Design of Interactive Systems (DIS)

Lecture 7: Techniques for designing interactive systems - Evaluation

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Part II Techniques for designing interactive systems

- **Chapter 7**: Understanding
- **Chapter 8**: Envisionment
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- **Chapter 12**: Multimodal Interface Design

Aims of the evaluation

- Deciding the aims for evaluation helps to determine the type of data required. For example, in the evaluation of the early concept for a virtual training environment the aims were to investigate:
  - Do the trainers understand and welcome the basic idea of the virtual training environment?
  - Would they use it to extend or replace existing training courses?
  - How close to reality should the virtual environment be?
  - What features are required to support record keeping and administration?

Aims of the evaluation

- The data we were interested in at this stage was largely **qualitative** (non-numerical), so appropriate data gathering methods were **interviews** and **discussions with the trainers**.
- If the aim of the evaluation is the comparison of two different **evaluation designs** then much more focused questions will be required and the data gathered will be more **quantitative**.

Metrics and measures

- What is to be measured and how? Table 10.3 shows some common usability metrics
- Such metrics are helpful in evaluating many types of applications, from small mobile communication devices to office systems.

Table 10.3 Common usability metrics

Usability objective	Effectiveness measures	Efficiency measures	Satisfaction measures
Overall usability	• Percentage of tasks successfully completed • Percentage of users successfully completing tasks	• Time to complete a task • Time spent on non-productive actions	• Rating scale for satisfaction • Frequency of use if this is voluntary (after system is implemented)
Meets needs of trained or experienced users	• Percentage of advanced tasks completed • Percentage of relevant functions used	• Time taken to complete tasks relative to minimum realistic time	• Rating scale for satisfaction with advanced features
Meets needs for walk up and use	• Percentage of tasks completed successfully at first attempt	• Time taken on first attempt to complete task • Time spent on help functions	• Rate of voluntary use (after system is implemented)
Meets needs for infrequent or intermittent use	• Percentage of tasks completed successfully after a specified period of non-use	• Time spent re-learning functionsNumber of persistent errors	• Frequency of reuse (after system is implemented)
Learnability	• Number of functions learned • Percentage of users who manage to learn to a pre-specified criterion	• Time spent on help functions • Time to learn to criterion	• Rating scale for ease of learning

People

- The most **important people** in evaluation are the people **who will use the system**.
- Analysis work should have identified the characteristics of these people, and represented these in the form of **personas**.
- **Nielsen's** recommended sample of **3-5 participants** has been accepted wisdom in usability practice for over a decade.
- Small number only helps for a **homogeneous** group
- Students are often readily available, but they are only representative of a **particular segment** of the population. If you have the resources, **payment** can help recruitment.

People

- Inevitably, your sample will be biased towards **cooperative people** with some sort of interest in **technology**, so bear this in mind when interpreting your results.
- For receiving brutally **honest reaction**, one of your colleagues, a friend, your mother or anyone you trust can be considered
- Recommended method for basic testing requires an evaluator to sit with each user and engage with them as they carry out the test tasks.
- you should provide help if the participant is becoming uncomfortable, or completely stuck.

The test plan and task specification

A plan should be drawn up to guide the evaluation. The plan specifies:

- **Aims** of the test session
- Practical details, including **where** and **when** it will be conducted, **how long** each session will last, the **specification** of equipment and materials for testing and data collection, and any **technical support** that may be necessary
- **Numbers** and **types** of participant
- Tasks to be performed, with a definition of successful completion. This section also specifies **what data** should be collected and **how** it will be analysed.

Reporting usability evaluation results to design team

- Even if you are both designer and evaluator, you need an organized list of findings so that you can prioritize redesign work.
- If you are reporting back to a design/ development team
  - it is crucial that they can see immediately what the problem is,
  - how significant its consequences are,
  - and ideally what needs to be done to fix it.

Evaluation: further issues

Evaluation without being there

- With the arrival of Internet connectivity, people can participate in evaluations without being physically present.
- If the application itself is Web-based, or can be installed remotely, instructions can be supplied so that users can run test tasks and fill in and return questionnaires in soft or hard copy.

Evaluation: further issues

Physical and physiological measures

- Eye-movement tracking (or ‘eye tracking’) can show participants’ changing focus on different areas of the screen.
- This can indicate which features of a user interface have attracted attention, and in which order,
- Physiological techniques in evaluation rely on the fact that all our emotions - anxiety, pleasure, apprehension, delight, surprise and so on - generate physiological changes.

