Eyelink

SR - Research

What——

Why——

Where——

How——

EYELINK

SR Research https://www.sr-research.com/

SR Research https://www.sr-support.com/

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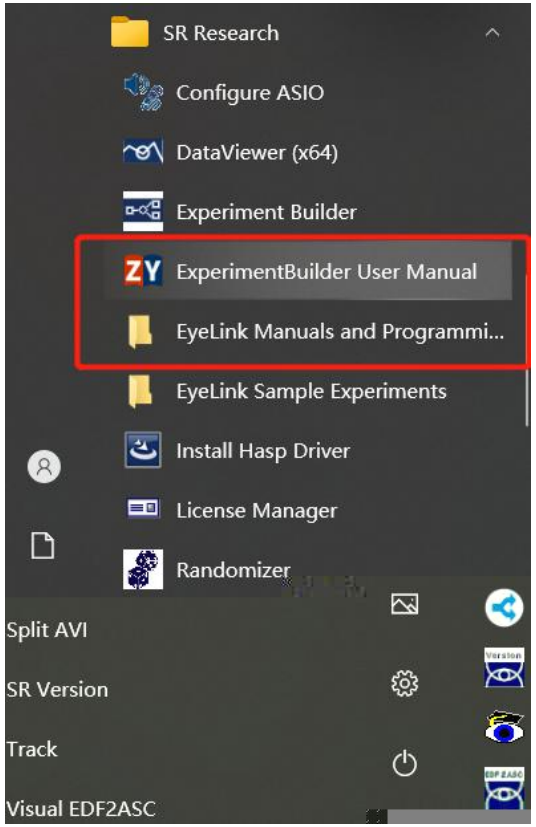
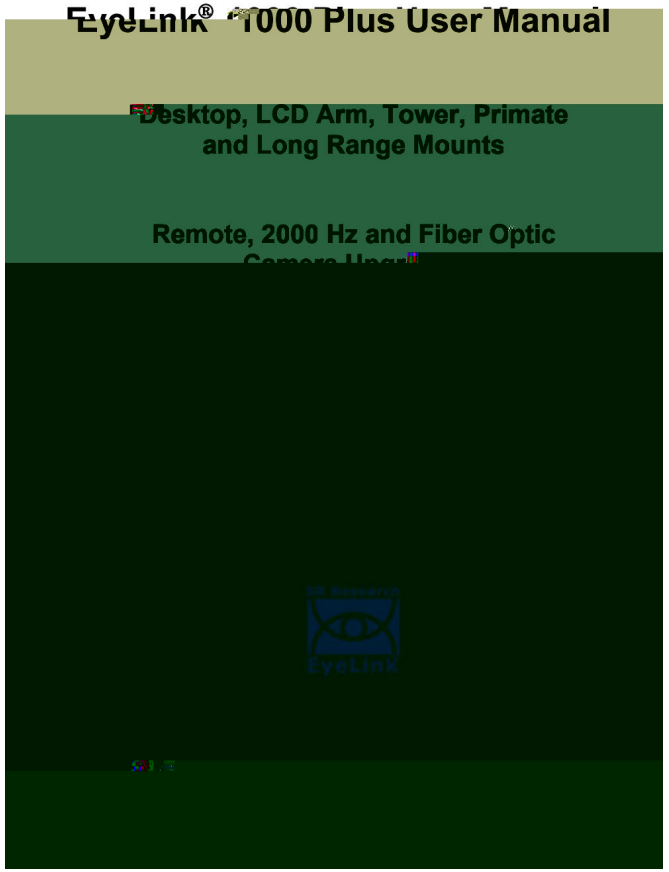
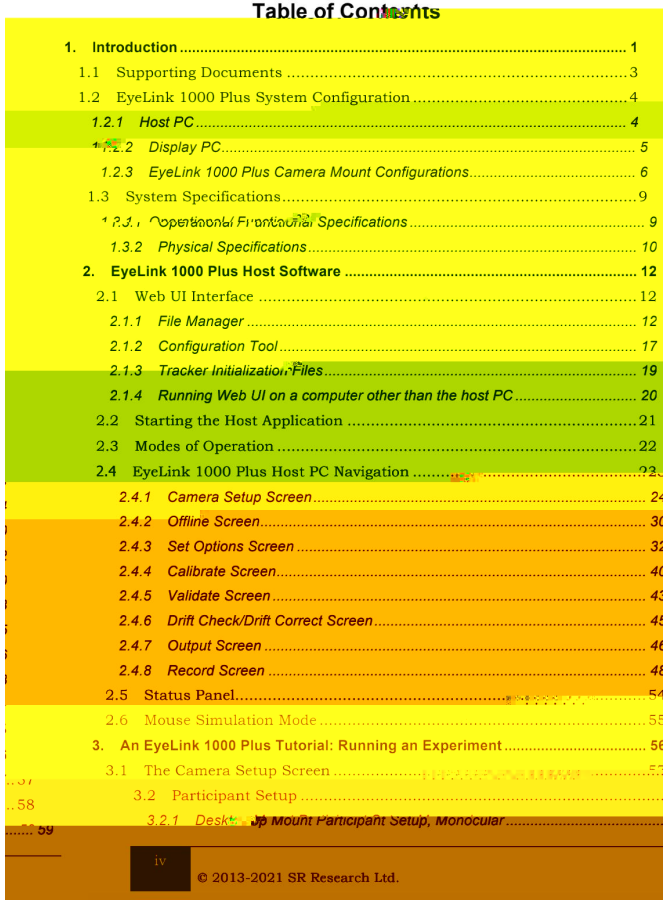

SR Research
Configure ASIO
DataViewer (x64)
Experiment Builder
ExperimentBuilder User Manual
EyeLink Manuals and Programmi...
EyeLink Sample Experiments
Install Hasp Driver
License Manager
Randomizer
Split AVI
SR Version
Track
Visual EDF2ASC


EyeLink® 1000 Plus User Manual
Desktop, LCD Arm, Tower, Primate and Long Range Mounts
Remote, 2000 Hz and Fiber Optic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What——

Why——

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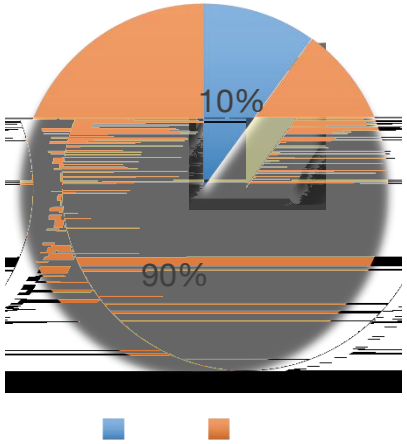


Why——

Reading &

Developmental

fMRI &

EEG &

cking solutions for
ch in reading and

Understanding the
development of cognitive,

Relevant Publications

The world's most popular and
effective solution for eye

Relevant Publications

Combine eye tracking with a
range of othe

Eye-tra
resea

Why——

Clinical & Oculomotor

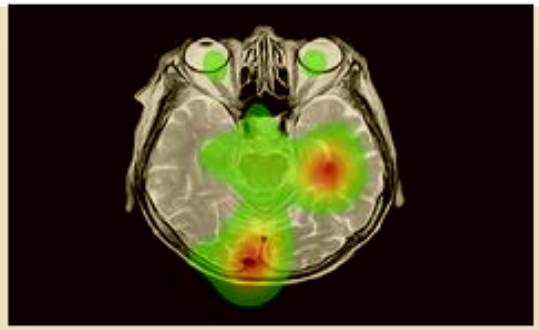
Relevant Publications

Research into oculomotor and cognitive dysfunction due to neuropsychiatric disorders.

Cognitive

Relevant Publications

Insights from eye tracking into attention, memory, decision making, and more.



Usability & Applied

Relevant Publications

Eye-tracking research out of the lab – solutions for usability and more.

