



# Policy Opportunities in the Global Crisis Being Created by AI, Robots, Desktop Manufacturing and BioMedicine

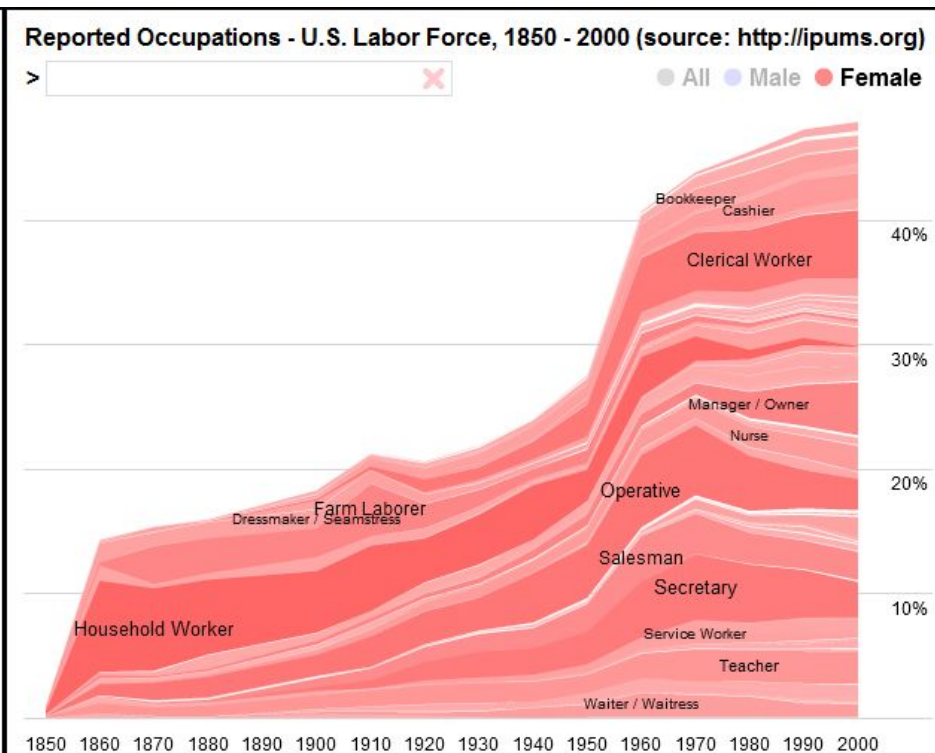
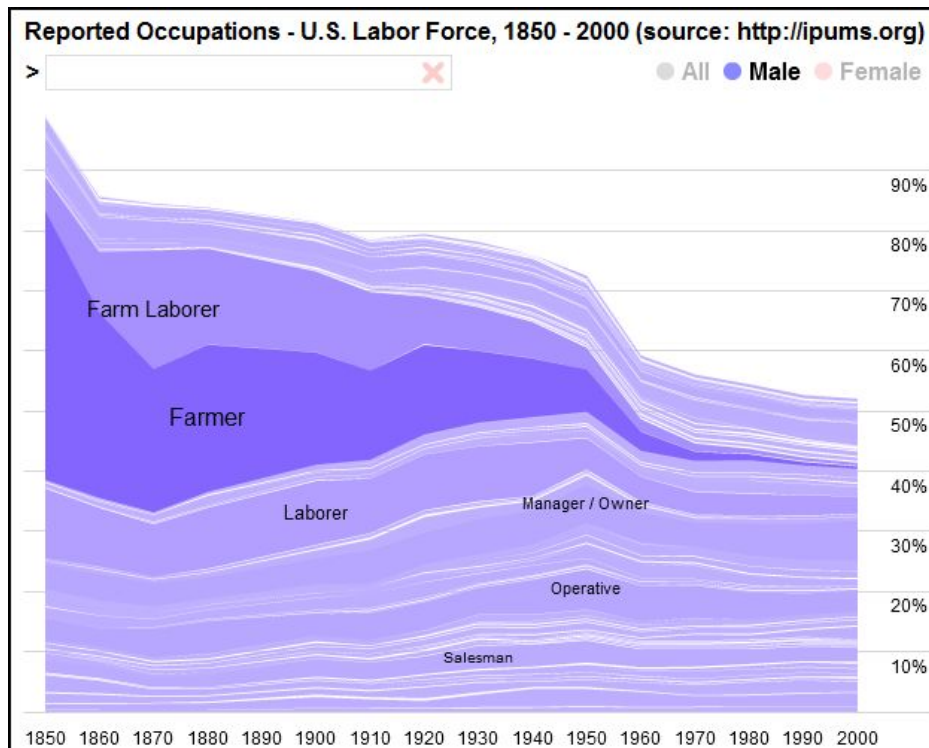
Governance of Emerging Technologies: Law, Policy & Ethics  
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# Jobs Change

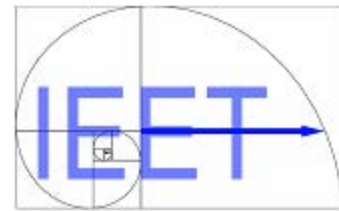
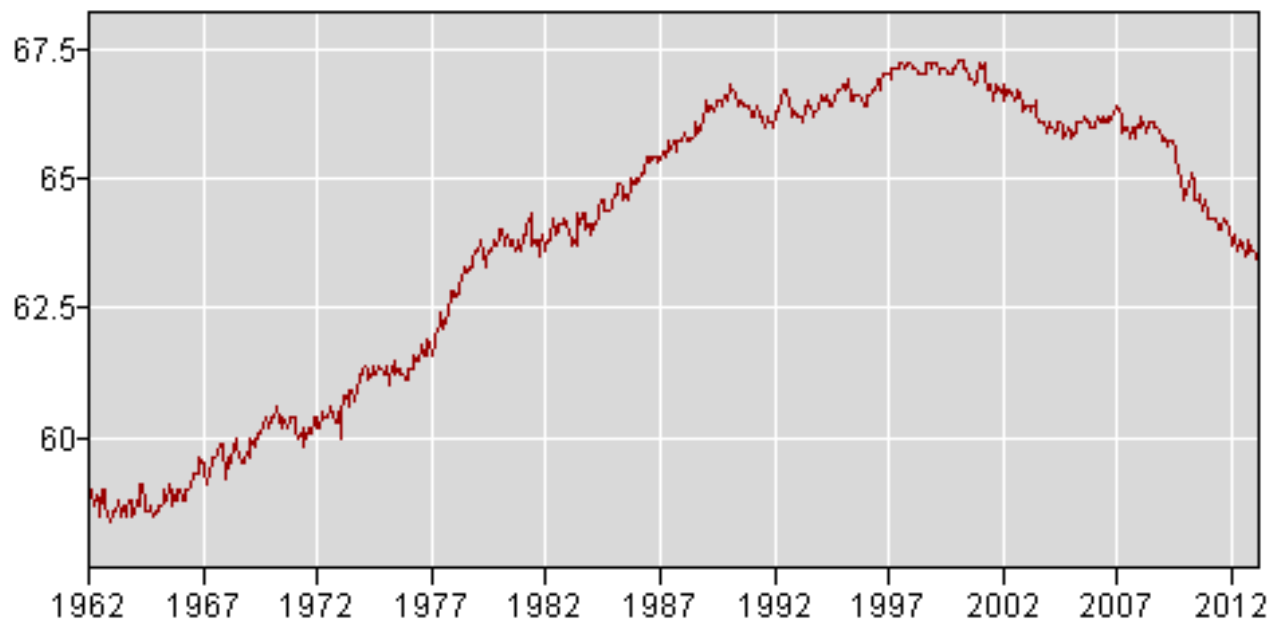
- As women entered the labor force in pink and white collar jobs, men were leaving farm and manual labor



# Structural Unemployment

- Paid labor force has declined since 2000
- Jobless recovery since 2008
- Aging of population and technological unemployment

The percent of 18-65 year olds in paid labor



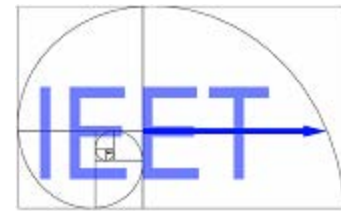


# Automation and Substitution

- All jobs are potentially automatable, done cheaper and better than by human workers

