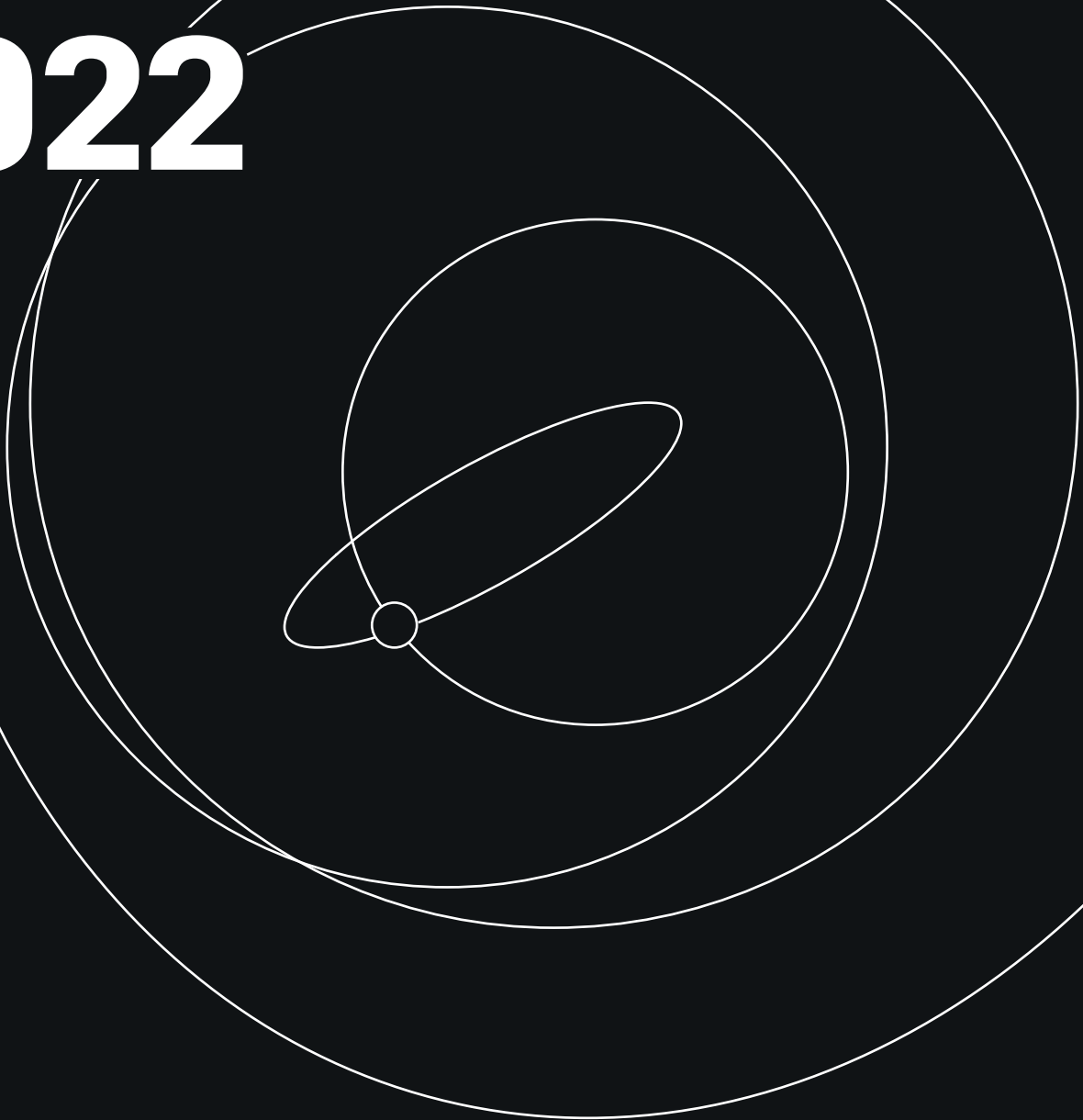


# Collision Anthology 2022



# Contents

Introduction	3
Outsight meets foresight	4
Collision ✦ 1 <b>Growing Pasifika</b>	6
The view through the strategic foresight lens	14
Collision ✦ 2 <b>Betting on Yourself</b>	16
Fast forward	26
Collision ✦ 3 <b>From the Shop Floor to the Top Floor</b>	28
Conclusion	36
Meet the team	38
Join the Outsight Network	40

# Introduction

What might the world look like in 10 to 20 years' time?  
Which sci-fi fantasies will turn out to be prophecies?  
For example: how might the emergence of genetically engineered coral, data unions, and augmented reality headsets redefine how we design the world around us?

Welcome to Autodesk Research Collision Anthology 2022, which merges present day open innovation projects with strategic foresight to bring you sci-fi inspired visions of three very possible futures.

Understanding how new, diverse technologies may impact our changing society helps us imagine a *possible future*. Armed with these possibilities, we can chart a path toward our *preferred future*.

This is the purpose of Autodesk Research collision stories. Residents of our innovation community, known as the Outsight Network, work on all kinds of future-focused projects, from architectural ecology to training robots.

We scanned the network for "weak signals of change"—the least certain but potentially most impactful of these projects—and collided them together. Add a surge of imagination and you've got a collision story.

