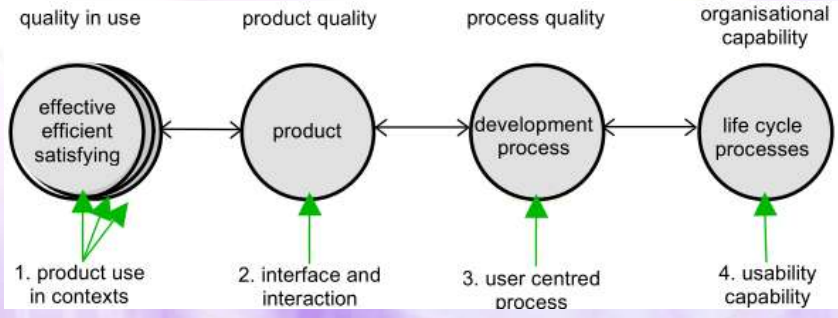
Interface Design

Covered topics

- International Standard & ISO 9241
- Design Principles
- Norman's Seven Principles
- Shneiderman's Eight Golden Rules
- Experimental Design

1.1. Types of standard

- The use of the product (effectiveness, efficiency and satisfaction in a particular context of use)
- The user interface and interaction
- The process used to develop the product
- The capability of an organization to apply user centered design



1.2. ISO Standards: ISO 9241

- ISO 9241: Ergonomic requirements for office work with visual display terminals
  - Part 2: Guidance on task requirements
  - Parts 3 -9: Hardware design requirements and guidance
  - Part 10: requirements and recommendations relating to the software attributes
  - Part 11: Guidance on Usability
  - Parts 12-17: Detailed guidance on the design of user interfaces
  - Part 20: Accessibility guideline for information communication equipment and services: General guidelines

ISO 9241 part10 (1996)

- Suitable for a task when effectively and efficiently supporting the user
- Self-descriptiveness when each dialogue step is comprehensive through feedback
- User Controllable
- Conformity with user expectations
- Error tolerance
- Suitability for individualization
- Suitability for learning

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2. Design principles

- Generalized abstractions for thinking about different aspects of design
- The do's and don'ts of interaction design
  - But at a high level
- What to provide and what not to provide at the interface
- Derived from a mix of theory-based knowledge, experience and common-sense

- Visibility
- Feedback
- Constraints
- Mapping
- Consistency
- Affordances

Exercices

- Do this on your own on in pairs
- Go find two illustrations of problems in the GUIs of software apps or the UI of a interactive device (not Web pages)
  - Problem must illustrate a violation of one of the design principles or usability guidelines
  - Describe the problems in these terms

2.1. Visibility

- This is a control panel for an elevator.
- How does it work?
- Push a button for the floor you want?
- Nothing happens. Push any other button? Still nothing. What do you need to do?

From:
www.baddesigns.com

- It is not visible as to what to do!

Visibility

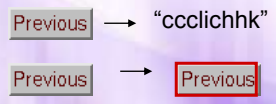
…you need to insert your room card in the slot by the buttons to get the elevator to work!

How would you make this action more visible?

- make the card reader more obvious
- provide an auditory message, that says what to do (which language?)
- provide a big label next to the card reader that flashes when someone enters
- make relevant parts visible
- make what has to be done obvious

2.2. Feedback

- Sending information back to the user about what has been done
- Includes sound, highlighting, animation and combinations of these
  - e.g. when screen button clicked on provides sound or red highlight feedback:



2.3. Constraints

- Restricting the possible actions that can be performed
- Helps prevent user from selecting incorrect options
- Three main types
  - physical
  - cultural
  - logical

Physical constraints

- Refer to the way physical objects restrict the movement of things
  - E.g. only one way you can insert a key into a lock
- How many ways can you insert a CD or DVD disk into a computer?
- How physically constraining is this action?
- How does it differ from the insertion of a floppy disk into a computer?

Logical constraints

- Exploits people's everyday common sense reasoning about the way the world works
- An example is the logical relationship between physical layout of a device and the way it works
  - See next slide for an illustration

Logical or ambiguous design?

