DESIGN QUARTERLY

ISSUE 03

TECHNOLOGY DRIVING CHANGE

How technology is changing the way we communicate and think about design.

Stantec

DESIGN QUAR-TERLY

THOUGHTS, TRENDS AND INNOVATION FROM THE STANTEC BUILDINGS GROUP.

The Stantec Design Quarterly tells stories that showcase thoughtful, forward-looking approaches to design that build community.

IN ISSUE 03: Technology is changing the way we live, and design. In this issue, we examine design through the lens of new technology—how we are adapting digital tools to our mission of design excellence. *Plus:* How demographic change will influence what we build for tomorrow.

IN THIS ISSUE:

TECHNOLOGY DRIVING CHANGE

RED PLANET CITY

Envisioning a vernacular architecture for a **metropolis on Mars**

BY MARCEL TARNOGORSKI, ALYSSA HAAS, AND AUBREY TUCKER

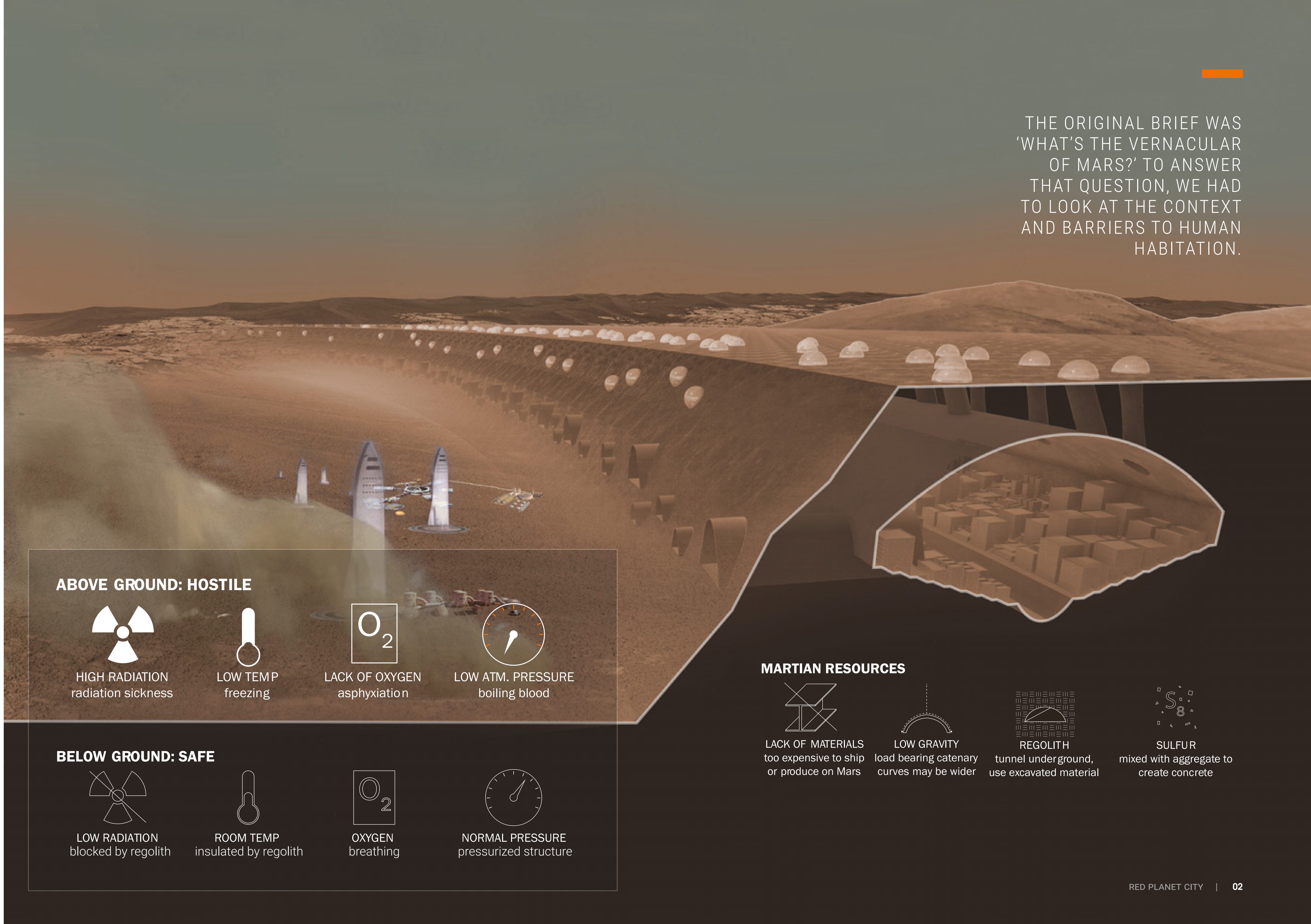
→

If humans were to permanently settle on Mars, what would the architecture of a Martian metropolis look like?

Inspired by the possibilities of parametric software used within Stantec's Innovative Technology Development Team, our entry led by co-op student Marcel Tarnogorski, explored the potential for life on Mars with computational design via the recent Marstopia competition. Curiosity led Marcel to investigate how parametric design with visual coding could be applied to realize a vision for the settlement of one million people on Mars.

The truth is, on Mars, the atmosphere really wants to kill you. There's a lot of radiation, it's extremely cold, there's no oxygen and there's no atmospheric pressure. We looked at the harsh climate, considered the lack of building material on Mars, and the prohibitive cost of shipping materials from Earth and realized we needed to think differently about habitation than we would for a typical earthbound design project. Inspired by the architecture of "Early Earth," we pursued the idea of using the planet itself as a building material, digging underground and using Martian dirt and regolith combined with sulfur to make our own 'Martian concrete.' >

THE ORIGINAL BRIEF WAS 'WHAT'S THE VERNACULAR OF MARS?' TO ANSWER THAT QUESTION, WE HAD TO LOOK AT THE CONTEXT AND BARRIERS TO HUMAN HABITATION.



A million Martians

We decided we didn't want to focus on the beginning stages of Mars settlement, where just a dozen or so people would occupy a temporary scientific outpost. With a larger population and more permanent structures we could create a unique and recognizable vernacular architecture. And, if we're going for a big city, why not double down and make a metropolis? A metropolis would have the ability to showcase a new Martian vernacular.

Early Earth

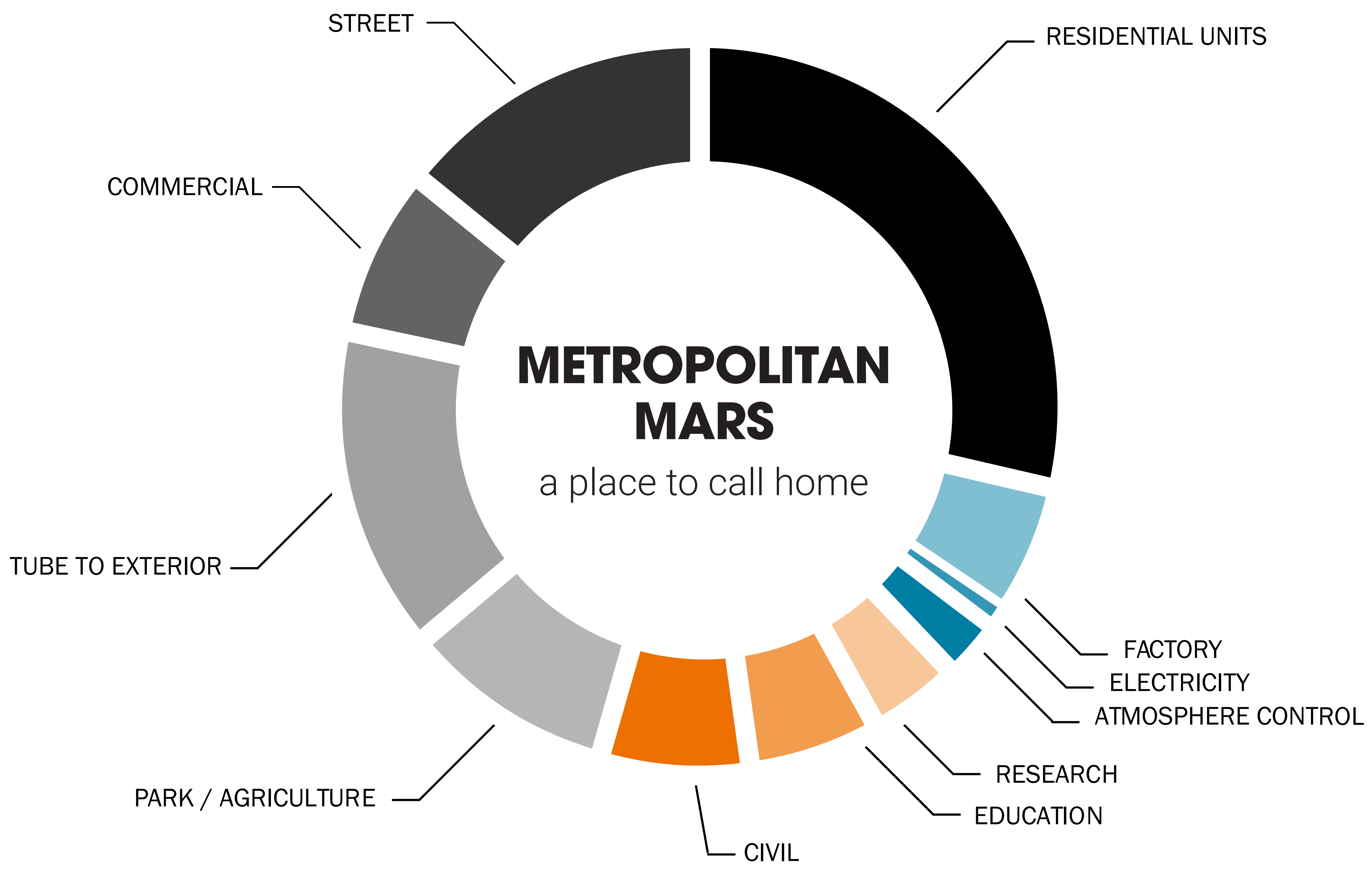
Next, we thought about the precedents for vernacular architecture on Mars. If we are designing for the first humans on Mars, maybe we can find inspiration in the structure built by the first humans on Earth? We looked at the architecture of cave dwellers and desert people who settled places roughly analogous to the Martian surface. The challenges in the desert or caves were similar; get yourself away from solar radiation, control the temperature to survive the heat, as well as the blistering cold at night.

