

Chapter 6

Understand Design Requirements and Prototype

Aims

- Before creative design can start it is essential that the designer develops a clear and thorough 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.
- However, it is rarely possible to acquire a thorough understanding of requirements until some design work has been completed.
- Requirements work (understanding), the design process, representations of design (envisionment) and evaluation are tightly interwoven.

What is Requirement?

- ▶ A requirement is 'something the product must do or a quality that the product must have' (Robertson and Robertson, 1999).
- ▶ 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.
- ▶ The task now is to turn this into requirements for a new product, system or service.
- ▶ Sometimes this is straightforward, but often it will need a creative leap.
- ▶ This is why the analysis/design/evaluation process is so iterative.
- ▶ The accuracy of the guess can only be judged when people review the requirements, something that is best done with the aid of scenarios and early designs or a prototype.
- ▶ Just to further complicate matters, additional requirements will emerge as the design process continues.

What is the Activity of Requirements?

- Requirements **gathering**, which suggests requirements are lying around waiting to be picked up with little interaction between designer and users.
- Requirements **generation**, which suggests a more creative activity, that tends to de-emphasize links to current practice.
- Requirements **elicitation**, which suggests some interaction between stakeholders and designers.
- Requirements **engineering** – often used in software engineering projects, usually a very formal approach.
- This is one of the reasons we have moved to the term ‘understanding’ as it encapsulates ideas of gathering and generation.

Requirement Specification

- ▶ Often clients will require a requirements specification – a formal document that contains the requirements.
- ▶ Developers also need a clear requirements specification at some point in the development process so that they can cost the project and manage it successfully.
- ▶ Requirements specifications are often formal written documents, but increasingly they include prototypes, screen shots and other media.
- ▶ When written they should be expressed in clear, unambiguous language, and worded so that it will be possible to test whether the requirement has been met in the final system.

Prioritizing Requirements

Requirements should be reviewed with customers and clients and modified as necessary.

- Decisions will almost always be made about the relative priority of the requirements, since few design projects have unlimited resources.
- One way of doing this is by using the '**MoSCoW rules**'. These classify requirements into:
 - ❖ **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

- Research work involves using a variety of techniques to understand and analyze someone else's needs, goals and aspirations.
- The key thing for designers to remember is that they are not the people who will be using the final system.
- 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.
- By engaging with people using various techniques that encourage the participation of people in the design process, designers will acquire a large number of stories that form the basis for the analysis work.
- Recasting several similar stories into more structured conceptual scenarios will also help the designer to understand and generate requirements.

Acting Out Requirement

- ▶ Alan Newell and his colleagues (e.g. Newell, Carmichael, Gregor, Alm and Waller, 2008) have developed methods for acting out requirements in order to make them more understandable to the groups of people they are designing for – primarily older people.
- ▶ The technique requires the designers to work with a professional script writer to develop a short stage play based on the requirements that have been generated.
- ▶ This is acted out by trained actors with the stakeholders making up the audience.
- ▶ Following the play a trained facilitator leads an audience discussion on the play and the issues that it raised.
- ▶ These discussion feed back into the understanding process helping to provide a rich understanding of the hopes, fears and concerns of the people.

Interview

- 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 is a vital way of gathering stories.
- Designers employ a range of different styles of interview.
- The *structured interview uses questions that are developed beforehand. The interview follows the wording exactly*
- Designers very frequently use *semi-structured interviews. Sometimes, the interviewer is armed with pre-prepared questions, but can reword these as appropriate and explore new topics as they arise.*

Structured Interview

- ▶ Structured interviews use pre-set questions which are not varied by the interviewer.
- ▶ Public opinion polls, for example of the sort produced in great numbers before elections, are normally based on structured interviews.
- ▶ Structured interviews are reasonably easy to carry out, simply because of the degree of pre-structuring.
- ▶ However, people are limited to very restricted replies, and it is difficult for the interviewer to follow up the unexpected response.

Unstructured Interview

- ▶ Often, the interviewer simply prepares a checklist, sometimes with suitable prompts such as ‘Tell me about the first things you do when you get into the office in the morning’.
- ▶ Clearly, this free-form approach is more demanding for the interviewer, but the data obtained does generally repay the effort.
- ▶ Completely unstructured interviews are sometimes used where it is particularly important to minimize designers’ preconceptions, or where very little background information is available beforehand.
- ▶ As the term suggests, there are no preset questions or topics beyond the general subject of the project in question.