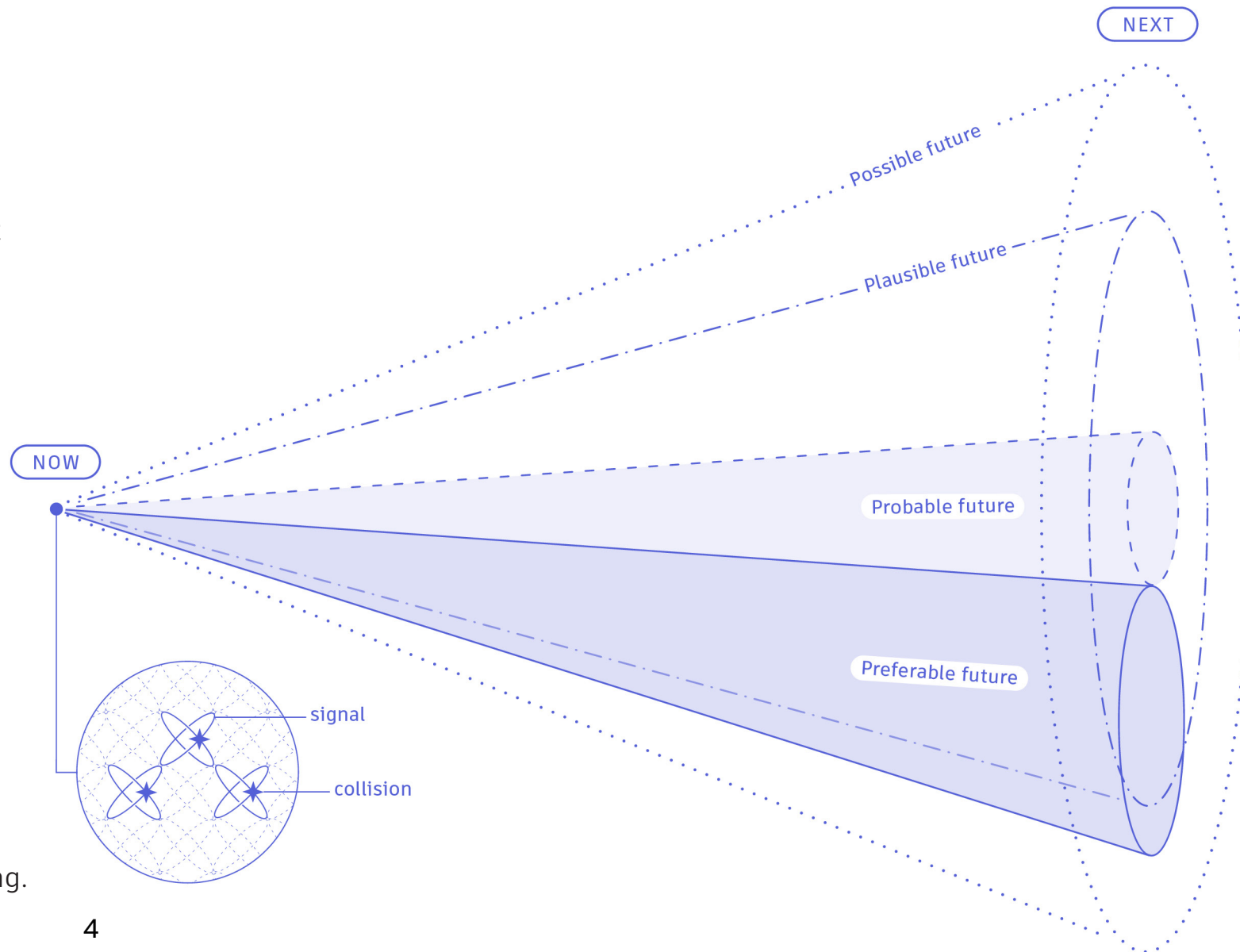
The imagined worlds you are about to visit are much more than fiction. They are speculative realities that could be realized within a decade or two.

# OUTSIGHT MEETS FORESIGHT

## Outsight Network residents

The Autodesk Research Outsight Network is a global innovation community, connected to the Autodesk Technology Centers, bringing together a network of innovation leaders from start-ups to customers, academia, industry teams, and groups within Autodesk.

The majority of residents work in technology, but their focus extends to environmental, economic, social, and political ideas. All residents are united in their passion for accelerating progress in designing and making.



## Strategic foresight

Strategic foresight is the practice of thinking about the future to navigate uncertainty and more proactively capitalize on change. It's not about prediction—think of it as a process for challenging your current assumptions about the future and replacing them with a new set of considerations.

To simulate our potential future, we scan the present for ideas that are outliers now but might indicate future trends. We call them "weak signals". These ideas can reveal something about our present and give us insight into our potential futures.

Our lens is this "futures cone", which contains all the possible destinations from the starting point of now. Seeing what's possible allows us to chart a course that bends our trajectory from probable outcomes to preferable ones. In other words, to build our preferred futures.

## Collision

The Outsight Network is glittering with weak signals of change. For each story, we picked two sparks from this constellation of ideas and collided them, generating something not yet imagined. We fed these collisions through a rigorous process of research and driver analysis to see where it could take us in the next two decades. And more importantly, where we want to go.



A collision story inspired by two Autodesk Research Oversight Network residents:

## CCA Buoyant Ecologies



## Fologram

### CCA Buoyant Ecologies [➤](#)

*environmental  
resident 2018–present*

The Architectural Ecologies Lab is a research group within the Architecture Division at California College of the Arts in San Francisco. The lab works to overcome ecological challenges, merging spatial practice with innovative techniques of material production and rigorous research. They're committed to using experimental fabrication processes, full-scale prototyping, and proof-of-concept tests that extend design ideas into the real world.

### Fologram [➤](#)

*technological  
resident 2020–present*

Fologram is expanding what is possible in design and construction through the use of mixed reality, namely using holographic instruction sets to construct complex objects. Their technology can be used to build interactive mixed reality experiences with design software that artists, architects, engineers, and many other 3D content creators already use everyday.