Evaluation: further issues

Physical and physiological measures

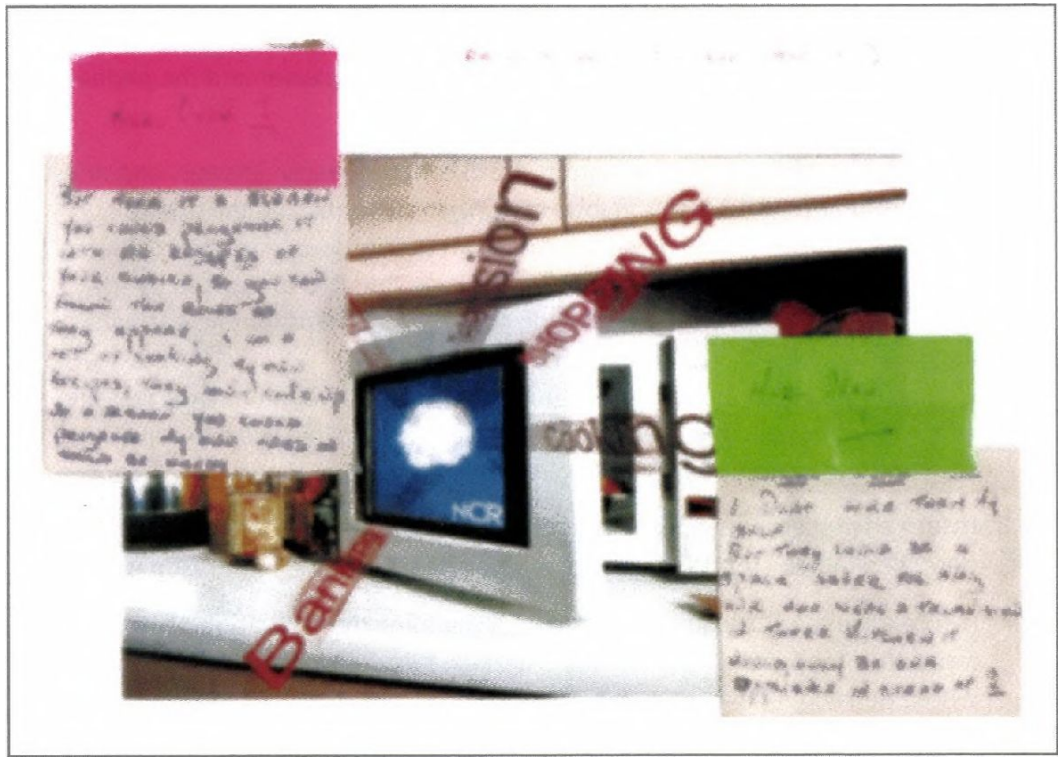
- The most common measures are of changes in heart rate, the rate of respiration, skin temperature, blood volume pulse and galvanic skin response
- Sensors can be attached to the participant's body and linked to software which converts the results to numerical and graphical formats for analysis.

Evaluating presence

- Designers of virtual reality - and some multimedia - applications are often concerned with the sense of presence, of being ‘there’ in the virtual environment rather than ‘here’ in the room where the technology is being used.
- A strong sense of presence is thought to be crucial for such applications as games, those designed to treat phobias, to allow people to ‘visit’ real places they may never see otherwise,

Evaluation at home

- People at home are much less of a '**captive audience**' for the evaluator than those at work.
- They are also likely to be more concerned about **protecting their privacy** and generally unwilling to spend their **valuable leisure time** in helping you with your usability evaluation.
- So it is important that data gathering techniques are **interesting** and **stimulating** for users, and make as **little demand on time and effort** as possible.



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Understanding

- Before creative design can start, the designer must develop a clear **understanding** of the ***people*** who will be involved with the product or system, the ***activities*** that are the focus of the design, the ***contexts*** in which those activities take place and the implications for the design of ***technologies****:* 'PACT'.
- From this understanding designers generate the **requirements** for the system that is to be designed.

