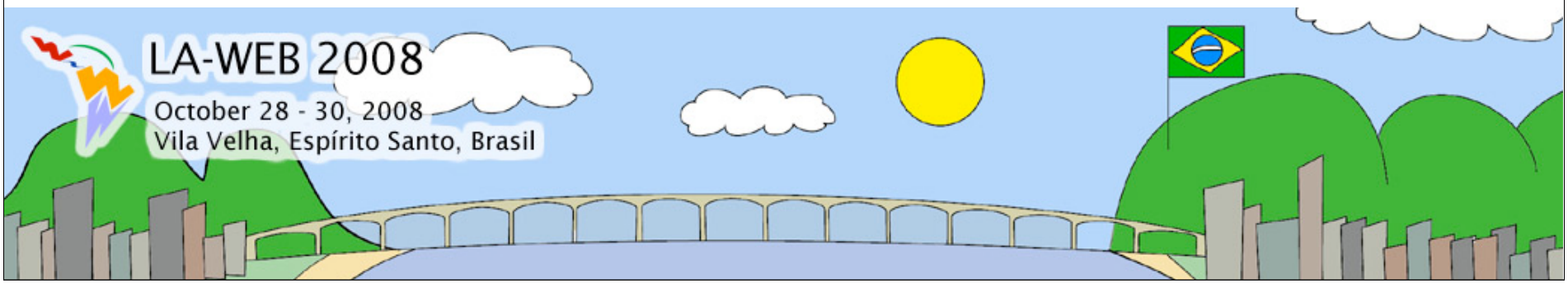
VirginiaTech
Invent the Future

chci center for human computer interaction virginiatech

Personal Information Ecosystems: Design Concerns for Net-Enabled Devices

Dr. Manuel A. Pérez-Quiñones
http://perez.cs.vt.edu/
Center for Human-Computer Interaction
Virginia Tech
Blacksburg, VA USA 24060



New challenge

- New problems arise when using a *collection* of devices, problems that were not there when we used each individually.
- How do we design the *user experience* when it is dictated by many vendors, platforms, protocols, etc?

Massive Proliferation of Devices


Microsoft

Vast amounts of information

How are these devices used together?

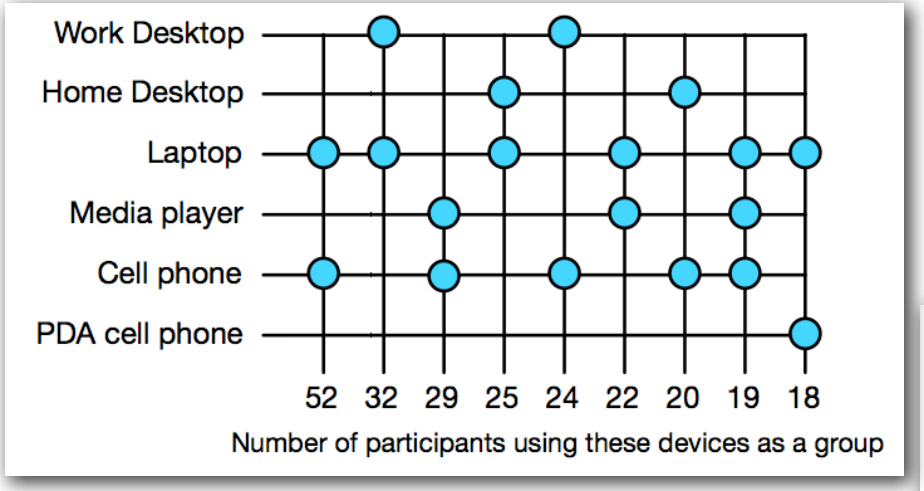
- Survey of 220 knowledge workers (Bay area, Blacksburg)
- Trend is toward mobility and multi-function
- Laptop most common device (96%), more than cellphone!
- Advanced handhelds are replacing laptops on particular trips