Collision [✦](#) 1 by Ellen Hlozan

# GROWING PASIFIKA

The sun is just cresting over the horizon as I set out in the [proa-totype](#)(\*1), a traditional Micronesian outrigger modified for today's work. As I sail towards the atoll where my apprentice, or [itang](#)(\*2), lives, I check on the [CRISPR polyps](#)(\*3) that live in the coral skeleton of the vessel.

#### \*1 proa-totype

A 'proa' is a Pacific sailboat with two parallel hulls. In the story, this term was incorporated into the vessel the characters sail in.

#### \*2 itang

People who trained under an older expert in traditional history, oratory, war strategy and tactics, and magic.

#### \*3 CRISPR polyps

CRISPR is a powerful tool for editing genomes, allowing researchers to easily alter DNA sequences and modify gene function. It was adapted from a naturally occurring genome editing system in bacteria. In our story, the genomes of the polyp creatures that live inside the coral have been edited.

#### \*4 king tide

An exceptionally high tide, occurring seven days a month, during which historic sites are under water. Most land at Lelu is artificial fill and experiences regular flooding, exacerbated by rising sea levels.

They're monitoring the conditions around them nicely. I can tell by their colors. I hope the data they are transmitting back to the Island Information Model (IIM) shows that conditions are right for the mangrove breakers we re-planted yesterday. Another [king tide](#)(\*4) might drown them.

My headset picks out my itang Isa on the shore and highlights her with a beautiful aura. She's just the right age to begin learning from an elder. As her atoll moves to meet the proa-totype, I can see her munching on some seaweed from her grandmother's sunken gardens. She's so lucky her matriarchal line held onto their [traditional land rights](#)(\*5) and adapted to the rising seas by sinking their gardens into the lagoon.

After Isa boards we set off for Lelu City 2.0, Micronesia's 77th grow site. [Lelu's](#)(\*6) expansion is breathtaking. Before we start our work for the day, Isa unfurls the electro-

kinetic membrane strands that will capture wave energy and use mineral accretion technology to stimulate the corals on our vessel to keep growing. The strands remind me so much of the tentacles on a jellyfish.

In addition to being my apprentice, Isa is a coral polyp genetic engineer, following in her mother's footsteps. Isa's mother first engineered a polyp that could also act as a sensor, communicating between the growing reefs and the IIM. Her family remains the guardian of a unique species of polyps that have been cultivated for generations, very much like a sourdough or kombucha mother. As Isa learns how to grow land with me, she also studies, samples, and trades corals with neighboring islands.

As we check in on the land we've been slowly growstructing, we can see that the initial corals for the breakwall are starting to attract more fish and other fauna, though this land won't be livable for many years to come. My headset overlays a hologram of where Lelu might need our attention. Headset holograms show what's needed to someone of any skill set. So anyone who sails by can make adjustments to keep the island growing.

Isa puts out a swarm call on her headset so other experts in training across [Pasifika](#)(\*7) can observe, learn, and

#### \*5 traditional land rights

Because Micronesian land is scarce, various mechanisms were developed to govern its distribution. In most areas, matrilineal inheritance of land rights was the norm.

#### \*6 Lelu

The ancient capital of the Pacific Ocean, Lelu developed in the six centuries preceding European contact (AD 1250–1850). Enormous amounts of coral were used to construct Lelu, including paving roads, building a seawall, and as landfill to reclaim land.

#### \*7 Pasifika

The people and cultures of the South Pacific islands, whose land is under threat from rising sea levels.

crowdsource repair ideas with her. These sessions are also archived in the Island Information Model knowledge bank for others to reference in the future.

Once the coral structure has matured, we'll be able to start dropping some mangrove seed breakers into the newly created lagoon. As the mangrove trees mature, they'll slowly grow the island outward, maintaining and expanding the coastline of this island with their roots.

When we started it would take 20 minutes to walk across Lelu City. Now it takes 40 minutes or longer on foot. I've been working as a growstruction specialist for almost two decades now, ever since the global referendum that launched us into a post-carbon world. Trade routes expanded to pass through Micronesian territory as we moved away from fossil fuels and towards the twisting, indirect routes of wind-powered seafaring.

This influx of land-based wealth brought the opportunity to form indigenous(\*8) trade unions to manage and protect the islands, atolls, and biodiversity of Micronesia. My holographic headset has been passively documenting our learnings and processes

for growing and maintaining our islands for years now; it learns as I learn.

This body of knowledge is transmitted back to the IIM HQ in real-time. Then feedback loops directly to my headset on where the corals, mangroves, and other growth structures need maintenance based on our CRISPR polyps sensing. From here, I can set out directly to neighboring grow sites in the proa-totype. It's essentially a floating construction site—in land-based terms.

Now that I have become an elder, I have the chance to pass along practices to my itang. Isa is both learning and helping to codify our practices so we can share them with the rest of the United Pasifika Nations at RootingPasifika 2045.

As I'm lost in reflection, Isa gets a loud ping on her headset. A RootingPasifika conference attendee on a nearby island, just adopting growstruction practices, has asked her for an urgent polyp transplant. We tack the proa-totype to the west to sail toward their slowly expanding coastline. ✨

#### \*8 indigenous

370 million indigenous peoples make up less than 5% of the total human population. But they manage over 25% of the world's land surface and 80% of the global biodiversity.

## Story decrypter | Insights from the author

You've just travelled to 2045: a post-carbon world adapting to rising sea levels in the Pacific islands. The differences between this future and now are environmental, social, and technological.

In this future, the shape of work has shifted dramatically: from mobile construction sites to digital twins and hologram technology. But more than this, there has been a shift in mindset **from building to cultivating**.

