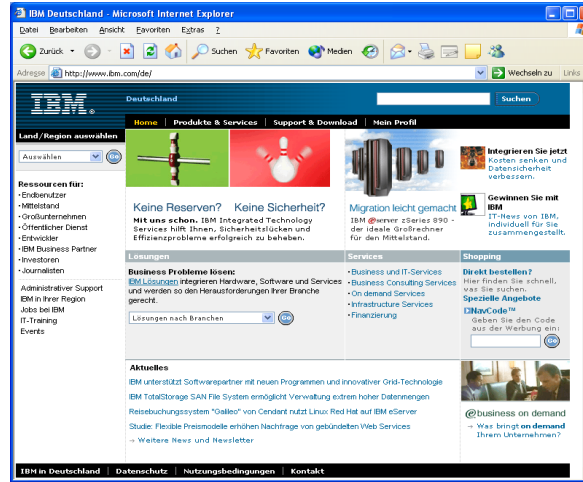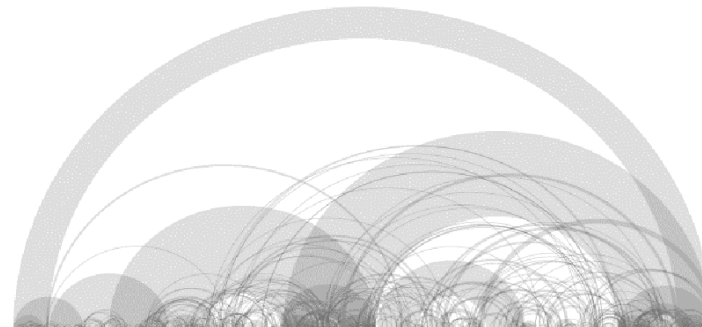# Structure

- Chapter 1:
  HCI and the WWW

- Chapter 2:
  Mobile and Ubiquitous User Interfaces

- Chapter 3:
  Information Visualization

1   Mobile and Ubiquitous User Interfaces

Literature:

• Scott Weiss: Handheld Usability, Wiley 2002

• Ch. Lindholm/ T. Keinonen/ H. Kiljander: Mobile Usability, McGraw-Hill 2003

• Nokia Series 60 Usability Guidelines, http://forum.nokia.com

Application Types for Mobile Devices

- Supporting functions for telephony
  - Phone book, texting, service setup
- Personal information storage
  - Contacts, calendar, notes, …
- Multimedia players
- Generic information services
  - Internet access, WAP, i-mode, …
- Enterprise applications
  - E-Commerce
  - Supporting mobile workforce
- Games
  - Stand-alone/networked, virtual/physical
- Utilities and productivity applications
  - Calculator, alarm clock etc.
  - Data transfer, synchronisation

WAP (Wireless Application Protocol)

- Set of protocols and languages to support Internet access on devices with limited computing & display abilities and low access speed
  - Versions 1.x and 2.0
  - WAP Forum now consolidated into Open Mobile Alliance (OMA)
    - » http://www.openmobilealliance.org/tech/affiliates/wap/wapindex.html
- Communication Client - WAP gateway in compiled (compressed) format
  - Over various carrier technologies, e.g. GPRS or HSDPA
- Wireless Markup Language (WML)
  - XML-based page description language
  - Reduced version of XHTML
  - Card deck metaphor: site = deck, page = card

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="no1" title="Card 1">
<p>Hello World!</p>
</card>
</wml>
```

