



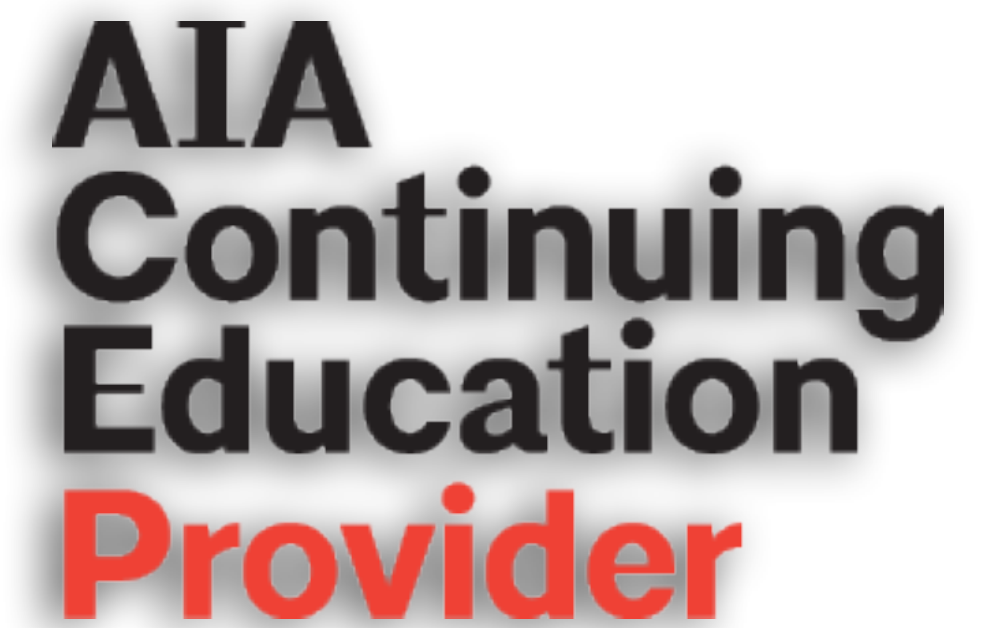
The EntreArchitect™ Community ANNUAL MEETING

The International Conference for Small Firm Entrepreneur Architects

Austin, Texas • November 1-3, 2022

With support from  Monograph

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Disruptive Technologies in Architecture... and You

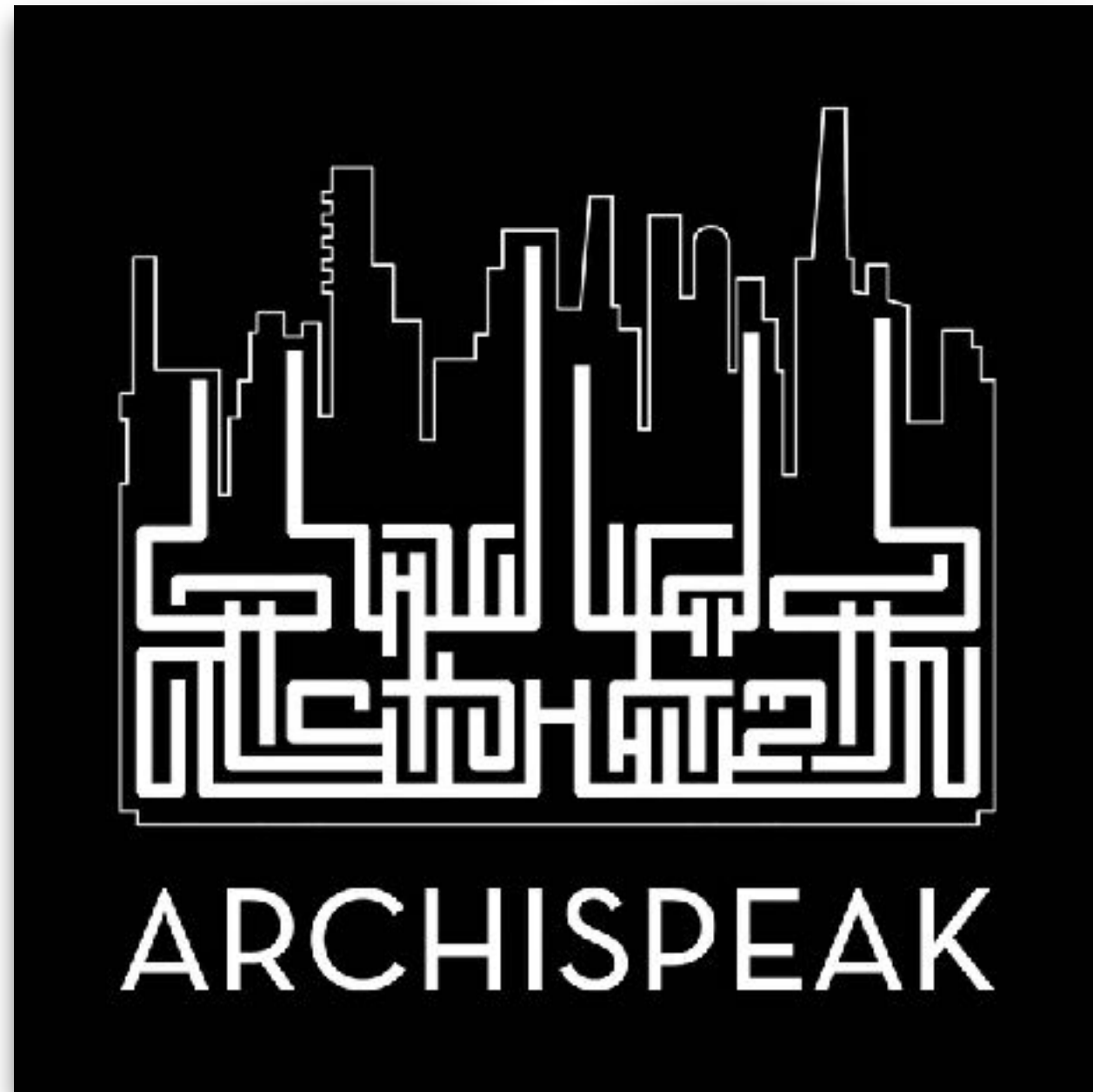
EVAN TROXEL, AIA

**EntreArchitect Annual Meeting
Nov 3, 2022**



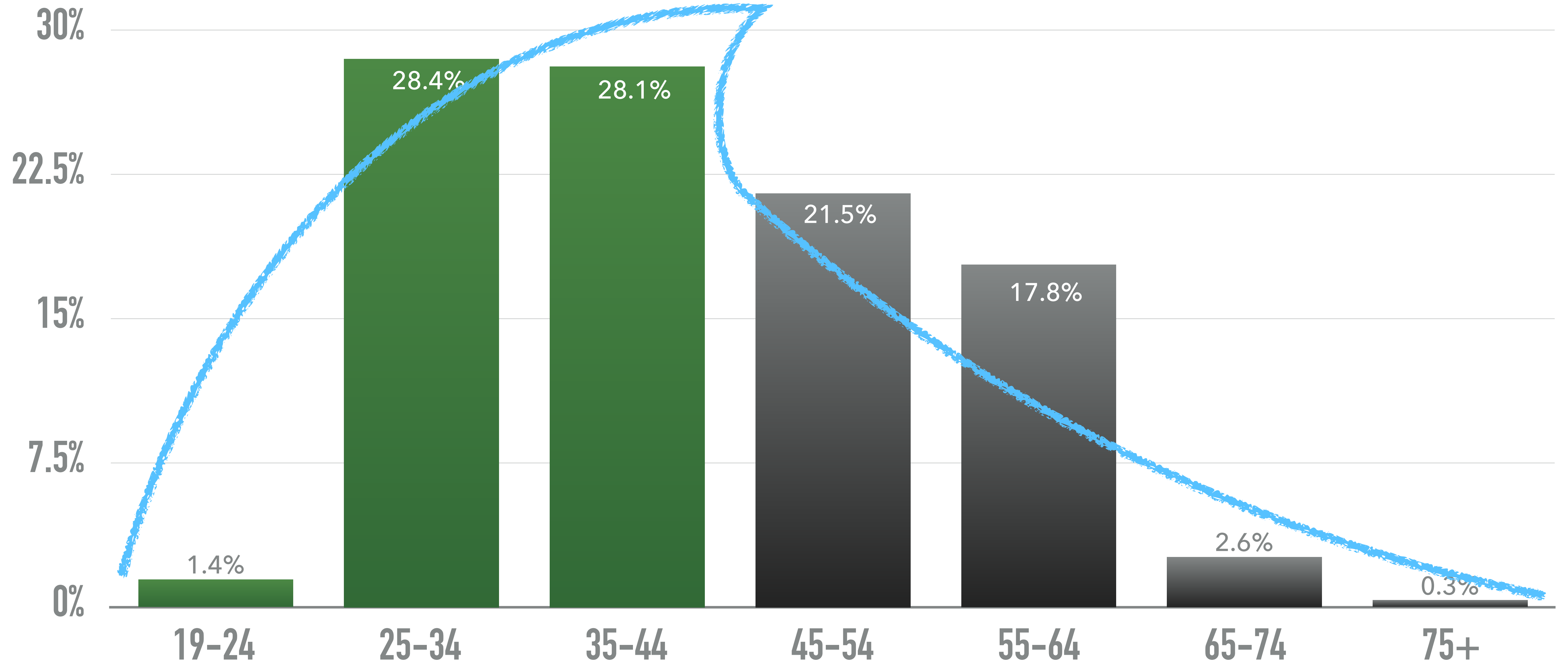
ON

THE PROFESSION



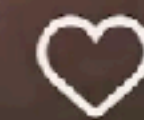


TYPICAL FIRM AGE DEMOGRAPHICS

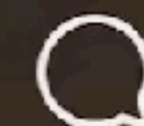


90'S QUESTIONS FOR MY 14 YEAR OLD

I'M GONNA ASK YOU SOME
QUESTIONS



27K



689



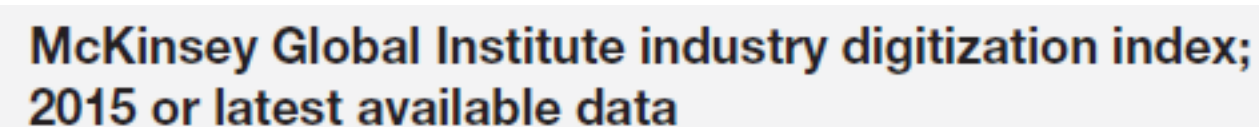
themccabelife

Follow

2020'S QUESTIONS FOR YOU

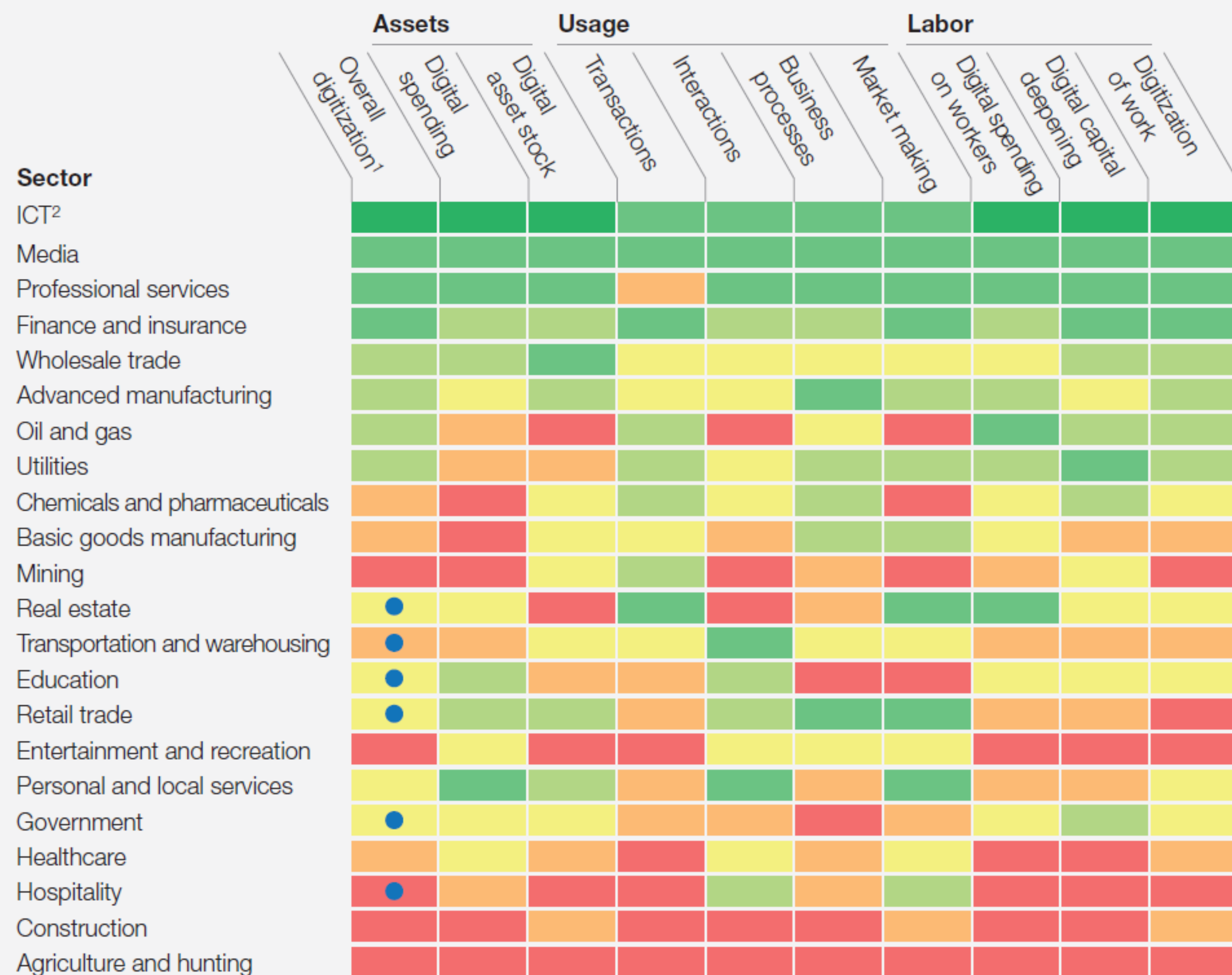
- BIM
- grasshopper
- wallacei, galapagos
- hypar
- midjourney, GPT3, DALL-E 2, stable diffusion
- blender
- generative design
- 6 degrees of freedom
- magic leap

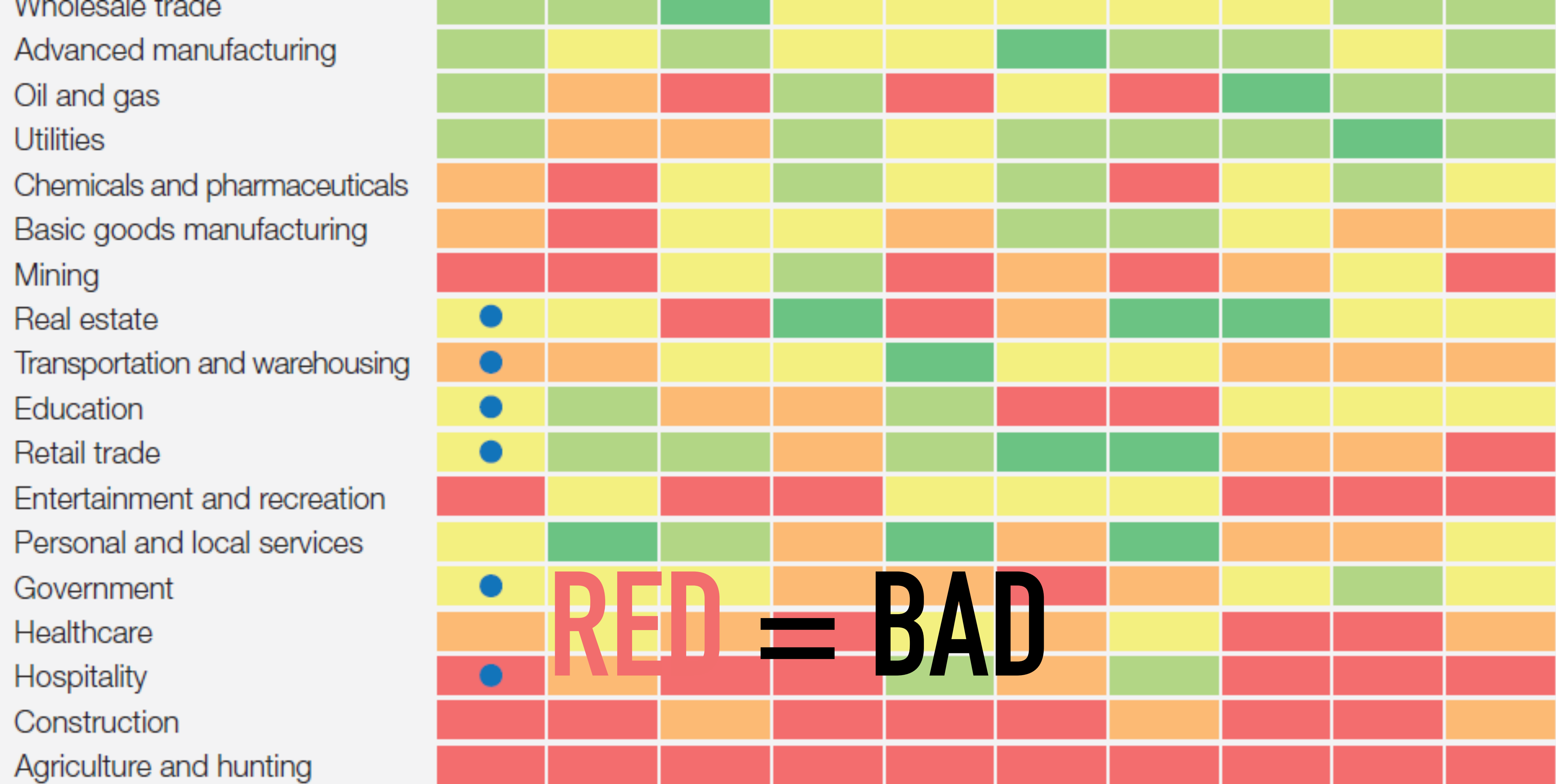
INDUSTRY DIGITIZATION INDEX



Relatively low digitization  Relatively high digitization

- Digital leaders within relatively undigitized sectors



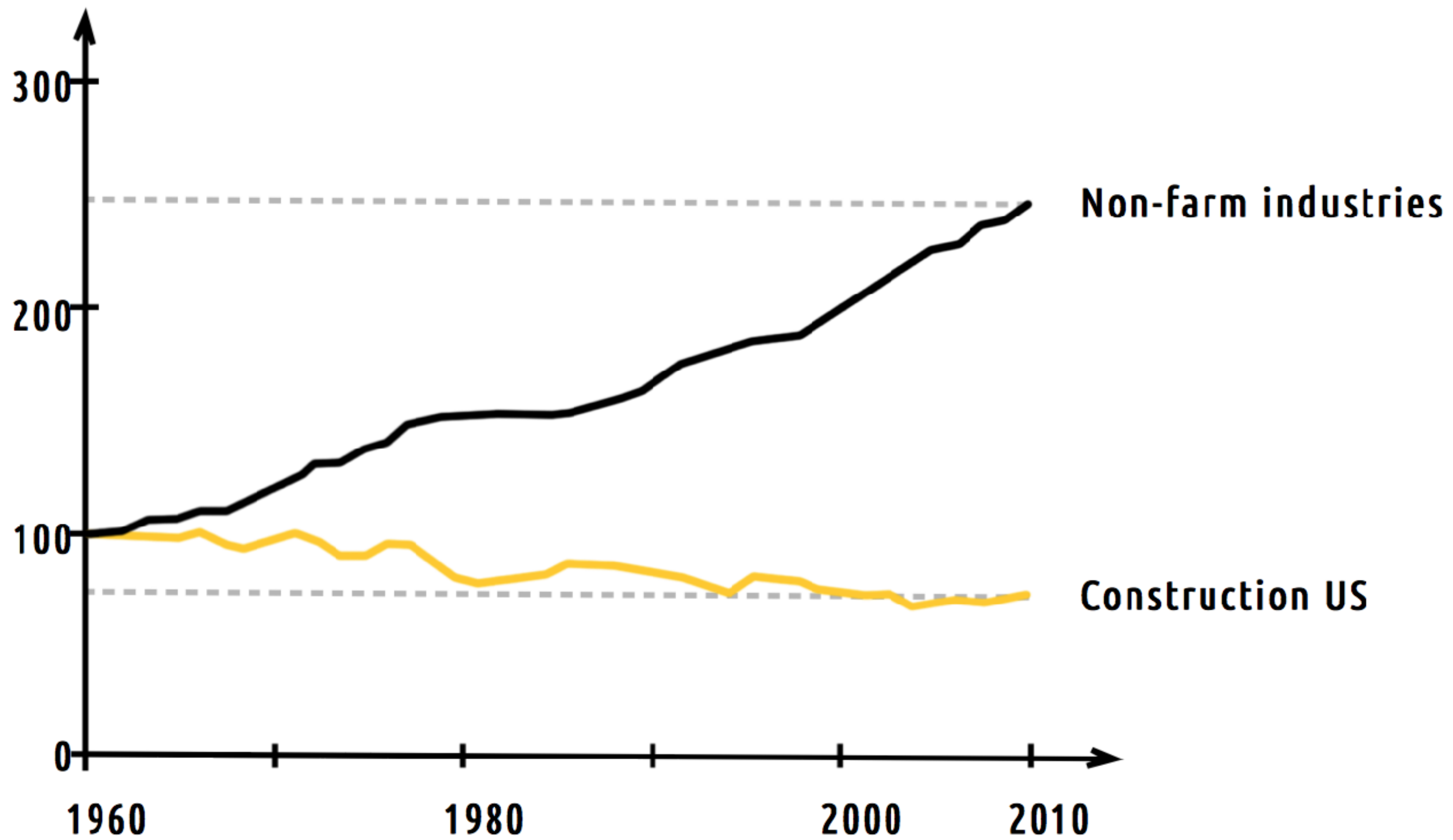


¹Based on a set of metrics to assess digitization of assets (8 metrics), usage (11 metrics), and labor (8 metrics).

²Information and communications technology.

