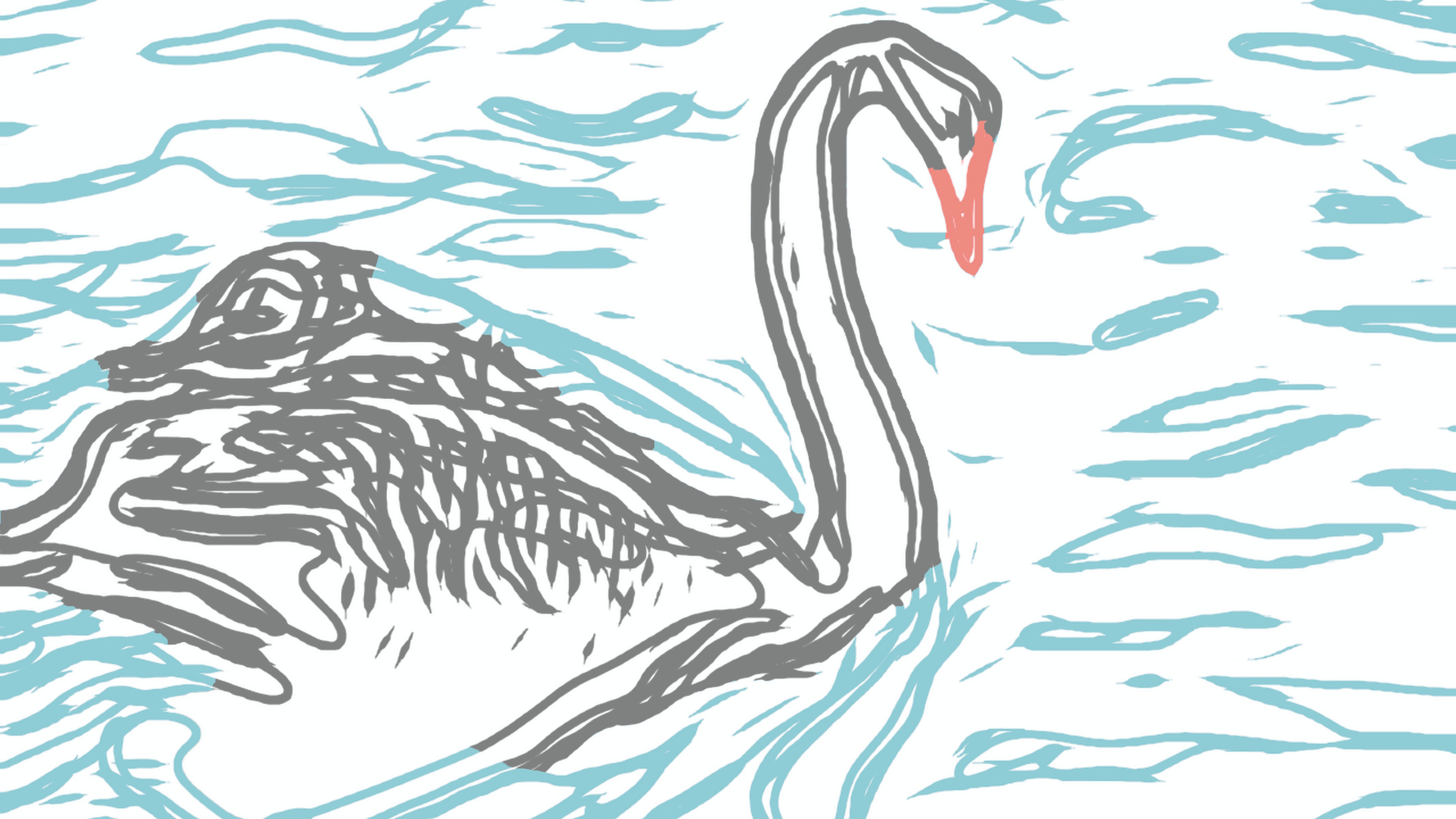


Frameworks for Learning and Intentional Technology Integration

Ruben R. Puentedura, Ph.D.

1. Black Swans and Antifragility



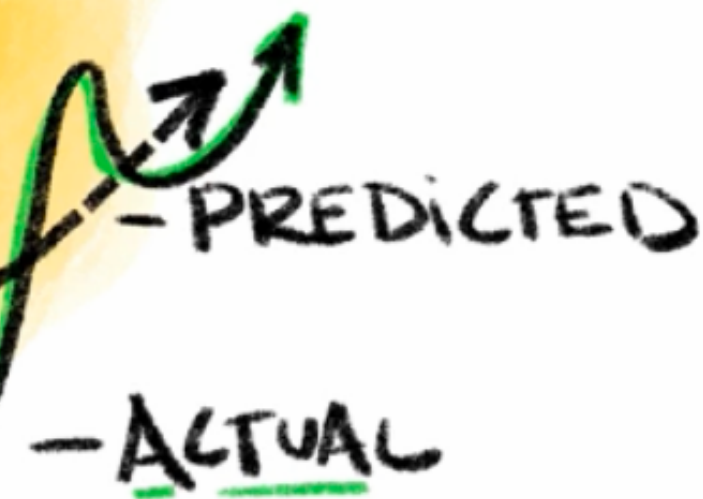
Black Swan Events

- Cannot be predicted ahead of time
- Have a major effect
- Can be rationalized retrospectively

WHAT ARE BLACK SWAN EVENTS?



