

Estimation of Rotation Gain Thresholds for Redirected Walking Considering FOV and Gender



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DAVIDSON RESEARCH IN
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ABSTRACT

Redirection techniques allow users to explore virtual environments (VEs) larger than the tracked workspace by imperceptibly manipulating the VE according to rotation gain thresholds. Previous work has estimated these thresholds, but this study was conducted on now-outdated hardware with a 40° FOV and without considering perceptual differences between genders. We present a within-participant user study in which we estimate and compare detection threshold gains for 40° and 110° FOVs and compare thresholds between genders.

HYPOTHESES

We tested the following hypotheses :

1. Participant discrimination between rotation gains is different in a 110° FOV compared to a 40° FOV.
2. Participant discrimination between rotation gains is different for females compared to males.

METHODS

Experiment Design:

- Two experiment blocks, one with 40° FOV and one with 110° FOV.
- Users turn 90° left or right in the VE.
- Test each gain from 0.6 to 1.4 sixteen times, incremented in steps of 0.1, in randomized order.
- User reports if they think the physical rotation was smaller or greater than the virtual rotation.

CONCLUSION

- Users with 110° FOV can be rotated an additional 13% less than with a 40° FOV.
- In general, males can be rotated more than females.
- Strong correlations between thresholds and simulator sickness were found, suggesting that simulator sickness is an important factor in determining how much the VE can be manipulated.
- At the 40° FOV, female detection thresholds were strongly correlated with simulator sickness suggesting that female detection thresholds have likely been too high.

