The Future of Work

Outline

[1] Some general contours

- [a] Observed changes to the work relationship
- [b] The Third Industrial Revolution
- [c] Skill-biased technological change

[2] Some thoughts on doomsday/liberatory scenarios

- [a] The End of Work

The Transformation of Employment Relations

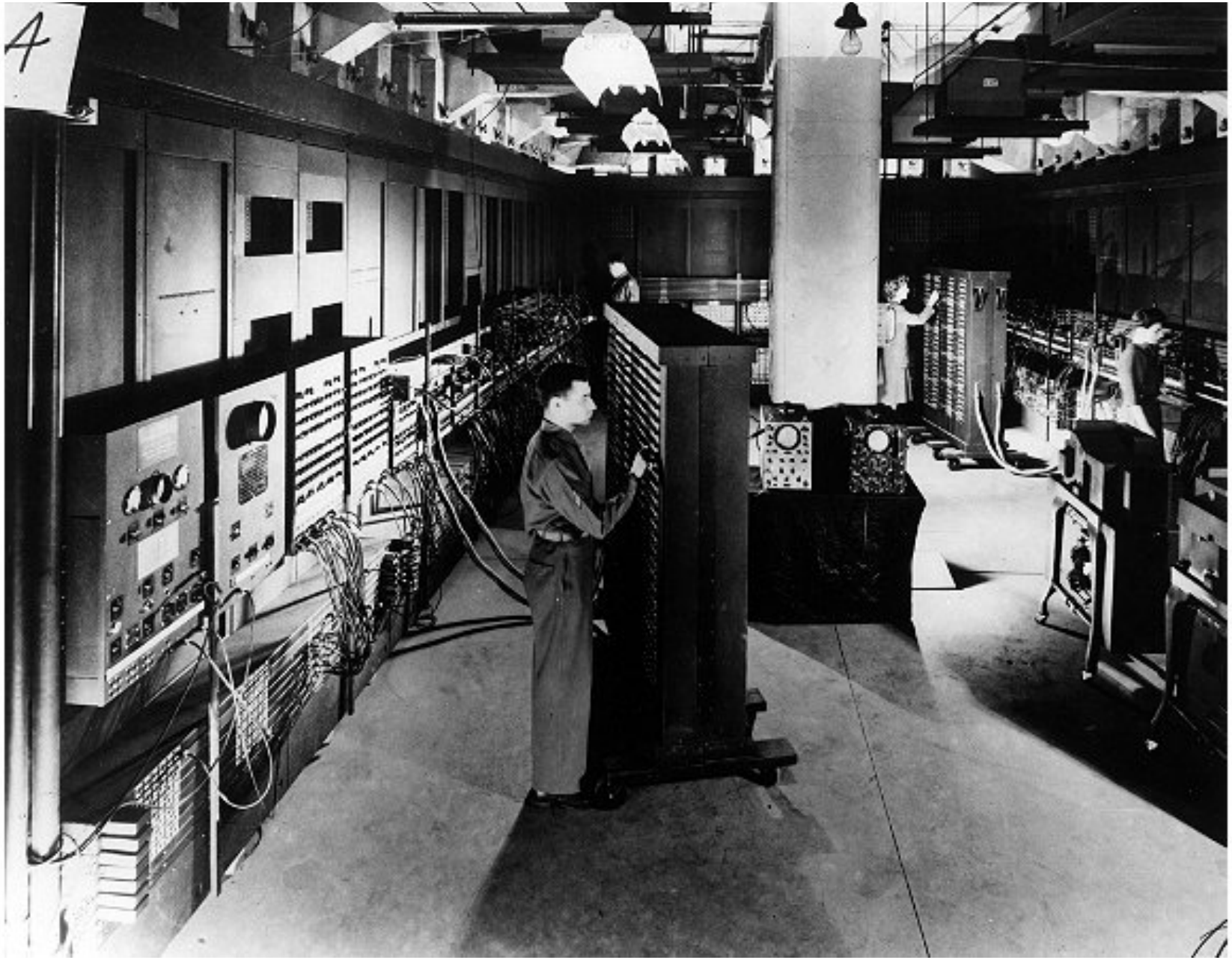
- Precarious work as the new normal

  →Employment that is "uncertain, unpredictable, and risky from the point of view of the work"

  1. Decline in attachment to employers
  2. Increase in long-term unemployment
  3. Growth in perceived job insecurity
  4. Growth in non-standard work arrangements
  5. Risk-shifting

  → Reconceptualization of the employment contract

- Globalization, **technological change**, union decline, political shifts



Source: http://www.computerhistory.org/revolution/birth-of-the-computer/4/78/321

The Third/Fourth Industrial Revolution

Revolution	Year	Information
	1	1784	Steam, water, mechanical production equipment
	2	1870	Division of labour, electricity, mass production
	3	1969	Electronics, IT, automated production
	4	?	Cyber-physical systems

What is a computer?

