MMI 2: Mobile Human-Computer Interaction

Introduction

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Mobile Interaction

- General topic
  - Human interaction with mobile devices
- Goals of this course
  - Design and evaluate better mobile user interfaces
  - Understand “human factors” and analyze requirements
  - Understand design principles
  - Learn how to do prototyping
  - Programming interactions
  - Sensors and their uses

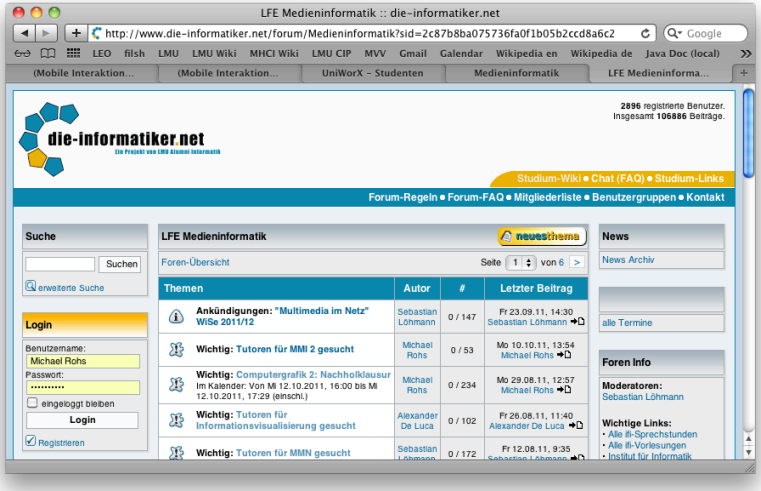
Organizational Details

- Time
  - Lecture: Wednesday 10:15-11:45
  - Exercises: Monday 14-16, Monday 16-18, Tuesday 16-18
- Lecturer
  - Prof. Dr. Michael Rohs, michael.rohs@ifi.lmu.de
  - Sprechstunde: Wednesday 15:00-16:00
- Lab assistants
  - Dipl.-Inform. Sven Kratz (Mo 16-18), sven.kratz@ifi.lmu.de
  - Steffi Grois (Mo 14-16)
  - Christine Wagner (Di 16-18)
- ECTS-Credits: 6
- Modul: WP3: Mensch-Maschine Interaktion 2
  - für Master Medieninformatik

Homepage and Forum

- Course Homepage
  - Slides, exercises, references, news
  - http://www.medien.ifi.lmu.de/lehre/ws1112/mmi2/

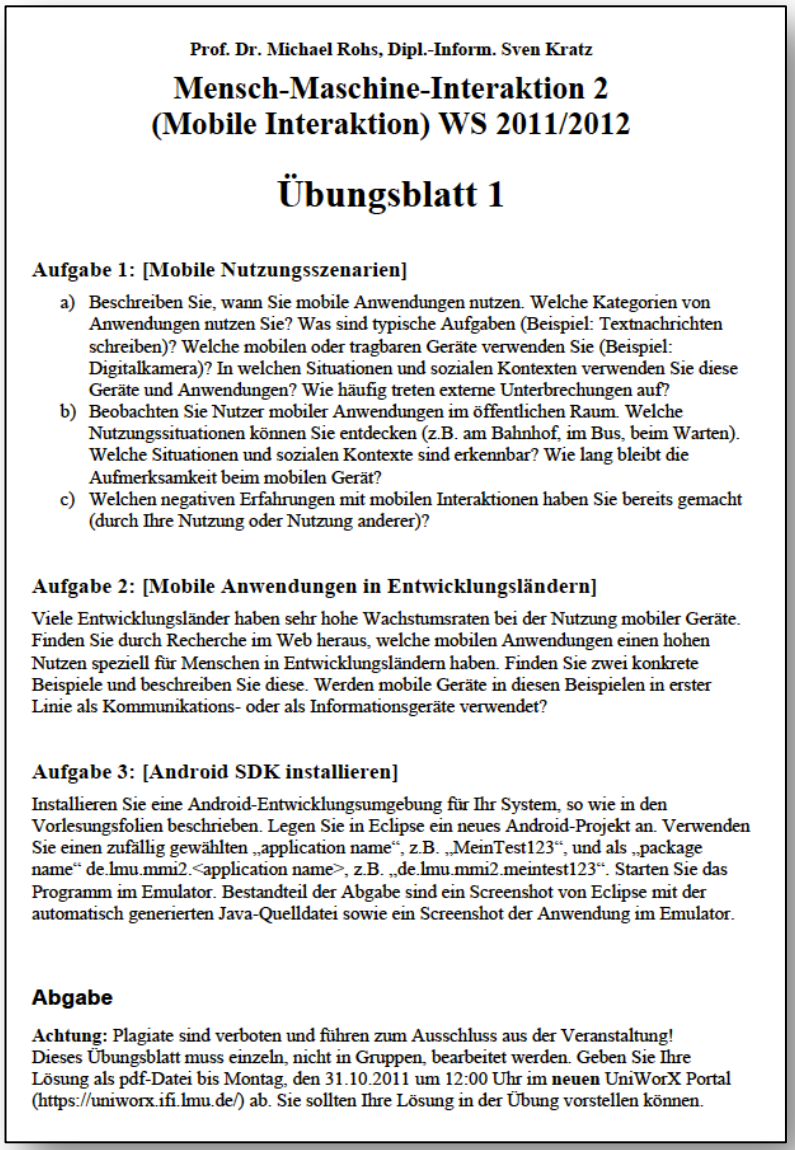
- Diskussionsforum
  - Discussion, feedback, announcements
  - http://www.die-informatiker.net → LFE Medieninformatik



Assessment

- Assignments
  - Done individually, if not stated differently on assignment
  - Assignments are pass/fail
  - No plagiarism!
- Grading
  - Bonus points for passed assignments

    up to 10% of grade
  - Final exam



Prof. Dr. Michael Rohs, Dipl.-Inform. Sven Kratz

Mensch-Maschine-Interaktion 2
(Mobile Interaktion) WS 2011/2012

Übungsblatt 1

Aufgabe 1: [Mobile Nutzungsszenarien]

a) Beschreiben Sie, wann Sie mobile Anwendungen nutzen. Welche Kategorien von Anwendungen nutzen Sie? Was sind typische Aufgaben (Beispiel: Textnachrichten schreiben)? Welche mobilen oder tragbaren Geräte verwenden Sie (Beispiel: Digitalkamera)? In welchen Situationen und sozialen Kontexten verwenden Sie diese Geräte und Anwendungen? Wie häufig treten externe Unterbrechungen auf?
b) Beobachten Sie Nutzer mobiler Anwendungen im öffentlichen Raum. Welche Nutzungssituationen können Sie entdecken (z.B. am Bahnhof, im Bus, beim Warten). Welche Situationen und sozialen Kontexte sind erkennbar? Wie lang bleibt die Aufmerksamkeit beim mobilen Gerät?
c) Welchen negativen Erfahrungen mit mobilen Interaktionen haben Sie bereits gemacht (durch Ihre Nutzung oder Nutzung anderer)?

Aufgabe 2: [Mobile Anwendungen in Entwicklungsländern]

Viele Entwicklungsländer haben sehr hohe Wachstumsraten bei der Nutzung mobiler Geräte. Finden Sie durch Recherche im Web heraus, welche mobilen Anwendungen einen hohen Nutzen speziell für Menschen in Entwicklungsländern haben. Finden Sie zwei konkrete Beispiele und beschreiben Sie diese. Werden mobile Geräte in diesen Beispielen in erster Linie als Kommunikations- oder als Informationsgeräte verwendet?

Aufgabe 3: [Android SDK installieren]

Installieren Sie eine Android-Entwicklungsumgebung für Ihr System, so wie in den Vorlesungsfolien beschrieben. Legen Sie in Eclipse ein neues Android-Projekt an. Verwenden Sie einen zufällig gewählten „application name", z.B. „MeinTest123", und als „package name" de.lmu.mmi2.<application name>, z.B. „de.lmu.mmi2.meintest123". Starten Sie das Programm im Emulator. Bestandteil der Abgabe sind ein Screenshot von Eclipse mit der automatisch generierten Java-Quelldatei sowie ein Screenshot der Anwendung im Emulator.

