UbiComp's Impact on Other Sciences

Why should others care about Ubiquitous Information?

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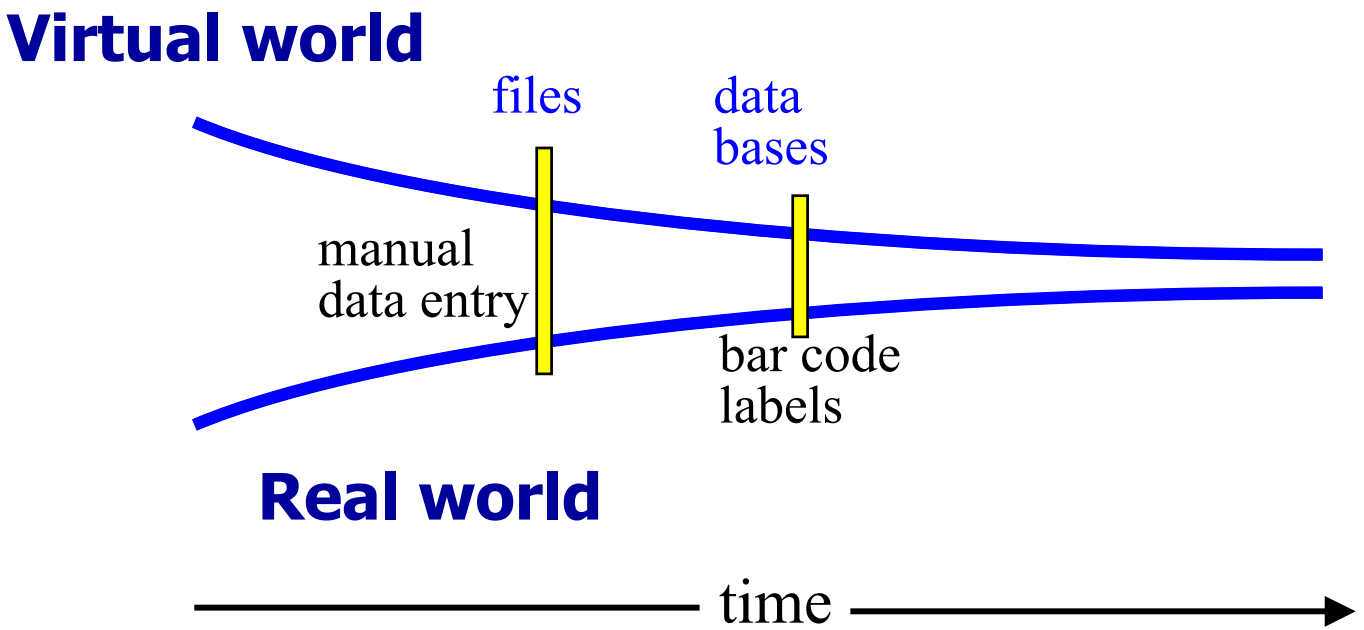
Definition

Information:

- (Encyclopaedia Britannica)

- [1] the communication or reception of knowledge or intelligence
- [2] knowledge obtained from investigation, study, or instruction …
- [3] the act of informing against a person
- [4] formal accusation of a crime made by a prosecuting officer ...

