Recapitulation Lecture #5

• Computer elements
  – Interaction devices
  – Focus on input

• Paradigms, Shifts
  – From Batch
  – To Ubiquitous

• Interaction models
  – Norman
  – Abowd & Beale
Abowd & Beale vs. Norman

• Norman 7 stages:
  – Helps understanding interaction

• Abowd & Beale:
  – Translation between languages
  – (user-input-core-output)
  – 4 translations
    • Articulation, Performance Presentation, Observation

Complex: Control panels, e.g. Lecture Room lighting
Simple: Virtual Reality, articulation is direct
Example Haptic IO
Example Haptic IO
Focus on Haptic Feedback

• Epidural Simulator from Yantric
• Haptic IO-device mounted in mannequin
• Interfaced with 3D models
  – Feedback
  – Visibility
  – Mental model (building of)
• Mental model is built from the combination of haptic force feedback and 3D visualization
Paradigm Shifts ...

“They grow up too fast.”
Yet another Paradigm ... 

The Internet of Things (IoT)

Libelium Smart World

- **Air Pollution**
  - Control of CO₂ emissions, factories, pollution emitted by cars and toxic gases generated in farms.

- **Forest Fire Detection**
  - Monitoring air temperature and green fire conditions to define alert zones.

- **Wine Quality Enhancing**
  - Monitoring soil moisture and trunk diameter in vineyards to control the amount of sugar in grapes and grapevine health.

- **Offspring Care**
  - Control of growing conditions of the offspring in animal farms to enhance its survival and health.

- **Sportsmen Care**
  - Wearable monitoring in high performance centers and fields.

- **Structural Health**
  - Monitoring vibrations and material conditions in buildings, bridges and historical monuments.

- **Smartphones Detection**
  - Detect iPhone and Android devices in general by any device which works with Wi-Fi or Bluetooth interfaces.

- **Perimeter Access Control**
  - Access control to restricted areas and detection of people in non-authorised zones.

- **Radiation Levels**
  - Distributed measurement of radiation levels in nuclear power stations surroundings to generate biological alerts.

- **Electromagnetic Levels**
  - Measurement of the energy radiated by cell stations and and Wi-Fi routers.

- **Traffic Congestion**
  - Monitoring of vehicles and pedestrian influence to optimize driving and walking routes.

- **Smart Roads**
  - Warning messages and diversions according to climate conditions and unexpected events like accidents or traffic jams.

- **Smart Lighting**
  - Intelligent and weather adaptive lighting in public areas.

- **Intelligent Shopping**
  - Setting alerts in the point of sale according to customer habits, preferences, process of alternating components for them and consumers.

- **Noise Urban Maps**
  - Sound monitoring in bars, noise and urban zones around them.

- **Water Leakages**
  - Detection of leakages at water tanks and pressure variations doing pipes.

- **Vehicle Auto-diagnosis**
  - Information system of transport to send real-time alarms to emergencies or guides for drivers.

- **Hom Location**
  - Search of individual items in big surfaces like warehouses or harbours.

- **Water Quality**
  - Water quality study in rivers and the sea for the use and availability for drinking use.

- **Smart Parking**
  - Monitoring of parking spaces availability in the city.

- **Waste Management**
  - Detection of rubbish levels in containers to optimise the waste collection routes.

- **Golf Courses**
  - Selection irrigation in dry zones to reduce the water resources required in the green.
Internet of Things

- “A Thing” connects to Internet
- “A Thing” participates with tasks
- Intelligent environment. Consequence of Ubiquitous / Cloud Computing

- Calls for new way of design
  - Service Design
  - What are the HCI aspects to address – Debate.
Design for IoT

- Key Characteristics (..., to develop an idea)
  - Intelligence, Hardware/Software
  - Connectivity, Wifi, Accessibility, Compatibility
  - Sensing, Experience awareness
  - Expressing, Interaction of Thing with Human
  - Energy, Power efficiency and sustainability
  - Safety, Person, personal data, physical well-being

- Sevice Design is a manner to solve complexity of connecting with multiple “things” all in a different way
The IoT in your living room ...
INTERACTION STYLES
Interaction Techniques

• An interaction technique is a way of using a physical input device to perform a generic task in a human-computer dialogue. *Foley et al. [1990]*

  **technical definition:**

• An interaction technique is a way to carry out an interactive task. It is defined in the binding, sequencing, and functional levels, and it is based on using a set of input and output devices or technologies.
Five Primary Interaction Styles

