neos®

the world's first neurophthalmoscope

8
exams
in 12 minutes

- ✓ Gaze holding
- ✓ Ocular Alignment
- ✓ Fusional Amplitudes
- ✓ Smooth Pursuit
- ✓ Saccades
- ✓ Visual Field
- ✓ Afferent Pupillary Function
- ✓ Efferent Pupillary Function

machineMD AG | Weyermannsstrasse 36, Bern 3008, Switzerland | www.machineMD.com

neos®

- Increase patient comfort with a head-mounted device
- Improve clinical efficiency with fast, automated, quantitative exams
- Inspire greater precision with quantitative reporting

Industry-leading eye tracking
neos® uses infrared eye tracking that records eye movements at **200Hz**, comfortably mounted in a headset that features **active cooling** to ensure patient comfort.

neos® is compatible with contact lenses and includes a range of **refractive error correction** lens inserts.

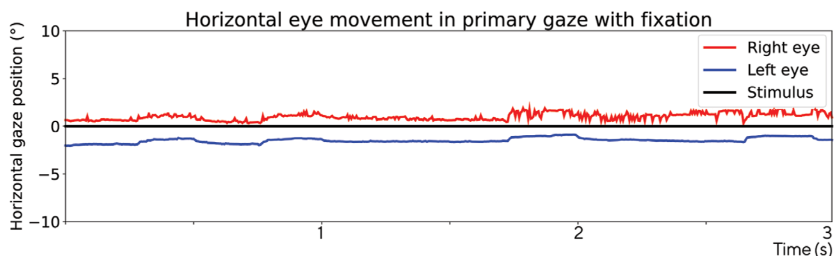
Data securely in the cloud
neos® processes all data in the cloud, enabling you to easily **access reports from your desk** and attach them to your local electronic health record system.

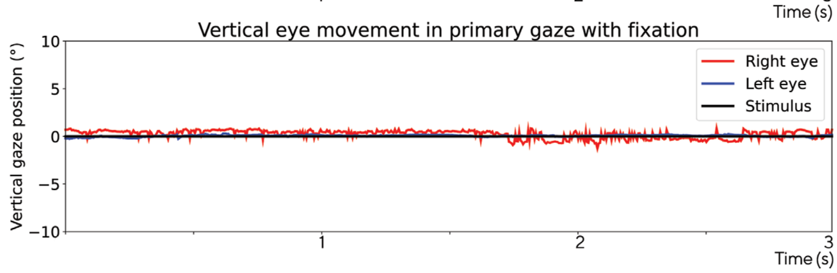
“My goal is to democratize specialist knowledge of neuro-ophthalmologists, enabling the earlier diagnosis of neurological disorders.”

Mathias Abegg, MD, PhD
Co-Founder and Medical Director
machine**MD**

Gaze Holding

- Binocular fixation
- 9 gaze positions ±10°
- Measures gaze position



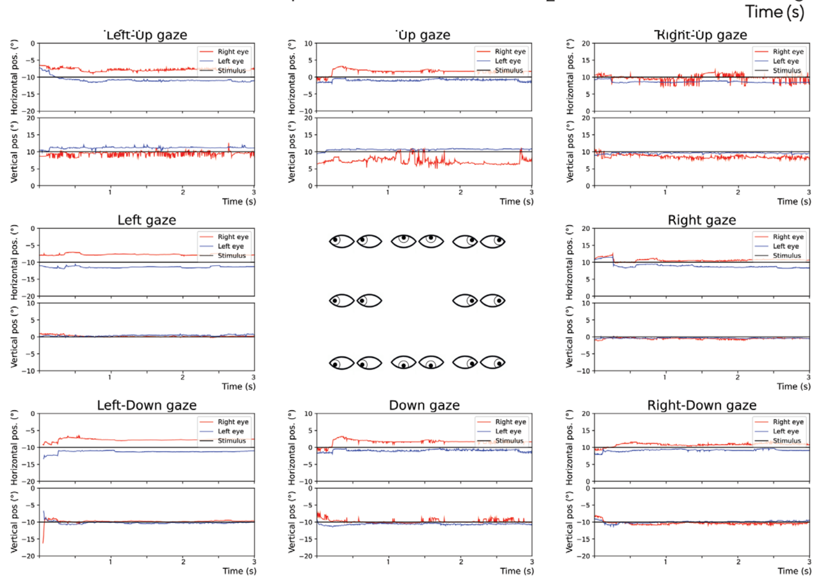


Optimized stimuli

Fixation and image clarity of a visual target require placement and maintenance of the fovea on the target[1].