Abgabe

Achtung: Plagiate sind verboten und führen zum Ausschluss aus der Veranstaltung! Dieses Übungsblatt muss einzeln, nicht in Gruppen, bearbeitet werden. Geben Sie Ihre Lösung als pdf-Datei bis Montag, den 31.10.2011 um 12:00 Uhr im **neuen** UniWorX Portal (https://uniworx.ifi.lmu.de/) ab. Sie sollten Ihre Lösung in der Übung vorstellen können.

Syllabus

- Understanding “human factors” and analyzing needs
  - Interaction when mobile
  - Models of interaction between people and their environment
- Understanding technology
  - Programming mobile interactions
  - Sensors and their uses
- Being creative
  - Rules and principles of iterative design
  - Prototyping techniques
- Being humble
  - User studies and evaluation methods

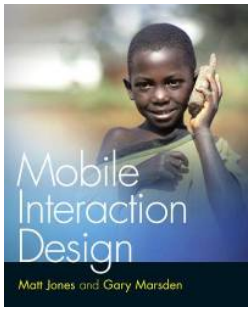
Lectures

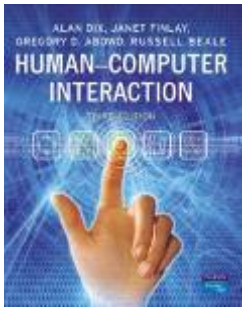
#	Date	Topic
1	19.10.2011	Introduction to Mobile Interaction, Mobile Device Platforms
2	26.10.2011	History of Mobile Interaction, Mobile Device Platforms
3	2.11.2011	Mobile Input and Output Technologies
4	9.11.2011	Mobile Interaction Design Process
5	16.11.2011	Mobile Communication
6	23.11.2011	Location and Context
7	30.11.2011	Prototyping Mobile Applications
8	7.12.2011	Evaluation of Mobile Applications
9	14.12.2011	Visualization and Interaction Techniques for Small Displays
10	21.12.2011	Mobile Devices and Interactive Surfaces
11	11.1.2012	Camera-Based Mobile Interaction 1
12	18.1.2012	Camera-Based Mobile Interaction 2
13	25.1.2012	Sensor-Based Mobile Interaction 1
14	1.2.2012	Sensor-Based Mobile Interaction 2
15	8.2.2012	Exam

Exercises

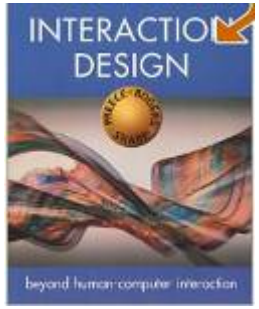
#	Date	Topic
1	24.10.2011	Mobile usage scenarios
2	31.10.2011	Touch screen input
3	7.11.2011	Animations
4	14.11.2011	Exchanging data
5	21.11.2011	Location-based audio
6	28.11.2011	Paper-prototyping a mobile application
7	5.12.2011	Evaluating the paper prototype
8	12.12.2011	Visualizing off-screen data
9	19.12.2011	Interacting with small targets
10	9.1.2012	Tactile feedback
11	16.1.2012	Feature recognition
12	23.1.2012	Feature recognition
13	30.1.2012	Gesture recognition
14	6.2.2012	Exam preparation

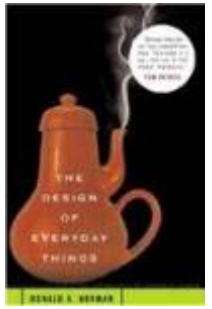
Books

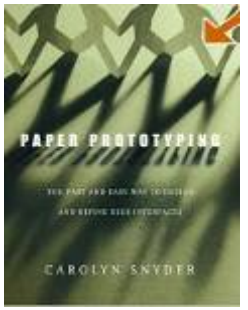




- Specific book on mobile interaction
  - Matt Jones, Gary Marsden: Mobile Interaction Design. Wiley, 2006.
- General books on HCI
  - Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale: Human Computer Interaction. 3rd Edition, Prentice Hall, 2004.
  - Jennifer Preece, Yvonne Rogers, Helen Sharp: Interaction Design: Beyond Human-Computer Interaction. John Wiley & Sons, 2011.
  - Donald A. Norman: The Design Of Everyday Things. Basic Books (Perseus), 2002.
  - Carolyn Snyder: Paper Prototyping: The Fast and Easy Way to Design and Refine User Interfaces. Morgan Kaufmann, 2003.





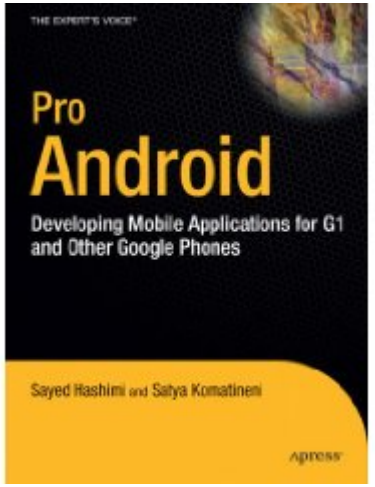


HCI Literature Sources

- Conferences
  - CHI (main), UIST (technical), DIS (design), INTERACT (Euro-Asian), CSCW (group work), TEI (tangible), Ubicomp, Pervasive, ACM Multimedia, ICMI (multimodal), ACE (entertainment)
- Journals
  - TOCHI (archival), interactions (magazine), PUC (Ubicomp), IEEE Pervasive
- Online
  - ACM Digital Library (www.acm.org/dl), hcibib.org

Android Book

- Sayed Y. Hashimi, Satya Komatineni:
  Pro Android.
  Apress, 2009. ISBN 1430215968.
  - General introduction into the concepts of Android
  - Recommended for exercises and project



- Lots of other books on Android available
  - Your choice

Early Mobile Communication Devices

- 1946 AT&T first commercial mobile phone service for private customers
  - Mounted in vehicles
  - Weighted 80 lbs

- 1972 Motorola prototype for Portable Radio Telephone
  - First mobile phone call April 3, 1973
  - DynaTAC 8000x first mobile telephone
    - could connect to the telephone network
    - could be carried by the user
  - www.cbc.ca/news/background/tech/cellphones/firstcellphone.html

Martin Cooper (considered the inventor of the mobile phone)

