Colour-coded Visual Aids for Learning Unfamiliar Virtual Keyboards

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Motivation and Problem

- Mobile text entry has an important role in everyday life.

- QWERTY layout remains dominant due to users' familiarity, not typing efficiency.

- Challenge: Learning alternative keyboard layouts is cognitively demanding and hinders adoption.

- Research question: Can colour-coding facilitate the learning of unfamiliar keyboard layouts?

Related Work

- Prior studies on typing performance with novel layouts (e.g. OPTI, FITALY, chord keyboards).

- Visual cues have been mostly explored for real-time assistance rather than long-term learning.

- There is a lack of studies on colour-coded aids as a spatial memory support for layout learning.

System Design

- Two novel keyboard layouts tested: OPTI II and FITALY.
- Hypothesis: Forming mental associations between letter positions and colours may enhance spatial memory.
- Implementation: Three vertical colour zones (red, blue, green), in a responsive web app, without autocorrect or word suggestions.

(a) The OPTI II keyboard layout.

(b) The OPTI II keyboard layout with colour-coded keys.

(c) The FITALY keyboard layout.

(d) The FITALY keyboard layout with colour-coded keys.

Study Design and Metrics

- **Participants**: 27, ages $\bar{x} = 26.04,\ \sigma = 6.04$, diverse educational backgrounds.

- **Design**: Within-subjects; each participant tested both layouts (with and without aid).

- **Procedure**: 4 sessions separated by $\geq$ 12 hours; aid introduction order was counterbalanced (Group 1: aid in Session 1, Group 2: aid in Session 3).

- **Tasks**: transcribe 5 phrases $\times$ 10 blocks per session (Enron dataset).

- **Measures**:
  - Quantitative: Typing speed (WPM, IKI) and accuracy (MSD, Backspaces) metrics.
  - Qualitative: NASA-TLX after each session; final questionnaire on perceived usefulness, ease of use, motivation, satisfaction.

Key Results: Speed

- **WPM**:
  - Significant increase from Session 1 to 2 for both groups (initial adaptation effect)
  - No significant differences in later sessions, regardless of aid timing

- **IKI**: Significant improvements across sessions, reflecting growing familiarity with the layouts.

- **Session 3 vs Session 1**: Higher WPM and lower IKI in Session 3, suggesting reduced QWERTY inference.

