

COM2002/3002/6222

Human Centred Systems Design

HC Lecture 2

Human-Computer Interaction



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COM 2002/3002/6222 Human Centred Systems Design

Assignment 1: Instructions

Answer all 5 questions covering Heidi Christensen's lectures.

Each question is worth 4%, and each answer should be no longer than 100 words (about five or six lines).

You can cite sources at the end of each answer (not included you wish. You may use diagrams but *not* pictures).

Note 1: Please use the provided documents as templates, answers beneath each question and then upload it to Moodle finished.

Note 2: This is an individual assignment. You must not else in preparing your answers. Any submissions which form of collusion will be subject to the University's normal plagiarism.

In order for it to be fair, please *do not* contact us with questions about the content – it's up to you to interpret each question and to respond appropriately.

Deadline Monday 13th November

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Name

< your name here >

Answer the following questions in your own words, in 100 words or less.

1. (HC) Using the PACT framework, describe the relationship between a user and a technology of your choice.

Design the HCI for a new set of augmented reality sports glasses for Explain the design choices you would make to create useful interface for the cyclist thinking especially about reducing the gulf of execution.

We designing a monitoring system for premature babies in the ward in hospital. Who are the primary, secondary, tertiary and stakeholders you will need to involve and why?

You are designing a spelling game to be used as a fun way for children to practice pronouncing words better at home with help from their parents. There are two main user groups: the parents and the children. Write a persona description for the parent.

5. (HC) Specify a Hierarchy Task Analysis for this task: "Measure and plot blood sugar levels of residents in a care home". Must include minimum of two subtasks and associated plans.



Attendance sheet



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Guest lecturer: Simon Wheatcroft

How IBM's app helped a blind ultra-marathon runner cross the Namib desert



WRITTEN BY
[Aaron Lee](#)

[Case Studies](#)

4 Jul, 2016



Armed with only a smartphone, blind racer Simon Wheatcroft ran 100 miles across a desert

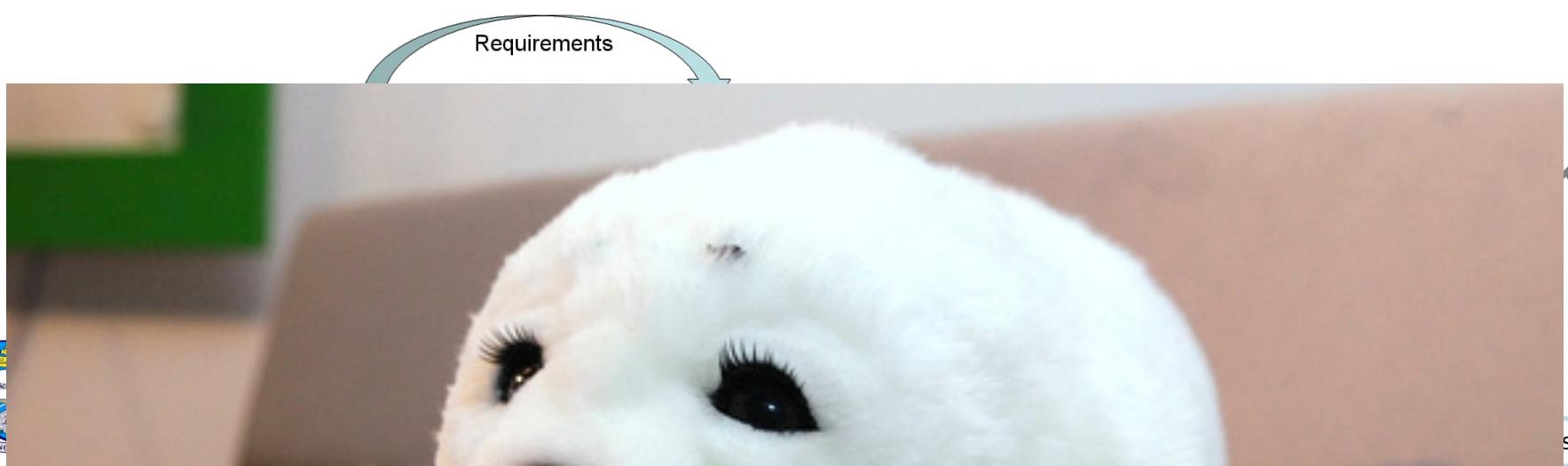
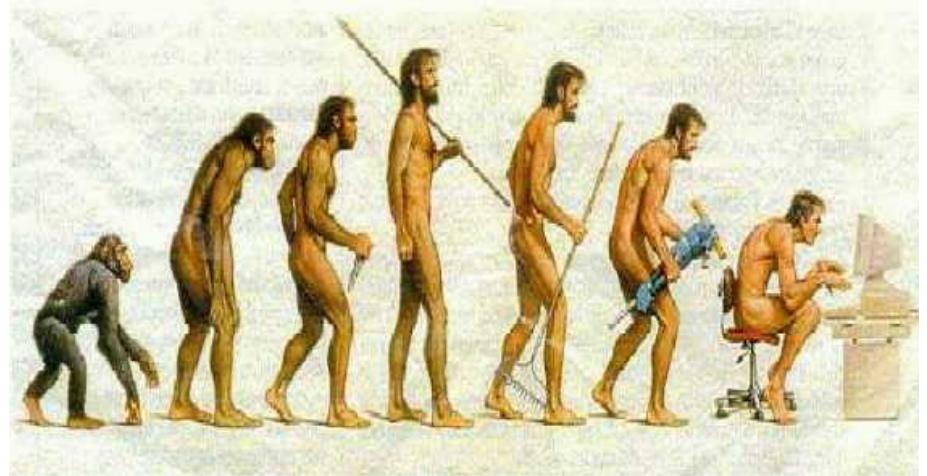
Running a marathon is a colossal test of endurance for trained athletes. So imagine running four of them in a row without being able to see.

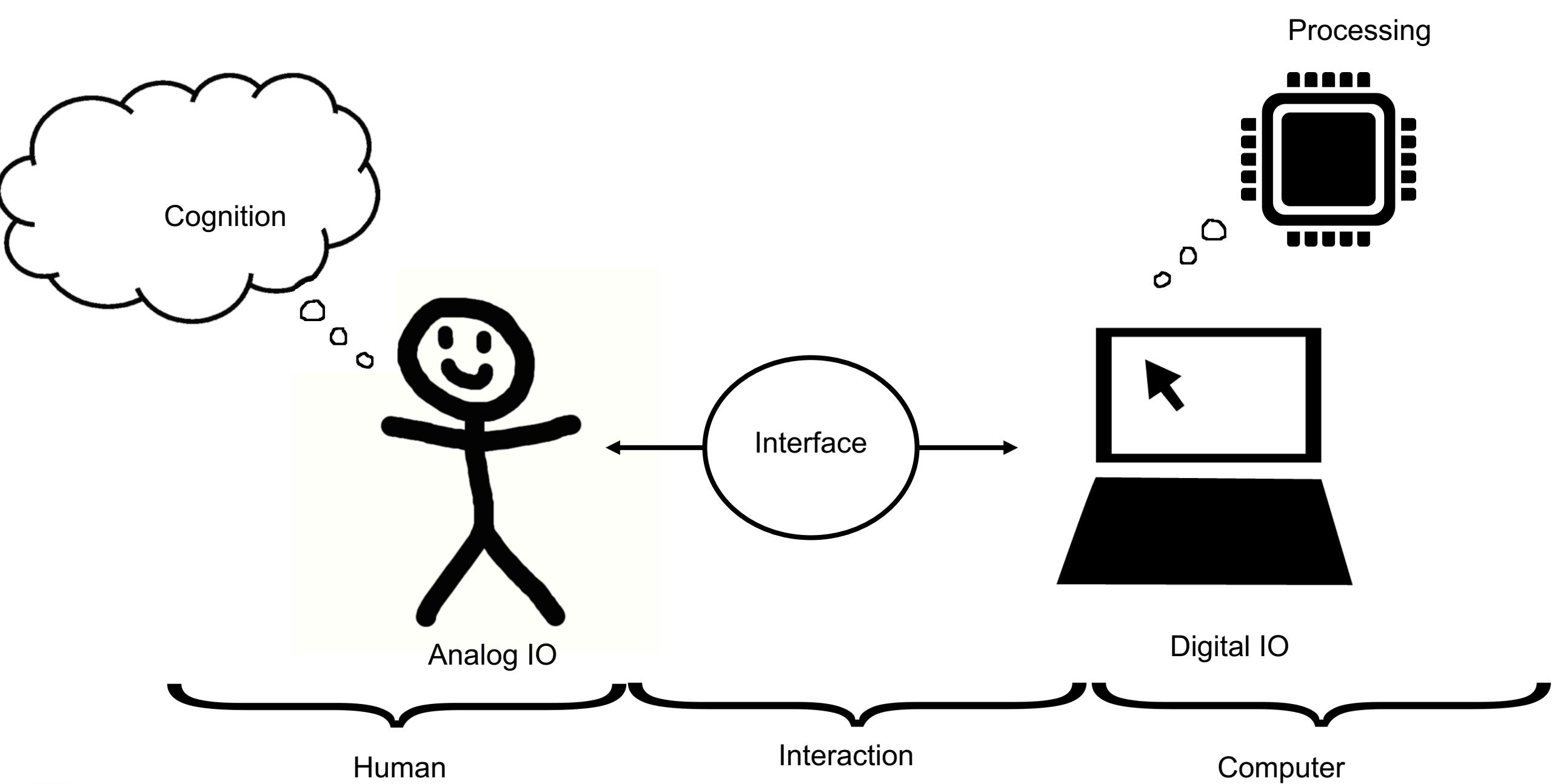
That's what blind ultra-marathon runner [Simon Wheatcroft](#) recently achieved, with the help of IBM's Platform-as-a-Service cloud, Bluemix Garage, when he took on the unforgiving conditions of the Namib desert for a 150-mile challenge.

Preparing for this test of endurance, Wheatcroft, who has been blind since the age of 17, worked with IBM's EMEA Bluemix team to work out how he could stay on track.

Last week: People and Technology

- Tools & technology deliver benefits
- All tools have an interface
- Technology must be:
 - useful, usable and used





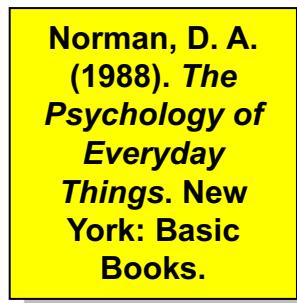
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Last week: People and Technology

- Interaction involves at least two participants (*the user and the system*)
- Both are complex, and are very different from each other in the way that they communicate and view the domain (*context*) and the task (*activity*)
- The *interface* must translate between them in order for interaction to be successful
- ‘**Models**’ of interaction can help understand what is going on



The ‘Execution-Evaluation Cycle’



Norman's model of a user's behaviour during an interaction ...

EVALUATION EXECUTION

1. *establishing 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 with respect to the goals and intentions*



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The ‘Execution-Evaluation Cycle’ – Using Google Search

EXECUTION

1. *“When was the last time Denmark won the European Football Championships?”*
2. *I will use Google search on my laptop*
3. *My plan is: i) open laptop; ii) start Chrome; iii) type in search phrase*
4. *Do the above*

Executing the actions

Forming my intention

Establishing the goal

Specifying the action sequence



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when was the last time that Denmark won the european championships



All

News

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Settings

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About 2,300,000 results (0.78 seconds)

[UEFA Euro 1992 - Wikipedia](#)

https://en.wikipedia.org/wiki/UEFA_Euro_1992 ▾

It was the ninth European Football Championship, which is held every four years and supported by UEFA. Denmark won the **1992** championship. The team had qualified only after Yugoslavia was disqualified as a result of the breakup and warfare in the country. Eight national teams contested the finals tournament.

[UEFA Euro 1988](#) · [UEFA Euro 1996](#) · [UEFA Euro 1992 Final](#) · [Henrik Larsen](#)

[Denmark at the UEFA European Championship - Wikipedia](#)

https://en.wikipedia.org/wiki/Denmark_at_the_Uefa_European_Championship ▾

Denmark at the UEFA European Championship. Denmark have participated in eight UEFA European Football Championships, and won the tournament once. In the final of Euro **1992** in Sweden, their 2–0 victory over Germany resulted in their first major tournament title.

[Euro 1964](#) · [Euro 1984](#) · [Euro 1992](#) · [Euro 2004](#)

[UEFA Euro 1992 Final - Wikipedia](#)

https://en.wikipedia.org/w/index.php?title=UEFA_Euro_1992_Final&oldid=111111111

The ‘Execution-Evaluation Cycle’ – Using Google Search

1. *I see the list of links appearing*
2. *I take this to mean that Google has finished its search*
3. *I evaluate whether I've been given the correct result*

Perceiving the system state

Interpret the system state

Evaluate the system state with respect to goals and intentions



The ‘Execution-Evaluation Cycle’

- Some interfaces cause problems for users due to ...
 - ‘**gulfs of execution**’
(the difference between the user’s formulation of the actions to reach the goal and the actions followed by the system)
 - ‘**gulfs of evaluation**’
(the distance between the physical presentation of the system state and the expectation of the user)
- An effective interface should aim to reduce these gulfs

Norman, D. A.
(1988). *The Psychology of Everyday Things*. New York: Basic Books.





when was the last time that Denmark won the european championships



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[Euro 1964](#) · [Euro 1984](#) · [Euro 1992](#) · [Euro 2004](#)

[UEFA Euro 1992 Final - Wikipedia](#)

https://en.wikipedia.org/wiki/UEFA_Euro_1992_Final ▾

The **UEFA Euro 1992 Final** was played between **Denmark** and Germany on 26 June 1992 at Ullevi in Gothenburg, Sweden, to determine the **winner** of **UEFA Euro 1992**. 90 minutes. 30 minutes of extra time if necessary. Penalty shoot-out if ...

[List of UEFA European Championship finals - Wikipedia](#)



The ‘Execution-Evaluation Cycle’

Norman, D. A.
(1988). *The Psychology of Everyday Things*. New York: Basic Books.

