Navigation and Dialogue

HCI Lecture 7

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Outline

- Navigation Design
- Dialogue Design
- Dialogue Analysis
- Exercise
- References

Interface Design Roadmap

- Conceptual Design
- Physical Design
- Interaction Modes
- Navigation Design
- Dialogue Design
- Information Presentation
- Screen Layout

- what is the conceptual model?
- what physical environment?
- what styles are appropriate?
- how is the interface structured?
- how to link interactions?
- how to show feedback/results?
- best grouping/structure/alignment?

- High-level to low-level, task-oriented refinement
- Data and presentation-oriented sometimes better:
  - task focus may suggest long tedious dialogues
  - instead: compact and interactive data presentation
- This lecture: notations to describe navigation and dialogue design

Interface Design Roadmap

Golden rules — the Where^3What of navigation:
- Where you are
- Where you’re going (or what will happen)
- Where you’ve been (or what has been done)
- What you can do now

Often, navigation is goal seeking:
- try to avoid these bits!

Different levels of structure, according to domain:
- app: widgets; screens; application; environment
- web: HTML; page layout; site; browser+www
- device: controls; physical layout; modes; real world

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Static Structure Diagrams

- Screen hierarchy
- shows structure/relationship
- system-oriented
- remember: deep is difficult!

- Navigation network
- show different paths through system
- including branches
- more task-oriented

JSD Diagram

- Old-fashioned technology and limited
- . . . but easily understood
- close connection to HTA
Dialogue in UIs

- **Dialogue** is the pattern of interaction between users and system
  - may be schematic (fill in blanks, e.g. names in wedding vows)
  - but course may change according to responses
- In UIs, Dialogue Design:
  - refers to structure of interaction
  - often low-level (cf cognitive models)
  - not only conversing, also for instructing, manipulating, etc
- Recall levels:
  - **lexical:** key or button presses/releases, icon shapes
  - **syntactic:** order of inputs/outputs
  - **semantic:** actual effect on application/data

Dialogue Notations

- Dialogue can get buried in the program or designed carelessly “on-demand”
- Instead we may describe it alone, precisely using:
  - diagrammatic notations
  - textual notations
  - specific programming tools
- Formal notations useful for testing, esp if executable
- Also allow analysis, e.g., to find:
  - difficult to reverse actions
  - missing actions
  - inconsistent actions
  - unreachable or unrecoverable states
  - likely errors
- To give semantics, descriptions can be linked (maybe mechanically) to behaviour or presentation.

Dialogue Notation Formalisms

- **State Transition Networks**
  - graphical notation
  - easy to understand
  - limited expressivity
- **Grammars**
  - textual
  - can be harder to understand
  - good expressivity
- **Process Calculi**
  - textual, primarily
  - harder to understand
  - good expressivity, esp for concurrency
- **Many others**
  - flowcharts, JSD diagrams
  - production rules (actions guarded by events)
  - Petri Nets
  - State charts, State and activity diagrams (UML)

State Transition Network (STN)

- Like a finite state machine with I/O (a transducer)
  - edges are input events and resulting actions
- Good for capturing sequential behaviour of dialogues
- Poor at capturing concurrency, escape, errors
  - State or edge “blow up”
- Diagrams can become cluttered and obscure
  - clutter: too many states, use hierarchical STNs
  - obscure: state names somewhat arbitrary

STN for a Watch with Modes

- Modes (where control mappings change) are introduced by event timings. Modes have obvious drawbacks but economise on controls.

STN for a Drawing Program
Hierarchical STNs

- Combining all operations would give clutter
- Simple structuring solves this, but what are the problems?

STNs for toggles

- Representing toggles concurrently leads to state explosion
- Inherent problem: needs a richer notation (e.g. UML state diagrams) or convention (separate STN for “microdialog” in DM).

STNs: concurrency problem

Grammars

- Regular expressions useful for making compound actions, e.g.
  
  `selectline + click + click* + doubleclick`

  Same computation model as JSD.
- BNF and extensions:
  
  - good for low-level detail, command line syntax
  - more powerful than STNs

  BNF with “visual terminals”

  ```
  MENU ITEM SELECT := point to item + mouse down + MENU RESPONSE
  MENU RESPONSE := invert item | blink item
  ```

  - Grammars may have cognitive validity
  - Still not good for concurrency, pervasive commands

  NB: non-standard + used for sequence

Process Calculi

```csp
dd

Adder = add-prompt! →
  (quit? → skip []
  zero? → show(total) → Adder []
  num? → show(total + num) → Adder)

Database = db-prompt! →
  (quit? → skip []
  set? → Getkey ; Getval []
  get? → Getkey ; Printval)

Getkey = key-prompt! → getkey?
Getval = val-prompt! → getval?
System = Adder || Database
```

- event guard
- sequence
- choice
- parallel

Dialogue Analysis

We can use descriptions to check some precise properties, of individual states or whole dialogue:

- Completeness
  - What happens on event X in state Y?
- Reversibility
  - How do we reverse action Z (e.g. “select line”)
  - … maybe navigation through dialog; not undo
- Reachability
  - Can you get anywhere from anywhere?
  - How easily?
- Dangerous states
  - Some states should be hard to get to
  - Perhaps guarded by warning dialogue
  - … although obvious problem if overused
Dialogue Analysis, continued

We can also analyse descriptions informally:
▶ check style guidelines, usability requirements
▶ consider lexical syntax
  ▷ differentiation and visibility of modes/states
  ▷ verb-noun (menu style) versus noun-verb (direct)
  ▷ physical layout (e.g. key sequence convenience, accidents)
▶ not independent of dialogue
▶ consider semantic intention
  ▷ ways of attaching/checking semantics
  ▷ maximising syntactic description

Exercise: Dialogue Notation

1. Pick your favourite application program — a word processor, drawing program, web browser
2. Considering the high-level static structure
   ▷ give a fragment of a screen hierarchy diagram
3. Considering some low-level interaction structure
   ▷ enumerate some input events and interface reactions
   ▷ produce some hierarchical STNs
4. What did you find difficult to capture? Do your diagrams help you suggest any improvements to the program’s interactions?
5. Many programs allow multiple windows (e.g. showing documents, or tool options) at once. Investigate ways of capturing this using dialogue notations.

References

These slides are mainly based on:
▶ Dix et al, Chapters 5 (esp. 5.6), 16.