

Mobile User-Interface Design: For Work, Home, and On the Way

Learning objectives

Participants will become familiar with the current state of mobile product/service development, including applications for phones/PDAs, vehicles, and music/consumer electronics; key technology, social, business, cultural, and UI issues, and learn specific techniques appropriate for designing and analyzing mobile products and services.

Concepts covered to assist professionals to design more effectively are these:

- User Analysis: Specification of user demographics and user-environment, user modeling, task analysis, and accounting for business objectives
- Metaphors: Easy recognition and memorability of fundamental concepts conveyed through words, signs, and images
- Mental models: Appropriate organization of data, functions, tasks, roles, and people
- Navigation of mental model: Efficient movement within the mental model via windows, menus, dialogue boxes, or control panels
- Appearance: Quality visual, acoustic, and touch characteristics
- Interaction: Effective input and output-feedback sequencing
- Information Visualization: Tables, charts, maps, and diagrams
- Basic visual design: Scale, proportion, rhythm, symmetry, and balance.

In this tutorial, participants will learn practical principles and techniques that are immediately useful. They will also have an opportunity to put them into practice through a series of pen-and-paper exercises.

Abstract

User interfaces (UIs) combining computation with communication functions, e.g., phone, video, the Web, and music are enabling mobile products/services to penetrate environments for work, play, and on the way. Consequently, developers must learn techniques to make mobile products/services easier to learn and use, more usable, useful, and appealing to an every wider, more diverse set of users. This tutorial summarizes key principles, techniques, and surveys issues and current products. Special attention is given to information design and visualization. Analyzing and designing mobile UIs from an information, visually-oriented design perspective can make product/services easier to produce, sell, learn, use, and maintain. Users will find it easier to find, sort, play, and pay.

Instructor

Aaron Marcus, President
Aaron Marcus and Associates, Inc. (AM+A)
1196 Euclid Avenue
Berkeley, CA 94708-1640, USA
Tel: +1-510-601-0994, Fax: +1-510-527-1994
Email: Aaron@AMandA.com

Main Contacts

Aaron Marcus, President
and Jane Ancheta, Executive Assistant
Aaron Marcus and Associates, Inc. (AM+A)
1196 Euclid Avenue
Berkeley, CA 94708-1640, USA
Tel: +1-510-601-0994, Fax: +1-510-527-1994
Emails: Aaron.Marcus@AMandA.com, Jane.Ancheta@AMandA.com

Duration

Full Day Tutorial

Lecture Contents

The following summarizes content for each lecture.

Introduction to instructor and tutorial (30 minutes)

This period will introduce the presenter and the tutorial schedule, procedures, and objectives.

Lecture 1: Mobile UI Design: Intro and Tour (120 minutes)

This lecture introduces key terminology and concepts regarding the user-interface development process (planning, research, analysis, design, implementation, evaluation, documentation, training, and maintenance) and user-interface components (metaphors, mental models, navigation, interaction, and appearance). We also introduce key issues for mobile user interfaces in terms of challenges of limited space, multimodal interaction, multiple contents, multiple use environments, and the wide range of user types. We tour current products (navigation, phone, PDA, specialized devices, wrist-top, etc.) and discuss how they are/are not providing adequate usability, usefulness, and appeal. We introduce branding, cross-cultural communication, and information-visualization challenges.

Lecture 2: 12 Myths of Mobile UI Design (60 minutes)

This lecture helps developers to understand key ideas of Mobile UI Design for phones/PDAs, but also for other devices. Developers share many illusions and delusions about mobile-device user-interface design. In the UI development world, there are many assumptions or myths floating around about the future of mobile devices. Myths are useful in summarizing inherited wisdom and guiding us to the future, but some become obsolete. As mobile devices continue to proliferate, UI and software developers must work together to make the most useful, useful, and appealing products and systems. Keeping in mind the difference between myths and misconceptions will help developers to design UIs that show the right things, in the right way, at the right time, to the right people. This lecture will pop a few conceptual balloons and put a few new twists on others. The lecture is based on Marcus, Aaron, "12 myths of Mobile UI Design," *Software Development Magazine*, May 2003.

Myth 01: Users want power and aesthetics. Features are everything.

Myth 02: What we really need is a Swiss army knife.

Myth 03: 3G is here!

Myth 04: Focus groups and other traditional market analysis tools are the best way to determine user needs.

Myth 05: If it works in Silicon Valley, it will work anywhere.

Myth 06: The killer app will be games, ...er, no, I mean, horoscopes, or...

Myth 07: Mobile devices will essentially be phones, organizers, or combinations, with maybe music/video added on.

Myth 08: The industry is converging on a UI standard.

