

Welcome

A wide-angle photograph of a natural landscape. In the foreground, dark green foliage and branches frame the scene. Beyond them is a large, calm lake with a small, green, tree-covered island in the middle-right. The background consists of several layers of mountains, with the most prominent one on the left having a dark, almost black, peak. The sky is filled with large, white, billowing clouds against a blue sky.

**Among the great things which are to be
found among us, the Being of Nothingness
is the greatest**

Leonardo Da Vinci



Design

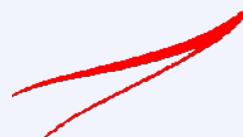
Abbas Moallem, Ph.D.

Overview

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- Design
- Navigation Design
- Screen Design and layout

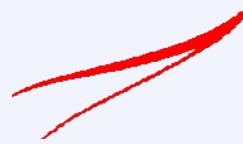




Natural Language

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- Familiar to user
- Speech recognition or typed natural language
- Problems
 - vague
 - ambiguous
 - hard to do well!
- Solutions
 - try to understand a subset
 - pick on key words



Touch

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- Touch screens, such as walk-up kiosks, detect the presence and location of a person's touch on the display
- Multi-touch support a range of more dynamic finger tip actions, e.g. swiping, flicking, pinching, pushing and tapping
- Now used for many kinds of displays, such as Smartphones, iPods, tablets and tabletops

Research and Design Issues

ISE 164 - HCI

- More fluid and direct styles of interaction involving freehand and pen-based gestures
- Core design concerns include whether size, orientation, and shape of touch displays effect collaboration
- Much faster to scroll through wheels, carousels and bars of thumbnail images or lists of options by finger flicking
- More cumbersome, error-prone and slower to type using a virtual keyboard on a touch display than using a physical keyboard

Research and Design Issues

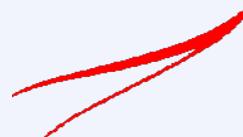
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- Will finger-flicking, swiping, stroking and touching a screen result in new ways of consuming, reading, creating and searching digital content?



Figure 6.23 The Swype interface developed for mobile touch displays

Source: Reproduced from <http://www.geek.com/articles/mobile/nuances-t9-trace-virtual-keyboard-allows-you-to-swipe-rather-than-type-20100323/technology/>.



Air-based gestures

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- **Uses camera recognition, sensor and computer vision techniques**
 - can recognize people's body, arm and hand gestures in a room
 - systems include Kinect
- **Movements are mapped onto a variety of gaming motions, such as swinging, bowling, hitting and punching**
- **Players represented on the screen as avatars doing same actions**

Home Entertainment

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- Universal appeal
 - young children, grandparents, professional gamers, technophobes



Figure 6.25 Touchless gesturing in the operating theater

Source: Courtesy of Kenton O'Hara, Microsoft.

Gestures in the operating theatre

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- A touchless system that recognizes gestures
- surgeons can interact with and manipulate MRI or CT images
 - e.g. two-handed gestures for zooming and panning

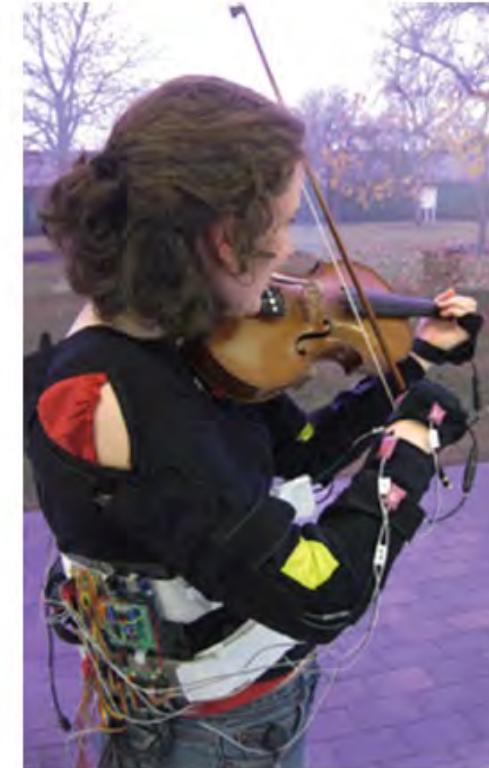


Figure 6.26 The MusicJacket prototype with embedded actuators that nudge the player



Research and Design Issues

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- How does computer recognize and delineate user's gestures?
 - Deictic and hand waving
- Does holding a control device feel more intuitive than controller free gestures?
 - For gaming, exercising, dancing

Haptic

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- Tactile feedback
 - applying vibration and forces to a person's body, using actuators that are embedded in their clothing or a device they are carrying, such as a smartphone
- Can enrich user experience or nudge them to correct error
- Can also be used to simulate the sense of touch between remote people who want to communicate

Multi-modal

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- Meant to provide enriched and complex user experiences
 - multiplying how information is experienced and detected using different modalities, i.e. touch, sight, sound, speech
 - support more flexible, efficient, and expressive means of human–computer interaction
 - Most common is speech and vision

Research and Design Issues

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- Need to recognize and analyse speech, gesture, and eye gaze
- What is gained from combining different input and outputs
- Is talking and gesturing, as humans do with other humans, a natural way of interacting with a computer?

Shareable

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- Shareable interfaces are designed for more than one person to use
 - provide multiple inputs and sometimes allow simultaneous input by co-located groups
 - large wall displays where people use their own pens or gestures
 - interactive tabletops where small groups interact with information using their fingertips
 - e.g. DiamondTouch, Smart Table and Surface

A smartboard

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(a)

Figure 6.27 (a) A SmartBoard in use during a meeting and (b) Mitsubishi's interactive tabletop interface, where collocated users can interact simultaneously with digital content using their fingertips

Source: (a) ©2006 SMART Technologies Inc. Used with permission. (b) Image courtesy of Mitsubishi Electric Research Labs.

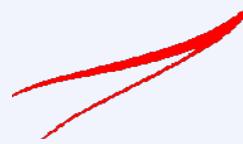
DiamondTouch Tabletop

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(b)

Figure 6.27 (a) A SmartBoard in use during a meeting and (b) Mitsubishi's interactive tabletop interface, where collocated users can interact simultaneously with digital content using their fingertips
Source: (a) ©2006 SMART Technologies Inc. Used with permission. (b) Image courtesy of Mitsubishi Electric Research Labs.



Advantages

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- Provide a large interactional space that can support flexible group working
- Can be used by multiple users
 - Can point to and touch information being displayed
 - Simultaneously view the interactions and have same shared point of reference as others
- Can support more equitable participation compared with groups using single PC

Research and Design Issues

ISE 164 - HCI

- More fluid and direct styles of interaction involving freehand and pen-based gestures
- Core design concerns include whether size, orientation, and shape of the display have an effect on collaboration
- Horizontal surfaces compared with vertical ones support more turn-taking and collaborative working in co-located groups
- Providing larger-sized tabletops does not improve group working but encourages more division of labor

Tangible

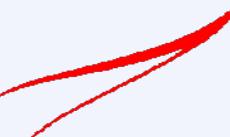
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- Type of sensor-based interaction, where physical objects, e.g., bricks, are coupled with digital representations
- When a person manipulates the physical object/s it causes a digital effect to occur, e.g. an animation
- Digital effects can take place in a number of media and places or can be embedded in the physical object

Examples

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- Chromarium cubes
 - when turned over digital animations of color are mixed on an adjacent wall
 - facilitates creativity and collaborative exploration
- Flow Blocks
 - depict changing numbers and lights embedded in the blocks
 - vary depending on how they are connected together
- Urp
 - physical models of buildings moved around on tabletop
 - used in combination with tokens for wind and shadows -> digital shadows surrounding them to change over time



Benefits

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- Can be held in both hands and combined and manipulated in ways not possible using other interfaces
 - allows for more than one person to explore the interface together
 - objects can be placed on top of each other, beside each other, and inside each other
 - encourages different ways of representing and exploring a problem space
- People are able to see and understand situations differently
 - can lead to greater insight, learning, and problem-solving than with other kinds of interfaces
 - can facilitate creativity and reflection

VoxBox

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- A tangible system that gathers opinions at events through playful and engaging interaction (Goldstein et al, 2015)

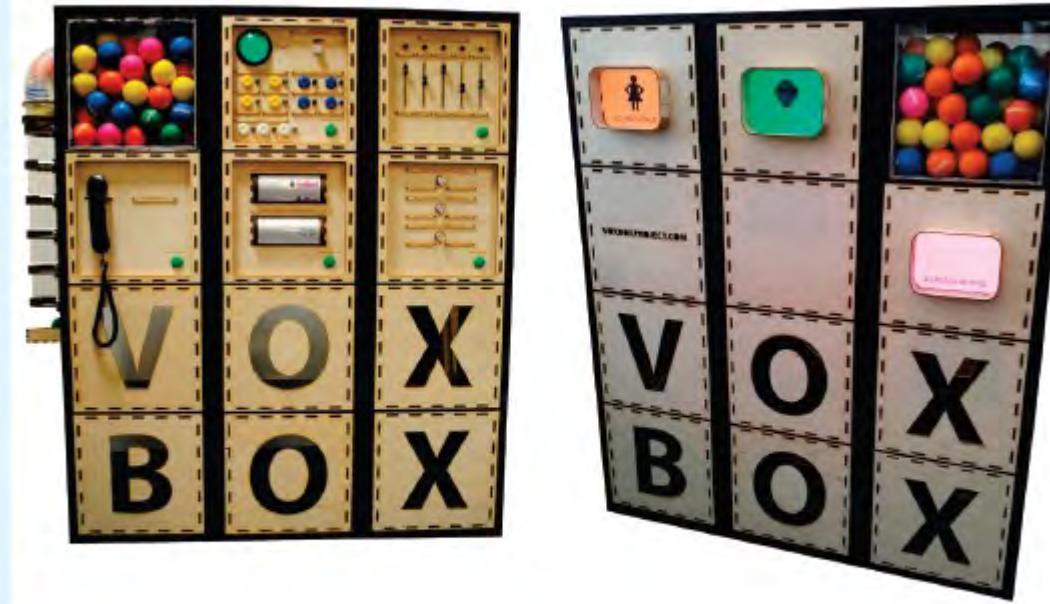


Figure 6.29 VoxBox – Front and back of the tangible machine questionnaire

Source: Golsteijn, C., Gallacher, S., Koeman, L., Wall, L., Andberg, S., Rogers, Y. and Capra, L. (2015) VoxBox: a Tangible Machine that Gathers Opinions from the Public at Events. In Proc. of TEI' 2015. ACM.

Research and design issues

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- Develop new conceptual frameworks that identify novel and specific features
- The kind of coupling to use between the physical action and digital effect
 - If it is to support learning then an explicit mapping between action and effect is critical
 - If it is for entertainment then can be better to design it to be more implicit and unexpected
- What kind of physical artifact to use
 - Bricks, cubes, and other component sets are most commonly used because of flexibility and simplicity
 - Stickies and cardboard tokens can also be used for placing material onto a surface

Augmented and Mixed Reality

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- Augmented reality - virtual representations are superimposed on physical devices and objects
- Mixed reality - views of the real world are combined with views of a virtual environment
- Many applications including medicine, games, flying, and everyday exploring

Examples

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- In medicine
 - virtual objects, e.g. X-rays and scans, are overlaid on part of a patient's body
 - aid the physician's understanding of what is being examined or operated
- In air traffic control
 - dynamic information about aircraft overlaid on a video screen showing the real planes, etc. landing, taking off, and taxiing
 - Helps identify planes difficult to make out

An Augmented Map

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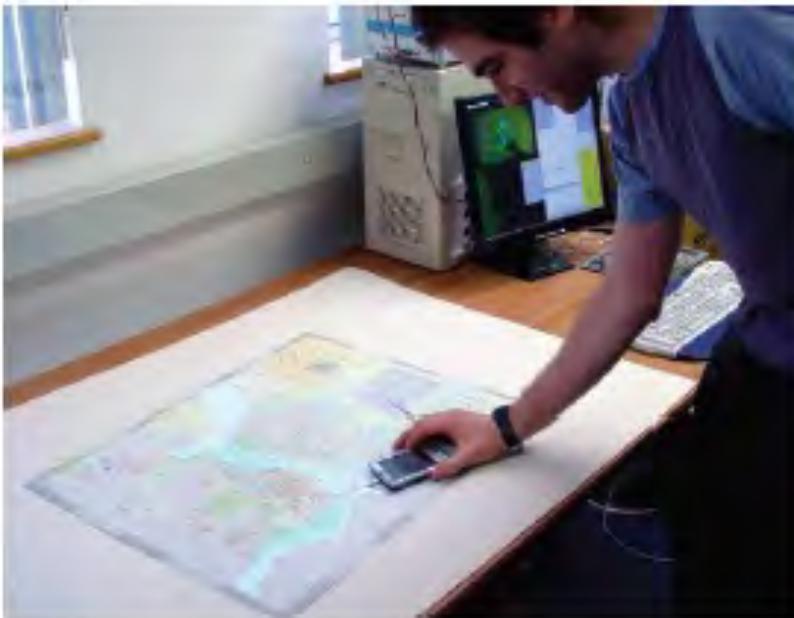


Figure 6.30 An augmented map showing the flooded areas at high water level overlaid on the paper map. The handheld device is used to interact with entities referenced on the map
Source: Reproduced with permission.

Top Gear James May in AR

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- Appears as a 3D character to act as personal tour guide at Science Museum

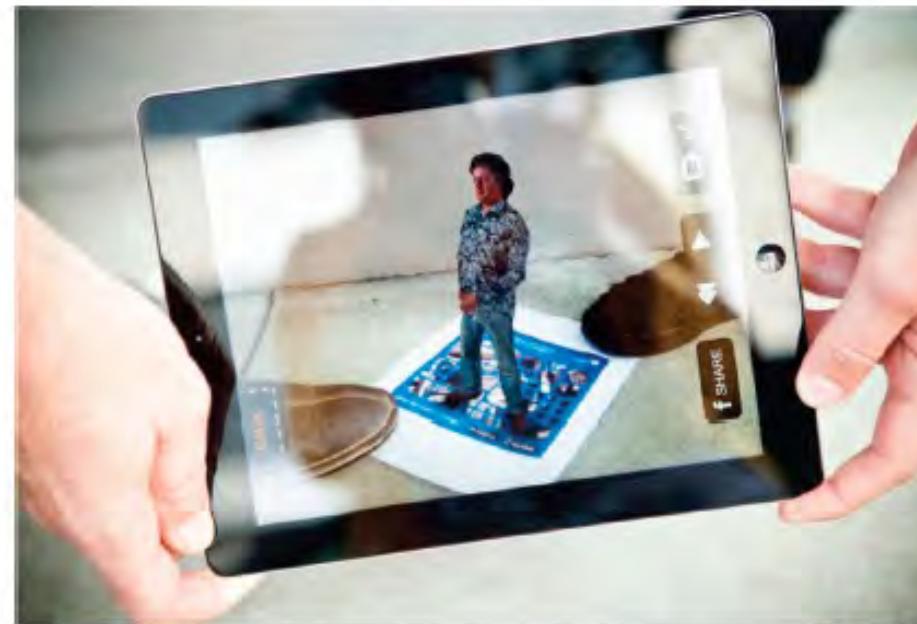


Figure 6.31 James May appearing in 3D Augmented Reality

Source: <http://www.wired.com/2012/04/top-gear-host-narrates-museum-exhibits-as-augmented-reality-avatar/>.
Roberto Baldwin/Wired/©Conde Nast



Research and Design Issues

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- **What kind of digital augmentation?**
 - When and where in physical environment?
 - Needs to stand out but not distract from ongoing task
 - Need to be able to align with real world objects
- **What kind of device?**
 - Smartphone, head up display or other?

Wearables

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- First developments were head- and eyewear-mounted cameras that enabled user to record what was seen and to access digital information
- Since, jewellery, head-mounted caps, smart fabrics, glasses, shoes, and jackets have all been used
 - provide the user with a means of interacting with digital information while on the move
- Applications include automatic diaries, tour guides, cycle indicators and fashion clothing

Google Glass: short-lived

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Figure 6.32 Google Glass

Source: <https://www.google.co.uk/intl/en/glass/start/>.

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- What were the pros and cons?

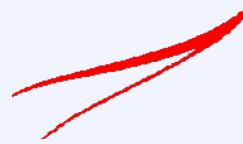


Research and Design Issues

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- **Comfort**
 - needs to be light, small, not get in the way, fashionable, and preferably hidden in the clothing
- **Hygiene**
 - is it possible to wash or clean the clothing once worn?
- **Ease of wear**
 - how easy is it to remove the electronic gadgetry and replace it?
- **Usability**
 - how does the user control the devices that are **embedded in the clothing?**

Robots and drones



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- Four types of robot
 - remote robots used in hazardous settings
 - domestic robots helping around the house
 - pet robots as human companions
 - sociable robots that work collaboratively with humans, and communicate and socialize with them – as if they were our peers

Advantages

ISE 164 - HCI

- Pet robots are assumed to have therapeutic qualities, helping to reduce stress and loneliness
- Remote robots can be controlled to investigate bombs and other dangerous materials



Figure 6.33 Left: Mel, the penguin robot, designed to host activities; right: Japan's Paro, an interactive seal, designed as a companion, primarily for the elderly and sick children

Source: (left) Image courtesy of Mitsubishi Electric Research Labs. (right) Courtesy of Parorobots.com.

Drones

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- Unmanned aircraft that are controlled remotely and used in a number of contexts
 - e.g. entertainment, such as carrying drinks and food to people at festivals and parties;
 - agricultural applications, such as flying them over vineyards and fields to collect data that is useful to farmers
 - helping to track poachers in wildlife parks in Africa
- Can fly low and stream photos to a ground station, where images can be stitched together into maps
- Can be used to determine the health of a crop or when it is the best time to harvest the crop

Drone in vineyard

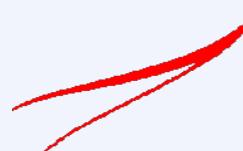
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Figure 6.34 A drone being used to survey the state of a vineyard

Source: Courtesy of Discover Sonoma County Wine

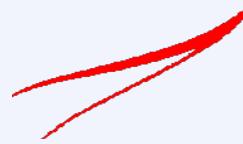
<http://www.latimes.com/business/la-fi-drones-agriculture-20140913-story.html#page=1>.



Research and design issues

ISE 164 - HCI

- How do humans react to physical robots designed to exhibit behaviors (e.g. making facial expressions) compared with virtual ones?
- Should robots be designed to be human-like or look like and behave like robots that serve a clearly defined purpose?
- Should the interaction be designed to enable people to interact with the robot as if it was another human being or more human-computer-like (e.g. pressing buttons to issue commands)?
- Is it acceptable to use unmanned drones to take a series of images or videos of fields, towns, and private property without permission or people knowing what is happening?



Brain-computer interfaces

ISE 164 - HCI

- Brain–computer interfaces (BCI) provide a communication pathway between a person’s brain waves and an external device, such as a cursor on a screen
- Person is trained to concentrate on the task, e.g. moving the cursor
- BCIs work through detecting changes in the neural functioning in the brain
- BCIs apps:
 - Games
 - enable people who are paralysed to control robots

Brainball game

ISE 164 - HCI



Figure 6.35 The Brainball game using a brain–computer interface

Source: “Brainball” from The Interactive Institute. Reproduced with permission.

Which interface?

ISE 164 - HCI

- Is multimedia better than tangible interfaces for learning?
- Is speech as effective as a command-based interface?
- Is a multimodal interface more effective than a monomodal interface?
- Will wearable interfaces be better than mobile interfaces for helping people find information in foreign cities?
- Are virtual environments the ultimate interface for playing games?
- Will shareable interfaces be better at supporting communication and collaboration compared with using networked desktop PCs?

Which interface?

ISE 164 - HCI

- Will depend on task, users, context, cost, robustness, etc.
- Mobile platforms taking over from PCs
- Speech interfaces also being used much more for a variety of commercial services
- Appliance and vehicle interfaces becoming more important
- Shareable and tangible interfaces entering our homes, schools, public places, and workplaces

Summary

ISE 164 - HCI

- Many innovative interfaces have emerged post the WIMP/GUI era, including speech, wearable, mobile, brain and tangible
- Raises many design and research questions to decide which to use
 - e.g. how best to represent information to the user so they can carry out ongoing activity or task
- New interfaces that are context-aware or monitor raise ethical issues concerned with what data is being collected and what it is used for

The background of the image is a collage of three photographs. On the left, a bare tree branch reaches across the frame against a bright blue sky with a single, large, white, fluffy cloud. In the center, a dark, silhouetted tree branch is visible against the same blue sky. On the right, a large, leafy tree with green foliage is shown against a clear blue sky.

See You Next Week

Overview

ISE 164 - HCI

- Interface types
 - highlight the main design and research issues for each of the different interfaces
- Consider which interface is best for a given application or activity

Activity

ISE 164 - HCI

- Sketch simple icons to represent the following operations to appear on a digital camera screen:
 - Turn image 90 degrees sideways
 - Auto-enhance the image
 - Fix red-eye
 - Crop the image
- Show them to someone else and see if they can understand what each represents



Basic edit icons on iPhone

ISE 164 - HCI

- Which is which?
- Are they easy to understand
- Are they distinguishable?
- What representation forms are used?
- How do yours compare?