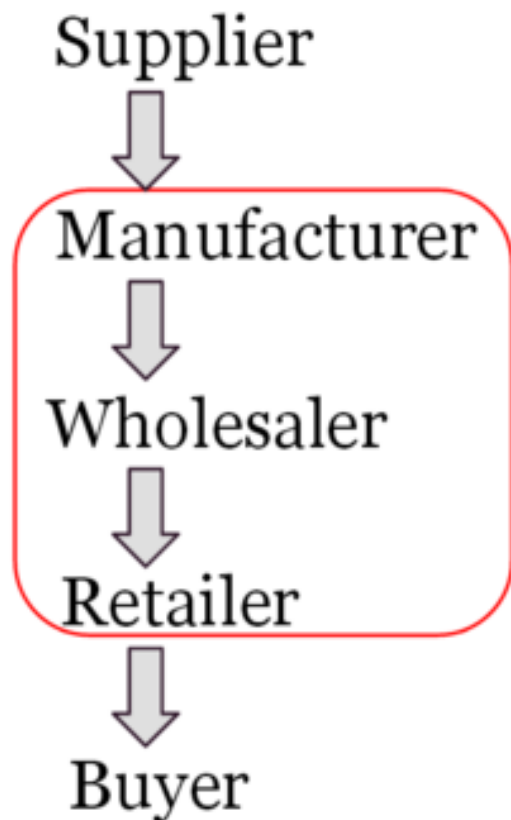


ICT makes it more profitable to invest in machines than to hire workers



# Disintermediation

- ICT reduces number of workers in supply chains



hulu

NETFLIX

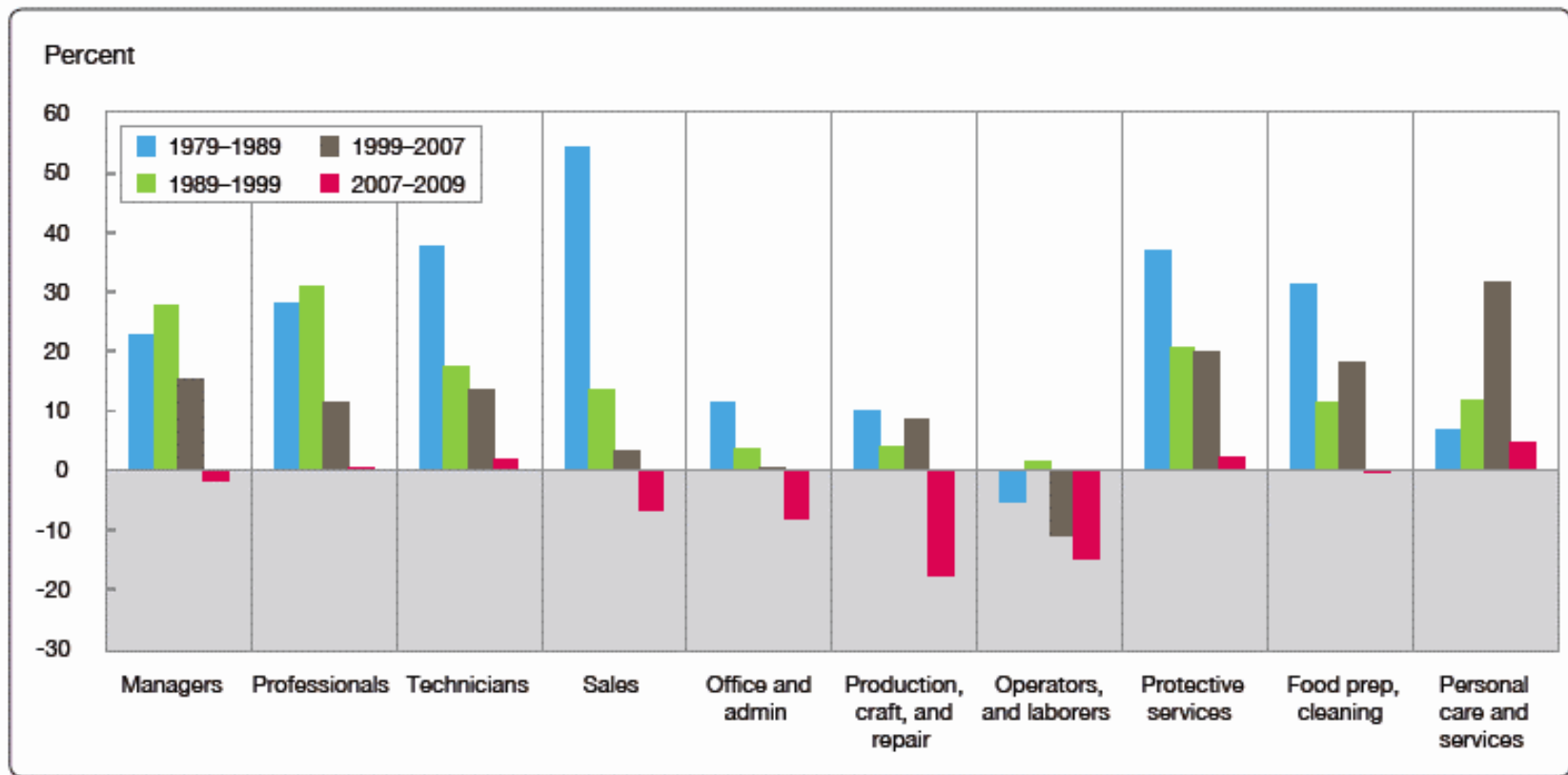


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and you're done.™

# Union Jobs Hit Hardest

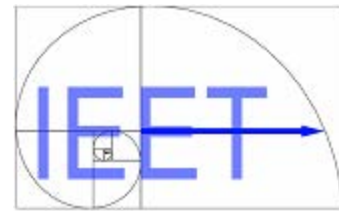
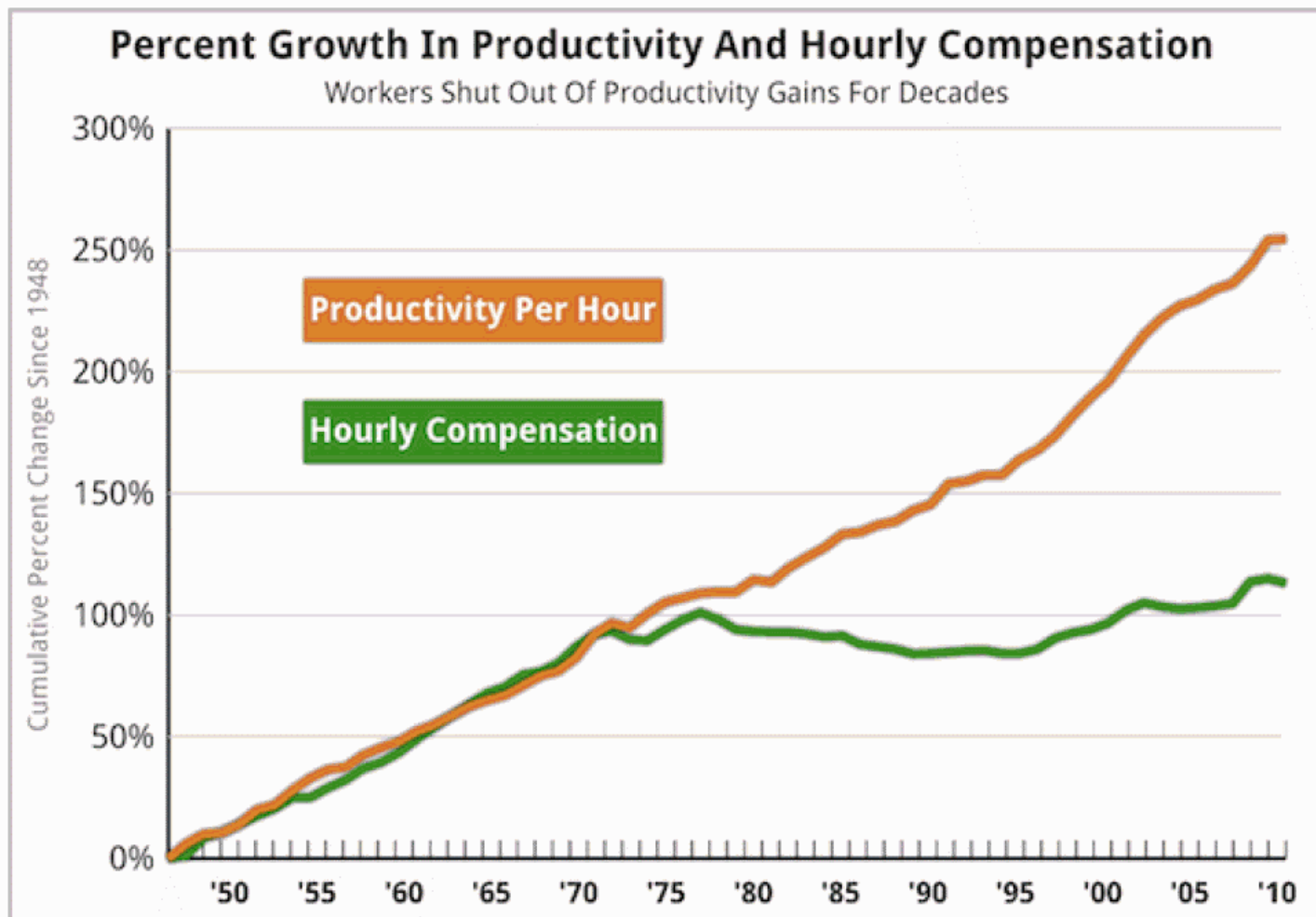
- Since the 1980s the fastest declining occupations had the highest rates of unionization, and the fastest growing occupations had low rates

