Design of Interactive Systems (DIS)

Lecture 6: Techniques for designing interactive systems - Evaluation

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The Edinburgh Festival scenario

Scenario name

What shall we do now?

Scenario history

Version	*Date*	*Author*	*Description*
1	20 April 2009	D. Benyon	Discussed at Struer meeting
1.1	4 May 2009	D. Benyon	Modified following discussions at Struer

Scenario type

Activity scenario

PACT

People – young, wealthy, no children

Activities – searching for information, making bookings, meeting friends

Context – flat in Edinburgh, assume fast Internet connection

Technology – HIC as currently specified.

The Edinburgh Festival scenario

Rationale

This scenario has been developed as part of the prototype P0 deliverable. It is intended to provide a rich description of a general context of use of the HIC. The scenario is deliberately vague with respect to a number of features such as input and output media and modalities, how the content is provided, etc., in order to stimulate discussion about such things. More concrete forms of the scenario are expected to be produced to illustrate a range of media/modalities. The scenario is also intended to provide a rich source of data so that issues concerning the semantics of the information space may be considered.

Scenario

1 Jan and Pat are a couple in their mid-thirties. Pat is a university lecturer in Cultural Studies and Jan is an accounts manager at Standard Life insurance. They live in the Stockbridge area of Edinburgh in a two-bedroom flat overlooking the river. It is 12.00 noon on 15 August. Jan and Pat are sitting in their large, airy kitchen/dining room. The remains of pizza and mixed salad mingle with a pile of newspapers on the kitchen table. Jan and Pat have recently returned from a holiday on the island of Zante and, apart from checking their e-mail, have not gone back to work. They decide that they would like to go to see one of the events that is happening as part of the Edinburgh Festival.

2 The Edinburgh Festival is a large arts festival that takes place in the city for three weeks in August. It consists of two arts festivals – the Edinburgh International

Festival and the Edinburgh Festival Fringe – a book festival, a film festival, a jazz festival and a variety of related events. The International Festival is the original, and up until the mid-1980s was the bigger of the two. This is the official festival, which features prestigious performers from around the world, world-class orchestras, composers, ballet troupes, etc. The Fringe, on the other hand, started as an unofficial adjunct to the festival, traditionally more informal and adventurous. It featured new theatres like the Traverse, or the work of artistic mavericks like Demarco. Gradually over the years it has become larger than the official International Festival. In total the Edinburgh Festival consists of some 1200 distinct events that take place at 150 different venues spread throughout the city.

3 Jan activates the HIC[1] and chooses 'Edinburgh Festival'.[2] The HIC connects to the different content providers who are registered as providing content about the festival. The display shows five categories of information – Times of Events, Specific Artists, Specific Events, Specific Venues, Types of Events – a catalogue and a query facility.[3]

4 'What sort of thing do you fancy doing?' asked Jan. 'Hmmm, something funny, perhaps,' Pat replied. 'Richard Herring, maybe, or Phil Kay? Stewart Lee? I guess we ought to check out the International Festival as well.' Jan entered the query 'What do we have for Richard Herring, or Stewart Lee?'.

5 The HIC displays *Excavating Rita*, *King Dong vs. Moby Dick* and *This Morning with Richard not Judy II*[4] along with a display[5] of categories of further information: TV Reviews, Newspaper Reviews, and Times of Events.[6] Jan makes the selection[7] of Times of Events. The HIC responds with details of the events it has retrieved, displaying the data Title, ShortDescription, Venue, FromDate, ToDate, ExceptDates, Days, StartTime, Duration, Cost, ConcessionCost.[8] 'What do you think?' said Jan. 'Check out *Excavating Rita* and *This Morning with Richard not Judy II*,' replied Pat. 'Well, there may not be any tickets left for *This Morning with Richard not Judy II*, I'll check.' Jan specifies that the HIC should monitor the number of tickets left for *This Morning with Richard not Judy II*.[9] The display shows 24 tickets left. 'You had better check *Excavating Rita* as well.' 'OK.' Jan instructs the HIC to monitor TicketsLeft for *Excavating Rita* as well. The display shows 45. The display highlights that the value of TicketsLeft for *This Morning with Richard not Judy II* has changed to 20, then to 18. 'Hmmm, *This Morning with Richard not Judy II* is selling fast, I don't think we are going to make that. Is there anything else?' says Pat.