Non-Human Primate

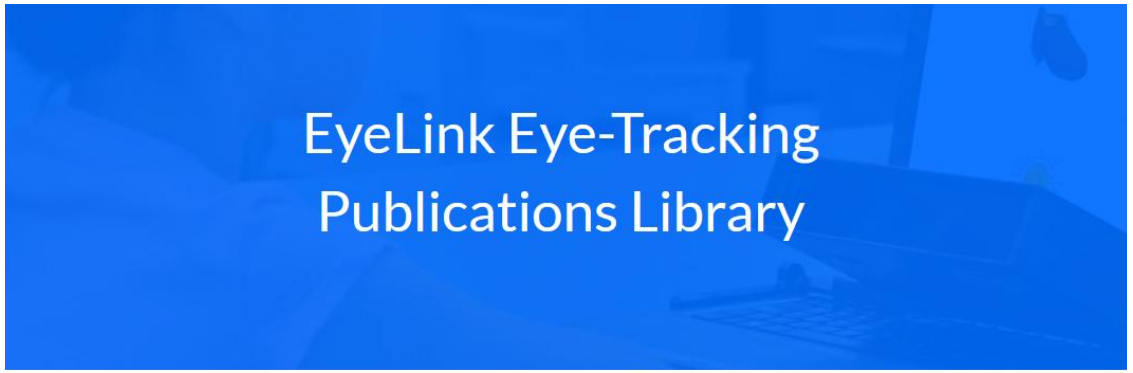
Relevant Publications

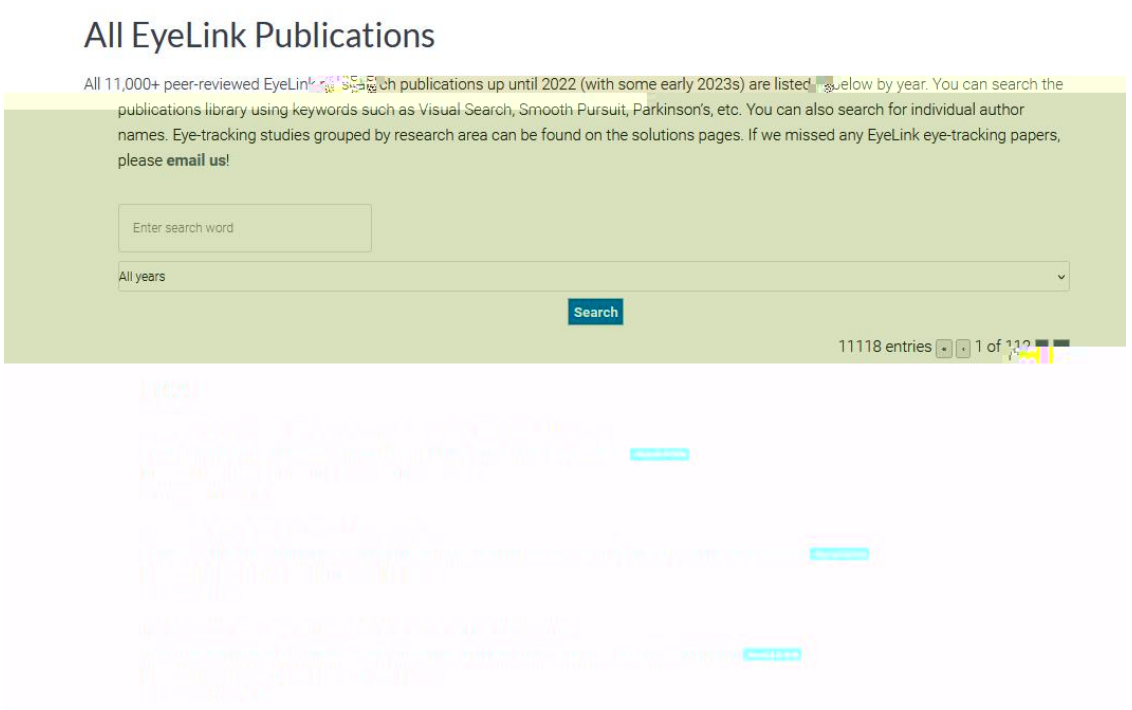
Fast, accurate, reliable, and non-invasive eye-tracking for non-human primates.

Why——

#眼动文章 详情>

- 82. 香港理工大学研究人员利用EyeLink眼动仪揭示粤语和普通话双语者对L1和L2中情感同源词感知的瞳孔测量研究。
- 81. 天津师范大学研究团队使用EyeLink眼动仪和Stroop边界范式揭示阅读过程中是否存在语义副中央凹-中央凹效应
- 80. 首都师范大学研究人员利用眼动追踪技术和快速自动命名任务揭示ADHD和发展性阅读障碍的共同发病机制
- 79. 中山大学中山眼科中心利用眼动技术揭示无弱视的斜视眼患者表现出视觉拥挤的情况
- 78. 广东外语外贸大学研究团队利用眼动技术揭示学习者的工作记忆能力（WMC）与视频授课中教师在场的影响作用
- 77. 西藏大学利用EyeLink眼动仪揭示音节边界在藏语阅读中的作用
- 76. 心理学报 | 南开大学研究团队利用眼动技术进行跨期决策中的维度差异的眼动偏好





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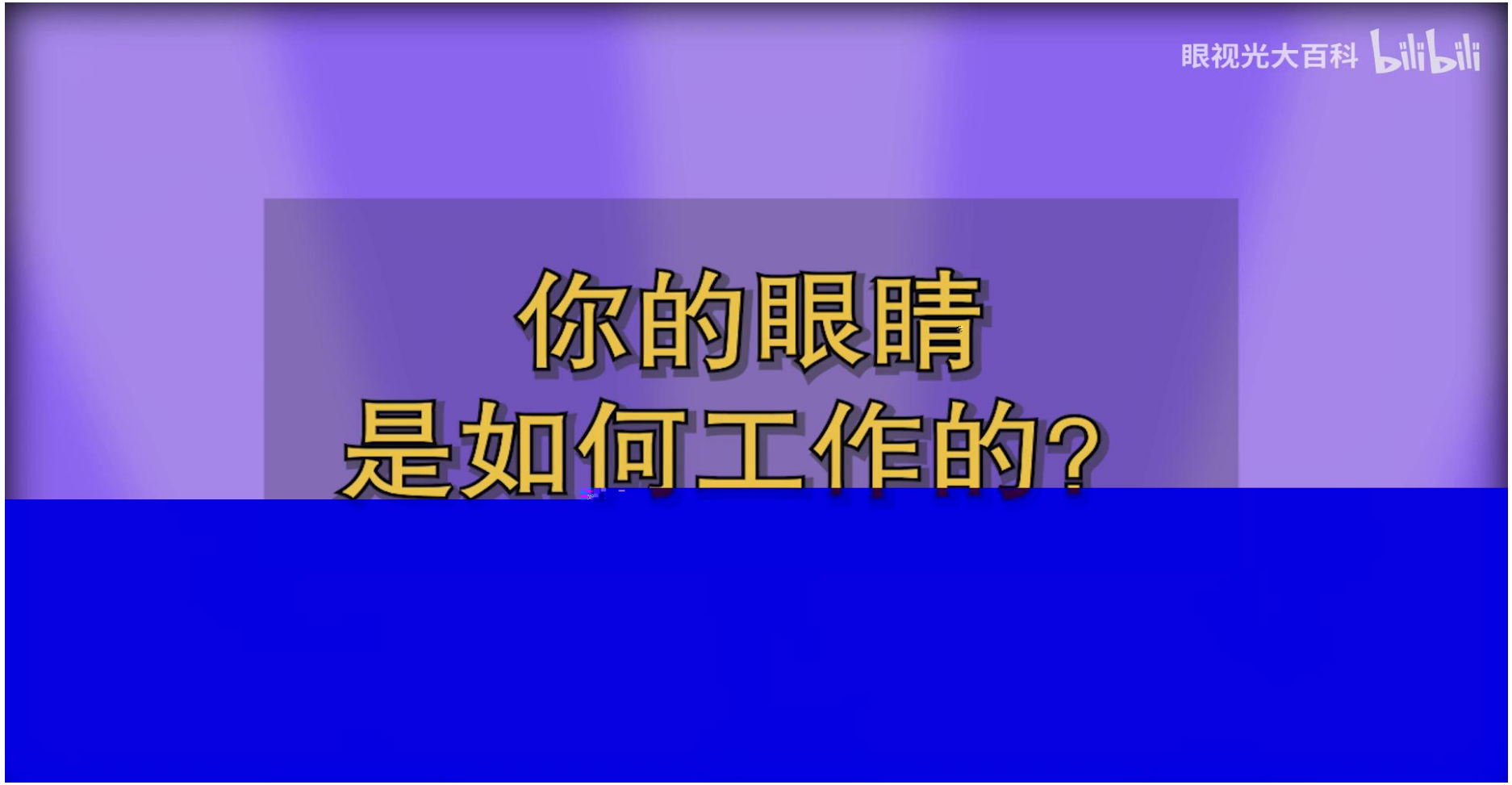
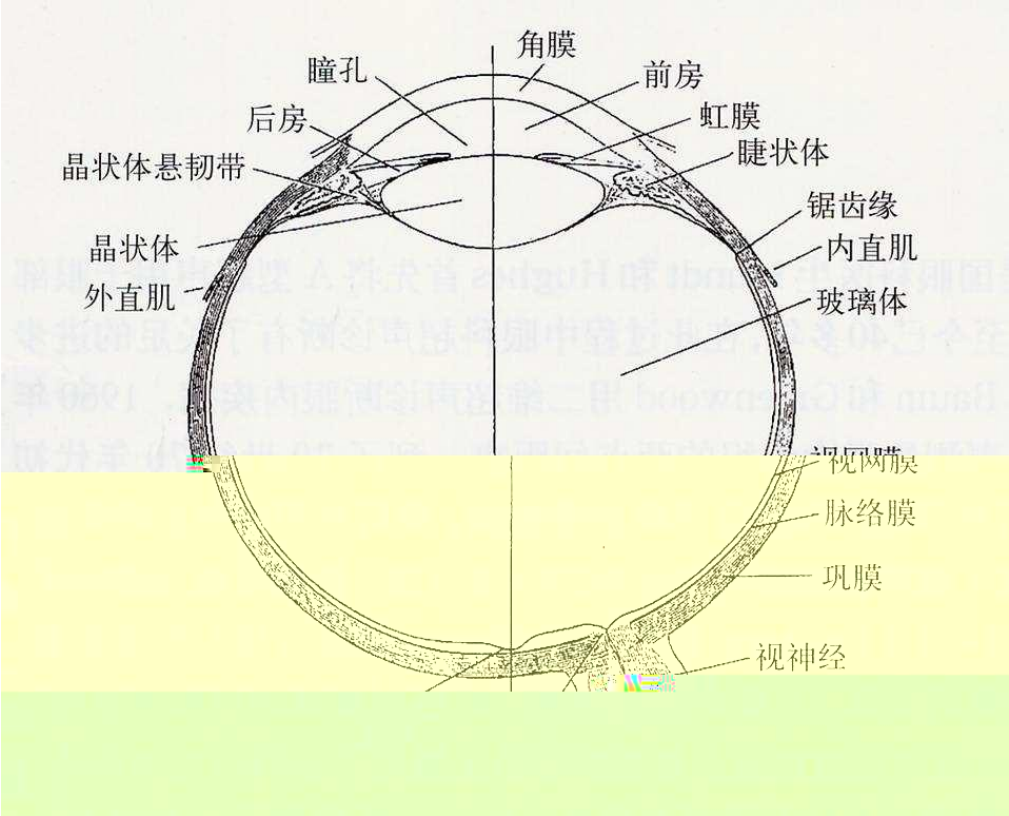
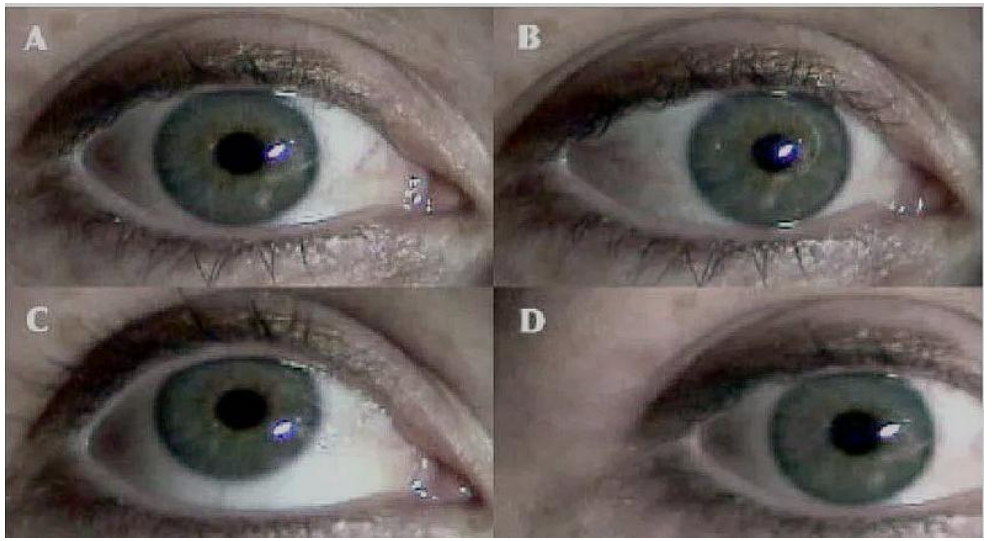


