# Exploring User Turning Perception and Comfort of the Segment Addition Redirected Walking Technique

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# Why Redirected Walking?

Many users experience Virtual Reality (VR) in their own living rooms. While virtual worlds can expand far and wide, the real-world tracking space users can walk inside is limited.
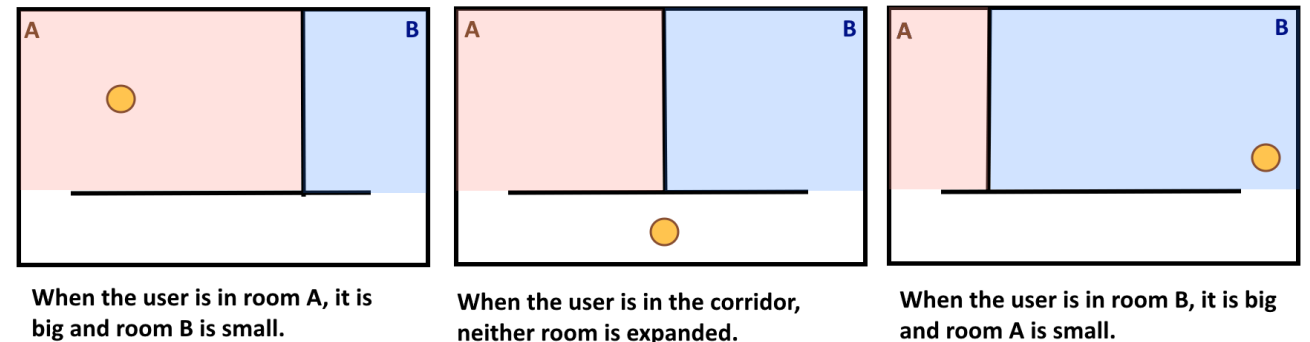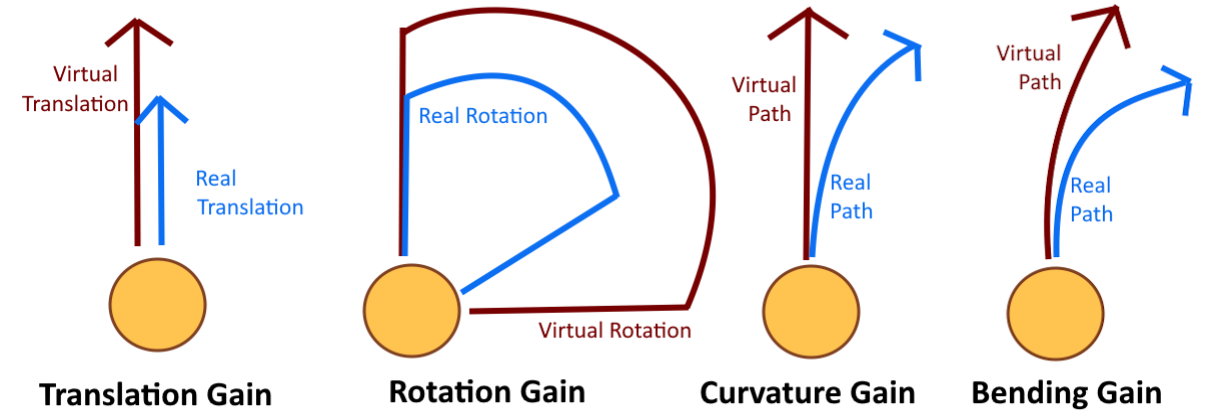
Real Walking lets users navigate naturally in VR, improving their sense of being in the virtual world and making search and navigation tasks easier.

**Redirected Walking lets the user walk in a bigger virtual space than physical space.**



Google Earth VR

# Redirected Walking Types

- Gain Manipulation – changing the virtual movements of the user compared to their physical movements.



**Translation Gain**  **Rotation Gain**  **Curvature Gain**  **Bending Gain**

- Environment Manipulation – changing the virtual environment so that virtual obstacles are in the way of the user moving outside the physical tracking space.



When the user is in room A, it is big and room B is small.

When the user is in the corridor, neither room is expanded.