RESULTS

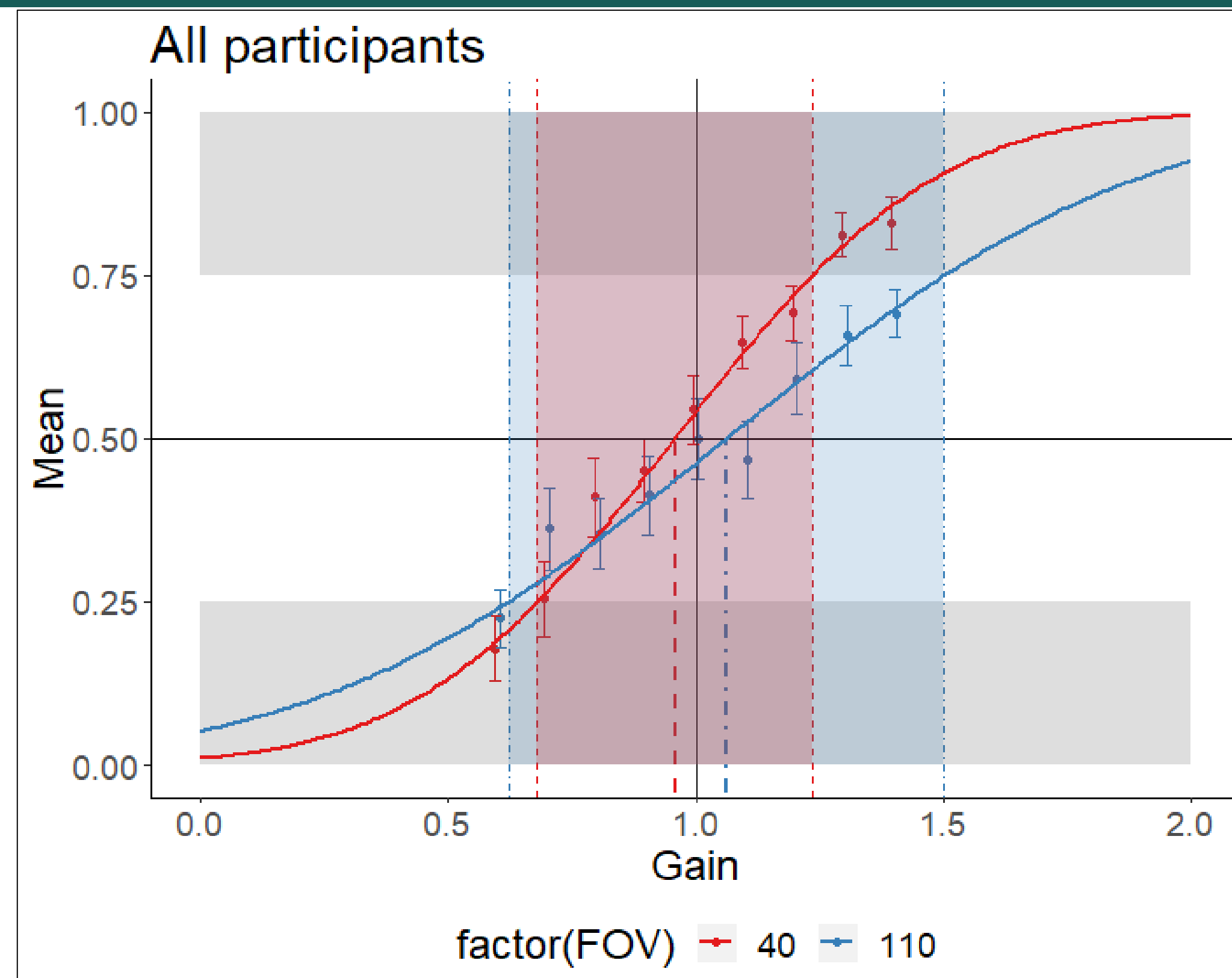


Figure 1: Threshold comparison between FOVs, pooled participant data.

Compared to a 40° FOV, a 110° FOV allows for a **33% decrease** and **61% increase** in rotations.

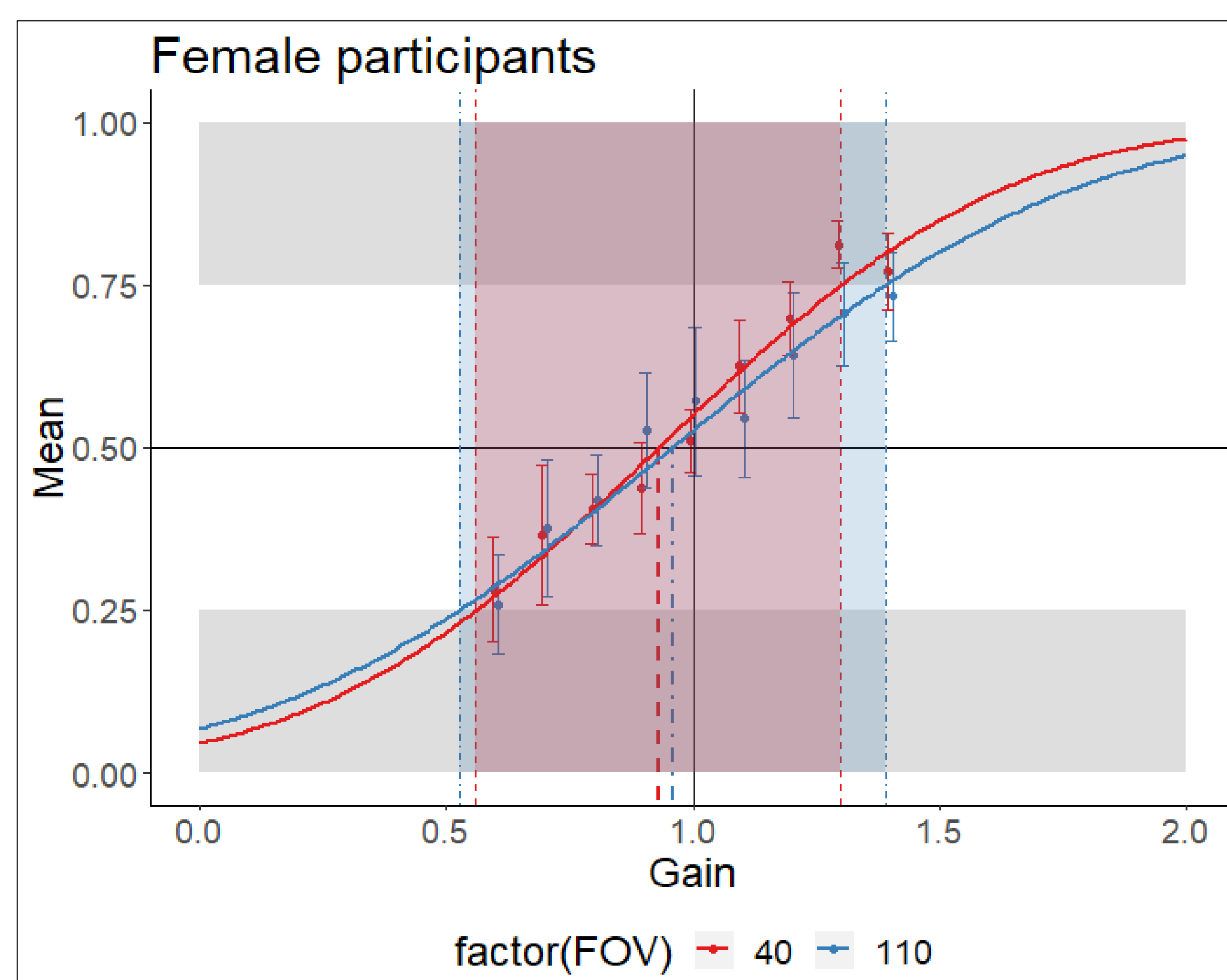


Figure 2: Threshold comparison between FOVs, female participants only.