Understanding requirements

- A requirement is ‘something the product must do or a quality that the product must have
- Designers will study current activities and gather stories of use and soon will have generated a great deal of information about the current situation and about people’s goals and aspirations

Prioritizing requirements

- Requirements should be reviewed with customers and clients and modified as necessary. One way of doing this is by using the '**MoSCoW rules**'.
  - **Must have** - fundamental requirements without which the system will be unworkable and useless, effectively the minimum usable subset
  - **Should have** - would be essential if more time were available, but the system will be useful and usable without them
  - **Could have** - of lesser importance, therefore can more easily be left out of the current development
  - **Want to have** but Won't have this time round - can wait till a later development.

Participative design

- Designers need to understand the requirements of other people.
- This is not easy, but talking to people using **interviews**,
- **observing people** and **recording their activities** on video,
- organizing **focus groups**, workshops, etc. will all help the designer to understand both the requirements for the new design and the problems people are having with existing ways of doing things.

Interviews

- One of the most effective ways of finding out what people want and what problems they have at the moment is to talk to them
- Interviews with all the various stakeholders in the domain are a vital way of gathering stories.
  - **Structured interview**
  - **Unstructured interview**
  - **Semi-structured interview**

Questionnaires

- Questionnaires are one way of streamlining the understanding process if a large number of people are to be surveyed and resources are not available to interview them individually.
- Questionnaires need to be designed, prototyped and evaluated in the same way as any other form of interaction design.
- A good questionnaire is time-consuming to construct so that all the items:
  - are understandable
  - are unambiguous
  - collect data which actually answers evaluation questions
  - can be analysed easily.

Working with groups

- An alternative to asking individuals or stimulating individuals to provide information is to work with groups of people.
- The most common example of this is the focus group.
- Here a group of people are posed questions by facilitators and encouraged to react to each other’s comments.

Fieldwork: observing activities *in situ*

- Observing people's activities as they happen is another excellent, though time-consuming, method of understanding and requirements generation.
- In other cases, an interviewee may describe the 'official' procedure rather than how something is actually done in practice. They might be embarrassed to admit to some difficulty they are having, or may just tell the designer something to get rid of them.

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Envisionment

- Envisionment is concerned with making **ideas visible**; with **externalizing thoughts**.
- Externalization can take all manner of forms: **stories and scenarios**, **presentations**, **sketches**, **formal models**, **software prototy**pes, **cardboard models** and so on.
- Envisionment is needed to **represent design** work to ourselves and to others.

Finding suitable representations

Example: Designer of a **new luxury sports car**. He or she doodles a **few designs** on paper and shows them to other designers on the team.

The designer is using four different representations in at least four different ways:

- The original representations focus on clearing the mind. In this case they are **doodles and sketches** that are used to generate new ideas, examine possibilities and prompt for questions.
- **The blueprints** given to the model maker and **the scale model** given to the Marketing and Sales departments are suitable for accurately expressing ideas to others.
- The **wind tunnel experiments** show representations being used to test ideas.
- The **computer model** is used to make predictions.

An outline envisionment process

Here is a suggested series of steps for the envisionment process

- Review requirements and conceptual scenarios.
- Develop representations of your design ideas. At a minimum these should include **concrete scenarios**, **storyboards** developing the main interaction sequences, and **snapshot sketches** of key screens or other aspects of the product.
- If your product is a new one, **experiment with different metaphors** and design concepts through your representations.
- Explore design ideas with the people who will be using the system wherever possible.
- Develop **wireframes** to provide more detail on the proposed structure and navigation.
- Iterate and gradually formalize the design (making it more concrete) through **prototypes** and **further evaluations**.

Basic techniques

- Sketches and snapshots
- Storyboards
- Moodboards
- Navigation maps
- Wireframes

Sketches and snapshots

In the sketches we can see that the designer has been exploring different ideas for displaying and searching through results of a search.

