User Interfaces

EECS 3461 – Sections A & B
Fall 2021

Resource Pack: Interaction III
Evaluation and Testing

Intellectual Property Notice

Dependencies

This resource pack assumes that you are already familiar with:

- R-Humans-I

- R-Design-V (and all previous)

- R-Interaction-II

Inquiry

Break down this resource pack into smaller pieces

1. Is *user experience* is different than *usability?*

2. What are the design principles of *visibility, constraints, consistency, feedback*

3. What are Shneiderman's 'eight golden rules' and Nielsen and Molich's 10 User Interface design guidelines?

1. Is *user experience* is different than *usability?*

Humans are Sense-Makers

- as humans, we are all about *making sense of our experiences*
    - **sensations**, **emotions**, and **meaning** are all part of this sense making
    - sense-making is omnipresent
    - sense-making can be nebulous
    - the experience of sense-making can be difficult to capture

- sense making is 'interior'
    - sense-making takes place in the body and the mind of the sense maker
    - sense-making is not directly observable

User Experience

- is about how people feel about using a interactive system

- is about their subjective experiences in using it, all aspects (e.g., looking, holding, opening or closing it, smelling it, etc) (e.g., pleasure, satisfaction, frustration, etc)

- is about both overall impression and the effect of small details (e.g., how smoothly a switch rotates, the sound of a click, the touch of a button when pressing it)

Subjective Qualities

Desirable aspects		
Satisfying	Helpful	Fun
Enjoyable	Motivating	Provocative
Engaging	Challenging	Surprising
Pleasurable	Enhancing sociability	Rewarding
Exciting	Supporting creativity	Emotionally fulfilling
Entertaining	Cognitively stimulating	Experiencing flow
Undesirable aspects		
Boring	Unpleasant	
Frustrating	Patronizing	
Making one feel guilty	Making one feel stupid	
Annoying	Cutesy	
Childish	Gimmicky	

Table 1.1 Desirable and undesirable aspects of the user experience

Design User Experience?

It is important to point out that one cannot design a user experience, only design *for* a user experience.

- e.g., "In particular, one cannot design a sensual experience, but only create the design features that can evoke it." [Sharp et al, p. 13-14, 2019]

Usability

- *usability* is operationalized in terms of different attributes, such as:
  - effectiveness, efficiency, safety, utility, learnability, memorability
  - usability is assessed via observable behaviours, which are then measured and interpreted

User Experience ≠ Usability

- thus, *user experience* is different than *usability*

- *user experience* is connected to sense making
  - sense-making takes place in the body and the mind of the sense maker
  - sense-making is not directly observable, is 'interior'

- *usability* is operationalized in order to be measurable
  - usability is assessed via observable behaviours wrt effectiveness, efficiency, safety, utility, learnability, memorability
  - thus, usability is about observability and measurability, it is exterior

2. What are the design principles of *visibility, constraints, consistency, feedback*?

Assigned Reading for Design Principles

Preece et al, 2019, Chapter 2: The Process of Interaction Design (23 pp.)

Design Principles

- Design principles are used by interaction designers to aid their thinking when designing for the user experience

- Design principles are generally followed, but there may be occasions when the choice may be made to violate the principle (rationales can and do exist for this)

- In implementing each principle, there is the potential to make assumptions about the user that may be incorrect

Design Principle: Constraints

Ensure non-applicable functionality is not selectable

- constrain the user's possible actions so that invalid or incoherent operations cannot be performed

- at a given juncture, of all the possible actions, some may not be applicable
  - they should not be **selectable** to prevent incorrect user actions
  - they should **possibly remain visible**
    - the **information** that the option exists <u>may still serve a function</u> even if the option itself is not selectable

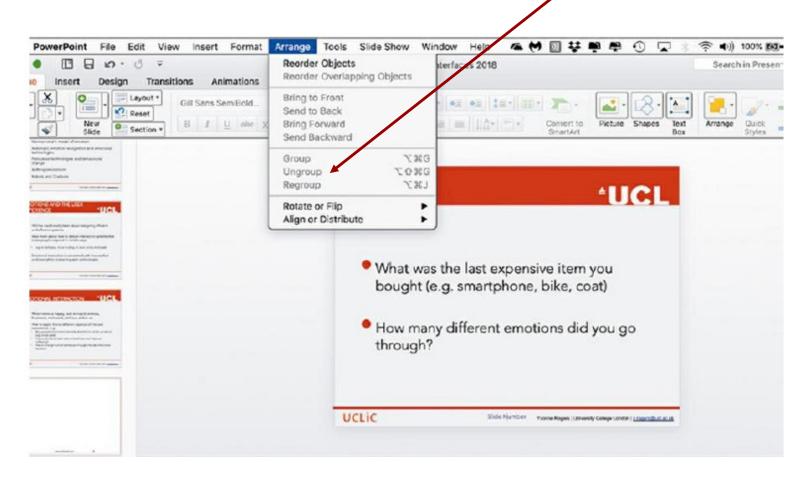assumptions: the designer may make assumptions about how the user perceives and makes sense of information

Example of a Constraint

these menu choices cannot be used since groupable items have not been selected,

thus these choices are not available for selection

but it is still useful to show that these options exist (supports learning) and to keep the menu consistent across all possible states

Design Principle: Visibility

For the given junction, ensure key functionality is visible

- Ensure there is an answer the user's question "What actions are possible at this juncture?"