Source: AppBrain; Bluewolf; Computer Economics; eMarketer; Gartner; IDC Research; LiveChat; US Bureau of Economic Analysis; US Bureau of Labor Statistics; US Census Bureau; McKinsey Global Institute analysis

LABOR PRODUCTIVITY INDEX



ADDITIONAL PRESSURES

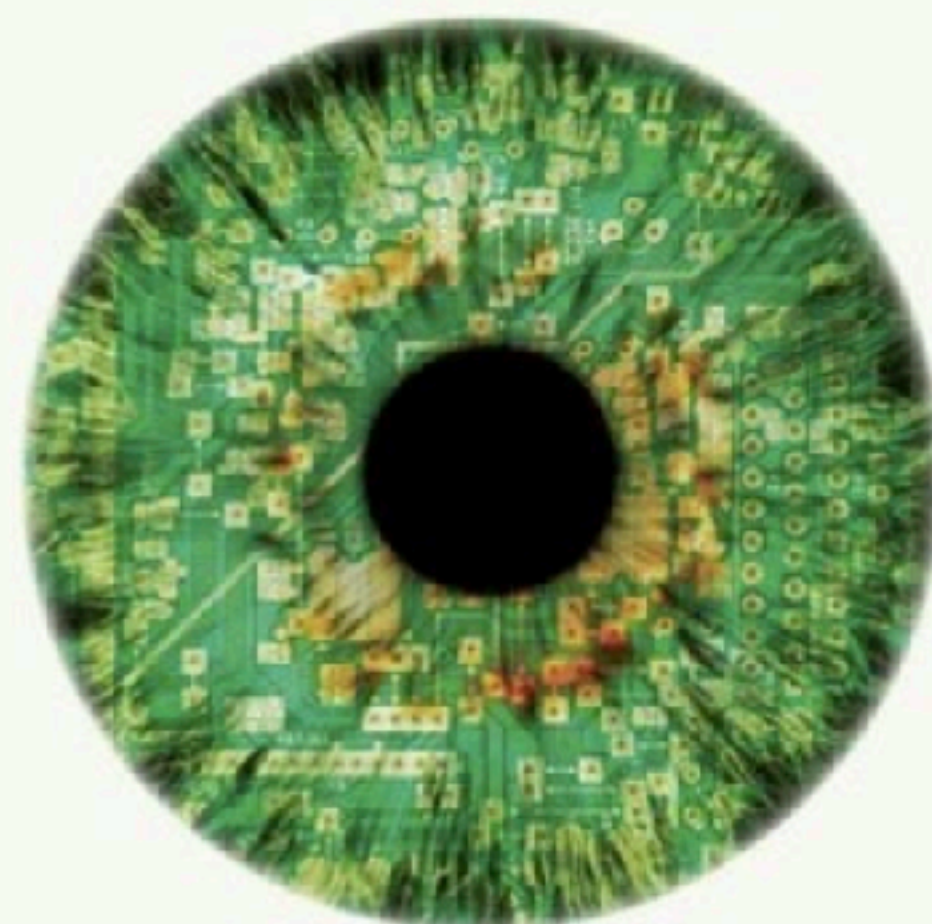
- climate change & sustainability
- building performance
- labor force
- work conditions
- pandemic; mental health
- other technology
- organization; management; leadership
- equity; diversity; inclusion
- expertise (or lack-thereof)
- competitive landscape
- training & prof. development
- economic cycles
- social issues
- legal; contracts; policy
- population growth

WHY DOES IT MATTER THAT WE OVERCOME THESE CHALLENGES?

- global floor area is expected to double by 2060.

**We need to build a city
the size of New York
every 5 weeks
for the next 30-40 years
zero carbon**

RICHARD DANIEL
SUSSKIND SUSSKIND

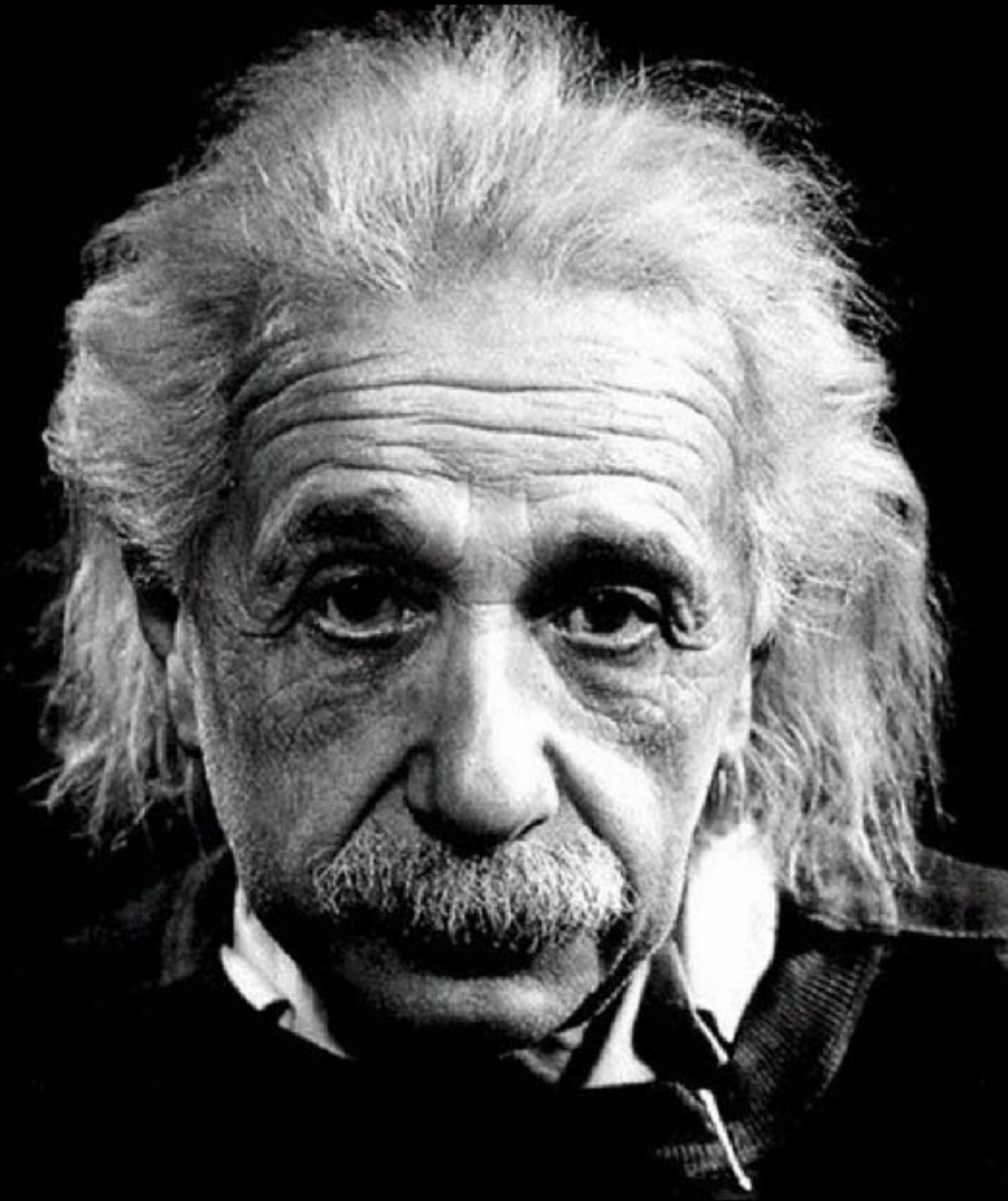


THE FUTURE OF THE PROFESSIONS

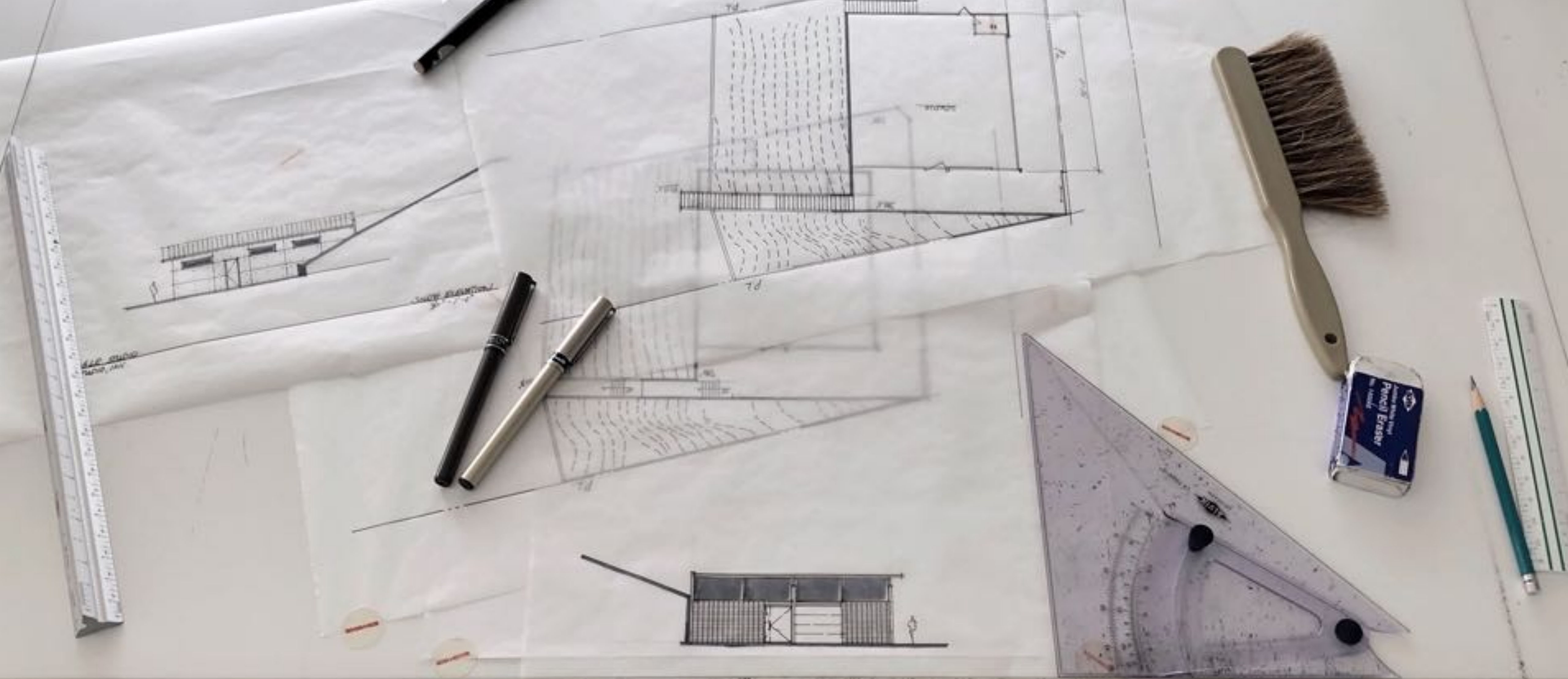
HOW TECHNOLOGY WILL TRANSFORM
THE WORK OF HUMAN EXPERTS

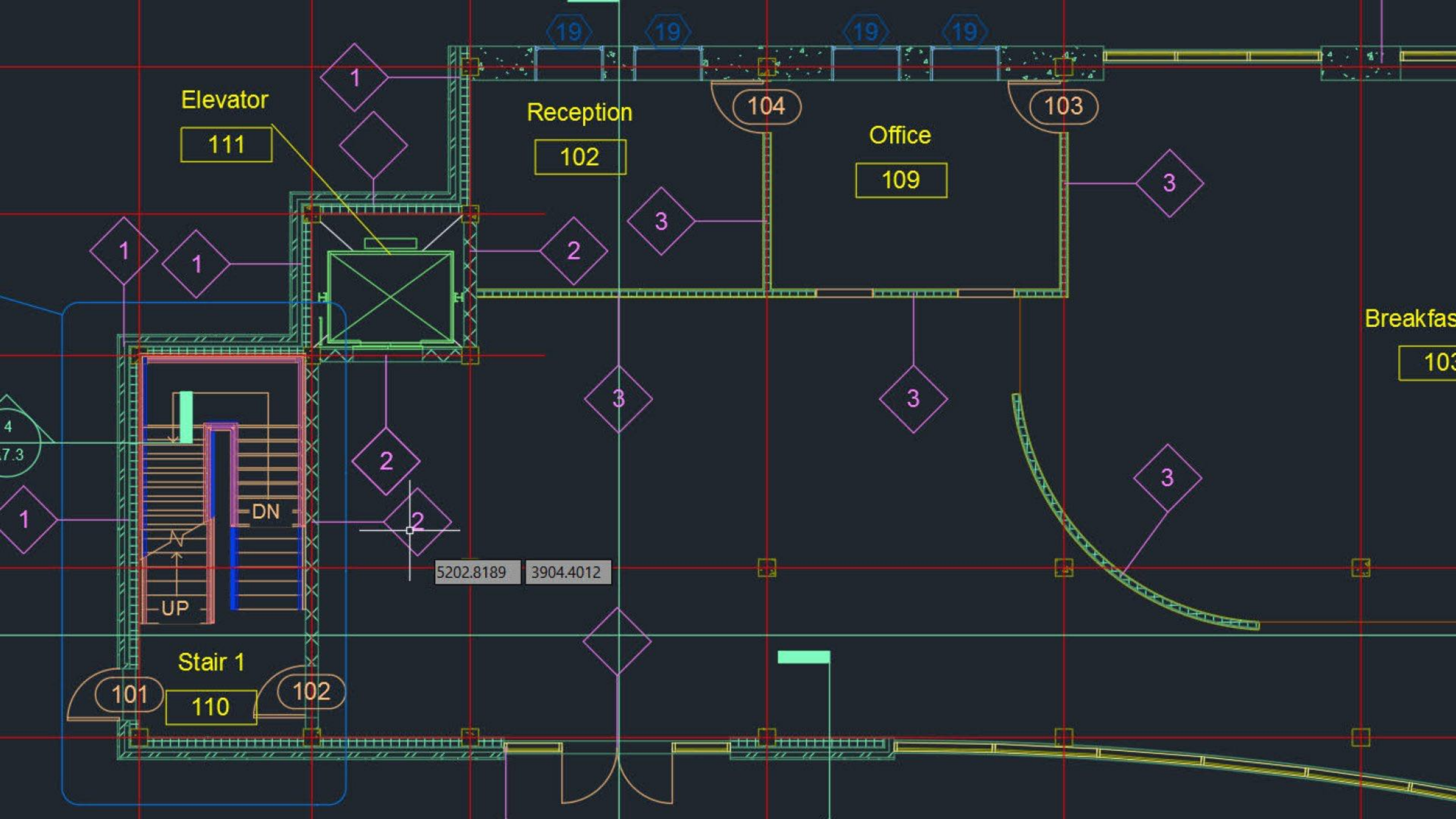
What do we owe the future?

**“Is this the
same exam
as the last
time?”**



**“Yes...
but the
answers have
changed.”**





Architecture Structure Systems Insert Annotate Analyze Massing & Site Collaborate View Manage Add-Ins Site Designer ArchVision NBS Extensions Modify

Modify Select Wall Door Window Component Column Roof Ceiling Floor Curtain System Mullion Railing Ramp Stair Model Text Model Line Model Group Room Room Separator Tag Room Area Area Boundary Tag Area By Face Shaft Wall Vertical Dormer Level Grid Set Ref Plane Viewer Datum Work Plane

Properties

3D View

3D View: Balcony View Edit Type

Graphics

Detail Level	Medium
Parts Visibility	Show Original
Visibility/Graphic...	Edit...
Graphic Display O...	Edit...
Discipline	Architectural
Default Analysis ...	None
Sun Path	<input type="checkbox"/>

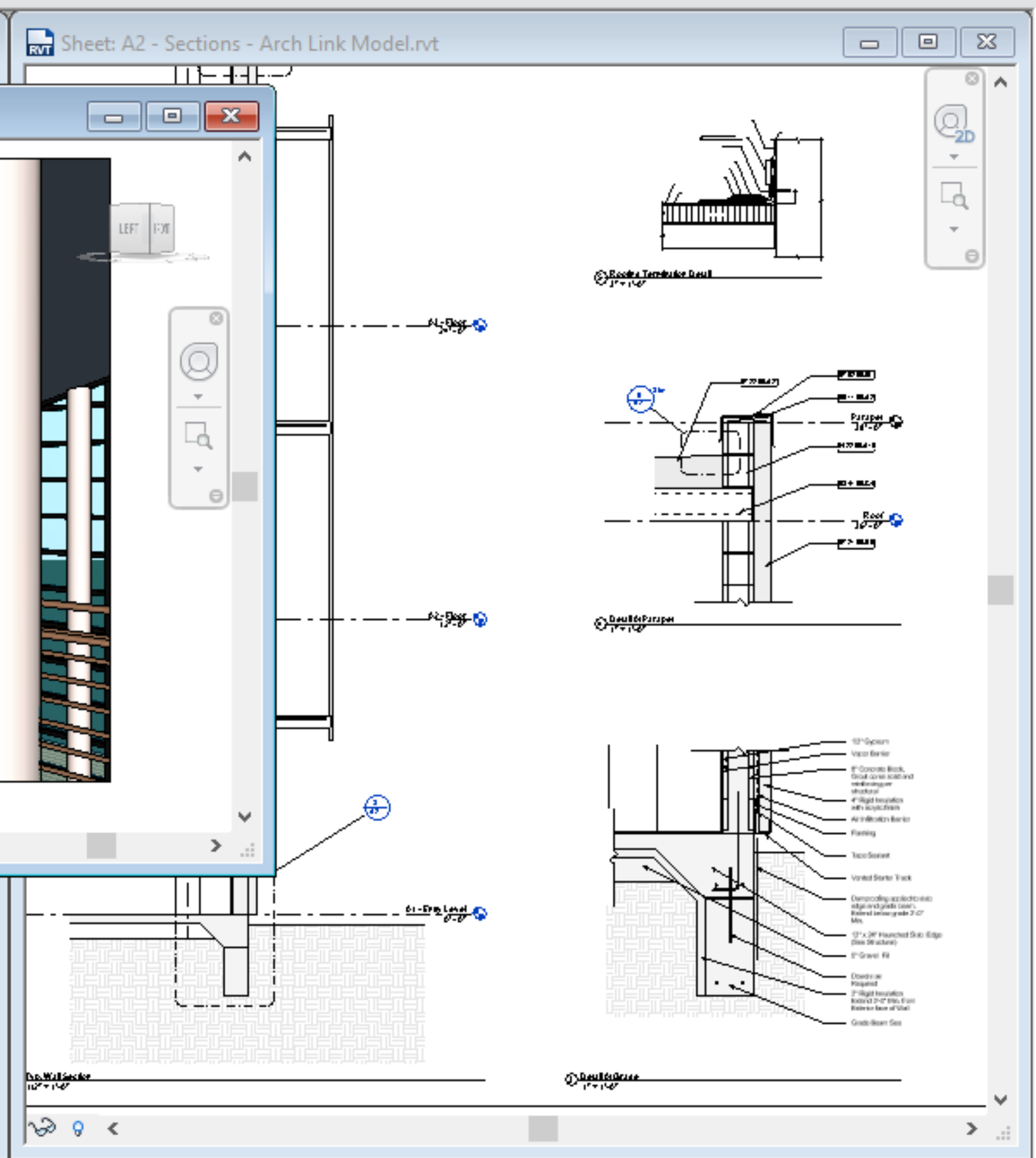
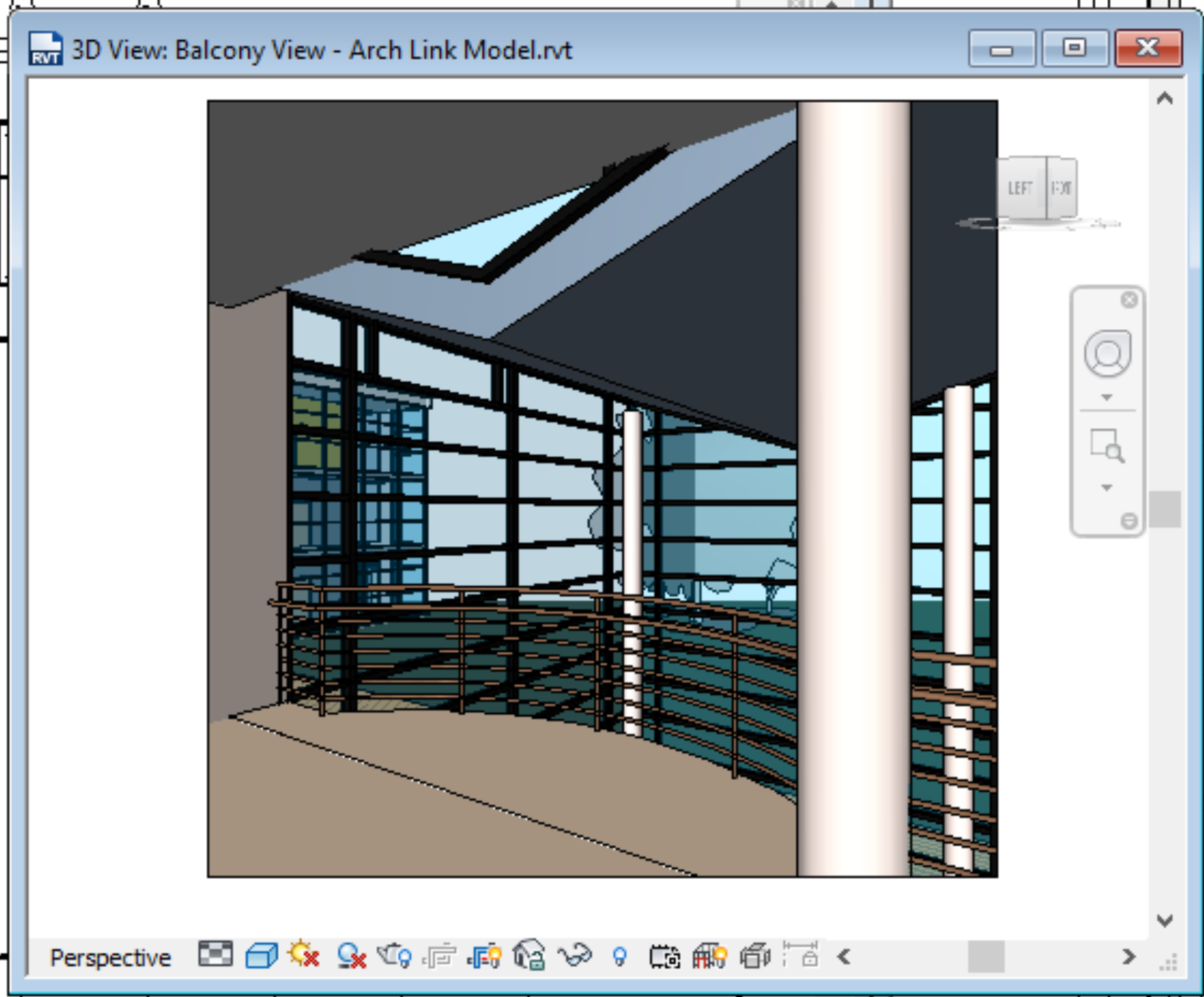
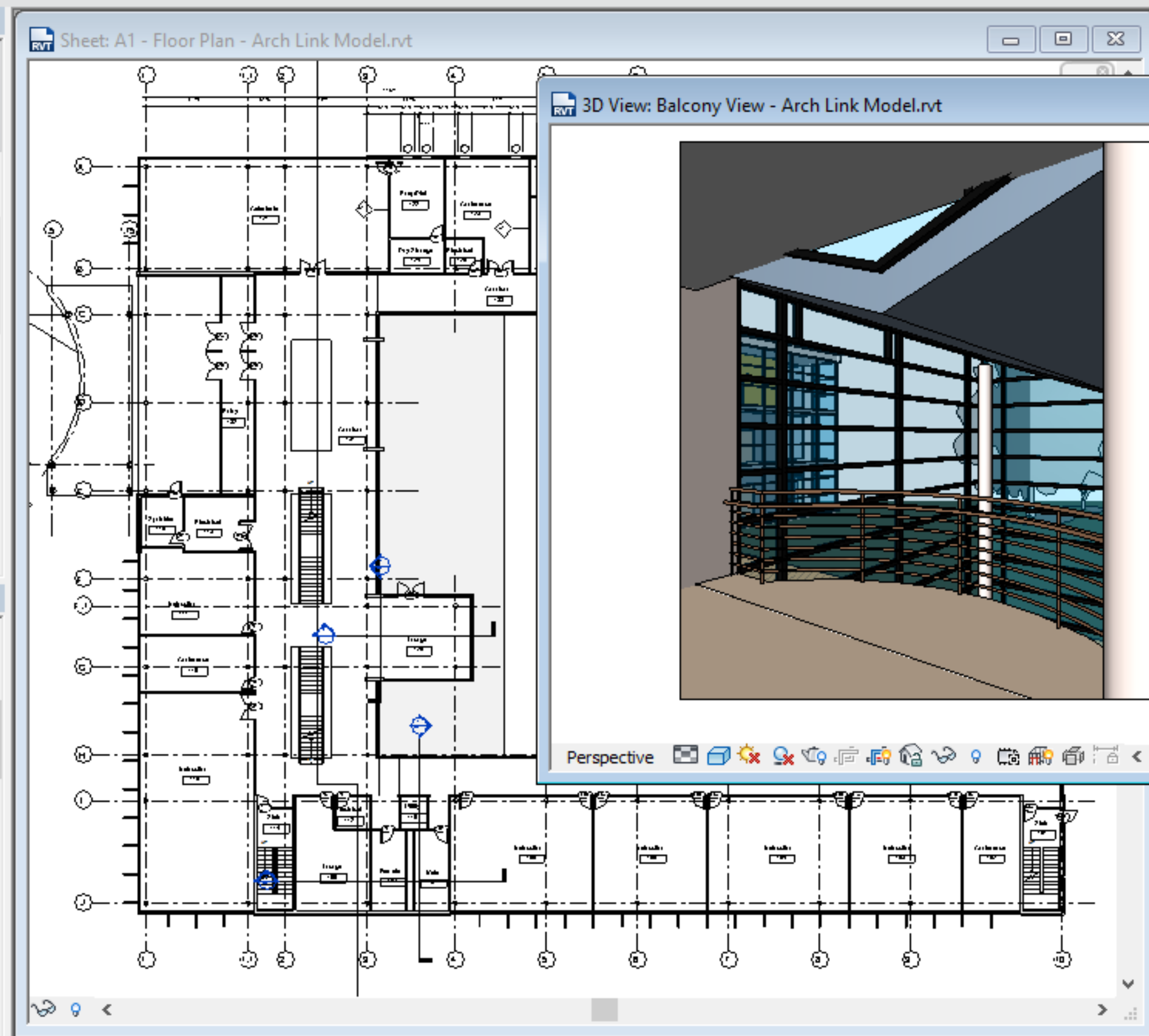
Extents