- Where do you plug the mouse?
- Where do you plug the keyboard?
- top or bottom connector?
- Do the color coded icons help?

From: www.baddesigns.com

More Logically Constrained

- Provides direct adjacent mapping between icon and connector
- Provides color coding to associate the connectors with the labels

From: www.baddesigns.com

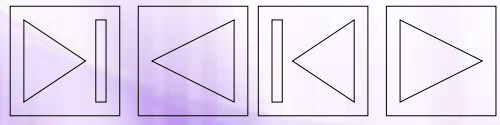
Cultural constraint

- Learned arbitrary conventions like red triangles for warning
- Can be universal or culturally specific
  - For SW we've accepted certain conventions, e.g. we know what to do with an icon
- Be concerned of cross-cultural conventions and other ambiguities!
  - Does an "X" mean "selected" or "not selected"
  - Is a check-mark better?

Which are universal ?
Which are culturally-specific?

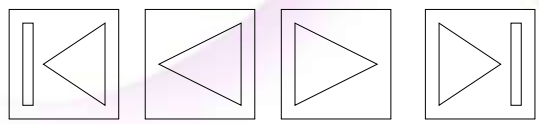
2.4. Mapping

- Relationship between controls and their movements and the results in the world
- Why is this a poor mapping of control buttons?



Mapping

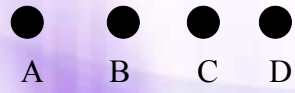
- Why is this a better mapping?



- The control buttons are mapped better onto the sequence of actions of fast rewind, rewind, play and fast forward
  - Is this a logical mapping (in most people's minds)?
  - Is there a mapping that makes more sense?

Mappings in the Kitchen

- Which controls go with which rings (burners)?



Why is this a better design?

2.5. Consistency

- Design interfaces to have similar operations and use similar elements for similar tasks
- For example:
  - always use ctrl key plus first initial of the command for an operation – ctrl+C, ctrl+S, ctrl+O
- Main benefit is consistent interfaces are easier to learn and use
- But… didn't a wise man say this?
  Consistency is the hobgoblin of little minds.
  - A foolish consistency is the hobgoblin of little minds (adored by little statesmen and philosophers and divines)

When consistency breaks down

- What happens if there is more than one command starting with the same letter?
  - e.g. save, spelling, select, style
- Have to find other initials or combinations of keys, thereby breaking the consistency rule
  - E.g. ctrl+S, ctrl+Sp, ctrl+shift+L
- Is this desirable? Does it defeat the purpose?
  - It may increase learning burden on user
  - It may make them more prone to errors
  - But it may still benefit frequent or experienced users

Internal and external consistency

- Internal consistency refers to designing operations to behave the same within an application
  - Difficult to achieve with complex interfaces
- External consistency refers to designing operations, interfaces, etc., to be the same across applications and devices
  - Very rarely the case, based on different designer's preference
  - Most successful in product families (e.g MS Office)
  - Op. Sys. vendors may define style guidelines

Keypad numbers layout

- A case of external inconsistency

(a) phones, remote controls

1	2	3
4	5	6
7	8	9
	0	

(b) calculators, computer keypads

7	8	9
4	5	6
1	2	3
0		

2.6. Affordances: to give a clue

- Refers to an attribute of an object that allows people to know how to use it
  - E.g. a mouse button invites pushing, a door handle affords pulling
- Norman (1988) used the term to discuss the design of everyday objects
- Since then has been popularized in interaction design to discuss how to design interface objects
  - E.g. scrollbars to afford moving up and down, icons to afford clicking on

What does 'affordance' have to offer interaction design?

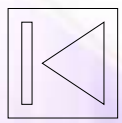
- Interfaces are virtual and do not have affordances like physical objects
- Norman argues it does not make sense to talk about interfaces in terms of 'real' affordances
- Instead interfaces are better conceptualised as 'perceived' affordances
  - Learned conventions of arbitrary mappings between action and effect at the interface
  - Some mappings are better than others

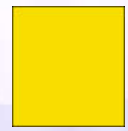
Physical affordances

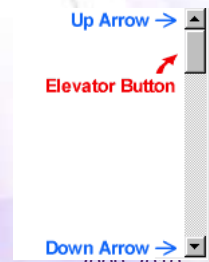
- How do the following physical objects afford? Are they obvious?