Research and design issues

ISE 164 - HCI

- There is a wealth of resources now so do not have to draw or invent new icons from scratch
 - guidelines, style guides, icon builders, libraries
- Text labels can be used alongside icons to help identification for small icon sets
- For large icon sets (e.g. photo editing or word processing) use rollovers

3. *Multimedia*

ISE 164 - HCI

- Combines different media within a single interface with various forms of interactivity
 - graphics, text, video, sound, and animations
- Users click on links in an image or text
 - > another part of the program
 - > an animation or a video clip is played
 - > can return to where they were or move on to another place

BioBlast Multimedia Learning Environment

ISE 164 - HCI



Figure 6.14 Screen dump from the multimedia environment BioBLAST
Source: Screenshot from BioBlast, ©Wheeling Jesuit University.

Pros and cons

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- Facilitates rapid access to multiple representations of information
- Can provide better ways of presenting information than can any media alone
- Can enable easier learning, better understanding, more engagement, and more pleasure
- Can encourage users to explore different parts of a game or story
- Tendency to play video clips and animations, while skimming through accompanying text or diagrams

Research and design issues

ISE 164 - HCI

- How to design multimedia to help users explore, keep track of, and integrate the multiple representations
 - provide hands-on interactivities and simulations that the user has to complete to solve a task
 - Use ‘dynalinking,’ where information depicted in one window explicitly changes in relation to what happens in another (Scaife and Rogers, 1996).
- Several guidelines that recommend how to combine multiple media for different kinds of task

4. Virtual reality

ISE 164 - HCI

- Computer-generated graphical simulations providing:
 - “the illusion of participation in a synthetic environment rather than external observation of such an environment” (Gigante, 1993)
- Provide new kinds of experience, enabling users to interact with objects and navigate in 3D space
- Create highly engaging user experiences

Pros and cons

ISE 164 - HCI

- Can have a higher level of fidelity with objects they represent compared to multimedia
- Induces a sense of presence where someone is totally engrossed by the experience
 - “a state of consciousness, the (psychological) sense of being in the virtual environment” (Slater and Wilbur, 1999)
- Provides different viewpoints: 1st and 3rd person
- Head-mounted displays are uncomfortable to wear, and can cause motion sickness and disorientation

Research and design issues

ISE 164 - HCI

- Much research on how to design safe and realistic VRs to facilitate training
 - e.g. flying simulators
 - help people overcome phobias (e.g. spiders, talking in public)
- Design issues
 - how best to navigate through them (e.g. first versus third person)
 - how to control interactions and movements (e.g. use of head and body movements)
 - how best to interact with information (e.g. use of keypads, pointing, joystick buttons);
 - level of realism to aim for to engender a sense of presence

Which is the most engaging game of Snake?

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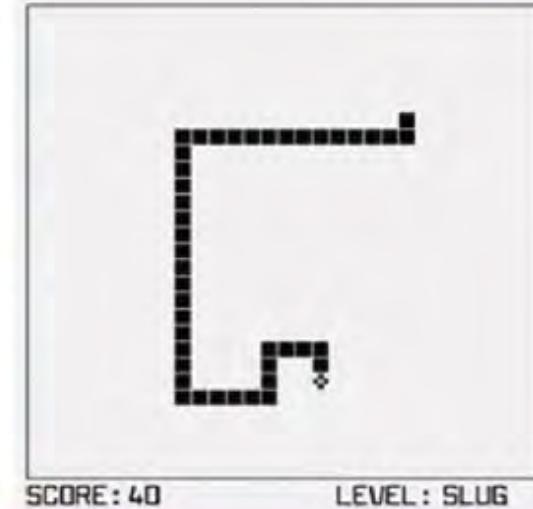
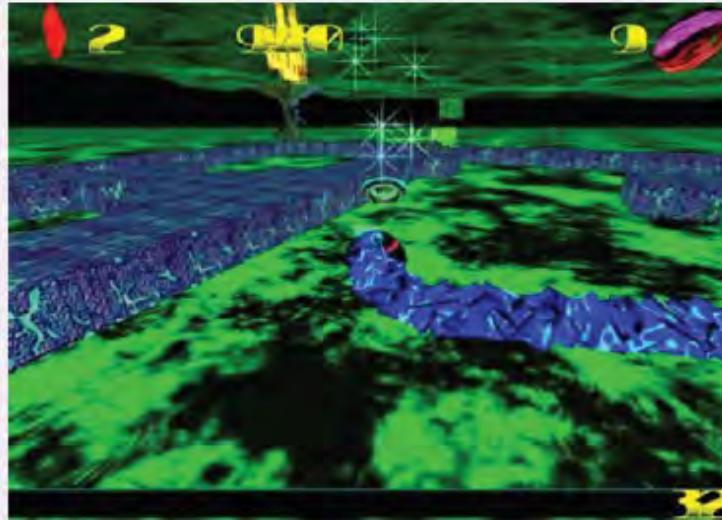


Figure 6.16 Two screenshots from the game Snake – the one on the left is played on a PC and the one on the right on a cell phone. In both games, the goal is to move the snake (the blue thing and the black squares, respectively) towards targets that pop up on the screen (e.g. the bridge, the star) and to avoid obstacles (e.g. a flower, the end of the snake's tail). When a player successfully moves his snake head over or under a target, the snake increases its length by one blob or block. The longer the snake gets, the harder it is to avoid obstacles. If the snake hits an obstacle, the game is over. On the PC version there are lots of extra features that make the game more complicated, including more obstacles and ways of moving. The cell phone version has a simple 2D bird's eye representation, whereas the PC version adopts a 3D third-person avatar perspective

5. Information visualization and dashboards

ISE 164 - HCI

- Computer-generated interactive graphics of complex data
- Amplify human cognition, enabling users to see patterns, trends, and anomalies in the visualization (Card *et al*, 1999)
- Aim is to enhance discovery, decision-making, and explanation of phenomena
- Techniques include:
 - 3D interactive maps that can be zoomed in and out of and which present data via webs, trees, clusters, scatterplot diagrams, and interconnected nodes

Dashboards

ISE 164 - HCI

- Show screenshots of data updated over periods of time - to be read at a glance
- Usually not interactive - slices of data that depict current state of a system or process
- Need to provide digestible and legible information for users
 - design its spatial layout so intuitive to read when first looking at it
 - should also direct a user's attention to anomalies or unexpected deviations

Which dashboard is best?

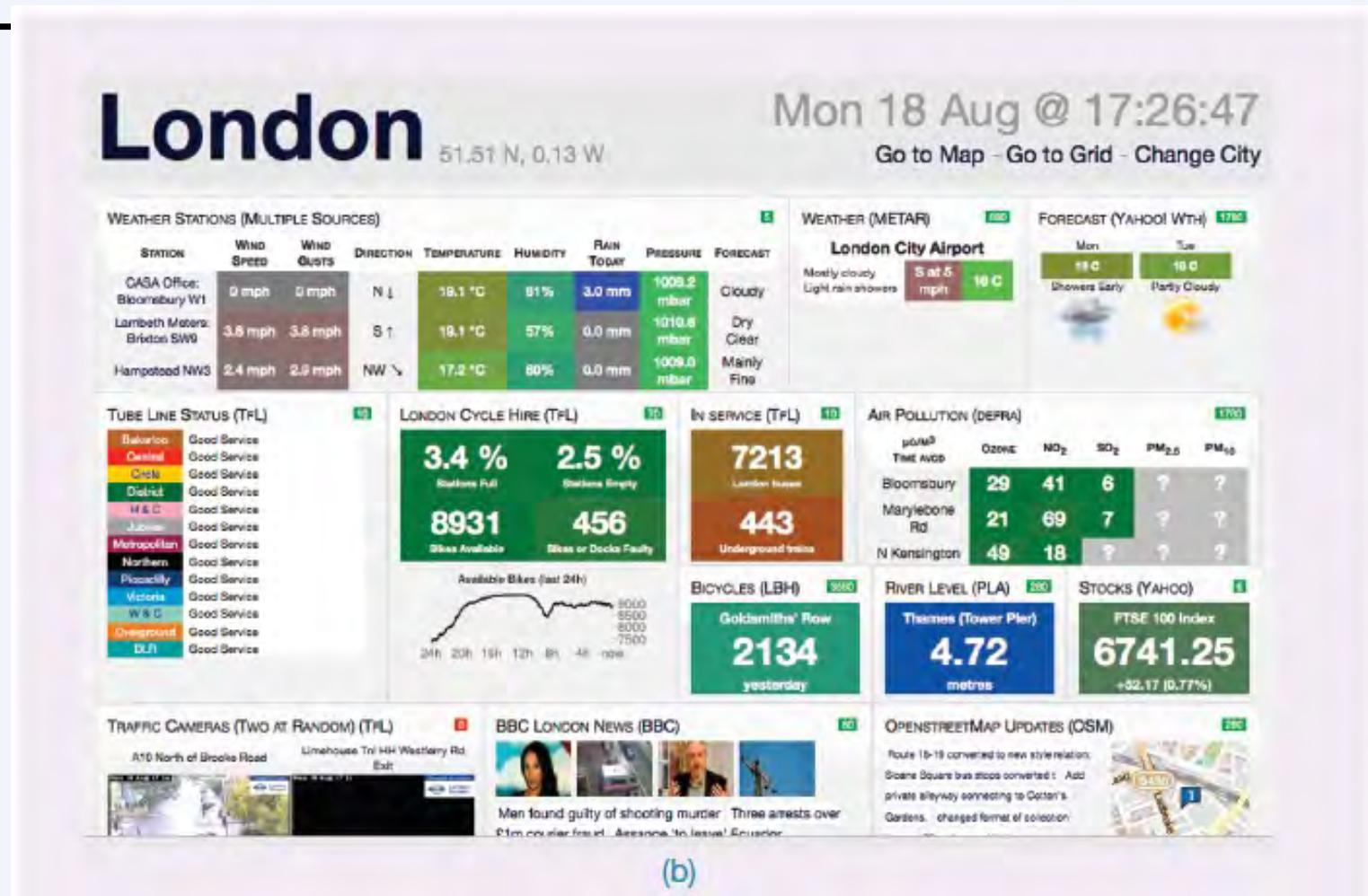
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(a)

Figure 6.18 Screenshots from two dashboards: (a) British Airways frequent flier club that shows how much a member has flown since joining them, and (b) London City that provides various information feeds. Which is the easier to read and most informative?

Which dashboard is best?



(b)

Figure 6.18 Screenshots from two dashboards: (a) British Airways frequent flier club that shows how much a member has flown since joining them, and (b) London City that provides various information feeds. Which is the easier to read and most informative?



Research and design issues

ISE 164 - HCI

- Whether to use animation and/or interactivity
- What form of coding to use, e.g. color or text labels
- Whether to use a 2D or 3D representational format
- What forms of navigation, e.g. zooming or panning,
- What kinds and how much additional information to provide, e.g. rollovers or tables of text
- What navigational metaphor to use

6. Web

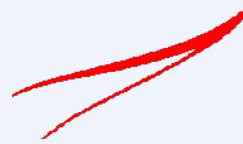
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- Early websites were largely text-based, providing hyperlinks
- Concern was with how best to structure information to enable users to navigate and access it easily and quickly
- Nowadays, more emphasis on making pages distinctive, striking, and pleasurable
- Need to think of how to design information for multi-platforms - keyboard or touch?
 - e.g. smartphones, tablets, PCs

Usability versus attractive?

ISE 164 - HCI

- Vanilla or multi-flavor design?
 - Ease of finding something versus aesthetic and enjoyable experience
- Web designers are:
 - “thinking great literature”
- Users read the web like a:
 - “billboard going by at 60 miles an hour” (Krug, 2000)
- Need to determine how to brand a web page to catch and keep ‘eyeballs’



In your face ads

ISE 164 - HCI

- Web advertising is often intrusive and pervasive
- Flashing, aggressive, persistent, annoying
- Often need to be ‘actioned’ to get rid of
- What is the alternative?

Research and design issues

ISE 164 - HCI

- Need to consider how best to design, present, and structure information and system behavior
- But also content and navigation are central
- Veen's (2001) design principles

(1)Where am I?

(2)Where can I go?

(3) What's here?

Activity

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- **Look at the Nike.com website**
- **What kind of website is it?**
- **How does it contravene the design principles outlined by Veen?**
- **Does it matter?**
- **What kind of user experience is it providing for?**
- **What was your experience of engaging with it?**

7. Consumer electronics and appliances

ISE 164 - HCI

- **Everyday devices in home, public place, or car**
 - e.g. washing machines, remotes, photocopiers, printers and navigation systems)
- **And personal devices**
 - e.g. MP3 player, digital clock and digital camera
- **Used for short periods**
 - e.g. putting the washing on, watching a program, buying a ticket, changing the time, taking a snapshot
- **Need to be usable with minimal, if any, learning**

A toaster

ISE 164 - HCI



Figure 6.19 A typical toaster with basic physical controls



Research and design issues

ISE 164 - HCI

- Need to design as transient interfaces with short interactions
- Simple interfaces
- Consider trade-off between soft and hard controls
 - e.g. buttons or keys, dials or scrolling

8. Mobile

ISE 164 - HCI

- Handheld devices intended to be used while on the move
- Have become pervasive, increasingly used in all aspects of everyday and working life
- Apps running on mobiles have greatly expanded, e.g.
 - used in restaurants to take orders
 - car rentals to check in car returns
 - supermarkets for checking stock
 - in the streets for multi-user gaming
 - in education to support life-long learning

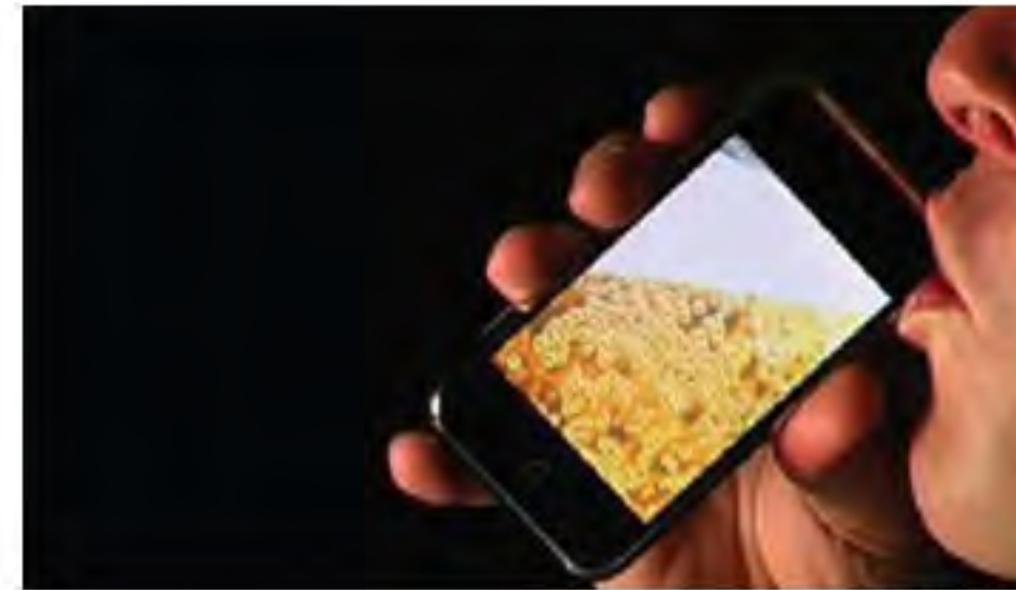
The advent of the iPhone app

ISE 164 - HCI

- A whole new user experience that was designed primarily for people to enjoy
 - many apps not designed for any need, want or use but purely for idle moments to have some fun
 - e.g. iBeer developed by magician Steve Sheraton
 - ingenious use of the accelerometer that is inside the phone

iBeer app

ISE 164 - HCI



hottrixdownload.com

Figure 6.20 The iBeer smartphone app

Source: iBeer™ Photo ©2010 HOTTRIX® Reproduced with permission.

QR codes and cell phones

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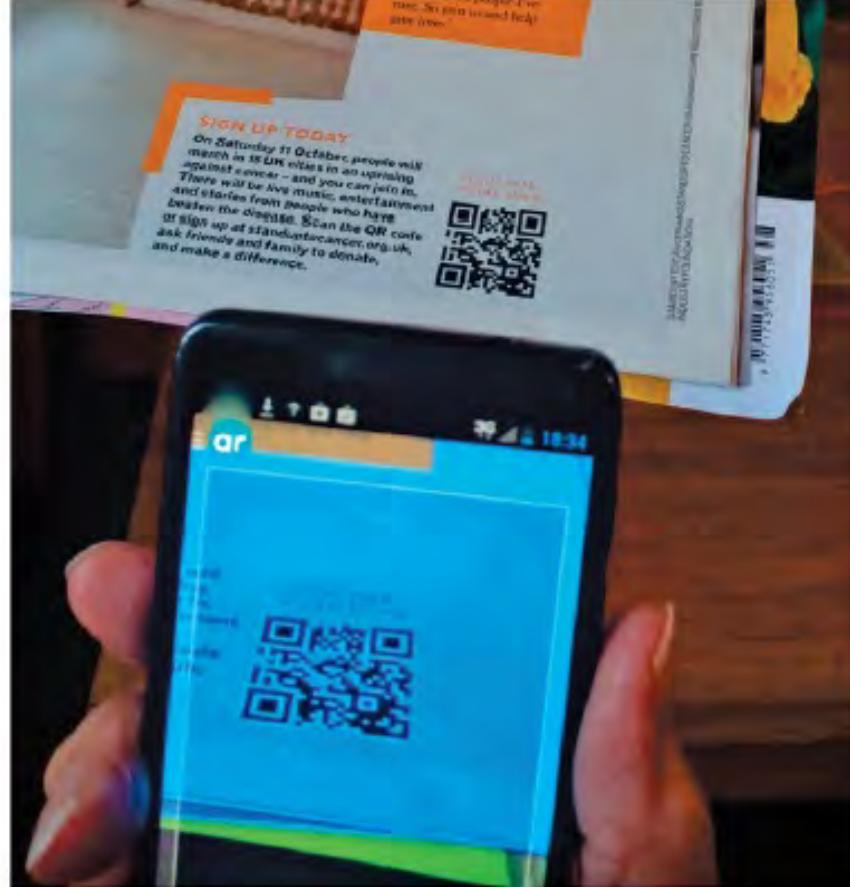


Figure 6.21 QR code appearing on a magazine page



Mobile challenges

ISE 164 - HCI

- Smaller screens, small number of physical keys and restricted number of controls
- Innovative physical designs including:
 - roller wheels, rocker dials, up/down ‘lips’ on the face of phones, 2-way and 4-way directional keypads, softkeys, silk-screened buttons
- Usability and preference varies
 - depends on the dexterity and commitment of the user
- Smartphones overcome mobile physical constraints through using multi-touch displays

Research and design issues

ISE 164 - HCI

- Mobile interfaces can be tricky and cumbersome to use for those with poor manual dexterity or ‘fat’ fingers
- Key concern is hit area
 - area on the phone display that the user touches to make something happen, such as a key, an icon, a button or an app
 - space needs to be big enough for fat fingers to accurately press
 - if too small the user may accidentally press the wrong key

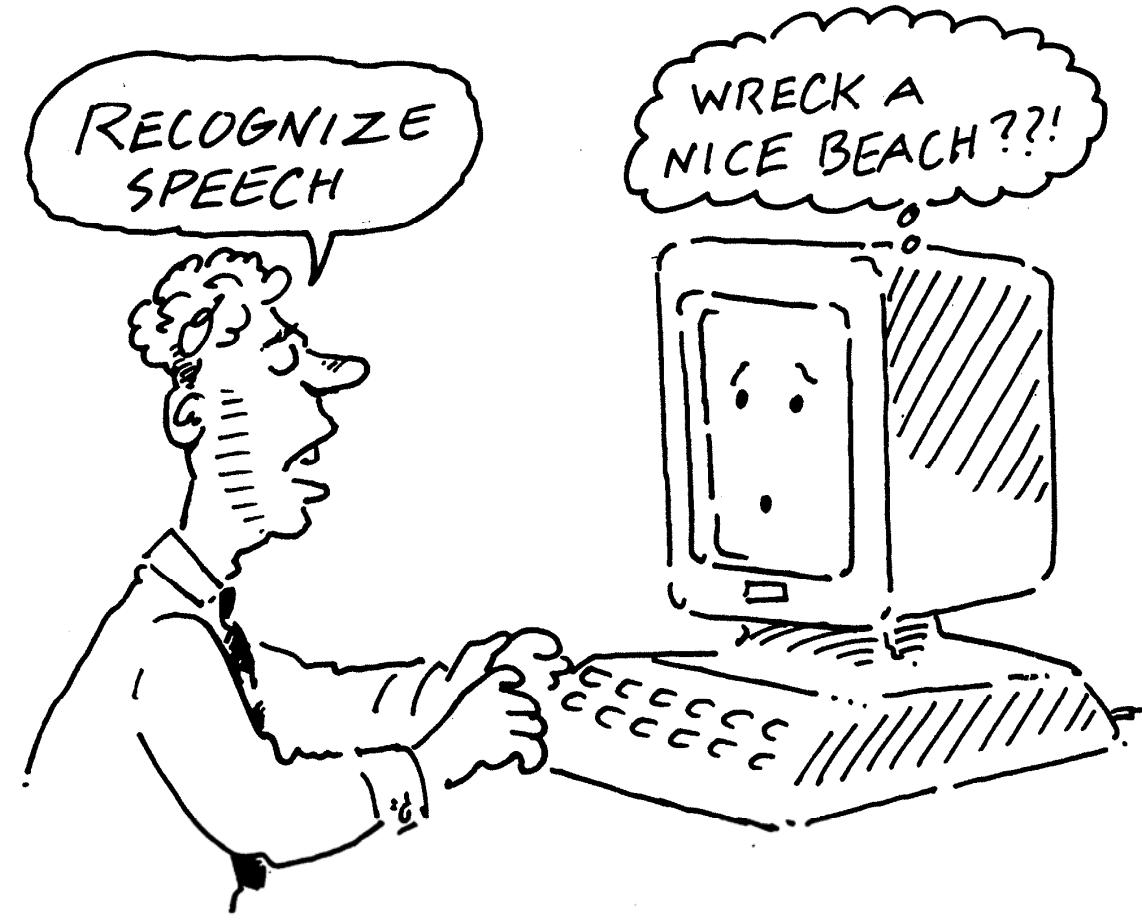
9. Speech

ISE 164 - HCI

- Where a person talks with a system that has a spoken language application, e.g. timetable, travel planner
- Used most for inquiring about very specific information, e.g. flight times or to perform a transaction, e.g. buy a ticket
- Also used by people with disabilities
 - e.g. speech recognition word processors, page scanners, web readers, home control systems

Have speech interfaces come of age?