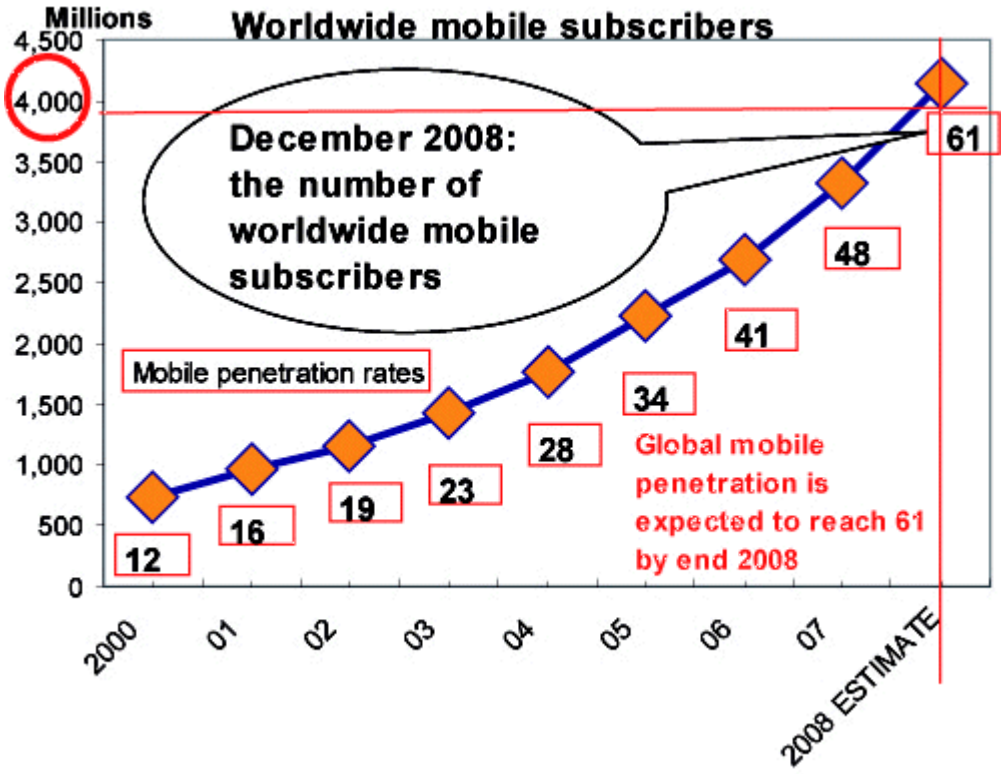
How Times Have Changed

- *"In 1954, the Marquis of Donegal heard that the Duke of Edinburgh possessed a mobile radio set with which he phoned through to Buckingham Palace – and anyone else on the network – while driving in London. The Marquis was more than a little jealous, and enquired of the postmaster general whether he, too, could have such a telephone. The polite but firm reply was "no". In the mid-1950s, if you were the husband of the Queen you could have a mobile telephone connection to the public network. But if you were a mere marquis, you could go whistle."*

  Agar, J.: Learning from the mobile phone. Journal of the Royal Society of Arts, pp. 26-27, January 2004.

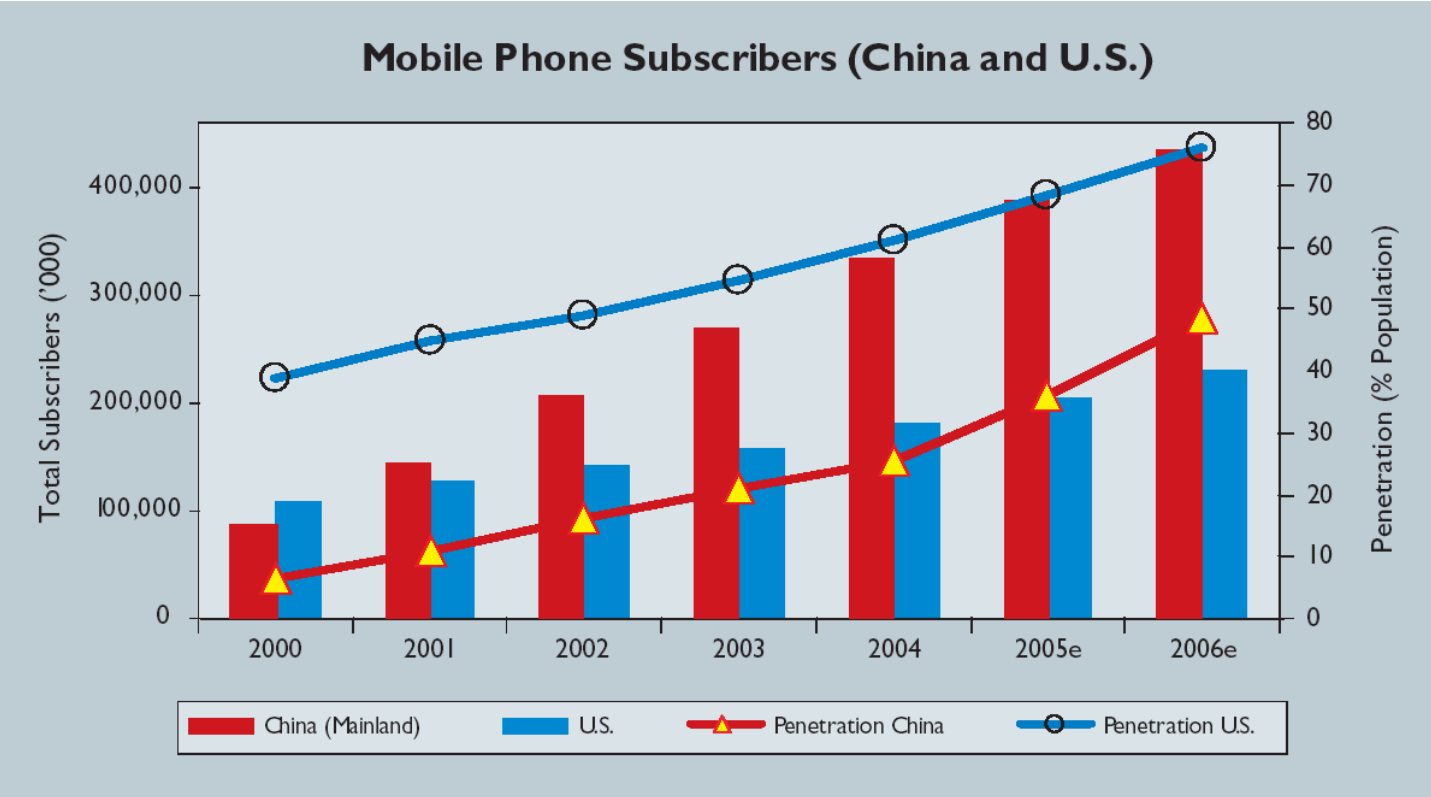
Today More Mobile Phones than PCs

- Mobile subscribers
  - 5.3 billion in late 2011
  - World population 7.0 bn
- BRIC countries one third and fastest growing
  - Brazil, Russia, India, China
  - 2.2 bn mobile subscribers (1.3 bn end of 2008)
- Europe
  - More than 1 mobile phone per inhabitant in some countries



http://www.itu.int/newsroom/press_releases/2008/29.html

Mobile Phone Subscribers in China

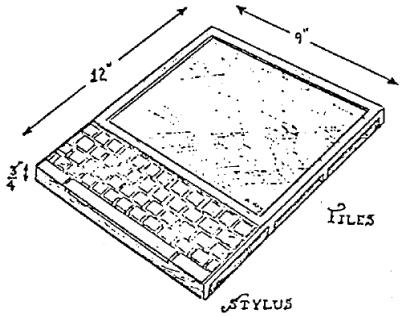


Source: UNCTAD numbers based on ITU World Telecommunication Indicators Database 2005 in UNCDAT Secretariat. Information Economy Report 2005. United Nations Conference on Trade and Development. Available at www.unctad.org/en/docs/sdteedc20051_en.pdf.

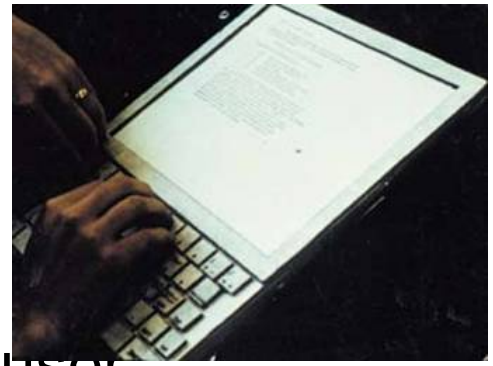
Notes: Growth Rate for Penetration 2005e, 2006e is calculated on the average growth of the prior 4 years; Growth Rate for Subscribers 2005e, 2006e is based on Economist Intelligence Unit (Margin of error for 2005-2006 data → +/_ 5%) from Noah, E. *China Wireless: The Regional Giant Answers the Call*. Analyst Report, (June 2005). Available at www.emarketer.com/Report.aspx?wire_china_jun05.

