

Scroll, Tilt or Move It

Using Mobile Phones to Continuously Control
Pointers on Large Public Displays

Sebastian Boring¹, Marko Jurmu², Andreas Butz¹

¹ University of Munich, Germany

² University of Oulu, Finland



Deutsche
Forschungsgemeinschaft

DFG



motivation



motivation



how to interact?

A person is shown from the side, holding a mobile phone. In the background, a large screen displays a map with a yellow square highlighting a specific location. The person appears to be using the phone to interact with the map on the screen.

How can we use **mobile phones**
as **pointing device**?

related work



Ballagas, et al. (CHI 2005)



Boring, et al. (Mobility 2007)



Madhavapeddy, et al. (UbiComp 2004)

related work



Jiang, et al. (CHI 2006)



Miyaoku, et al. (UIST 2004)



Pears, et al. (VisApp 2008)

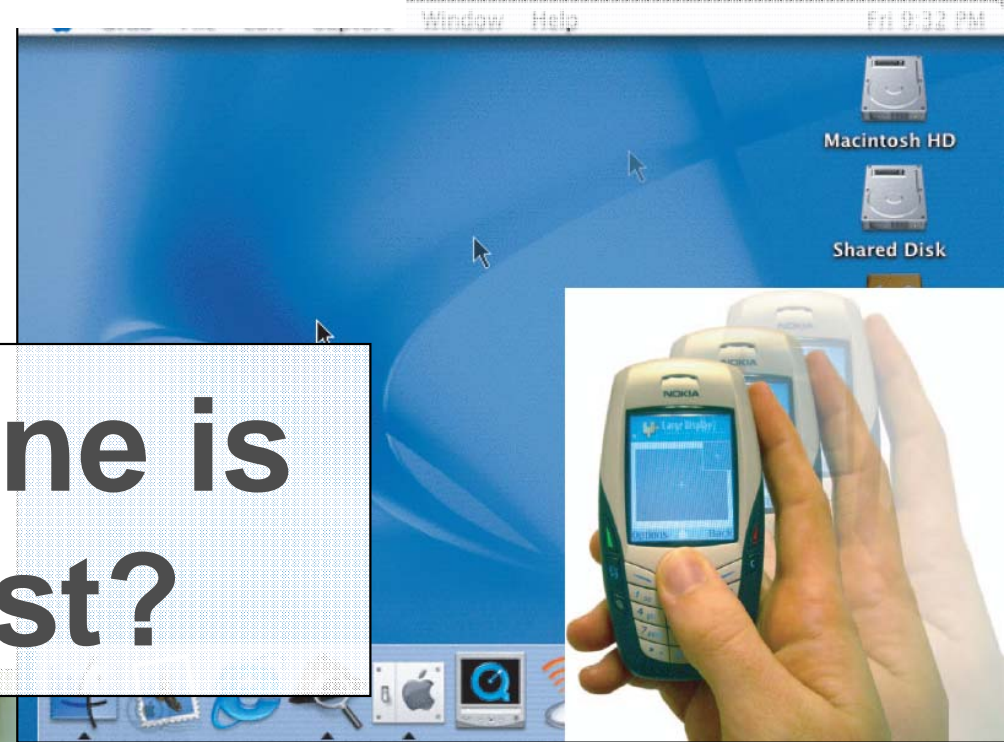
**Continuous &
Absolute
Interaction**

related work



Silfverberg, et al.
(GI 2001)

**Which one is
the best?**



Ballagas, et al. (IEEE Pervasive
Computing 2006)



Vajk, et al. (Computer Games
Technology 2008)

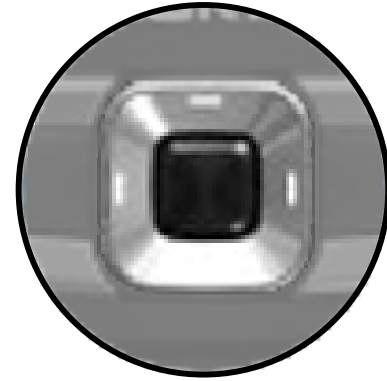
relative pointing



Keypad

Sensors

Camera



Scroll

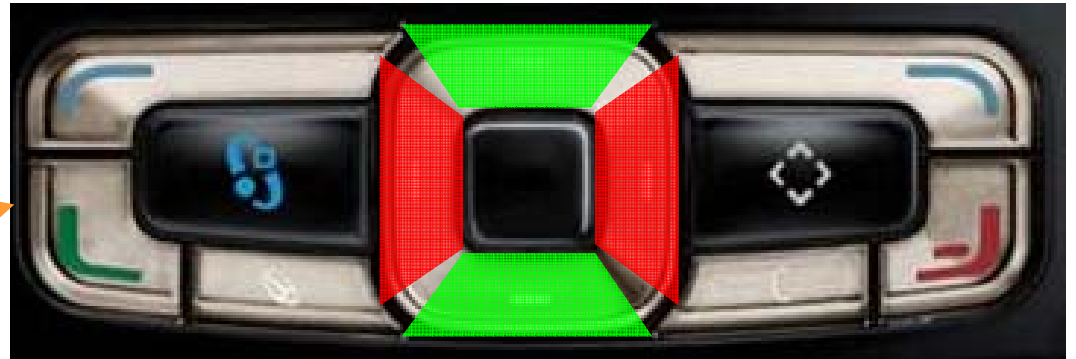
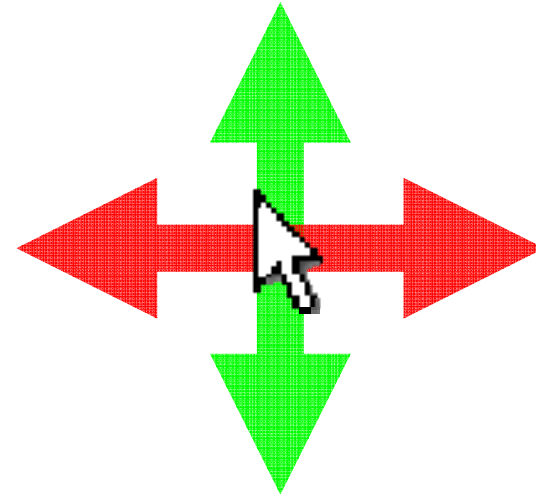