ISE 164 - HCI



Get me a human operator!

ISE 164 - HCI

- Most popular use of speech interfaces currently is for call routing
- Caller-led speech where users state their needs in their own words
 - e.g. “I’m having problems with my voice mail”
- Idea is they are automatically forwarded to the appropriate service
- What is your experience of speech systems?

Format

ISE 164 - HCI

- Directed dialogs are where the system is in control of the conversation
- Ask specific questions and require specific responses
- More flexible systems allow the user to take the initiative:
 - e.g. “I’d like to go to Paris next Monday for two weeks.”
- More chance of error, since caller might assume that the system is like a human
- Guided prompts can help callers back on track
 - e.g. “Sorry I did not get all that. Did you say you wanted to fly next Monday?”



Research and design issues

ISE 164 - HCI

- How to design systems that can keep conversation on track
 - help people navigate efficiently through a menu system
 - enable them to easily recover from errors
 - guide those who are vague or ambiguous in their requests for information or services
- Type of voice actor (e.g. male, female, neutral, or dialect)
 - do people prefer to listen to and are more patient with a female or male voice, a northern or southern accent?

10. Pen

ISE 164 - HCI

- Enable people to write, draw, select, and move objects at an interface using lightpens or styluses
 - capitalize on the well-honed drawing skills developed from childhood
- Digital pens, e.g. Anoto, use a combination of ordinary ink pen with digital camera that digitally records everything written with the pen on special paper

Pros and cons

ISE 164 - HCI

- Allows users to quickly and easily annotate existing documents
- Can be difficult to see options on the screen because a user's hand can occlude part of it when writing
- Can have lag and feel clunky

Welcome

Screen Design

Abbas Moallem, Ph.D.

**Among the great things which are to be
found among us, the Being of Nothingness
is the greatest**

Leonardo Da Vinci



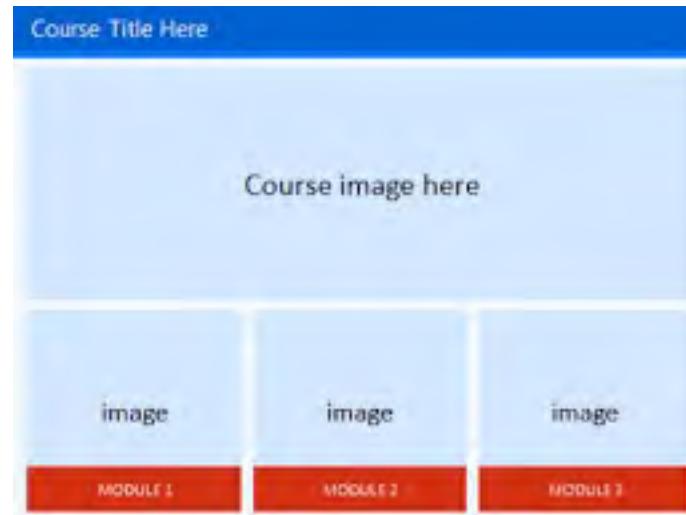
Overview

- **Screen Design and Layout**
 - Grouping
 - Order
 - Decoration
 - Alignment
 - White Space
 - Presentation of Information



Screen Design and Layout

- **What is the user doing?**
- **What information is required?**
- **What comparisons may the user need to make?**
- **In what order are things likely to be needed?**





Screen Design and Layout

- **Grouping**
- **Order**
- **Decoration**
- **Alignment**
- **White Space**
- **Presentation of Information**



Exercise

- Look at these two columns of numbers and try to find out the biggest number in each column.

532.56	672.865
179.3	1.005763
266.317	382.583
15	2502.56
73.948	432.935
1035	2.0175
3.142	652.87
497.6256	56.34



Exercise

- Look at these two columns of numbers and try to find out the biggest number in each column.

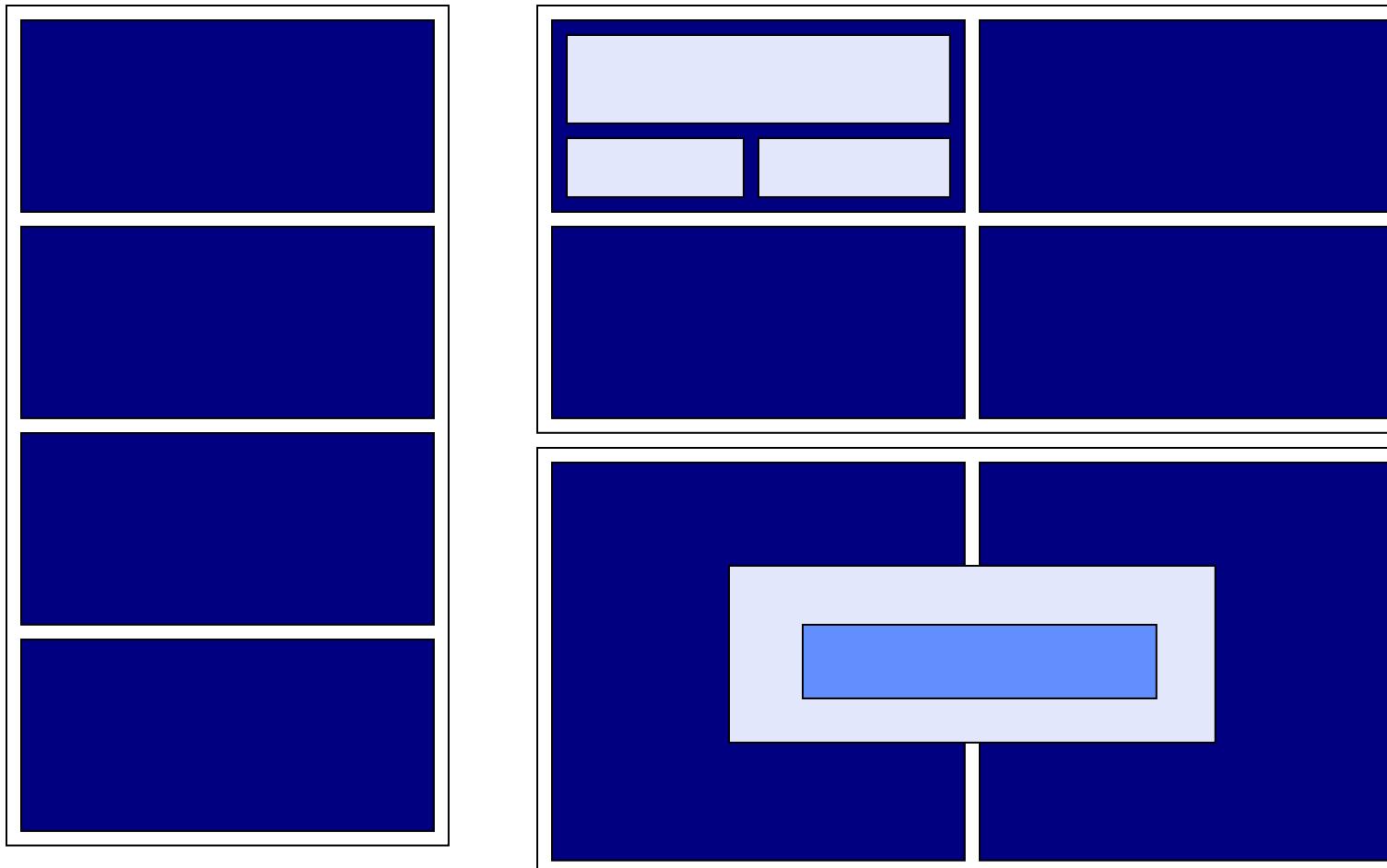
532.56	672.865
179.3	1.005763
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15	2502.56
73.948	432.935
1035	2.0175
3.142	652.87
497.6256	56.34

1035.0
532.56
497.6256
266.317
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15.0
73.948
3.142

2502.56
672.865
652.87
432.935
382.583
56.34
2.0175
1.005763



White Space





User Actions and Control

- Entering Information
- Objects
 - Static Objects
 - Dynamic Objects
- Affordances



Appropriate Appearance

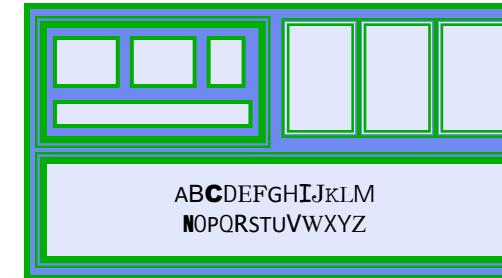
- Presenting information
- Aesthetics and Utility
- Localization and Internationalization



Screen Design and Layout

➤ Basic principles

- Grouping
- Structure
- Order
- Alignment
- Use of white space





Basic Principles

- **Ask**
 - what is the user doing?
- **Think**
 - what information, comparisons, order
- **Design**
 - form follows function



Available Tools

- **Grouping of items**
- **Order of items**
- **Decoration - fonts, boxes etc.**
- **Alignment of items**
- **White space between items**



Grouping and Structure

Logically together \Rightarrow Physically together

Billing details:

Name
Address: ...
Credit card no

Delivery details:

Name
Address: ...
Delivery time

Order details:

item	quantity	cost/item	cost
size 10 screws (boxes)	7	3.71	25.97
.....



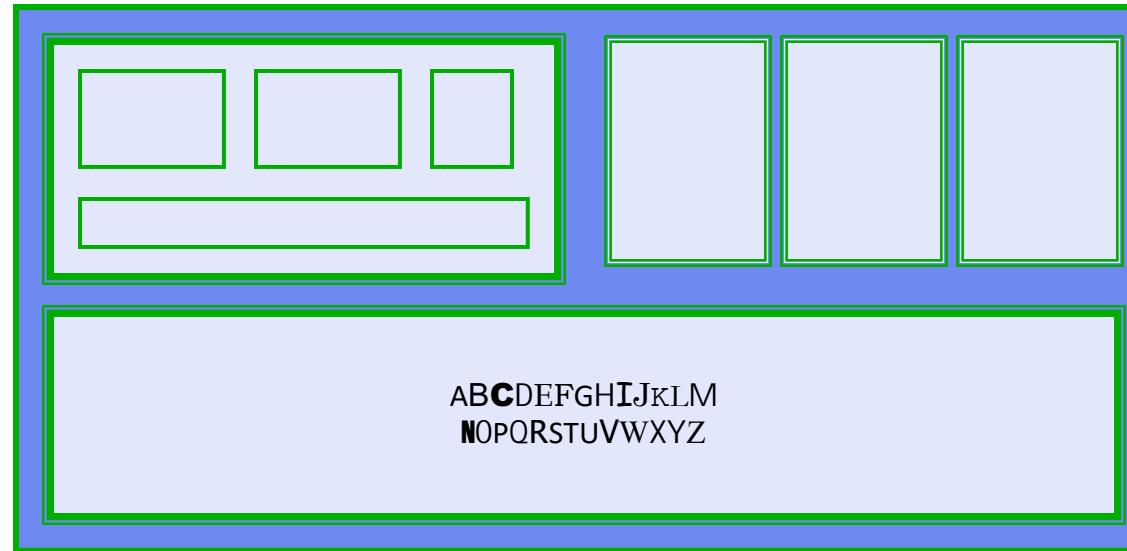
Order of Groups and Items

- **think! - what is natural order**
- **should match screen order!**
 - use boxes, space etc.
 - set up tabbing right!
- **instructions**
 - **beware the cake recipient syndrome!**
... mix milk and flour, add the fruit
after beating them



Decoration

- Use boxes to group logical items
- Use fonts for emphasis, headings
- but not too many!!





Alignment - Text

- you read from left to right (English and European)
⇒ align left hand side

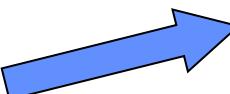
Willy Wonka and the Chocolate Factory
Winston Churchill - A Biography
Wizard of Oz
Xena - Warrior Princess

boring but
readable!



fine for special effects
but hard to scan

Willy Wonka and the Chocolate Factory
Winston Churchill - A Biography
Wizard of Oz
Xena - Warrior Princess





Alignment - Names

- Usually scanning for surnames

⇒ make it easy!

Alan Dix
Janet Finlay
Gregory Abowd
Russell Beale



Dix , Alan
Finlay, Janet
Abowd, Gregory
Beale, Russell



Alan Dix
Janet Finlay
Gregory Abowd
Russell Beale





Alignment - Numbers

think purpose!

which is biggest?

532.56
179.3
256.317
15
73.948
1035
3.142
497.6256



Alignment - Numbers

visually:

long number = big number

align decimal points

or right align integers

627.865
1.005763
382.583
2502.56
432.935
2.0175
652.87
56.34



Multiple Columns

- Scanning across gaps hard:
(often hard to avoid with large data base fields)

sherbert	75
toffee	120
chocolate	35
fruit gums	27
coconut dreams	85



Multiple Columns - 2

- Use Leaders

sherbert	75
toffee	120
chocolate	35
fruit gums	27
coconut dreams	85



Multiple Columns - 3

- or graying (vertical too)

sherbert	75
toffee	120
chocolate	35
fruit gums	27
coconut dreams	85



Multiple Columns

- Bad Alignment

sherbert	75
toffee	120
chocolate	35
fruit gums	27
coconut dreams	85



White space - the counter

WHAT YOU SEE



White space - the counter

WHAT YOU SEE

THE GAPS BETWEEN



Space to Separate





Space to Structure





Space to Highlight





User Action and Control

- Entering information
- Knowing what to do
- Affordances



Entering Information

- **Forms, dialogue boxes**
 - presentation + data input
 - similar layout issues
 - alignment - N.B. different label lengths
- **Logical layout**
 - use task analysis (ch15)
 - groupings
 - natural order for entering information
 - top-bottom, left-right (depending on culture)
 - set tab order for keyboard entry

Name: Alan Dix

Address: Lancaster



Name: Alan Dix

Address: Lancaster



knowing what to do

- **What is active what is passive**
 - where do you click
 - where do you type
- **Consistent style helps**
 - e.g. web underlined links
- **Labels and icons**
 - standards for common actions
 - language – bold = current state or action



Appropriate Appearance

Presenting Information

Aesthetics and Utility

Colour and 3D

Localisation & Internationalisation



Presenting Information

- **Purpose Matters**
 - sort order (which column, numeric alphabetic)
 - text vs. diagram
 - scatter graph vs. histogram
- **use paper presentation principles!**
- **but add interactivity**
 - softens design choices
 - e.g. re-ordering columns
 - ‘dancing histograms’ (chap 21)

name	size
chap10	12
chap5	16
chap1	17
chap14	22
chap20	27
chap8	32
...	...



Aesthetics and Utility

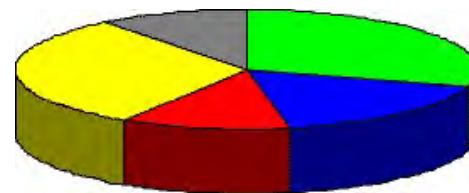
- Aesthetically pleasing designs
 - increase user satisfaction and improve productivity
- Beauty and utility may conflict
 - mixed up visual styles ⇒ easy to distinguish
 - clean design – little differentiation ⇒ confusing
 - backgrounds behind text
 - ... good to look at, but hard to read
- But can work together
 - e.g. the design of the counter
 - in consumer products – key differentiator (e.g. iMac)





Colour and 3D

- both often used very badly!
- colour
 - older monitors limited palette
 - colour over used because 'it is there'
 - beware colour blind!
 - use sparingly to reinforce other information
- 3D effects
 - good for physical information and some graphs
 - but if over used ...
 - e.g. text in perspective!! 3D pie charts





Bad use of Color

- **over use** - without very good reason (e.g. kids' site)
- **color blindness**
- **poor use of contrast**
- **do adjust**
 - adjust your set!
 - can you still read your screen?



Across Countries and Cultures

- Localisation & internationalisation
 - changing interfaces for particular cultures/languages
- Globalisation
 - try to choose symbols etc. that work everywhere
- Simply change language?
 - use 'resource' database instead of literal text
 - ... but changes sizes, left-right order etc.
- Deeper issues
 - cultural assumptions and values
 - meanings of symbols
 - e.g. tick and cross ... +ve and -ve in some cultures
 - ... but ... mean the same thing (mark this) in others





Summary



Following the basic rules in screen design and layout facilitate help to a better user interface and facilitate communication with other stake holders.



Thank You for your Participation

Welcome

Navigation

Abbas Moallem, Ph.D.

Among the great things which are to be found among us, the Being of Nothingness is the greatest

Leonardo Da Vinci



Four Golden Rules

- knowing where you are
- knowing what you can do
- knowing where you are going
 - or what will happen
- knowing where you've been
 - or what you've done



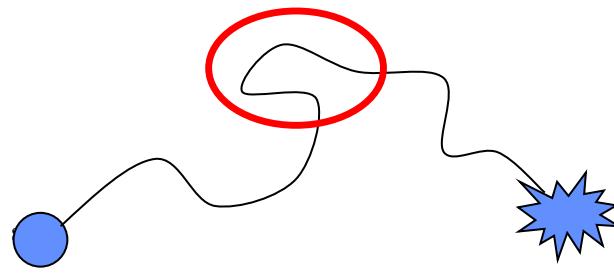


Global Structure-Hierarchy

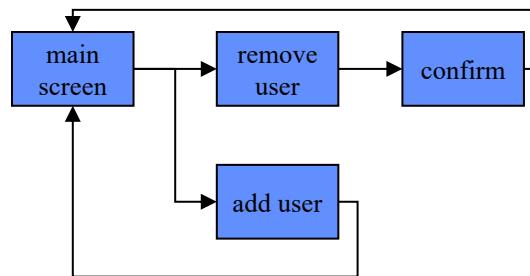
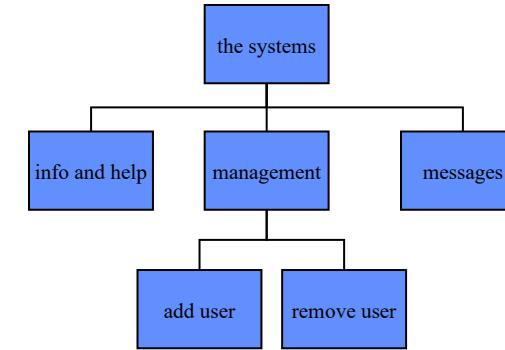
- Hierarchical Organization
- Depth and Breadth



Navigation Design



local structure – single screen
global structure – whole site





Levels

- **Widget choice**
 - menus, buttons etc.
- **Screen design**
- **Application navigation design**
- **Environment**
 - other apps, O/S



Structure

- **Within a screen**
 - later ...
- **Local**
 - looking from this screen out
- **Global**
 - structure of site, movement between screens
- **Wider still**
 - relationship with other applications