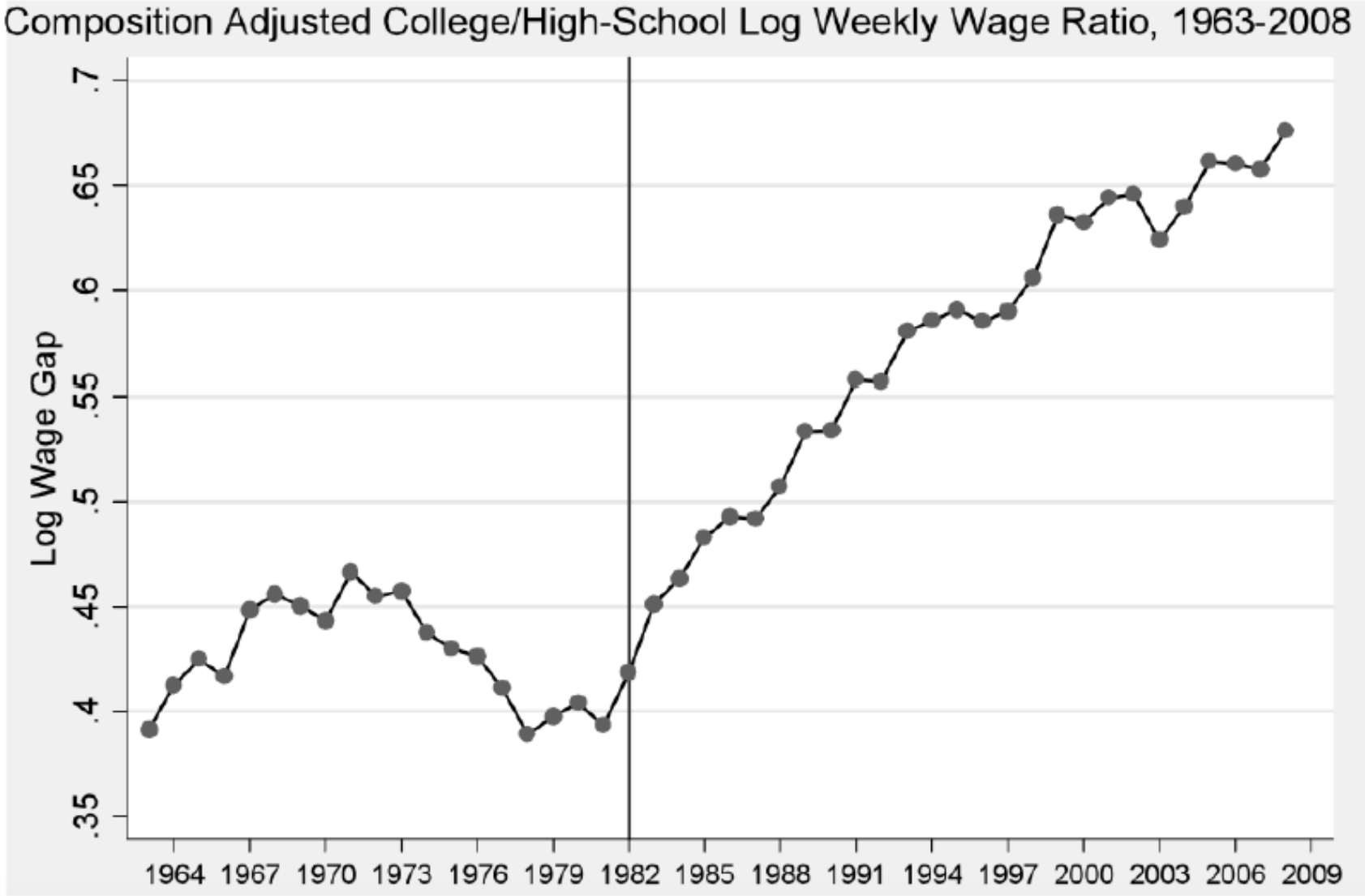
Computer Pioneers

Skill-Biased Technological Change

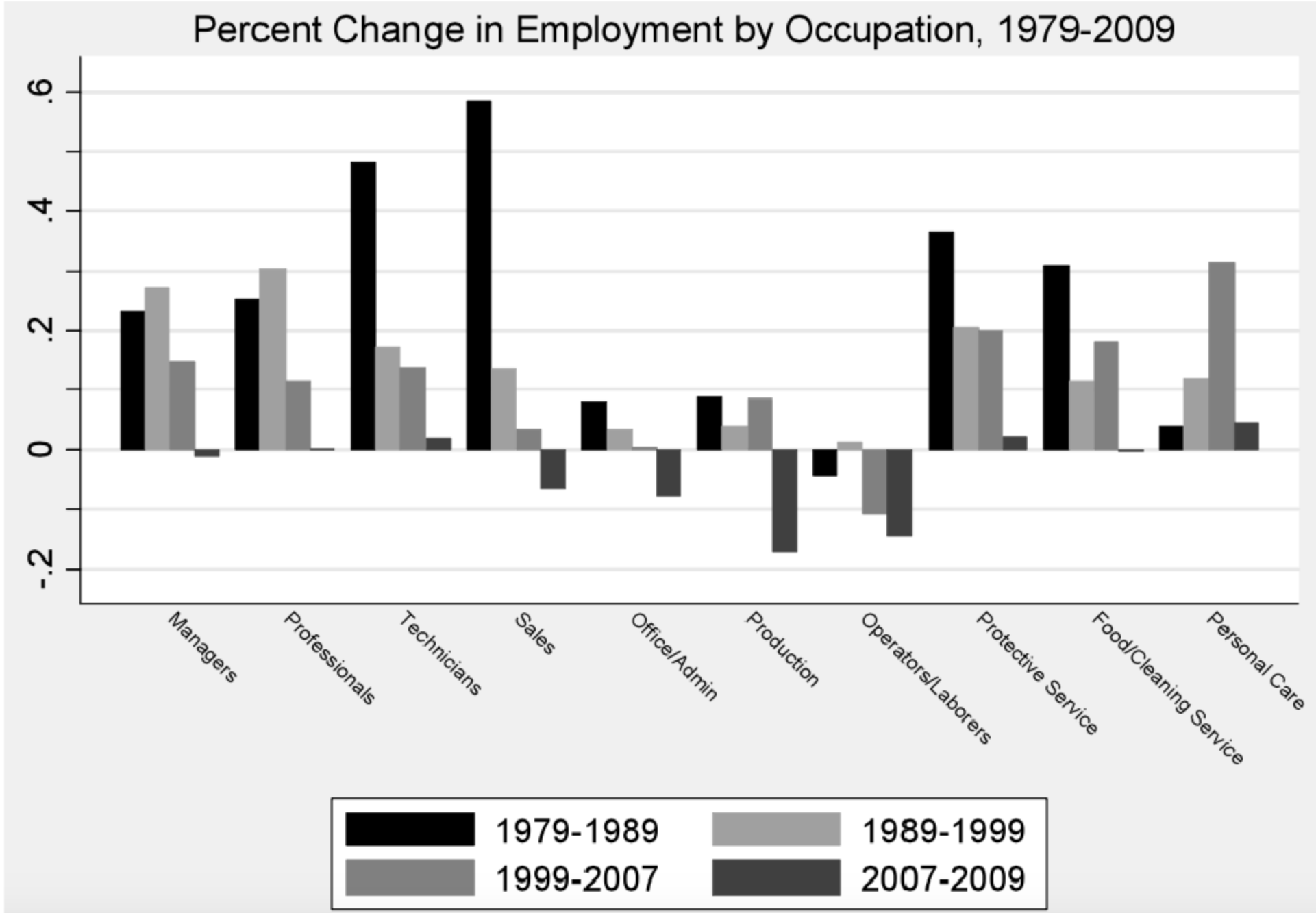
- Coincidence of two trends
  - Increase in earnings inequality between university and high-school educated workers
  - Rise of computing

- Technological change is the single most important factor behind the increase in earnings inequality across the wage structure

- In other words, the increased use of computers and technical skills related to computing represents skill-biased technological change → higher demand for high-skill labor (decrease in demand for low-skill worker)



Source: Acemoglu & Autor, "Skills, Tasks and Technology", 2010.



