Scroll, Tilt or Move It

Using Mobile Phones to Continuously Control Pointers on Large Public Displays

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motivation
motivation
How can we use mobile phones as pointing device?
related work

Ballagas, et al. (CHI 2005)

Discrete & Absolute Interaction

Boring, et al. (Mobility 2007)
Madhavapeddy, et al. (Ubicomp 2004)
related work

Jiang, et al. (CHI 2006)

Miyaoku, et al. (UIST 2004)

Continuous & Absolute Interaction

Pears, et al. (VisApp 2008)
related work

Which one is the best?

Silfverberg, et al. (GI 2001)

Vajk, et al. (Computer Games Technology 2008)

Ballagas, et al. (IEEE Pervasive Computing 2006)
relative pointing

Keypad

Sensors

Camera

Scroll

Tilt

Move
Movement Ratio: 200 px within 1 second
Tilt Down
Tilt Up
Tilt to Left
Tilt to Right
No Tilt

**Speed:** dependent on tilting angle
Speed: dependent on phone movement
Select Targets on a Remote Display
Click Start Button

Move to Target

Hover on Target
target sizes

24 px  48 px  72 px
target distances

336 px

96 px
target directions

Linear

Diagonal
<table>
<thead>
<tr>
<th><strong>Screen Size:</strong></th>
<th>50” (16:9)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>1106 x 622 mm</td>
</tr>
<tr>
<td><strong>Resolution:</strong></td>
<td>1366 x 768 pixels</td>
</tr>
<tr>
<td><strong>Viewer Distance:</strong></td>
<td>1.5 m</td>
</tr>
</tbody>
</table>
[3 Techniques ×
3 Target Sizes ×
2 Target Distances ×
8 Target Directions] = 144 combinations

3 Repetitions for each combination
→432 data points per participant

12 participants in our study
H1: Move performs better than Tilt for all sizes, directions and distances

H2: Move performs better than Scroll for larger targets and high distances

H3: Move and Tilt have higher error rates than Scroll for small targets (regardless of the target’s distance)
results: task time

![Graph showing median selection time (in ms) vs target sizes (in px). The graph compares different methods: Tilt, Move, and Scroll. The data is presented for different target sizes: 24, 48, and 72. The graph highlights trends and differences in median selection times.]
results: task time
results: error rates

Mean Error Rate (in %)

Target Size (in pixels)

Long Short
Tilt Move Scroll
results: error rates

Mean Error Rate (in %)

Target Size (in pixels)
overshooting effect

Tilt:

Move:

Scroll:

Placement: NW, Distance: 336 pixels
All hypotheses were supported!

Move and Tilt both suffered from slight phone movement during selection

Tilt introduced “skill” component

Fatigue was highest for Move!
conclusions

Three relative pointing techniques: Scroll, Tilt and Move

Tilt and Move are faster but introduce several errors $\rightarrow$ need to be improved

Overshooting effect needs to be addressed to decrease error rates!
future steps

**Improve** the techniques: Use snapping to prevent overshooting.

Use the winning candidate to compare **personal versus public** control placements.
acknowledgments

People:
Otmar Hilliges, Bettina Conradi, Dominikus Baur and all OzCHI reviewers

Funding:
DFG, Ubi Program and the participating companies, GETA, TES and the German state of Bavaria
Questions?

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