Text Input

Interaction Techniques and Technologies (ITT), SS 2015

Session 5 (11.05.2015), Raphael Wimmer

Overview

These are slides/notes for the lecture, automatically generated from the slide set. Please extend this outline with your own notes.

Goals for this Week

Know

- text input methods
- typical text input speeds
- keyboard hardware

Learn

- measuring typing speed
- PyQT's signals and slots

Practice

- Python
- text input

Today

- **12:15 - 12:30** Overview of today's session
- **12:30 - 12:45** Discussion of previous assignment
- **12:45 - 13:15** Text input: metrics and numbers
- **13:15 - 13:45** Keyboards: Technical Background, Layouts
- **14:15 - 14:45** PyQt, Signals & Slots, Events
- **14:45 - 15:30** Assignment, Discussion of Previous Assignments

Where are We?

- **Conducting and Logging Experiments** (+ intro to Python / PyQT)
- **Documenting and Visualizing Experiments** (+ intro to pylab, matplotlib)
- **Pointing** (pointing devices, Fitts' Law, Steering Law, CD gain, …)
- **Text Entry** (speed, models, keyboard layouts, input techniques)
- **Models of Interaction** (KLM, GOMS)

Quiz: Which of the following statements is true?

- Fitts' Law says that the time to select a target increases linearly with distance
- Eye movements can be modeled using Fitts' Law
- A high CD gain is important for pointing on large displays
- Touch screens are rate-control, direct, absolute pointing devices
- A *t test* indicates whether two values are statistically different

Figure 1: http://pingo.upb.de/1903

Assignment 4: Measuring the Effects of Different Transfer Functions

Retrospective: Reaction Times

60,000

Last week I came across an interesting number that is repeated all over Twitter…

Twitter search: "60,000 visual"[1]

. . .

Analysis of this urban legend[2]

The Model Human Processor

Reaction and Processing Times

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[1]https://twitter.com/search?q=60%2C000%20visual&src=typd
[2]http://cogdogblog.com/2012/07/06/60000-times-question/

Luke Hartman PhD @LukeHartman7 · Apr 9
Professors, the human brain processes **visual** information **60,000** times faster than text-based information. Use more images. #deathbypowerpt

⤶   ⇄ 1   ★ 3   +👤   •••

Yoav B Guttman @whybegee · Apr 8
'Online audiences can actually process **visual** data **60,000** times faster than text alone' ow.ly/Lly4B

⤶   ⇄   ★ 2   +👤   •••

Mario Saverin @MarioSaverin · Apr 5
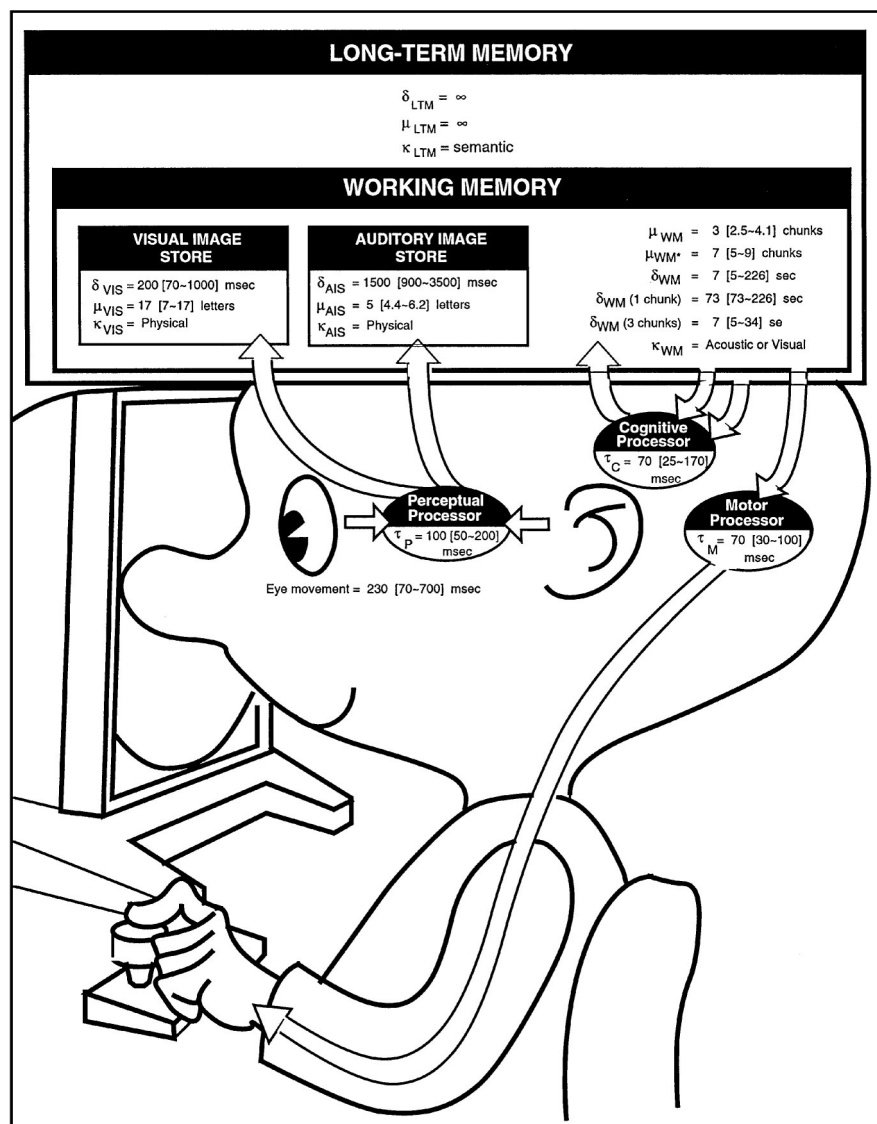According to Ekaterina Walter of Sprinklr, "Our brains process visuals **60,000**