Crop View	<input checked="" type="checkbox"/>
Crop Region Visible	<input checked="" type="checkbox"/>
Far Clip Active	<input checked="" type="checkbox"/>
Far Clip Offset	127' 0 121/256"

Properties help Apply

Project Browser - Arch Link Model.rvt

- 02 - Floor
- 03 - Floor
- 3D Views
 - 03 - Floor Public - Day Rendering
 - 03 - Floor Public - Night Rendering
 - Balcony View**
 - Building Courtyard From Parking Area (3D)
- Elevations (Building Elevation)
 - Courtyard Elevation - South Win
 - East
 - North
 - South





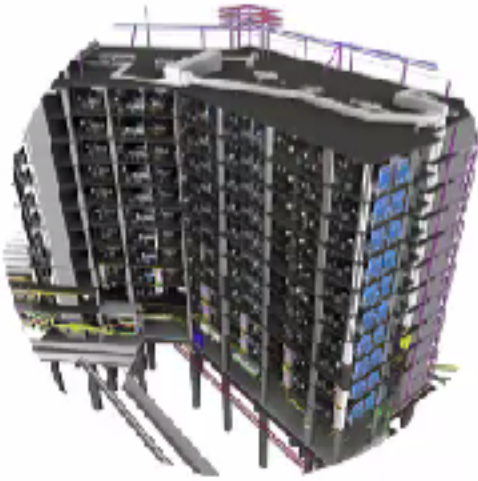


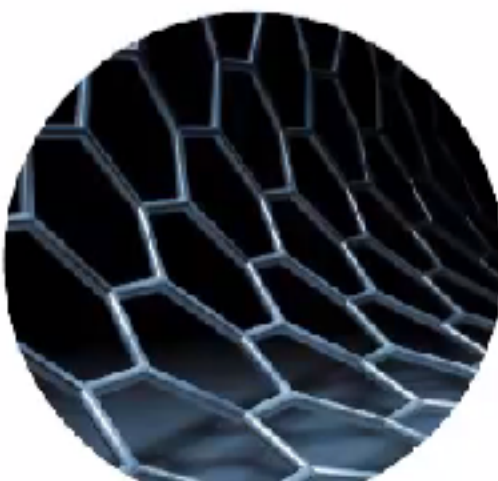





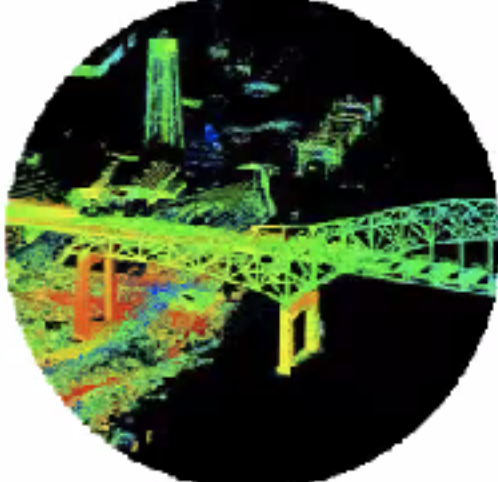

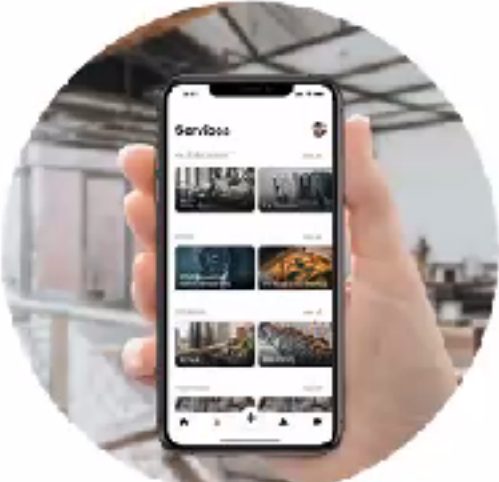
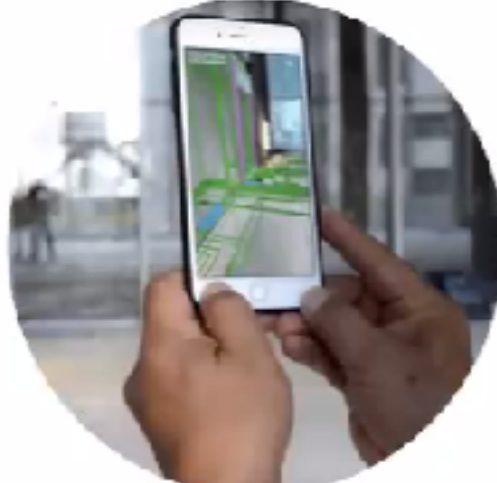








What has gotten us here will not get us there.

A close-up photograph of Grumpy Cat, a famous internet meme. The cat has a grumpy expression, with its mouth slightly downturned and its eyes looking off to the side. It has a mix of brown, white, and black fur. The background is blurred, showing some red and blue colors.

**THERE ARE
TWO THINGS
ARCHITECTS
HATE**

**THE WAY THINGS ARE
CHANGE**

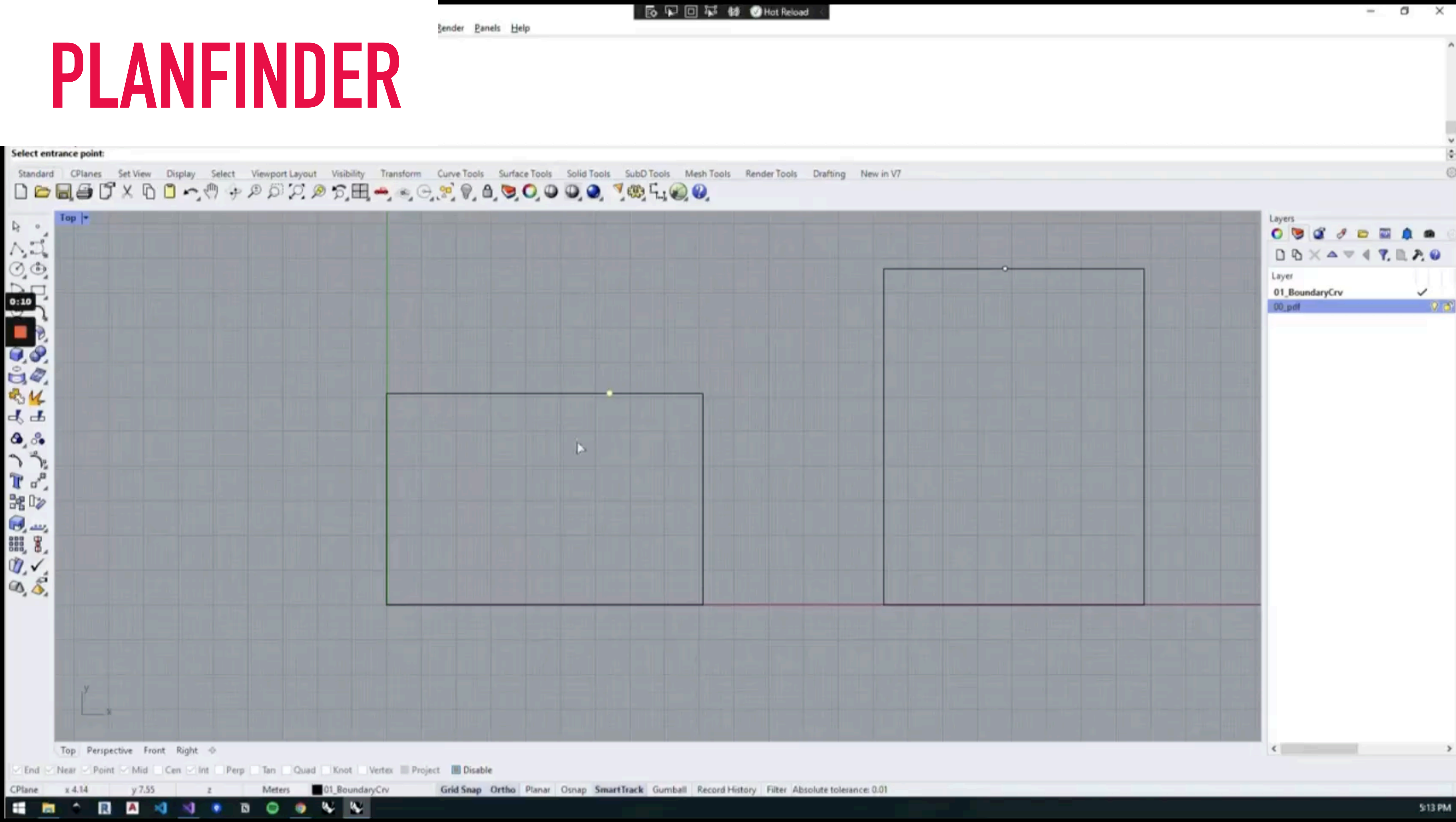
**I am here as a human portal
to the tech.**

Models	Robots	Vision	Methods	Other Tech	Enablers	
 <p>BIM</p>	 <p>Autonomy</p>	 <p>AR/VR</p>	 <p>Advanced Materials</p>	 <p>Electric Vehicles</p>	 <p>AI/ML</p>	 <p>IoT</p>
 <p>Digital Twins</p>	 <p>Drones UAV</p>	 <p>Reality Capture</p>	 <p>Modular Prefab</p>	 <p>(TeX) Tenant Experience</p>	 <p>Mobile</p>	 <p>Blockchain</p>
 <p>GIS</p>	 <p>Robotics</p>	 <p>Computer Vision</p>	 <p>3D Printing</p>	 <p>BMS</p>	 <p>Computation Design</p>	 <p>5G/LTE/Wifi</p>

DISRUPTIVE TECHNOLOGY IN ARCHITECTURE

Design technology & BIM

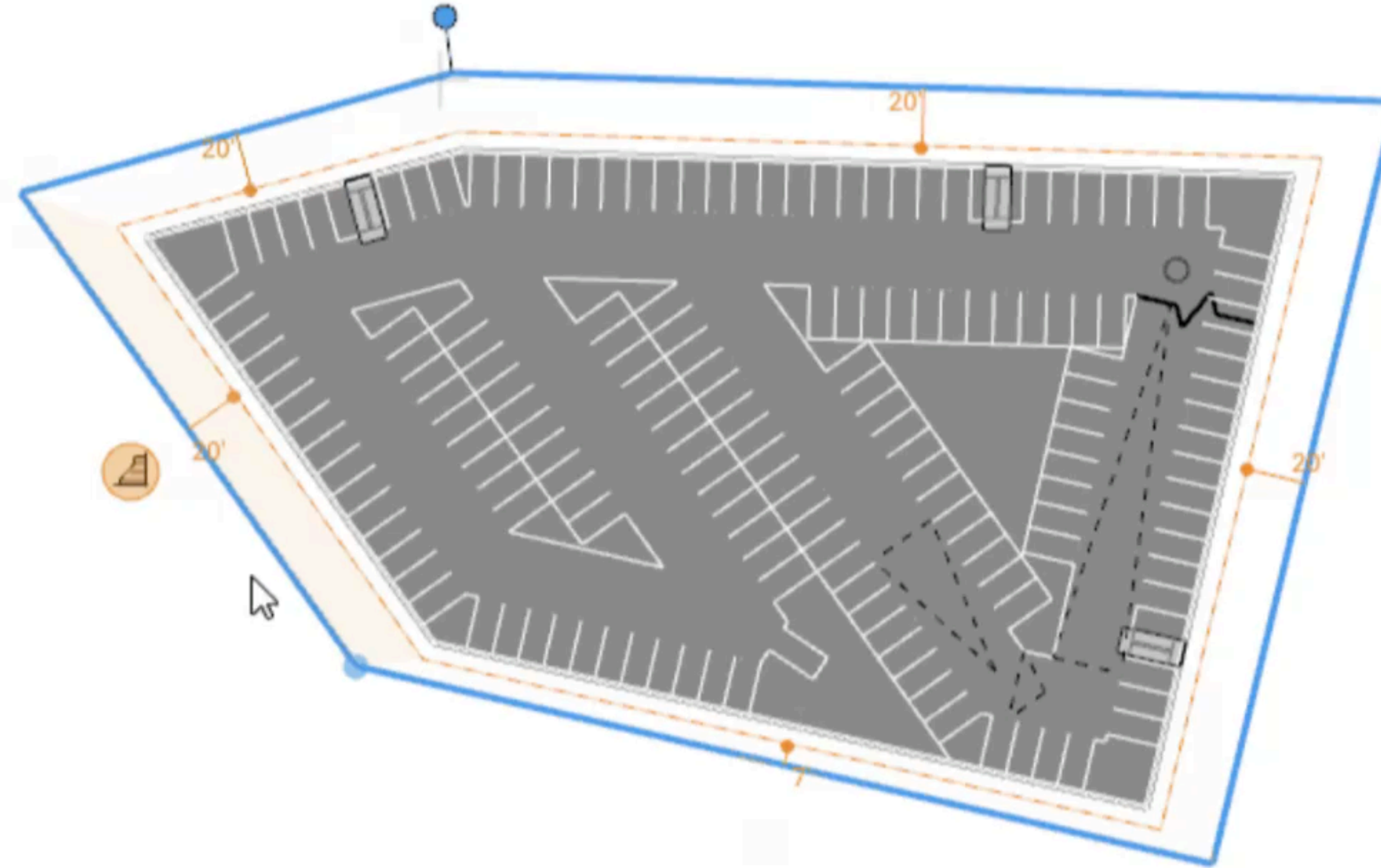
PLANFINDER

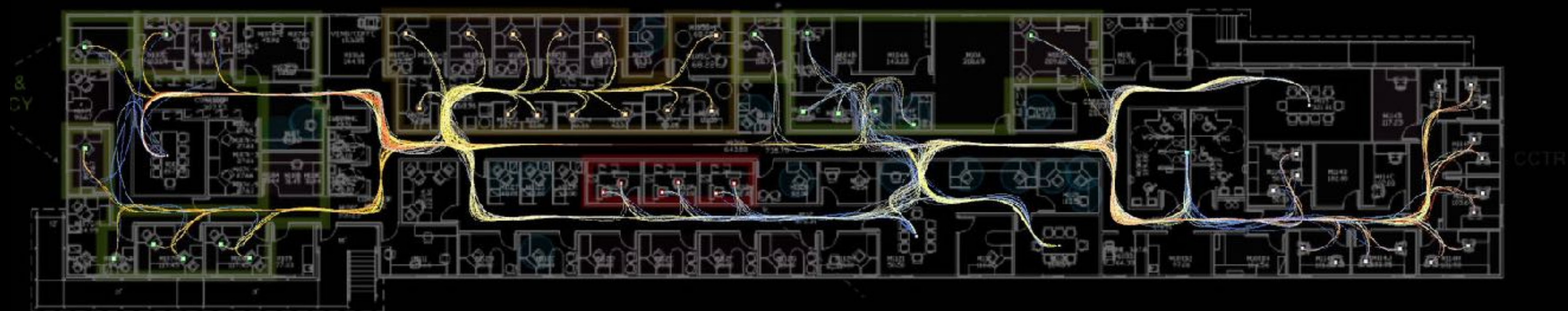
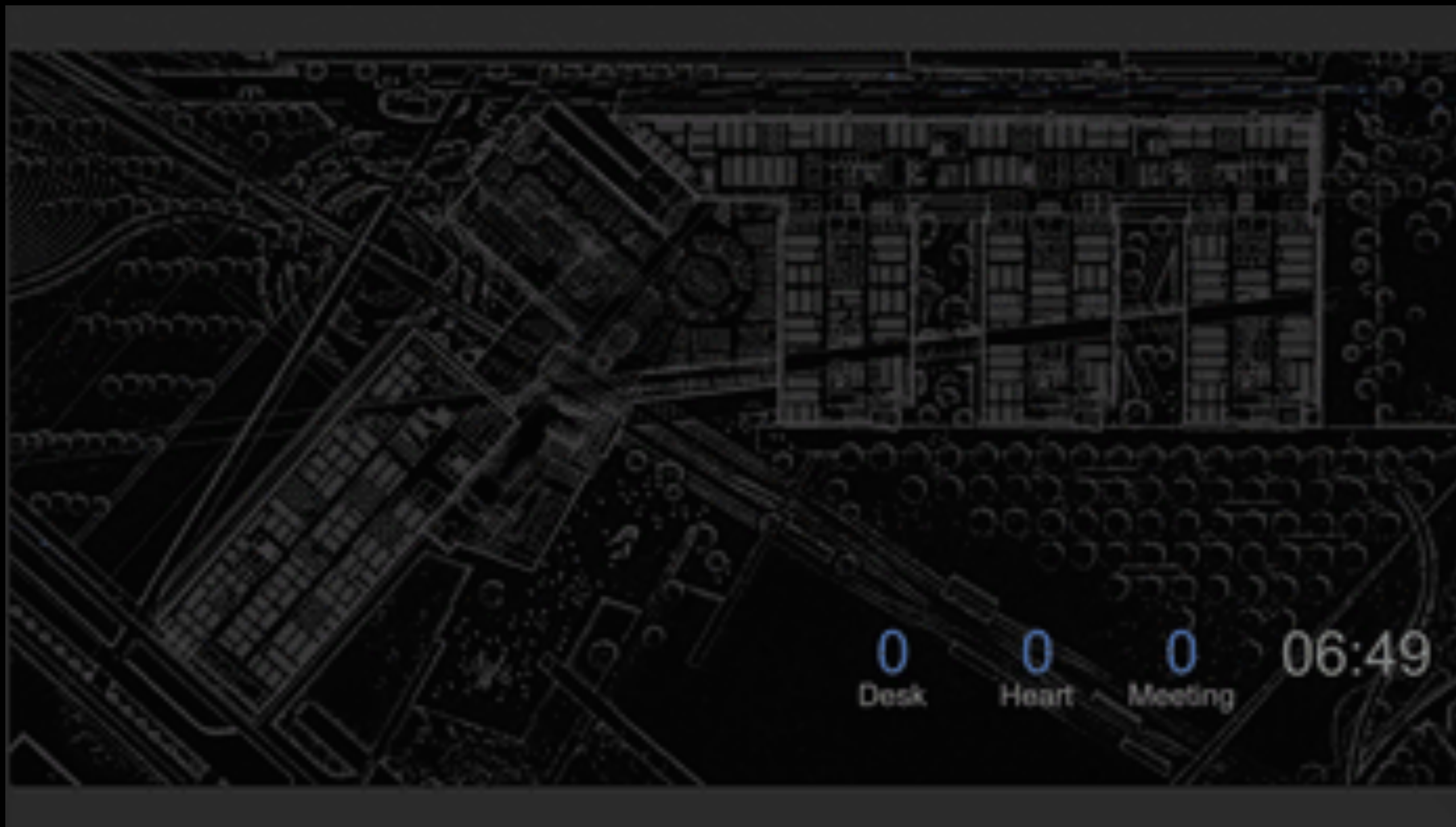


FINCH



TESTFIT





WORKFLOW

Snapshots

Import

Add Function



Obayashi Quantity Extrac...



SRI Facade By Image



About/Edit

Experimental

☐ Enable 120s Execution Limit

Reference Image

Data from a file input.

000009.png

100%

Panel Inset



0.1

☐ Sample Range

Panel Thickness



0.25

☐ Sample Range

Glass Position

What percentage along the panel thickness should the glass sit?