neos® presents a novel stimulus: an Unidentified Flying Object, UFO, projected at infinite distance (over 20m).

In addition to the neos® report for gaze holding, stability of fixation is also interesting to review in the neos® tests for smooth pursuit and during the fusional amplitude tests of convergence.



1. Rucker JC. Nystagmus and Saccadic Intrusions. Contin Minneap Minn. 2019;25(5):1376-1400. doi:10.1212/CON.0000000000000772

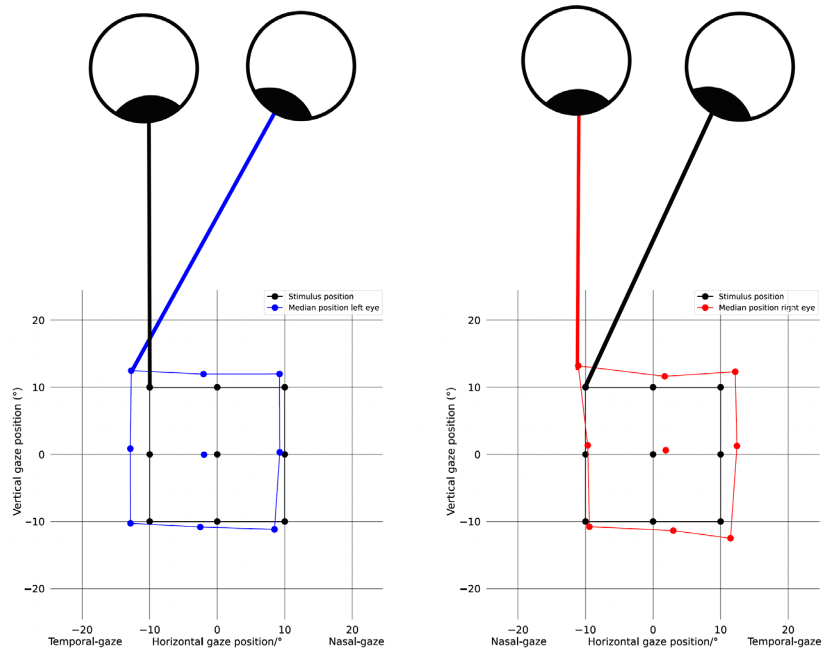
Ocular Alignment

- Automated alternate cover test
- 9 gaze positions ±10°
- Measures median deviation

Automated alternate cover test
The neos® test sequence comprises alternate covers lasting 1.5 seconds each, beginning with primary gaze followed by the ±10° cardinal gaze positions.

Presented in the style of the Hess Screen
In the neos® report, black points represent the stimulus position for the fixating eye, and the red / blue points represent the median position of the covered eye.

Median latent deviation
The difference between the black dot and the coloured dot is the median deviation of the phoria in that gaze direction.



Possible deviations include[1]:
- **exo**deviations, in which the eyes are turned laterally relative to one another
- **eso**deviations, in which the eyes are turned medially relative to one another
- **hyper**deviations, in which one eye is higher than the other.