This world is more climate aware, making Indigenous Pacific Islanders the custodians of valuable land along sea trading routes. Advances in data collection, storage, and computing power allow us to use a constant stream of high-quality data to build intelligence about the island.

The **mass convergence of industries** also has a significant role to play here. As architecture, construction, and agriculture merge, we no longer differentiate between growing and constructing.

The ancient city of Lelu was originally built from coral in the 13th–19th centuries. But with mineral accretion technology, which stimulates growth using a small electrical current, coral can now grow 3 to 4 times faster.

The living coral polyps that build reefs have been genetically engineered as an optimized building material. "Growstructing" takes a more traditional approach of cultivation and applies it to building sites. It makes for a more sustainable industry and reduces the need to transport materials.

Of course, **data is ubiquitous**. To the point where the concept of "remote sensing" tech in landscape is used to manage everything. Environmental sensors are constantly sending data that live updates the Island Information

Model, a digital twin of the island that evolves as the real-world version grows.

Videos from our protagonists' headsets are also used as data. Training is crucial for both artificial intelligence and people. This scenario blends the two, with video footage being shared among peers, and with the digital twin of the island.

Teamwork is more flexible, open, and data-driven. Maintenance is seen as a creative challenge and crowdsourcing enhances imagination. Human creativity isn't outsourced to robots, but assisted by a rich history of data and real-time feedback.

This is a future of **spatial computing and cloud knowledge**, where we rely on having information overlaid onto our

realities. We'll understand the world through embedded interfaces, and knowledge will be retained in new ways. Interestingly, these connections have particular resonance for non-Western cultures, such as that of Micronesia, where people look back in order to look forward.

**Ellen Hlozan**  
Community Manager

# The view through the strategic foresight lens

by Radha Mistry

The aim of adopting Strategic Foresight practice is to anticipate and prepare for **many possible futures**, in order to diminish blind spots and make sure strategy and perspective will still be tenable. But how do we collectively bridge the gap between where we are today, and where we think we're headed tomorrow? How might we as a society ensure that future-focused efforts are taking us in the right direction? Enter science fiction.

At a broader level, science fiction can be used as a tool for gaining strategic foresight through scenario building. This is where it becomes relevant for organizations grappling with a level of disruption in their industry.

Creating this anthology was an exercise in deliberately bridging the space of uncertainty between multiple future horizons and the singular horizon of the present. Strategic foresight practices filter all possible futures down into those that not only seem plausible, but that might actively be **pursued as preferable**.

Taking a moment to think about it, the notion of finding value in stories isn't new. Our histories, creeds, and technologies are very much embedded in fantasy and fable. Storytelling has allowed generations to intentionally curate a different version of our surrounding context—a point of reference which we're not typically

afforded in real-time and at the human scale.

Using science fiction, specifically, as a mechanism to quiet the turbulence around us can provide clarity in our perception. The world is full of weak signals and fragmented indicators. By reducing the noise and amplifying interesting weak signals, we can create a new lens on reality and begin to **reveal critical insights** into the shaping of our futures. Everyone can begin to be proactive about their future rather than merely reacting and succumbing to circumstances.

Science fiction universes are full of rich and expansive landscapes. They offer new terrains to explore, innovate within, and learn from in our futures. New virtual spaces of interaction, new entities to collaborate with, new design and production languages to unearth, new infrastructures, new histories, new technologies. Each new thing however, can only offer a partial glimpse into a potential future.

In these small acts of future-making (imagining) who else comes into view? What kind of collective future emerges through the incarnation of millions of new things? It's impossible to know for certain, futurists often use fictional scenarios to unpack and **prototype the potential impact of what is changing** and what is not. The stories in this anthology are therefore less a prediction of what's to come and more a **provocation on what might be**. It's a peek at emerging realities with the potential to shape the new possible for everyone.

**Radha Mistry**

*Former Foresight Practice Lead, Autodesk Research*







A collision story inspired by two Autodesk Research Oversight Network residents:

## City Scanner



CREO

### MIT Senseable City Lab [↗](#)

*technological, political  
resident 2021–2022*

City Scanner is a project at MIT Senseable City Laboratory aiming to democratize environmental data by delivering insights at the hyperlocal level. The City Scanner platform is centered on whiteburn, a sensing node that can magnetically attach to any vehicle. It collects and streams real-time data that can be analyzed by MIT's algorithms to detect pollution hotspots and trends.

### CREO | BIOBULB [↗](#)

*environmental, technological  
resident 2018–2022*

CREO BIOBULB is a high performance engineered ecological system. It comprises advanced biotechnologies, environmental intelligence, and Artificial Intelligence that can effectively remove toxins from the air while creating a microenvironment. BIOBULB technology components include the intersection of engineering, eco-tech, mechatronics, material sciences, and the built environment.

Collision [★](#) 2 by Madebo Fatunde

# BETTING ON YOURSELF

Renilda looked to the ceiling and bit back a curse. Nothing in this new apartment made any sense. This was the second time she'd stubbed her left pinkie in as many days, and she was nearly certain that this time it had broken. Though she'd been working all day, she wasn't at all satisfied with her progress.

She flopped onto the couch she'd been moving and gingerly tested the toe that was now furiously radiating pain up through her left foot. She closed her eyes against the pain and sprawled out, beginning a mental countdown which was soon interrupted by a buzzing against her thigh. She pulled the glasses from her pocket and blinked into the call. She was confronted with a smoothly animated avatar of a nurse.

"Mrs. Ng! [We noticed a sudden spike—](#)"(\*1)

"Yeah, I stubbed my toe is all. Nothing serious."

"Well, we're pleased to hear that. Would you like us to activate your drone for an evaluation?"

"That won't be necessary. I'm fine, really. Bye now."