Compared to a 40° FOV, a 110° FOV allows for a **28% decrease** and **90% increase** in rotations.

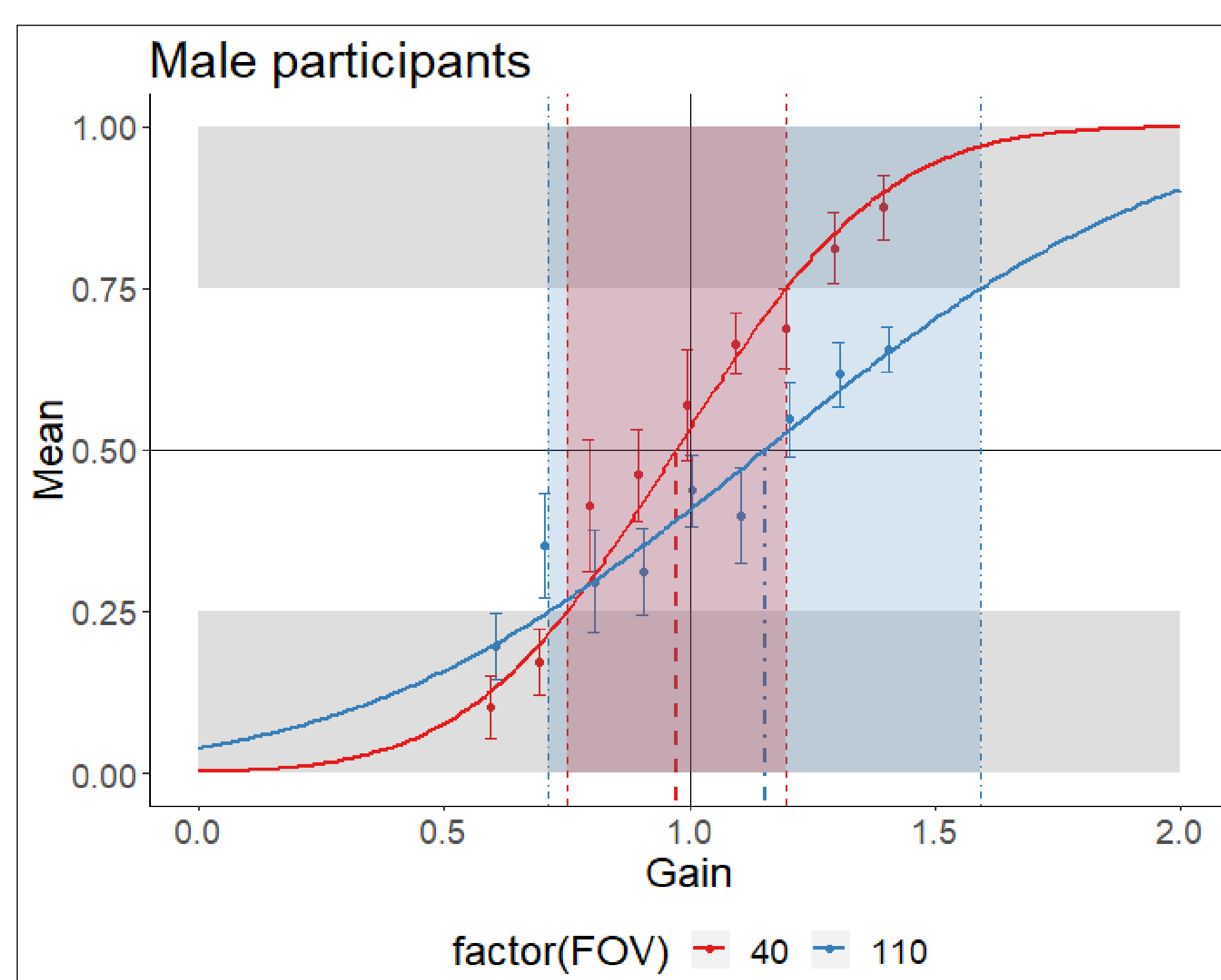


Figure 3: Threshold comparison between FOVs, male participants only.

Compared to a 40° FOV, a 110° FOV allows for a **37% decrease** and **40% increase** in rotations.



Figure 4: Comparison of 110° and 40° FOV.



Figure 5 (left): Participant wearing the VR headset.

Figure 6 (right): Image of the virtual environment.

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