https://www.bilibili.com/video/BV1Ro4y1C7Do?t=55.2

Where——


角膜
瞳孔
前房
后房
虹膜
睫状体
晶状体悬韧带
锯齿缘
晶状体
内直肌
外直肌
玻璃体
视网膜
脉络膜
巩膜
视神经


A
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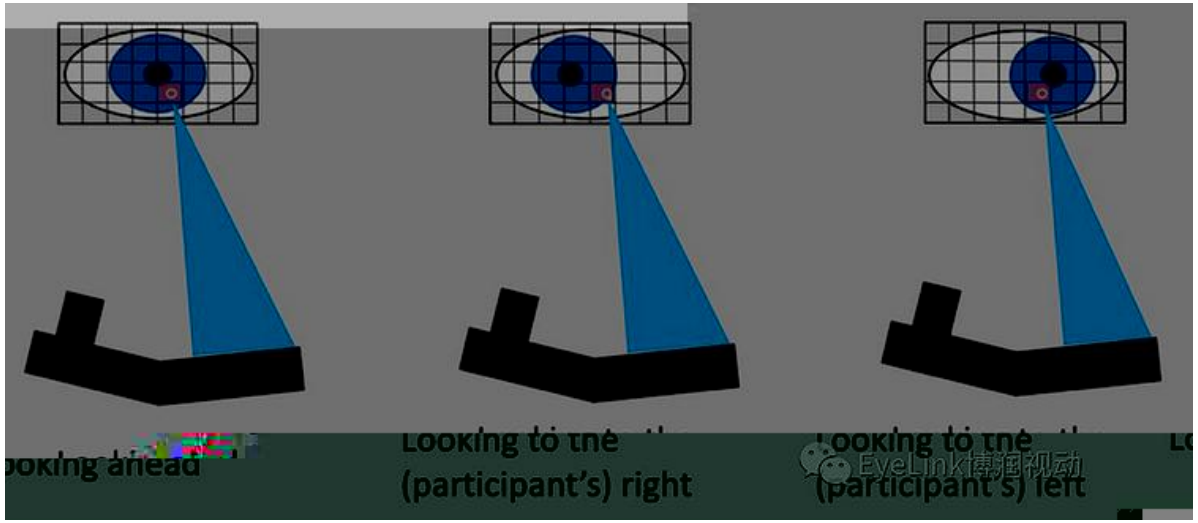

Looking to the
(participant's) right
Looking to the
(participant's) left

How——

Javal 1897 ……

Miles 1928 peep - hole method , 0.25

……

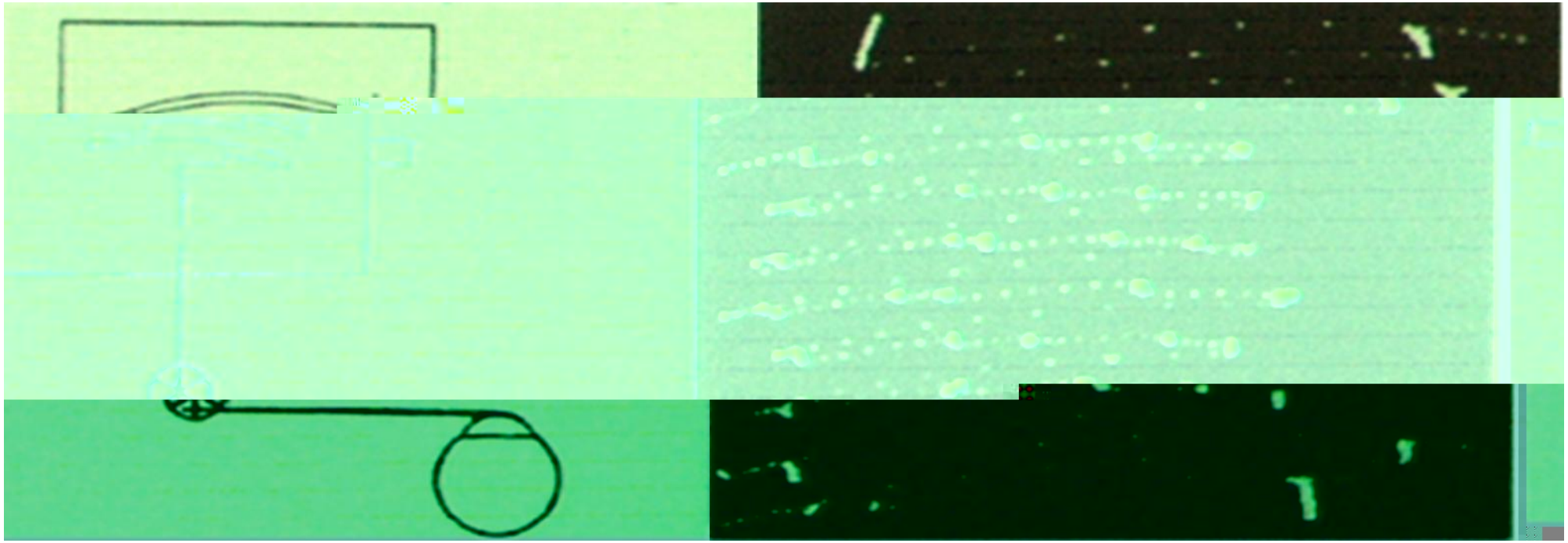
Freeman 1916 ……

Ohrwall 1912

”