"Okay. Well, if you—"

\*1

In this future world, real-time sensors are a key tool used in healthcare.

Renilda ended the call. She lay back down and glanced up into the display corner for her time readout. It was quarter past noon. A message flashed across the screen: "Don't forget your VaultMinder appointment! I'm grinding against a deadline, but I'll try to make it. Love you. -S"

Sereeta would be catching her second wind for a long night of work on this interminable Singapore project. A wave of annoyance at her daughter crested, then broke inside Renilda, leaving an undertow of longing. Somehow her offhand comments to this brilliant, dense child about needing some help around the house had resulted in a move to Virginia. More specifically, to this [state-of-the-art retirement home](#)(\*2) with its fleet of nanny drones and innumerable connected, sensorized surfaces and appliances.

She gestured her calendar open and punched into the call, figuring that she might as well cross the item off her list. Her new living room faded away and was replaced with a gunmetal grey room disturbed only by a black desk, its occupant, and—behind her, she knew—the faint suggestion of a doorway.

"Good afternoon, Mrs. Ng. Welcome back to your personal data vault. My name is [Maxton](#)(\*3) and, as I am sure

\*2

This high-end retirement community offers its residences cutting-edge therapies as well as the chance to earn money from devices that collect their data.

\*3

Maxton is a consultant from Renilda's data union, who helps manage her portfolio of personal data products.

Sereeta has informed you, I'll be working with you today to go through your [data union](#)(\*4) portfolio, make any needed tweaks to your VaultMinder contract, and to consider some of the recent bids that have come in since last quarter.

"Before we begin, I'd like to assure you that I have been over all this information with Sereeta earlier this week, and, though she cannot make today's call, she has approved the changes I've recommended which you can verify at any time on your multi-sig vault."

"Mm-hmm. She did mention."

"Do you have any questions for me?"

"No. Let's get on with it."

"Alright. Well I'm happy to report your portfolio yielded a 15% greater return over last quarter, with much of that coming from a critical policy insight drawn from [data you donated](#)(\*5) to the local data lab."

"Well, isn't that something."

"...Additionally, your move to the Loial Grove retirement community and, more importantly, its sensor network,

has opened several new potential revenue streams. It's truly a state-of-the-art facility, and it has one of the most robust health bundles I've seen."

"Everyone keeps telling me how these robo-nannies are going to make me a pile of money. I have one question: will that pile come before or after they bug me to death? Oh! And another question: how much valuable data will my death produce?"

Maxton laughs nervously. "I know you've been a bit skeptical, but this portfolio will do a lot to supplement your social security and your earnings from your writing. I'm sure your new accommodation will help generate more column ideas!"

"Maxton, is it?"

"Ma'am?"

"Cut to the chase."

"Right, well, the main thing. A [bid has just come in](#)(\*6) for some of the particulate data coming from your [facility's biofiltration system](#)(\*7). There's a big appetite for respiratory data right now, and this particular product is

\*4

Data unions bundle individual users' real-time data, allowing them to share in the revenues paid by third parties to access the data.

\*5

In this future, people authorize the pooling of their data by the data union, whose admins then collectively bargain with interested parties for the highest yield (monetary and otherwise).

\*6

This private company wants to purchase residents' respiratory data for research purposes.

\*7

The building is fitted with an "integrated biome" filtration system, which uses indoor plants to remove toxins from the air while creating a microenvironment.

focused on the long-term effects of certain inhalant therapies. Considering your age, medical history, and the sheer number of data points collected by this air filtration system, your cohort should be able to command a considerable bid.”

She sat back as, at Maxton’s gesture, the estimated value of her stake in the union offer for access to this data stream materialized before her.

“Every month?”

“Yes ma’am.”

“In 2038 US dollars?”

“Yes ma’am.”

“And this is just one of these newfangled streams?”

[Chuckling] “Yes ma’am.”

“I might have to start being nicer to the robo-nannies. Might let them check out my toe.”

“Ma’am?”

“Don’t worry about it, Maxie. Is that all for now?”

“That’s the major edit, I did send a comprehensive summary if you’d like to review it later.”

“If Sereeta thinks it’s all okay, then I’ll approve. Especially this big one. For breathing! Can you imagine?!”

Renilda thumbed her agreement on the bid and watched as a bright tendril reached from the ceiling to grasp the agreement, pulling it into the constellation of entities she now supplied with her digital leavings.

“Perverts,” she said smiling up at the ceiling.

“Okay, well thank you for your time, Mrs. Ng. Don’t hesitate to call if you need anything.”

“You too, Maxie!”

She exited the meeting and did a quick body scan, noting that the throbbing in her toe had lessened considerably.

After a moment, she addressed the glasses again.

“System. Call my kid.” ✦

## Story decrypter | Insights from the author

You've just experienced a narrative probe into one possible 2038. I'd like to draw your attention to certain features of this future: the decentralized data economy, the aging population, and the propagation of big data-driven longevity research.

What are **data unions**? One of the biggest stories of the past decade has been the progressive revelation of how our personal data is aggregated and sold. We are, the saying goes, the product sold by many of the most valuable companies in the world without our informed consent. One proposed remedy: users should be able to own and be compensated for access to their data. Simple enough, right?

It's one thing to own your own data, but most individuals' data is practically worthless on its own. Data unions bundle individual users' real-time data, allowing them to share in the revenues paid by third parties to access the data.

In the story we show Renilda working with a consultant, Maxton, to manage her portfolio of data union products.

In this future, people with access to data-collecting devices can retail their digital information through the intermediaries of any number of specialty data unions.

The members authorize the pooling of their data by union admins, who then collectively bargain with interested parties for the highest yield (monetary and otherwise).