Example

Thinking about the Department's website, about how often would you say that you have used the following during the last week:

Timetable information	not at all <input type="checkbox"/>	most days <input type="checkbox"/>	every day <input type="checkbox"/>	more than once a day <input type="checkbox"/>
Staff home pages	not at all <input type="checkbox"/>	most days <input type="checkbox"/>	every day <input type="checkbox"/>	more than once a day <input type="checkbox"/>
Module information	not at all <input type="checkbox"/>	most days <input type="checkbox"/>	every day <input type="checkbox"/>	more than once a day <input type="checkbox"/>

Structured interview

Interviewer: What sort of things do you need information about in a typical week?

Interviewee: Well, I'm afraid I don't always get to lectures – I work part-time – so I will often need to check what the lecture covered and important dates for things like coursework hand-ins. They always seem to be changing tutorial rooms, so I like to check that as well.

Interviewer: So you need to find the academic material for lectures you've missed. Even for the ones I've been to actually. I'm not very good at taking notes. And then there's all the information about dates and places and so on? Do you do look on the noticeboard but there's such a lot of stuff on there and I'm not sure it's always up-to-date or what applies to me. It's a bit easier on the Intranet but not much.

Interviewer: Where do you look for information now? Let's start with the room changes – you said you checked both the noticeboard and the Intranet?

Interviewee: Well I do, but ideally I'd ask someone reliable from my group. Then I'd be sure I was getting the whole story...

Interviewer: So what else might you ask about?

Interviewer reflects back what has been said.

Interviewer has not foreseen this, but the flexible structure provides the chance to follow up.

Unstructured interview

Think Aloud Commentaries

- ▶ When it is necessary to know a good deal of low-level detail about current technology, users can be asked to talk through the operations concerned – including their internal cognitive processes – as they use the technology in question.
- ▶ This data, properly termed a ‘verbal protocol’ (Ericsson and Simon, 1985), can provide helpful indications of current problems.
- ▶ It is important to remember, however, that by imposing the requirement to generate a commentary you are interfering with the very process you are attempting to study.
- ▶ Further, not all cognitive processes can be accessed by the conscious mind.
- ▶ The description of the ‘contextual interview’ in Beyer and Holtzblatt (1998) suggests some ways of alleviating this problem.

Practical Considerations

Get to know the background.

‘Idiot questions’ can uncover unspoken assumptions, but use them deliberately, not by accident.

Be careful about using people’s own jargon until you are sure that you have it right.

For work activities, background research might include studying company reports, brochures, websites and organization charts or scanning through software manuals and promotional materials.

For home and leisure activities, what is relevant depends very largely on the context.

Keeping Track of Interview

- Interviewing is hard work and more effective if carried out by a pair of interviewers.
- One person can take the lead while the other makes notes.
- Of course, the note-taking burden is relieved if the interview is audio- or video-recorded. In this case, make sure you check the equipment before each session and periodically during the interview.
- Even when the interview is recorded, notes are still useful, especially if they include regular records of the time, which will help to find key points – it will take you one hour at the least to watch one hour of videotape even without any analysis or transcription.
- In addition, your notes will be vital if (for example) building work outside has muffled a section of the audio, or the heavy regional accent that was understandable face-to-face proves impenetrable on tape.
- A full transcription is rarely needed, but if it is, an audio-typist can save hours of your time.
- The typist will need briefing about any technical terms.

Reflection and Exploration

- ▶ Reflecting back during the interview helps confirm that you have understood what has been said.
- ▶ It is often a good idea to have the interviewee review a summary of the interview.
- ▶ This might be because the interviewee's knowledge is central to the new design, or sensitive material is involved, or the context is very unfamiliar.
- ▶ You should also look over the notes of the interview yourself to identify any points that need clarification.

When to Stop?

- ▶ Deciding when to stop interviewing means balancing practical constraints against the comprehensiveness of the data.
- ▶ Certainly, all significant stakeholder groups must be covered.
- ▶ Beyer and Holtzblatt (1998) suggest two or three interviewees per role (or type of stakeholder) across three or four different types of organizations.
- ▶ In many cases, client resources limit the process.
- ▶ With unlimited resources, the general rule is to stop once no new insights are being obtained.

Questionnaire

- ▶ Questionnaires are one way of streamlining the requirements process if a large number of people are to be surveyed and resources are not available to interview them individually.
- ▶ However, constructing a workable questionnaire is surprisingly difficult and time-consuming.
- ▶ It is a skilled task to devise the wording of questions when there are no opportunities to detect and clear up misunderstandings as they happen.
- ▶ Questionnaires need to be designed, prototyped and evaluated in the same way as any other form of interaction design.
- ▶ For small numbers of people – up to 10 or so – an interview will obtain the same information, and more, in a manageable way.
- ▶ This will consume little or no extra resource if the time required to construct a questionnaire is taken into account.