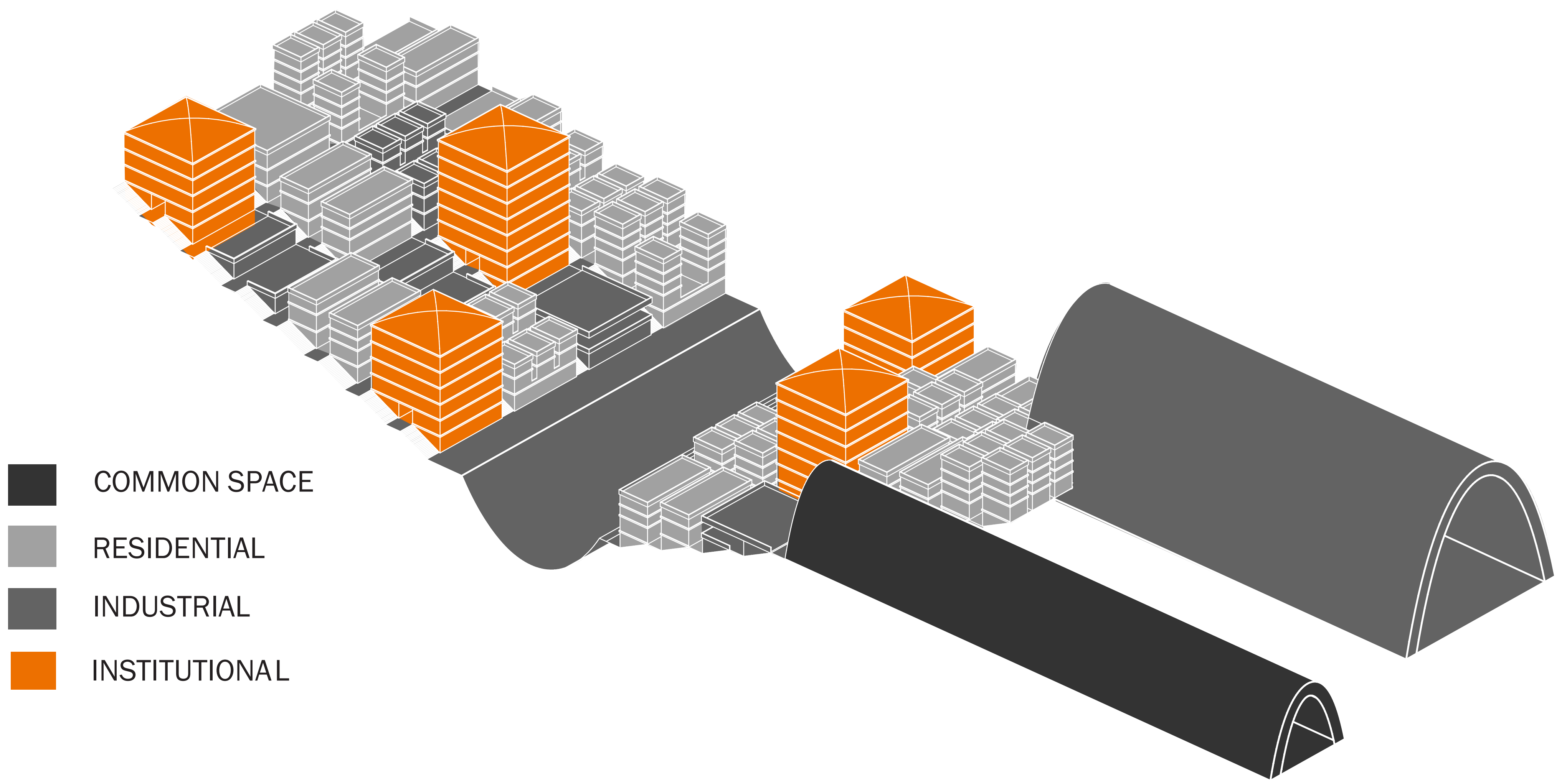
A tunnel

Vernacular architecture is about responding to the context with local materials—like the wooden fishing shacks in maritime regions designed with loose floorboards that can be replaced when the waves wash them away. On Mars, there are no traditional building materials, like Earth's trees or bamboo, just barren desert. But, the regolith on Mars itself is good at blocking radiation and has enough thermal mass to stabilize the temperature. Instead of trying to build a pressurized container of our own, we chose to tunnel into the terra firma. The tunnel provides us with a structure that can be made airtight and habitable. Pressurize the interior, provide oxygen, keep it thermally regulated and shielded from radiation, and the tunnel becomes an ideal setting for an underground city.

Less gravity, bigger span

The gravity on Mars is one-third that of earth, which allows for stable super spans like our 314-meter-across tunnel. Another reason we can go big? There are no seismic events or earthquakes, therefore no seismic issues to be concerned about. Environmental control takes place at the boundary of the tunnel and any penetrations through it. This frees up designers to express themselves on the interior of the tunnel without any thermal or pressure-controlled requirements for the building envelopes within.





Settling Mars

So, how would we get to Mars? What would it require to make Mars habitable? We used SpaceX's reusable BFR rocket, which will carry up to 150 tons per trip, as a guideline. We broke down the payloads for each trip: drones to start digging, drones to start 3D-printing structures and making the tunnel, and drones to test the tunnel before we start populating them with people. Then we figured out how many people could come per flight. >

HOW TO SETTLE MARS?

DRONE, BUILD, SETTLE. REPEAT.

1 **Land.** Land a rocket that has in situ resource utilization (ISRU) systems which enable us to use what's on Mars to create things we need for human habitation. Via the Sabatier reaction, carbon dioxide from the Martian atmosphere is converted into methane as a rocket fuel to return to Earth. While oxygen to support life is produced from electrolysis of Martian water.

2 **Excavate and mine.** Excavation drones start digging out the capillary while mining drones begin refining sulfur for use in Martian concrete, a mix of molten sulfur and regolith.

3 **Excavate and pressurize artery.** Excavation drones drill and bulldoze inside.

4 **Test systems.** Drones test the interior and seal areas for occupation.

5 **Populate.** A crew of six humans settles a scientific outpost in the tunnel and begin planting.

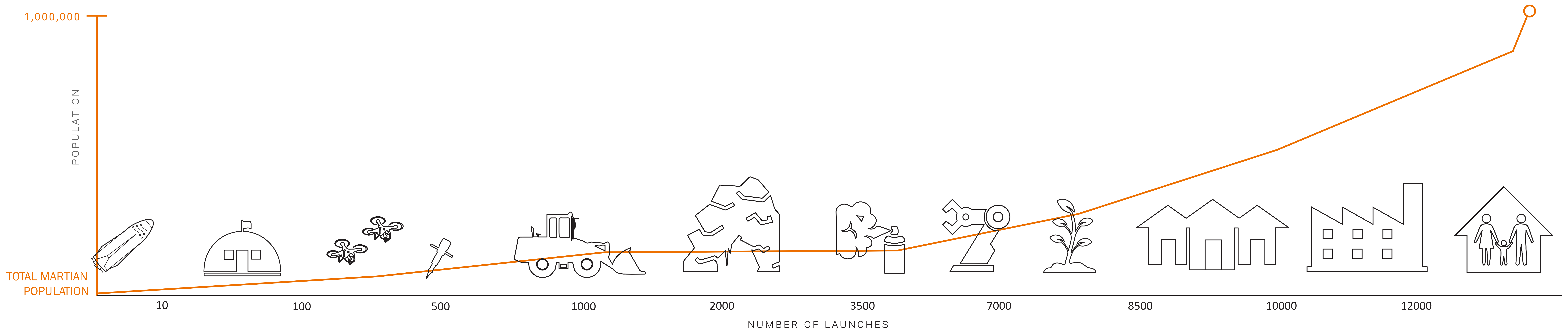
6 **Build structures in artery.** Once new areas are made airtight, 3D-printing drones move in, building with Martian concrete.

7 **Expand and excavate.** Once the main artery is carved out and pressure sealed, it's settled. Excavation bots carve out new pockets for expansion as needed.

8 **Establish self-sustaining community.**

9 **Expand manufacturing capabilities.**

10 **Enjoy the metropolis.**



We would begin with 100 humans/flight, to ensure they have all the life support and material goods they need, but eventually we can bump it up to 200 humans/flight. We estimate 12,536 trips would be needed to supply all the drones and materials and human populace. If a fleet of 1000 SpaceX rockets made a round trip every 52 months (4.33 years), that would mean 13 trips, spaced 52 months apart, or roughly 56 years to transport a million people to Mars.

The Hanging Gardens of Babylon, alien agriculture

The epic logistical under-taking required to just get people and houses built inspired us to look at the mythic Hanging Gardens of Babylon as both a vernacular design element and as a means for food production. The tunnel's large pressurized and temperature-controlled cross-section could support agricultural crops which can be tended and harvested by drones, feeding the population of settlers and providing oxygen.