This arrangement gives individuals leverage not only to command a fairer share of the multi-billion-dollar personal data market, but also precise control over what data they sell and the ability to influence the sorts of products that their data is amalgamated into.

In the story, Maxton helps Renilda consider whether to opt into a supplier-member relationship with two different

data union products. The first is something like an **open-source city-scale digital twin** built out of data donated by citizens and turned into visualizations and dashboards to aid public advocacy.

The second is from a private company that makes an "integrated biome" system which uses **AI analytics** to grow indoor plant ecosystems that filter and analyze airflow within buildings. They are requesting access to use Renilda's (and, presumably, other residents') data in part of a respiratory function study.

While I've declined to speculate on the precise nature of the medical system in this potential 2038, Renilda's new home offers cutting-edge therapies to ease and reverse the symptoms of aging. Also, the opportunity to earn some money and contribute to ongoing longevity research through the abundance of data their facility and devices capture from residents.

This future examines the neighboring realities of **data as labor**, the complexities of owning and managing that data, plus the ongoing role of sensors and data in increasing human life and health spans.

**Madebo Fatunde**  
Strategic Foresight Practitioner

# Fast forward

by Alex Stern

Science-fiction, forecasting, and speculative scenarios tend to overpromise and underdeliver. Yet many **visions of the future do eventually come true**. When they do, change is rapid rather than gradual. Take smartphones—they finally came into their own in 2007 and changed not only how we communicate but the very fabric of our society virtually overnight.

We're currently entering a new phase of change, where predictions not only come true much faster, but sometimes can't keep pace with the changing reality. In his 2020 book "The Future Is Faster Than You Think", Peter Diamandis makes a compelling case that there will be more upheaval and change in the next decade than the prior 100 years combined.

Digitalization of technology is improving business performance exponentially—just like we've seen in computing.

On top of that, **technologies and entire industries are converging**. The lines between artificial intelligence, robotics, sensors, networks, 3D printing, virtual reality (VR), augmented reality (AR), synthetic biology, and blockchain are blurring. This convergence has the potential to **disrupt every business model and ecosystem** out there. The transformative power of the smartphone was that it combined so many things into **one platform**—a platform that keeps rapidly evolving, changing the world around it as it spins along.

Now imagine for a second what that smartphone moment means for your industry. If you think your industry is immune from this convergence trend, think again. Sony just reaffirmed its commitment to build an electric car, combining its consumer electronics and UI experience with a battery-electric vehicle built by Honda. Architects and construction companies are using AR

and VR to improve their processes and design quality—technology borrowed from the gaming and entertainment industry. Manufacturing companies, too, are using immersive tools to improve collaboration and let end-customers experience a product before it's even built.

All of this change may sound scary, but as these collision stories show, exponential technology advancement and convergence is going to **create immense opportunities**. Applying these new ways of working will help us solve the serious problems facing our world today. Climate change, equal access to education and economic opportunities, and scarcity of resources are some of the main challenges that these collisions might help us solve.

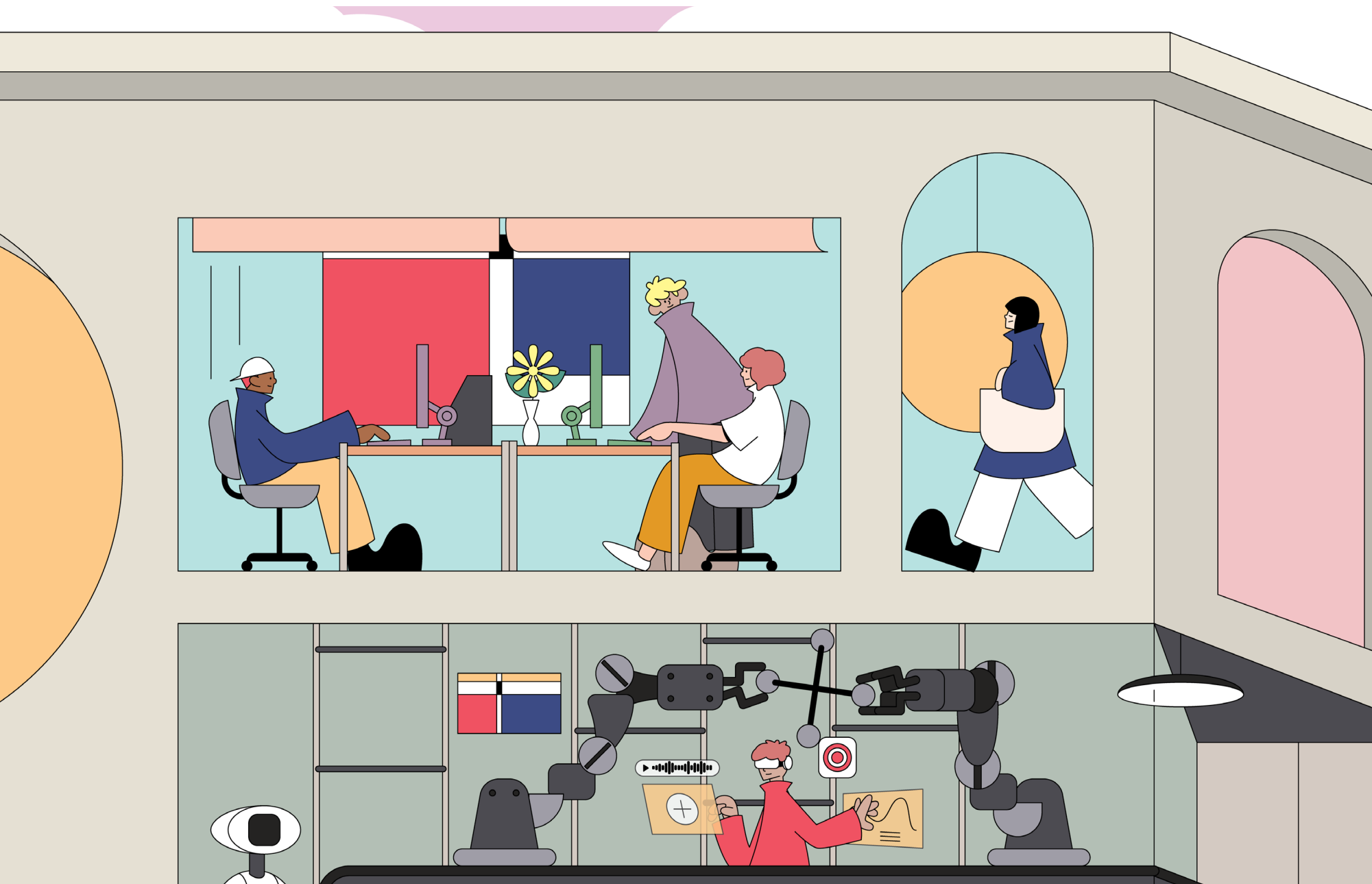
At a minimum, how we work is going to be much more efficient. Automation, insights, and smooth flows between