```
------ Card 1 ------

Hello World!
```
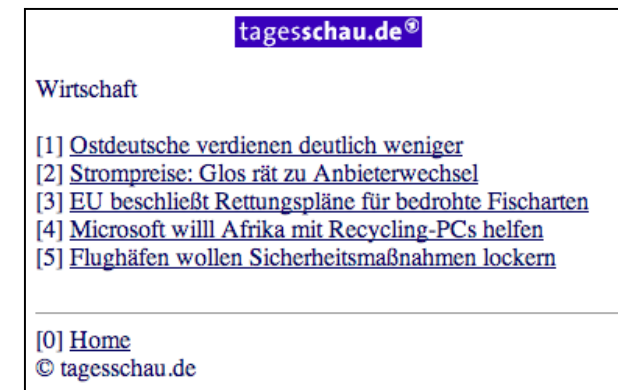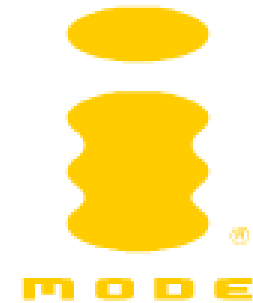
CHTML (Compact HTML)

- Reduced version of HTML targeted at mobile devices
  - Defined in W3C Note (1998)
- Not based on XML, but HTML-like syntax
  - Compatibility with HTML Web sites
- Does not support e.g.:
  - JPEG files, tables, frames, image maps, multiple fonts, style sheets
  - But supports GIF
- Easily operated by four buttons:
  - Cursor forward, cursor backward, select, back/stop
- Current trend:
  - Modern mobile browsers tend to render large part of HTML

i-mode

- Portal service for mobile phones
  - Pages defined in CHTML (more precisely, iHTML)
  - Colour graphics, video, sound: Standard formats
  - Requires specific i-mode compatible handset
  - Packet-switched data transfer, "always on"
- Developed by NTT DoCoMo, Japan (1999)
  - Most successful mobile data service worldwide
    - » 2006: 47 million users in Japan
  - Offered also in other countries (Germany: e-Plus), being phased out due to lack of customers

Typical Design Cycle

audience definition

focus groups

design

information architecture & graphics

prototype

test for usability

spec

implementation

delivery
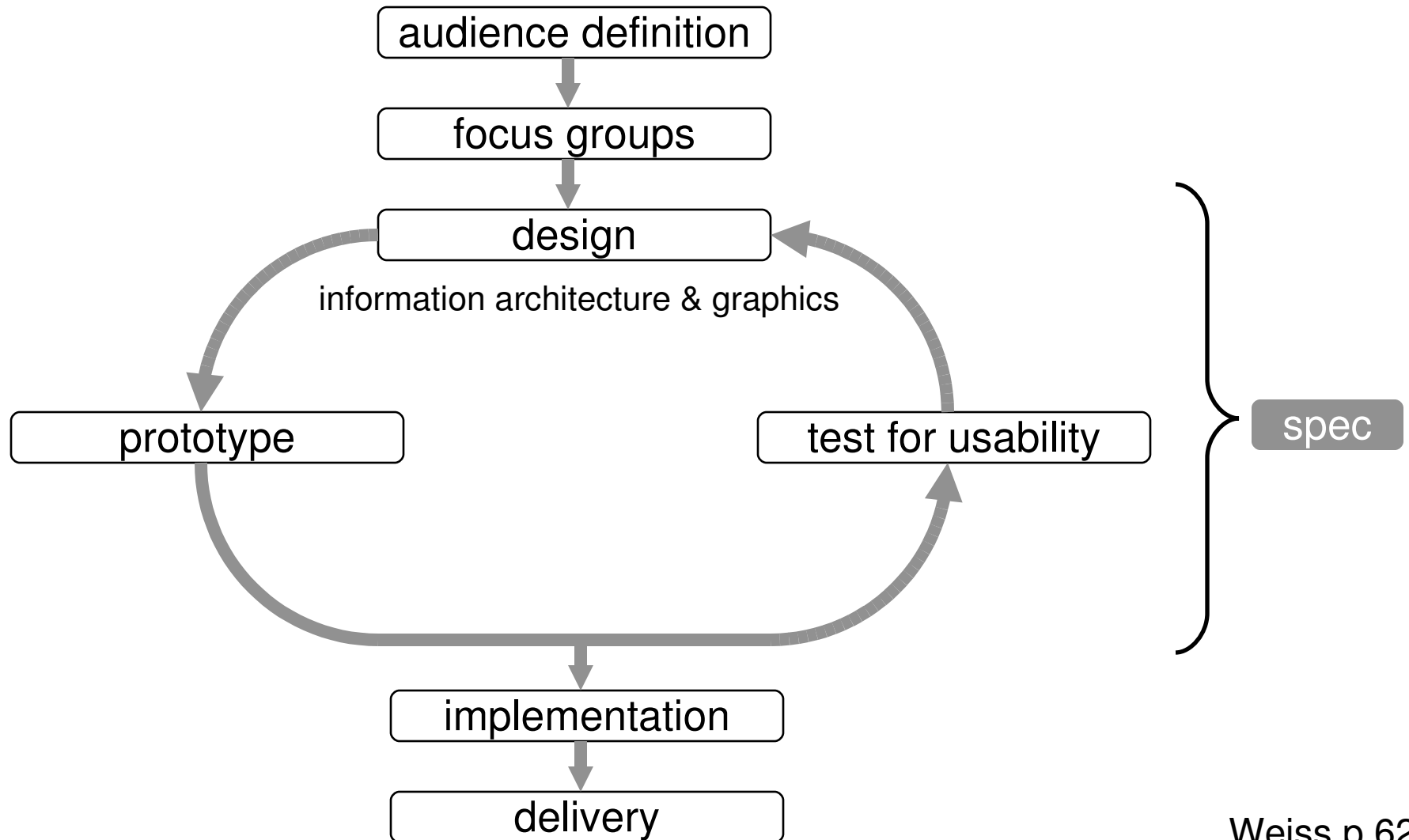
Weiss p 62

Audience Descriptions (1)

- Audiences are described descriptively and by ranges of traits
- *Early adopter*
  - Might acquire technology for the sake of trying something new
- *Novice and savvy*
  - Novice: either little time of usage or low level of proficiency
  - Border novice/savvy may change with version updates
- *Internet savvy*
  - Time spent on the Web, ability to define specific terms
- *Teenager or senior*
- *Phone, PDA, and/or pager savvy*
- *Everyday consumer*
  - Amount spent online/in shops, # of catalogs browsed, income, …
- *Physically challenged*

Weiss p 72 ff

Audience Descriptions (2)

- *Complex application user*
    - E.g. experience from home banking, spreadsheet usage
