

# User Learning and Performance with Bezel Menus

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# Touchscreen phones

- Direct manipulation

- Eyes-free Interaction

*“If you are blind you are simply out of luck. p.s., we are all blind at times”*

*– Bill Buxton*

- Mode-switching problem

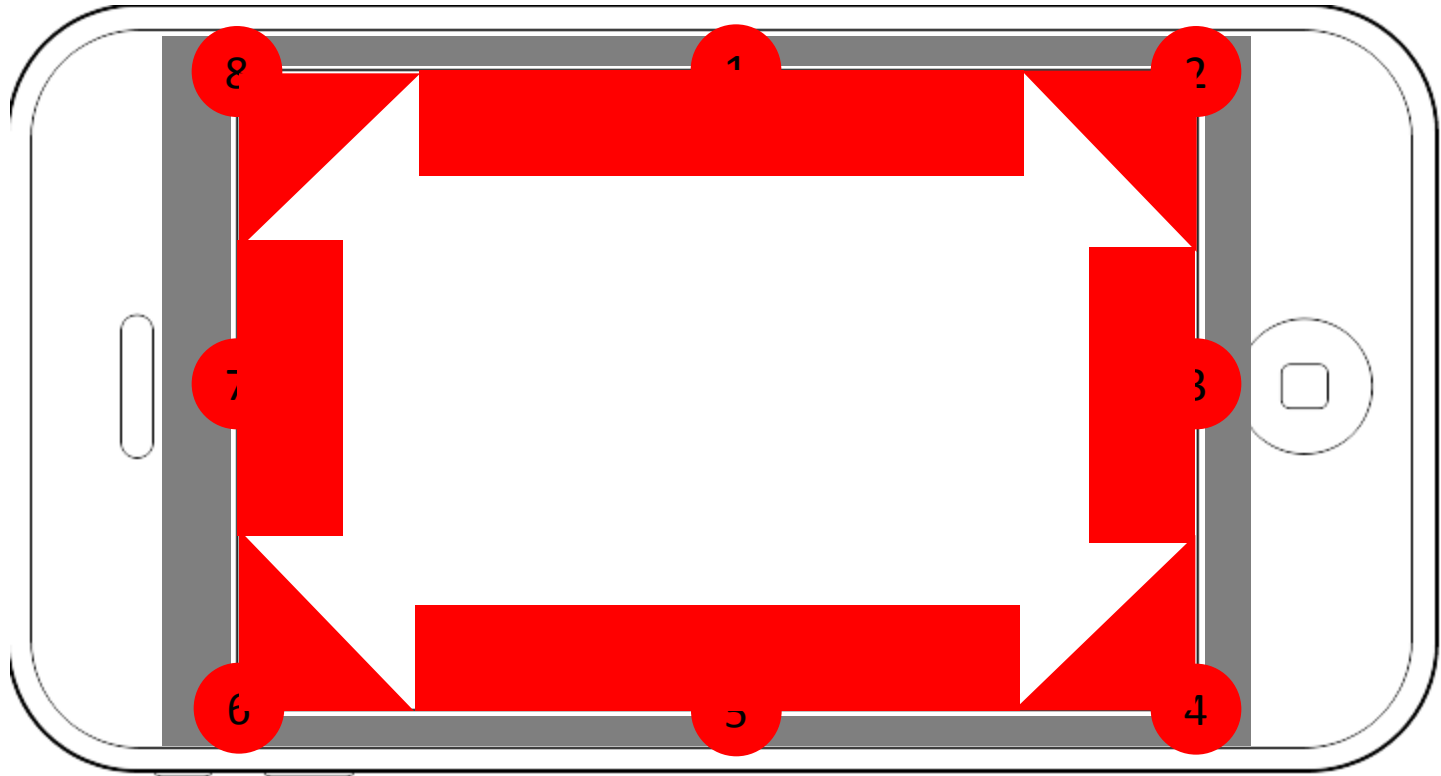


# Bingo!

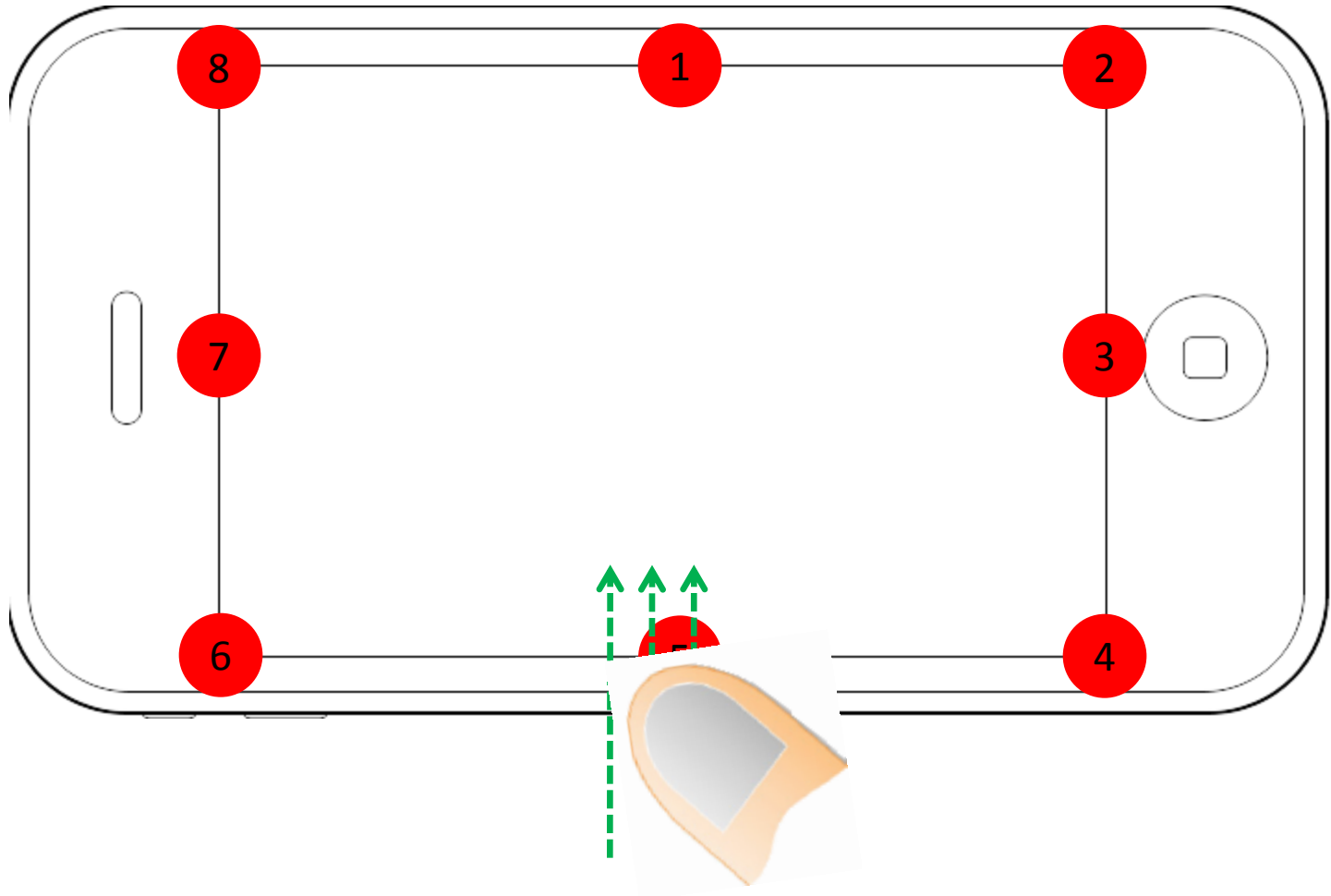


**(Unused) Bezel Space**

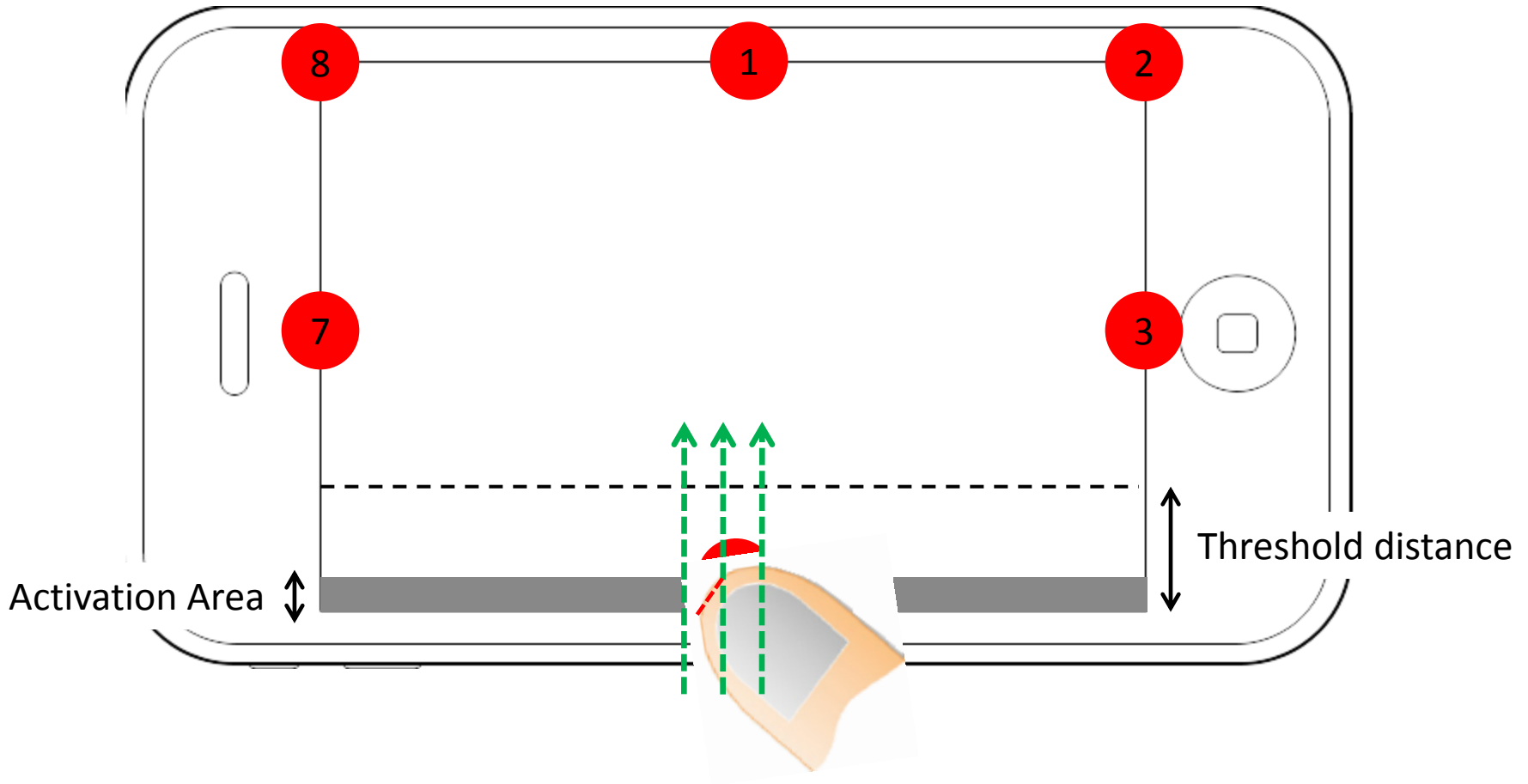
# Targets



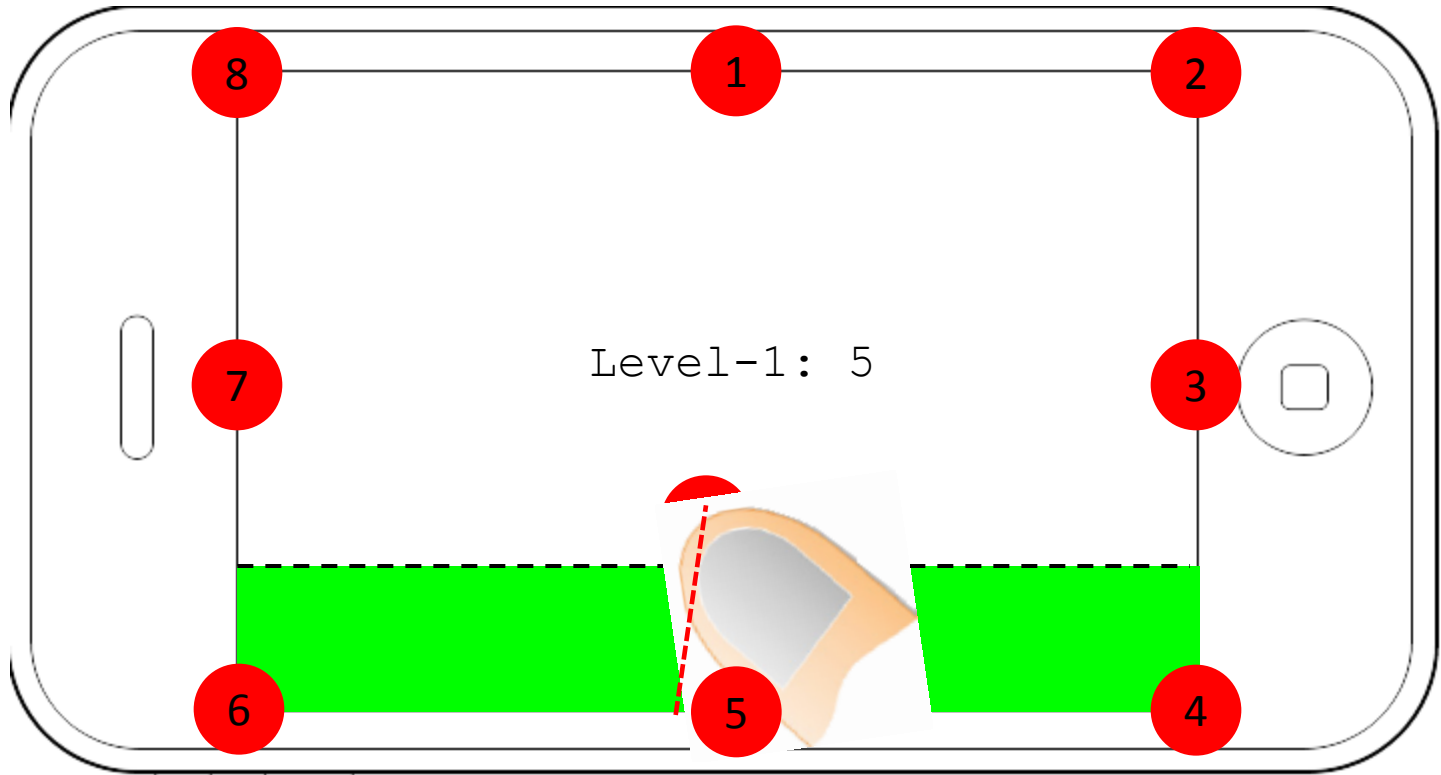