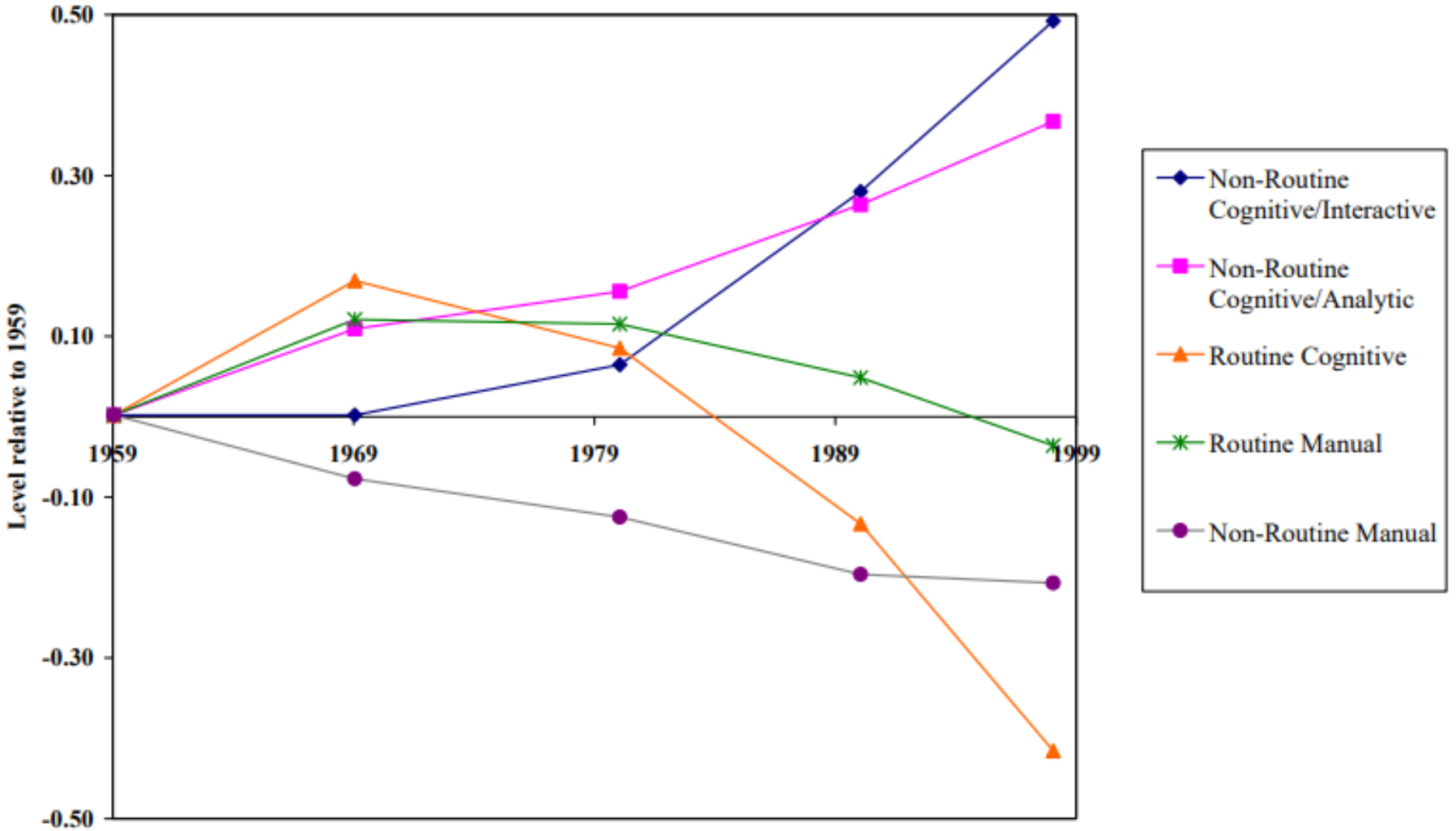
Source: Acemoglu & Autor, "Skills, Tasks and Technology", 2010.

TABLE I

PREDICTIONS OF TASK MODEL FOR THE IMPACT OF COMPUTERIZATION ON FOUR CATEGORIES OF WORKPLACE TASKS

	Routine tasks	Nonroutine tasks
	Analytic and interactive tasks	
Examples	• Record-keeping • Calculation • Repetitive customer service (e.g., bank teller)	• Forming/testing hypotheses • Medical diagnosis • Legal writing • Persuading/selling • Managing others
Computer impact	• Substantial substitution	• Strong complementarities
	Manual tasks	
Examples	• Picking or sorting • Repetitive assembly	• Janitorial services • Truck driving
Computer impact	• Substantial substitution	• Limited opportunities for substitution or complementarity

Figure 2: Economy-Wide Measures of Routine and Non-Routine Task Input:
1959 - 1998 (1959 = 0)



Source: Autor, Levy, Murnane (2001)

Computerization of routine jobs

- Jobs susceptible to computerization are those that:
  - Have well-defined tasks
  - Are routinized
  - Non-cognitive/creative

- E.g. routine manufacturing jobs
- What is a database? Desk Set (1957)

What about the services?

