Exocentric Pointing in Virtual Reality: Measuring the Intrinsic Geometry of the Visual Space

Final Presentation on my Bachelor Thesis

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Luneburg (1947)

- Theoretical analysis of the visual space
- The visual space has a hyperbolic curvature ($K < 0$)
- The curvature is constant
- Empirical evidence for theory given by many experiments

Koenderink et al. (2000)

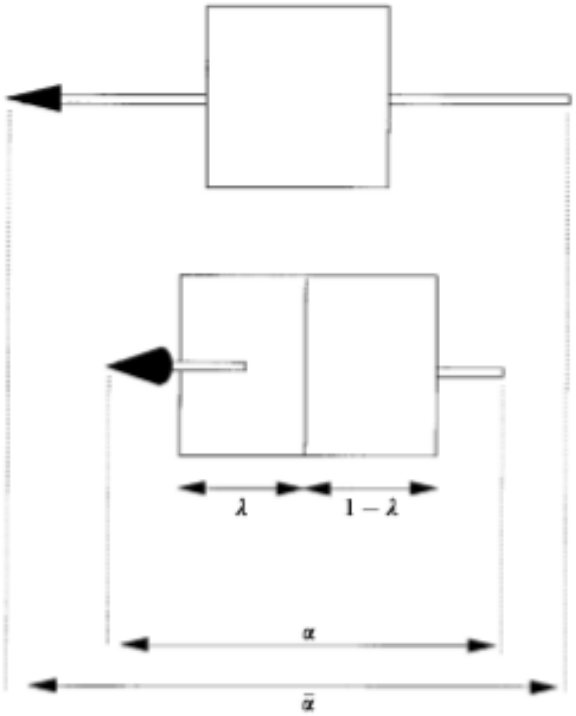

Figure 1: Schematic pointer in Koenderink et al. (2000).

- Exocentric pointing
- Natural conditions: open field, head movement
- Curvature dependent on distance $\Rightarrow$ non-constant curvature
- Elliptic in near space, hyperbolic in far space

Hypotheses

- Similar results to real life (RL) experiment
- Differences between the dark and the light condition
- Symmetry in the dark condition
- Angular deviation will depend on β

Method

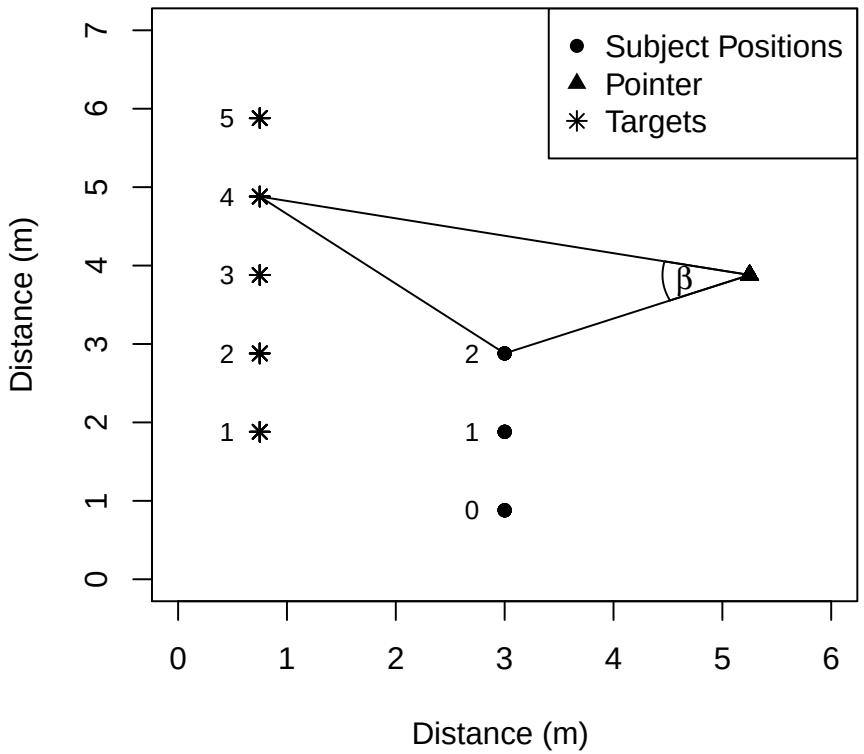

Figure 2: Schematic image of stimuli arrangement.