# Expert – Step 1



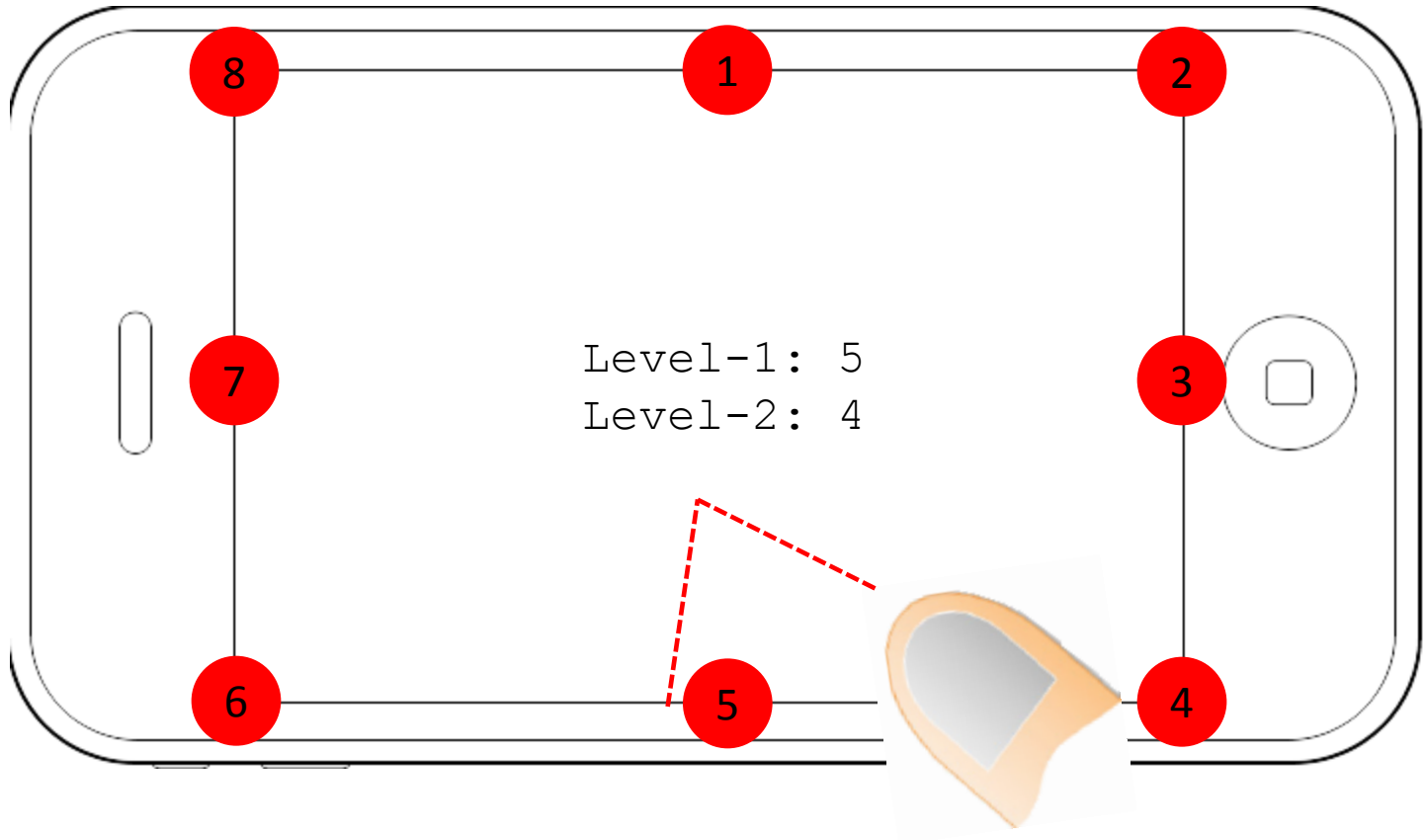
# Expert – Step 2



# Expert – Step 3

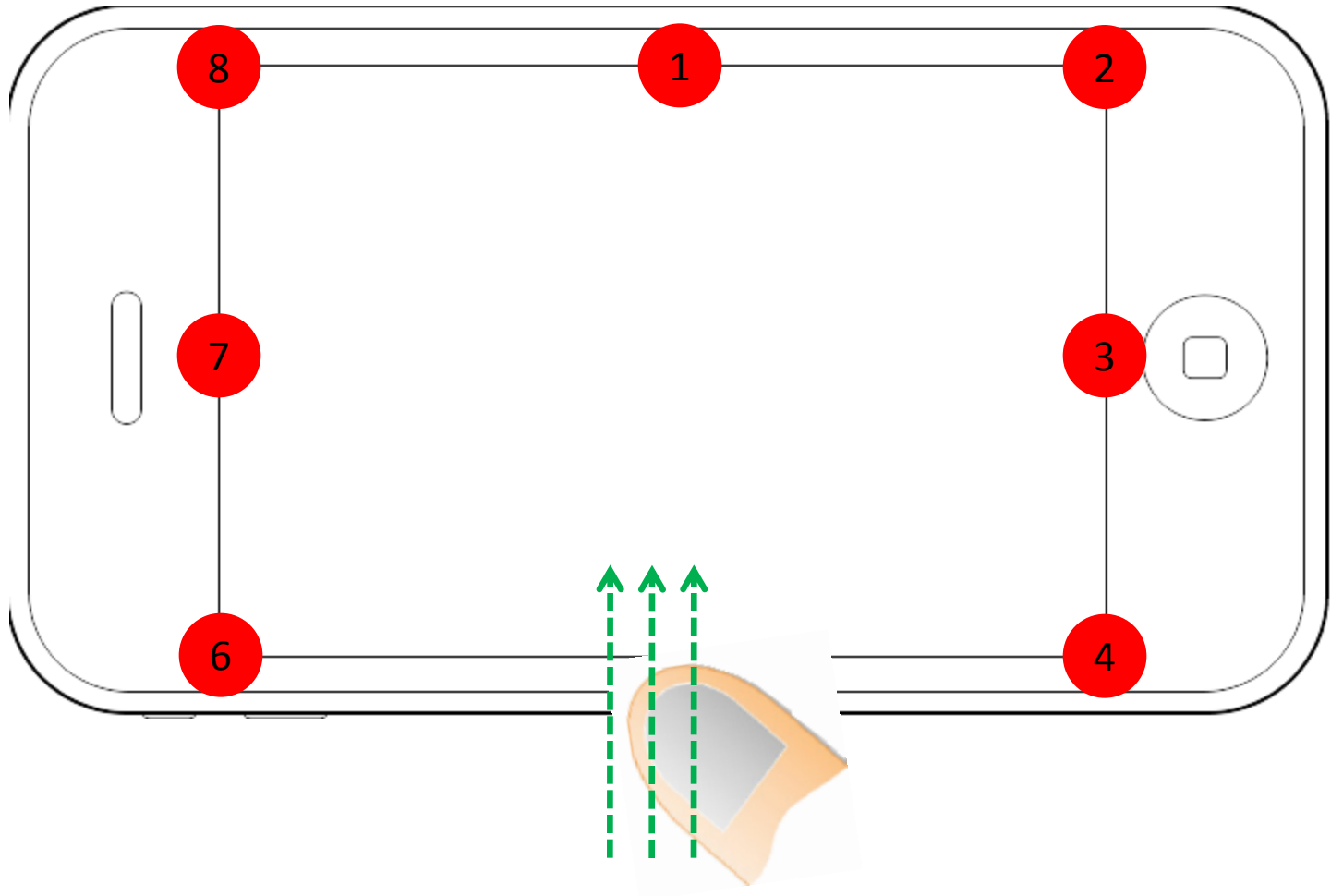


# Expert – Level 2

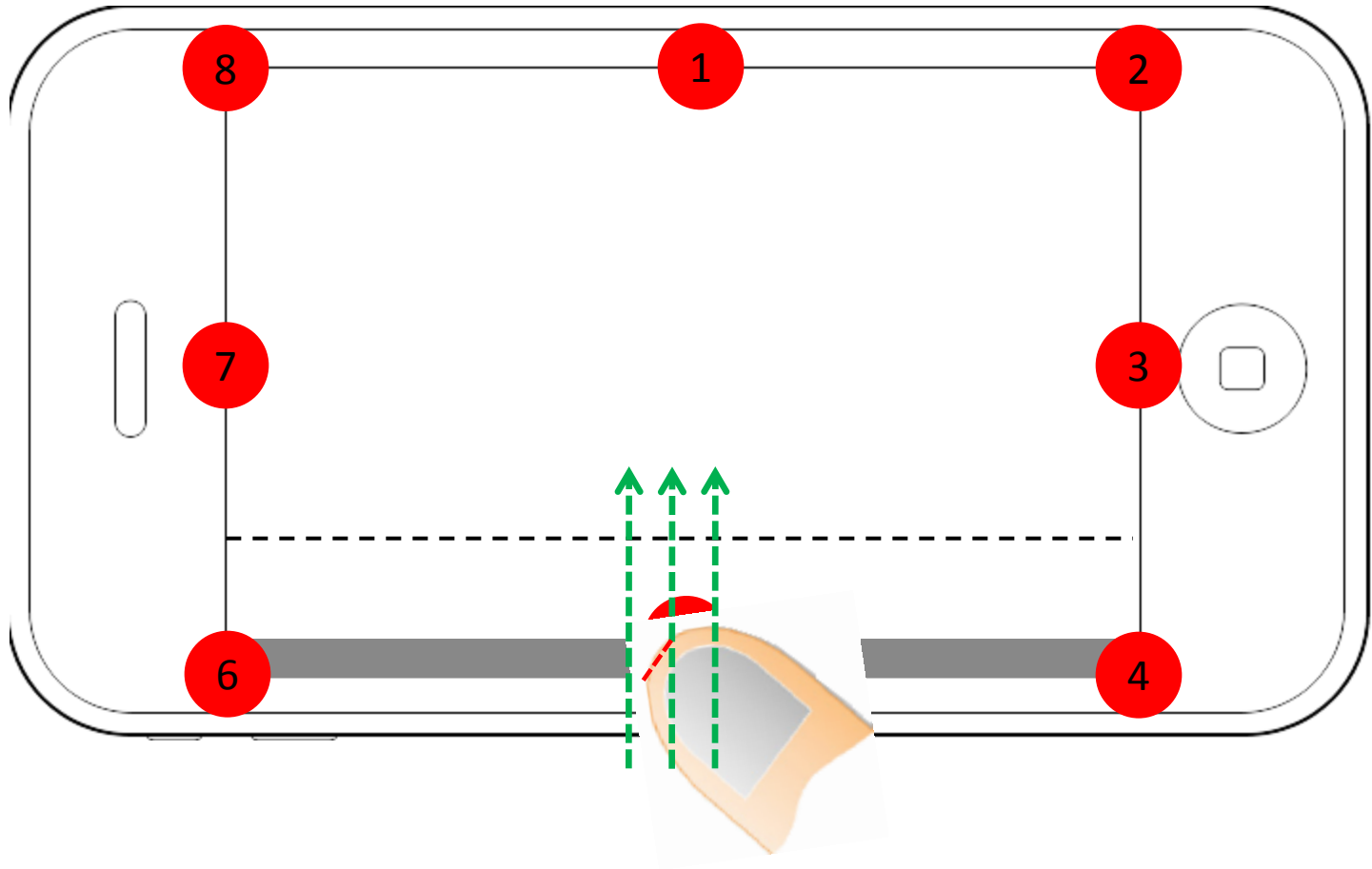