1. Rucker JC, et al. The neuro-ophthalmological examination. Handb Clin Neurol. 2011;102:71-94. doi:10.1016/B978-0-444-52903-9.00009-1

Efferent Pupillary Function

- Tests dilation rate of both eyes
- No pharmacological testing
- Measures pupil diameter

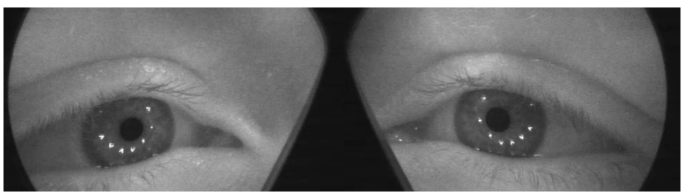
Manual examinations miss 50% of anisocoria[1]

Pupil diameter and dynamics are determined by the interaction between the sympathetic and parasympathetic nervous systems. Whereas the parasympathetic system primarily drives pupillary constriction, the sympathetic system primarily drives pupillary dilation[2].

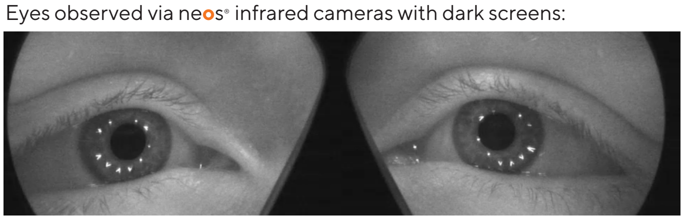
neos® presents a bright stimulus for 5 seconds, comprising an icy landscape with an igloo fixation point, projected at infinite distance (over 20m). neos® then presents a dark screen with no fixation point for 15 seconds.

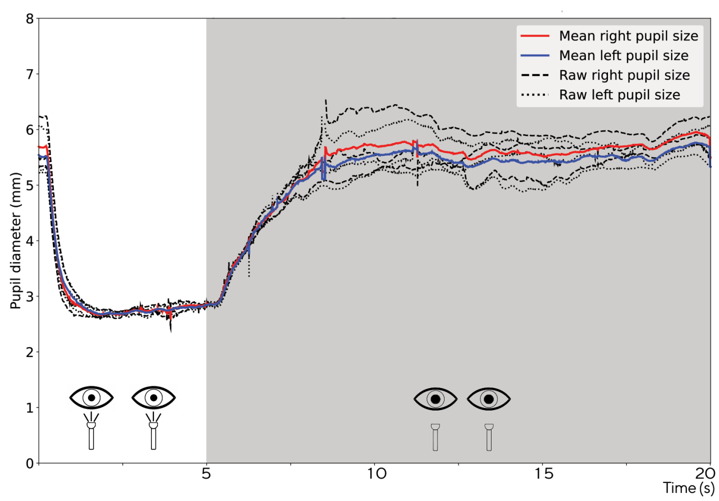
neos® repeats this sequence 4 times, and the mean pupil diameter is highlighted for each eye in the below report.

Eyes observed via neos® infrared cameras with bright screens:



Eyes observed via neos® infrared cameras with dark screens:





1. Couret D, et al. Reliability of standard pupillometry practice in neurocritical care: an observational, double-blinded study. Crit Care Lond Engl. 2016. Mar 13;20:99. doi: 10.1186/s13054-016-1239-z

2. Bower, M. M., et al. (2019). Quantitative Pupillometry in the Intensive Care Unit. Journal of Intensive Care Medicine. doi:10.1177/0885066619881124

Afferent Pupillary Function

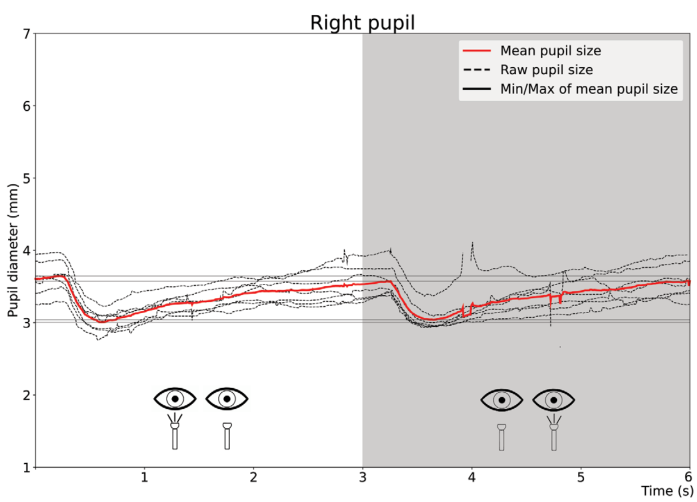
- Automated swinging flashlight test
- Eliminates ambient light
- Measures pupil diameter