Narrowing the Gap



Source: Friedemann Mattern

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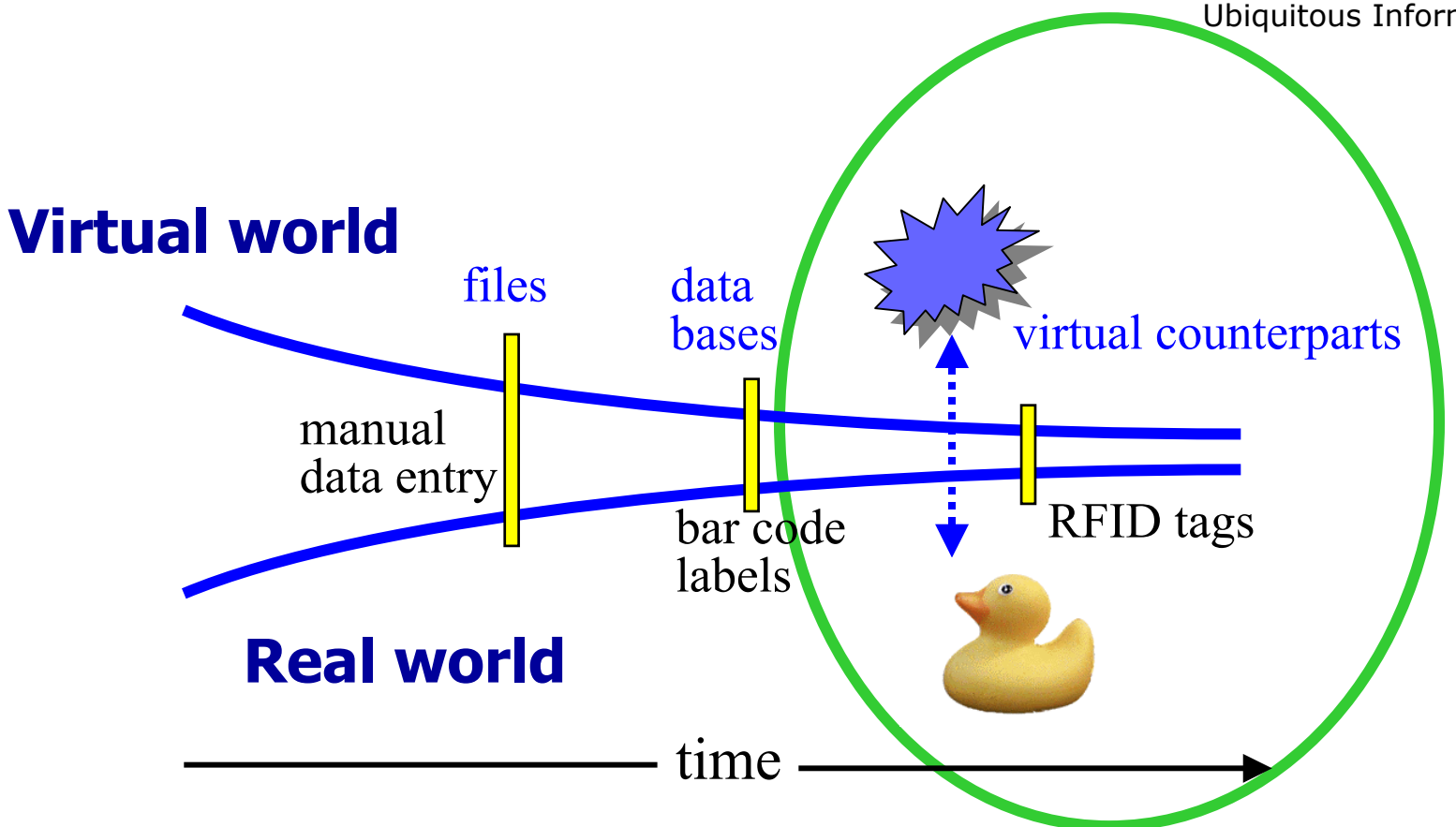

- ultimate consequence of Ubiquitous Computing:
  - the real world is mapped in the virtual world
    - completely
    - in real-time

Source: Friedemann Mattern

Outline

- Economics
  - Real-time economy
  - Taxation
  - Microeconomic issues
- Law
  - Privacy
  - Accountability
  - Consumer protection
- Sociology
- Philosophy
  - Ontology
- the problem of explaining the world