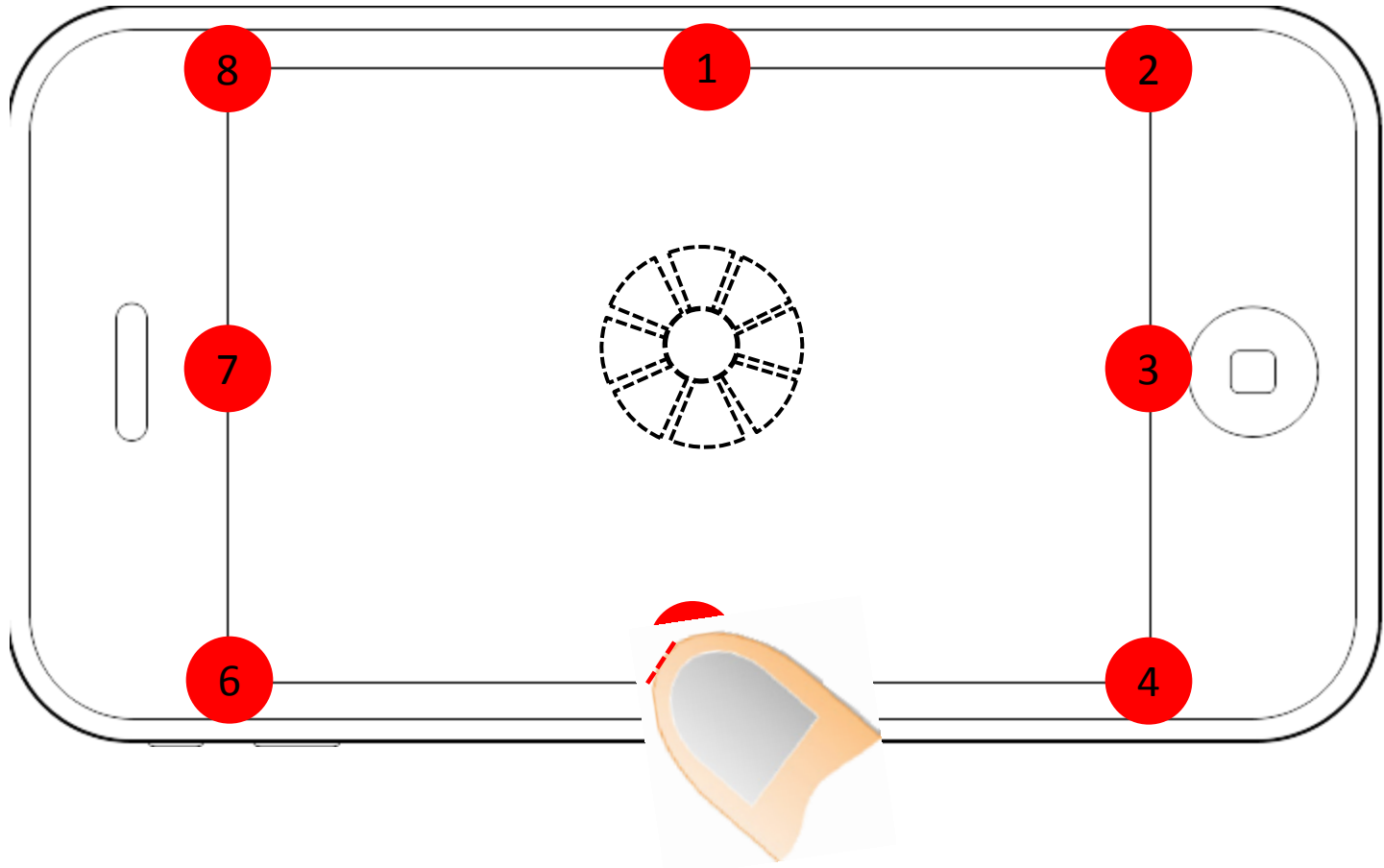
# Novice – Step 1



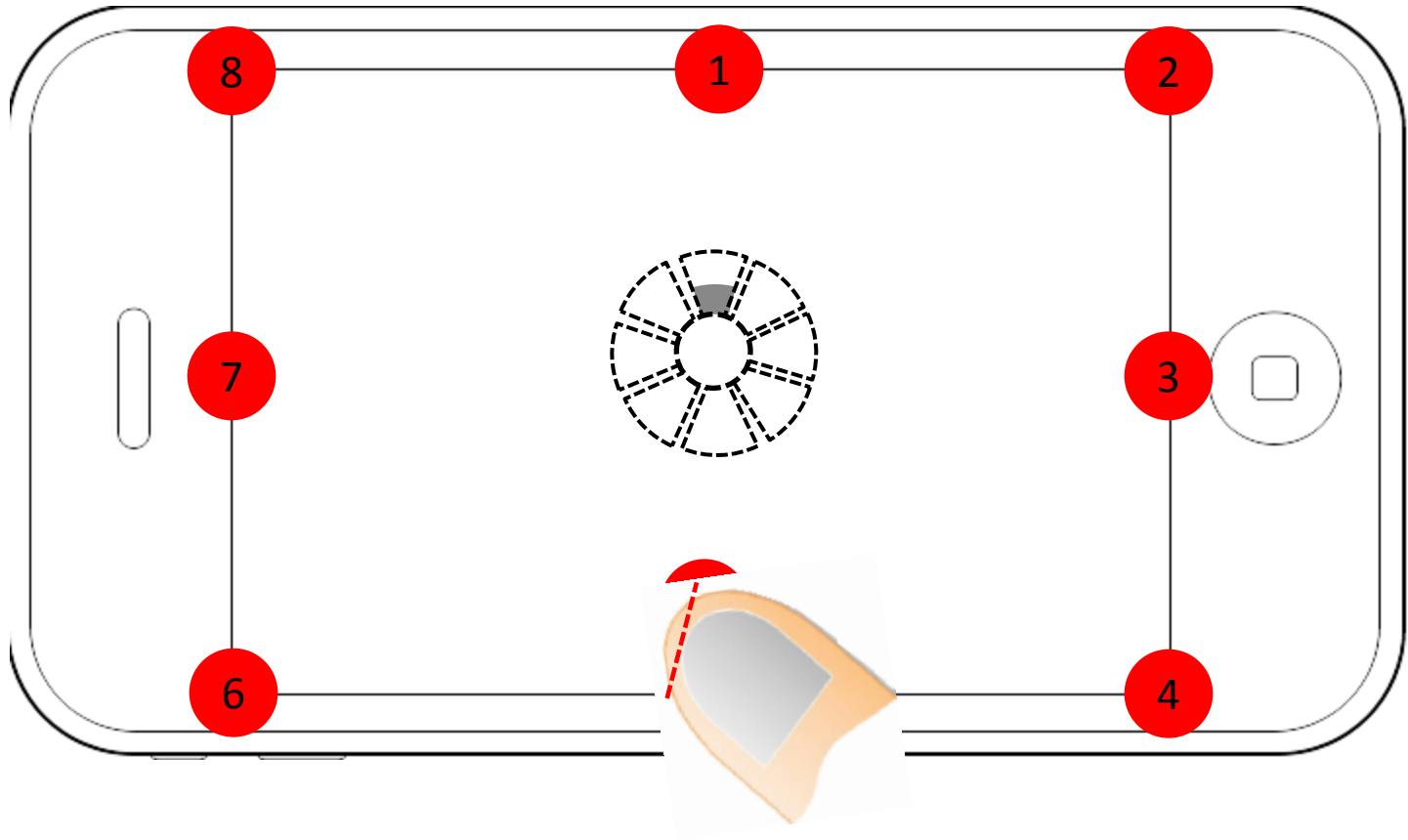
# Novice – Step 2



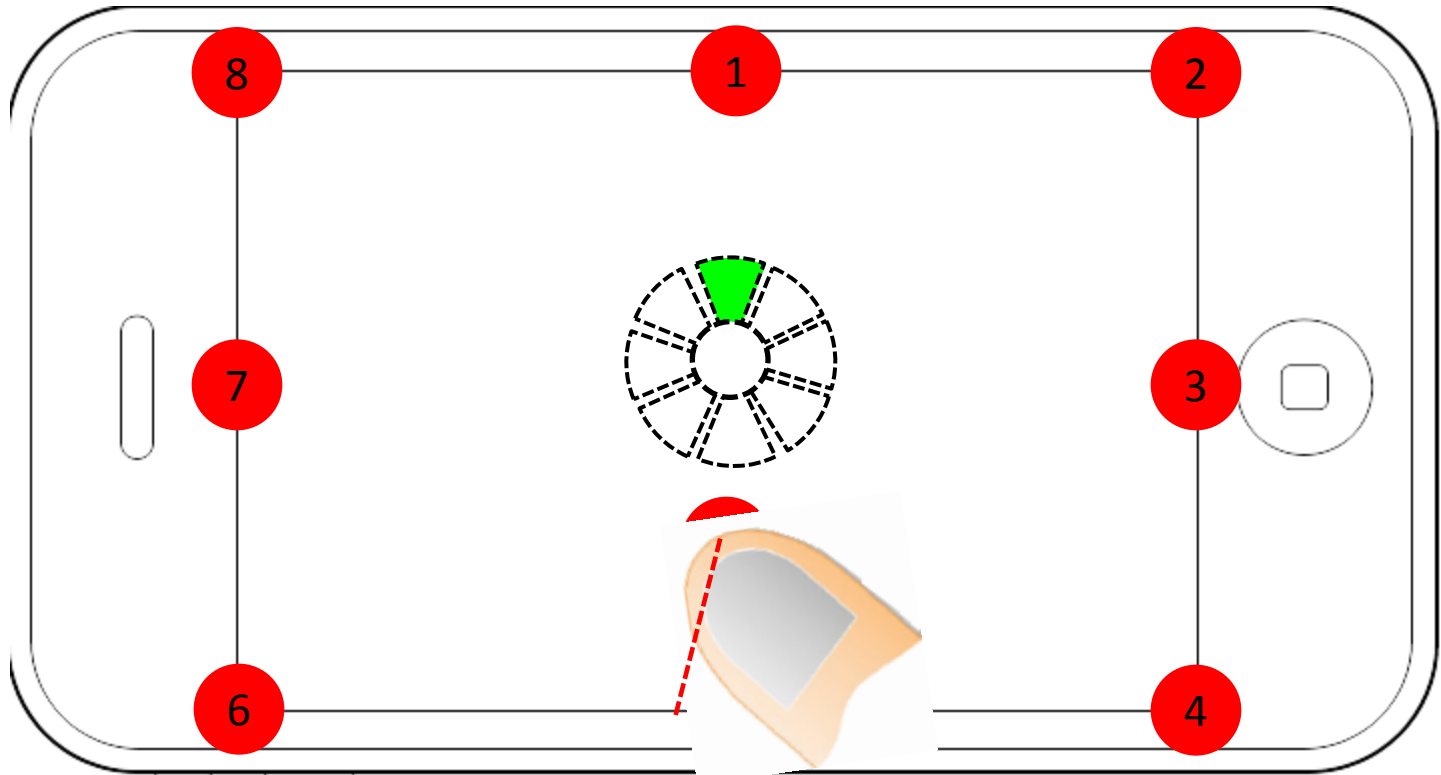
# Novice – Step 3



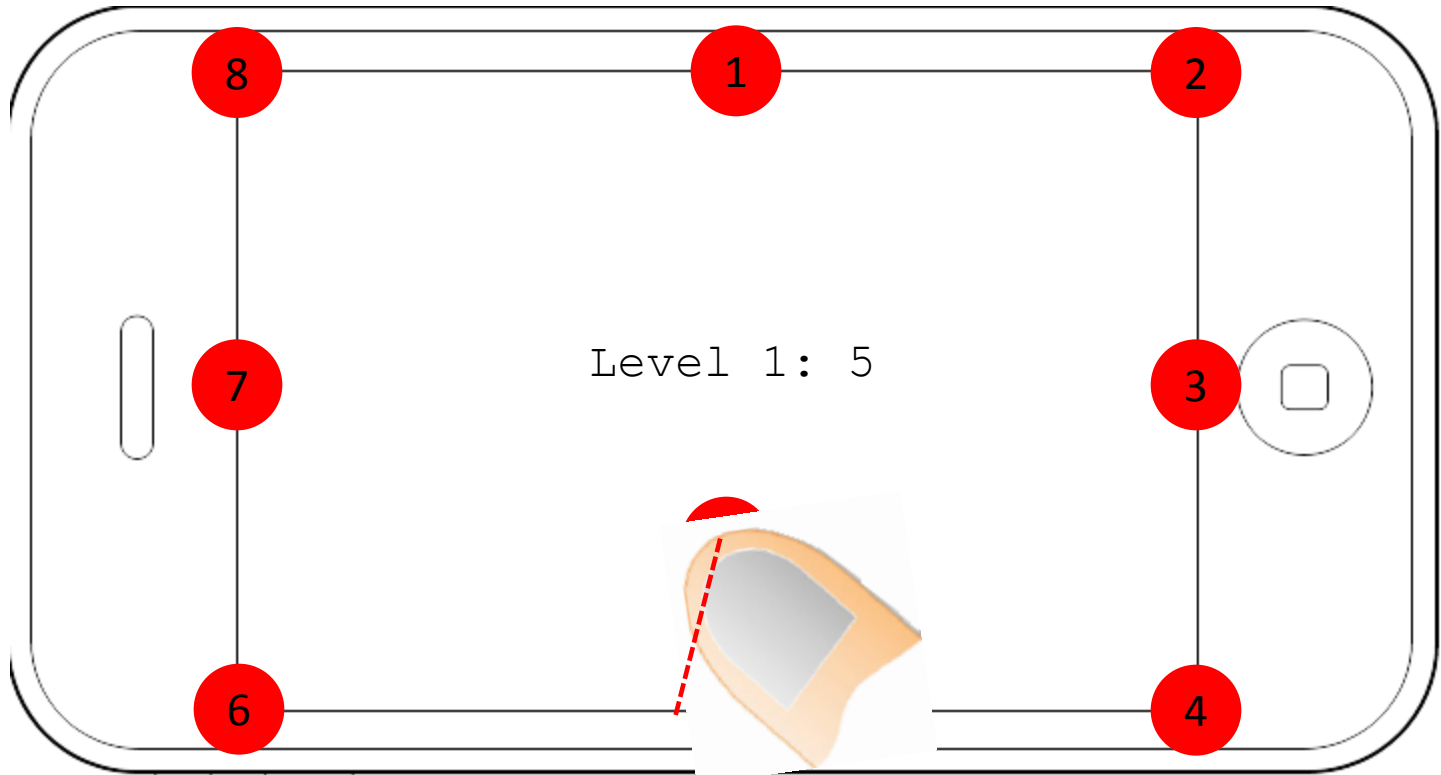
# Novice – Step 3



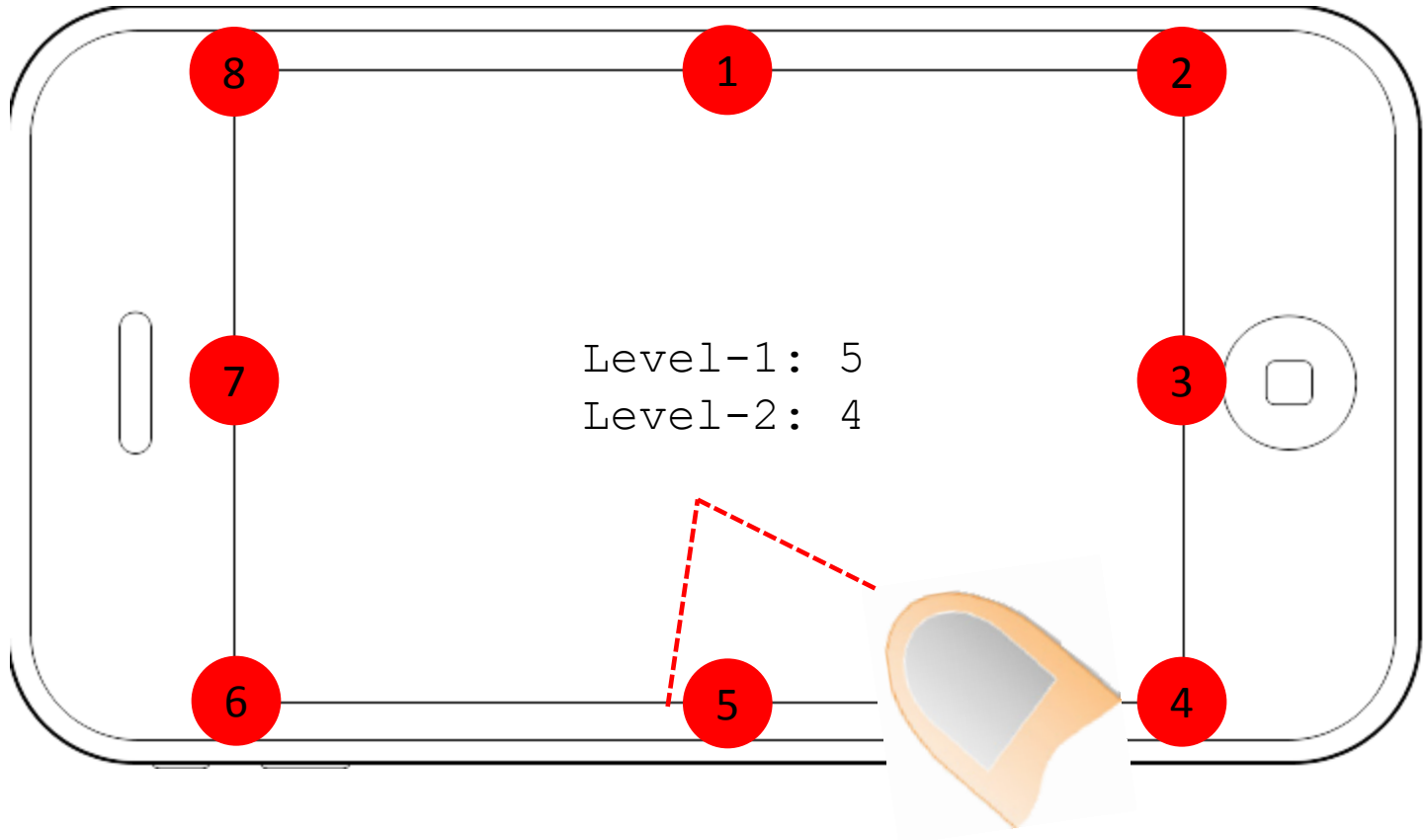