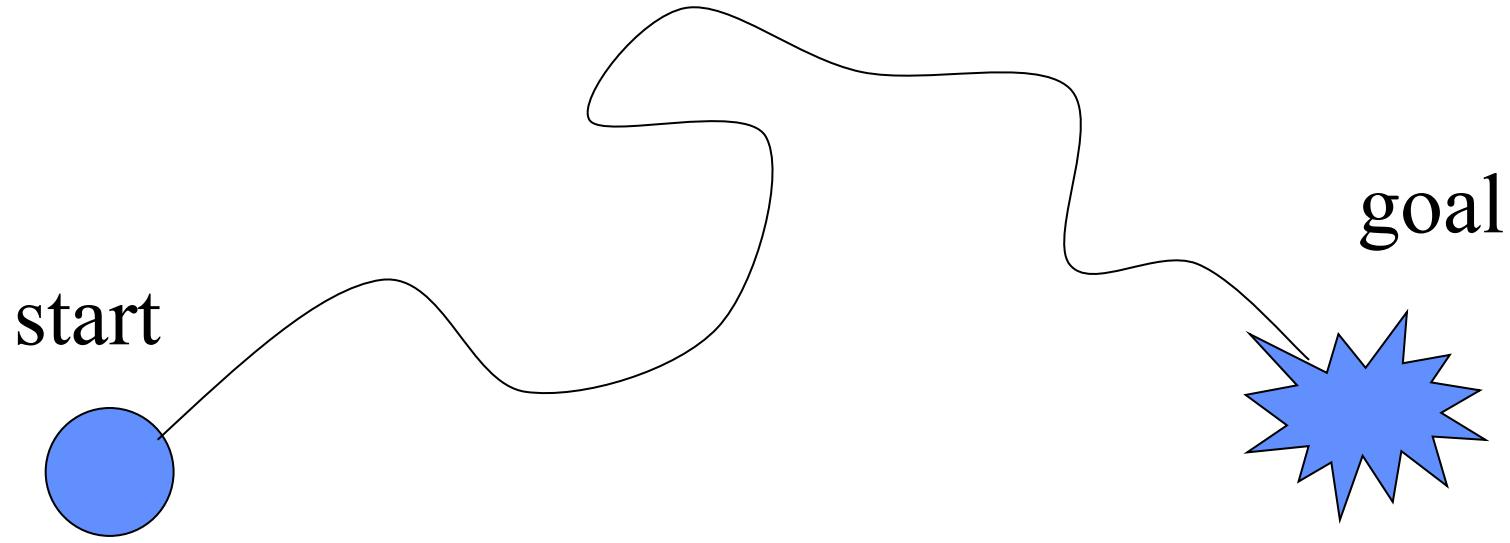


Goal Seeking





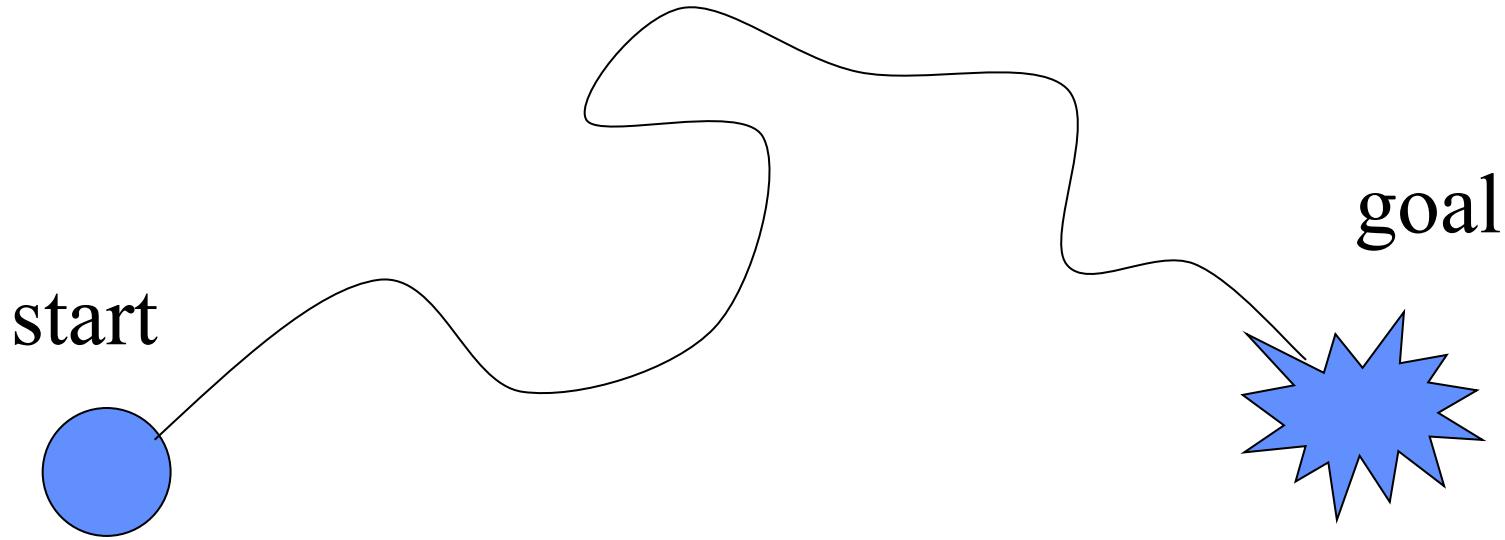
Goal Seeking



progress with local knowledge only ...



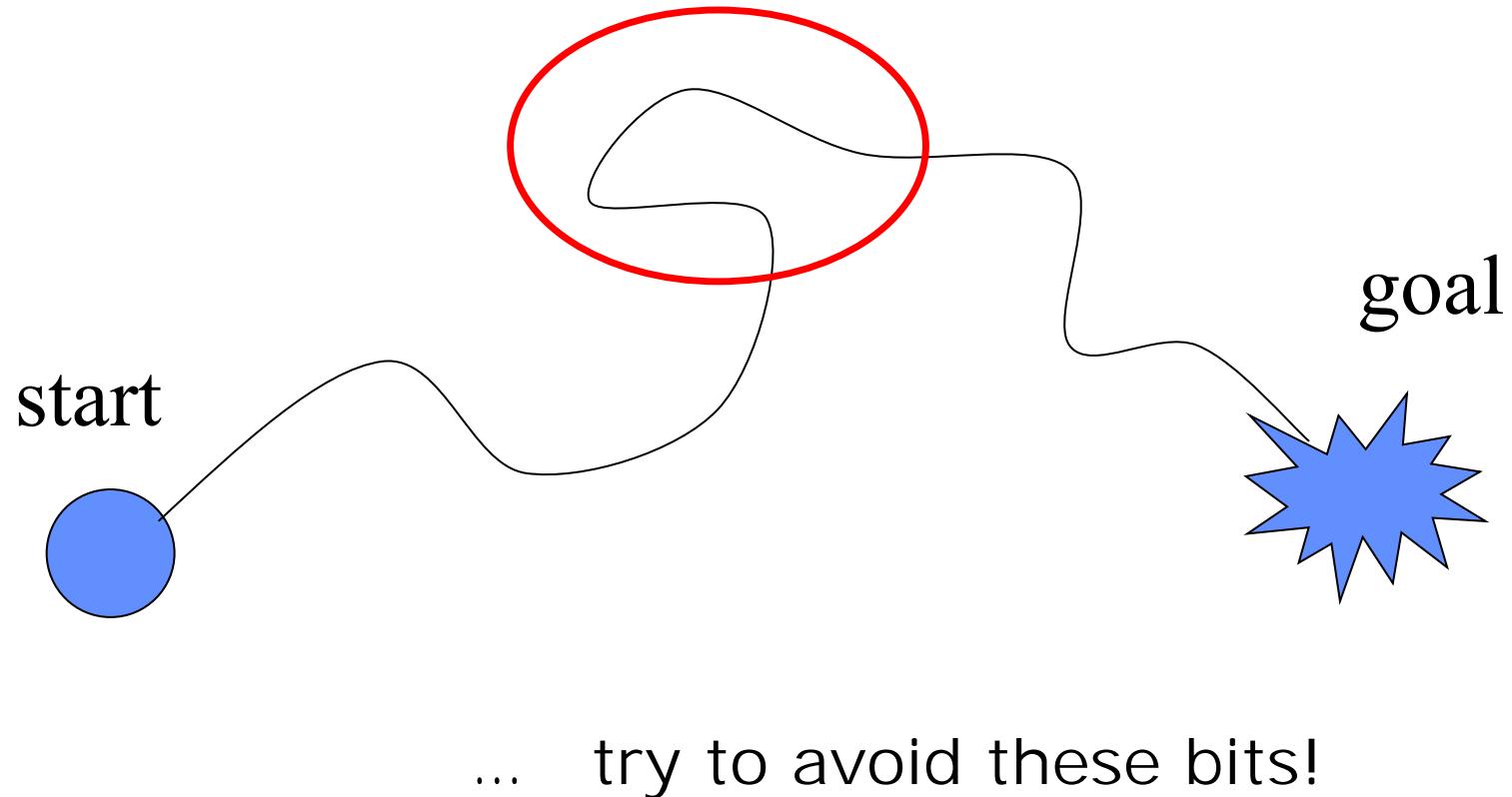
Goal Seeking



... but can get to the goal



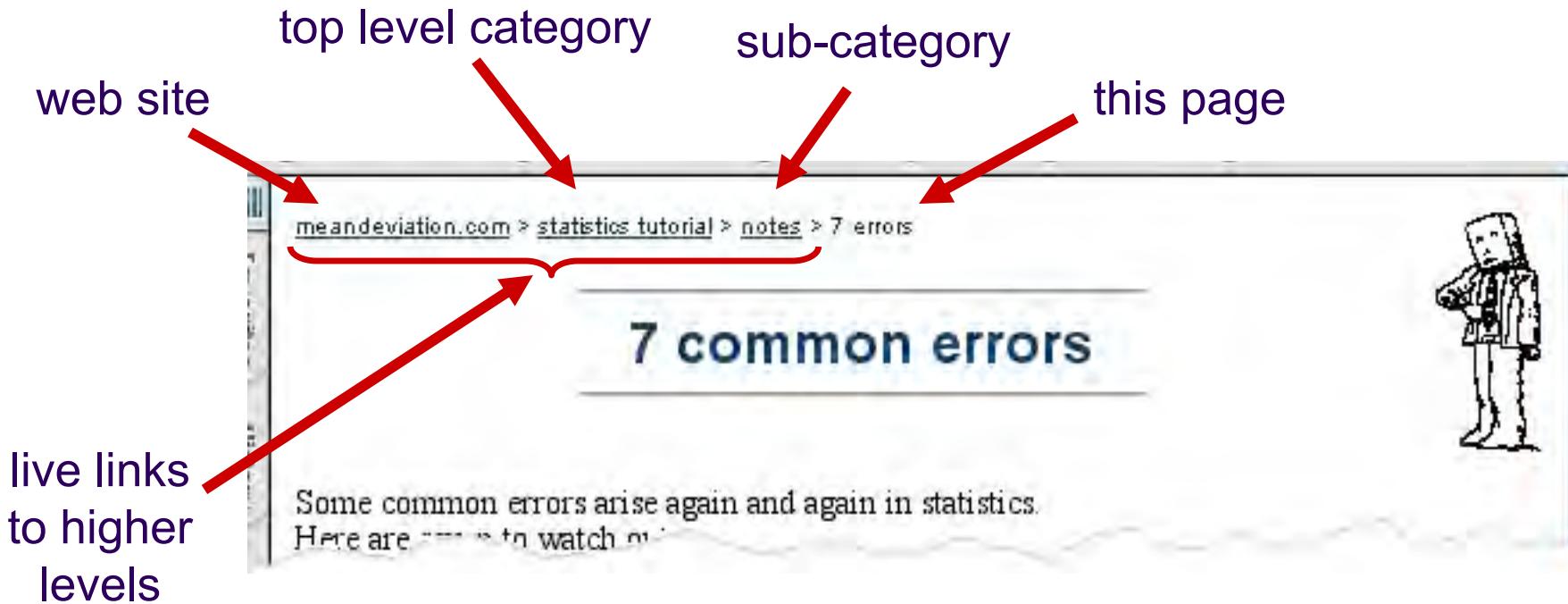
Goal Seeking





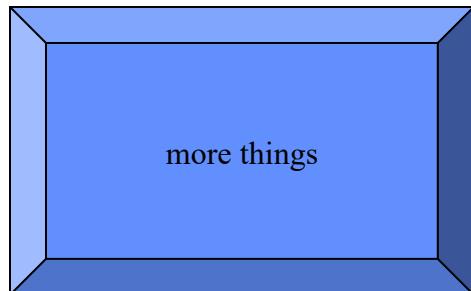
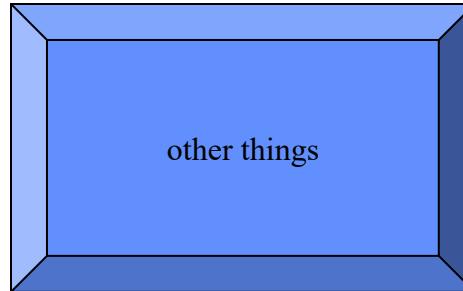
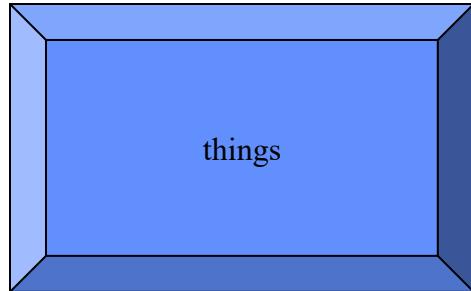
Where you are – breadcrumbs

shows path through web site hierarchy





Beware the big button trap



- **where do they go?**
 - lots of room for extra text!



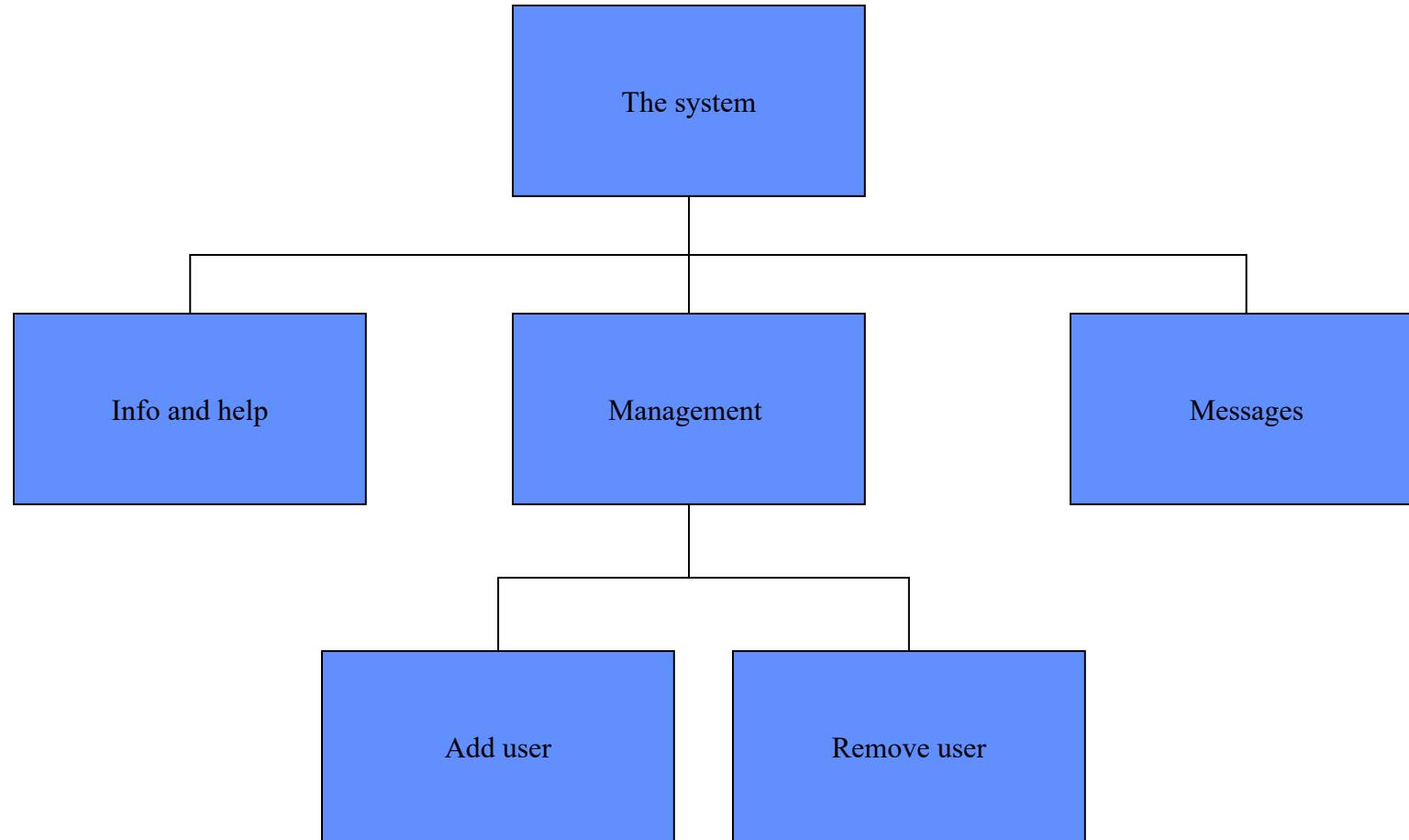
Modes

- **lock to prevent accidental use ...**
 - remove lock - 'c' + 'yes' to confirm
 - frequent practiced action
- **if lock forgotten**
 - in pocket 'yes' gets pressed
 - goes to phone book
 - in phone book ...
 - 'c' – delete entry
 - 'yes' – confirm
 - ... oops !





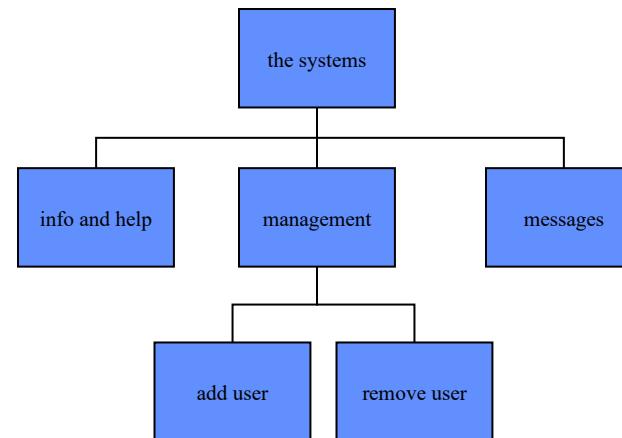
Hierarchical Diagrams





Hierarchical Diagrams ctd.

- **parts of application**
 - screens or groups of screens
- **typically functional separation**





Navigating Hierarchies

- Deep is difficult!
- Misuse of Miller's 7 ± 2
 - short term memory, not menu size
- Optimal?
 - many items on each screen
 - but structured within screen



Dialogue

what does it mean in UI design?

Minister: do you *name* take this woman ...

Man: I do

Minister: do you *name* take this man ...

Woman: I do

Minister: I now pronounce you man and wife



Think about Dialogue

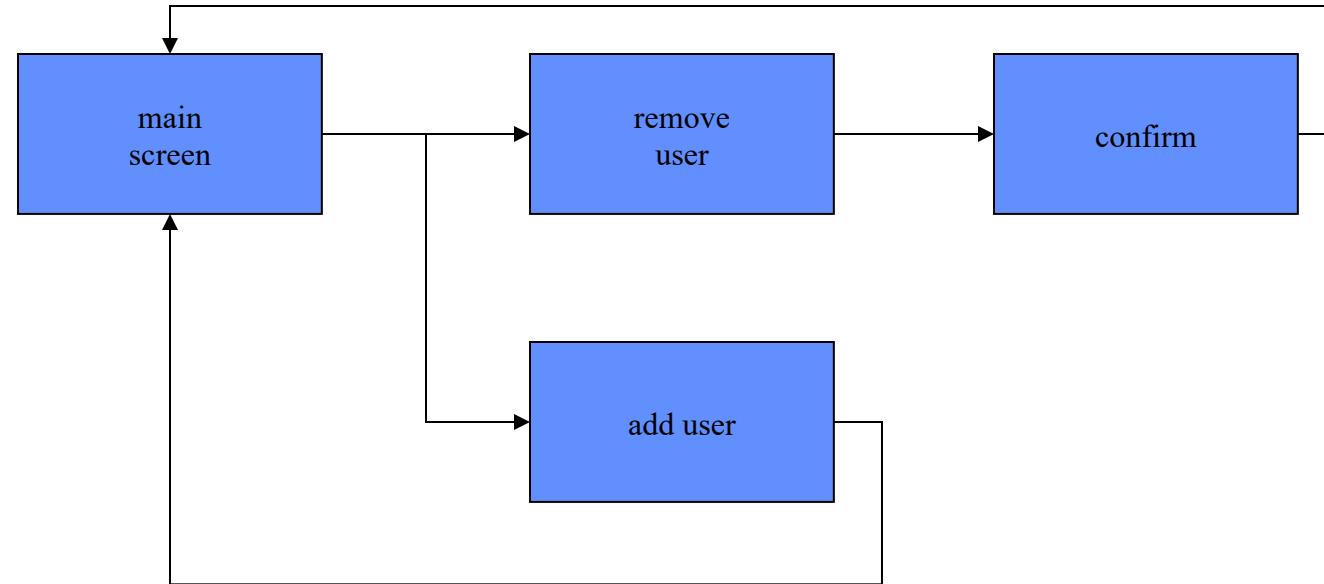
what does it mean in UI design?

Minister: do you *name* take this woman ...

- **marriage service**
 - general flow, generic – blanks for names
 - pattern of interaction between people
- **computer dialogue**
 - pattern of interaction between users and system
 - but details differ each time



Network Diagrams

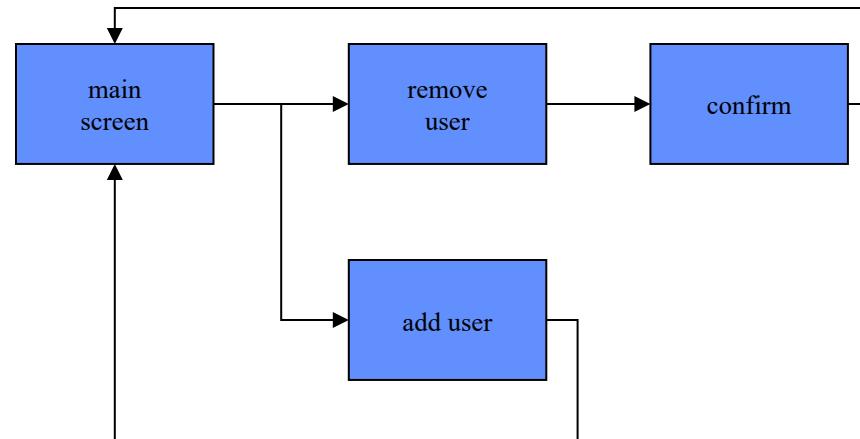


- **show different paths through system**



Network Diagrams ctd.