Tilt



Move

scroll



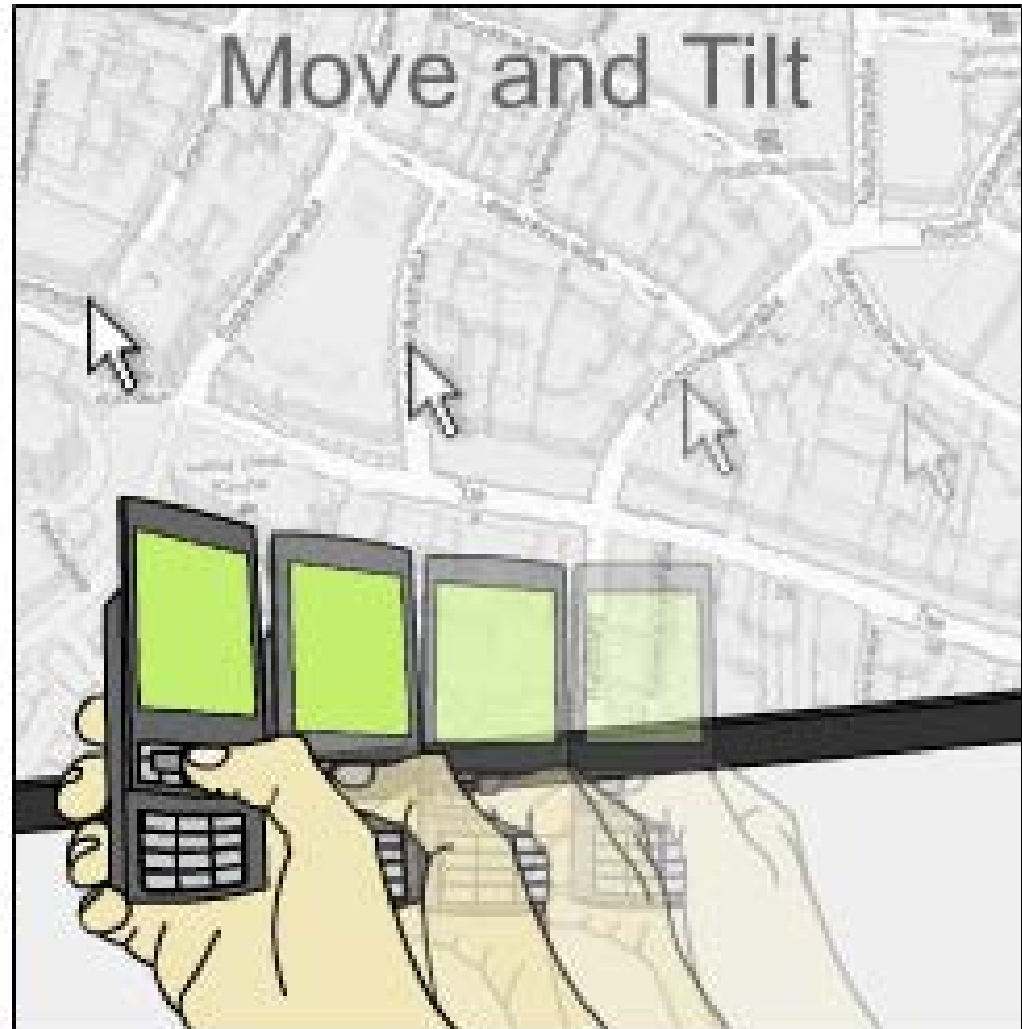
Movement Ratio: 200 px within 1 second

tilt



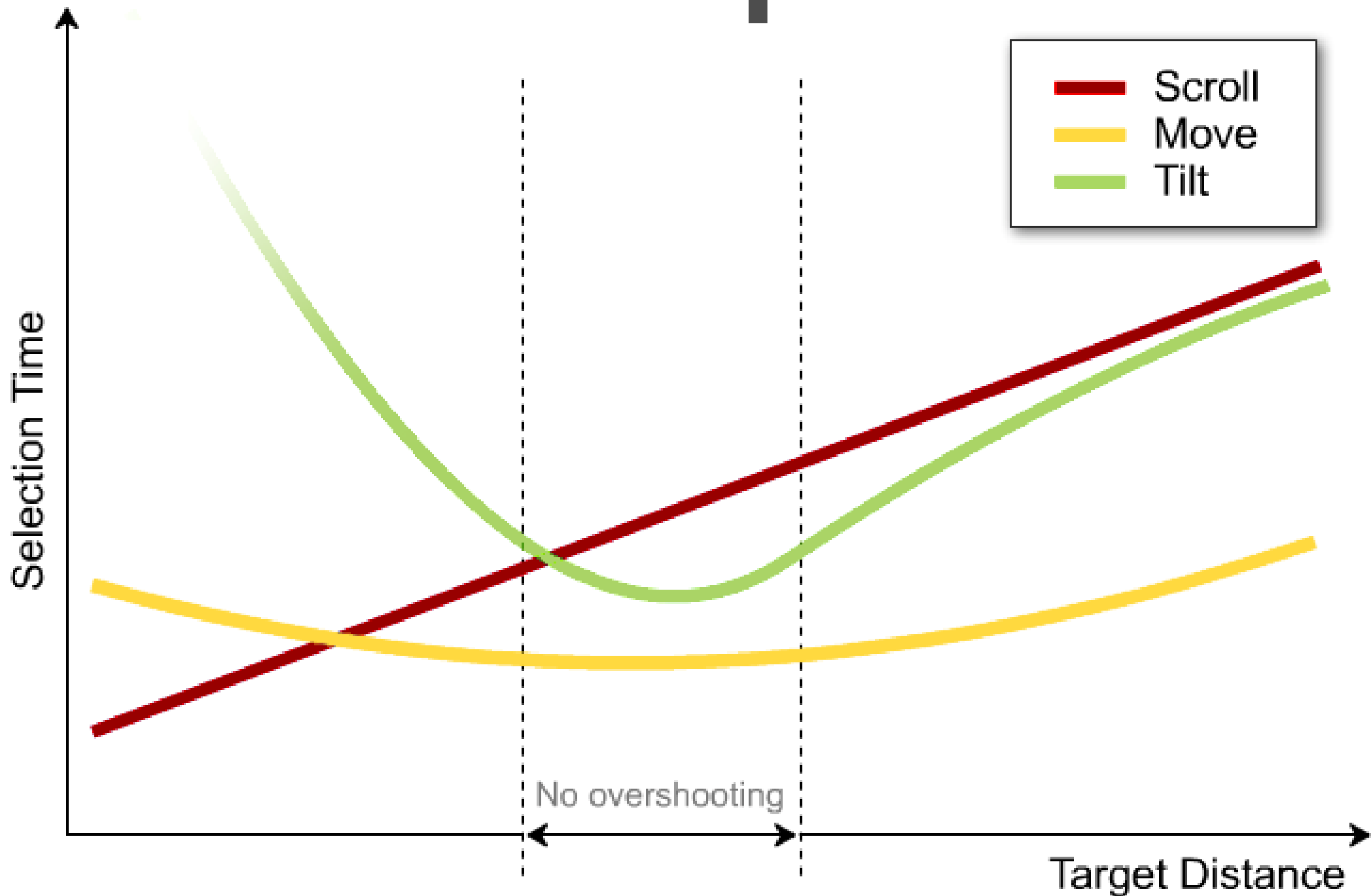
Speed: dependent on tilting angle

move



Speed: dependent on phone movement

prediction

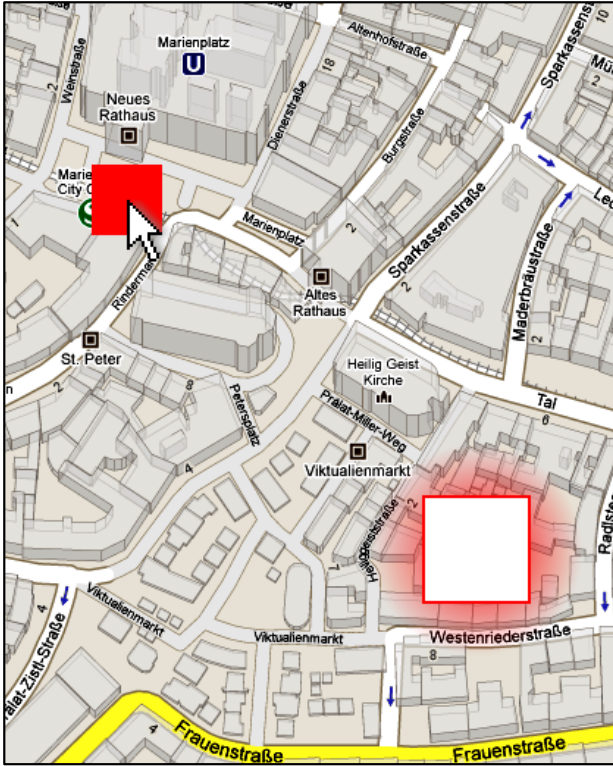


evaluation

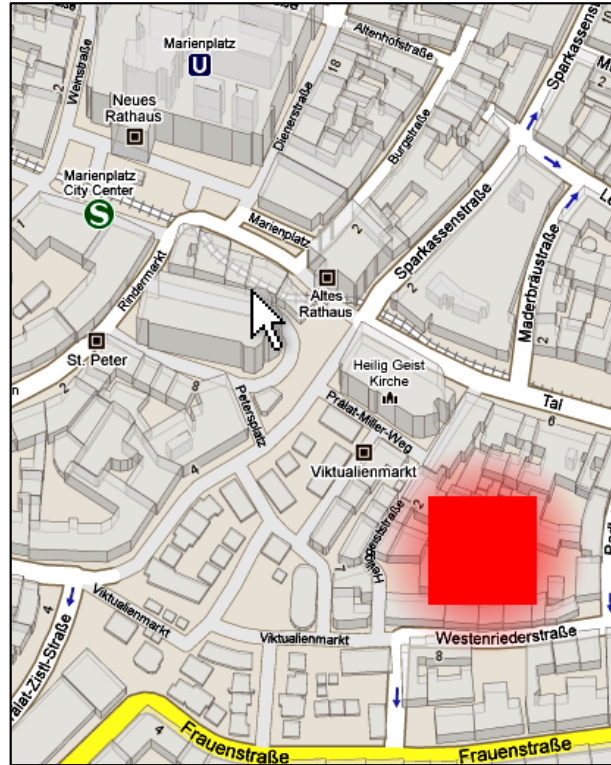
A person is seen from the side, holding a mobile phone. In the background, a large screen displays a map of a city with a yellow square highlighting a specific location. To the right, there is a poster with the word 'bioinformatics' and a photo of three people. The scene is set in a room with a wooden door and a sign that says 'wireless HÖRSÅLA'.