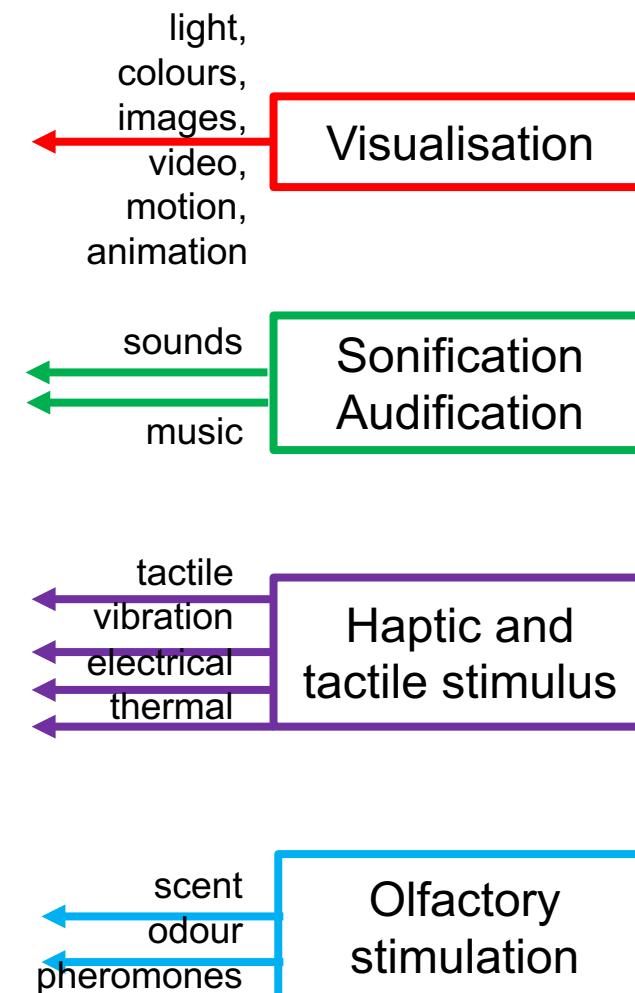
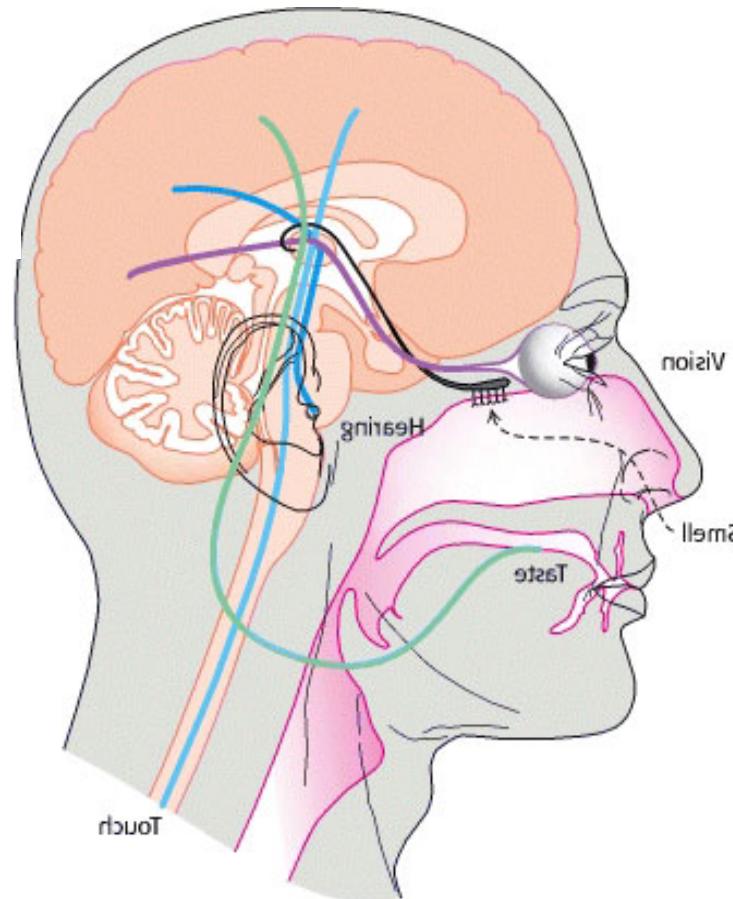


1. Establish the goal: *getting more light*
2. Form the intention: *switch on the main room light*
3. Specify the action sequence: *tell home automation system to do it*
4. Execute the action: *“Alexa, turn on the lights”*
5. Perceive the system state: *main room light is off*
6. Interpret the system state: *lightbulb is broken/Alexa didn’t understand me*
7. Evaluate the system state: *still not enough light*



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System feedback



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Heidi Sidi

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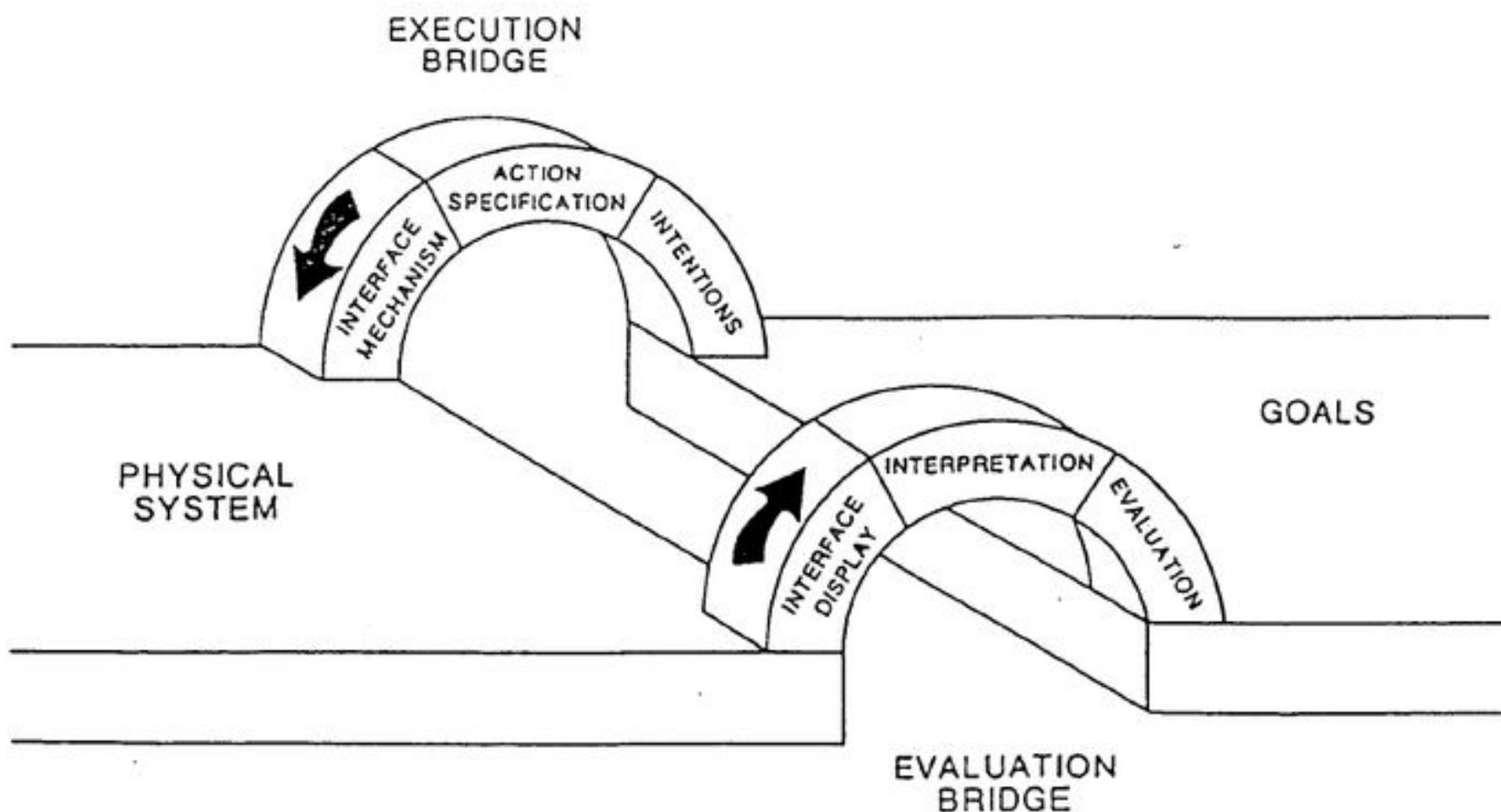
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The ‘Execution-Evaluation Cycle’



Problem Interfaces



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Amazon Echo system interface



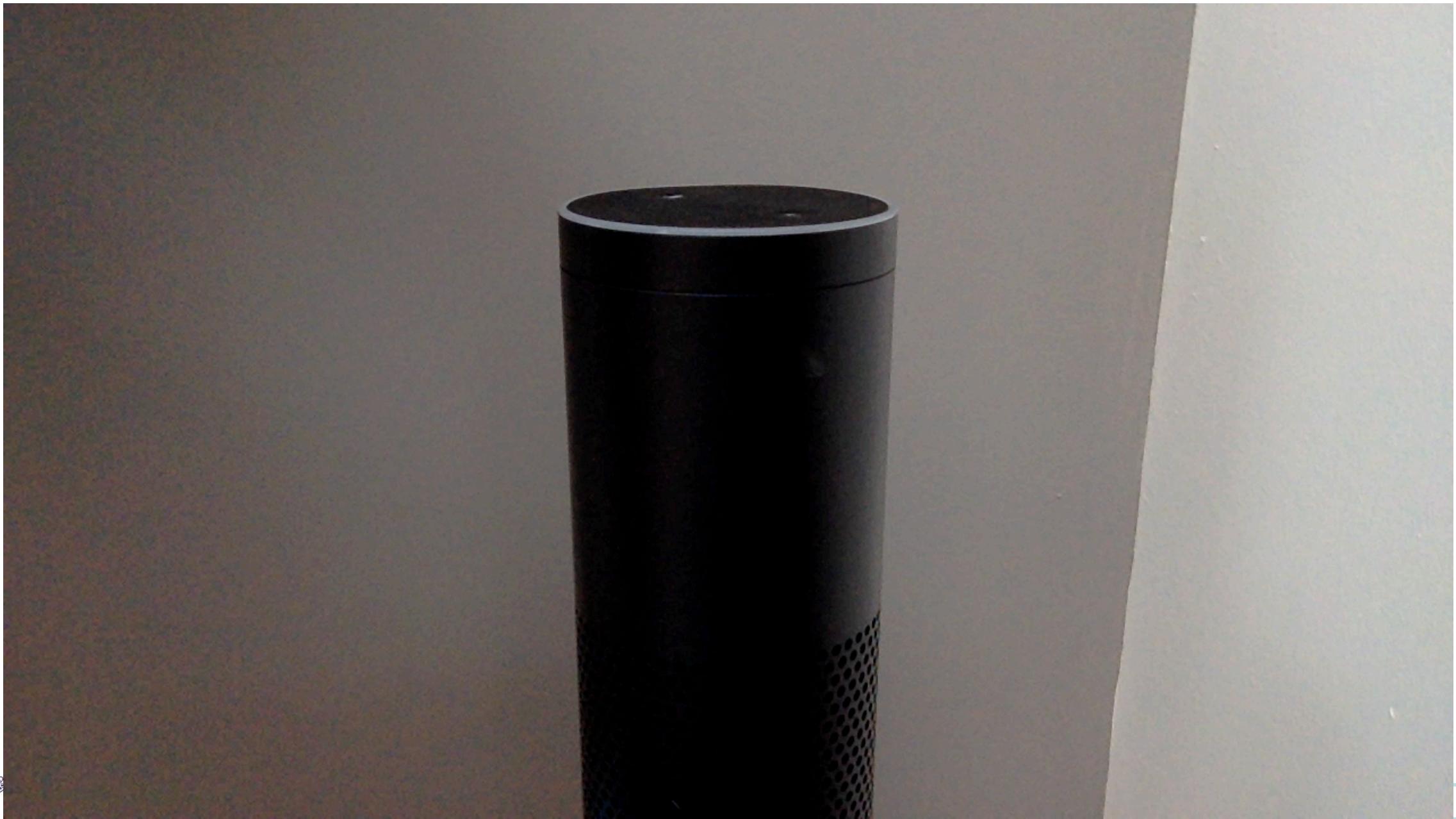
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amazon echo



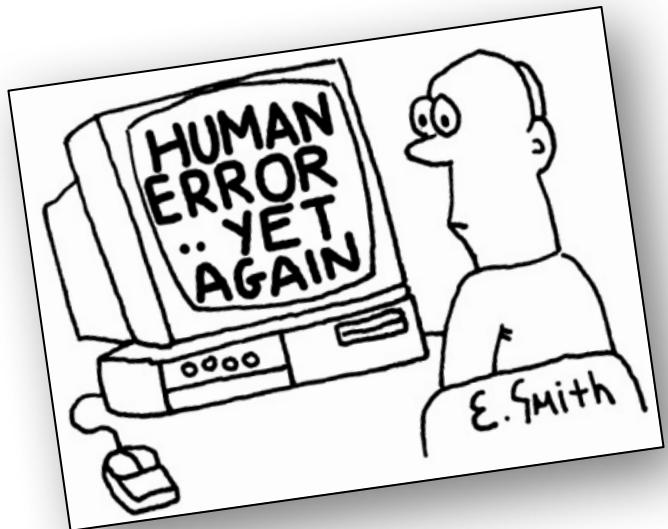
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Amazon Echo demo