COVID-19



FOR EXAMPLE:
THE TITANIC

COMPLETELY UNPREDICTABLE



MAKES SENSE IN HINDSIGHT



HIGHLY IMPACTFUL



IMPACTFUL



UNPREDICTABLE

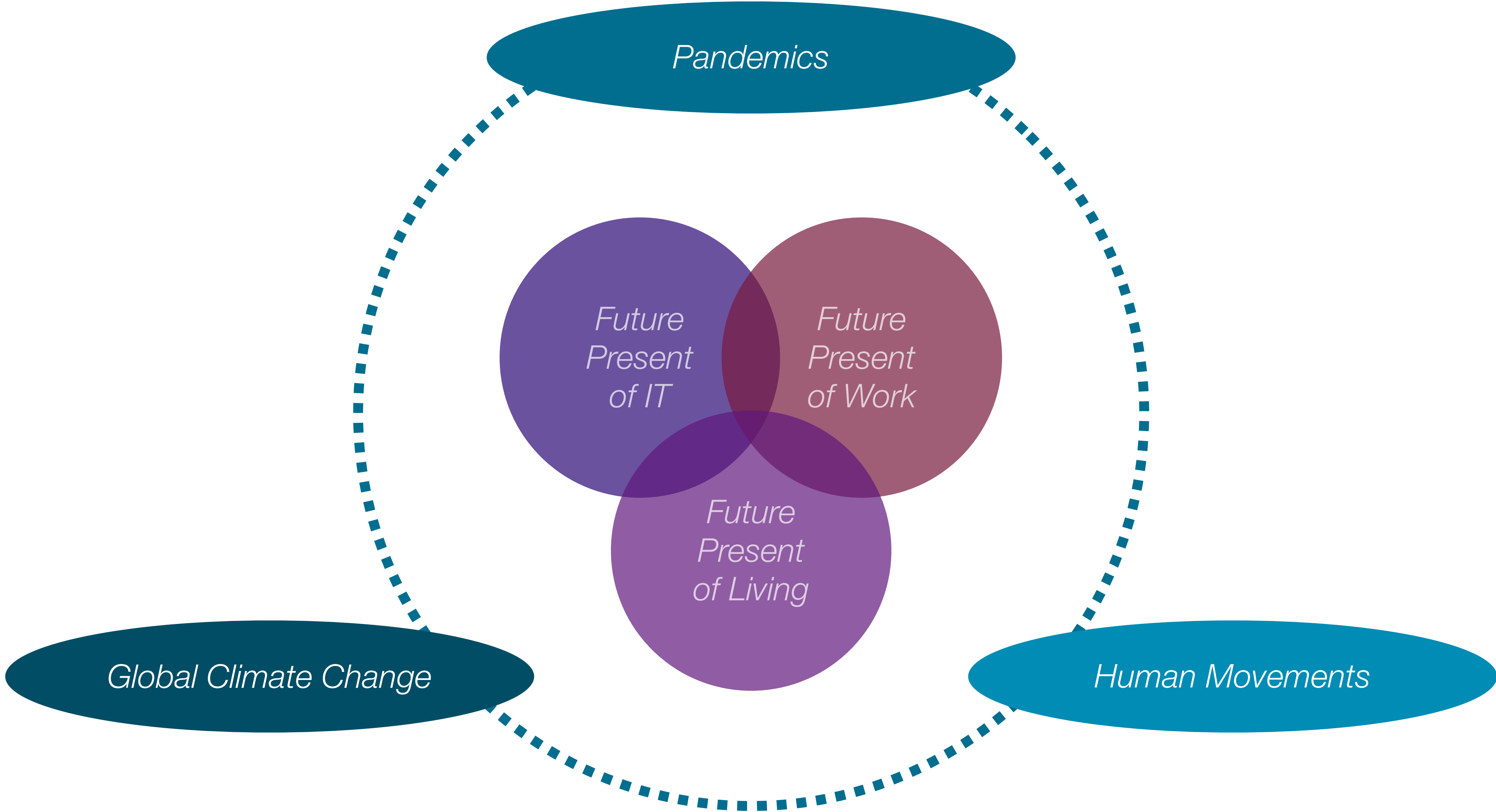


MAKES SENSE

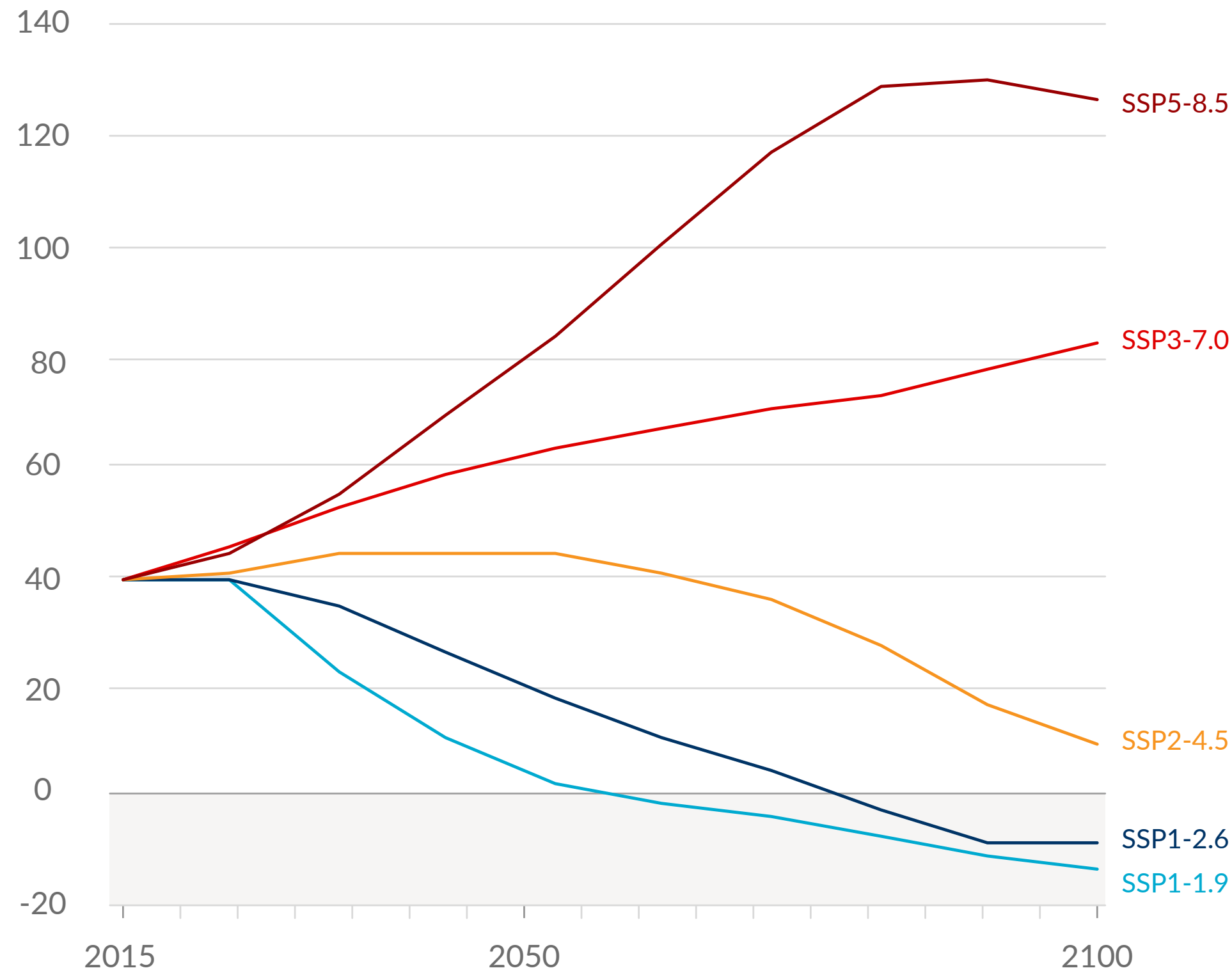


BLACK SWAN EVENTS

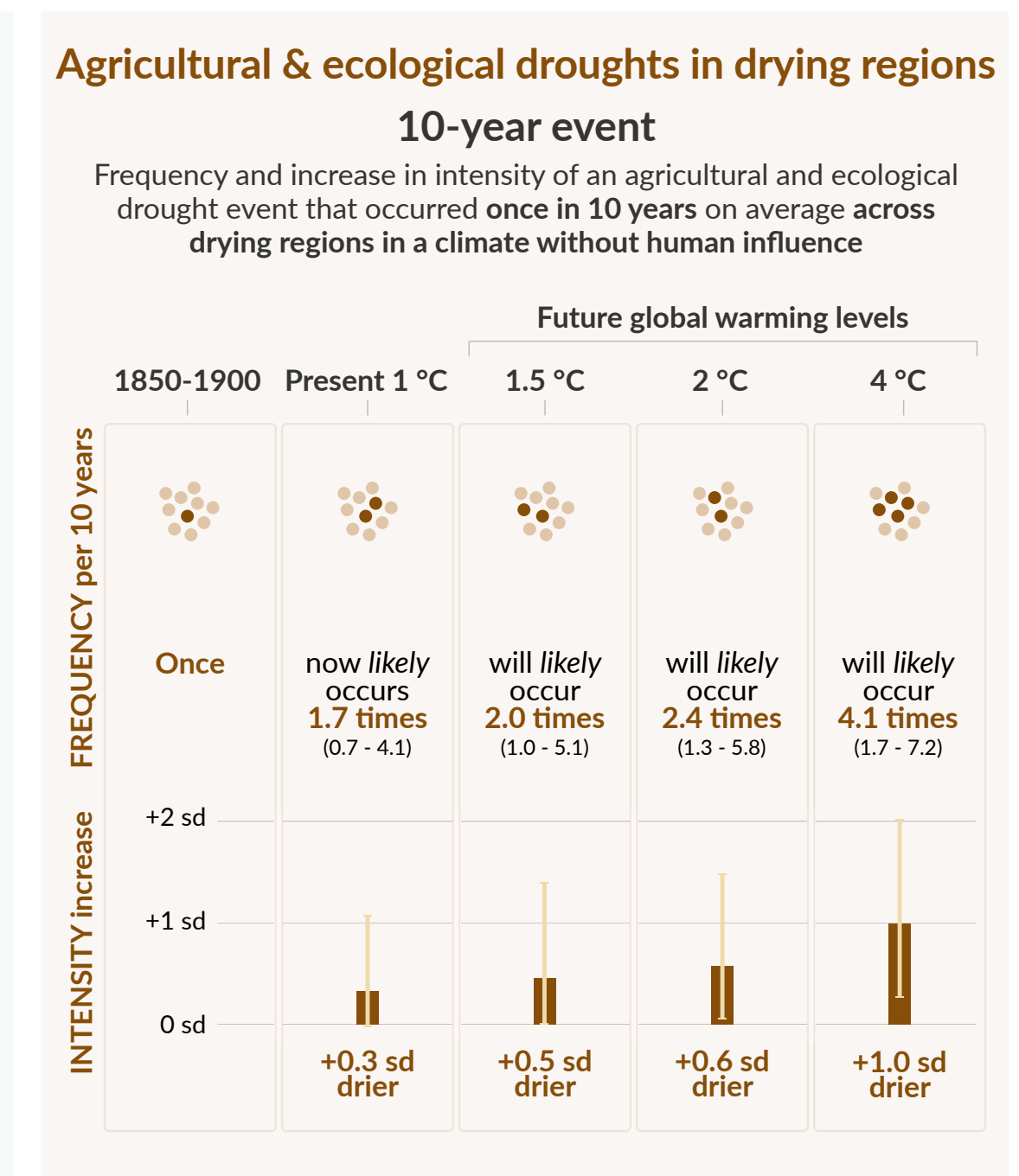
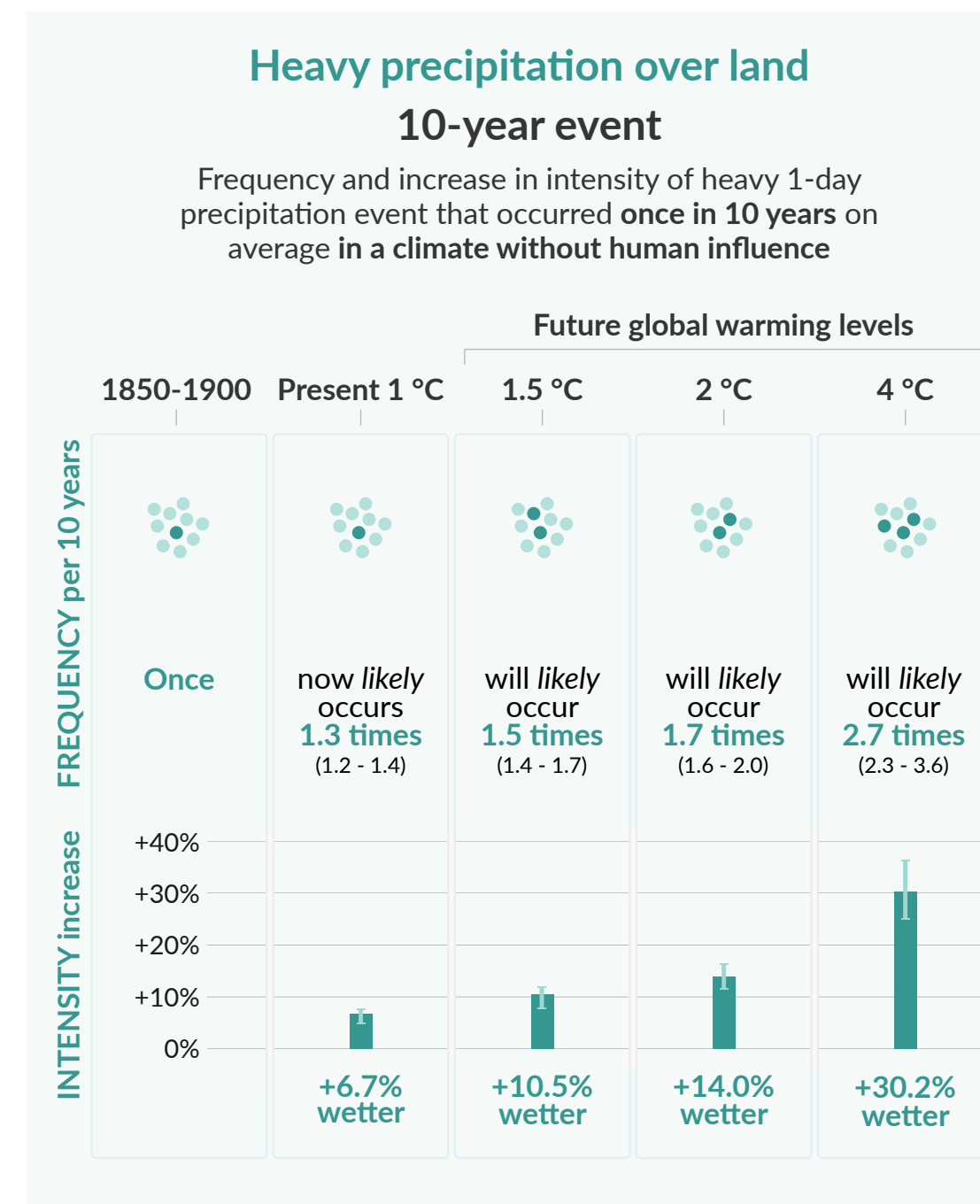
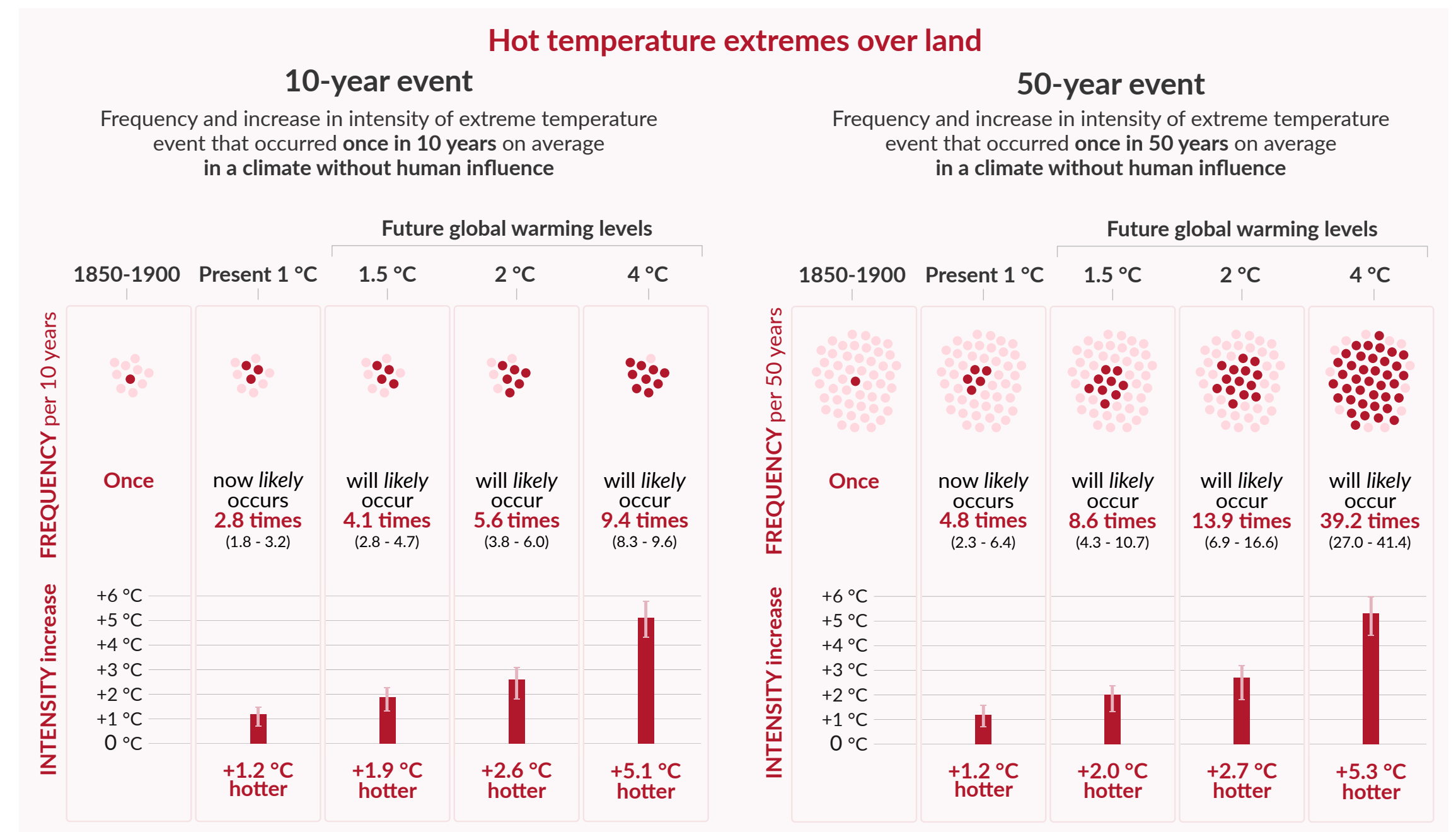
Nesting Grounds for Black Swans



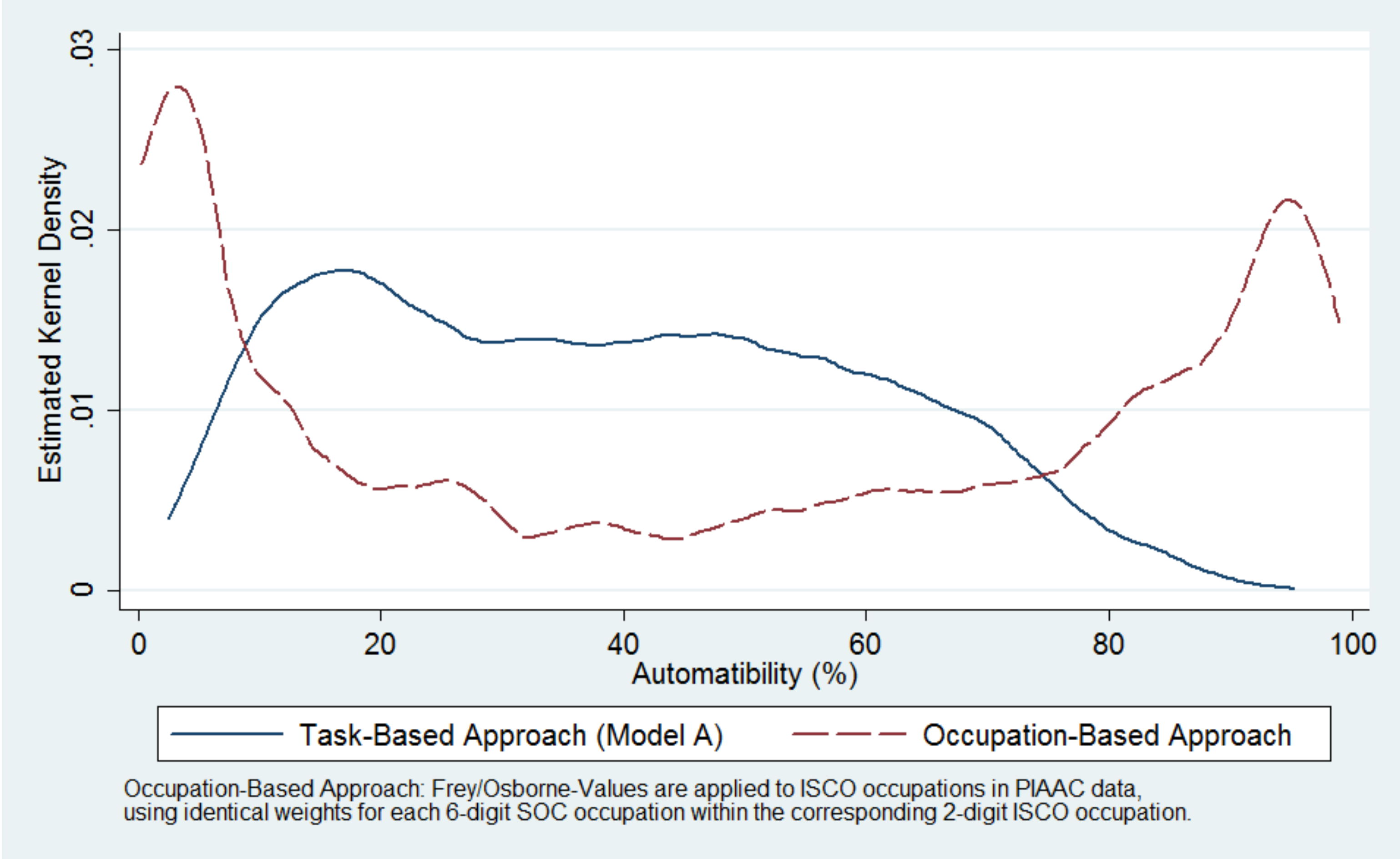
Carbon dioxide (GtCO₂/yr)