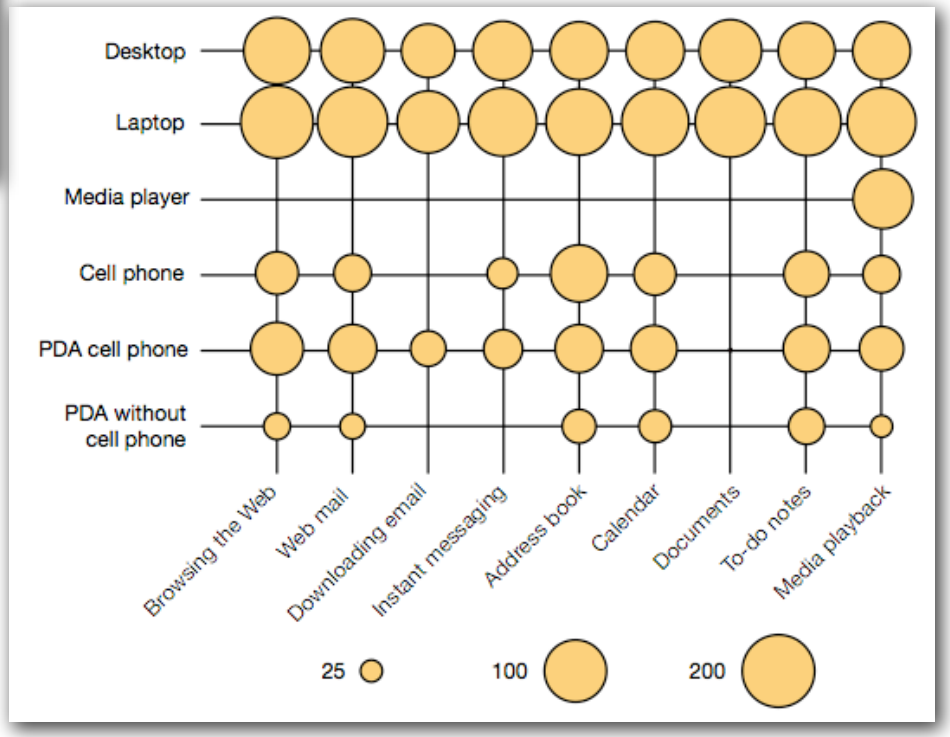
M. Tungare, M. Pérez-Quiñones (2008) *It's not what you have, but how you use it: Compromises in mobile device use.* CoRR arXiv:0801.4423v1.

Devices Used Together

- Cellphones + laptops (share network)
- Specialization: Music (mp3 player) + laptop
- Context important: multiple mp3 players
- Multi function over simpler devices (iPhone, Blackberry, Treo over plain PDA)

Coupling of devices





Some Initial Observations

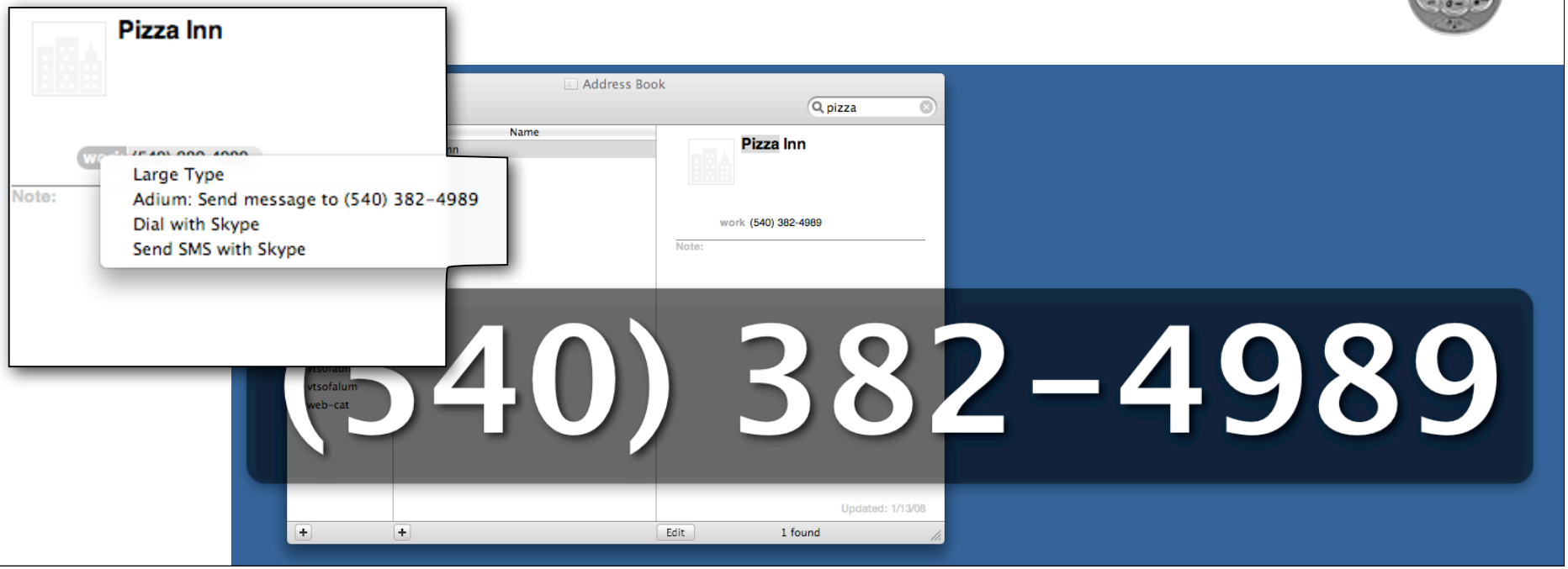
- How do we study the collection of devices together as an interactive unit?
- We need a framework with which to discuss, evaluate, study, and design the device collective.
  - Must all devices provide same functionality?
  - Are all *pairings* equal?
  - Which information goes where?

