Indirect Touch Manipulation for Interaction with Stereoscopic Displays

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Indirect 3D multi-touch interaction
Comparing Indirect and Direct Touch in a Stereoscopic Interaction Task

A.L. Simeone and H Gellersen, 3D User Interfaces 2015
4DOF docking task

- Three Techniques
  - **DS3** (Depth-Separated Screen Space)
  - Martinet et al. 2012
4DOF docking task

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  - **DS3** (Depth-Separated Screen Space)  
    Martinet et al. 2012
  - **Triangle Cursor**  
    Strothoff et al. 2011
4DOF docking task

• Three Techniques
  • **DS3** (Depth-Separated Screen Space)  
    Martinet et al. 2012
  • **Triangle Cursor**  
    Strothoff et al. 2011
  • **Indirect4**
Indirect4 - 4 DOF manipulation
Indirect4

\[ T_{z+} \quad R_{y-} \quad T_{z-} \quad R_{y+} \quad T_{x-} \quad T_{x+} \quad T_{y+} \quad T_{y-} \]
First Study

• Goals
  • Performance evaluation
**First Study**

- **Goals**
  - Performance evaluation
  - Quality of the interaction experience
    - Vision-related symptoms
    - Fatigue
    - Focus
    - Manipulation
Results

- Both techniques were faster than the **Triangle Cursor**
Results

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- The performance of Indirect4 was comparable to DS3
Results

- Both techniques were faster than the Triangle Cursor.
- The performance of Indirect4 was comparable to DS3.
- Indirect4 provided a better quality of vision and was less fatiguing.
What we learned...

- Absolute mappings
  - Indirect selection was problematic
What we learned...

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  - Indirect selection was problematic
- Integrated rotation
What we learned...

• Absolute mappings
  • Indirect selection was problematic
• Integrated rotation
• The Triangle Cursor might be more suited to top-down rather than frontal interaction
Indirect6 - 6 DOF manipulation
Indirect6 - 6 DOF manipulation
Indirect6

$T_{z+}$ $T_{z-}$ $R_y$ $R_z$ $T_X^+$ $T_X^-$ $T_y^+$ $T_y^-$ $R_x$
Results

- **DS3** was faster overall
Results

• DS3 was faster overall
• However, selection in DS3 and Surface6 was instantaneous
  • Whereas in Indirect6 selection took a significant amount of time
Results

- **DS3** was faster overall
- However, selection in **DS3** and **Surface6** was instantaneous
  - Whereas in **Indirect6** selection took a significant amount of time
- Net manipulation times between **DS3** and **Indirect6** were comparable
Future Directions

- Improve indirect touch selection
Future Directions

• Improve indirect touch selection
• Explore a two-stage manipulation technique
Future Directions

• Improve indirect touch selection
• Explore a two-stage manipulation technique
• Explore synergies between indirect touch and mouse/pen input
Future Directions

- Improve indirect touch selection
- Explore a two-stage manipulation technique
- Explore synergies between indirect touch and *mouse/pen* input
- Explore the indirect touch paradigm on devices with other form factors
Conclusion

- Indirect touch can turn ordinary tablets into 6DOF devices
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- It does not have to be a replacement for direct touch but an alternative
Conclusion

• Indirect touch can turn ordinary tablets into 6DOF devices
• It does not have to be a replacement for direct touch but an alternative
• Advantages that indirect has over direct touch can provide new challenges that for direct touch
  • and vice versa
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