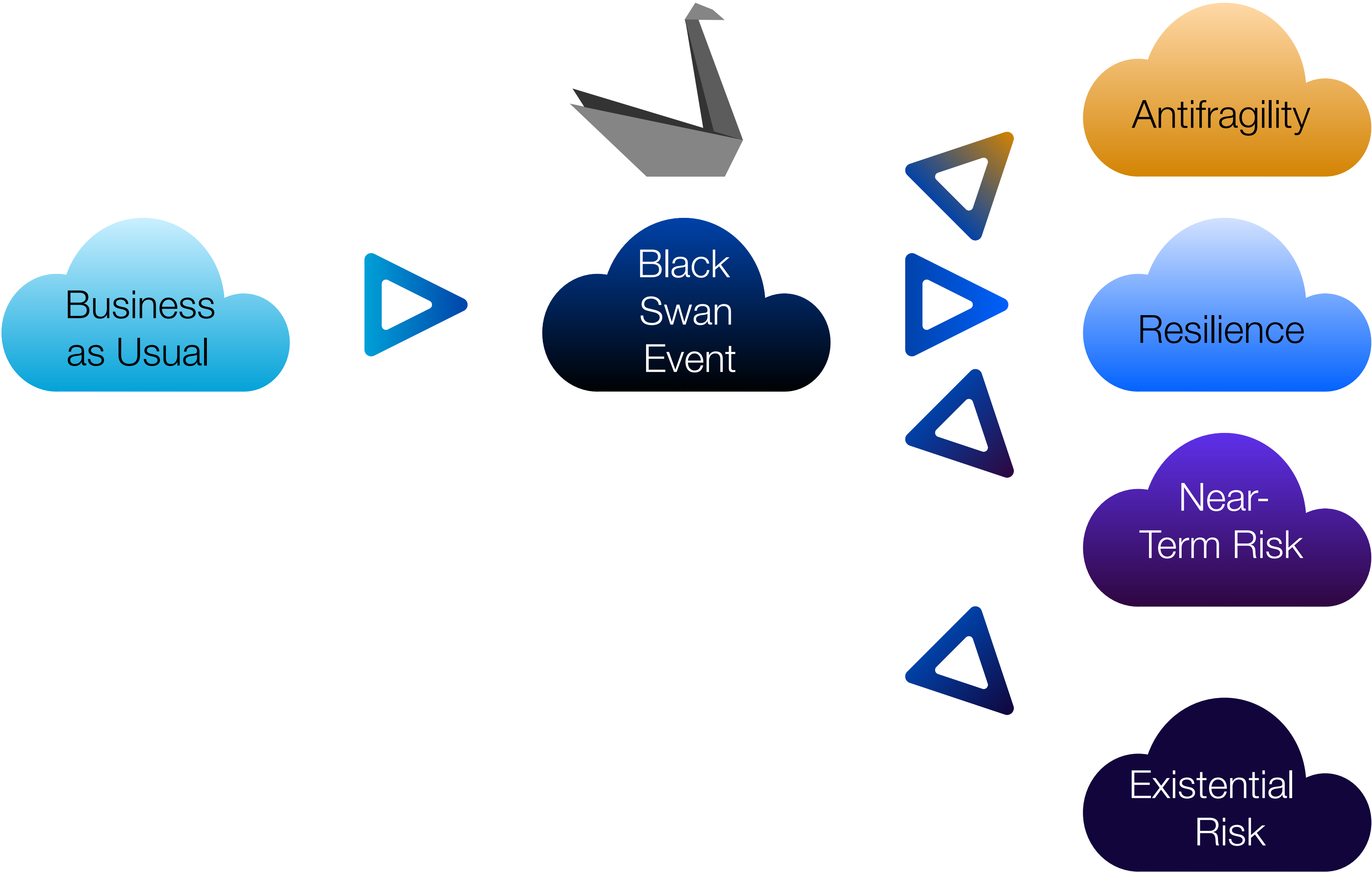
Scenario	Near term, 2021–2040		Mid-term, 2041–2060		Long term, 2081–2100	
	Best estimate (°C)	Very likely range (°C)	Best estimate (°C)	Very likely range (°C)	Best estimate (°C)	Very likely range (°C)
SSP1-1.9	1.5	1.2 to 1.7	1.6	1.2 to 2.0	1.4	1.0 to 1.8
SSP1-2.6	1.5	1.2 to 1.8	1.7	1.3 to 2.2	1.8	1.3 to 2.4
SSP2-4.5	1.5	1.2 to 1.8	2.0	1.6 to 2.5	2.7	2.1 to 3.5
SSP3-7.0	1.5	1.2 to 1.8	2.1	1.7 to 2.6	3.6	2.8 to 4.6
SSP5-8.5	1.6	1.3 to 1.9	2.4	1.9 to 3.0	4.4	3.3 to 5.7



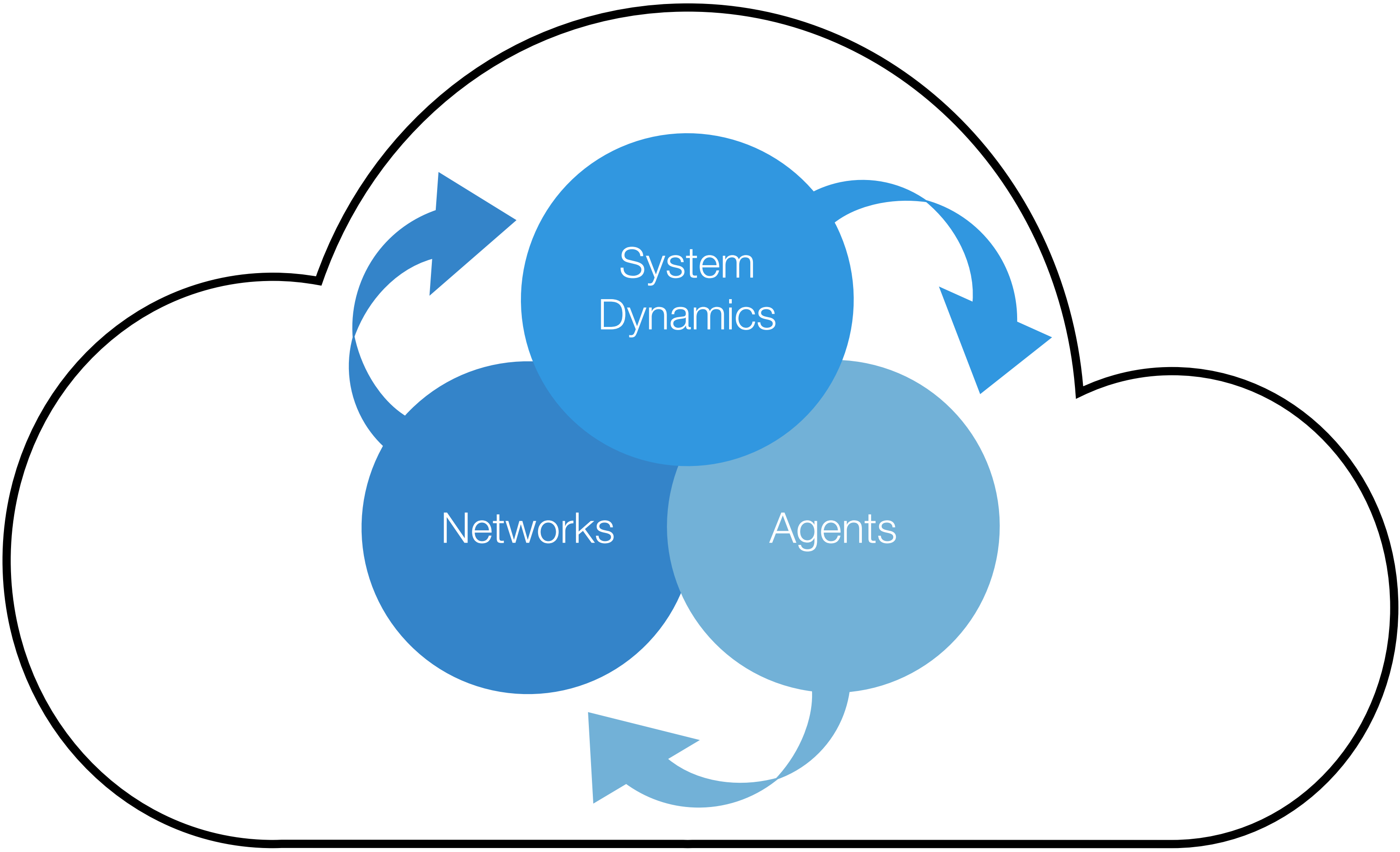
Distribution of Automatability in the US (Task-Based vs. Occupation-Based Approach)



After the Swan: Four Paths



Unpacking the Impact: Three Layers



Slack Swan Thinking

SESSION 1
OCTOBER 23, 2020

SYSTEMS • COMPONENTS • CONNECTIONS

BREAKOUT 1:
How MIGHT YOU MODEL...
FEEDBACK PROVIDED TO STUDENTS?
ADAPTIVE COURSE CONTENT
"LEVELING UP"
Here's why you shouldn't procrastinate

BREAKOUT 2:
INDECISION + TRAGEDY of the COMMONS → CATASTROPHE
WHAT WOULD YOU ATTACK FIRST?
FUNDING
MORE STUDENTS
COLLECTIVIZING THE COMMONS
INDECISION
TRAGEDY of the COMMONS
DIVERSIFYING FUNDAMENTS OR INFLOW
CHANGE the MODEL!

LET'S START WITH A BATHTUB

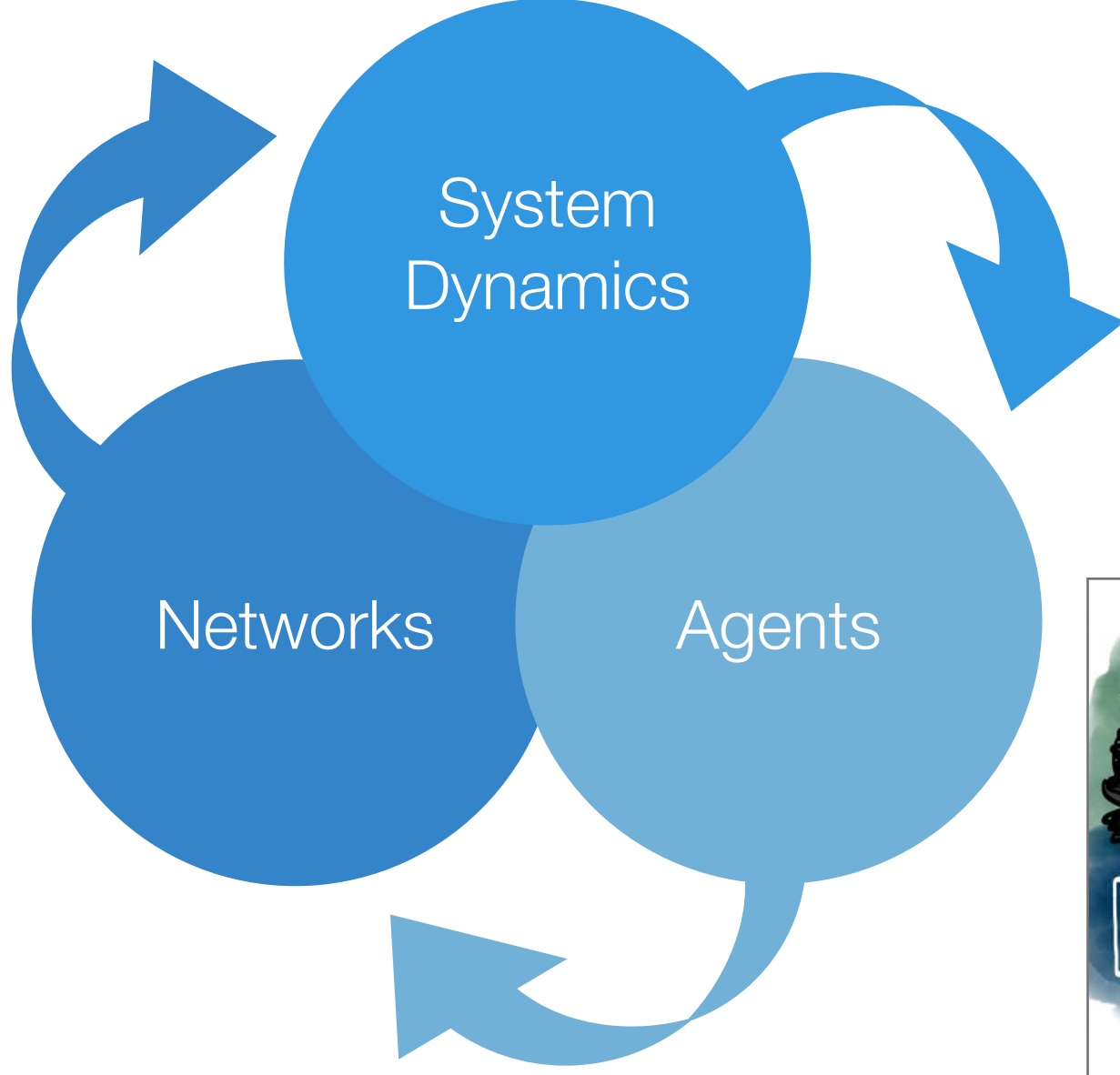
STOCKS

ARCHETYPES
EXPONENTIAL GROWTH
DECAY
GOAL SEEKING
GAP

How DO WE MAKE SURE THE TUB DOESN'T OVERFLOW?