0.1

☐ Sample Range

Construct Parapet

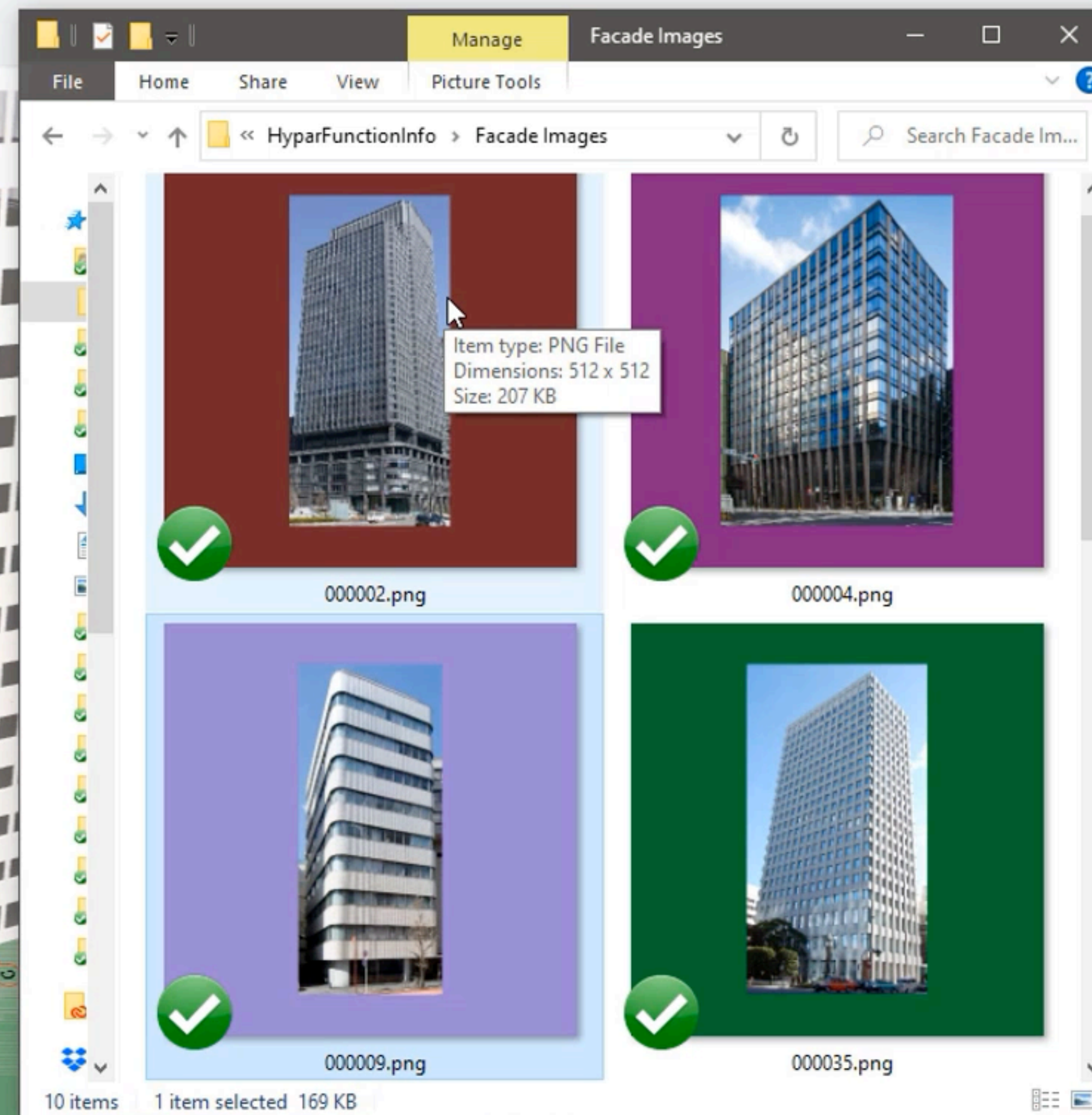


Off

☐ Sample Range

Panel Gap Size

The half size of the gap between panels



Unit

mt

m2

count

count

m2

m3

mt

m2

m2

count

m2

count

m2

count

count

m2

count

m2

m2

count

count

count

count

count

m2

m2

m2

count

count

m2

m2

count

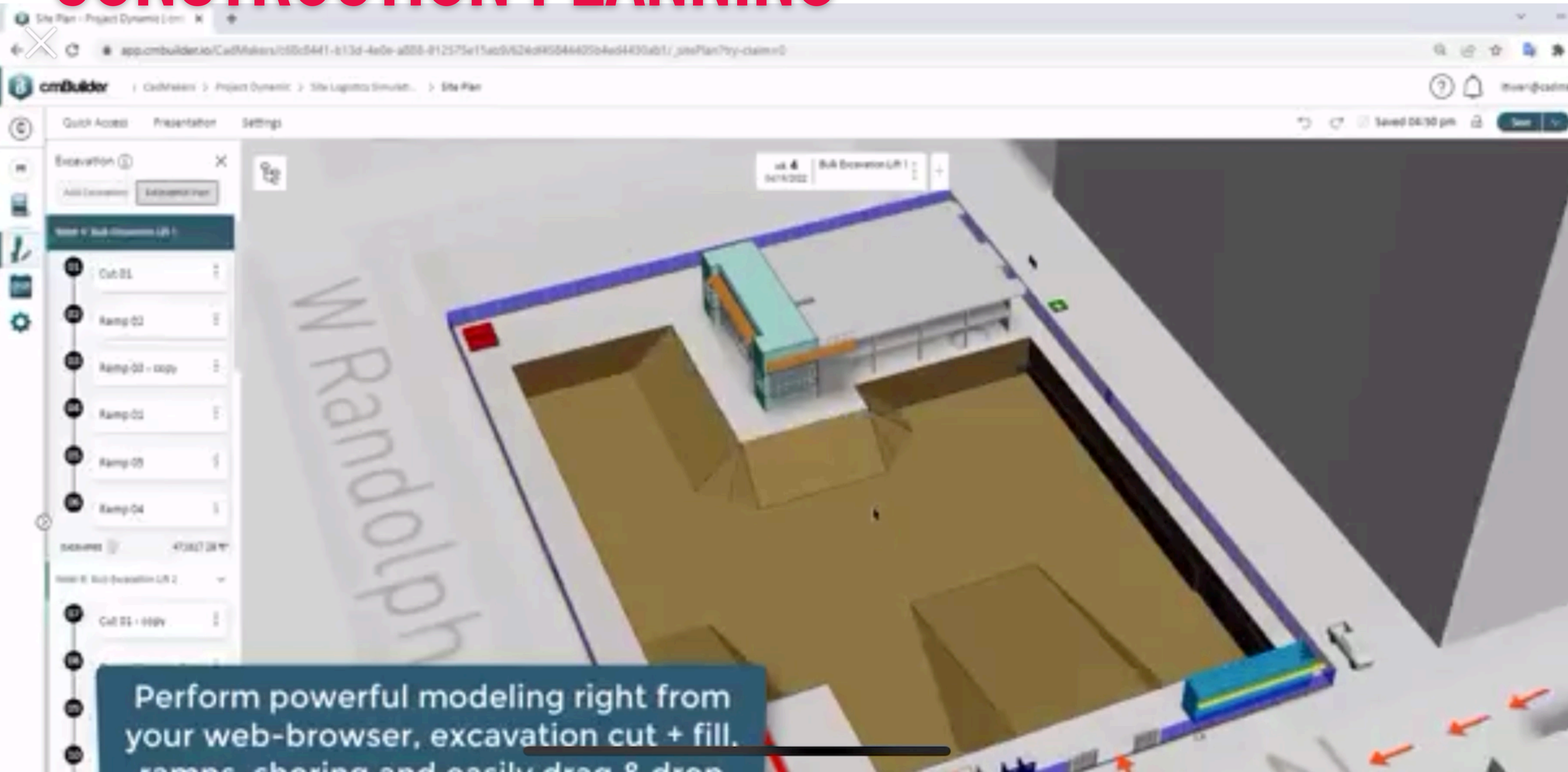
count

m2

DISRUPTIVE TECHNOLOGY IN ARCHITECTURE

Game engines & Real-time

CONSTRUCTION PLANNING

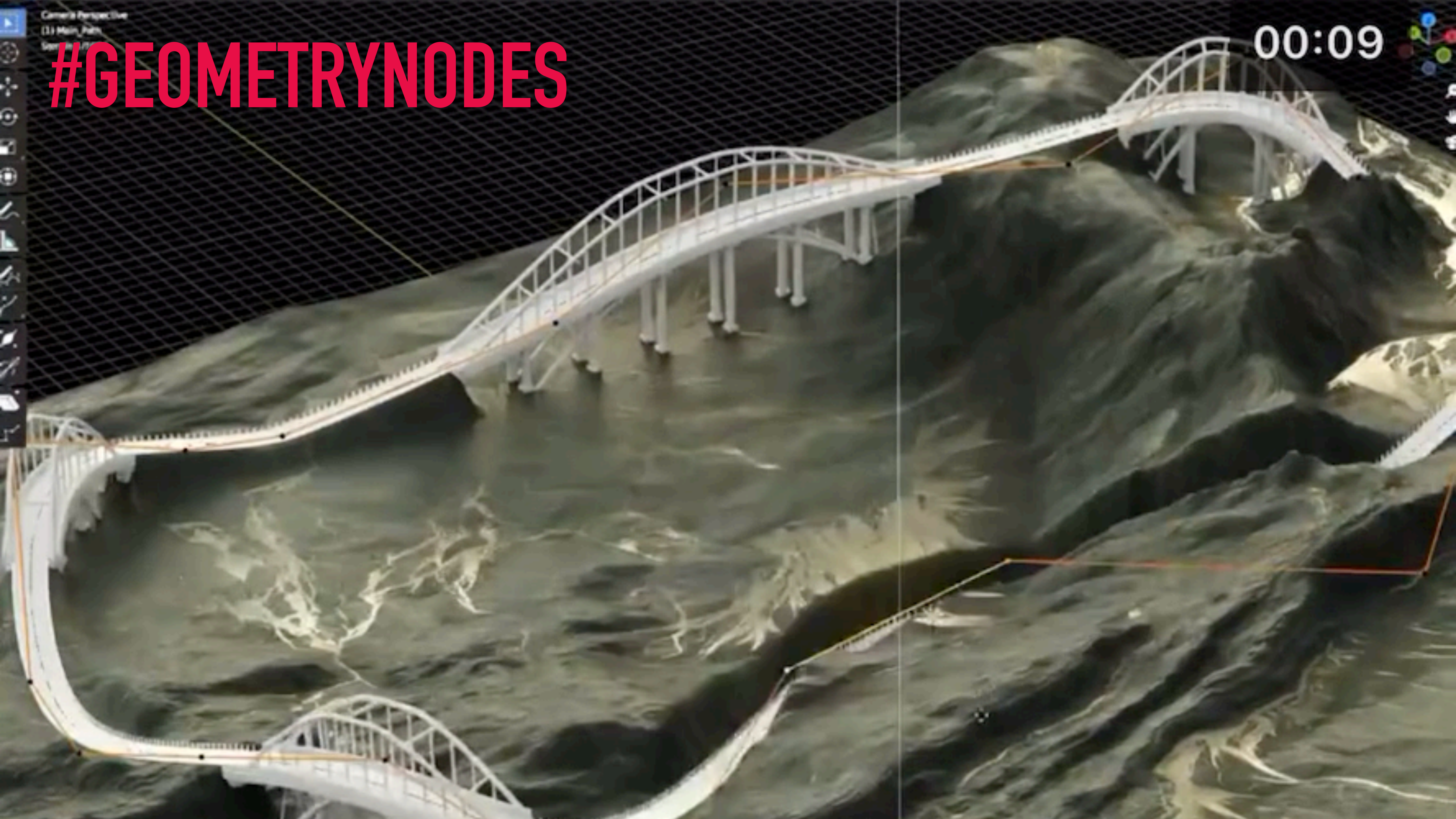


#GEOMETRYNODES



Camera Perspective
(1) Main Path
00:09

#GEOMETRYNODES



BUILD

OBJECTS

Search items

Filter items

Wall Tool

Door

Window

Wall Pattern

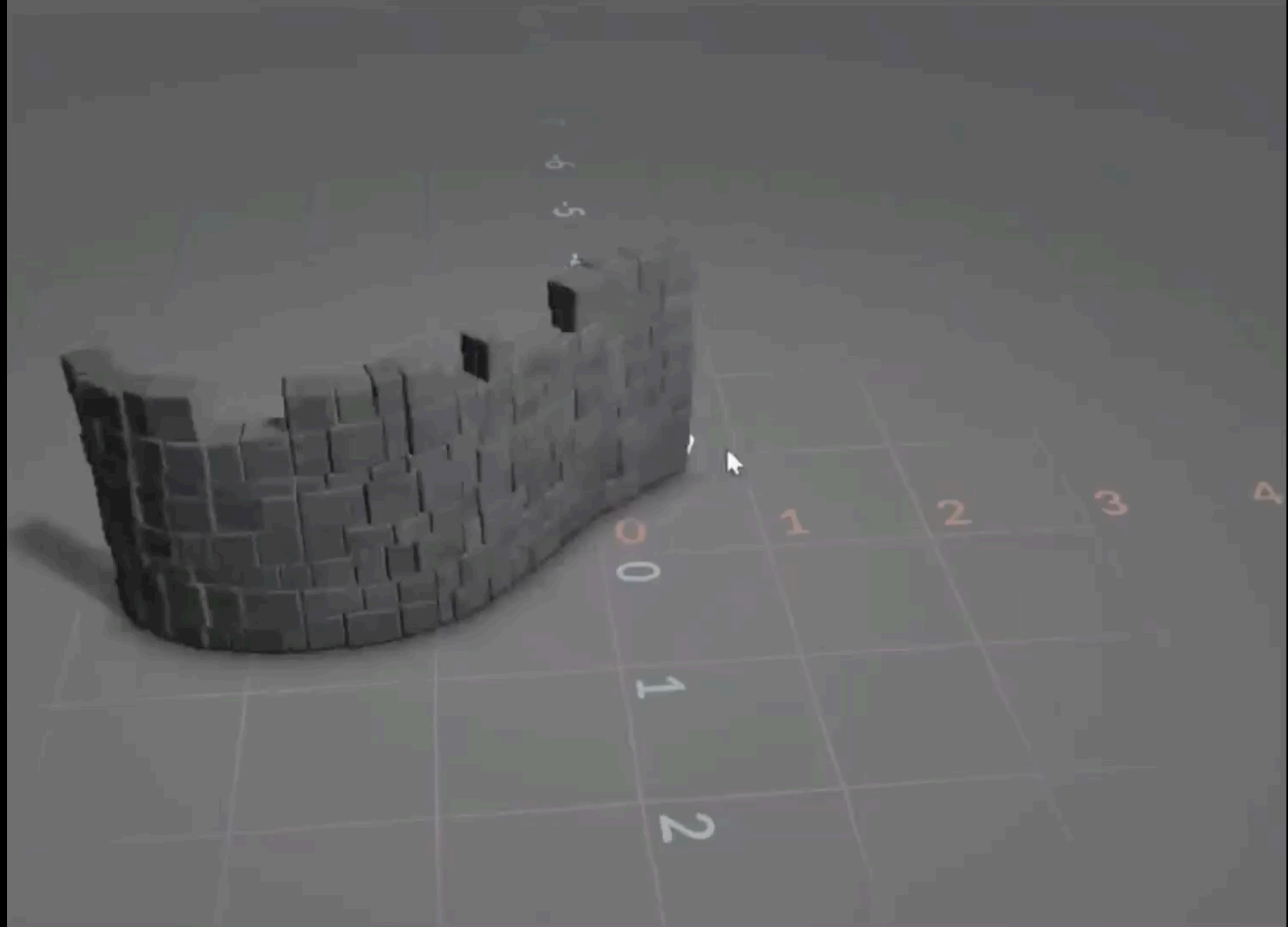
Floor Pattern



PROVIVALANDER28



JIM-122



UNREAL 5

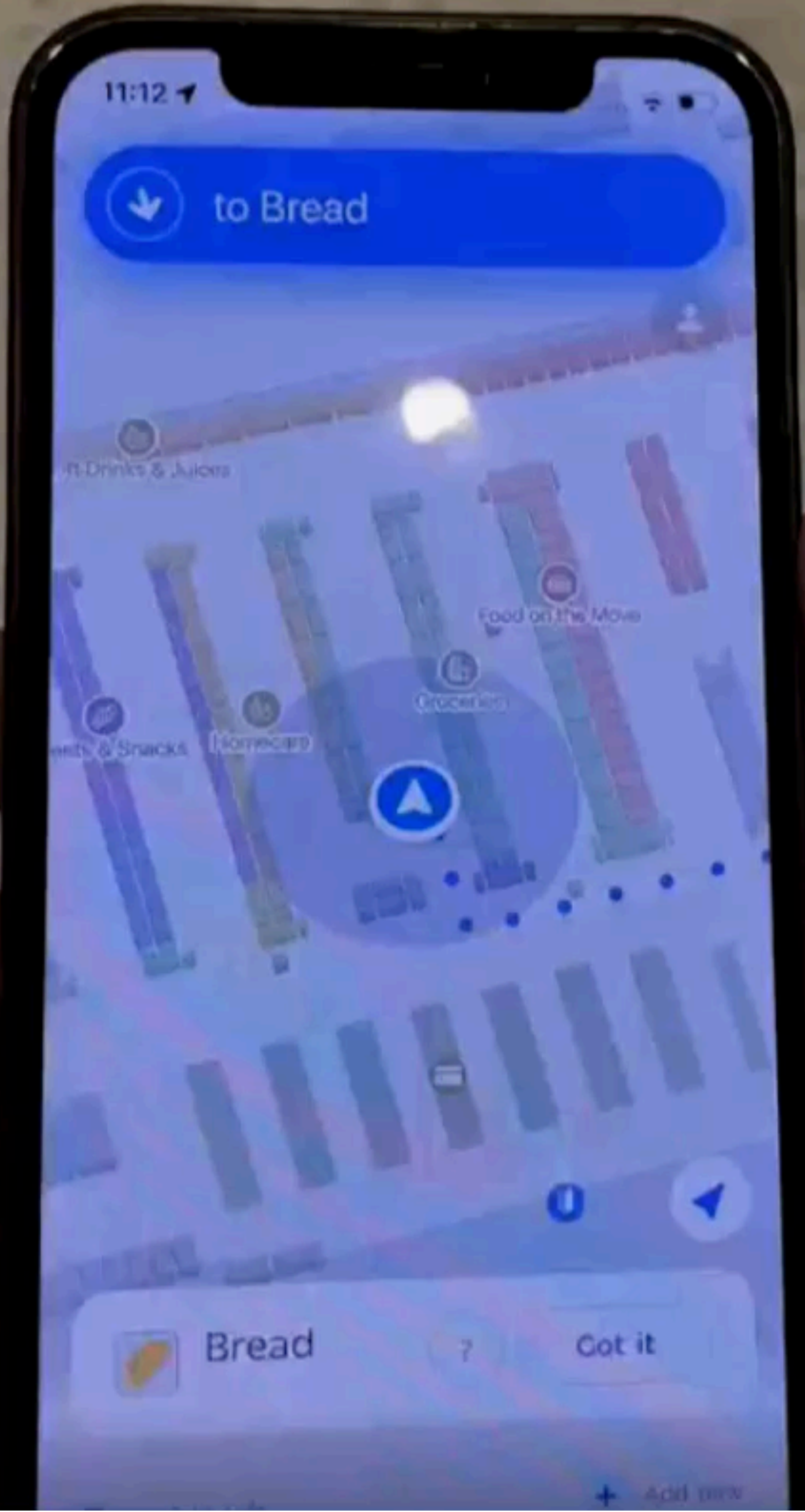


UNREAL 5



DISRUPTIVE TECHNOLOGY IN ARCHITECTURE

Augmented and Virtual Reality





Dan Burgar

+ Follow



Very cool! Disney debuts its first AR-enabled short film, 'Remembering' on Disney+. AF... [Show more](#)



00:44





RoomPlan

Approach the Marker until you see the progress circle. Complete the progress circle by shifting from left to right, to view the Marker from a range of angles.



Arkio

y'all ready for this?

DISRUPTIVE TECHNOLOGY IN ARCHITECTURE

Artificial Intelligence (AI)

DALL-E 2
Stable Diffusion
Imagen
MidJourney

how to draw an owl

1.



2.



1. Draw some circles

2. Draw the rest of the owl

How to draw an owl

1.



1. Draw some circles



2. img2img: "An owl perched on a branch, high-quality, Pixiv, WLOP, Greg Rutkowski, ArtStation. Oil on canvas."

