CH1- Introduction

Designing Interactive products to support the way people communicate and interact in their everyday and working lives

Key Elements

• Understanding of the capabilities and desires of people

• Technology available to interaction designers

• Methodology (knowledge of how to identify requirements and develop them into a suitable design

What to design. Take into account:

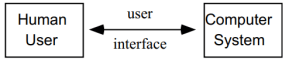
– Who the users are (average, expert, etc)

– What activities are being carried out

– Where the interaction is taking place

• Need to optimize the interactions users have with a product - So that they match the users' activities and needs

Dual Processor" Theory: – Every interactive system is a distributed system running on two processors:



User productivity =Functionality (what the computer can do)*Usability (what people can do with the computer)

• If either of these is zero, the system is useless

The benefits almost always outweigh the costs

Process:

• Establishing requirements

• Developing alternatives

• Prototyping

• Evaluating

Usability goals

• Effective to use (is product capable of doing what is supposed to do?)

• Efficient to use (can users sustain a high level of productivity)

• Safe to use (what is the range of possible errors? Need to protect users from dangerous conditions, Xray?)

• Have good utility (does the product have an appropriate set of functions?

• Easy to learn (how fast can you learn the product?)

• Easy to remember how to use

Design Principles

Visibility: is it visible as to what to do? Make relevant parts visible.

Feedback: sending information back to user about what has been done. (sounds, highlighting, animation)

Constraints: restricting the possible actions that can be performed. Helps prevent user from selecting incorrect option

Consistency: design interfaces to have similar operations and use similar elements for similar tasks. Easier for user to learn and use- internal consistency: designing operations to behave the same within an application. External consistency: designing operations, interfaces, to be same across applications and devices

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Affordance: to give a clue.

A five level conceptual model of the UI

• At each level:– Design must be done– **Problems can occur**

1. Task Level: What is to be done by the user

2. Conceptual Level: User's intended mental model of the system

3. Interaction Style Level: Command-driven, menu-driven, direct manipulation, hypermedia•Design elements that are repeated throughout the system

4. Interaction Element Level: Specific windows, dialogs, commands, menus

5. Physical Element Level: Bitmaps, characters, data structures, callbacks

"There are no good user interfaces ... just user interfaces that fit"

Malfunction: "A mismatch between what the user wants, needs or expects and what the system provides"• "A breakdown in usability"• "An obstacle to performing a desired task"

– **Error**: Identifiable mistake on the part of the designer

– **Defect**: A deviation from what the user needs

Interaction design: Is concerned with designing interactive products to support the way people communicate and interact in their everyday and working lives

CH2- Evaluation

Why: to check users' requirements and that users can use the product and they like it.

• **What**: a conceptual model, early prototypes of a new system and later, more complete prototypes.

• **Where**: in natural and laboratory settings.

• **When**: throughout design; finished products can be evaluated to collect information to inform new products.

Where to evaluate

• **Laboratories**: provides the control necessary to investigate if requirements are met.

• Natural Settings or wild studies.

• **Living Laboratories**: Between regular labs and natural settings.

When to evaluate

•**Formative evaluations**: When evaluations are done during design to check if product continues to meet user's need.

• **Summative evaluations:** when evaluations are done to assess the success of a finished product.

Types of evaluation: laboratory based with users, in the field with users,

studies that do not involve users

Any settings not involving users: **Inspections**: employed to predict user's behavior and to identify usability problems based on knowledge of usability, user's behavior, context is which system will be used and kinds of activities users undertake. Done by experts.1. **Heuristic** Evaluation 2. **Cognitive** walkthroughs. **Analytics**: Technique for logging data either at a customer's site or remotely. It is a method for evaluating traffic through a system. **Models**: Technique used primarily for comparing the efficacy of different interfaces for the same application.

Ch3- An evaluation Framework

DECIDE: a framework to guide evaluation: Determine the goals. Explore the questions. Choose the evaluation methods. Identify the practical issues. Decide how to deal with the ethical issues. Evaluate, analyze, interpret and present the data.