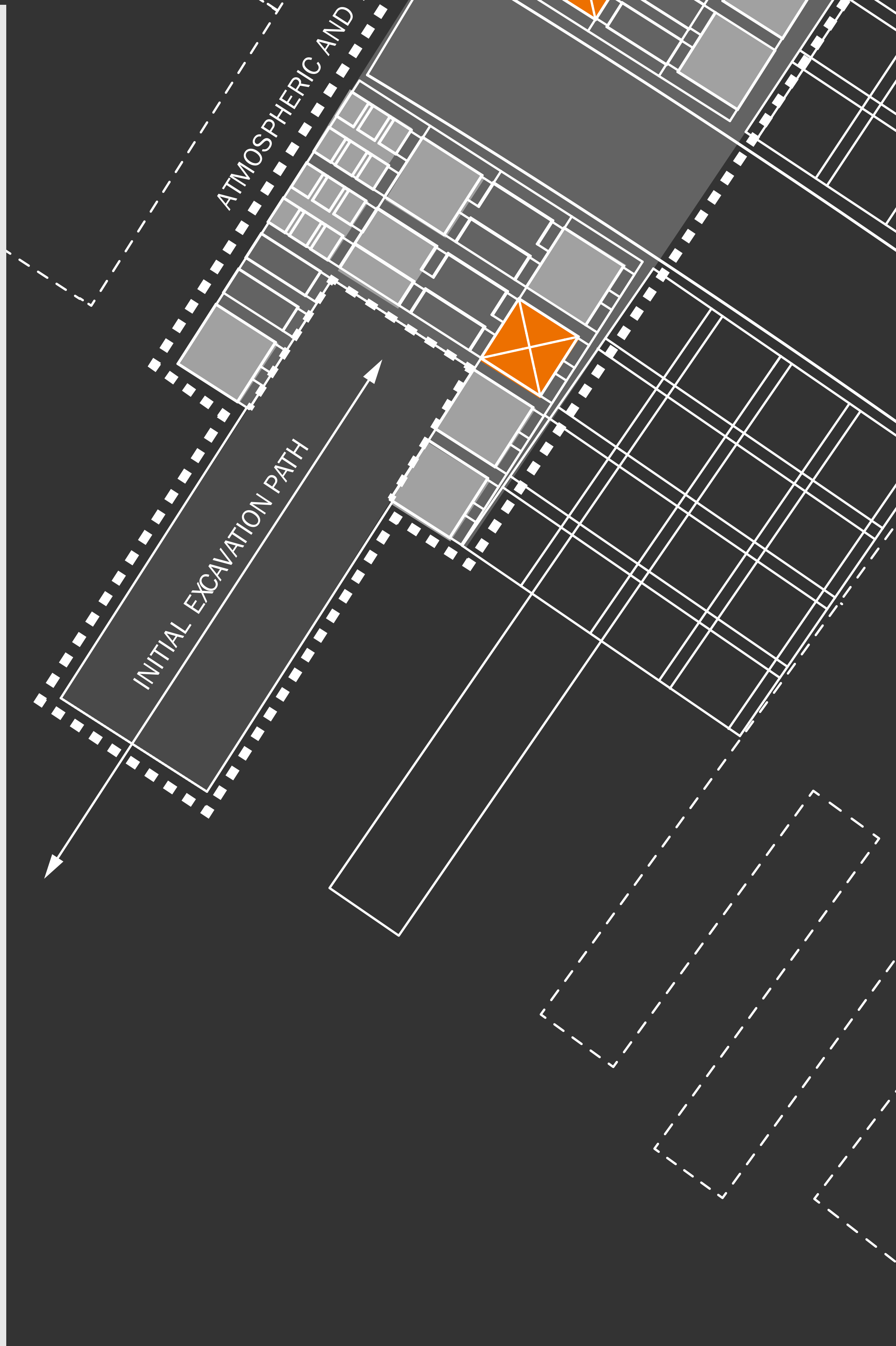
Oasis

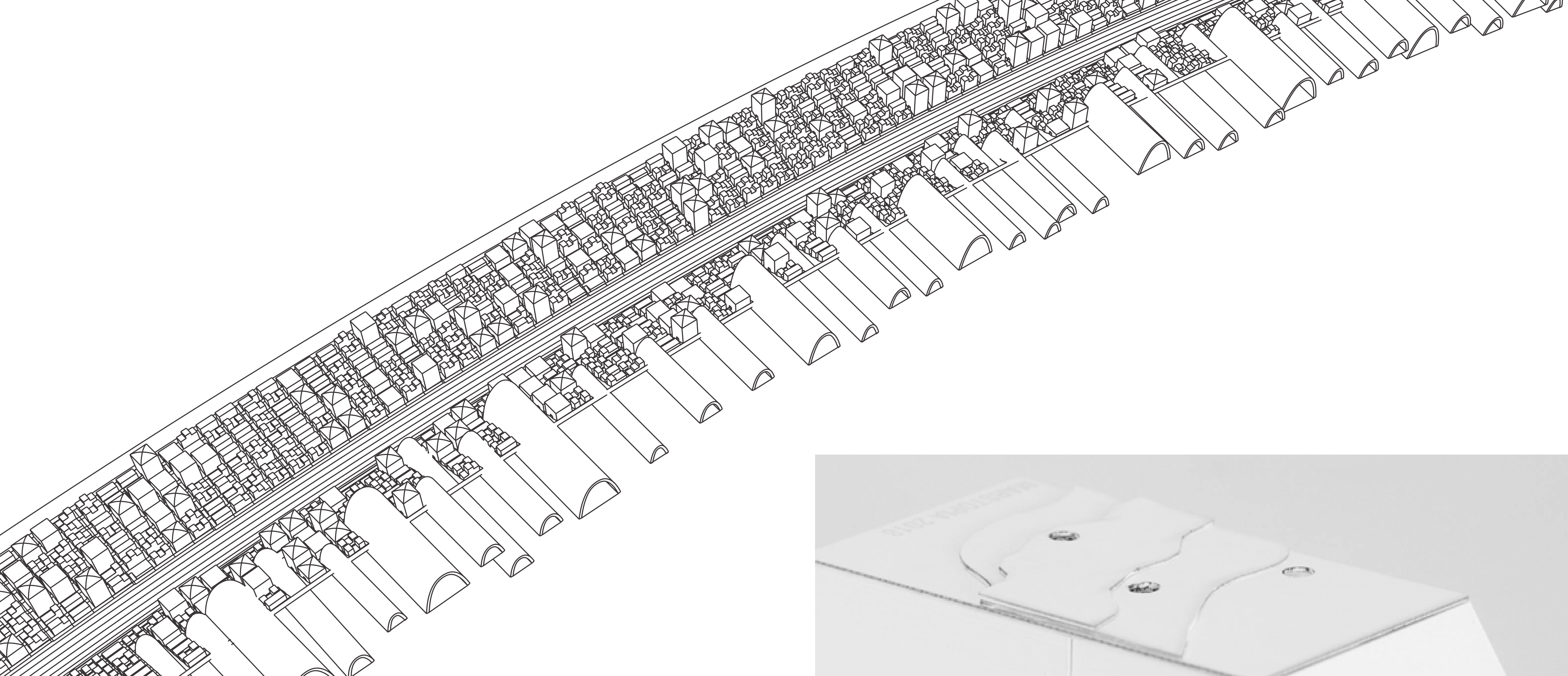
We wanted to create pragmatic amenities that would recall the comforts and pleasures of life on Earth. The skylights and river are key elements in carving out an oasis in an otherwise hostile environment. The circadian rhythm of Mars is close to that on the Earth, so we inserted skylights on the tunnel ceiling to help settlers experience a normal day and night. The river below, made from Martian ice, starts at the top of the city and meanders all the way through, where its treated and pumped back up to the start. It serves as an aquaponic loop, a source for irrigation and habitat for fish.

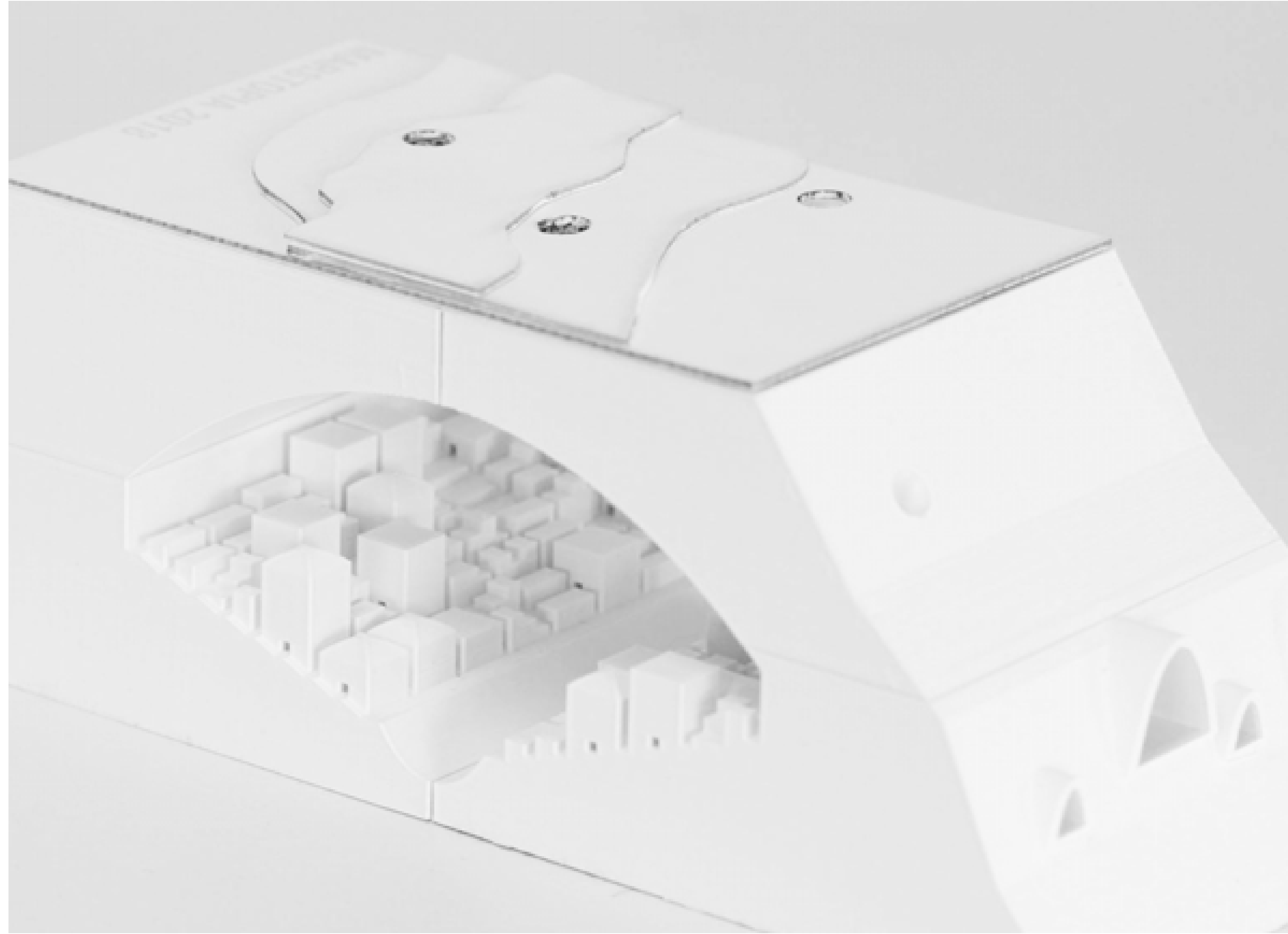
Pushing technology

Grasshopper, a parametric design software, helped us explore the architecture and infrastructure project details. Grasshopper allows designers to push and pull design parameters without rebuilding the model from scratch, as the software adjusts the design to the new value of the parameter in real-time. This technology means rapid option generation, and informed decision-making on viability of options.

The entire model for our Mars metropolis was generated through Grasshopper, which allowed us to emulate the vastness, uses and variety of building types of the city through computational design. We ran a script to populate the model to understand and simulate the needs and conditions for one million people to live on Mars in a pleasant community.We tried to make it feel urban. The city blocks are laid out on a grid, but each is unique, and they follow the curve of an actual cliff- landscape inside the tunnel. 3D block models were printed directly from Grasshopper to study how light would play against the structures. >







3D PRINTED MODEL OF THE MARTIAN CITY

Why research?

Theoretical projects, like designing a Mars metropolis, let us push the boundaries of what's possible with design technology, process and thinking at hand. It helps challenge our preconceptions and problem-solving skills, providing rapidly generated alternatives. It enables us to see possible efficiencies from adopting new technologies or workflow. It's exploratory and compelling. Architecture is moving quickly towards computational design and parametric design, we know that—and we want to be on the leading edge leveraging its potential to solve client and societal challenges here on Earth. D

Marcel Tarnogorski is a co-op student in Stantec's Innovative Technology Development from Dalhousie University. Computational designer Alyssa Haas works in the Stantec Vancouver office, within Aubrey Tucker's Innovative Technology Development Team.

Forecasting change

Three perspectives on how demographic change will influence design

BY JON CARDELLO, BARRY KOWALSKY, AND GAIL BORTHWICK

→

Demographic change is sweeping North America.

A significant portion of the population (22-23% in the U.S./Canada), the baby boomer generation, is entering retirement age. By 2060, the senior (65+) share of the U.S. population will rise to 24 percent from 15 percent. How and where they want to live as seniors will change the places we design. Our population is greying significantly.

At the younger end of the spectrum, millennials (20% of the population) have now entered the workforce bringing with them a new set of preferences.

