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CHI 2004 Tutorial Proposal:

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

Instructor

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Duration

Full Day Tutorial

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.

Experience Intelligent Design

User Interfaces
Information Visualization

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.

Lecture Contents

The following summarizes content for each lecture.

Introduction to instructor and tutorial (15 minutes)

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

Lecture 1: Mobile UI Design: Intro and Tour (45 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: UI Development Process and Principles (45 minutes)

This lecture discusses in detail the user-centered UI development process, UI design components, how to interview users, develop user models, write scenarios, perform task analysis, and design user-centered prototypes. We also distinguish between Web application and Website design and discuss the ROI of usability showing possible savings. We explain basic human factors principles related to universal behavior and basic UI design guidelines related to consistency, user control, feedback, forgiveness, perceived stability, aesthetic integrity, and modelessness. We discuss basic usability principles leading to simplicity, consistency, and clarity. We give specific details and discuss issues related to each principle, e.g., how mobile devices may need/need not to carry over paradigms from desktop experience, and how to achieve progressive disclosure appropriately.

Lecture 3: Usability in UI Development Process (30 minutes)

This lecture describes how to maximize usability using usability planning and analysis techniques, prototyping, and gaining user feedback. We describe the user feedback process, how to include users in the design process, the use of online surveys, focus groups, contextual observation, needs analysis interviews, heuristic evaluations, the use of paper prototypes, html schematics, and more detailed visual prototypes. We emphasize solving information-design and interaction-model issues before spending the time on detailed visuals. We show how to apply usability considerations to a specific intranet access project detailing all of the steps involved.

Lecture 4: 12 Myths of Mobile UI Design (30 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 5: Case Study of Phone/PDA UI (30 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 6: Vehicle UI Design and Culture Dimensions (30 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 7 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 experience, making it more "fun" to find, sort, play, and pay.

Exercises

The exercises will reinforce participants' understanding of philosophy, principles, and practice by analyzing and designing solutions for mobile devices. The overall objective is to design a restaurant finder for a mobile device. The application allows users to locate restaurants in cities by searching a database on a mobile device. Users will be able to perform tasks such as "Find a restaurant in the theatre district that serves Indian food in the under-\$20 range." The marketing team for Restaurant Finder

has generated a list of high-level requirements. They have also proposed initial designs for screens, which will be supplied, but teams are free to improve this initial analysis and design through user modeling, needs analysis, task analysis, and screen redesign. Teams will consider additions, subtractions, or changes to the supplied functional and information requirements.

Exercise 1 (45 minutes)

Exercise 1 will involve user modeling and needs analysis. Each team will brainstorm then develop 5-7 user types, then carry out structured interviews. Some of the team will play users, others interviewers. Teams will present results briefly in bulleted presentations.

Exercise 2: Task Analysis and Design (45 minutes)

The teams will write scenarios for primary user types, writing down all the possible tasks, then prioritizing them into easy, moderate, and difficult, based on importance and frequency of use. Teams will consider what metaphors, mental models, navigation, and interaction emerge from the previous exercise. Teams will present results briefly.

Exercise 3: Screen Design (45 minutes)

Starting with easy tasks, teams will chunk noun-information groups and verb-action groups on sticky notes, organize them onto sheets of paper representing screens, then draw screen layouts with detailed information and widgets for each main screen. Teams will consider use of space, ways to handle long lists, best use of icons, headers, and specific labels and behaviors of soft keys and navigation keys. Teams will present results briefly.

Closing discussion (15 minutes)

The presenter will solicit feedback and questions from the participants.

Description of handout materials Participants will receive the following:

- About 50 pages of lecture slides handouts (three per page)
- About 20 pages of notes for the three exercises
- 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.

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 CHI audience

CHI 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 the CHI 2004 Call for Proposals. The CHI community has embraced interest in mobile devices, the Internet, vehicle systems, and information appliances. Aaron Marcus presented a panel about vehicle UI design for the first time ever at CHI in 2003, which was well attended and has presented mobile UI panels and SIG sessions at CHI since 1999. 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 the European community of 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. CHI 2004 attendees from Europe are likely to be especially interested in this tutorial, but it should also attract Asian and North American attendees.

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. Group exercises with paper and pen provide direct experience in understanding usability, usefulness, and appeal issues in the context of user profiles, user scenarios, and fast prototypes. Participants work in teams of 5-8 people during most of the exercises.

Schedule of Events and Time Allocations

Morning Session

Time	Topic
9:00-9:15	Intro to Tutorial and Speaker
9:15-10:00	Lecture 1: Mobile UI Design: Intro and Tour
10:00-10:15	Lecture 2: UI Development Process and Principles
10:15-10:30	Break
10:30-11:00	Lecture 2: UI Process and Principles, continued
11:30-12:00	Lecture 3: Usability in UI Development Process
11:00-11:30	Lecture 4: 12 Myths of Mobile UI Design
12:00-1:30	Lunch

Afternoon Session

Time	Topic
1:30-2:00	Lecture 5: Case Study of Phone/PDA UI Development
2:00-2:30	Lecture 6: Vehicle UI Design and Culture Dimensions
2:30-3:00	Lecture 7: Making Music Metadata Management Fun in Consumer Electronics

3:00-3:15	Break
3:15-3:45	Exercise: Part 1
3:45-4:15	Exercise: Part 2
4:15-4:45	Exercise: Part 3
4:45-4:00	Closing discussion

Modification of Materials from Previous Conferences

This tutorial will use updated materials based on AM+A's specific mobile UI design tutorials and lectures given worldwide since 1999, including a mobile UI tutorial given at Mobile and Phone Mobile Navigation/Tokyo 2000 and at Wireless Systems Design/San Jose 2003, and lectures at the CHI 2003 panels on vehicle UI design and on emotion. The tutorial will incorporate updated keynote lectures about vehicle UI design and culture given at several conferences worldwide in 2002-3 and a new lecture about music metadata management oriented to 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 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 (analog)	Cellular Cellular Phones	Telephone only
2G (current) (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 H/PCs ???	Multimedia streaming ITS/GPS/LBS M-Commerce/ IC Bluetooth interoperability Global roaming

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Promising User Group: Teenagers

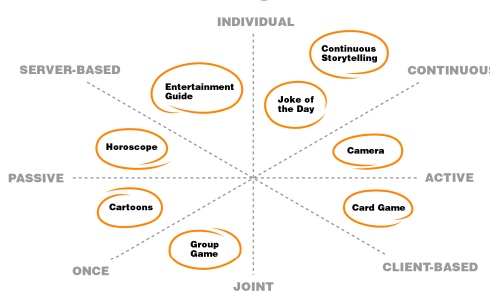
- Teenagers are dominant consumers in Asia/Europe
- Small, cheap and customizable
 - Custom faceplates, screensaver, ring tones to distinguish their own from everyone else's
 - SMS (Short Message Service), predictable text input to be always with their friends
- E.g.* Cybiko
 - Beam notes, e-mails, PDA,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

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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

Mosberg Review/Wall Street Journal, 12 February 2003, p. D4

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What about Emotions in Vehicle UI Design?

- Biological emotions (arousal, reward-punishment, fear/anger, love/bonding): 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

[Typology of Emotions, Ross Buck, U of CT, 2002, <http://wattlab.coms.uconn.edu/ftp/users/buck/UConn9-00/sld001.htm>]

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

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DaimlerChrysler: Dashboard Displays of Braking+ Maintenance

- 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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