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Economics

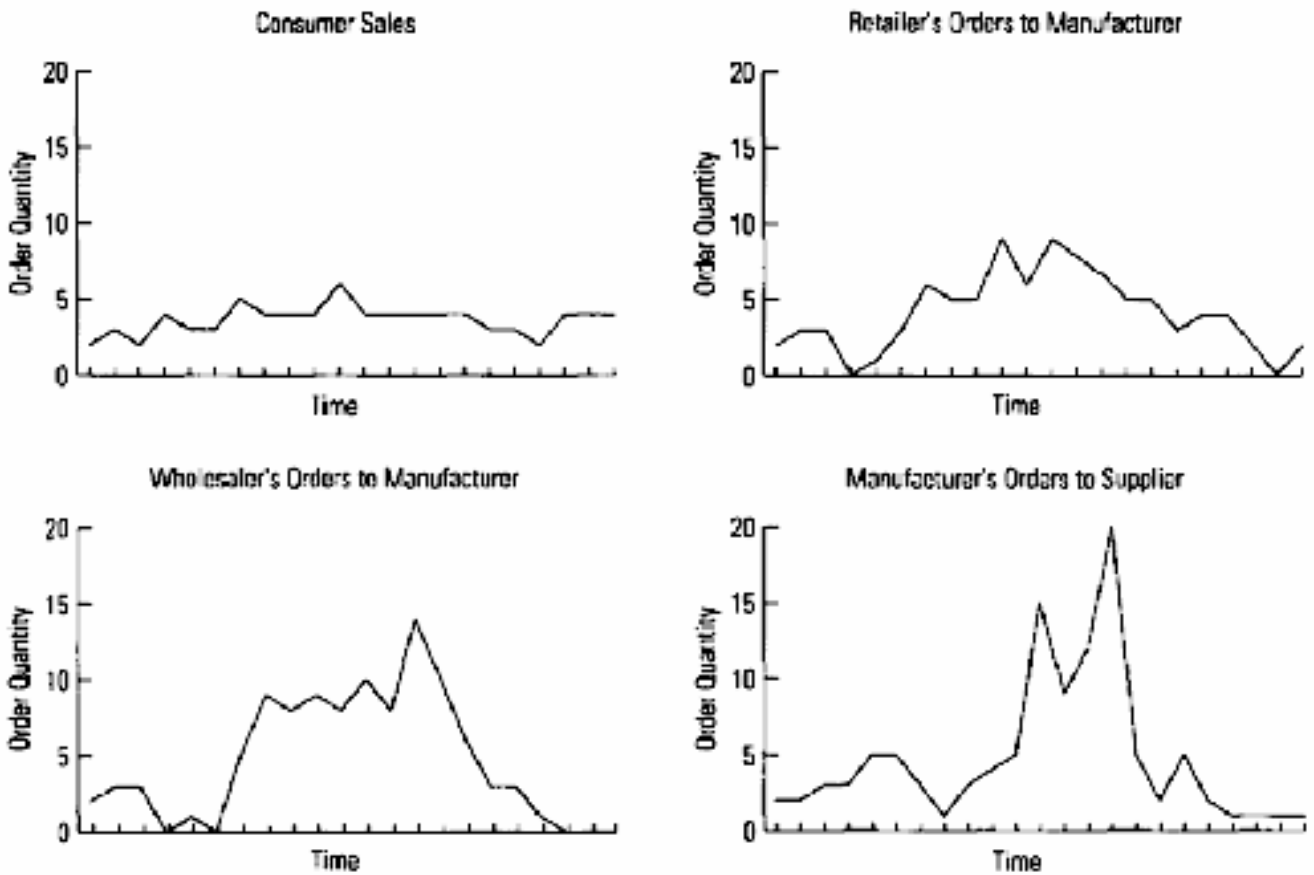
- Thesis:

  with UbiComp Systems much better resource allocation possible

- old economy → new economy → now economy
  - (real-time economy)
  - real world represented in the virtual world
    - as complete as possible
    - instantaneously

Bull-whip-effect

Figure 1 Increasing Variability of Orders up the Supply Chain



Real-time economy

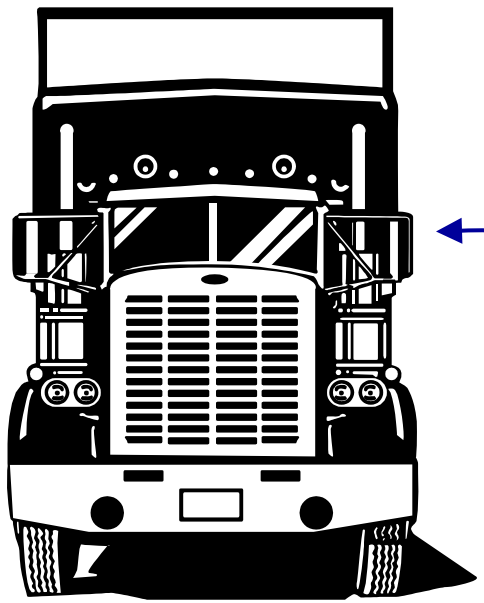
- reducing the bull-whip effect
  - Daimler Chrysler
    - $7.2m reduced stock
    - $10m improved order fulfillment
  - Sun
    - saved $15m, earned a plus of $30m
    - in ¼ year!
  - and this only through better software, no UbiComp systems involved (tagging etc)
- no macroeconomic wasting any more
  - milk bottle reduces price with age
    - super-market becomes stock-market
  - shelf line rotation → no forgotten goods in warehouse
  - smart pill-box keeps track of taken medicine
  - if transport was too hot, do not use chemicals