Illustrated by Karina Branson
ConverSketch.com

ASU ShapingEDU



Slack Swan Thinking

SESSION 3
DECEMBER 16, 2020

NETWORKS

WHAT HAPPENS WHEN INDIVIDUAL ACTORS WORK AS A NETWORK?

DEFINITIONS
NODE → Individuals in a system
DIRECTIONAL → A child + parent
My child is not also my parent
SYMMETRICAL → Friends
DEGREES
EIGENVECTOR CENTRALITY → Measures the QUALITY of the CONNECTIONS
BETWEENNESS → who is BETWEEN hubs
LOUVAIN → Natural distribution of connections, betweenness

TOOLS
WHO WOULD YOU ASK for INNOVATIVE REMOTE TEACHING IDEAS?
VISIONE.ETHZ.CH

BREAKOUT INSIGHTS
CAN WE USE EIGENVECTOR CENTRALITY to UNDERSTAND & IDENTIFY CONNECTORS?
MAPPING STRENGTHS of STUDENTS in a CLASS
at different scales

EXAMPLE DISEASE MODELING
WHOLE SYSTEM
AGENTS SHOW MORE NUANCE
NETWORKS (w) ILLUMINATE BLACK SWANS

Illustrated by Karina Branson
ConverSketch.com

ASU ShapingEDU

Slack Swan Thinking

SESSION 2
NOVEMBER 18, 2020

AGENTS
INDIVIDUALS in the SYSTEM
LEADS TO NEW PATTERNS!
A FEW MORE EXAMPLES:
SEGREGATION
KIDS in SCHOOLS
Who are the Parents listening to?
MODELS SHARING AGENTS SHOW DIVERSITY
DIFFERENT AGENTS, SAME TIME
SAME EFFECTS in CANADA?
ACCESS to BROADBAND
RURAL/ URBAN \$\$\$
INTERNATIONAL STUDENTS

SYSTEMS EXAMPLES in ACTION
ENERGY CONSUMPTION
SUBSIDIZE RENEWABLES? → People USE MORE ENERGY
CARBON TAX → People REDUCE CONSUMPTION
COVID RESPONSE
DELAYS in the SYSTEM
RESTRICTIONS LIFTED
RESTRICTIONS in PLACE

VARIABLES
SAME AGENTS, DIFFERENT TIMES
ACCESS to TECH
PERCEIVED VALUE
of PEOPLE in a HOME NEEDING BROADBAND
COMMUNITY COLLEGE ENROLLMENT
ECONOMIC DOWNTURN
WILL PEOPLE ENROLL?
WHY or WHY NOT?

BREAKOUTS
PICK ONE of the EXAMPLES ABOVE
WHAT are the KEY STOCKS and FLOWS?
How do AGENTS BEHAVE/INFLUENCE the SYSTEM?

Illustrated by Karina Branson
ConverSketch.com

ASU ShapingEDU



- How do I make this unit of instruction antifragile?
- How do I make this course antifragile?
- How do I make this degree antifragile?
- How do I make this institution antifragile?

- **How do I make this student learning antifragile?**

Given these Black Swan nesting grounds, what do you see as the three most pressing challenges for your school?

Given what you have seen thus far, including the challenges listed by participants, what questions do you have at this point?

2. SAMR and Antifragility

Transformation

Redefinition

*Tech allows for the creation of new tasks,
previously inconceivable*

Modification

Tech allows for significant task redesign




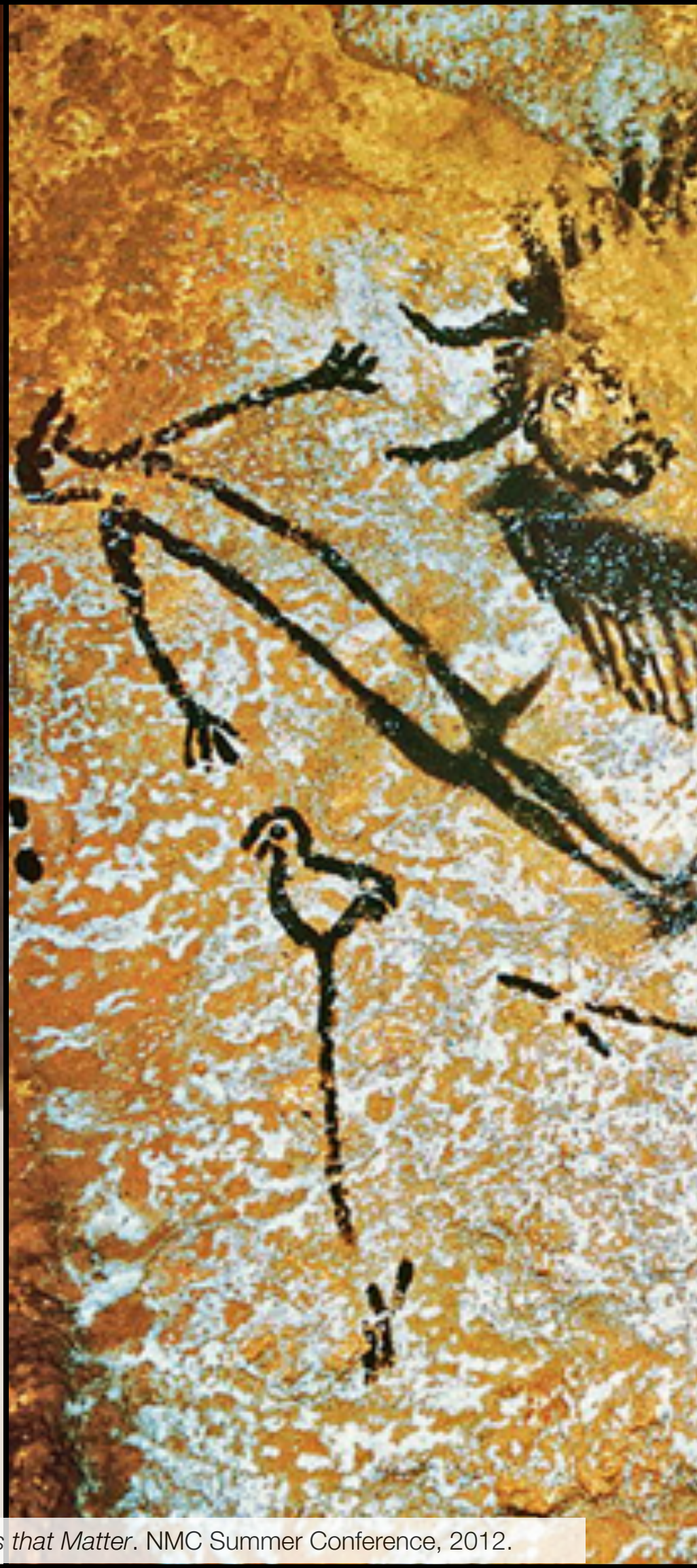

Augmentation

*Tech acts as a direct tool substitute,
with functional improvement*

Substitution

*Tech acts as a direct tool substitute,
with no functional change*

Enhancement

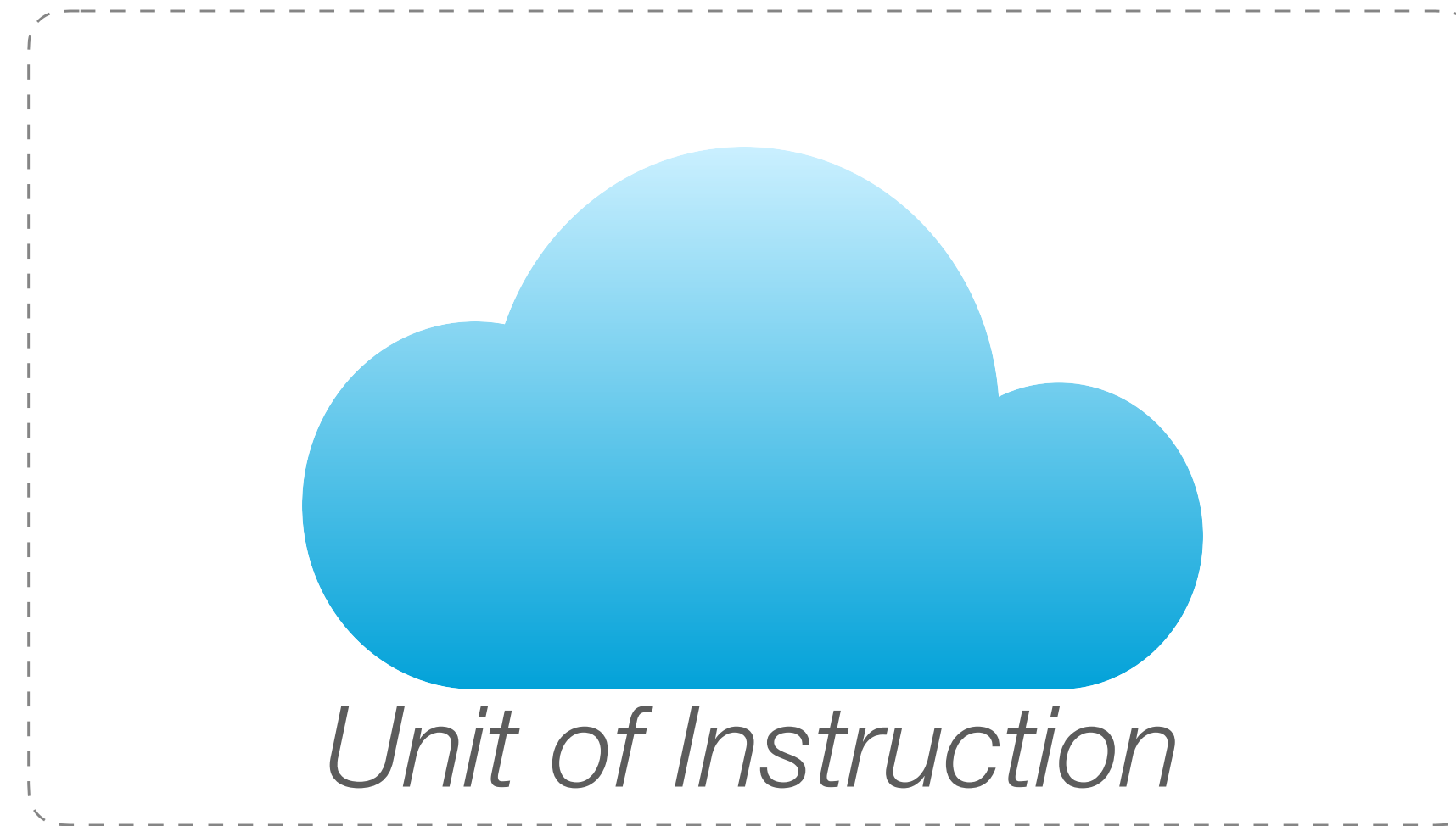
Social	Mobility	Visualization	Storytelling	Gaming
200,000 years	70,000 years	40,000 years	17,000 years	8,000 years
				

The EdTech Quintet – Associated Practices

Social	Communication, Collaboration, Sharing
Mobility	Anytime, Anyplace Learning and Creation
Visualization	Making Abstract Concepts Tangible
Storytelling	Knowledge Integration and Transmission
Gaming	Feedback Loops and Formative Assessment