We've already seen these demographic shifts changing demand for space within the workplace, but it's the preferences for how the retiring boom generations want to live—where they want to be, what they need to access, and how technology will enable those preferences—that will shape demands for our built environment, and therefore continue to influence design.

Streetscape, Atelier + Flora Lofts will feature residential and artist lofts, retail and gallery space.
Dallas, Texas

We checked in with experts on design for the health, mixed-use, and residential markets to see how they predict design trends will be reshaped by these demographic shifts.

Jon Cardello on Multi-Family Residential

Sixty-somethings are much healthier today, and they don't want the traditional 55-plus designs.

Contrary to past generations, a large portion of retiring baby boomers want to move into the urban centers. Boomers want places with activity; restaurants, cultural venues, museums. Residences may feature components of outdoor space such as pools and pool decks, however it's really the urban connections and amenities they most desire.

Boomer preferences are affecting the availability of amenities and services in new buildings. Now, operators are offering options for private chefs, specialized spa services, and health and wellness programs in their buildings, as well as communal spaces for hosting social events such as wine tastings.

Boomers want the convenience and flexibility to leave their residence for a month to go visit their grandkids. Families aren't in the same town or city anymore. In terms of size, they may have downsized from a four or five-bedroom home to a one or two-bedroom home, but space distribution is changing, We're seeing a higher demand for larger living spaces from boomers. While Millennials want smaller, affordable units that allow them to live that urban lifestyle. As this demographic change occurs relative to traditional market rate residential and multi-family, the units are getting bigger not smaller. That person may only want a one-bedroom, but they want a full dining room, wine cellar, and a reading area in their bedroom.

The units aren't designed with a technology in mind—technology changes too fast—but rather for residents who bring their preferred technology with them. A significant demographic is embracing the anti-technology world. They don't want that phone connected to the hip all day long, they don't want Alexa telling them what's going with the weather and everything. They want a simpler life that takes away from the constant connectiveness.

We've seen a reduction in parking spaces per unit occur in urban centers so it's not two cars per family anymore, it's much less. Some people don't have cars, some people have two cars, and some people have one car, but the average ratio is about 0.7 space per unit today.

It's easy to understand that today's seniors don't want to move into a stepped or continuing care environment until they absolutely need to be. While they're active, healthy, they want to be with young people, and we need to keep this in mind, as we develop new multi-family developments in the future. >

Barry Kowalsky on Health

The floodgates are opening in terms of the application of remote technology enabling new streams for health treatment. There are three ways this new technology is changing the way we treat and receive treatment.

1

The link between provider patient care is changing with remote presence technology. Now, a real-time diagnosis can occur with aid of a remote heart monitor and other sensors. Patients in remote locations can now gain the medical diagnosis of a specialist within a large urban center, from their own community hospital. And, the day isn't far off when we are going to see surgical procedures done remotely, in fact, the military is already using this approach.

2

Health monitoring with help from AI (artificial intelligence) will be able to detect a heart attack or stroke and notify a hospital to dispatch care—before the user even knows they are in distress. Similarly, monitor system technology can alert family or a social worker to check in, if an elder hasn't used the water closet, or opened the refrigerator in say, 12 hours.

3

Physician to physician interaction. A general practitioner will be able to send your data (X-rays or doppler tests, lab work) to a specialist for a diagnosis and to see if urgent action is needed — all tracked in a single electronic health record. This expedites the interaction, and time to diagnosis and treatment plan, between the family physician and the specialist.

FOR ELDERCARE, THE ADVENT OF THIS MEDICAL TECH SUGGESTS PEOPLE CAN LIVE INDEPENDENTLY WITHIN THEIR EXISTING COMMUNITY MUCH LONGER. COMMUNITY-BASED, FACE-TO-FACE CARE CAN TAKE PLACE ANYWHERE THERE'S A GOOD INTERNET CONNECTION, AND APPROPRIATE DIAGNOSTIC TOOLS.

Designers must think about these types of wireless care and what it means to the built environment. We will see more healthcare delivery in the community setting, like health booths in a mall where you can hook up yourself up to sensors and have a consult with your physician. Design of community clinics will change, and you won't necessarily have to go to the hospital to see a specialist anymore.

As architects and designers, we need to think more systemically about healthcare. If we're good at understanding how the technology, lifestyle, and healthcare aspects can work together, there might be less demand to build hospitals, because we will build healthy lifestyles and remote access to care into our community fabric. We need to go back to a much broader way of thinking about design from a total human needs perspective. It's challenging, but to me, that's exciting. ›

Gail Borthwick on Mixed-Use

Not so long ago, a developer with a medical office building portfolio looking toward mixed-use might have included a pharmacy or a retail shop that sells seniors medical supplies to its tenant mix. But today's seniors are living and thriving differently than previous generations, they take yoga classes, they eat healthy diets, and hang out at local food hotspots to see and be seen. And, they have more expendable income than previous generations. Today, that medical office building might consider incorporating residential, retail, fitness centers, dining, and public spaces in the mixed-use approach. As this trend continues, things are going to look different. Today's seniors are looking for a community in which they can age gracefully in place and developers know that catering to this very large demographic group makes good business sense.

Mixed-use has a bright future as the lines between live, work, and play continue to blur. Workplaces must support innovation with collaboration spaces and provision of options for where and how we work. Residential options must be part of a community—walkable, bike-friendly and accessible—to create an enhanced human experience.

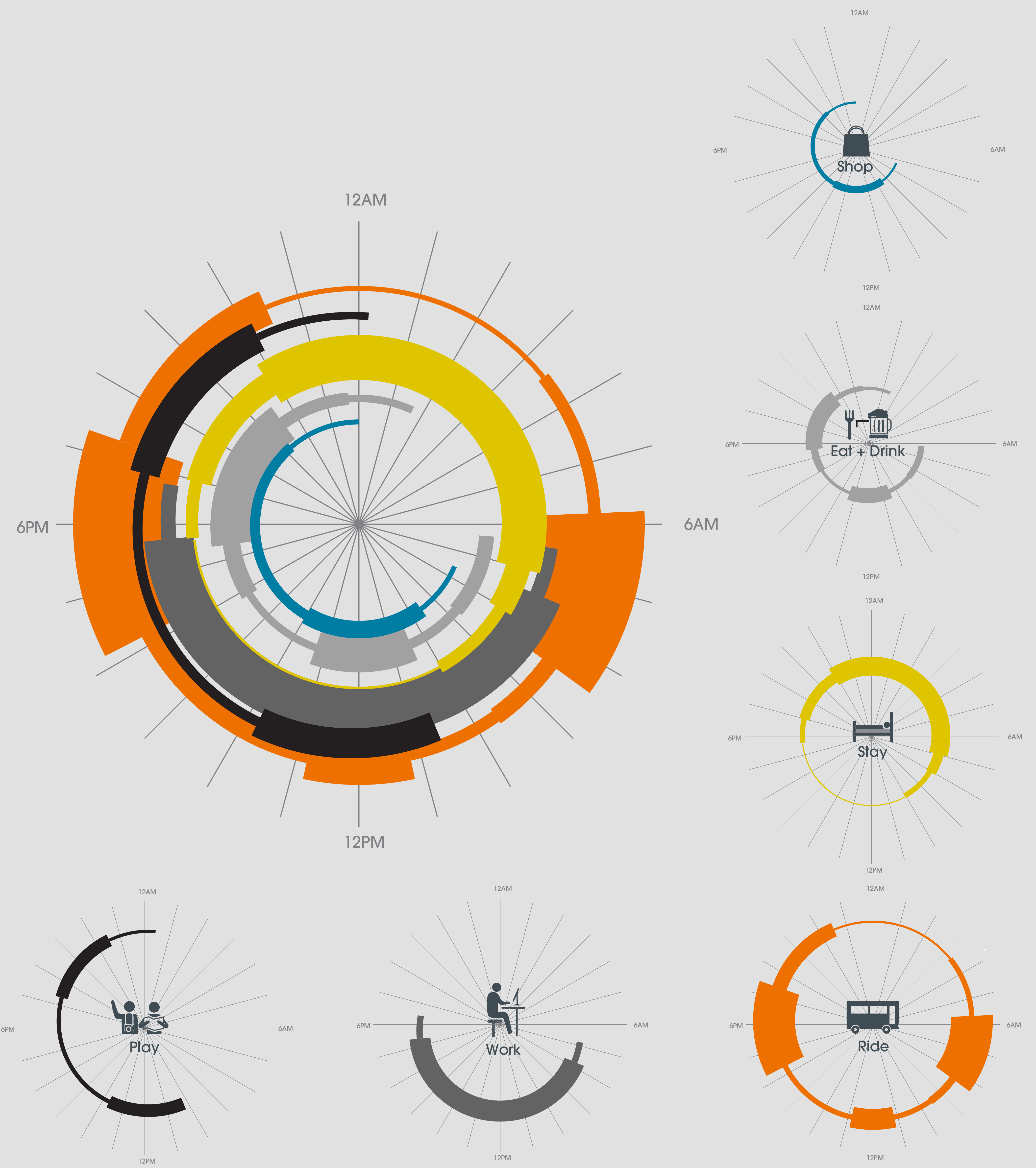
While Millennials have grown up with technology, the retiring Baby Boomers have a strong incentive to embrace it to maintain that independent lifestyle they strongly desire. Accessible also means easy access to the latest technologies. Gerontechnology—technology that's designed for seniors—has a big role to play in this. Today's seniors value independence, so we will see technology expanding in regard to safety, convenience, caregiving applications to make this possible. Wearable technology will empower seniors, allowing them to stay independent longer. In mixed-use, I think there's an opportunity for residents' interest in quality of life to align with the goals of developers.

Perhaps the strongest driver of mixed-use developments, is the emotional and social element. People want to live in a walkable, mixed-use neighborhood for the sense of community. A mixed-use development brings social value. D

Jon Cardello is the Sector Leader for Commercial for Stantec and is based in Miami. Based in Calgary, healthcare architect Barry Kowalsky is passionate about improving healthcare delivery. Gail Borthwick specializes in architecture for mixed-use buildings in Toronto, bringing clients expertise in commercial building design and project economics.

24-HOUR AMENITY CLOCK

Our 24/7 activity clock shows us the program mix that can co-exist on a site over 24 hours. Mixed-use allows for 24/7 activity on a site that permits people to embrace a lifestyle where they can live, work, play, sleep, entertain themselves within a walkable neighborhood. This 24/7 approach to mixed-use also buffers the highs and lows in the real estate leasing market for the developer who wants the project to be financially viable. Commercial leases tend to have much longer lease terms which can bring stability to mixed-use developments, while a residential component can bolster the entire development.



Crunch time

Data-driven design, parametric design, and real-time visualization are reshaping the design process.

A CONVERSATION WITH AUBREY TUCKER,
INNOVATIVE TECHNOLOGY DEVELOPER.

Austin Oaks Development
Austin, Texas


Austin Oaks Development
Austin, Texas

Technological change in the design industry advances rapidly. Currently, we see the design process changing with the availability of technology that harnesses the power of data. Computational design bridges the gap between complex sets of information and the digital, visual representation of design in 3D, and it presents this information in real-time. To catch up with the latest thinking on these innovations, we spoke with Stantec Innovative Technology Developer Aubrey Tucker.