- *Online transaction user*
    - E.g. number of items purchased online per month
- *Credit user*
- *Enthusiast*
    - ...of anything
- *Commuter*
    - Transport means, distance, frequency, number of travellers, …
- *High-income and high net worth*
    - "Einkommen" und "Vermögen"
- *Geo-specific*
    - Specific location
    - Multi-unit house vs. single-family home, …

Weiss p 72 ff

Indian Needs

- Katja Konkka, in: Lindholm et al.
  - Exploring the needs of Indian mobile phone users on the spot
  - Functional needs and emotional needs
- Cultural background
  - Example: Orange = Hinduism, Green = Islam
  - Example: Swastika symbol ("all the good") is similar to "Hakenkreuz"
- Specific context conditions
  - Noise: Traffic, chatter, car horns, …
  - Temperature, moisture
  - Use of a touch screen after eating with one's hands?
- Economic context conditions
  - Mobile phone as a long-term investment
  - Culture of sharing
- Specific usage patterns
  - Example: Guessing the caller vs. Calling-Line Identification
  - Addresses replaced by landmarks and directions

Example: Mobile Enterprise Application

- Supporting field service
  - Access customer and inventory databases
  - Access documentation and specifications
  - Order spare parts
- Record customer data on-site
  - Including signatures
- Alert and dispatch of technicians in the field
- Typical platform: Smartphone

extendedsystems.com

Example: Mobile Game (Stand-alone, Virtual)

- One user

- Interaction only by local screen and keyboard

- Fully virtual setting
  - No relationship to surrounding real world
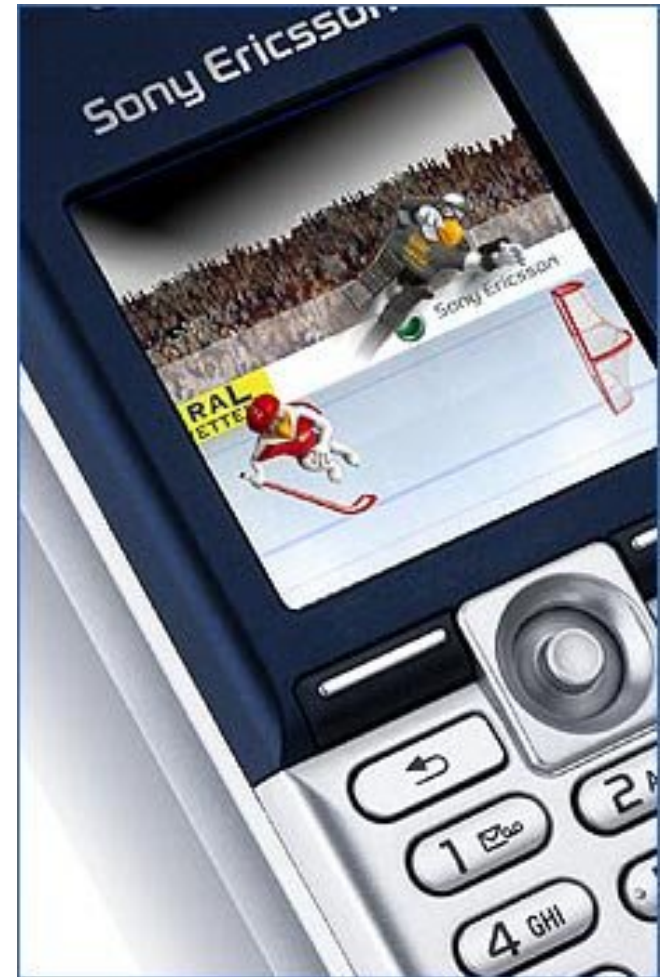
icemania.org

Example: Mobile Game (Stand-alone or two parties, Physical)

- Table tennis game "SymBall"

- Mobile phone as input device
  - Camera used for movement detection

- Mika Hakkarainen, Charles Woodward, VTT, Finland

game view

pattern recognition   racket control

Figure 1. SymBall game concept.