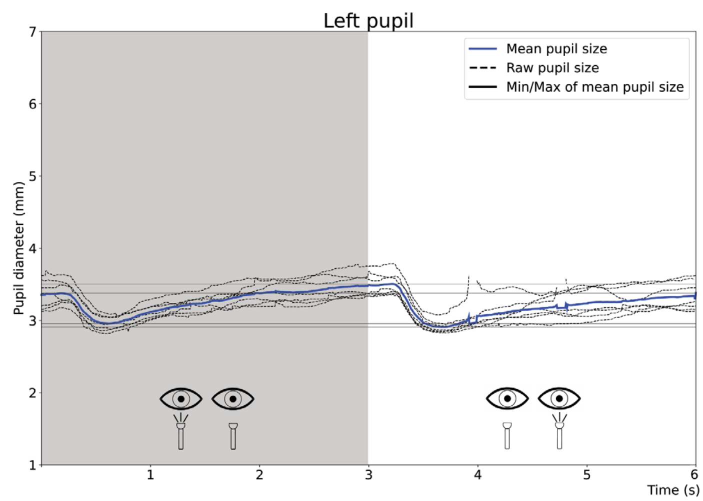
Only 40% of RAPD magnitudes are correctly estimated via manual swinging flashlight tests[1].

Quantitative pupillometry can provide more reliable measurements with a lower error rate[2]. Pupillometry devices provide variables including maximum size, minimum size, constriction velocity, constriction amplitude, and response latency.

neos® uses an automated, digitalized version of the swinging flashlight test: displaying a bright stimulus to one eye while the other eye is shown a dark screen for 3 seconds. The stimulus is repeatedly alternated between the two eyes.

neos® plots minimum and maximum mean pupil diameters for each eye as black horizontal lines obtained during the test sequence.





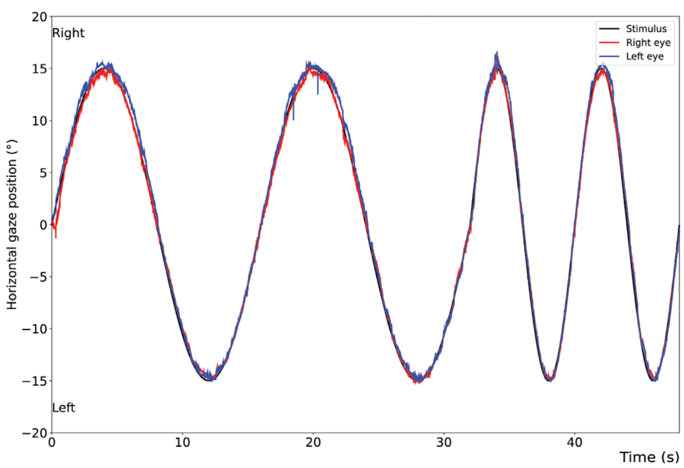
1. Boucher T, Fortin É, Evoy F. The standard swinging flashlight test: reliable or not (P1.9-009). Neurology. 2019; 92(15 Supplement): P1.9-009.
2. Bower MM, et al. Quantitative Pupillometry in the Intensive Care Unit. J Intensive Care Med. 2021;36(4):383-391. doi:10.1177/0885066619881124

Horizontal Smooth Pursuit

- Velocities: 0.0625Hz and 0.125Hz.
- Amplitude: 15°
- Measures gaze position

neos® presents a forest scene with a fixation point of a fairy in a glowing circle, projected at infinite distance (over 20m). The stimulus is always shown under binocular conditions.

neos® measures gaze position while the patient tracks the fairy moving in the horizontal direction with two different velocities: 0.0625Hz followed by 0.125Hz. Two repetitions are made for each velocity with an amplitude of 15°.