Select Targets on
a Remote Display

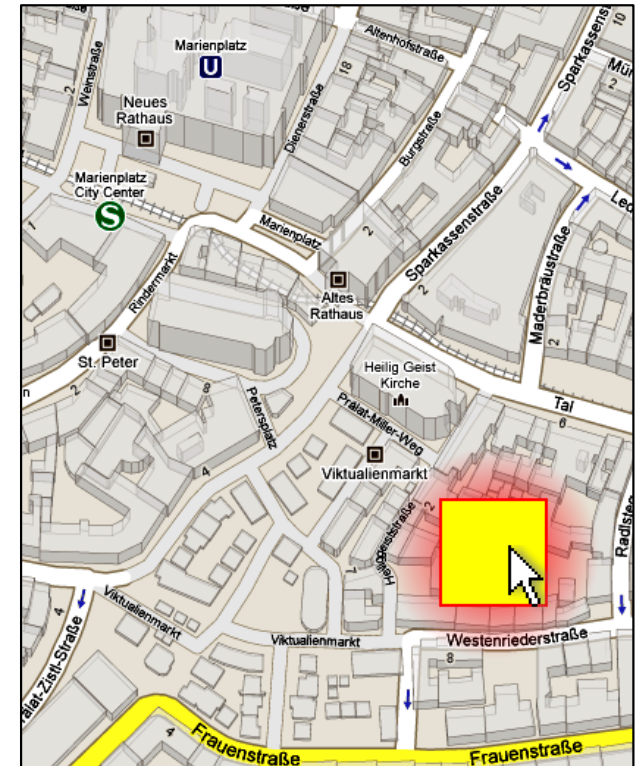
task



Click Start Button

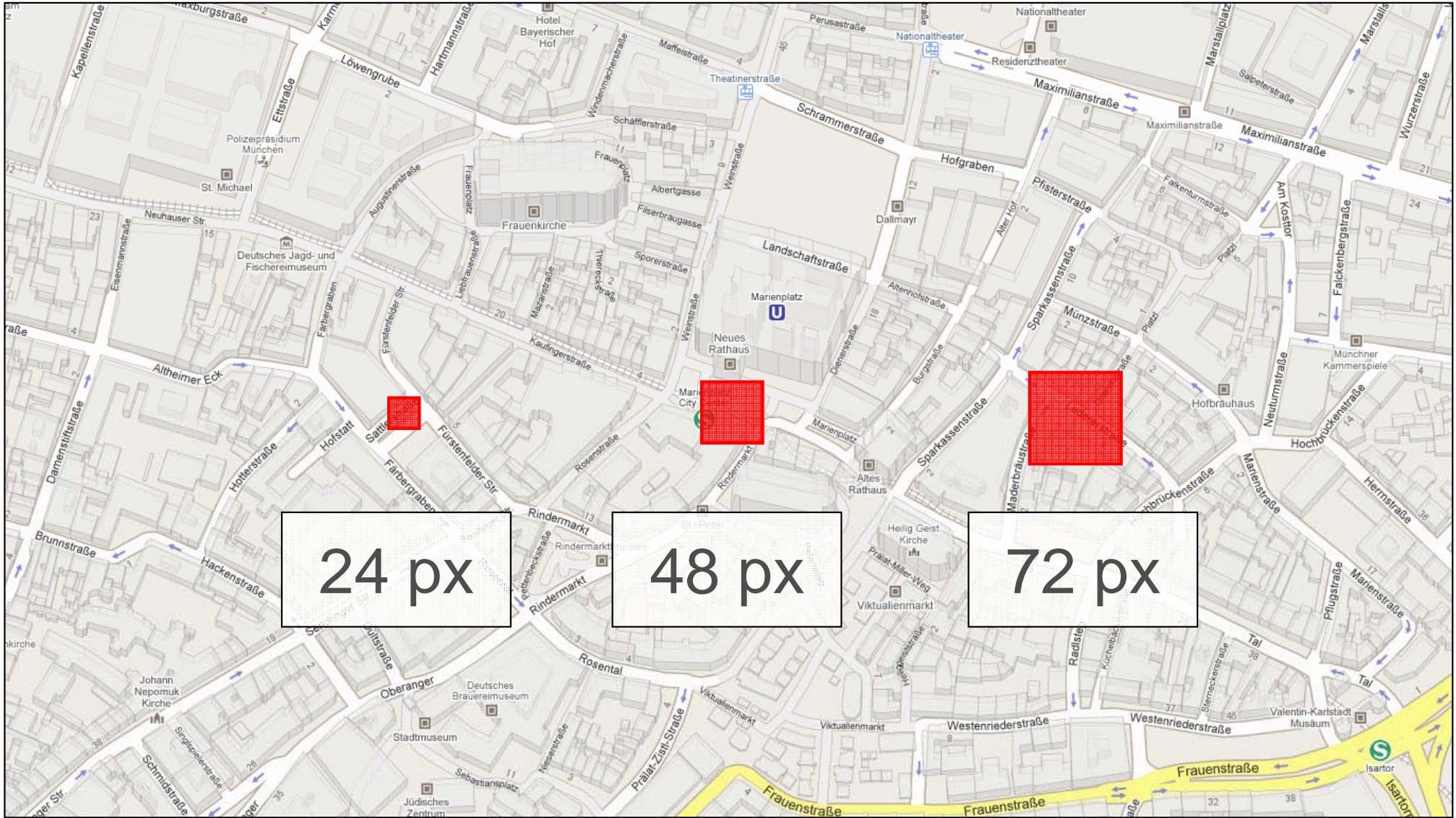


Move to Target

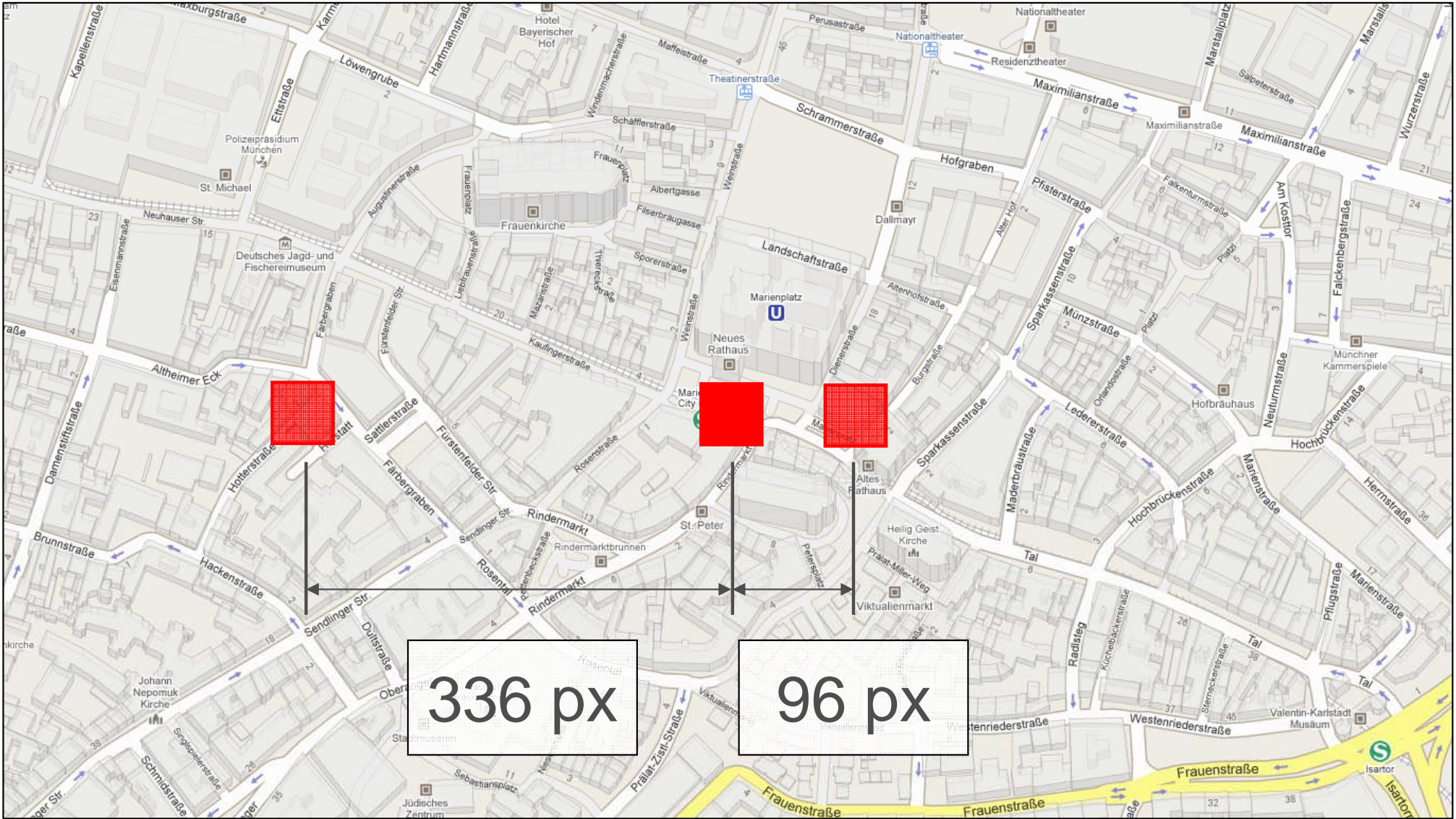


Hover on Target

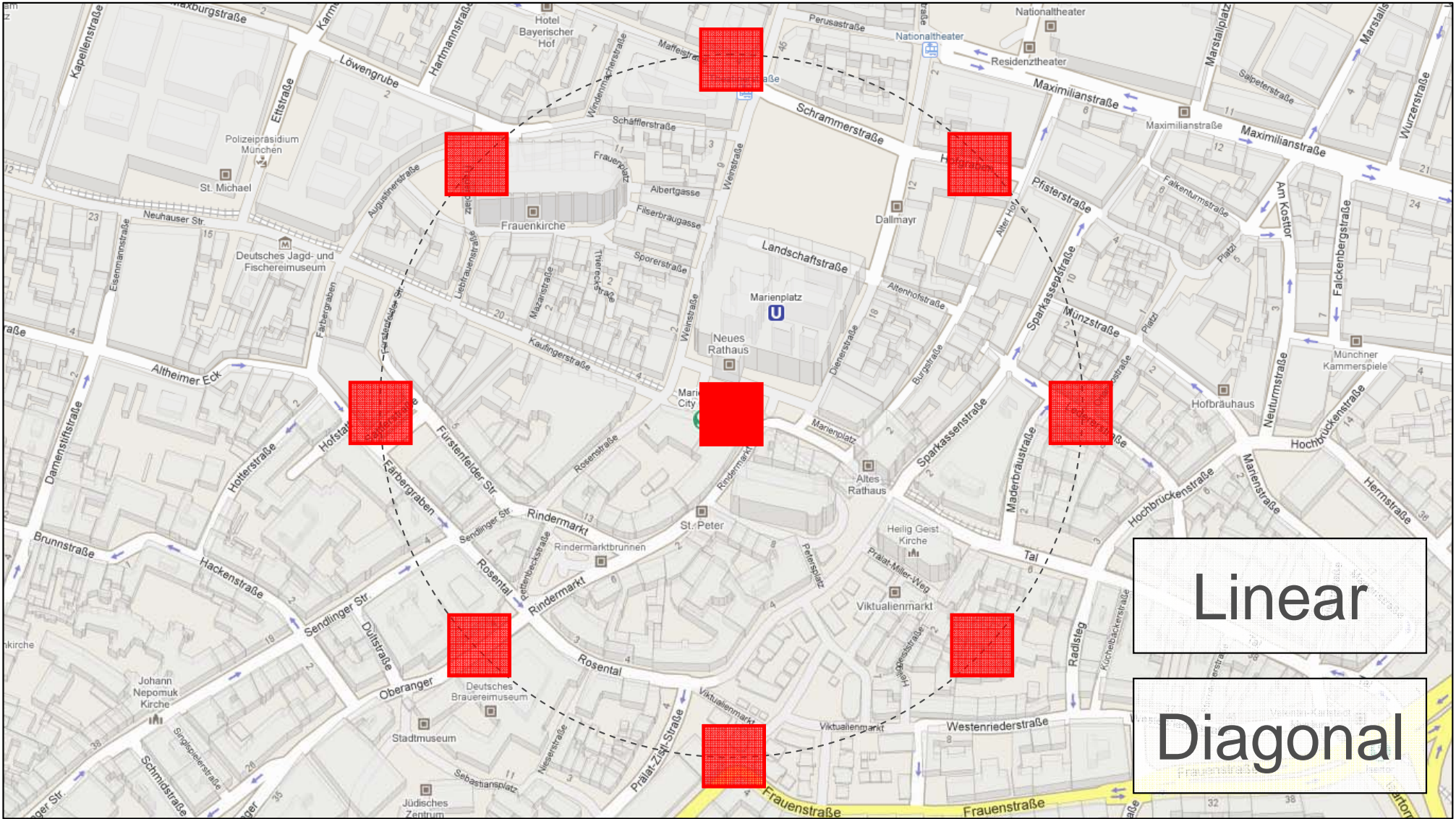
target sizes



target distances



target directions



apparatus

Screen Size: 50" (16:9)
1106 x 622 mm

Resolution 1366 x 768 pixels

Viewer Distance: 1.5 m

study design

[3 Techniques ×
3 Target Sizes ×
2 Target Distances ×
8 Target Directions] = 144 combinations