Human Error

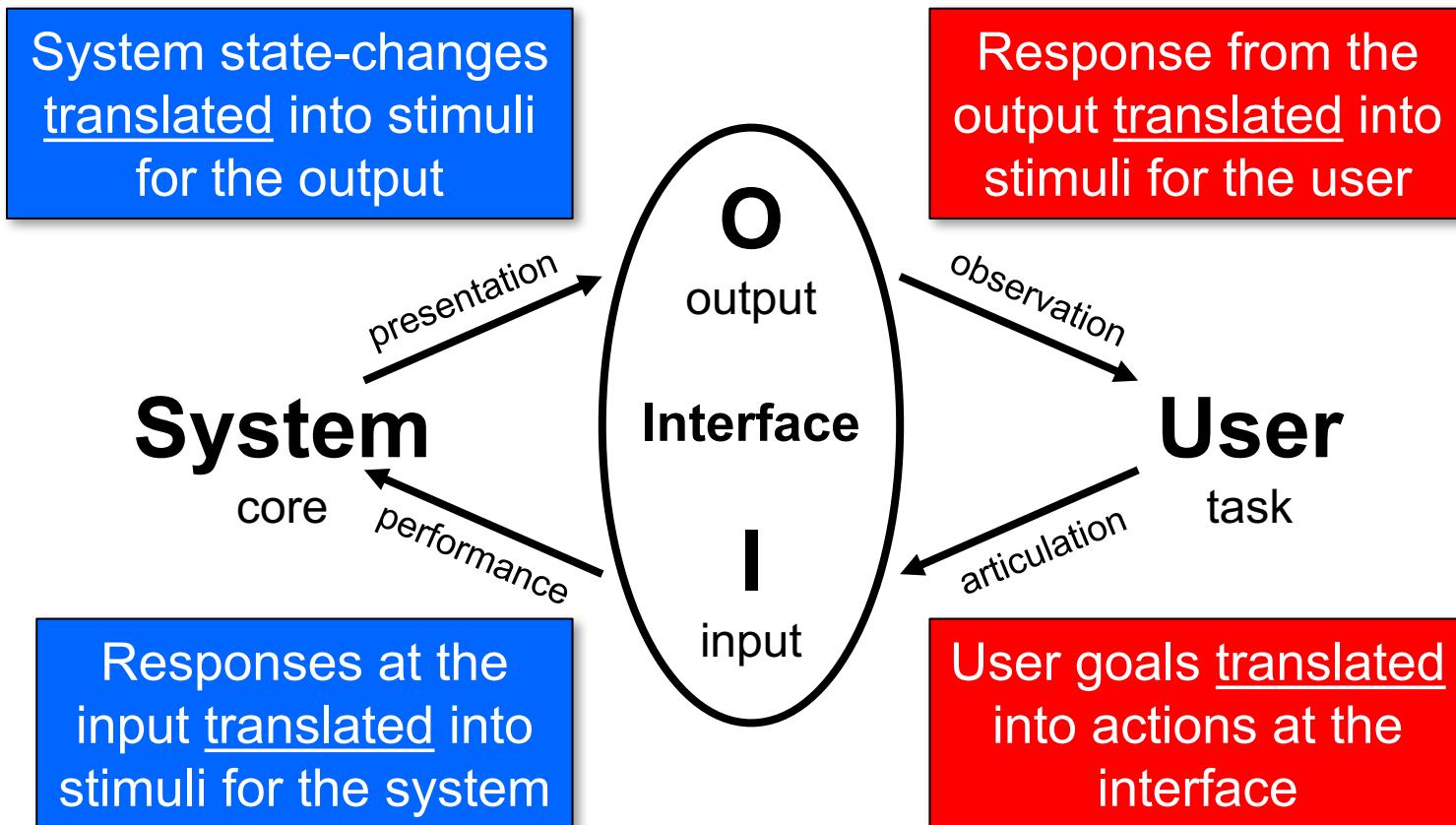
- Human errors can be classified into '**slips**' and '**mistakes**'
- These can be distinguished using Norman's '*gulf of execution*'
 - **'slip'**: when a user that understands a system well and knows exactly what to do to satisfy their goals, accidentally executes the wrong action, e.g., by pressing the wrong button
 - **'mistake'**: when a user that doesn't understand a system well, formulates a wrong action
- Slips may be corrected by, for example, better screen design
- Mistakes may need a radical redesign of the system and/or better user training





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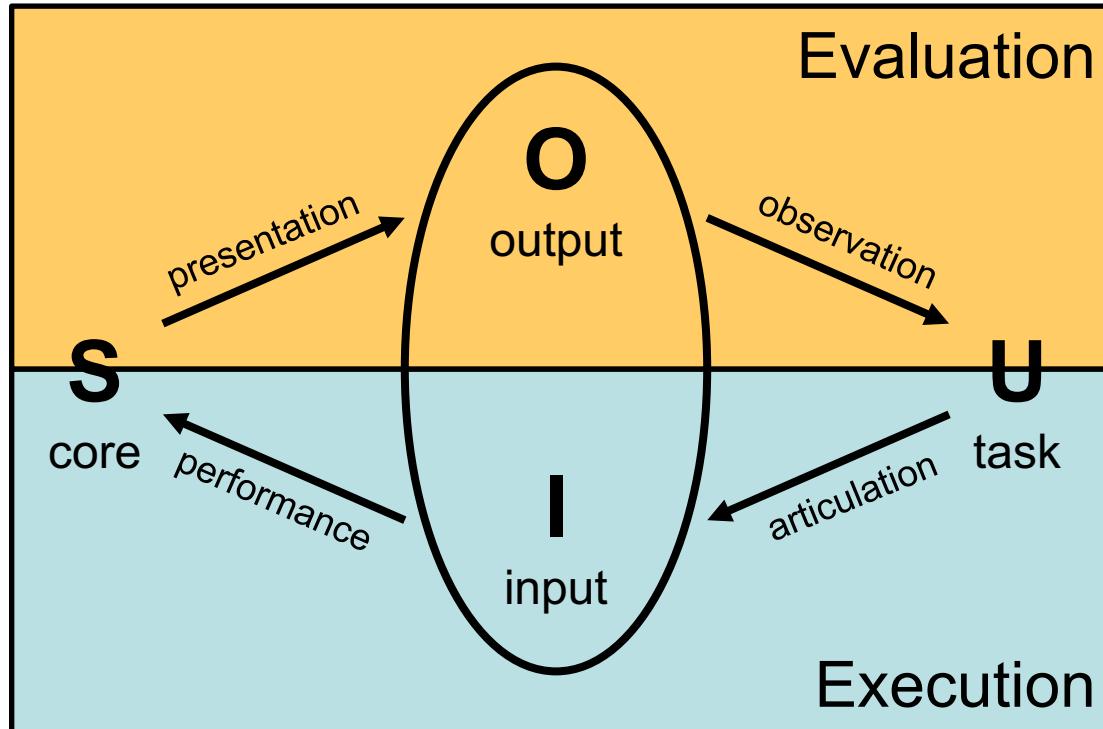
The ‘Interaction Framework’



Abowd, G. D., & Beale, R. (1991). Users, systems and interfaces: a unifying framework for interaction. In D. Diaper & N. Hammond (Eds.), *HCI'91: People and Computers VI* (pp. 73-87). Cambridge: Cambridge University Press.



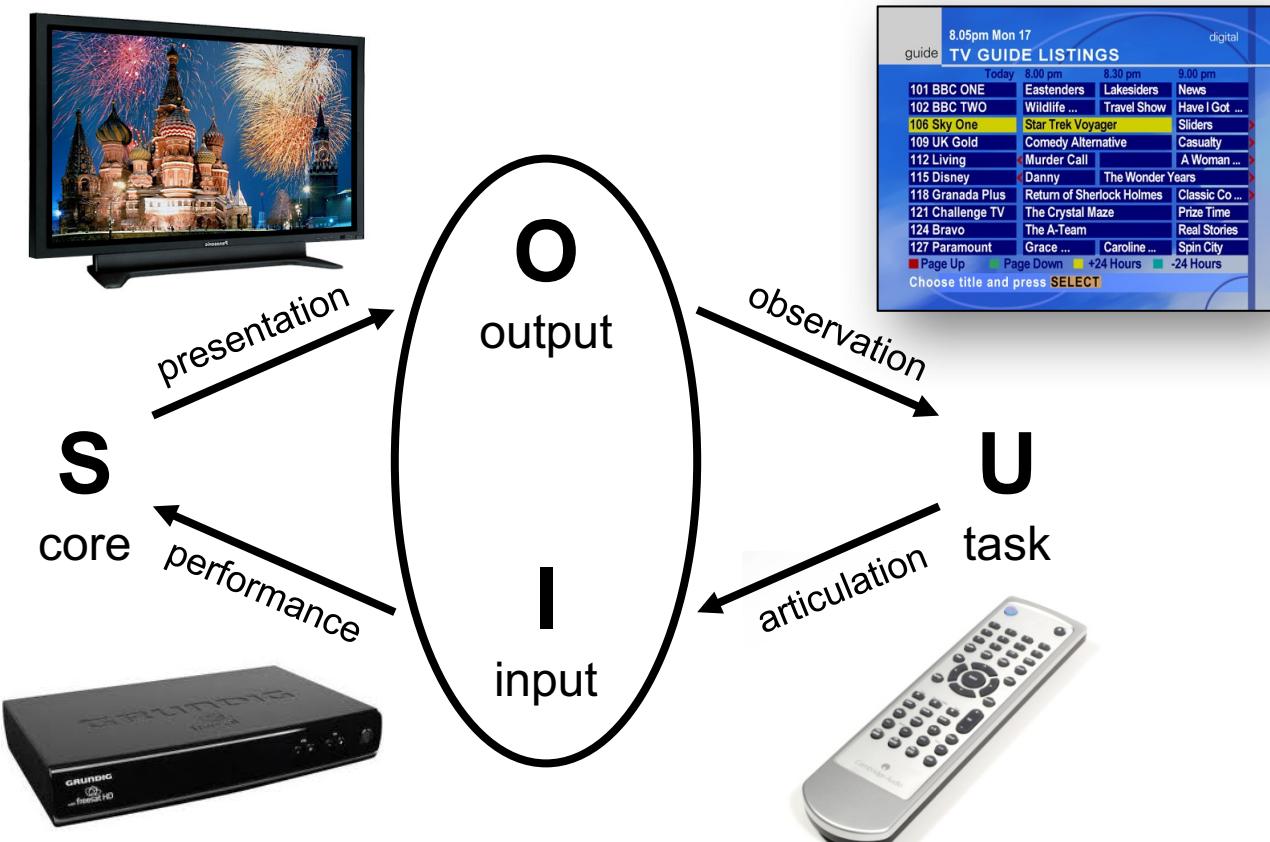
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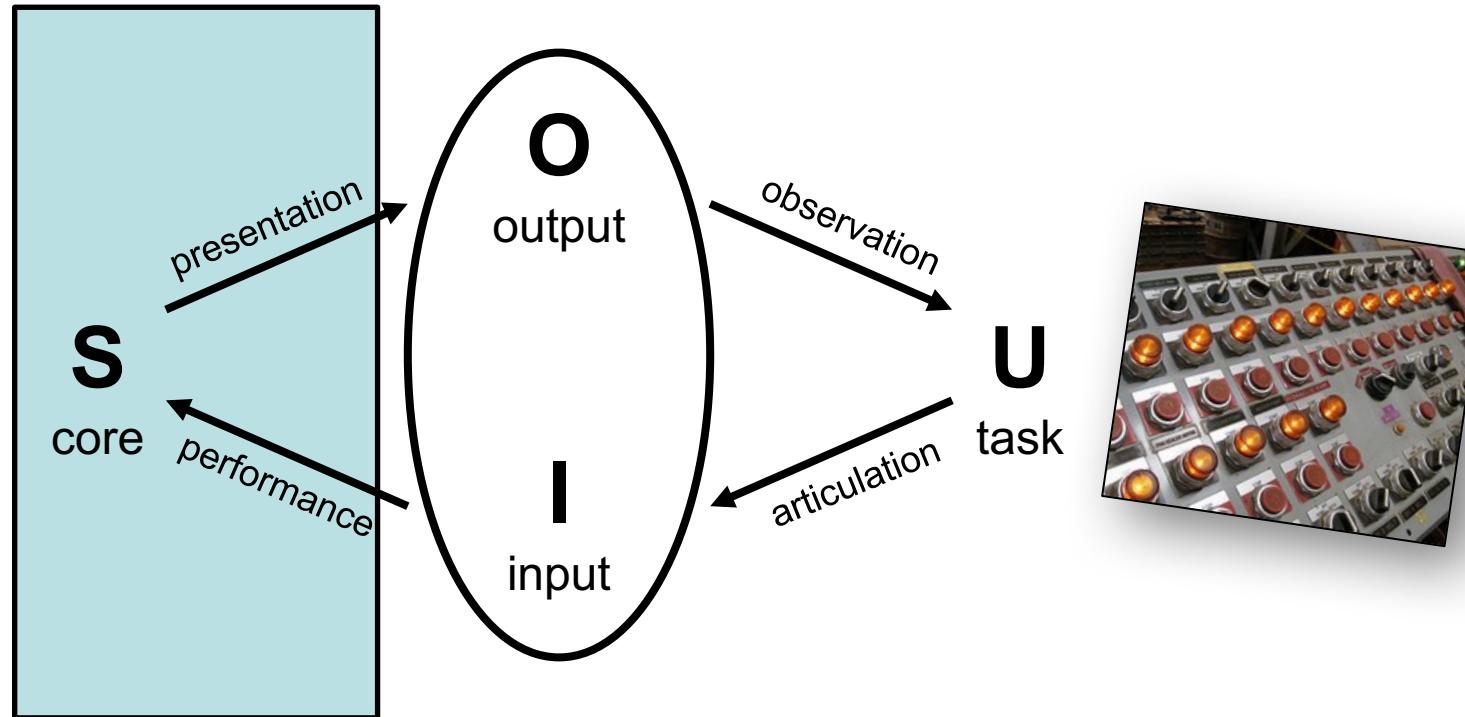


Abowd, G. D., & Beale, R. (1991). *Users, systems and interfaces: a unifying framework for interaction*. In D. Diaper & N. Hammond (Eds.), *HCI'91: People and Computers VI* (pp. 73-87). Cambridge: Cambridge University Press.



