Human-Computer Interaction
IT 113, 2 credits
First trimester, both modules 2000/2001

Input devices

Slides from Class 3:
1. Fitts' Law for Hand Movements
2. Soft Keyboards
3. Alternative Hard Keyboards

New Slides:
4. The Isometric Joystick
5. Hand-Printing for Text Input

Memory

6. Long-Term Memory and the Principle of Encoding specificity
7. Working Memory: Mini-Experiments and Principles
8. Working Memory in System Use

The Problem With the Isometric Joystick

Isometric Joystick: Experimental Setup

Location of the AccuPoint isometric joystick on a keyboard

The Problem With the Isometric Joystick

## Isometric Joystick: Results

The isometric joystick’s jitter becomes visible when velocity is plotted against time.

### Hand-Printing for Text Input

"Graffiti" for Text Input

Graffiti is a simplified form of hand-printing introduced for the PalmPilot and other hand-held devices.

Can you see potential dangers in frequent use?
Immediate Usability of Graffiti


With the weighted accuracy rate, the frequency of the letters written is taken into account.
Long-Term Memory

Encoding Specificity: Mini-Experiment (1)

<table>
<thead>
<tr>
<th>Name</th>
<th>Größe</th>
<th>Art</th>
<th>Letzte Änderung</th>
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<td>Mon, 15. Jun 1987</td>
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Encoding Specificity: Mini-Experiment (2)
Questions About the Mini-Experiment

1. What factors made it hard or easy to remember information about the displayed files?

2. What differences did you notice between iconic and text representations?

Long-Term Memory: Basic Concepts

Types of long-term memory

Episodic memory
"The kind of memory that renders possible the conscious recollection of personal happenings and events dated in the rememberer’s past"

Semantic memory
"... the memory necessary for the use of language. It is a mental thesaurus, organized knowledge a person possesses about words and other verbal symbols, their meaning and referents, about relations among them, and about rules, formulas, and algorithms for the manipulation of these symbols, concepts and relations."

Procedural memory
"... enables organisms to retain learned connections between stimuli and responses, including complex stimulus-response patterns and sequences."
Encoding Specificity: Basic Concepts

General distinction

- Encoding of information in long-term memory
- Retrieval of information from long-term memory

The Principle of Encoding Specificity

What is important for memory performance is not only what happens at the time of encoding and retrieval

Most important is the compatibility between the circumstances of encoding and retrieval

Encoding Specificity: Examples

Examples of Relevant Circumstances

1. Presentation modality
   E.g., visual vs. auditory

2. Specific context
   E.g., other stimuli that are present at the same time

3. General context
   E.g., room, time, alcohol level

4. Mental operations that are performed with the stimuli
   E.g., looking at the form, thinking about the meaning

5. Expectations (at encoding time) about the circumstances of retrieval
   Does ‘I expect to have to recognize the stimuli or to generate them?
Working Memory

Components of Working Memory

Visuo-spatial sketch pad

Central executive

Phonological loop

Working Memory: Mini-Experiment

The following lists describe files stored on the Web site of the German Cognitive Science Society
Try to memorize each list, cover it up, and then reproduce it on the right

List 1

application.ps
forms.html
conferences.html
journal.html
application.txt
index.html
broschure.ps
mailing-list.html
**Working Memory: Mini-Experiment**

**List 2**

m1.txt*
m2.txt*
m3.txt
m4.txt*
m5.txt
m6.txt*
m7.txt*
m8.txt*

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**Working Memory: Mini-Experiment**

**List 3**

A4folded.ps*
A4-preview.ps*
L209-A4.tex*
L-209US.tex*
LaTeX2eA4.tex*
L2e:US.tex*
WordA4.rtf*
WordUS.rtf*
Working Memory: Mini-Experiment

List 4

- European paper, to be used with a previewer, in PostScript format
- Old version of LaTeX, for printing on European paper
- Old version of LaTeX, for printing on American paper
- New version of LaTeX, for printing on European paper
- New version of LaTeX, for printing on American paper
- Document processing system
  - Microsoft Word, for printing on American paper
  - Document processing system
    - Microsoft Word, for printing on European paper

What Determines Success in Retention?

What determines how much you can store in working memory?

1. Time required for pronunciation

   About 2 seconds can be stored

   This factor is relevant insofar as the phonological loop is used

2. Number of chunks

   What determines the number of chunks?
   - Meaning (which depends on prior knowledge)
   - Consistent patterns
Instructions
In class, a typical interaction of a user with a system will be demonstrated
Make a note of the types of content that $Ul$ needs to store in working memory
If you think $S$ could be redesigned to reduce the burden on $Ul$'s working memory, indicate how

Facts
What's the name of that file / that command ... ?

Goals
What am I doing / have I done / do I still need to do?

Improved support by $S$
Chapter 2 - The Computer

2.7 Processing, p. 96
2.8 Summary, p. 101

Chapter 4 - Usability Paradigms and Principles

Overview

4.1 Introduction, p. 143
4.2 Paradigms for interaction, p. 144

This section discusses a number of widespread types of interaction. Most of these will be familiar to you, so the point is to compare the main features and to relate them to the other ideas in the course. In Class 5 we analyze the concept of direct manipulation (4.2.7) in some depth.

[End], p. 162

Homework for Class 5

Question 1

Consider how can Fitts' Law be used to analyse the input devices of $S$.

In particular, can you think of a way in which an improvement to $S$ could be justified in terms of Fitts' Law?

If you think that Fitts' Law has no applicability to your $S$, explain why you think so.

Question 2

Using the concepts introduced in Sections 2.6 and 2.7, what do you think is the technical limitation of $S$ (e.g., with regard to memory or processing capacity) which has the most serious consequences for $U$?

What are the most important consequences of this limitation?
Question 3

Think of an example where $U$, while using $S$, has to retrieve information from his long-term memory under circumstances that differ considerably from the circumstances surrounding his storage of that Information?

(Cf. the discussion of the principle of encoding specificity.)

Note: Even if you can’t think of a very interesting example for your $S$, come up with the best example you can.

Could $S$’s design be changed to make the circumstances more similar? Why or why not?