- Difficult to automate
  - Interpersonal adaptability
  - E.g. childcare
- Difficult to outsource/trade
  - In-person production
- But, minimal educational requirements

Building on the task model…

- Frey and Osborne (2013): How Susceptible Are Jobs to Computers?

- Increasing availability of information that facilitates outlining contingencies of complex/affective tasks
  - Big data
  - Sensors
  - Cheaper robotics

Frey and Osborne (2013)

- Automation likely to continue across wide range of occupations barring certain engineering bottlenecks
  - Perception → structured vs. unstructured work environments
  - Creativity → can't be easily defined, much less encoded
  - Social intelligence → care, nurturing, negotiation, persuasion
- Likelihood of imminent computerization depends on these three task characteristics

```
{ "poems": [
"NO POET'S DON'T OWN WORDS",
"I AM THAT I AM",
"JUNK IS NO GOOD BABY",
"I DON'T WORK YOU DIG",
"KICK THAT HABIT MAN",
"COME TO FREE THE WORDS",
"RUB OUT THE WORD",
"RE CALLING ALL ACTIVE AGENTS"
]}
```

```
import itertools
import math

class Poem:
    def __init__(self, s, title=True):
        self.sequence = s.split()
        self.text = []
        self.is_reading = False
        self.max_line_length = len(s)
        if title == True:
            self.title = s

        def make_perms(sequence):
            """
            Create a list of all possible permutations of a
            given sequence.
            """
            for p in itertools.permutations(sequence):
                p = list(p)
                p.reverse()
                line = " ".join(p)
                self.text.append(line)
            self.text.reverse()

        make_perms(self.sequence)
        self.line_length = len(s)
        self.lines = len(self.text)
        self.chars = len("".join(self.text))
```

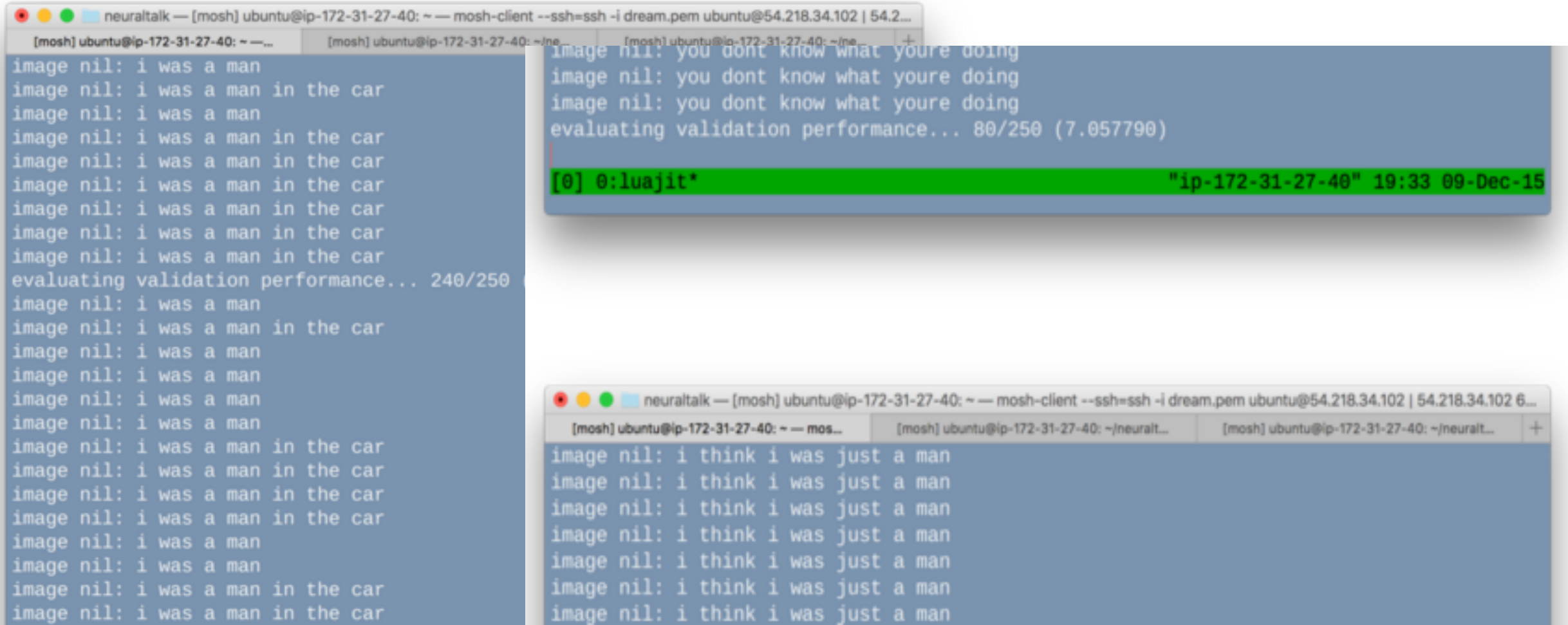
Source: https://github.com/josephmoore/Permutations