‘Indirect Manipulation’ Interface

Feedback to the user is from the system and from the interface (*and can be delayed*)

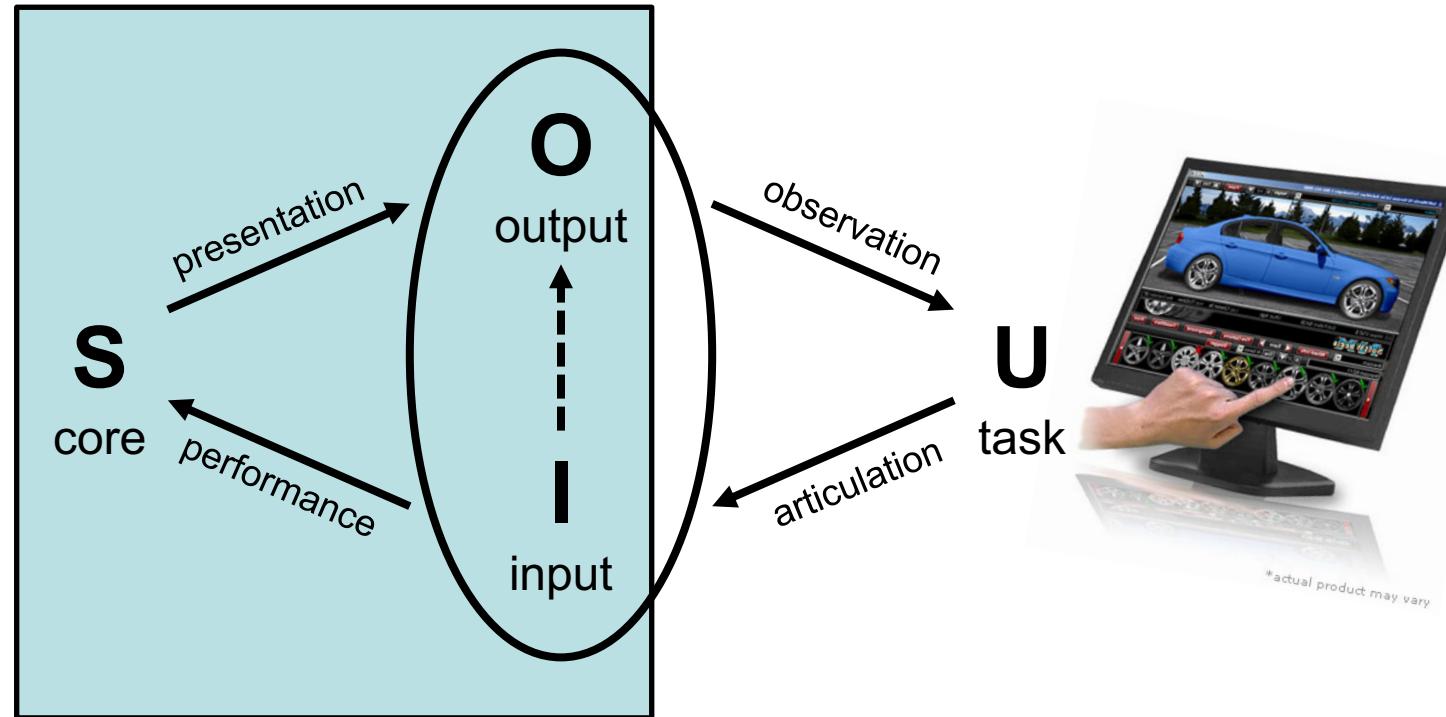


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'Direct Manipulation' Interface

Feedback to
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Making a table – *indirect* manipulation interface

Screenshot of Microsoft Word showing the Table Design ribbon tab selected. The ribbon tabs include Word, File, Edit, View, Insert, Format, Tools, Table, Window, and Help. The Table tab is highlighted with a blue underline.

The status bar at the bottom shows "Document1".

On the far left, there is a vertical pane with checkboxes for table properties:

- Header Row
- Total Row
- Banded Rows
- First Column
- Last Column
- Banded Columns

The main area displays a table with 3 rows and 3 columns. The top-left cell contains a small icon with a plus sign (+). The table has a black border and is positioned in the center of the document window.

The ribbon tabs are: Home, Insert, Design, Layout, References, Mailings, Review, View, Table Design (selected), Layout.

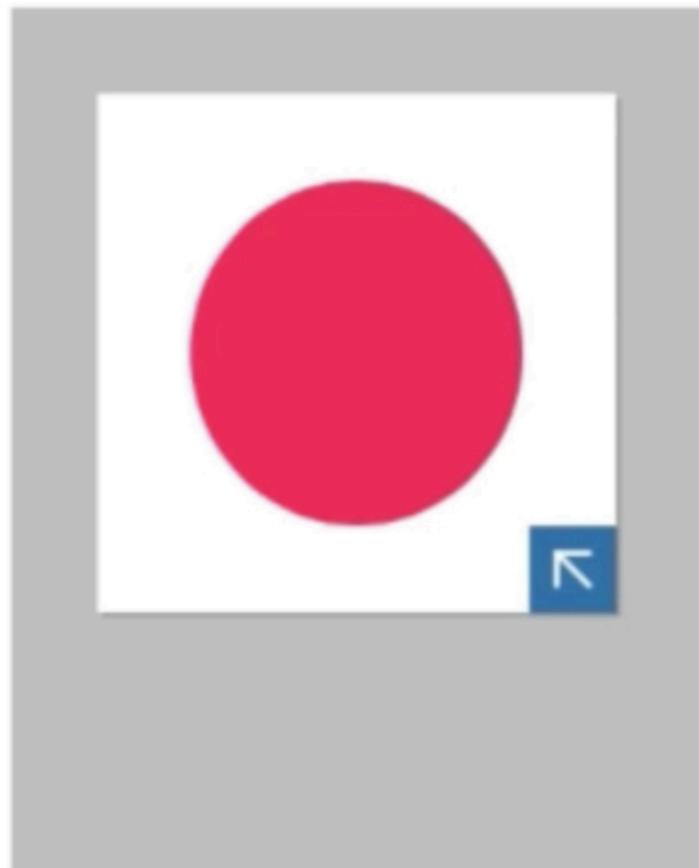
The status bar shows: Document1, 1/2 point.

Making a table – *direct* manipulation interface

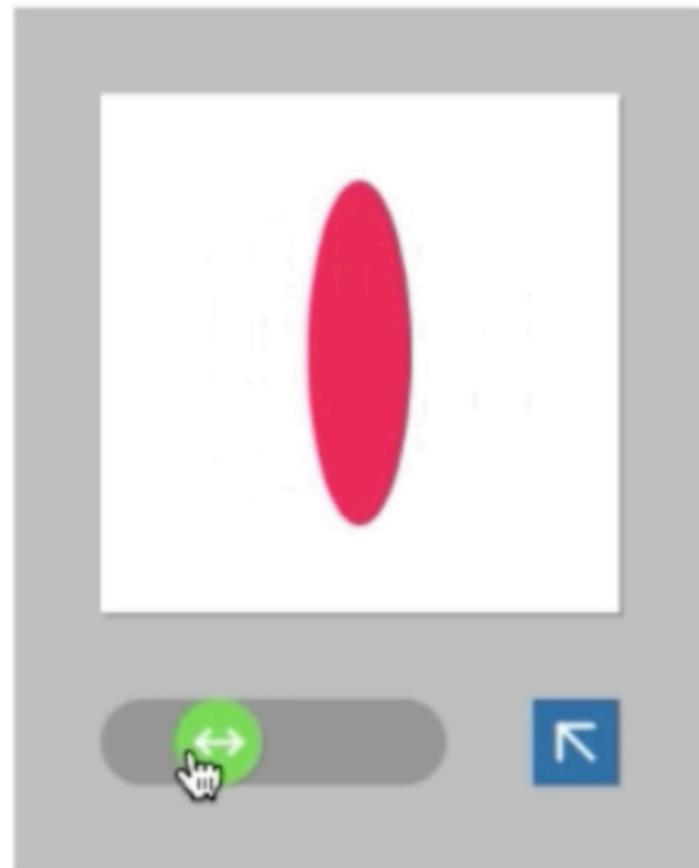
The screenshot shows a Google Sheets document window. At the top, there's a toolbar with a folder icon, file tabs (File, Tools, Table, Add-ons, Help), and a message saying "All changes saved in Drive". Below the toolbar is a detailed ribbon-style menu bar with sections for "Normal text" (with dropdowns for font style, size, and color), "Font" (set to Arial), "FontSize" (set to 11), "Bold" (B), "Italic" (I), "Underline" (U), "Text Color" (A), "Font Color" (red), "Font Size" (dropdown from 2 to 7), "Font Family" (dropdown from 1 to 7), "Font Style" (dropdown from 1 to 7), "Font Weight" (dropdown from 1 to 7), "Font Color" (dropdown from 1 to 7), and "Font Size" (dropdown from 1 to 7). The main area of the window contains a 3x7 grid of empty cells. The first cell in the top-left corner has a small dropdown arrow icon in its top-right corner, indicating it is currently selected or being edited.



Direct



Indirect

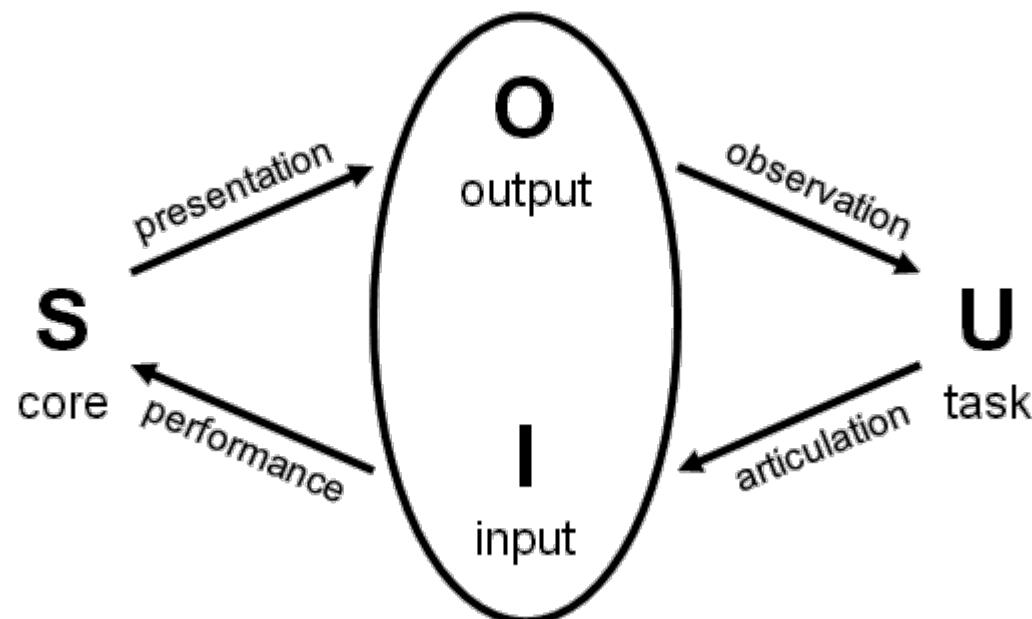


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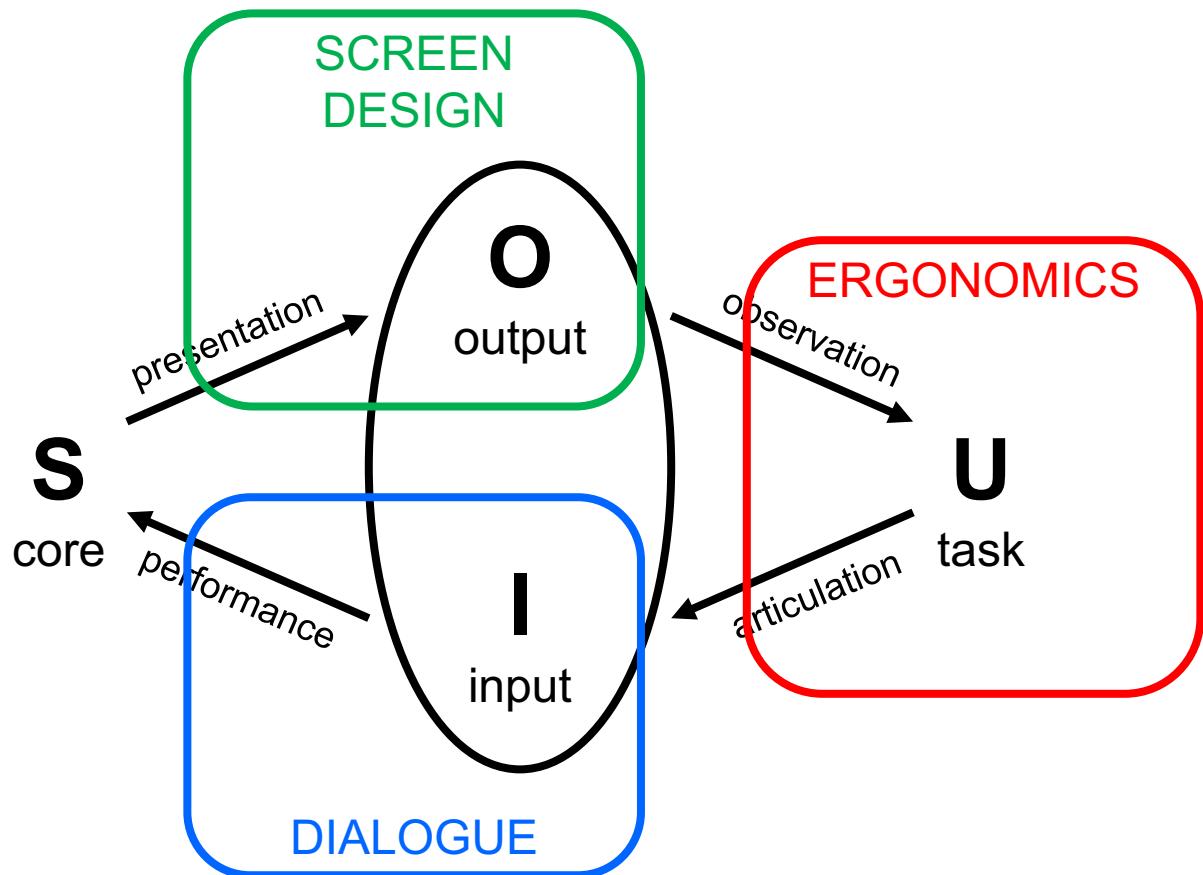
Exercise (*work in pairs*)



- Choose an interface with which you are familiar (e.g. smartphone, TV controller, car radio etc.)
- Analyse its use using the '**interaction framework**'
- Rank the four different translations in terms of their relative difficulty (*with reasons*)