Virtual affordances

- How do the following screen objects afford?
- What if you were a novice user?
- Would you know what to do with them?







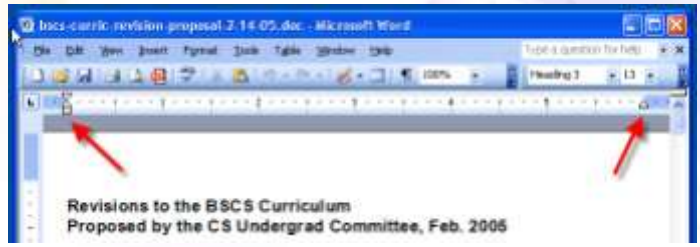
Exercise: Physical and Perceived Affordances

- Take a cell phone, digital camera, or PDA
  - Have laptop? Open a fancy software app: Outlook, Eclipse, etc?
- In a small group
  - Identify any physical affordances the device has
  - Identify any perceived or visual affordances the software user interface has
- Write these down, be prepared to share or turn in

A Good Example

- Kodak DC-290 digital camera

Adjusting Tabs in MS Word



Web Links

- What are the conventions that help you recognize a link?
- Would you are argue this is an affordance?
  - A perceived affordance – convention of a mapping between action and effect
  - Does it “afford” clicking on it?
- Examples of problems with this?

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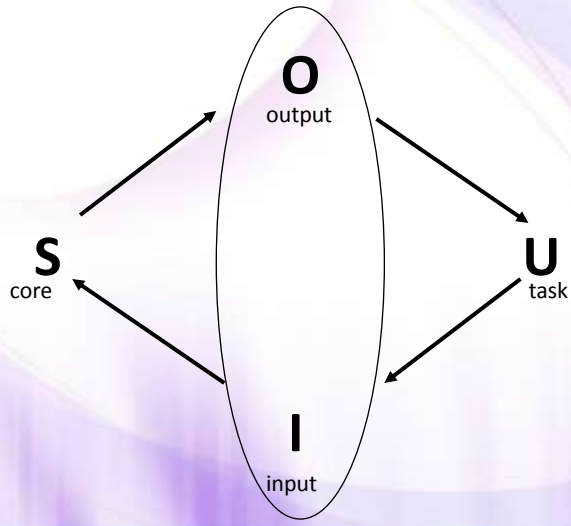
3. Norman's model of interaction (1988)

- Norman's stages of human interaction
  - intention, selection, execution, evaluation
  - problems identified as gulfs of execution and evaluation
- Most influential in HCI
- Interaction cycle has two major phases - Execution and Evaluation

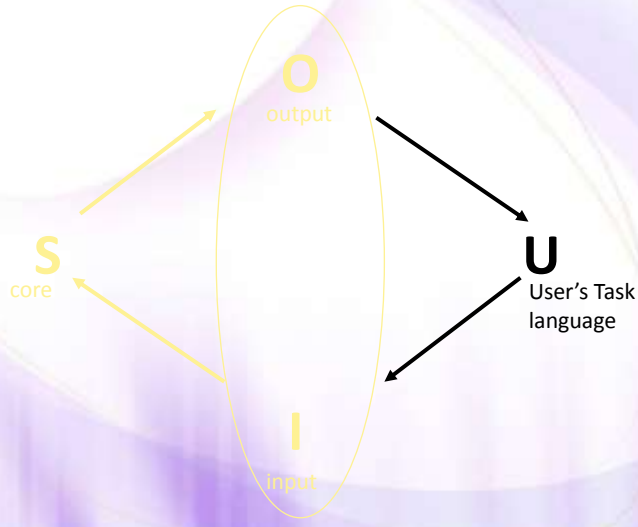
Execution and Evaluation cycle

1. Establish the goal
2. Forming the intention
3. Specifying the action sequence
4. Executing the action
5. Perceiving the system state
6. Interpreting the system state
7. Evaluating the system state w.r.t. goals and intentions