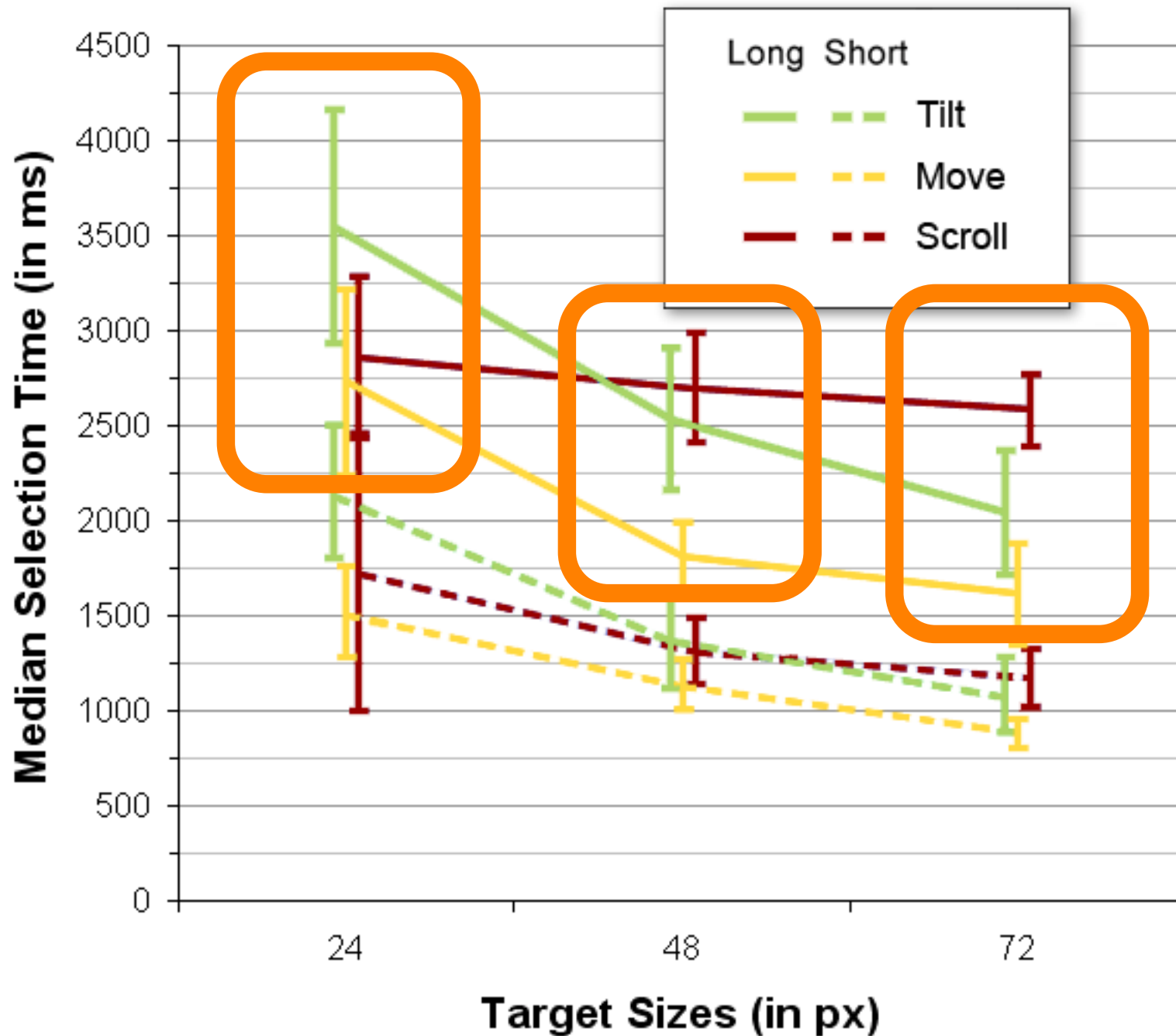
3 Repetitions for each combination
→ 432 data points per participant

12 participants in our study

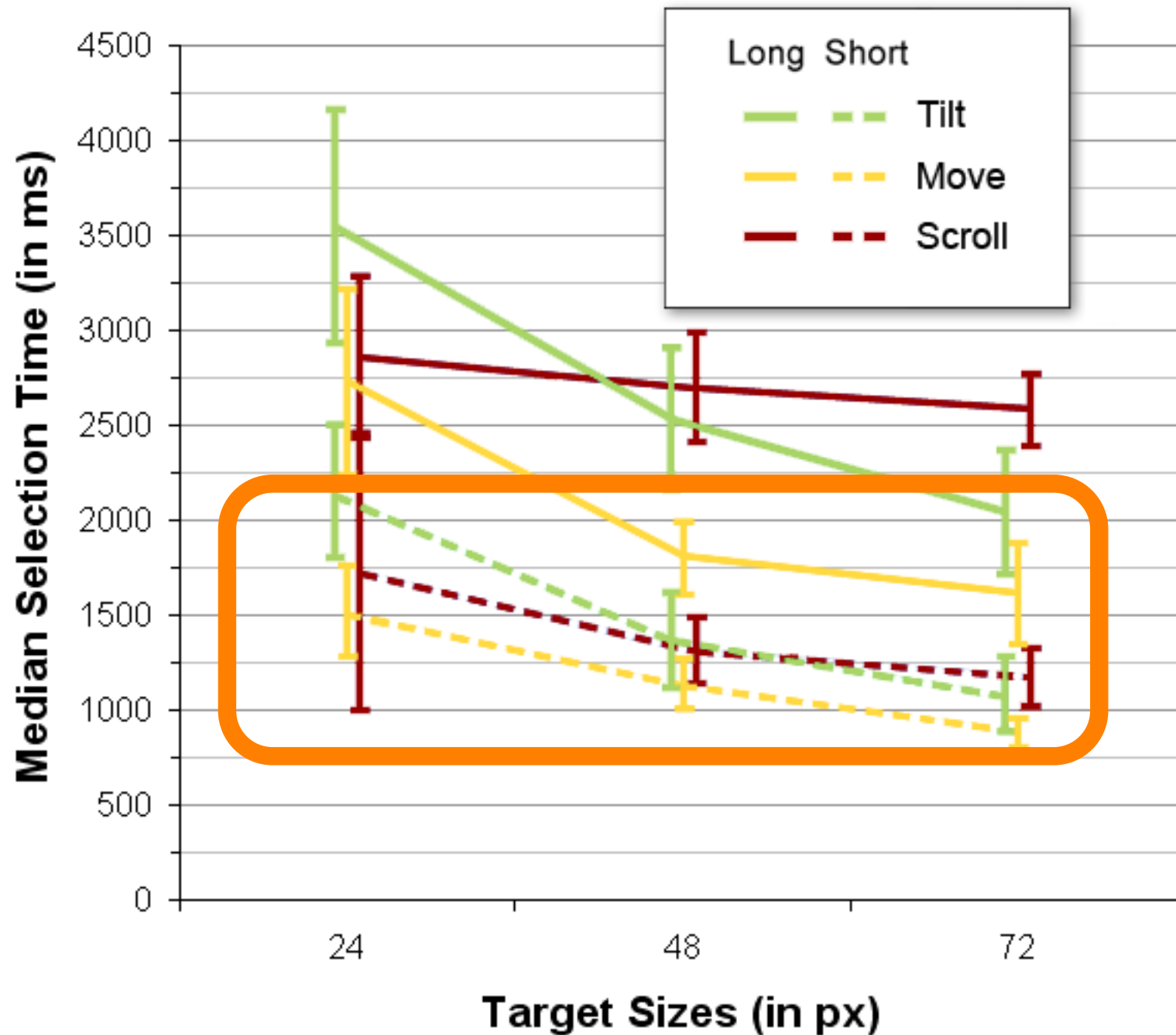
hypotheses

- 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)

