point to one such obvious shift: Larger retailers that families already rely on for their online orders will only continue to grow. That means Amazon, yes, but also the likes of Walmart and Costco. The increase in business experienced by these behemoths will set off a series of ripple effects. For starters, the troubles of beleaguered department stores and overly prevalent malls will only continue. But of arguably more significance are the ways in which such changes will further hurt local businesses.

As such, cities and small towns alike are expected to become increasingly homogenous as unique businesses close up shop. While e-commerce giants are poised to suck up many of these stores’ day-to-day interactions, chains are also set to do the same. And as empty storefronts begin to proliferate—including of course, those left from restaurants—local shopping districts are likely to become less and less appealing.

Under normal circumstances, crowds are good for in-store sales, but now—and potentially for the foreseeable future—packed spaces are synonymous with danger. This means that delivery services, whose business has already skyrocketed, will likely only continue to see an increase in growth.

Design at urban level

There is now a pressing need to bridge the technical and regulatory gaps in urban planning. Collaborative efforts by designers, logistics specialists, and security experts must establish guidelines and define best practices. Architects and planners need to rethink shared spaces, public or private, to make them controllable, manageable, and able to be immediately re-purposed in an emergency.

We need to address flaws in digital infrastructure, too. It has become even more evident how vital the data we produce is for governments’ efforts to assess and forecast the virus’s spread and mitigate its impact. We routinely turn over our data to private companies to use for commercial purposes, yet we consider government use of the same data an invasion of our privacy, even though all governments are mandated to defend us from threats to our security, health, and welfare.

A post-coronavirus approach to urban design should integrate the data we produce with our electronic devices into the Territorial Information System. But that requires digitalizing the countries where they are located. Italy is paying a high price for its chronic delay in nurturing a digital culture. COVID-19 is exacerbating the socioeconomic gap between people who, thanks to financial means and digital education, have access to the Internet and other electronic tools, and those who don’t. The predictable result of this is discrimination, marginalization, and growing distrust of government and other institutions.

More touchless faucets and sensor-operated doors. Every doorknob, light switch, thermostat, and the high-traffic button will be swept away, replaced by motion activation or voice command. And every previous objection based on cost can be easily countered with memories of a global economic catastrophe. Digital Twins will be woven into every new construction project through the use of BIM data. While over time, buildings and infrastructure we retain, but upgrade, can be ‘twinned’ as well. We’ll want to monitor and correct structural and utility issues remotely as much as possible.

The Breathing House in Indonesia (FuturArc Sep-Oct 2016) is named for the generous large glass openings that serve as windows and doors, where the bricks were cleverly laid to create voids or that allow cross ventilation and an abundance of light. Some of the buildings will adopt different approaches in relation to being organic in context with nature, and minimalist in structure, form and massing, with distinct passive designs incorporated.

Another project in Malaysia, the Planter Box House (2019), shows how a planter box façade is used as a filter to redefine the internal and external spatial relationship, introducing a new view for the internal living area and external public space as well as attempting a way of being self-sufficient in food through urban farming. The house is covered by more than 40 types of edible plants, tripling the green area of the site. In Singapore, the site plan of Cornwall Gardens (2016) enabled a series of voids and crevices to be carved out on the structure, breaking down the building mass for daylight penetrations and ventilation. The front façade is clad with charcoal for solar insulation and absorption of air pollutants.

Similarly, the dormitory blocks at Pioneer and Crescent Halls, Nanyang Technological University (2016), Singapore, are positioned in such a way that maximises their interaction with greenery, wind and water. This synergy of the green and blue infrastructures seeks to enhance the quality of life of the students and communities. On the inner façade, the double-glazed casement windows catch the wind when opened and allow an increased airflow through the bedrooms. This 'breathing' façade system provides physical comfort and wellness to the residents. In Vietnam, Stepping Park House (2019) was designed to become a living extension of its surroundings and becomes part of the natural landscape. The fenestrations and the central volume ensure a steady flow of wind movement from the park throughout the spaces.

In Australia, Our Lady of the Assumption Catholic Primary School (2019) is enclosed in a high-performance envelope with light, airy interiors. An educational space that elevates well-being, a vast four-storey atrium acts as the main entry via a central circulation spine, connecting all areas on the upper levels of the building with the ones on the ground floor.

In Hong Kong, the University of Chicago Center (2019) offers maximised views via generous floor-to-ceiling glazing with custom-designed frit patterns, allowing for light/shadow to further connect the building with its surroundings.