—— — (, , 2012)

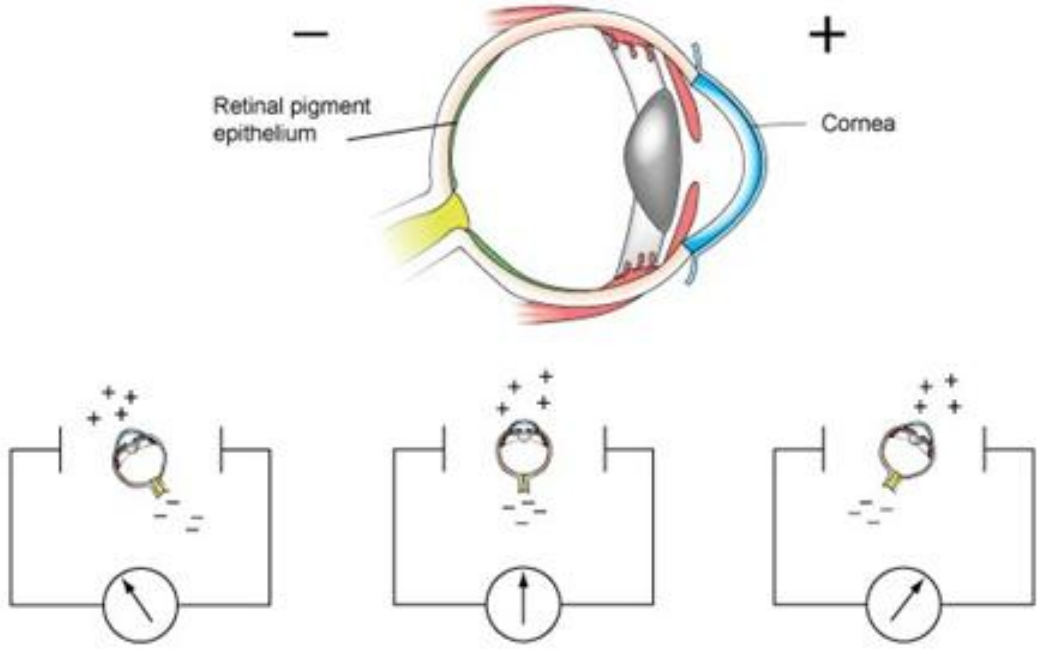
How——



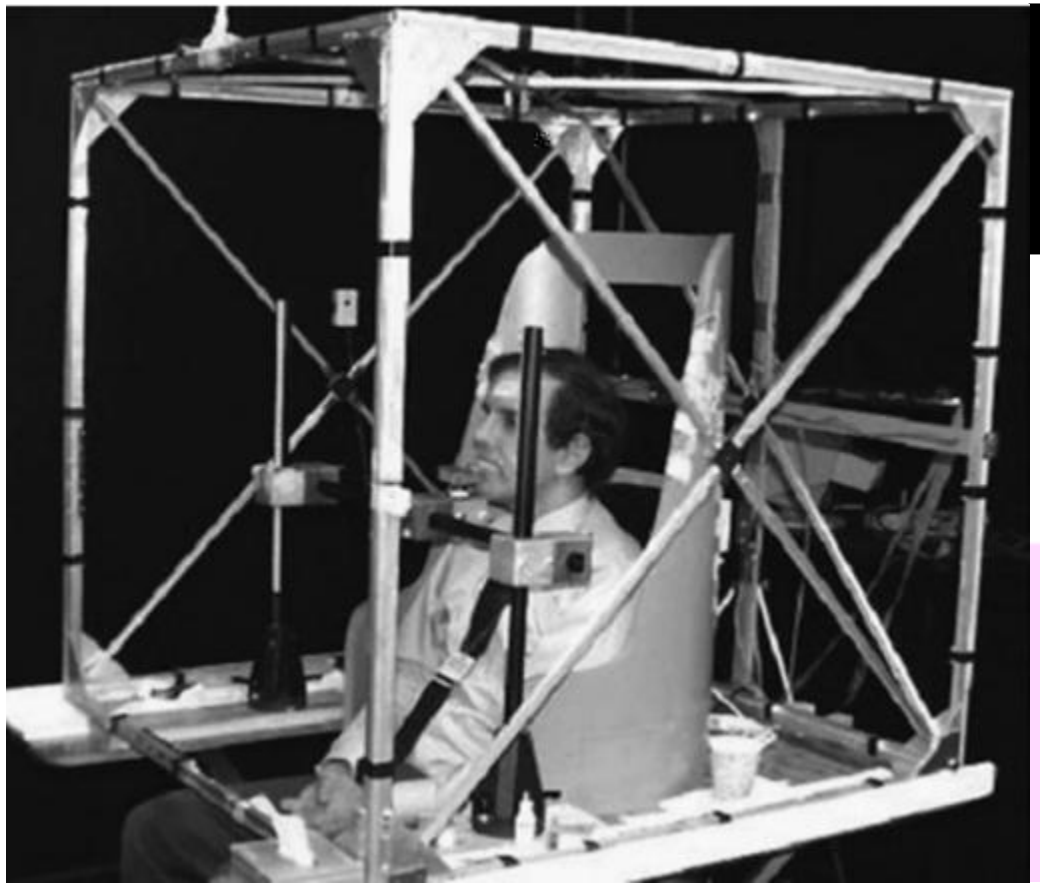
1897 Delabrre
1898

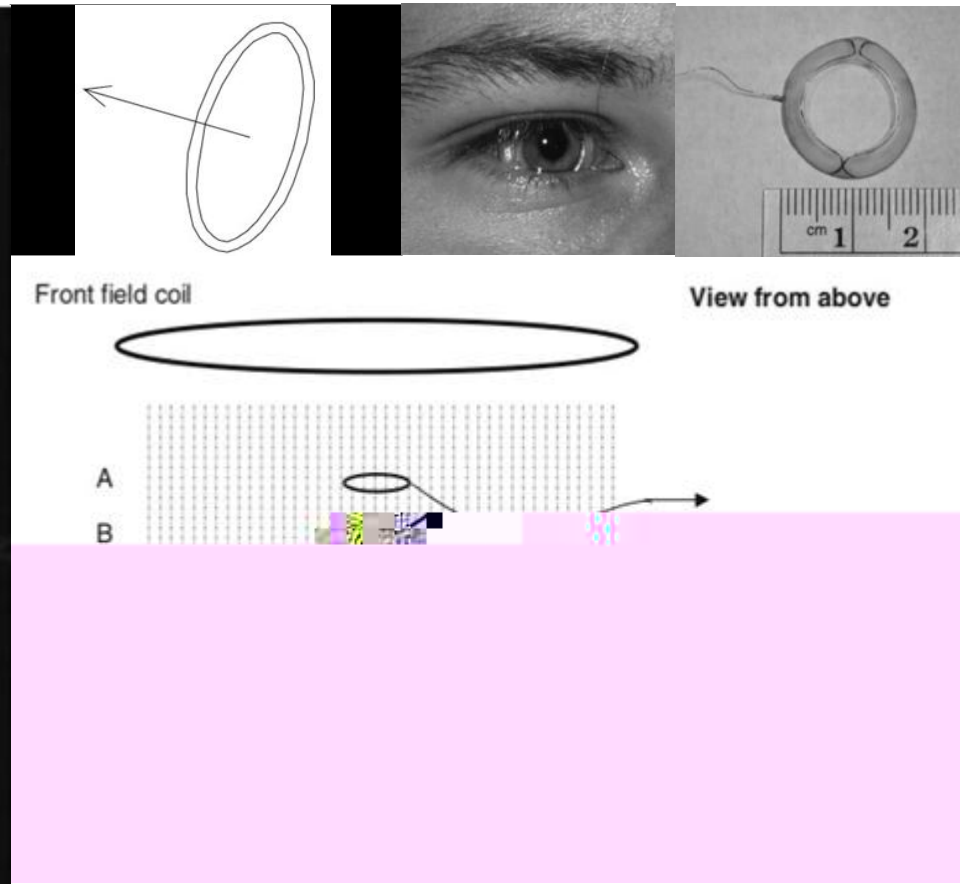
-

Cornea - Retinal Potential / Cornea +

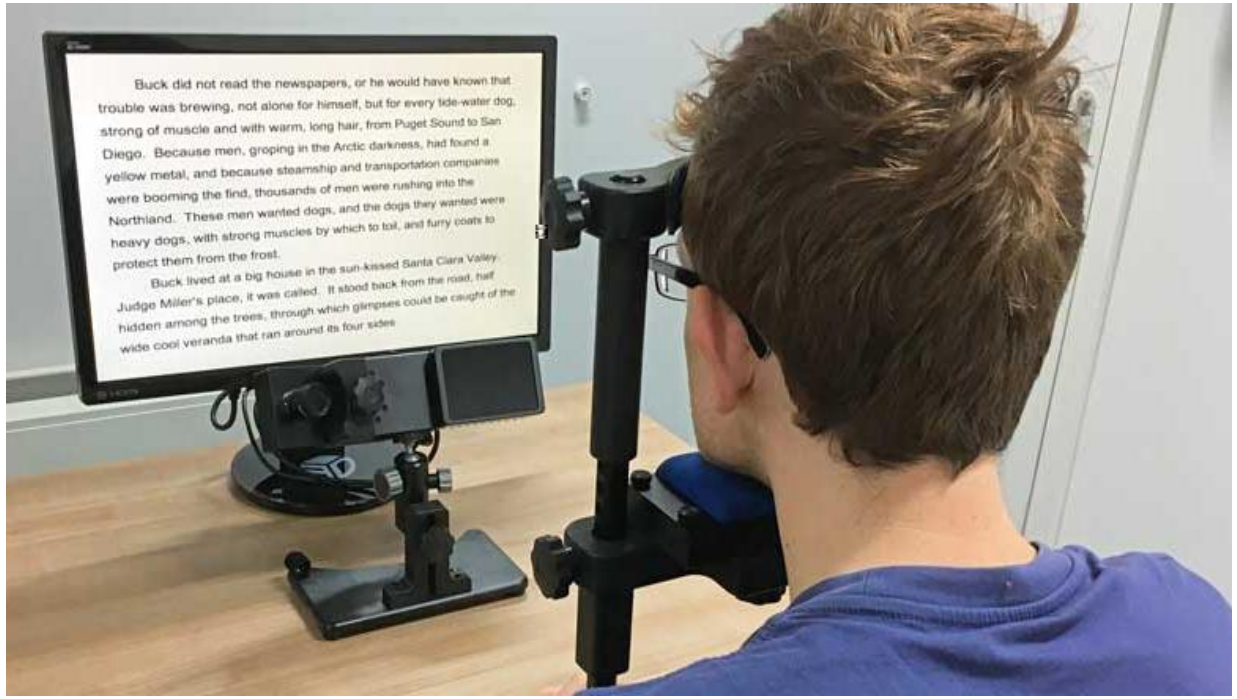


Search Coil





EYELINK


Buck did not read the newspapers, or he would have known that trouble was brewing, not alone for himself, but for every tide-water dog, strong of muscle and with warm, long hair, from Puget Sound to San Diego. Because men, groping in the Arctic darkness, had found a yellow metal, and because steamship and transportation companies were booming the find, thousands