- Four (valid) subjects
- Additionally, one non-naïve subject for comparison with RL experiment

Method

Figure 3: Example scene, dark condition.

Method

Figure 4: Example scene, light condition.

Results and Discussion

- Measured: pointer orientation, reaction time, head orientation
- Intrinsic geometry depends on individual $\Rightarrow$ evaluation per subject
- ANOVA over: lighting, pointer position, β, subject position

Results and Discussion: β

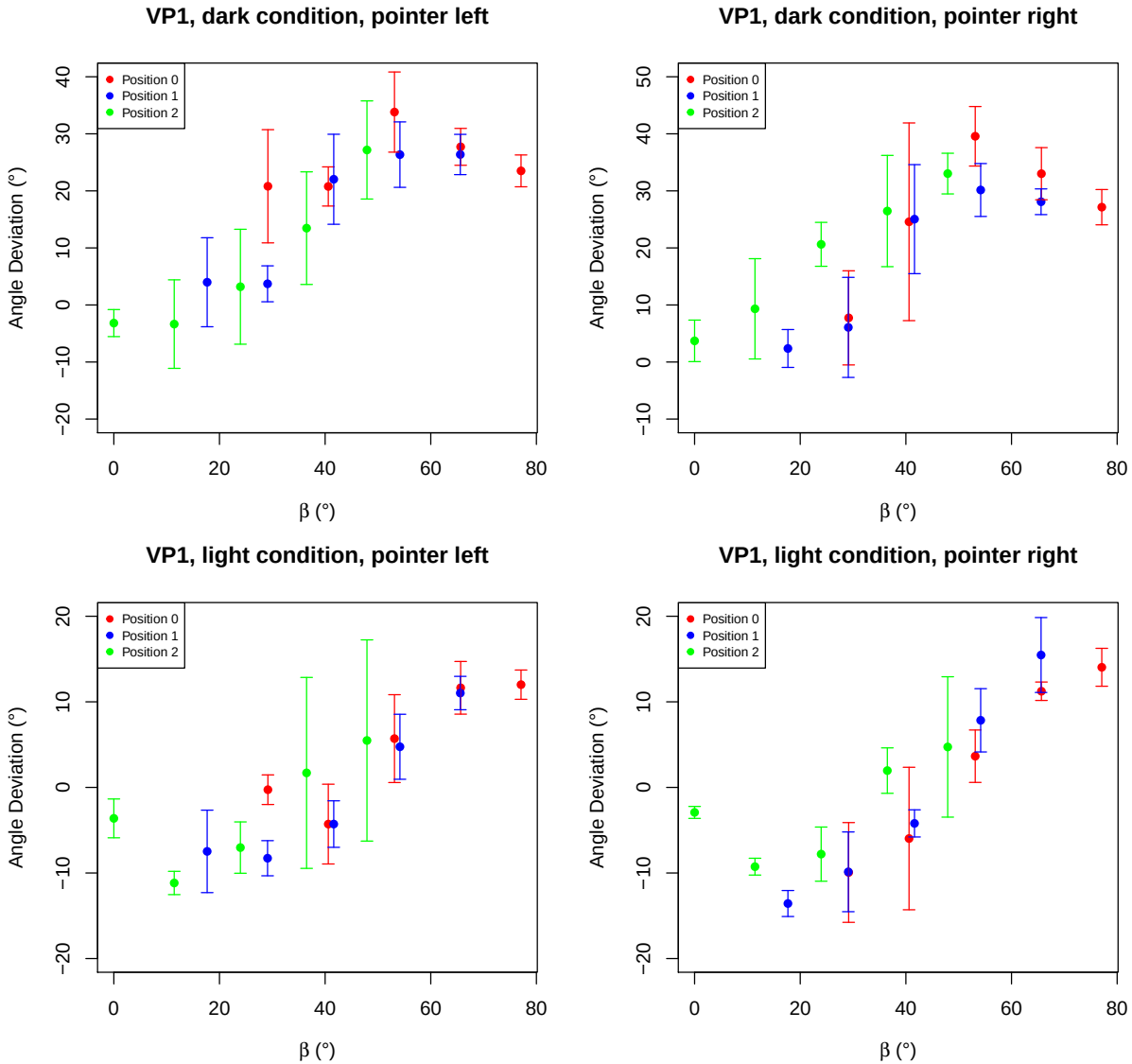

Figure 5: Angular deviation first subject (VP1).

