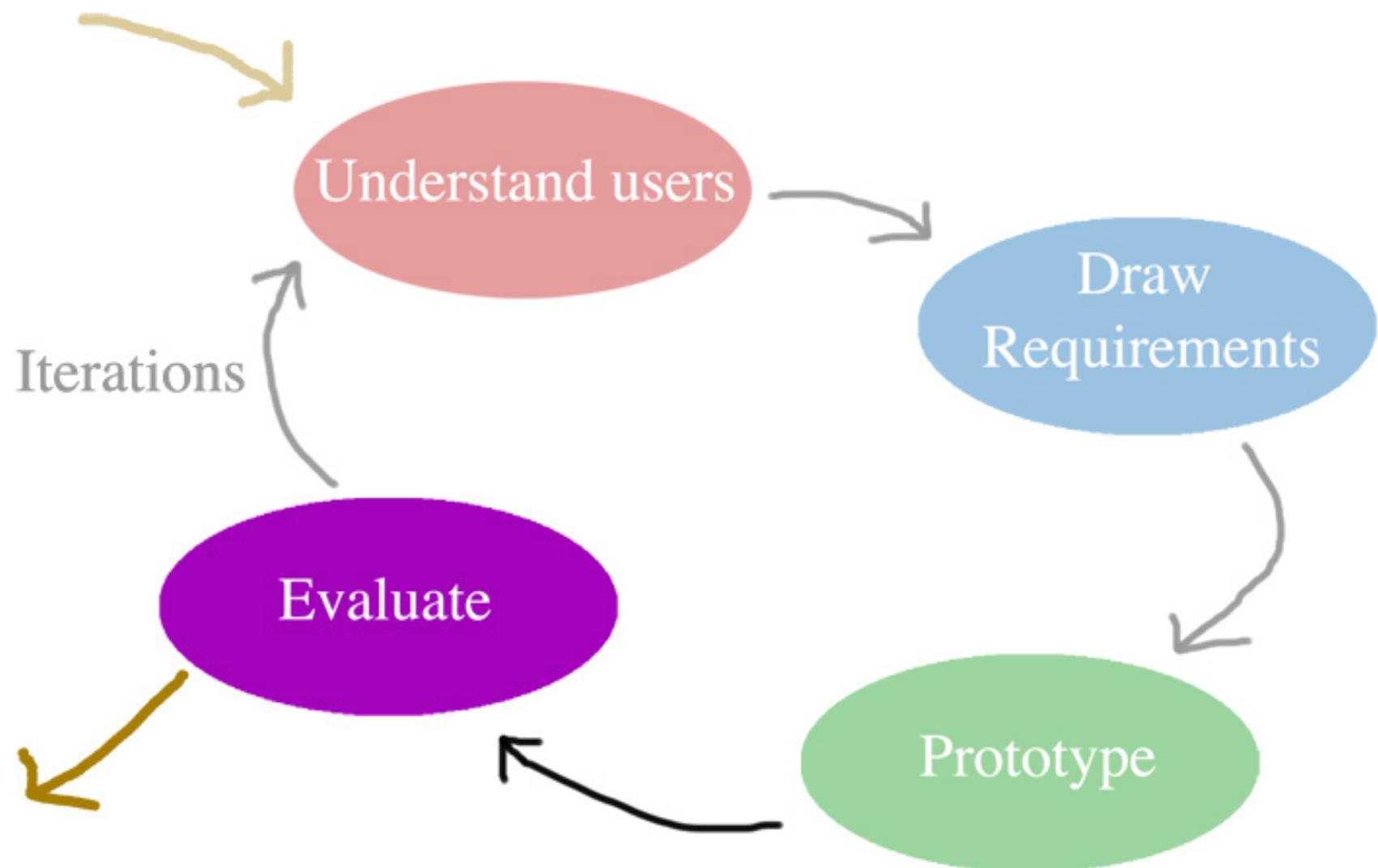


CS4826 HCI

Week 10

The User-Centred Design Process



Evaluation methodologies.

Evaluation is the phase of the design process when the effectiveness of the system and its respondance to the set of requirements is assessed.

The primary distinction to be made about evaluation regards two different possible modalities applicable:

- **Analytical modality**: by performing a *simulation (model)* of how the user's activities will be performed.
- **Empirical modality**: by building testing a prototype, or testing an existing system in the hands of users or conducting a series of experiments.