Passerini et al., CACM Oct. 2007

Alan Kay's Dynabook (1968)



- Vision of a mobile computer with focus on UI
- A portable interactive personal computer, as accessible as a book
- Envisioned as a learning aid for children
- Problem: software that facilitates dynamic interactions between the computer and its user

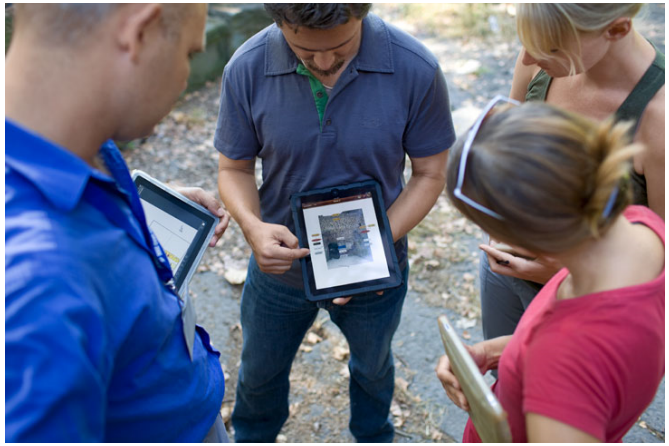


- "The Dynabook will have considerable local storage and will do most computing locally, it will spend a large percentage of its time hooked to various large, global information utilities which will permit communication with others of ideas, data, working models, as well as the daily chit-chat that organizations need in order to function. The communications link will be by private and public wires and by packet radio."

http://www.artmuseum.net/w2vr/archives/Kay/01_Dynabook.html

“Dynabooks” Today

- Field work supported by tablet PCs
- Example: Work in archaeological sites
  - Capture notes and images
  - Exchange data
  - Match items to databases



- Source: www.apple.com/ipad/pompeii

Mobile Interaction is Usage in Context

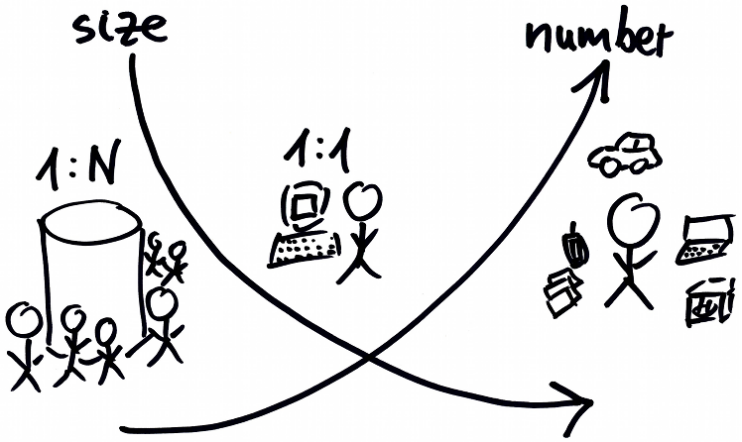
- Primary real-world task

Adapted from a slide by Albrecht Schmidt

Mobiles “in the Wild” and “on the Go”

- Interruptions
  - From environment or device itself
  - Short attention periods
- Changing environments
  - Noise, lighting conditions
- Full concentration on device impossible
  - Cognitive capacity shared with other tasks
- Presence of others, social situation
  - Incoming call changes social situation
- Importance of events in environment
  - Environment provides relevant information
  - Acting in the environment based on combination

Ubiquitous Computing



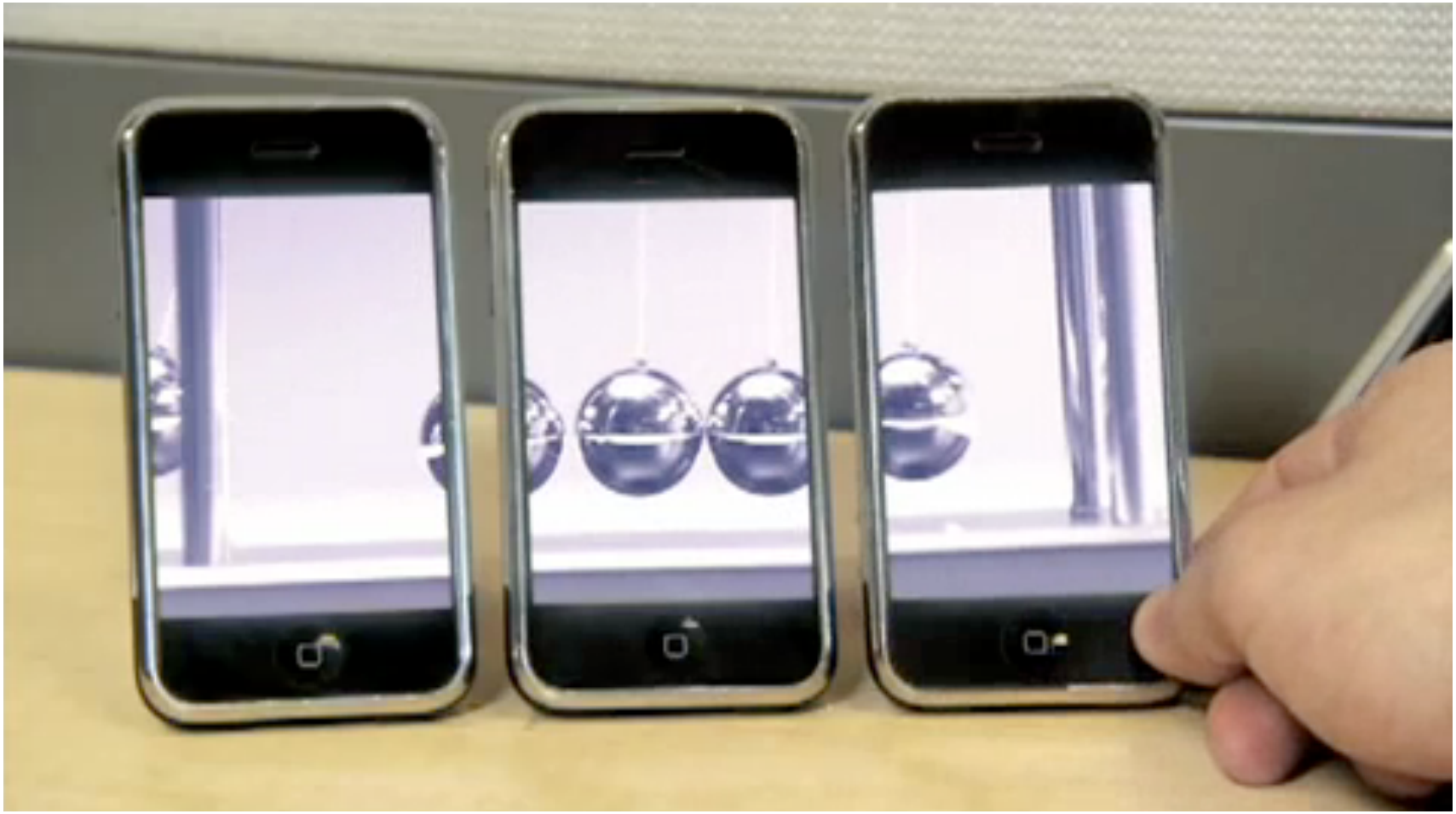
"The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it."

Mark Weiser

- Computers embedded in everyday things
- Technology moves into the background
- Computers in the world, instead of world in the computer

