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Pointing at static targets in a virtual reality environment: performance of visually impaired vs. normally-sighted persons

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Introduction

The pointing task mobilizes visuo-attentional and oculomotor functions. Our hypothesis is that it could be a good rehabilitation tool. We have developed this pointing task as an exploratory experiment in which we try to know if the patients manage to do it.

Question

How can a visually impaired person with central vision impairment perform a pointing task with the head in a virtual environment?

Method

Virtual Reality & Microperimetry

Subjects must point at the target using a reticle that moves with the head. This study is developed with PTVR, an open-source VR toolbox (<https://ptvr.inria.fr/>).

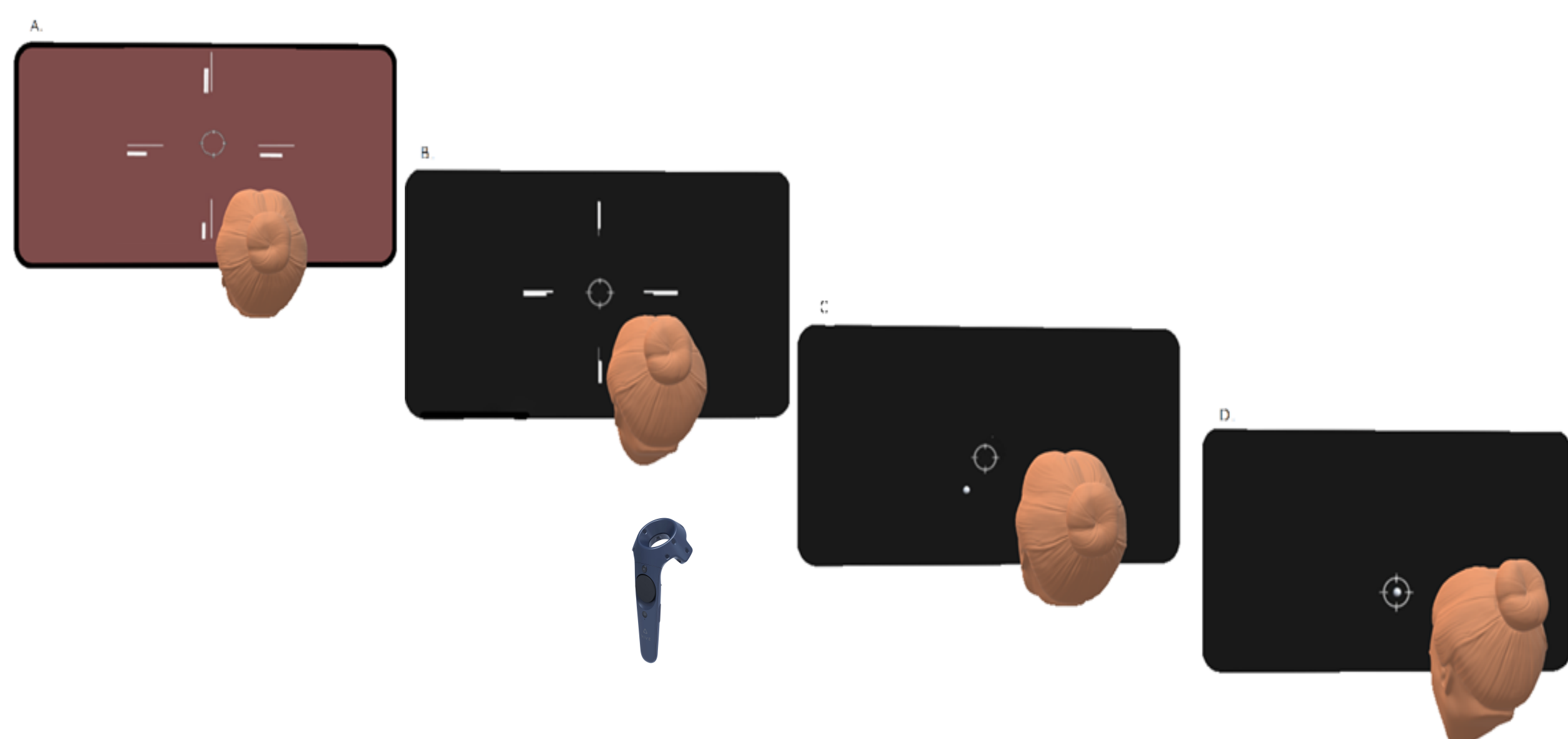


Figure 1. Trial procedure

Reticle

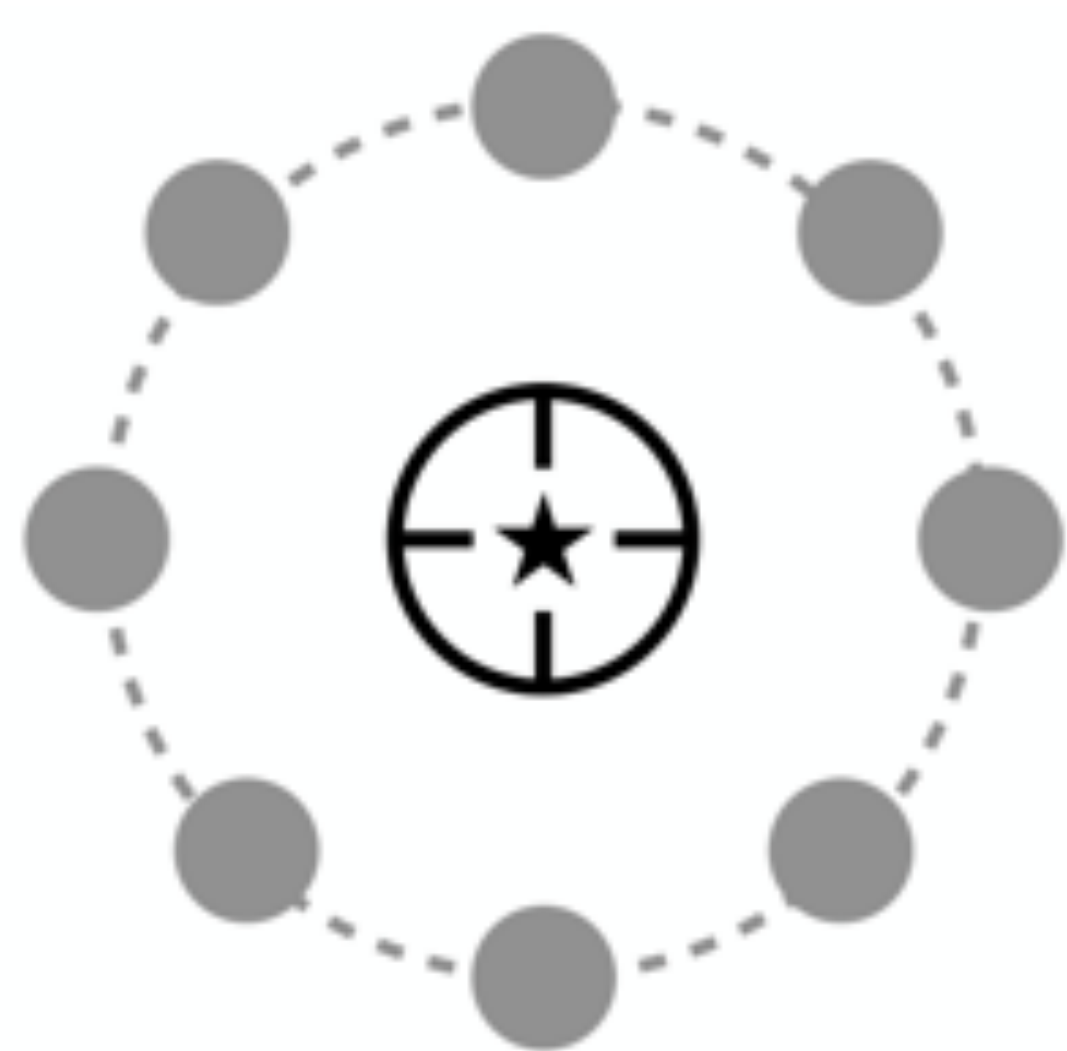


Figure 2. Reticle in central position and all target positions

The reticle has 2 conditions **centered** or **eccentric** of 10° from the center. An eccentric reticle has 8 possible positions on the 8 half-meridians.