6 'Well, hundreds of things, actually.' Jan responded: 'Let's see. At 1 pm we have 'Verdi's Macbeth', a lunchtime talk at the Queen's Hall, or an archive recording of

Sir John Barbirolli at 2.15. The Nimmo Twins in 'Posh Spice Nude' at the Gilded Balloon, that's at 1.30. . . .' Jan continues to browse the listings, jumping to read reviews, watching snippets of TV Reviews, checking times and so on.[10] The display highlights changes in the TicketsLeft for *Excavating Rita*, now down to 35. At 12.30 the display indicates that *This Morning with Richard not Judy II* has started. 'Well, we had better do something,' said Pat. 'Let's go for *Excavating Rita* and book our tickets now.' Jan selects *Excavating Rita* and 'booking' and the Booking Office at the Pleasance Theatre is displayed.[11]

7 The booking form has fields for Name, Address, PhoneNumber, PostCode and CreditCard type, ExpiryDate and Number. Jan selects 'personal profile' on the HIC,[12] confirms that the details should be Jan's, and the data is entered onto the booking form.[13] 'Just a minute,' says Pat, 'Kat and Toni might like to come. Why don't you check?' Jan activates the phone[14] and selects Kat and Toni.[15] The number is dialled and Toni answers. 'We are going to see *Excavating Rita* with Richard Herring at the Pleasance. Do you fancy coming? It starts at 3.30 and there are only 35, sorry 32 tickets left.' 'Sure,' says Toni, 'We'd love to. I'll come online.'[16] Jan returns to the booking form and specifies four tickets. The total credit card amount is calculated and displayed. Jan confirms the transaction and receives a confirmation number.

8 Jan sees that Toni is online and changes to the conferencing system that they both use. Jan enters the message[17] that they have the tickets and suggests meeting for a drink beforehand. There is some discussion about the location, pubs versus restaurants versus cafés, food or not, etc.[18] Toni indicates that the area is not familiar. 'I'll see if there is a map,' says Jan.

9 Jan selects the Specific Venues category, selects the Pleasance Theatre,[19] and selects map. A map showing the area is displayed. All the restaurants, cafés, pubs, etc.[20] are shown. Jan selects Pubs and the display changes to remove the other eating and drinking places. The pubs are highlighted and referenced.[21] Jan selects three or four pubs in turn and gets information about the pub type, distance from the Pleasance, etc. Jan returns to the conference and sends the message to Toni that there is the Pleasance Courtyard, but it will be packed,[22] or the Southsider. It's a 10-minute walk, but it serves Maclays which is a nice beer.

10 Toni says that some help getting there would be useful. Jan attaches the map to a message and sends it to Toni. When Toni gets it, the HIC at Toni's end is able to provide instructions about how to get to the Southsider. 'See you in the pub in an hour, then,' says Pat, 'but you had better get started. I just checked the traffic on the Dalkeith Road and it's terrible.'

Evaluating Early Interface Prototype

Usability Principles

- *Learnability.* Can people guess easily what the system will do, based upon previous experience? This covers the usability principles of visibility, consistency, affordance and familiarity.
- *Effectiveness.* Can people correct or change previous decisions, and complete their desired task easily, effectively and safely? This covers the usability principles of navigation, control, feedback, recovery and constraints.
- *Accommodation.* Is the system designed to afford a multiplicity of ways in which people can accomplish their goals? Is it pleasant to use? This covers the usability principles of flexibility, style and conviviality.

Summary

- How scenarios were developed to explore the design space of the HIC device
- How the scenarios were analyzed in order to understand the main functionality the device required
- How the key design concepts were developed through prototyping ideas, evaluating them and redesigning them
- How key design concepts were realized physically and how the physical design affected the conceptual design and vice versa
- How a physical design was evaluated, focusing on some key aspects of the design.

Part II Techniques for designing interactive systems

- **Chapter 7**: Understanding
- **Chapter 8**: Envisionment
- **Chapter 9**: Design
- **Chapter 10**: Evaluation
- **Chapter 11**: Task Analysis
- **Chapter 12**: Visual Interface Design
- **Chapter 12**: Multimodal Interface Design

Evaluation

- Forth main process of interaction systems design
- Reviewing, testing a design idea, piece of software, product or service
- Criteria:
  - System is *learnable*, *effective* and *accommodating*
  - Is this enough?
- Designers are concerned not just with surface features such as the meaningfulness of icons, but also with whether the system is fit for its purpose, enjoyable, engaging and so on.

Aim

- Appreciate the uses of a range of generally applicable evaluation techniques designed for use with and without users
- Understand expert-based evaluation methods
- Understand participant-based evaluation methods
- Apply the techniques in appropriate contexts.

