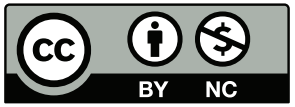
Employment and Computers



Employment Issues

- Computers create jobs
- Computers destroy jobs
- What is the net effect?
- What, if anything, should we do?

It's Not Just Automation

- The obvious effect is displacement: a computer doing a job that a person used to do
- But the computer industry has its own characteristics; these affect employment, too

The Issue Isn't New

- There are many centuries of history of machinery displacing humans from some jobs
- Often, that's been good—but not always
- Automation—letting gadgets *decide* things, rather than just supply brute force—has exacerbated this

Jacquard Looms

- Early 19th century invention—used punch cards to control the pattern to be woven into cloth
- Took a lot of the skill out of weaving
- There were job losses among the (hand) weavers
- Some claim that there were riots
- (There were other issues, including increased global trade)

From Wikipedia

The Luddites

- The Luddites (England, early 19th century) targeted power looms because they converted a skilled job into low-wage drudgery
- (There were many other reasons for their rebellion)

Woodworking

- Until the 19th century, woodworking tools were largely the same for many, many centuries
- The circular saw blade was invented around 1813 (some say by a Shaker woman, Tabitha Babbit), leading to large, water-powered tools
- A late 19th century woodshop would be familiar to a hobbyist furniture maker—but the tools were driven by belts running to a long, central shaft, instead of by individual electrical motors
- But—a modern computer-numerical controlled (CNC) milling machine works in a fundamentally different fashion
- The skills needed are completely different—and operating the machines, once they're programmed, requires much less skill

A Continually Contentious Issue

- Displacement of workers by machines has remained a contentious issue
- Management cited cost-cutting; labor asserted that workers, too, should reap the benefits of increased productivity
- Often, the rationale for the displacement was that only low-skill jobs were being taken by machines, freeing humans for more creative work. (People had forgotten the weavers by then. . .)
- That notion broke down by the 1970s

Typesetting

- Typesetting via “hot lead” machines was a very skilled job
- Phototypesetting and computerized typesetting eliminated the entire profession
- An entire class of skilled workers were without jobs
- As computers have become more powerful and more ubiquitous, this phenomenon has occurred repeatly

But. . .

- Computers have also created many jobs
- The high-tech sector was and is one of the hottest sectors in the American economy
- What is the net effect?

The Rise of AI

- Computers are getting “smarter”—and they’re able to do more jobs
- There are programs that can write sports stories
- Vision and speech processing are (more or less) at acceptable levels.
- Legal research? Medical diagnostics?
- Suppose that computers get so good that “full productivity” requires far fewer workers than full employment?

Hardware Jobs

- Computers have to be manufactured, too
- Is this a net job gain or loss?
- Many are manufacturing jobs—and are subject to the same dynamics as any other manufacturing jobs

Manufacturing Computers

- Some of the high-end items (such as very new, high-end CPU chips) are still manufactured in the U.S.
- More and more, computer manufacturing has moved to low-wage countries
- Even highly-automated factories need some people. . .

Computer Hardware Isn't Very Green

- Making chips and circuit boards requires lots of nasty chemicals
- The U.S. and other developed countries generally have much stricter pollution and worker safety laws
- Is that the reason for some of the cost differential?
- Are companies really outsourcing toxic waste and sick workers?
- (Similar problems exist when recyling old computers.)

The Sharing Economy

- Are Uber, Lyft, etc., something new?
- Or are they an Internet gloss on old—and perhaps illegal—practices?
- Both?

Matching Demand and Supply

- “Car-sharing” matches people who want rides with drivers
- This is what radio-dispatched car services have done for decades—it is not new
- It is more efficient, and adds features like real-time maps—but does that make it fundamentally different?

Is it Legal?

- Are Uber, Lyft, etc., drivers just unlicensed cab drivers? (In some cities, Uber does have regulatory approval.)
- In general, cabbies must be licensed, insured, etc.
- Why is this different?
- Is this just using the Internet as a way to evade regulations?

Are the Drivers Contractors or Employees?

- "Control over workers and how they do their jobs is the most important test of whether someone is an employee, according to various tests used by federal and state courts, and government agencies." (from *Upstart Business Journal*)
- "Employees, unlike contractors, must receive minimum wage and overtime, workers' compensation and unemployment insurance. Employers would be liable for Social Security contributions and expenses like gas and vehicle maintenance that the contractors now bear individually. The companies could be socked for legal fees and penalties for misclassification. And workers would have the right to form a union."
- Is this difference Uber et al.'s cost edge?