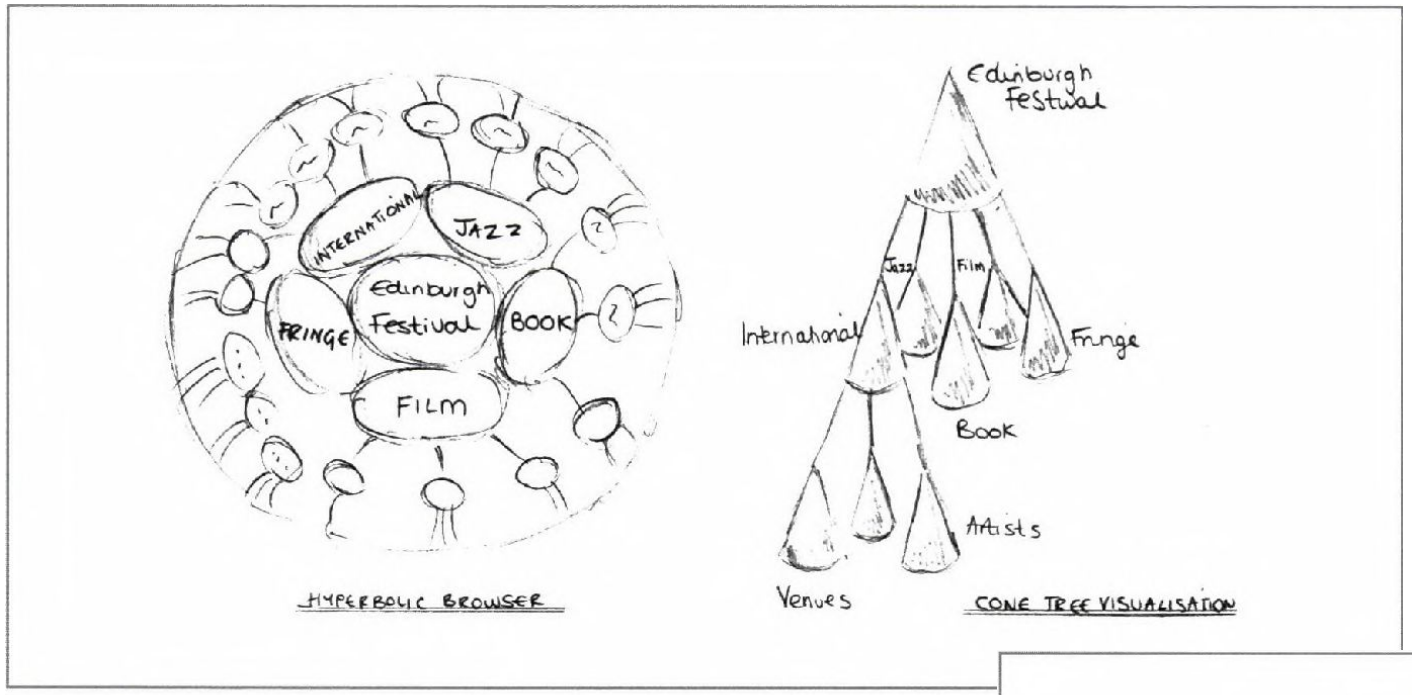
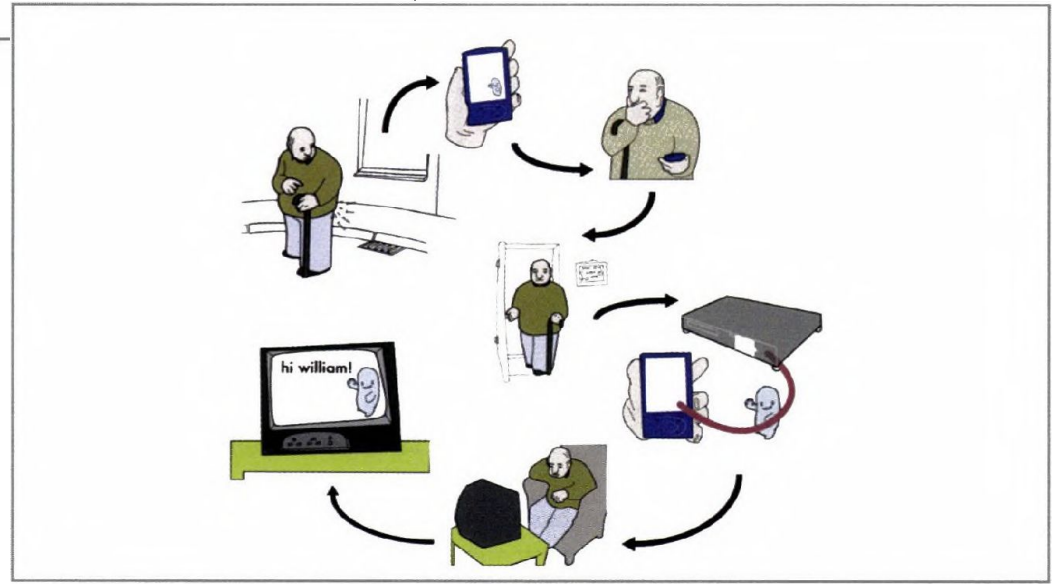