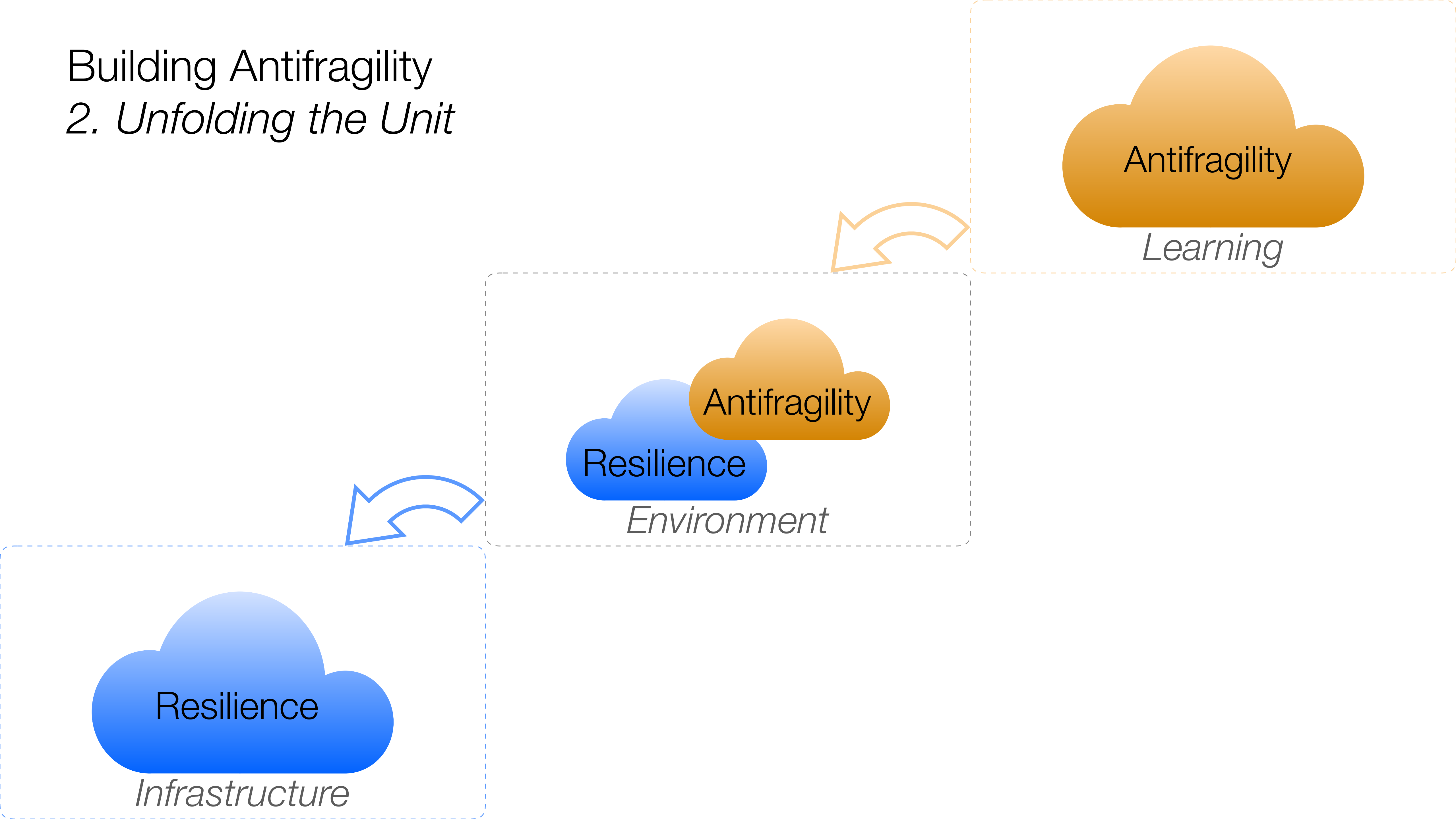
Building Antifragility

1. Before the Swan



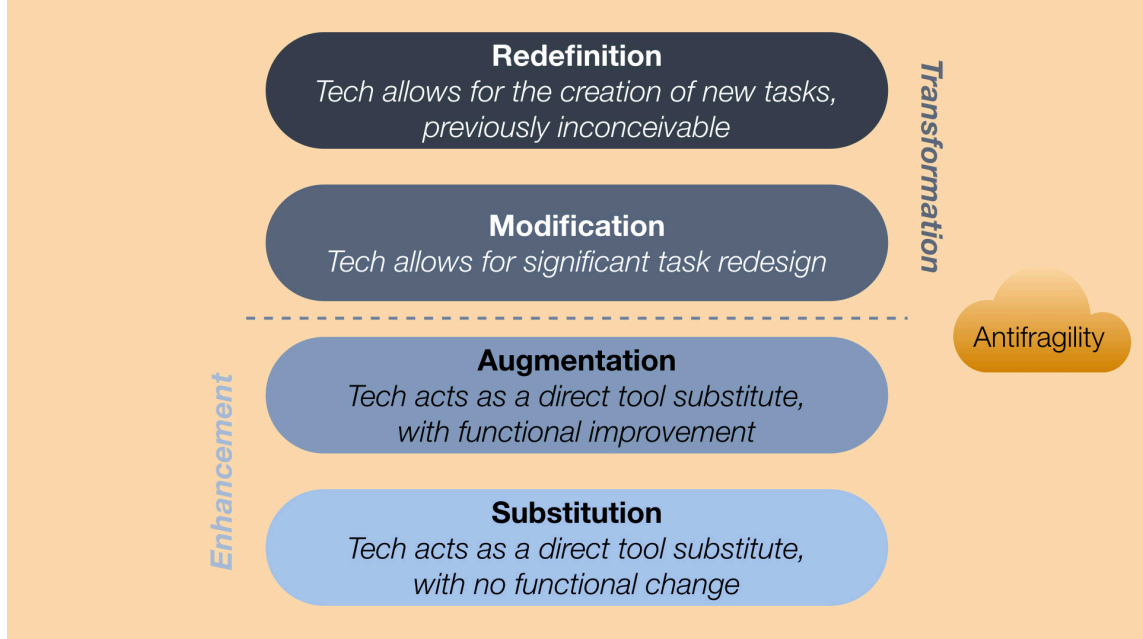
Building Antifragility

2. *Unfolding the Unit*

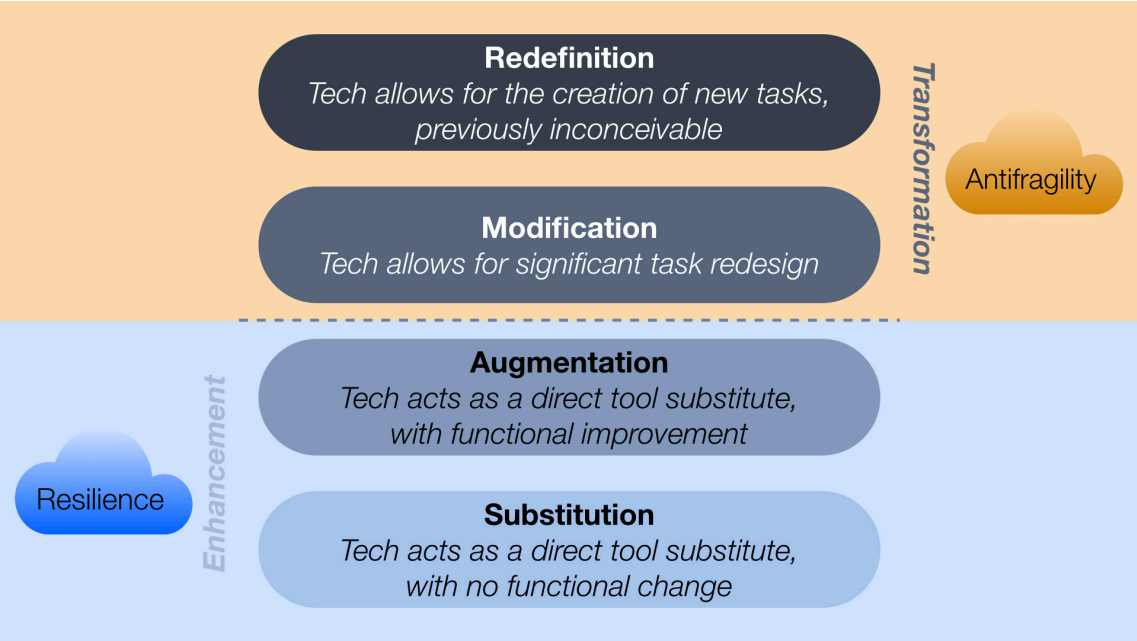


Building Antifragility

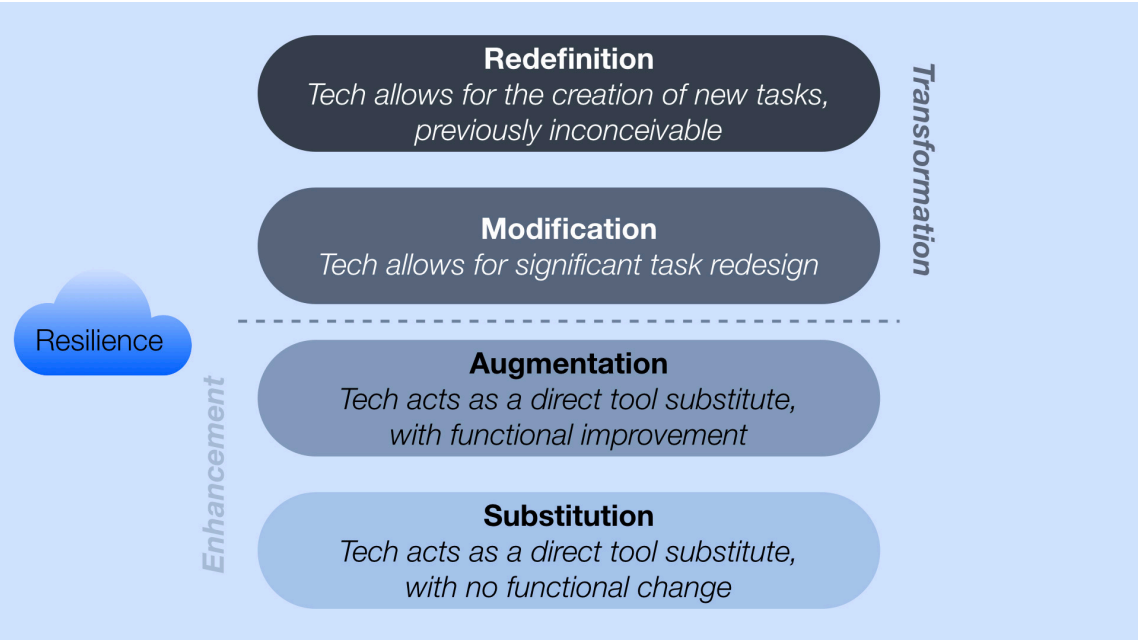
3. Scaffolding with SAMR



Learning



Environment

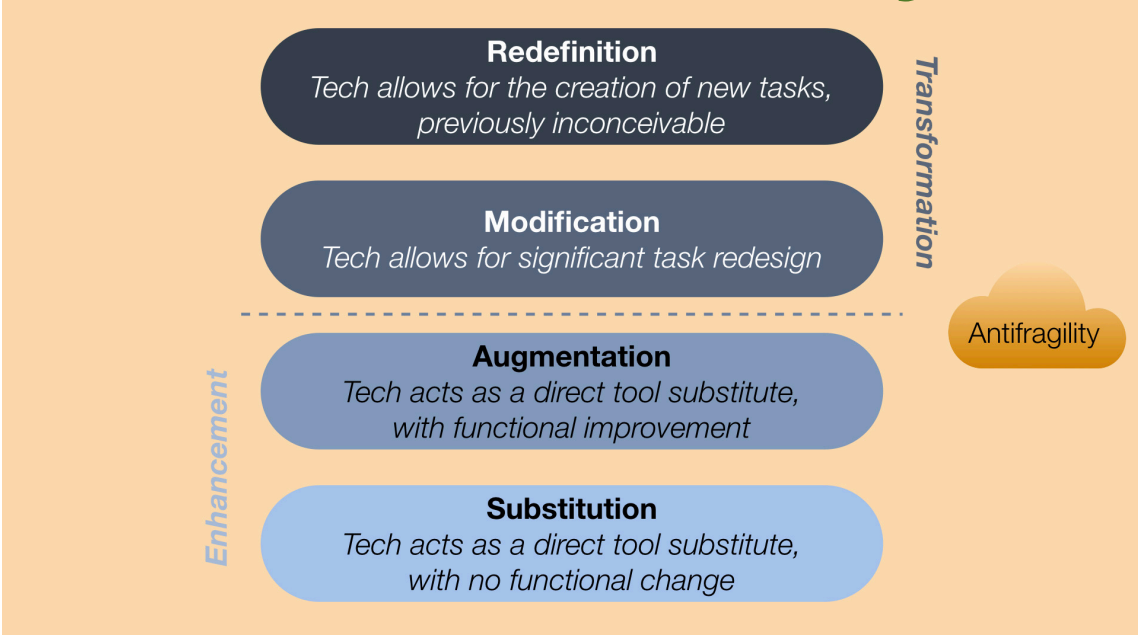


Infrastructure

Building Antifragility

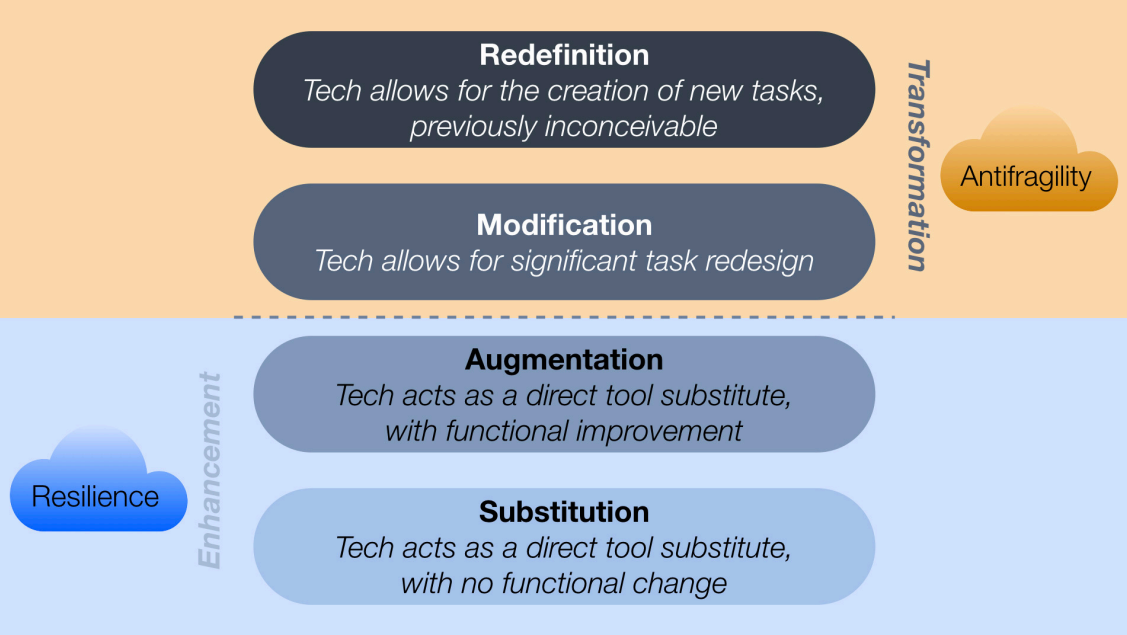
4. An Example in 3 Parts

STEM Activity



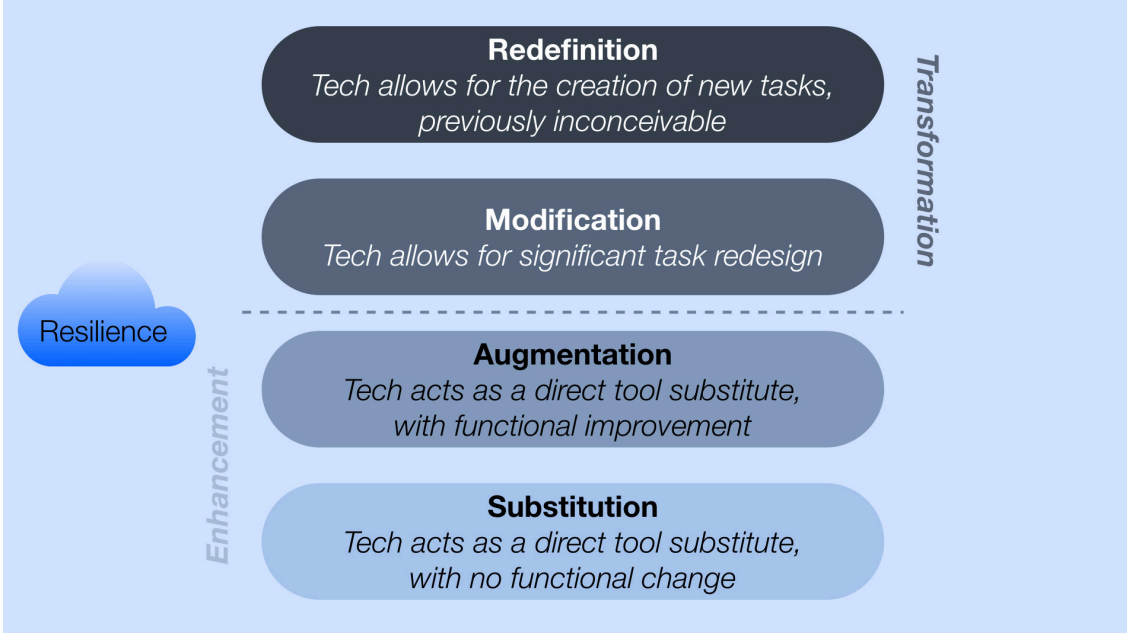
Learning

Collaboration

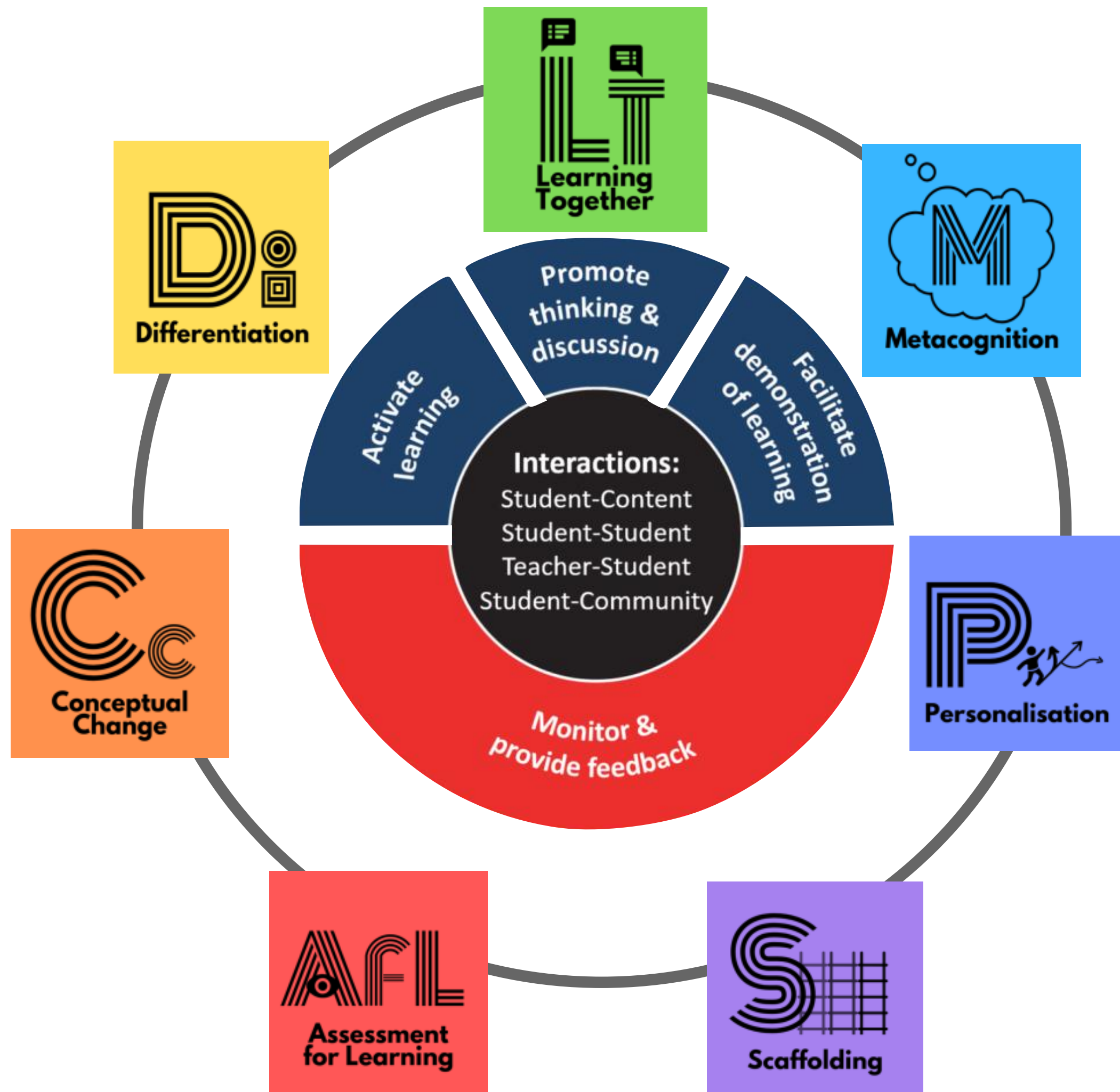


Environment

Telepresence



Infrastructure



Defining Hybrid Modes of Learning

Hybrid Modes of Learning are those where:

- Some students attend class *remotely online*, and some students attend class in *face to face (f2f)* mode;
- At least some of the instruction takes place *synchronously* for both groups;
- The students that are remote, and those that are f2f may change over time in *predictable* or *unpredictable* fashion - for example:
 - *Predictable*: a rotation schedule, required by classroom COVID-19 occupancy limits, where half the students are remote one week, and f2f the next;
 - *Unpredictable*: in any given week, a student may not be able to attend f2f due to COVID-19 exposure, and have to attend class remotely.

Infrastructure: Telepresence and Hybrid Modes

	S	A	M	R
Design Focus	Robust Substitutive Use of Zoom	Enhancing Telepresence	Defining Collaboration	Scaffolding Agency