# Novice – Step 4



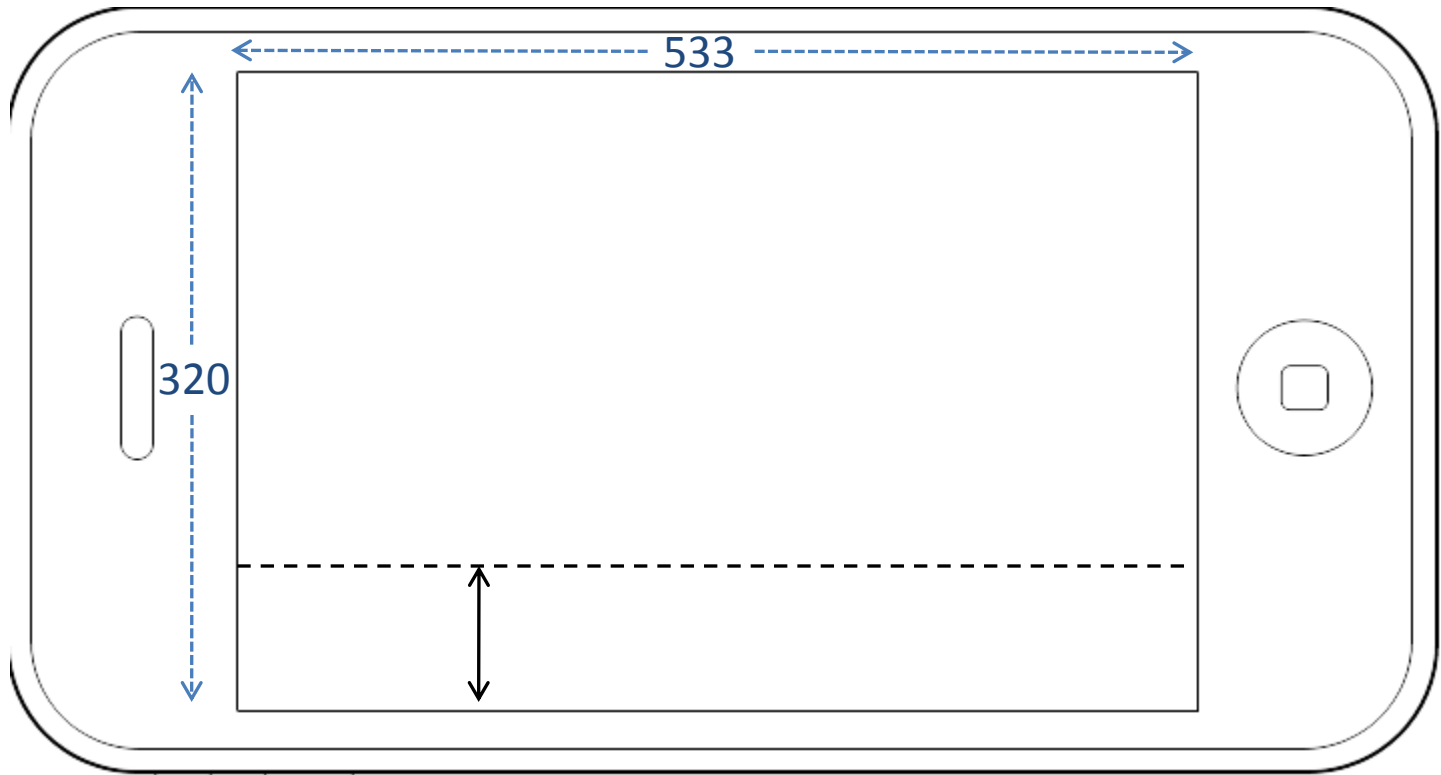
# Novice – Step 4



# Expert – Level 2



# Pilot Study 1

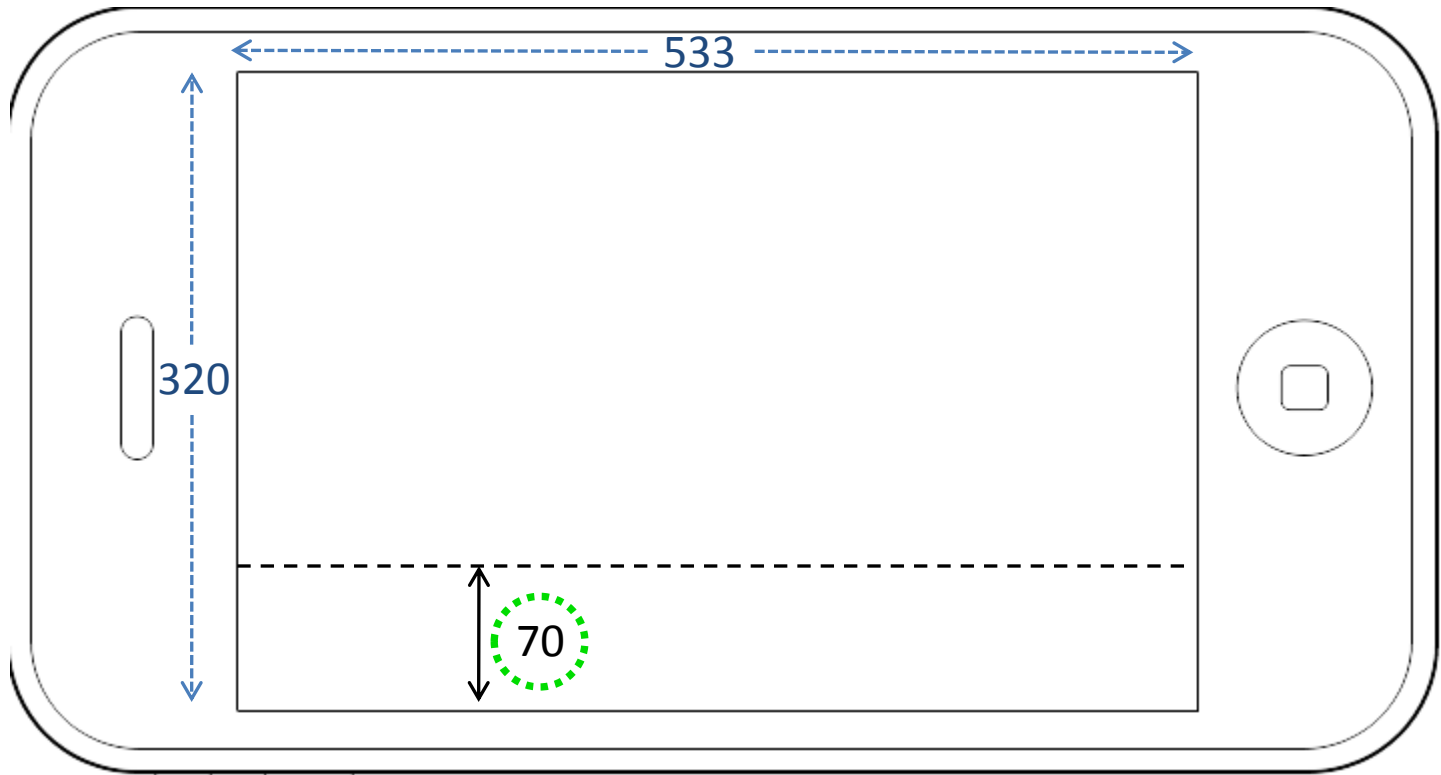


- 4 participants (M, right-handed, avg age: 23.3)