Results and Discussion: Lighting

- Lighting very significant for the first and the third subject
- Higher positive deviation in the dark condition
- More symmetry given in the light condition

Results and Discussion: Lighting

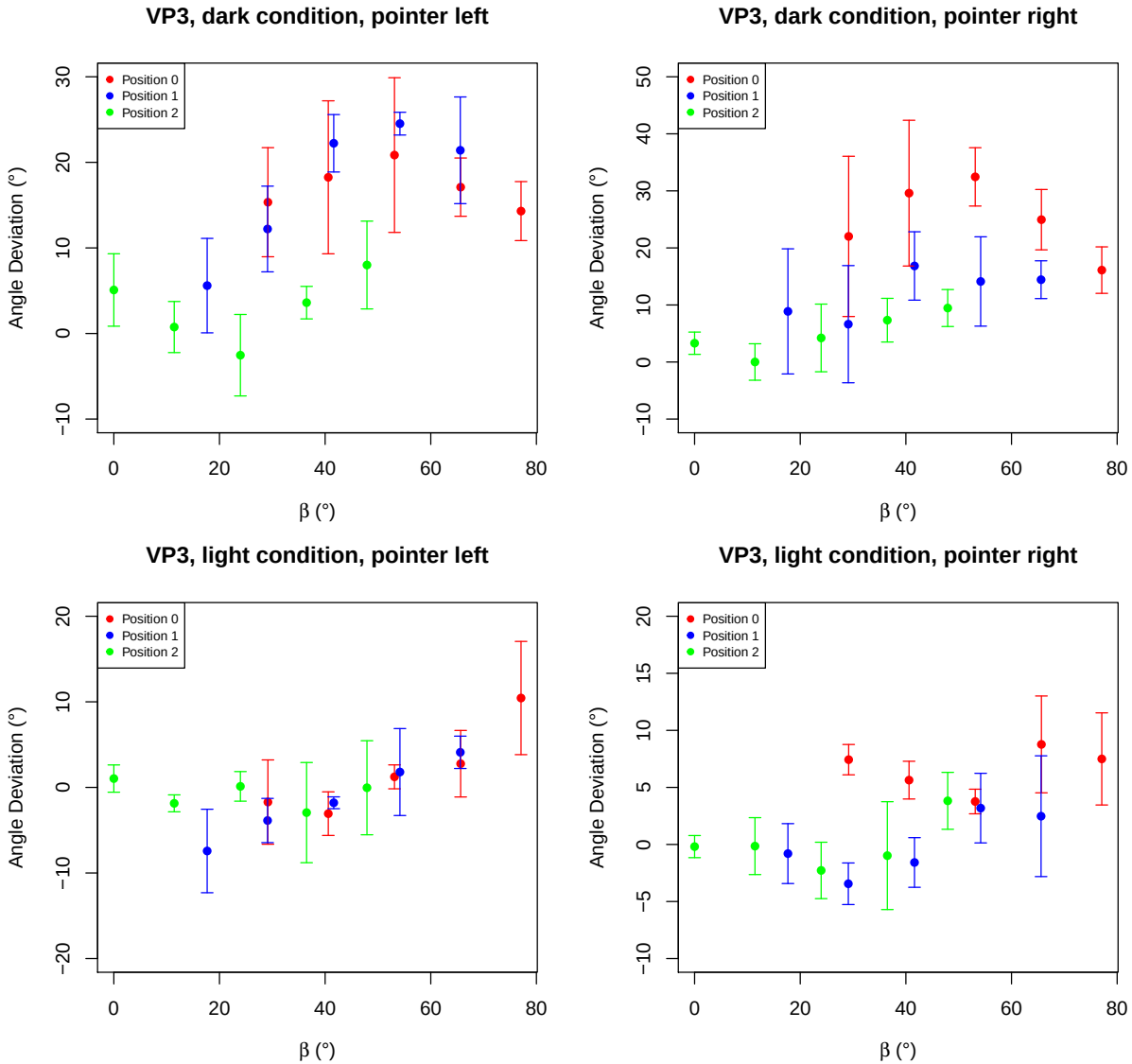

Figure 6: Angular deviation third subject (VP3).