Smooth-pursuit movements allow clear vision of a moving target by holding the image steady on the fovea[1]. Pursuit performance requires focused attention to track a particular object.

Saccades are the fastest eye movements, with speeds as high as 700°/s and durations usually less than a tenth of a second. Their main function is to bring new images on to the fovea.

neos® tests saccades by presenting the stimulus at ±10° and ±20° both horizontally and vertically. Each position is repeated several times and always binocularly.

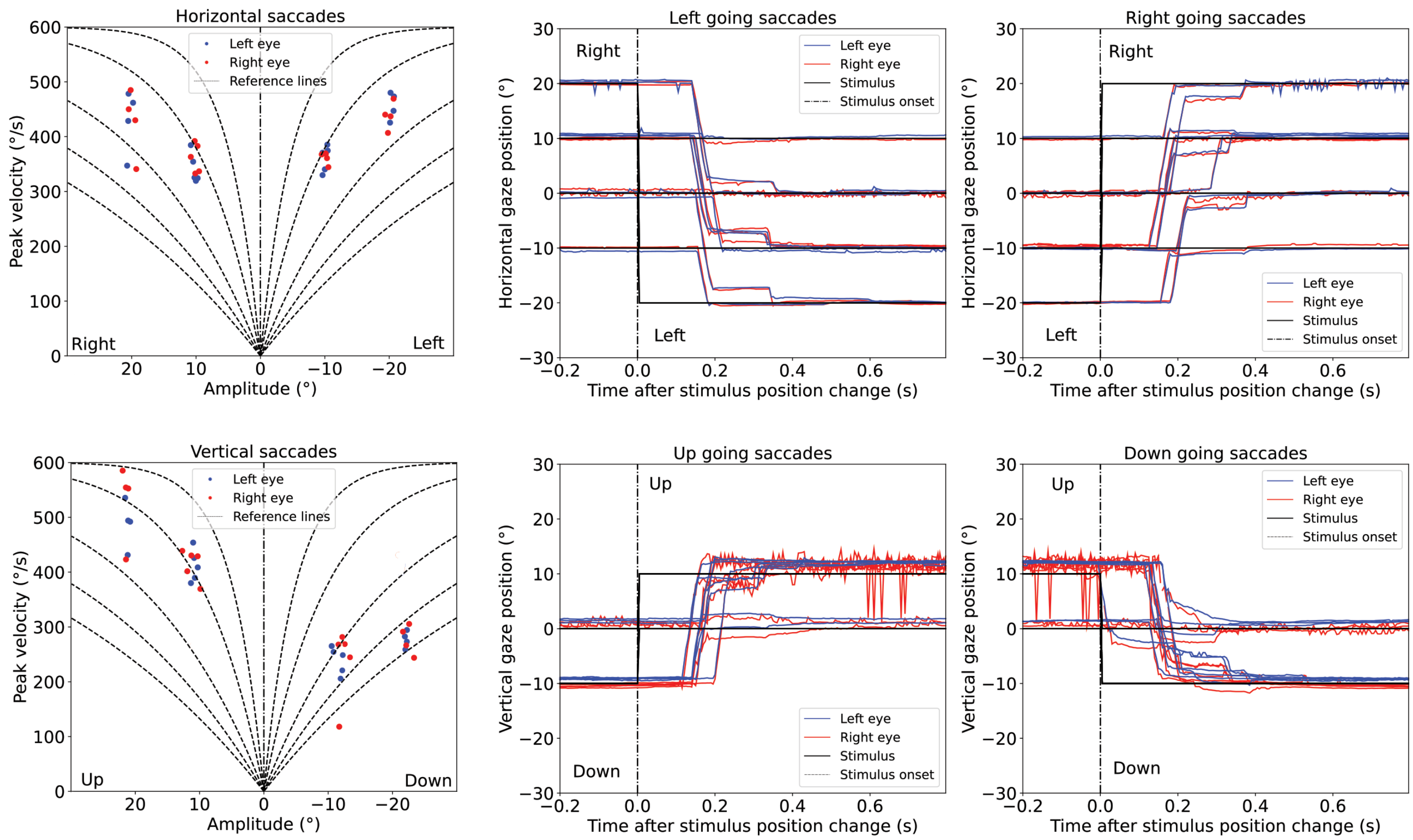
neos® measures gaze position relative to the stimulus, and also reports peak velocity for each eye at each angle (see right page).