Questionnaire (cont..)

- ▶ Questionnaires are ideally suited to gathering a large amount of quantifiable data, or to capture responses from people who cannot be involved more directly.
- ▶ The design of a questionnaire will depend on whether the researcher wishes to collect exploratory information (i.e. qualitative information for the purposes of better understanding or the generation of hypotheses on a subject) or quantitative information (to test specific hypotheses that have previously been generated).
- ▶ **Exploratory questionnaires:** If the data to be collected is qualitative or is not to be statistically evaluated, it may be that no formal questionnaire is needed.
- ▶ **Formal standardized questionnaires:** If the researcher is looking to test and quantify hypotheses and the data is to be analyzed statistically, a formal standardized questionnaire is designed.

The Advantages of Questionnaires

- ▶ Practical
- ▶ Large amounts of information can be collected from a large number of people in a short period of time and in a relatively cost effective way
- ▶ Can be carried out by the researcher or by any number of people with limited affect to its validity and reliability
- ▶ The results of the questionnaires can usually be quickly and easily quantified by either a researcher or through the use of a software package
- ▶ Can be analyzed more 'scientifically' and objectively than other forms of research
- ▶ When data has been quantified, it can be used to compare and contrast other research and may be used to measure change
- ▶ Positivists believe that quantitative data can be used to create new theories and / or test existing hypotheses

The Disadvantages of Questionnaires

- Is argued to be inadequate to understand some forms of information - i.e. changes of emotions, behavior, feelings etc.
- Phenomenologists state that quantitative research is simply an artificial creation by the researcher, as it is asking only a limited amount of information without explanation
- Lacks validity
- There is no way to tell how truthful a respondent is being
- There is no way of telling how much thought a respondent has put in
- The respondent may be forgetful or not thinking within the full context of the situation
- People may read differently into each question and therefore reply based on their own interpretation of the question - i.e. what is 'good' to someone may be 'poor' to someone else, therefore there is a level of subjectivity that is not acknowledged
- There is a level of researcher imposition, meaning that when developing the questionnaire, the researcher is making their own decisions and assumptions as to what is and is not important, therefore they may be missing something that is of importance

Questionnaire Analysis

- ▶ Analyzing the data requires thought and time.
- ▶ If most respondents have awarded feature 'A' 5 out of 7 for usefulness but feature 'B' 6 out of 7, does this really mean that feature B is better?
- ▶ Or is it enough that both features score above the mid-point?
- ▶ Maybe feature A was misunderstood – without a follow-up question the data is difficult to interpret.
- ▶ This is easy to do in an interview, but would add significantly to the length of a questionnaire.
- ▶ Where respondents have been given the opportunity to express opinions as unstructured answers, you will need to devise a scheme for classifying this material so that it is usable.

Likert Scale

- ▶ Perceptions of system design are often collected through rating scales, known as Likert scales (Likert, 1932).
- ▶ The Likert scale is the most common of a number of methods for eliciting opinion.
- ▶ People are asked to indicate their agreement with a statement using a five-point scale: Strongly agree. Agree, Neutral. Disagree, Strongly disagree.
- ▶ or a seven point, four point or ten point scale.
- ▶ There are a number of different styles.

Semantic Differential

- ▶ Another approach is to devise 'bipolar' rating scales, often called semantic differentials.
- ▶ These derive from the work of Osgood (Osgood, 1952) and have evolved into a very powerful way of uncovering the feelings people have towards ideas, products and brands.
- ▶ For example Brian Lawson used semantic differential to find out what people liked about pubs and we have used similar methods to explore what people liked about places.
- ▶ Web-based questionnaire services will often give clear and good advice on types of question and how to design questionnaires.

5-point traditional Likert scale:

	Strongly agree	Tend to agree	Neither agree nor disagree	Tend to disagree	Strongly disagree
I like going to Chinese restaurants	[]	[]	[]	[]	[]

5-point Likert-type scale, not all labeled:

	Good		Neutral		Bad
When I think about Chinese restaurants I feel	[]	[]	[]	[]	[]

6-point Likert-type scale:

	Never	Infrequently	Infrequently	Sometimes	Frequently	Always
I feel happy when entering a Chinese Restaurant	0	0	0	0	0	0

Did you feel that the environment was?