Results and Discussion: Symmetry

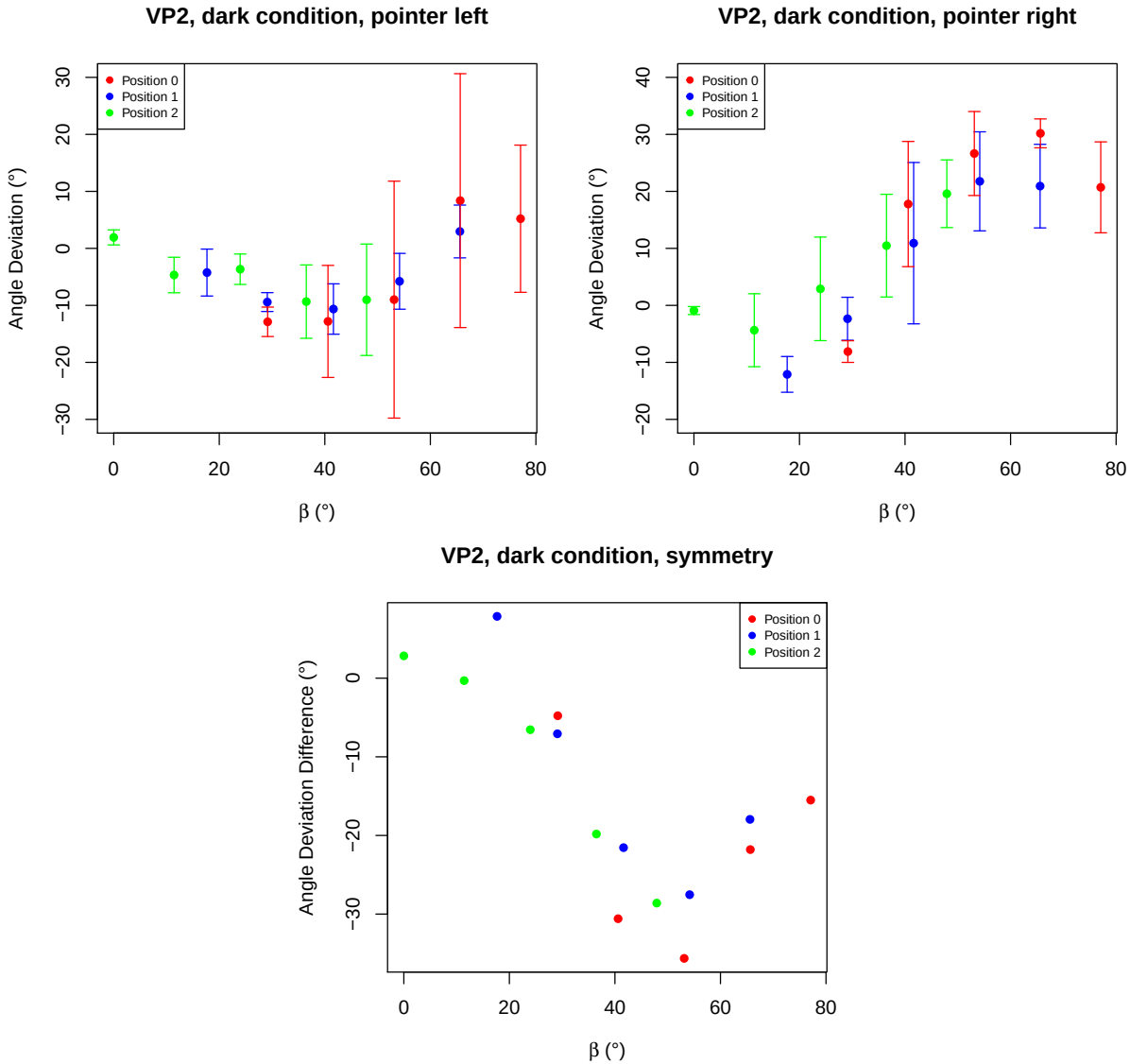

Figure 7: Angular deviation second subject (VP2) in the dark condition and symmetry deviation (left pointer condition minus right pointer condition).