Myth 09: Highly usable systems are just around the corner.

Myth 10: One underlying operating system will dominate.

Myth 11: Mobile devices will be free-or nearly free.

Myth 12: Advanced data-oriented services are just around the corner.

Lecture 3: Case Study of Phone/PDA UI (60 minutes)

This lecture presents a case study of advanced UI development for Samsung that sought to explore opportunities to combine phone and PDA functions. The lecture introduces fundamental elements of mobile UI development, including user data gathering, including contextual inquiry and “shadowing” (which is necessary for mobile users), user profiling (personas and models), use scenarios, task analysis, rapid prototyping, and usability evaluation, including consideration of usefulness, appeal, and culture criteria. The lecture will chronicle the development process and discuss the issues that arose in conducting research about business and culture models, emerging technology, and advanced UI techniques. We explain the six fundamental use spaces for all mobile products (identity, information resource access, commerce, entertainment, relationship building/maintenance with others, and self-enhancement. We show how we used information about a limited number of users to determine key characteristics of the functions, data, and UI. We shall look at an interactive prototype that shows the best 100 ideas produced from the study combined into one demonstration. This lecture is based on a case study that appeared in *Interactions* in 2002. Other examples also will be given from a variety of contexts, platforms, and user communities. Reference will be made briefly to development of a file sharing messaging application for the Web for Microsoft, development of mobile device advanced UI catalogue for Samsung, smart-car vehicle navigation system for Motorola, to vehicle information displays. All of these projects are ones on which AM+A has worked and has abundant case-study materials. We shall also briefly refer to a video-based ethnographic study of mobile phone users in four different countries.

Lecture 4: Vehicle UI Design and Culture Dimensions (60 minutes)

This lecture introduces fundamental human factors issues of the driver experience, and introduces the unique characteristics of vehicle UI design (emphasis on safety, cognitive overload, automotive industry considerations). We also survey innovative approaches to dashboard displays, navigation, and other enhanced functions that are transforming the vehicle user experience into a complete information, aesthetics, and entertainment environment. A brief recap of vehicle navigation issues will be provided. We shall introduce culture issues and the potential influence of emotion theory on vehicle UI experience design. We shall show innovative approaches to driver information visualization, including augmented reality and novel chart/diagram techniques. This lecture is based in part on an article AM+A published in *Information Visualization* journal in November 2002.

Lecture 5: Making Music Metadata Management Fun in Consumer Electronics (30 minutes)

This lecture introduces the issues of consumer electronics UI design issues, especially for the very hot issue of music players with music metadata management functions for phones, music players, PDAs, desktop synching, and vehicle systems. We compare several Web-based music players (iTunes, Rhapsody), discuss some possible improvements, and show information visualization techniques that can improve the user's experienced, making it more “fun” to find, sort, play, and pay.

Description of handout materials Participants will receive the following:

- About 50 pages of lecture slides handouts (three per page)
- About 50 pages of reprints, including an article by AM+A about a case study of Samsung phone/PDA prototypes published in *Interactions*, an article about vehicle UI design issues and novel display prototypes published in *Information Visualization* in November 2002, and portions of a new AM+A white paper about music player UIs and music metadata-management UI-design issues.
- An updated bibliography and URL collection for mobile/vehicle/music UI development will be sent to participants after the tutorial.

Speaker Bio

The following is background on the speaker:

Aaron Marcus, President

Mr. Marcus received a BA in Physics from Princeton University (1965) and a BFA and MFA in Graphic Design from Yale University Art School (1968). He is an internationally recognized authority on the design of user interfaces, interactive multimedia, and printing/publishing documents. Mr. Marcus has given tutorials at SIGGRAPH and SIGCHI conferences, and at seminars for businesses and academic institutions around the world. He co-authored *Human Factors and Typography for More Readable Programs* (1990), *The Cross-GUI Handbook* (1994), and authored *Graphic Design for Electronic Documents and User Interfaces* (1992), all published by Addison-Wesley. Mr. Marcus was the world's first professional graphic designer to be involved full-time in computer graphics (1967), to program a desktop publishing system (for the AT&T Picturephone, 1969-71), to design virtual realities (1971-73), and to establish an independent computer-based graphic design firm (1982). In 1992, he received the National Computer Graphics Association Industry Achievement Award for contributions to computer graphics.

