Designing Interactive Systems 2

Lecture 1: Introduction, History, Design Space of Input Devices

Prof. Dr. Jan Borchers

hci.rwth-aachen.de/dis2
How DIS1 and DIS2 Cover HCI

Prof. Dr. Jan Borchers: Designing Interactive Systems 2

Use and Context
- U1 Social Organization and Work
- U2 Application Areas
- U3 Human-Machine Fit and Adaptation

Human
- H1 Human Information Processing
- H2 Language, Communication and Interaction
- H3 Ergonomics

Computer
- C1 Input and Output Devices
- C2 Dialogue Techniques
- C3 Dialogue Genre
- C4 Computer Graphics
- C5 Dialogue Architecture

Development Process
- D1 Design Approaches
- D2 Implementation Techniques and Tools
- D3 Evaluation Techniques
- D4 Example Systems and Case Studies

DIS 1

DIS 2
DIS2 Class Syllabus

• Part 1
  Key Concepts

• Part 2
  Usage and Design of UI Toolkits and Design Systems

• Part 3
  UIs Beyond the Desktop

• Part 4
  Prototyping Process
**Administrivia**

- Format: Lecture+Lab (V3/Ü2)
- 6 ECTS credit points
- Class times
  - **Lecture** on Wednesdays (9:30–12:00)
  - **Lab** on Mondays (14:30–16:00)
Team

Prof. Dr. Jan Borchers

Kevin Fiedler

Oliver Nowak

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E-Mail Subject: [DIS 2]

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E-Mail Subject: [DIS 2]
The Question Flow Chart

Does it contain matters of personal concern?

- No (Default)
  - RWTHmoodle Forum

- Yes
  - Email with the subject prefix [DIS 2] to Oliver & Kevin (Not Jan 😊)

Alternatively: A quick chat after the lecture ☕️
Your Final Grade

Final Exam (60 min)
July, 24th
or August, 27th

70%

Project (5 weeks)
2 people

30%

Note: You can only deregister from the course up to three days before the final project milestone is due (May 26).
Assignments & Project

• Assignments distributed weekly
  • You present your approaches in the lab
  • For some assignments you will need a Mac
  • No Mac? Contact Kevin and Oliver

• Project starts on April 22nd
  • 5 weeks, groups of two
  • You receive milestone documents instead of assignment sheets
    • Weekly milestone deadlines
    • Milestones discussed in the lab

You cannot deregister from the exam after three days before the final project milestone is due (May 26).

To pass the course, you have to pass the final exam and the project.
Who Are You?

• Audience
  • M.Sc. Computer Science / Media Informatics / Software Systems Engineering
  • B.Sc. / M.Sc. Technical Communication
  • B.Sc. / M.Sc. Human-Technology Interaction and Communication
  • B.Sc. Computer Science, ...

• Prerequisite: Designing Interactive Systems (DIS1) strongly recommended
Limited Seats

• **42 seats** available

• Register in RWTHonline by the end of **today**

• Seats will be assigned **tomorrow**

• **Sign the Declaration of Compliance document** and upload it to the Sciebo folder (all on the class website) as a PDF using this naming scheme:

  Lastname-Firstname.pdf  
  (Example: Nowak-Oliver.pdf)

**Deadline:** **Today, 10.04.24, 23:59**
Course Website

• All information about this course can be found online

• hci.rwth-aachen.de/dis2
CHAPTER 1

Evolution of User Interface Programming Paradigms
Batch Processing

- Prepare data on punch cards
- Wait for result as printout offline
Time-sharing Systems

• Command line interaction
• Shorter turnaround (per line)
Full-screen textual UIs

- Turnaround per character
- Interaction starts to feel “real time”
Menu-based Systems

- Apps have UI component
- But: menu hierarchy, app still "in control"
- **Threading** becomes important
Graphical User Interfaces

- Pointing devices in addition to keyboard
- Event-based program structure
- User in control, application reacts in **callbacks**
CHAPTER 2

Design Space of Input Devices
Design Space of Input Devices

• Card, Mackinlay, Robertson 1991

• Categorization of input devices according to physical, mechanical and spatial properties

• Why?
  • Compare input devices
  • Identify new input modalities

Reading assignment in Moodle
Movement Primitives

Input device := \langle M, \text{In}, S, R, \text{Out}, W \rangle
Example
Compositions

- **Merge**
- **Layout**
- **Connect**
In-Class Exercise

• Plot out the input capabilities of the Ferrari Racing Controller on the Card Design Space of Input Devices.

• The controller consists of a steering wheel with 8 buttons and a rotary switch with 5 states, as well as 2 pedals.

• Assume that the steering wheel can only have one full rotation.
### In-Class Exercise

#### Layout

<table>
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<tr>
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<th>Linear</th>
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<th>Rotate</th>
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<tbody>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>rX</td>
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<td>P</td>
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<td>dF</td>
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</tr>
</tbody>
</table>

- **P**: 1 switch with 5 states
- **dP**: 8 buttons
- **F**: 2 pedals with an infinite number of states each
- **dF**: 2 pedals with an infinite number of states each
- **R**: 1 steering wheel with an infinite number of states
- **dR**: buttons (8 in total)

### Key Components

- 8 buttons
- 2 pedals with an infinite number of states each
- 1 steering wheel with an infinite number of states
- Rotary switch (5 states)
Is This Space Complete?
Testing Points

• **Expressiveness** describes how precisely the meaning is conveyed

• For input devices, expressiveness suffers if $|In| \neq |Out|$
  
  • $|In| < |Out|$: Cannot specify all legal values
  
  • $|In| > |Out|$: Can specify illegal values
Testing Points

• **Effectiveness** describes how well the intention can be communicated
CHAPTER 3

Window System Architecture
Window Systems: Basic Tasks

- **Input handling**
  Pass user input to appropriate application

- **Output handling**
  Visualize application output in windows

- **Window management**
  Manage and provide user controls for windows
Window Systems: Requirements

- Independent of hardware and operating system
- No noticeable delays (few ms) for basic operations, e.g. moving window, redrawing cursor
- Customizable look&feel for user preferences
- Input & Output in parallel
- Multimedia support: Graphics, audio, …
- Support for various input devices and modalities
Window Systems: Evaluation Criteria

- **Availability**
  Platforms supported

- **Productivity**
  For application development

- **Parallelism**
  External and internal

- **Performance**
  Usage of resources and latency

- **Graphics model**
  RasterOp vs. vector

- **Appearance**
  Look & Feel, exchangeable?
Window Systems: Evaluation Criteria

- **Extensibility**
  In source code or at runtime

- **Adaptability**
  Localization and customization at runtime

- **Resource sharing**
  E.g., fonts

- **Distribution**
  Over network

- **API**
  Structure and comfort

- **Independence**
  Of application and interaction logic inside programs written for the WS

- **Inter-Application Communication**
  Copy & Paste, Drag & Drop
Window Systems: Conflict

App developer

WS developer

User
Window System Architecture

- Apps
- User Interface Toolkit
- Window Manager
- Base Window System
- Graphics & Event Library
- Hardware

More abstract, user-oriented
What's Next?

• **Today**
  • Register in RWTHonline
  • Submit your signed Declaration of Compliance
    • Link on the website

• **This week**
  • Read the Design Space paper
  • Start with the first assignment

• We will do the seat allocation tomorrow