

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, Ruby...
- 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?

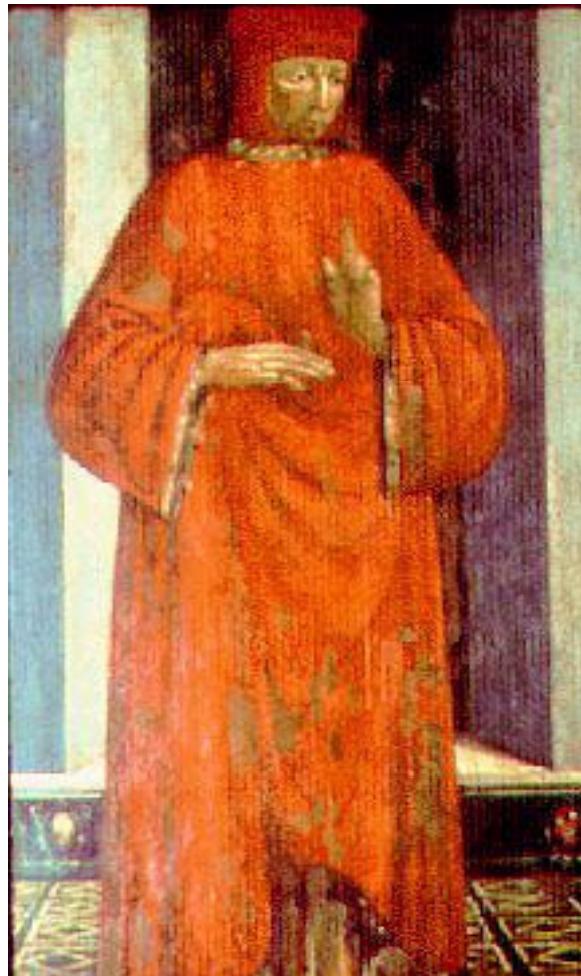
Computer mediated transactions

- A computer is now involved in almost every transaction
 - Even cash registers and ATMs are just PCs with a special interface
 - Web-based transactions are even more powerful since they directly connect to a database
 - How does the presence of a computer in transactions impact economic activity?

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



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



Francesco di Marco Datini

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

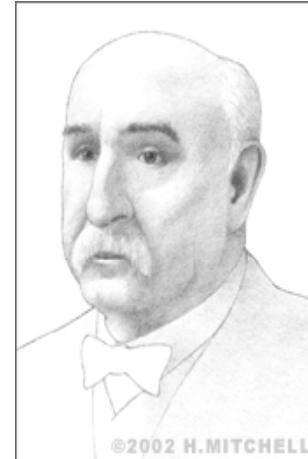
- How do you ensure that your full shipment is received at other end of voyage...with no written language?
- Answer
 - Match clay tokens to jars of oil loaded on ship
 - Seal tokens in clay envelope, stamp clay with seal
 - Bake “bulla” in kiln, send with shipment
 - At other end, the recipient breaks open the envelope and compares tokens to jars on ship
 - Later, inscribed marks on bullae as check
 - Some argue this lead 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 and revenue sharing

- Publisher has space on page for ad *impressions* (views by readers)
- Advertiser wants to pay for *clicks*
 - Adv knows how much clicks are worth
 - Publisher wants to sell each impression to the highest bidder for that impression
 - value/impression = value/click \times **clicks/impression**
 - Adv can buy clicks while publisher sells impressions
 - Need to forecast clicks per impression: a giant statistical/machine learning problem
- Revenue shared by publisher and aggregator at time of click