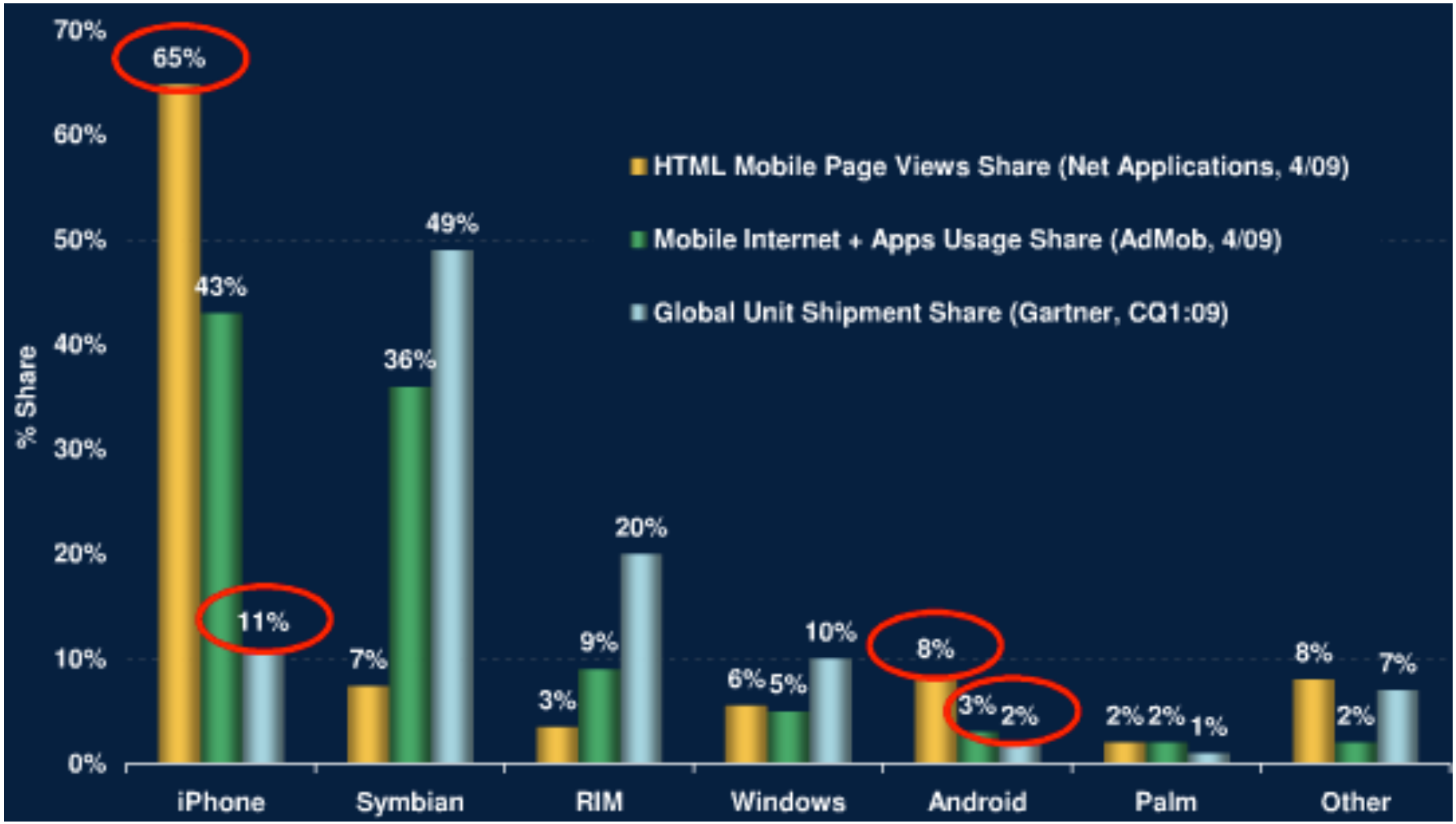
- Mobile devices as always available mediators
- Entry point into the digital world

What can you do with your phone?



http://www.youtube.com/watch?v=Pgsw-NgDoFE

iPhone / Android:
Mobile Web Share > Shipment Share



Source: Morgan Stanley, 2009

Mobile Internet Uses (2008)

And one more thing...

Das iPhone und ich

Mensch und Internet werden eins, dank des iPhones von Apple. Die ersten vier Wochen mit dem neuen Wundergerät.

ZEIT ONLINE, www.zeit.de/2008/38/iPhone-38

www.mmetrics.com/press/PressRelease.aspx?article=20080318-iphonehype

Mobile Internet Uses (2008)

Mobile Content Consumption: iPhone, Smartphone and Total Market: January 2008

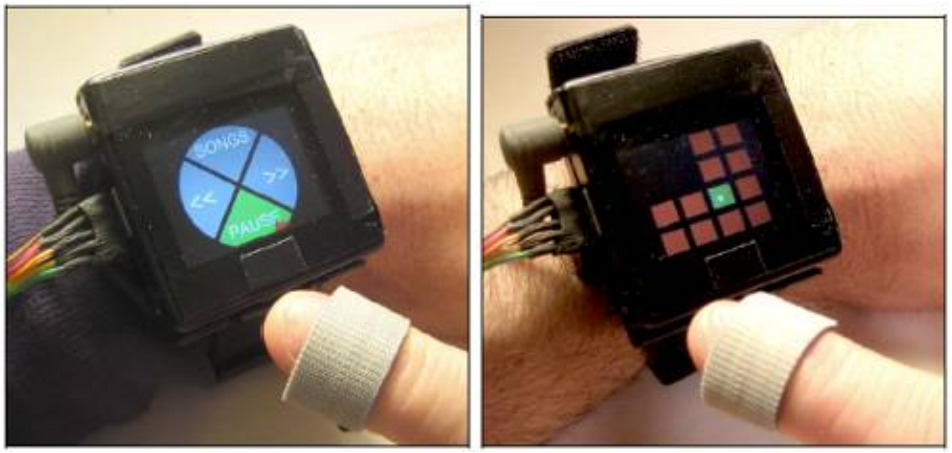
Activity	iPhone	Smartphone*	Market
Any news or info via browser	84.8%	58.2%	13.1%
Accessed web search	58.6%	37.0%	6.1%
Watched mobile TV and/or video	30.9%	14.2%	4.6%
Watched on-demand video or TV programming	20.9%	7.0%	1.4%
Accessed Social Networking Site or Blog	49.7%	19.4%	4.2%
Listened to music on mobile phone	74.1%	27.9%	6.7%

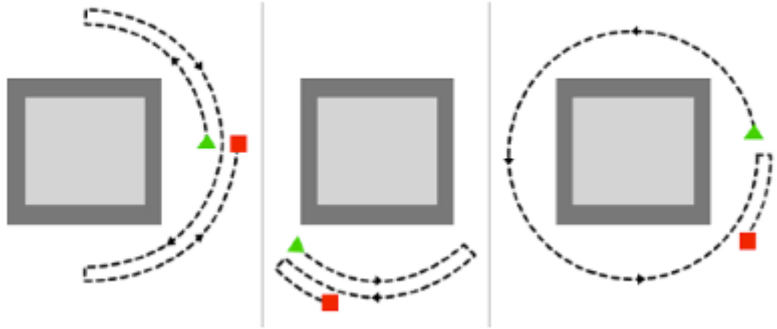
Source: M:Metrics, Inc., Copyright© 2008. Survey of U.S. mobile subscribers. Data based on three-month moving average for period ending 31st January 2008, n = 31,389.

http://www.mmetrics.com/press/PressRelease.aspx?article=20080318-iphonehype

Magnets as Input Devices

- “Abracadabra” (Harrison, Hudson)
  - Wireless, unpowered, high fidelity finger input for mobile devices
- Extending the input area beyond the device
- User study: 92% selection accuracy for 16º radial targets

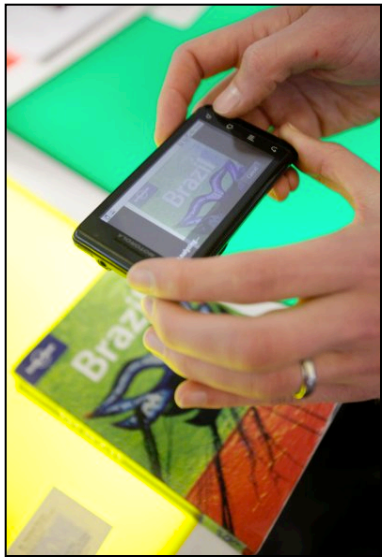




Harrison, Hudson: Abracadabra: Wireless, High-Precision, and Unpowered Finger Input for Very Small Mobile Devices. UIST 2009.

Visual Search: Camera Phones Recognize the World Around Us

- Example: Google Goggles for Android
  - Visual search queries for the Web
  - Recognizes a wide range of artifacts
  - Landmarks, barcodes, book covers, etc.
  - Text translation
- Future?
  - Plants, cars, faces?