	<i>Very</i>	<i>Quite</i>	<i>Neither</i>	<i>Quite</i>	<i>Very</i>	
Ugly						Beautiful
Pleasant						Unpleasant
Stressful						Relaxing
Harmful						Harmless
Exciting						Boring
Interesting						Uninteresting
Memorable						Forgettable
Meaningful						Meaningless
Confusing						Understandable
Significant						Insignificant

Cultural Probe

- ▶ Probes are collections of artifacts designed to elicit requirements, ideas or opinions in specific contexts.
- ▶ ‘Cultural probes’ were developed by Bill Gaver and colleagues (Gaver *et al.*, 1999) in working with elderly people located in three European cities.
- ▶ The overall aim was to design technologies that would foster greater participation in the community by older people.
- ▶ The designers first got to know the groups in person, then introduced them to the cultural probes packages.
- ▶ Each person received a collection of maps, postcards, a disposable camera and booklets – each item being carefully designed to stimulate interest and curiosity, and suggesting ways in which people could use it to send ideas back to the designers.
- ▶ They were ‘designed to provoke inspirational responses’ (*ibid*, p. 22).

Cultural Probe (cont..)

- Postcards asked people to list their favorite devices.
- The disposable cameras had customized covers which suggested scenes to be captured, such as ‘the first person you will see today’ or ‘something boring’.
- Over a period of weeks, many of the probe materials were sent back to the designers, carrying rich data about the lives of the elderly people.
- Not all items worked out as planned – the authors do not specify which – and the materials were selectively redesigned before being distributed to subsequent participants.
- All in all, the exercise was highly successful in capturing the general sense of what it meant to be elderly in the communities involved, although it is noted that the results did not have a direct impact on design.

Probology

- The philosophy behind cultural probes was rather different than trying to gather requirements and illustrate well the difference between requirements elicitation and requirements generations.
- Gaver argues that probes are meant to confront, they are intended to provide inspiration for designers rather than elicit specific requirements.
- Technology probes are another form of probe that were used to gather requirements for home technologies.
- In discussing the use of mobile probes (Nordhci 2004) argue that probes are humane, they create fragments of understanding and insight and use uncertainty through providing stories.
- Probes inspire and provoke designers to engage with the lives of others.
- Probes represent the 'turn to the personal'.
- Probes are an amalgam of social science methods (such as photography, diaries, life documents, etc.) that enable designers to focus upon the individual's everyday life, going beyond the general.

Card Sorting Technique

- Card sorting is particularly relevant in web site design as the structure of the content is critical.
- At its most basic card sorting involves writing concepts onto cards and then grouping them in different ways.
- A group of people work with a facilitator to structure data, concepts, objects or other artifacts, trying to understand what categories are most appropriate to group them together.
- This results in a taxonomy (a classification) and a set of high level concepts known as an ontology.
- Where the results from a large number of people are available, various mathematical grouping techniques can be used.
- The affinity diagram that is part of the Contextual Inquiry methods is a similar technique.

Focus Group

- Here a group of people are posed questions by facilitators and encouraged to react to each other's comments.
- If they are part of a group, users can be asked to describe how they cooperate to manage activities.
- Members of the group can stimulate each other's memories, and discussion may flow more naturally than in the single user interview. The approach is widely used
- Focus groups can be enhanced by the use of scenarios, prototypes and other stimuli.
- For example we have used
 - an AIBO robotic pet as a stimulus for talking about companionship with groups of older people, printed scenarios
 - screen shots of a mock-up automatic teller machine (ATM) to generate requirements for personalised ATM services
 - maps and visitor guides to generate requirements for the a mobile guide application.
- However, group discussion may also inhibit comment about sensitive issues, for example deviations from official procedure, and can have the effect of highlighting unusual incidents disproportionately.

Focus Group (cont..)

- ▶ One such example is CARD (Collaborative Analysis of Requirements and Design, Tudor *et al.*, 1993; Muller, 2001).
- ▶ CARD uses physical playing cards with which a group can lay out, modify and discuss the flow of an activity.
- ▶ In the analysis phase, each pre-formatted card contains users' accounts of what is done and why for an individual component of the activity.
- ▶ Requirements on innovations in human practices or technologies can then be discussed around the cards. CARD is also intended to support design and evaluation.
- ▶ IDEO Method Cards is a collection of 51 cards representing different ways that design teams can understand the people they are designing for.
- ▶ The cards can be used by researchers, designers, engineers and mixed groups think about design issues and generate debate and it were classified as four suits—Ask, Watch, Learn, Try—that describe various types of activity.