Results and Discussion: Subject Position

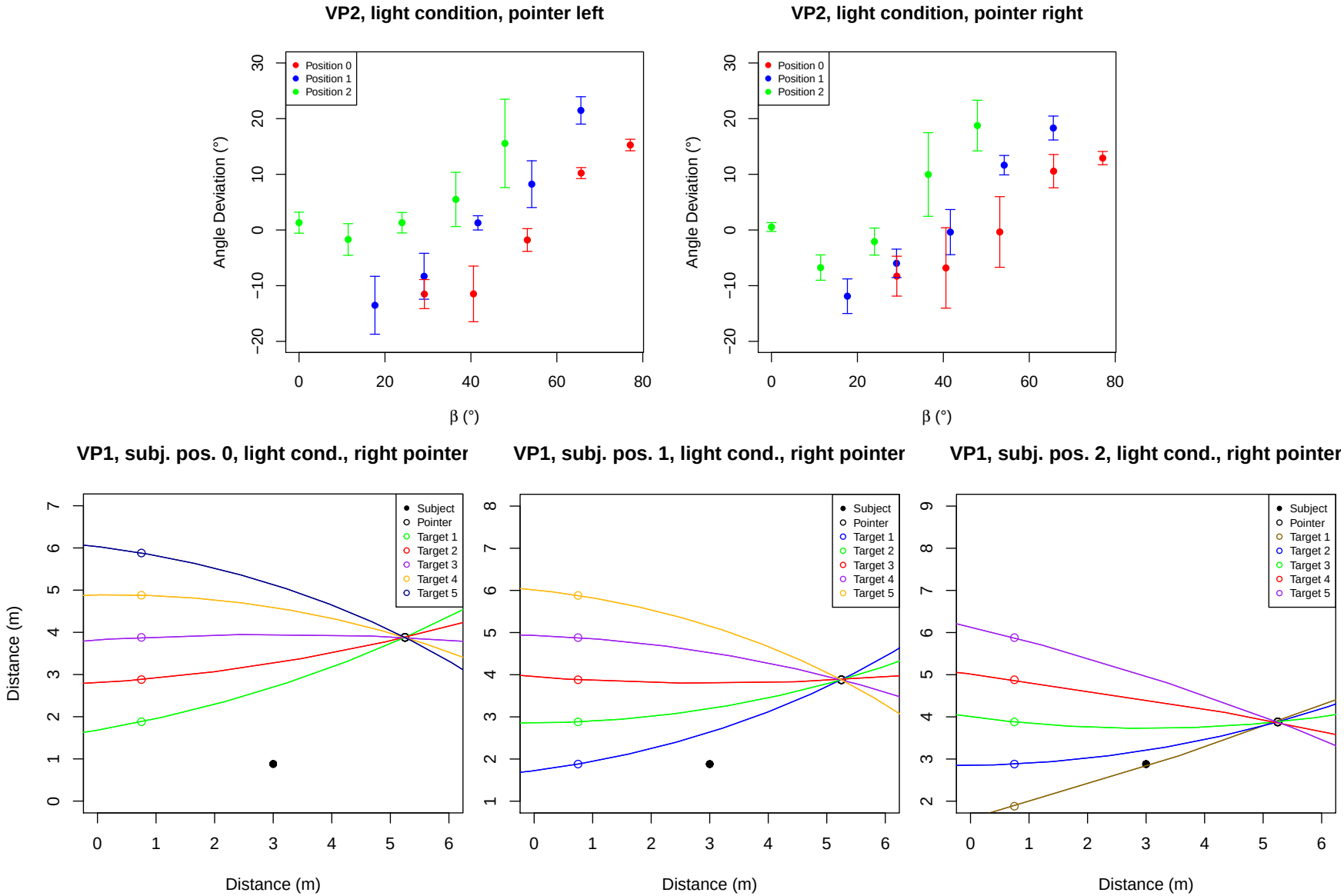

Figure 8: Angular deviation second subject (VP2) in the light condition and circle arcs first subject (VP1) in the light condition, pointer right.

