

# Four Eras of Information, Four CDO Roles

---

Thomas H. Davenport, Babson

College/MIT/Deloitte/International Institute for Analytics

MIT CDO and IQ Symposium

July 14, 2016

# Changing the Way Information Is Used

1.0

- Transaction focus
- Small, structured, static data
- Back-office analysts
- Internal decisions
- Spreadsheets/OLAP/EDW
- Descriptive analytics

1975-?

2.0

- Big, unstructured, fast-moving data
- Rise of data scientists
- Data products in online firms
- Rise of Hadoop and open source
- Visual analytics
- “Agile is too slow”

2001-?

3.0

- Mix of all data
- Internal/external products/decisions
- Analytics a core capability
- Move at speed and scale
- Predictive and prescriptive analytics

2013-?

4.0

- Analytics embedded, invisible, automated
- Cognitive technologies
- “Robotic process automation” for digital tasks
- Augmentation, not automation

2016-?

# Offense and Defense Both Required of CDOs

---

## Offense

- ▶ *Analytics and insights*—developing insights and analytical models from data
- ▶ *Digital transformation*—using data to transform business processes and business models
- ▶ *Data products*—developing new products and services based on data and analysis
- ▶ *Customer relationships*—using data to improve customer access, service

## Defense

- ▶ *Security and privacy*—monitoring and preventing data breaches, cyberattacks
- ▶ *Integrity and quality*—providing clean, integrated, common data to the business
- ▶ *Regulatory compliance*—monitoring and enforcing compliance with relevant data policies and regulations
- ▶ *Governance*—structures for managing and controlling data

# Data 1.0 | Transactional Data and DSS

---



1.0

## Transactional Data and DSS

Offense:

- Descriptive analytics/reporting
- Beginning of customer data use

Defense:

- Data quality and integrity
- Minimal security

# Data 1.0: (Nonexistent) CDO Role

---

## Offense

- ▶ Build data warehouses and marts
- ▶ Provide reporting capabilities
- ▶ Allow some customer access to data

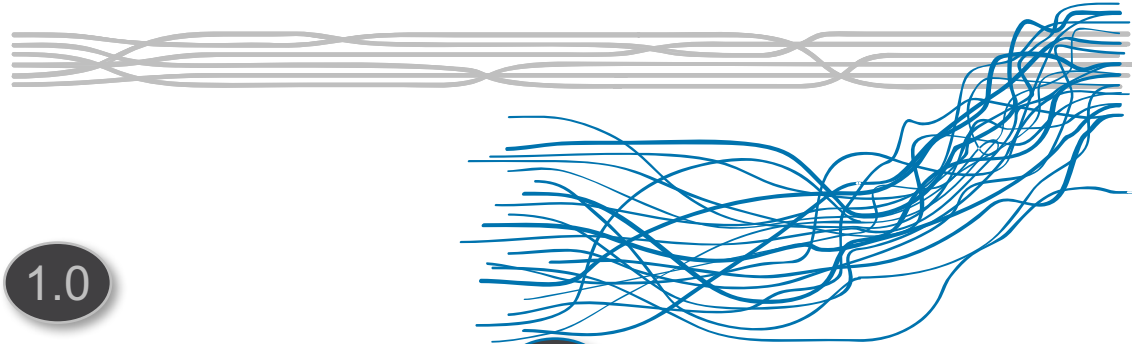
## Defense

- ▶ Manage data quality and integrity
- ▶ Foster good passwords
- ▶ Try to control spreadsheet proliferation



# Data 2.0 | The Big Data Era

---



1.0

Offense:

2.0 Big Data

- From descriptive analytics to web analytics
- Target ads and emails with analytics
- Beginning of data products—search etc.

Defense:

- Get enough data to swamp quality problems
- Offer users some privacy guarantees