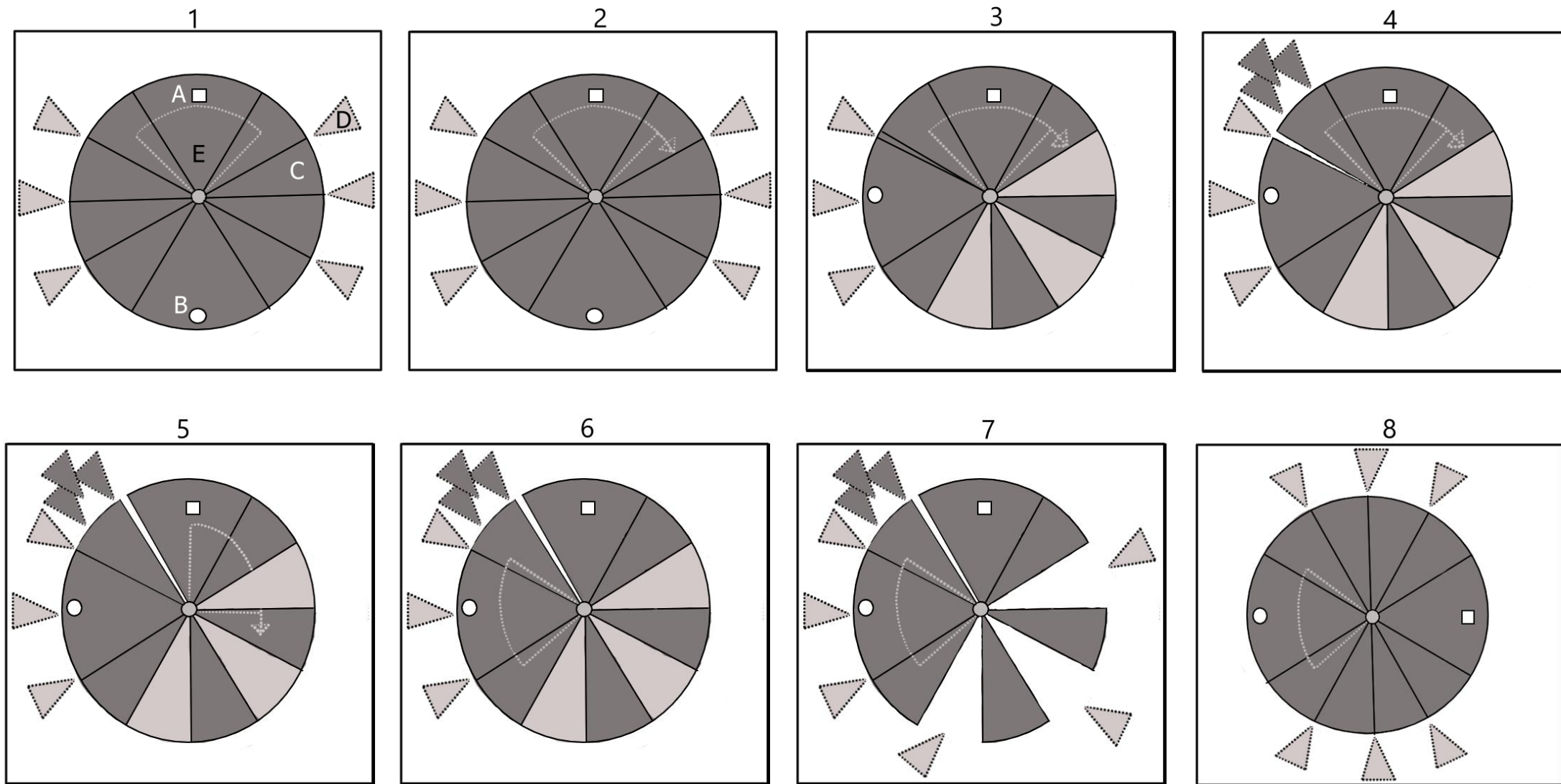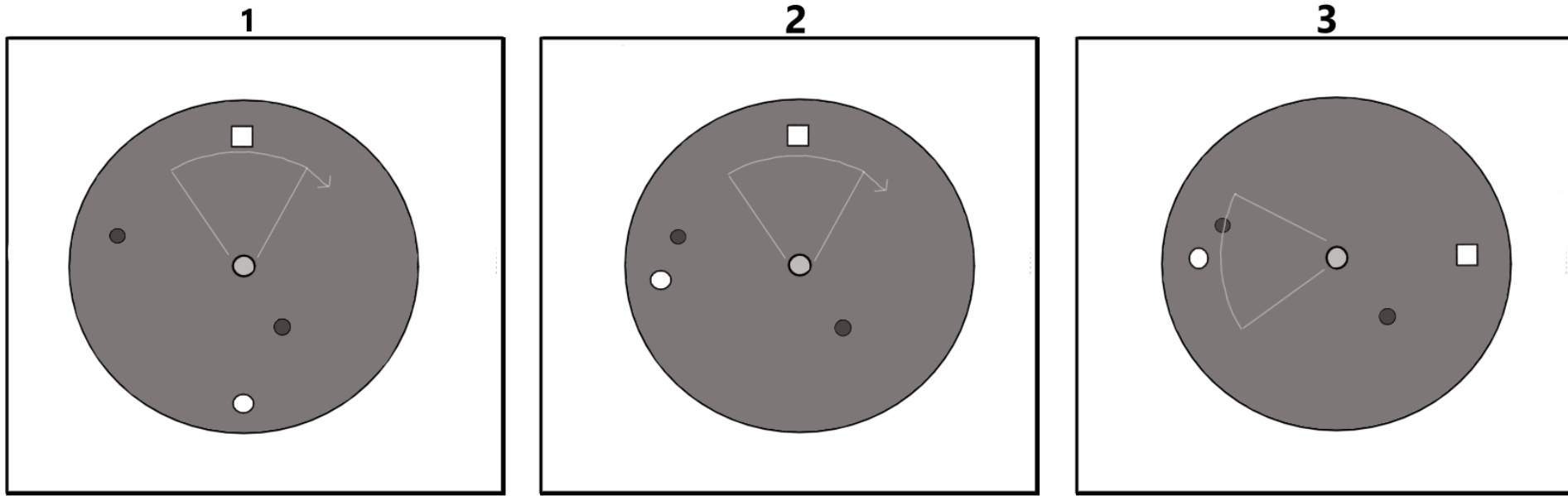When the user is in room B, it is big and room A is small.