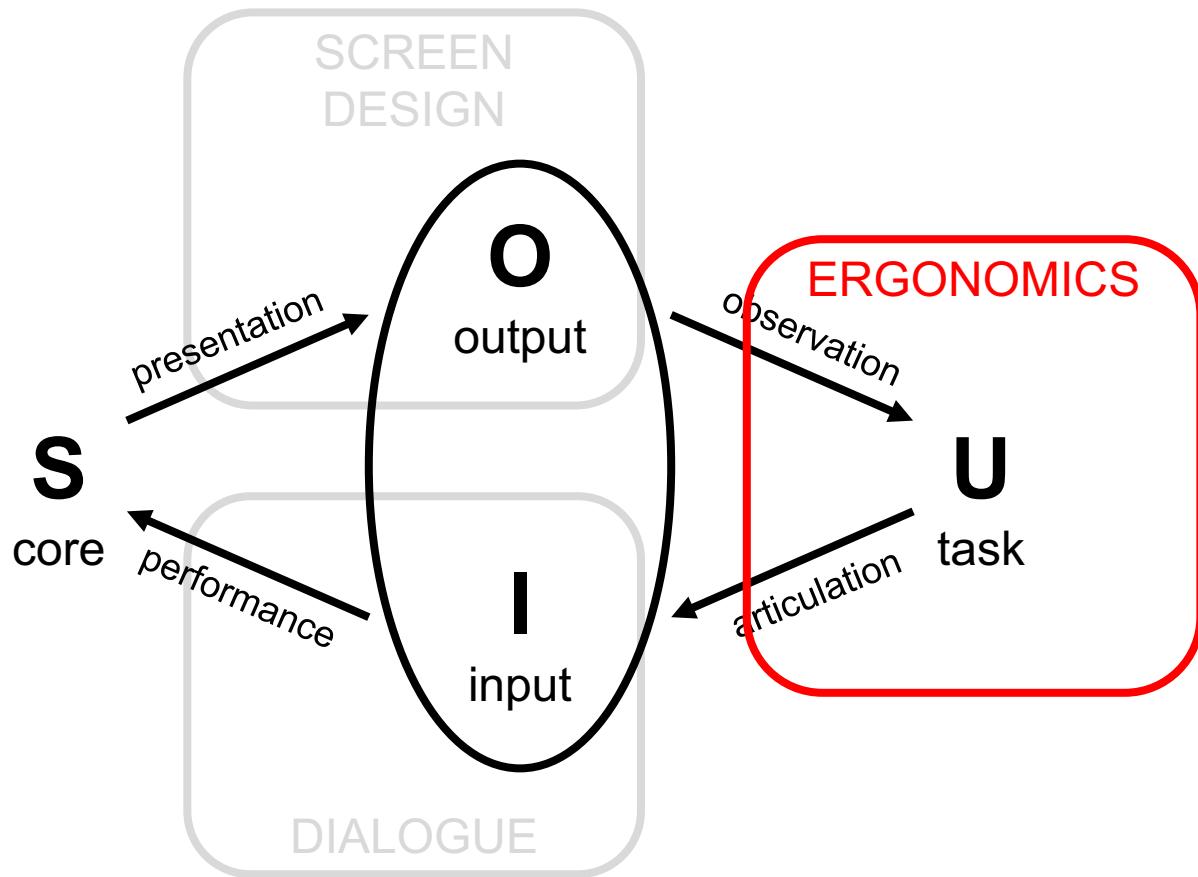
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Ergonomics

- Guidelines for the arrangement of controls and displays ...
 - place together those that are functionally related
 - organise sequential ones to reflect the order of their use in a typical interaction
 - make the most commonly used ones most easily accessible
 - overall arrangement must be appropriate to the user's position
- Guidelines for the physical environment ...
 - smallest users should be able to reach all the controls and see the displays
 - largest users should not be cramped



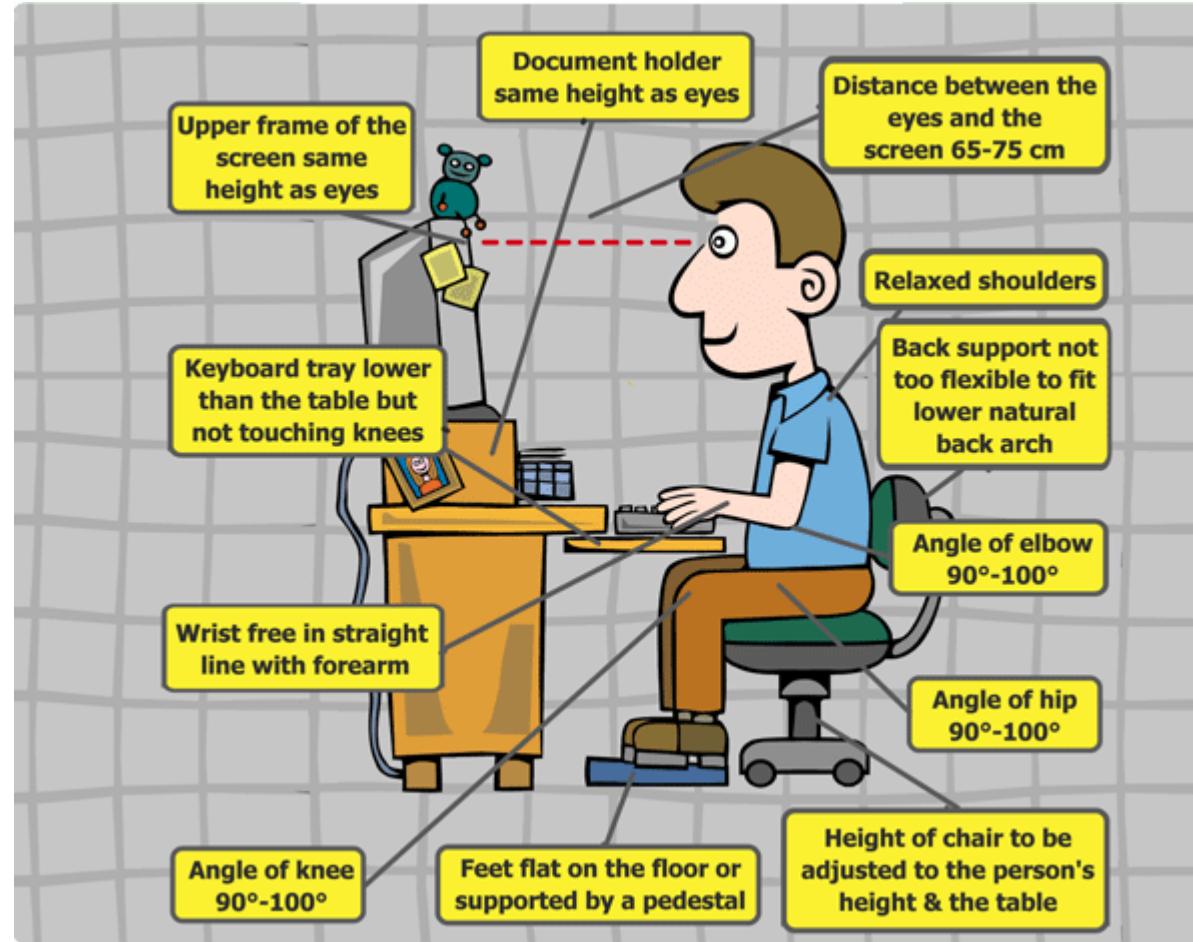
Ergonomics



- Health & safety
 - position
 - temperature
 - lighting
 - noise
 - time
- Colour
 - be as distinct as possible
(e.g. no critical information in blue)
 - use common conventions
(e.g. red for stop, green for go)
 - be aware of cultural differences
(e.g. red symbolises happiness and good fortune in China)



Ergonomics



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Ergonomics



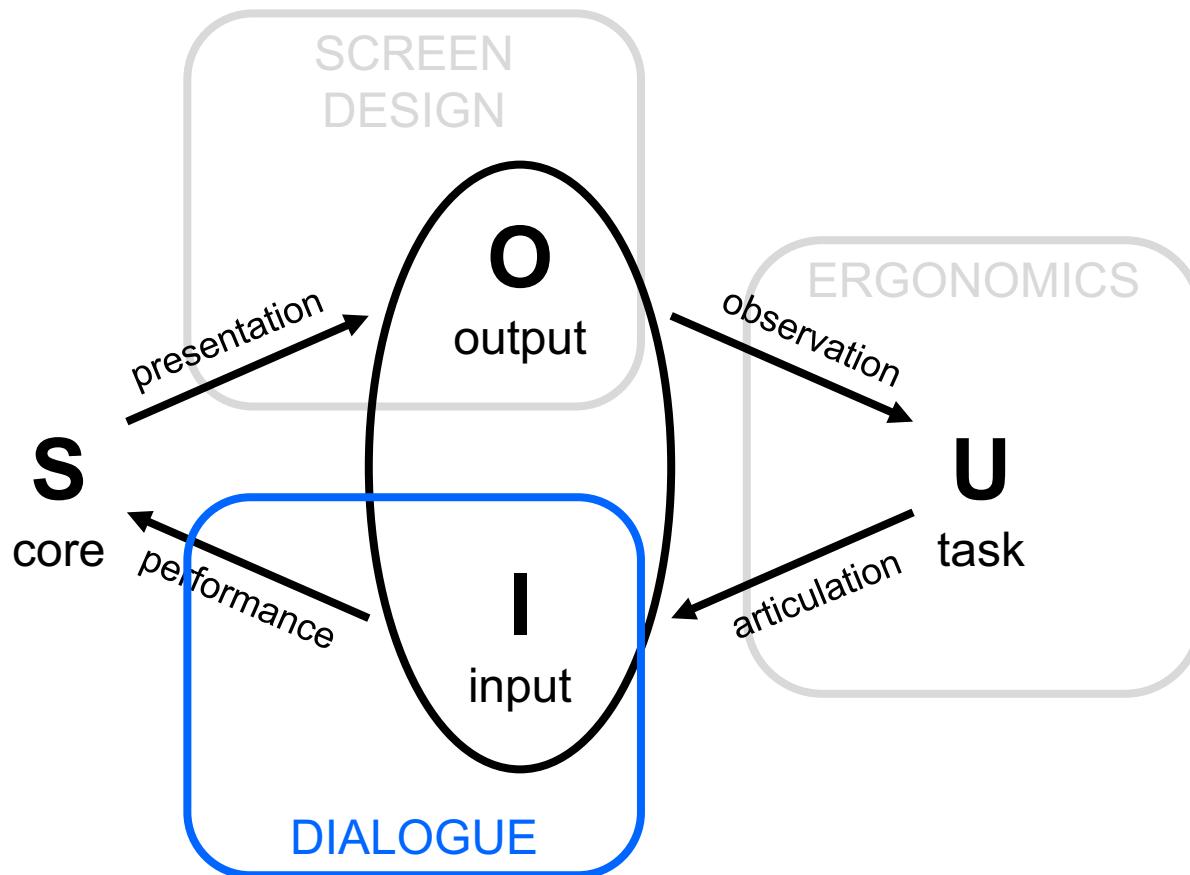
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5 minutes break



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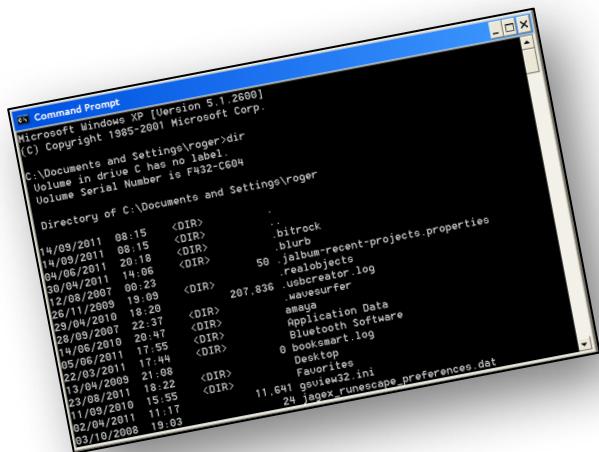


Dialogue (*Interaction Styles*)

- Command-line interfaces
- Graphical user interfaces (*WIMP*)
- Form-fills and spreadsheets
- Point-and-click
- Agent-based interfaces
- Spoken language interfaces
- Gesture-based interfaces
- Wearable interfaces
- Brain-computer interfaces



Command-Line Interfaces



- Pros ...
 - direct access to system functionality
 - flexible (*parameters and switches*)
 - can be applied to many objects at once
- Cons ...
 - difficult to use (*and learn*)
 - commands (*and their syntax*) must be remembered
 - commands are often obscure
 - commands vary across systems
- Command lines provide an '**indirect manipulation**' interface



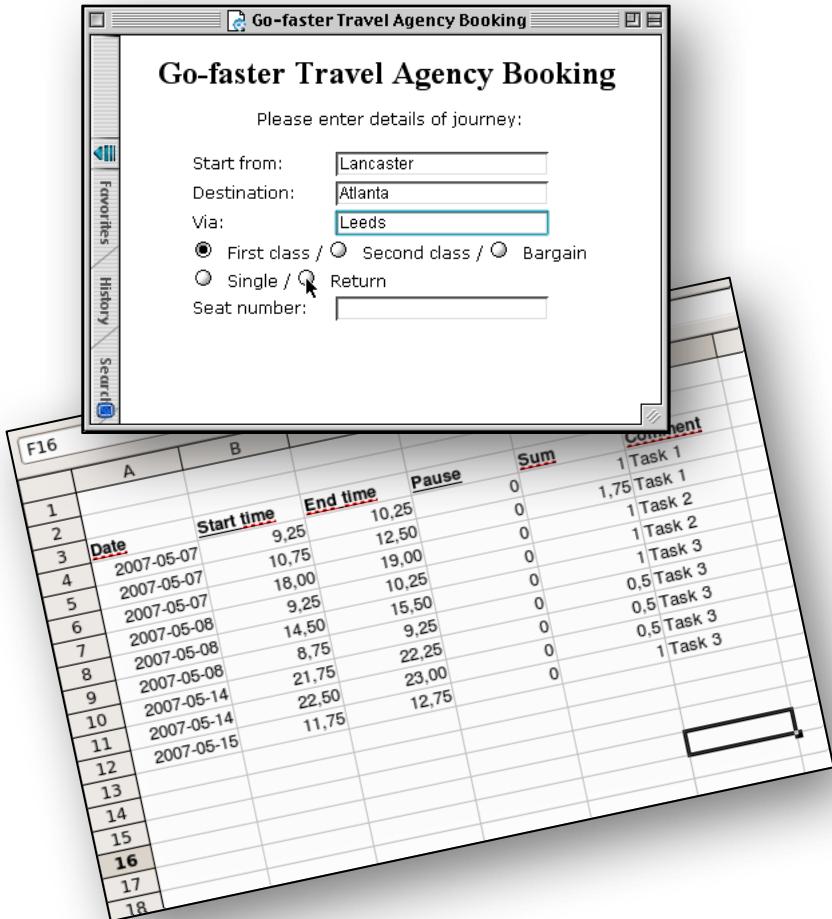
Graphical User Interfaces (GUIs)



- E.g. '**WIMP**' ...
 - 'Windows'
(shares a device's graphical display among multiple applications at the same time)
 - 'Icons'
(image/symbol used to represent a file, folder, application or device)
 - 'Menus'
(list of commands or options)
 - 'Pointers'
(devices to select items)
- WIMP provides a '**direct manipulation**' interface



Form-Fills and Spreadsheets



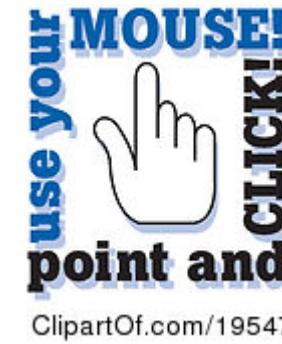
- Primarily used for data entry
- Often based on an actual form (*therefore layout is familiar to the user*)
- Have to allow for correction of mistakes by the user
- Easy to learn
- The distinction between input and output is blurred



Point-and-Click Interfaces



- Used in most multimedia systems and web browsers
- You can point at ...
 - places on a graphic image
 - a word in some text
 - an icon/button
- Closely linked to the concept of '**hypertext**'
- Particularly useful for touchscreen interfaces