the different stages of designing and making things will take out any friction we're currently experiencing. We'll be able to focus our time on being more creative, with more time for deep thinking and problem solving. In the best-case scenario, how we work may be entirely different, changing society in fundamental and positive ways we can't even begin to imagine today.

**Alex Stern**

*Manufacturing  
Strategy Lead,  
Autodesk*





A collision story inspired by two Autodesk Research Oversight Network residents:

## MTConnect



## Duality Robotics

### MTConnect Institute [➤](#)

*technological, economic resident 2019–present*

MTConnect Institute is a leader in Model Based Enterprise (MBE) standards and information modeling. They are working to develop the next generation of information models to communicate design in a way that creates complete digital representation of a product throughout its lifecycle. They are actively developing the language to describe the lifecycle of parts, manufacturing processes, and decentralized task-based models for integration of manufacturing equipment.

### Duality Robotics [➤](#)

*technological resident since 2019–present*

Duality is building an enterprise metaverse for digital twins that helps robots understand humans. In order to support training and testing of modern machine learning systems, they must generate rich and varied data. By bringing together digital twins with live human testers in a realistic, multiplayer environment, they can provide a cost-effective data source that is realistic, intentional, and scalable.

Collision [★ 3](#) by Francis Gonzales

# FROM THE SHOP FLOOR TO THE TOP FLOOR

**I**t's a brisk fall morning about 30 minutes outside Laramie, Wyoming, and Gil is on autopilot. Today is his last day on the shop floor(\*1) at Green Gears, one of the leading manufacturers in CNC machined(\*2) parts for the booming clean tech industry. As he enters the building and approaches the mounted case on the wall, the glass door automatically swings open. He reaches in and pulls his AR glasses out of the charging station. First stop, the break room to get some coffee.

He chats with a few of the other maintenance workers, swapping war stories about particularly nasty breaks and how they fixed them. He'll miss this. He can't help but feel that these are his people, and he worries that he might not speak the same language as his new colleagues on the top floor. As he leaves the break room and heads to the shop floor a message appears in the top right corner of his glasses that says, "Recording now in progress."

The factory hums with activity. A cacophony of beeps and whirring parts echoes around the sparse concrete and steel environment. Gil scrolls through the notifications on his headset as he walks across the factory floor. The swarm of industrial robots sense his presence and flow around him. On his left a massive six-axis robotic arm wheels by and carefully positions itself at a workstation

before screwing itself into the floor. The big machines are stationary, but nearly everything else in the shop is on wheels. A million tiny sensors(\*3)—all speaking to each other—making up one fully connected system.

Every day the factory looks different. Henry Ford's factory was a carefully tuned music box with thousands of pieces meticulously crafted to play a single tune. Green Gears' smart factory, on the other hand, is designed for adaptability. They have a few pieces that they specialize in, but what sets them apart is the shop can be reconfigured quickly to change what is produced. This allows them to keep their machines running at full capacity and smooths out supply chain issues for their customers. The industry term for this new and sometimes chaotic business model is Manufacturing as a Service (MaaS), but Gil likes to call it jazz.

Gil's first maintenance call is in the L7 quadrant. The predictive maintenance AI picked up a weird rattling a few days ago and flagged it for review. Gil opens the job brief and studies the machine's chart while a pair of collaborative robots (aka cobots) work on prepping the station. One opens the metal siding to expose the parts in question while the other lays out the tools Gil might need to operate. As he approaches the machine, a dull

\*1

In this 2032, the last people on the factory floor will be the machine maintenance crew. That is, until the robots learn how to mend themselves.

\*2 **CNC (computer numerical control) machining**

A subtractive manufacturing process, using precision computer-controlled cutting tools to remove material from a plastic or metal block.

\*3

Ubiquitous sensing technology and common machine language will be essential to the Industrial Internet of Things (IIoT).



voice comes over his headset to remind him, “[This repair is being recorded for training purposes.](#)”(\*4)

Two and a half hours later he finishes the repair. The POV video from his headset is combined with the data from the machine’s sensors and a second camera angle from one of the cobots. Thanks to the union’s recent negotiations, [he owns 50% of the IP created during that repair](#)(\*5). This means anytime Green Gears sells the data he gets a cut.

These days there’s a huge demand for this kind of footage from simulation companies training the next wave of robots bound for the factory floor. Having a stake in the game makes it a little easier to deal with [the state of constant surveillance](#)(\*6). Gil jokes with his kids that he’s a content creator.