## Change in employment by occupation, 1979-2009



# Growing Productivity, Stagnant Wages...

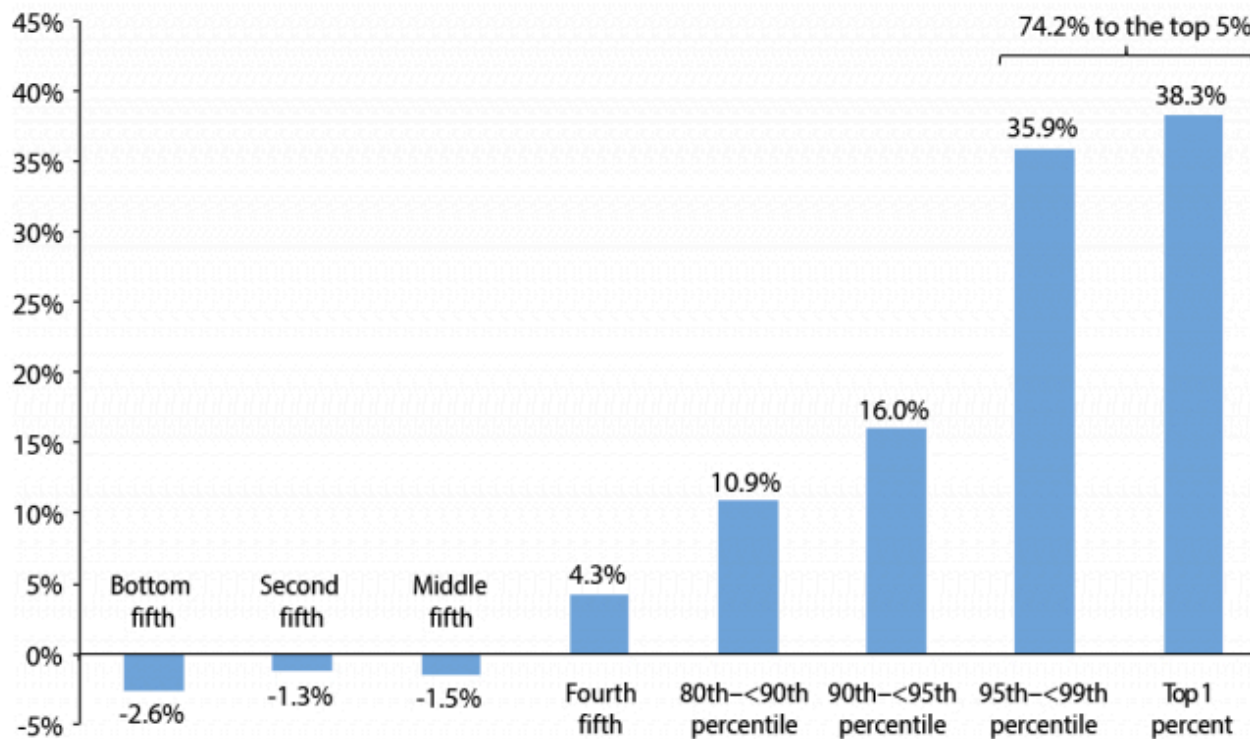
- Deskilling Jobs, Keeping the Profits



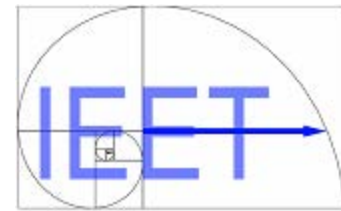
# ...and Growing Inequality

- Redistribution of wealth to the top 10%

■ Share of total household wealth growth accruing to various wealth groups, 1983–2010



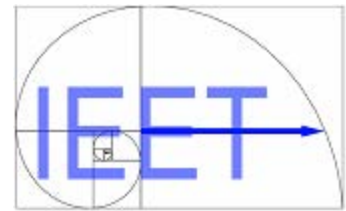
Source: Wolff (2012)





# Last Holdouts: Healthcare, Education

- Professional core with growing hierarchical management
- Complex product resistant to measurement, “efficiency” and automation
  - Learning outcomes and standardized tests and curricula
  - Health outcomes and standardized testing, treatment and care plans



# Hospital Robots and AI

- Even diagnosing, prescribing and surgery can be automated



Robot  
nurses aides



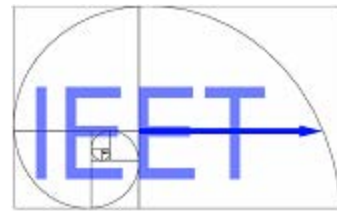
Telepresence  
doctors



Robotic surgery



Robot home care



# Clinical Decision Support

- Expert diagnostic and treatment systems used by nurses and PAs do better than doctors for most conditions

**Clinical Features**

- seizures
- loss of consciousness
- photophobia
- headaches

>> Add Symptom Search

Pregnancy --- Not Specified ---

Region --- Not Specified ---

Age: Adult

**Nervous System**

- ☒ MIGRAINE
- ☒ BACTERIAL MENINGITIS
- ☒ EPILEPSY SYNDROMES
- ☒ GENERALISED EPILEPSY
- ☒ PARTIAL SEIZURE
- ☒ GUILLAIN-BARRÉ SYNDROME
- ☒ TRAUMATIC BRAIN INJURY
- ☒ CEREBRAL HYPOXIA
- ☒ FAMILIAL HEMIPLEGIC MIGRAINE
- ☒ RAPID EYE MOVEMENT BEHAVIOR DISORDER

**Infectious Diseases**

- ☒ CARBON MONOXIDE POISONING
- ☒ LEAD POISONING
- ☒ CYANIDE POISONING
- ☒ DROWNING
- ☒ DYSPHAGIA
- ☒ ERGOTISM

**Trauma and Toxicology**

- ☒ CARBON MONOXIDE POISONING
- ☒ LEAD POISONING
- ☒ CYANIDE POISONING
- ☒ DROWNING
- ☒ DYSPHAGIA
- ☒ ERGOTISM

**Endocrine and Metabolic Diseases**

- ☒ DIABETIC COMA
- ☒ HYPOGLYCEMIA
- ☒ DIABETES MELLITUS TYPE-1
- ☒ GLYCOGEN STORAGE DISEASE TYPE-I
- ☒ PELIZAEUS-MERZBACHER DISEASE
- ☒ HYPONATREMIA