ARCHITEXT

DESCRIBE YOUR IDEAL APARTMENT

a house with two bedrooms
and two bathrooms

CREATIVITY



Low



Medium



High

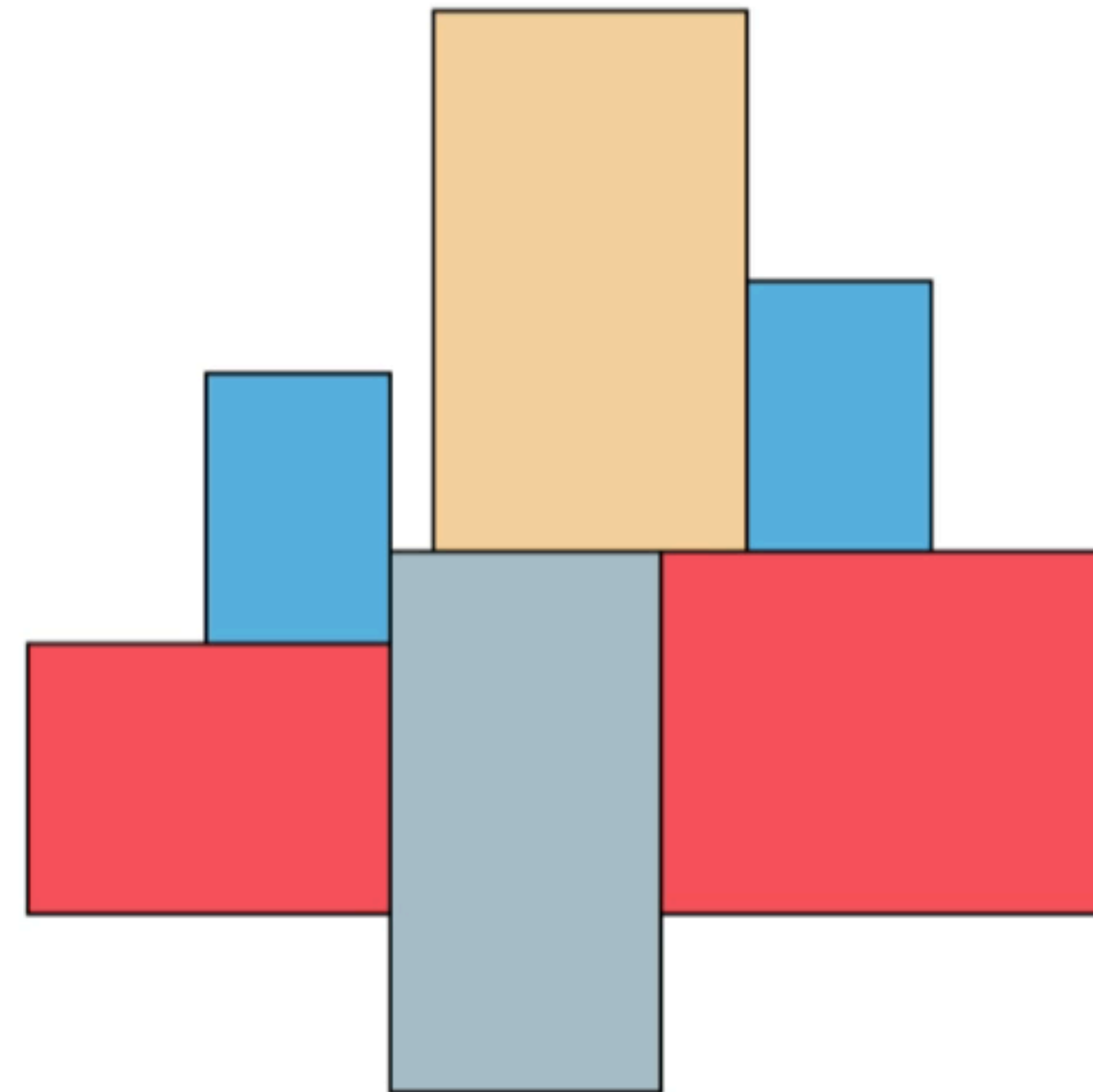
Clear

SUBMIT



GENERATED LAYOUT

2.61s



LIVING AREA BEDROOM KITCHEN BATHROOM HALLWAY

#MidJourney







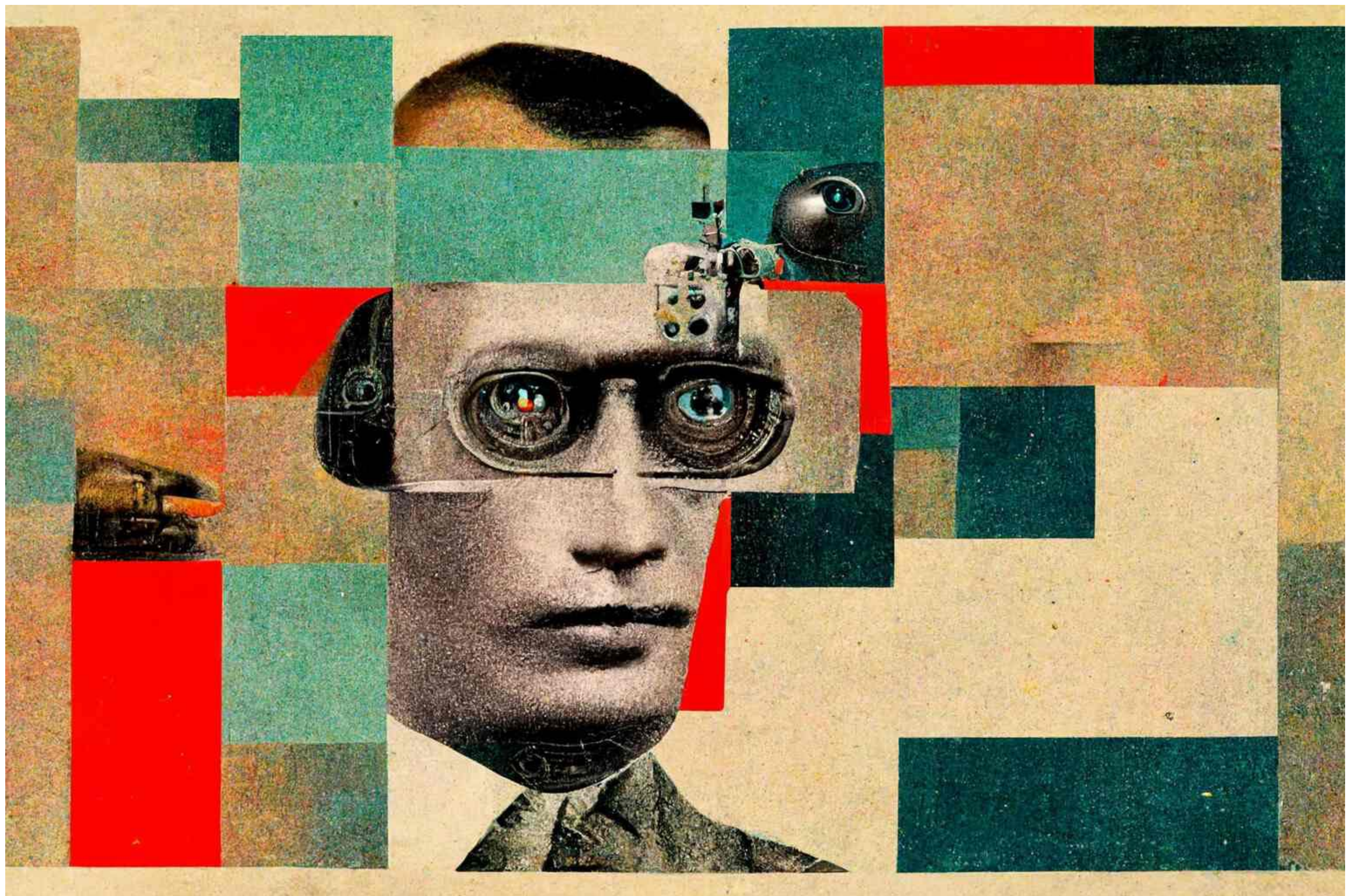


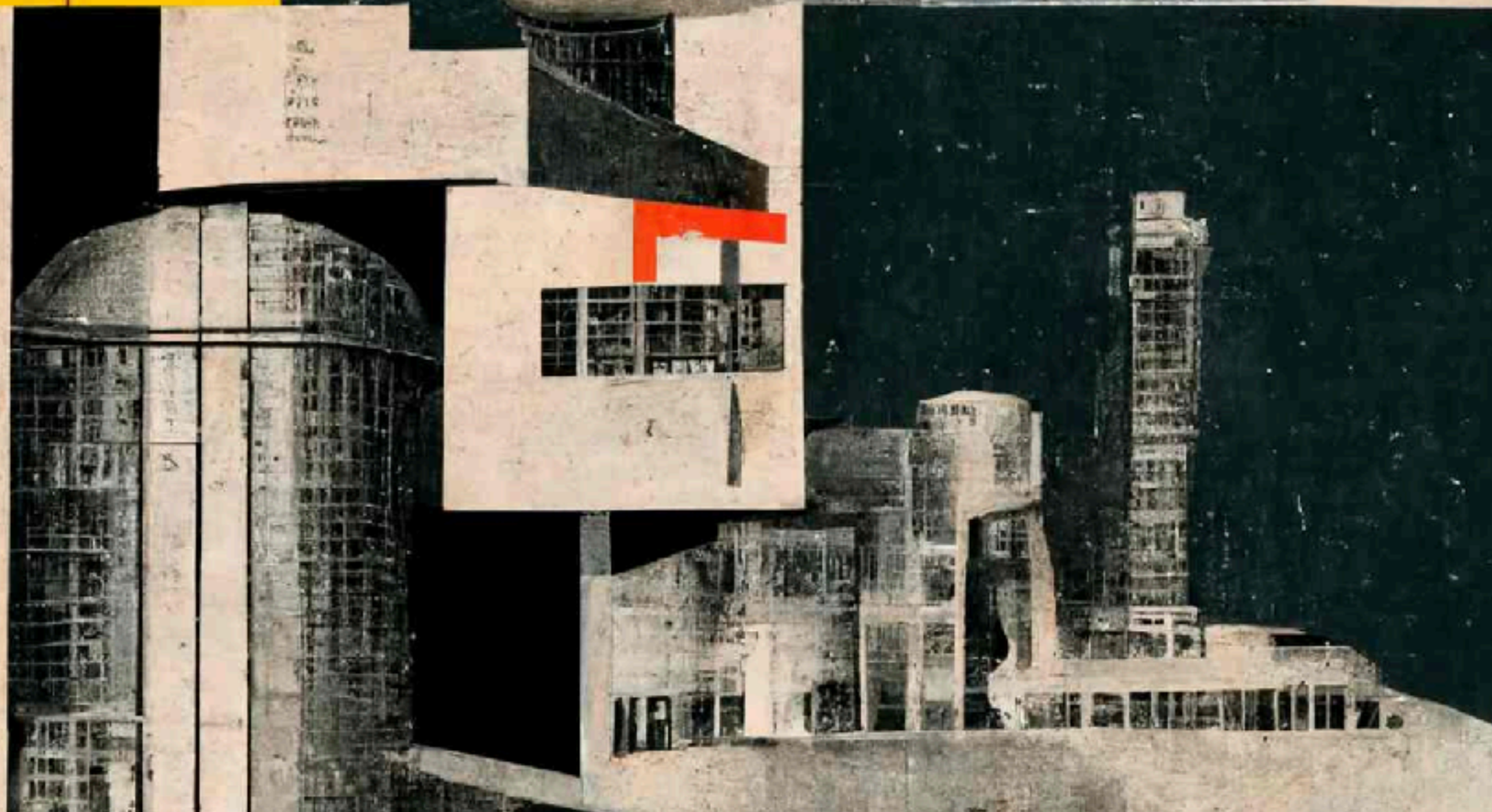
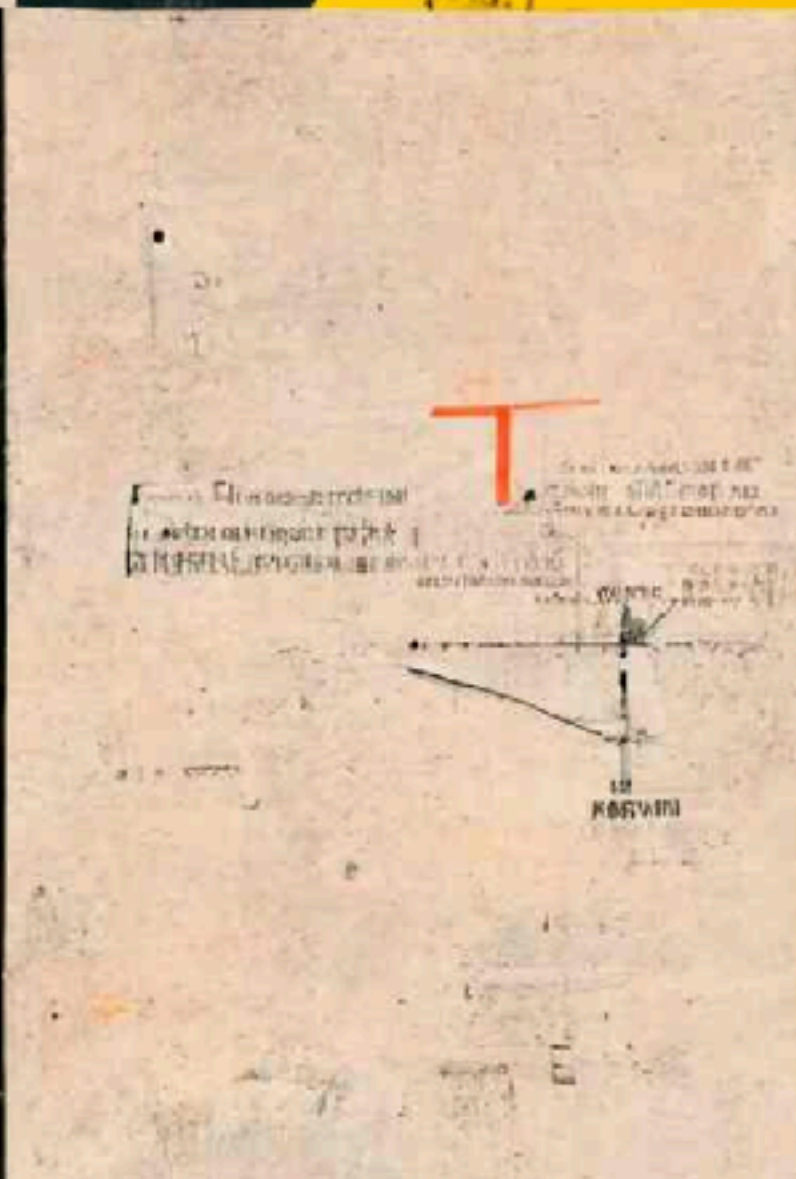
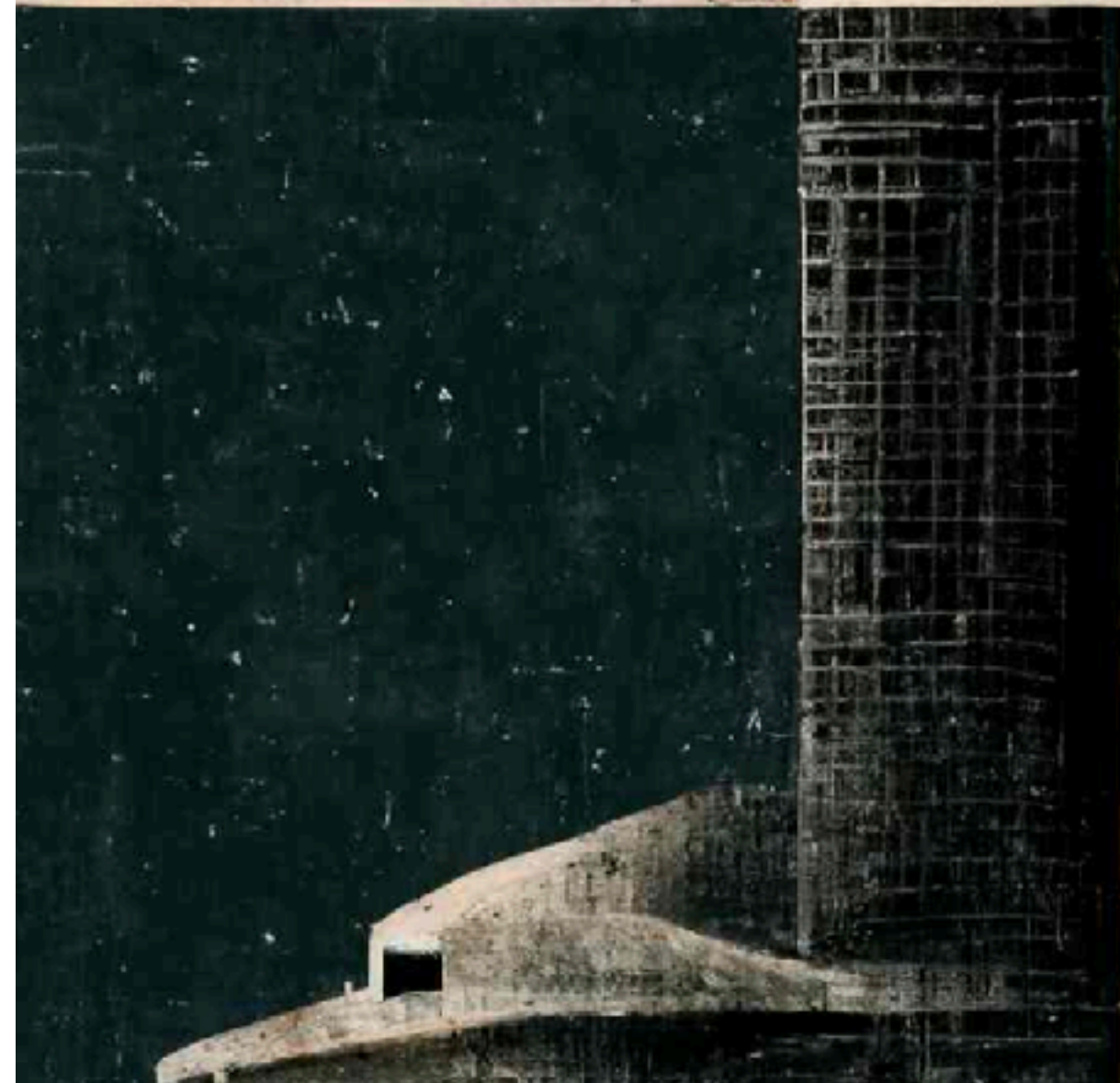
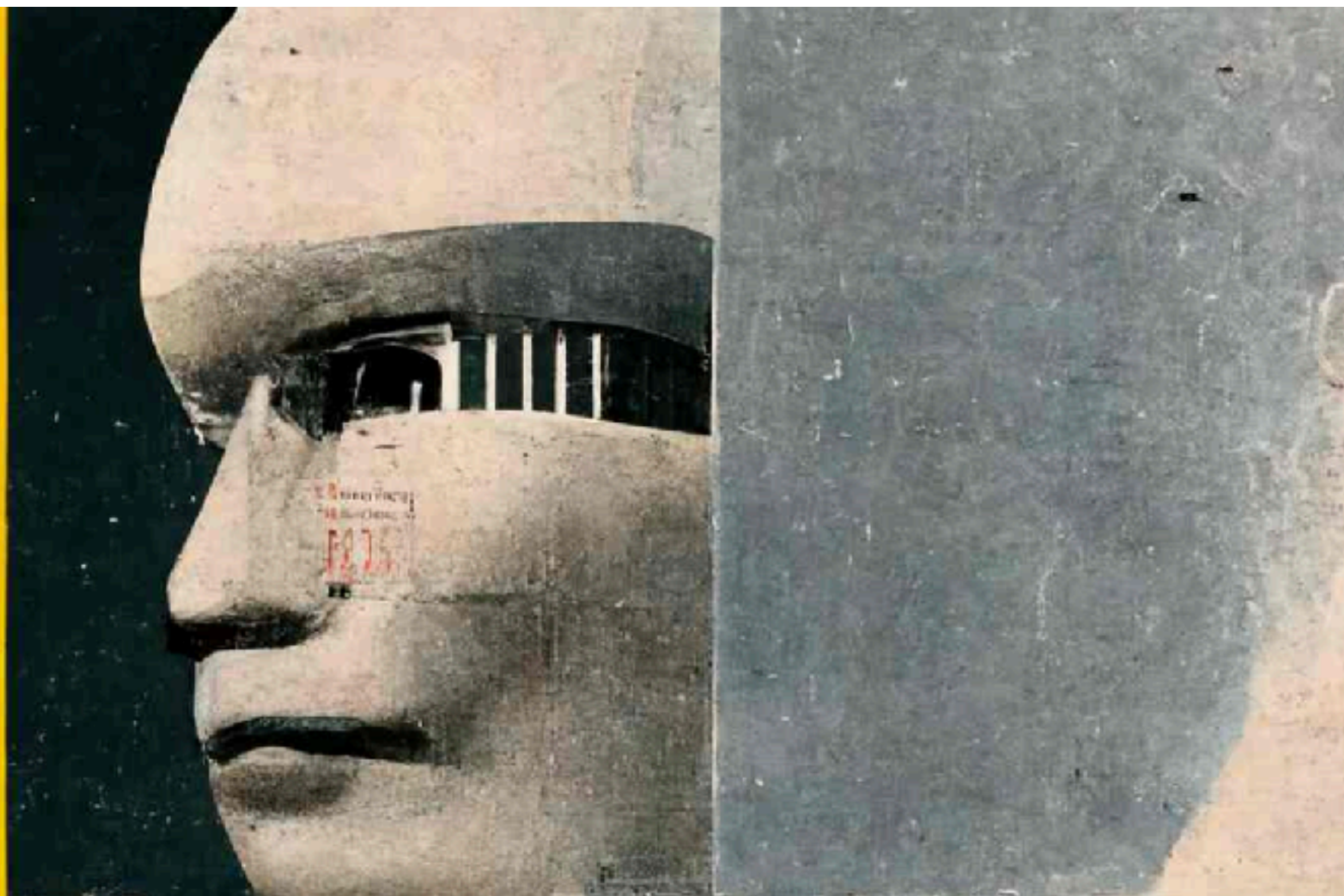
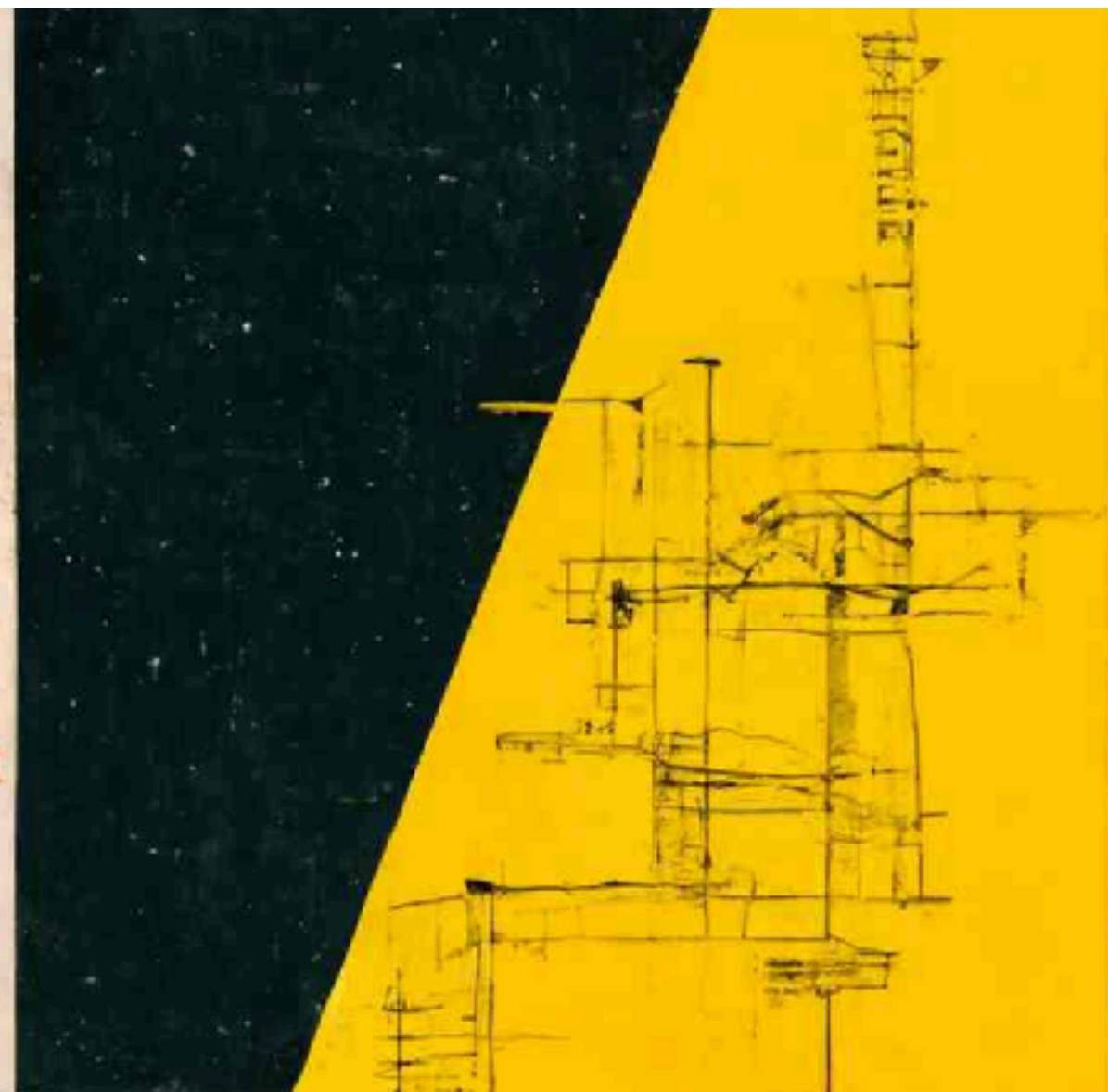