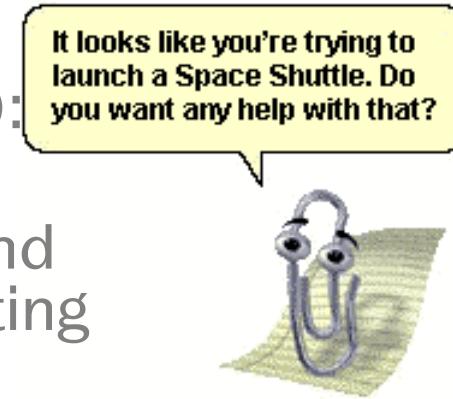
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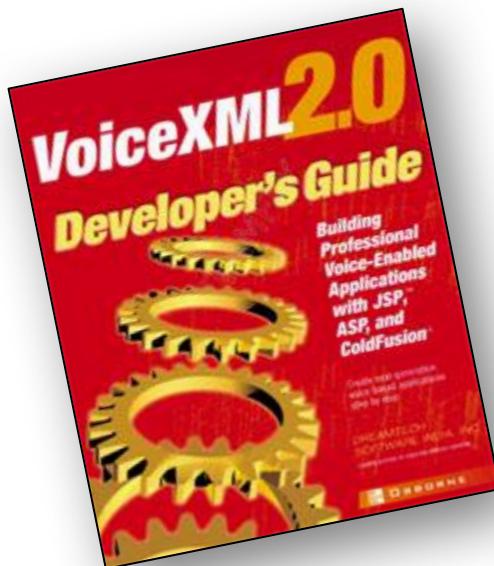
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Agent-Based Interfaces

- ‘Intelligent user interface’ (IUI):
 - an autonomous agent sits between the UI and the back-end application observing and reacting to the user’s actions
- ‘Delegated user interface’ (DUI):
 - an autonomous agent sits between the user and the application’s UI, or between the user and the application itself (*bypassing the normal UI*)
 - in both cases the application UI is effectively substituted by the agent’s UI



Spoken Language Interfaces



- Spoken language dialogue system (SLDS) using speech input ('*automatic speech recognition*' - ASR) and/or speech output ('*text-to-speech synthesis*' - TTS)
- Becoming more commonplace, especially over the telephone and on mobile devices
- Advantage is that it can be used '**hands-free eyes-free**'
- Overly complex dialogues can be difficult for users to navigate



Spoken Language Interfaces

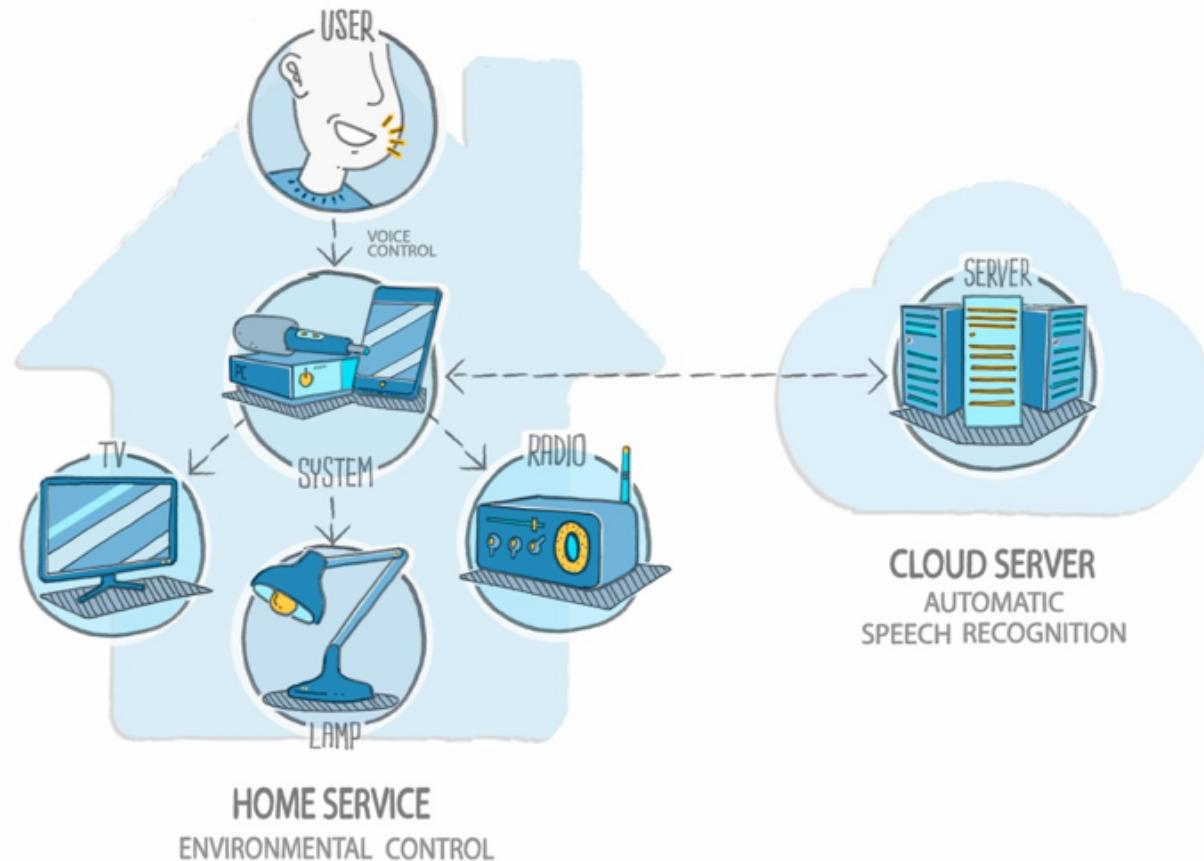


Speech Recognition \Rightarrow Text
Translation \Rightarrow Text \Rightarrow Speech Synthesis

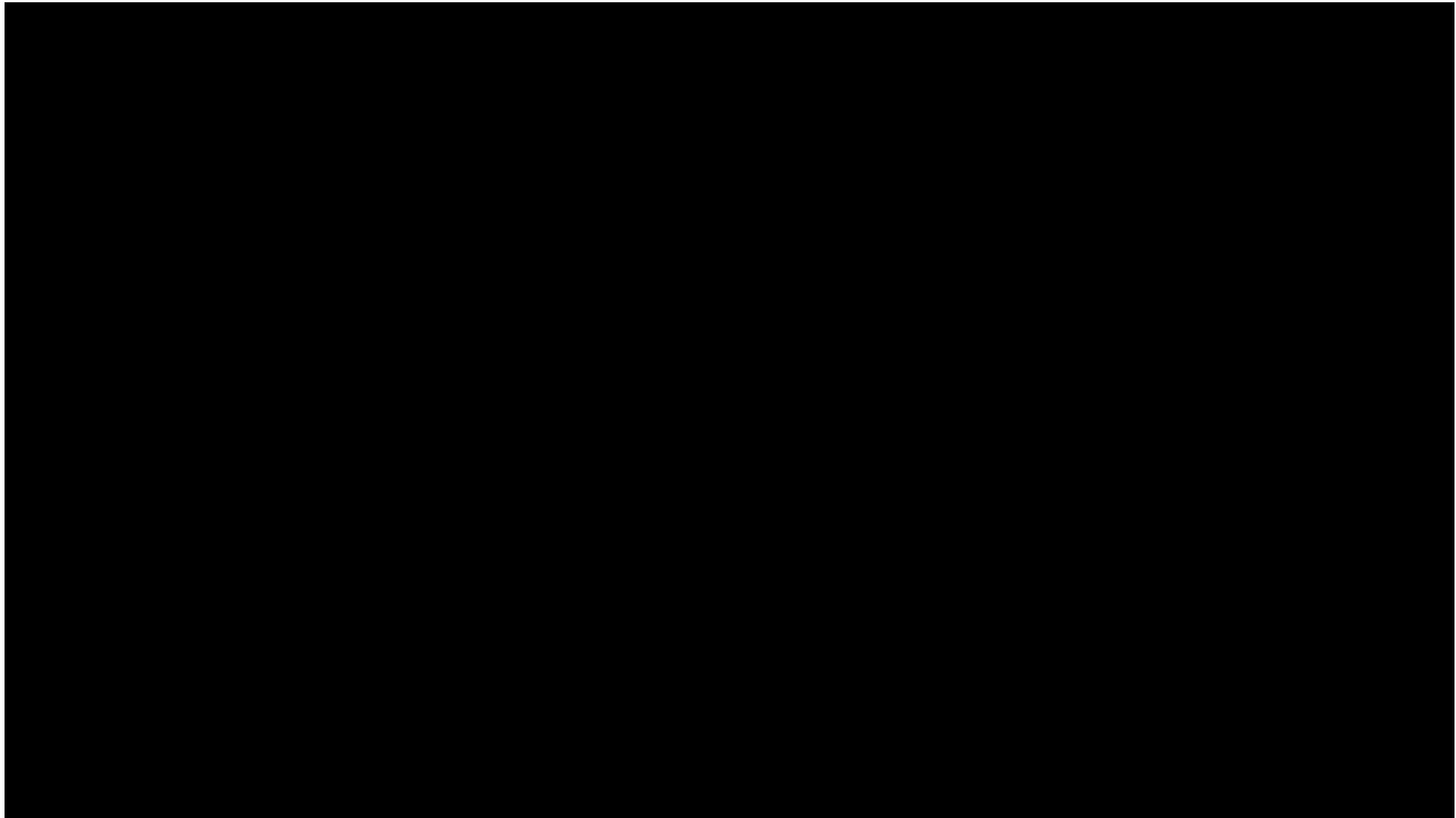


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Cloud-based speech technology



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Gesture-based Interfaces

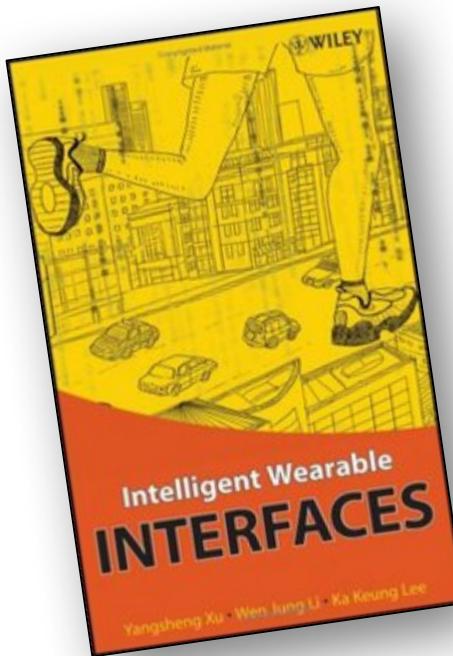


- Becoming very popular, especially with the release of Microsoft's '**Kinect**' device
- The Kinect device features ...
 - an RGB camera
 - a depth sensor
 - a multi-array microphone
- Kinect provides ...
 - full-body 3D motion capture
 - facial recognition
 - voice recognition capabilities



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Wearable Interfaces



Steve Mann's "wearable computer" and "reality mediator" inventions of the 1970s have evolved into what looks like ordinary eyeglasses.



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Wearable Interfaces



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Wearable Interfaces

Steve Mann's "wearable computer" and "reality mediator" inventions of the 1970s have evolved into what looks like ordinary eyeglasses.



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Brain-Computer Interfaces

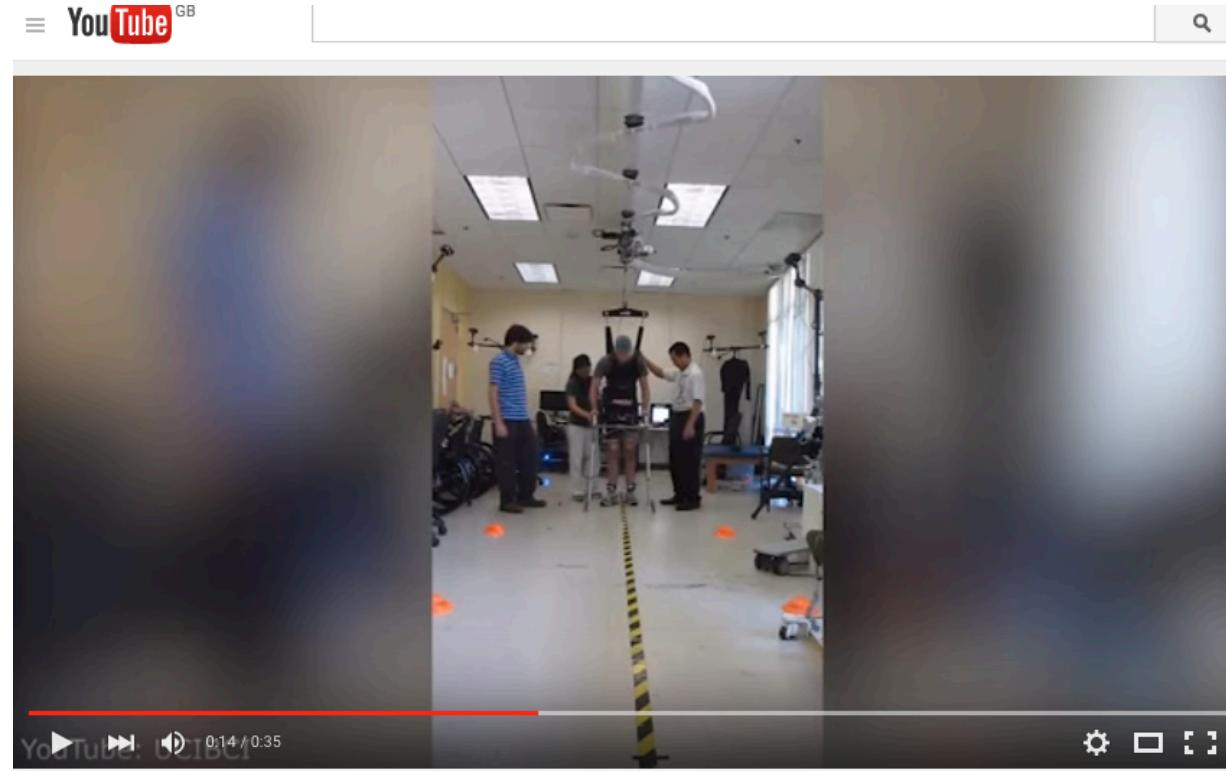


- Brain–computer interfaces (BCI) provide a communication pathway between a person's brain activity and an external device
- The user is trained to concentrate on the task (*e.g. moving a robot arm*)
- BCIs work through detecting changes in the neural functioning in the brain



BCI helps paralysed man to walk

- <https://www.youtube.com/watch?t=4&v=CsdM88CTcAg>



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What's the Best Interface?

