

Computer Mediated Transactions

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Outline

- Waves of innovation and their implications
 - Combinatorial innovation
 - Mechanical, electrical, electronics, software
- Computer mediated transactions
 - Enforce new contracts
 - Better align incentives
 - Enable for data extraction and analysis
 - Enable controlled experimentation
 - Enable personalization and customization
- Collaborative computing
 - Optimizing workflow for knowledge workers
 - Micromultinationals

Waves of innovation

- Huge innovation on web in the last 15 years
 - Web pages, search engines, wikis, databases, etc.
 - Why has there been so much innovation?
 - Why has it been so rapid?
- Examples of combinatorial innovation
 - Set of component technologies that can be combined and recombined to create new innovations
 - 1800: Interchangeable parts
 - 1900: Gasoline engine
 - 1960: Integrated circuits
 - 1995-now: Internet
 - Often process takes years, or decades to play itself out



But this time...

- Component parts are all bits!
 - Protocols: TCP/IP, HTTP, CGI, SQL
 - Languages: HTML, XML, Java, Python, Perl...
- Bits/protocols/languages can be combined to make...
 - Web pages, intranets, chat rooms, auctions, exchanges, video streaming, VOIP, search engines...
 - Note: no time-to-manufacture, no inventory problems, no delivery problems
 - Bits can be shipped around the world in seconds, and innovators can work in parallel
- Result: extremely rapid evolution and technological progress
- Question: what are implications for commerce?

Computer mediated transactions

- A computer is now involved in almost every transaction
 - Even cash registers are just PCs with a special interface
 - Web-based transactions are even more powerful since they directly connect to a database
 - Original intent was just accounting
 - But the record of transactions has other uses
 - *How does the presence of computer-mediated transactions affect economic activity?*

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One result: better contracts

- Contracts are fundamental to commerce
 - Simplest form: “I will do X if you will do Y”
 - Exchange of goods, services, labor, etc.
 - Major problem: monitoring the contract
 - Sometimes observe performance
 - Quality of goods, service, actions, effort may not be observed
 - Where do computers come in?
 - Historically advances in technology have enabled better measurement and monitoring
 - Computers move this capability to a new level

Computer as accountant



Francesco di Marco Datini

- Since the computer serves as intermediary it can not only make record of transactions, but also verify contractual performance
- Allows us to structure more elaborate contracts and improve economic efficiency



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Better monitoring makes for better contracts

- Mediterranean shipping 8000 BC
- Cash registers 1883
- Semi trucks 1990s
- Video stores 1990s
- Online advertising 2000s

Mediterranean shipping 8000 BC

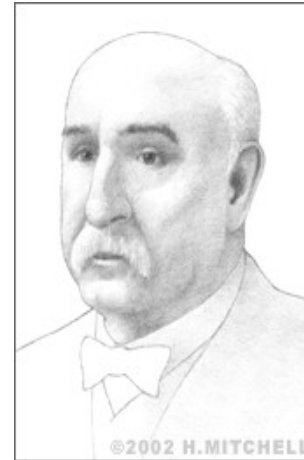
- How do you ensure that your full shipment is received at other end of voyage...with no written language?
- Answer
 - Match clay tokens (bullae) to jars of oil loaded on ship
 - Seal tokens in clay envelope, stamp clay with seal
 - Bake bullae in kiln, send with shipment
 - At other end of journey, recipient breaks open the envelope and compares tokens to jars on ship
 - Later, inscribe marks on bullae as check, which may have led to writing

Examples of bullae 3300 BC



How do you ensure employees don't steal?

- From cash register
 - Answer: put a bell on it
 - 1883 patent to James Ritty and John Birch for the “Incorruptible Cashier”
 - Paper tape + bell recorded transactions
- From truck
 - Put a “vehicular monitoring system” on it
 - Improves gas mileage, logistics, and honesty!



