

Usability Study for 360-Degree View Interfaces

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Introduction

A surveillance system typically involves monitoring multiple video feeds of cameras in an extensive area. This study focuses on the mobile system in which cameras are attached to dynamic objects such as persons, vehicles, or aircraft to provide a remote 360-degree view. The design of the view interface can be essential for effective observation. We present an experimental study to investigate the effectiveness of three designs of 360-degree view interfaces.

Where is the red barrel in relation to you?



(a) 90-degree x 4, with left, front, right, and rear



(b) 180-degree x 2, with front, and rear



(c) 360-degree x 1, panorama

Figure 1. Three 360-degree interfaces from the same viewpoint

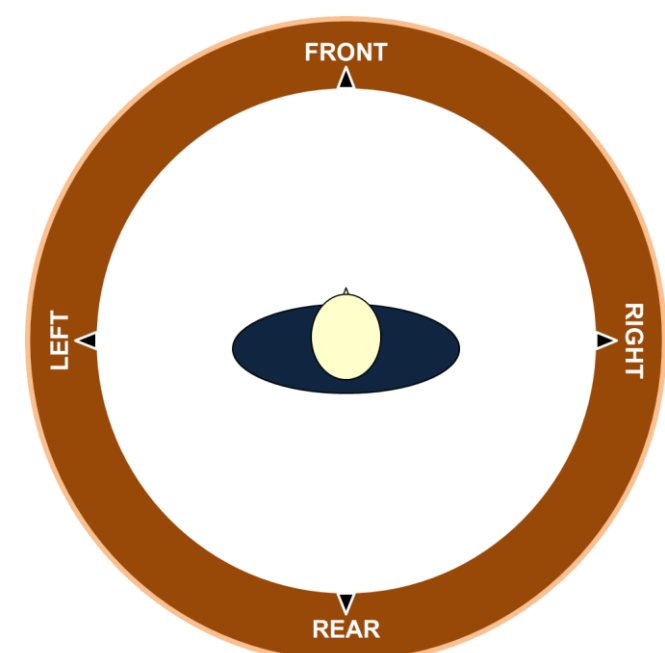


Figure 2. Compass rose, tapped to indicate a target barrel

Method

We compared three 360-degree interfaces (Figure 1) and simulated the video feeds in a virtual environment. Participants performed two spatial tasks on each interface:

- Locate 10 targets (red wooden barrels) within 10 minutes.
- Identify the relative angle of the target from their heading direction on a compass rose (Figure 2).

After locating all targets or after 10 minutes had passed, participants were asked to locate the targets on the overhead map (Figure 3).



Figure 3. Overhead map of terrain

Dependent Measures

To assess performance, we recorded these dependent measures: number of selected targets, task time, target angle, and target location on overhead map. At the end of the three interface sessions, a questionnaire was used to collect participants' satisfaction with the interfaces, and to identify if the peripheral views were perceived to be used during navigation.

Results

Our experiment was conducted with 20 participants (16 males and 4 females), age 18 or older.