**Cardiovascular Diseases**

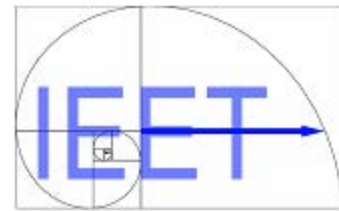
- ☒ HYPERTENSION
- ☒ ADAMS-STOKES SYNDROME

**Suggested Diagnoses**

- MIGRAINE
- CARBON MONOXIDE POISONING
- HYPOGLYCEMIA
- VIRAL ENCEPHALITIS, MYELITIS AND ENCEPHALOMYELITIS

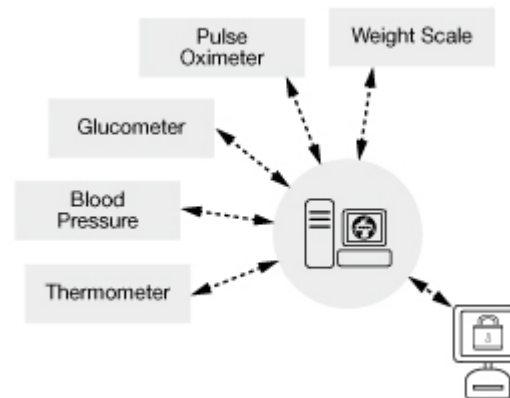
**visualizer**

Your session is being captured.



# HomeCare Telemonitoring

- Home and medical telemonitoring of heart, blood pressure, blood sugar, urinalysis, prescription compliance, etc.





# Distance and Online Learning

- Online and hybrid models growing
- The cost bubble in higher education is about to burst

## K-12 Courseware

- University of Phoenix is largest in US
- MOOCs at Stanford, Harvard, MIT

### Kindergartner- 2nd Grade

Calvert-Complete  
Curriculum

Saxon-Complete  
Curriculum

\$900 State Approved  
Curriculum

### 3rd Grade- 5th Grade

Calvert 1-2 Courses +  
Odyssey

Saxon 1-2 Courses +  
Odyssey

Odyssey-Complete  
Curriculum+ Computer

\$500 State Approved  
Curriculum + Odyssey

### 6th Grade- 8th Grade

Odyssey-Complete  
Curriculum+  
Computer

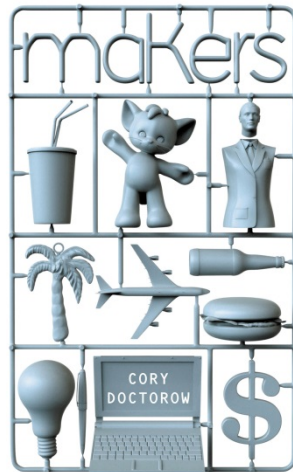
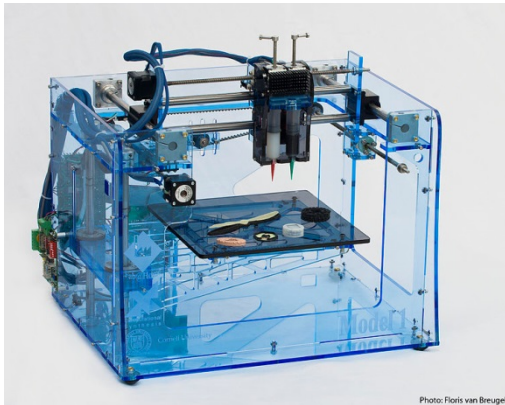
\$500 State Approved  
Curriculum + Odyssey

The screenshots show various features of online courseware:

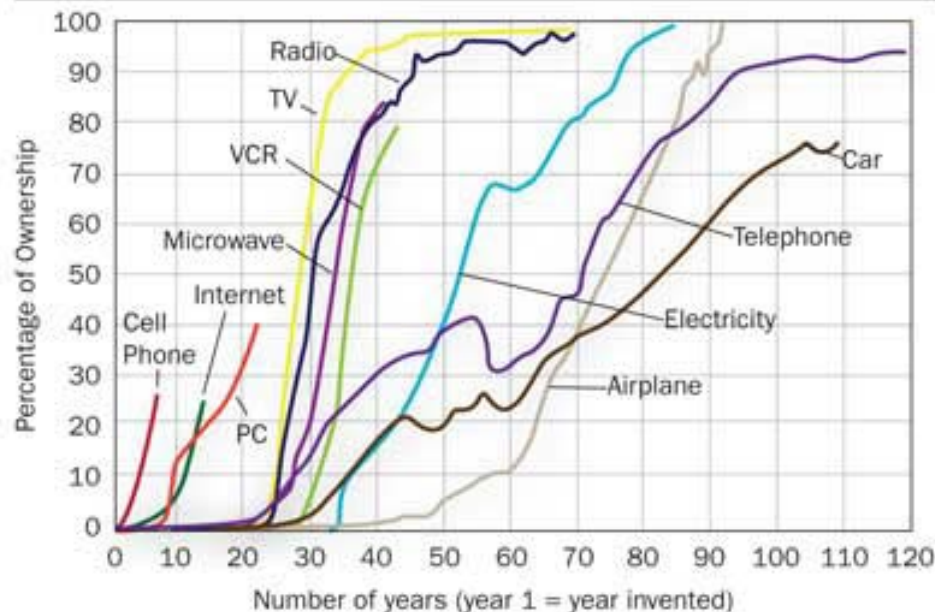
- Top Left:** A course page for Ancient Greece featuring a large image of the Parthenon facade. Navigation links include Course Info, Calendar, Topic List, Introduction, Readings, Map, Timeline, Images, Quiz, Global, Map, and Timeline.
- Top Right:** A timeline view of Ancient Greece from 900 BCE to 30 CE, showing periods like Geometric, Archaic, Classical, and Hellenistic.
- Bottom Left:** A calendar view for January, showing dates and corresponding topics like 'The Art of the Ancient Near East' and 'The Art of China'.
- Bottom Right:** A world map showing the locations of various ancient civilizations, including Prehistory, Ancient Near East, Egypt, China, Japan, India, Ancient Americas, Greece, Rome, Early Christianity / Byzantium, Islam, Europe, and Early Medieval/Romanesque.

# 3D Printing & Desktop Manufacturing

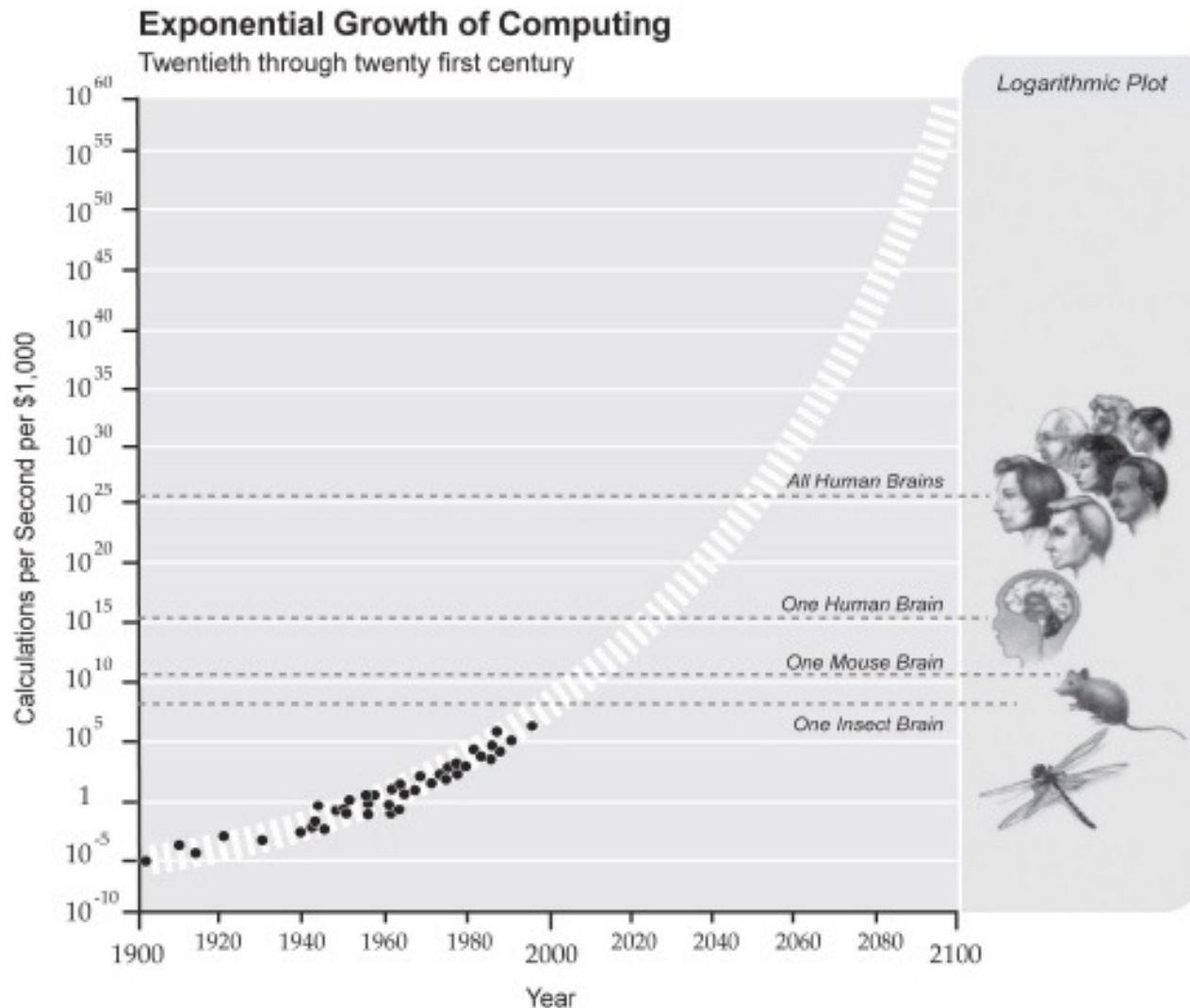
- Half of all employment is involved in production, transport or sales of things
- Diffusion of desktop manufacturing could be very rapid