of men were rushing into the Northland. These men wanted dogs, and the dogs they wanted were heavy dogs, with strong muscles by which to toil, and furry coats to protect them from the frost.
Buck lived at a big house in the sun-kissed Santa Clara Valley. Judge Miller's place, it was called. It stood back from the road, half hidden among the trees, through which glimpses could be caught of the wide cool veranda that ran around its four sides

EYELINK

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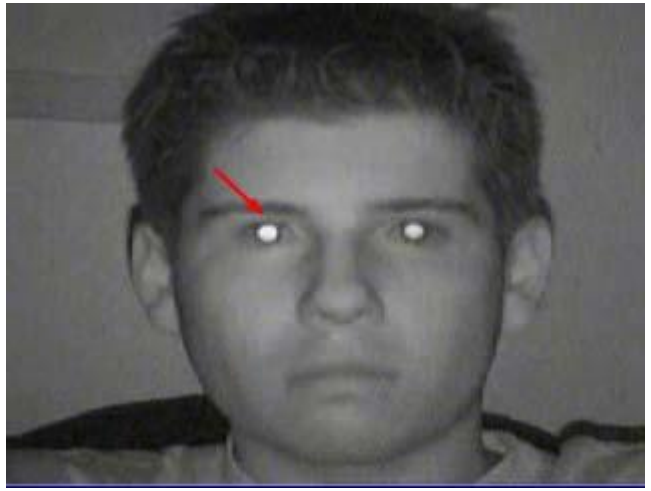
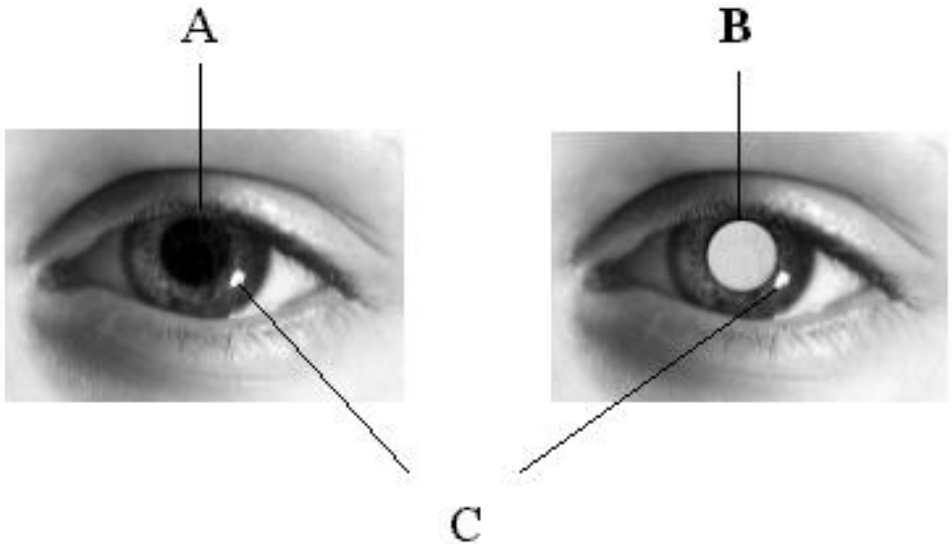
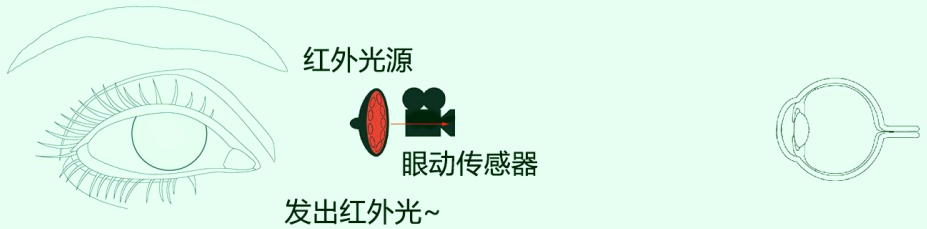
Pupil



