So You’ve Invented a New Keyboard Layout?

- Scenario: You have designed a new keyboard layout, and you want to know how good it is
- Strategy: compare it with existing techniques
- Basic research questions
  - How fast is it?
  - How accurate is it?
- In-class exercise: What are independent (IV) and dependent variables (DV)?

Measures (DV)

- Speed
- Accuracy
- Qualitative feedback
  - Comfort
  - Device impressions
  - Report as anecdotes or quotes
- In-class exercise: How would you make an operational definition of speed?

Speed Measures: Words per Minute

\[
WPM = \frac{|T| - 1}{S} \times 60 \times \frac{1}{5}
\]

- |T| Length of the transcribed string
- \( T \) Timing begins after the first character was pressed
- \( S \) Duration in seconds
- \( \frac{1}{5} \) Estimated length of a word: 5 characters including spaces (Yamada, 1980)

+ Easiest measure, you just need a watch
- Disregards errors in the final text
- Alternative: insist on the user correcting all errors, but may lead to user frustration
- Disregards the process of entering
  - E.g., It doesn’t matter how many times you pressed the backspace key.
Speed Measures: Keystrokes per Second (KSPS)

\[ KSPS = \frac{|IS| - 1}{S} \]

- Length of the input stream (all characters including backspaces)
- Reflects the process during text entry (every keystroke counts)
- May not reflect real use
  - E.g., a fast but error-prone keyboard may have a high KSPS

Accuracy Measures: Keystrokes per Character (KSPC)

\[ KSPC = \frac{|IS|}{|T|} \]

- Length of the input stream
- Length of the transcribed string

Simplicity
- No distinction between backspaced characters that are initially correct vs. those that are initially incorrect
- Check (Wobbrock, 2007) for discussion of other measures

Other Variables

- How should I treat other variables: age, gender, finger lengths, hand size, etc.?
  - Include those that make sense as IVs ⇒ more experimental conditions!
  - Leave as random ⇒ Control

Internal vs. External Validity

- A study has internal validity if it produces a single, unambiguous explanation for the relationship between two variables
- External validity refers to the extent to which we can generalize the results to people, settings, times, measures, and characteristics other than those used in that study
- Always a trade-off, strike an appropriate balance depending on the goal of your research

Definitions from (Gravetter and Forzano, 2012)
**Effect from Learning**

- **Learning curve:** relationship between experience (or time) and performance
- **Rapid raise at the beginning followed by a plateau**

**Time**

**Performance**

Keyboard A

Keyboard B

**Skilled use**

**Immediate usability**

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**Experimental Design**

- Usually preferred: **within-group design**
  - Minimizes confounding effects from the behavioral differences between participants
- Sometimes, we need a **between-groups** design
  - E.g., when testing whether a keyboard favors users with right-handedness over those with left-handedness
  - When there are interferences between conditions, e.g., different keyboard layouts on the same hardware

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**Choosing the Task**

- **Copy** text
  - Exclude behaviors that may compromise the measures, e.g., pondering what to write
  - Allows identifying error because the content is known
  - Can control the distribution of letters and words
- **Create** own text
  - Mimics typical usage
- **Compromise:** **Read and memorize** a short sentence before entering

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**Choosing the Text**

- 500 phrases in moderate length, easy to remember, and representative of the target language
- Ignore case and enter all characters in lowercase.
  + Allows replication
- Examples:

  - there will be some fog tonight
  - round robin scheduling
  - time to go shopping
  - frequently asked questions
there will be some fog tonight

Assignment Zero:
Writing a Review for Dummies

- Write a review about the evaluation section for one of these papers:
  - Typing on Flat Glass\(^1\) (Findlater et al., CHI '11)
  - The ILine Keyboard\(^2\) (Li et al., UIST '11)

- Required reading for background:
  - Evaluation of Text Entry Techniques\(^3\) (MacKenzie, 2007)

- Peer grading
  - In groups of 3, select one of the papers
  - Individually review the evaluation sections in the paper
  - Grade each other's review
  - Structured review form and grading form will be posted online
  - Submission: 3 \times original reviews and 6 \times peer grading feedback
  - **Deadline:** Tuesday, April 23rd, 2013 before 12:00 noon

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Typing on Flat Glass
Available at: http://dl.acm.org/citation.cfm?id=1979301
The 1line Keyboard
Available at: http://dl.acm.org/citation.cfm?id=2047257