Gysin Permutations

Rather than training the machine with an image caption set, I trained it with dialogue from subtitles and matching frames extracted at 10 second intervals from every episode of *The X-Files*. This is just an experiment, and I'm not expecting stellar results.

That said, the robot is already spitting out some pretty weird and genuinely creepy lines. I can't wait until I have a version that's trained well enough to feed in new images and get varied results.

Source: http://rossgoodwin.com/



Talk to Transformer

GPT-2 is a large transformer-based language model with 1.5 billion parameters, trained on a dataset[1] of 8 million web pages. GPT-2 is trained with a simple objective: predict the next word, given all of the previous words within some text. The diversity of the dataset causes this simple goal to contain naturally occurring demonstrations of many tasks across diverse domains. GPT-2 is a direct scale-up of GPT, with more than 10X the parameters and trained on more than 10X the amount of data.

When will we reach the singularity?

GENERATE ANOTHER

Completion

When will we reach the singularity? As far as we know, the singularity is when some event, a quantum event, happens to the universe; and our predictions about that singularity are not as precise as we might like them to be. Is the singularity happening today? It is not happening today. It is very hard to predict what will happen on some day in the future, as you might say that your 100 years into the future is 100 years into the past.

It is easy for people to talk about the singularity because they are doing that already and

https://talktotransformer.com/

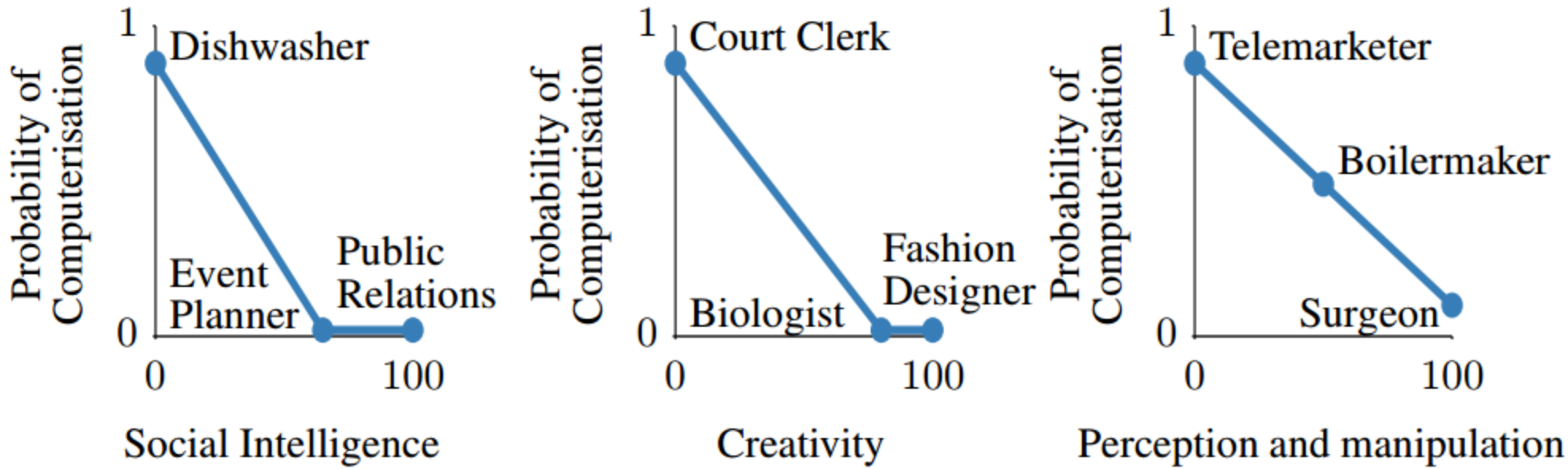
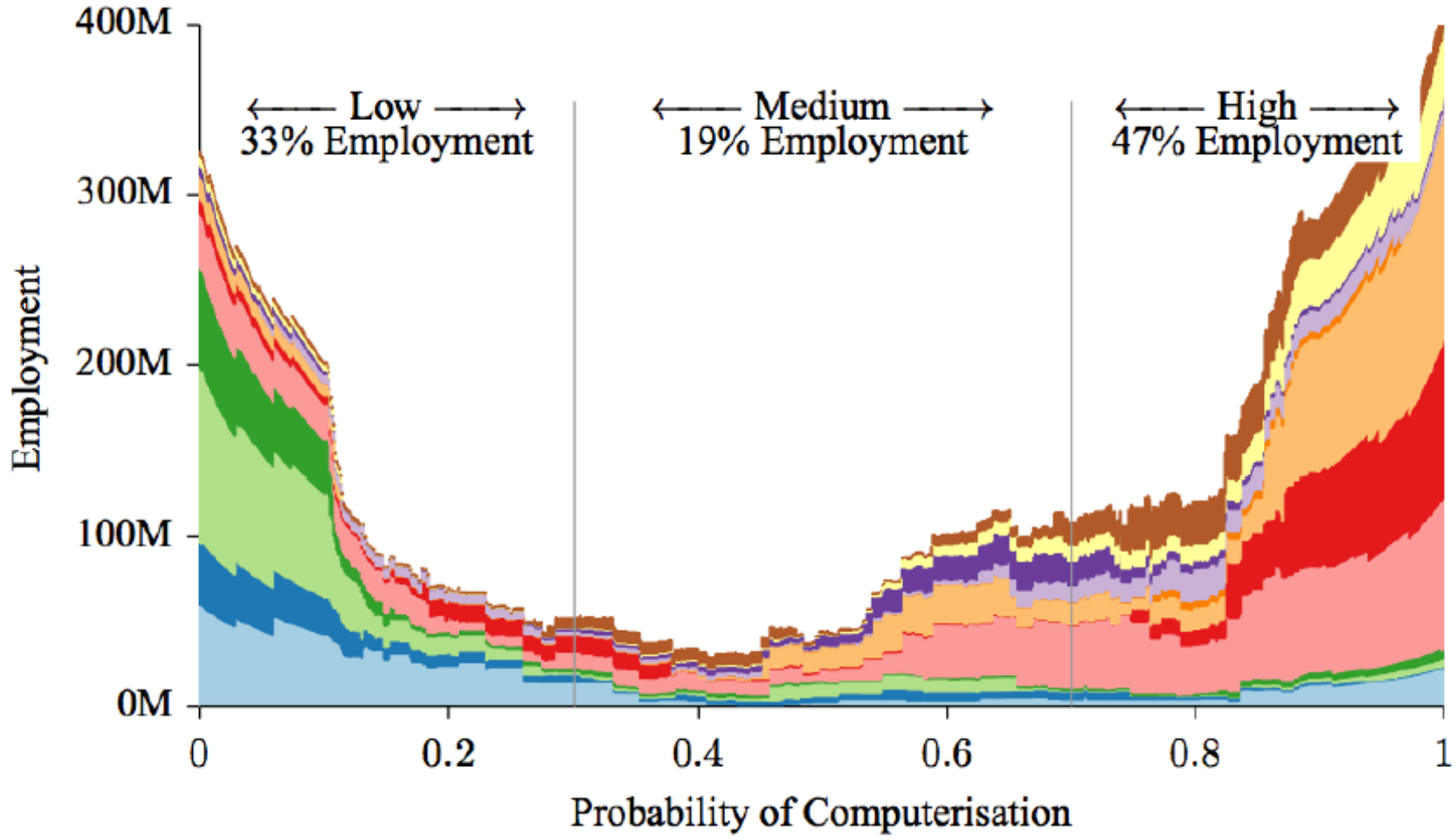


FIGURE I. A sketch of how the probability of computerisation might vary as a function of bottleneck variables.

Computerisation bottleneck	O*NET Variable	O*NET Description
Perception and Manipulation	Finger Dexterity	The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects.
	Manual Dexterity	The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
	Cramped Work Space, Awkward Positions	How often does this job require working in cramped work spaces that requires getting into awkward positions?
Creative Intelligence	Originality	The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem.
	Fine Arts	Knowledge of theory and techniques required to compose, produce, and perform works of music, dance, visual arts, drama, and sculpture.
Social Intelligence	Social Perceptiveness	Being aware of others' reactions and understanding why they react as they do.
	Negotiation	Bringing others together and trying to reconcile differences.
	Persuasion	Persuading others to change their minds or behavior.
	Assisting and Caring for Others	Providing personal assistance, medical attention, emotional support, or other personal care to others such as coworkers, customers, or patients.