Visual Code Widgets (2004)

- Printable user interface elements
  - Embedded in user's environment
  - Camera phone as "see-through tool"

Handheld Augmented Reality Games on Cereal Boxes: “Penalty Kick” (2005)

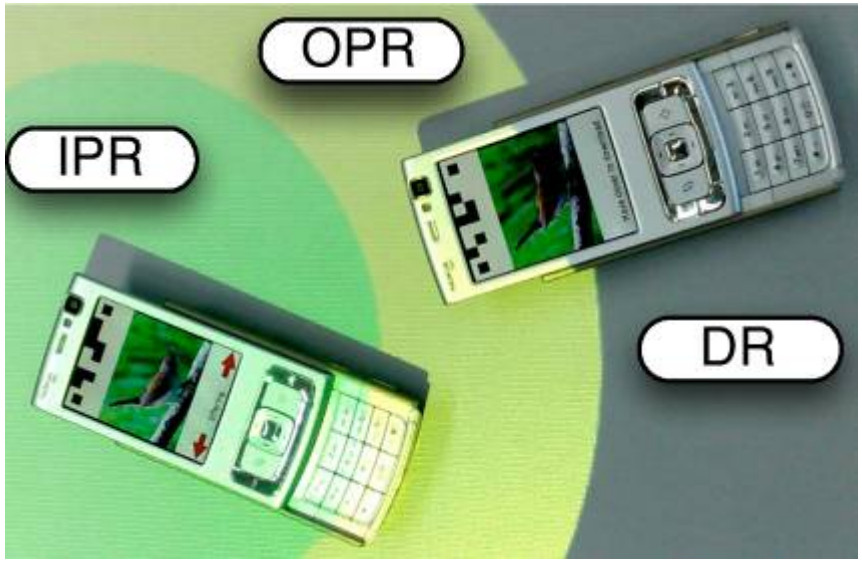
INFORMATION

Eye-Tracking Study

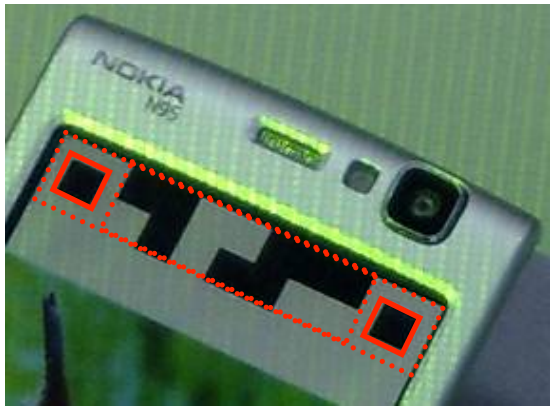
- Binocular head mounted Eyelink 2 system (SR Research)
  - 250 Hz sample rate
  - Recorded eye movements and video of subject's view
- Typical sequence for visual context
  - Checking price on display
  - Eyes move ahead to scan for next item
  - Hand movement follows

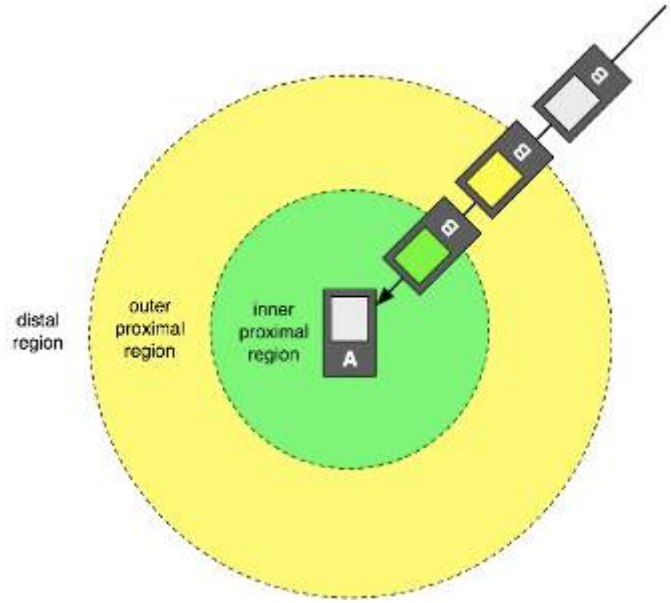
St . Mauritz

Mobile Devices and Interactive Tabletops



- Camera-projector system
  - Works with regular tables
  - Pubs, cafés, meeting rooms
- Map spatial configurations to application-specific semantics
  - Proximity regions around devices
- Dynamic marker



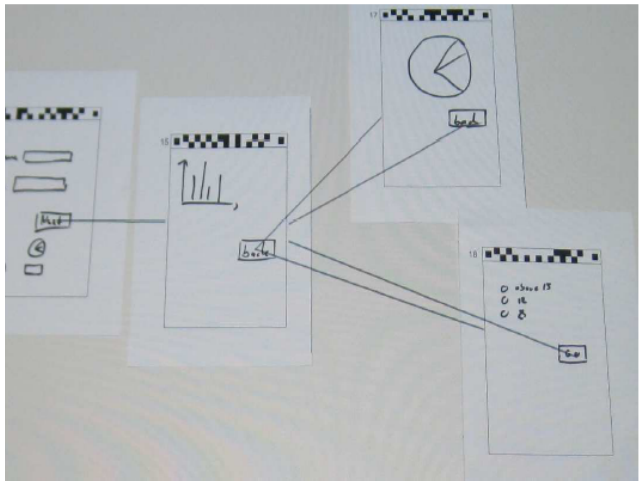


Kray, Rohs, Hook, Kratz: Bridging the Gap between the Kodak and the Flickr Generations: A Novel Interaction Technique for Collocated Photo Sharing. IJHCS 2009.

Linking Mobile Devices with Interactive Tabletops

Paper Prototyping on Interactive Tabletops

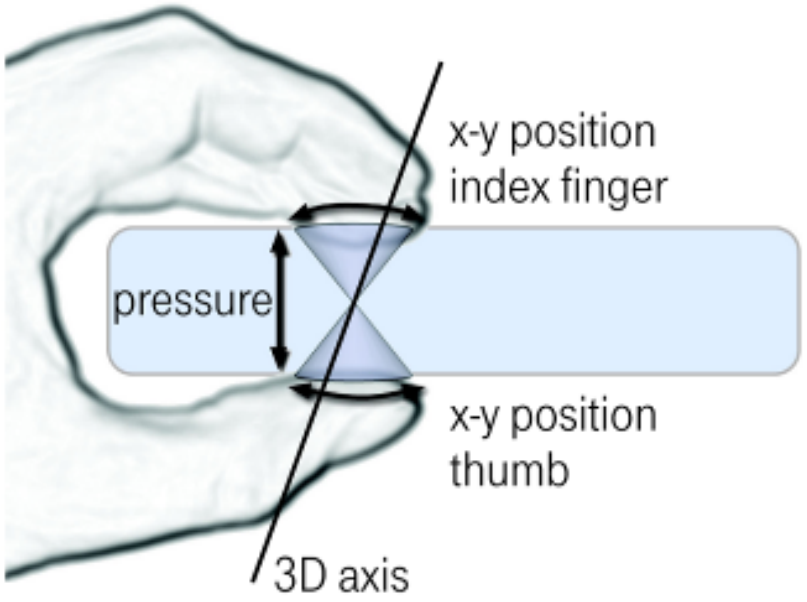
- Support early design process of mobile applications
- Sketch interface screens on paper
- Define dynamic interface behavior on the tabletop
- Generate runnable prototypes



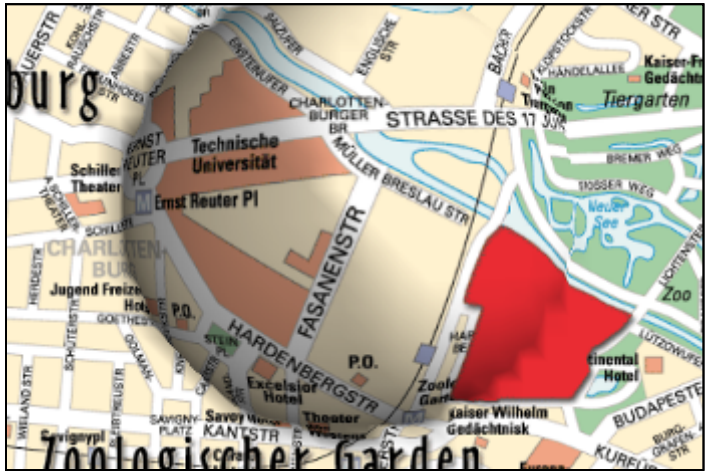
Bähr, Kratz, Rohs: A Tabletop System for supporting Paper Prototyping of Mobile Interfaces. Ubicomp Workshop PaperComp 2010.