What is computational design?

In a traditional design process, designers will rely upon their professional qualifications and experience to solve design problems. With computational design, designers manipulate design elements parametrically and then explore computationally. This emerging design process includes generative design or parametric design, in which you're creating multiple options or iterations by manipulating parameters—data values. >

How did we use this process at Austin Oaks?

With Austin Oaks, a mixed-use project in Texas, we wanted to look at different aesthetic options while being mindful of the client's concern about costs, and we had access to a specific manufacturer, so we had to design within those parameters. Once we created a script for that data, we were able to iterate over half a million options that were physically possible for the exterior based off the manufacturing constraints. We harnessed data to optimize design for value-engineering on the external sun-shading system. A common analogy might be thinking about the process like a mixing board for producing music. The data feeds into the mixing board, and the designers simply turn the volume up or down on aspects of the design approach, material composition or assembly.

Where else are we using this?

One interesting application is slab automation detailing. In structural engineering, they spend a lot of time doing rebar detailing for concrete slabs, which takes hours to translate from calculation to modeling. With the tool we've developed we can specify each slab in less than 90 seconds, by reading all the information from the calculation software and simply modeling it in Revit. This is a huge benefit to our clients, and makes our design process more efficient.

Which are the points at which computational design would be a handy tool on new building project, for instance?

It's the dance at the beginning of a project where you figure out the size of the building footprint and core spaces—and in the case of commercial developments it's when you determine if the project is financially viable. Designers are planning for the building essentials from bathrooms and common areas to egress plans, and corridors for fire exiting. These decisions really affect how space is laid out within a building, and how much leasable, retail, or shared and amenity space will be possible.

If you look at it computationally, you can make those elements parametric, and you can look at more building forms. You can explore more creative and iconic shapes, not just a simple glass rectangle. You can look at playing with more interesting facades, making a building more dynamic in nature—creating a building that will stand out in the skyline.

YOU'RE ENABLED BY THE TECHNOLOGY, YOU'RE NOT CONFORMING TO IT.

What's the biggest benefit to the early stage architectural work?

Once you move into the design development stage, computational design helps designers explore how skin termination works, consider buildings systems more deeply—essentially making the building systems and components more integrated. You can incorporate the effect of light louvers, daylighting, and new wellness factors such as the depth of daylight penetration in a space. In design, it enables us to look at manufacturer's options and model those efficiently.

How is parametric design connected to the visualization of design?

One of the best things about taking a computation design approach is the ability to represent the push and pull of the parameters visually, to see what's possible. You can use real time visualization to run through a lot of options during your time presenting to the client. You can have them wear a VR headset like the Oculus Rift and walk them through a design option. With parametric design, a client can make a suggestion or ask for a design change, and you could realize the change in front of them. In the 3D immersive environment, we can support more informed design decisions, show our client sightlines and other spatial qualities.

How does real-time visualization benefit the design process?

You get more interesting conversations and feedback using visualization. Let's say a team is designing a hospital. During a user engagement session, they are walking through a proposed unit design with hospital staff and there is a concern raised about storage space. Using visualization, both the design team and the end users can see the issue. Whether you're doing a VR walkthrough or just a video walkthrough on a large screen, the third dimension leads to a deeper understanding than drawings or renderings can convey. You get much more interesting conversations using visualization around the day-to-day needs, how occupants use space and how the design criteria impacts the finished space. That's the biggest benefit of real-time visualization. ›

part of this process is managing client commentary so that it's captured and can be incorporated systematically. With Royal Columbian Hospital, we tracked design and client commentary within Revizto which allowed us to tour high coordination areas, prioritize design effort and delegate tasks.

What's next for parametric design?

Interdisciplinary connections. We'd like to a create a passive connection between building performance engineering and architecture in our workflow. We can do more building performance tests earlier in the process of architectural design. So, if a building is exploring wildly different aesthetic options, the design team could be simultaneously testing the building performance effects and that means better performing buildings for occupants and for our planet. D

***Aubrey Tucker** is Stantec's innovative technology developer lead for British Columbia.*

Austin Oaks Development
Austin, Texas

Technology horizon

Four technologies we're looking forward to.

1

Twin Motion is a simplified version of the Unreal game engine, and it's really powerful. It enables us to create high-end real-time graphics with atmospheric effects and bring them into virtual reality. Think immersive video game.

2

Oculus Go is an untethered headset. It's a wireless, more mobile VR headset that we can bring to a client's office.

3

The Matterport is a 3D Camera captures real-world environments in immersive digital 3D.

4

Crane eye is a form of passive reality capture. Every time the crane is moving, it's taking pictures, building a detailed view from above. It's cheaper and easier with less red tape than drone photography.

MAKERSPACES MAKE IT BIG

Makerspaces are coming to the library, university, and workplace near you. What inspires and defines the contemporary makerspace?

PWC Digital Services
Miami, Florida

OLD IDEA, NEW FORM

BY GRETCHEN DIESEL, GWEN MORGAN, ALLIE SCHNEIDER

The term "makerspace" may be new, but the inventor's workshop has been with us for some time. Thomas Edison experimented with the telephone, recording the human voice and other technological breakthroughs at his laboratory and workshops in Menlo Park, New Jersey—an early North American example of a research and development facility. In the 1800s, libraries hosted dedicated spaces for quilting, crafting, sewing. But why has the makerspace trend emerged recently? In 2001, MIT started its FabLab digital fabrication facility with a class called "How to make almost anything." But something special happened in 2005, a perfect storm of conditions which made it possible for makerspaces to flourish. That year, the bible for the do-it-yourself maker *Make Magazine* launched, and Etsy, an online marketplace for handmade goods, kicked off. The economic crash of 2008 gave DIY solutions and belt-tightening a boost. Online platforms for how-to and lifehacks flourished. The dawn of the iPad and information at our fingertips spurred a sea change in education — toward skills and innovation and away from memorization.

Maybe the appeal of makerspaces is our DNA? Mark Hatch, the founder of TechShop and author of *The Maker Movement Manifesto*, argues that making is fundamental to human nature and today the tools are more accessible than ever. Access to tools, he theorizes, lets us engage with actions such as sharing, learning, and participating that bind and support our communities. ›

OUR TEAM (ALLIE SCHNEIDER, GRETCHEN DIESEL, AMY MARTINEZ, JULIE ZITTER, AND MICHELLE JUDY) TRAVELED THE U.S. TOURING AND GATHERING DATA ON ALL KINDS OF MAKERSPACES, INCLUDING IN PROJECTS DESIGNED BY STANTEC. FROM OUR RESEARCH, FOUR CATEGORIES OF SPACES EMERGED AS ESSENTIAL TO TODAY'S MAKERS.

DISCOVERY LABS

Discovery labs engage people and get them comfortable working with making things. They expose people to simple technologies or tools—to see what happens. They are dynamic, energetic, and colorful with ample space for finished project display. They contain simpler tools and materials, like LEGO, yarn, felt, popsicle sticks, paper, scissors, and glue. They can be mobile, for example, held within a wheeled cart.

WHO: Makers of all ages
WHERE: Elementary/middle schools, public museums, and libraries
WHEN: Short-term projects, sometimes just a few hours

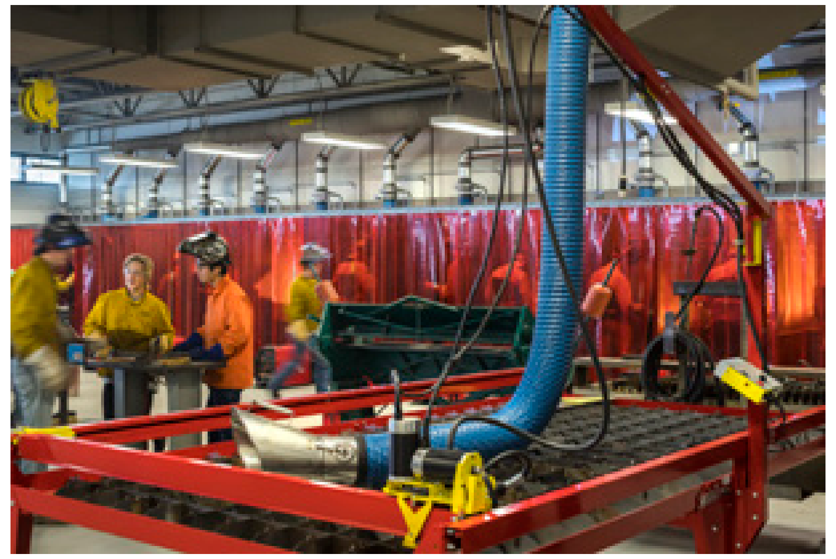
Lab School of Washington
Washington, D.C.

FABRICATION LABS

Fabrication labs support specific curriculum such as mechanical engineering, project-based, or career and technical learning. They're outfitted with robust technology (3D printers, laser cutters, routing, painting, vacuum molding, small-scale robotics), overhead-accessible cord reels for power and extensive storage. They often partner with local industry and require a staff to support the educational program. Posted instructions remind students to reset the space for the next user.

WHO: Students
WHERE: Middle schools, high schools, career and technical schools, universities
WHEN: Semester-long projects

STEAM lab at Plano Academy High School
Plano, Texas



INDUSTRIAL LABS

Industrial labs have bigger, more advanced digitally-controlled tools and are often connected with industry partners who perform product development. They are spaces where industry can cultivate a skilled workforce through mentorship and training. As tech-heavy spaces they use a lot of digital design hardware—clean areas for computers and design, and dirty spaces for printing, fabrication, etc. which requires full-time staff to maintain and monitor. They can also have vigorous user training programs and require protective equipment.

WHO: Product designers
WHERE: Large companies, membership-based hubs
WHEN: Long-term projects, 24-7 access

Genesee Career Institute
Flint, Michigan

CO-WORKING AND INCUBATOR SPACES

Incubator spaces are creative, collaborative spaces where big ideas can be tested and shared. These spaces (like co-working spaces) are not so much about making physical things as the ideation phase of creativity. They facilitate connections between experts or investors to advance an idea and help devise a strategy to bring it to market. Membership supports full-time staff, reception and IT or AV services. Larger incubators can include conference rooms and auditoriums for presentation.

WHO: Start-ups, independent creatives and entrepreneurs
WHERE: Urban centers
WHEN: Membership tends to be monthly/yearly >

WeWork
Washington, D.C.

AN EVOLUTIONARY CYCLE

Makerspaces are not new, but rather have an evolutionary cycle that can be driven by innovation or space design. A new kind of space can initiate the cycle—in education, for instance, new spaces can drive a change in curriculum and projects.

The contemporary workplace is experiencing a cultural shift toward creativity and innovation over the completion of rote tasks. To do so, companies require spaces that inspire and promote collaboration. Likewise, education will continue to emphasize the skills that employers desire in collaborative and project-oriented settings. Workplace needs and expectations shaped in higher education will continue to reshape the makerspaces in the future.