Shneiderman 98

- Direct manipulation
- Menu selection
- Form filling
- Command language
- Natural language
  - These are all in response to the baseline of command languages
  - All types not appropriate for all tasks
  - Often useful to blend interactions styles in one UI
- We restrict to standard interaction
Interaction Styles & Categories

• Describe form of communication between user and computer

• Linguistic styles
  – Command line
  – (natural) Speech

• Key-Modal styles
  – Function keys
  – Q & A interaction
  – Menu driven
  – Form Fill-in

• Direct manipulation
  – GUI
  – Forms (Form Fill-in)
Command Language

• Oldest style of interaction
• Instructions are expressed to computer directly
  • Parsing or Direct Execution
• Communication purely textual
• Options:
  • Single characters
  • Whole words
  • Abbreviations (e.g. cd, ftp)
  • Function keys
  • Combinations of the above
Example Command Language

CLI: command line interface
cat, ls, clear, ctrl-d, > ; there is lot to know to make this work ...
Example Command Line Interface

Terminal Activity

Activity  Edit

[olpc@xo-D0-39-68 /]$ cat --help
Usage: cat [OPTION] [FILE]...
Concatenate FILE(s), or standard input, to standard output.

-A, --show-all     equivalent to -vET
-b, --number-nonblank number nonempty output lines
-e                  equivalent to -vE
-E, --show-ends    display $ at end of each line
-n, --number       number all output lines
-s, --squeeze-blank suppress repeated empty output lines
-t                  equivalent to -vT
-T, --show-tabs    display TAB characters as ^I
-u                  (ignored)
-v, --show-nonprinting use ^ and M- notation, except for LFD and TAB
--help display this help and exit
--version output version information and exit

With no FILE, or when FILE is -, read standard input.

Examples:
cat f  g Output f’s contents, then standard input, then g’s contents.
cat Copy standard input to standard output.

Report bugs to <bug-coreutils@gnu.org>.

[olpc@xo-D0-39-68 /]$
Issues in Command Language

• Issues:
  – # of keystrokes required to complete command
  – burden on (operator) memory

• Main characteristics:
  – grammar required
    • limited set of commands
    • subset of natural language
    • syntax often of form “action - object”
Guidelines Command Language

• Meaningful commands & command *names*
  – based on task analysis
• Meaningful command use consistent abbreviations
• Redundancy is okay (provides customizability)
• Use consistent CL format (syntax)
• Follow ‘de facto’ standards
• Provide way to execute *sets of commands*
  – batch processes, Pipelines
• Provide online help, feedback, undo, replay, etc
• Use extra *options* to alter behavior slightly
  – reduce memory load
  – e.g. unix -r option for 10 commands (11 instead of 20)
# Command Language

From literature:

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• flexible</td>
<td>• low visibility</td>
</tr>
<tr>
<td>• appeals to “power” users</td>
<td>• requires substantial training and memorization</td>
</tr>
<tr>
<td>• allows user initiative</td>
<td>• not useful for “novice” users</td>
</tr>
<tr>
<td>• allows convenient creation of macros</td>
<td>• poor error handling (relative)</td>
</tr>
<tr>
<td>• cheap</td>
<td></td>
</tr>
</tbody>
</table>
Text-based Natural Language

• Allan Turing: Turing Test
• HEX: Chatterbot

Relevant characteristics
– Convenience (familiar words)
– Expressive power (combinations)
– Ambiguity
  • “The house was built by the river by the local council”
– Context
  • Cleaning lady earns € 250,
    Managing director € 250(.000,-)
Hex: G’day mate.
   > hi, how are you?
Hex: I am just fine thanks! And you?
   > I am fine
Hex: If you are fine, it’s your business, mate! Would you like to hear a
   joke? Knock, knock...
   > who is it?
Hex: Well, I could tell you who it is, but you’d never believe me ;^o
   > are you a man or a computer?
   > that is pretty funny
Hex: Well, that is pretty funny I agree ... but who cares? Which part of
   the country are you from?
   > I am from Texas
Hex: Oh, what’s it like there?
   > Texas is hot
Hex: We have such nice weather all year round back home. I’m not really
   used to really cold temperatures.
   > where are you from?
Hex: I come from Perth which is in Western Australia. It’s a nice place
   at this time of year, so it was a bit of a shock to arrive to these
   freezing temperatures.
   > you are australian?
Hex: It’s cool being from Australia I guess. Gives you something to chat
   about when talking with a Yank!
   > i am not a yank!
Hex: In Australia we call all Americans yanks. It’s a term of endearment
   actually. As far as I’m concerned, everyone here bar myself is a yank!
   > do you like america?
Hex: A common myth about Americans are that they are stupid! This is
   because most of us Aussies only get to see America through TV. I
   have met some Americans who think I’m from Austria or Japan(!), and
   who are surprised that I speak such good English!
   > what’s australia like?
Hex: Australia is a great country, IMHO. It is so vast (about the same
   size as the USA), but has a small population (about 1/15 of the
   USA). People are friendly, the weather’s good, what more could you want?
   > it’s far away from everywhere
Hex: What was your provocation for suggesting its far away from
   everywhere? So, have you ever visited Australia?
   > no i haven’t
Hex: Oh well, that’s a pity!
Natural Language