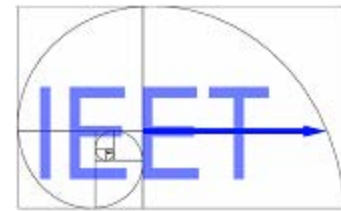
Technology Adoption



# Technological Acceleration



- Computer power doubles every two years



# Any Jobs?

- Jobs requiring human empathy and insight are probably going to be the last to automate
- But still..



Robot prostitutes



AI Counseling



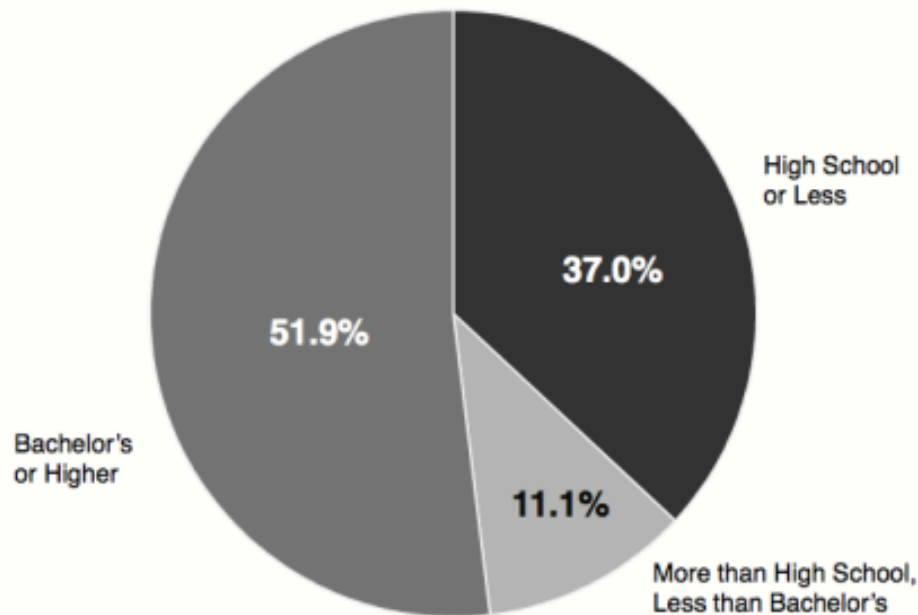
Smartphone confession



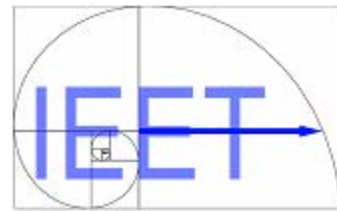
# Education is a Shrinking Shield

- So far, education has determined who is most vulnerable
- But un- and underemployment of college grads is rising

EDUCATION REQUIREMENTS OF OCCUPATIONS HELD BY COLLEGE GRADUATES



Source: U.S. Bureau of Labor Statistics, authors' calculations

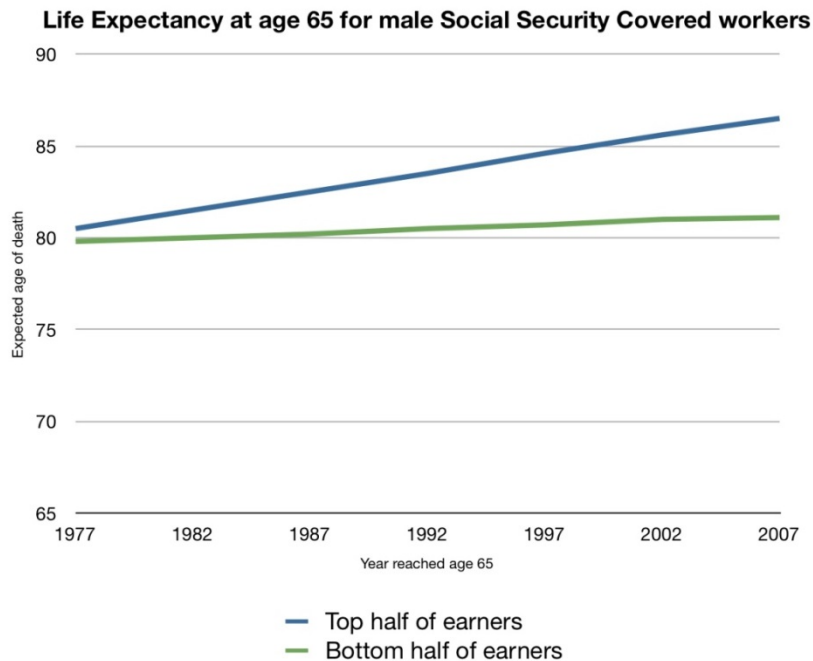


# Part-time Work on the Rise

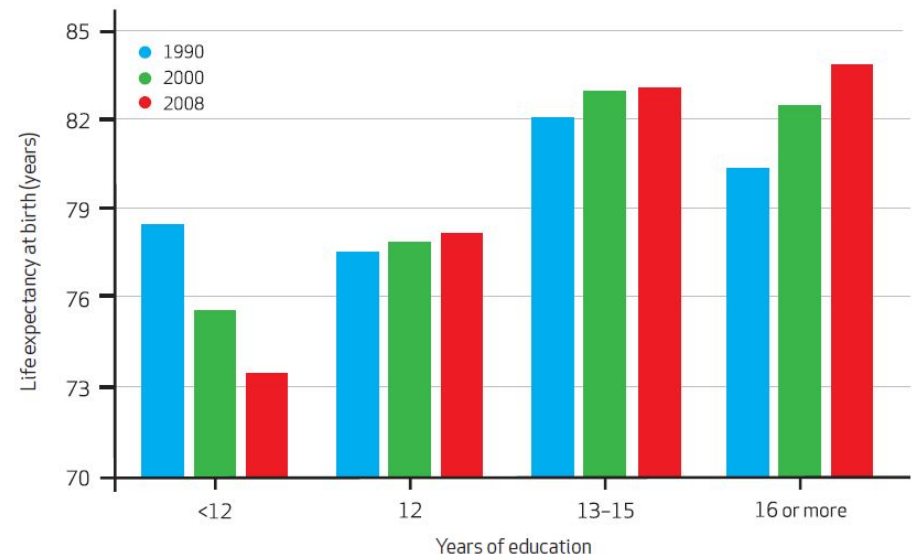


# We're Living Longer

- At least those with education and affluence are
- Life expectancy for poor females is declining