Mobile And Desktop Apps

- Are mobile applications just a smaller version of their desktop counterpart?
- Weiser's ubicomp vision had device sizes. Simon Harper's "one size fits all" hinders growth.
- Must software follow along? Small=phone, medium=desktop, large=wall?
  - Do small devices need to be functional replicas of the desktop counterparts?

Address Book Example

- Context and use changes the software
- e.g. Dial a number



Facebook Example

Devices Are Used Together

- Set an alarm on your laptop
- Synchronize your laptop to your desktop, phone, ipod

To Sync Or Not To Sync

- Synchronization is problematic, error prone, difficult to configure...
  - ...and the wrong thing to do?
  - Do we really need full replica of our information in all of our devices?
- Two examples from our survey...

Task-based

"Usually my contacts on the phone are just with numbers while my contacts on the computer are just with email addresses (makes sense since I'm using the former to make calls and the later [sic] *to send emails). [...]"*

Context-based

"I have two MP3 players: A small one for the gym and large one for long travel, etc. and I do not have the same music on both of them. It is generally difficult to make the synchronization software for each player understand that I do not want it to grab my entire music library, only the portion that I want to send to that particular player."

Personal Information Ecosystems

Definition: A *personal information ecosystem* is a system of devices and applications that are present in the information environment of a user helping the user fulfill his/her information needs.

Example: Apple iTunes/ iPod

- Natural information flow
- Not functional replicas of each other
- Easy transition between them
- Individually not as useful as in ecosystem

Devices As Organisms

- *Biotic* - living organisms... devices
- *Abiotic* - environmental factors... infrastructure (wi-fi, cables, etc.)
- Removal or introduction of some *biotic* organisms can produce imbalance in ecosystem. *Abiotic* factors support life in the ecosystem

Information Is Energy

- Biological ecosystems - flow of *energy* keeps ecosystem in balance
- PI ecosystem - flow of *information* keeps it in balance

Interdependencies

- **Symbiosis** - one organism obtains food from another one, the other one benefits from relationship
- PIE examples
  - Laptop + Cellphone together gain wireless access
  - iTunes + iPod

Interdependencies

- **Commensalism** - one organism obtains benefits while the other one is not affected
- PIE examples
  - Logitech Harmony remote controls
  - RSS feeds, content syndication, calendar subscriptions - benefit the device subscribed, no harm to publish information

R. Ball, P.S. Pyla, M.A. Pérez-Quiñones (2007) *OSI and ET: originating source of information and evidence traceability*. CHI 2007 Extended Abstracts, pp. 2261-2266

Interdependencies

- Parasitism - one device benefits while harming the other
- PIE Example
  - Email-enabled devices that use POP3 mail protocol
  - Bluetooth headsets

Environment

- Biological system - organism congregate around sources of energies, predators follow prey, water, etc.
- Personal Information system - wi-fi and other resources support the flourishing of PIE
  - Coffee shops with free wi-fi
  - Companies settle near Internet backbone, or near enough power

Equilibrium

- PIE is in equilibrium if information is flowing freely through the environment, all organisms receiving the required *energy* (information) to support the user's tasks
- New device or device failure - PIE is out of equilibrium until user can fulfill needs

Design Implications

- Device variety and diversity
- Consistency is not the answer
- Filing, synch, data management
- Environment, affordances
- Social norms

Device Diversity

- All devices are not the same
- Variety and diversity of devices is good for ecosystem
- Information must flow freely [more content syndication, better synchronization algorithms, better file management]
- Interdependencies must be factor into design and adoption

Balance in PIE

- How do we measure when a PIE is in equilibrium?
- What is the impact of introducing a new device?
- What is the harm of a device being a parasite?

Filing & Data Management

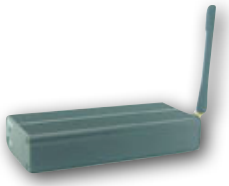
- Management of data in PIE is becoming a significant issue
- Synch? Not necessarily
- Data on the cloud makes it *always* available, what impact does this have on the PIE (change in the environment)

Consistency Is Not It

- Consistency across devices is difficult to define
  - Many iPods work differently
  - Phone lookup in address books is very different from phone to desktop
- What makes consistency important? Syntactical features? Look vs Feel? Conceptual?

Affordances and Context of Use

- Sometimes context of use is hard to detect
  - Other times easy if the environment supports it
- Consider building environmental support for PIE



Social Norms

- Ubiquity is pushing computing into the social realm
- Why was Clippy hated so much?
  - Interrupted work, socially inept
  - Social norms dictate how we interact
- Requests, Interruptions, Responses

VirginiaTech
Invent the Future

chci center for human computer interaction virginiatech

Discussion