Analytical modality.

Analytical techniques can sometimes be carried out quite quickly and informally.

Two-stage process:

1. Determine the sequence or method by which the activity is performed by means of a *walkthrough*: each step of the sequence is determined from the state of the interaction after the previous step and from the user's current goal. This creates a model of the activity
2. Analyse the steps in the sequence against measures/guidelines.

Analytical modality.

In many interactive contexts, there is no single walkthrough sequence because the activity may be performed in **several different ways**. Sometimes it is necessary to model a number of alternative sequences in order to check for possible usability problems (see for example how to do task analysis)

Limit of this approach is that there is no way to include in the walkthrough model information about the external condition and the **context** in which the activity is performed (for example: in case of possible different alternative sequences of execution, what are the causes to determine one instead of another?)

Analysis techniques.

GOMS analysis methods

Cognitive Walkthrough

Heuristic Evaluation

(ref. to user studies)

Analysis techniques: GOMS.

The GOMS model of performance has four parts:

- **Goals**: the end-state that the user is trying to achieve;
- **Operators**: the basic actions available to the user for performing a task (such as moving the mouse pointer, clicking the mouse button, pressing a key, etc);
- **Methods**: they are sequences of operators, or procedures, for accomplishing a goal;
- **Selection rules**: they are invoked when there is a choice of method.

Analysis techniques: Cognitive Walkthrough.

Cognitive Walkthroughs provide a method of analysing designs in terms of **exploratory learning**.

Analysis by CW involves simulating the way users explore and gain familiarity with interactive systems.

Analysis techniques

Formal methods: evaluating the effectiveness of design decisions on the basis of requirements.

Framework: cognitive walkthrough

Analysis techniques: Cognitive Walkthrough.

The model of exploratory learning:

0. The user starts with a rough plan of what he or she wants to achieve - a task to be performed;
1. The user explores the system, via the user interface, looking for actions that might contribute to performing the task;
2. The user selects the action whose description or appearance most closely matches what he or she is trying to do;
3. The user then interprets the system's response and assesses whether progress has been made towards completing the task.

Analysis techniques: Cognitive Walkthrough.

The analysis by CW involves simulating steps 1, 2 and 3 at each stage of interaction, by asking questions of the form:

Q1. *Will the correct action be made sufficiently evident to the user?*

Q2. *Will the user connect the correct action's description with what he or she is trying to do?*

Q3. *Will the user interpret the system's response to the chosen action correctly, that is, will the user know if he or she has made a right or a wrong choice?*

Analysis techniques: Heuristic Evaluation.

The method of Heuristic Evaluation can be applied also to those situations where the method of operation is not fully predictable, and where the user is not a complete novice.

H.E. relies on two techniques in combination:

1. It employs a team of **expert evaluators** (process of aggregation);
2. A set of design **heuristics** is used to guide the analysis that the evaluators apply.

The experts perform a thorough walkthrough of the system under assessment evaluating it against a set of guidelines. Usually a team of 3 experts covers the 80% of the problems present in a system.

Analysis techniques: Heuristic Evaluation.

Jakob Nielsen's 10 Heuristics for evaluation:

Visibility of system status

The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.

Match between system and the real world

The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.

User control and freedom

Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.

Consistency and standards

Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

Error prevention

Even better than good error messages is a careful design which prevents a problem from occurring in the first place.

Analysis techniques: Heuristic Evaluation.

Recognition rather than recall

Make objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.

Flexibility and efficiency of use

Accelerators -- unseen by the novice user -- may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

Aesthetic and minimalist design

Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

Help users recognize, diagnose, and recover from errors

Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.

Help and documentation

Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

Analysis techniques: Heuristic Evaluation.

Advantages:

relatively low cost; intuitive to perform; no advance planning required; suitable for use early in the development process; it relies on strong expertise and competence.

Disadvantages:

this method doesn't involve the real users!!!!

Moreover, some problems occurring when the system is used in the real work practice and context cannot be highlighted by expert evaluators.

Empirical modality.

Empirical evaluation is basically based on the development of **prototypes**: representations of all or some of the functionalities of the system that can be used to test the user's performance of the activity.