Brainstorming

- Once again there is a wealth of good advice from management consultants and system designers about how to organize and structure brainstorming sessions.
- Brainstorming sessions should be fun to participate in, but to achieve this they require an experience facilitator.
- They also require some stimuli, whether as pictures, text or video, to get the ideas flowing.
- Participants will need some way of recording their thoughts and ideas; a whiteboard, flip chart, paper and colored pens.
- Post-it notes in different colors can be used to capture ideas.
- This can be useful if the brainstorming session is followed by an affinity analysis.

Brainstorming (cont..)

- An important point about brainstorming is not to dismiss ideas too soon.
- The sessions should begin with an 'anything goes' approach.
- Generate plenty of ideas.
- These can then be filtered in a part of the session that tries to look at the feasibility of the ideas and their practical impact.
- A good technique for helping brainstorming sessions is to get different members of the group to adopt different roles - the ideas generator, the critic, the sceptic, the pragmatic, the documenter, and so on.

Fieldwork

- Observing people's activities as they happen is another excellent, though time consuming, method of understanding and requirements generation.
- Interviews and questionnaires provide one side of the story, but it is difficult for people to describe all the details of the relevant aspect of everyday life or work.
- Sometimes this is because the activity is intrinsically difficult to describe in words – many manual procedures fall into this category – or because it requires complex and subtle cooperation with other people or events.
- 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.

Observing in situ

- Data from observation helps to get round these problems.
- In its simplest form, the designer can simply ask ‘Can you show me how you do that?’ during an interview.
- More complex or larger activities will require someone to spend some time on site observing as unobtrusively as possible.
- This is best done after some initial interviewing, so you have some idea what it is you are looking at.
- Everyone at the scene must be informed what is happening and grant their permission in advance, even though they may not be your main focus.

Observing in situ (cont..)

- Ideally you need to see a range of variations on the normal activity and situations where things go wrong, but this may not be possible in many situations.
- Here the important point is to identify what you have **not** observed, so you do not over-generalize from your data.
- If you are lucky enough to be able to choose what you observe, then just as with interviews, the time to stop is when no new information appears.
- As in interviews, notes should be taken and video recording is very useful, particularly for sharing the observation with other design team members.

Observation

- ▶ Being unobtrusive is a skill of its own, and your very presence will naturally tend to make people self-conscious and may alter their behavior.
- ▶ With time, this effect will decrease.
- ▶ It is much less of a problem where the activity you are observing absorbs all the participants' attention, or if you can find a task to carry out which does not interfere with your data collection.
- ▶ It is also hard to observe effectively where the activity is simply one of people processing data at computers with little or no interaction with other people or artifacts.
- ▶ Here it would be more productive to ask people to demonstrate aspects of interest rather than waiting for them to occur in real time.
- ▶ There are also ethical issues associated with observing people, permissions need to be obtained and anonymity of who said and did what should be ensured.

Workplace Study

- ▶ Workplace studies have become the most widely practiced requirements method in the area of Computer Supported Co-operative Working (CSCW).
- ▶ By studying work as it actually happens in its real-world setting, researchers and practitioners aim to overcome many of the difficulties inherent in CSCW.
- ▶ Another factor in their popularity has been the high proportion of CSCW researchers who come with backgrounds in sociology and anthropology, where ethnography – the key approach in workplace studies – has long been practiced.
- ▶ Strictly speaking, an ‘ethnography’ is the output of observational fieldwork rather than the fieldwork itself.
- ▶ They often focus on elucidating the role and high-level requirements for a proposed new technology through a deep understanding of work in practice.
- ▶ In other projects, the ethnographer’s ‘added value’ is in the definition of usage stories and scenarios, the identification of practical issues for implementation and as a focus for a higher degree of stakeholder involvement (although in some instances, the ethnographers themselves have acted as proxy users

Ethnomethodology

- Ethnomethodologists hold that social rules, norms and practices are not imposed externally on everyday life, but that social order is continuously and dynamically constructed from the interactions of individuals.
- As a corollary of this it is philosophically unsound to generalize beyond the setting where the ethnomethodological ethnography has been undertaken, or to analyze the findings from a theoretical standpoint.
- Ethnographic work in human-centre design projects is not always the preserve of specialist 'ethnographers'.
- As the approach has gained popularity, technologists and HCI practitioners frequently 'do some ethnography' for themselves.
- Their sometimes casual adoption of the techniques has attracted some adverse comment from those trained in the field (Forsythe, 1999), and more cautious practitioners often refer to their work as 'ethnographically informed'.

