Building Antifragile Schools

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1. Black Swans and Antifragility
Black Swan Events

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

scenarios, the multiple lines of evidence entering the assessment of future global surface temperature response to radiative net zero around or after 2050, followed by varying levels of net negative CO$_2$ emissions scenario (SSP1) reached under the very low GHG emissions scenario (SSP1) than not

B.1.3

scenario (SSP2) crossed is defined here as having the assessed global surface temperature change, averaged over a 20-year period, at least 1.5°C above the present

SSP1-1.9

B.1.2

scenario (SSP1) to be exceeded in the intermediate scenario (SSP2) or

SSP2-4.5

Future global warming levels

1850-1900 Present 1 °C 1.5 °C 2 °C 4 °C

Once now likely occurs 2.8 times (1.8 - 3.2) will likely occur 4.1 times (2.0 - 6.7) will likely occur 6.6 times (3.9 - 10.7) will likely occur 9.4 times (5.9 - 15.7)

10-year event Frequency and increase in intensity of extreme temperature event that occurred once in 10 years on average in a climate without human influence

Future global warming levels

1850-1900 Present 1 °C 1.5 °C 2 °C 4 °C

Hot temperature extremes over land

10-year event Frequency and increase in intensity of extreme temperature event that occurred once in 10 years on average in a climate without human influence

Future global warming levels

1850-1900 Present 1 °C 1.5 °C 2 °C 4 °C

50-year event Frequency and increase in intensity of extreme temperature event that occurred once in 50 years on average in a climate without human influence

Future global warming levels

Agricultural & ecological droughts in drying regions

10-year event Frequency and increase in intensity of an agricultural and ecological drought event that occurred once in 10 years on average across drying regions in a climate without human influence

Future global warming levels

1850-1900 Present 1 °C 1.5 °C 2 °C 4 °C

Heavy precipitation over land

10-year event Frequency and increase in intensity of heavy 1-day precipitation event that occurred once in 10 years on average in a climate without human influence

Future global warming levels

1850-1900 Present 1 °C 1.5 °C 2 °C 4 °C

SSP5-8.5

SSP3-7.0

SSP2-4.5

SSP1-2.6

SSP1-1.9

Carbon dioxide (GtCO$_2$/yr)

2015 2050 2100

Approved Version

mary for Policymakers

Figure 4.
Foreign-Born People Living in the United States: 1850 to 2010, Projected 2020 to 2060
By 2028, the foreign-born share of the U.S. population is projected to be higher than at any time since 1850.

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

In conclusion, using information on task-usage at the individual level leads to significantly lower HVWLPDWHVRIMREV³DWULVN´VLQFHZRUNH rs in occupations with ± according to FO ± high automatibilities nevertheless often perform tasks which are hard to automate.

C. Results for other OECD countries

Figure 3 shows the share of workers at high risk by OECD countries, i.e. the share of workers whose automatibility is at least 70%. This share is highest in Germany and Austria (12%), while it is lowest in Korea and Estonia (6%).

The results for Germany are very similar to the results of a recent representative survey among German employees, where 13% of employees consider it likely or highly likely that their job will be replaced by machines (BMAS 2016). Furthermore, our results for Germany are comparable to a recent study by Dengler and Matthes (2015), who use a different methodological approach but also find that 15% of all jobs in Germany are at risk of automation. Moreover, they also find a bi-polar distribution of automatibility with moderate polarisation.

We exclude the Russian Federation from our sample. This is because when we restrict the Russian PIAAC sample to those observations where all relevant variables are non-missing, then the distribution of these variables is not representative. The results for Canada should be treated with some caution, as relevant explanatory variables for extrapolating the automatibility are missing, see Annex B.

Towards a Reskilling Revolution

Table 2 depicts examples of jobs that have high, medium and low levels of similarity. It indicates that a job pair is most likely to have a degree of job-fit that would enable a viable job transition if similarity scores are at least 0.85 or above.

Figure 1 depicts the overall job-fit matrix between all 958 types of jobs (categorized by job family) in the United States in our dataset. Where a zone is highlighted in dark blue, the corresponding row and column define two occupations with a combined profile that suggests a high degree of job-fit.

By themselves, similarity scores provide a useful tool for a systematic and comprehensive comparison of job-fit and for identifying viable job transition options. However, as with any composite index, the scores provide a highly aggregated summary view of the theoretical viability of any given job transition. Additional filter criteria are needed to ensure that the job-fit indicated by the aggregate similarity score stays realistic.