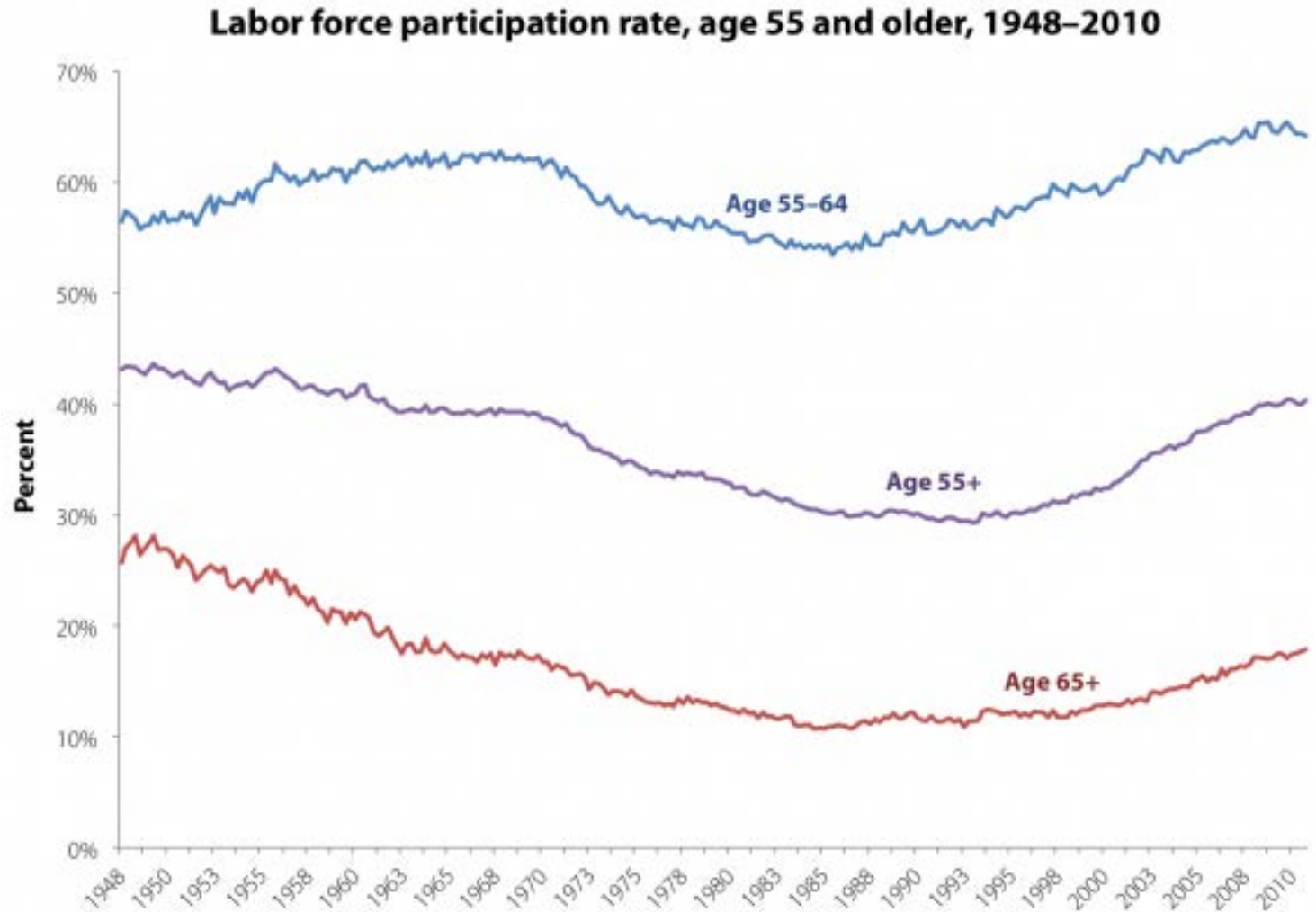


**Life Expectancy At Birth, By Years Of Education At Age 25 For White Females, 1990–2008**



# Working Longer

- Older workers staying in labor force longer



Source: Bureau of Labor Statistics, 1948–2010

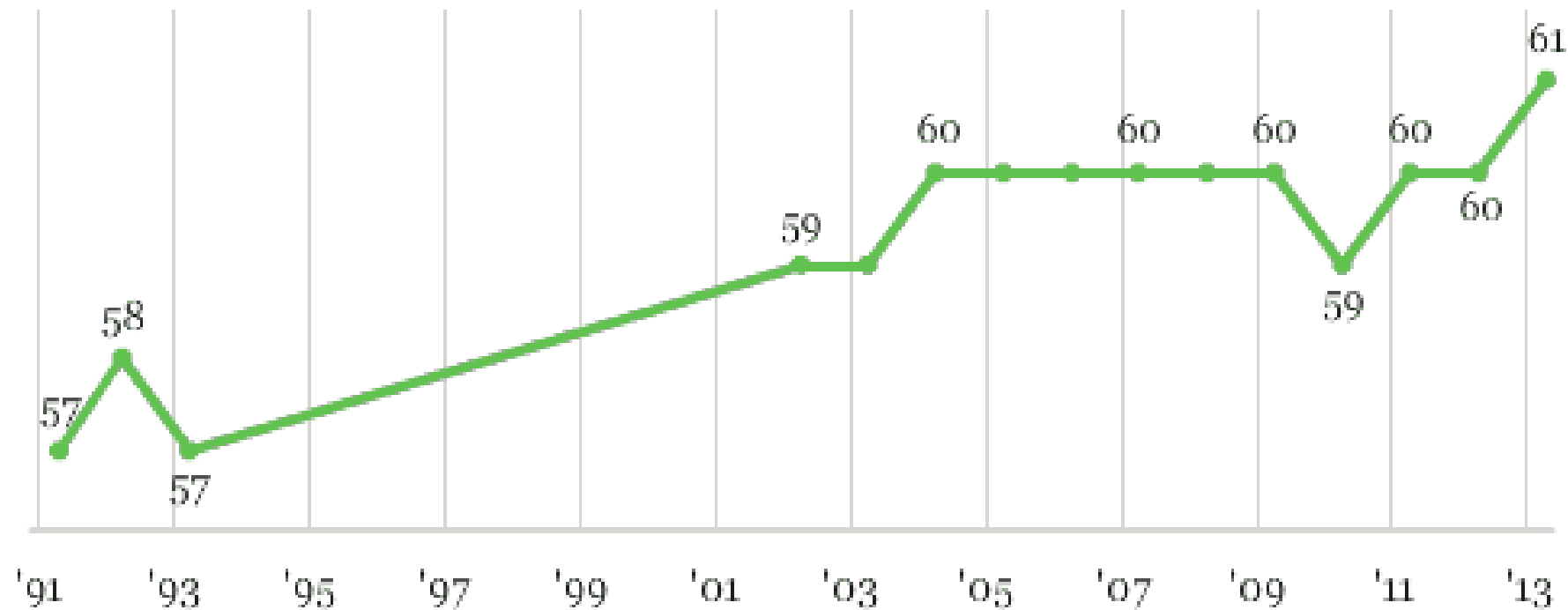


# Retiring Later

*At what age did you retire?*

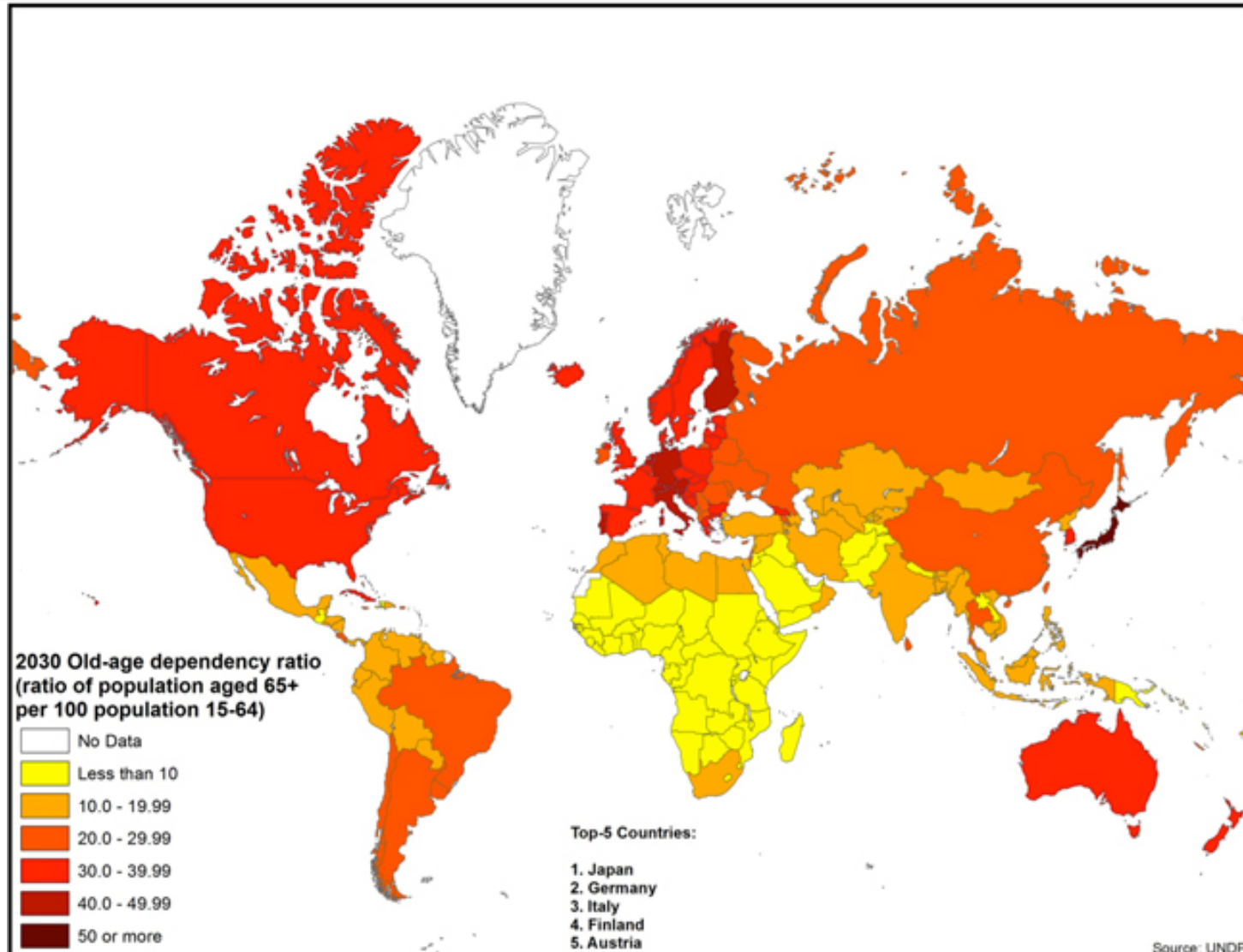
Among adults who are retired

■ Average age



# Old Age Dependency Ratio

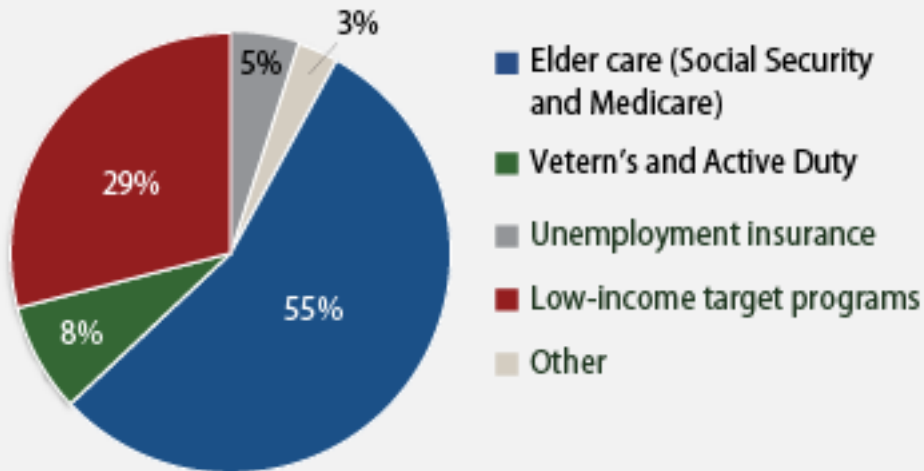
- Crashing fertility rates
- Reform of pension and social security systems
- But where will seniors find jobs if retirement age raised?



# “Entitlement” Debate

- The policy debate in US has not caught up
- Austerity is macroeconomic dead-end

Seniors followed by low-income Americans account for most federal money going to individuals



Source: Office of Management and Budget, Fiscal Year 2012 Budget of the U.S. Government (Historical Tables).

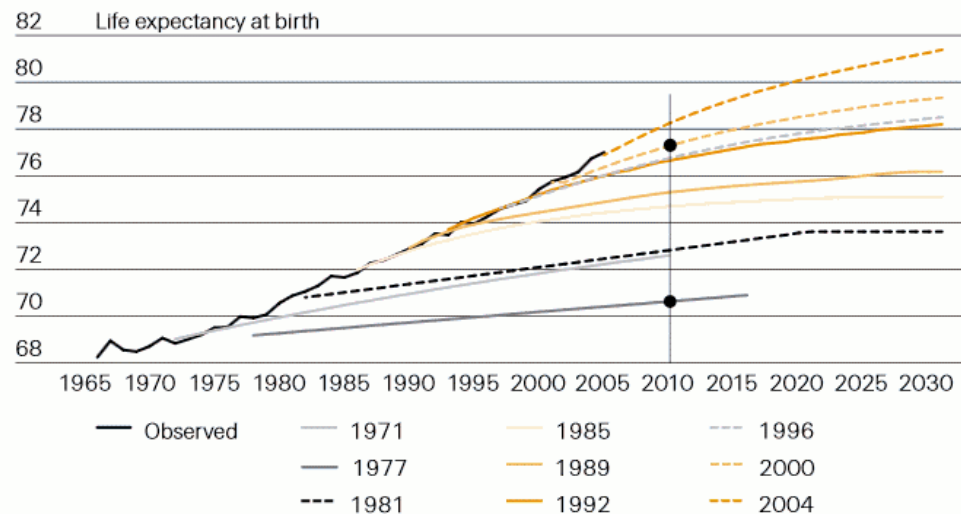
## AUSTERITY SURVIVAL GUIDE



# Longevity Risk or Dividend?

- IMF 2012 on “longevity risk”: If average life spans by 2050 were to increase 3 years more than now expected aging-related costs would increase by 50 percent
- *Longevity Dividend* if therapies slow aging, reduce disease and disability
- But we still need to address insolvency of pensions and inequity of dependency ratio

Figure 4: Actual and projected life expectancy at birth, UK males



The chart demonstrates how experts have historically underestimated life expectancy. For example, the life expectancy of a UK male born in 2010 was estimated to be 71 years in 1977. By 2000, this estimate was revised to more than 77 years.



# Denial and Magical Thinking

- It won't happen because it didn't happen
- Techno-utopians: If it happens there will be magical nano-boxes and everything will be free

So the singularity is the nerd way of saying, "in the future, being rich and white will be even more awesome."