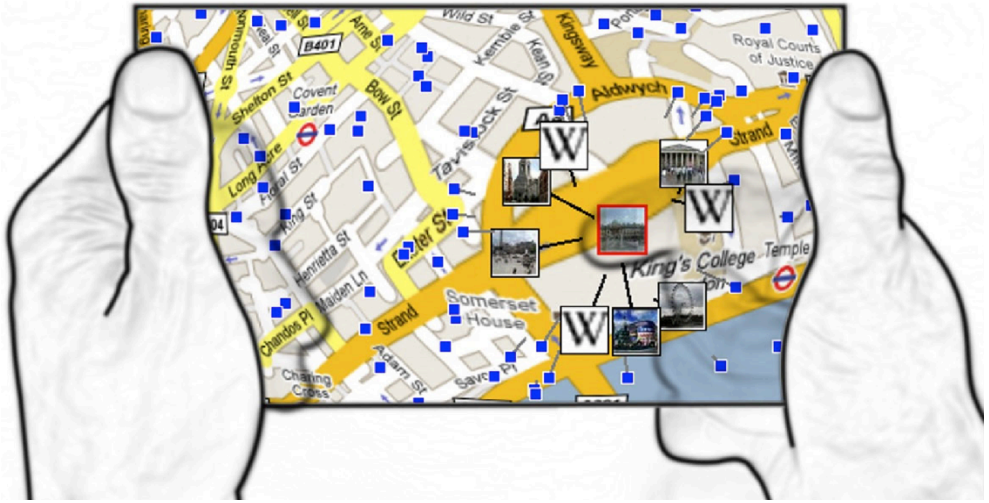
Pressure-Sensitive Two-Sided Multitouch Interaction

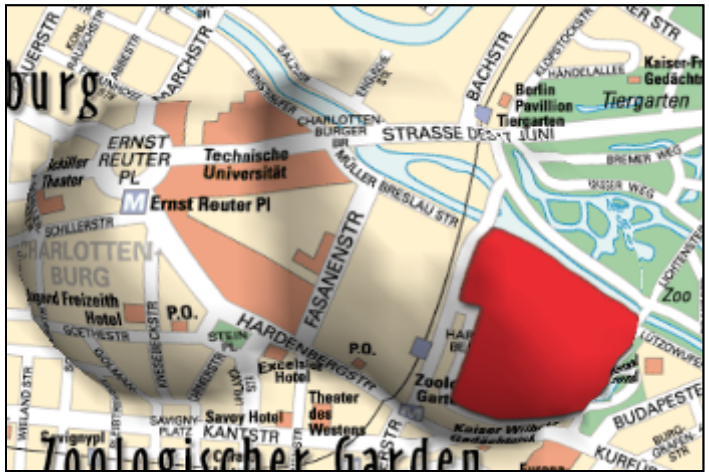
- Metaphor
  - Holding an object between thumb and index finger
- Common in everyday interactions
  - Grabbing, sliding, twisting, turning
- Local input with high expressivity
  - Precise pressure
  - Thumb - index finger positions

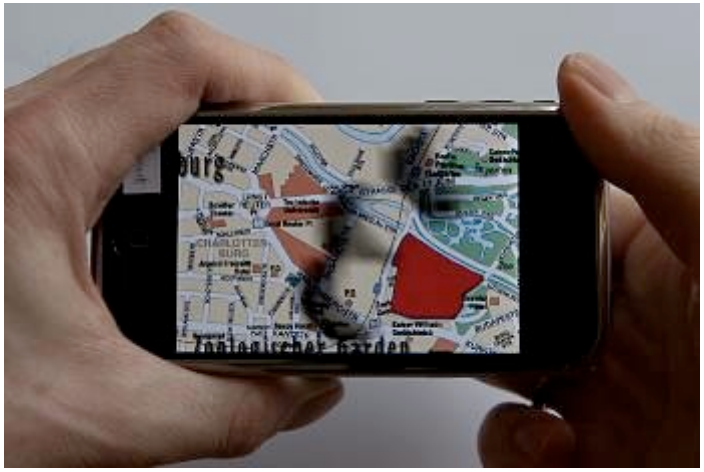


Pressure-Sensitive Map Zooming









Essl, Rohs, Kratz: Squeezing the Sandwich: A Mobile Pressure-Sensitive Two-Sided Multi-Touch Prototype. Demo at UIST 2009.

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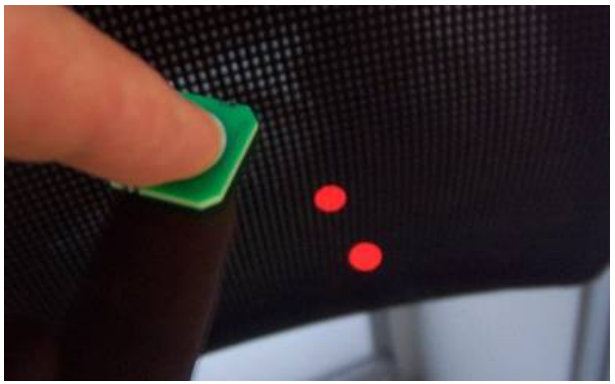
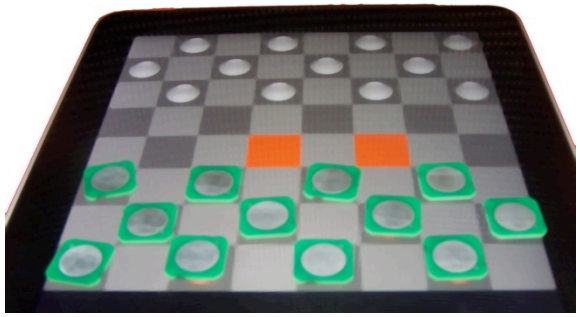
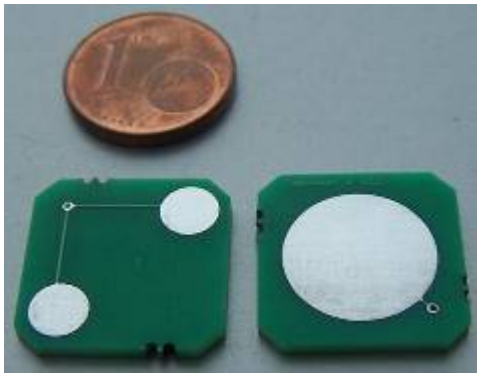
FASANENSTR
HARDENBERGSTR
P.O.
Zoo
BUDAPESTER STR

CapWidgets: Capacitive Markers for Multitouch Screens

- Make physical widgets usable on devices on a capacitive touch screen
  - iPad, Android tablets
- Enables
  - Board games using physical pieces
  - Physical dials and switches
- Research topics
  - Material & design of capacitive markers
  - Construction of active markers
  - Applications for capacitive widgets on mobile devices







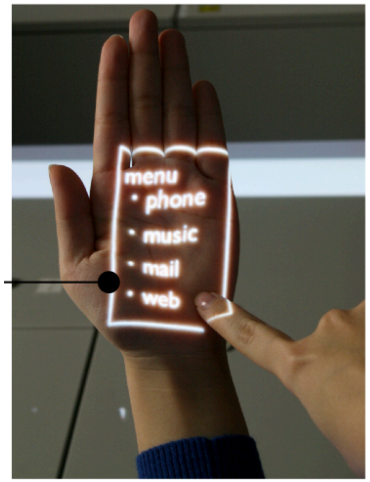
Kratz, Westermann, Rohs, Essl: CapWidgets: Tangible Widgets versus Multi-Touch Controls on Mobile Devices. Work in Progress, CHI 2011.