Interaction framework



Interaction framework



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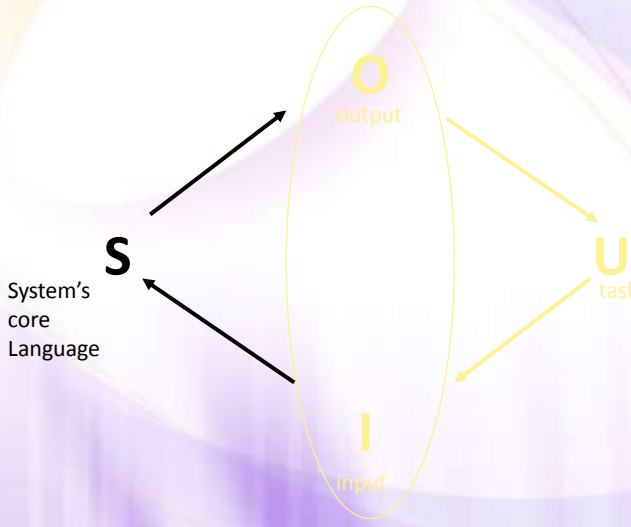
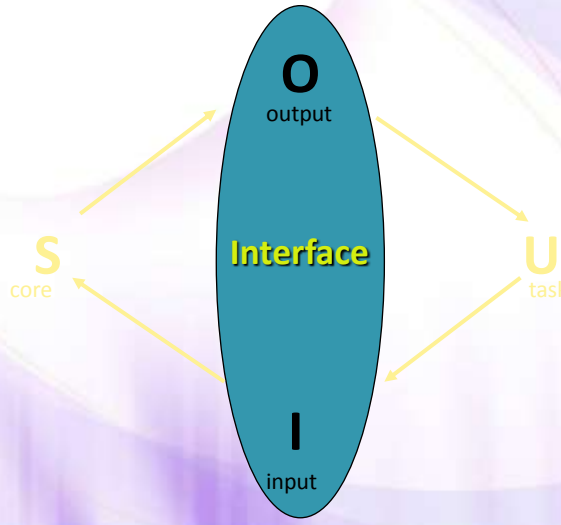
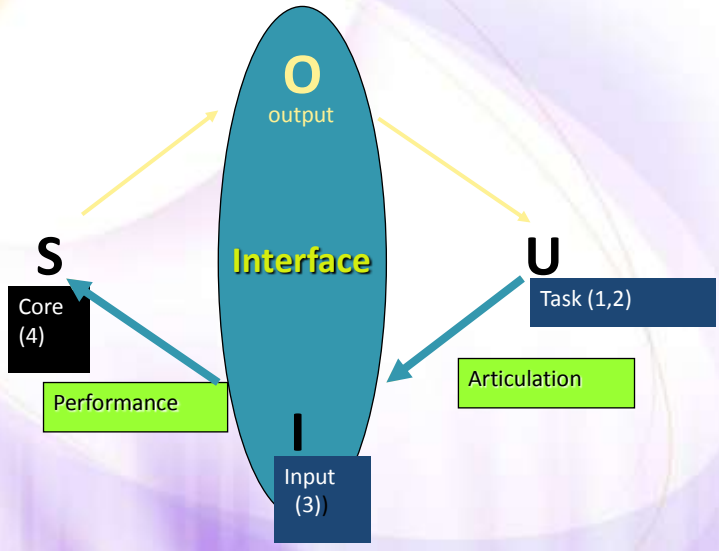


