The Impact of Material Design 3's 48dp Minimum Touch Guideline on User Interaction Accuracy in Android Applications

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ABSTRACT

Touchscreen interfaces depend on finger input, which is inherently less precise than mouse input due to finger size and motor variability. Small touch targets lead to increased selection errors, slower task completion, and reduced usability. **Google's Material Design 3** recommends a minimum touch target size of **48dp to improve interaction reliability and accessibility.** This study experimentally evaluates the impact of that guideline on user accuracy.

LITERATURE REVIEW

Y. Chen et al., "Smaller touch targets increased input errors, especially for users with motor impairments, while larger targets improved accuracy," 2013.
Google, "Material Design guidelines recommend a minimum touch target size of 48dp to improve interaction accuracy, usability, and accessibility," n.d.
J. Wu et al., "Increasing touch target size improved selection accuracy, task efficiency, and accessibility in mobile applications," 2022.
Z. Jin et al., "Smaller buttons increased error rates and task completion time, particularly among older adult users," 2007.
H. Im et al., "Investigation of icon design and touchable areas for smartphone controls identified optimal sizes for user interaction," 2015.

REFERENCES

- **[1] K. B. Chen, A. B. Savage, A. O. Chourasia, D. A. Wiegmann, and M. E. Sesto, "Touch screen performance by individuals with and without motor control disabilities," Applied Ergonomics, vol. 44, no. 2, 2013.**
- **[2] Google, "Material Design layout and touch targets," n.d. [Online]. Available: material.io**
- **[3] Y. Im, T. Kim, and E. S. Jung, "Investigation of icon design and touchable area for effective smart phone controls," Human Factors and Ergonomics in Manufacturing & Service Industries, vol. 25, no. 2, 2015.**
- **[4] Z. X. Jin, T. Plocher, and L. Kiff, "Touch screen user interfaces for older adults," Computers in Human Behavior, 2007.**

METHODOLOGY

Hypothesis: ***48dp targets will produce significantly fewer misclicks and faster completion times than 32dp targets.***

1. **Design:** Within-subject experiment comparing 48dp vs 32dp touch targets on Android (Android Studio, Nahwal version).
2. **Tasks:** Participants activated three UI controls — button, toggle switch, radio button — at randomized screen positions.
3. **Measures:** App automatically recorded total completion time (ms), number of trials (15 per condition), misclicks, and average time.
4. **Order:** All participants completed 48dp condition first, followed by 32dp to maintain consistent baseline.

RESULTS

2,076 ms	2,331 ms	2,918 ms	12.3% Increase	300% Increase
Avg. time @ 48dp target	Avg. time @ 32dp target	Avg. time @ 24dp target	Total time: 48dp vs 32dp targets	Misclicks: 48dp vs 32dp targets

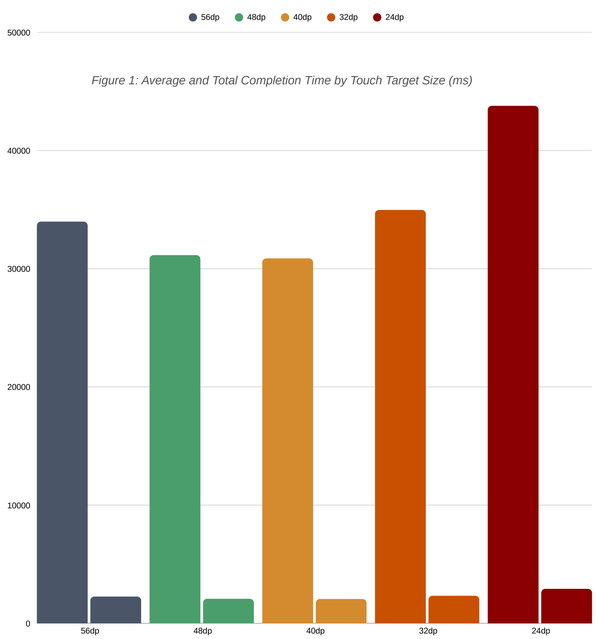

Figure 1: Average and Total Completion Time by Touch Target Size (ms)

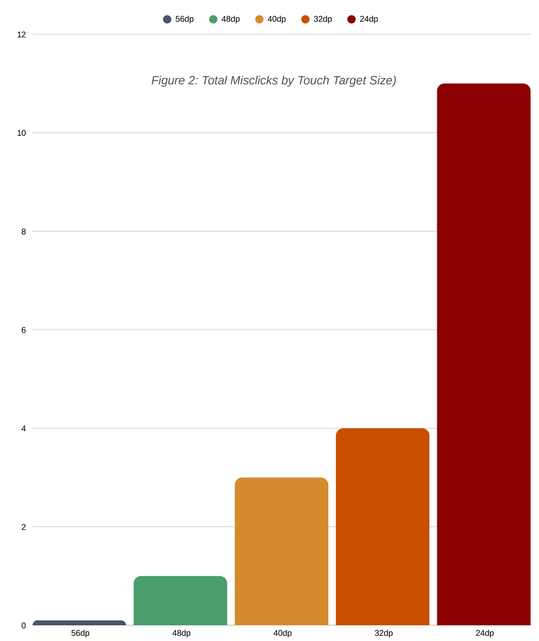

Figure 2: Total Misclicks by Touch Target Size)

CONCLUSION

- **Design:** Within-subject experiment comparing 48dp vs 32dp touch targets on Android (Android Studio, Nahwal version).
- **Average completion time** was 11% faster at 48dp (2,076ms) vs 32dp (2,331ms), demonstrating measurable usability gains.
- The 40dp size showed the absolute fastest average time (2,058ms), suggesting the **48dp guideline is a safe**, accessibility-inclusive minimum.
- **Misclicks increased significantly below 40dp** — especially at 24dp (11 misclicks) — indicating a clear usability threshold.
- **The 1,000% increase** in misclicks from 48dp to 24dp demonstrates that touch target size has a non-linear impact on accuracy, small reductions in size cause disproportionately large error rates.
- The results validate Google's **48dp guideline as a practical standard** not only did 48dp outperform smaller sizes, but going larger (56dp) showed no meaningful accuracy improvement.

FULL DATA SUMMARY

TARGET (dp)	Total (ms)	Avg (ms)	Misclicks
56	33,983	2,265	0
48	31,148	2,076	1
40	30,873	2,058	3
32	34,969	2,331	4
24	43,778	2,918	11

LIMITATIONS IN TESTING

- **Order bias** — all participants completed 48dp before 32dp, so fatigue or learning effects may have influenced the 32dp results
- **Limited demographics** — no data collected on age, hand size, or motor ability, all of which directly affect touch accuracy
- **Only 3 UI controls tested** — button, toggle, and radio button may not represent all interaction patterns in real Android apps