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Cognitive Technologies: The Next Step Up for Data and Analytics

A presentation by Thomas H. Davenport
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Cognitive Technologies: The Next Step Up for Data & Analytics

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Smart People Are Concerned About the Next Step

- "I am in the camp that is concerned about super intelligence…I don't understand why some people are not concerned." (Bill Gates)
- "The development of full artificial intelligence could spell the end of the human race." (Stephen Hawking)
- "Advancing machine intelligence is the most important problem facing the world today." (Nobel economist Robert Schiller)
- "We will soon be looking at hordes of citizens of zero economic value. Figuring out how to deal with the impacts of this development will be the greatest challenge facing free market economies in this century." (Michael Malone, Bill Davidow)

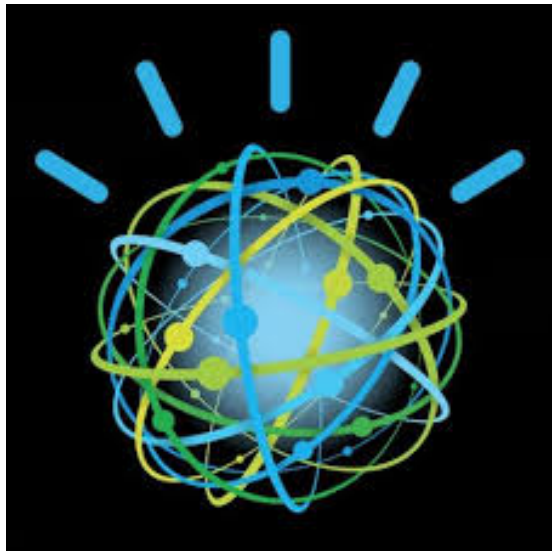
Many Reasons to Automate Human Work

Too much data

Expensive labor

Need for accurate decisions

Tedious work

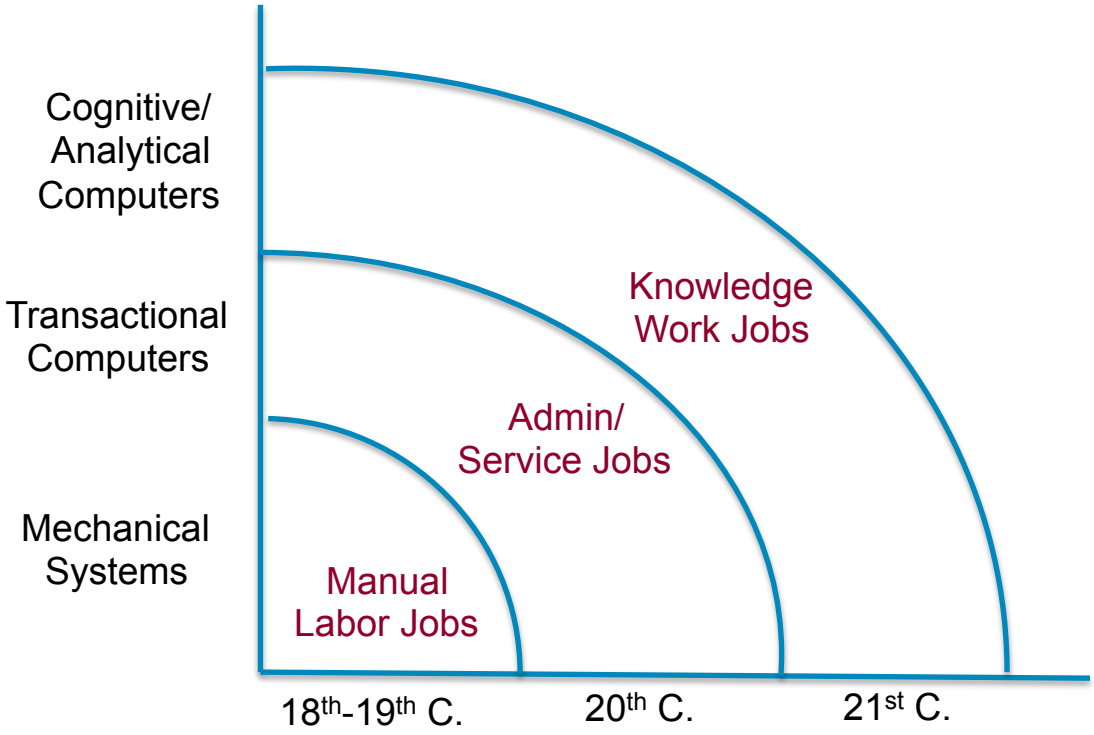


Powerful technologies

Why Care About Less Work?

- Work matters to human meaning and happiness
- The technology is getting more capable by the day, and we aren't
- Previous technological revolutions have created substantial dislocations
- Our society is already highly unequal, and becoming more so
- Unless we determine the appropriate role for humans in this revolution, there may be substantial resistance to a technology that could provide substantial value

Are Knowledge Workers Next to Go?