- At a given juncture, of all the afforded actions, some may be applicable and others not
    - of those that are applicable → are they signified to the user in a way that is understandable?
    - of those that are not applicable → why might we want it to be visible (but not selectable?)

- this principle serves to bridge the gulf of execution

- assumptions: designer may make assumptions about how the user perceives and makes sense of information

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Design Principle: Feedback

Provide feedback to signal what action has been done and what this action has accomplished

Answer the user's question "What was the result of the action that I just performed? "

this principle serves to bridge the gulf of evaluation

• assumptions: designer may make assumptions about how the user perceives and makes sense of information

Design Principle: Consistency

Be consistent

- have similar operations and use similar elements for achieving similar tasks

Why be consistent?

- a consistent interface employs rules, and rules can be learned and absorbed by the user

- thus, consistency in an interface can support learning

- but sometimes consistency can be enforced in ways that are not actually helpful

Consistency Should be Based on Meaningful Principles

- It is possible to be consistent on the basis of different principles (as the next example will demonstrate)

- Although enforcing consistency according to one principle may be logical to the designer, it may not be meaningful or useful to the user

- When we think of consistency, we should think *"consistency with respect to what underlying principle and will this principle be helpful to the user?"*

Grudin's Knife Analogy (1989) [p.24]

- Scenario #1: There are different knives, including butter knives, steak knives, table knives, and fish knives.

- Principle #1: These knives are all used in the kitchen, let's use the following principle:

  - Put things in the location where they are likely to be needed or used.
  - Thus, put the knives in the top drawer by the sink

- Put all of the knives in that location, this is **consistent**

- The principle makes it easy for everyone to find the knives, if it is followed consistently

- ….When all we have are kitchen knives, this is easy.

Grudin's Knife Analogy (1989) [p.24]

- Scenario #2: There are different knives, including butter knives, steak knives, table knives, and fish knives. Some of these are really sharp. Some of these are special occasion knives or oversize knives. And there are putty knives and paint-scraping knives and jack-knives.

- Principle #1: Put things in the location where they are likely to be needed or used.
  - Kitchen knives go in the kitchen. Tools go in the garage. Jack-knives go in the pocket or backpack.

- But since this is a complicated domain, this consistency rule begins to break down

- We might employ additional **principles**:
  1. When convenient "real estate" is limited, prioritize prime real estate for frequently used items; put infrequently used items in less convenient locations
     - Knives that are special purpose are put in the cabinet in another room
  2. When items are special cases, build a special provision for them
     - Knives that don't fit or are too sharp to put in the drawer, then placed special safe places (e.g., in a wooden block).

What does this Knife Analogy tell us?

- The knife example demonstrates when we think of **consistency,** we should be thinking "consistent according to which principle(s)?"

- By analogy, the concept applies to interfaces, in terms of aspects such as:
  - organization (of tools, functions, information); visual presentation; mode of interaction, etc

- it might not make sense to be consistent to a particular principle at the expense of another principle

- the complexity of the domain may require the use of multiple principles

In Sum

- The design principle of constraints says to ensure non-applicable functionality is not selectable (and that non selectable does not mean not visible)

- The design principle of visibility says to ensure that the user's (tacit) question "What actions are possible at this juncture?" is always answered by the interface

- The design principle of feedback says to ensure that the user's (tacit) question "What was the result of the action that I just performed? " is always answered by the interface

- The design principle of consistency says to have similar operations and use similar elements for achieving similar tasks, but 'similar' needs to be based on principles that are meaningful for the user (and not the designer)

3. What are Shneiderman's 'eight golden rules' and Nielsen and Molich's 10 User Interface design guidelines?

Shneiderman's 'eight golden rules'

- Ben Shneiderman is a computer scientist who conducted fundamental research in Human-Computer Interaction

- In the mid-1980s, he proposed design guidelines, and these guidelines often get turned into heuristics for evaluation
    - design guidelines → to be applied *prospectively*
    - evaluation heuristics → to be applied *retrospectively*

Shneiderman's 'eight golden rules'