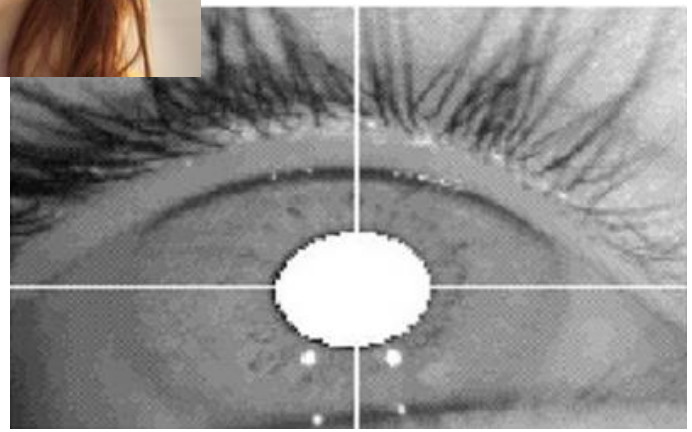
Corneal Reflection



明瞳追踪效果



光源与视轴在一条直线上。此时，瞳孔呈现出亮色，而



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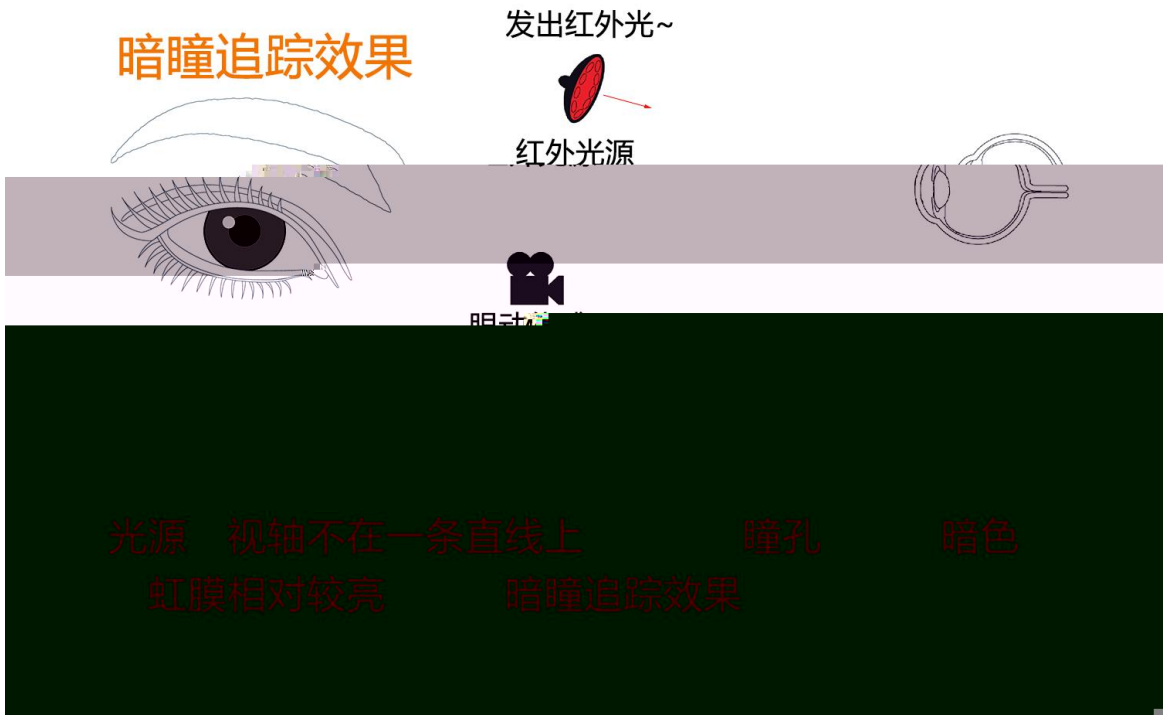

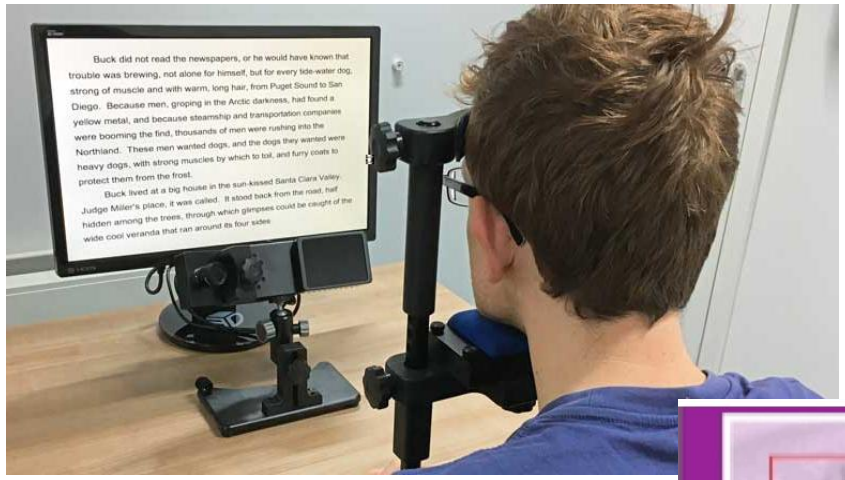

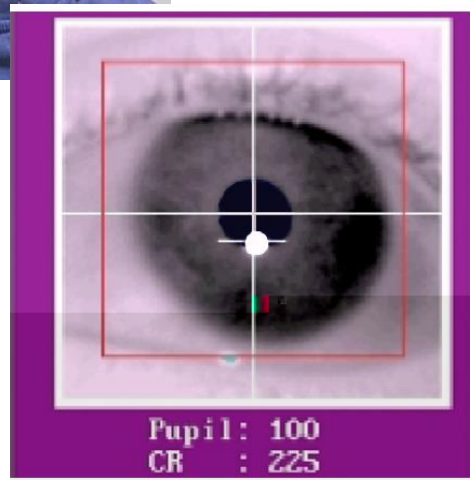

- EyeLink

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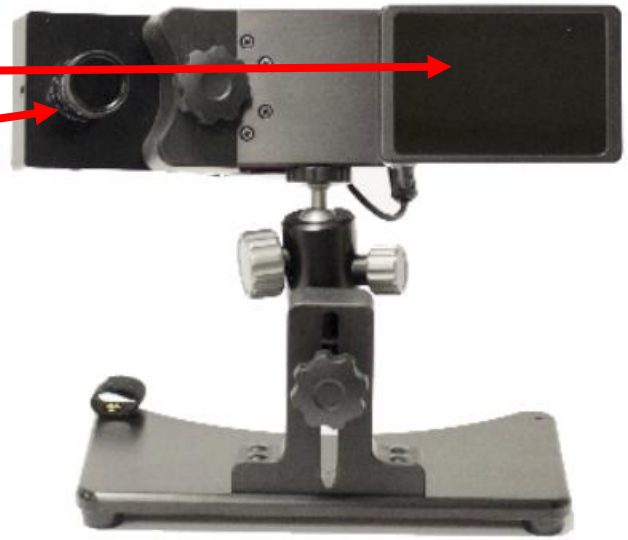
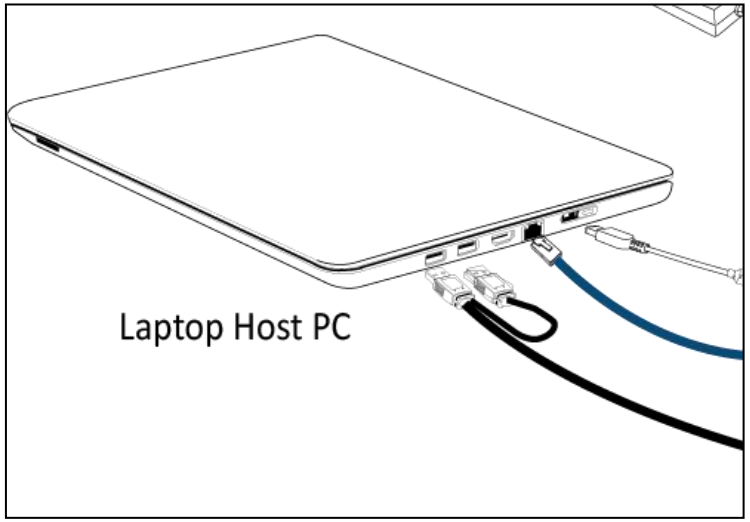
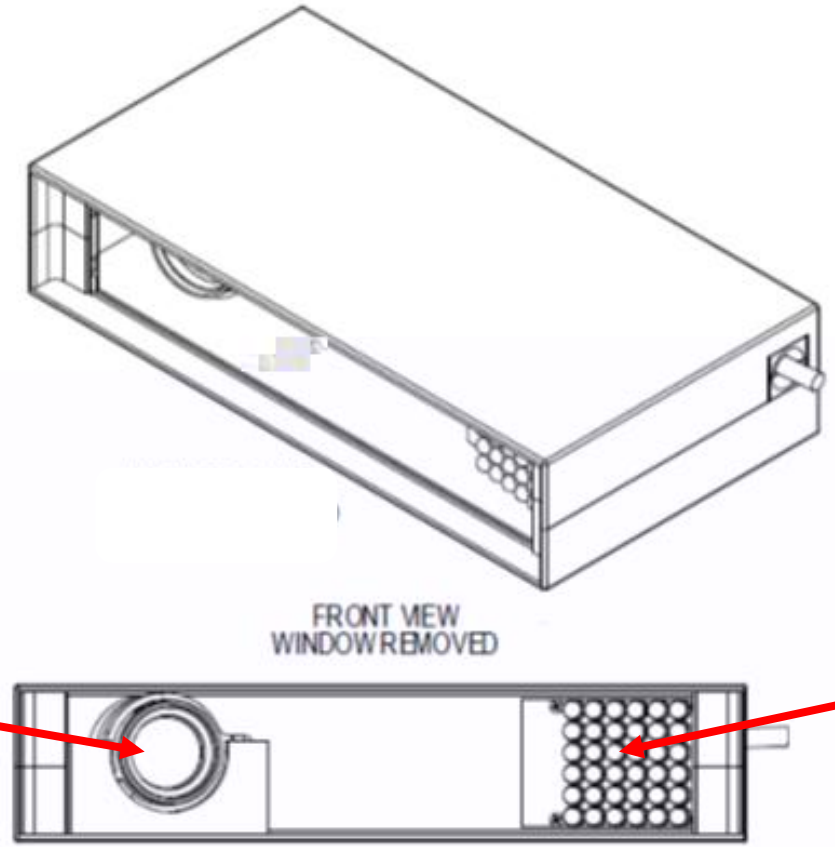
3) +