Results and Discussion: Comparison VR with RL

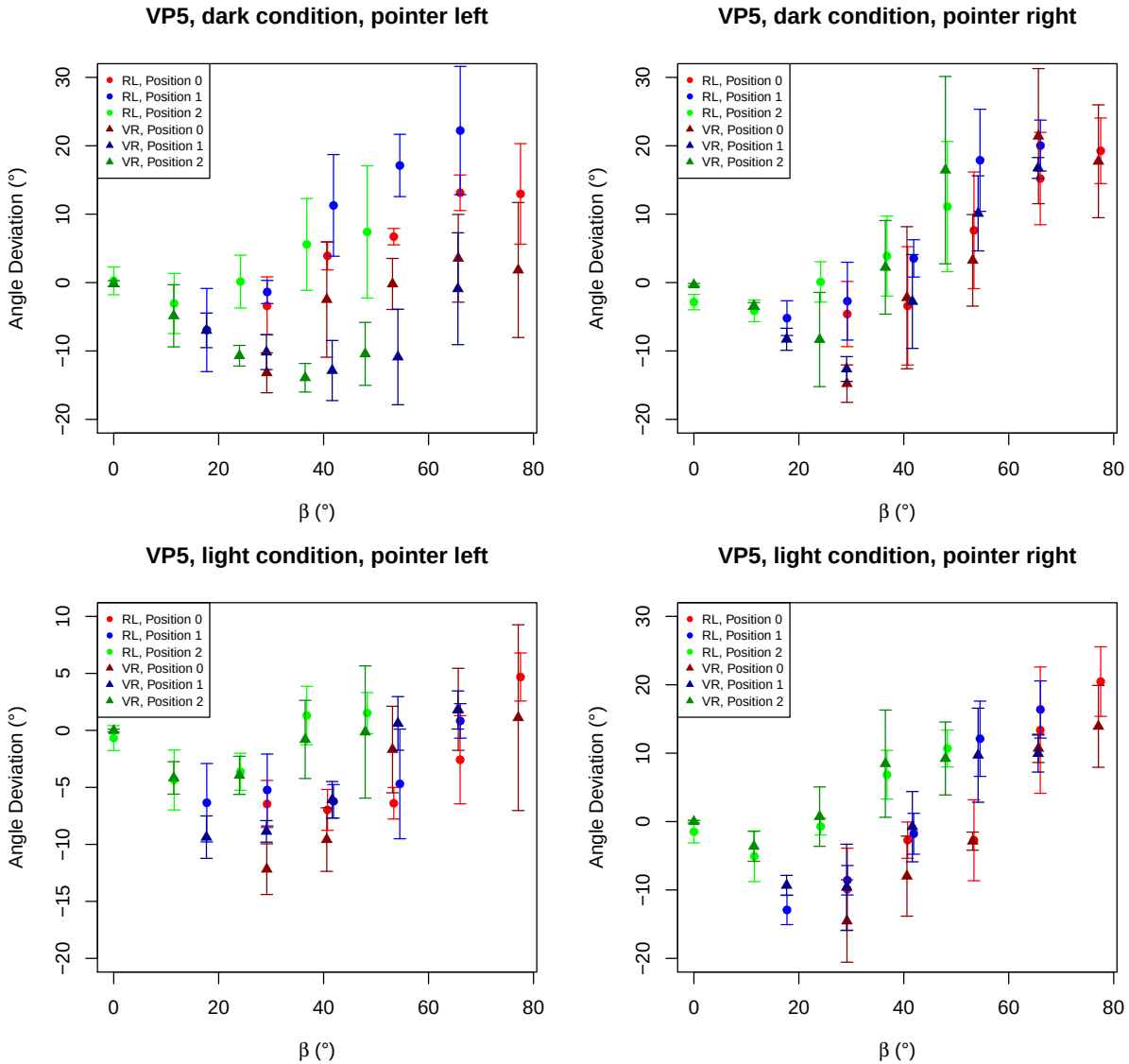

Figure 9: Angular deviation real life experiment (RL) and virtual reality experiment (VR) fifth subject (VP5).

Conclusion

- Intrinsic geometry of the visual space is of non-constant curvature
- Lighting and hence monocular cues make a difference
- VR is a possible method for measuring the intrinsic geometry of the visual space

Thank you for your attention! :)