Example: Mobile Game (Networked, Virtual)

http://www.3g.co.uk

ASIA Hong Kong : Artificial Life announced the release of its first massive multi-user 3G mobile game called "Virtual Penguins."

The new game is based on the life and fate of the popular Emperor Penguins. The game simulates the difficult live cycles these penguins endure on the Antarctic ice and establishes a massive multi-user mobile virtual community. It is custom built for 3G phones. However, a single player version will also be released. The game is offered in high resolution 3D animation technology.

Players of the game take on the role of individual penguins. They have to go through several cycles of breeding and feeding their offspring. Players first have to find a mate (a second player) and then jointly the two players need to care for the egg that the female penguin will lay …

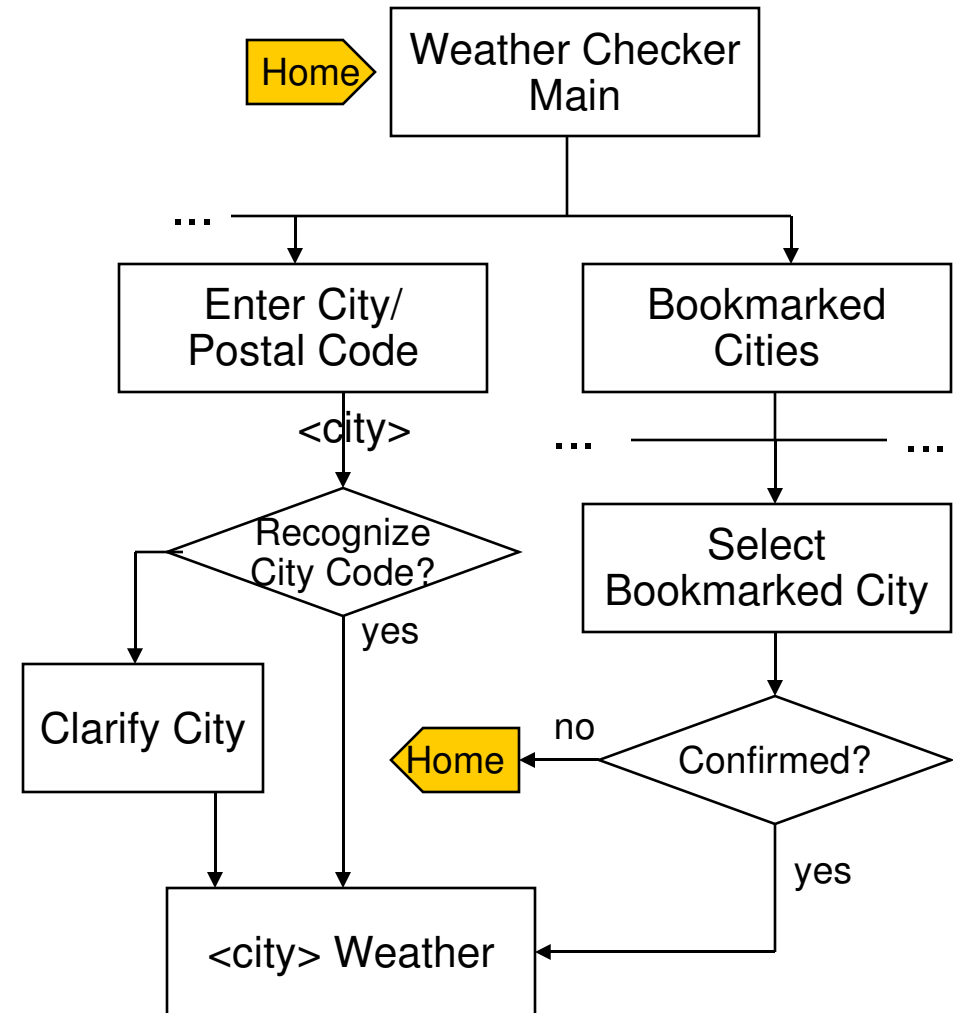# Example: Mobile Game (Networked, Physical)

- Backseat Gaming
  http://www-alt.medien.ifi.lmu.de/
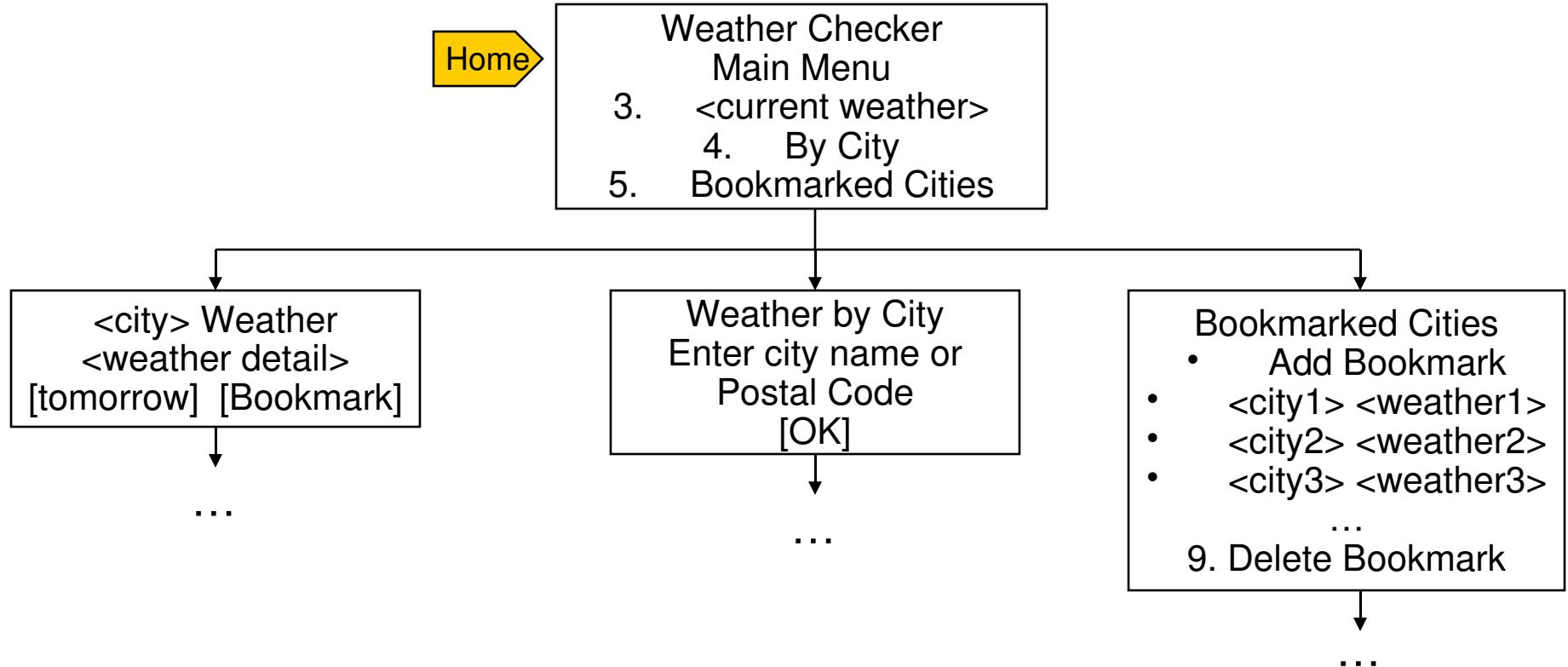 en/events/pi03/papers/brunnberg.pdf
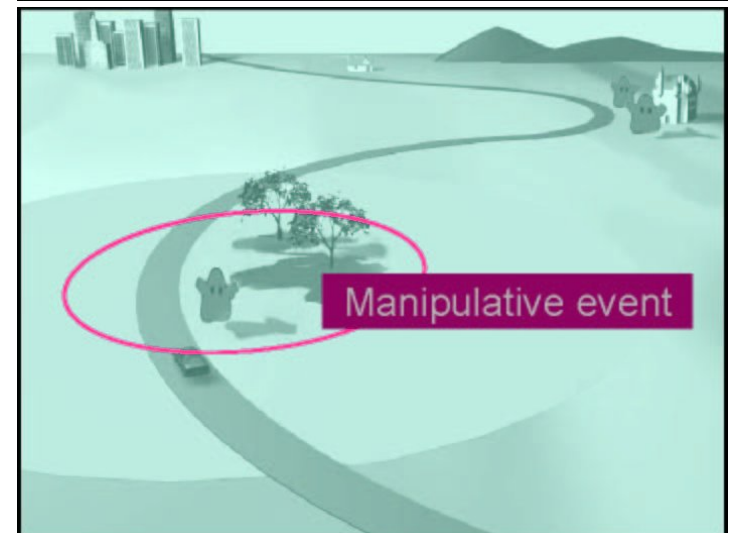
Application (Interface) Design (1)

- Starting point:
  - Usage scenarios using concrete *personae*
  - Important questions at this level:
    - » Why will it be used? How is the cost reimbursed?

- If more precise documentation is required:
  - From scenarios to sequence charts, flow charts, or activity diagrams

- Abstraction into application map
  - Shows key dialogs and navigation structure
  - Check against scenarios

Home → Weather Checker Main

...

Enter City/ Postal Code

Bookmarked Cities

<city>

Recognize City Code?

... ...

Select Bookmarked City

yes

Clarify City

Home ← no ← Confirmed?

yes

<city> Weather

Application (Interface) Design (2)

- From application map to page map
  - Shows menus and data entries
- Note: With more complex interface technology, simple design aids like application/page maps may be replaced by more advanced tools.