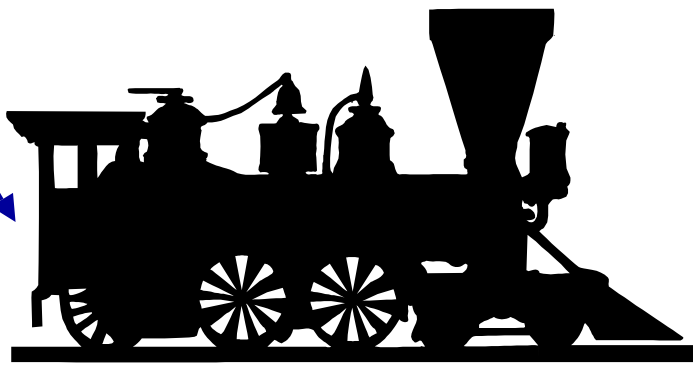
Real-time economy

- other economic benefits:
  - improved supply-chain-management, logistics
    - always know where goods are, when they arrive, ...
  - potential to quickly react
    - plane engine reports failure, spare part waits at destination airport
    - if transport is too hot, order new chemicals
  - customer satisfaction
    - keep track of orders
    - help desk is able to provide up-to-date information
- but also negative consequences:
  - putting economies on autopilot can lead to accidents (e.g. 1987 stock-market crash) → need for circuit breakers
  - market lives from lack of information
    - perfect market is innovation-unfriendly place

Taxation

- Products determine their taxes autonomously
  - no failures or corruption, low costs





Tax: 0.30 CHF

Tax: 0.05 CHF

Microeconomic analysis

- classical economic theory
  - models with average behavior of market participants
    - households
    - corporations
- with UbiComp fine-granular analysis possible
  - distinctions by region, gender, social class
  - relevance?

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Privacy

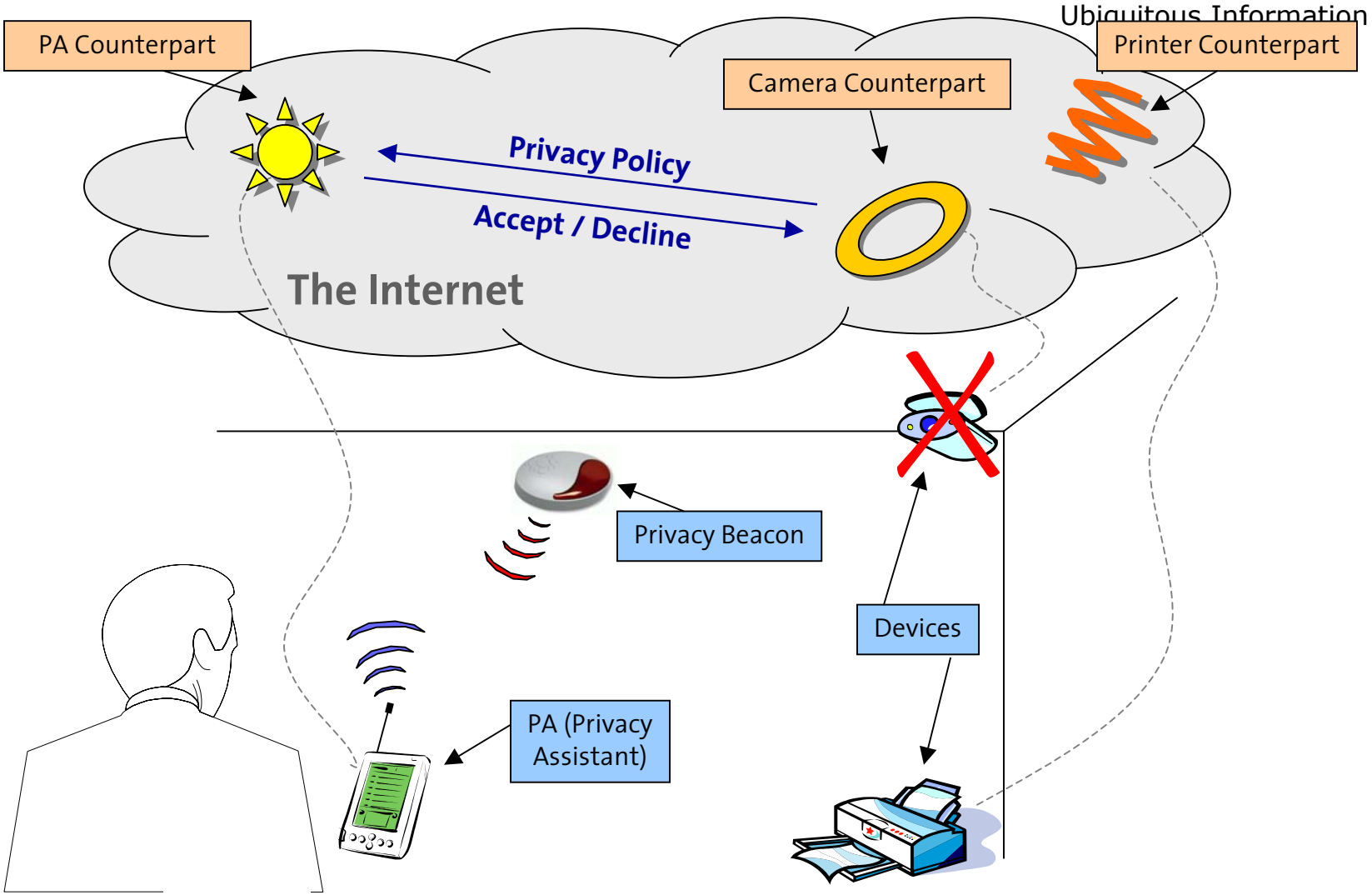
- we already leave data-traces everywhere ...
  - bank transactions
  - car license plates on Limmatquai
    - or at swiss border
  - Migros, Coop
- ... and it doesn't get any better
  - face recognition
    - 1m cameras in GB
  - personal items communicating with the world
    - PDA, car, watch, coffee cup, belt, shoe
- not only quantity, but also quality changes
  - unlimited coverage (24/7): home, school, office
  - loss of awareness
  - Important: ensure that opt-out remains possible!