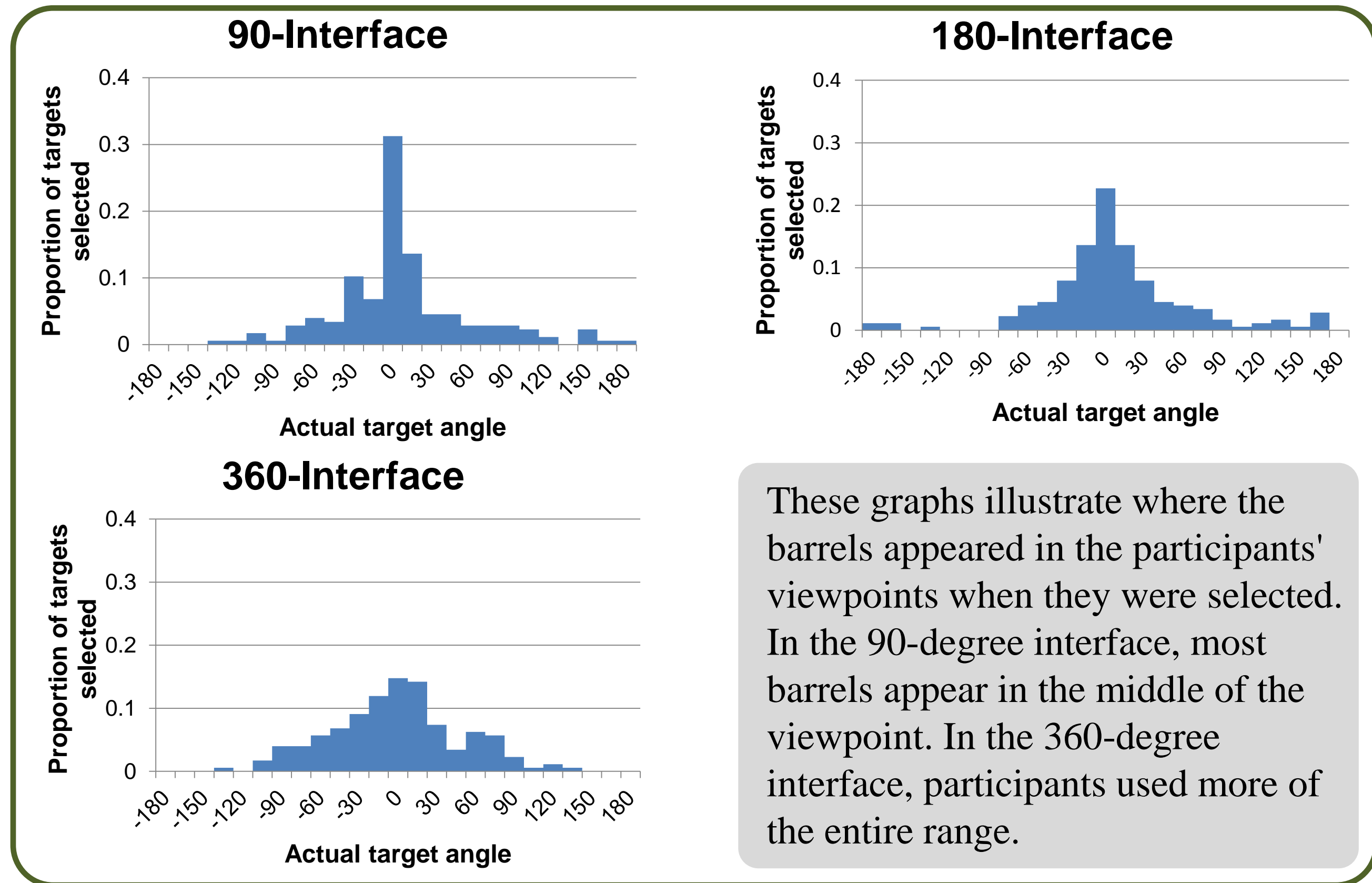


Figure 4. Frequency histograms of actual target angle vs. proportion of targets selected

These graphs illustrate where the barrels appeared in the participants' viewpoints when they were selected. In the 90-degree interface, most barrels appear in the middle of the viewpoint. In the 360-degree interface, participants used more of the entire range.

The 360-degree interface led to more errors in estimating angle on the compass rose (Figure 5). The 90-degree interface led to the fewest map errors (Figure 6).