- Office and Administrative Support
- Farming, Fishing, and Forestry
- Construction and Extraction
- Installation, Maintenance, and Repair
- Production
- Transportation and Material Moving
- Management, Business, and Financial
- Computer, Engineering, and Science
- Education, Legal, Community Service, Arts, and Media
- Healthcare Practitioners and Technical
- Service
- Sales and Related

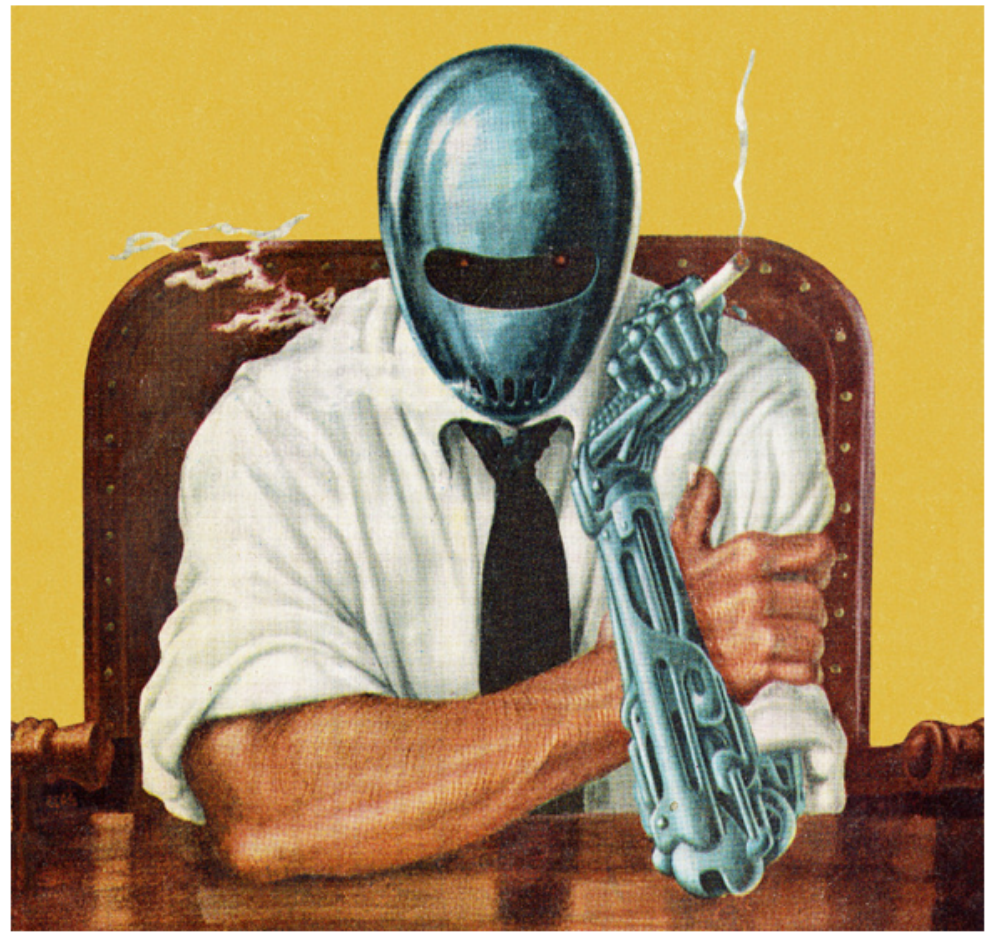
Source: Frey & Osborne, *The Future of Employment*, 2013.

Some critiques

- Occupations != jobs
  - Tasks can be redistributed and reconfigured into new job titles that don’t eliminate occupations entirely or create new occupations
- Organizations implement new processes, tech and will shape what gets eliminated, reconfigured
- AI itself will drive employment growth in new occupations

MARCUS WOHLSEN BUSINESS 08.08.14 6:30 AM

WHEN ROBOTS TAKE ALL THE WORK, WHAT'LL BE LEFT FOR US TO DO?



Basic/minimum income schemes

- Basic income/demogrant/citizen's wage/universal benefit = modest, unconditional income paid by a political community to its members (van Parijs 2004)
  - Cash paid on a regular basis
  - Top up with income from other sources
  - No work or means test = less administrative costs

- Objections
  - Costly?
  - Work incentives?