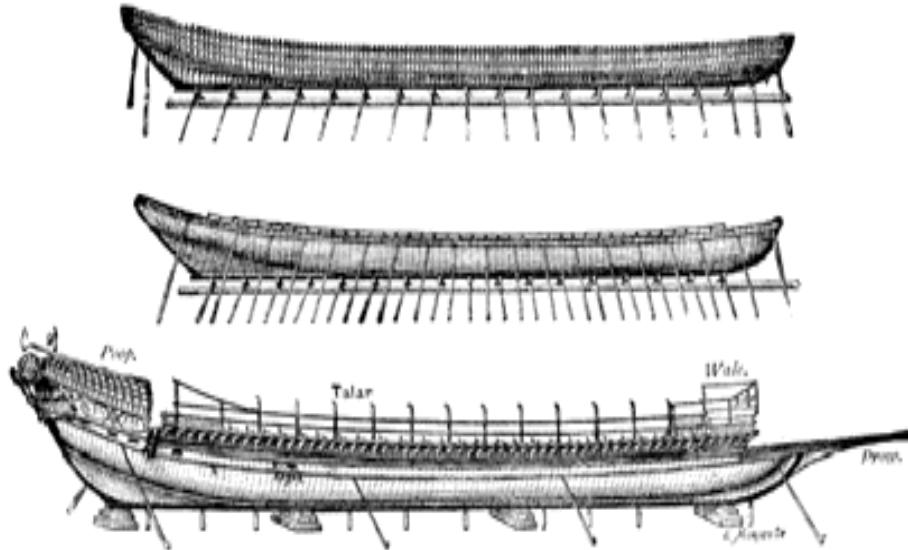
Computer mediated transactions make advertising accountable

- What advertiser really wants is conversions (purchases)
- 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

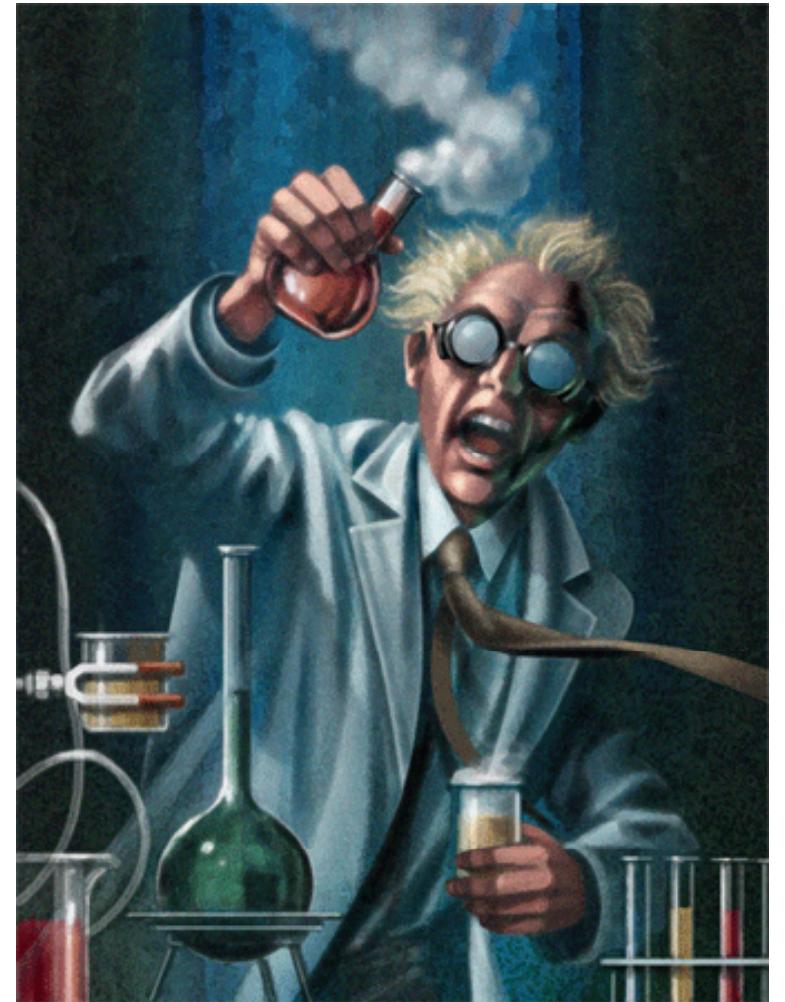
- Records of transactions allows for optimization of buying process from ad to sale
 - Advertising effectiveness
 - Debugging purchase process
 - Estimation of useful marketing relationships
- Assembly line for marketing which can be fine tuned on a component-by-component basis
 - Venice: 14th century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

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



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
- Tradeoff between enhanced service and privacy
 - People generally are not concerned with intended use of data
 - But are worried about the unintended uses: subpoena, civil rights, etc.