Participants have a right to:

- Know the goals of the study;
- Know what will happen to the findings;
- Privacy of personal information;
- Leave when they wish;
- Be treated politely.

Identify practical issues. ex, how to:

•Select users

•Find evaluators

•Select equipment •Stay on budget •Stay on schedule

Evaluate, interpret & present data

• Reliability or consistency: can the study be replicated and get same results?E.g. a highly controlled experiment would be highly reliable, but unstructured interviews would have a low reliability.

• Validity: is it measuring what you expected? Are we meeting the goal?

• Biases: is the process creating biases? Biases occur when results are distorted. e.g. Evaluators get to decide what is and what is not important. (subjective)

• Scope: can the findings be generalized?

• Ecological validity: is the environment influencing the findings? i.e. Hawthorn effect. (users are aware of being studied)

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Outtake:

Users can be categorized:

– By class

• Determined by the pattern of use:

» e.g., manager, salesperson, shipper, client

– By personality type

• Shy or reticent

• Inarticulate

• Disinterested or defensive

• Intimidated

• Involved designer!

– By ability

• Physical disability

» --> innovative I/O may be needed

• Colourblind

» --> don't use colours as the only means of conveying information

• Dyslexia or other cognitive glitches

» --> watch out for left vs. right!

• Illiteracy

» --> icons may be needed

• Computer illiteracy

• Ignorance of domain / learner

CH4- Data gathering and analysis

Five key issues:

• Setting goals
  -Decide how to analyze data once collected
  -Goals influence data gathering sessions, techniques and analysis of data.

• **identifying participants**
  -Decide who to gather data from
  -Done via sampling of population who fits profile. -Probability sampling (random sampling) and non-probability sampling (convenience sampling or volunteer panels)

• **Relationship with participants**
  -Informed consent when appropriate
  -Consent not needed when collecting data for requirements activity

Triangulation

-Look at data from more than one perspective

-**Triangulation of data** – data drawn from different sources or people or places

-Investigator triangulation – different researchers

-Triangulation of theories or frameworks through which to view data or findings

-**Methodological triangulation** – looking at different data gathering techniques

• **Pilot studies**

-Ensure proposed method is viable before embarking on real study

-Plans should be tested and validated (e.g valid questionnaires)

Data, info & conclusions

• Raw data – collected data

• Information – data analyzed and interpreted

• Conclusions – action to be taken based on info

Data recording: self-documenting (questionnaires, diaries, interaction logging), notes, audio, video, photographs, Notes+photographs, Audio+photographs, Video – captures both visual and audio data.

Introduction → Warm-up (easy qs non-threatening) → Main body (qs in logical order) → Cool-off period (easy qs/ diffuse tension) → Closure

Three main data gathering methods: interviews, questionnaires, observation

Interviews

Unstructured: not directed by a script|generate rich data but !replicable|

Structured: tightly scripted|replicable but lack richness, questionnaires

Semi-structured: guided by a script but interesting issues can be explored in more depth. Balance between richness and replicability

Focus groups – Interviewing people in groups- useful for investigating community issues.

Closed and open questions

CH4- Continued

Encouraging a good response

• Make sure purpose of study is clear

• Promise anonymity

• Ensure questionnaire is well designed

• Offer a short version for those who do not have time to complete a long questionnaire

• If mailed, include a stamped addressed envelope

• Follow-up with emails, phone calls, letters

• Provide an incentive

• 40% response rate is high, 20% is often acceptable

Online questionnaires:

-Responses are usually received quickly No copying and postage costs Data can be collected in database for analysis Time required for data analysis is reduced Errors can be corrected easily

-Sampling is problematic if population size is unknown

Observation Methods

Direct: Structuring frameworks – Degree of participation (insider or outsider) – Ethnography Direct in controlled: think aloud technique

Indirect observation: tracking users' activities –Diaries – Interaction logging – Web analytics

Ethnography: philosophy with a set of techniques + participant observation and interviews

• Co-operation of people being observed is required

• Informants are useful

• Data analysis is continuous

• Interpretivist technique

• Questions get refined as understanding grows• Reports usually contain examples

Quantitative data – expressed as numbers

Qualitative data – difficult to measure sensibly as numbers, e.g. count number of words to measure dissatisfaction

Quantitative analysis – numerical methods to ascertain size, magnitude, amount, averages, means, percentages, graphical rep. Web analytics

Qualitative analysis – expresses the nature of elements and is represented as themes, patterns, stories, categorizing data, looking for critical incidents
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Ch5- Evaluation studies: From controlled to natural settings

Usability testing: test if product is usable by the intended user population to achieve the tasks for which it was designed.