Figure 2: Card et al, 1983

Operation	Typical Time (ms)
Sensory reception	1 - 38
Neural transmission to brain	2 - 100
Cognitive processing	70 - 300
Neural transmission to muscle	10 - 20
Muscle latency and activation	30 - 70
Total	113 - 528

Table 1: Typical latencies in human sensorimotor control (Bailey, 1996, p.41)

- approximate average reaction times (source[3]):

    - visual: 270 ms
    - auditory: 150 ms
    - touch: 155 ms
    - proprioception: similar to touch?

- minimal visually perceptible latency: 5 ms (Ng. et al, 2012[4])

Text Input / Text Entry

Typing speed

- http://typing-speed-test.aoeu.eu/?lang=en

Hardware

Keyboard implementations

see blackboard

Ghosting / N-key rollover

- simple matrix scanning of contact mats leads to ignored keypresses
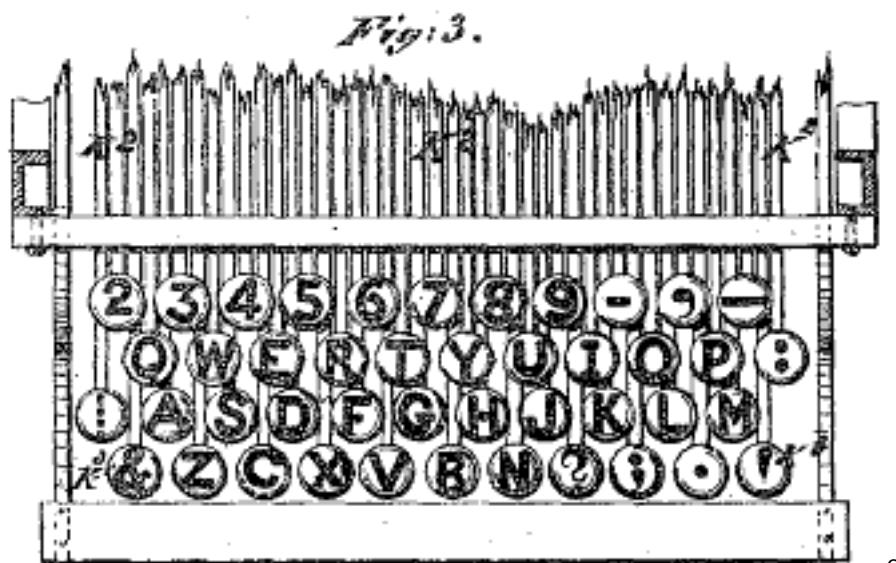- Info in Geekhack.com wiki[5]
- Ghosting Demo by Microsoft Research[6]

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[3] http://biae.clemson.edu/bpc/bp/lab/110/reaction.htm
[4] http://dl.acm.org/citation.cfm?id=2380174
[5] http://geekhack.org/showwiki.php?title=NKey+Rollover+-+Overview+Testing+Methodology+and+Results
[6] https://www.microsoft.com/appliedsciences/content/projects/KeyboardGhostingDemo.aspx

Keyboard Layouts

QWERTY

o

- ~1870
- staggered rows required for key levers
- de-facto standard

Dvorak

Figure 3: Wikimedia Commons, PD

- ~ 1936
- optimize key locations to minimize finger movement
- shown to be faster than QWERTY (disputed![7])

Neo

- since 2004

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[7]http://www.utdallas.edu/~liebowit/keys1.html