- **what leads to what**
- **what happens when**
- **including branches**
- **more task oriented than hierarchy**





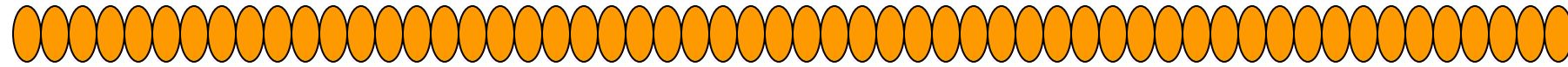
Wider still ...

- **Between applications and beyond ...**
 - **style issues:**
 - platform standards, consistency
 - **functional issues**
 - cut and paste
 - **navigation issues**
 - embedded applications
 - links to other apps ... the web

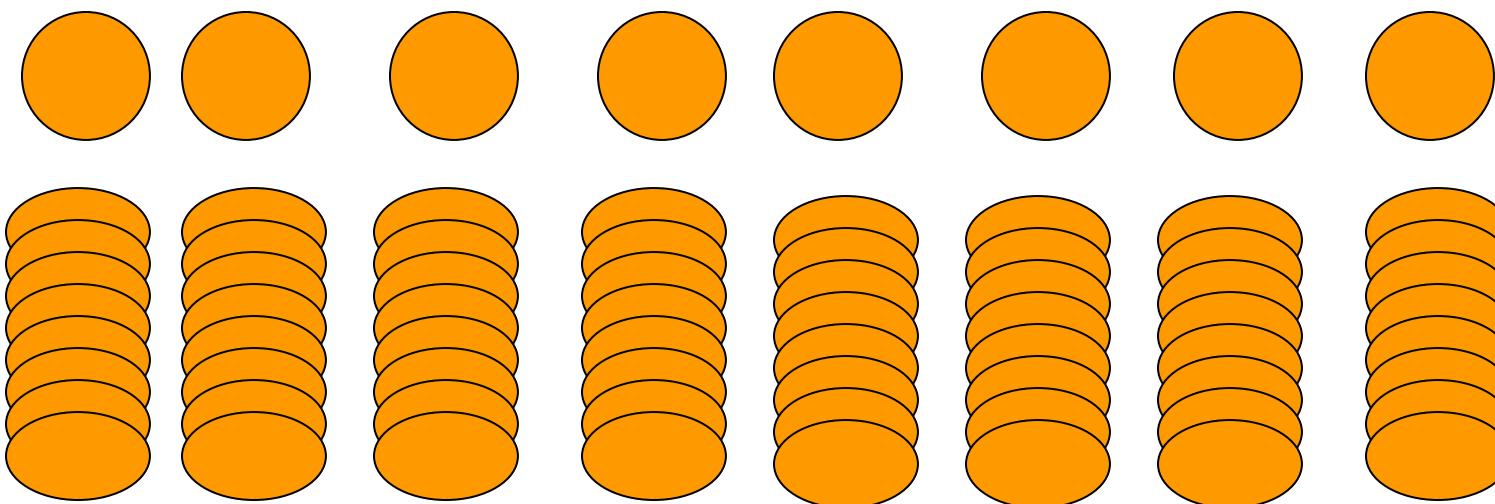


Depth

1



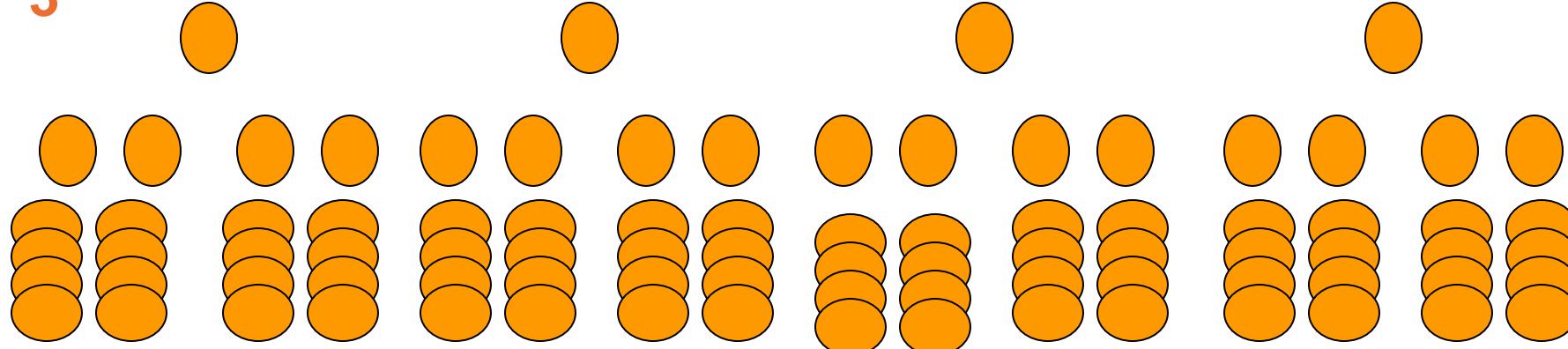
2



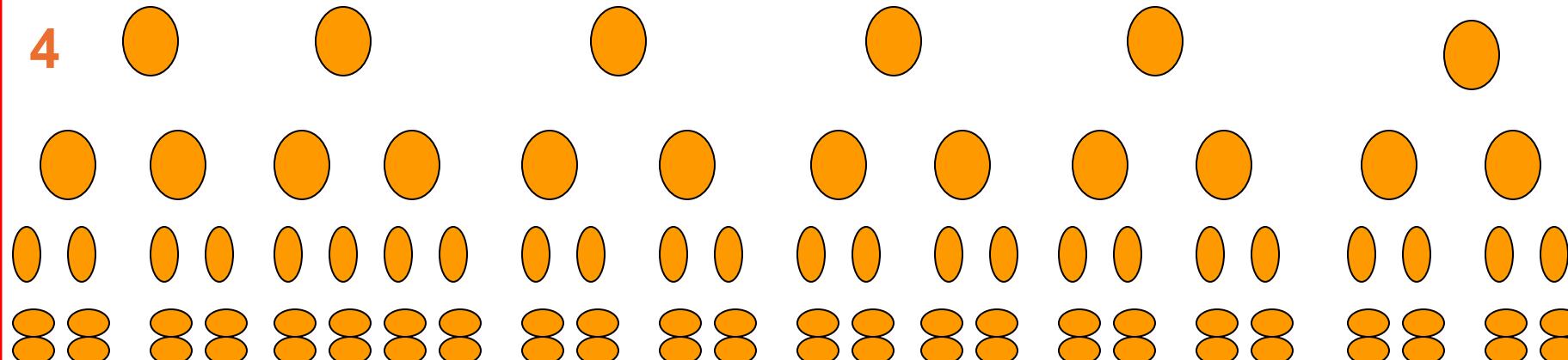


Depth

3



4





Depth

- Maximum Breadth (single layer for 64 options)
- Two hierarchical organizations (breadth constant across the levels of any given hierarchy- eight options).
- Three hierarchical organizations (breadth constant across the levels of any given hierarchy-four options).
- Four hierarchical organizations (breadth constant across the levels of any given hierarchy-Two options).

According Miller, 1981 and Lee and MacGregor' 1985



The web ...

- **Widget choice**
 - **Screen design**
 - **Navigation design**
 - **Environment**
-
- ▶ elements and tags
 - ``
 - ▶ page design
 - ▶ site structure
 - ▶ the web, browser, external links



Explore Depths

- **Explore interaction**
 - what happens when
- **Explore cognition**
 - what are the users thinking
- **Explore architecture**
 - what is happening inside



Depth and Breadth

- The performance is best at two Levels depts. at the intermediate levels of depts.
- Search time better.
- Error rate lower.
- Performance (both time and accuracy) decreases as depth increases, Menu structure with a lot id dept present significant navigational problems to users. (Kiger, 1984)
- If the user's goal is vague, then the two options might be better than eight because there is at list a 50-50 chance of the first selection being correct.
- On the other hand, if the target is explicit, then greater breadth might be advantageous because eight options at the top are likely to be more specific and less ambiguous than only two very general options. (McDonald et al, 1983)



Thank You For Your Participation



Welcome

Requirements

Abbas Moallem, Ph.D.

It is only with the heart that one can see rightly; what is essential is invisible to the eye. 

Antoine De Saint-Exupery

Overview

- **HCI in the Software Process**
- **User-centered and Software Process**
- **The Software Life Cycle**
- **Requirements**





What is a user-centered approach?

User-centered approach is based on:

- **Early focus on users and tasks:** directly studying cognitive, behavioral, anthropomorphic & attitudinal characteristics.
- **Empirical measurement:** users' reactions and performance to scenarios, manuals, simulations & prototypes are observed, recorded and analyzed.
- **Iterative design:** when problems are found in user testing, fix them and carry out more tests.

Software Lifecycle

- Software engineering is the discipline for understanding the software design process, or life cycle.
- Designing for usability occurs at all stages of the life cycle, not as a single isolated activity.



A simple interaction design lifecycle model

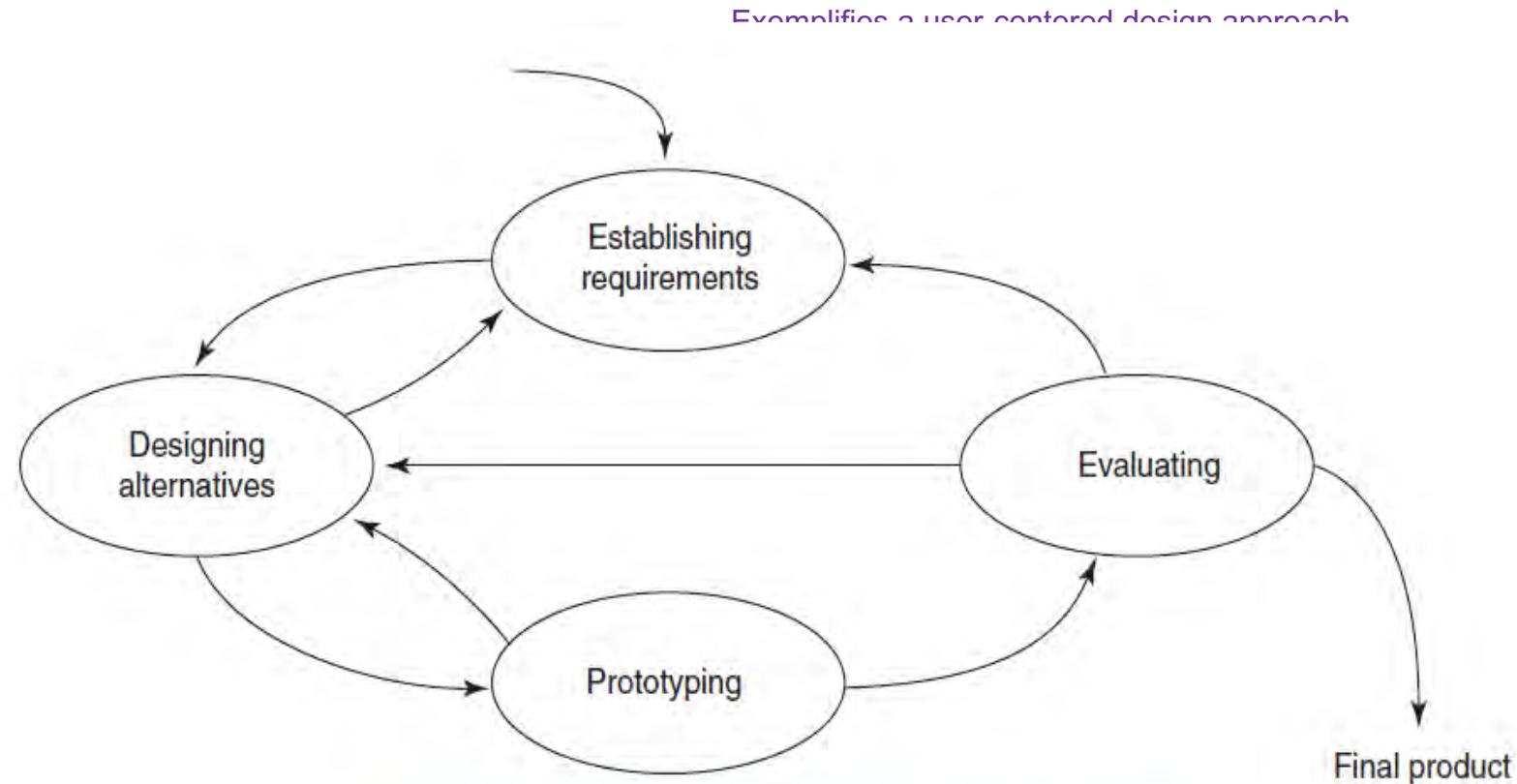
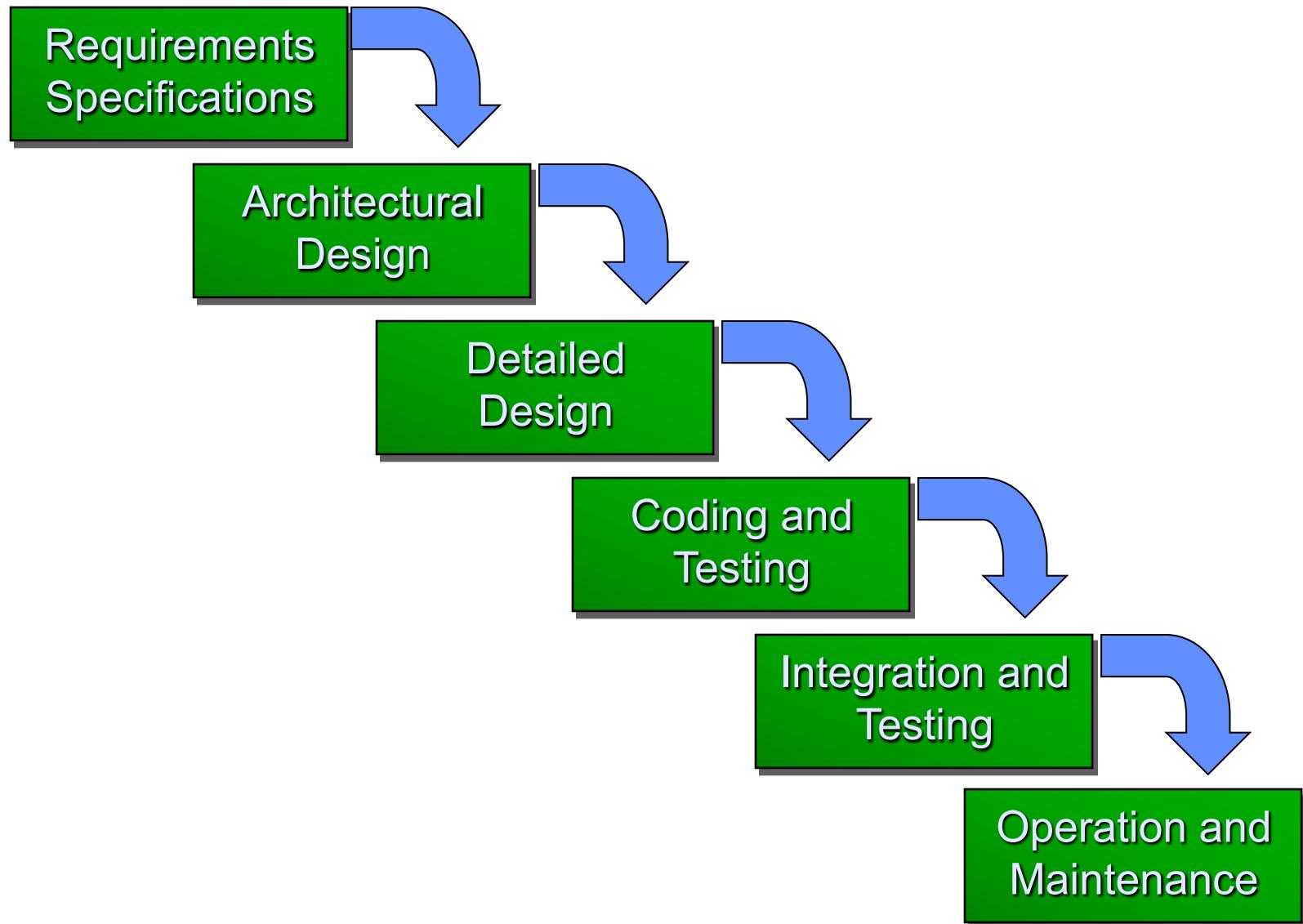


Figure 9.3 A simple interaction design lifecycle model

Software Life Cycle



Activities in the life cycle

Requirements Specification

designer and customer try capture what the system is expected to provide can be expressed in natural language or more precise languages, such as a task analysis would provide.

Architectural Design

high-level description of how the system will provide the services required factor system into major components of the system and how they are interrelated needs to satisfy both functional and non-functional requirements.

Detailed Design

refinement of architectural components and interrelations to identify modules to be implemented separately the refinement is governed by the non-functional requirements.





Who are the users/stakeholders?

- Not as obvious as you think:
 - those who interact directly with the product
 - those who manage direct users
 - those who receive output from the product
 - those who make the purchasing decision
 - those who use competitor's products
- Three categories of user (Eason, 1987):
 - primary: frequent hands-on
 - secondary: occasional or via someone else
 - tertiary: affected by its introduction, or will influence its purchase

Who are the stakeholders?

- Suppliers
- Local shop owners

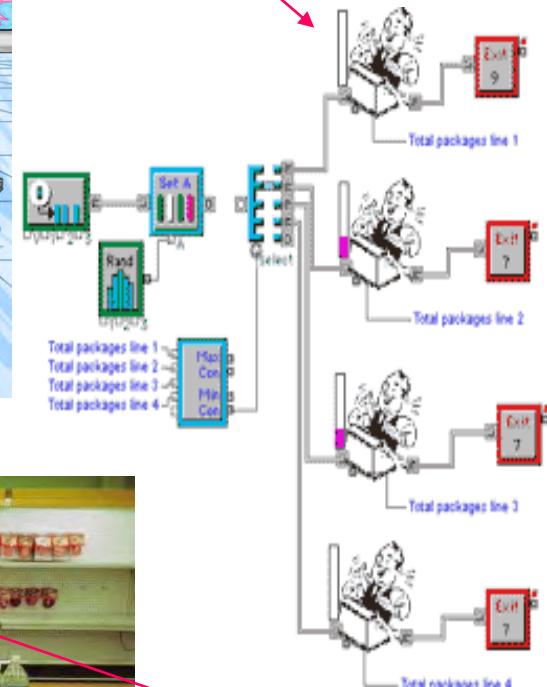


Managers and owners



Customers

Check-out operators



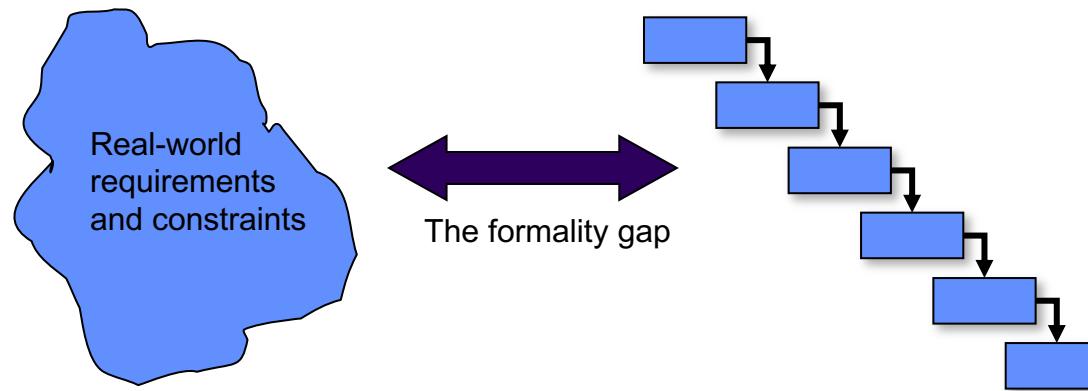


What do we mean by ‘needs’?