```
[Home]      Weather Checker
            Main Menu
         3.   <current weather>
            4.    By City
         5.   Bookmarked Cities
```

```
<city> Weather        Weather by City       Bookmarked Cities
<weather detail>      Enter city name or     •    Add Bookmark
[tomorrow]  [Bookmark] Postal Code          •   <city1> <weather1>
                        [OK]                 •   <city2> <weather2>
                                             •   <city3> <weather3>
    …                                                 …
                          …                  9. Delete Bookmark

                                                      …
```

Application (Interface) Design (3)

- Paper prototyping
  - Based on scenarios or more detailed maps
  - Using "blinders" (template resembling shape of device)
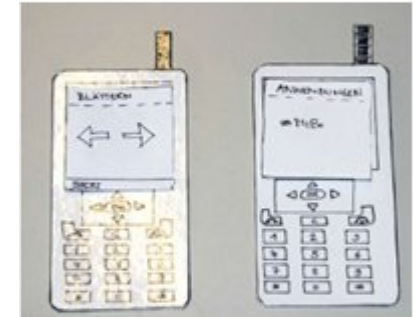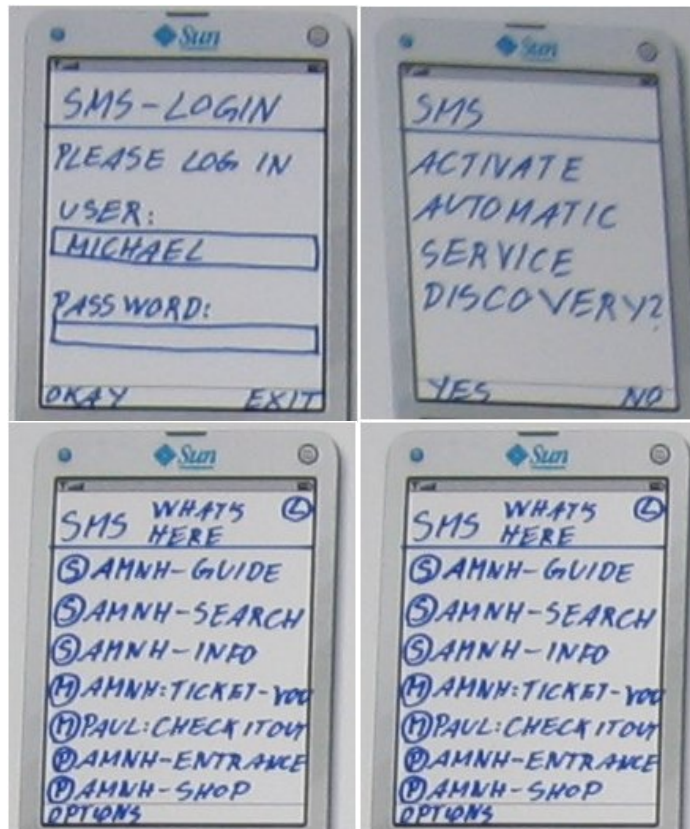
User Interface Elements for Mobile Devices (1)

- Icons
  - No fixed standard for size, color depth or style on handheld devices
  - Keep icons small but recognizable
  - Avoid three-dimensional icons
  - Nouns are easier to iconify than verbs. Sentences should not be iconified.
  - Icons should be intuitive *or* memorable, or both.
  - Do not use text in icons.

- Audicons
  - Sound equivalent of icons
  - Effective if brief, distinctive, non-intrusive
  - Problematic with handheld devices in noisy environments

User Interface Elements for Mobile Devices (2)

- Menus
  - Sets of commands hidden behind a button bar or tap-and-hold element
  - Menus usually affect all the application or portal
  - Menus are often invoked by special hardware key

- Popup menus
  - Appear in place over a call to action
  - Convention: vertical triangle

- Text entry fields

- Check boxes

- Radio buttons

- Push buttons
  - Provide audio or visual feedback on press (and on state)
  - Name after action to be performed (not just "OK")
  - Place along bottom to avoid obscuring contents

User Interface Elements for Mobile Devices (3)

- Progress indicators
  - Use a progress indicator for every operation that will last more than two seconds
  - Use a single process indicator, not a series of indicators
  - Indicate current action (as text)
  - If possible, provide "Cancel" or "Stop" option
  - If possible, show estimate for remaining time to completion
- Dialog boxes, forms, wizards
  - On PDAs and advanced mobile phones
- Clipboard model (cut, copy, paste)
  - Existent on PDAs and pagers
  - Not always available on mobile phones

The "Navi-Roller" Story

- Multi-function navigation roller
  - Scrolling up and down
  - Clicking on the roller
  - Used in Nokia 7110, 7160, 7190
- Introduced together with WAP Internet access
  - To ease browsing
- Inconsistent usage of roller in applications