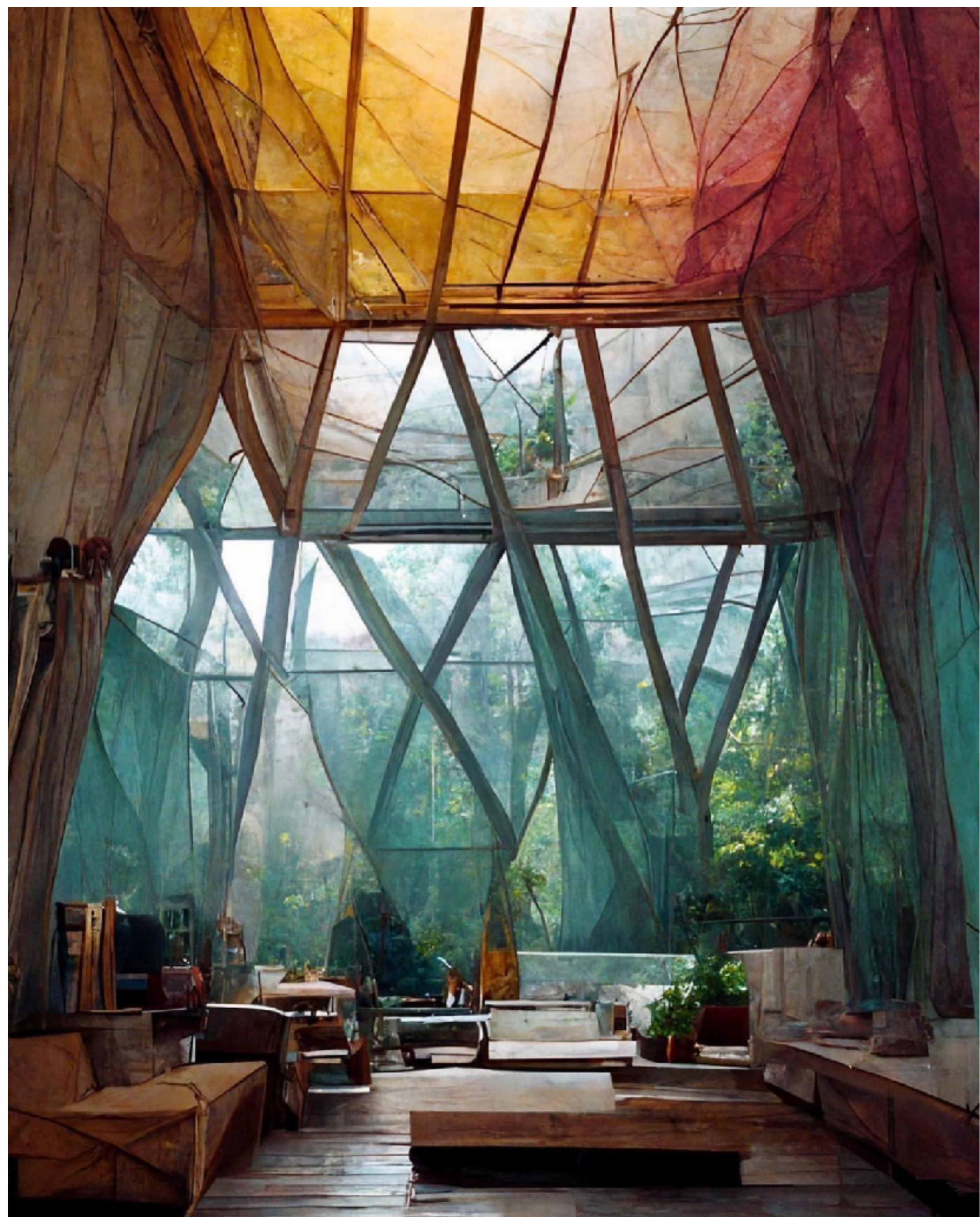




Deep breath



















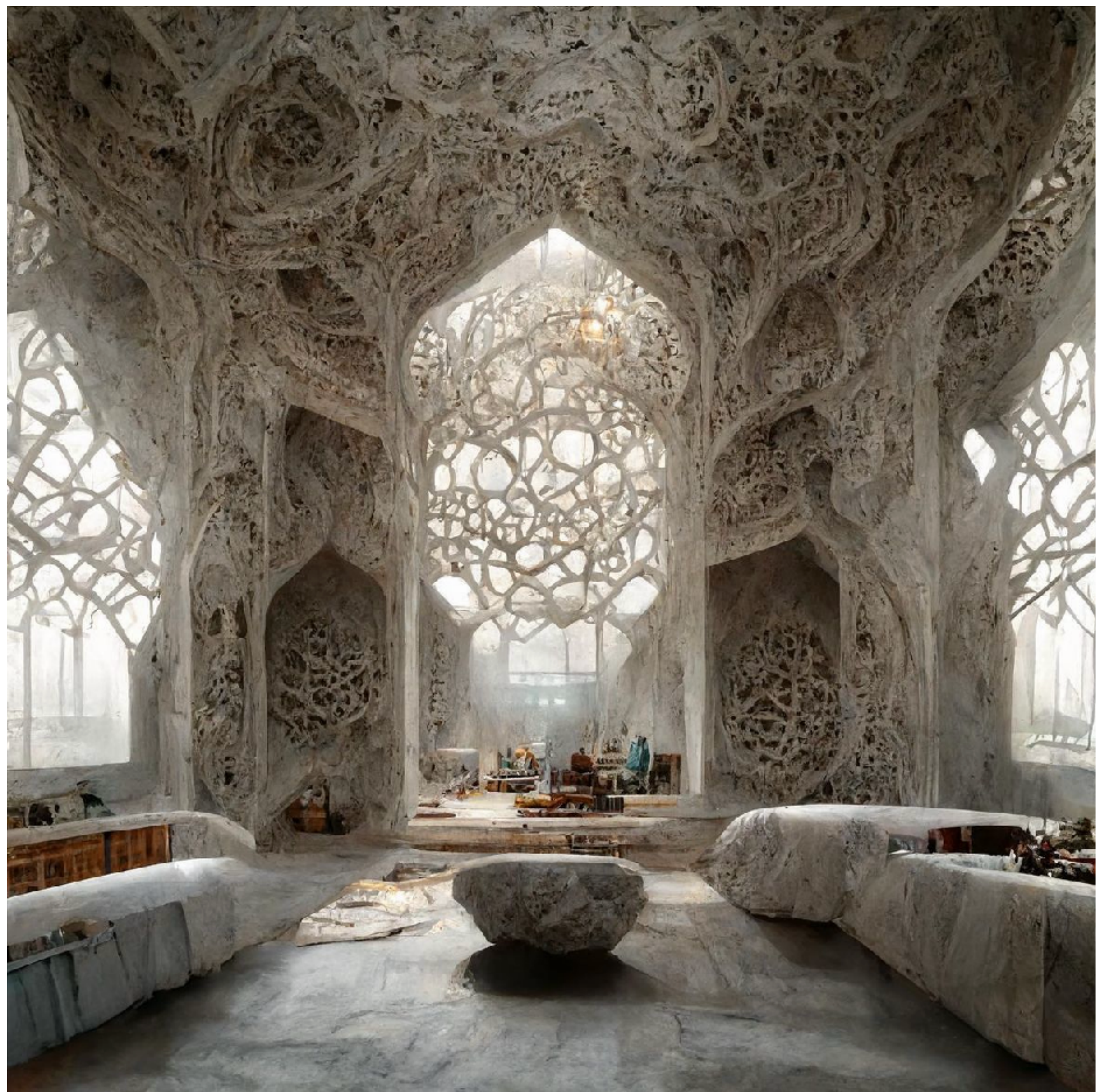


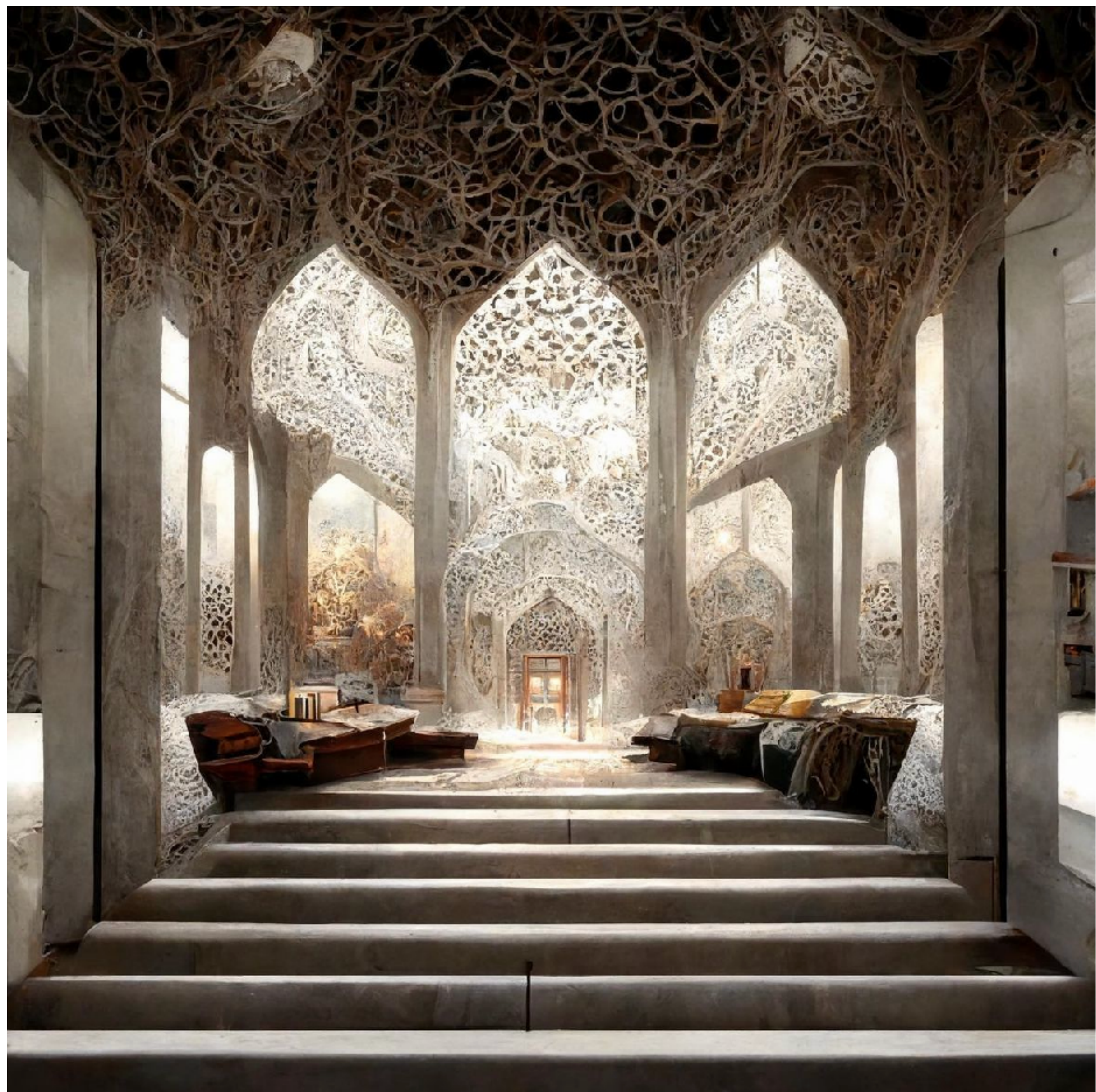
































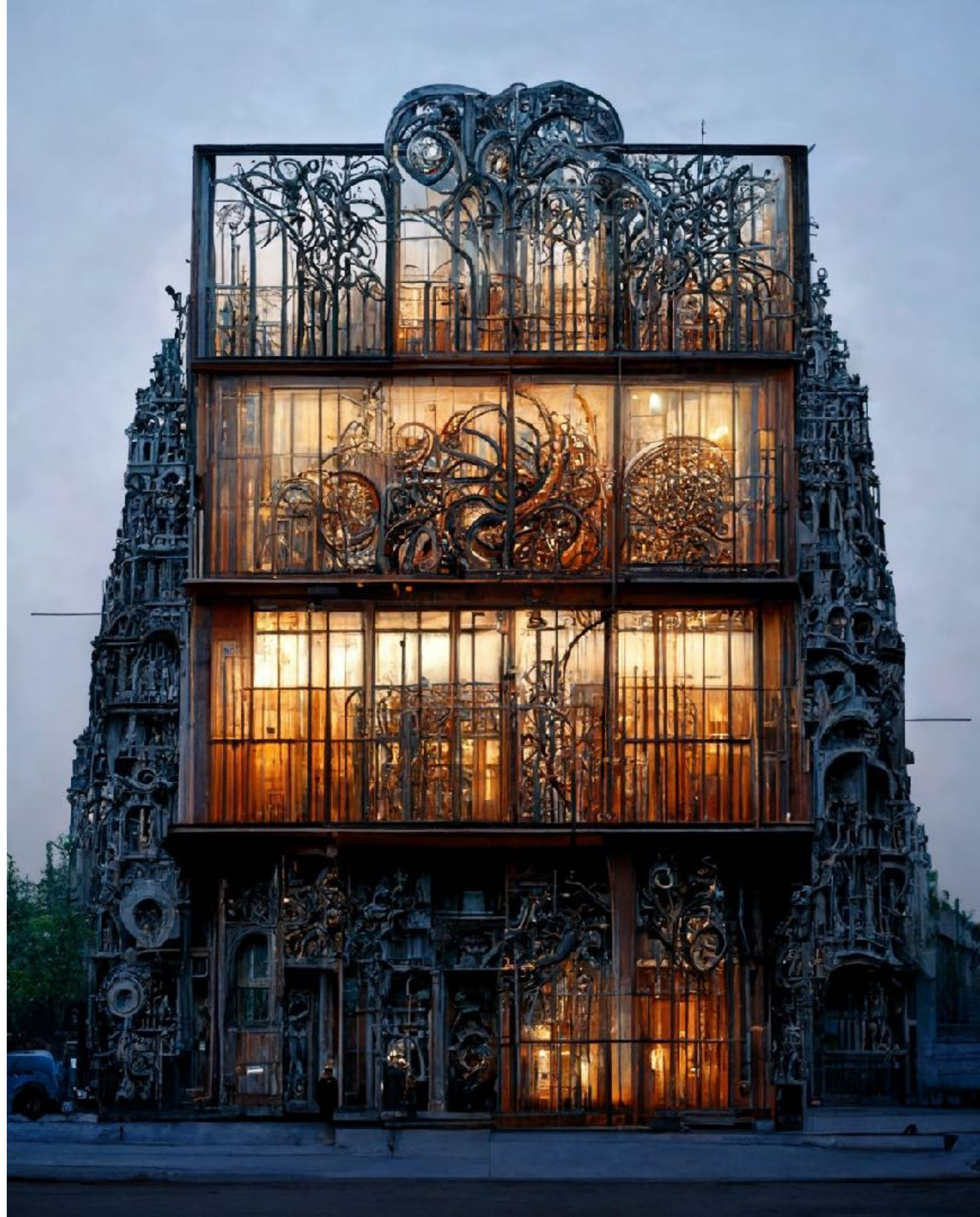


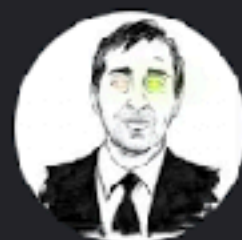












Balaji Srinivasan ✓

@balajis

Type in some words and push a button. You can get clothing without knowing how to sew.

Type in some words and push a button. You can now get a painting without knowing how to draw.

7:15 PM · 9/11/22 · [Twitter for iPhone](#)

38 Retweets **15** Quote Tweets **590** Likes



Balaji Srinivasan ✓ @balajis · 12h

Replying to [@balajis](#)

Many professions once considered arts were turned into sciences, then made routine

Just like a human-programmed machine can create better & cheaper clothes than almost any unaided human, a human-programmed machine can now create better & cheaper art than almost any unaided human