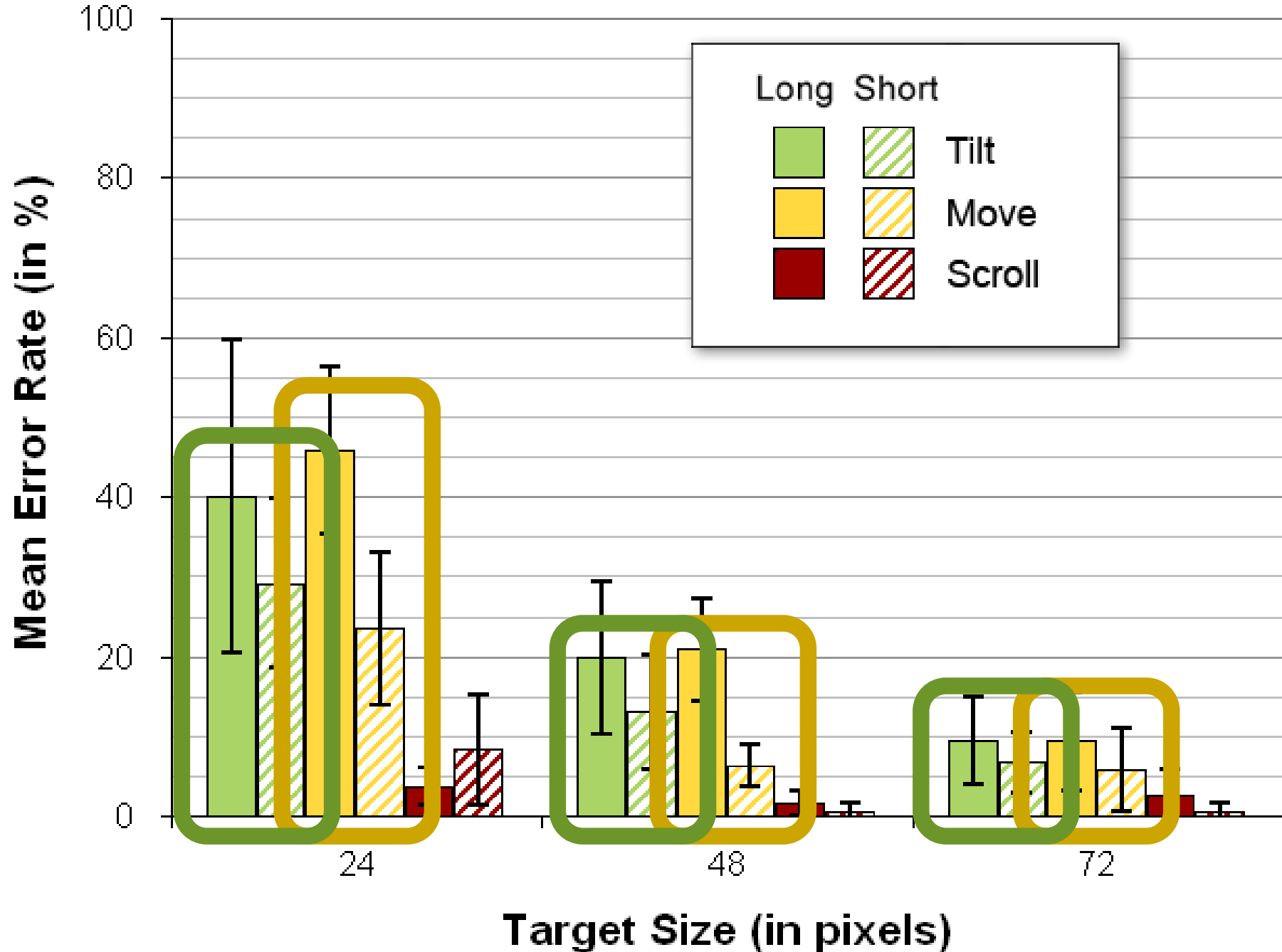
results: task time



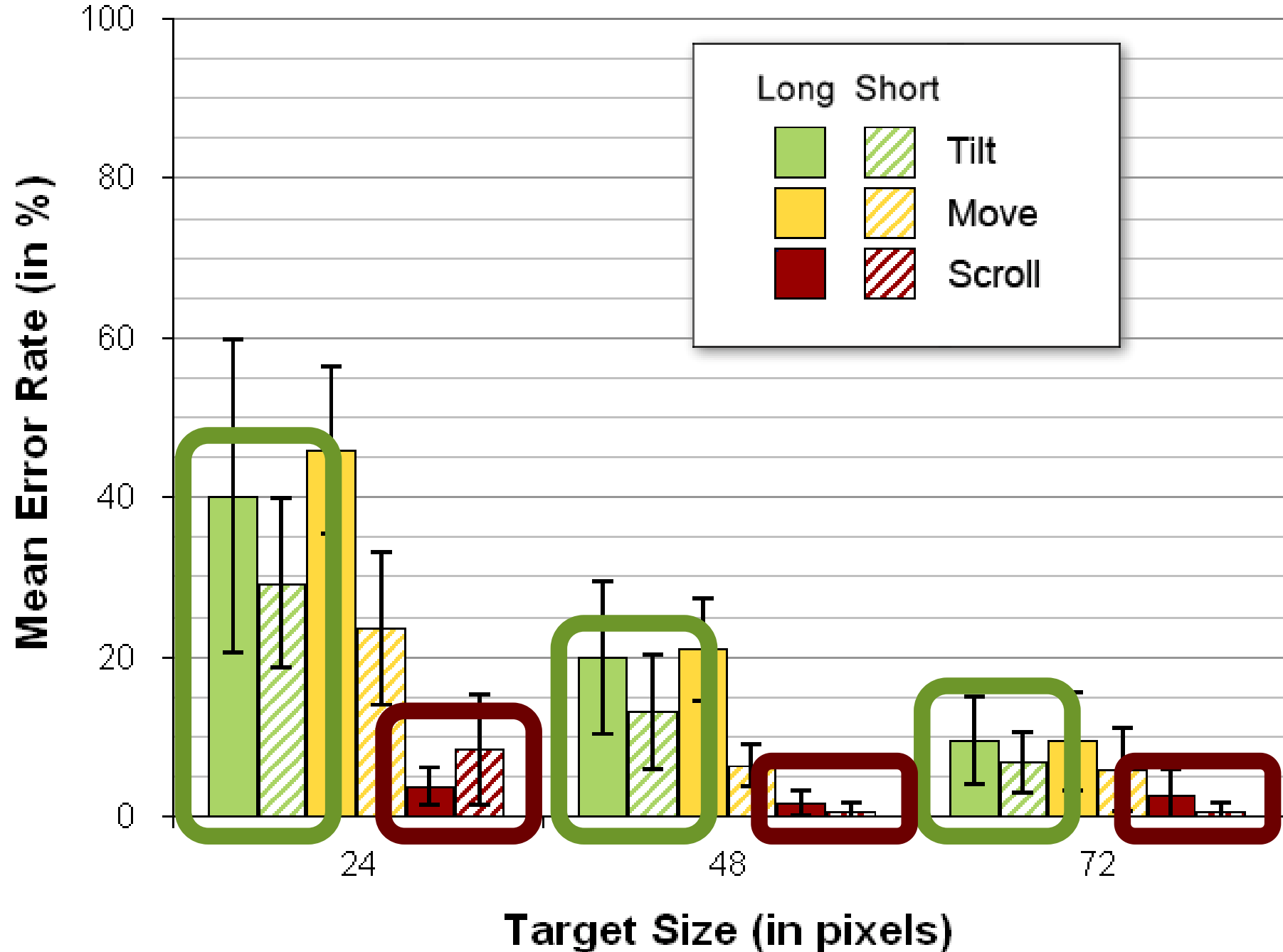
results: task time



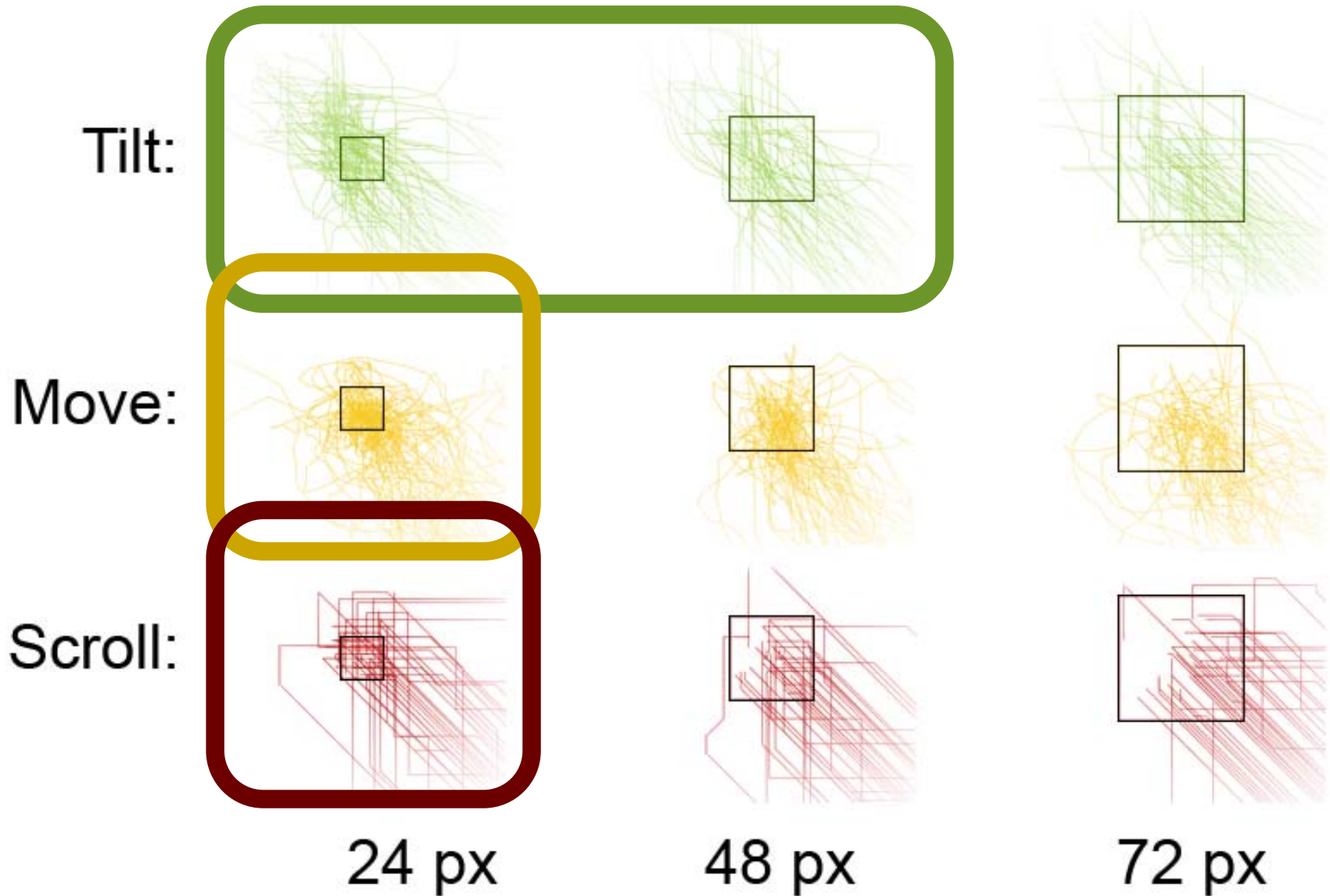
results: error rates



results: error rates



overshooting effect



Placement: NW, **Distance:** 336 pixels

discussion

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 → 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

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end

Questions?

Sebastian Boring
sebastian.boring@ifi.lmu.de