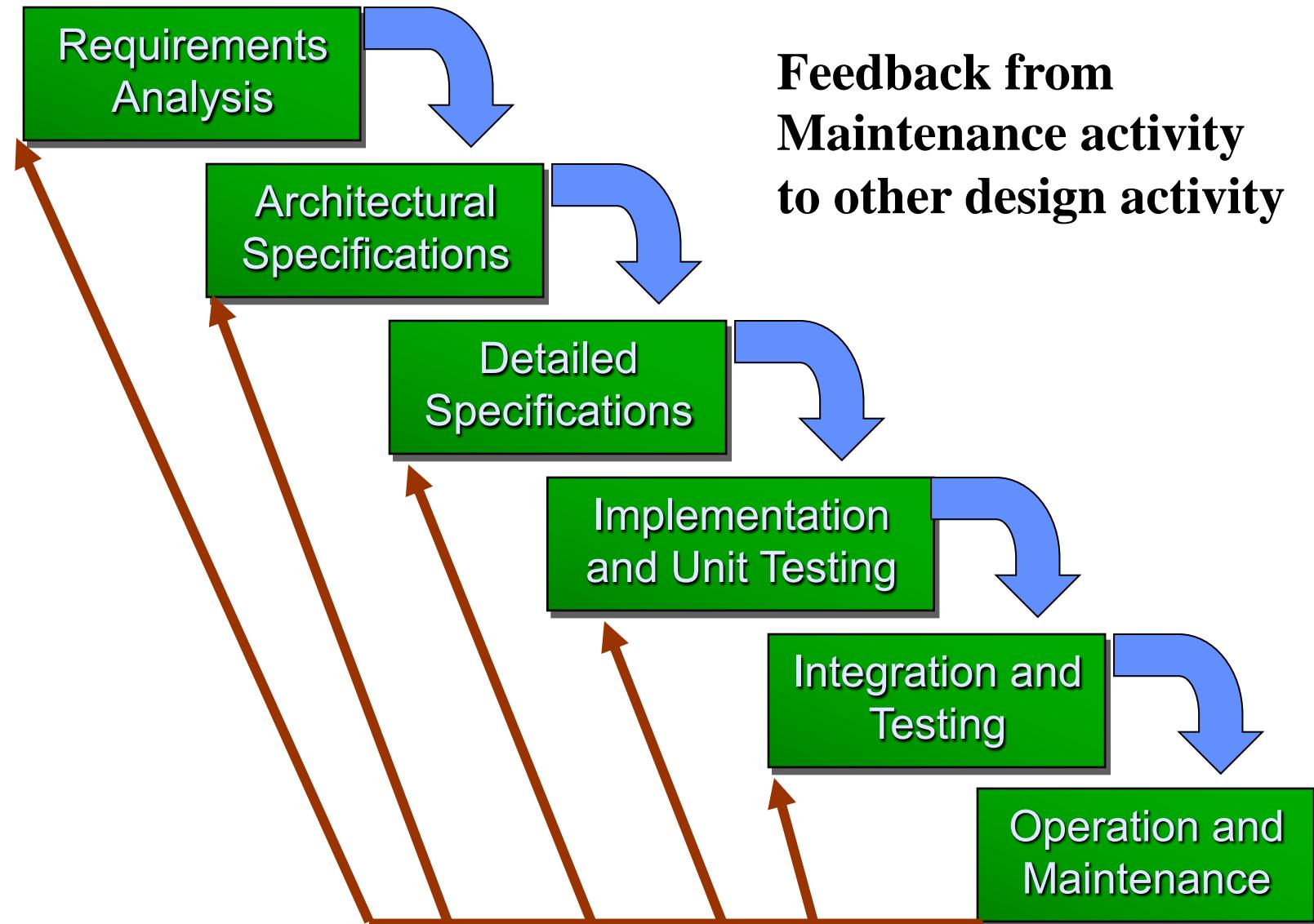
- **Users rarely know what is possible**
- **Users can't tell you what they ‘need’ to help them achieve their goals**
- **Instead, look at existing tasks:**
 - **their context**
 - **what information do they require?**
 - **who collaborates to achieve the task?**
 - **why is the task achieved the way it is?**
- **Envisioned tasks:**
 - **can be rooted in existing behaviour**
 - **can be described as future scenarios**

Verification and Validation

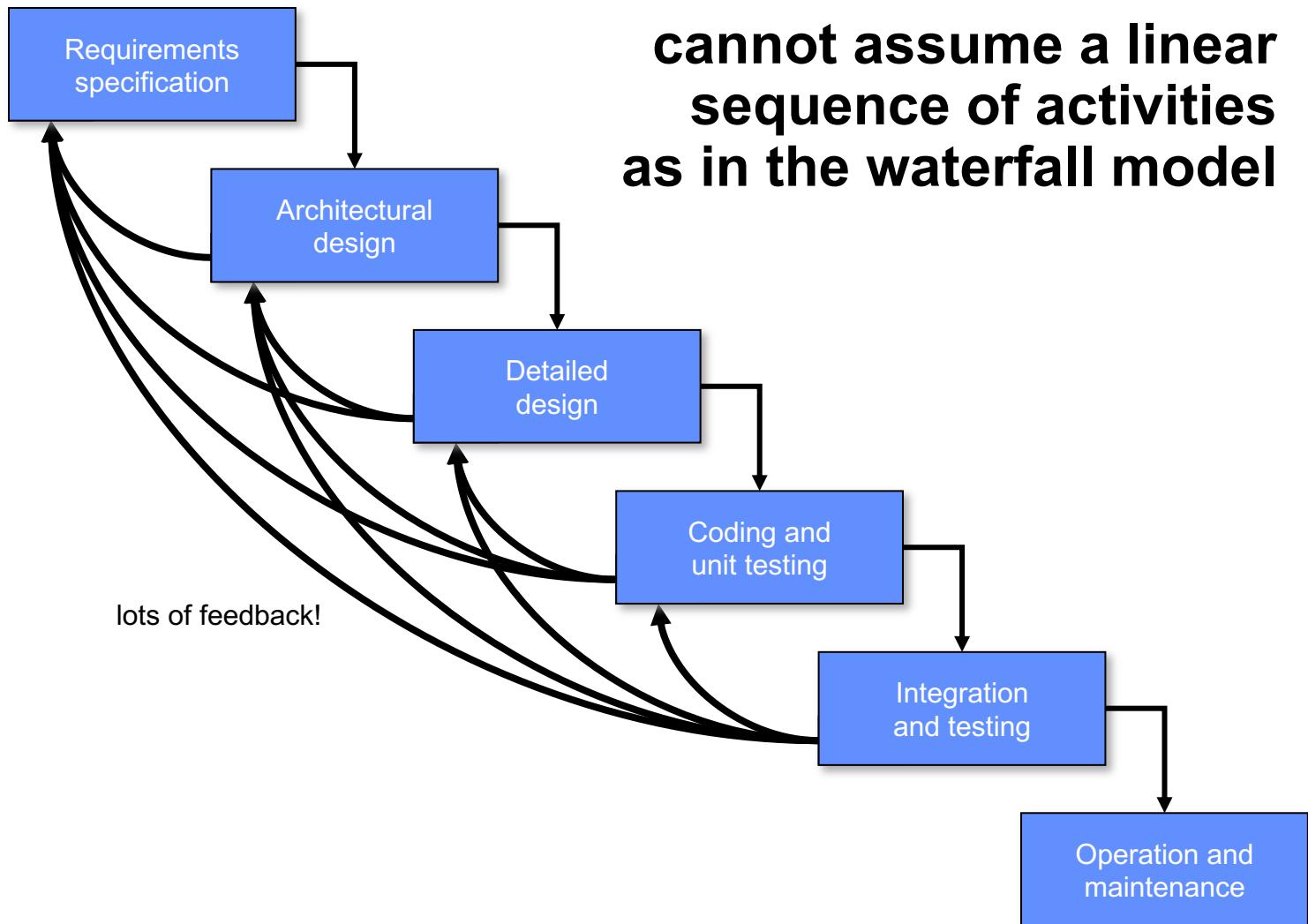
- Verification
- Designing the product right
- Validation
- Designing the right product
 - The formality gap
 - Validation will always rely to some extent on subjective means of proof.
 - Management and contractual issues.
 - design in commercial and legal contexts.



Validation and Verification



Life Cycle for Interactive Systems



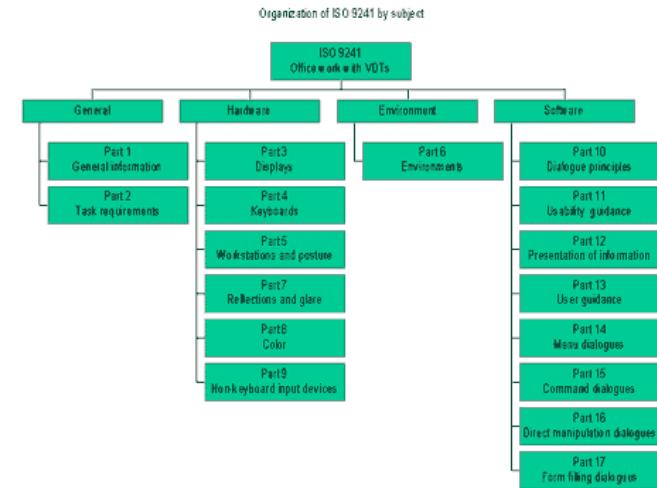


Usability Engineering

- The ultimate test of usability based on measurement of user experience.
- Usability engineering demands that specific usability measures be made explicit as requirements.
 - Usability specification
 - Usability attribute/principle
 - Measuring concept
 - Measuring method
 - Now level/ worst case/ planned level/ best case
- Problems
 - usability specification requires level of detail that may not be possible early in design.

ISO Usability Standard 9241

- **Adopts Traditional Usability Categories:**
- **Effectiveness**
 - Can you achieve what you want to?
- **Efficiency**
 - Can you do it without wasting effort?
- **Satisfaction**
 - Do you enjoy the process?





Some Metrics from ISO 9241

Usability objective	Effectiveness measures	Efficiency measures	Satisfaction measures
Suitability for the task	Percentage of goals achieved	Time to complete a task	Rating scale for satisfaction
Appropriate for trained users with	Number of power features used	Relative efficiency compared with an expert user	Rating scale for satisfaction power features
Learnability	Percentage of functions learned	Time to learn criterion	Rating scale for ease of learning
Error tolerance	Percentage of errors corrected successfully	Time spent on correcting errors	Rating scale for error handling



Summary

The software engineering life cycle

- distinct activities and the consequences for interactive system design.

Usability engineering

- making usability measurements explicit as requirements.

Iterative design and prototyping

- limited functionality simulations and animations.

Design rationale

- recording design knowledge
- process vs. structure



How the customer explained it



How the Project Leader understood it



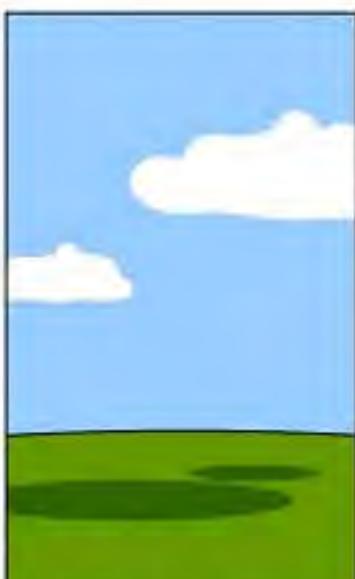
How the Analyst designed it



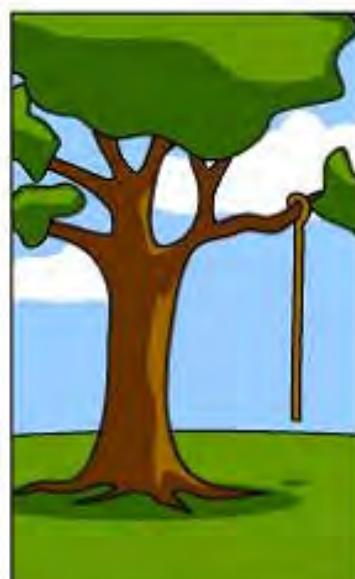
How the Programmer wrote it



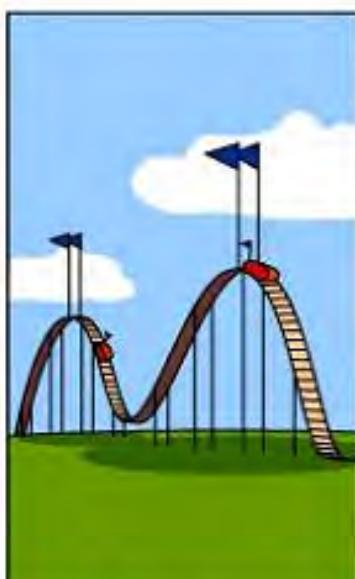
How the Business Consultant described it



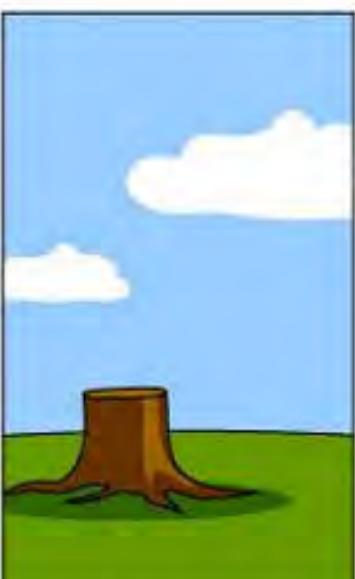
How the project was documented



What operations installed



How the customer was billed



How it was supported



What the customer really needed

Thanks for Your Participation



Welcome

HCI in Software Process: Waterfall, Agile and Google Design Sprint

Abbas Moallem, Ph.D.



It is only with the heart that one can see rightly; what is essential is invisible to the eye.

Antoine De Saint-Exupery

Overview

- **HCI in the Software Process**
- **Waterfall Development**
- **Agile Development**
- **Google Design Sprint**



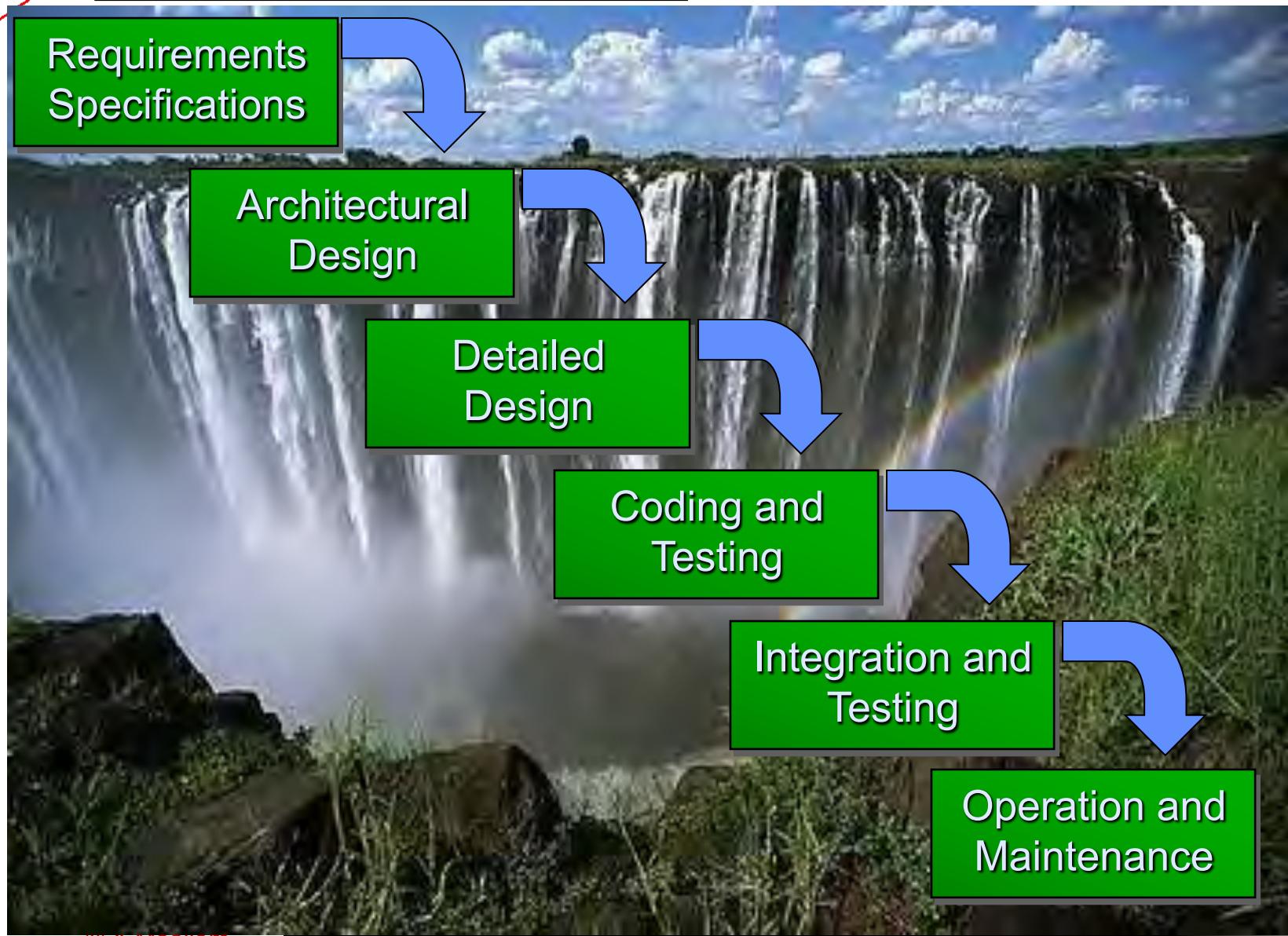


Software Development Methodology

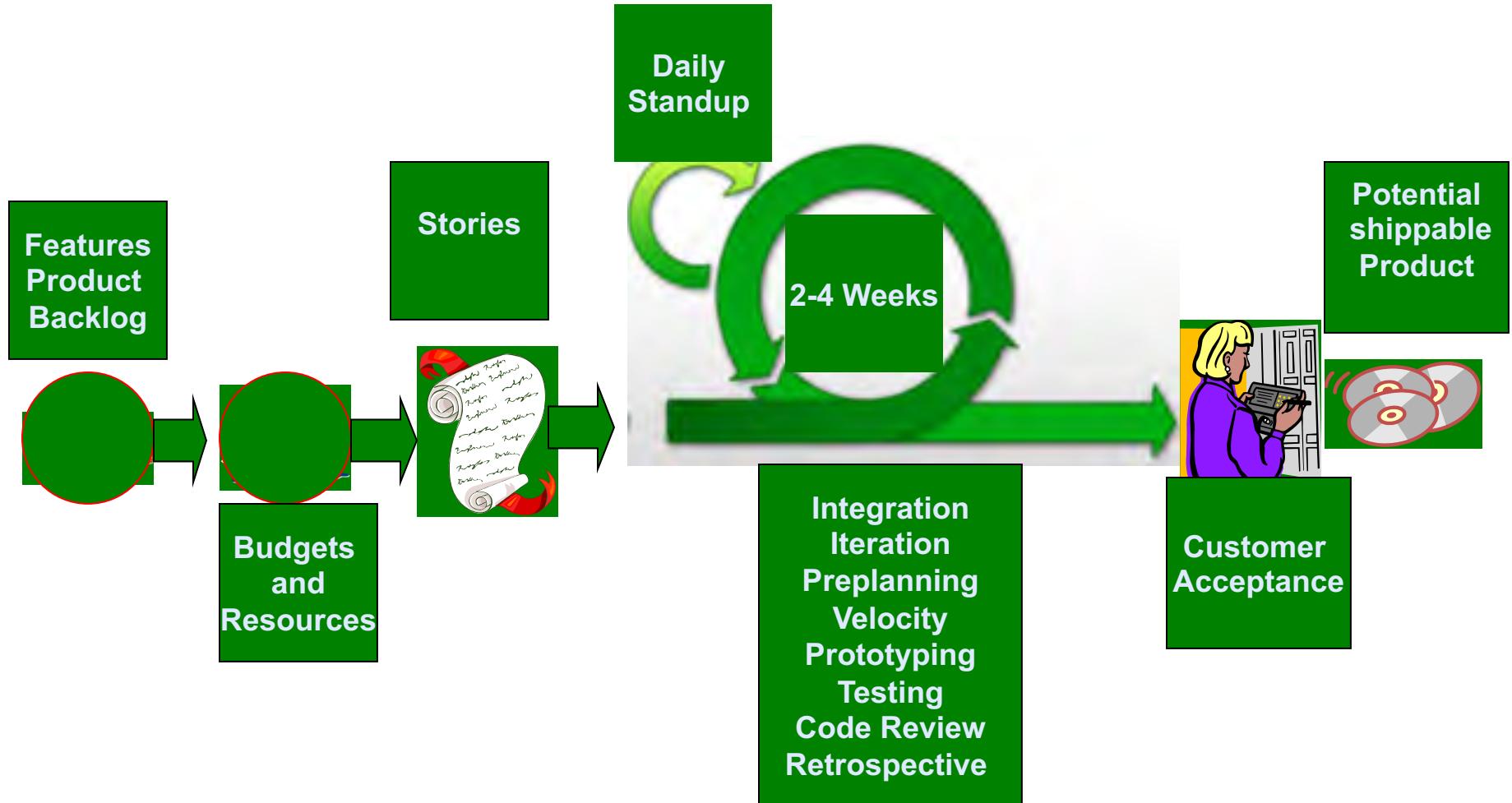
Waterfall

- The waterfall model is a sequential software development model in which development is seen as flowing steadily downwards through the phases of requirements analysis, design, implementation, testing (validation), integration, and maintenance.

Waterfall Development



Agile Development



Agile Software Development

- **Implementation of each feature set or “story” one by one.**
- **Organization of the development teams into “scrums”.**
 - Iterative, incremental practices and dividing development into more or less thirty day iterations each called “sprints”.
- **Close monitoring and control through daily scrum meetings or “stand up meetings”.**
- **Validating the results with the acceptance criteria and “Demoed” to all groups.**



Software for Agile Development



Jira Software



Agile
Management



User-centered Design In Agile Method

- How and when is user feedback and requirement collected?
- When should user studies be conducted?
- At what stage and how should the general architecture be decided?
- When and how is the detailed design created?
- When and how deep should usability evaluation be conducted?
- How would the limited resources of the UE team be used to cover all needs?



User and Usability Evaluations

- Agile does not leave enough time to thoroughly evaluate the design with user evaluation.
- Usability testing requires time to plan, prepare, and conduct.
- In a short design life cycle it is hard to conduct user evaluations for all features independently and out of context.



Advantage and Disadvantage

- Bring users new features incrementally without waiting a long time to get another big release.
- User-centered design is not implemented as part of the product design
- Does not necessarily improve usability. A user-centered design, adapted to the needs of the users, is the key to success and better user experience.