Figure 8.1 Sketches of possible visualization

Individual snapshots of a design can be provided to show key moments in an interaction



Storyboard

Storyboarding is a technique taken from filmmaking - using a simple cartoon-like structure, key moments from the interactive experience are represented

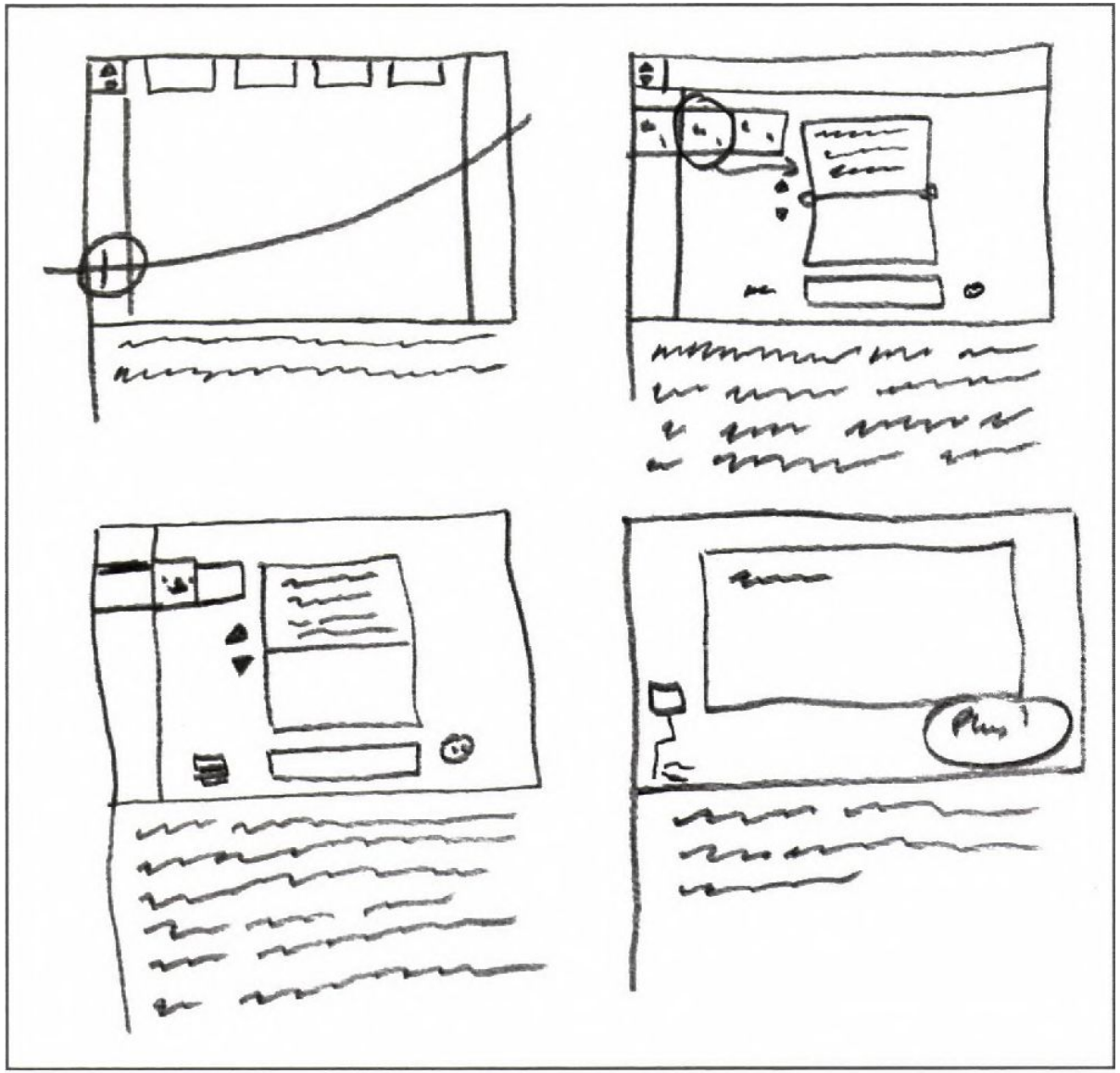


Figure 8.3 Sketched storyboard for the HIC

Mood board

Mood boards are widely used in advertising and interior design.

