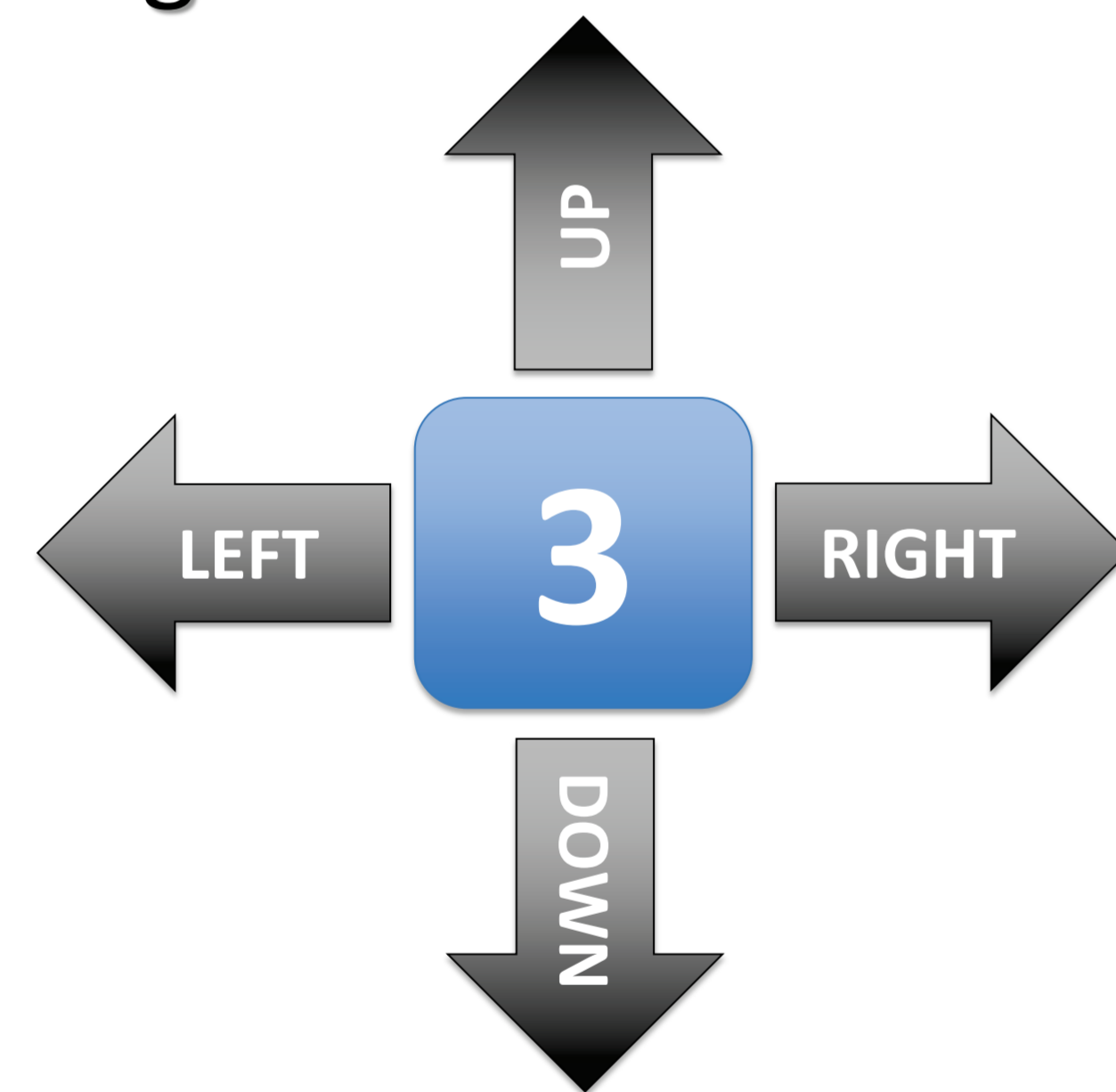


User Authentication

- Has been a persistent problem as most popular techniques have security issues:
 - Limited unique password combinations
 - Digit lock: **10,000** 4-digit
 - Pattern lock: **3,89,112** Android OS
 - Other approaches:
 - Very different
 - Thus, harder to adapt

The Hybrid Technique

Augments four gestures to each numeric key (0-9)