1. Strive for consistency.

- Consistent sequences of actions should be required in similar situations; identical terminology should be used in prompts, menus, and help screens; and consistent color, layout, capitalization, fonts, and so on, should be employed throughout.
- Exceptions, such as required confirmation of the delete command or no echoing of passwords, should be comprehensible and limited in number

2. Seek universal usability.

- Recognize the needs of diverse users and design for plasticity, facilitating transformation of content.
- Novice to expert differences, age ranges, disabilities, international variations, and technological diversity each enrich the spectrum of requirements that guides design.
- Adding features for novices, such as explanations, and features for experts, such as shortcuts and faster pacing, enriches the interface design and improves perceived quality.

http://www.cs.umd.edu/~ben/goldenrules.html

Shneiderman's 'eight golden rules'

3. Offer informative feedback.

- For every user action, there should be an interface feedback.
- For frequent and minor actions, the response can be modest, whereas for infrequent and major actions, the response should be more substantial.
- Visual presentation of the objects of interest provides a convenient environment for showing changes explicitly

4. Design dialogs to yield closure.

- Sequences of actions should be organized into groups with a beginning, middle, and end.
- Informative feedback at the completion of a group of actions gives users the satisfaction of accomplishment, a sense of relief, a signal to drop contingency plans from their minds, and an indicator to prepare for the next group of actions.

http://www.cs.umd.edu/~ben/goldenrules.html

Shneiderman's 'eight golden rules'

5. Prevent errors.

- As much as possible, design the interface so that users cannot make serious errors
- If users make an error, the interface should offer simple, constructive, and specific instructions for recovery.
- Erroneous actions should leave the interface state unchanged, or the interface should give instructions about restoring the state.

6. Permit easy reversal of actions.

- As much as possible, actions should be reversible.
- This feature relieves anxiety, since users know that errors can be undone, and encourages exploration of unfamiliar options.
- The units of reversibility may be a single action, a data-entry task, or a complete group of actions, such as entry of a name-address block.

http://www.cs.umd.edu/~ben/goldenrules.html

Shneiderman's 'eight golden rules'

7. Keep users in control.

- Experienced users don't want surprises or changes in familiar behavior.

- Experienced users are annoyed by tedious data-entry sequences, difficulty in obtaining necessary information, and inability to produce their desired result.

8. Reduce short-term memory load

- Humans' limited capacity for information processing in short-term memory requires that designers avoid interfaces in which users must remember information from one display and then use that information on another display

http://www.cs.umd.edu/~ben/goldenrules.html

Nielsen and Molich's 10 User Interface Design Guidelines

- About 4 years later, two usability experts (Jakob Nielsen and Rolf Molich) published a list of ten user interface design guidelines

- these guidelines further iterate upon Shneiderman's eight golden rules

- can you spot the overlap/differences?

Nielsen and Molich's 10 User Interface Design Guidelines

1. Visibility of system status.

- Users should always be informed of system operations with easy to understand and highly visible status displayed on the screen within a reasonable amount of time.

2. Match between system and the real world.

- the language and concepts in the interface should mirror what the users would find in the real world

- piggybacking on user's expectations derived from their real-world experiences

3. User control and freedom.

- Allow 'backward' steps, such as undoing and redoing previous actions.

Nielsen and Molich's 10 User Interface Design Guidelines

4. Consistency and standards.

- ensure that both the graphic elements and terminology are maintained

5. Error prevention.

- Whenever possible, design systems so that potential errors are kept to a minimum; eliminate or flag actions that may result in errors
- do not require users to detect and remedy problems

Nielsen and Molich's 10 User Interface Design Guidelines

6. Recognition rather than recall.

- maintaining task-relevant information within the display while users explore the interface (don't require users to remember things)
- ensure users can employ recognition instead of recall as they use the interface (Recognition is always easier than recall because recognition provides the use of cues)

7. Flexibility and efficiency of use.

- allow frequent actions to be achieved through faster means (e.g., abbreviations, function keys, hidden commands and macro facilities)
- allow users to customize or tailor the interface to suit their needs

8. Aesthetic and minimalist design.

- Keep clutter to a minimum. Do not allow unnecessary information to competes for the user's limited attentional resources (which could inhibit user's memory retrieval of relevant information).

9. Help users recognize, diagnose and recover from errors.

- provide error messages in plain language; do not assume users are unable to understand technical terminology

10. Help and documentation.

- if possible, design the system so that the user does not need to consult documentation.
- if this is not possible, ensure the documentation is easily located, specific to the task at hand and worded in a way that will guide them through the necessary steps towards a solution to the issue they are facing

https://www.interaction-design.org/literature/article/user-interface-design-guidelines-10-rules-of-thumb

In Sum

- Schneiderman, Nielsen and Molich are all experts who developed lists of rules and principles for 'good' design
  - Schneiderman's list came first, then Nielson and Molich (as well as other after them)

- the 4 design principles discussed earlier are abstractions of these items