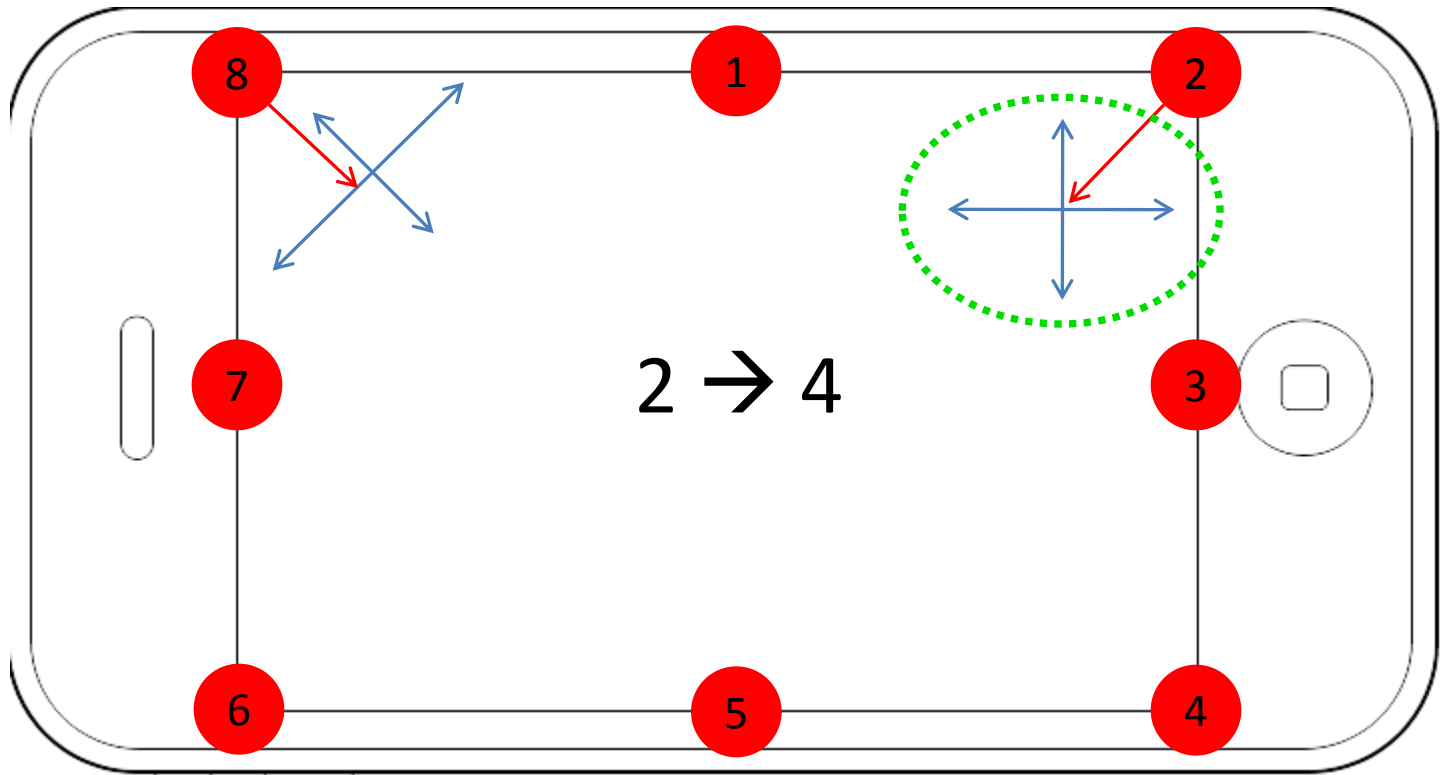


# Pilot Study 1



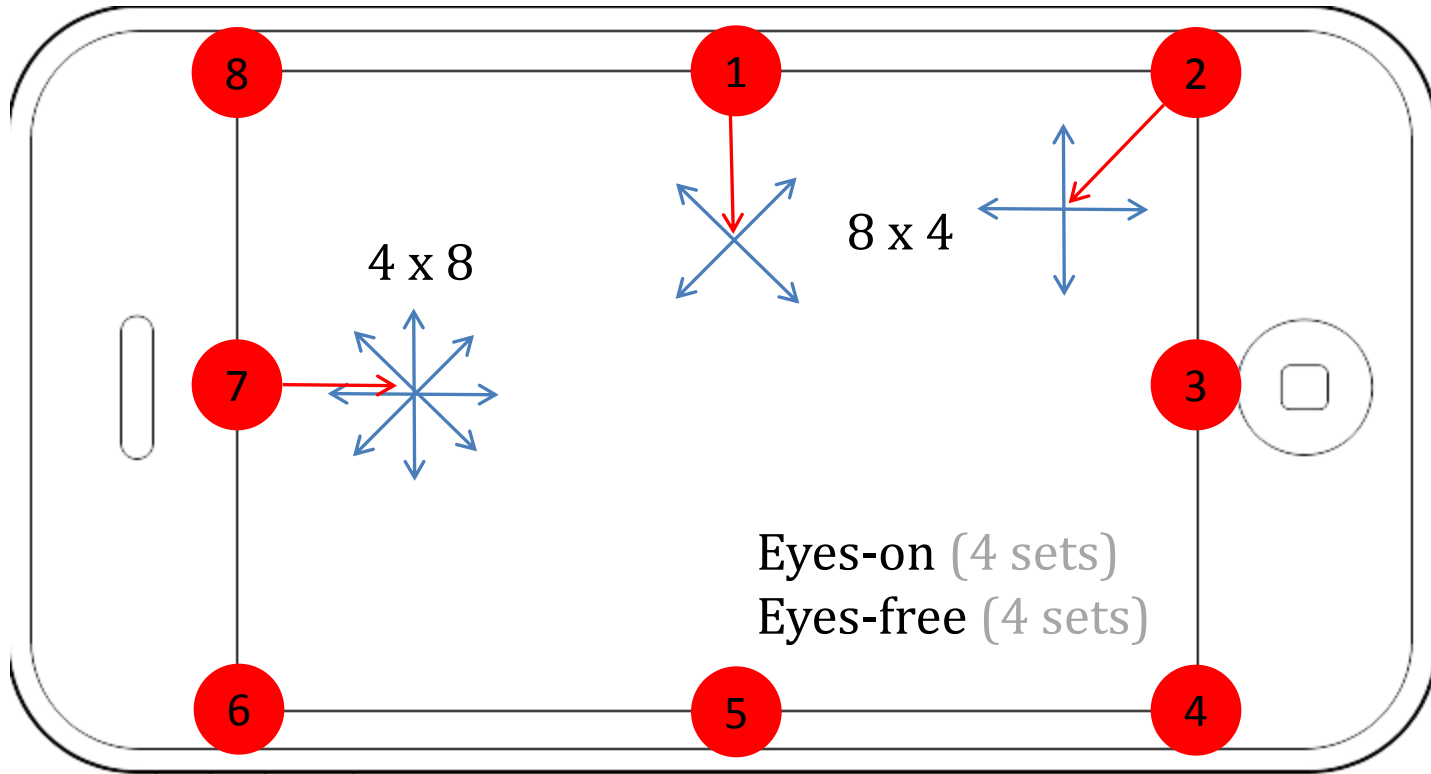
- 4 participants (M, right-handed, avg age: 23.3)
- Measured: Accuracy (97.3%)

# Pilot Study 2



- 4 participants (M, right-handed, avg age: 23.3)
- Measured: Accuracy (96.6%)

# User Study 1



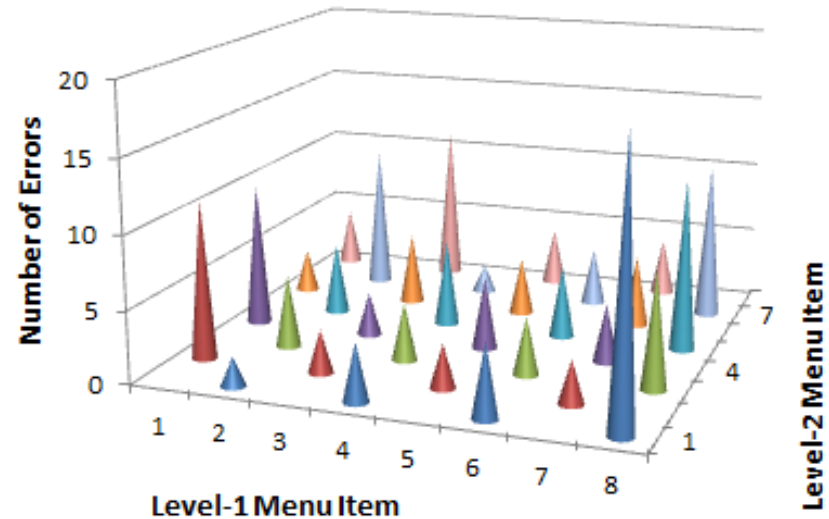
- 12 participants (1F, right-handed, avg age: 26.5)
- Measured: Accuracy, speed

# Results

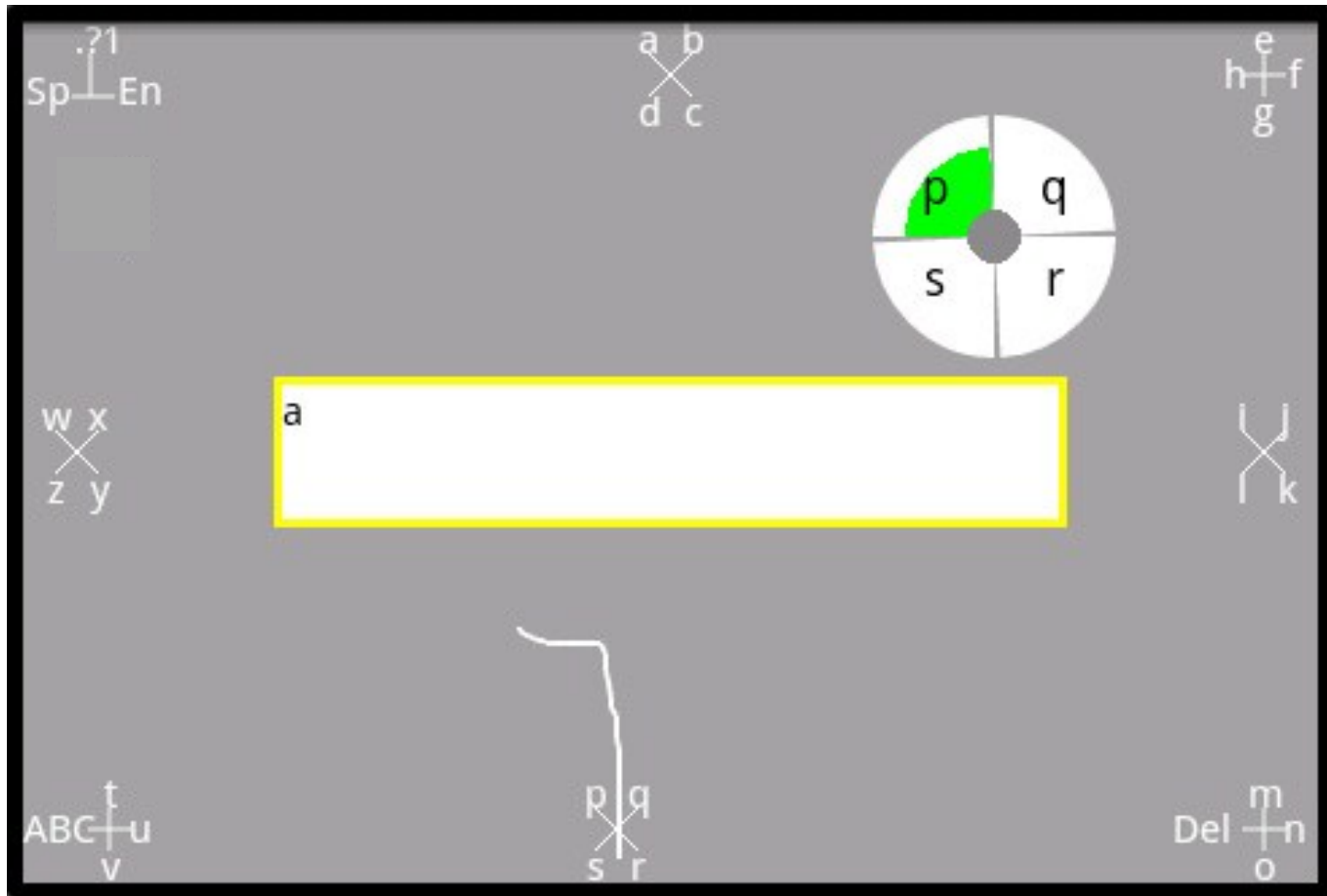
Eyes-on	Eyes-free
26.67 (sd=2.2)	29.3 (sd=2.37)

L <sub>4x8</sub>	L <sub>8x4</sub>
28 (sd=2.37)	30.67 (sd=1.5)

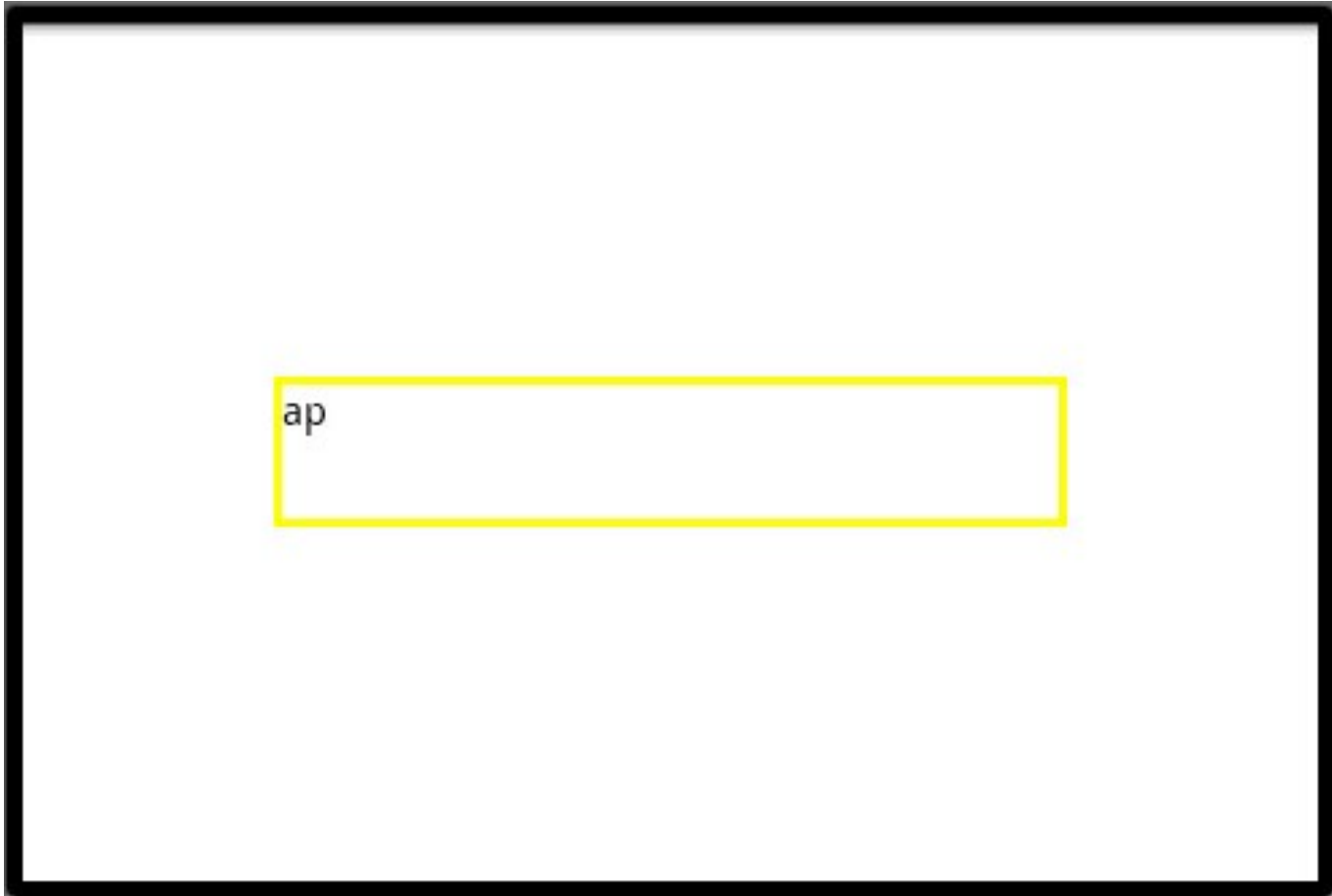
- “easy to memorize”
- “eyes-free is surprisingly easier”
- Major errors: 26.6% using upper left corner (number 8)