- Similar to digit lock, easier to adapt
- Increases unique combinations:
 - Hybrid: **62,50,000** 4-symbol

A Pilot Study

- Three 4-symbol password types:
 1. Digits only
 2. Gesture only
 3. Hybrid
- Investigated user performance

Apparatus

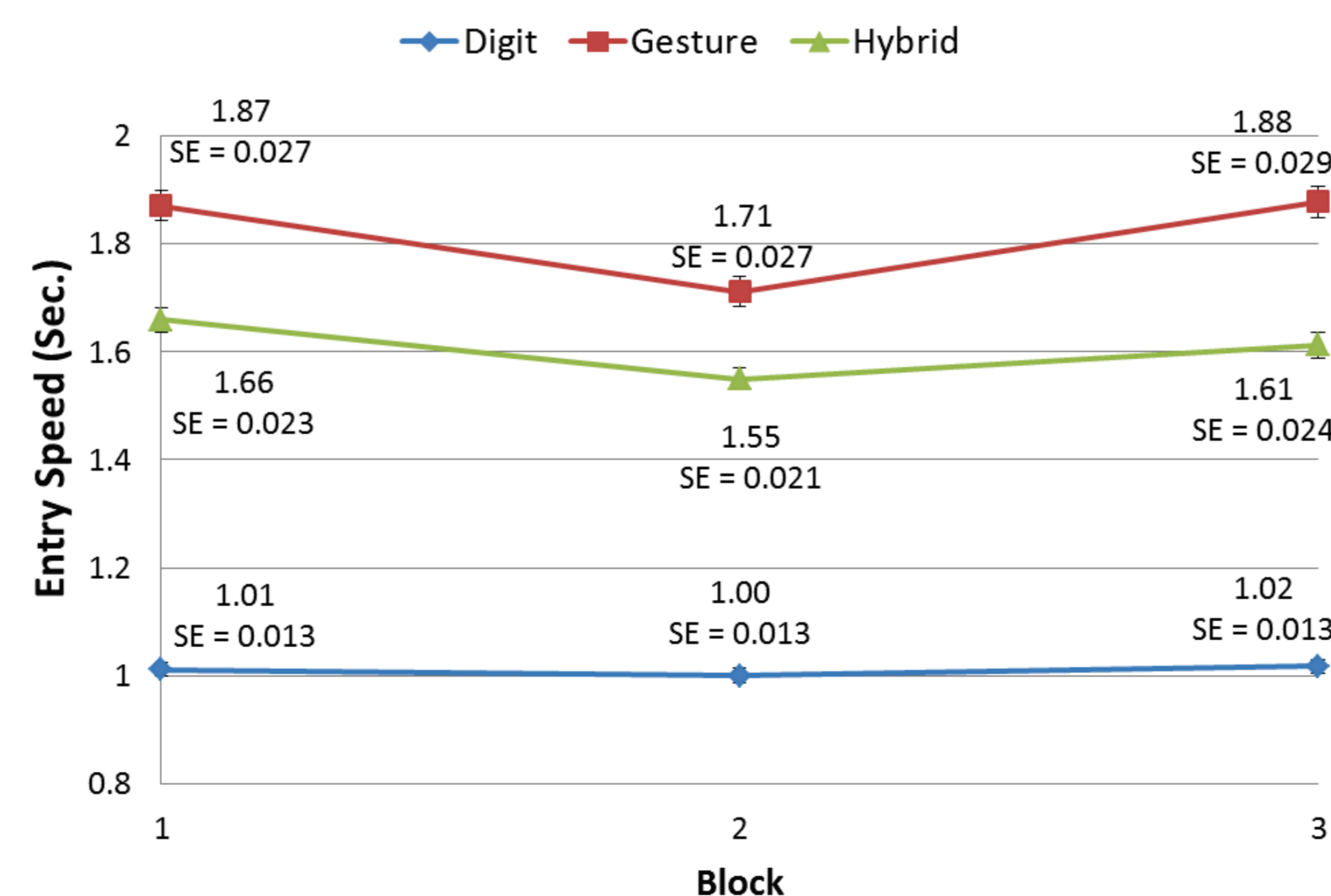
- Nokia Lumia 800 with Windows Phone 7 OS
- A custom app replicated the default lock-screen



- Within-subjects design:
 - 12 participants ×
 - 3 counterbalanced conditions (3 passwords) ×
 - 3 blocks × 35 attempts = 3,780 in total.

