Man and Machine
The Impact of Technology

Charles Fadel, charles@curriculumredesign.org; New York City, February 28, 2012
Volatile
Uncertain
Complex
Ambiguous

Source: US Army War College, 2001
Consequences are already visible

Source: YouTube video on Occupy movement
Engineering PhD median salary

- US (CA): $125,200
- Germany: $99,400
- China: $53,700
- India: $39,200

How do you justify 2-3x differential?
IN MORE DEVELOPED COUNTRIES

Source: “Tough Choices or Tough Times” 2007, National center on education and the economy

IN LESS DEVELOPED COUNTRIES

Race up the Value Chain

Creative Work

- Research
- Development
- Design
- Marketing and Sales
- Global Supply Chain Management

Routine Work
DONE BY PEOPLE

Routine Work
DONE BY MACHINES
Impact of Technology?
Google Autonomous Vehicle – Videos

>300kmiles, one minor accidents, occasional human intervention
Fixed* mindset $\rightarrow$ Lose job $\rightarrow$ displacement (far fewer drivers)
Growth mindset $\rightarrow$ Start company $\rightarrow$ adaptation... BUT

- Requires upskilling
- Far fewer owners
- Not clear it will be the same owner
  $\rightarrow$ displacement again
Impact of Technology

- Autonomous vehicles
- Telepresence
- Telemedicine

Nonroutine Skill

Radiologist → Pathologist
Legal discovery → Legal Opinion
Security video monitoring → RoboGuard
Typing clerk → Bookkeeping

Routine Skill

Impersonal delivery

Personal delivery

Surgeon
Court proceeding
Policeman
Taxi driver

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“Computational Pathologist”

“Computers found more accurate than doctors in breast-cancer diagnosis”

Science Magazine November 10, 2011

“Computational Pathologist” by Stanford Schools of Engineering and Medicine
Even modeling

H&M admits using a mannequin as digital model with “no flaws”

Source: Le Monde Culture & Idees, December 24, 2011
Even Pop Stars

• **Video** – Hatsune Miku, “Vocaloid”
Displacement due to Technology

Ox → Harvester
Horse → Automobile
Lab Mice → Assays (not soon enough...)

Humans:
  Scribes → printing press
  Washers → washing machine
  Cashiers/Attendants → bar code scanner
  Healthcare/Finance/Services/Jeopardy champions → Watson
“What is…?”

“I for one welcome our new computer overlords“

Ken Jennings,
Jeopardy champion, lost to Watson
Schedule a meeting with Dilbert and Alice for next Tuesday at ten.

Never mind. My phone took care of it.

Awkward.
High-speed manipulation - Videos
Replace Workforce With Robots

Terry Guo, CEO of Foxconn, said last July that the Taiwan-based manufacturing giant would add up to one million industrial robots to its assembly lines inside of three years.
"All those in favour of accepting more robots?"
A combinatorial explosion of possibilities
Reality Check

"We tend to overestimate the effect of technology in the short run…"

"and underestimate the effect in the long run."

Source: Roy Amara, Former President, Institute for the Future
Music exercise – Audio
(Incremental) Innovation rule-based $\rightarrow$ automatable

Mono bi poly system

One-blade propeller  Two-blades  Three-blades  Four-blades  Double four-blades

Different products evolve according to the same pattern

Source: Invention Machine “IM Labs”
Automation is partial in practice

- Process of three manual steps A, B, and C.
  - A: crack egg
  - B: scramble egg
  - C: fry egg
- Step B automated, but steps A and C performed manually by a human.
- If steps A, B, and C are automated, there is always some larger process that contains the process A, B, C as a sub-process:
  - 1: Obtain egg (manual)
  - 2 (A, B, C): Crack, scramble and fry egg (automated)
  - 3: Season, present, and serve egg (manual)
- The larger process continues to require human involvement. BUT IT REQUIRES NEW SKILLS.

Source: Robert Plotkin; Author, “The Genie in the Machine”
Safe Bet

“The best pathway involves teaching children to “learn how to learn””

Vernor Vinge
Science-fiction author
Popularizer of the Singularity concept
A prescient view

“The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn”

Alvin Toffler
The Race between Technology and Education

Inspired by “The race between technology and education”
Pr. Goldin & Katz (Harvard)
Economists advising the global discussion

Building economic *resilience*:

Aspirationally: What traits for what world? (GDP vs GHI)

*Proactively: What skills for what jobs?*
Positions?

- “Technology is not really moving that fast”
- “It is, but we will adapt” (in the meantime, ouch)
- “It is, and this time is different, so what do we do?”
Thank you!

“What should students learn in the 21st century?”

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