Self-Driving Cars

- Tremendous progress in the last few years
- We may have self-driving taxis and trucks in the near future
- ☞ Waymo (a Google subsidiary) has a license to offer fully robotic taxi service in Arizona
- Hybrid models: convoys of trucks, with a human driver only in the lead vehicles, have crossed Europe
- What about taxi and truck drivers?
- And: in cities, this may reduce the need for cars even further. What will this do to the auto industry?

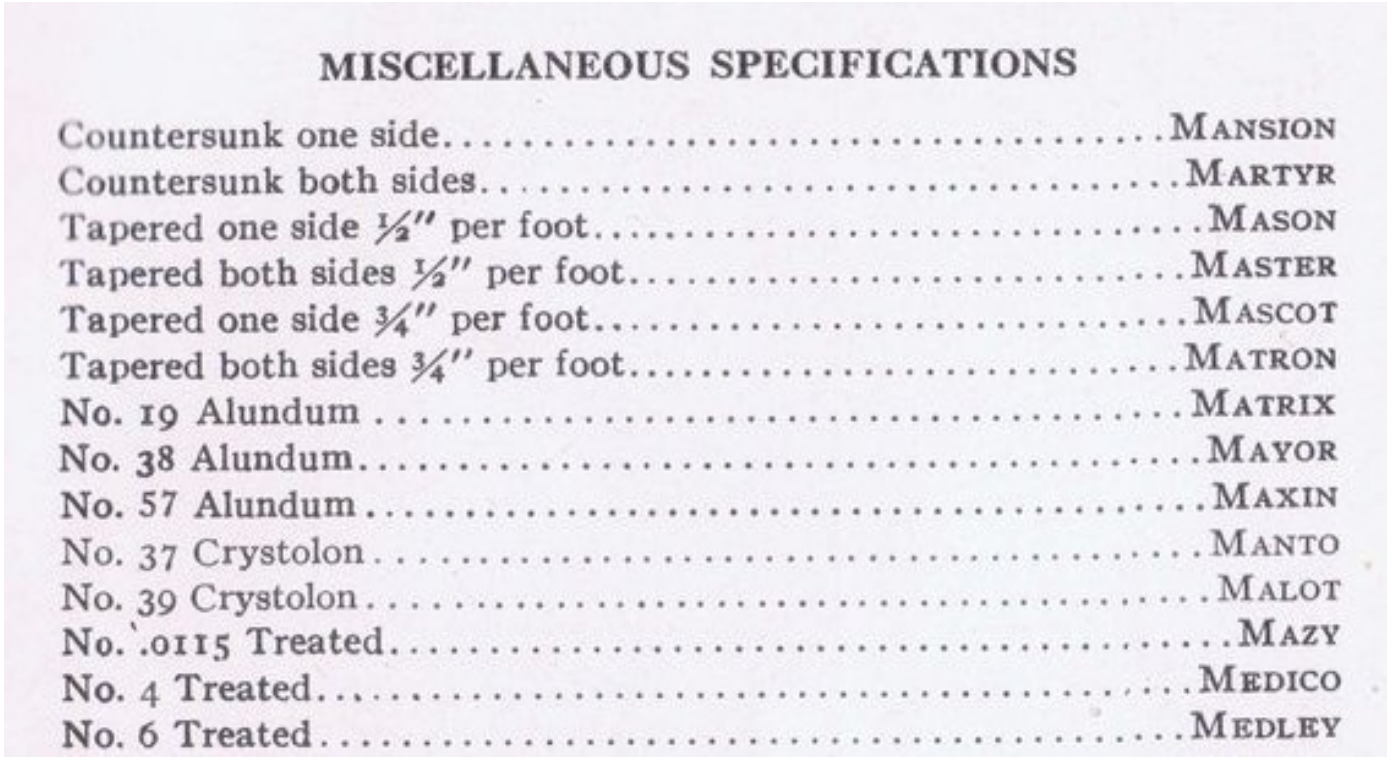
The Human Element

- There are situations where people prefer dealing with humans
- Starbucks is flourishing—and hasn't installed high-end vending machines
- Shared risk: "the pilot is always first to the scene of the crash"
- Trained employees are *much* faster at dealing with complex situations
- Non-routine jobs are much harder to automate
- But—computers keep getting better. Where is the cross-over point?

Shopping

- Mail-order catalogs have been around for more than a century
- Commercial catalogs included telegraph code words for products
- Later, phone-ordering and 800 numbers became common
- Why is Amazon different?