Usability Testing Procedure

- Select the participants
- Identify the tests (set of tasks)
- Setup the equipments
- Perform tests
- Identify usability problems
- Interpret and present the data

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- recording performance of typical users doing typical tasks.
- Done in Controlled settings.
- Users are observed and timed.
- Data is recorded on video & key presses are logged
- The data is used to calculate performance times, and to identify & explain errors.
- User satisfaction is evaluated using questionnaires & interviews.
- Field observations may be used to provide contextual understanding.

Labs and Equipment

- Custom-built labs with a main testing laboratory (with equipment) and an observation room where evaluators watch and analyze.• Can be in an office.• Usability labs - very expensive and labor-intensive to run and maintain.• Mobile usability labs – less expensive (referred to as lab-in-a-box).• Remote usability testing (UserZoom) – users perform a set of tasks with a product in their own setting and interactions with the software are logged remotely.

- **Null hypothesis** – No difference in results
- **Alternative hypothesis** – a difference exists
- **Two-tailed hypothesis** –difference not stated (can be either way), cannot be supported
- **One-tailed hypothesis** – difference is stated and supported

CH6- Analytical evaluation

Nielsen's heuristics

- Visibility of system status.
- Match between system and real world.
- User control and freedom.
- Consistency and standards.
- Error prevention.
- Recognition rather than recall.
- Flexibility and efficiency of use.
- Aesthetic and minimalist design.
- Help users recognize, diagnose, recover from errors.
- Help and documentation.

3 stages:

- Briefing session to tell experts what to do.
- Evaluation period of 1-2 hours in which:

– Each expert works separately;
– Take one pass to get a feel for the product;
– Take a second pass to focus on specific features.

- Debriefing session in which experts work together to prioritize problems.

Advantages and problems

- Few ethical & practical issues to consider because users not involved.
- Can be difficult & expensive to find experts.
- Best experts have knowledge of application domain & users.
- Biggest problems:

– Important problems may get missed;
– Many trivial problems are often identified;
– Experts have biases.

The 3 questions from evaluators

- Will the correct action be sufficiently evident to the user?
- Will the user notice that the correct action is available?
- Will the user associate and interpret the response from the action correctly?

GOMS

- Goals – what the user wants to achieve (eg. find a website.)
- Operators - the cognitive processes & physical actions needed to attain goals, (eg. decide which search engine to use.)
- Methods - the procedures to accomplish the goals, (eg. drag mouse over field, type in keywords, press the go button.)
- Selection rules - decide which method to select when there is more than one.

Fitts' Law predicts that the time to point at an object using a device is a function of the distance from the target object & the object's size.

The GOMS and KLM models and Fitts' Law can be used to predict expert, error-free performance for certain kinds of tasks.

Ch 7 – Heuristic Evaluation

Phases of Heuristic Evaluation

1) Pre-evaluation training: give evaluators needed domain knowledge and information on the scenarios
2) Evaluation: individuals evaluate and then aggregate results
3) Severity rating: determine how severe each problem is (priority)
4) Debriefing: discuss the outcome with design team

Heuristics

•H2-1: Visibility of system status: keep users informed about what is going on
•H2-2: Match between system and real world: speak the users' language
•H2-3: User control and freedom: "exits" for mistaken choices, undo, redo, don't force down fixed paths
•H2-4: Consistency & standards
•H2-5: Error prevention
•H2-6: Recognition rather than recall: make objects, actions, options, and directions visible or easily retrievable
•H2-7: Flexibility and efficiency of use: accelerators for experts
•H2-8: Aesthetic and minimalist design: no irrelevant information in dialogues
•H2-9: Help users recognize, diagnose, and recover from errors: error messages in plain language, precisely indicate the problem, constructively suggest a solution
•H2-10: Help and documentation