Inside the Portable Duo:



EyeLink Portable Duo Eye Tracker,
Showing Internal Camera Lens and Illuminator

EYELINK

1)
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2)
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3)
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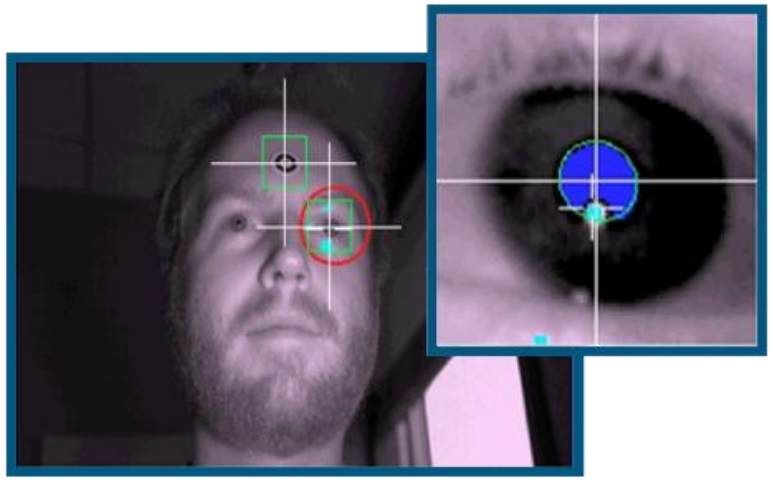
CR