In Malaysia, the International School of Kuala Lumpur (2017) has created voids or courtyards in the spine building, which not only serve as breakout areas for students and staff, but also allow for breezes to cross ventilate the building. In **Vietnam**, the double-layered roof and walls of (2019) mitigate heat gain and protect from heavy rains while enhancing air circulation. The spatial design favours connectedness and openness, in an attempt to integrate the built structures with the surrounding blue and green areas, as well as helping students experience an interactive living and learning style.

3. Design of Commercial Spaces

In **China**, the **Shanghai Greenland Center** (*FuturArc* 3Q 2019) is designed in such a way that the boundaries between the inside and outside have been blurred, creating a lush and spacious arena and contributing to improving occupants' health and well-being. In **India**, vertical green walls run along the entire two-floor length of the **Office for Communiqué** (2019) along its eastern and western edges, and treated fresh air is brought in to improve indoor air quality. The design of this office project seeks to prioritise comfort, health and well-being of its users.

It's hard not to pay more attention to our physical realm these days given the fact so many of us are sheltering in place, or are likely to be doing so soon. Anecdotally, at least, DIY home improvement projects are on the rise; if you're like me, your closet has never been better organized. For many in the design community, however, the rapid spread of COVID-19 has caused them to reevaluate their life's work, and what it might mean to design for a world that will never be quite the same, especially when it comes to how we gather in and use large public spaces, like airports, hotels, hospitals, gyms, and offices.

Open offices were already on the decline before Covid-19, and workplace leaders will take the best of what they've learned from virtual working to help create office spaces that allow for a balance of isolated concentration and productive, meaningful collaboration.

Sanitizing stations

Think of a residence in terms of quarantine zones. The red zone is the outside contagious world, the green is the virus-free living space inside. The yellow transition zone is the critical one. This space, according to Carlin, is where people coming

indoors need to ensure that if they have come into contact with the coronavirus, they don't contaminate the home. This is where a sink or hand-washing station comes into play. "Now they've come back home, in the transition zone, they're going to leave their clothing, clean themselves up," Carlin says.

Anti-viral fabrics and surfaces

Specific virus-repelling materials are particularly useful in the kitchen, a space that Carlin considers the "number one area of transmission." As people tend to gather and talk in kitchens, there's a greater chance of virus shedding, so Carlin says architects should focus on replacing countertops that can harbor the coronavirus, especially those made of materials that are pitted or grooved.

Ventilation

Nancy Ruddy, founding principal at CetraRuddy, points to leveraging basic elements to transform homes to maintain emotional well-being, given that few people have the opportunity to change scenery as they shelter in place. To that end, Ruddy notes that ensuring good airflow and circulation in indoor spaces is important for dispersing potentially virus-dense air. Rather than focusing on heating, ventilation, and air conditioning (HVAC) systems to do this, she advocates using natural airflows and breezes.

Nature and wellness

Ruddy notes the importance of creating green spaces, noting that plants and trees are scientifically proven to make us feel less stressed. She says people are filling their homes much more with indoor plants. Furthermore, she notes that there's a growing trend toward introducing a natural flow between the indoors and outdoors. These can be achieved, she says, by having huge floor-to-ceiling doors leading to the outside. "Home design creates drama, and we're doing that with garage doors," she says. "That was never used in our living rooms, but we're seeing that kind of mechanism where the doors go up into the ceiling."

Location Independence

After months of remote work, buyers are cutting ties with the cities where they work, looking for more space and privacy in the suburbs, the country, and second-home destinations like South Lake Tahoe, Palm Beach, Hawaii, and the Hamptons. They are looking for larger homes, on large lots. Some are buying land when they can't find what they want in a frenzied market. "They're moving farther afield," says Andrew Cogar, president of Historical Concepts. His architectural firm has seen an uptick in business in Maryland, the Carolinas, and Virginia. "Everyone is on Zoom. You can set up your base anywhere."

A Multi-Purpose Sanctuary

As Americans work, study, and exercise at home, they are expecting much more from their homes. "People are digging into their homes in a way that we haven't seen since the 1950s," says designer Patrick Mele. "People want to make their homes as singular and interesting and particular to them as they can." They want space to exercise, and not just on a Peloton bike in the bedroom but in a light-filled room that can rival that canceled SoulCycle membership. They want a dedicated home office, and probably two, with good lighting and an elegant backdrop for a Zoom call. "The pandemic reaction is all about being inside your bubble," says Mala Sander, an associate broker with Corcoran in the Hamptons. "You are making your bubble as beautiful and accessible as possible."