# Data 2.0: (Still Nonexistent) CDO Role

---

## Offense

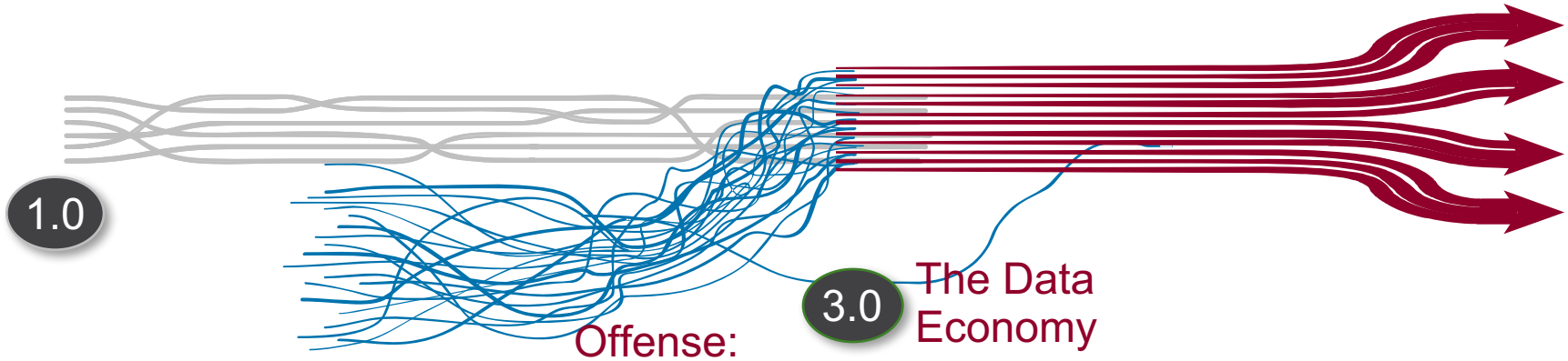
- ▶ Explore open source tools
- ▶ Switch from EDW to Hadoop
- ▶ Hire data scientists
- ▶ Read *Lean Startup*

## Defense

- ▶ Assuage Brussels on privacy
- ▶ Hire hackers to build security
- ▶ Control Hadoop proliferation



# Data 3.0 | The Data Economy



2.0

- Predictive and prescriptive analytics
- Lead central analytics groups
- Monetize data

Defense:

- Protect against breaches
- Pacify regulators



# Data 3.0: The Rise of the CDO

---

## Offense

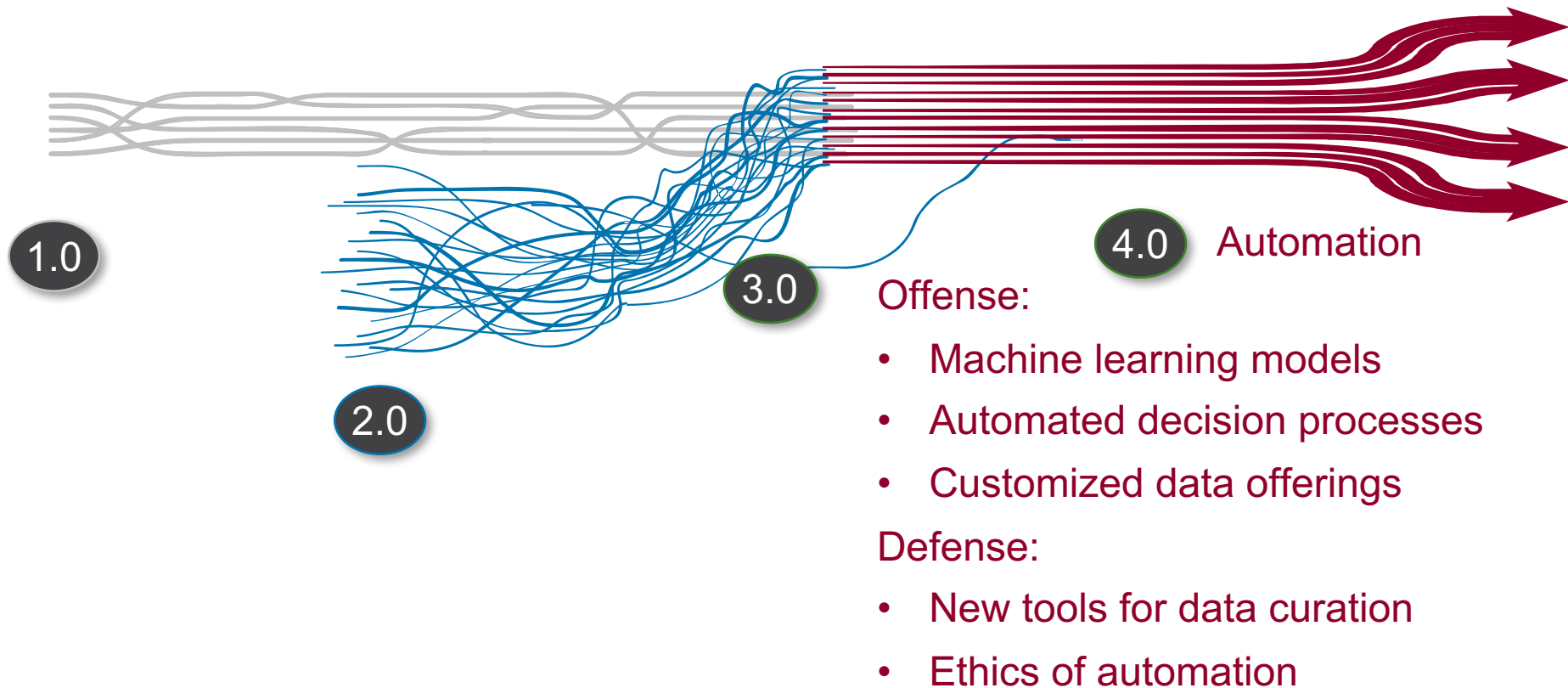
- ▶ Support analytics across the enterprise
- ▶ Build a data lake
- ▶ Engage the business in data product development
- ▶ Foster self-service BI