# Text-Entry

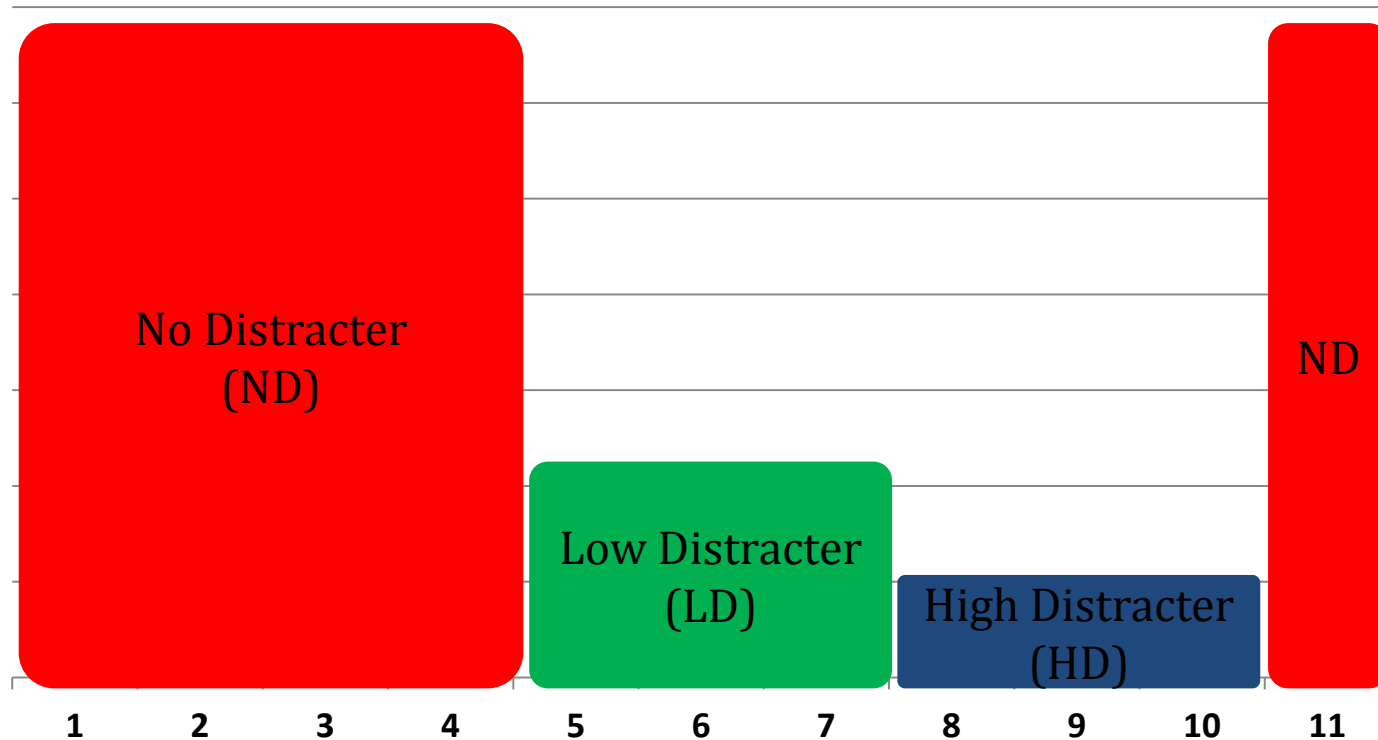


# Text-Entry



ap

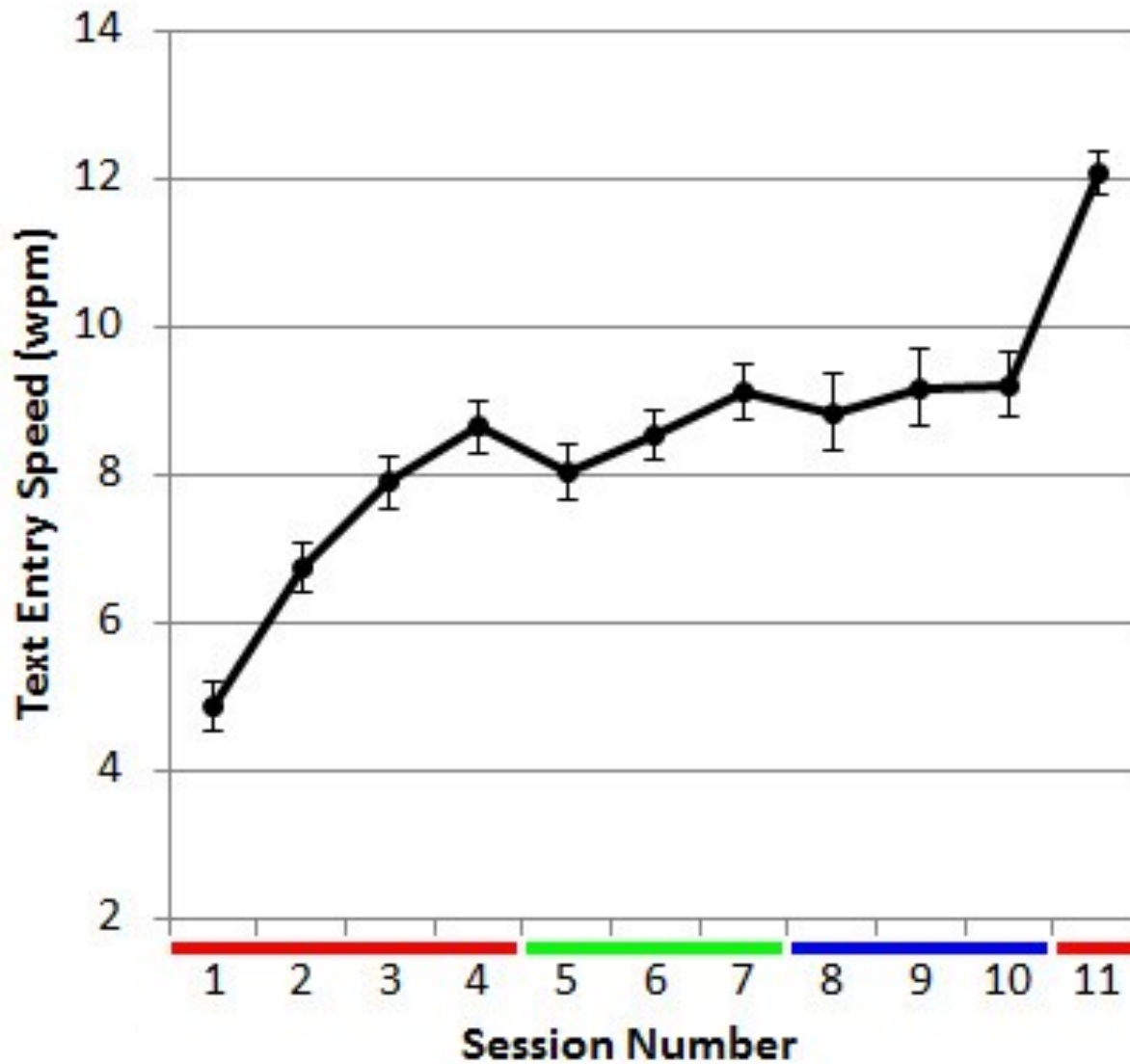
# Study Design



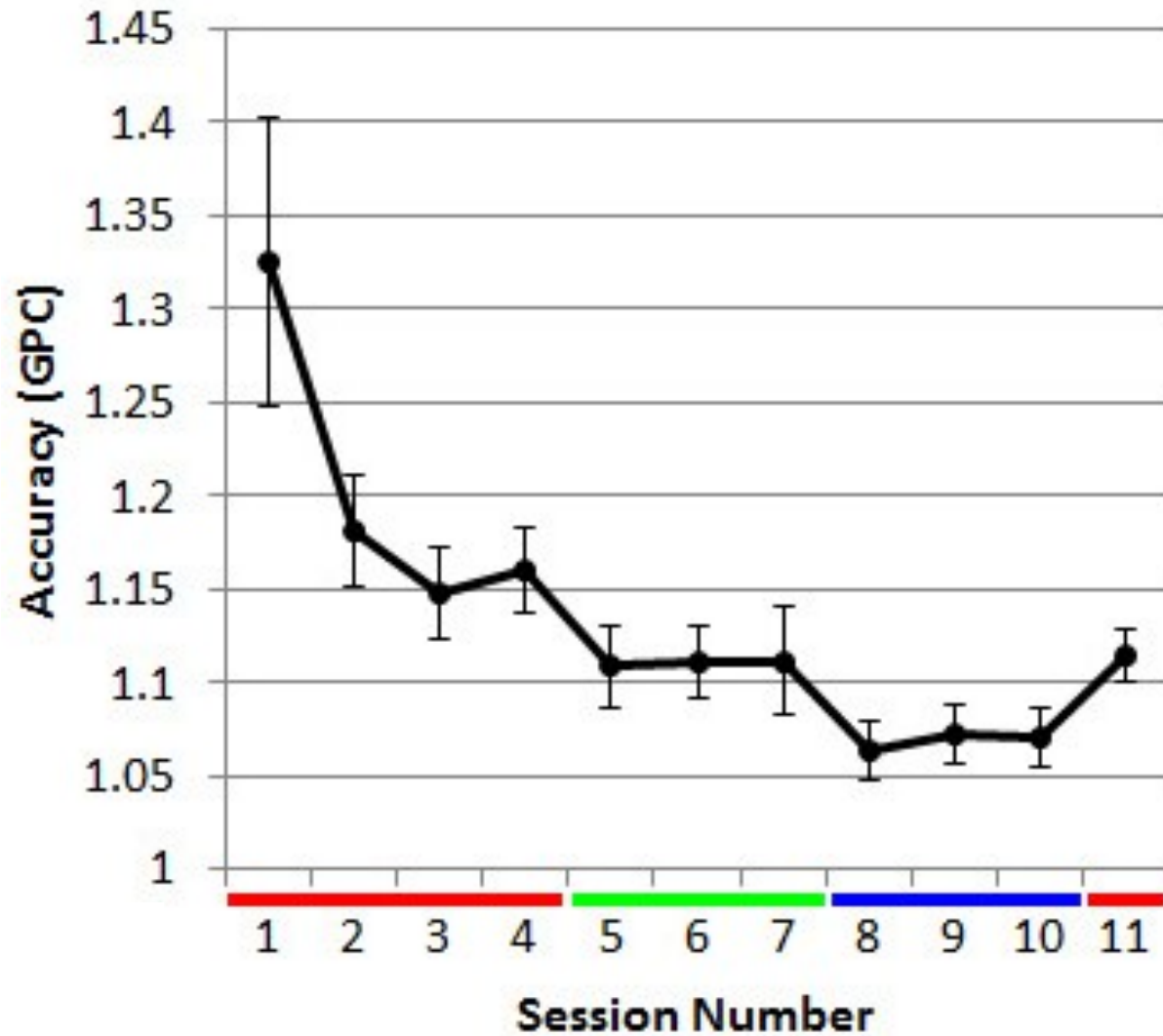
Participants: 8 (1F, right-handed, avg age: 27,  
typing speed: 50.75 wpm, \$10 per session)