Telegraph Codes in Catalogs



MISCELLANEOUS SPECIFICATIONS

Countersunk one side	MANSION
Countersunk both sides	MARTYR
Tapered one side ½″ per foot	MASON
Tapered both sides ½″ per foot	MASTER
Tapered one side ¾″ per foot	MASCOT
Tapered both sides ¾″ per foot	MATRON
No. 19 Alundum	MATRIX
No. 38 Alundum	MAYOR
No. 57 Alundum	MAXIN
No. 37 Crystolon	MANTO
No. 39 Crystolon	MALOT
No. .0115 Treated	MAZY
No. 4 Treated	MEDICO
No. 6 Treated	MEDLEY

From the Norton Company grinding wheel catalog

Amazon

- It's more convenient—impulse-buying is easy
- It's cheaper to operate
- It's cheaper *at scale*
- However, Amazon has created many more delivery jobs—but it is experimenting with drones

Telecommunications

- Some of the effects of computers on jobs are more due to telecommunications than to computers per se
- That, in turn, is partly due to drastically lower prices for communications
- And while technology has helped, it's likely as much the effect of competition driving innovation, rather than innovation driving down prices

Automation and Telecommunications: The Early Days

- Originally, phone calls were connected by operators
- In one small town, there were two undertakers
- The wife of one of them was the local telephone operator; she connected grieving family members to her husband's business
- The other undertaker, Almon Strowger, invented the first phone switch, so that people could dial calls and not have to deal with an operator
- (Human operators could not handle today's call volumes—there aren't nearly enough people!)

The Phone System

- Prior to 1983, AT&T was *the* phone company—"Ma Bell"
- It provided most of the long-distance capacity; its subsidiaries provided most local service
- It manufactured most of its own equipment
- It was a legally regulated "natural" monopoly, with a guaranteed rate of return

The End of the Bell System

- On 1 January 1983, AT&T was broken up by court order subsequent to a consent decree
- The long distance company retained ownership of (most of) Bell Labs and the manufacturing facilities
- There was already some competition for long distance, notably from Sprint and MCI
- Local service was to be provided by seven “regional Bell operating companies” (RBOCs), which would retain their monopoly status

What Has Happened Since Then?

- Bell Labs is no longer the world-class R&D place it once was—not enough funding. Alcatel "merged" with Lucent; Nokia then bought the new company
- Competition drove down prices for long distance calls, but local calls remained a monopoly—and didn't drop in price very much
- The 1996 Telecom Reform Act was supposed to lead to local service competition—but didn't, for lots of reasons
- The seven RBOCs merged to two big ones (SBC and Verizon) plus Qwest
- Verizon bought MCI (there was also fraud on MCI's part); SBC bought AT&T
- The growth areas have been Internet and cellular; "POTS" (Plain Old Telephone Service) isn't interesting anymore to anyone

The Rise of Telecommuting

- With the rise of the Internet, it became very easy for many people to work at home
- Great during snowstorms, flu pandemics, etc.
- Spread jobs around

The Down Side

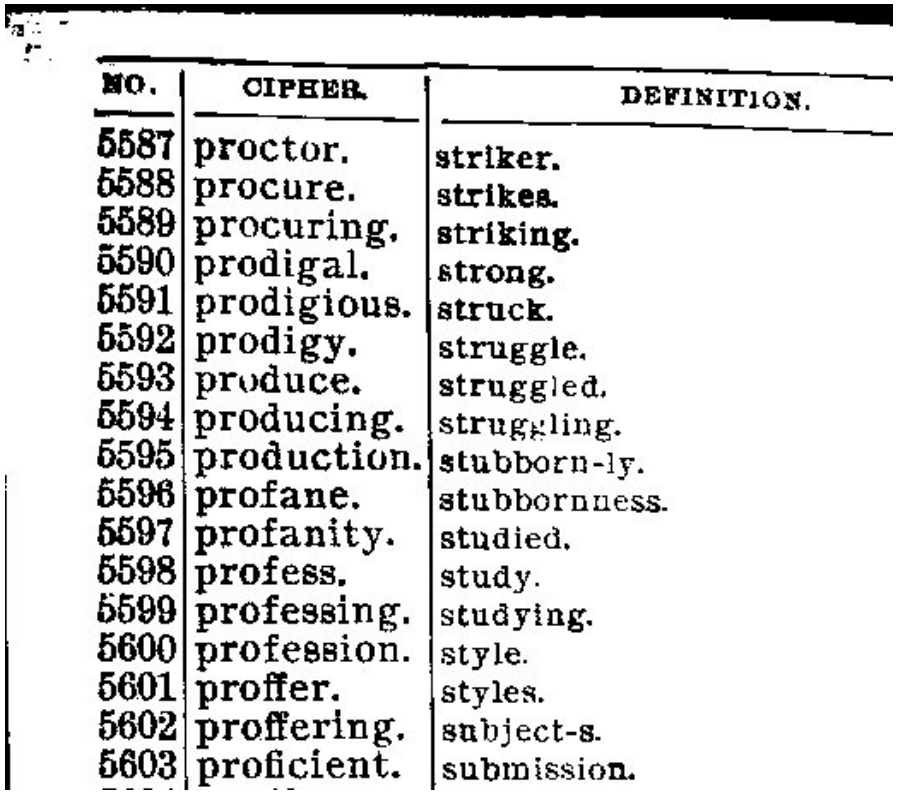
- It can be isolating—no casual conversations with coworkers (though IM, VoIP, and social media have helped with that)
- (I experienced that type of isolation in 1980, using a 134.5 bit/second hard-copy terminal. . .)
- Harder for workers to organize
- Easy for management to move jobs to lower- and lower-wage areas
- Home piecework manufacturing was outlawed long ago—should this be treated the same way?