LUIs

- Continuous speech recognition (CSR)
- Natural language understanding
  - common already
  - often narrow in focus (specialized)
- Query languages almost natural language
  - grammar limited
Voice Output

• Has to do with Computer-Human Interaction
  Synthesis of voice
• BT
  – VODIS: Voice Operated Database Inquiry System
• KPN Telecom
  – DIAL 118 phone number request
  – Computer operated answer
• Sound-Cards have Speech Synthesis
  – Time indication system
  – Read aloud
• New interfaces use sound/voice for instruction
Example Voice Synthesis (in)
Example Voice Synthesis (in)
Example Voice Synthesis (out)
Example Voice Synthesis (out)
Example Voice Synthesis (out)
Natural Language

From literature:

**Advantages**
- natural to specify (no need to learn syntax)
- less intimidating for novices
- Recently, progress!
- Fits mobile devices

**Disadvantages**
- can not be applied generally yet
- requires clarification dialog
- may require more keystrokes (unless spoken)
- unpredictable results

Human Computer Interaction 2014, fjv
Key-Modal Styles

• Require Input by user/operator
• Question and Answer
• Function key interaction
• Menus
Function-key Interaction

Function keys:
- Term covers use of number of *special input devices* used for *interaction* with a machine e.g.
  - numeric keypads
  - credit card readers (chipper, how many F-keys?)
  - car park barrier operators
  - cash machines, etc.
- Strict sequence of operations
- Not much training required
- Useful in public places
Example Function-Key UI
Question and Answer Interaction

- (1) system prompts user, (2) user types answer
- Often text-based
- Questions asked one at a time
- Suitable where short data entry required
  - e.g. wizards, installation software
- Limited variation in sequence
  - some branching possible
- Little training needed
- Limited support for correcting errors
- Slow in use (depending on user)
- Control is not with the user
Form Fill-in

- Includes spreadsheets
- Designed for clerical workers with little experience
- Interfaces mimic paper forms (metaphor)
- Navigation: designed to move insertion point without looking at screen
- Structured way of gathering info
- Should be possible to go back
- If transcription: make screen resemble paper
Form Fill-in

From literature:

**Advantages**
- simplifies data entry
- requires modest training
- convenient assistance (recognition vs. recall)
- allows for form-management tools

**Disadvantages**
- consumes screen space
- context and application dependent
- uses menu style for parameter fill-in
Menu Style Interaction

- Covers toolbars, palettes, text-based menus, etc.
- Selection possible in multiple ways
  - pointing
  - typing letter or number
  - shortcuts instead of pointing
Characteristics of Menus

• Offer only those *actions* that make sense in the current situation (e.g. *grey out* others)
• Use based on *recognition* not *remembering*
• Item names and icon must be carefully chosen
• Not suitable for complex actions
  – e.g. commands with many operands
  – copying a set of files from one disk to another
• Can be cumbersome way accessing info
  – e.g. if wading through a number of submenus is required
• Menu may take up screen space, solution:
  – pull-down, pop-up, radial, fish-eye
Styles of Menus

• There are many variations
  – pull-down & pop-up
  – command
  – cascading menus
  – iconic menus
  – tree-structured menus (site maps)
  – pie-menus (pop-up radial)
  – multiple-column menus (common on WWW)

• Lots of studies have been done
  – how many items/to what depth
  – dynamically rearranging content according to frequency of use
  – role of stable position within a pull-down menu
  – titling (where is the title placed)
User Feedback with Menus