Video store rentals

- Originally store purchased videos from studio, rented to customers
 - But price was high, so only bought a few
 - Much unhappiness among all parties
- Revenue sharing model
 - Distributor *gives* videos to store
 - Each time one is rented, revenue is shared according to pre-specified formula
- But need verifiable way to count the transactions
 - Use bar codes, computers, and network
 - Each side of the transaction can verify correctness on a daily basis

Online advertising

- Publisher has space for ad impression on page, wants to sell it to the highest bidder
- Advertiser doesn't care about ad impression, wants clicks = visitors and sales
- Answer
 - Value per impression = value per click x clicks per impression = $VPC \times CTR$
 - If we can estimate CTR, we can convert one to the other
 - Huge statistical/machine learning problem
- Revenue sharing
 - Publisher and search engine can share revenue from click

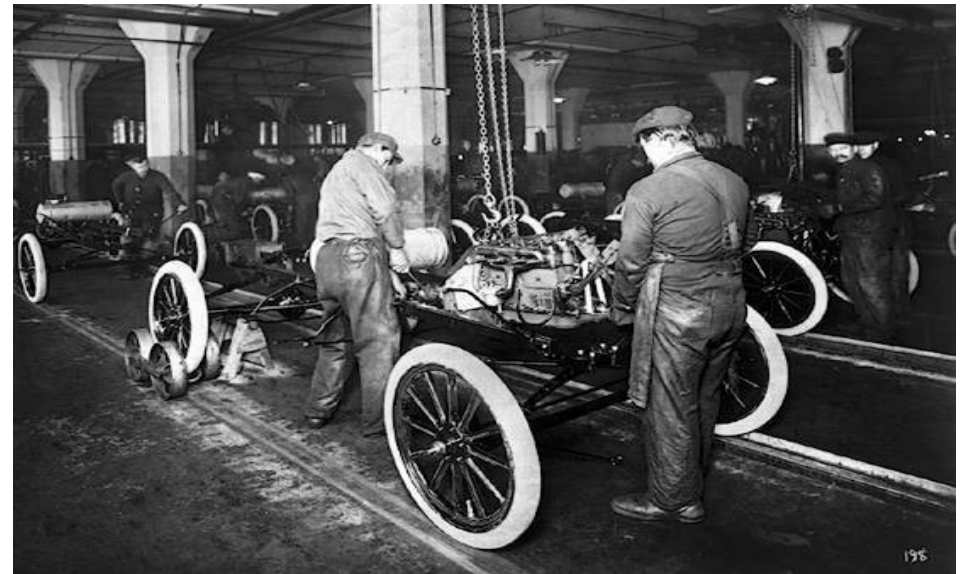
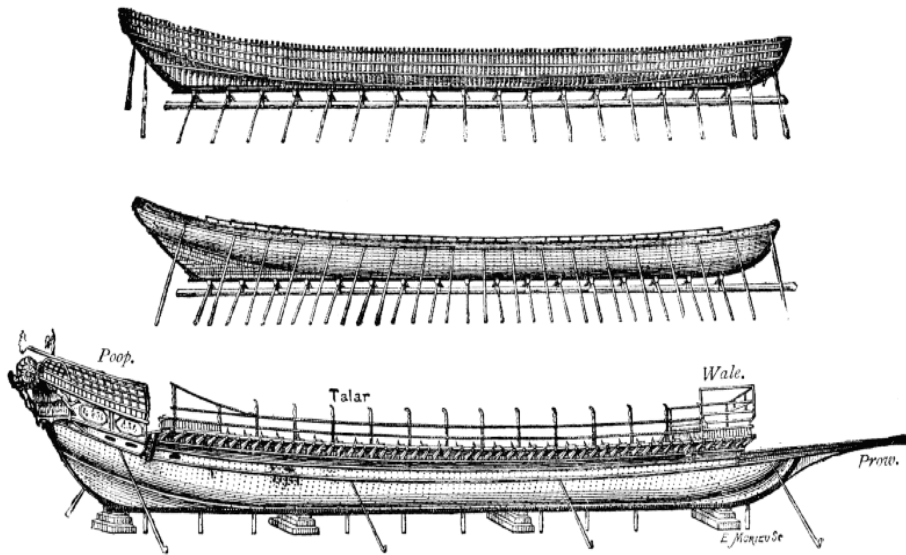
Computer mediated transactions align incentives

- A purchase can be linked back to a click or an impression, making advertising accountable
 - ...at least on a statistical basis
 - Advertiser and publishers can run experiments with different treatments to see what works
- Cases
 - Search advertising
 - Display advertising
 - Mobile advertising
 - TV, radio, print, etc.