Our Answer Is…Yes…and No

- Many knowledge work job *tasks* will be automated
- Some knowledge workers will lose their jobs, depressing hiring
  - 8 lawyers where there were 10
- There will be a lot of jobs (no one knows how many) working alongside smart machines
- Immense productivity gains will fund retraining and redeployment of people
- But workers can't afford to be complacent

Ten Automatable Knowledge Work Jobs

1. Teacher/Professor—online content, adaptive learning
2. Lawyer—e-discovery, predictive coding, etc.
3. Accountant—automated audits and tax
4. Radiologist—automated cancer detection
5. Reporter—automated story-writing
6. Marketer—programmatic buying, focus groups, personalized e-mails, etc.
7. Financial advisor—”robo-advisors”
8. Architect—automated drafting, design
9. Financial asset manager—index funds, trading
10. Pharmaceutical scientist—cognitive creation of new drugs

Technologies Driving Knowledge Work Automation

- Analytics and big data
- Machine learning
- Neural networks/deep learning
- Rule engines
- Event stream/complex event processing
- “Cognitive computing,” e.g., Watson
- Robotic process automation
- Custom integrations and combinations of these in a “cognitive cloud”

Just How Smart Are Smart Machines?

Level of Intelligence Task Type	Human Support	Repetitive Task Automation	Context Awareness and Learning	Self-Aware intelligence	
Analyze Numbers	BI, Data viz, hypothesis driven analytics	Operational analytics, scoring, model mgmt	Machine learning, neural nets	Not yet	
Digest Words, Images	Character and speech recognition	Image recognition, machine vision	Q&A, NLP	Not yet	The Great Convergence
Perform Digital Tasks (Admin and Decisions)	BPM	Rules engines, RPA	Not yet	Not yet	
Perform Physical Tasks	Remote operation;	Industrial robotics, collaborative Robotics	Fully Autonomous Robots, Vehicles	Not yet	

The Technology Is Great—But How About People and Processes?

- People
  - We need an alternative to automation
  - We need to begin preparing people for the impacts of these technologies
- Processes
  - Identify those in need of more and better cognition
  - Measure them, implement quickly, achieve value quickly
  - Design what people and cognitive technologies do in them

(Pages and pages of similar graphics on Google Image, so all three must be necessary!)

People: Automation or Augmentation?

- Augmentation—smart humans helping smart machines, and vice-versa
- People do this by aiding automated systems that are better than humans at their particular tasks, or by focusing those tasks at which humans are still better
- The classic example: freestyle chess
  - Better than humans or automated chess systems acting alone
  - Humans can choose among multiple computer-recommended moves
  - Humans know strengths and weaknesses of different programs
- We've seen this before: textile machinery, spreadsheets

Five Ways of Stepping

- *Step in*—humans master the details of the system, know its strengths and weaknesses, and when it needs to be modified
- *Step up*—humans take a big-picture view of computer-driven tasks and decide whether to automate new domains
- *Step aside*—humans focus on areas they do better than computers, at least for now
- *Step narrowly*—humans focus on knowledge domains that are too narrow to be worth automating
- *Step forward*—humans build the automated systems

Five Ways of Stepping, in Teaching

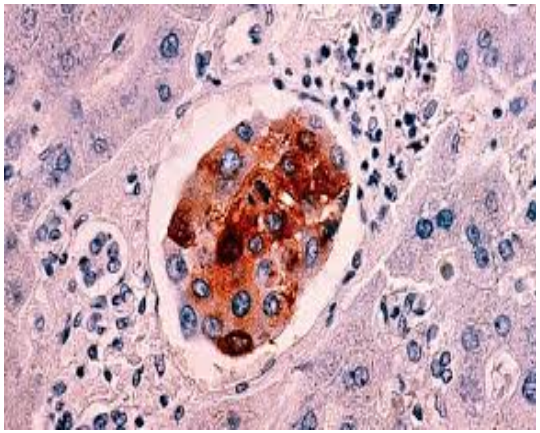
- *Step in*—teachers become experts in adaptive learning and online content and monitor student success with various tools
- *Step up*—teachers or administrators oversee the progress of online and adaptive learning for an entire institution
- *Step aside*—teachers focus on things automated systems don't do well—student social and emotional growth, leadership ability, etc.
- *Step narrowly*—teachers specialize in content areas that are not economical to automate, e.g., instruction in Hmong, or distressed real estate
- *Step forward*—teachers (or teaching-oriented programmers) build adaptive learning and online content systems for vendors

Cognitive Processes—Criteria and Examples

- Knowledge bottleneck
  - Veterinary diagnosis and treatment
- Need for decision quality and consistency
  - Insurance policy underwriting
- Too much data or content for humans to digest/analyze
  - Oncology, digital marketing
- Cognition currently too expensive for broad application
  - Investment advice, college education