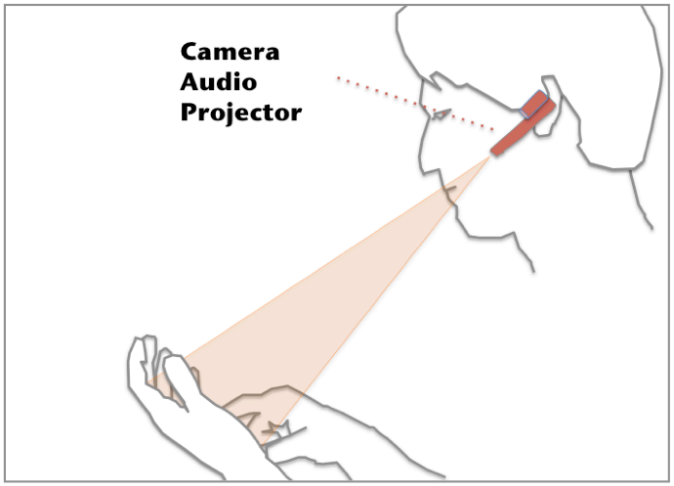
CapWidgets: Capacitive Markers for Multitouch Screens

Wearable Pico Projectors

- Advantages
  - Frees hands
  - Less jitter
- Examples
  - Sixth sense (Mistry)
  - Earphone (Rekimoto)
  - Helmet mounted
  - Glasses
- Adaptive projection
- Gesture recognition

Mistry, Maes, Chang. WUW – Wear Ur World: A wearable gestural interface. CHI EA 2009.

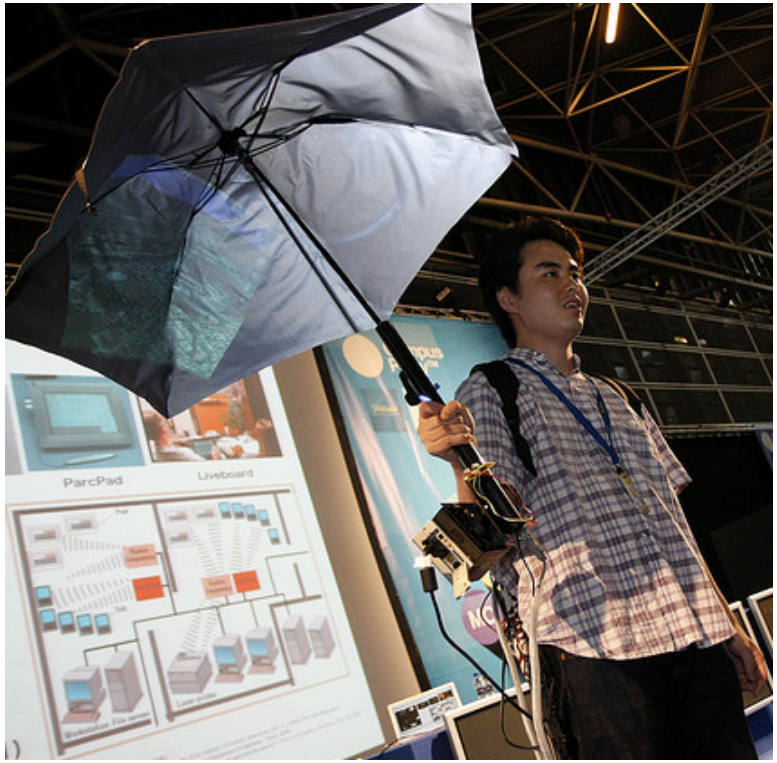




Tamaki, Miyaki, Rekimoto. BrainyHand: an ear-worn hand gesture interaction device. CHI EA 2009.

Handheld Pico Projectors

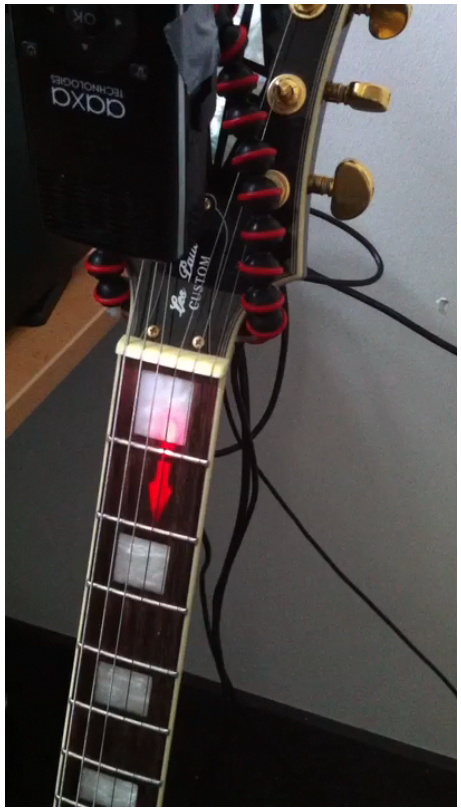
- Pileus – The Internet Umbrella
  - www.pileus.net
- Integrated projection space
- Object provides context



Hashimoto, et al.: Pileus: The Umbrella Photo Browser to Relay Experiences in Rainy Days. UbiComp 2006 Demo.

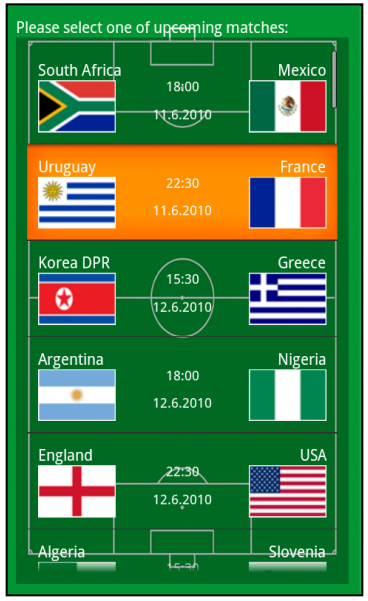
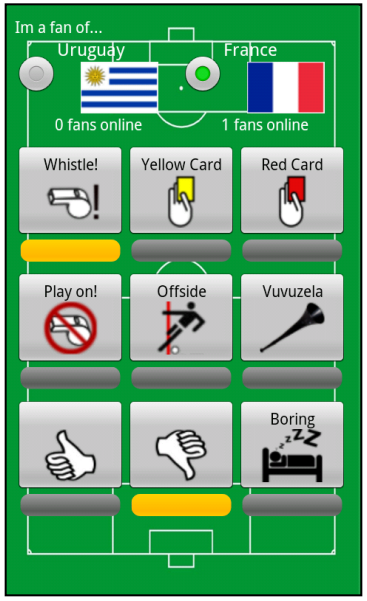
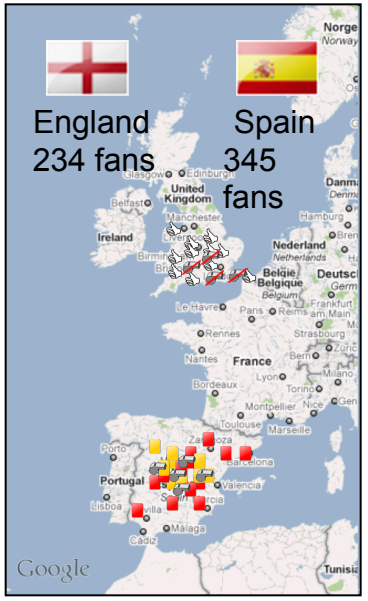
Pico Projectors Attached to Objects

- Ad-hoc attachable to physical objects
  - Musical instrument
  - Mechanical tool
  - Bicycle
  - etc.



Löchtefeld, et al.: GuitAR – Supporting Guitar Learning through Mobile Projection. CHI EA 2011.

World Cupinion Android App

Rate world cup soccer games while watching

- Interfaces with a large number of simultaneous users
  - Mobile social networking supporting the connectedness of peers in a large community
  - Designing for awareness of community opinion
  - Visualization of shared experiences
  - Mobile multimedia experience sharing
  - Cross-media applications (TV, mobile Internet)