Requirement Gathering And User Research

- Requirement gathering and user studies, even in the smallest projects, require some time.
- It is unrealistic to define that in an Agile environment all phases of design can be implemented in one sprint or a three to four week cycle.
- Some experience suggests planning user studies in a separate cycle.
- In-depth study are very difficult to conduct due to a lack of time and resources.
- Only quick on-line survey by company employees. Or quick study are possible.



Global Architecture Versus Feature Design

- it is easy to understand the notion of minimum critical specification or smallest set of requirements and how features are going to be incrementally added to an existing product, based on the customer needs.
- However, it is harder to define how and when the general architecture of the product should be redefined based on usability criteria.
- This applies both in redesigning an existing product and designing a new product.

Google Design Sprint

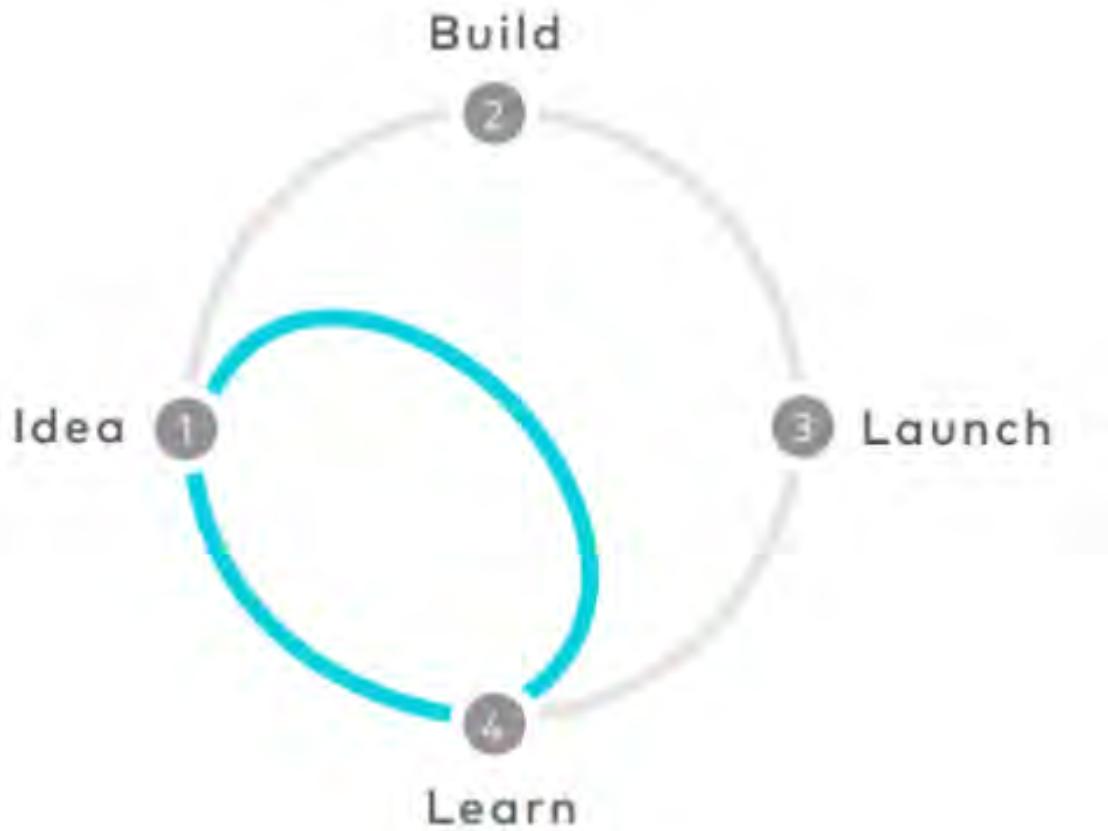


Photo by [Google Design Sprint](#)

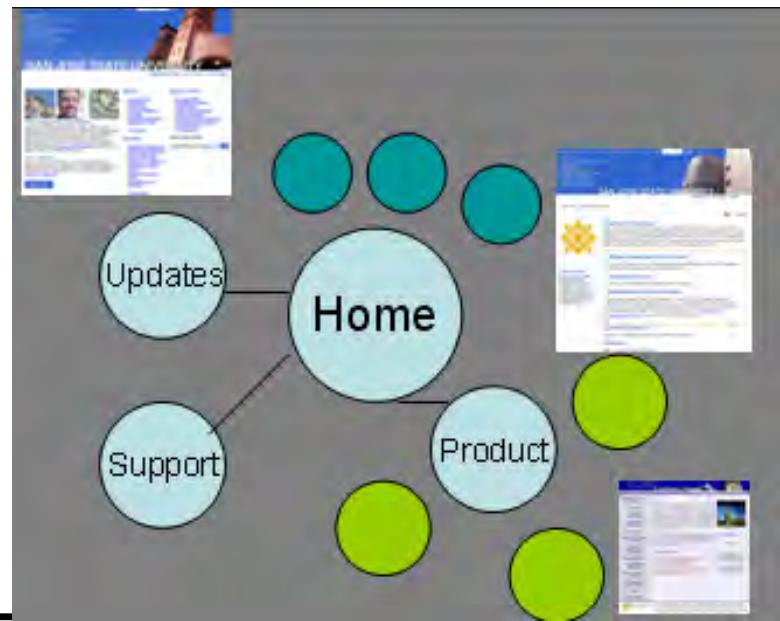
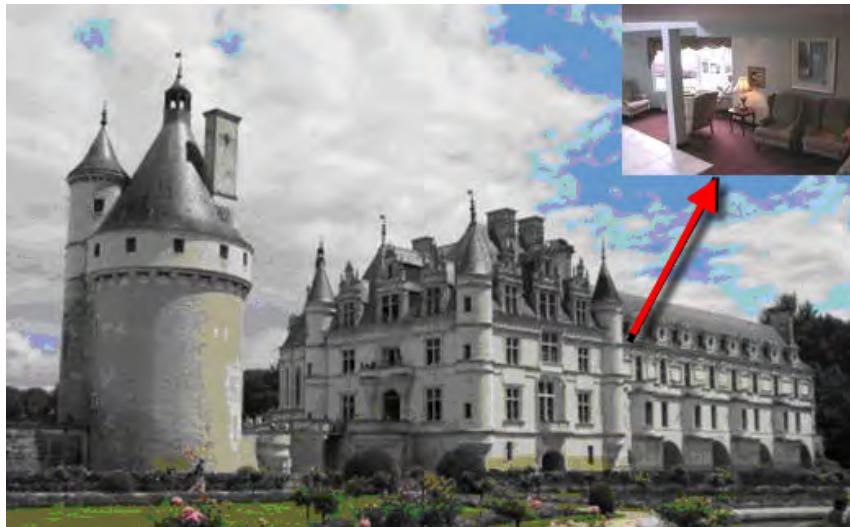


Design Sprint Steps

Set the Stage

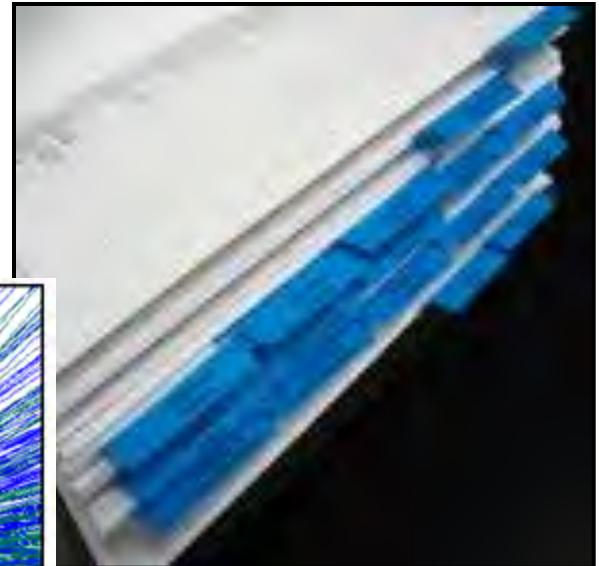
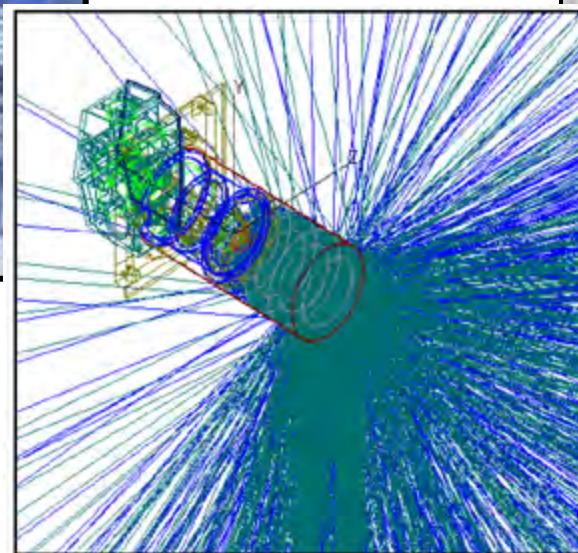
- 1. Monday: Map**
- 2. Tuesday: Sketch**
- 3. Wednesday: Decide**
- 4. Thursday: Prototype**
- 5. Friday: Test**

Global Architecture Versus Feature Design



Design

- Conceptual Design
- Interactive Prototyping and Evaluation
- UI Specification and Implementation





Summary

The software engineering life cycle

- distinct activities and the consequences for interactive system design.

Usability engineering

- making usability measurements explicit as requirements.

Iterative design and prototyping

- limited functionality simulations and animations.

Design rationale

- recording design knowledge
- process vs. structure



Summary

Four basic activities in the design process

- 1. Establishing requirements**
- 2. Designing alternatives**
- 3. Prototyping**
- 4. Evaluating**

User-centered design rests on three principles

- 1. Early focus on users and tasks**
- 2. Empirical measurement using quantifiable & measurable usability criteria**
- 3. Iterative design**



Thanks for Your Participation
...see you next week...

Welcome

Design Thinking

Abbas Moallem, Ph.D.

It is only with the heart that one can see rightly; what is essential is invisible to the eye.

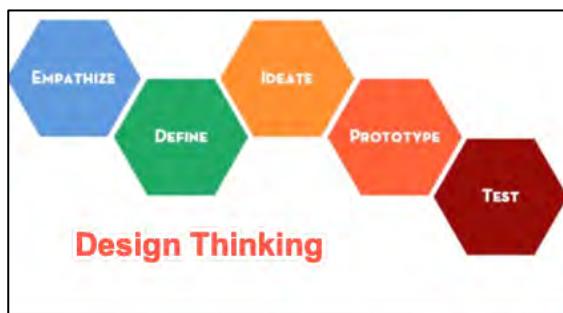
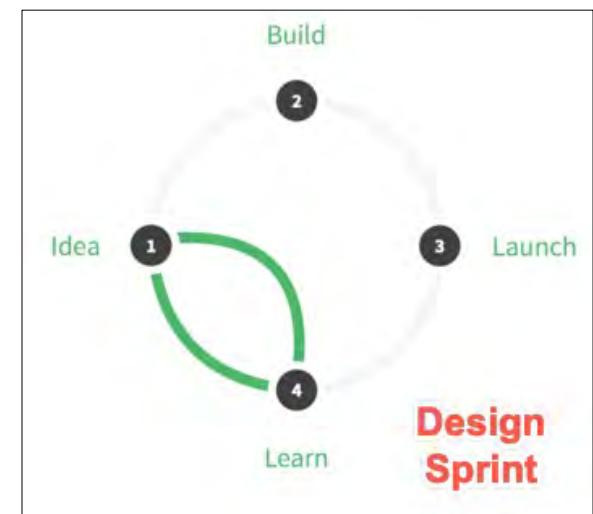
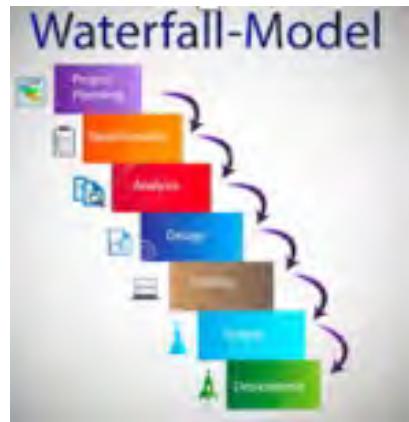
Antoine De Saint-Exupery

Overview

- **What is Design thinking**
- **5 Stages in the Design Thinking Process**
 - Empathize
 - Define
 - Ideate
 - Prototype
 - Test



Introduction



Design Thinking

Design thinking is a process for creative problem solving. Design thinking has a human-centered core.

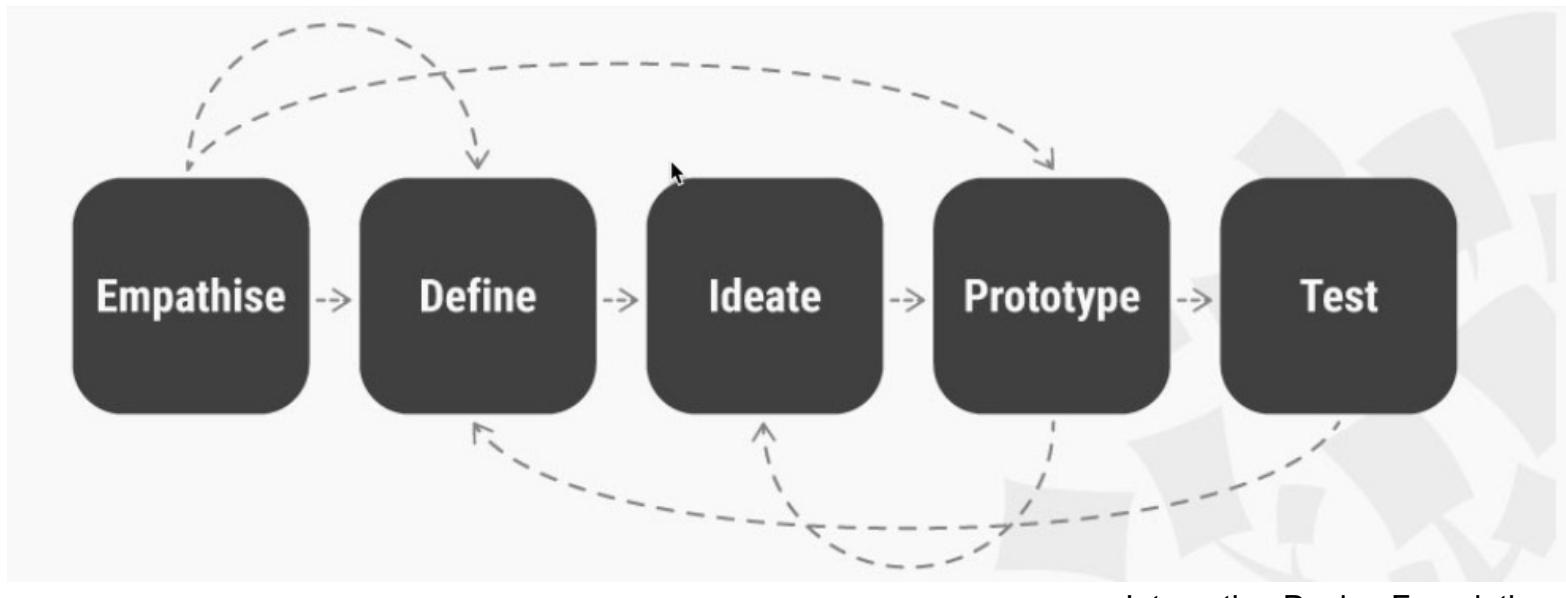
It encourages organizations to focus on the people they're creating for, which leads to better products, services, and internal processes.



"IDEO"