The challenge will be for the workplaces of the future to reflect and engage those educated in these environments. In creating a setting for makers for today's office, we must ask 'What are current and future students going to have exposure to, and therefore demand from, their workplace? What do we need to stay ahead of on that cycle?' >

Who needs a makerspace and why?

EDUCATION
Technology made information on anything suddenly available at the touch of a button, prompting a shift in educational approach away from memorization of facts and figures. Rather, schools are striving teach students how to find the resources they need to collaborate and problem solve, often through project based learning. STEAM environments, career and technical education institutions and universities are revamping themselves with makerspaces that help match students with the skills their future employers are looking for: problem solving, working with teams, creating, evaluating and validating new ideas.

LIBRARIES
Increasingly digital, libraries now need less space for stacks. To engage users in the community and connect them with knowledge, they've made themselves popular sites for community makerspaces and classes in crafting.

RESIDENTIAL
Multi-family dwellings are getting in on the maker action, too. As smaller urban dwellings become popular in multi-family housing, property developers can offer makerspace for assembling furniture or crafting as a shared amenity.

WORKPLACE
In the workplace, makerspaces are emerging as crucial elements in fostering a culture of creativity and innovation to engage that younger generation that looks for personal fulfillment at work. In the war for talent, top firms think investment in makerspace is critical to drive corporate culture toward innovation, creativity and "intrapreneurship" (internal entrepreneurs). Recent graduates are comfortable studying in collaborative environments, and the workplace makerspace has much to offer for continuing this trend, but it must be carefully aligned with company success goals.

HEALTHCARE
Nurses have been hacking their own solutions to suit their technological needs for years. More recently, we're seeing makerspaces added as a custom shop where these hacks can be made, tested and even manufactured.

SEE
MAKERSPACES
IN VIRTUAL
REALITY

PREDICTING THE FUTURE OF MAKERSPACES

Where do we see makerspaces going? To the virtual realm, for sure. We also predict a rise in partnerships between educational institutions and start-ups around makerspaces. As live, work and play blurs in our society, we also wonder how makerspaces will adapt to a society where working at home is increasingly an option. We're also curious to see if maker culture and small-scale production will result in more retail outlets for goods and crafted items from independent producers and designers.

Makerspaces aren't this generation's foosball table, they're an asset that taps into a defining characteristic of our humanity and differentiator for companies and education facilities—and because of that, they're only going to gain prominence in the future. D

Gretchen Diesel creates experiences for clients in the corporate, education and healthcare markets from Stantec's Houston office. Based in Plano, Texas, Stantec interior designer Gwen Morgan is passionate about developing K-12 schools and higher education facilities.Stantec's Allie Schneider works on engaging and collaborative interior environments from the Austin, Texas office.

Robert R. Shaw Center for STEAM
Kady, Texas

Essential aspects of Makerspaces

DISPLAY
Displaying work, sharing projects with others, and getting their feedback can be important in a makerspace.

FLEXIBILITY
Movable furniture is a critical component that supports independent work at various scales and teaming up.

SHARING
Makerspaces allow users access to a variety of tools that they likely don't have themselves (3D printers, laser cutters, CNC routing, specialty equipment, and in the case of co-working, office space) in one place.

MATERIALS
Makers need materials to make, and the space can stock its own free materials, charge users for what they use, or allow users to bring their own supplies.

STORAGE
Storage needs vary with the scale and duration of projects. For example, long-term projects may require a secure space to keep prototype designs.

ASK AN **EXPERT**:

WHY SHOULD DESIGN FIRMS LEVERAGE GAMING ENGINES?

INTERVIEW BY JOHN DUGAN

SARAH DREGER

DISCIPLINE LEADER
DIGITAL PRACTICE (BUILDINGS)

As the global leader of Digital Practice for Stantec Buildings, Sarah ensures Stantec's practioners are working with the latest and greatest in technology turning their experience into wise approaches to technological integration across the Buildings group. Today, we're discussing why her group would borrow tech from the video game world and how they apply it to solve design challenges.

> **“Not only can technology help that process, but the visual simulations help support marketing activities — not only for us but for our clients too.”**
>
> **SARAH DREGER**

JOHN DUGAN: WHAT’S DRIVING US TO LOOK AT NEW TECHNOLOGY IN THE VISUALIZATION REALM?

SARAH DREGER: Globalization, we have design stakeholders from all over the world. So, we ask ourselves how best to enable these conversations, to make sure everybody understands what's going on relative to a project, and then how best to share current status and decisions for those who aren't present. That’s where we see the advantage of taking a technology that was developed for gaming and bringing it into our industry for the benefit of our clients and our design teams.

JD: WHY SHOULD DESIGN FIRMS LEVERAGE GAMING ENGINES?

SD: If you stop and think about it, it really makes sense. If you look at the realistic quality of games or brief rendered animations today, they're photorealistic. It’s amazing. One of the challenges we have as a design firm, is bringing that experience to our clients to help drive critical informed decision-making earlier in the design process. Clients often think they know what they want, but in the complex world of building design, sometimes things get lost in translation between initial concept and opening day. It's up to us, as design professionals, to try and make that a more fluid, seamless process. In the case of gaming technology, it already exists; we don’t need to reinvent the wheel, we just need to apply that powerful technology to a new realm—design.

We're also working with the internal and external teams designing the project. It’s important to get everybody on the same page. It can help a person envision what the layout of the room is going to be, where services are going to be placed, door swings, things like that. Add to this the ability to simulate the lighting conditions throughout the day of the space and it allows them to make quicker, more informed decisions. Not only can technology help that process, but the visual simulations help support marketing activities—not only for us but for our clients too.

But, I think the most compelling aspect of visualization is that it creates a common space where people, regardless of geography or location or expertise, can go into a single virtual location and have a shared experience. Imagine everyone—client, architect, interior designer, engineer—are all looking at exactly the same thing, from the same perspective. It enables intelligent conversation, integrative thinking, and rapid problem-solving.

JD: HOW CAN WE APPLY THIS?

SD: The portable, accessible nature of this gaming technology makes it appealing and powerful. For example, I've used it with a surgical team. Any architect working in the health sector understands how difficult and expensive it is to take a surgical team out of their natural habitat—the operating room. And, they’re surgical specialists, not architects! So, it’s sometimes difficult to get them to understand the space that they're helping design. A two-dimensional drawing or paper mock-up is not going to communicate if the door swing will impede workflow within an active operating room, for example.

We use virtual reality in concert with the gaming engine to create the desired experience. We can take one or two people on-site and set up a virtual space in a manner of minutes, at a location that's convenient for them. Surgeons can come in and experience the whole space—the whole site—in minutes versus hours. They can see what the lighting looks like. They can tell where their equipment is at physical scale and can interact with objects, equipment within that space. Simulating the real-life experience of their future operating room allows them to ›

comment in a meaningful way. That one review of the OR suite saved us a ton of time and energy because we got the first one right, and then simply replicated that design throughout the rest of the department.

JD: **IS THIS EMBLEMATIC OF HOW WE'RE APPROACHING NEW TECHNOLOGY?**

SD: The design industry is historically behind in technological advancement when compared with others. Consequently, we often create our own technology to advance the building design industry and meet the growing needs of the practice, but we always look at other industries such as manufacturing or gaming, for ideas and innovation. That's where we see some of the biggest opportunities. We're not just looking for something new and shiny, we're looking to leverage technology from other industries and all sources to advance and support our practice.

There are so many opportunities for innovation if we just look to the future. Not only will we benefit as an industry, but our clients will benefit as well.

When I look to the future, I see technology as the great equalizer. It's going to narrow the gap between the theoretical and the actual, between design and fabrication, it will change our role and how we engage. To me, that's pretty cool. D

Sarah leads the global Digital Practice team which leverages and develops technology in support of our client, team and project goals.

MASS *TIMBER*

The healing properties of natural materials aren't the only benefit of building with wood.

BY JEFF SANNER

→

Sacramento Downtown Commons Medical Offices
Sacramento, California
Use of natural finishes, such as the real wood veneer shown here, has been shown to benefit healing.

Healthcare designers searching for ways to reinforce a connection between humans and nature should look toward adopting the much-advanced technology of engineered mass timber for use in healthcare environments; specifically, for the construction on the facilities' structural frame, floors, and walls. Visually exposing mass timber elements could lead to better outcomes for patients. >

High Prairie Health Centre
High Prairie, Alberta

Nature's healing effects

Science tells us that humans derive psychological and physiological benefits from our relationship with nature. Following on research by Roger Ulrich on the benefits of a window view in surgery recovery, researchers have looked at natural materials, views of nature and their healing effects. David Robert Fell's 2010 experiments showed that wood interiors have stress-reducing properties.

A post-occupancy study at Bridgepoint Active Healthcare Toronto shows a tangible connection between use of natural materials and health outcomes. Today, creating a connection with nature drives many design decisions. We apply this thinking in all our work, but it is particularly critical in the design of healthcare environments where welcoming more daylight into patient rooms, employing dedicated fresh air systems, providing healing gardens, and depicting scenes of the outdoors have been connected tangibly to better results for patients and staff alike.

Much remains to be studied in terms of the effects of natural materials on humans, but there is strong evidence for a connection between natural materials in interior spaces and the reduction of stress. Employing timber in healthcare design gives us an opportunity to use a natural, sustainable material to promote well-being and healing.

A number of concerns about the use of wood in healthcare design remain, but each can be overcome—and the potential benefits of using this type of wood in healthcare are great. Now it's time for mass timber to take hold in healthcare. >

MORE BRIDGEPOINT'S
POST-OCCUPANCY RESEARCH

Bridgepoint Active Healthcare
Toronto, ON

(Stantec/KPMB/Diamond Schmitt/HDR)

Baptist Health South Florida
Proton Therapy Center
Miami, Florida

What is mass timber?

Sustainable, Renewable, Carbon Sink.

Mass timber is made from sustainable wood, grown in managed forests, typically from widely available softwoods – spruce, pine, and fir. Even Mountain Pine Beetle kill trees have been used for cross-laminated timber. Wood also acts as a carbon sink, storing carbon dioxide. A nine-story CLT building stores 180 tons of carbon while the steel and concrete version would generate 135 tons of carbon dioxide during production.

ENGINEERED
Mass timber is made from small trees and engineered with a smooth surface free of defects.

LAMINATED
Glulam – Glued laminated timber is comprised of layers of dimensioned lumber bonded together with durable, moisture-resistant structural adhesives. It has been used for decades and is sought after for its versatility and curve-handling.

CLT
Cross laminated timber is made by placing layers of parallel beams atop one another perpendicularly, gluing them and pressing them together, resulting in panels that can be half a foot thick. Unlike regular wood, CLT is strong in two directions.

NLT
Nail laminated timber features elements composed of layers of dimensional lumber held together by nails.

LVL
Thin (1/16”) layers of wood are held together by glue resulting in high strength material used for beams and columns.

MODULAR
CLT panels can be pre-cut to designer’s specifications at the factory and assembled on site, thereby reducing construction time and cost. Assembly of a nine-story CLT building is estimated to be 30% faster than the same building with steel and concrete.