Saccade related parameters include amplitude, saccadic latency, saccadic velocity, and saccadic accuracy[2].

1. Kheradmand A, et al. Eye movements in vestibular disorders. Handb Clin Neurol. 2016;137:103-117. doi:10.1016/B978-0-444-63437-5.00008-X
2. Larrazabal AJ, et al. Video-oculography eye tracking clinical applications. Comput Biol Med. 2019;108:57-66. doi:10.1016/j.compbiomed.2019.03.025

Horizontal & Vertical Saccades

- Prosaccadic eye movements
- Tests ±10° and ±20°
- Measures gaze position and peak velocity



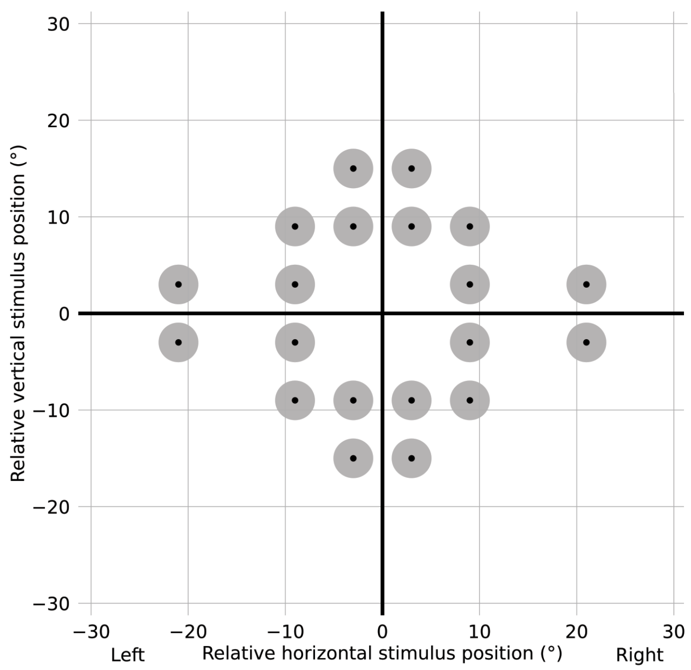
Peak velocity reference lines generated according to formulae in the book by Leigh RJ, Zee DS. The Neurology of Eye Movements.

Visual Field

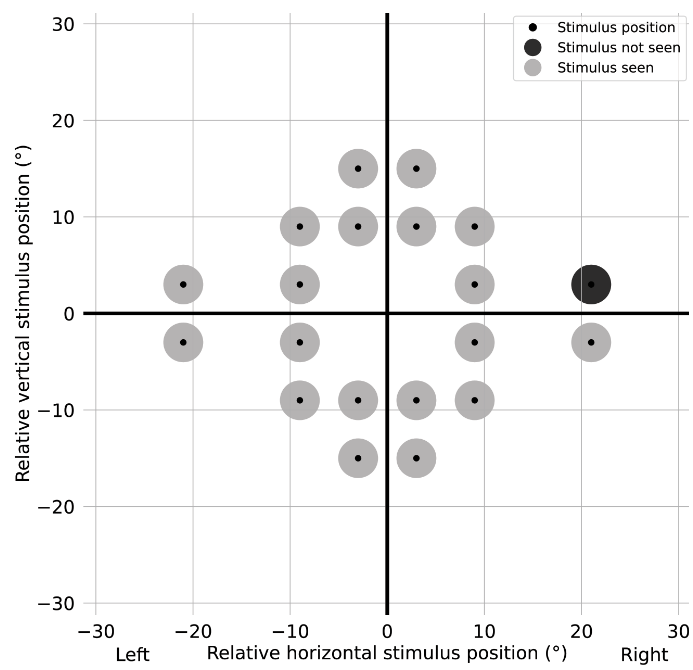
- Adaptive, gaze dependent strategy
- Static suprathreshold perimetry
- Measures central 30°

neos® performs this test for both eyes using monocular stimuli. The patient is shown a fixation cross and a stimulus with maximal brightness appears according to an adaptive pattern. neos® detects the saccadic movement to the location of the stimulus and moves the fixation target accordingly.