<https://www.ideo.com/blogs/inspiration/what-is-design-thinking>

5 Stages in the Design Thinking Process



<https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process>

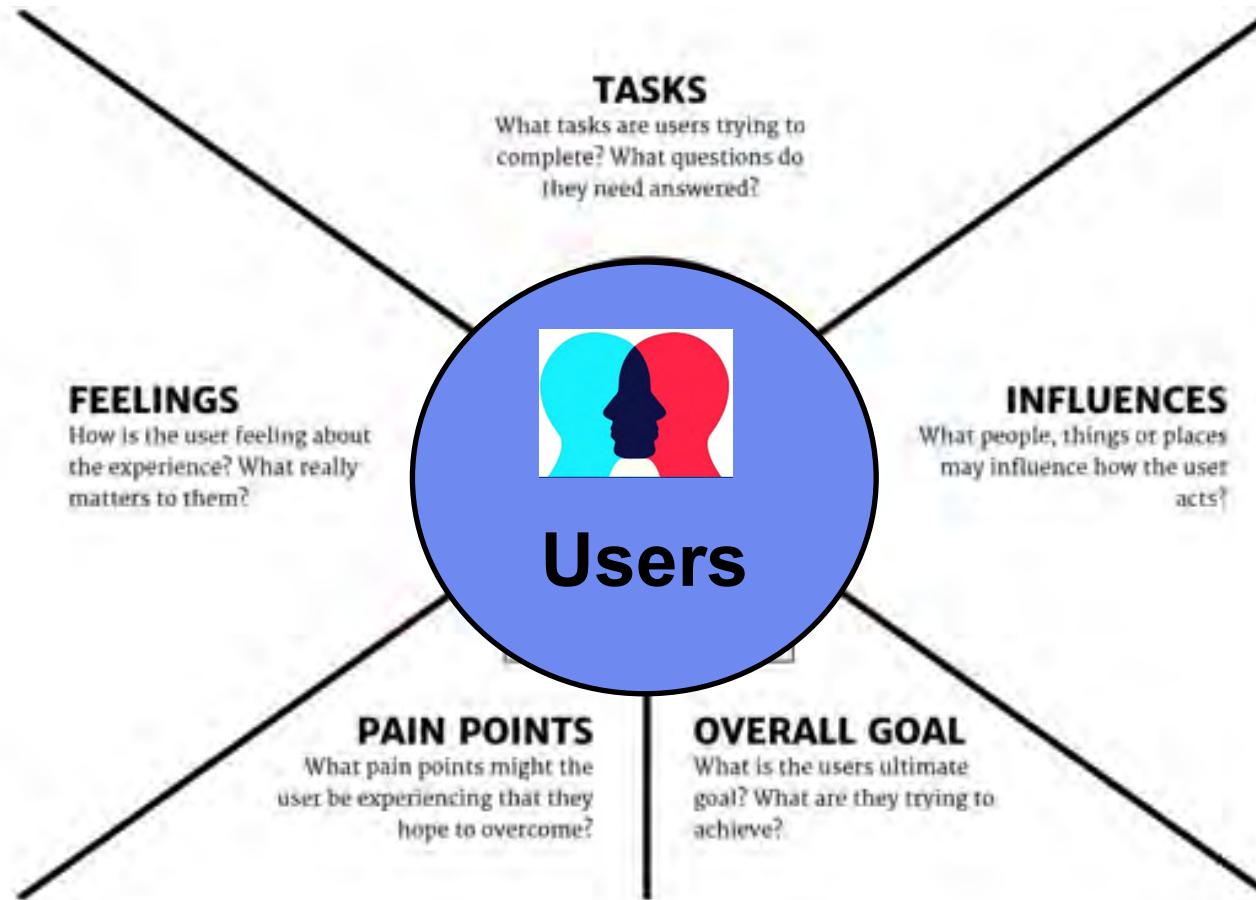


Step 1-Empathize

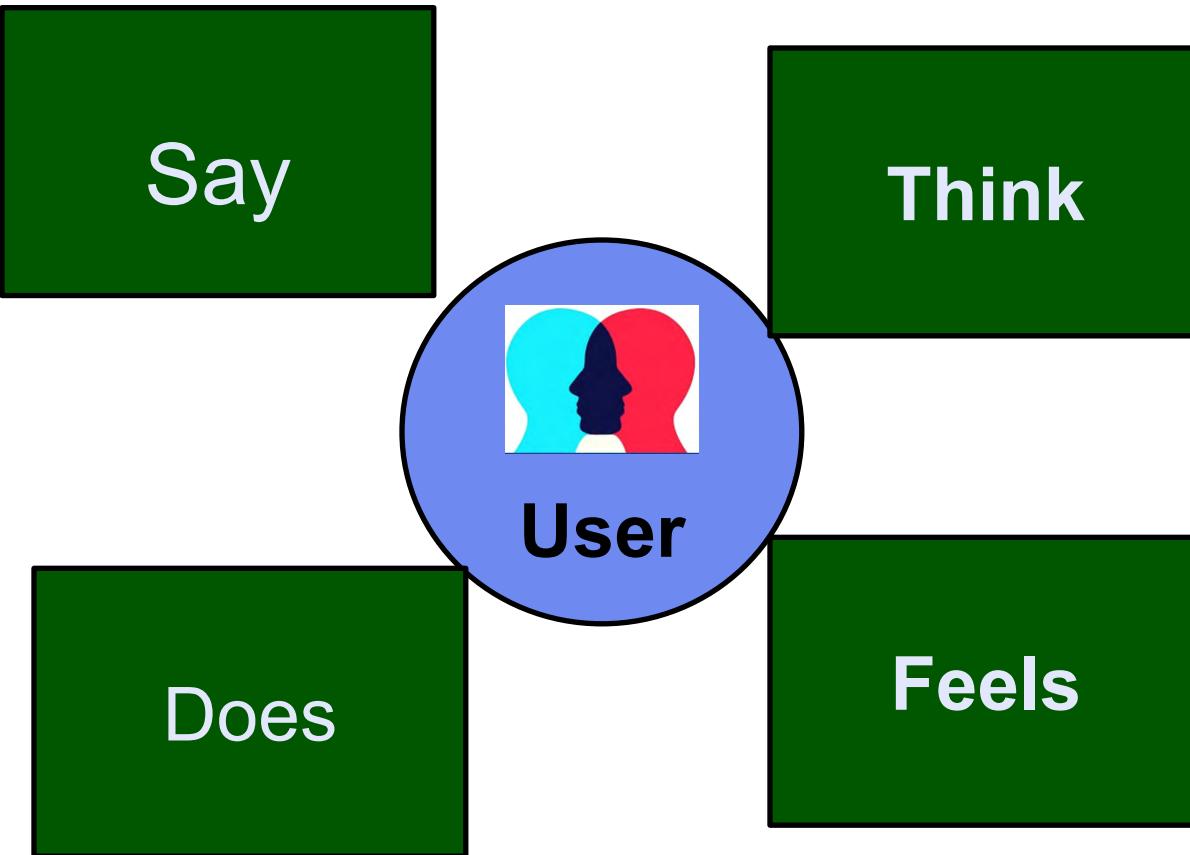
Understand Users



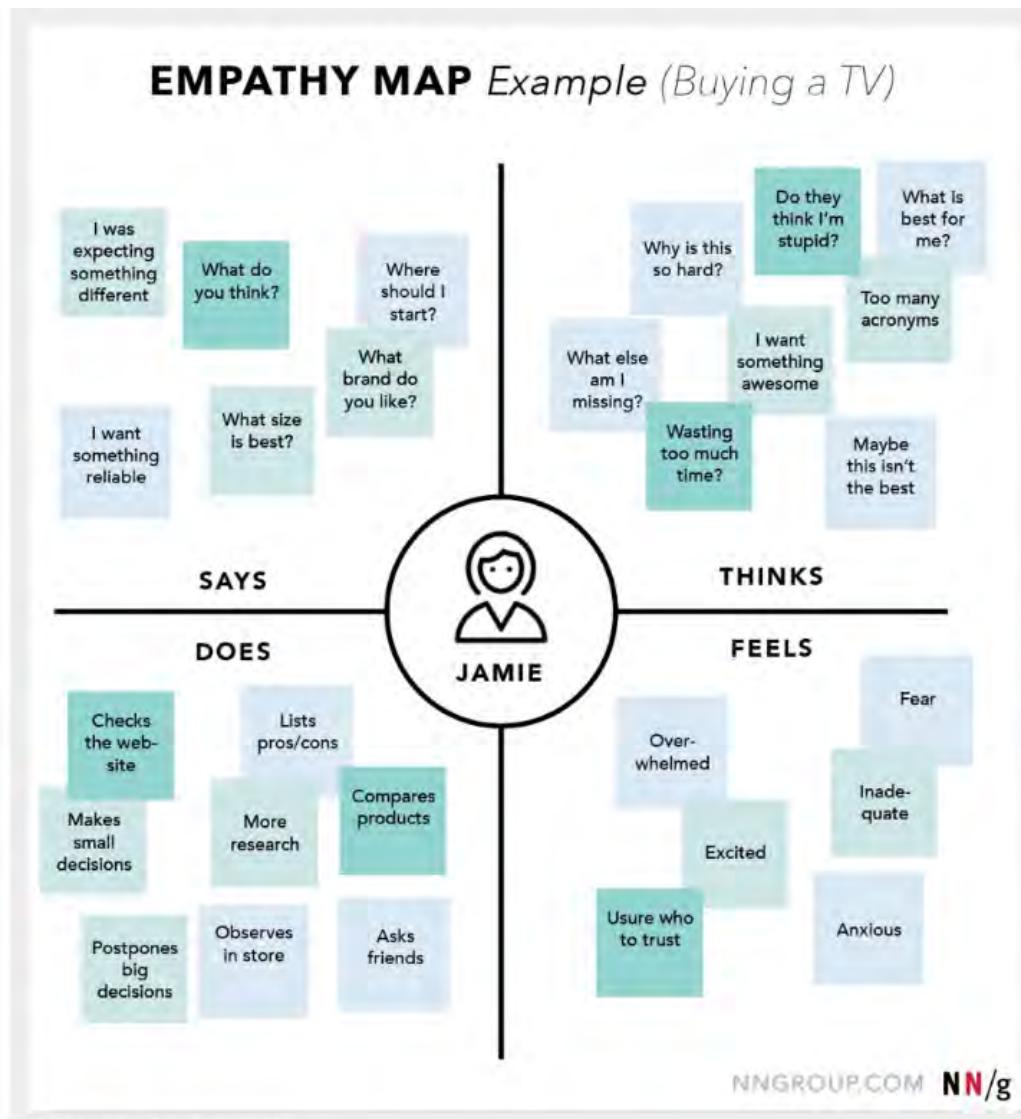
Understand Users



Empathy Map



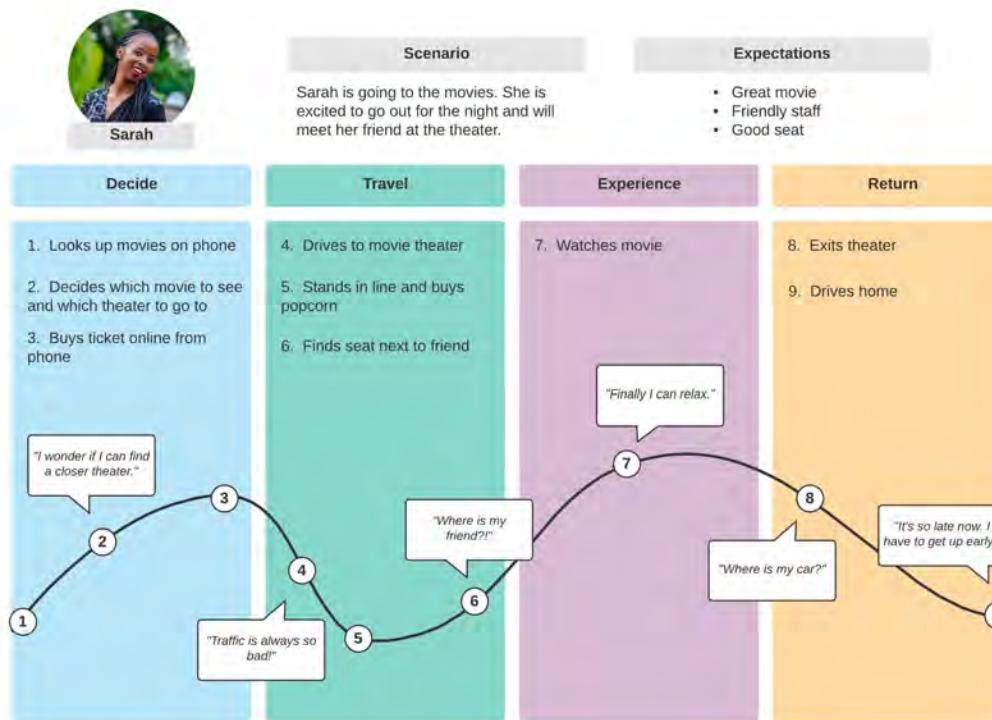
Empathy Map Example



An example empathy map <https://www.nngroup.com/articles/empathy-mapping/>

User Journey Mapping

Technique to Visualization Users Daily Accomplishments



Journey Mapping- Components



Character,
emotion,
expectation

Persona/Actor

SCENARIO

sequence of events

goal or need and
specific
expectations.



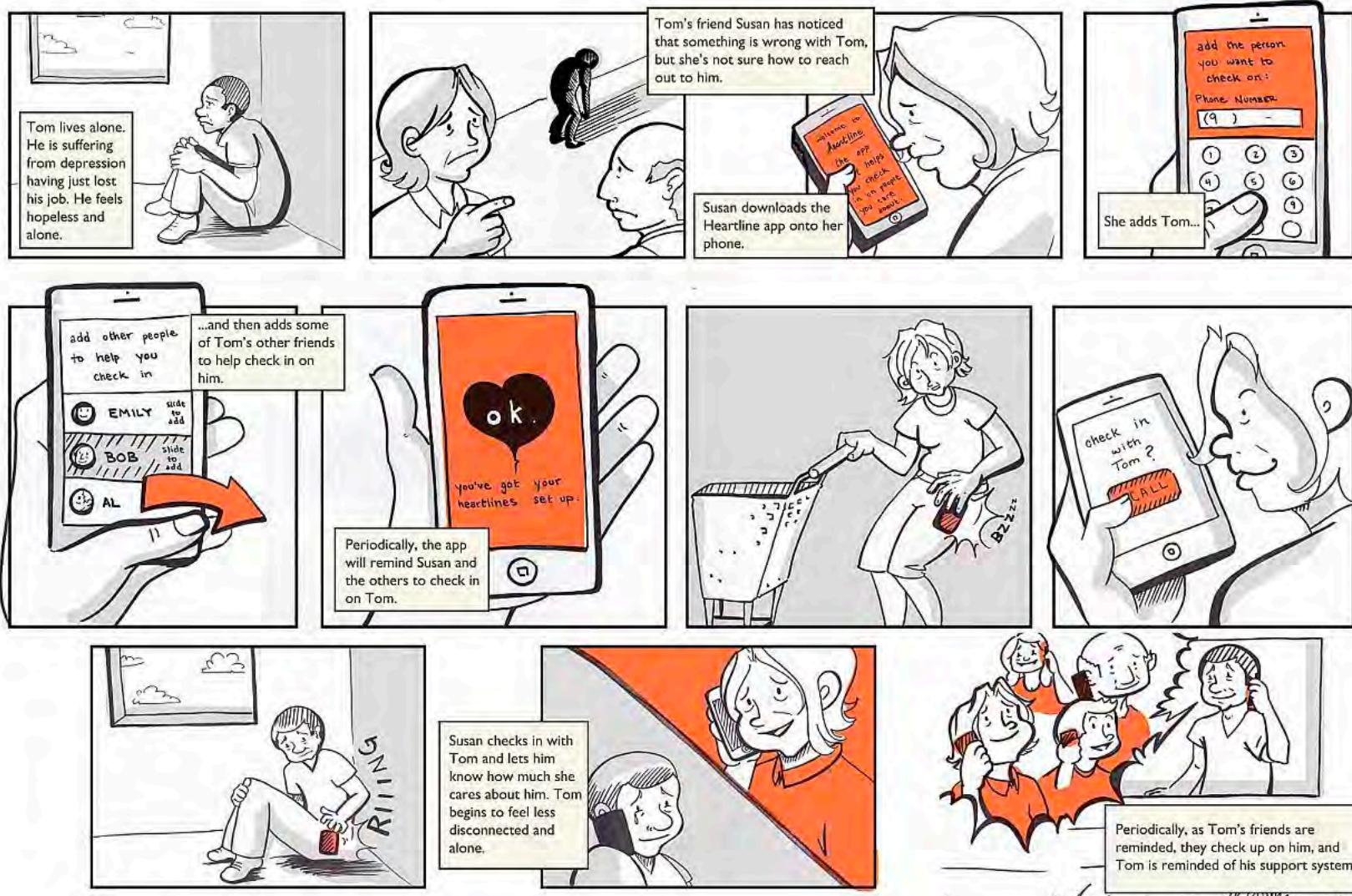
Journey
phases are
the different
high-level
stages in the
journey

ACTS

Actions, Mindsets, and
Emotions

Storyboarding

<https://uxplanet.org/a-beginners-guide-to-user-journey-mapping-bd914f4c517c>



Example

PLAYER JOURNEY

mad-pow

FRANK

43, Call Center Manager, Family Man
Recently diagnosed with high cholesterol

Frank's about to start his first 8 week weight loss challenge. He's diagnosed with high cholesterol and wants to lose weight and eat healthy. Frank has a family history of heart disease and wants to live longer.

While Frank's trying to maintain his diet and exercise routine, he's also trying to get his wife and kids involved. He's trying to make healthy choices and encourage his wife and kids to do the same.

Frank's trying to make his diet and exercise routine easier by getting his wife and kids involved. He's trying to make healthy choices and encourage his wife and kids to do the same.

Frank's trying to make his diet and exercise routine easier by getting his wife and kids involved. He's trying to make healthy choices and encourage his wife and kids to do the same.

After losing weight, Frank's trying to maintain his diet and exercise routine. He's trying to make healthy choices and encourage his wife and kids to do the same.

Frank's trying to make his diet and exercise routine easier by getting his wife and kids involved. He's trying to make healthy choices and encourage his wife and kids to do the same.

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MAP

APR MAY JUN JULY AUG SEPT OCT NOV DEC JAN FEB MAR APR



GAME HIGHLIGHTS

SCHEDULED NOTIFICATIONS

WEEKLY

MONTHLY

YEARLY

SAMPLE ACTION PLANS & KUDO SCORES

- WEEK 1 (WEEK)
- 1. Take control of your diet and exercise routine.
- 2. Drink 8 glasses of water per day.
- 3. Eat more fruits and vegetables.

2 Kudos

- WEEK 2 (WEEK)
- 1. Take control of your diet and exercise routine.
- 2. Drink 8 glasses of water per day.
- 3. Eat more fruits and vegetables.

11 Kudos

- WEEK 3 (WEEK)
- 1. Take control of your diet and exercise routine.
- 2. Drink 8 glasses of water per day.
- 3. Eat more fruits and vegetables.

19 Kudos

- WEEK 4 (WEEK)
- 1. Take control of your diet and exercise routine.
- 2. Drink 8 glasses of water per day.
- 3. Eat more fruits and vegetables.

5 Kudos

- WEEK 5 (WEEK)
- 1. Take control of your diet and exercise routine.
- 2. Drink 8 glasses of water per day.
- 3. Eat more fruits and vegetables.

14 Kudos

- WEEK 6 (WEEK)
- 1. Take control of your diet and exercise routine.
- 2. Drink 8 glasses of water per day.
- 3. Eat more fruits and vegetables.

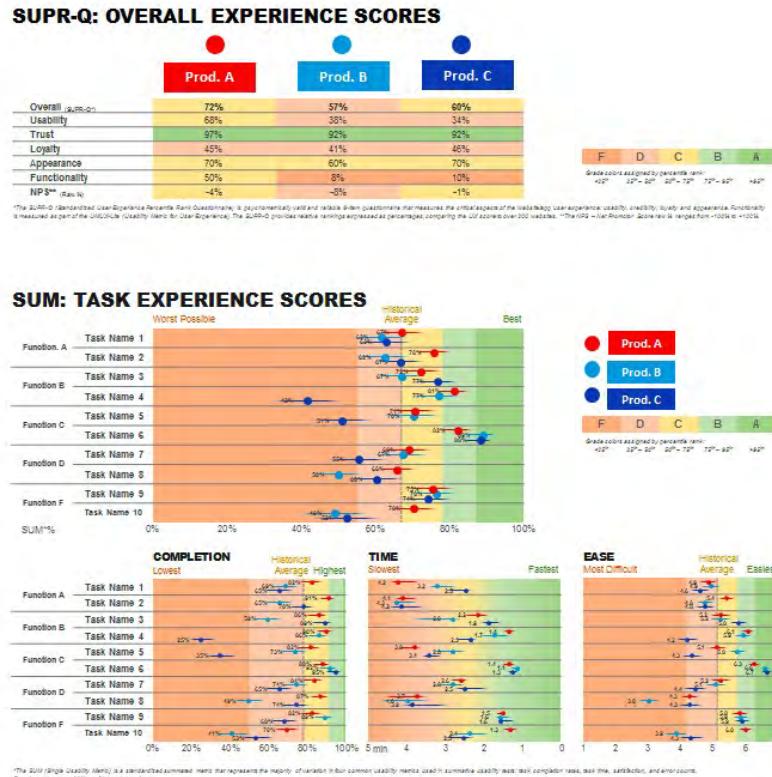
4 Kudos

- WEEK 7 (WEEK)
- 1. Take control of your diet and exercise routine.
- 2. Drink 8 glasses of water per day.
- 3. Eat more fruits and vegetables.

25 Kudos

<https://uxmastery.com/how-to-create-a-customer-journey-map/>

Scorecards



BUILDING A UX METRICS SCORECARD
by Jeff Sauro, PhD

Step 2- Define

- Defining the core problems that that team have identified.
- Establishing features, functions that will allow to solve the problems with the minimum of difficulty.

DEFINITION



Step 3- Ideate

- Generating generating ideas.
- User Needs base on observations in the Define stage.



Step 4- Prototype

Production of Low fidelity prototype for specific features





Generate Design Alternatives

- Humans stick to what they know works
- But considering alternatives is important to ‘break out of the box’
- How do you generate alternatives?
 - ‘Flair and creativity’: research and synthesis
 - Seek inspiration: look at similar products or look at very different products

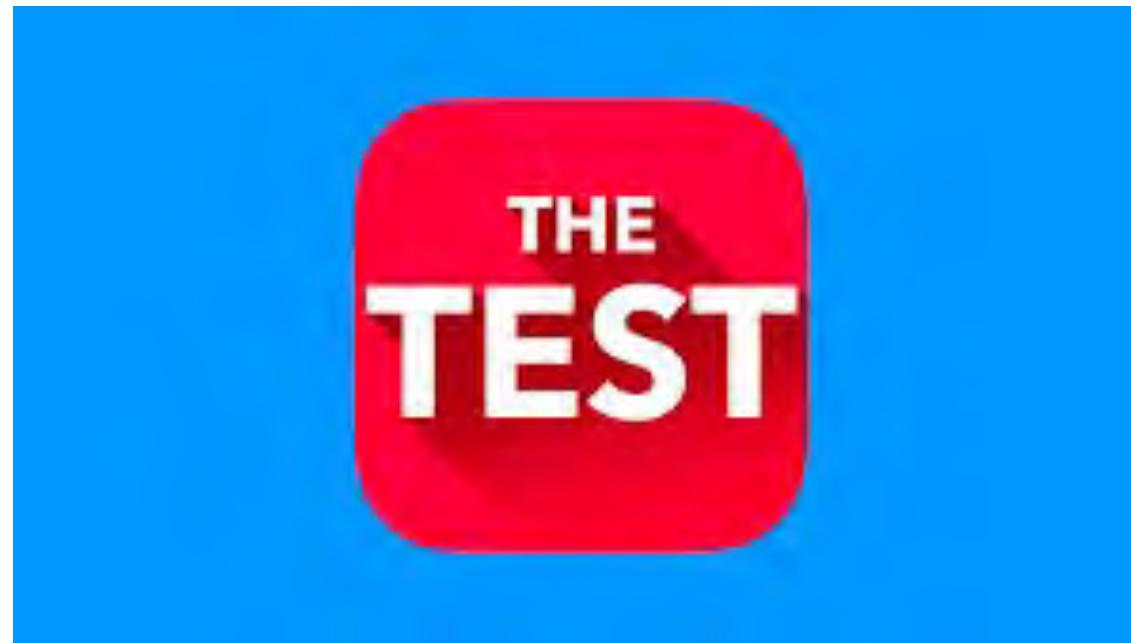


Select among Alternatives

- Evaluation with users or with peers, e.g. prototypes
- Technical feasibility: some not possible
- Quality thresholds: Usability goals lead to usability criteria set early on and check regularly
- Safety: how safe?
- Utility: which functions are superfluous?
- Effectiveness: appropriate support?
 - task coverage, information available
- Efficiency: performance measurements
- Learnability: is the time taken to learn a function acceptable to the users?
- Memorability: can infrequent users remember how to achieve their goal?

Step 5-Test

Evaluation and testing test the complete product using the best solutions identified during the prototyping phase



Design Sprint

Design Sprint is a five-day process to solve problems and test ideas.

Participants

- Owner Decider
- Facilitator
- Marketing expert
- Customer service
- Design expert
- Technology expert
- Financial expert

5 Day Program

- Set the Stage
- Monday: Map
- Tuesday: Sketch
- Wednesday: Decide
- Thursday: Prototype
- Friday: Test

Summary

- Design thinking is a process for creative problem solving. Design thinking has a human-centered core.
- Design Sprint is a five-day process to solve problems and test ideas.





Thanks for Your Participation
...see you next week...

Questions





Resources

- Course: Design Thinking - The Beginner's Guide:
 - <https://www.interaction-design.org/courses/design-thinking-the-beginner-s-guide>
- Don Norman. "Rethinking Design Thinking", 2013:
 - <http://www.core77.com/posts/24579/rethinking-design-thinking-24579>
- Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation Introduction, 2009
- Bill Moggridge, "Design Thinking: Dear Don", 2010:
 - <http://www.core77.com/posts/17042/design-thinking-dear-don-17042>
- Journey Mapping 101
 - <https://www.nngroup.com/articles/journey-mapping-101/>
- Building a UX Metrics Score
 - <https://measuringu.com/ux-scorecard/>
- Templates
 - <https://uxpressia.com/templates/cjm-for-avia-travel>

Think Out of the box



MISCELLANY / THE TRUCK THAT COULDN'T

Hoffa-hoffa-hoffa-hoffa-hoffa throbs the engine of the big trailer truck, hurtling down from Ypsilanti and on into Ann Arbor. *Beck-beck-beck-beck-beck* clack the tires on the pavement along State Street, a sound to fill a teamster with reverie and maybe set him to thinking of pulling in soon for a bite . . . you know what the truck drivers always say: if you

want a good meal in Ann Arbor, look for a place where the University of Michigan football players eat . . . easy now, underpass coming . . . sign says 12-foot clearance . . . plenty of room—this rig stands only . . . what was the figure? . . . got it here someplace . . . ah, here . . . 12 and a half feet . . . let's see . . . that gives six inches to spare so . . . RUMPF!