STRONG
Mass timber’s strength is comparable to steel and concrete. Pound for pound, glulam is stronger than steel.

INSULATING
Wood is more naturally insulative than steel or concrete, and this goes for mass timber, too.

BEAUTIFUL
Wood is a warm, tactile and beautiful material—natural hewn wood or laminated wood have the ability to connect people back to nature.

The state of the wooden hospital

When one thinks of designing with mass timber (or CLT, cross-laminated timber), fire safety is a primary concern. How will the timber structure remain sound for evacuation, fire-fighting, and remediation? The International Building Code treats mass timber as a combustible material, so the code limits the height and area allowable for timber use in healthcare institutions, while there is more flexibility for use in workplace applications. This offers the opportunity for project types such as medical office buildings and ambulatory/outpatient care facilities to become early adopters of timber construction today.

Innovations in coating materials means, timber members can be treated with a fire-retardant coating. And, equivalency—when a non-standard assembly can match or outperform the code standard—allows designers to use wood and exceed code requirements. This strategy has been realized on the 18-story mass timber framed Brock Commons Student Housing at University of British Columbia. The wood structure of this timber framed building, currently the world's tallest of its kind, is wrapped in fire-rated gypsum. Stantec provided mechanical and electrical engineering and sustainability consulting for the project.

And, if we take a close look at mass timber production technology, mass timber is engineered to have a safety advantage over steel that boosts mass timber's fire rating. When fire hits an additional timber beam layer, it is designed to char, seal and protect the inner layers, whereas steel melts.

Infection control

Within hospital design and material selection, infection control is paramount. To widely adopt wood, the design community must know that exposed mass timber is as good or better than traditional materials for infection control in the hospital environment. Mass timber, unlike sawn lumber, is engineered so that its exposed surfaces are smooth, free from the cracks and knots within raw wood. It can be coated to create a durable surface that holds up to cleansers over time. Potentially, it offers reduced off-gassing versus vinyl or plastic, a healthy side effect.

Sacramento Downtown Commons Medical Offices
Sacramento, California
Real wood veneer adorns the columns and the large faceted feature seen above at Downtown Commons.

Ease of construction

Modular construction is already available for project elements such as headwalls, toilet rooms, equipment installations using mass timber. But because timber is comparatively lighter than steel or concrete but of similar strength, larger scale modularity is on the way. The size of the module will only be limited by the size of what can be shipped to the site in one piece.

The lighter weight of mass timber will affect the state of the building below grade, its footings and foundations. The lighter the building overall, the less material required in the ground which means less to dig, ultimately reducing construction cost and schedule. >

Sacramento Natural Foods Co-op
Sacramento, California

What is biophilic design?

Biophilia theory suggests humans feel better in nature. Our well-being benefits from the visual representations of nature and its processes.

We put biophilia theory into practice for the design for the Sacramento Natural Foods Co-op. We wanted to create a real and authentic experience for long-time co-op members. To achieve this, we connected the design aesthetic with elements of earth and nature, provided places for real patina to occur over time, and dedicated locations for revolving art and creative signage.

BY REBECCA KEEHNER

1 NATURAL MATERIALS
Reclaimed wood tables are from storm-felled city trees. Vertical wooden slats and wood plank ceilings reference agricultural barn buildings.

2 NATURAL SHAPES AND FORMS
Botanical motifs are designed into the perforation patterns of the metal focal feature screens, in the upholstery patterns, and in the large spherical pendant feature lighting.

3 NATURAL PATTERNS AND SENSORY VARIATION
The produce area features flat rough wood boards, corrugated metal, smooth stained concrete, bright copper woven metal mesh and artwork. Varied surfaces in the deli include smooth reflective polished concrete floors, matte wood islands with cool polished quartz surfaces, and contrasting white tile at the perimeter.

4 EXPLORATION AND DISCOVERY
Glimpses into the stairway lead up to the mezzanine dining with indoor and outdoor "hidden" dining. The mezzanine perimeter walkway features a slatted wood screen and occasional full balcony glimpses of the retail store below.

Whichever way one looks at mass timber, as a design element with healing properties or an advanced building material that can reduce project costs and carbon footprint, meeting our society's social and environmental responsibility to future generations. I believe it's clear that there is a bright future for wood in the buildings where our community heals. D

Based in Stantec's Chicago office, Jeff Sanner is passionate about innovative approaches to building design. Based in Stantec Sacramento, designer ***Rebecca Keehner*** *focuses on commercial interiors.*

Santa Clara Valley Medical Center Pavillion
Santa Clara, California

CITY LIGHTS

Data visualization helps cities choose path to revitalization.

BY GREG HALL

Particle crowd simulation animation showing tagged area attractors for the simulation. The size of the label illustrates the strength of the attractor at a specific time of day.

Photorealism isn't the goal here, communication is.

SEEING A CITY'S ARCHITECTURE IS ONE THING, its infrastructure is another, and its people are another. And then there's seeing its data—such as how many people go where and do what in which buildings at any point from sun up to midnight. The latter can be illuminating.

When the Mayor of Pittsburgh and the city's Downtown Retail Task Force wanted to know where to focus their efforts on revitalization of retail and pedestrian-friendly areas such as the Smithfield and Forbes corridor, they first need to understand the utilization, and lack thereof, of the downtown district. Leveraging data from the city's detailed utilization studies, we created a virtual 3D model of Pittsburgh's golden triangle. The city hoped to take this data and look at op-portunities for developing the area in a manner that would activate it to unlock its potential.

The use of 3D digital visualization and animation technologies presented the information to a broad audience, from the client through the engineers, in an easily understood medium. These data visualization tools create a common ground, enabling participants from various back-grounds and knowledge sets to contribute value to the wide array of potential solutions using a data-driven decision-making process.

Two dimensional forms of repre-sentation tend to generate gaps in information and understanding when you consider the multi-dimensional nature of the challenge at a city or district scale. In plan, the utilization information is only identified on a two-dimensional plane, at a single moment of time. ›

For the Pittsburgh revitalization project, we pumped all the city's data into a 3D model, which we programmed to illustrate utilization over time on a typical day. As the information changes over time, the data drives animation within the 3D model in forms of color, motion, etc. How many people are going where? Which storefronts are vacant? Which are active? What's the traffic count through the area?

Photorealism isn't the goal here, communication is. Why is this visualization so effective as a tool? In our meeting, stakeholders and consultants from diverse backgrounds—politicians, community members, developers, architects, designers, transportation experts—all scrubbed through the model, hour by hour, to experience how the city changed on a typical day.

It was live, and powerful. And the shared experience immediately jumpstarted the conversation about the key issues and concerns of the participants. No time was wasted in discovering the right path to revitalization. D

Architect Greg Hall serves as discipline leader in Stantec's Pittsburgh, PA office, focusing on the buildings practice and projects within the commercial/industrial studio.

MORE
URBAN PLACES

Visualizing a walkable city. The particle crowd simulation animation shows areas in 5 minutes walking radius. The graphic illustrates the proximity of three major downtown towers and the amenities between.

TECH, IN PRACTICE

Parametric design, virtual reality and an integrated 3D process are revolutionizing the way buildings are made. We spoke with four practitioners about their approach to this new technology, how it enhances the design process, and ultimately results in better buildings.

It is all data driven. When you are working in programs such as Grasshopper or Dynamo, you plug in your numbers, adjust your sliders, and watch your model take shape. You can increase and decrease window sizes and counts. You can utilize it to generate multiple fenestration patterns—refining the amount of light you let into a space. You're playing with numbers, but the advantage is you can see the changes happen quicker and in real time. It all comes down to designing a script for the application. You have to invest time to build these scripts, they don't happen overnight. But, once you have the base script, you can create multiple iterations faster than building a new model each time.

With my team's recent Northern Lights competition entry, I could control the length, height, shape, and rotation of buildings, adjust the number of perforations in the building, and the position at which one volume of space intersects with another building. And I could develop multiple schemes before choosing to refine the final scheme. With Grasshopper, I can see all the design possibilities in real time, evolving the design solution faster and cleaner than in a traditional 2D design approach.

I get excited working in this data-informed manner, but what also interests me is how I can start applying this technology to the reality of architecture, automating the simple tasks that are usually time consuming—driving efficiency into my craft. This is where we can really start to excel in our profession. These programs can give us more time to focus design effort on solving really critical client design challenges. I like the idea of using these tools more creatively at the onset of a project as well. Whereas architects once used sketching and physical modeling to generate ideas, we now rely on the digital realm. But we can still explore that creative freedom of sketching and physical modeling with programs like Rhino, SketchUp, Maya, and 3D Studio Max. I'm a firm believer in using every tool in our arsenal to help us create the best design solutions for our clients.

While it didn't start with my last project, The Lucas Museum of Narrative Art, my interest in organic architecture was strengthened by having the opportunity to work on it. I've always loved being outside. Outside has a freedom to it, you don't feel locked in or closed off. By shaping buildings more organically, like we did with the Lucas Museum project, you can start to read a building as more inviting—a more natural environment. For example, perforations bring in light, like a tree canopy, to create a soft ambience to the interior, while double-curved walls echo the shape of a canyon. This type of approach to design makes people more aware of their physical surroundings, and enriches their experience of place.

Design technology applications have created more opportunity to be inspired by nature and its natural forms and spaces, they open the door to application of complex geometries, patterns, and a better understanding how they will interact with the sun, artificial light, rain, and wind.

DANIEL MASSARO

ARCHITECTURAL DESIGNER | CHICAGO, IL

Architectural Designer Daniel Massaro works on projects in the Civic, Hospitality, and Sports and Entertainment markets from Stantec's Chicago studio.

By shaping buildings more organically, like we did with the Lucas Museum project, you can start to read a building as more inviting—a more natural environment.

In a traditional design process, the engineers typically enter the design discussions during the schematic design phase, when the conceptual decisions such as the massing, program, location of MEP (mechanical, electrical and plumbing) areas, façade elements have been made by the architect. As engineers, we are charged with figuring out how much cooling, heating, power, water will be required to operate the building. I call that a 2D process. It's very simple.

TRENDING INNOVATIVE PLATFORMS

RHINOCEROS (RHINO)

3d graphics and design application which provides mathematically precise representation of curves and freeform shapes.

GRASSHOPPER 3D

a visual programming language that runs with Rhino which allows users to drag components on a canvas and create an algorithm that generates a design.

ENSCAPE

an architectural rendering plug-in that produces virtual reality and fly-through animations.

REVIT

autodesk's bim (building information modeling) software for architectural design, mechanical, electrical, plumbing and structural engineering, as well as construction.

But things are changing rapidly. Today, I'm collaborating with the architects that are using parametric analysis and rapid iteration processes to discover a multitude of design solutions. We are quickly moving towards 3D environment where the architects are creating their initial design concepts, and testing concepts in 3D, simultaneously the engineers can communicate how these concepts will affect the building's operations, how much heating and the cooling will be required. With AI (artificial intelligence) coming into play, this process will include a programmatic analysis that can show designers options for placement of patient rooms, a courtyard, a lobby, or core services. We can link these decisions to architectural building efficiencies or building processes, but also to energy performance, comfort, equipment capacities, shaft sizes, and so on.