Crowd Sourcing

- Here small specific tasks are put on the web and volunteers sign up to take the tasks in return for a small payment.
- Amazon's 'Mechanical Turk' is the best known example, but needs careful design of the task if it is to be effective.
- Another example: Wikipedia. Instead of they are creating an encyclopedia on their own, hiring writers and editors, they gave a crowd the ability to create the information on their own. The result? The most comprehensive encyclopedia this world has ever seen.
- The principle of crowdsourcing is that more heads are better than one. By canvassing a large crowd of people for ideas, skills, or participation, the quality of content and idea generation will be superior.
- There are different types of crowdsourcing: crowdsource design (Dell social innovation challenge, G-WIN, Zooniverse, etc.), crowdfunding (Kickstarter, Fig, Indiegogo, etc.), microtask (my starbuck idea, CrowdVoice, Co-Contest, etc.), crowdstorming (Ideastorm, Ideaken, Kraft, etc.) and open innovation (Unilever, Innovation Exchange, Nesta UK, etc.).

Crowdsourcing (Pros & Cons)

- ▶ Crowdsourcing's biggest benefit is the ability to receive better quality results, since several people offer their best ideas, skills, & support.
- ▶ Crowdsourcing allows you to select the best result from a sea of 'best entries,' as opposed to receiving the best entry from a single provider. Results can be delivered much quicker than traditional methods, since crowdsourcing is a form of freelancing. You can get a finished video within a month, a finished design or idea within a week, and microtasks appear within minutes.
- ▶ Clear instructions are essential in crowdsourcing. You could potentially be searching through thousands of possible ideas, which can be painstaking, or even complicated, if the instructions are not clearly understood.
- ▶ Some forms of crowdsourcing do involve spec work, which some people are against. Quality can be difficult to judge if proper expectations are not clearly stated.

Reflective Framework

- Why is an observation about a work practice or other activity striking?
- What are the pros and cons of the existing ways technologies are used in the setting?
- How have ‘workarounds’ evolved and how effective are they?
- Why do certain old-fashioned practices, using seemingly antiquated technologies, persist, despite there being available more advanced technologies in the setting?
- What would be gained and lost through changing current ways of working or carrying out an activity by introducing new kinds of technological support?
- What might be the knock-on effects (contingencies arising) for other practices and activities through introducing new technologies?
- How might other settings be enhanced and disrupted through deploying the same kinds of future technologies?

Techniques Summary

- ▶ Techniques for understanding people's activities in context include interviews, observation and collecting samples of artefacts, complemented by background research away from the domain of interest.
- ▶ Using more than one technique helps to compensate for their individual limitations.
- ▶ Requirements work must be documented for communication and use in design; the usual way of doing this is a requirements specification supported by illustrative materials.
- ▶ The use of scenarios starts early in the design process, with the construction of conceptual scenarios for exploring requirements and illustrating their application.

Outline for Representation Process

1. Review requirements and conceptual scenarios
- 2a. 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.
 - More complex or creative projects will benefit from the other techniques discussed. Large developments in particular will benefit from more formal structures for concrete scenarios.
- 2b. If your product is a new one, experiment with different metaphors and design concepts through your representations.
- 2c. Explore design ideas with the people who will be using the system wherever possible (using techniques described in Chapter 7).
3. Resources permitting, explore and document detailed design decisions using a method such as claims analysis or QOC.
4. Reconsider requirements in the light of the developing design, and carry out supplementary analysis where gaps in your background information have been uncovered.

Prototype as Design Representation

- ▶ A prototype is a concrete but partial representation or implementation of a system design and used extensively in most design and construction domains.
- ▶ Lim and Stolterman (2008) present a view of prototypes as „tools for traversing a design space where all possible design alternatives and their rationales can be explored... Designers communicate the rationales of their design decisions through prototypes. Prototypes stimulate reflections, and designers use them to frame, refine, and discover possibilities in a design space.“ (p. 7:2).
- ▶ Prototypes may be used to demonstrate a concept (e.g. a prototype car) in early design, to test details of that concept at a later stage and sometimes as a specification for the final product.
- ▶ A prototype may be made of something as simple as paper, cardboard or other suitable material, or it may be developed using a sophisticated software package.
- ▶ The main distinguishing characteristic of a prototype is that it is interactive. Something happens when a person „presses“ a „button“ – even if the button is drawn on paper and the action consists of a menu on a Post-it note being added by the designer.
- ▶ The appropriateness of a prototype will depend on a number of factors such as whom the prototype is aimed at, the stage of the design process and what features the designer is looking to explore.