A Home, Not Just a Showpiece

Suzanne Kasler's design clients are looking for spaces that are as comfortable as they are welcoming, with durable fabrics that will hold up to extra use. "Having a more comfortable and more accessible and more usable house is important because

everybody is home and they need a place to go,” says Kasler. The home office, arguably the biggest “must-have” of the moment, needs to be functional, not just attractive, even if that means the printer is no longer hidden inside a cabinet. Homeowners are “not apologizing that it is a working office,” Cogar says. “Desk spaces get bigger, lighting gets better.”

Second Home, Primary Destination

The second home has taken on a central role for homeowners who retreated to theirs during the pandemic, and many homeowners are adding upgrades more typical of a primary residence, like more storage and expanded kitchen pantries. Those who didn’t own a second home before the pandemic are looking to buy one now, focusing on properties that could be used on a regular basis, with space for the children to study, and good wireless networks so the family can work, not just play.

Second-home markets are seeing a surge in buyers. “When I was a kid, I always said people come [here] to spend their money, not make it,” says Whitney McGurk, a sales associate at Brown Harris Stevens in Palm Beach, Florida. “Now they’re moving their businesses here” and staying longer.

Outdoor Expansion

Pandemic life has been one lived largely outdoors, so homes with ample outdoor space are selling fast. Homeowners want those spaces to be welcoming, with pools, cabanas, and outdoor living rooms with features like a fireplace, a television, a bathroom, and a kitchen with a pizza oven. Homeowners are also looking for quiet nooks so they can escape without ever leaving. Barn houses, sheds, garages, and carriage houses are being converted to artist studios, home offices, or classroom space for the children. Landscape architect Miranda Brooks says some of her clients are now living in the country full-time, experiencing their homes in a different way than before. As the world rapidly changes around them, she says, “They are sort of reimagining their lives.”

IV, CONCLUSION

In today’s largely urban and interconnected world, infectious disease outbreaks and other public health emergencies pose a real threat to large cities. Pandemic Realities addresses the spatial configurations, modes of living, and notions of the human body engendered by disruptive public health crises such as Covid-19 outbreak.

As the world faces new globalized health threats, there is a need to design the home/ the city of tomorrow, living in times whereas pandemics and viruses will be part of our everyday life. By designing for the needs of a pandemic reality, architects act as guarantors and guardians of the Public Health of a community. Virus outbreaks have their impact on urban space as well as on the living of millions of people.

In managing any public health crisis, the design of a city will have two overall tasks – dealing with the sudden large number of sick people and keeping city life as normal as possible for everyone else. One thing that’s clear from this pandemic is that there won’t be a flip of a switch that will suddenly fill malls, airports, office buildings, parks, and arenas with people. There will be a gradual re-engagement with our communities, and the architecture that defines those communities will be layered with a cautious optimism.

In upcoming airport projects, the combination of the Internet of Things (IoT) and facial recognition will offer a more seamless and touch-free journey. The dirtiest part of the airport is the check-in kiosk so these will be retrofitted with biometric units and our face becomes our token. We will no longer need to exchange our documents and truly create a touch free environment. Many airports overseas already use digitally controlled temperature scanners for arriving international passengers, quickly identifying symptomatic travelers.

Temperature sensors and facial recognition could detect a symptomatic worker in the building, triggering a series of physical changes. The heating and cooling system could immediately change to create a negative pressure environment in the zone where the illness was detected, preventing air that maybe contaminated from getting to another area of the building. Meanwhile, the glass panels on the building façade could instantly open to let fresh air into unaffected spaces. Those within the building continue their day, comforted by the fact that they’re safe where they are. The same technology can be used to regulate temperature and humidity to keep people comfortable under regular, illness-free conditions,

improving energy efficiency and operating costs. What might be motivated initially for safety reasons could enhance wellness, not just avoid illness.

As all of us emerge from our homes and re-engage with our communities, the one thing we will be looking for is an underlying trust in the places and spaces into which we're emerging. And, the hope that we can safely be together again will fuel an optimistic re-thinking of the built environment. Research shows there can be improvements for children in learning, and adults' workplace productivity levels can increase when they have a connection to the natural world.

Although pandemics have long been a tragic scourge on our cities, they've also forced architecture and city planning to evolve.

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