Participants

$N = 36$

- 20 visually impaired (*mean age* = 79)
- 16 normally sighted persons (*mean age* = 64)

Discussion

The virtual reality was well received by the visually impaired subjects. Results show a significant difference in performance between patients and normally-sighted persons. An effect of the activation radius on the reaction time is observed as well.

Results

Virtual Reality

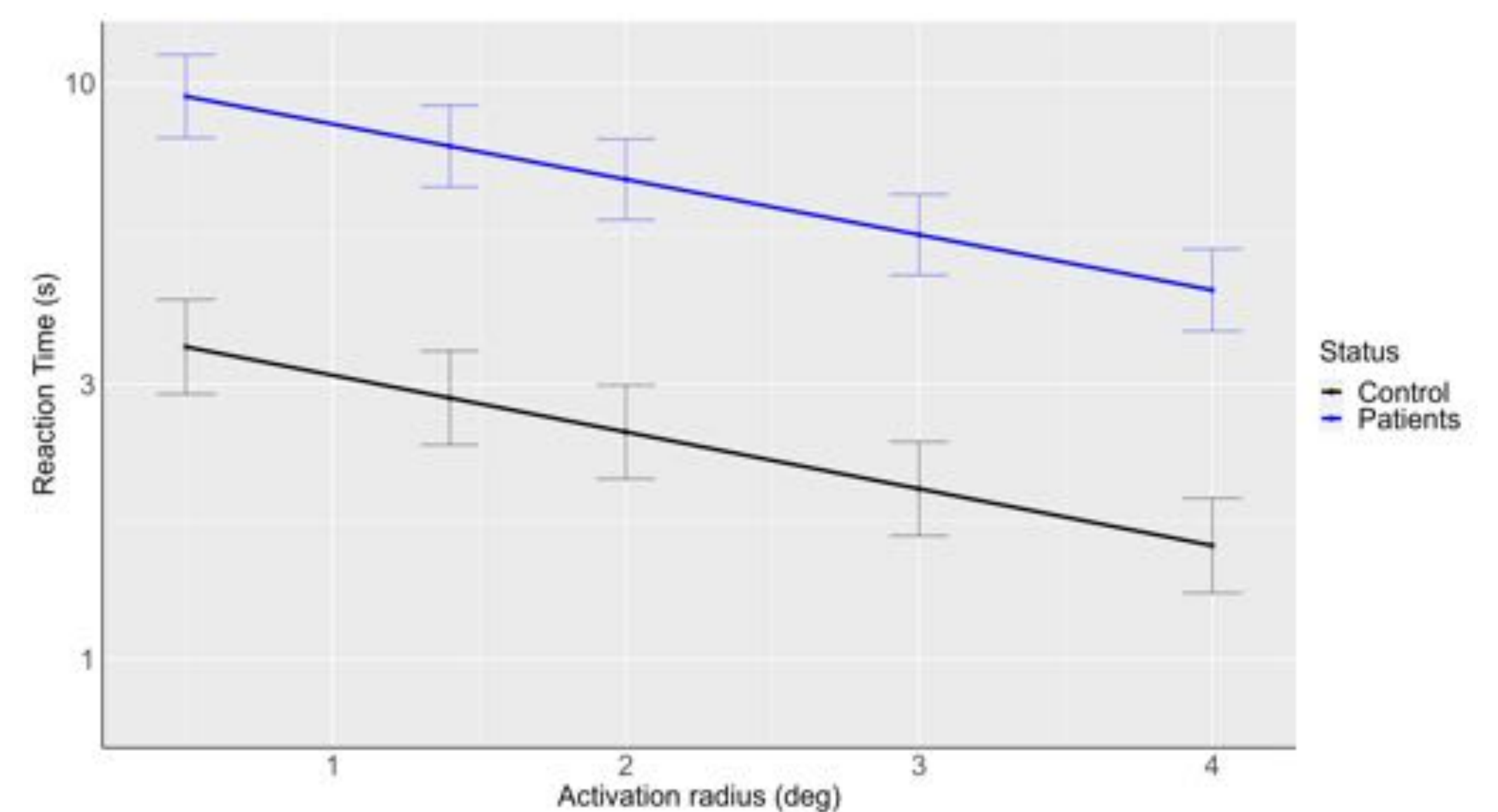


Figure 3. The effect of the activation radius on the reaction time