Assembly line for marketing

- Records of transactions allows for optimization of buying process from ad to sale
 - Advertising effectiveness
 - Debugging purchase process
 - Estimation of useful marketing relationships
- Assembly line for marketing which can be fine tuned on a piece-by-piece basis
 - Venice: 14th century
 - Detroit: 1909

Assembly lines for manufacture: 14th century Venice to 20th century Michigan

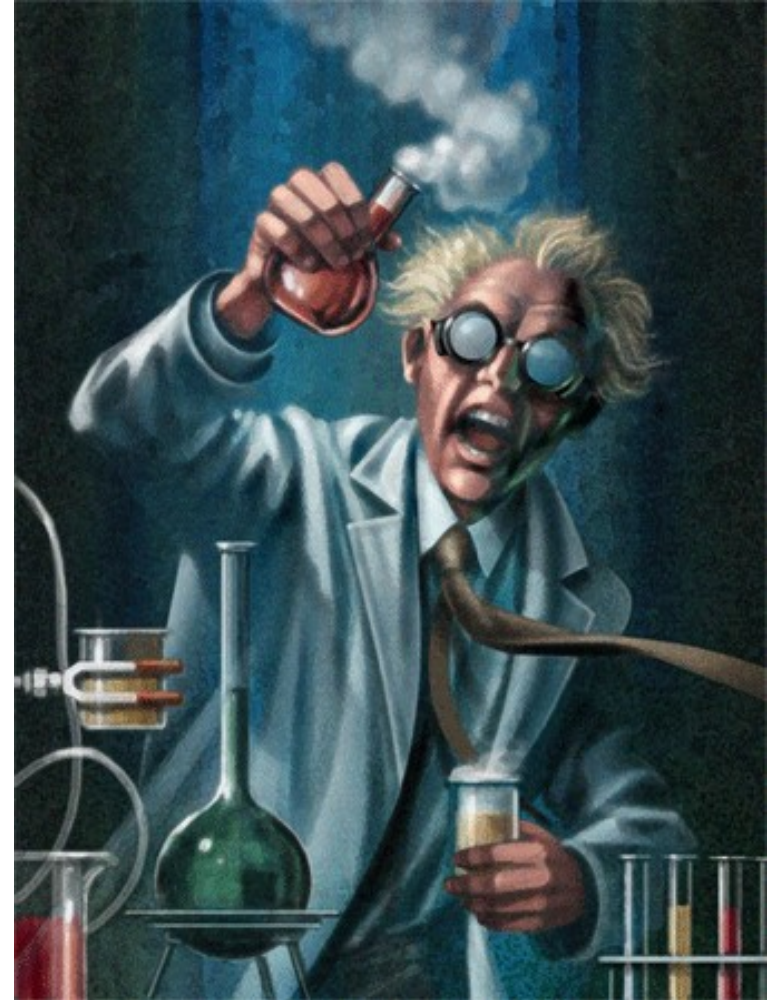


Data extraction and analysis

- Since online transactions are computer mediated, can study data for patterns
 - Which converts better [diamond] or [diamonds]?
 - How do clicks vary over time of day?
 - What keywords perform best?
 - What advertiser characteristics predict success?
- Build predictive and causal models
 - Formulate hypotheses
 - Build models
- But you don't stop there...

Controlled experimentation

- Data from computer mediated transactions allows for measurement
 - But it takes controlled experimentation to determine causality
 - One of the critical reasons for Google's success is experimentation and continuous improvement
 - Experimentation should be available in every web environment
 - Data vs HiPPO



Customization and personalization

- Computer mediated transactions allow for “mass customization” whereby transactions can be optimized for individuals
- Purchases on Amazon, searches on Google
- Challenges
 - Informed consent
 - Benefits of personalization v privacy
 - Primary issues are trust and security
 - Intended v unintended use