Since the system is interactive, testing must be carried out **with people**, either under **controlled conditions** or out in the **field**.

Empirical modality.

Two possible approaches to empirical evaluation:

- **Summative** evaluation: a single evaluation exercise is performed at the end of the iterative enhancement process (when it's too late to influence the design! See Waterfall model).
- **Formative** evaluation: the approach is oriented towards helping form the solution of the design problem. Check design decision that have already been made and to assist in making the decisions that lie ahead. Evaluation happens throughout

Empirical modality.

Methods of **formative evaluation (from more open-ended to highly structured)**:

- A.** Learning from designing and building prototypes.
- B.** Running informal user tests of the initial prototype.
- C.** Conducting a series of field tests (or progressive enhancements of the same prototype). Full-scale field test.
- D.** Testing a component of the design under controlled conditions.

Empirical modality.

B. Informal testing of prototypes.

Goals of informal testing:

to know as soon as possible whether we have made the right choice, and are on course to achieve a solution to the overall design problem.

It is important to make constant reference to the requirements expressed in order to provide a solution to the design problem.

Empirical modality.

Conducting the investigation (six-stage framework, Newman & Lamming, 1995).

1. **Identifying key properties**: we identify the usability properties to be measured, stating particular requirements that the design should attain.
2. **Developing the prototype**: we make ready the prototype to be used for the evaluation.
3. **Experimental design**: we design the experiment: we locate the users who will test the system, we define the activities the users should perform, and we schedule the tests.
4. **Collecting data**: we run the tests and collect data; each user is briefed suitably beforehand on the testing procedures (provide documentation).
5. **Data analysis**: we analyse the data to establish how the conditions of testing have affected the performance of activities.
6. **Drawing conclusions**: we draw conclusions about any improvements needed in the design.

Empirical modality.

C. Iterative field tests.

The primary aims are to expose a prototype to a wide variety of realistic forms of use, and to give the evaluators a chance to observe this usage thoroughly. Both of these require **time**.

Example: Participative evaluation: users participate in extended field tests. Users are drawn into the investigation and they actively support the designers in the development of the solution.

Empirical modality.

Some techniques applied in empirical usability testing (see what discussed about user studies):

- **Observations;**
- Analysis of verbal protocols (on video material);
- Software logging (very limited method);
- Collecting users' opinions by means of questionnaires and interviews.

Empirical modality.

Cooperative evaluation: involving end-users into the evaluation of a device/interface

- setting up a task list: people will be invited to perform these tasks
- While, doing this the users will be asked to comment on their actions (Thinking Aloud Technique)
- Also observations of how they are dealing with the tasks
- De-briefing interview at the end

Empirical modality.

D. Controlled experiments in support of design.

We control carefully the conditions under which the system is used:

- accurate measurements of the usability levels,
- performance comparison in different designs considering specific variables.

1. Choice of samples of a population
2. Consider a set of variables (and nuisance variables)
3. Set the context of the task performance
4. Analyse the data by means of statistical methods.

Examples of Empirical Evaluation

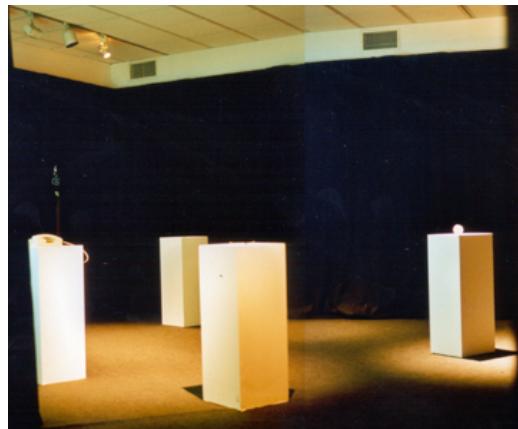
SHAPE Project, Hunt Museum

Full interactive exhibition “Re-Tracing the Past”

Public performance, 10 days

Documentation through: video recordings, observations
and notes, interviews and informal conversations