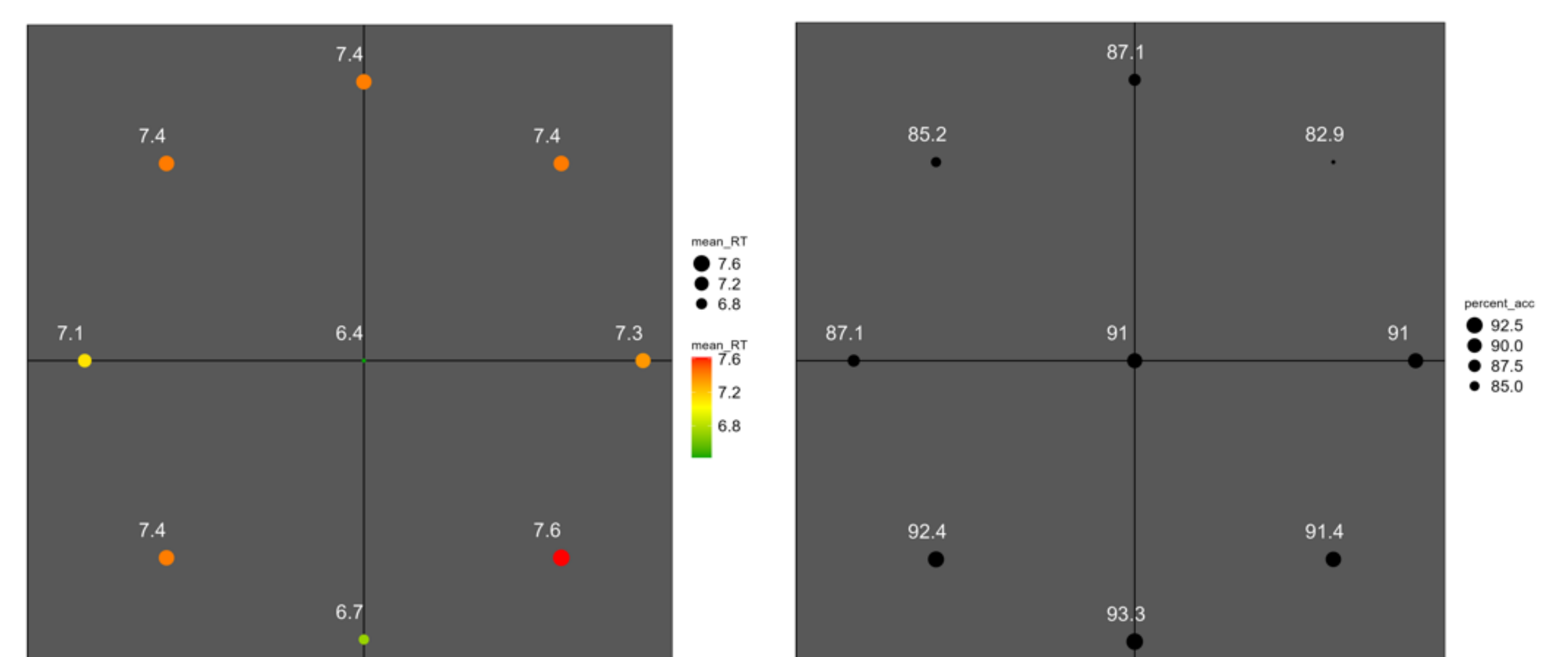
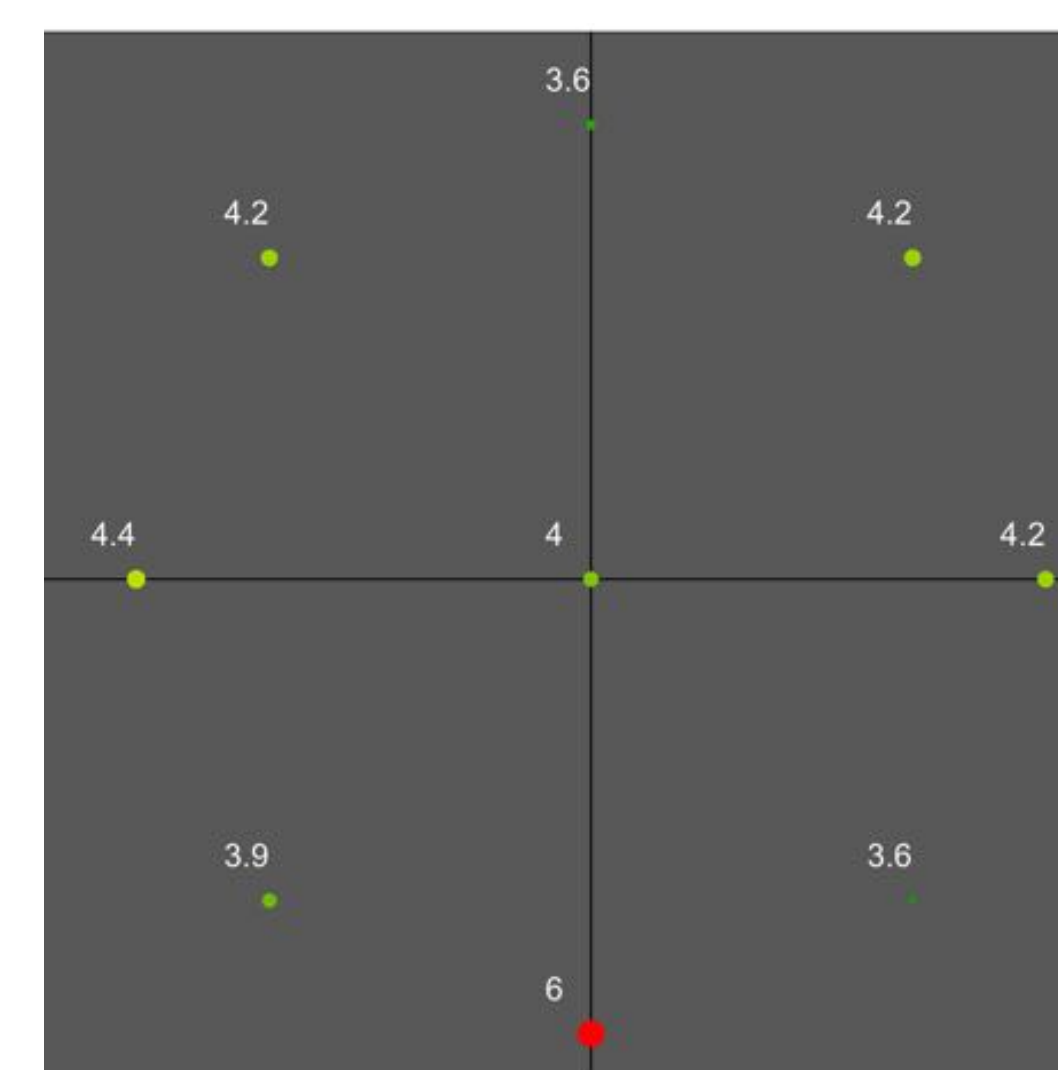


Figure 4. Reaction time & accuracy averaged across patients



This patient has a very specific deficit when the reticle is on the 270° .