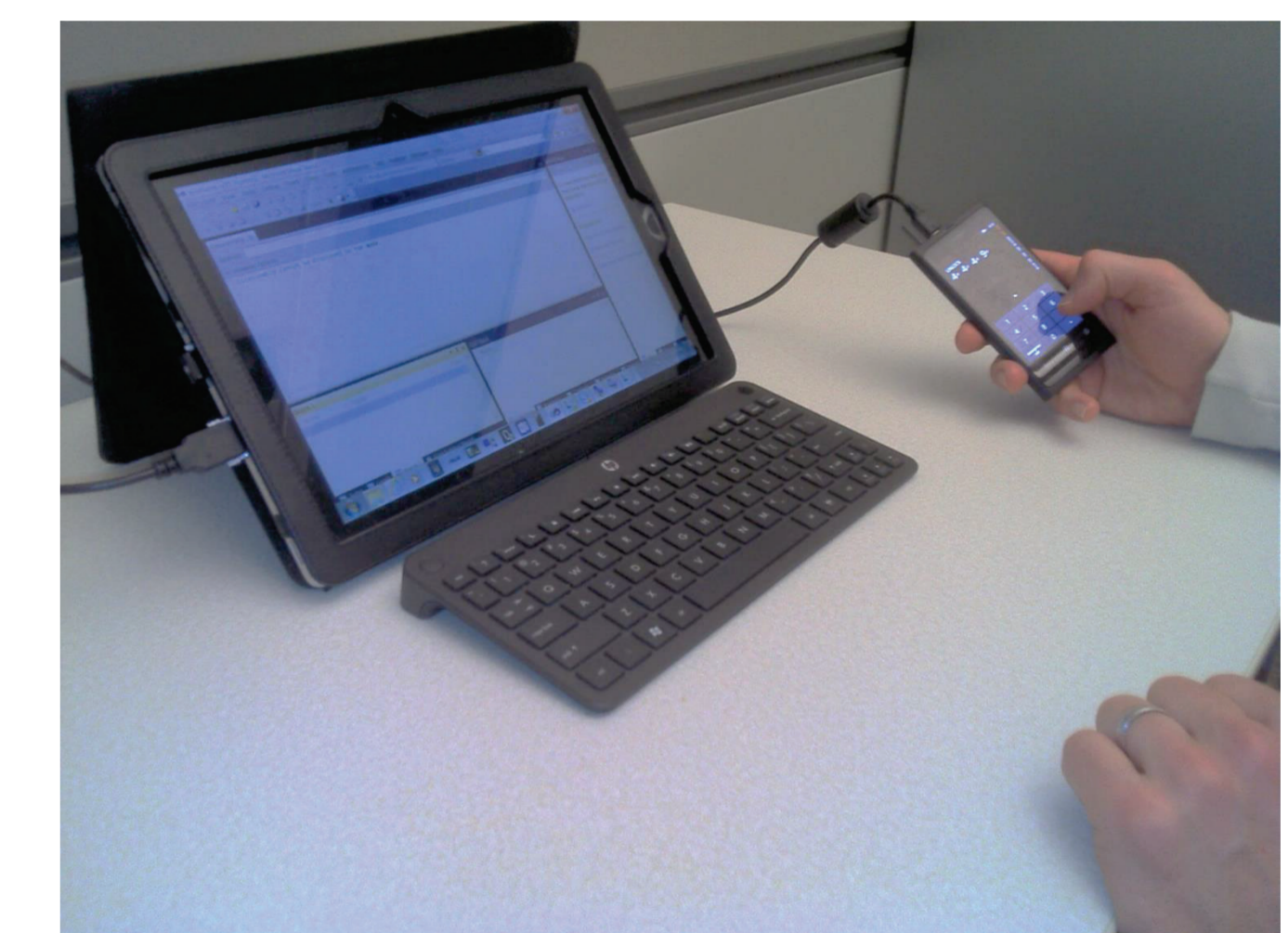
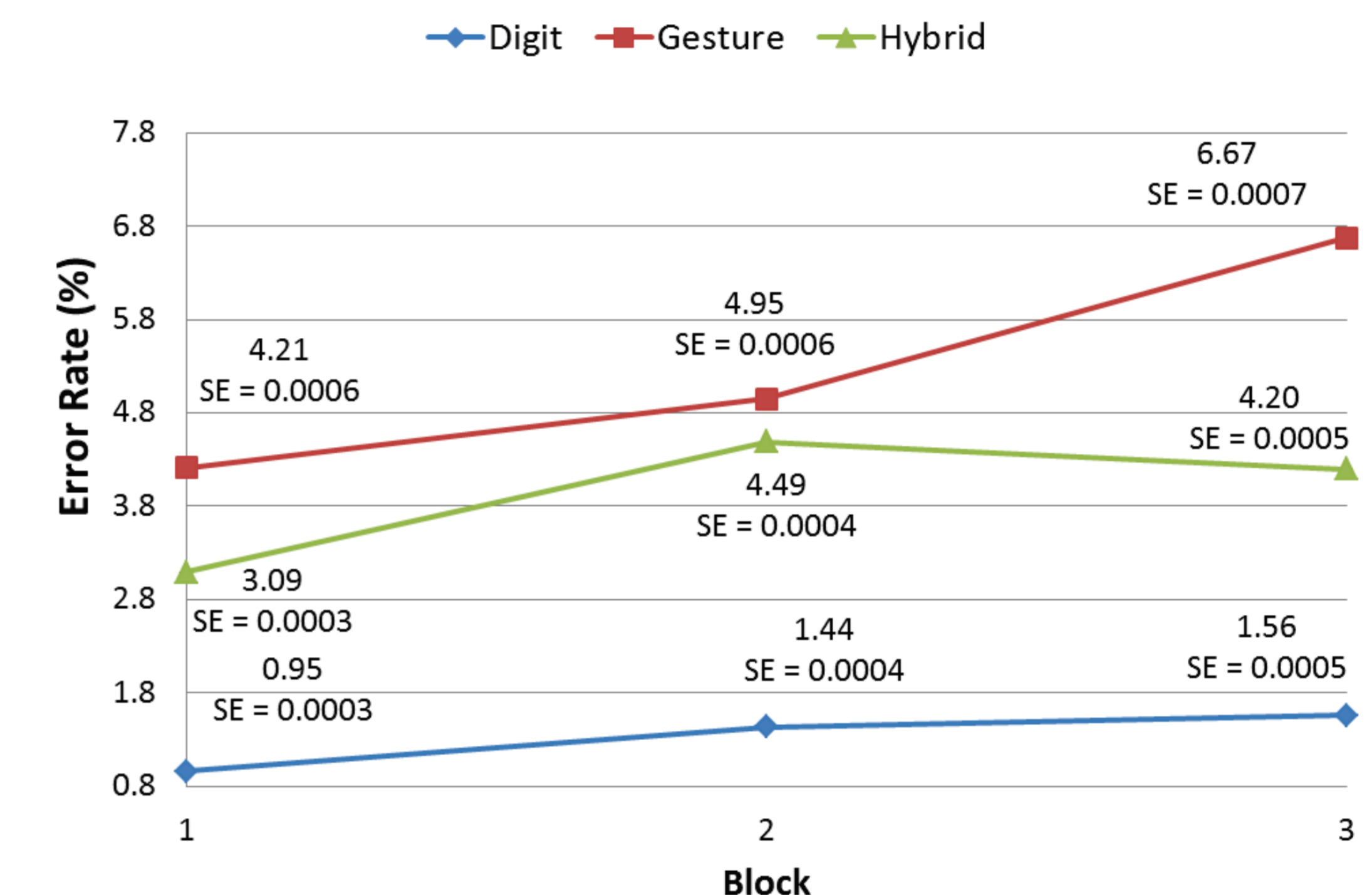
Entry Speed

- Significantly slower
- Significant effect of block on gesture



Accuracy

- Significantly more error prone
- No significant effect of block



User Feedback

- 67% felt comfortable
- 100% felt more secure
- 83% found hybrid harder to memorize

Summary

- Theoretically, hybrid is harder to penetrate
- Also slower and more error prone
 - A longitudinal study is necessary
- User feedback is generally positive