For example, prospective job movers are unlikely to be hired when their work experience and educational background are significantly divergent from the requirements of a job. The US Bureau of Labor Statistics' Occupational Information Network (O*NET) provides a reasonable measure of this profile, in the form of so-called 'job zones'. Job zones capture an occupation's expected level of education, related experience, and on-the-job training required to perform a job. They are measured on a 1-to-5 scale, where occupations in job zone 1 require little or no preparation (for example dish washers) and occupations in job zone 5 require extensive preparation (for example molecular and cellular biologists). By restricting job zone changes to no more than -1 or +1, our analysis allows us to control for unrealistic or unrewarding moves. The restriction also ensures consistency in the actual level of skills and knowledge use within any given occupation.

Figure 1: Job transition matrix between 958 jobs in the United States


Figure B15: Examples of Pathways for Mine Cutting and Channeling Machine Operators

- **Mine Cutting and Channeling Machine Operators**
  - Construction and Extraction Occupations
  - Wage: $51,000

- **Structural Iron and Steel Workers**
  - Construction and Extraction Occupations
  - Wage: $66,000
  - Similarity score: 0.86
  - 18 opportunities with pay rise

- **Subway and Streetcar Operators**
  - Transportation Occupations
  - Wage: $62,000
  - Similarity score: 0.86
  - 18 opportunities with pay rise

- **Tile and Marble Setters**
  - Construction and Extraction Occupations
  - Wage: $45,000
  - Similarity score: 0.86
  - 20 opportunities with pay cut

- **Excavating and Loading Machine and Dragline Operators**
  - Transportation Occupations
  - Wage: $45,000
  - Similarity score: 0.91
  - 20 opportunities with pay cut

- **Rail-Track Laying and Maintenance Equipment Operators**
  - Construction and Extraction Occupations
  - Wage: $53,000
  - Similarity score: 0.86
  - 18 opportunities with pay rise

- **Structural Iron and Steel Workers**
  - Life, Physical and Social Science Occupations
  - Wage: $78,000
  - Similarity score: 0.85
  - 18 opportunities with pay cut


Business as Usual → Black Swan Event → Antifragility, Resilience, Near-Term Risk, Existential Risk
• 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?
2. SAMR, the EdTech Quintet, and Antifragility
Substitution
Tech acts as a direct tool substitute, with no functional change

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

Modification
Tech allows for significant task redesign

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

Enhancement

Transformation

Ruben R. Puentedura, As We May Teach: Educational Technology, From Theory Into Practice. (2009)
<table>
<thead>
<tr>
<th>The EdTech Quintet – Associated Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
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<tr>
<td>Mobility</td>
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<td>Visualization</td>
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<td>Substitution</td>
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<td>Redefinition</td>
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<td>Differentiation</td>
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<td>Integration</td>
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<td>Amplification</td>
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<td>Infrastructure</td>
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</table>
# Hybrid Modes and Telepresence

<table>
<thead>
<tr>
<th>Design Focus</th>
<th>S: Appropriate Substitutive Use of Zoom</th>
<th>A: Stocks &amp; Flows</th>
<th>M: Networks</th>
<th>R: Agents</th>
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<tbody>
<tr>
<td>Practices</td>
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<td>• create asymmetries</td>
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<td>• keep in reciprocal picture</td>
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<td>Creation of own spaces</td>
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<td>Driver of own projects</td>
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<td>Bring world into picture</td>
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Video, Duration, and Attention

- Total Maximum Time: 11 minutes
- Ratio of Segments: 1:2:3 (approx.)
- One Possible Breakdown:
  - 2 minutes for background
  - 4 minutes for development
  - 5 minutes for application


## The EdTech Quintet – Associated Practices

<table>
<thead>
<tr>
<th>Practice</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td>Provides diversity to the ZPD</td>
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<tr>
<td>Mobility</td>
<td>Creates the context for the process</td>
</tr>
<tr>
<td>Visualization</td>
<td>Aids in segmenting ZPD, bridging gaps</td>
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<tr>
<td>Storytelling</td>
<td>Aids in the integration of the ZPD</td>
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<tr>
<td>Gaming</td>
<td>Provides frameworks for independent practice</td>
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</tbody>
</table>
**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

**Infrastructure**
Primary Focus: EdTech Baseline
Implement shared tools and practices
Substitution
Tech acts as a direct tool substitute, with no functional change

Modification
Tech allows for significant task redesign

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

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

Amplification
Primary Focus: System Dynamics
Enhance selected leverage points
**Substitution**
Tech acts as a direct tool substitute, with no functional change.

**Modification**
Tech allows for significant task redesign.

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

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

**Integration**
Primary Focus: Networks
Create people/practice networks.
**Redefinition**
Tech allows for the creation of new tasks, previously inconceivable

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

**Modification**
Tech allows for significant task redesign

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

**Differentiation**
Primary Focus: Agents
Develop learner/community agency
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:
  - 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/9h5wgKQdqE
    - How to Apply the SAMR Model – https://youtu.be/ZQTx2UQOvbU
    - 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:
    - 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
Hippasus

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