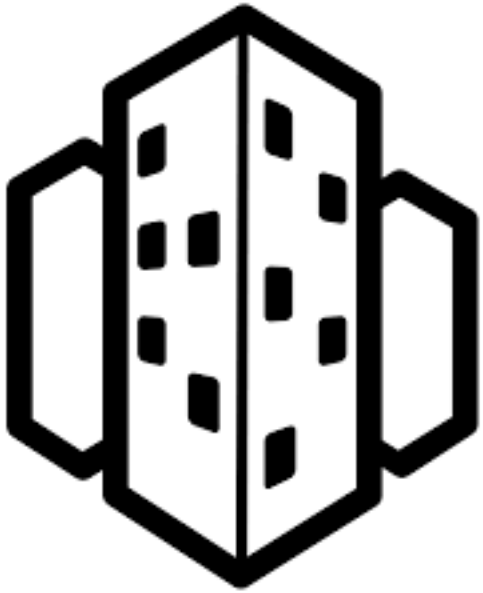
Oncology, For Example

- Over 400 types of cancer
- Hundreds of oncogenes and tumor suppressor genes
- Biome probably implicated in cancer too
- Oncology information needs to be integrated with EMR data
- Over 75 different drugs for breast cancer alone
- Treatment options changing very quickly
- In short, too hard for humans, but machines don’t find it easy either—yet



Implications for Organizations

- Take an augmentation perspective from the beginning
- Pick the right cognitive technology for your problem
- Get good at work design for smart humans and smart machines
- Give your people the options and the time to transition to them
- Put someone in charge of thinking about this



Implications for Government and Education

Government

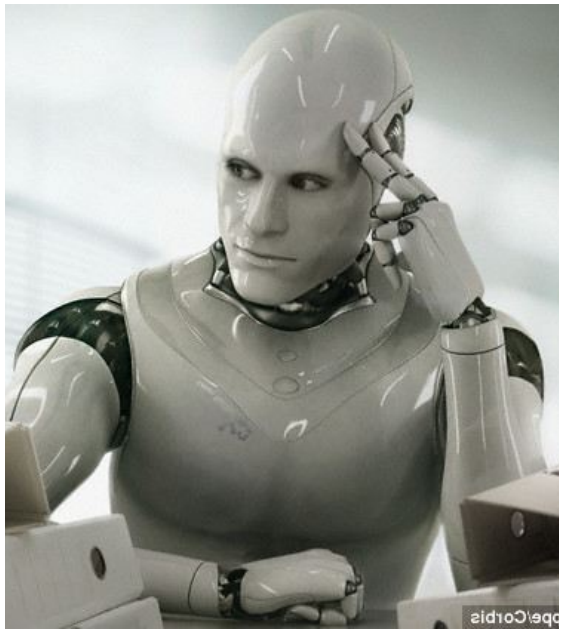
- Start a public dialogue on automation and augmentation
- If necessary, guarantee jobs, not incomes
- Encourage augmentation with tax and licensing policies
- Engage with NGOs and private sector organizations for planning and policy

Education

- STEM and computer science for step in, step forward roles
- Arts, social/emotional intelligence for step aside roles
- Let students follow their passions for step narrowly roles

A Really Intelligent Analytics Manager Would …

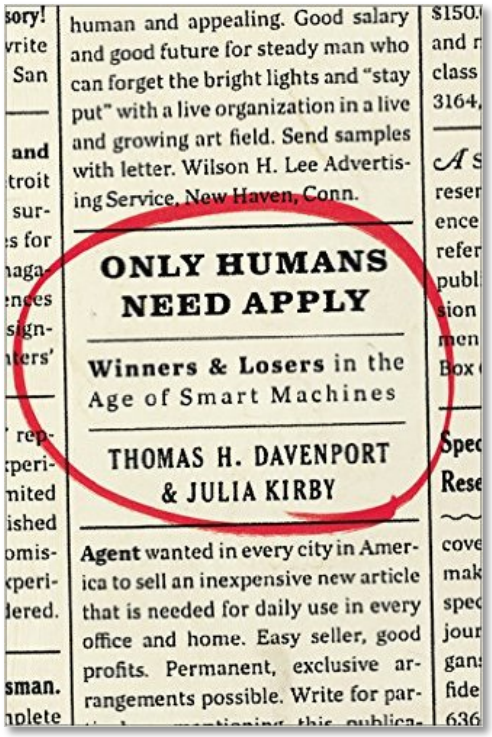
- Monitor developments in cognitive technologies (particularly machine learning)
- Anticipate the automation of decision-making supported today by analytics
- Partner with business managers to pilot smart machine solutions
- Foresee the data and analytics needed to augment human decisions at the next level



What Are You Waiting For?

- The technology is good, and getting better rapidly
- Knowledge workers are ready to have their work augmented and to augment smart machines
- Cognitive processes need improvement and innovation
- Start your engines!

Questions?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Winners & Losers in the Age of Smart Machines

THOMAS H. DAVENPORT & JULIA KIRBY

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"An invigorating, thought-provoking, and positive look at the rise of automation that explores how professionals across industries can find sustainable careers in the near future …"

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