Heuristic evaluation is a discount method
➔ cheaper in the long run

Severity Rating:

0- don't agree that this is a usability problem
1- cosmetic problem
2- minor usability problem
3- major usability problem; important to fix
4- usability catastrophe; imperative to fix

CH4 – Extra

Q1. How is the malfunction manifested?

a)Malfunctions detected by the system (easiest to detect)
– omission of an argument – incorrect date format
Cure:– Better prompts, consistency, visible examples, more forgiving of alternatives
b)Malfunctions detected by the user during operation
–wrong path in menu hierarchy– !finding required help– not being able to perform a certain action– not being able to tell which state system is in
Cure:– Improve functionality, feedback, clarity, simplicity
c) Malfunctions undetected (until later)
– output produced is wrong due to wrong inputs– unnecessary work performed
Cure:– Improve feedback indicating consequences of input; simplify
d) Inefficiencies
– excessive response time– excessive think time– unnecessarily long command sequences– unnecessary repetitions– complex operations that require use of reference
Cure:– Simplify, speed system up

Q2. What Stage in the Interaction the Malfunction Occur?

a) When the user decides on next goal (Forms an intent to do inappropriate thing)– decides to empty a field because user thinks it is unimportant (when itis important)– decides to charge default exchange rate (when should obtain current exchange rate)
Cure:– Lead user through task better; better feedback; better training
b) When the user specifies the action (Action does not match the goal)
– deletes the record instead of emptying a field
Cure:– Improve clarity, feedback, prompts, conceptual model
c) When the system executes the action– Defects in functionality
Cure:– Fix functionality in normal way
d) When the user interprets the resulting system state
– thinks bank account has been debited when it has not– thinks system has 'hung' when it has not– thinks some data must be entered when it is the default– cannot understand resulting error message
Cure:– Better feedback, better conceptual model

Q3. At Which Level Does the Malfunction Occur?

a) Task level (Task and goals not supported)
– What the user wants to do cannot be done by the system
– Functionality is not provided
Cure:– Add functionality

b) Conceptual level (User has wrong mental model; does not understand intended conceptual model)
– thinks that money is being deducted from bank account when it is being charged to a credit card– thinks that dragging a file to the desktop means they are no longer on the disk– thinks that dragging a disk to the trash can icon deletes disk contents
Cure:– make conceptual model clearer; improve metaphors
c) Interaction style level (system wide problem)
– does not know how to pull down a menu– scrolls a page instead of a line– goes to next screen instead of scrolling– retypes command after an error instead of editing it
Cure:– make operation of the interface more intuitive and consistent
d) Interaction element level (specific detail inappropriate)
– selects wrong button because label is misinterpreted– specifies invalid command syntax– specifies wrong code for option
Cure:– More attention to details of the interface, simplification
e) Physical element level (Physical execution incorrect)
– presses wrong key accidentally– clicks on wrong pixel in image– types ahead when system is computing; keystrokes later applied to wrong action
Cure:– Defenses to protect user from consequences; better hardware design; fix bugs in code

Q4. Why Does the Malfunction Occur?

a)Lack of (on the part of the user):– Motivation:– Attention:– Input information processing:– Cures: Clearer, more consistent feedback– Discrimination:– Cures: Improved expression of information– Physical coordination:– Cures: Alternate interaction mechanisms, better feedback– Recall:– Cures: Better mnemonics, online help, quick lookup mechanisms, command completion
– Knowledge / lack of learning:
b)Learning difficulties that cause malfunctions:– Learning is difficult– Learners make ad-hoc interpretations– Learners generalize from what they know– Learners have trouble following directions– Problems and features interact– Prerequisites and side-effects confuse learners– Help facilities do not always help– Other causes of malfunctions:• Excessive resource demands• External events (e.g. noise)• Misleading or inadequate training• Unrealistic task definitions• Intrinsic human variability