Practices	<ul style="list-style-type: none"> • Personal space <ul style="list-style-type: none"> ▸ <i>On/off choice</i> • Total “on” time <ul style="list-style-type: none"> ▸ <i>Limited duration</i> • Environmental space <ul style="list-style-type: none"> ▸ <i>Backgrounds</i> • Space differentiation <ul style="list-style-type: none"> ▸ <i>Breakout rooms</i> • Classroom materials <ul style="list-style-type: none"> ▸ <i>Resource libraries</i> 	<ul style="list-style-type: none"> • Spaces <ul style="list-style-type: none"> ▸ <i>physical</i> ▸ <i>conceptual</i> • Uses <ul style="list-style-type: none"> ▸ <i>learning</i> ▸ <i>social</i> ▸ <i>recreational</i> • Presence <ul style="list-style-type: none"> ▸ <i>local/remote</i> ▸ <i>sync/async</i> 	<ul style="list-style-type: none"> • Collective functions <ul style="list-style-type: none"> ▸ <i>create asymmetric actions</i> • Local/Remote <ul style="list-style-type: none"> ▸ <i>define reciprocal options</i> 	<ul style="list-style-type: none"> • Creating student spaces • Supporting student projects • Framing student worlds

Redefinition

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Modification

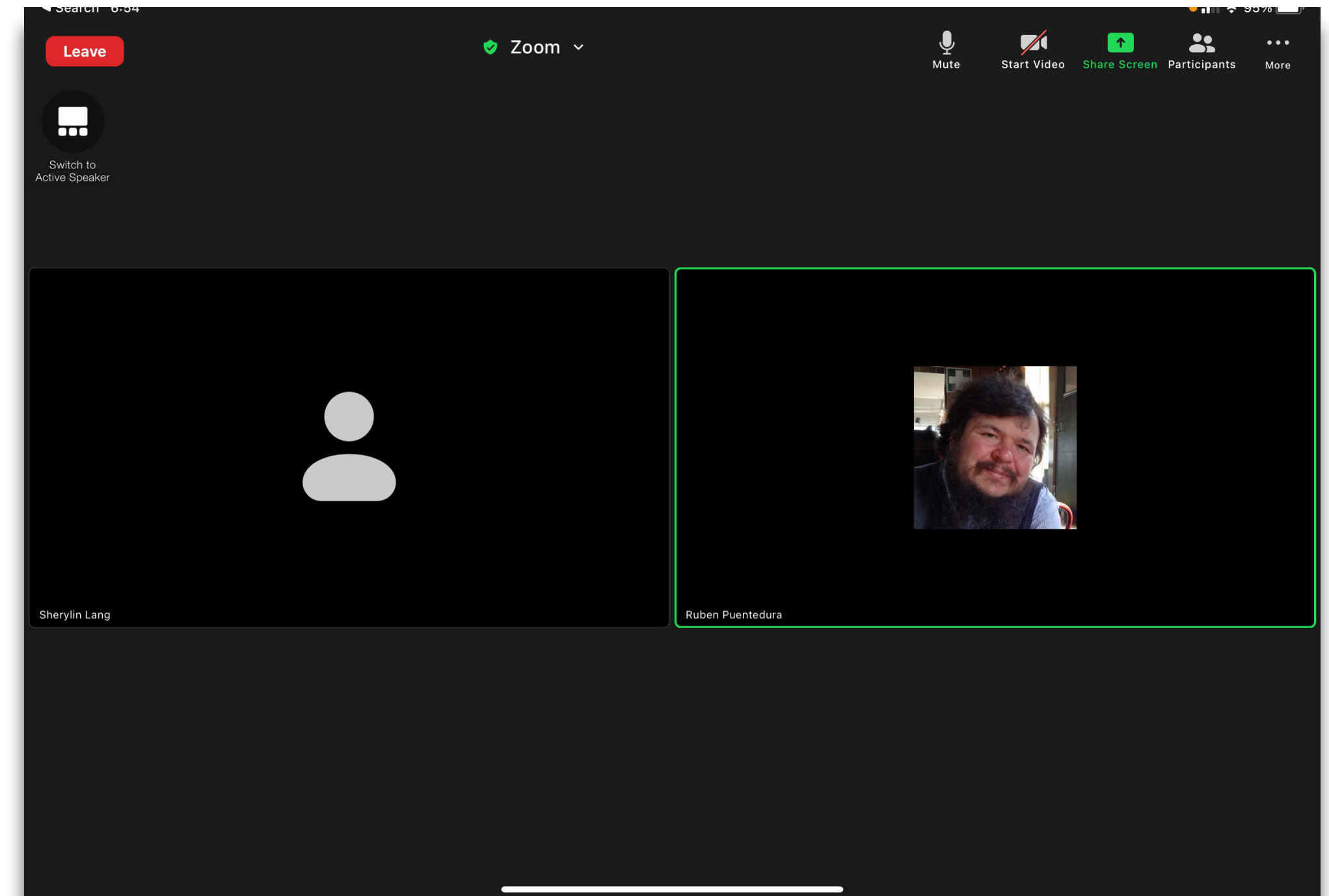
Tech allows for significant task redesign

Augmentation

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with functional improvement*

Substitution

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with no functional change*



Infrastructure

Primary Focus: Shared Telepresence

Redefinition

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Modification

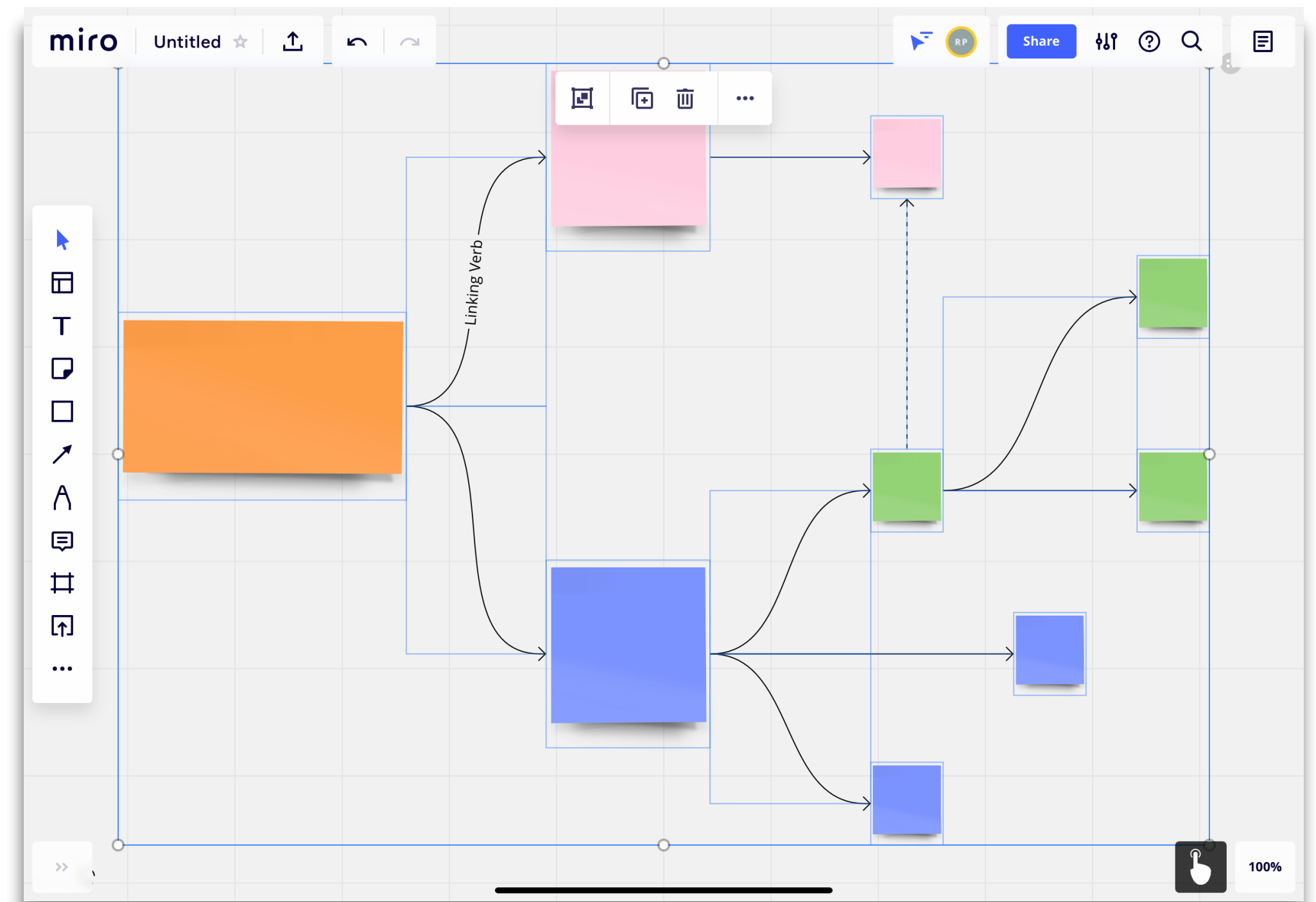
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Amplification