Figure 5. Average reaction time for a patient

Microperimetry

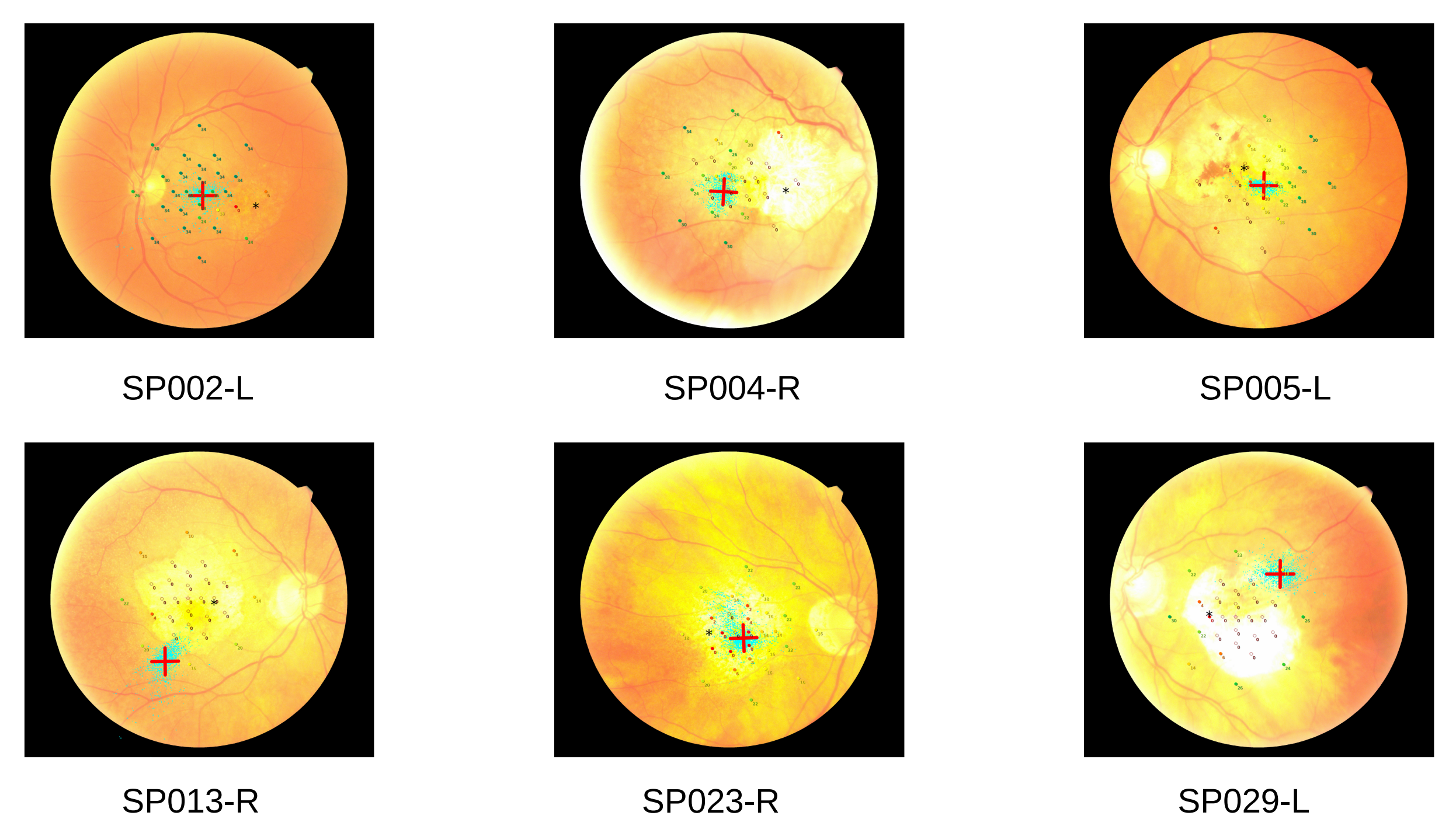


Figure 6. Six cases of patients, each image shows the color fundus image, the fixations and the stimulus pattern

Perspectives

- Analyze the performance of patients as the function of their scotoma characteristics.
- Monocular vision experiment.