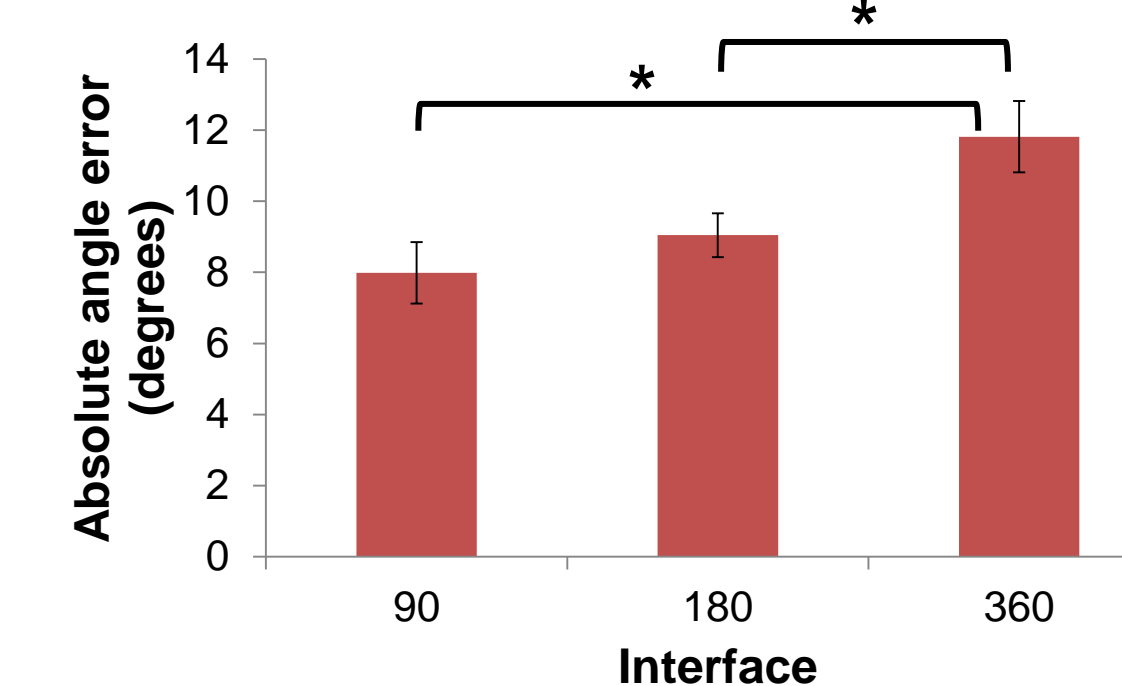


Figure 5. Average absolute angle errors

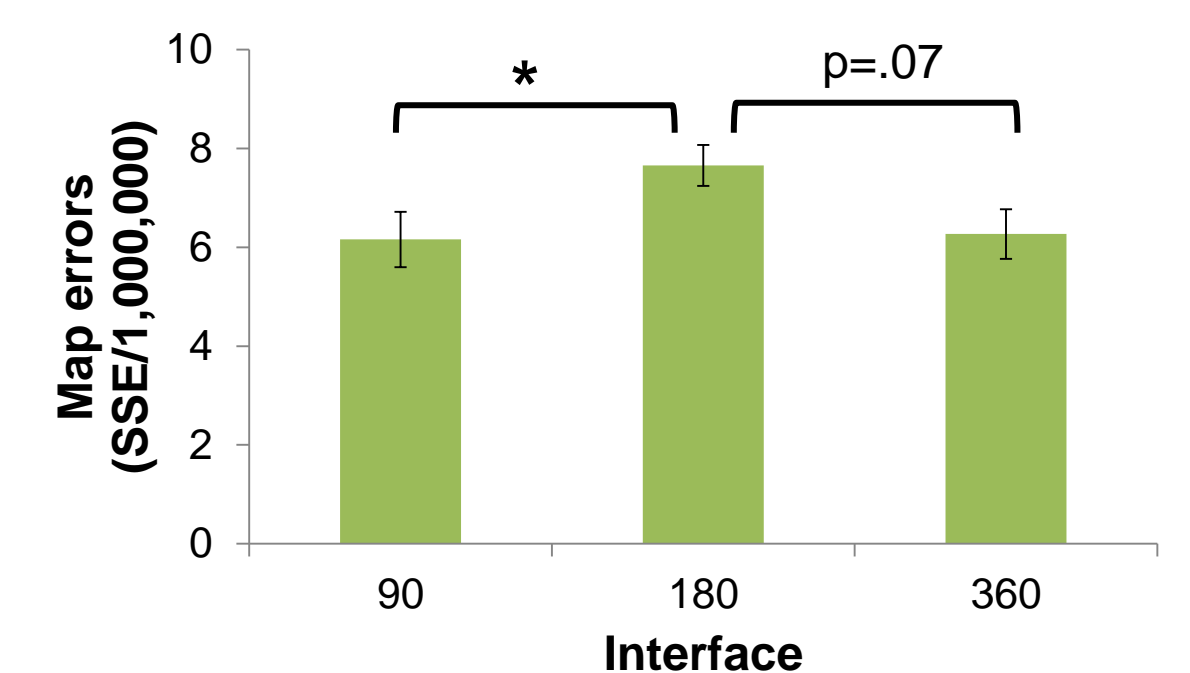


Figure 6. Average map errors

Future Work

We will extend this work to explore how the periphery is used to convey information, compare the differences between active navigation and passive viewing, and add computer vision aids to identify unusual contents in the scene.