# Segment Addition

- Uses Change Blindness, where users are less likely to notice changes to an environment when they don't see the change happening.

- New redirected walking technique that adds 'segments' to the environment outside the user's field of view.

# Segment Addition

# Moving Goalposts

- A technique was created for comparison – Moving Goalposts.

- With moving goalposts, the goals move while the rest of the environment stays the same.
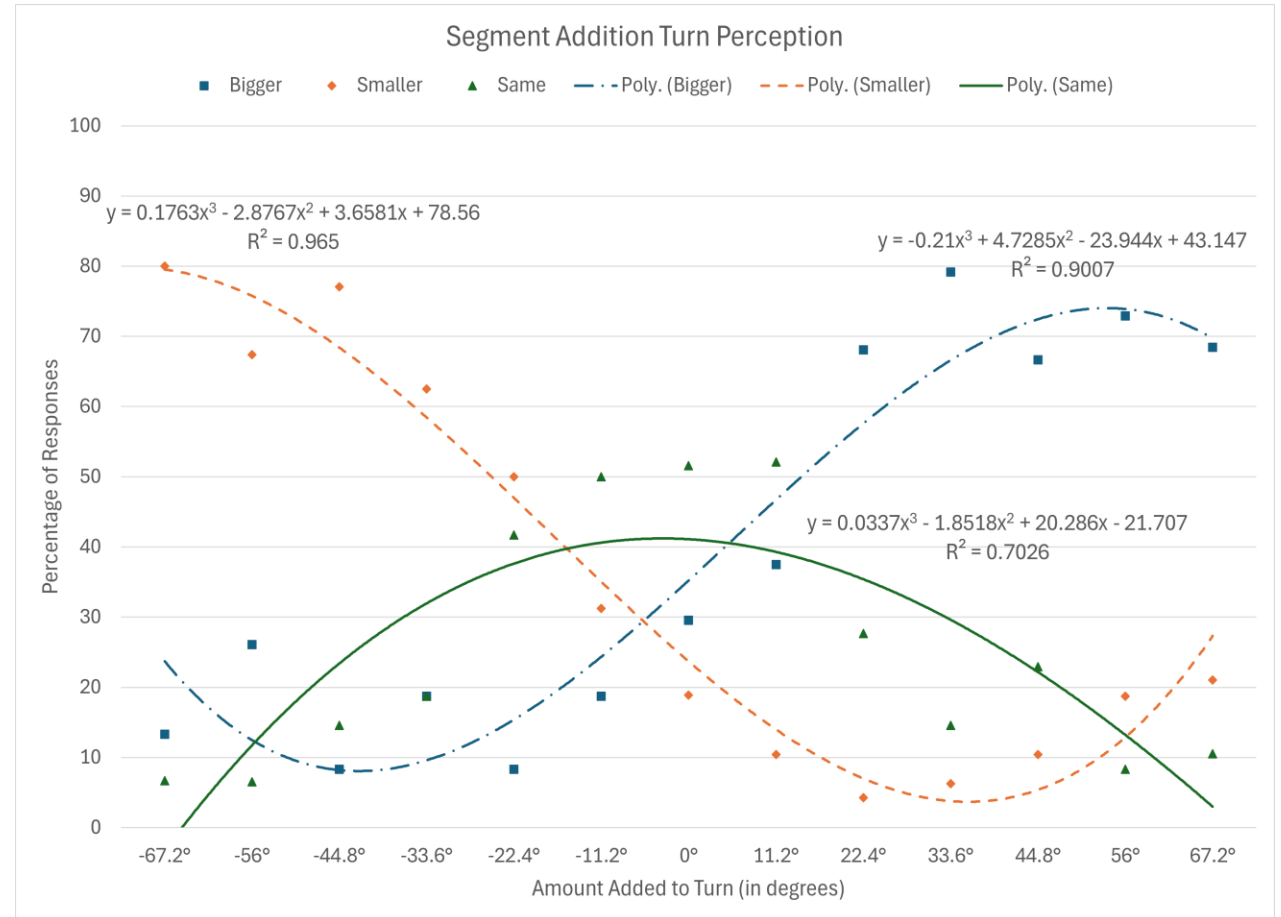
# Segment Addition – User Study