- Is multimedia better than tangible interfaces for learning?
- Is speech as effective as a command-based interface?
- Is a multimodal interface more effective than a monomodal interface?
- Will wearable interfaces be better than mobile interfaces for helping people find information in foreign cities?
- Are virtual environments the ultimate interface for playing games?
- Will shareable interfaces be better at supporting communication and collaboration compared with using networked desktop PCs?

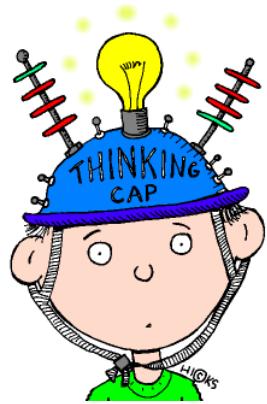


What's the Best Interface?

- The answers depend on the task, users, context, cost, robustness, etc.
- For example ...
 - mobile platforms are taking over from PCs
 - speech interfaces are becoming more robust
 - appliance and vehicle interfaces are becoming more important
 - shareable and tangible interfaces are entering our homes, schools, public places, and workplaces



Exercise (*work in pairs*)

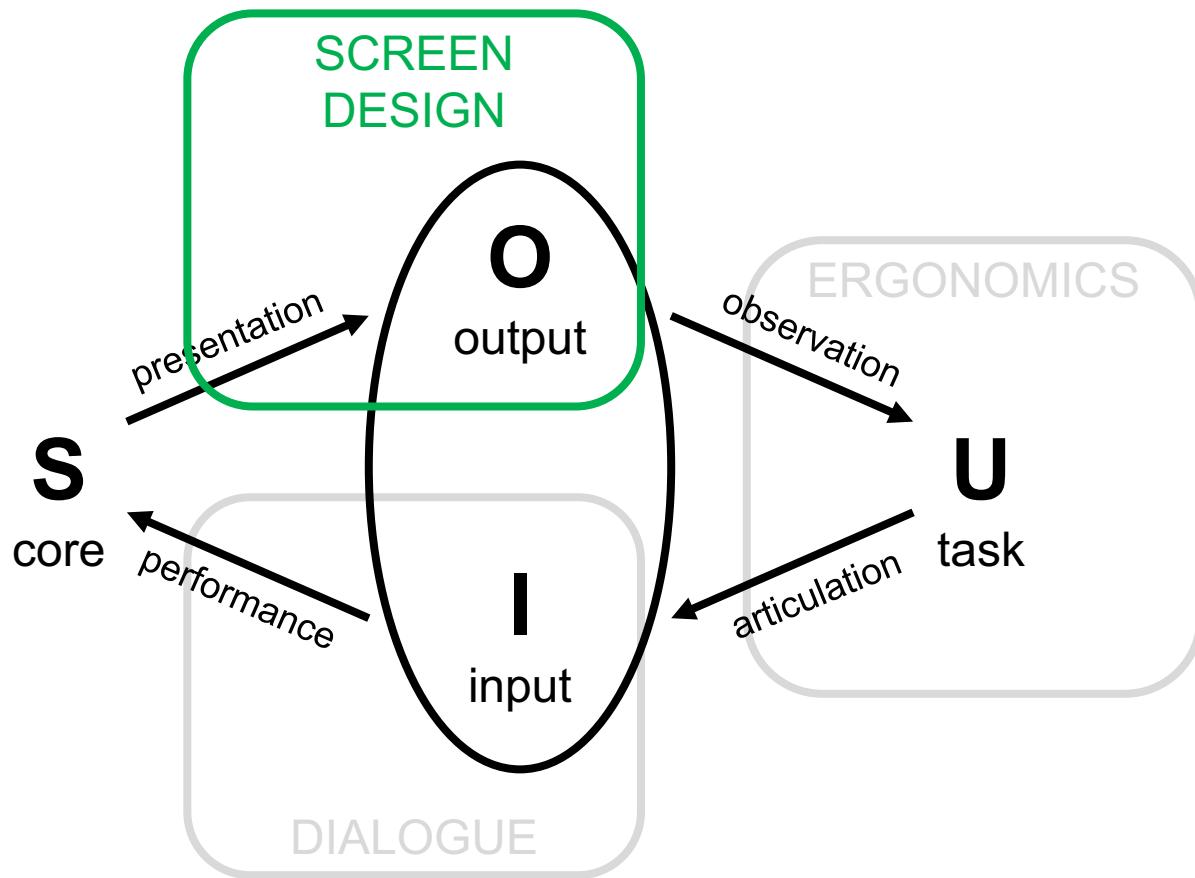


1. You are tasked with designing an information system for search and rescue personnel attending a natural disaster
2. What would be the most appropriate human-computer interface (*and why*)?
3. Be prepared to share your insights with the class



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The ‘Interaction Framework’



Abowd, G. D., & Beale, R. (1991). Users, systems and interfaces: a unifying framework for interaction. In D. Diaper & N. Hammond (Eds.), *HCI'91: People and Computers VI* (pp. 73-87). Cambridge: Cambridge University Press.



Screen Designs



- WIMP elements are called '**widgets**'
- How widgets are used defines the '**look and feel**' of an interface
- In addition to windows, icons, menus and pointers, there are ...
 - buttons, toolbars, palettes, dialogue boxes
- Issues ...
 - appearance (*what they look like*)
 - interaction (*how they behave*)
 - semantics (*what they mean*)

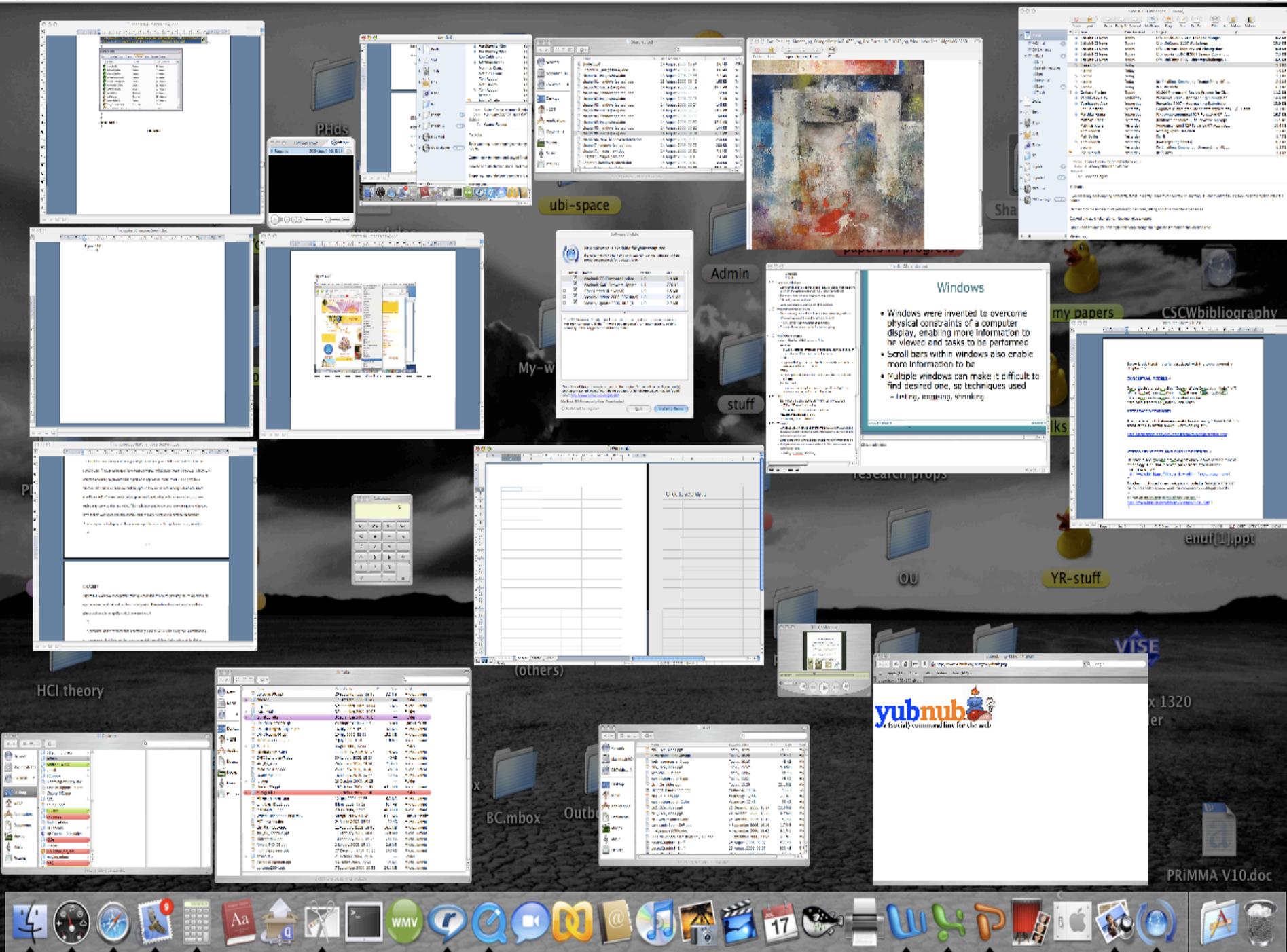


Windows



- Areas of the screen that behave as if they were independent
 - can contain text or graphics
 - can be moved or resized
 - can overlap and obscure each other, or can be laid out next to one another (*tiled*)
- ‘Scrollbars’
 - allow the user to move the contents of the window up and down or from side to side
- ‘Title bars’
 - describe the name of the window





Top Sites History



Edit

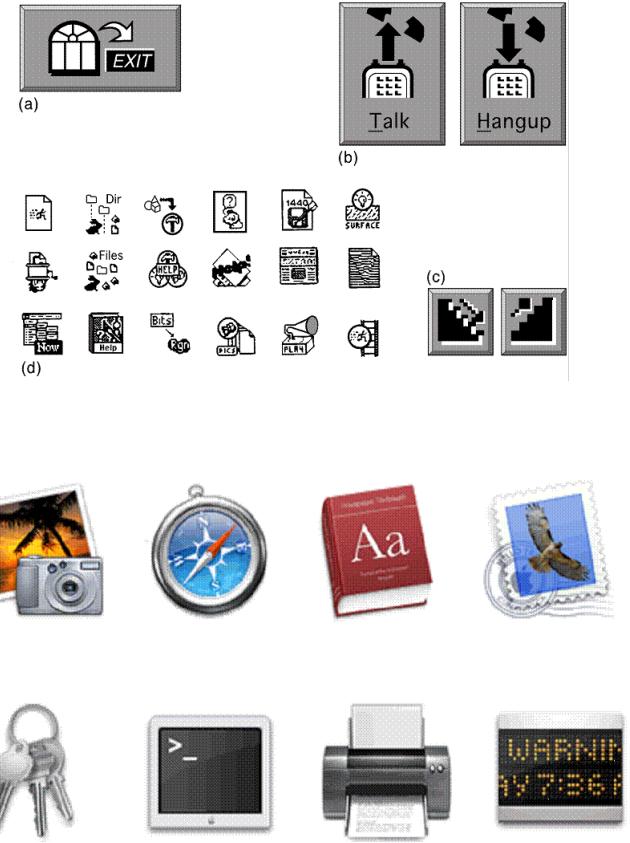
Search History

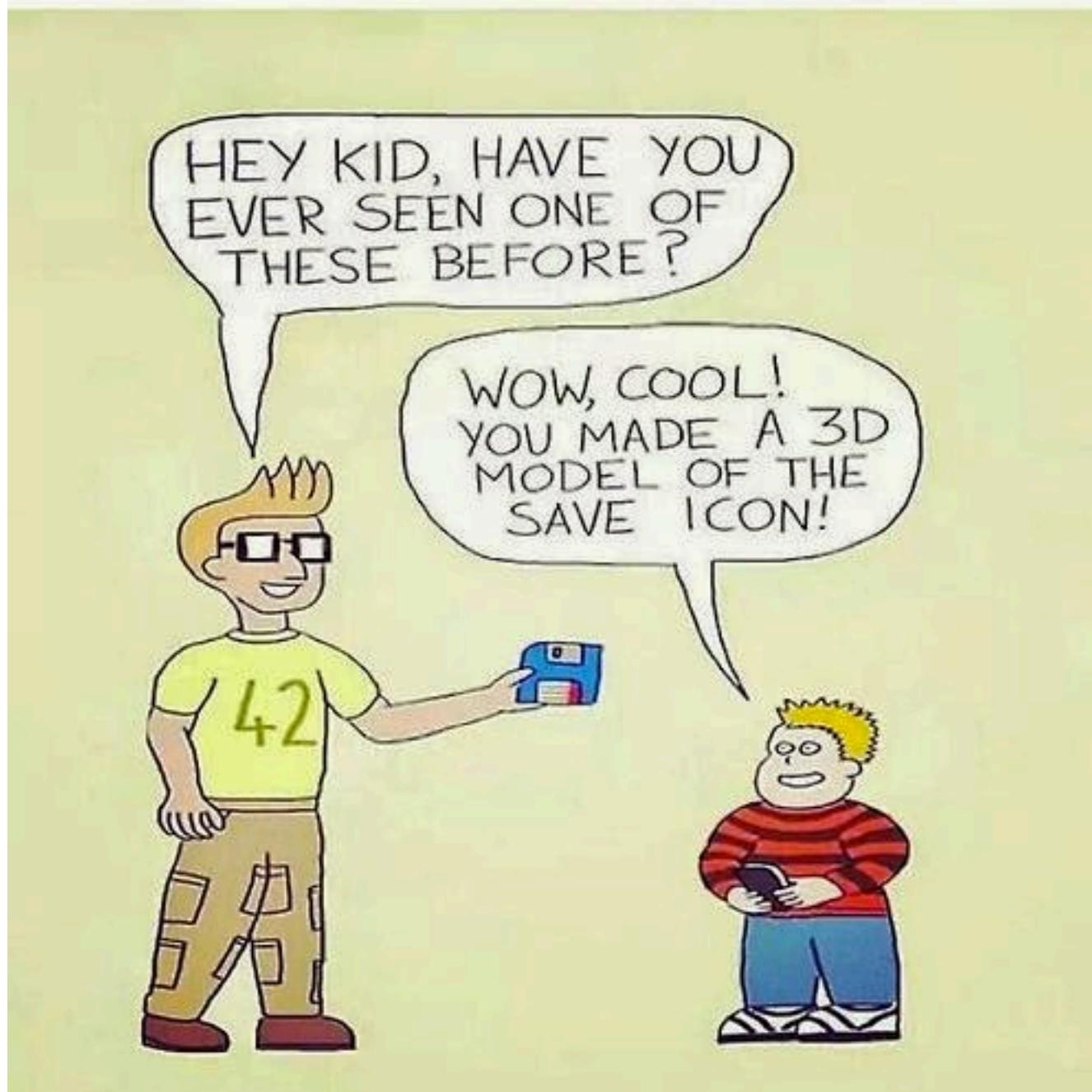


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Icons

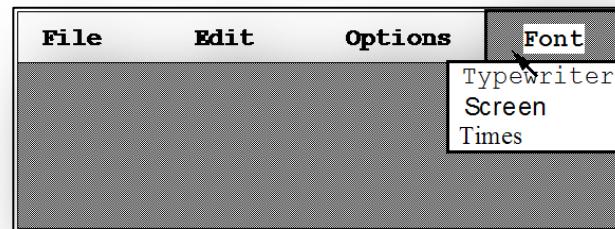
- Small picture or image
- Icons represent some object in the interface (*often a window or an action*)
- Icons can be ...
 - highly stylized
 - realistic
- Windows can be closed down ('iconised')





