Designing Interactive Systems I
Lecture 12: Petri Nets

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http://hci.rwth-aachen.de/dis
Petri Nets

• Better approach to dialogs that have several states at once
• But not better for sequential dialogs and mutually exclusive UI elements (radio buttons)
• Relatively old formalism to model concurrency
Petri Nets

- Transition fires when all input places have one or more token
- A token is produced in each output place
- Positions of all tokens represent the current state
- NOTE: This is different from state machines
In-Class Exercise

- Draw the Petri net for our dialog box with concurrent “Bold” and “Italic” options (ignore “Underline” for now)
Petri Net For “‘Bold & Italic’” Dialog

- **Ellipse**: place where user input can occur
- **Circle**: UI place
- **Rectangle**: transition
- **Token**: A token is consumed from each input place
- **Transition ‘fires’**: when all input places have tokens
- **A token is produced in each output place**

**User actions represented as a new token**

**User presses ‘Bold’**
- T1
- Bold On
- Bold Off

**User presses ‘Italic’**
- T3
- Italic On
- Italic Off

**User presses**
- Bold On
- Bold Off
- Italic On
- Italic Off

**T1**
- Bold On
- Bold Off

**T2**
- Bold On
- Bold Off

**T3**
- Italic On
- Italic Off

**T4**
- Italic On
- Italic Off
State Charts

- By Harel; used in UML
- Example: TV Control Panel
- State Charts extend STNs
  - Hierarchy
  - Concurrent sub-nets
    - ON resumes both state machines
  - Escapes
    - OFF always active
  - History
    - Link marked “H” goes back to last state on re-entering subdialog
Some dialog descriptions are clear enough to serve as user documentation (similar to GOMS)

Especially if description uses screen shots and is semi-formal
Digital Watch – User Instructions

- Two main modes
- Limited interface
  - 3 buttons
- Button A changes mode
Digital Watch – User Instructions

- Dangerous states
- Completeness
  - Distinguish depress A and release A
  - What do they do in all modes?
Digital Watch – User Instructions

and …

that’s just one button
Semantics - Raw Code

- Event loop for word processor
- Dialogue description
- Very distributed
- Syntactic/semantic trade-off
  - Terrible!

```c
switch ( ev.type ) {
    case button_down:
        if ( in_text ( ev.pos ) ) {
            mode = selecting;
            mark_selection_start(ev.pos);
        }
        ...
    case button_up:
        if ( in_text ( ev.pos )
             && mode == selecting ) {
            mode = normal;
            mark_selection_end(ev.pos);
        }
        ...
    case mouse_move:
        if (mode == selecting) {
            extend_selection(ev.pos);
        }
        ...
} /* end of switch */
```
Design In The World Of Business
Competitive Forces

• A competitive market encourages changes and sacrifices the iterative design process
• Need for speed
• Cost reduction
• Featurism
• Satisfying several classes of customers
Life-cycle of Products

- Months to move from invention to production, but decades until product acceptance
- For example, gestural interfaces took 30 years to move from research labs to commercial products
  - Goals: affordable and reliable
- Small companies and startups can take more innovation risks compared to larger companies
- Cases: VideoPhone (p. 270-274) or Keyboards (p. 274-279)
Incremental and Radical Innovation

- Incremental innovation—slow and natural evolution process
  - Significant changes overtime; make exiting product better
  - Hill climbing analogy
  - E.g., automobile evolution, radical idea but then slow development

- Radical innovation—fast and based on new technologies
  - Changes paradigms
  - E.g., television and music industries

- With technologies becoming more available and less expensive, such as 3-D printers and open-source code, anyone can realise their ideas now. DIY communities are rising rapidly and transforming people from being passive consumers to proactive
Further Reading

• Alan Dix et al.: Human-Computer Interaction, 3rd ed. (2003), Chapter 16

• Ben Shneiderman: Designing The User Interface, 5th ed. (2009), esp. chapter 5
Roadmap

Cognition
- Performance
- Models of interaction
  - Affordances
  - Mappings
  - Constraints
  - Types of knowledge
  - Errors
- Design principles

History
- History of HCI
- Visions
- Phases of Technology

Design Process
- Iterative design
- User observation
- Ideation
- Prototyping
- User studies and evaluation
- Interaction design notation

Cognition diagram: Goal → Plan → Specify → Perform → Compare → Interpret → Perceive → World

History diagram: History of HCI → Visions → Phases of Technology
What’s Next?

- **Designing Interactive Systems 2**  
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  [hci.rwth-aachen.de/dis2](hci.rwth-aachen.de/dis2)
  
  - What makes a UI tick?
  
  - Technical concepts, software paradigms and technologies behind HCI and user interface development

- **Current Topics in HCI**  
  6ECTS  
  [hci.rwth-aachen.de/cthci](hci.rwth-aachen.de/cthci)
  
  - Understand & practice ways to do research in HCI
  
  - Learn about up-to-date developments in HCI and interactive multimedia from new books and recent conference/journal articles

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