- data from 29 participants was used in the analysis.

- 14 participants saw Segment Addition first followed by Moving Goalposts.
The other 15 participants saw Moving Goalposts followed by Segment
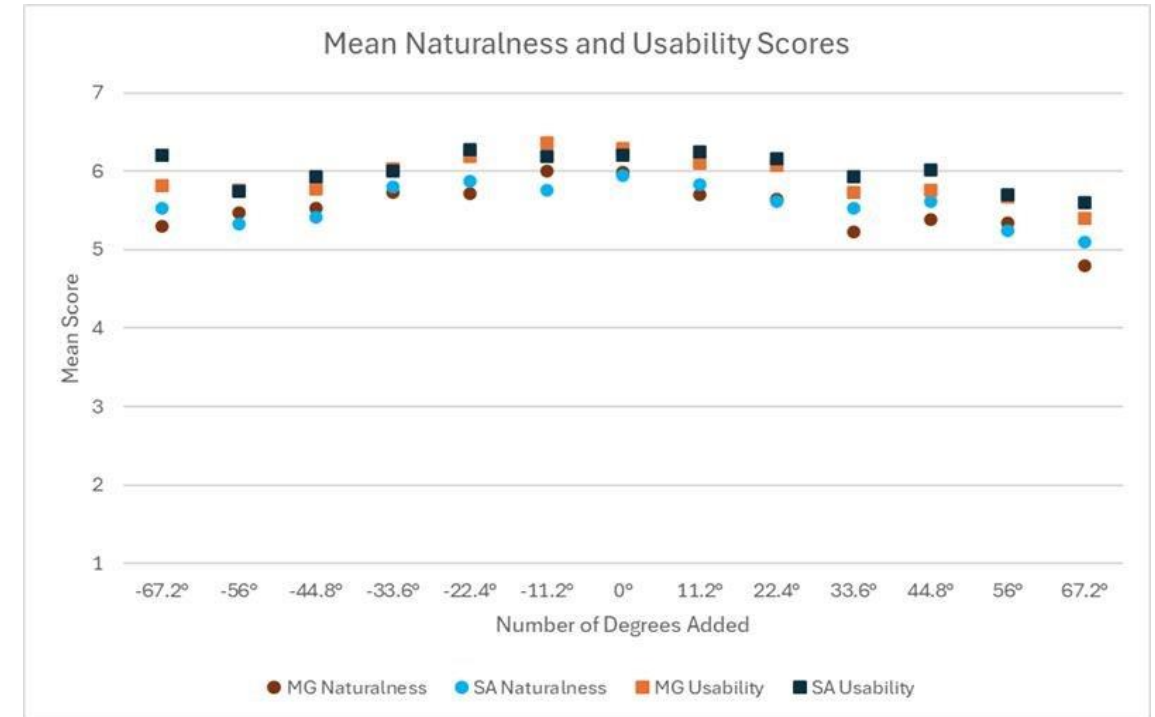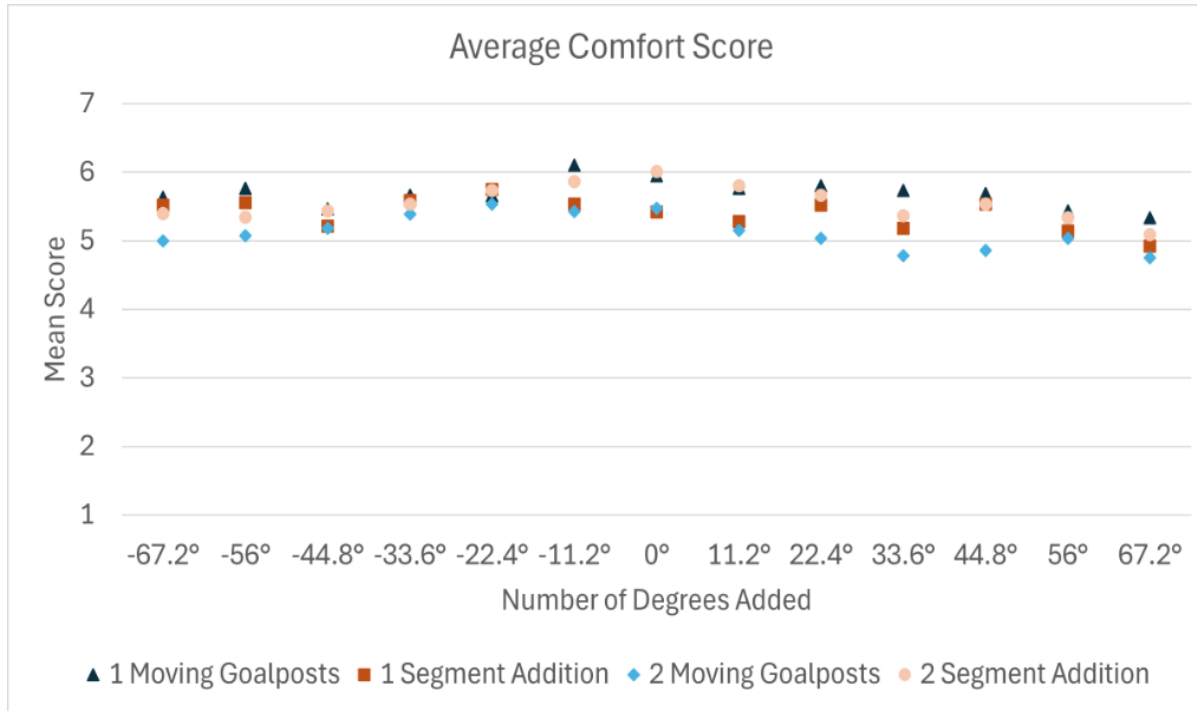Addition.

# Segment Addition - Results

Users noticed large changes in turn amount, but few could explain how the change took place.

As the turn deviated further from a half-turn, users were more likely to notice the change.



Segment Addition Turn Perception

■ Bigger  ◆ Smaller  ▲ Same  — · Poly. (Bigger)  — — Poly. (Smaller)  —— Poly. (Same)

$y = 0.1763x^3 - 2.8767x^2 + 3.6581x + 78.56$
$R^2 = 0.965$

$y = -0.21x^3 + 4.7285x^2 - 23.944x + 43.147$
$R^2 = 0.9007$

$y = 0.0337x^3 - 1.8518x^2 + 20.286x - 21.707$
$R^2 = 0.7026$

Percentage of Responses

Amount Added to Turn (in degrees)

# Segment Addition - Results



Naturalness, Comfort and Usability remained high even when large changes were made to the environment.

# Thank you for listening!

- Paper available at:

  https://dl.acm.org/doi/full/10.1145/3749012.3749065

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