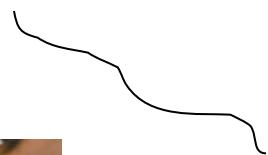
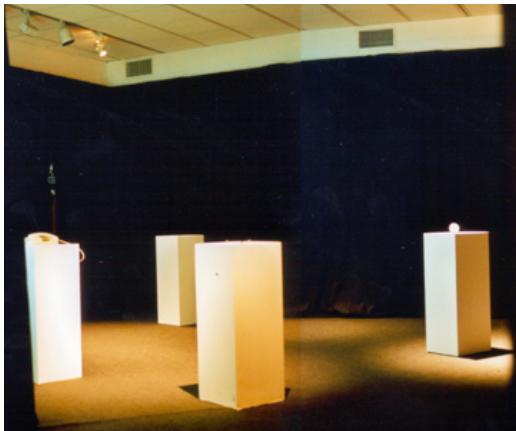
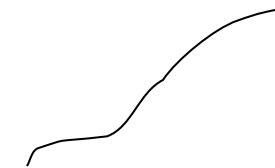
SHAPE: “Re-Tracing the Past”



SHAPE: “Re-Tracing the Past”



The Study Room



The Room of Opinion



SHAPE: “Re-Tracing the Past”

Evaluation and reflection:

People's experience of the two spaces

Appreciation of material qualities

Patterns of activities

Individual traces, perception of their own contribution to the exhibition



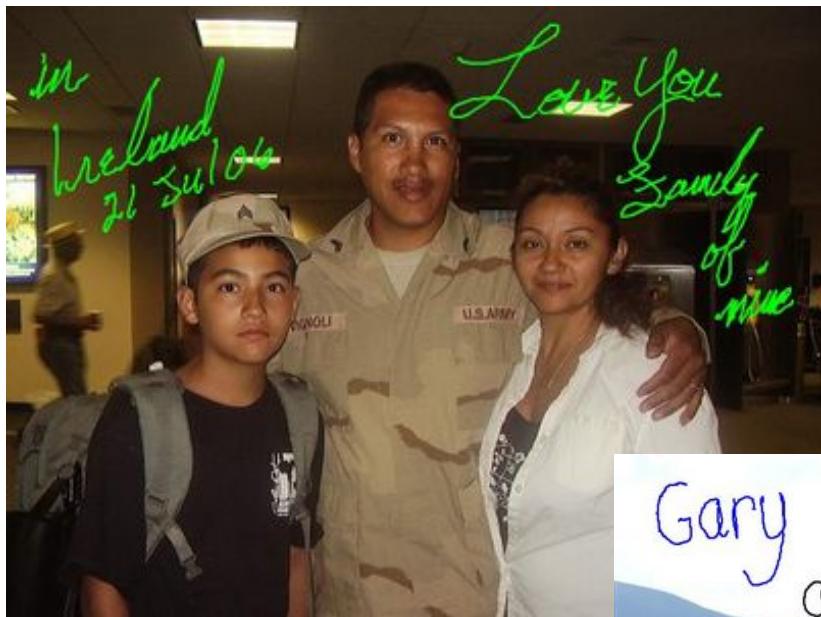
Shared Worlds: The Shannon Portal



Sharing stories and images
Linking different places
Linking the airport with its surroundings
Importance of physical design



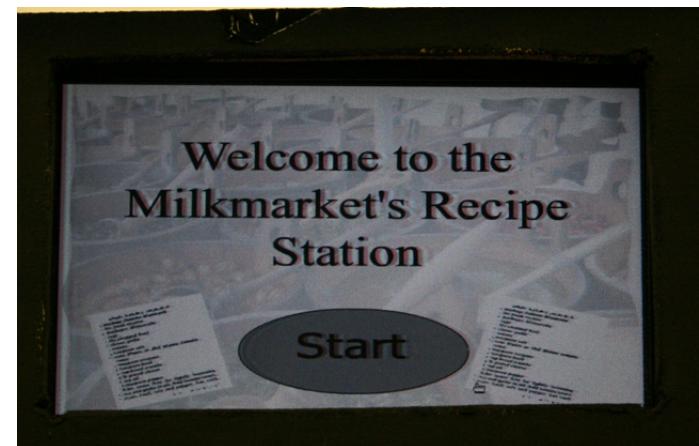




Gary Sinnott
and
Kyle Sinnott
and
Robyn Merrick



Shared Worlds: the Milk Market Recipe Station



The Recipe Station: Interactive public installation that allows passengers to browse recipes using ingredients from the Limerick Milk Market