How to ensure privacy

Four different views:

- „You have zero privacy anyway, forget about it"
  - Scott McNealy, CEO Sun Microsystems
- „An era of democratization of information comes; you may shoot back at Big Brother"
  - David Brin, Author of „The transparent society"
- US self-regulatory approach
- European legislative approach

Privacy Infrastructure



Source: Marc Langheinrich

Other law issues

- Accountability:
  - are you responsible for the actions of your software agents?
    - false informations, denial of service
    - how ensure/enforce QoS?
- Consumer protection:
  - I want to keep a diet
    - but the chips keep calling in the supermarket
  - last milk bottle in the shelf raises its price

2 CHF

5 CHF

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Sociology

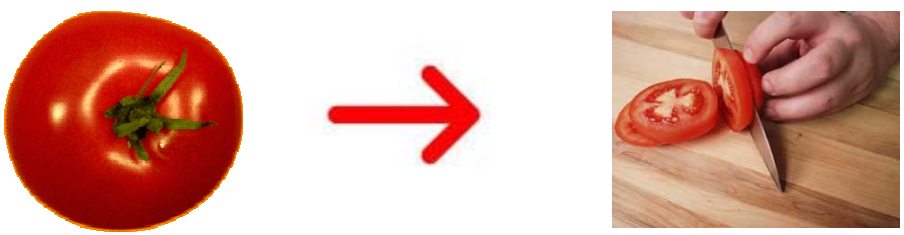
- UbiComp technology could have revolutionary consequences:
  - perfect memory: things are never forgotten
    - once a mistake, always a mistake?
  - much more technology dependency
    - loss of control?
  - new interaction forms needed
    - can people keep up with the technological progress?
- many perceived drawbacks

  → Michael's talk

Philosophy

Ontology:

is this the same bottle?



how about the tomato?

→ General problem: how to represent the world?

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Explain the world

- i.e. provide the links real <-> virtual world
- Philosophical problem
  - which computer scientists try to solve pragmatically
- ... with economical implications
  - same service (DNS-like) for everyone
  - new economic branch
    - two-class society?
- ... and legal ones
  - what if the world is explained badly?
    - the pill-box was not of aspirins, but of morphine
  - IT becomes through UbiComp life-critical
    - in the past just few applications like autopilots

Are we narrowing the gap?

- … or do we just move the problem?
- to be part of the UbiComp-world you need a world explainer
  - install/configure/update/maintain/…
  - do we all understand the world in the same way?
- new and more complex technology dependencies
  - lots of new problems and possible causes
    - low battery, communication problem, mud in my shoe
- who does the tagging?
  - are these people trustful?
    - to have the „right" tagging is inherently irresolvable by automation
  - how about UbiComp-viruses?
- and who is tagging the tags?
  - bull-whip-effect in tag supply chain?