# Luddite Policies

- Machine bans will be proposed
- But they will impose high costs on consumers, and lower quality goods & services
- Agricultural subsidies & protectionism
- Adapting is preferable



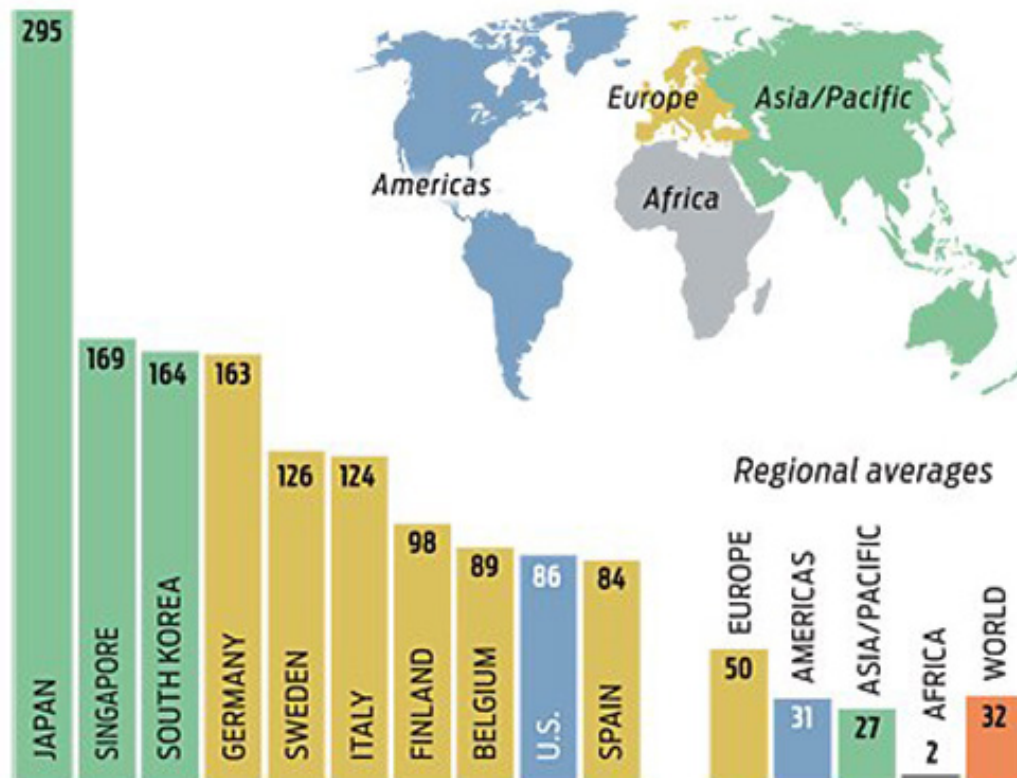


# Change with Prosperity

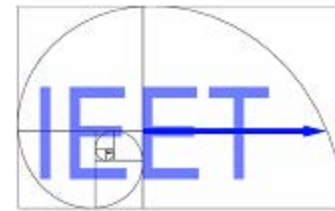
- In egalitarian countries technological change has led to prosperity

## TOP 10 COUNTRIES BY ROBOT DENSITY

(Industrial robots per 10 000 manufacturing workers)



Country	Ratio of Pay CEO : Avg Worker
Japan	11:1
Germany	12:1
France	15:1
Italy	20:1
Canada	20:1
South Africa	21:1
Britain	22:1
Mexico	47:1
Venezuela	50:1
United States	475:1



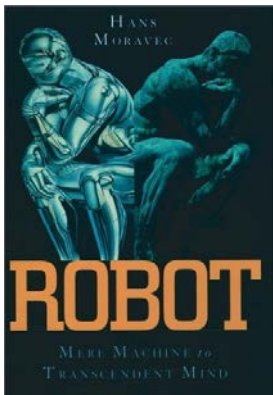
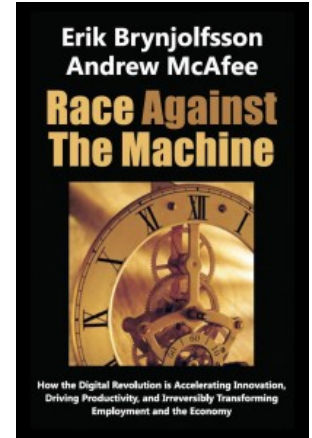
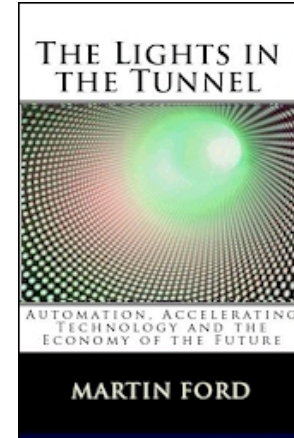
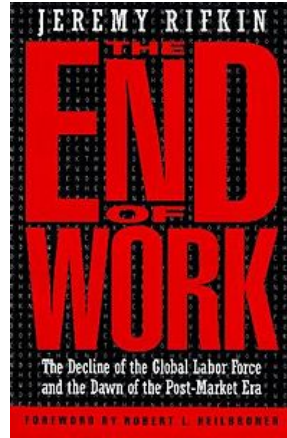
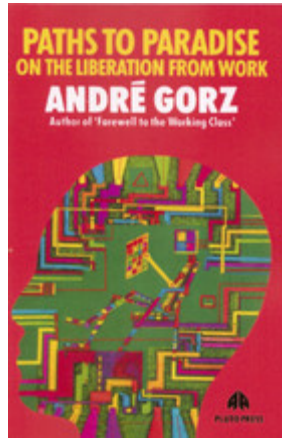
# Interim Policies

- NBER 2013: “Smart Machines and Long-Term Misery” Jeffrey Sachs & Laurence Kotlikoff – Tax older workers to ensure human capital accumulation for younger underemployed
- Public financing of higher education and job re-training
- Public employment
- Public subsidies for private sector jobs
- Shorter work-weeks

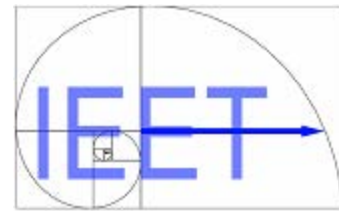


# Beyond Work

- Imagining the liberation from toil since Condorcet



Hans Moravec 1995: "When industry is totally automated and hyper-efficient, it will create so much wealth that retirement can begin at birth. We'll levy a tax on corporations and distribute the money to everyone as lifetime social-security payments."



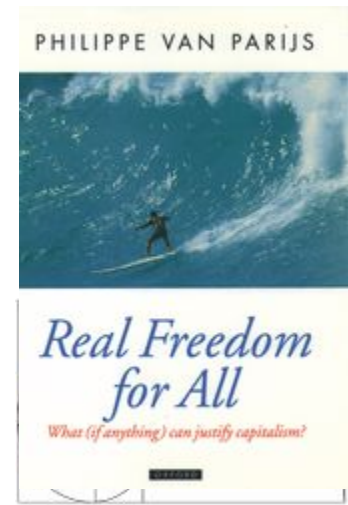


# Divorcing Income from Work

- Tom Paine: Annual payments should be made "to every person, rich or poor...in lieu of the natural inheritance, which, as a right, belongs to every man..."
- Expanding social wage
- Universal basic income guarantee
- Economies need consumers even more than workers

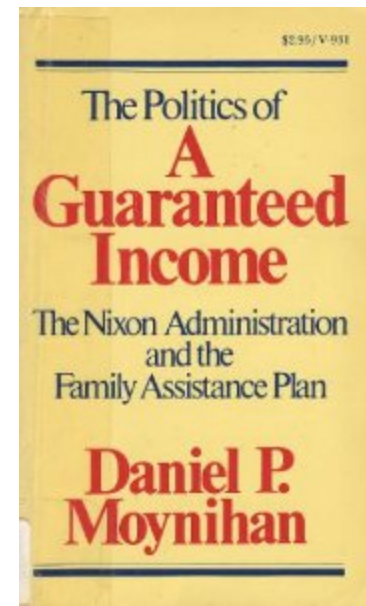


Tom Paine



# BIG in 1960s US Policy

- Robert Theobald and Committee on the Triple Revolution (1964)
- James Tobin, John Kenneth Galbraith advocate for BIG
- Milton Friedman's "negative income tax"
- 1968: 1000+ economists call for BIG
- Moynihan & Nixon propose Family Assistance Plan to replace AFDC, passed House, failed in Senate



# Fiscal Reforms

- Increase progressivity of the income tax
- *But with shrinking employment and dependency ratio...*
- Carbon taxes
- Consumption taxes
- Public ownership of resources (Alaskan citizen's dividend)



# For more information

- Institute for Ethics and Emerging Technologies  
ieet.org
- These slides:  
<http://ieet.org/archive>
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