- Quite simply you gather visual stimuli that capture something of how you feel about the design - **photographs** and other **images, colours, textures, shapes, headlines** from newspapers or magazines, quotations from people, pieces of fabric and so on.

Fig. 8.5. Funky wall

Navigation maps

Navigation is a key feature for many systems. Navigation maps focus on how people move through the site or application. The aim is to focus on how people will experience the site

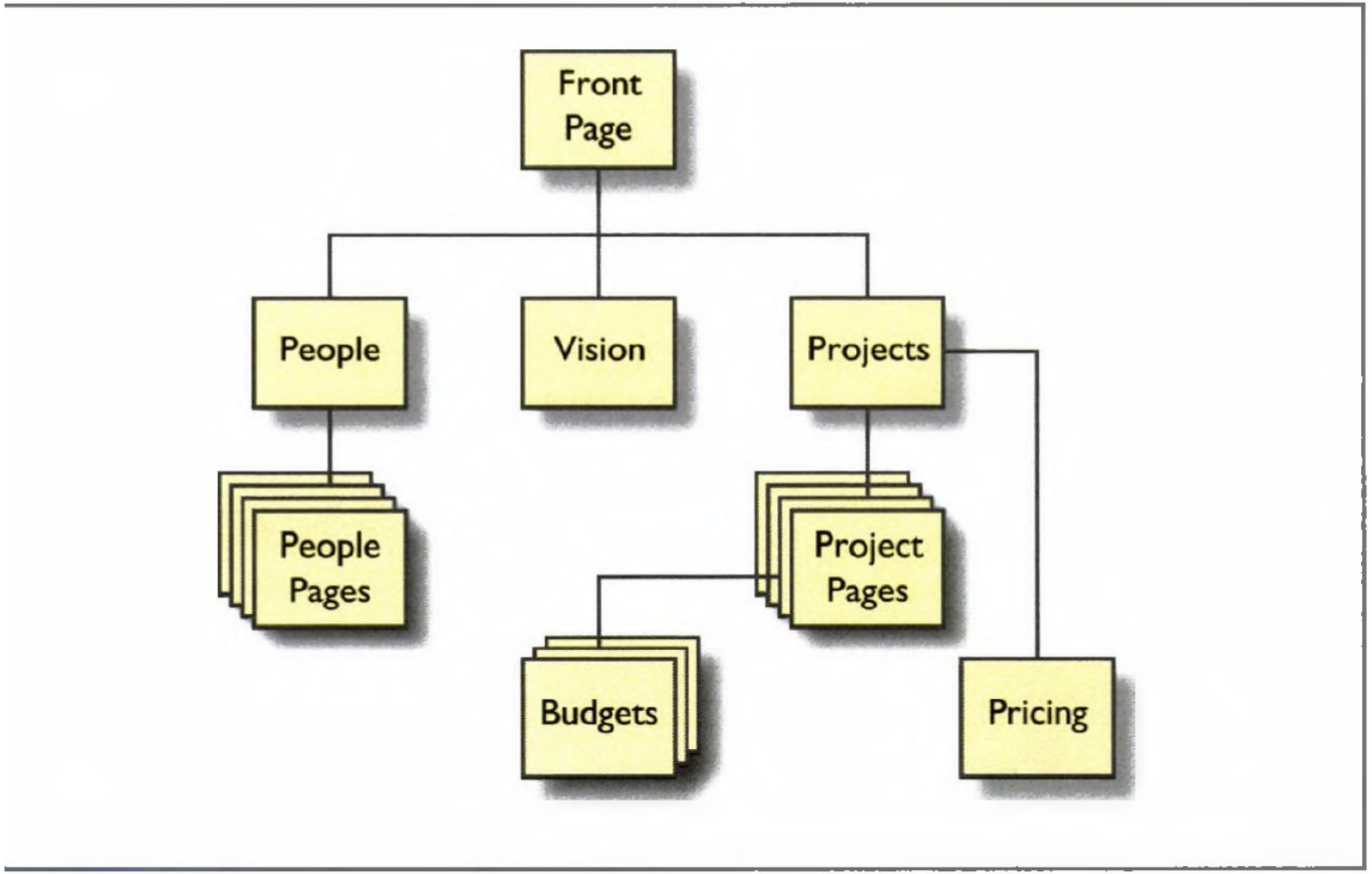


Figure 8.7 Navigation map for a website

Wireframes

- Wireframes are outlines of the structure of a software system. They used to be concerned principally with website design.
- It has become a mainstream technique for handheld devices.