Mean WPM per Block with 95% CI


Mean IKI per Block with 95% CI
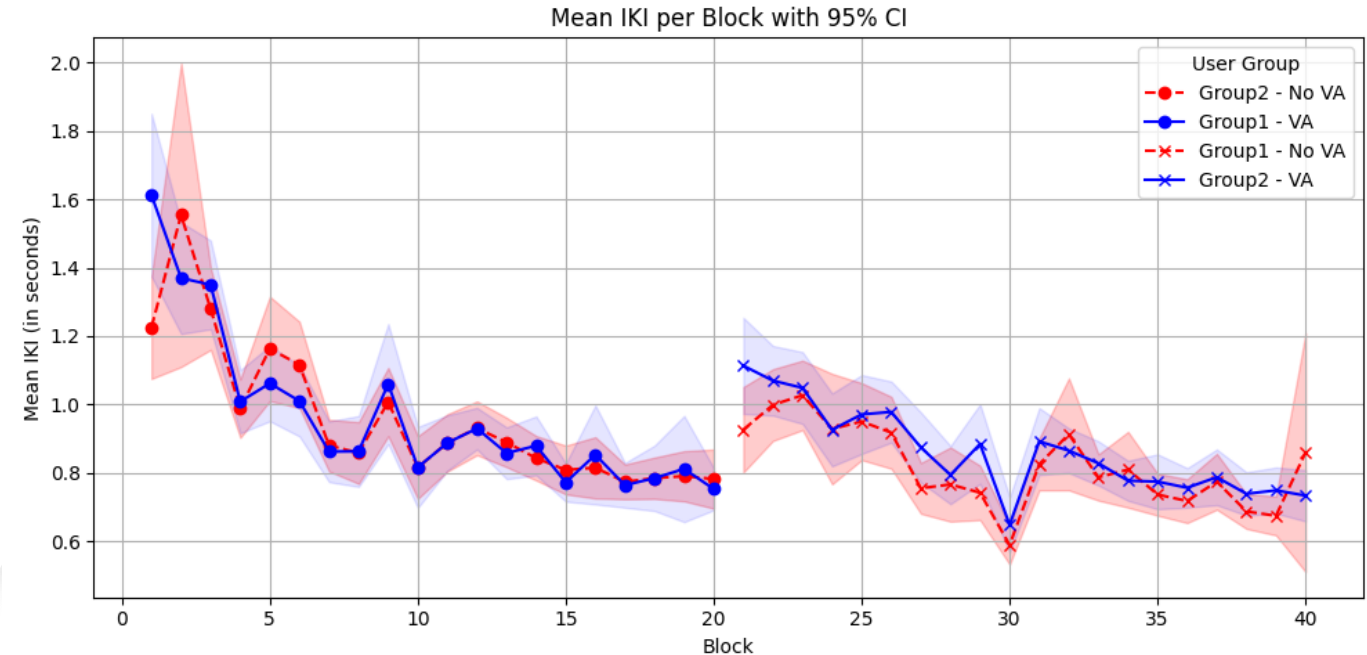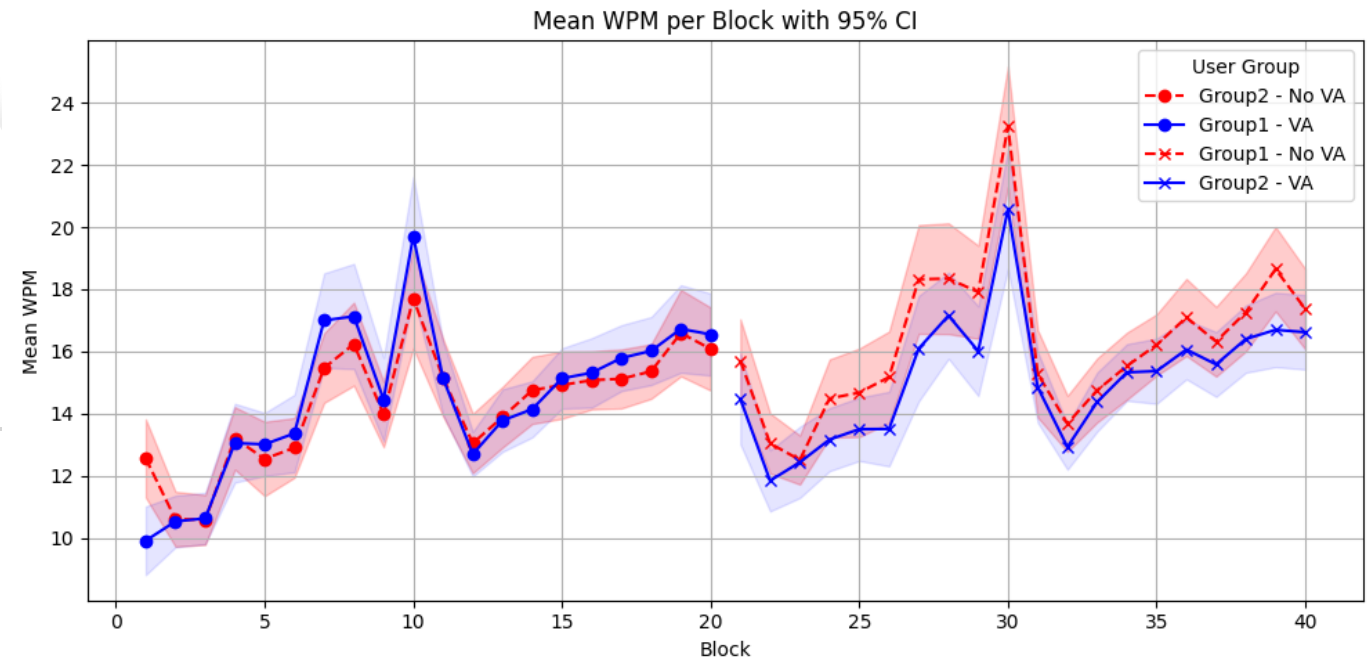
Key Results: Accuracy

- Metrics: Minimum String Distance, Backspaces per Block.
  - MSD adjusted for sentence length.