- Well-designed menu incorporates feedback
- What options are available? (greyed out)
- Visual information
  - highlighting current item
  - underlining accelerator keys
  - ‘ticks’ in front of selected options (sound feedback)
  - ‘walk-through’ arrows indicating submenus
  - dots ‘...’ showing that selection refers to further dialogue
  - separator lines to group
- Feedback on end of selection process (visibility)
  - the appropriate action has occurred
Example Menu Style

• What options are available?
• ImageJ: java based image processing
Issues on Single Menu Panel

• Meaningful item name
• Top-level panels of menus most error prone
• It should be easy to go back
  – Undo function is useful (incorporated ?)
• IF undo not possible THEN
  do not place item at of menu-top
  OR near frequently used options
• Critical actions
  – do not use accelerator keys
• *Try out menus with real users*
Examples Menus (i)
Examples Menus (ii)

• To see updates from friends, photos and feeds, the Zumobi Ziibii interface (http://www.zumobi.com) allows users to choose between two styles of presentation.
• On the left is a static list of text/image items with a gestural swipe used to control paging, and on the right is a dynamic scrolling ticker (called “River”) which horizontally scrolls titles and images across the screen.

Remark: Newer interaction modes are probed with Menu-structures.
Organizing a Single Menu Panel

• No ‘right’ number of items
  – certainly not 7 ± 2
• Grouping strategy should be applied
  – categorical
  – conventional
  – frequency of use
  – importance
  – sequence of use
  – alphabetical (if all other fails...)
• FishEye menu style (cf. *direct manipulation*)
Menu Style : Topics of Concern

1. Naming of items on option list
2. Depth vs. breadth
3. Categorization
4. Time to selection, cf. Fitt’s law:

\[ T = k \log_2 (D/S+0.5) \]

- \( T \) = time to move hand to target
- \( k \approx 100\text{ms} \),
- \( D \) = distance,
- \( S \) = size of target

• How would this work for newer interactions?
Menu Selection

From literature:

### Advantages
- reduces learning time
- reduces keystrokes
- structures decision making
- easy to support error handling

### Disadvantages
- too many menus for complex tasks
- can be slow for frequent users
- consumes screen space
  - requires rapid display rate
Direct Manipulation

- **Windows, Icons, Menus, Pointers**, aka **WIMP**, Forms, (other objects)
- Objects can be acted upon directly by user with pointing device
- Choice of forms and icons important
  - a. match:
  - designer’s representation - user’s understanding
  - b. choice of metaphors
  - c. explicit attention to ways in which instantiated and ‘real’ objects differ
  - d. cultural bias of representation
Archetypal Direct Manipulation
Menus in Direct manipulation

Menu Bar (top of screen) menu drags down
- pull-down menu - mouse hold and drag down menu
- drop-down menu - mouse click reveals menu
- fall-down menus

Contextual menu appears where you are
- pop-up menus - actions for selected object
- pie menus - arranged in a circle
- compass menus
Direct-Manipulation Systems: WYSIWYG word processing

Aligning Temporal Data by Sentinel Events: Discovering Patterns in Electronic Health Records

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ABSTRACT
Electronic Health Records (EHR) and other temporal databases contain hidden patterns that reveal important cause-and-effect phenomena. Finding these patterns is a challenge when using traditional query languages and tabular displays. We present an interactive visual tool that complements query formulation by providing operations to align, rank and filter the results, and to visualize estimates of the intervals of validity of the data. Display of patient histories aligned on sentinel events (such as a first heart attack) enables users to spot tasks in our Lifesight project. In this paper we first motivate the problems, describe the interface, and discuss the results of our evaluations. While the examples in this paper are from the medical domain, the type of temporal data analysis we address is common in other fields such as surveillance and intelligence (10), criminal activities patterns (5), Web session log analysis (11), or the study of human activities in general.

MOTIVATION
Our colleagues at Harvard Medical School highlight two
Example Direct Manipulation
Example Fish-Eye menus

See paper hci.liacs.nl
Example Fish-Eye Menus
Review #6

• Interaction Styles
  – Command Line
  – Natural Language
  – Speech
  – Key-Modal
  – Menus
  – Form fill-in
  – Direct Manipulation

• Hybrid Styles
  – Lecture 7
AI suddenly realizes that he's stumbled across the Mother of All undocumented Windows options.