Figure 4: neo-layout.org

- http://www.neo-layout.org/
- optimized for German language
- 6 layers, with many Unicode symbols, foreign characters
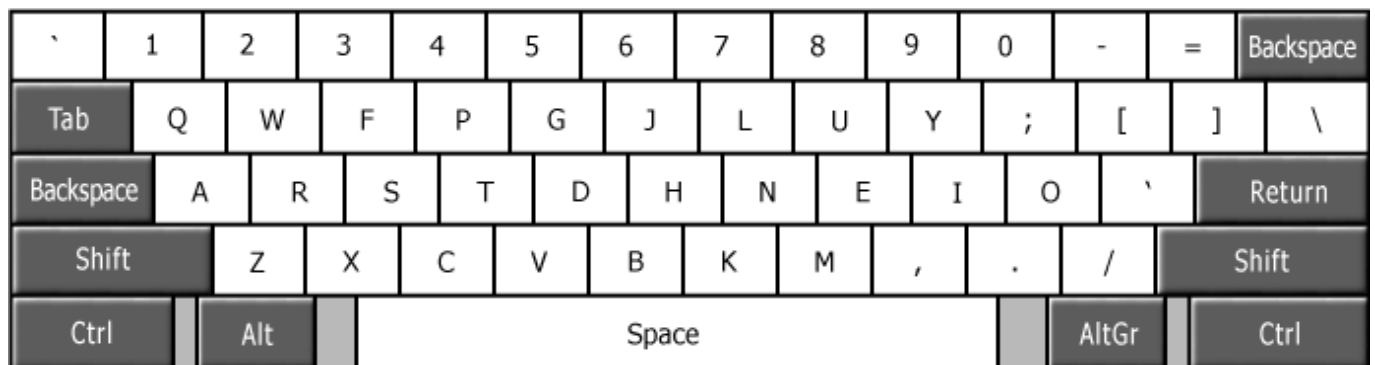
Colemak

Figure 5: colemak.com

- since 2006
- http://colemak.com
- keys used for common shortcuts (Ctrl+Z/X/C/V) same as in QWERTY
- designed for English language

QFMLWY & Co.

Figure 6: carpalx project

- since 2005
- CarpalX project[8]
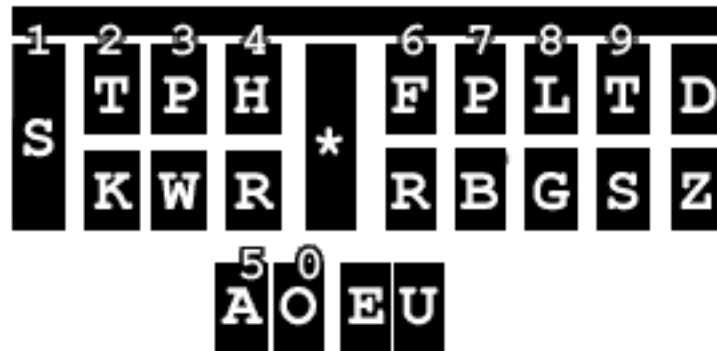- automatically optimized layouts based on different corpora

Stenotype

Figure 7: Wikimedia Commons, PD

- Open Steno Project[9]

Typical Text Entry Speeds

Source: WP:Words per minute[10]

- 1 word per minute (WPM) = 5 characters per minute (CPM)

- Handwriting: 30 wpm

- Stenography: 350 wpm

- Speaking: avg. 150 wpm, pro: 350-500 wpm, record: 637 wpm

- Reading: 250-300 wpm (typical adult)

- Morse: good: 20 wpm, pro: 60 wpm, record: 76 wpm

- One-key-keyboard (MacKenzie, 2010)[11]: 5 wpm

QWERTY

- Hunt-and-peck: 30-40 wpm
- Professional Typist: 50-80 wpm
- World Record: 216 wpm (1946, using the Dvorak layout)

Stenotype

- Beginner: 100 wpm
- Professional Stenotypist: 200 wpm
- World Record: 360 wpm

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[8] http://mkweb.bcgsc.ca/carpalx/

[9] http://openstenoproject.org/

[10] https://en.wikipedia.org/wiki%20/Words_per_minute

[11] http://www.yorku.ca/mack/TOCHI2010.html

Novel Keyboard Layouts

Chording Keyboards

Figure 8: Buxton, 2010

http://research.microsoft.com/en-us/um/people/bibuxton/buxtoncollection/detail.aspx?id=7

See also: http://www.loper-os.org/?p=861

PianoText

https://www.youtube.com/watch?v=-ykkTXo2Zyg

http://pianotext.mpi-inf.mpg.de/

Tera-Keyboard (Ghost in the Shell)

https://youtu.be/YZX58fDhebc?t=14

Discussion on the SciFi Interfaces blog[12]

Mobile Phone Keyboards

- Gizmodo: 12 smartphone keyboards that are trying to reinvent mobile text input[13]