- Results indicated no significant differences across groups or sessions for both metrics.

- Errors and sentence length did not meaningfully influence users' performance.

Mean MSD per Block with 95% CI

Mean Amount of Backspaces per Block with 95% CI
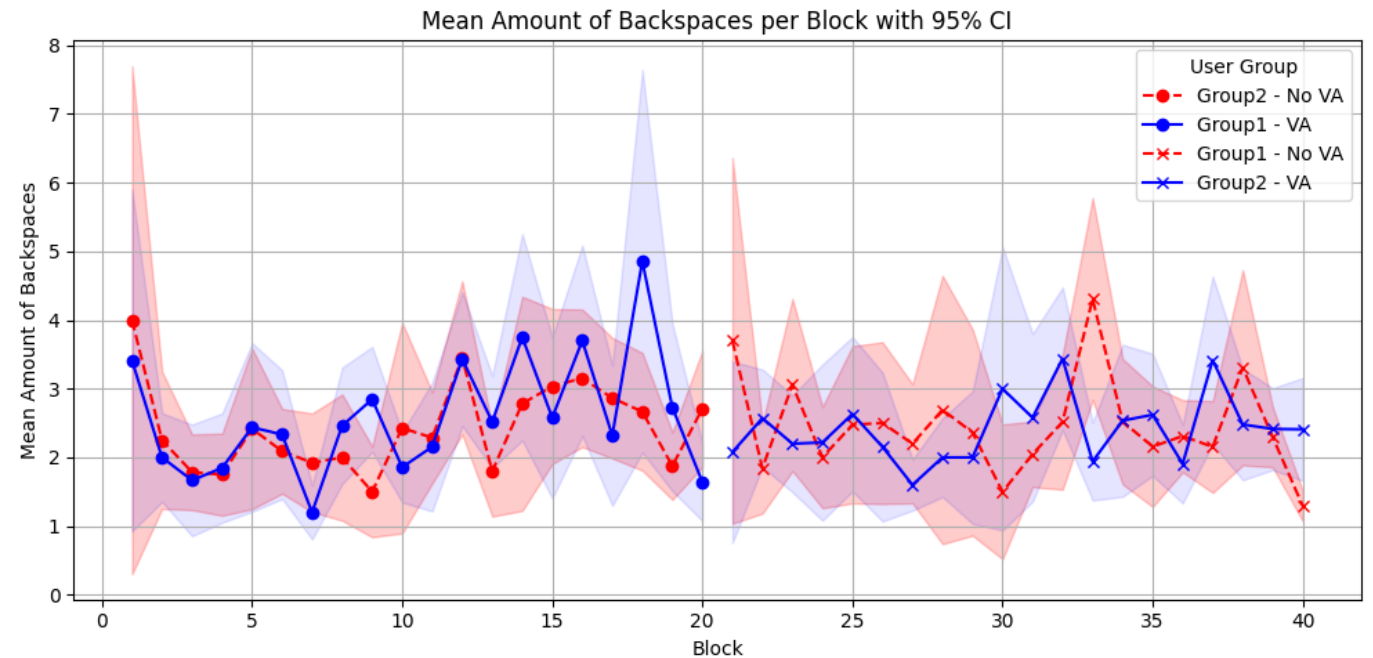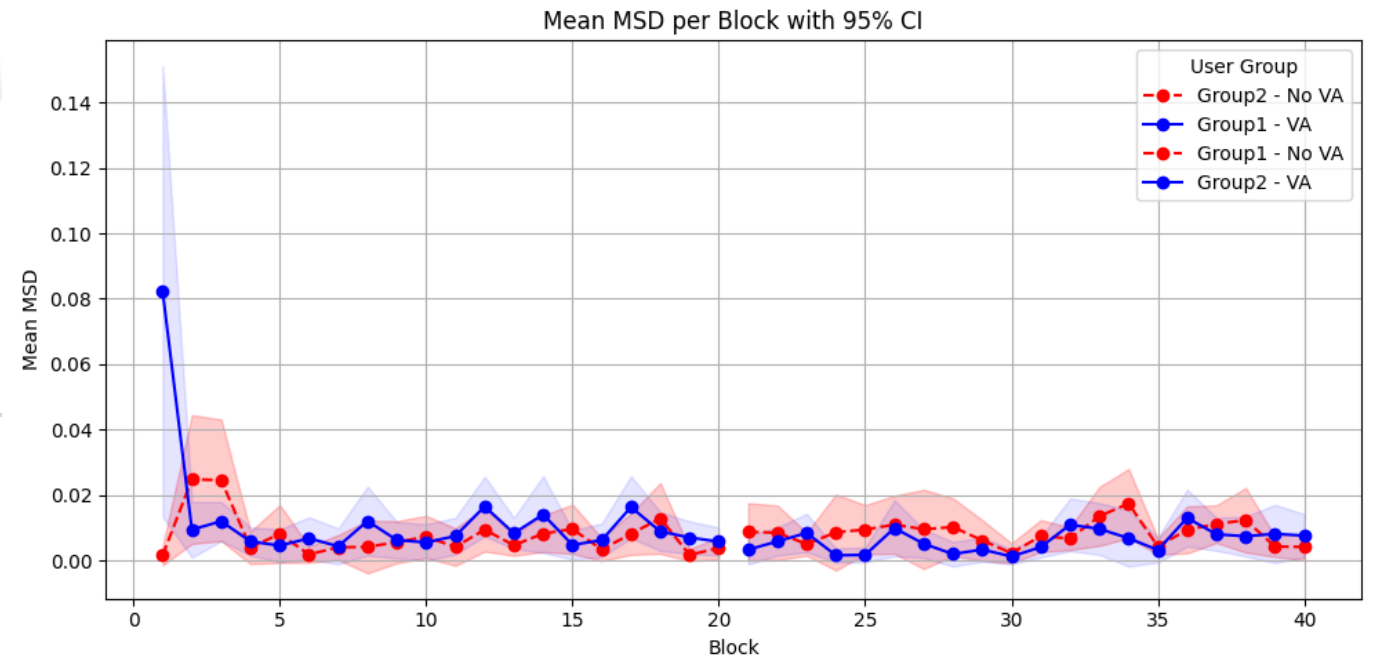
Key Results: Overall Experience and Perceived Workload