  - Selection from menu
  - Bring up list of possible selections
- No space for labelling the roller (for press)
  - Very dynamic softkey without instructions
- Next generation of interface style (Series 45) based on "Navi-roller usability autopsy"

Nokia 7110

Example: Nokia Interface Evolution

Series 20
"NaviKey"

3330

Series 30

6610

Series 40
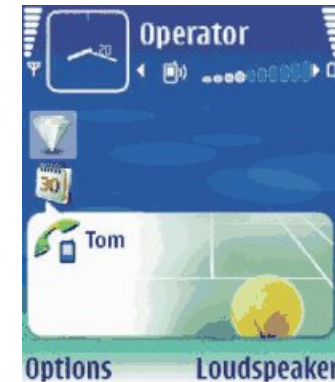
6230i

Series 60

3250

nokiaport.de

Key Design Guidelines for Handheld Devices (1)

- ***Design for users on the go***
  - Handhelds are likely to be used in distracting situations
  - Wireless users typically have immediate goals
- Examples:

Desktop	Handheld (wireless)
Comparing prices of flights, making reservations	Checking status of particular flight
Gathering background on a company	Getting drive directions to specific office of the company - on the road
Researching a medical condition and its consequences	Monitoring a medical condition
Reading a movie/theatre review	Purchasing a cinema ticket to avoid the line

Weiss

Key Design Guidelines for Handheld Devices (2)

- Select vs. Type
  - Avoid text entry as far as possible
  - Support all available text input methods
  - Exceptions:
    - » Text input may be still adequate in specific cases!
- Be aware it is a phone
  (of course only if it is, in fact)!
  - Any activity may at any point in time be interrupted
  - Main source for interruption = incoming call
 - Applications have to be able to suspend and resume

Key Design Guidelines for Handheld Devices (3)

- *Consistency*
- Consistency among applications on the same device
  - Use identical conventions, shortcuts, terminology
  - Do not assume that users want to learn new techniques
  - Example: Left softkey for "action", right softkey for exit/close
- Consistency among similar devices
  - Example: Softkey conventions on mobile phones
- Consistency across platforms
  - Make processes and terminology similar e.g. on Web and mobile
  - Take into account appropriateness for small screen
  - Example: iPhone Web browser

Excerpts from Series 60 Guidelines (1)

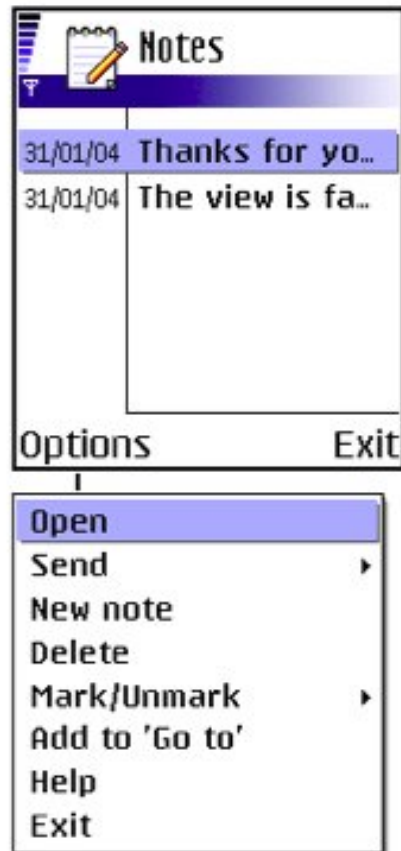- The key questions to be answered in navigation
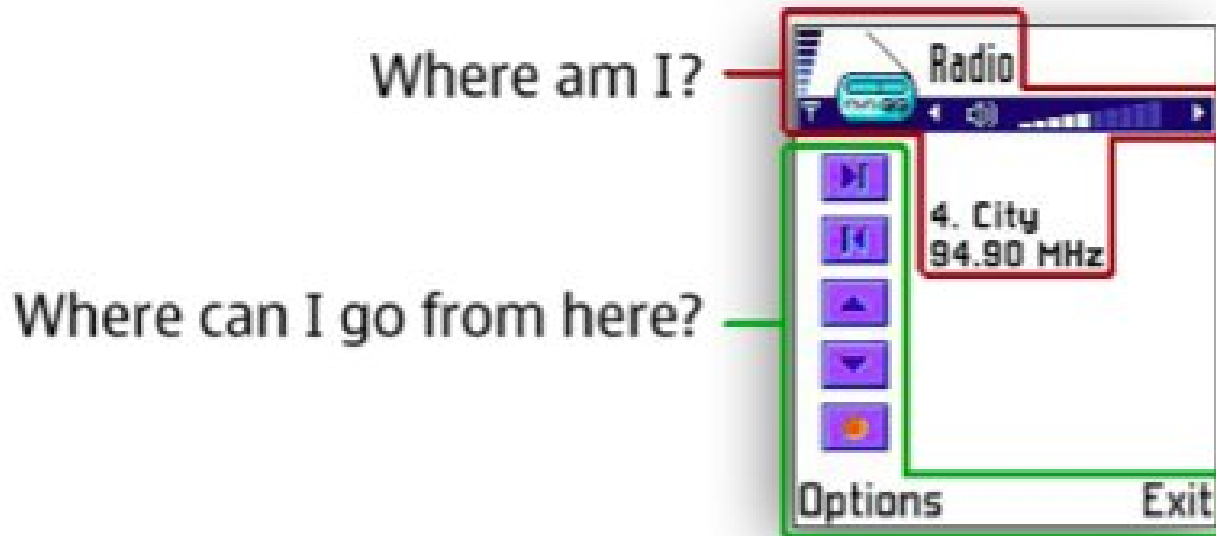
Series 60 Symbian phones = industry standard going beyond just Nokia

Excerpts from Series 60 Guidelines (2)
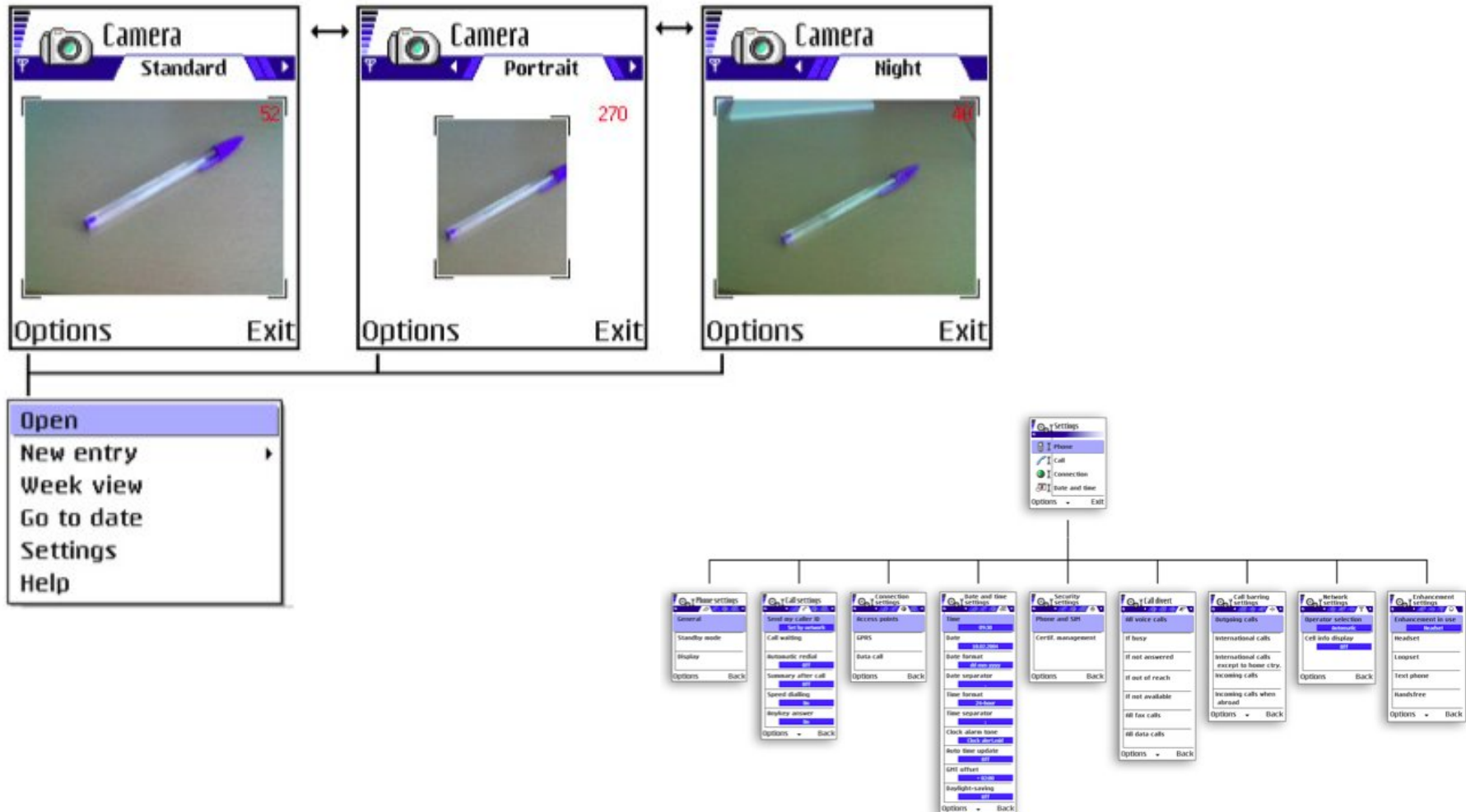
- Main menu styles

No focus

Using focus

Custom main menu (games)

Excerpts from Series 60 Guidelines (3)

- Using tabs

Usability and Mobile Gaming

- Fun is a main factor game usability

- Mobile games are typically played for brief time periods, so there is no extra time to learn how to navigate inside the game.

- Playing should be as intuitive as possible and the challenge should be in the game play, not in the interaction with the game user interface.