Mr. Marcus is President and Principal Designer/Analyst of Aaron Marcus and Associates, Inc., a user-interface and information-visualization development firm with more than 22 years of experience in helping people make smarter decisions faster at work, at home, at play, and on the way. AM+A), has developed user-centered, task-oriented solutions for complex computer-based design and communication challenges for clients on all major platforms (client-server networks, the Web, mobile devices, information appliances, and vehicles), for most vertical markets, and for most user communities within companies and among their customers. AM+A has served corporate, government, education, and consumer-oriented clients to meet their needs for usable products and services with proven improvements in readability, comprehension, and appeal. Working with either client R+D or marketing groups, AM+A uses its well-established methodology to help them plan, research, analyze, design, implement, evaluate, train, and document metaphors, mental models, navigation, interaction and appearance. AM+A's clients include BankInter, BMW, DaimlerChrysler, The Getty Trust, HP, McKesson, Microsoft, Motorola, NCR, Nokia, Oracle, Peoplesoft, Sabre, Samsung, Tiscali, US Federal Reserve Bank, Visa, Wells Fargo Bank, and Xerox. AM+A helped design the first user interfaces for America Online, Sabre's Travelocity, and Microsoft's ThreeDegrees.com.

Attendee Background

Intended audience: researchers and developers of phone/PDA, vehicle, music/consumer electronics, and other mobile devices/appliances.

Level: introductory: emerging developments from research efforts that will enrich user-interface design in new directions. Note: participants may be

advanced user-interface designers, but many of the topics may be new to them, such as vehicle UI human factors issues, culture issues, or music metadata issues. Beginning user-interface designers will definitely benefit.

Justification for attendees

CHI/HCI/UPA researchers and developers acknowledge the importance of mobile UI design and user-experience design issues and have even called out this area for special attention in conference RFPs. The CHI/HCI/UPA community has embraced interest in mobile devices, the Internet, vehicle systems, and information appliances. Aaron Marcus has presented tutorials and panels on this subject since 1997 in Asia, Europe, and North America, including mobile UI design tutorials at CHI and HCII conferences. Product/service success will depend on developers' sensitivity to the concepts and issues addressed in this tutorial. There is a great deal of interest in Asian, European, and North American locations for UI developers in phone/PDA, vehicle, and music/entertainment systems. Consequently, there should be significant interest in attending a tutorial of this kind, which will be relevant to phone/PDA, vehicle, entertainment, and Internet-oriented UI development. At CHI 2004 in Vienna, this tutorial was the most well attended of all tutorials offered.

How tutorial will be conducted

Illustrated lectures introduce the terminology, concepts, issues, principles, development processes, techniques, and tours of current development critiqued against the criteria introduced earlier. Discussion during the lectures and at the end will allow for understanding usability, usefulness, and appeal issues in the context of user profiles, user scenarios, and fast prototyping.

Schedule of Events ns

The following is the schedule and time allocation, which can be adjusted to the needs of the event organizers.

Time	Topic
09:00	Tutorial begins
09:00-09:30	Introduction to Tutorial, Background of Speaker
09:30-10:30	Lecture 1: Mobile UI Design: Intro and Tour
10:30-11:00	Break
11:00 12:00	Lecture 1: (Continued)
12:00-13:30	Lunch
13:30-14:30	Lecture 2: 12 Myths of Mobile UI Design and Discussion
14:30-15:30	Lecture 3: Case Study of Phone/PDA UI design
15:30-16:00	Break
16:00-17:00	Lecture 4: Vehicle UI Design and Culture Dimensions
17:00-17:30	Lecture 5: Making Music Metadata Management Fun in Consumer Electronics
17:30 pm	Tutorial ends

Modifications

Changes of Materials from Previous Conferences are the following: This tutorial will use updated materials, including hundreds of new images, but will be based on AM+A's time-tested mobile UI design tutorials lectures given worldwide since 1999, including a mobile UI tutorial given at Mobile and Phone Mobile Navigation/Tokyo 2000, Wireless Systems Design/San Jose 2003, CHI 2003 panels, and a CHI 2004 tutorial. The tutorial will incorporate updated lecture materials about vehicle UI design, wrist-top devices, and some aspects of culture given at several conferences worldwide in 2002-4 and a new lecture about music metadata management oriented media/entertainment systems, one of the hottest areas of development for the Internet, phone/PDAs, and vehicle entertainment systems.

Sample Materials

The following pages show sample screens. Upon request, more sample screens are available, including complete PDF handout sections. Please contact Mr. Aaron Marcus at Aaron.Marcus@AMandA.com or Ms. Jane Ancheta at Jane.Ancheta@AMandA.com.