Visual Field Left Eye



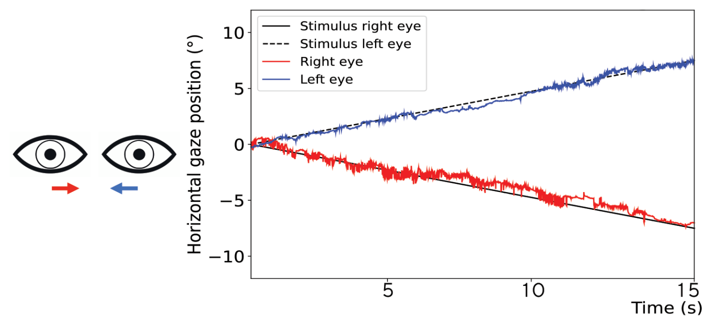
Visual Field Right Eye



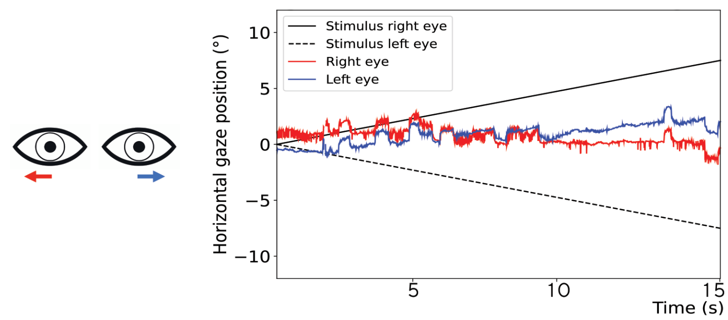
Fusional Amplitudes

- Tests fusional reserves
- Rest time between tests
- Measures gaze position

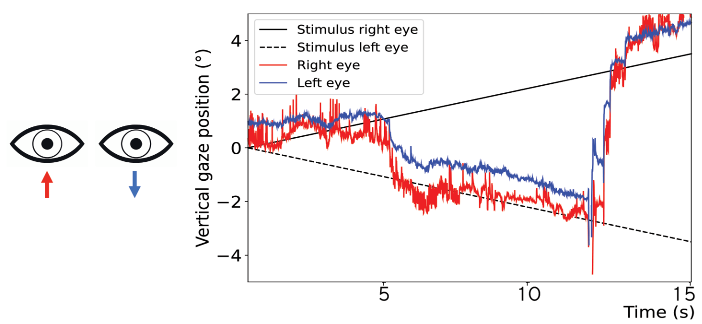
Horizontal convergence: 7° (12 p.d.)



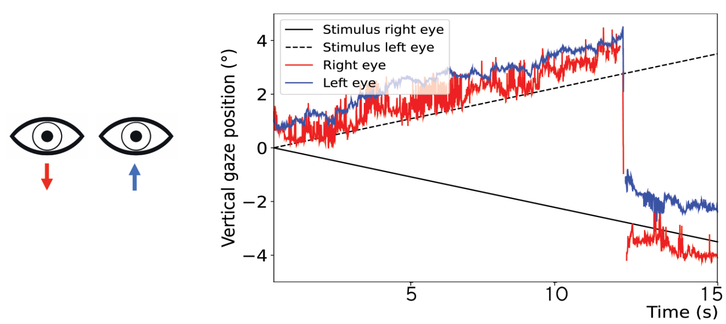
Horizontal divergence: 7° (12 p.d.)