- Usability provides the framework and tools for playability

- The interface is the essential factor for a game's success

- If usability problems get in the way of intense game playing, the game probably will not be played again.

From: Tip Of The Month: Usability And Fun – Best Friends In Mobile Games (Nokia Forum)

Basic Design Issues for Games

- When playing a game, users should experience the game world
- The game navigation structure should support the experience
- Use of high-level UI components should be avoided
- Game menus should look and feel like the game.

- Mobile games are played in a context where interruptions often occur:
  - somebody might call or send an SMS message,
  - the player might need to pause the game to buy a bus ticket.
  - Therefore, the game design should support saving and pausing.

From: Tip Of The Month: Usability And Fun – Best Friends In Mobile Games (Nokia Forum)
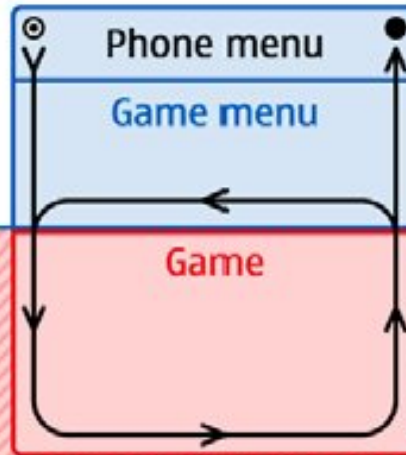
Experience

Legend:
- Custom graphics
- Standard UI components
- Use flow
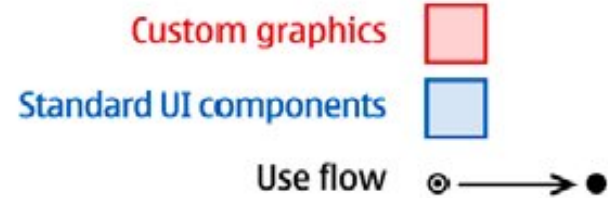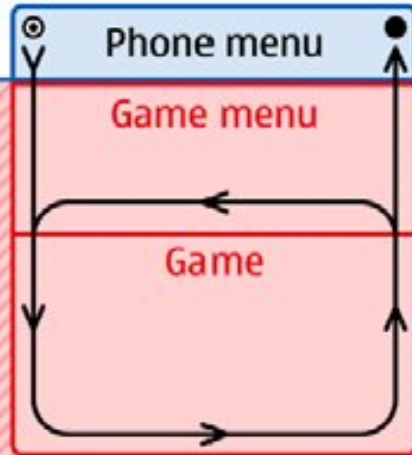
Immersive experience | Adequate experience | Broken experience
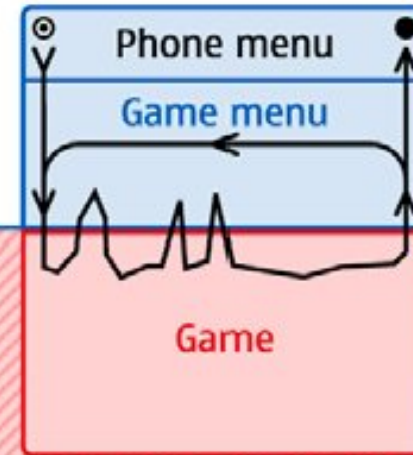
Phone menu — Game menu — Game — Game experience

From: Tip Of The Month: Usability And Fun – Best Friends In Mobile Games (Nokia Forum)

- Example
- Game vs. Menus

10 Usability Recommendations for Games (1)

- **Provide a Clear Menu Structure**
  Use only one main menu, accessible with the left soft key. Keep the menu short. In general, use the left soft key for OK, select, and menu; use the right soft key for cancel and back.

- **Simplicity Is Key**
  If two solutions are equally valid, use the simpler. Make sure each entity in the game is unique, and not easily confused with any other. Provide different game modes only if they are truly different and valuable.

- **Provide Help When Needed**
  Keep help text short. If feasible, scroll text one screen at a time, not one line at a time. Display short text on the screen to explain new items, characters, and situations in the game. Provide a setting to disable in-game help. Provide a graphic representation of which keys are used for which functions. Do not expect players to read help text or force them to do so.

- **Be Relentlessly Consistent**
  Use the mother tongue of the user. Be consistent with the phone's UI, with game industry conventions, and within the game itself. Use the left soft key for OK, select, and menu; use the right soft key for cancel and back.

- **Don't Waste the User's Time**
  Allow her to skip the introduction. Do not require re-entry of data. Provide shortcuts and reasonable default values.