## Defense

- ▶ Start to anticipate cyberattacks
- ▶ Address breaches/hacks quickly
- ▶ Get business leaders engaged in governance
- ▶ Keep your resume current



# Data 4.0 | The Age of Automation



# Data 4.0: The CDO Role in Automation

---

## Offense

- ▶ Identify processes to be automated
- ▶ Specify man/machine division of labor
- ▶ Make every data product, ad, or promotion targeted
- ▶ Bring new levels of efficiency and effectiveness

## Defense

- ▶ Automated data quality/integrity
- ▶ Automated threat intelligence
- ▶ Try to keep track of models
- ▶ Engage managers and regulators in assumptions and create transparency



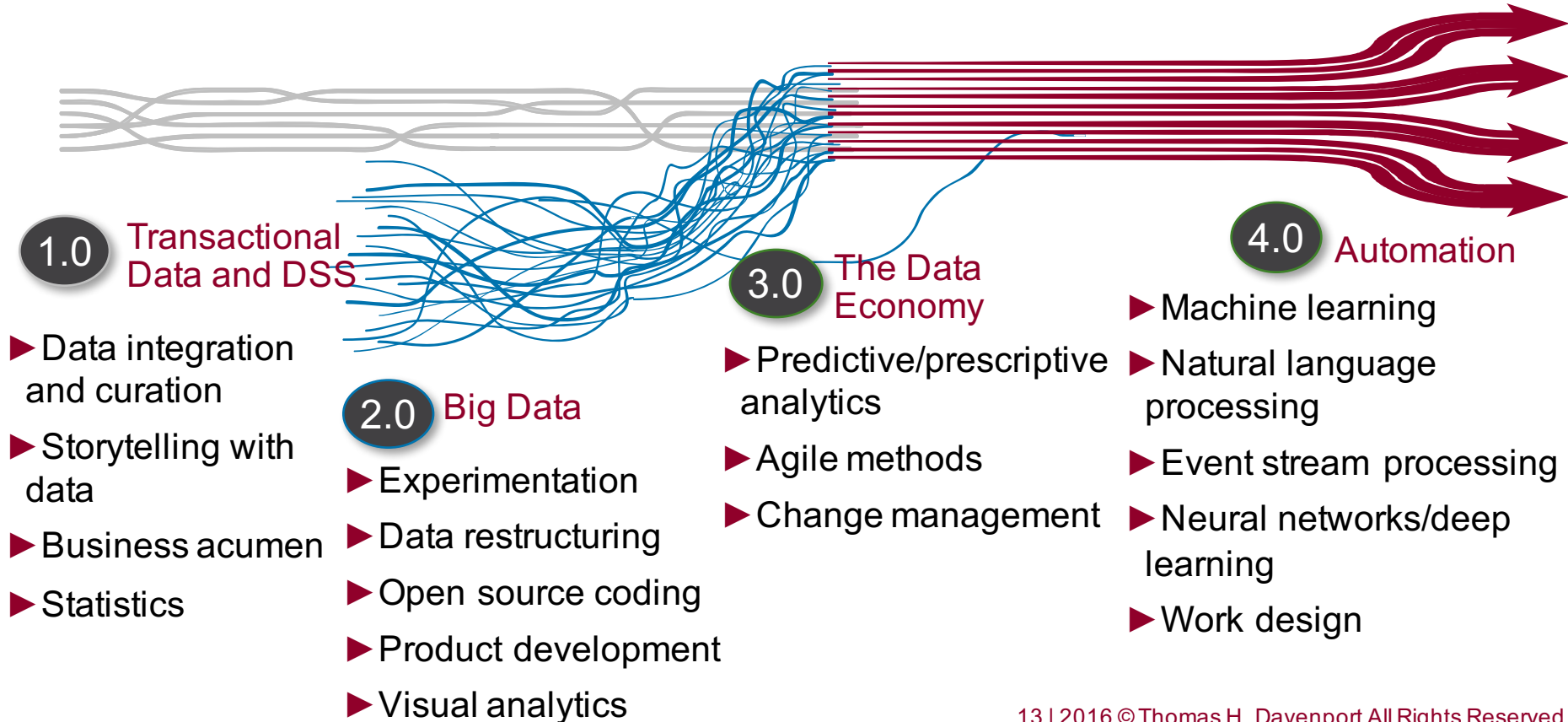
# Prerequisites for 3.0 and 4.0 Organizations

