Living in a Smart Environment
Implications for the Coming Ubiquitous Information Society

V. Coroama, J. Bohn, F. Mattern
ETH Zurich

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Motivation

- Ubiquitous Computing vision
  - "The Computer for the 21st Century" Mark Weiser 1991
- 1999 first conference for "Handheld and Ubiquitous Computing"
  - Precursor of UbiComp
- Public perception since 1-2 years
  - Exponentially increasing
  - RFID tags and consumer privacy most prominent in the public discourse
    - Often overestimating consequences (or ignoring them)

Living in a Smart Environment

- Interdisciplinary research project initiated Feb. 2002
  - Computer scientists, privacy experts, psychologists, sociologists, economists
  - Seek dialogue with politics and society
- Development of scenarios
  - 5 different life situations
  - Analyzed from the specific perspective of the participants
  - 14 most relevant consequences as last book chapter

Shopping Scenario

- Future supermarket: all products
  - Can sense, compute, communicate
  - Aware of their own state (fabrication date, temperature)
  - Know about other products in the vicinity
  - Know about ambient conditions (weather)
- Every item has its own variable price
  - Decreases when expiration date approaches
  - Increases if few products remaining
  - Prices for ice raise when hot weather forecasted
  - Regular customers receive special prices

More realistic Example?

- Supermarket goods extreme example
  - Public acceptance and economical use rather questionable
- Clear trend towards an anywhere, anytime, anything information availability
  - Ubiquitous Information Society
- Our thesis: first goods to be heavily price-discriminated (and therefore UbiComp-enabled)
  - Expensive enough: UbiComp infrastructure does not increase price significantly
  - Both sellers and (a large enough) fraction of buyers should benefit
  - Easy acceptance: nowadays already some price discrimination

How about Insurances?

- Vehicles
  - Expensive enough
  - Large enough
  - Large amounts of energy
  - Widely used

→Likely to be forerunners for many Ubiquitous Computing applications

- Insurances
  - Huge markets & great influence

→Likely to use technologies that promise large savings

Information Asymmetry

- George A. Akerlof, 1970: „The market for lemons: Quality uncertainty and the market mechanism“
  - 2001 Economy Nobel Prize
  - These:
    - With market asymmetry, quality products are pushed out of the market by low-quality products (=lemons)
  - E.g., second-hand car market
    - Because of buyer's lack of information, "lemons" drive quality cars out of the market
- In insurance markets
  - Insurer (seller) is the one with less information

Nowadays Insurances

- Split customers into classes depending on a few factors
  - Vehicle type
  - Driver‘s experience
- Inside a class, cross-financing from low risks to high risk drivers
- Other possible discrimination factors
  - Annual mileage
  - Route type (highway vs city vs country-road)
  - Time of day, weather
  - Neighborhood where you park
  - …

Omniscient Insurers

- Further discriminate → everyone has a highly personalized insurance rate
- Incentives for the insurer
  - Gain market shares in the attractive market segment of low-mileage drivers
  - "clean up your portfolio"
- Incentives for the customers
  - Low-risks drivers would save costs
  - 1999 Progressive pilot project: customers reduced mileage by 13% and saved 25% of costs

Generalized Pay-per-use?

- Trend towards granularization of services in many markets
  - Telephony, energy
- Why not choosing the vehicle insurance on a daily basis, too?
  - The car could do that automatically depending on the destination (known to the navigation system)
  - Prototypical example being developed
  - Ride-by-ride insurance
  - Or even more often, for every portion of a ride

Social Compatibility

- Commonly mentioned ubiquitous computing benefits
  - Will permit marginal groups lead a more independent and/or integrated life
    - Elderly, physically handicapped, cognitive deficiencies
  - Ubiquitous information = overcoming the digital divide
    - Everybody has access to all information

Social Compatibility

- But:
  - Nowadays, free information is often sponsored by advertisers
  - High quality, independent information often costs money
    - Public vs private television
    - Producers information vs independent consumer tests
  - Complexity of using such smart artifacts → Problems for exactly these marginal groups
- Ubiquitous information society
  - Danger of gap getting larger, not smaller
  - … and affect the way real-world objects behave!

Proposed Solutions

- Aiming a soft augmentation of artifacts
  - Deliberately stop augmentation at a point
  - People can still use them in the “old” way
- Technical: diversification of devices
  - Horizontal diversification
    - Different devices, platforms, communication means for the same task
  - Vertical diversification
    - Redundantly deploying many devices of the same type

Take Home Message

- Ubiquitous Information Society
  - Will have strong impact on everyday life
- Allows much better customer discrimination
  - Example: vehicle insurances
  - Also possible: health insurances, supermarket goods
- Some marginal groups could benefit from new devices and technologies
  - But also danger of a widening digital divide
- The technical possibilities cannot be stopped
  - Technology builders, society and politics should start a dialogue about implications