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Myth 5: If it works in Silicon Valley, it will work anywhere, 2/2

- Language localization necessary, not sufficient
- Chinese PDA prototype uses new fundamental metaphors: People, relationships, and knowledge (*i.e.*, best-practice action-plans coupled to wisdom of traditional experience), not documents, applications, and folders
 - Source: WuKong, research prototype PDA/phone developed by Sony Ericsson, www.PointForward.com
- Culture/national characteristics affect service patterns, *e.g.*, customer attitudes to security
 - Example: Japan providers bill per packet, US, per unit of time

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What's Desirable: Advanced User Interfaces

Input/Output Problem

- Speech Recognition/Synthesis
- Multi-Modal Interfaces

Space-Saving Techniques

- Superimposition and Transparency
- Transient Interface Elements
- Zooming and Animation

Adaptive Interface

- Context Awareness
- Affective Computing
- Deep Personalization
- Time-shifting (asynchronous email made time shifting a killer app)

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Evolution of Networks, Devices and Services

Network	Device	Application Services
1G Cellular (analog)	Cellular Phones	Telephone only
2G (current) Digital narrowband (circuit-switched)	Phones PDAs Pagers	Digital phone service Text-based Web access (WAP) SMS
(2.5G) Digital midband (packet-switched)	Smartphones PDAs	More graphical web access
3G (target) Digital BROADBAND	Smartphones PDAs Portable entertainment units HPCs ???	Multimedia streaming ITS/GPS/LBS M-Commerce/ IC Bluetooth interoperability Global roaming

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Promising User Group: Teenagers

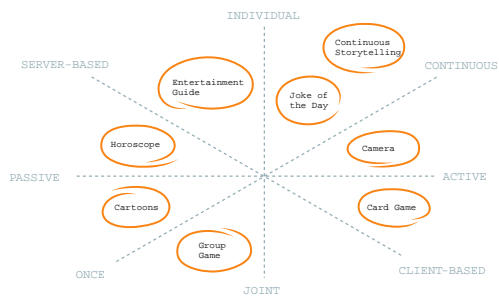
- Teenagers are dominant consumers in Asia/Europe
- Small, cheap and customizable
 - Custom faceplates, screensaver, ring tones to distinguish their own from everyone else's
 - SMS (Short Message Service), predictable text input to be always with their friends
- E.g. Cybiko
 - Beam notes, e-mails, PDA, game and MP3 player



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Usage Space: Entertainment Diagram



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Contextual Observation Plan

- Create matrix of possible user attributes
- Recruit users matching desired profile
 - Recruited teenager, college student, minister, woman entrepreneur, etc.
- Create observation protocol
- Run observations and self-log
- Return for group interpretation

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Usage Space Diagram: You are Here

The diagram consists of five overlapping circles arranged in a circle. The top-left circle is yellow and labeled 'Self-Enhancement'. The top-right circle is pink and labeled 'Relationships'. The bottom-left circle is blue and labeled 'Information'. The bottom-right circle is orange and labeled 'Identity'. The bottom-center circle is green and labeled 'Commerce'. Each circle contains several small icons representing various user activities related to that category.

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Findings

- Design for safety
- Avoid cognitive and sensory overload
- Reduce complexity
- Use graphical UI interface only when necessary
- Allow customization of information
- Use of physical controls
- Follow driver-centered design process

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2003: Layout Chaos: Japan, Europe

ward Phones Put Form O

The image shows a variety of mobile phones from 2003, including flip phones and candy-bar phones. Some phones have very small screens and many physical buttons, while others have larger screens and fewer buttons. The phones are arranged in a grid, and some have text labels next to them, such as 'Nokia 2110' and 'Nokia 2110i'.

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What about Emotions in Vehicle UI Design?

- Biological emotions (arousal, reward-punishment, fear/anger, love/longing): based upon specific neurochemical systems
- Social emotions (pride, guilt, etc.): Based biologically upon attachment
- Cognitive emotions (interest, boredom, curiosity): Based biologically upon expectancy
- Moral emotions: based upon a combination of social attachment and expectancy

[Typological Emotions, Ross Buck, U of CT, 2000, http://web.bu.edu/users/ad/buck/BUCK000-0001001.html]

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New Freedom, New Demands: AM+A Info Viz Prototypes, 1/3

The image shows a steering wheel with a small screen in the center. To the right of the steering wheel are two panels of information displays. The top panel has a vertical list of colored bars (red, green, yellow) and icons. The bottom panel has a horizontal bar chart and a digital clock showing '13:37'.

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DaimlerChrysler: Dashboard Displays of Braking+ Maintenance

The image shows a dashboard with several gauges and a central display. The central display shows a warning icon (a triangle with an exclamation mark) and the text 'BRAKE' and 'MAINTENANCE'. The gauges include a speedometer, a tachometer, and a fuel gauge.

- Automatic emergency brake system protector gives acoustic/visual warning of impending collision; stops vehicle automatically if driver fails to

[DaimlerChrysler: The Fascination of Research 1999]

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