Challenges in Evaluation

- Evaluation of different types of system, or evaluation in different contexts, may offer particular challenges.
- Evaluation is closely tied to *understanding*, *design* and *envisionment*
- Only features represented in a form approp. for the type of evaluation can be evaluated
- Who is involved in the evaluation?

Evaluation Types

- There are two main types of evaluation
- Expert-based methods
  - reviewing some form of envisioned version of a design by usability expert or interaction designer
- Participant methods:
  - Involves recruiting people (end-users) to use an envisioned version of a system
  - The characteristics of the target population should be captured through personas

Evaluation

- Evaluation occurs throughout interaction design process
- At different stages, different methods will be more or less effective
- Form of envisionment of the future systems is also critical to what can be evaluated
- Obtaining feedback to inform early design concepts
- Deciding between different design options

Checking for Usability Problems

- Testing will identify potential problems once a stable version of the technology is available
  - Vertical or horizontal prototype
- Check that interaction is ‘user-friendly’ just before development is completed
- formative evaluation, because the results help to form - or shape - the design
- Government departments often require suppliers to conform to accessibility standards and health and safety legislation

Expert Evaluation

- There is **no** substitute for getting real people to use your design, but expert evaluation is effective, particularly early in the design process
- Experts will pick up common problems based on this experience, and will identify factors that might otherwise interfere with an evaluation by non-experts
- Expert will **walk through** representative tasks or scenarios of use
- Additionally they may *adopt one of the personas*.

Expert Evaluation: Heuristic evaluation

- Refers to a number of methods in which a person trained in HCI and interaction design examines a proposed design to see how it measures up against a list of principles, guidelines or ‘heuristics’ for good design
- design principles
  - or heuristics

1. Visibility	7 Feedback
2 Consistency	8 Recovery
3 Familiarity	9 Constraints
4 Affordance	10 Flexibility
5 Navigation	11 Style
6 Control	12 Conviviality

Expert Evaluation: Discount usability engineering

- If time is very short, a quick review of the design against the following triad can produce reasonably useful results
- usability principles:
  - *learnability* (1-4)
  - *effectiveness* (5-9)
  - *Accommodation (10-12)*

1. Visibility	7 Feedback
2 Consistency	8 Recovery
3 Familiarity	9 Constraints
4 Affordance	10 Flexibility
5 Navigation	11 Style
6 Control	12 Conviviality

- **You should not evaluate your own designs.**

Jakob Nielsen's 10 general principles for interaction design

- #1: Visibility of system status
- #2: Match between system and the real world
- #3: User control and freedom
- #4: Consistency and standards
- #5: Error prevention
- #6: Recognition rather than recall
- #7: Flexibility and efficiency of use
- #8: Aesthetic and minimalist design
- #9: Help users recognize, diagnose, and recover from errors
- #10: Help and documentation

https://www.nngroup.com/articles/ten-usability-heuristics/

Expert Evaluation: Cognitive walkthrough

A rigorous paper-based technique for checking through the detailed design and logic of steps in an interaction

Inputs to the process are:

- An understanding of the people who are expected to use the system
- A set of concrete scenarios representing both (a) very common and (b) uncommon but critical sequences of activities
- A complete description of the interface to the system - this should comprise both a representation of how the interface is presented, e.g. screen designs, and the correct sequence of actions for achieving the scenario tasks, usually as a hierarchical task analysis (HTA).

Having gathered these materials together, the analyst asks the following four questions for each individual step in the interaction:

- Will the people using the system try to achieve the right effect?
- Will they notice that the correct action is available?
- Will they associate the correct action with the effect that they are trying to achieve?
- If the correct action is performed, will people see that progress is being made towards the goal of their activity?

Expert Evaluation: Cognitive walkthrough

- What if any of answers in negative?
  - usability problem has been identified and is recorded
  - redesign suggestions are not made at this point
- If the walkthrough is being used as originally devised, this process is carried out as a group exercise by analysts and designers together
- The analysts step through usage scenarios and the design team are required to explain how the user would identify, carry out and monitor the correct sequence of actions

Cut-down Versions of Cognitive walkthrough

- **cognitive jogthrough**
  - video records are made of walkthrough meetings
  - annotated to indicate significant items of interest
  - design suggestions are permitted
  - low-level actions are aggregated wherever possible
- **streamlined cognitive walkthrough**
  - Will people know what to do at each step?
  - If people do the right thing, will they know that they did the right thing, and are making progress towards their goal?