Prototypes

- A prototype is a concrete but partial representation or implementation of a system design
- A prototype may be made of something as simple as paper, cardboard or other suitable material, or it maybe developed using a sophisticated software package.
- **Hi-Fi**
- **Lo-Fi**
- **Paper**
- **Video**

Presenting designs

- Presenting design ideas **clearly** and **appropriately** is a key skill of the designer.
- The design process is a long one, with many different stages, there are many different people involved
- There are many different reasons for giving a presentation
- People at the senior management are generally concerned with **strategic issues** rather than detail, so a presentation to **management** should focus on **impact**, **image** and **concept**.
- If the presentation is aimed at the **client** then one would expect a **bit more detail** and some idea of **how it works**.
- If the presentation is aimed at **end-users** then it is most likely to concentrate on the **detail of the design** and the workings of the system.

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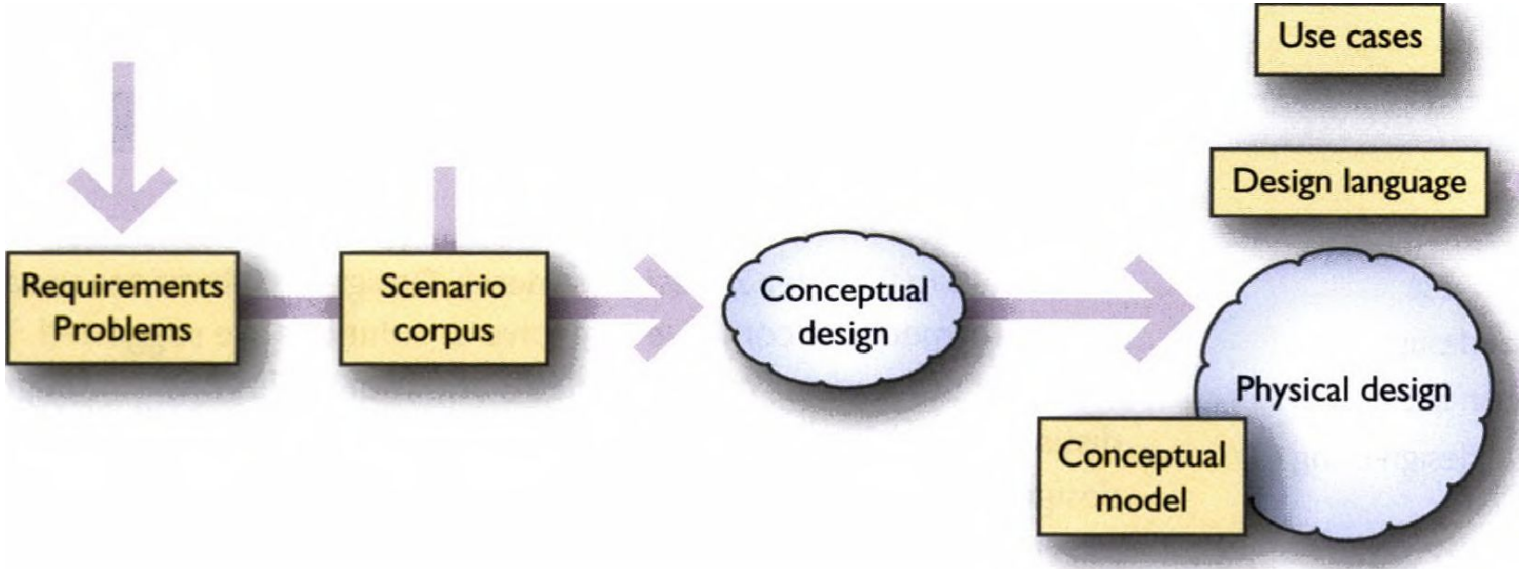
Designs

- In design we distinguish **conceptual design** - design in the abstract - from **physical design** - where ideas are made concrete.
- Conceptual design is concerned with arriving at an **abstract description** of the system - its logic, functions, structure and content - but not with how the structure and functions are to be physically realized.
- Physical design is concerned with **who does what**, how the artefacts will **look** and how they **behave**.



Conceptual designs

- Designers need to ensure that their conception of the system is **easily learnt by people** and **fits with their expectations** and preferences.
- But often we have to spend a long time looking for some function, or we do not know about the existence of some function, because the designer has put it somewhere unexpected. The lack of standards for the menus of mobile phones, for example, results in the need to search the whole structure for an expected command.
- A good conceptual model will come from considering the underlying metaphor.