Primary Focus: Rich Collaboration Spaces

Redefinition

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Modification

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Augmentation

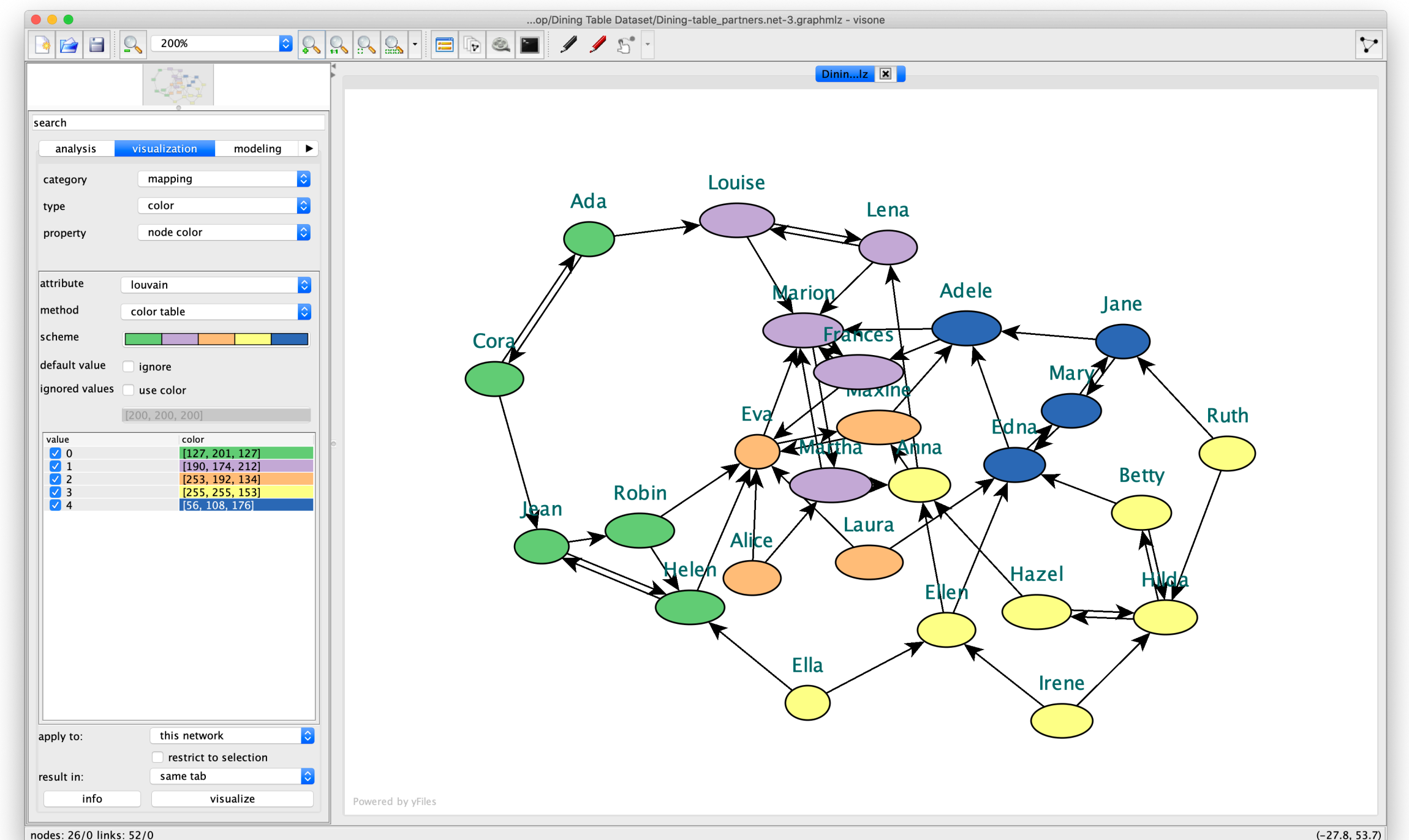
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Substitution

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Integration

Primary Focus: Enhanced Social Networks



Redefinition

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Modification

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Augmentation

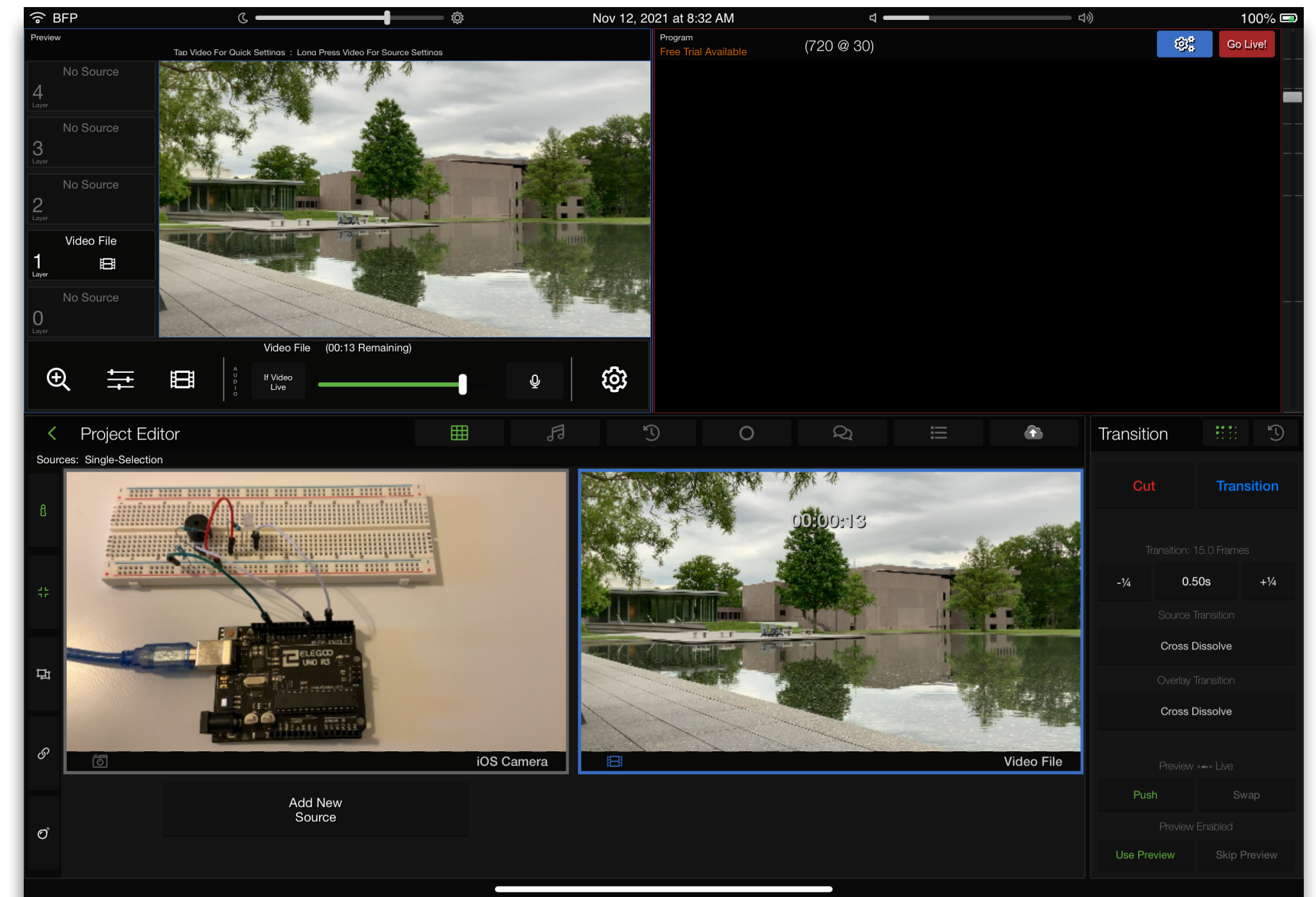
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Substitution

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Differentiation

Primary Focus: Shared Video Creation



Redefinition

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Modification

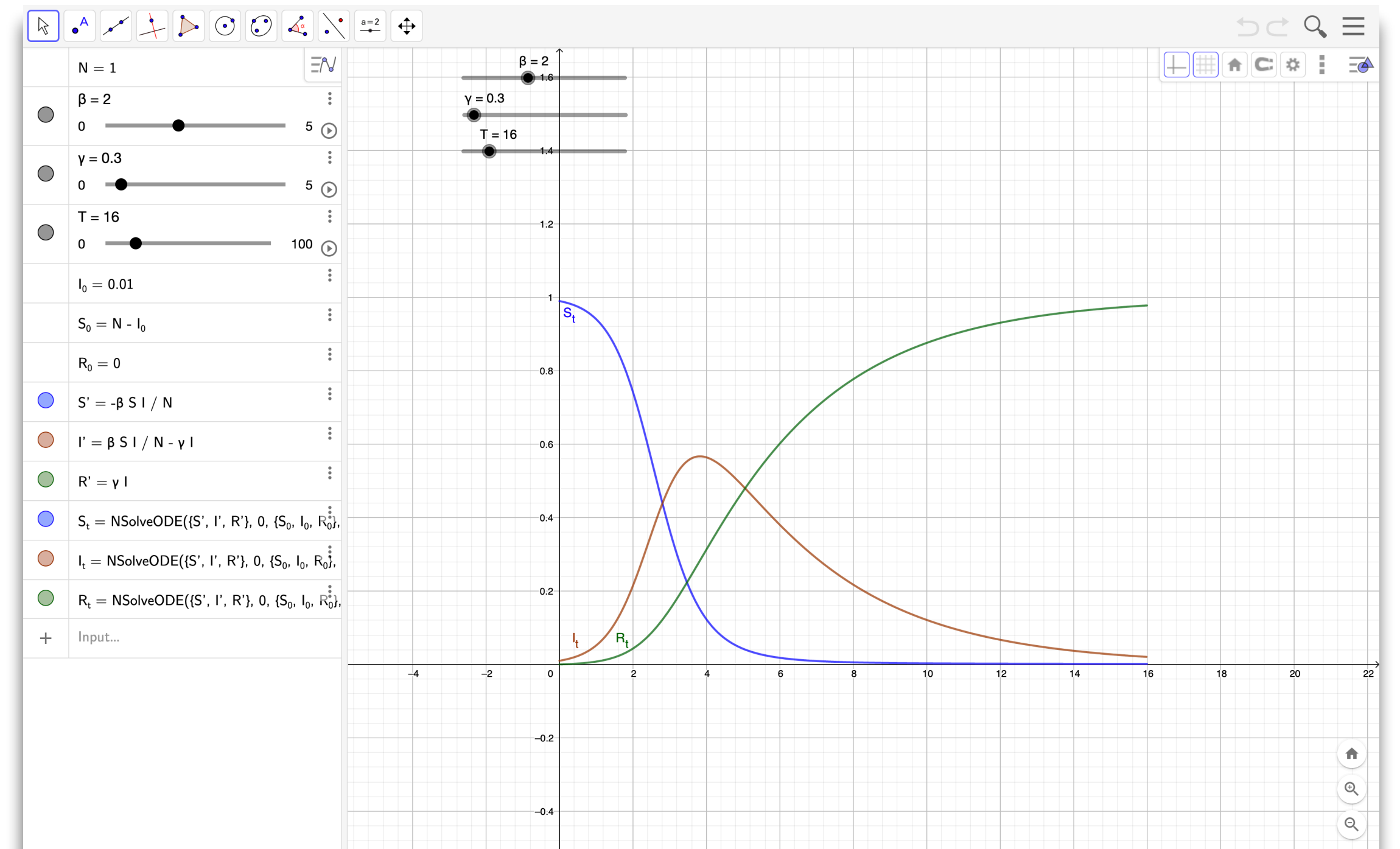
Tech allows for significant task redesign