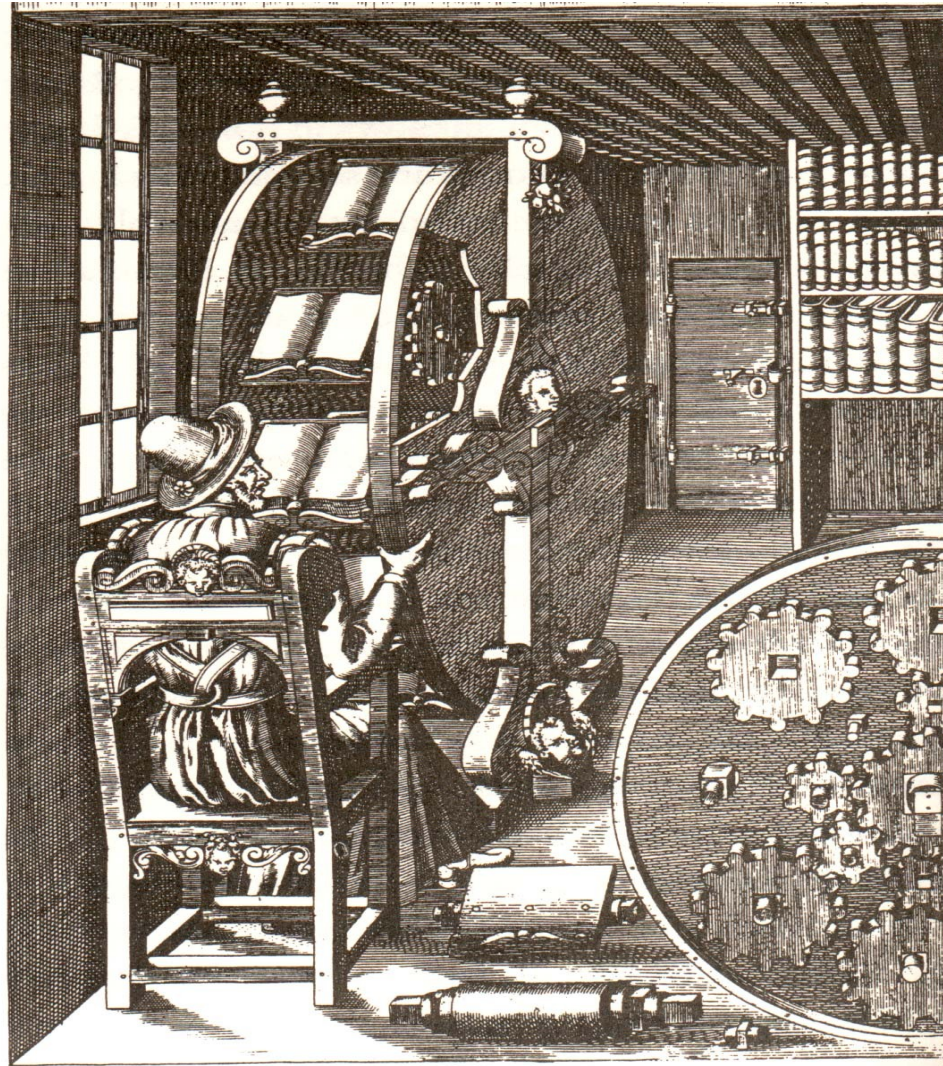
But advertising is just the beginning...

- Computer mediated transactions make advertising accountable
- But computer mediated transactions also allows for other kinds of optimization
 - Logistics
 - Customer feedback
 - Product design and evolution
 - Recommender systems
- Improves business processes across the board

Knowledge workflow

- Assembly of mechanical parts
 - Assembly lines: technique to optimize the flow of product through factory in 1908
- Assembly of ideas
 - How to optimize the flow of ideas through the organization in 2008
 - Separation, distribution and optimization of tasks
 - Multiauthored documents and collaboration
 - Version tracking and control
 - Experimentation and fine tuning
 - Overcome barriers of distance
 - Outsourcing the details
 - Micromultinationals - see below

Productivity enhancement for knowledge work?



Bookwheel, from Agostino Ramelli's
Le diverse et artificiose machine, 1588.

Enabled by “cloud computing”

- Evolution of computing
 - Mainframe
 - Data was in one place but access was controlled
 - Networked workstation
 - Data in many places, access open
 - Personal computer
 - Open access, data mostly on single computer or LAN
 - Cloud computing
 - Open access, data in one place: store once, read everywhere
 - Access from any device
 - Facilitates both teamwork and maintenance

Infrastructure for rent

- Barriers to entry for online businesses are falling fast
 - Can purchase space in data center, storage on demand, development environment from Google, Amazon, and others
 - Allows you to scale your business to meet customer growth
 - Allows for “combinatorial innovation” pushed to a new level
 - Not only innovation, but now actual deployment!
 - Fosters a huge burst of creative activity

Micromultinationals

- Cheap communications
 - Email, webpages, wikis, VOIP, wireless, collaborative computing, cloud computing
 - Opens doors to small business around the world
 - SMEs can have access to technology that only the mega-multinationals could afford a decade ago
- Combinatorial innovation
 - Businesses can be born international
 - Huge parallel innovation in technology and commerce
 - This is only the beginning