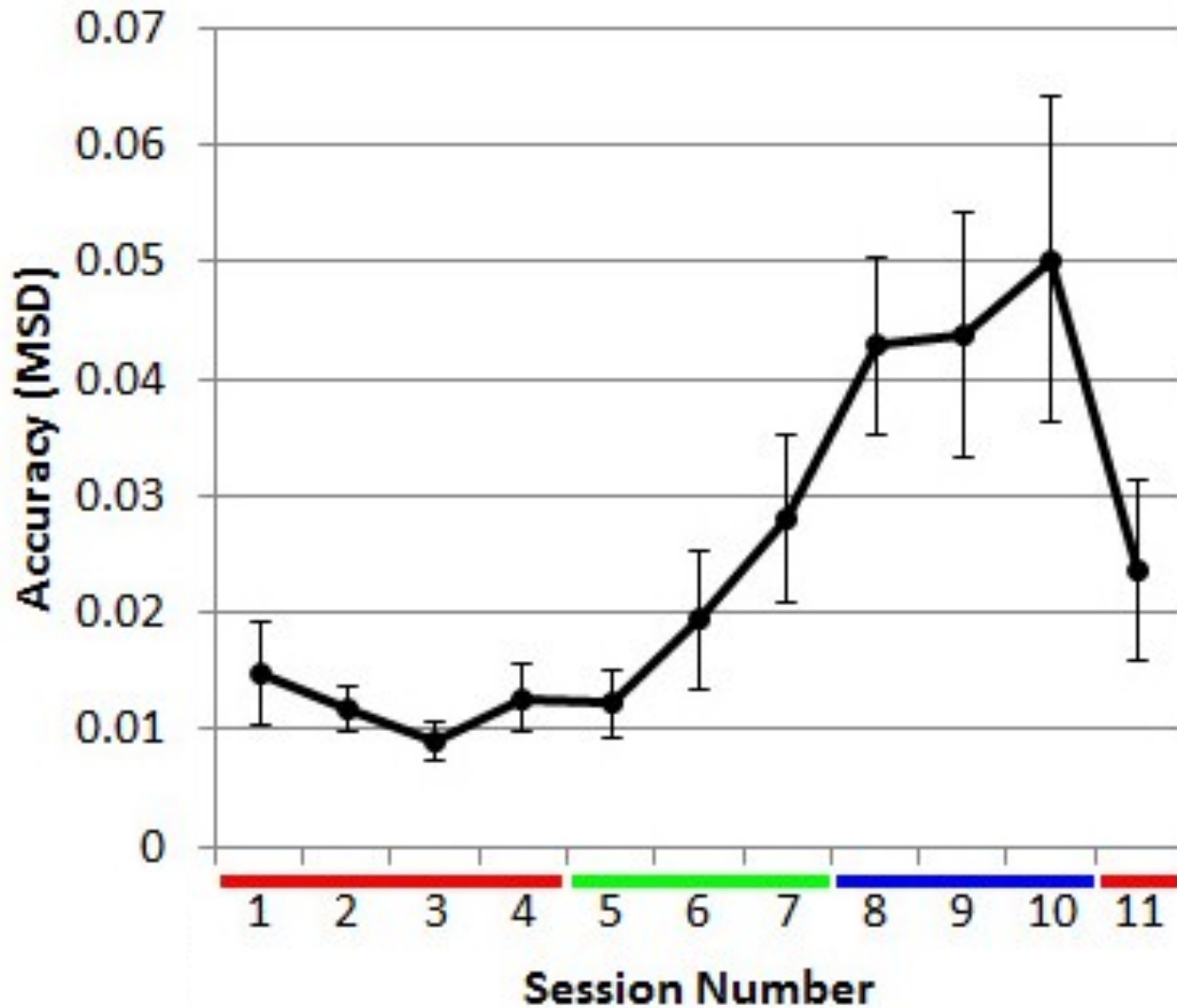
# WPM (Words per Minute)



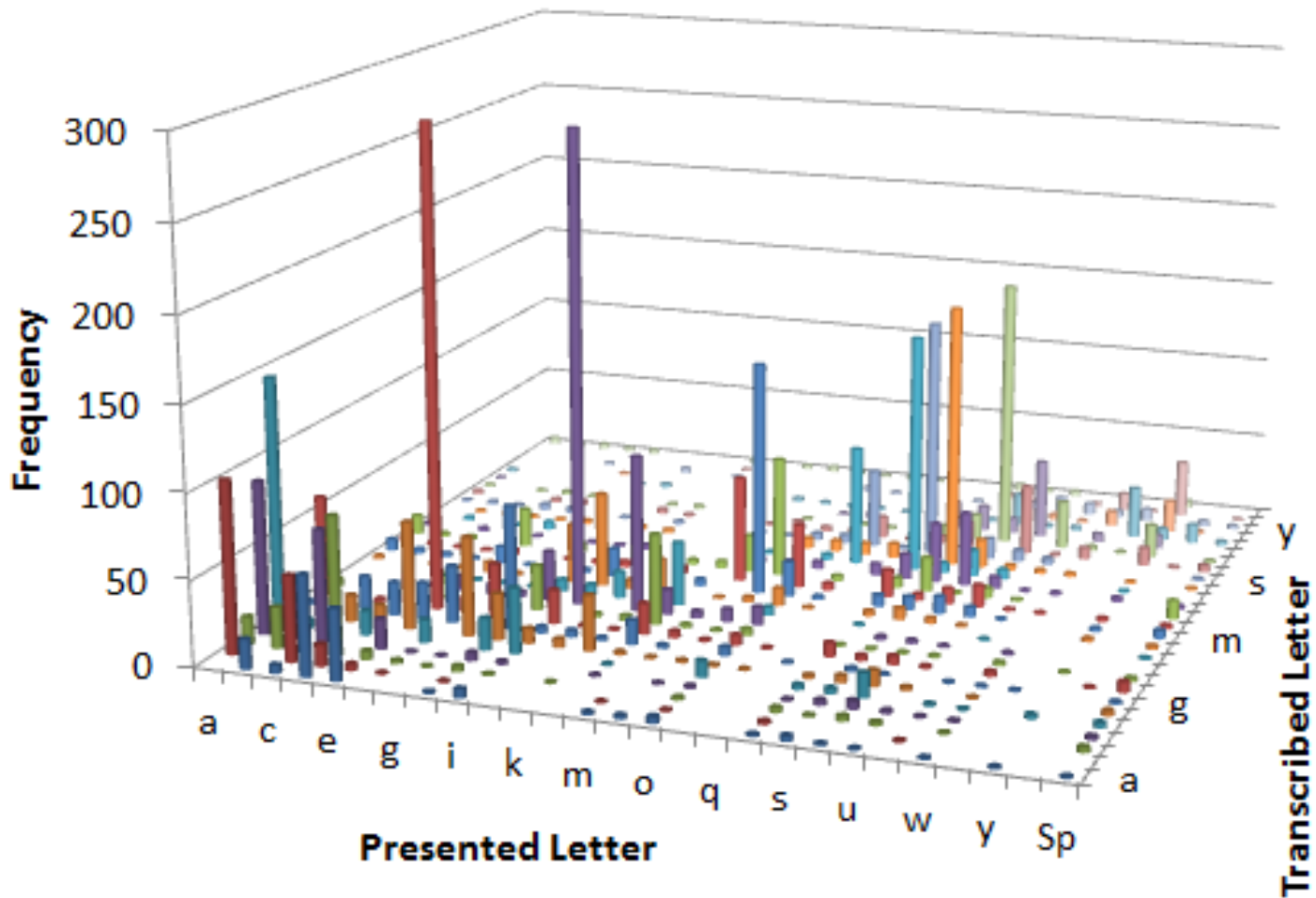
# GPC (Gesture per Character)



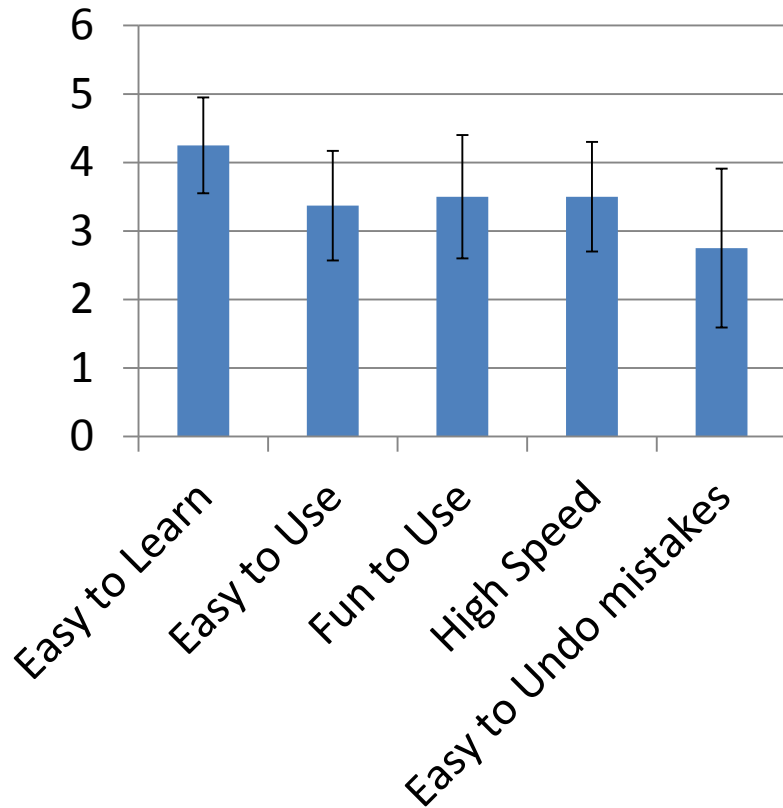
# MSD (Minimum String Distance)



# Confusion Matrix



# Qualitative Feedback



- *“faster”,*
- *“quick to learn”*
- *“eyes-free is possible”*
  
- *“no need to worry about the small [QWERTY] keys”*
  
- *“mechanical, patterns such as ‘the’ are very easy to perform eyes-free, once learnt”.*

# Design Implications

- **Accessibility** (right-thumb => bezel 1-5 preferable)
- **Preferable Layout** (16: L<sub>4x4</sub>, 32: L<sub>8x4</sub>)
- **Ergonomics** (restrictions due to touch-sensitive bezel)
- **Threshold Distance** ( $\sim 1/7^{\text{th}}$  of the screen size)

# Conclusion

- + Enable interaction with minimal visual attention (*work under direct sunlight, while walking*)
- + Solve occlusion, fat-finger and mode-switching problem
- + Result in more screen space for the actual content
- + Useful for complex realistic applications (*video editor, word processor, text entry*) requiring numerous controls
- # of menu items limited to 64 (32 at best)
- Has a learning curve

**Thank You**