---

- ▶ No silos of people, data, or technology
- ▶ Leaders who get it and are willing to engage and invest
- ▶ Relatively few battles between the business and IT
- ▶ A strategy that focuses on services and processes, not just the best products
- ▶ A willingness to pursue this for the long haul



# (Cumulative) Skills Across the Eras



# What's Driving the Move to Automation?

---

Expensive labor

Too  
much  
data

Humans not good decision-makers

Tedious work



Powerful technologies

# A Smooth Transition from Analytics to Automation

---

Correlation/  
Regression

Text  
Analytics

Natural  
Language  
Processing

Logistic  
Regression

Machine  
Learning

Neural  
Networks

Deep  
Learning

# Smart People Concerned About the Future of Smart People



- ▶ “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)



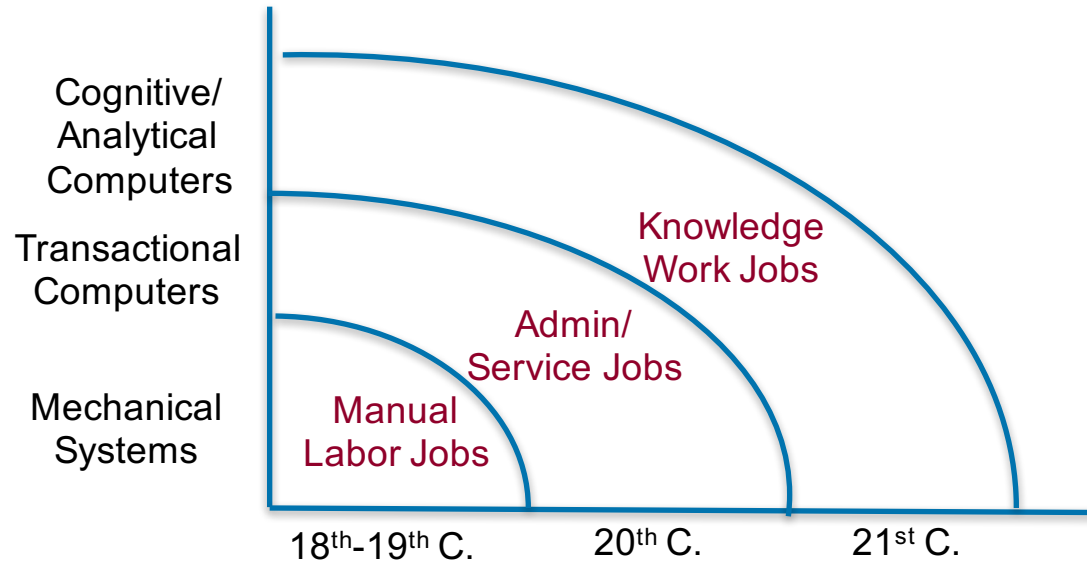
- ▶ “Advancing machine intelligence is the most important problem facing the world today.” (Nobel economist Robert Schiller)



- ▶ “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)



# Are Knowledge Workers Next to Be Automated?



# My 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 could fund retraining and redeployment of people
- ▶ But workers can't afford to be complacent



# Ten Knowledge Work Jobs with Automatable Tasks

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. Financial asset manager—index funds, trading
9. Programmer—automated code generation
10. Quantitative analyst—machine learning, etc.



# 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	The Great Convergence
Analyze Numbers	BI, Data visualization, hypothesis driven analytics	Operational analytics, scoring, model management	Machine learning, neural nets	Not yet	
Digest Words, Images	Character and speech recognition	Image recognition, machine vision	Q&A, natural language processing	Not yet	
Perform Digital Tasks (Admin and Decisions)	Business process management	Rules engines, Robotic process automation	Not yet	Not yet	
Perform Physical Tasks	Remote operation	Industrial robotics, collaborative robotics	Fully autonomous robots, vehicles	Not yet	

# The Impact on 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 augmentation 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



# The Five Augmentation Steps in Quantitative Analysis

- ▶ *Step in*—analysts become experts in machine learning, and evaluate model outputs for reasonability
- ▶ *Step up*—analysts get promoted to CDO, and monitor the overall performance and implications of machine learning models
- ▶ *Step aside*—analysts focus on methods that machine learning doesn't address, e.g., categorical data analysis
- ▶ *Step narrow*—analysts specialize in business domains that are too narrow to automate with machine learning (predicting garage door failure)
- ▶ *Step forward*—analysts build new machine learning systems





# General Messages for CDOs

---

- ▶ Balance offense and defense
- ▶ Get clear about boundaries and overlaps with CIOs, CDigOs, CISOs, and CAOs
- ▶ Don't try to top-down architect your way to success
- ▶ Focus on effective information behaviors
- ▶ Orchestrate participation and buy-in; good data is everyone's job!