Image Prompt

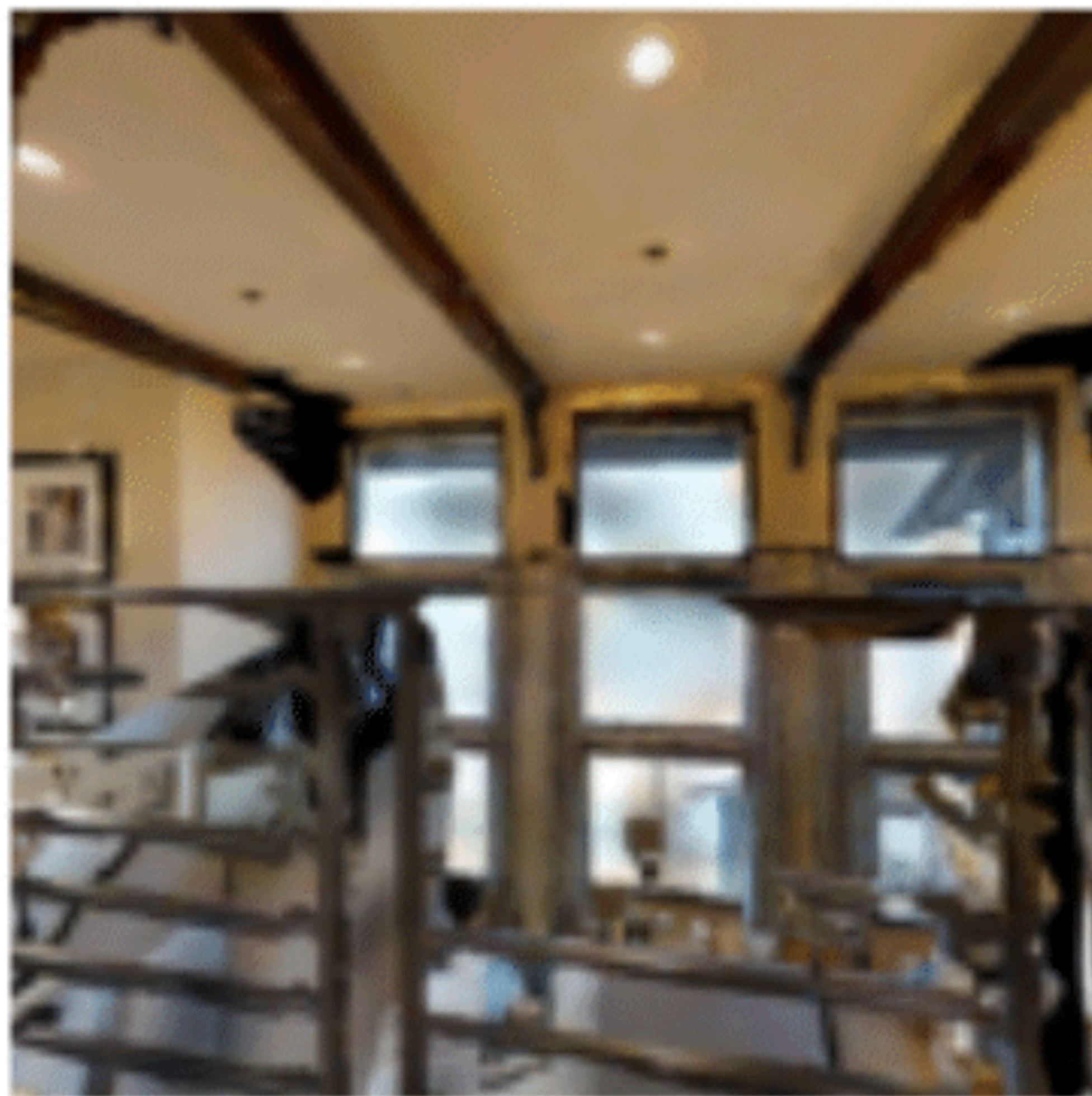
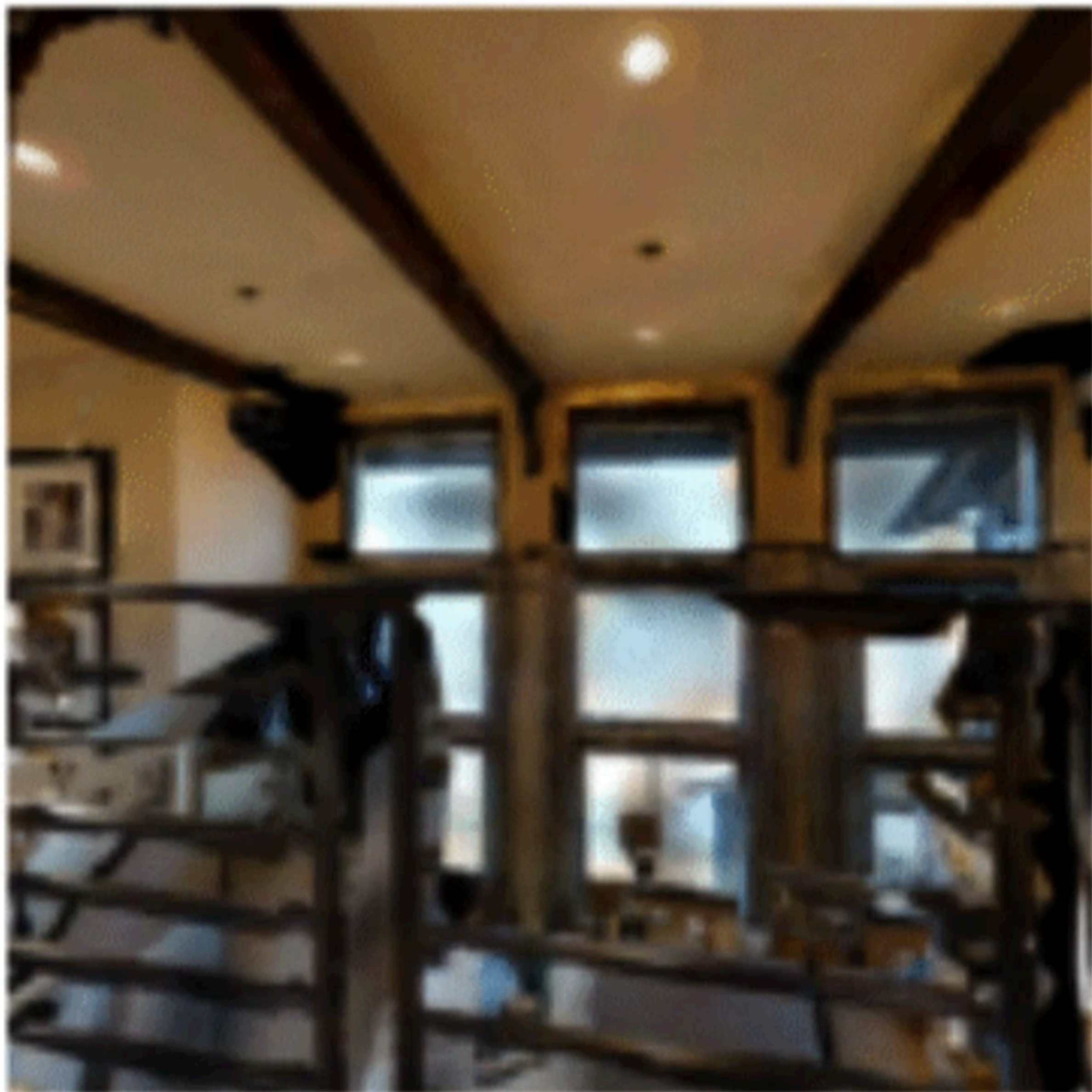
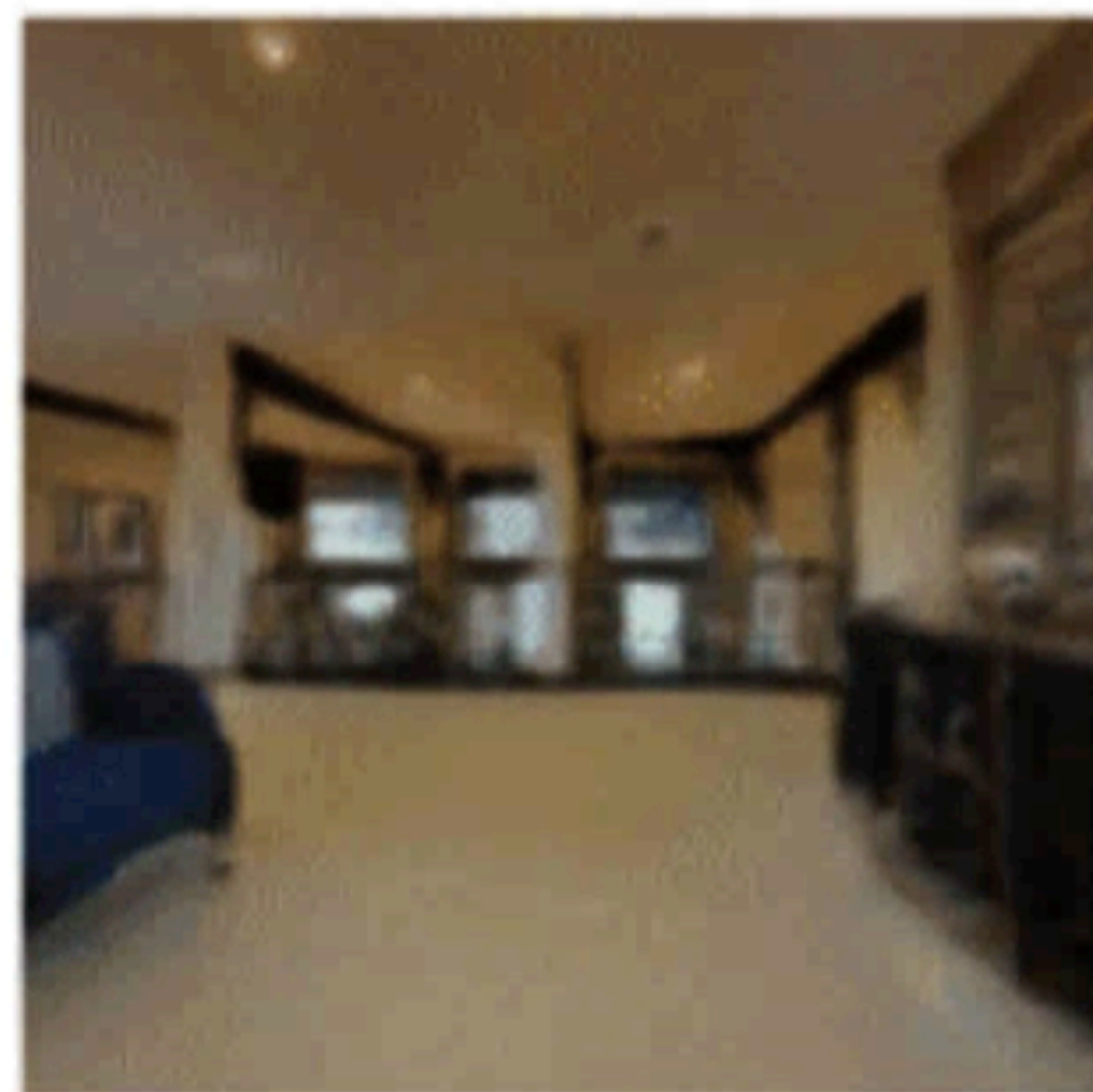
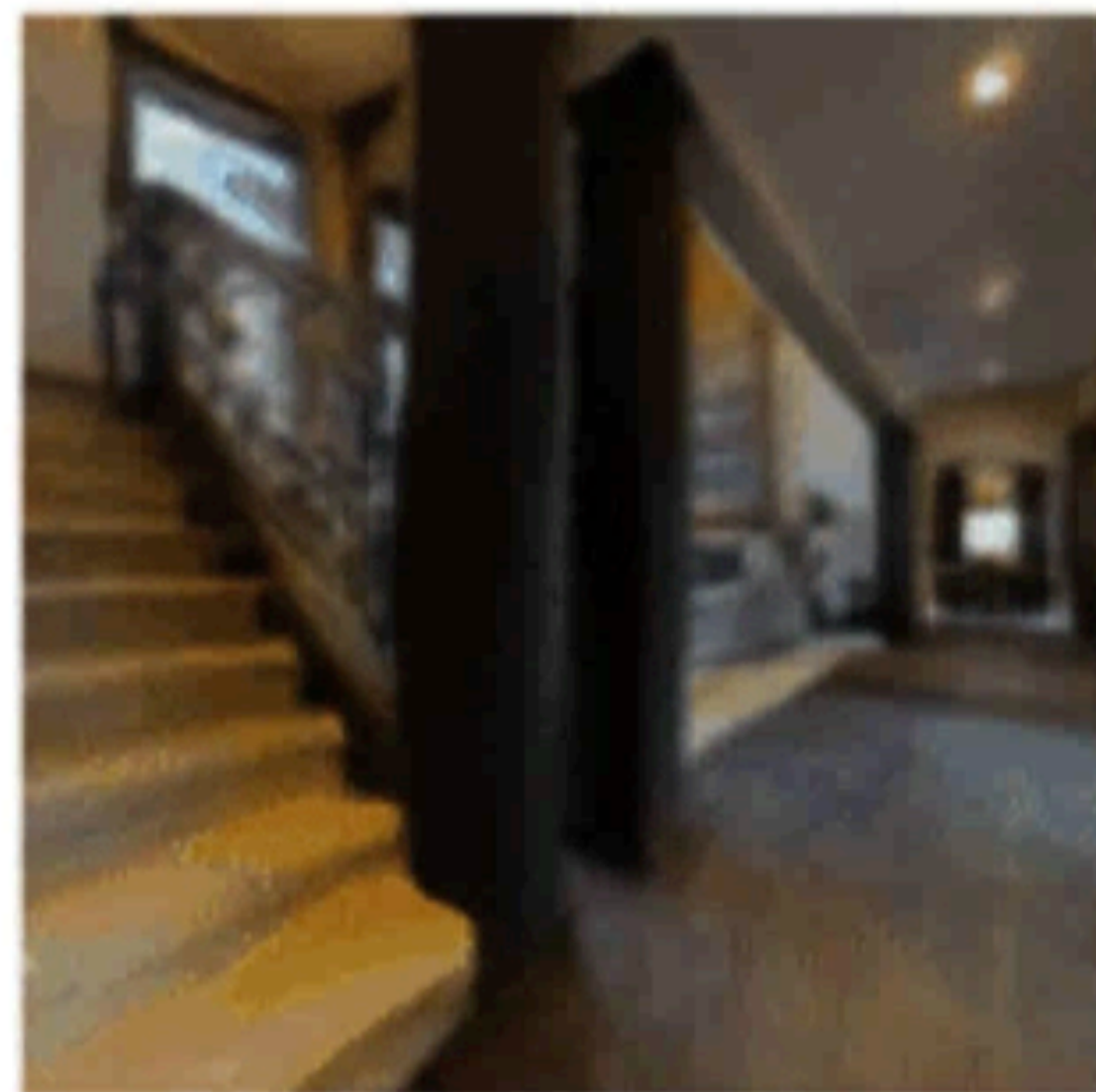


Image Prompt

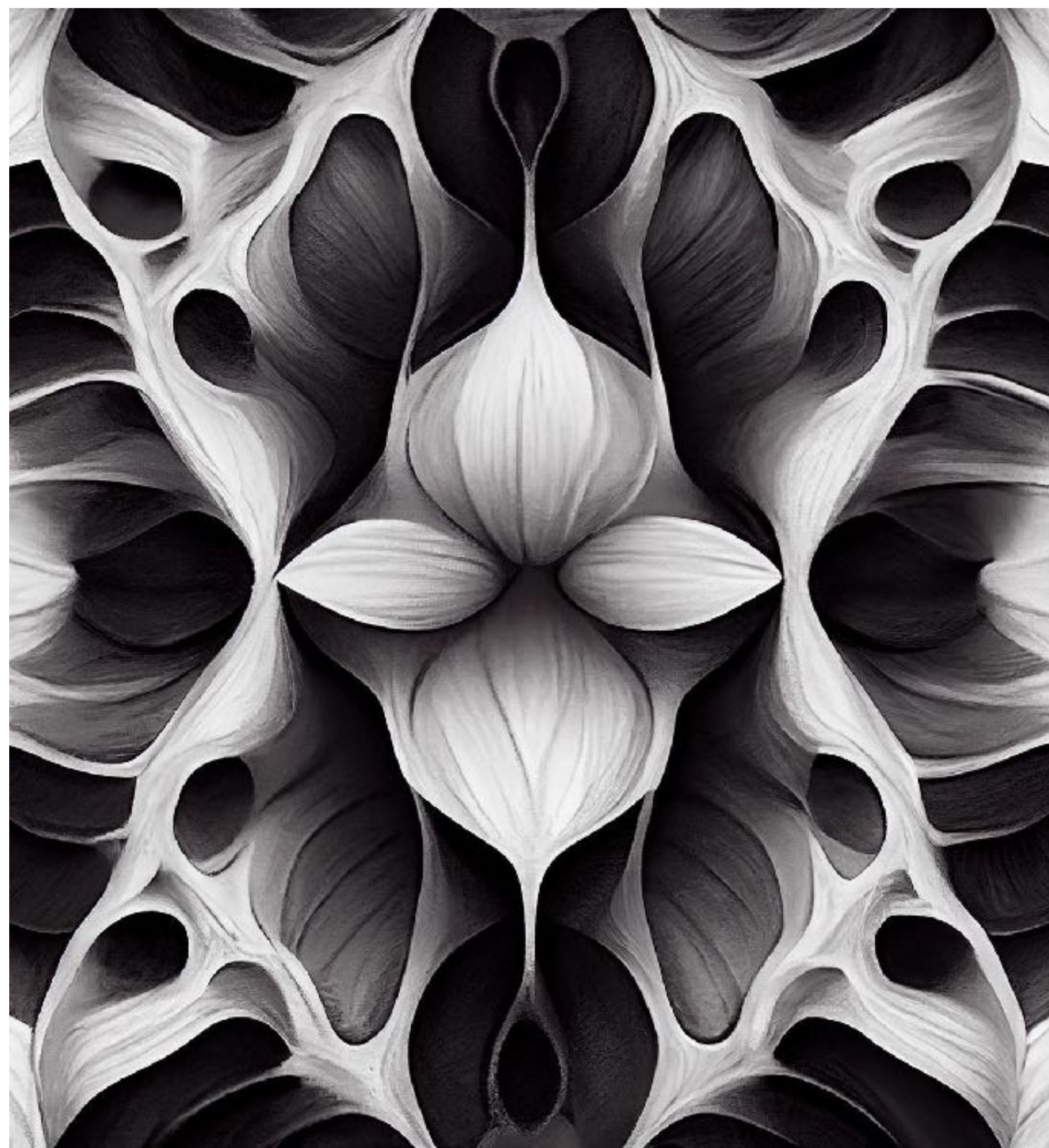


Generated Output



<https://github.com/apple/ml-gaudi>







Balaji Srinivasan ✓ @balajis · 23h

The impact of AI on employment is non-obvious. It doesn't just end jobs, it creates new ones.

For example, learning to prompt is much easier than learning to code. So, it might be relatively easy to retrain people to become prompt engineers.



tobi lutke ✓ @tobi · 8/24/22

AI can now draw the owl.
#stablediffusion

How to draw an owl

1.



1. Draw some circles

2. img2img: "An owl perched on a branch, high-quality, Pixiv, WLOP, Greg Rutkowski, ArtStation. Oil on canvas."



46



123



645





Balaji Srinivasan ✓ @balajis · 23h

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46 123 645



Balaji Srinivasan ✓
@balajis

A rough guess as to how AI disruption of art could play out.

- Anyone can now create decent art
- Good artists become exceptional
- And great art *critics* may suddenly become great artists

So, less jobs for artists...but more for art historians?!



Balaji Srinivasan ✓ @balajis · 8/12/22

Art history: now an applied subject.

"A portrait of a knight with plate mail armor and a longsword in the style of [Rembrandt, René Magritte, Claude Monet, Pablo Picasso]."

[Show this thread](#)





Balaji Srinivasan ✓ @balajis · 23h

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Balaji Srinivasan ✓ @balajis · 8/12/22

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[Show this thread](#)



Jason Ballard
@JasonDBallard

Conventional wisdom was AI wouldn't impact creative fields (art, architecture, etc.) for a long time if ever. Dall-E and Midjourney are a wakeup. The most surprising but immediately obvious thing about these tools is that they inspire human creativity, not replace it.

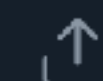
7:54 AM · 8/29/22 · [Twitter Web App](#)

1 Quote Tweet 24 Likes



Jarett Gross @JarettGross · 7h
Replying to [@JasonDBallard](#)

Maybe even amplify



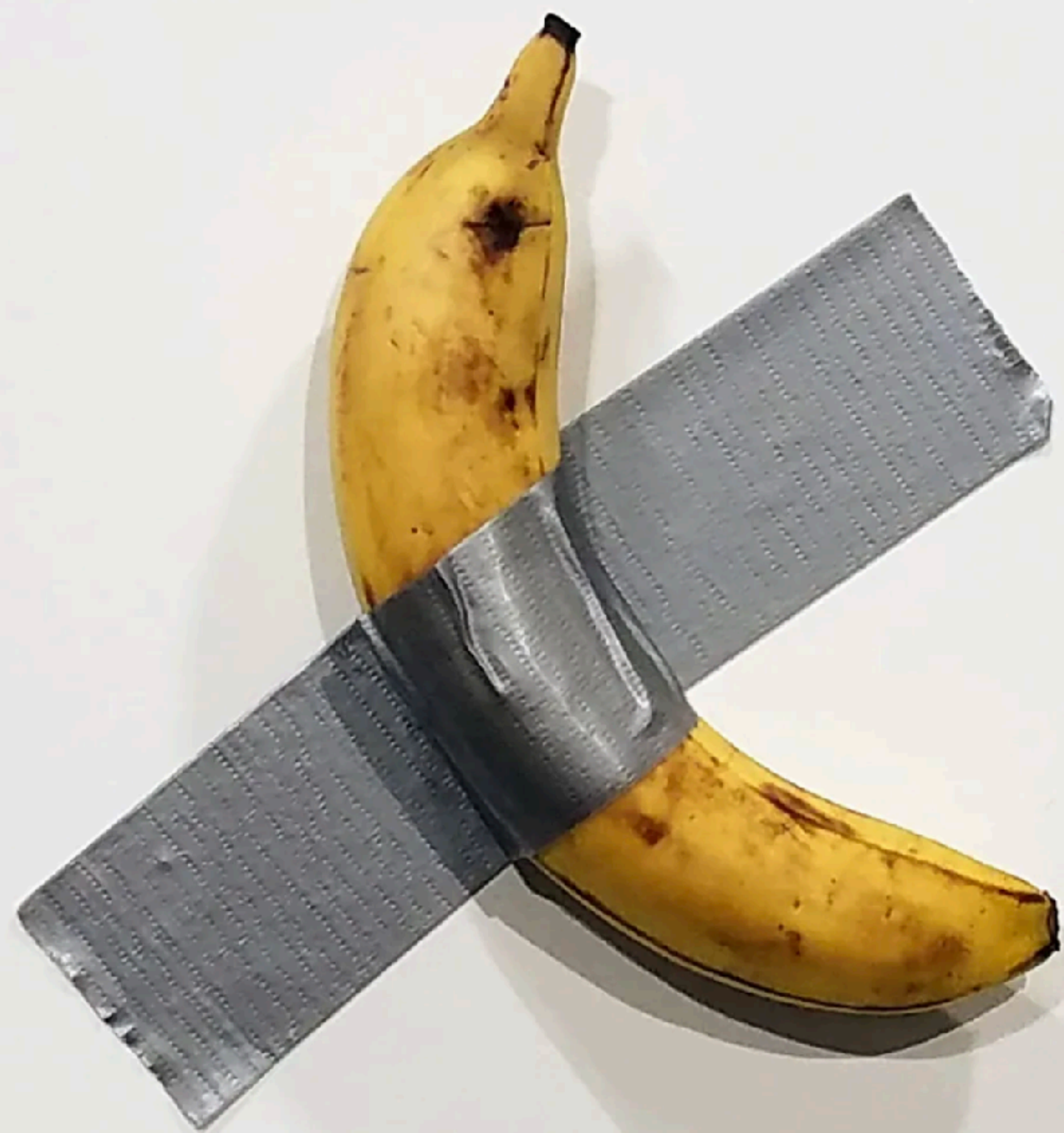
***An A.I.-Generated Picture Won an Art
Prize. Artists Aren't Happy.***

An A.I.-Generated Picture Won an Art Prize. Artists Aren't Happy.

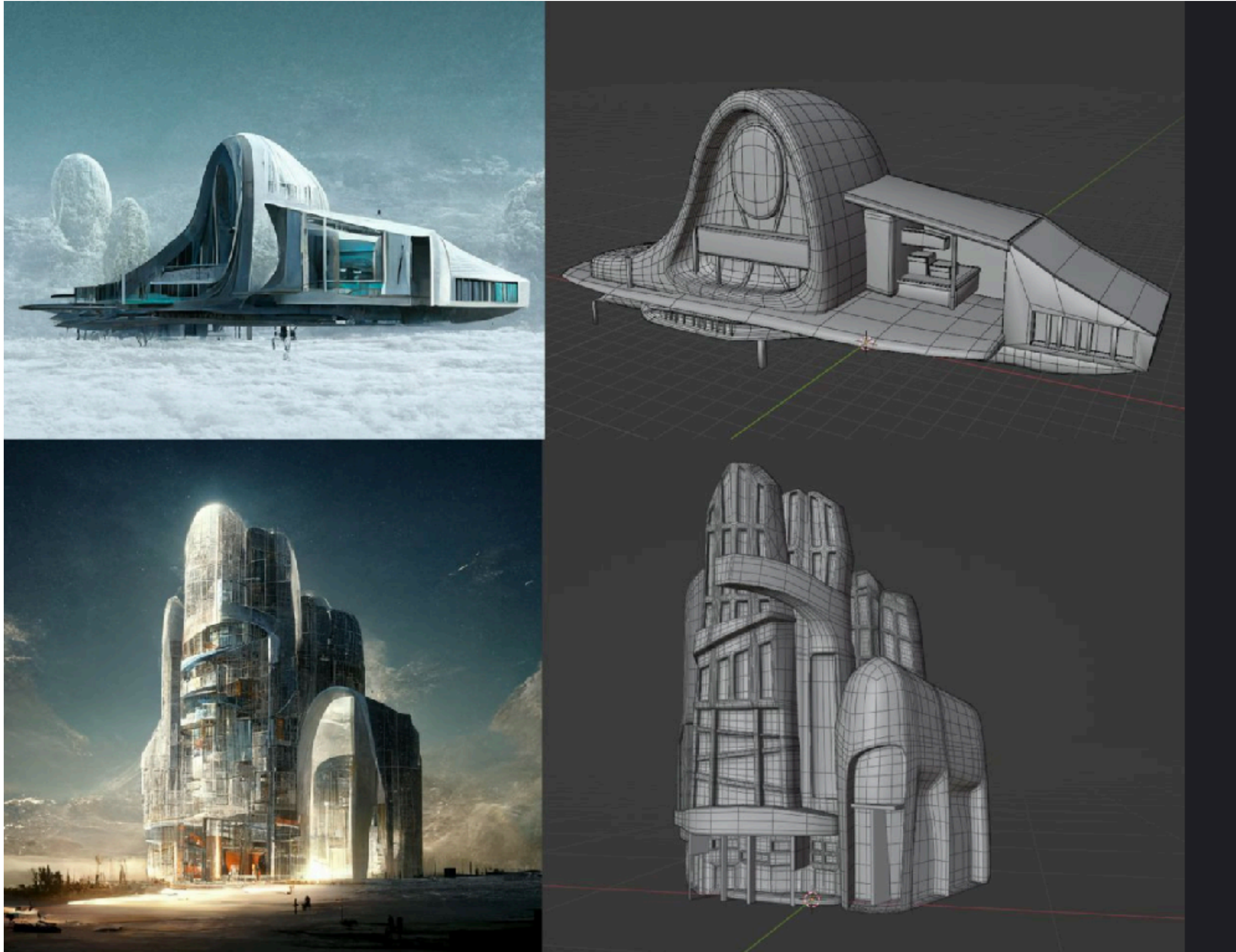
"I won, and I didn't break any rules," the artwork's creator says.



Jason Allen's A.I.-generated work, "Théâtre D'opéra Spatial," took first place in the digital category at the Colorado State Fair. via Jason Allen



KAEDIM



Joe Garth · 3rd+
Founder at Brushify.io
3h · Edited · 🌐

[+ Follow](#)



We have arrived: AI generated concept art to AI generated clean quad topo 3d Mesh. It even separates the mesh into separate parts in a logical way. Still a lot of work needed for detailing etc, but for generating complex/interesting shapes this is incredibly disruptive and groundbreaking technology. This will shake the art/3d world and change the way we create art.