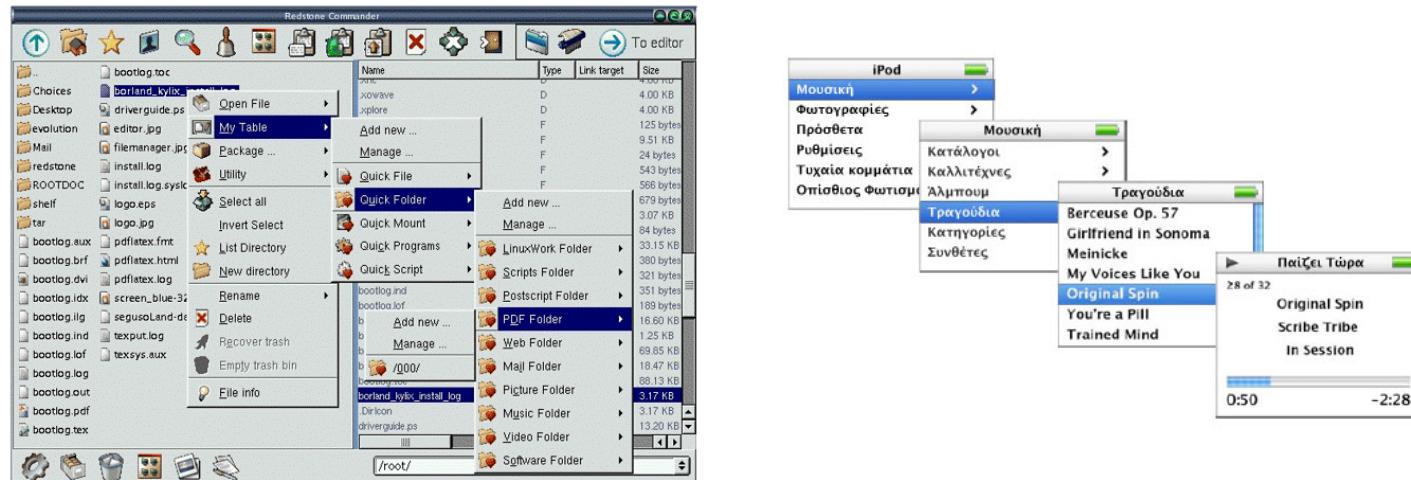
Menus

- Choice of operations or services offered on the screen
- Required option selected with ‘**pointer**’
 - problem: *takes a lot of screen space*
 - solution: *pop-up menu appears when needed*
- ‘**Menu bar**’ at top of screen (*normally*)
 - pull-down menu (*mouse hold and drag down*)
 - drop-down menu (*mouse click reveals menu*)
 - fall-down menus (*mouse just moves over bar*)



Menus

- ‘**Expanding menus**’ enable ...
 - more options to be shown on a single screen than is possible with a single flat menu
 - more flexible navigation, allowing for selection of options to be done in the same window
- ‘**Cascading menus**’ are the most popular
 - downside is that they require precise mouse control
 - can result in overshooting or selecting wrong options



Menus

- ‘**Contextual menus**’ provide access to often-used commands that make sense in the context of a current task
 - they appear when the user ...
 - presses the Ctrl key (*Mac*) or right-clicks (*Windows*)
 - while clicking on an interface element
 - they help overcome some of the navigation problems associated with cascading menus
- ‘**Keyboard accelerators**’
 - key combinations (*same effect as menu item*)
 - two kinds
 - active when menu open (*usually first letter*)
 - active when menu closed (*usually Ctrl + letter*)



Pointers

- Important component
 - WIMP style relies on pointing and selecting things
- Wide variety of graphical images
- Uses mouse, trackpad, joystick, trackball, cursor keys or keyboard shortcuts



Buttons

- Individual and isolated regions within a display that can be selected to invoke an action

Gender: Male Female

Interests: web development user interfaces music

Submit

- Special kinds ...
 - radio buttons (*set of mutually exclusive choices*)
 - check boxes (*set of non-exclusive choices*)



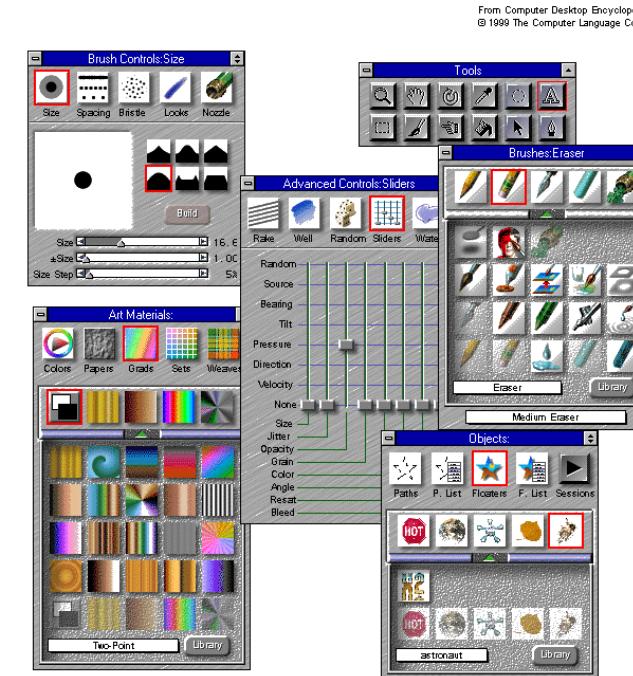
Toolbars

- Long lines of icons
- Fast access to common actions
- Often customizable:
 - choose which toolbars to see
 - choose what options are on it



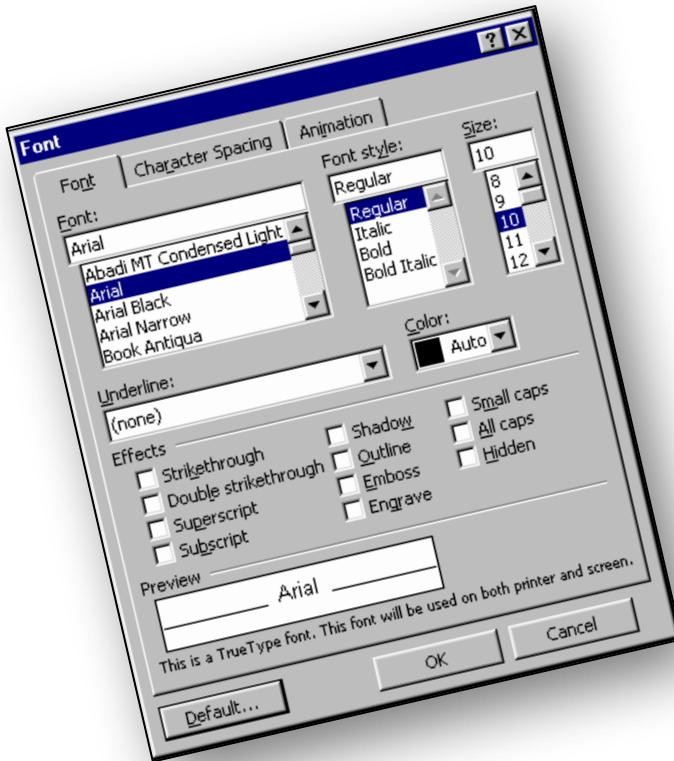
Palettes and Tear-Off Menus

- Problem: menu not there when you want it
- Solution: ‘palettes’ (*little windows of actions*)
- Palettes are shown/hidden via a menu option (e.g. *available shapes in drawing package*)
- Sometimes menus ‘tear-off’ to become palettes



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Dialogue Boxes



- Information windows that pop up to inform of an important event or request information
- Acts as a container for other GUI objects
- E.g. when saving a file, a dialogue box is displayed to allow the user to specify the filename and location - once the file is saved, the box disappears



Shneiderman's '*Eight Golden Rules of Interface Design*'



Ben Shneiderman
(inventor of the
text hyperlink)

1. Strive for consistency
2. Enable frequent users to use shortcuts
3. Offer informative feedback
4. Design dialog to yield closure
5. Offer simple error handling
6. Permit easy reversal of actions
7. Support internal locus of control
8. Reduce short-term memory load

<http://faculty.washington.edu/jtenenbg/courses/360/f04/sessions/schneidermanGoldenRules.html>



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Offer informative feedback

Good example

Change bar color & style

User-friendly progress bar shows the percentage of completeness

Show or hide page numbers

Trivia Quiz
The best Star Trek trivia quiz on the internet!

20%

Most Star Trek stories depict the adventures of humans and aliens who serve in Starfleet, the space-borne humanitarian and peacekeeping armada of the:

- Planets United Federation
- United Federation of Planets
- The United Planets Federation
- Federation of United Planets

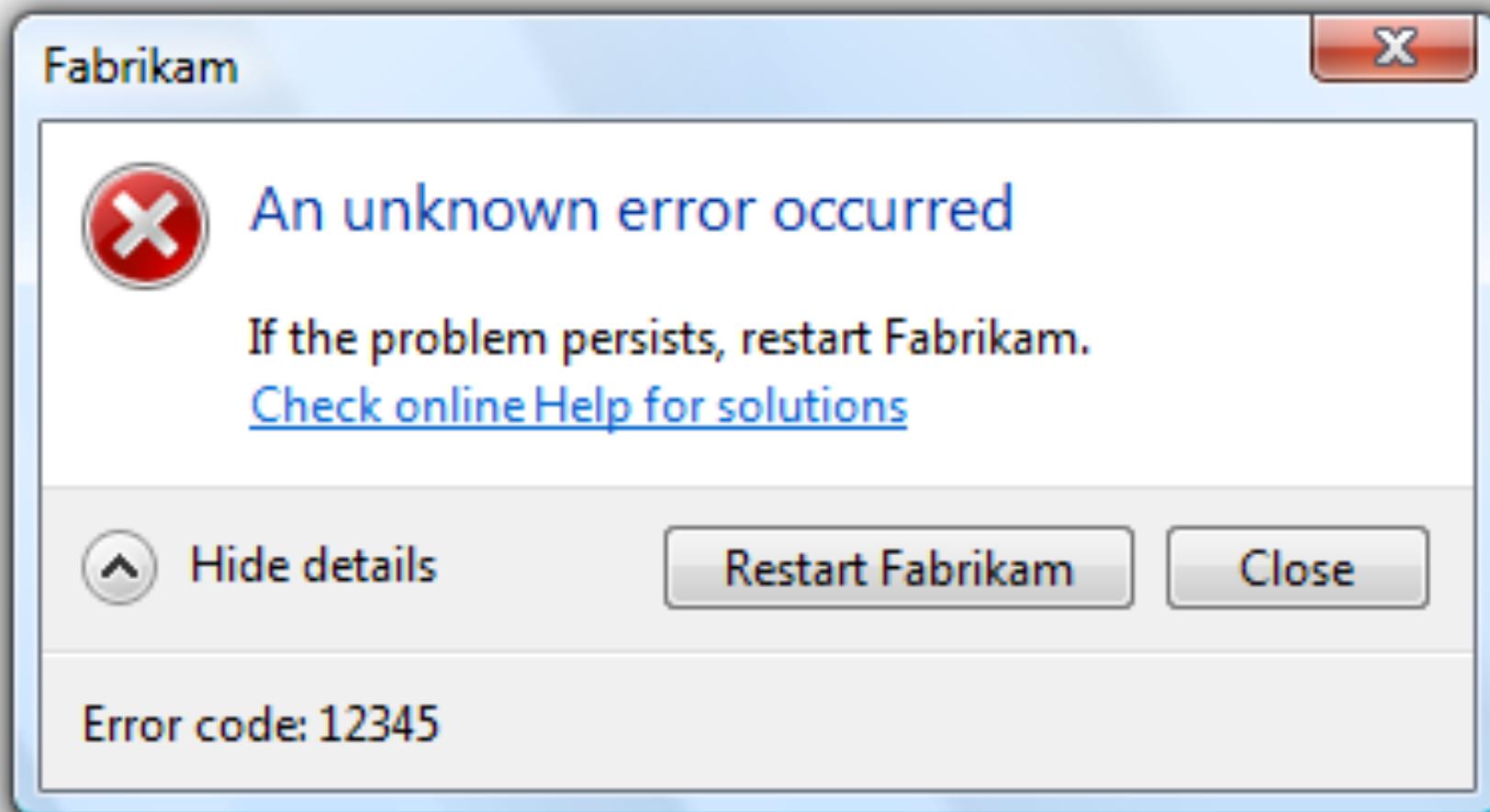
Next Page [Previous](#)

2 / 5



Offer informative feedback

Bad example



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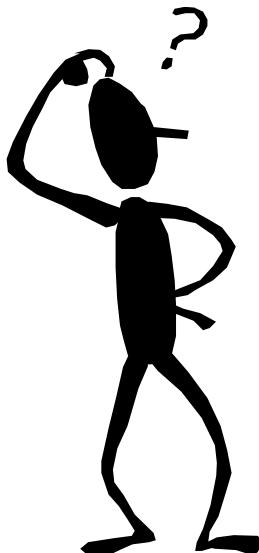


This lecture has covered ...

- Models of interaction
- The ‘execution-evaluation cycle’
- The ‘interaction framework’
- Direct/indirect manipulation
- Ergonomics
- Dialogue/interaction styles
- Interfaces
- Screen design
- Shneiderman's eight golden rules of interface design



Any Questions ?



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Next time ...

Designing Interaction



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