“It’s Not a Real Job”

- Some telecommuters (especially part-timers) have trouble convincing others that they’re really working
- “Could FedEx drop off my packages at your house, since I work and you’re home?”
- Hard to draw work/life boundaries—how do you “leave” work at the end of the day?
- First Blackberries and now smartphones have made that worse
- (Back when cell phones were expensive, I turned down opportunities to get an employer-paid phone, because I didn’t want to be that available, especially to people who would call instead of emailing. . .)

Unions and Telecommuters

- How do telecommuters organize?
- Do union organizers have electronic contact information for everyone?
- How do they communicate securely?
- Can you conduct an electronic strike vote?
- What is the online equivalent of a picket line?



NO.	CIPHER.	DEFINITION.
5587	proctor.	striker.
5588	procure.	strikes.
5589	procuring.	striking.
5590	prodigal.	strong.
5591	prodigious.	struck.
5592	prodigy.	struggle.
5593	produce.	struggled.
5594	producing.	struggling.
5595	production.	stubborn-ly.
5596	profane.	stubbornness.
5597	profanity.	studied.
5598	profess.	study.
5599	professing.	studying.
5600	profession.	style.
5601	proffer.	styles.
5602	proffering.	subject-s.
5603	proficient.	submission.

Confidentiality codebook used by 19th century railroad workers

But. . .

- It has made decent, (relatively) safe jobs available to part-timers across the country, especially women
- A customer service center no longer requires a building with enough trained employees living nearby; instead, it's many people, working from home with a computer, an Internet connection, and a VoIP phone
- Many of these jobs were in economically depressed areas

Off-Shoring

- The obvious next move: move these jobs to low-wage countries
- Not just call centers—software can be done elsewhere, too
- Drives corporate costs down, but increases unemployment in the U.S.

Why India?

- Large population of English speakers
- Many of them are well-educated
- (Many other people there are poor and poorly educated—but it's a very large country)
- Stable government; rule of law
- It hasn't worked out quite as had been expected

The Problems with India

- Demand for programmers has driven up wages considerably
- Time zone differences and lack of face-to-face contact make managing outsourced software projects a lot harder than many people anticipated
- It's relatively easy to offshore well-specified modules that interact only through well-defined interfaces
- For software with complex interactions, it's a *lot* harder, and generally involves many long airplane rides

Moving Elsewhere?

- Few other places have India's population of well-educated English speakers
- China and Russia have many fewer English speakers (to say nothing of political issues)
- Singapore's population is too low
- These countries and others are competing to some extent, but India is still on top

Is Offshoring Good?

- Yes, it cuts costs for American companies
- Perhaps it cuts employment or wages for American employees
- But—“offshore” people are still people; they need to eat, too
- Why is it better to protect “our” jobs than “theirs”?

We Have to Eat, Too

- The issue isn't so much "us versus them" as the vast disparity in wage scales
- This will, over time, equilibrate
- That said, we're in a transition period now
- It will take time for things to settle down—and it isn't clear what will happen to wages here over the long term

Problems

- Industrial changes are not new—but these are faster
- Too fast for people, schools, jobs, governments to adapt?
- The nature of computers has, at least for now, eliminated many skilled jobs
- Some—but not all—of the replacement jobs are lower-skilled, and hence lower-paying
- But what happens when computers become smart (or smart enough)?

Too Many Workers?

- What if automation becomes good enough that there just aren't enough full-time jobs to go around?
- Is there a point where society can produce enough, world-wide, with a significantly smaller workforce than the full available population?
- What should *society* do?