Now rather than arriving at a meeting with a spreadsheet, our engineers are using tools that graphically represent engineering solutions, that reflect performance by color. Visually simple and easy to understand.

Previously, engineers were not advising the architect on those decisions early enough in the design process. In this emerging process, the designers have the benefit of continuous feedback from the engineers before they commit to a design approach or concept, and they can have confidence that the best engineering solution is reflected. We don't have to reverse engineer building systems into an untested design concept. From my perspective, it's about bringing our disciplines toward the 3D environment. It's about the ability to speak the same language. Where once we were working in silos, now we're achieving true integration. And, the project and clients greatly benefit from this integrative thinking.

Previously, it was a given that the plant room would be in the farthest and most obscure place within the building. Now they can see the benefit of a more sensible location. For instance, if we break out of the traditional plant room approach and can instead serve utilities from top and bottom, the building core can be reduced, and overall building efficiency benefits. That means more useable space for the client.

Now, say we're designing a high rise building that would rely on renewables such as wind turbines. Through analysis, together we can find right solution so the tower is optimized to capture energy but that presents itself as a beautiful design, showcasing engineering innovation within the architectural language.

I believe when art and science work together to create an integrated and informed approach to building design, the result will always be a better solution—for our clients and will promote a healthy and sustainable future for us all.

SERGIO SÁDABA

ENGINEER | SEATTLE, WA

Based in Seattle, Sergio Sádaba leads Stantec's Buildings Performance Group

The design industry has pretty much moved toward designing and modeling all projects in Revit. It is just standard fare now. Recently, we've augmented our design process with the addition of Enscape and VR software. By doing so, we're able to bring those drawings to life in new ways. And, we've seen a huge benefit from the end user perspective.

For years, we've shown plans and elevations to communicate design intent. There's a lot of back and forth with the client and users. It's difficult to get the client to understand what they're looking at, and to sign off on a two-dimensional concept. It's a language that they aren't fluent n. VR has changed all that. Use of VR has made it easier for us to demonstrate design intent. In VR, users can look around and experience the space before they're committed to it. It provides users a new sense of confidence in what they're approving, and the ability to communicate changes earlier in the process—when things cost less money to change. In turn, it frees up more time for the design team to focus design effort on creating beautiful and functionally efficient design spaces.

For University of California at San Francisco (UCSF) Precision Cancer Medicine Building, we set up VR at the client site so that they could easily come and see the project develop—week after week. The client team would stop by and experience the project in 3D, and by doing so, they were able to notice things in VR that they didn't see in 2D drawings—a column that was an obstruction or a computer too far away from where patient consultations would take place. When the client was immersed in the 3D model, they noticed those issues right away. At UCSF, we also showed the client how they could use VR to simulate the patient arrival on day one, so they could better prepare and train staff in the space before it opened—so our design model is helping the client not only achieve a smoother design process, but our model value extends into the building operation from a clinical perspective. It's that kind of transformational impact, that gets me excited to go work.

JESSICA O'REGAN

DESIGNER | PHILADELPHIA, PA

Based in Philadelphia, Jessica is a designer focusing on healthcare planning and interiors.

UCSF Precision Cancer Medicine Building
San Francisco, California

UCSF Precision Cancer Medicine Building
San Francisco, California

The primary tool that I run, dRofus, leverages data for BIM purposes and to manage and maintain project information. The data can be leveraged in Revit to help us graphically, in particular by generating color-coded floor plans to provide detailed information, for all rooms that need slab depressions or require daylight. We used dRofus on complex healthcare projects, and often in alternative project delivery, where we are designing as they are trying to build.

dRofus ensures that project information is controlled, centralized, and sometimes visualized. It tracks changes, standardizes data, runs reports, links to Revit, aids in compliance and project management.

Either we're given criteria we have to meet, or we're given someone else's designs and we have to achieve a completed project within a set of programming rules. With this technology, the designer benefits. When working in Revit, a designer can see that 'Oh this room requires a sink, and this one doesn't' and things like that without having to flip through a binder full of documents to see if they're being compliant.

dRofus can also be used for building programming. You can create the functional program for the building within the tool and generate reports for room data sheets and project criteria. This technology allows us to have controlled information coming from a central place that can act as the source of truth for the whole project team. In the case of Calgary Cancer Centre, Stantec has people in four provinces and people in the UK working on the project.

There are models designers, engineers, and consultants are working in, and they need consistent information from a controlled source. With this software, the team is accessing the most up-to-date information from the same source which leaves less room for inconsistencies between models and between documents generated by different team members.

You can use it for validating items from the program, services, equipment and furnishings in Revit, comparing required items to design items. In projects that tend to be equipment-heavy such as healthcare, this is important. Now that everything is moving to the cloud, it's crucial that everyone is looking at the same information. D

TAMMY ADOLF

INTEGRATED DESIGN DATA MANAGER
VANCOUVER, BC

Stantec Digital Practice team member Tammy Adolf focuses on BIM data management, standards and document control.

FINAL THOUGHT:

Exploring design frontiers

Architects and designers can harness powerful new tools, but only with the right mindset.

BY MICHAEL SIEGEL

Lucas Museum of Narrative Art
Los Angeles, California
(MAD + Stantec)

“...our team comes into the office and we have an entirely new set of challenges to solve. But, between the experienced generation that’s seen it all, and the youngsters that embrace digital tools, we’re excited to take any challenge on.”

Lucas Museum of Narrative Art
Los Angeles, California
(MAD + Stantec)

In a studio far, far away, there's a group of kids developing a workflow for the architecture of the future. They're going to steal your next job opportunity.

That might sound a bit brash, or strike panic in hearts of designers, but there’s a lot of truth to it. Designers have an array of powerful digital tools at their disposal today, and those that can harness them in the smartest, most efficient way in service of the best design outcome will own the day.

Our first introduction to the vision for The Lucas Museum of Narrative Art (LMNA) was a stunning presentation of the “liminal” vision for a museum that challenged what architecture could be. Developing the strategy for how to deliver the project has been a four-year journey which has completely changed the way we practice architecture. From this experience, I’ve seen how powerful new approaches to design that maximize technology can be. What I’ve learned from our digital design practice on this project points toward the future of design.

There are many fears and anxieties that exist around this technology, but much of what I have experienced counterbalances those worries. Today, I find it worthwhile to dispel some of the myths about this digital design, to share what it isn’t and what it is. ›

Myth: Technology is driving change.
Reality: Projects drive change.

In this new design methodology, we leverage and push technology in extreme ways, that's at the forefront of what we do every day. But we're not doing this just because we love technology and exploring its potential or having access to some cool tech tools.

No, design technology comes into play because we have a challenging project, a limited budget, with a design team dispersed around the globe. We have really difficult work to complete. It can't be done by traditional means.

It just isn't practical to look at a drawing on a piece of paper in Los Angeles and have a conversation with colleague in New York, and a consultant in Germany at the same time. The global team drove us to make LMNA a paperless, cloud-based project. We share a paperless drawing set as a book online, live. LMNA is a giant job with a complex geometry, bringing together the best and the brightest engineers from around the globe, so we need to push that software interoperability, and parametric modeling quickly. We're embracing this technology to get the job done. It's a matter of survival.

Myth: Computational design will take away creative power from designers.
Reality: Computational and parametric design allow us to iterate, refine, and ultimately design better. But that's not all.

This technology won't create a design for you. Rather, it allows designers to control, enhance, and fine-tune the design. First, we must take control of the math, the data that governs the design. It allows you to change the value in different parameters and say, "Okay, if it's sloped this much, not that much, what would it look like?" And "If it had two steps in it instead of three steps, what would it look like?" >

Lucas Museum of Narrative Art
Los Angeles, California
(MAD + Stantec)

Lucas Museum of Narrative Art
Los Angeles, California
(MAD + Stantec)

We're using parametric design in applications when we've designed something and want to refine it. We put the VR goggles on and look at it together, then change the proportions and the dimensions just a little bit, and say, "Ah! That's the most beautiful one."

Parametric design requires more upfront time, because you must build the script, but once that's done, creating versions of the design is as easy as toggling a number in the parametric model. You can tweak it. You can change it. You can make it more beautiful, more code-compliant, more constructible—whatever you need to do. The design technology really enables us to perform a more thorough, more informed, more in-control design analysis.

Myth: This technology is new.
Reality: The technology isn't always new, but pushing it and finding ways for different programs to work together often is.

Some of these tools and applications have been around for five, or even ten years. But now we're pushing the use of all of them and linking them, using one program for modeling complex shapes, and another for playing with the complex geometry as a script. Then once we have it the way we like it, it goes into Revit, the industry-standard documentation tool.

Myth: Digital technology does the heavy lifting in design.
Reality: To fully explore it, DIY customization is a must.

It's a mindset. For example, one mindset might say "We can't design like that, because the applications can't handle those shapes." Our mindset says,
"Well, we'll design it in a different software or design a process to make it possible." With a positive mindset, if we need something customized, we make it ourselves.

You teach yourself. Don't wait for permission. If you see a workflow that can help you—say a piece of automation that a structural engineer uses—figure out how to apply that in your work! Innovative thinking can save us weeks in design time. It's an empowering mindset. >

Myth: Digital design is done by individuals.
Reality: Digital design requires teams, and lots of mentorship.

My experience is that no one team member has the answer. It is our shared intellect that will push us toward meeting our goal. For LMNA, our team mentors top-down and bottom-up, because we realized quickly that young professionals coming out of school have the skill-sets and knowledge to run these powerful digital technology tools. But those young designers lack the practical experience in the strategies required to get a large building built. The result is that the whole LMNA team became much more tightly connected than it was five years ago, which is exciting for everyone involved, and is benefitting the project.

Embracing change

If you're willing to embrace these tools, and work this way, the scope of what the architect does is limitless. We can connect to and collaborate with the construction team more holistically. And we create stronger bonds with the vendors that supply the project. It's exciting to me, for example, that our exact design model is used to fabricate parts for building the museum—the same digital data you see in a virtual reality flythrough.

Not easy

Most days of the week, our team comes into the office and we have an entirely new set of challenges to solve. But, between the experienced generation that's seen it all, and the youngsters that embrace digital tools, we're excited to take them on.

As a dad, I've watched my own kids grow up. They would get a new video game, and go down in the basement and they'd plug it in—throwing the box in the garbage. No need for instructions. Their attitude was: "We'll figure it out."

That's analogous to how architects must operate in a technology enhanced future. Don't be afraid. Go figure it out. Solve real problems and deliver amazing results. Clearly, this is where design is going. If you want to be competitive and deliver great design, this is the future.

It might seem a bit overwhelming at first, but it becomes rewarding when you start winning the game— when you can publish a whole construction document set from a model built in the cloud. And, when we can put VR goggles on, and walk our client through their project virtually, years before a shovel ever hits dirt.

It's worth the effort. D

Architect Mike Siegel leads Stantec's Lucas Museum of Narrative Arts team in Los Angeles, CA.

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