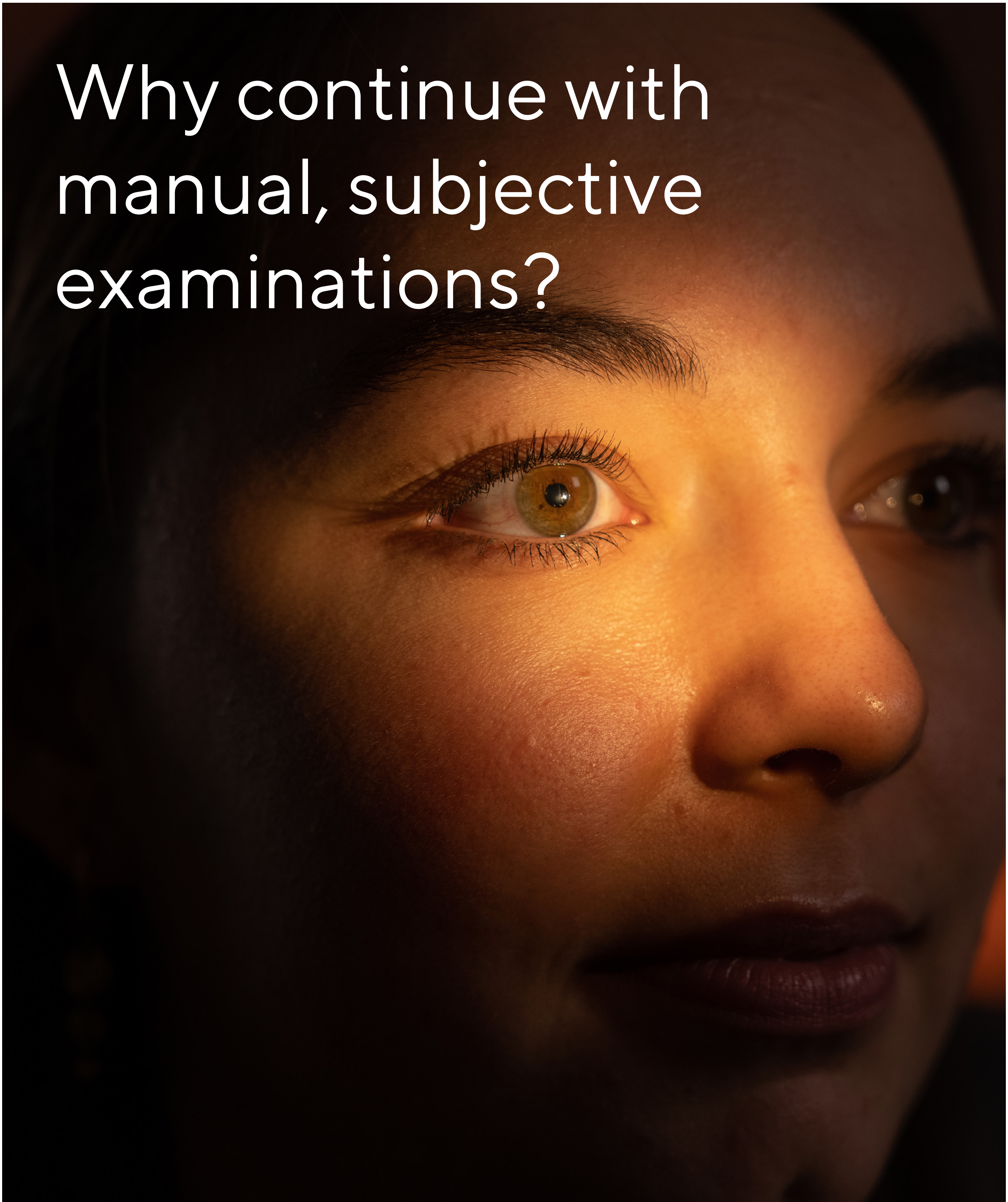


Vertical divergence, left ↓, right ↑: 3° (5 p.d.)



Vertical divergence, left ↑, right ↓: 3° (5 p.d.)




Why continue with
manual, subjective
examinations?