Using Prototype

- ▶ For the design team representations like navigation maps and flow charts might be meaningful, but for clients and ordinary people some form of prototype is crucial for capturing the outcomes of the envisioning techniques we have discussed so far.
- ▶ The prototype might seek to highlight just the interface, or some crucial aspect of the functionality.
- ▶ Prototypes are first and foremost a way of involving people and clients in evaluating your design ideas.
- ▶ There are two main kinds of prototyping – low fidelity (lo-fi) and high fidelity (hi-fi).
- ▶ Also there are video prototypes, a medium that is becoming increasingly useful and common in interaction design.

Hi-Fi Prototype

- ▶ Hi-fi prototypes are similar in look and feel, if not necessarily in functionality, to the anticipated final product.
- ▶ They are produced in software, whether in the development environment which will be used for implementation or in packages that will allow interactive effects to be mocked-up easily.
- ▶ It is useful for detailed evaluation of the main design elements (content, visuals, interactivity, functionality and media) – for example, hi-fi prototypes can be used in usability studies to establish whether people can learn to use the system within a specified amount of time.
- ▶ It often constitutes a crucial stage in client acceptance – as a kind of final design document which the client must agree to before the final implementation.
- ▶ It is generally developed fairly well into the project when ideas are beginning to firm up, unless there is some crucial issue that needs to be resolved before any other work can proceed.

Hi-Fi Prototype (cont..)

- ▶ A problem with developing hi-fi prototypes is that people believe them!
- ▶ This is dangerous if the designer has not checked details and thought through ideas clearly beforehand.
- ▶ A simple error – perhaps in the name of a customer, or of a product – can completely ruin a prototype because clients or employees will get confused. If everything else seems real why aren't the customers our real customers?
- ▶ For hi-fi prototyping accurate detail is vital. Another problem with hi-fi prototyping is that it suggests such a system can be implemented. Inevitably a degree of effort and time is consumed in producing the prototype.
- ▶ If this is in the eventual development environment, developers can be understandably reluctant to discard work on features rejected in exploring the prototype.

Lo-Fi Prototype

- Lo-fi prototypes – often termed paper prototypes, since that is what they are usually made from – on the other hand, have the following features.
- They are more focused on the broad underlying design ideas – such as content, form and structure, the “tone” of the design, key functionality requirements and navigational structure.
- They are designed to be produced quickly, and thrown away as quickly.
- They capture very early design thinking and should aid, not hinder, the process of generating and evaluating many possible design solutions.
- The products of some of the envisioning techniques discussed previously are kinds of lo-fi prototypes in some respects.
- However, the most usual form of this sort of prototype is a series of „screenshots“ that people can „walk through“ (for example, a button on screen shot 1 can be „clicked“ and this is followed by screen shot 6, etc.).
- How the prototype is implemented is limited only by your imagination, by time and the materials readily to hand.

Lo-Fi Prototype (cont..)

- ▶ Very flexible prototypes can be produced simply and quickly using screen-sized pieces of stiff paper and index cards or Post-its in different colors.
- ▶ Permanent features of each screen are drawn on the card; dynamic items such as dialogue boxes or menus use the cards or Post-its, cut to size as necessary.
- ▶ Overlays of acetates can simulate dynamic features, or allow people to write comments using wipe-off pens.
- ▶ But it is really important not to spend too much time doing this – the whole point is the low investment in the prototype build.
- ▶ If you are spending a good deal of time trying to replicate design details on paper, you should probably be using a hi-fi software prototype instead.

Practical Issues with Paper Prototype

- Robustness – if a paper prototype is to be handled by lots of people it needs to be tough enough to survive.
- Scope – focus on broad issues and key elements; if you are trying to tell too detailed a story it can be hard for users to understand.
- Instructions – there is a trade-off between adding enough detail for someone to be able to use the prototype without the designer helping (in which case the boundary between the design ideas and the supplementary information can be hard to see) and adding so much detail that it needs someone to talk the user through it (which may affect the user's responses).
- Flexibility – have parts of the paper prototype adjustable so that people viewing it can „redesign it“ on the fly, e.g. by using sticky notes to represent parts of the screen where the user can move elements around or add new items.