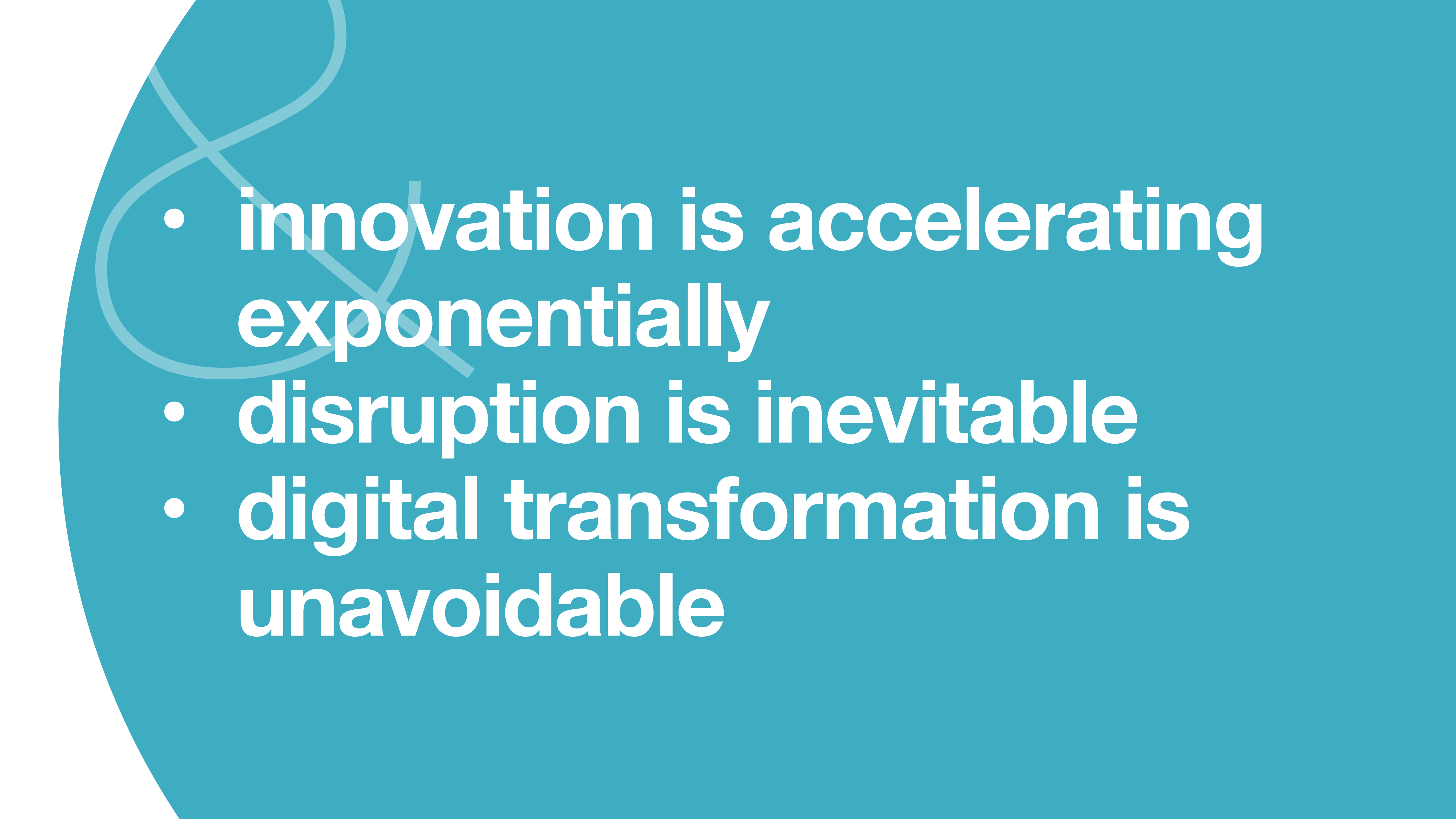
I never thought i'd see this in my lifetime, let alone while i'm still in my 30s. The future is without question a brighter place technologically. However I'm acutely aware of the vast social implications of this sort of task automation. This will displace human jobs as less artists will be needed to produce the same amount of content. These two examples were created using basic text prompts in midjourney. The output was then transferred to Kaedim which creates a 3d mesh in a single click. The final result is exported as FBX and shown in the blender viewport. The mesh has quad topology and is split into logical pieces so subdivision and bevelling can easily be applied.

<https://www.kaedim3d.com/> #art #ai #technology
#work #jobs #automation #content #content





**Technology is moving
faster than we have
been implementing it.**

- 
- **innovation is accelerating exponentially**
 - **disruption is inevitable**
 - **digital transformation is unavoidable**



People avoid change



5 WHY'S

Why don't AEC organizations invest in new tech?
Because they don't have time.

Why don't they have time?
Because they have project deadlines and their

Why don't they have fees?
Because the market is competitive and fee margins are

Why is the market competitive?
Because their services are now a commodity.

Why are their services a commodity?
Because they are undifferentiated from their competitors.

Why the AEC industry may have Luddite built into its ...

"On the surface, this is surprising because AEC firms are designing and constructing facilities that have long lives. However, the focus is on current execution and delivery of projects, not the long-term business health." The lack of future planning leaves scarce understanding as to where innovation and change need to happen.

Innovate or Die - Why the Construction Industry Needs ...

October 15, 2018. Blog. "Innovate or die" has long been the motto of marketers, tech-savvy entrepreneurs, and those working on the cutting edge of the health and science industries. Nevertheless, the word "innovation" seems absent in the construction sector. The construction industry is one of the oldest and largest in the world ...

Why the AEC industry is lagging behind: five barriers to ...

A lack of understanding about building management systems is often a problem throughout the design process. As Tom explains in his article in the CIBSE Journal, Data with destiny - BMS protocols, "consultant engineers must understand the discipline, and be able to communicate opportunities to clients effectively. They must be competent enough to understand the system integration and include ...

AEC Productivity: How to Start Fixing It

Many people have talked recently about the McKinsey & Company report "Reinventing construction through a productivity revolution," which does an in-depth study of productivity in architecture ...

5 Major Problems in the Construction Industry [2021 Updated]

Though poor productivity cuts across many areas, the net result is invariably the same: dwindling profitability and rising costs. Thus, despite the demand potential for new construction projects worldwide, AEC businesses will face the same old problems. The impact of these issues will affect AEC companies in a variety of ways.

PDF AEC industry culture: A need for change

AEC INDUSTRY CULTURE: A NEED FOR CHANGE A. Weippert 1 Queensland University of Technology, Brisbane, Australia. S.L. Kajewski 2 Queensland University of Technology, Brisbane, Australia. ABSTRACT (CIB T6S4 and T6S7) Future development in determining new and improved ways for Architecture and Engineering Contractors

KPMG report: Construction industry slow to adopt new ...

A lack of clear regulations has kept many AEC firms from formally incorporating the equipment into their workflow, but those that have used the technology experimentally have confirmed its game ...

PDF Disruption, Transformation and Innovation in the AEC Industry

Understand how the AEC industry is being disrupted Learn how architecture, engineering, and construction firms are being impacted by industry disruption and transformation Learn how associative thinking can drive innovation in AEC firms Learn what emerging technologies will impact the future of the AEC industry. Key learning objectives

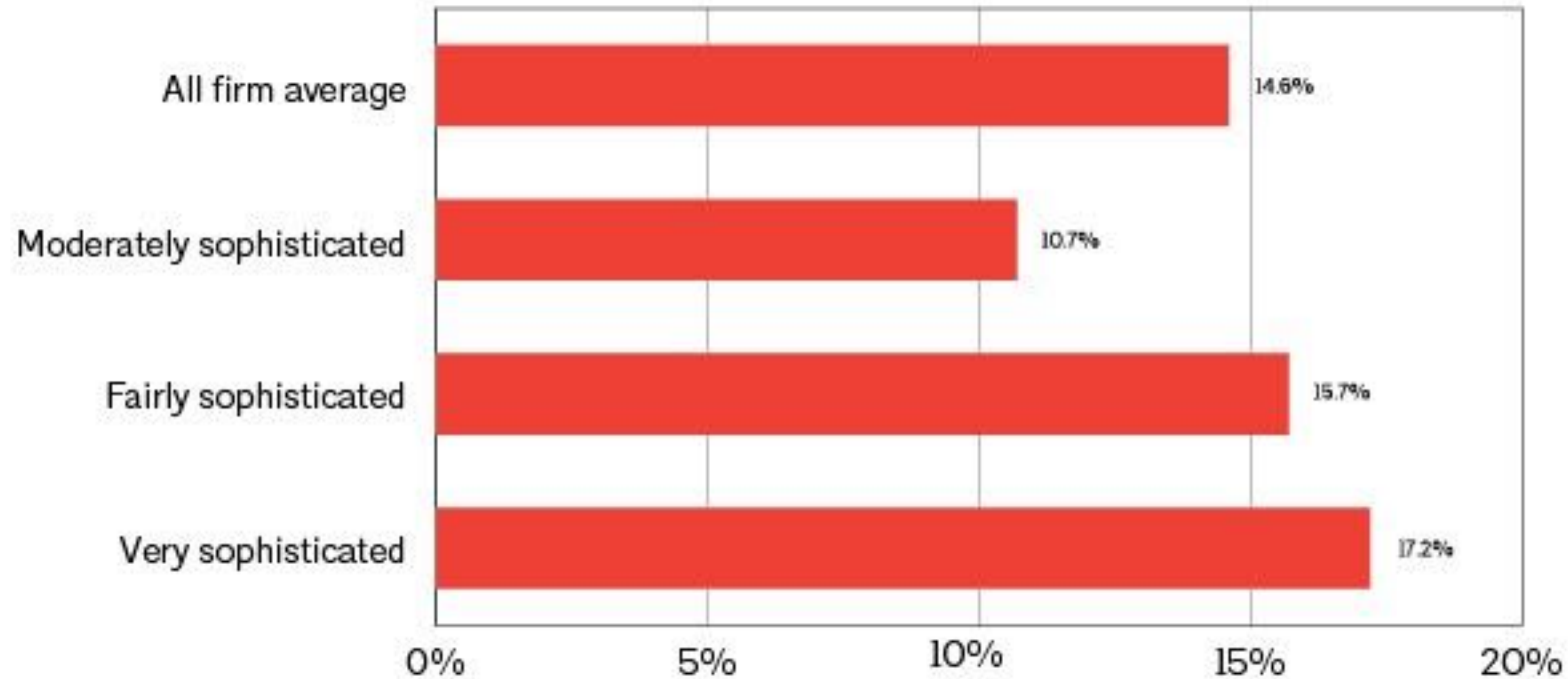


1966

**Technology is the answer, but
what was the question?**

– Cedric Price, Architect

COULD IT HELP US MAKE MORE MONEY?



Technologically sophisticated firms have been more profitable. 2018 profitability by perceived technological sophistication, average percent across all firms.

Source: [Architect Magazine](#)

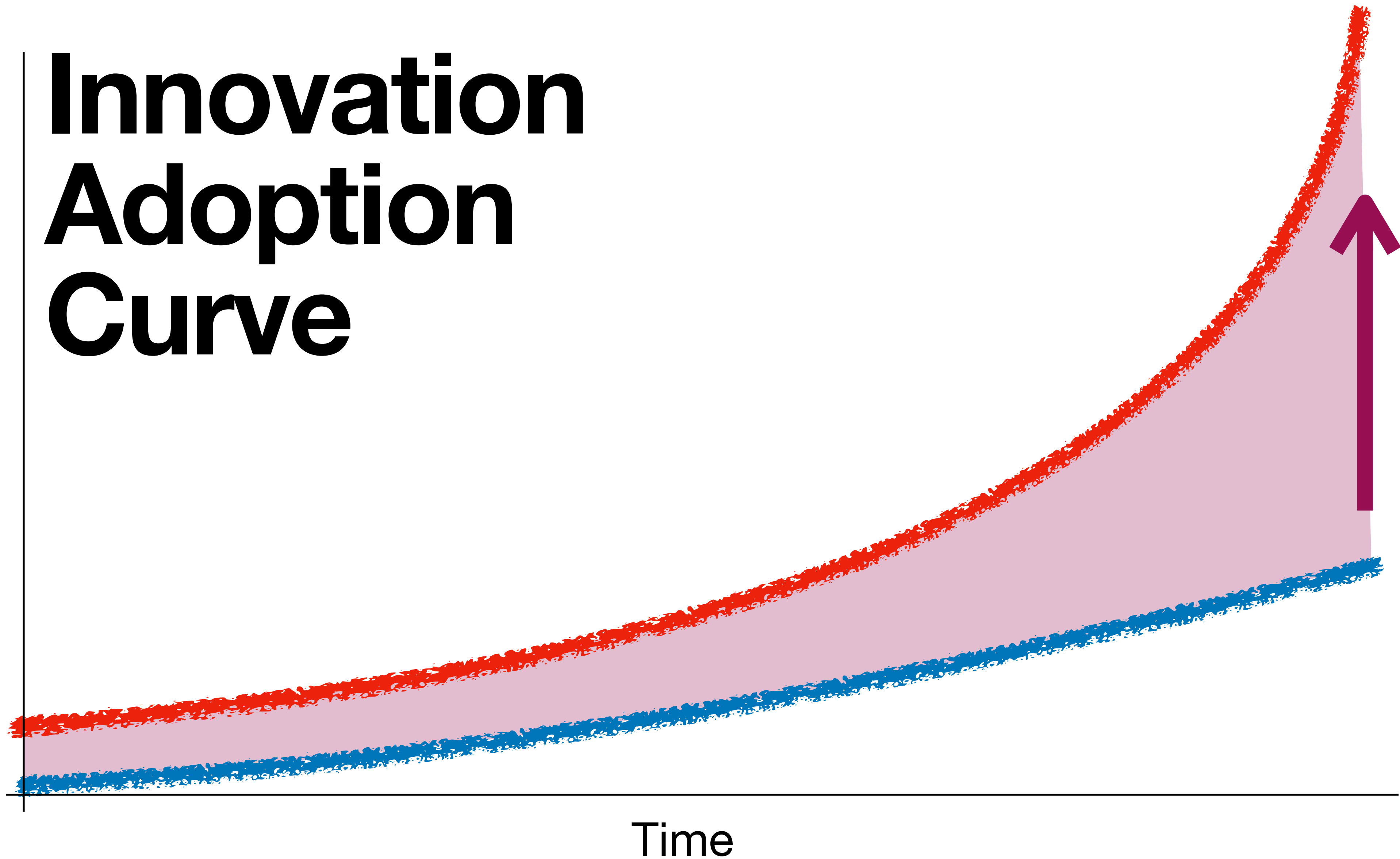


Many firms price their services as a commodity—for a fixed price or as a percentage of the costs of construction—which typically doesn't provide a premium for a superior design solution.

– Philip Bernstein, FAIA

Innovation Adoption Curve

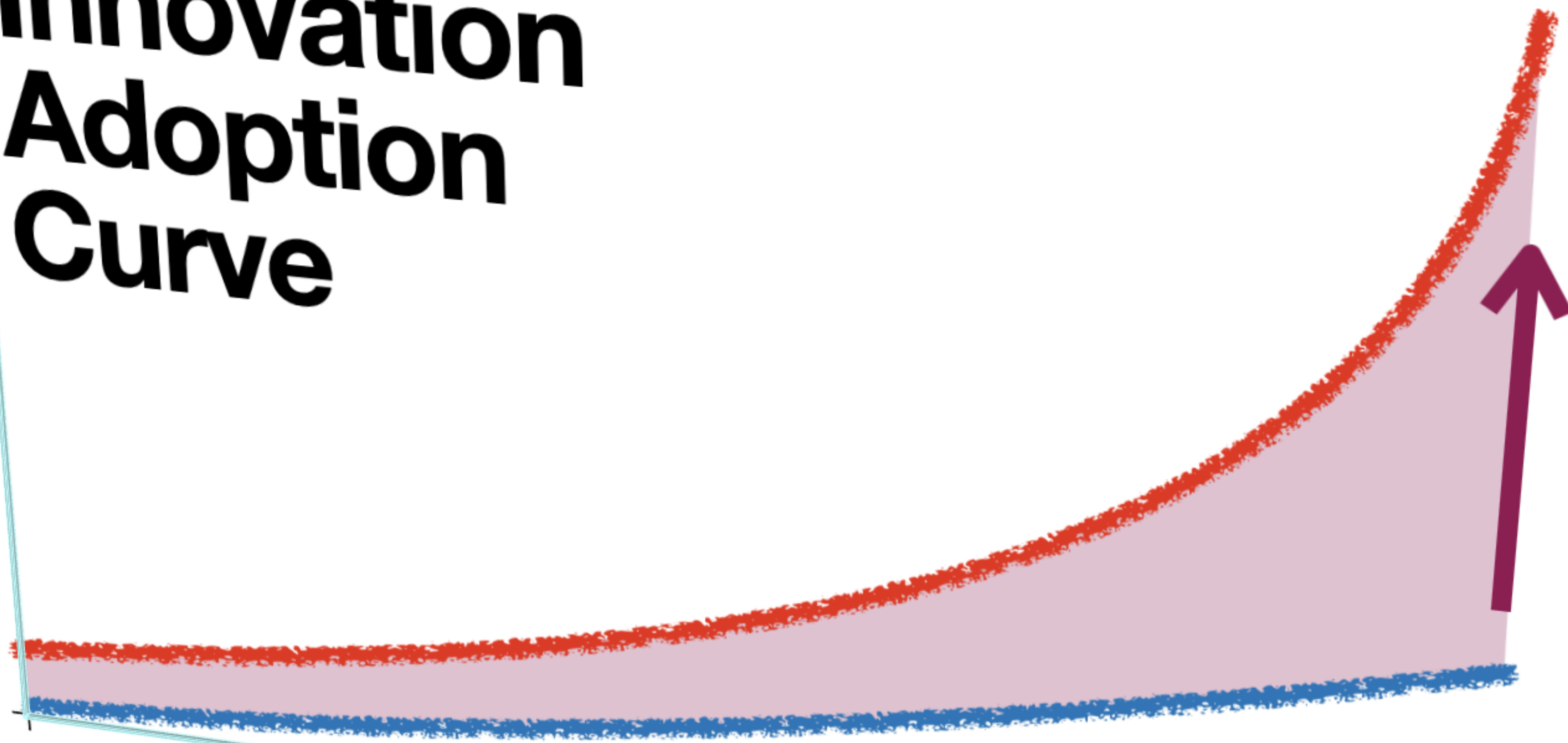
Amount

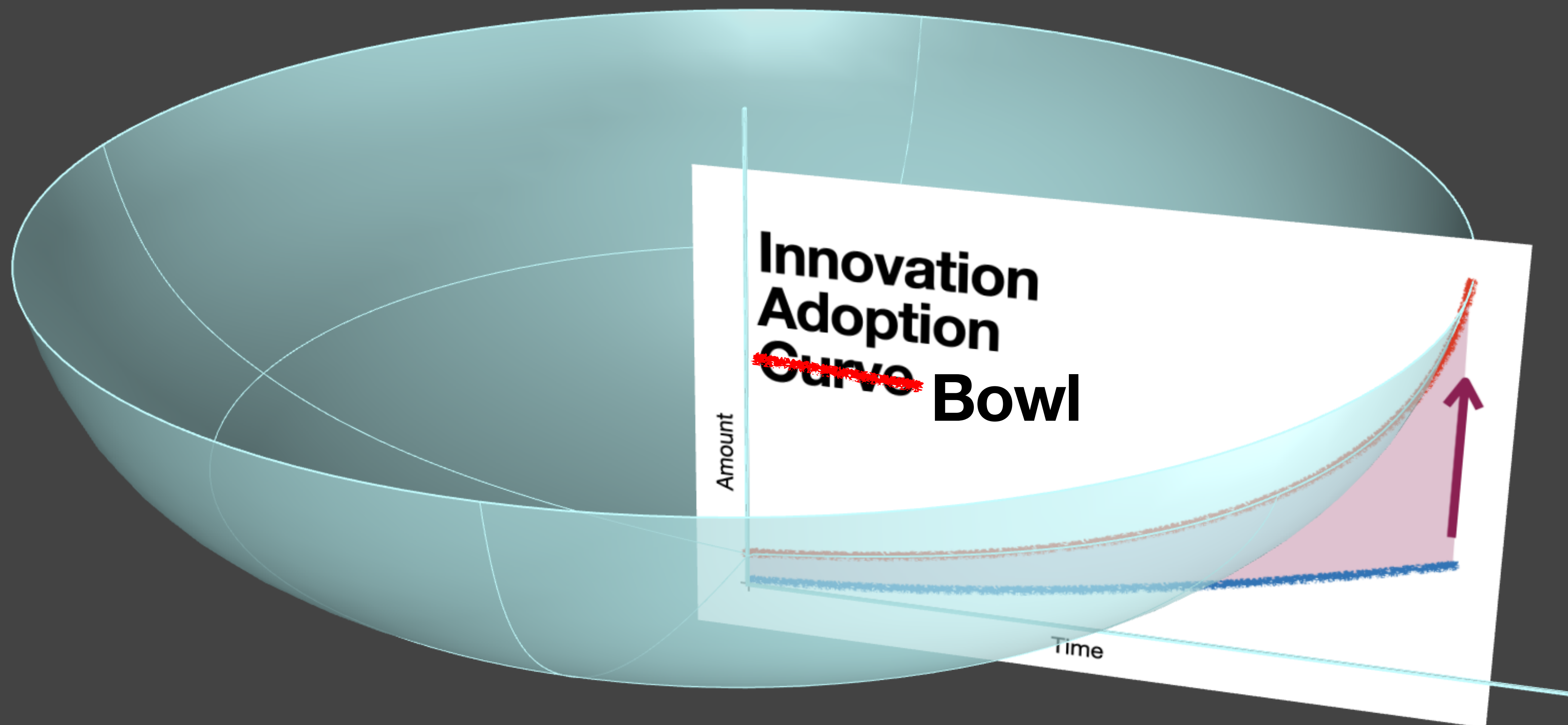


Innovation Adoption Curve

Amount

Time





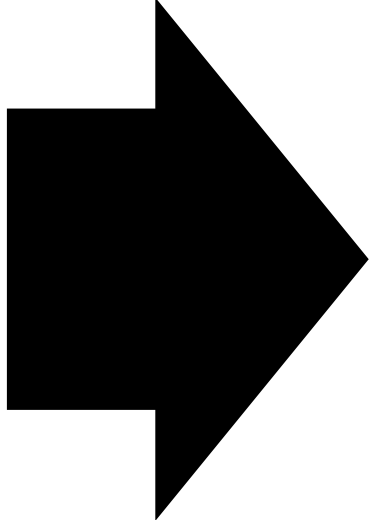
Again:

What do we owe the future?

Here's the twist.

**I am here as a human portal
to the tech. and the people.**

data
+
information



people
+
wisdom



A dark, atmospheric photograph of a rocket launch at night. A rocket is seen ascending vertically, leaving a massive, billowing plume of white smoke and fire that fills the lower left portion of the frame. To the right of the rocket, a tall, complex metal service structure, likely a mobile launcher platform, stands against the dark sky. The overall scene is dimly lit, with the primary light source being the rocket's engines.

**Find the right people.
Listen to what they say.
Do it.**

**Where do you find the
right people?**



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Evelyn Lee, FAIA, NOMA

@evelynmlee



This quote in the Keynote for
[@AIAYAF](#)'s [##aiayafmission2130](#) by
Dr. Chris Luebke of [@Your2040](#)
really stood out for me:

Knowledge is a commodity; action is
not.

What actions are you going to take
today to change your tomorrow?

How are you going to design the
future we want?

5:58 AM · 8/26/22 · [Twitter Web App](#)

Knowledge is a commodity; action is not.

What actions are you going to take today to change your tomorrow?

How are you going to design the future we want?

A close-up photograph of Grumpy Cat, a famous internet meme. The cat has a grumpy expression, with its mouth slightly downturned and its eyes looking off to the side. It has a mix of brown, white, and black fur. The background is blurred, showing some red and blue colors.

**THERE ARE
TWO THINGS
ARCHITECTS
HATE**

**THE WAY THINGS ARE
CHANGE**



THERE ARE
TWO THINGS
ARCHITECTS
ARE RESPONSIBLE FOR

THE WAY THINGS ARE
CHANGE