Augmentation

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Substitution

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with no functional change*



Infrastructure

Primary Focus: Analytic/Modeling Tools

Redefinition

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Modification

Tech allows for significant task redesign

Augmentation

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Substitution

Tech acts as a direct tool substitute, with no functional change



Amplification

Primary Focus: Device Data Sensors

Redefinition

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previously inconceivable*

Modification

Tech allows for significant task redesign

Augmentation

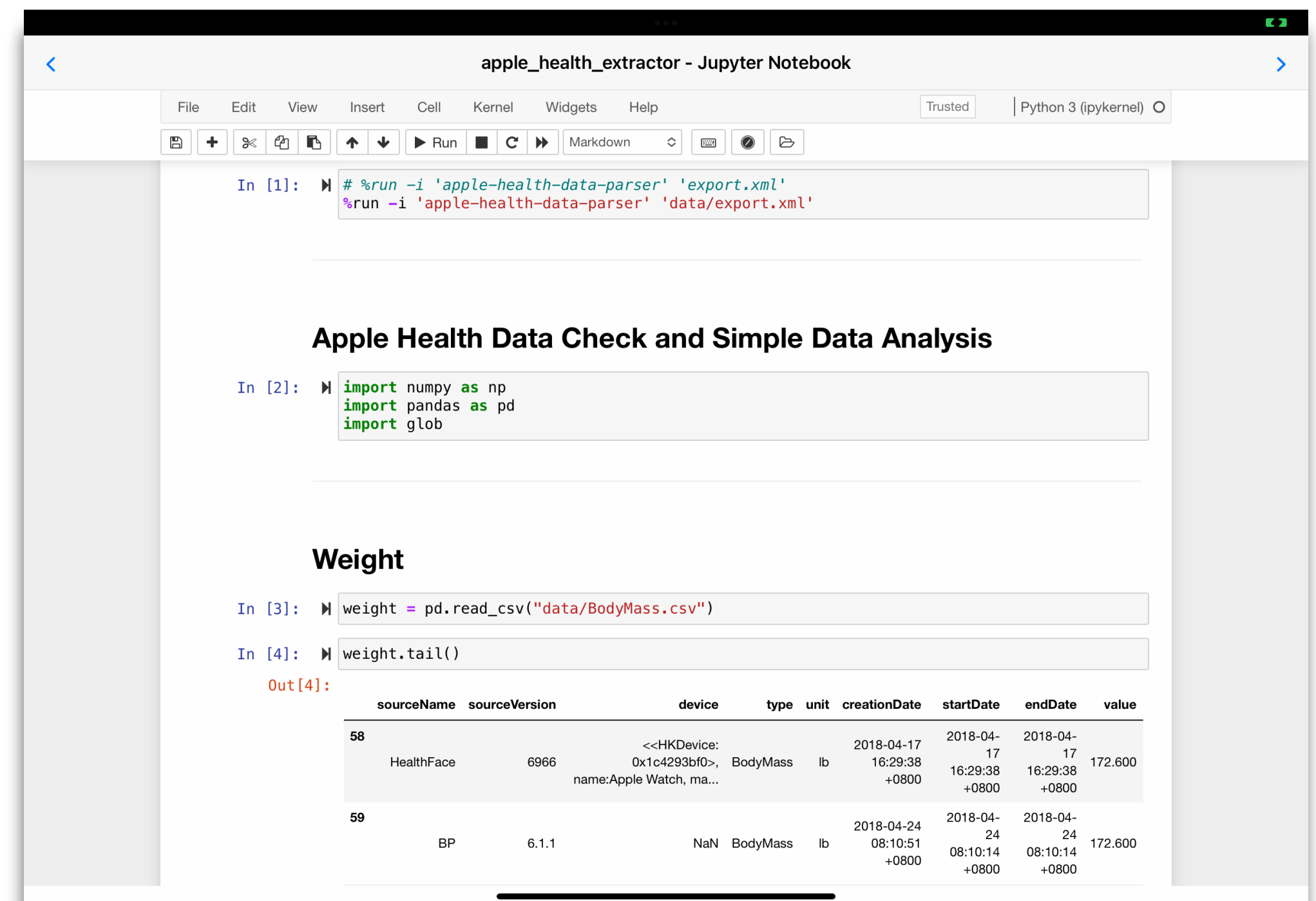
*Tech acts as a direct tool substitute,
with functional improvement*

Substitution

*Tech acts as a direct tool substitute,
with no functional change*

Integration

Primary Focus: Computational Thinking



```
apple_health_extractor - Jupyter Notebook
File Edit View Insert Cell Kernel Widgets Help Trusted Python 3 (ipykernel)
In [1]: # %run -i 'apple-health-data-parser' 'export.xml'
        %run -i 'apple-health-data-parser' 'data/export.xml'

Apple Health Data Check and Simple Data Analysis

In [2]: import numpy as np
        import pandas as pd
        import glob

Weight

In [3]: weight = pd.read_csv("data/BodyMass.csv")

In [4]: weight.tail()
Out[4]:
```

	sourceName	sourceVersion	device	type	unit	creationDate	startDate	endDate	value
58	HealthFace	6966	<<HKDevice: 0x1c4293bf0>, name:Apple Watch, ma...	BodyMass	lb	2018-04-17 16:29:38 +0800	2018-04-17 16:29:38 +0800	2018-04-17 16:29:38 +0800	172.600
59	BP	6.1.1	NaN	BodyMass	lb	2018-04-24 08:10:51 +0800	2018-04-24 08:10:14 +0800	2018-04-24 08:10:14 +0800	172.600

Redefinition

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Modification

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Augmentation

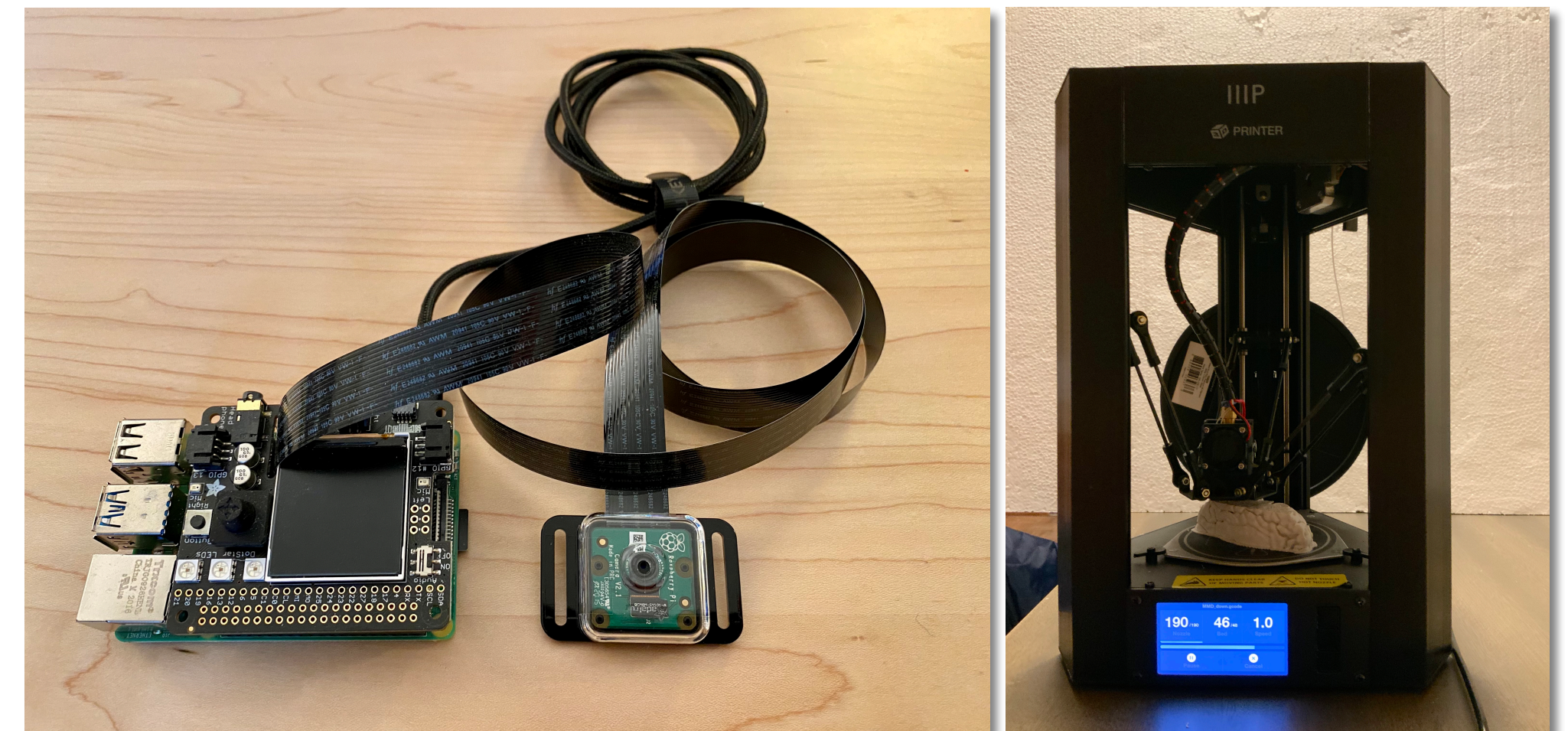
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Substitution

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with no functional change*

Differentiation

Primary Focus: Making/Measuring



Redefinition

*Tech allows for the creation of new tasks,
previously inconceivable*

Differentiation

*Primary Focus: Agents
Develop learner/community agency*

Modification

Tech allows for significant task redesign

Integration

*Primary Focus: Networks
Create people/practice networks*

Augmentation

*Tech acts as a direct tool substitute,
with functional improvement*

Amplification

*Primary Focus: System Dynamics
Enhance selected leverage points*

Substitution

*Tech acts as a direct tool substitute,
with no functional change*

Infrastructure

*Primary Focus: EdTech Baseline
Implement shared tools and practices*

Additional Resources

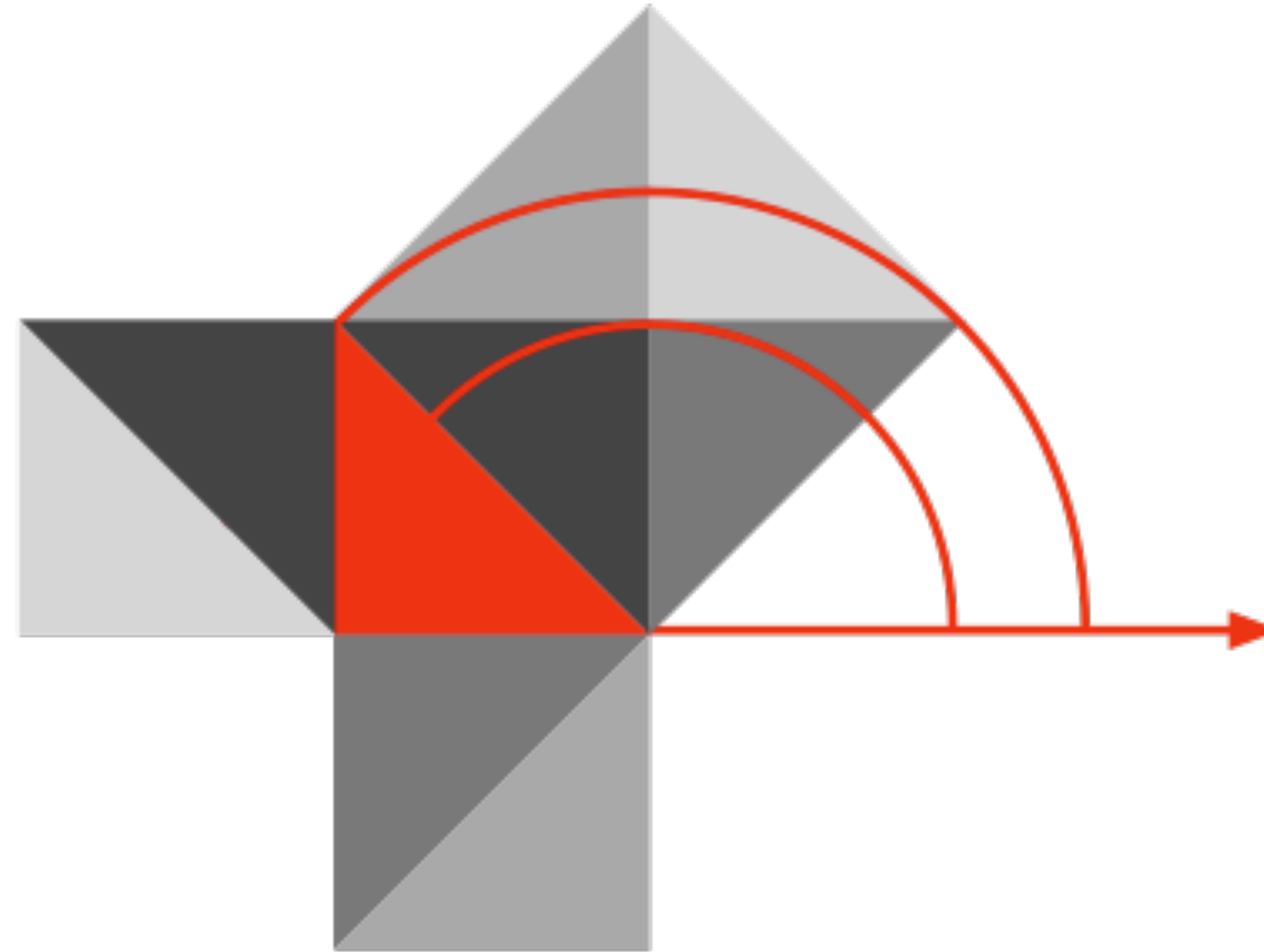
- **SAMR and the EdTech Quintet:**

- For an overview of both models in one location, this video covering the basics is probably the best place to start:
 - *Technology in Education: A Brief Introduction* – <https://youtu.be/rMazGEAiZ9c>
- One particularly accessible and concise introduction focusing exclusively on the SAMR model was codeveloped with Common Sense Education:
 - *What is the SAMR Model?* – <https://youtu.be/9b5yvgKQdqE>
 - *How to Apply the SAMR Model* – <https://youtu.be/ZQTx2UQQvbU>
 - *The Impact of the SAMR Model* – <https://youtu.be/SWU0Dzz6gs0>
- The EdTech Quintet has a rather interesting set of connections to older - much older - technologies, as discussed in this presentation:
 - *The NMC Perspective Series: Ideas that Matter* – <https://youtu.be/NemBarqD6qA>
- Finally, for those wishing to dig a little deeper, a conversation between Dr. Bebell and Dr. Puentedura has more of the inside story on the research:
 - *Demystifying SAMR* – <https://youtu.be/L9h9ePoXqS8>

- **Black Swan Thinking:**

- Dr. Puentedura's ongoing project, sponsored by ASU under its ShapingEDU umbrella:
 - *What Are Black Swan Events?*
 - *Of Swans, Dragons, and How to Tell Them Apart (Without Getting Singed)*
 - *Session 1: Why The Little Dutch Boy Was The Little Doomed Boy*
 - *Session 2: How The Leopard Didn't Get Its Spots*
 - *Session 3: Who Framed The Narrative Of Cock Robin?*
 - *Black Swan Thinking Foundations*
 - *A Black Swan Game*

Hippasus



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Twitter: @rubenrp

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