From: Series 40 Game Usability Study (Nokia Forum)

10 Usability Recommendations for Games (2)

- **Use Natural Controls**
  Use the 2, 4, 6, and 8 keys for horizontal and vertical movement as well as the arrow keys; use the 1, 3, 7, and 9 keys for diagonal movement, if enabled. Use the 5 key as the action button. Design the game so that it does not lure the user into pressing two keys at once, since many mobile devices (and all Series 40 devices) do not support simultaneous key presses.

- **Enable Save and Pause**
  Provide a simple save-game feature. Have the game auto-save when the user presses the red phone button - use the destroyApp() method to do this. Provide a pause mode (left soft key, which goes to the game menu); this can be done using the hideNotify() method. If the user quits the game from the pause mode, have the game auto-save.

- **Conform to Real-World Expectations**
  For example, when jumping or throwing objects, the flight path should be predictable. There must be no invisible barriers that the player cannot pass or holes that he cannot reach. Do not end the game arbitrarily. Implement a realistic physics model if relevant (for example, racing games).

- **Go Easy on the Sound**
  Provide sound for feedback, but ensure that the game is playable with the sound off, and provide an easy way to turn sound off within the game. No annoying sounds: not too loud, not too high-pitched. Avoid background music, if possible.

- **Implement a High Scores List**
  Tell the user what score he reached before asking for a name; provide the previously entered name as the default. Do not force the user to enter a name; make it optional.

From: Series 40 Game Usability Study (Nokia Forum)

Six Mobile Messages

- (1) Mobile applications need to be redesigned for different terminals, because a **small user interface does not scale down**. Feature prioritization is critical.

- (2) Users are **cognitive, emotional, contextual and cultural** actors. It takes segmentation, personalization, and continuous evolution to fulfill their versatile changing needs.

- (3) The mobile industry faces a wireless **complexity** threshold. To overcome it we will have to provide a seamless user experience of terminals, applications and services.

- (4) For mobiles, **fancy visions** and real end-user **value** conflict. Taking the next step requires the resolve to make instead of dream and decide instead of speculate.

- (5) A user interface is as good as the workmanship behind it. Great UIs are born out of a passion for **detail**. The more you polish the better it gets.

- (6) The **challenge** of mobile UI development is **shared** among external software firms, industry consortiums, and service providers. Reasonable development stability is a must.

Keikonen/Lindholm