Video Prototype

- ▶ The potential of video as a tool within the participatory design process, from initial observation, through ideas generation and design exploration, what Mackay et al called “video brainstorming” and “video prototyping” (2000).
- ▶ Vertelney’s method involves the creation of a physical mock-up model of the product, a video is then shot with an actor interacting (or “acting”) with the model as though it were fully functional.
- ▶ The products display dynamics are simulated in an animation program, and are superimposed (or composited) on the video ensuring synchronization to give the appearance that the product is actually responding to the person’s actions. The “weatherman” technique, where a video image is superimposed onto computer graphics.
- ▶ Actions are captured against a blue screen (typically a green screen is used now) allowing removal of the background (via chromakey color removal) and the superimposition of the video image onto a pre-modeled 3D environment.
- ▶ With appropriate real world camera movement synchronized with parallel movement within the virtual environment, the resulting composite can be a powerful effect.

Prototype Trade-off

- ▶ As with so many aspects of design the designer has to consider the trade-offs in terms of time, resources, the aim of the evaluation, the stage of the project and so on.
- ▶ Indeed, when reflecting on how and what to prototype, the designer should think in terms of the PACT elements – people, activities, contexts and technologies.
 - Who is the prototype aimed at?
 - What is the designer trying to achieve with the prototype?
 - What stage of the project are things at and what is the context for the use of the prototype?
 - What technologies (hi-fi or lo-fi) are appropriate?

Prototype Pitfall

- Prototyping functionality in software has its own pitfalls. For example, if the interface prototype diverges from the functional prototype it may not be possible for them to be brought together.
- Other dangers include people being unable to evaluate functionality because the interface is distractingly difficult – something that happened in DISCOVER,
- We recovered the situation by refocusing the early evaluation sessions on interaction mechanisms and considering functionality much later, when the worst problems had been resolved.
- Incidentally, this illustrates the value of prototyping with people as early as possible in the process.
- The software designers themselves had naturally experienced no problems with virtual movement.

Prototype Tools

- Given the wide range of uses for prototyping and the large number of occasions when it is used, it is not surprising that there are a wealth of software tools that can be used.
- A good prototyping tool should: Allow easy, rapid modification of interface details or functionality.
- For designers who are not programmers, allow direct manipulation of prototype components.
- For incremental and evolutionary prototypes, it should facilitate reuse of code. Not constrain the designer to default styles for interface objects.
- For requirements animation include paper, PowerPoint (e.g. for illustrating main screens) and drawing packages. Data manipulation languages such as SQL can be effective in animating the functionality of a system.
- Throw-it-away (rapid) prototyping emphasizes rapid evaluation and changing requirements. Useful software here includes Macromedia Director and similar tools, Visual Basic, PowerPoint, hypermedia tools and Web tools such as Dreamweaver or Flash.
- For evolutionary and incremental prototyping there is a compromise between production and prototyping and a long-term view of system development, so a development environment that can be used for implementation is needed. Reuse of code is likely and hence object-oriented languages are suitable.

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Presenting Design

- ▶ Presenting design ideas clearly and appropriately is a key skill of the designer.
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- ▶ 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 and there are many different reasons for giving a presentation.
- ▶ The combination of these will affect what sort of presentation and what sort of representation is suitable.
- ▶ If the ideas are aimed at senior management, for example, then it is likely that the focus is on vision, concepts and key features of design.
- ▶ People in this position are generally concerned with strategic issues rather than detail, so a presentation to management should focus on impact, image and concept.

Conclusion

- ▶ There is no firm distinction between requirements, design and evaluation, so many of the techniques described here could be used at various stages of the design process.
- ▶ Design starts with researching and understanding the situation at hand, but in the course of achieving that understanding, designers iterate between the exploration of new concepts, understanding and evaluation of ideas, designs and opinions.
- ▶ Using the techniques described here should ensure that designers undertake a human-center process.
- ▶ Envisionment and prototyping bring designs to life for both designers and the people who will use the new designs.
- ▶ Prototypes can be anywhere along the spectrum of technical sophistication, be put together in half an hour or take several days of programming.
- ▶ The point is to explore ideas, not to build an entire parallel system or product. Prototyping is at the heart of a human-center design process.

Reference

- ▶ David Benyon. Designing interactive systems: A comprehensive Guide to HCI, UX and Interaction Design. Addison-Wesley, Pearson 2013.
- ▶ Rex Hartson and Pardha S. Pyla. The UX book: Process and Guidelines for Ensuring a Quality User Experience. Elsevier 2012.
- ▶ Donald A. Norman. The Design of Everyday Things. Basic books 2002.
- ▶ Alan Dix, Janet Finlay, Gregory D. Abowd and Russell Beale. Human-Computer Interaction. Prentice hall, Pearson 2003.