This might be one of Gil’s last repairs on the shop floor. It’s a bittersweet moment and a time for reflection. Gil had always been a tinkerer. Before he joined Green Gears, he had 20 years of hands-on experience assembling everything from cars to wind turbines. Over the course of those two decades, he watched as production moved overseas and automation thinned the human resources on the assembly lines. Gil accurately predicted that working in machine maintenance would be a more future

proof position, but found his professional growth stunted by his lack of computer science skills.

The three-year Industrial Internet of Things (IIoT) Pathway at Green Gears was the breakthrough he needed. It provided a structured way for him to learn AI, machine learning, and data science skills on the job. Now, instead of responding to maintenance calls on the shop floor, he’ll be helping train Green Gears’ AI as a Maintenance Oversight Officer. He’ll go from being a firefighter to [working at a systems level](#)(\*7) in something more akin to forest management. It’ll be a new challenge, but Gil is up for it. After all, he plays jazz. ✦

\*4

Robots will need training to work safely alongside people on the factory floor—so there will be a new market for high-quality training data.

\*5

In the future, workers could benefit from the sale of their data to the simulation companies training their replacements.

\*6

Worker surveillance and data privacy will be major topics of contention.

\*7

A completely automated shop floor is unlikely in 2032. In fact, formalized upskilling will be essential for attracting workers in a highly competitive market.

## Story decrypter | Insights from the author

This story explores the Future of Work in 2032. The three big changes in this scenario are an increase in domestic manufacturing, automation, and labor shortages. Together these three critical factors will shape the Factory of the Future.

**Domestic manufacturing** will increase in the US because it's getting harder to find cheap labor abroad and global supply chains are increasingly volatile. What's more, ubiquitous sensing technology—underpinned by a **common machine language**—will offer total visibility into the production process and boost efficiency levels.

In the Factory of the Future, the robots will be let out of their “cages” and will work side-by-side with their human counterparts. For that to happen in a safe manner, the robots will need to be trained.

Using a **simulated training environment** is a natural choice because it allows the AI and robot to learn much quicker and without any real-world risk to people or

property. As a result, there will be a new market for high-quality training data.

A completely automated shop floor is unlikely in 2032, instead we'll see companies desperately scrambling to upskill/reskill their workforce. This will give workers more leverage and I think we'll see a return of strong unions who will grapple with issues of worker surveillance and data privacy.

The title for this piece, “From the shop floor to the top floor”, was a line from an IIoT sales brochure. I've used it here to signify a pathway for professional development that I hope emerges for many reasons, not least because my grandfather worked on an assembly line for 42 years with little to no opportunity for upward mobility.

I think we're witnessing a transformational moment in the manufacturing space. The factory of the past was optimized for productivity, **the factory of the future will be optimized for resilience.**

My preferable future is one in which workers are treated with dignity and empowered to be creative problem-solvers. And I firmly believe Autodesk can help make this future a reality.

**Francis Gonzales**  
*Strategic Foresight Specialist*

# Conclusion

For almost the entirety of human history, the future has been very much like the past. Unsurprisingly, evolution hasn't prepared us to consider the longer term. But with the arrival of exponential and advanced technologies, we are now mediating an overwhelming level of change.

Thinking about the future has become critical. Futures thinking helps us to navigate uncertainty and more proactively capitalize on change. It helps us understand how issues unfolding today could affect our businesses tomorrow.

Autodesk Research is able to look across forces of change—social, technological, environmental, economic, and political—to scan the horizon for weak signals. These fragmented indicators can give us insight into our potential futures and reveal something about the present.

Created thanks to this "signal scanning" capability, this anthology is about connecting the dots between issues with the most uncertainty and the most potential impact on our industries and lives.

Which innovative projects might coexist and what might their collective impact be? How will the nature of our work change over the next 10 to 20 years? How prepared are we for these possible changes?

The stories you have read are prototypes of what the future might look like. They offer an exciting glimpse of not only what is possible but what is probable. But perhaps most importantly, what is preferable.

More robust visions of the future will equip us to create the futures we want.

# Meet the team

## Collision +1 GROWING PASIFIKA



**Ellen Hlozan** ↗  
*Editor-in-Chief + Writer*

Ellen Hlozan is a Community Manager at [Autodesk Research](#) ↗. She manages a large-scale network of global innovation organizations, inspiring impactful collaborations between residents and researchers.

She specializes in design thinking facilitation and strategic foresight focused on advancing emerging technologies.

In her free time, Ellen volunteers as the Global Partnerships Lead at [WIN: Women in Innovation](#) ↗, a non-profit organization seeking to close the gender gap in innovation leadership.

## Collision +2 BETTING ON YOURSELF



**Madebo Fatunde** ↗  
*Writer*

As part of the Strategic Foresight team at [Autodesk Research](#) ↗, Madebo Fatunde investigates the future of Autodesk and our core industries.

Madebo, MS, is a writer and foresight strategist, building a practice at the intersection of arts, technology, and culture. His work helps organizations identify and adapt to inbound vectors of change, and take action towards their preferred futures.

His passion is using storytelling about the future to empower better decision-making today.

## Collision +3 FROM THE SHOP FLOOR TO THE TOP FLOOR



**Francis Gonzales** ↗  
*Writer*

As a Strategic Foresight Specialist at [Autodesk Research](#) ↗, Francis Gonzales tells stories about the future that inspire, provoke, and ultimately catalyze change.

He is an expert in technology adoption, systems thinking, and change management, with experience working in more than 15 emerging economies at the intersection of technology and innovation for social good.

With an MBA in Design Strategy, he is equipped to assess customer needs today in order to identify the business opportunities of tomorrow.

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