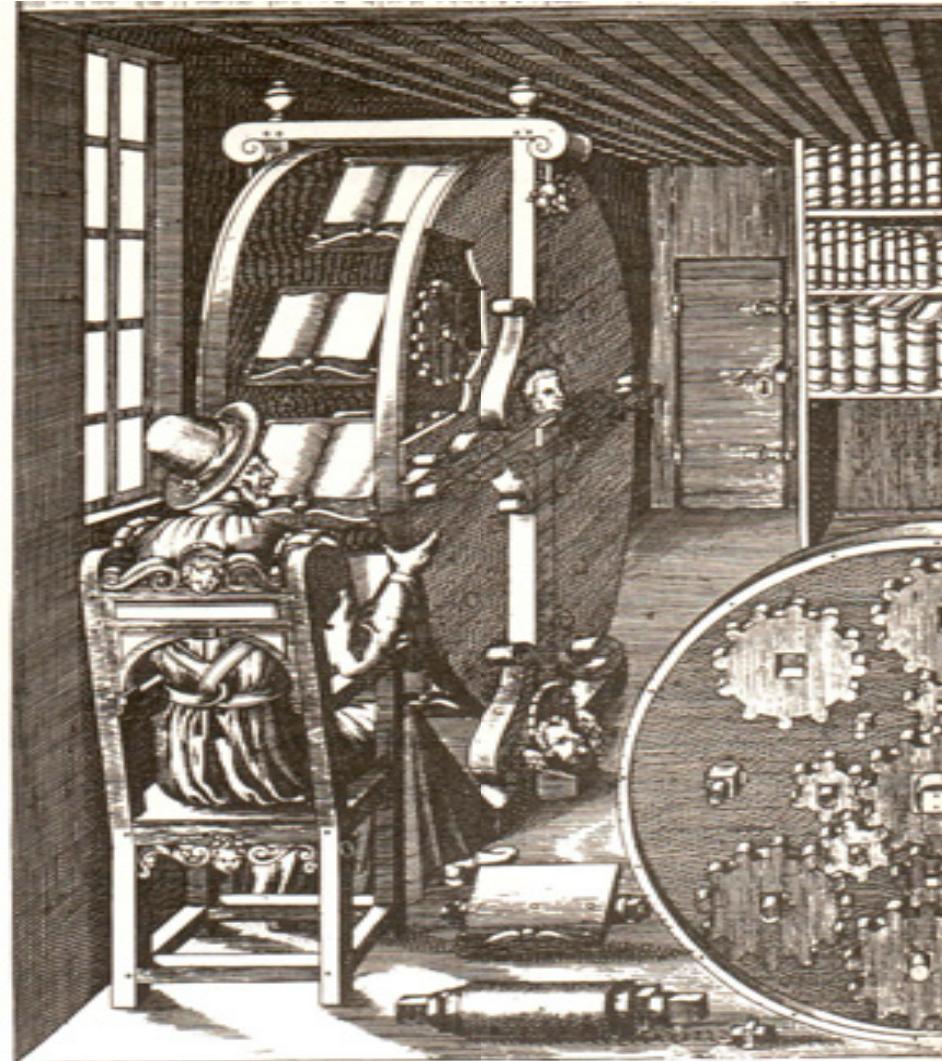
But advertising is just the beginning...

- Computer mediated transactions allow one to optimize advertising
- But computer mediated transactions also allows for other kinds of optimization
 - Logistics
 - Customer feedback
 - Recommender systems
 - Product development
- Improves business processes across the board

Knowledge workflow

- Assembly of mechanical parts
 - Assembly lines: how to optimize the flow of physical 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

Early hypertext: 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 in one place, access by individual
 - Personal computer
 - . Data in many places, access by individual
 - Client server
 - . Data in one place, access remotely by individual
 - Cloud computing
 - . Data in one place, access remotely by groups
 - . Access by multiple devices
 - . Facilitates both teamwork and data 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, Microsoft and others
 - All costs are variable – even in short run
 - 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