Exploring design concepts

Bill Verplank (Verplank, 2007) is an interaction designer argues that interaction design is ‘design for human use’ and focuses on three main things,

1. **How do you do?**
2. **How do you feel?**
3. **How do you know?**

How do you do?

- For example, one distinction he highlights is between handles and buttons.
- Handles are better for continuous control (e.g. a trombone), but buttons are better for discrete control

How do you feel?

- ‘How do you feel?’ concerns how we make sense of the world and the sensory qualities that shape media.

How do you know?

- ‘How do you know?’ concerns the ways that people learn and plan; how designers want people to think about their system.
- Paths are good for beginners as they provide step-by-step instructions on what to do. Maps are good for understanding alternatives.

Exploring design space

- Design can be thought about through the concept of a design space. A design space constrains a design in some dimensions whilst allowing exploration of alternatives in others
- Designers always work within constraints, whether these are financial or functional, but they need to take care not to impose too many constraints too early in the process.
- In HIC project, a key design decision was how search results should be displayed and selected.
- Font size is a key design issue. Features of using large font size are:

1. **It can be seen from further away (positive).**
2. **It takes up valuable screen space (negative).**
3. **It means fewer tracks can be displayed (negative).**

Metaphors in design

- Metaphor is generally seen as taking concepts from one domain (called the source domain, or the vehicle) and applying them to another.

Conceptual design using scenarios

- Stories aid **understanding**, **conceptual scenarios** abstract from stories to provide **generic activities**. Fixing certain design constraints leads to concrete scenarios that may finish up as functional specifications expressed as **use cases**.
- A scenario corpus is developed that should be discussed and evaluated at design team sessions and with the participation of stakeholders.
- There are degrees of concreteness in scenarios. The most concrete forms are used to envision or evaluate specific interactions.

Objects and actions in MP3 example

Table 9.2 Object–action analysis of part of scenario MP3/01

Activity	Consists of sub-activities	Action	Object	Comments
Search for MP3 track by name P3	Go to Search function **P3**	Go to	Search object	'Search object' – may need revision?
	Enter query (track name) **P3**	Enter (*user input*) Confirm	Search object Query	
Play track P4	Select search result (MP3 track) **P4**	Select	Search result (*track*)	= MP3 track. There is no 'browse search result' formula here, as it is specified that search result contains only one object (track)
	Play track **P4**	Play (*start play*)	Track	'Play' does not imply playing complete track – track may be paused, stopped, fast-forwarded, etc. 'Start Play' may be the better term

Physical design

- physical design is concerned with how things are going to work and with detailing the look and feel of the product.
- Physical design is about structuring interactions into logical sequences and about clarifying and presenting the allocation of functions and knowledge between people and devices.
- There are three components to physical design:
  - **Operational design** is concerned with specifying how everything works and how content is structured and stored.
  - **Representational design** is concerned with fixing on colours, shapes, sizes and information layout. It is concerned with style and aesthetics.
  - **Interaction design** in this context is concerned with the allocation of functions to humans or to technology and with the structuring and sequencing of the interactions.

Design languages

A design language consists of the following:

- A set of *design elements* such as the use of colour, styles and types of buttons, sliders and other widgets
- Some *principles of composition* (i.e. the rules for putting them together)
- Collections of *qualifying situations* - contexts and how they affect the rules.

A consistent design language means that people need only learn a limited number of design elements and then they can cope with a large variety of different situations.

Microsoft's design language

Starting with the Windows 7 mobile platform and moving onto the desktop in Windows 8, Microsoft have introduced a new design language for their products. The inspiration for the language is described on their website as being Swiss influenced print and packaging and Microsoft software such as Zune and Office Labs, plus games that focus on motion and content over chrome.

The main features of the design language are:

- **Motion.** A system is created to bring the interface to life by developing a consistent set of motions or animations which provide context for usability.
- **Typography.** Aiming for the right balance of weight and positioning can help lead users to more content.
- **Content not Chrome.** Extra chrome is removed so that in the UI, the main focus becomes the content.
- **Honesty.** Design specifically for a hand-held device, incorporating a high resolution screen and using touch. Interaction is expedited and made simple.

Source: www.microsoft.com/design/toolbox/tutorials/windows-phone-7/metro/