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[12]https://scifiinterfaces.wordpress.com/2013/07/24/the-secret-of-the-tera-keyboard/
[13]http://gizmodo.com/12-smartphone-keyboards-that-are-trying-to-reinvent-mob-1695151919
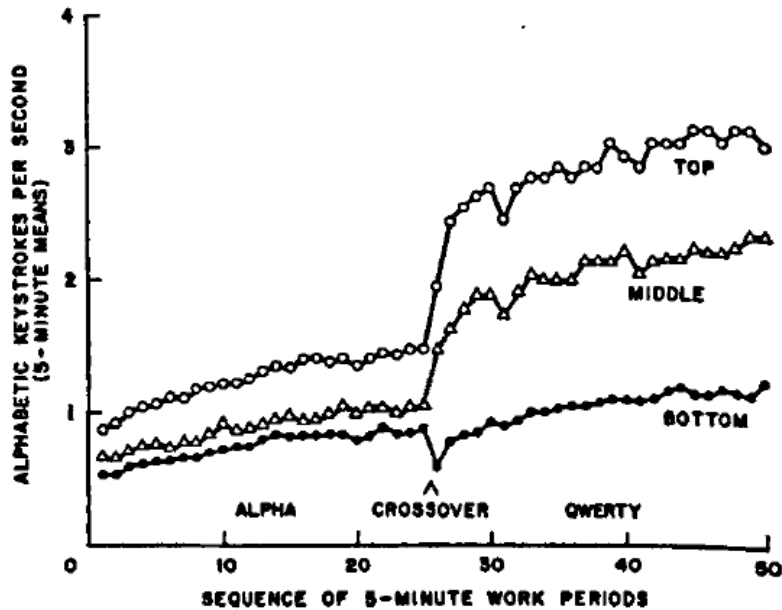
Learning Trade-off

Figure S. Keying rates for alphabetic characters on both keyboards for all A-Q subjects in each third of the rank order.

Figure 9: Michaels, 1971

S. Eugene Michaels (1971). Qwerty Versus Alphabetic Keyboards as a Function of Typing Skill. In *Human Factors: The Journal of the Human Factors and Ergonomics Society* 1971 13:DOI: 10.1177/001872087101300504

Slow Improvement

Outlook

Quiz: Which of the following statements is true?

- A chording keyboard with seven buttons could replace a standard QWERTY keyboard
- A person's text input speed is generally correlated with their reaction speed to visual stimuli
- Handwriting is generally slower than touch typing
- Ghosting allows for typing faster
- 120 wpm equals 100 ms per keypress

Next Session

- Keystroke Level Model (KLM)
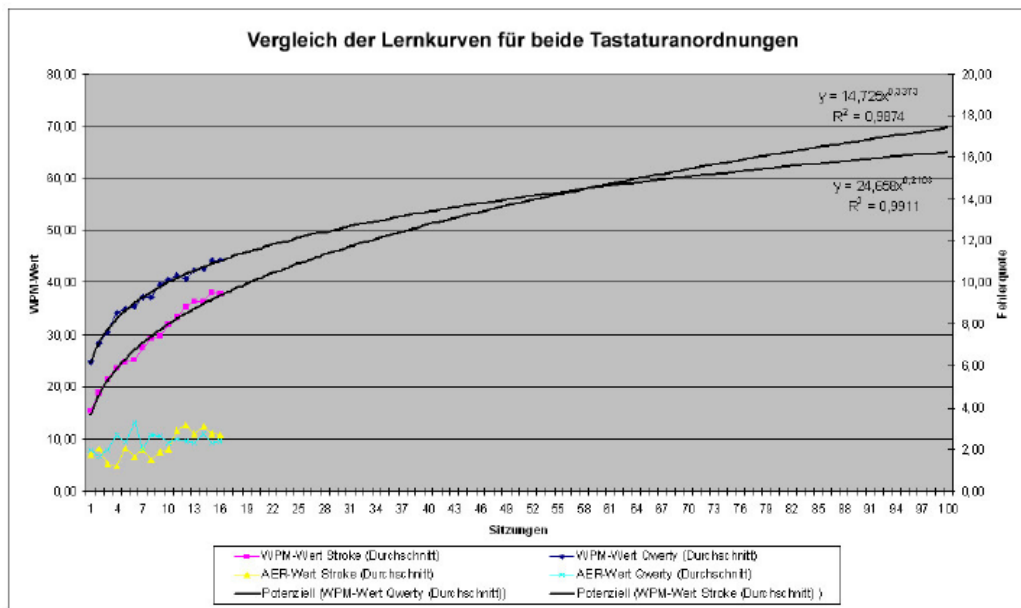- Goals, Operators, Methods, Selection Rules (GOMS)

Course Assignment

ENDE

Figure 10: Johannes Jüngst, Diplomarbeit, 2010

Figure 11: http://pingo.upb.de/1903