- Group 2 rated colour-coding more positively.
  - Suggests the aid may be more useful when introduced after an initial adaptation phase.
- No significant differences on perceived workload.
  - Except for Typing Mental Demand for Group 1 in Session 1 vs Session 2.
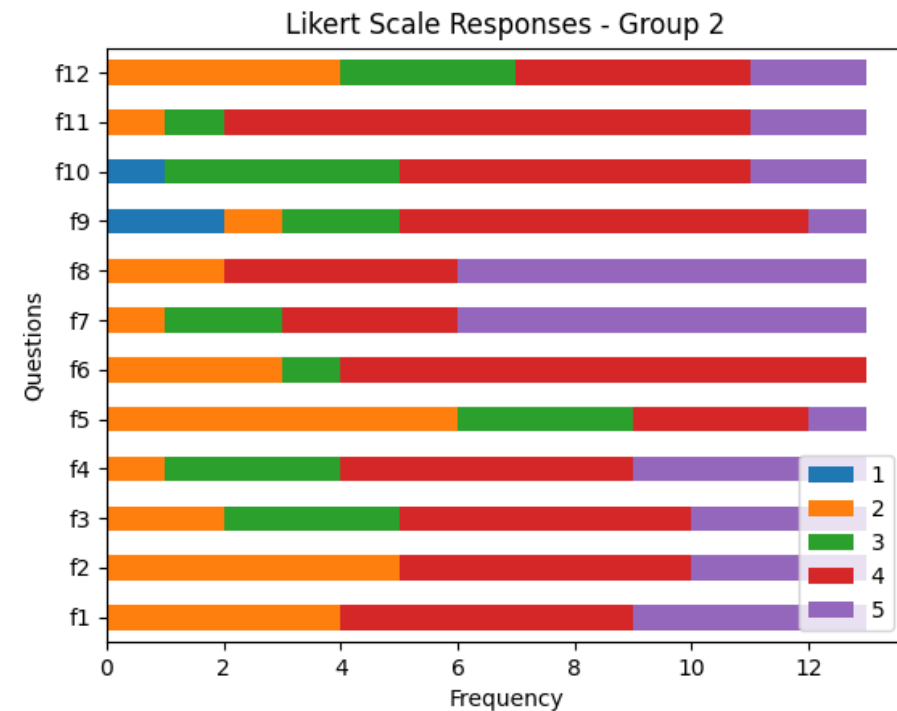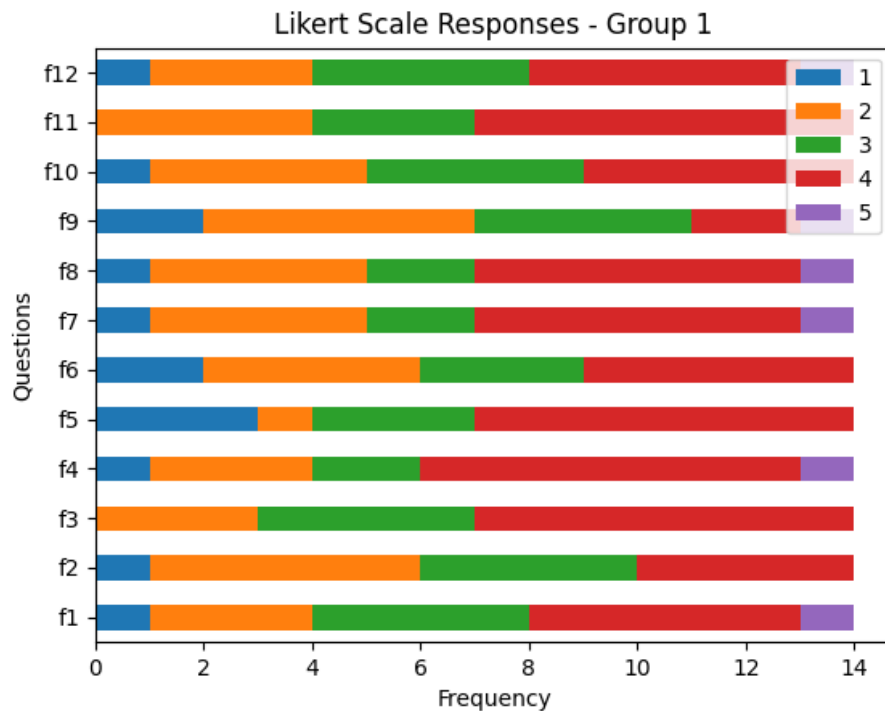
Discussion and Future Work

- **Quantitative**: Visual aid showed no direct measurable performance effect.
- **Qualitative**: Introduction timing matters – aid may work better after cognitive load drops.
  - May reduce frustration and support motivation after initial adaptation
- **Design implication**: consider *when* to introduce visual aids in learning systems

- Sample consisted mostly of university students → limited generalizability
- Remote study with varying devices → uncontrolled variability
- No long-term retention was tested

Future Work:
- Delayed follow-ups to measure spatial memory.
- Alternative visual cues (e.g. vowel highlighting).
- Pre-training with colour-letter association

Conclusion

- Visual aids didn't improve speed/accuracy, but can improve user perception when introduced after adaptation.

- Timing is key for introducing learning support tools in HCI.

- Potential for broader application in alternative keyboard adoption strategies.

Thank you for your attention. Questions?

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