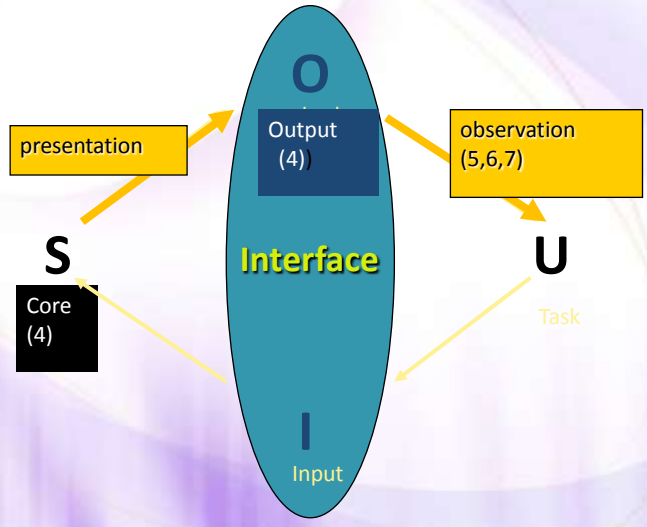
Interaction framework



Execution phase of cycle



Evaluation phase of cycle



Interaction Framework

- **Interaction** is achieved through both the
  - Dialogue design
  - Interface styles
- **Execution and evaluation** depends on
  - The input language (dialogue)
  - The user's ease in manipulating the interface through the input device.
  - Clear mapping from dialogue to task

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4. Shneiderman's Principles of HCI Design

- Shneiderman's syntactic/semantic model
  - A user's mapping between computer syntax, computer semantics, and task semantics
  - Problems identified when the user's mapping is poor
- Shneiderman's principles
  - Recognize Diversity
  - You Should Use the Eight Golden Rules of Interface Design
  - Prevent Errors

4.1. Recognize Diversity

- In order to recognize diversity, you, the designer, must take into account the type of user frequenting your system, ranging from
  - novice user,
  - knowledgeable but intermittent user, and
  - expert frequent user.
- Each type of user expects the screen layout to accommodate their desires:
  - novices needing extensive help,
  - experts wanting to get where they want to go as quickly as possible.
- Accommodating both styles on the same page can be quite challenging.
- You can address the differences in users by
  - including both menu or icon choices as well as commands (ie. Command or Control P for Print as well as an icon or menu entry), or
  - providing an option for both full descriptive menus and single letter commands.

How to apply ?

- Make your main navigation area fast loading for repeat users
- Provide a detailed explanation of your topics, symbols, and navigation options for new users
- Provide a text index for quick access to all pages of the site
- Ensure your pages
  - are readable in many formats,
  - to accommodate users who are blind or deaf, users with old versions of browsers, lynx users, users on slow modems or those with graphics turned off

4.2. Eight golden rules of interface design

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
   - consistent color, layout, capitalization, fonts, and so on should be employed throughout.
2. Enable frequent users to take shortcuts
   - to increase the pace of interaction use abbreviations, special keys, hidden commands, and macros

Eight golden rules of interface design

3. Offer informative feedback for every user action
   - for every user action, the system should respond in some way (in web design, this can be accomplished by DHTML - for example, a button will make a clicking sound or change color when clicked to show the user something has happened)
4. Design dialogues to yield closure
   - Sequences of actions should be organized into groups with a beginning, middle, and end. The informative feedback at the completion of a group of actions shows the user their activity has completed successfully

Eight golden rules of interface design

5. Offer simple error handling
   - design the form so that users cannot make a serious error; for example, prefer menu selection to form fill-in and do not allow alphabetic characters in numeric entry fields
   - if users make an error, instructions should be written to detect the error and offer simple, constructive, and specific instructions for recovery
   - segment long forms and send sections separately so that the user is not penalized by having to fill the form in again - but make sure you inform the user that multiple sections are coming up
6. Permit easy reversal of actions

Eight golden rules of interface design

7. Support internal locus of control
   - Experienced users want to be in charge. Surprising system actions, tedious sequences of data entries, inability or difficulty in obtaining necessary information, and inability to produce the action desired all build anxiety and dissatisfaction
8. Reduce short-term memory load
   - A famous study suggests that humans can store only 7 (plus or minus 2) pieces of information in their short term memory. You can reduce short term memory load by designing screens where options are clearly visible, or using pull-down menus and icons

4.3. Prevent Errors

- Prevent errors whenever possible
  - Steps can be taken to design so that errors are less likely to occur, using methods such as
    - organizing screens and menus functionally,
    - designing screens to be distinctive and
    - making it difficult for users to commit irreversible actions.
  - Expect users to make errors, try to anticipate where they will go wrong and design with those actions in mind.

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Methodology

- What to test and how to test
- It takes ingenuity and experimentation
  - granularity spectrum: individual interaction techniques to task performance