Participant-based Evaluation

- Various degrees of cooperation with people
- Cooperative evaluation
  - a means of maximizing the data gathered from a simple testing session
  - participants are not passive subjects but work as co-evaluators
  - a reliable but economical technique in diverse applications
- Participatory heuristic evaluation
- Co-discovery
- Controlled experiments

- Cooperative evaluation guidelines
- Prepare questions during and after the evaluation

Table 10.1 Guidelines for cooperative evaluation

Step	Notes
1 Using the scenarios prepared earlier, write a draft list of tasks.	Tasks must be realistic, doable with the software, and explore the system thoroughly.
2 Try out the tasks and estimate how long they will take a participant to complete.	Allow 50 per cent longer than the total task time for each test session.
3 Prepare a task sheet for the participants.	Be specific and explain the tasks so that anyone can understand
4 Get ready for the test session.	Have the prototype ready in a suitable environment with a list of prompt questions, notebook and pens ready. A video or audio recorder would be very useful here.
5 Tell the participants that it is the system that is under test, not them; explain and introduce the tasks.	Participants should work individually – you will not be able to monitor more than one participant at once. Start recording if equipment is available.
6 Participants start the tasks. Have them give you running commentary on what they are doing, why they are doing it and difficulties or uncertainties they encounter.	Take notes of where participants find problems or do something unexpected, and their comments. Do this even if you are recording the session. You may need to help if participants are stuck or have them move to the next task.
7 Encourage participants to keep talking.	Some useful prompt questions are provided below.
8 When the participants have finished, interview them briefly about the usability of the prototype and the session itself. Thank them.	Some useful questions are provided below. If you have a large number of participants, a simple questionnaire may be helpful.
9 Write up your notes as soon as possible and incorporate into a usability report.	

Sample questions *during* the evaluation:
- What do you want to do?
- What were you expecting to happen?
- What is the system telling you?
- Why has the system done that?
- What are you doing now?

Sample questions *after* the session:
- What was the best/worst thing about the prototype?
- What most needs changing?
- How easy were the tasks?
- How realistic were the tasks?
- Did giving a commentary distract you?

Participant-based Evaluation

- Cooperative evaluation
- Participatory heuristic evaluation
  - it extends the power of heuristic evaluation without adding greatly to the effort required
  - the participants are involved as ‘work-domain experts’ alongside usability experts and must be briefed about what is required
- Co-discovery
- Controlled experiments

Participant-based Evaluation

- Cooperative evaluation
- Participatory heuristic evaluation
- Co-discovery
  - A naturalistic, informal technique that is particularly good for capturing first impressions
  - best used in the later stages of design
  - having participants explore new technology in pairs
- Controlled experiments

Participant-based Evaluation

- Cooperative evaluation
- Participatory heuristic evaluation
- Co-discovery
- Controlled experiments
  - appropriate where the designer is interested in particular features of a design
  - experiment needs to be carefully designed and run
  - Independent, dependent, and confounding variable

Evaluation in Practice

The main steps in undertaking a simple but effective evaluation project are:

1. Establish the aims of the evaluation, the intended participants in the evaluation, the context of use and the state of the technology; obtain or construct scenarios illustrating how the application will be used.
2. Select evaluation methods. These should be a combination of expert-based review methods and participant methods.
3. Carry out expert review.
4. Plan participant testing; use the results of the expert review to help focus this.
5. Recruit people and organize testing venue and equipment.
6. Carry out the evaluation.
7. Analyse results, document and report back to designers.

Evaluation in Practice

- cost-benefit trade-off

Table 10.2 Perceived costs and benefits of evaluation methods. A '+' sign denotes a benefit, and a '–' a weakness. The numbers indicate how many respondents mentioned the benefit or weakness.

Benefit/weakness	Formal heuristic evaluation	Informal expert review	Usability evaluation
Cost	+ (9)	+ (12)	– (6)
Availability of expertise	– (3)	– (4)	
Availability of information			+ (3)
Speed	+ (10)	+ (22)	– (3)
User involvement	– (7)	– (10)	
Compatibility with practice			– (3)
Versatility			– (4)
Ease of documentation			– (3)
Validity/quality of results	+ (6)	+ (7)	+ (8)
Understanding context	– (10)	– (17)	– (3)
Credibility of results			+ (7)

Source: Adapted from Vredenburg, K., Mao, J.-Y., Smith, P.W. and Carey, T. (2002) A survey of user-centred design practice. *Proceedings of SIGCHI conference on human factors in computing systems*, MN, 20–25 April, pp. 471–8, Table 3. © 2002 ACM, Inc. Reprinted by permission