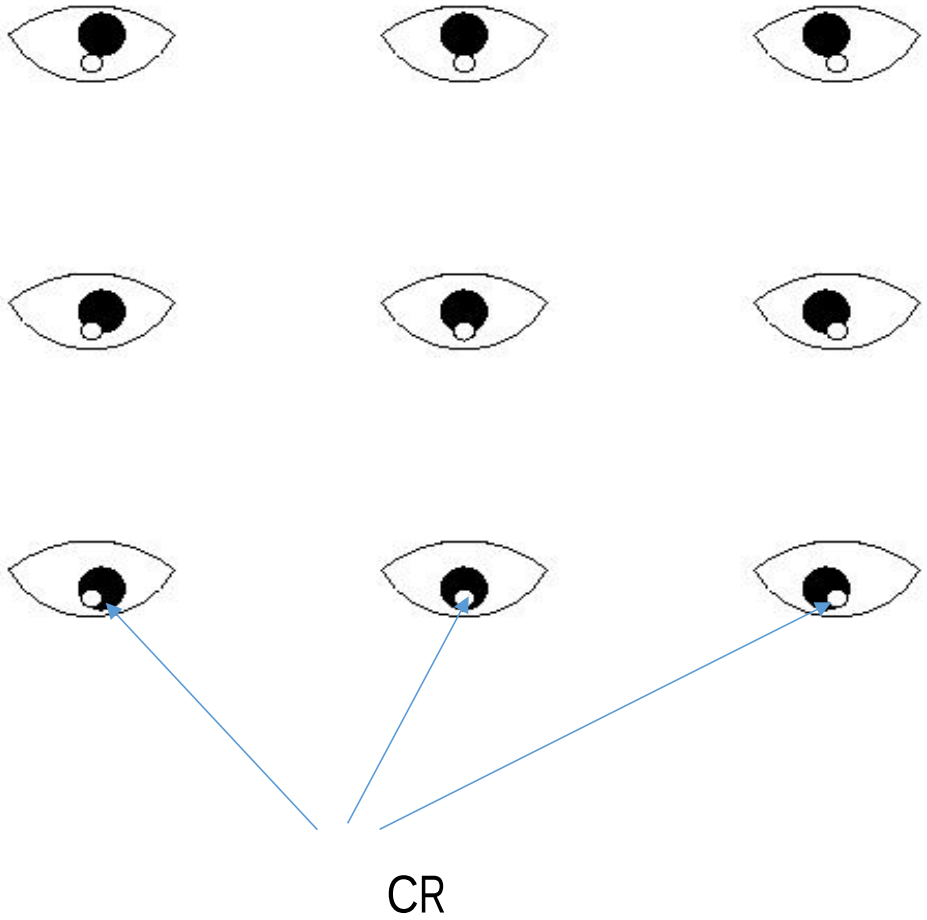
2000

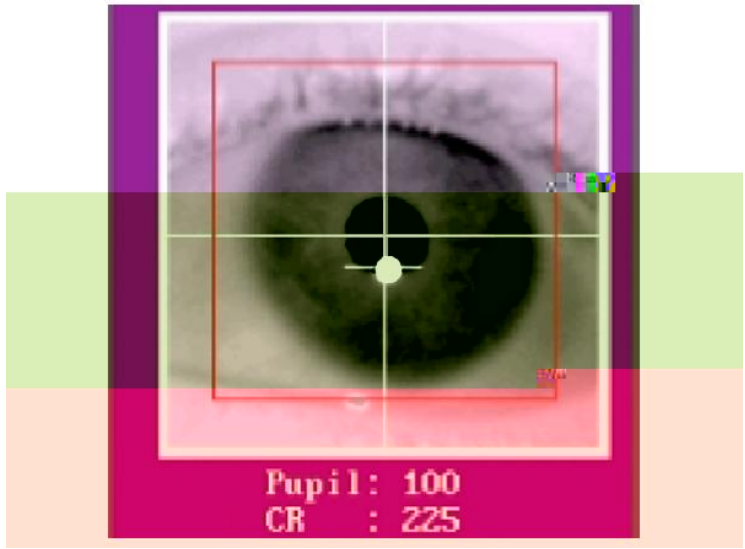
+

RTOS



Pupil - CR Tracking





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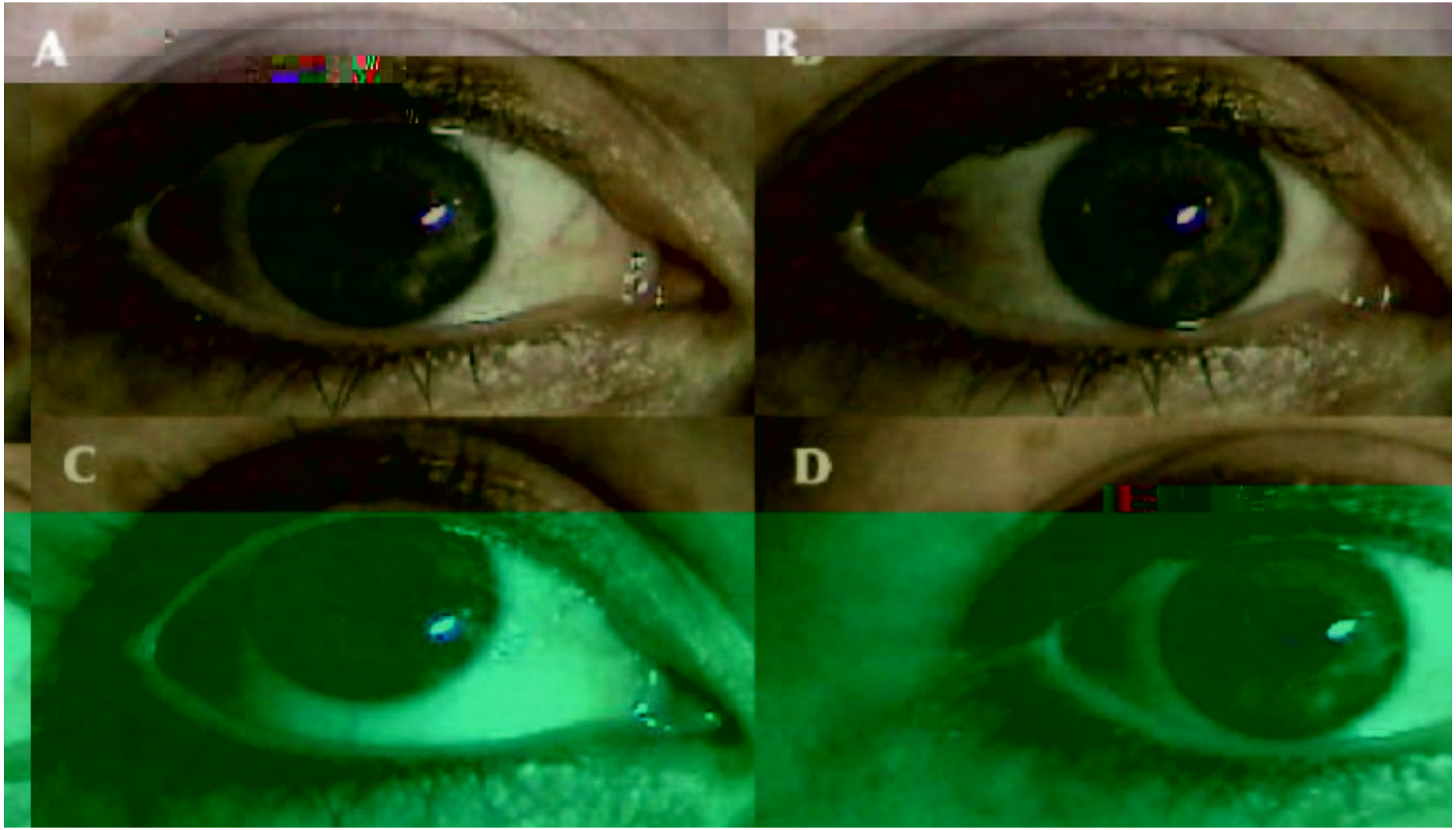
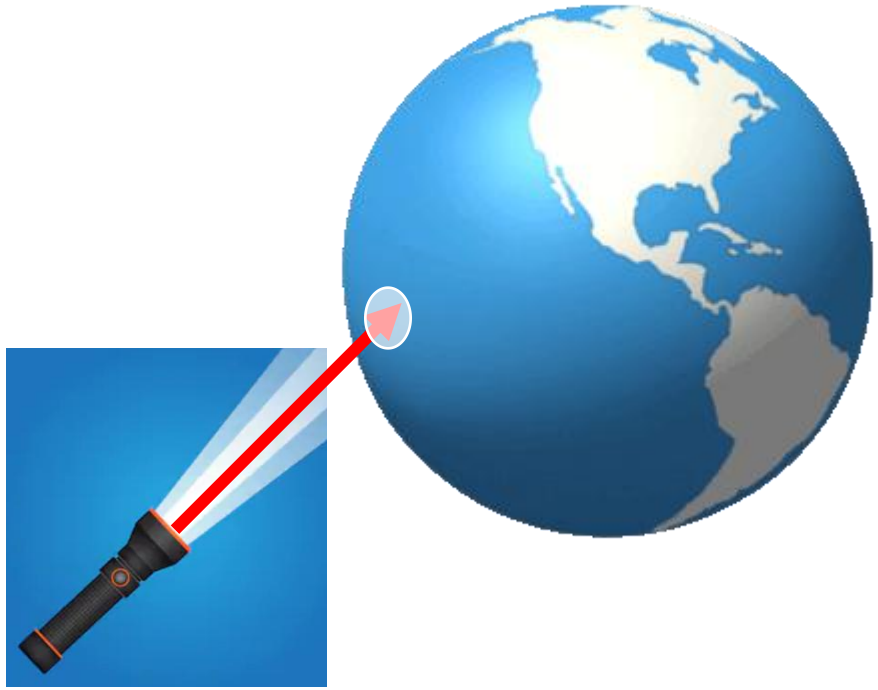


CR –



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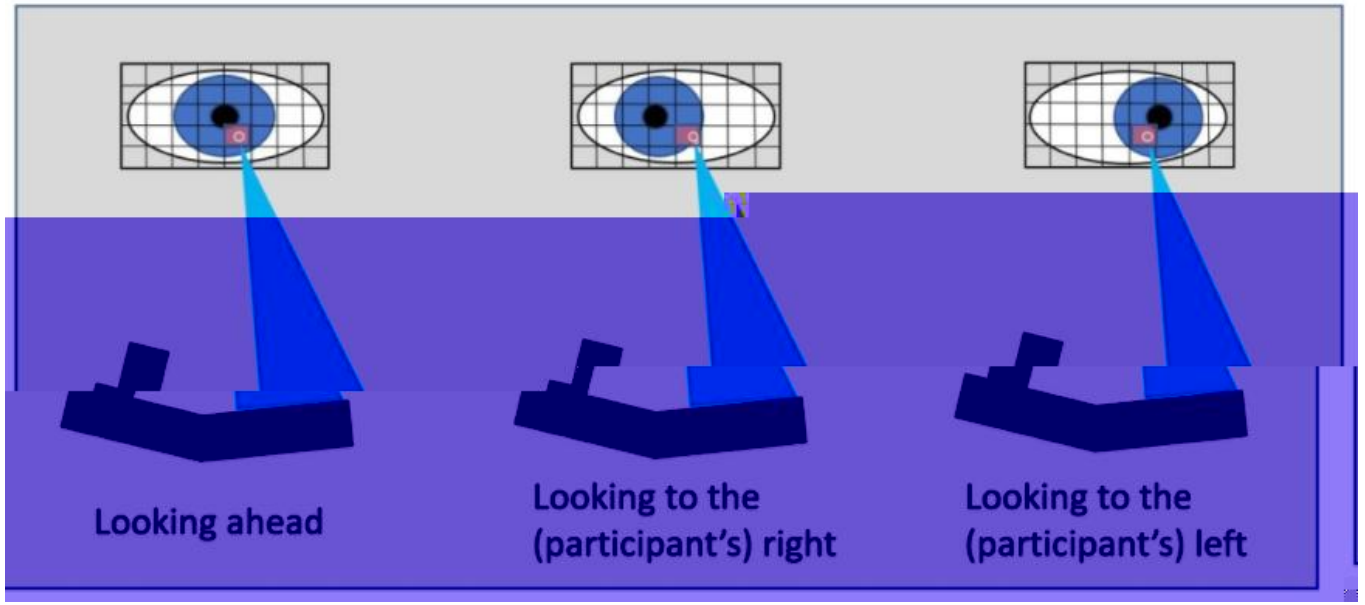
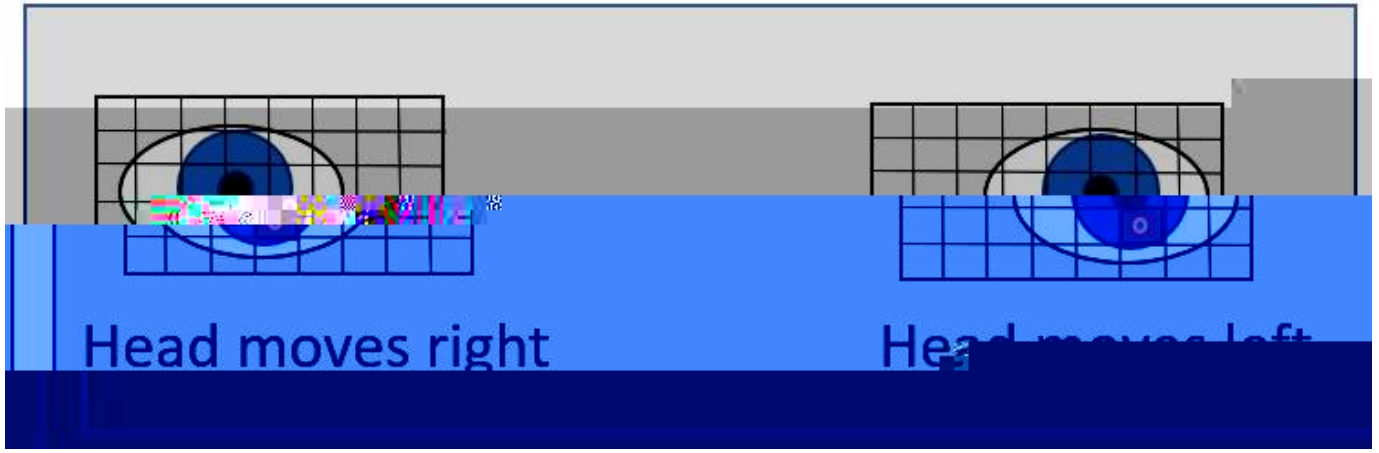
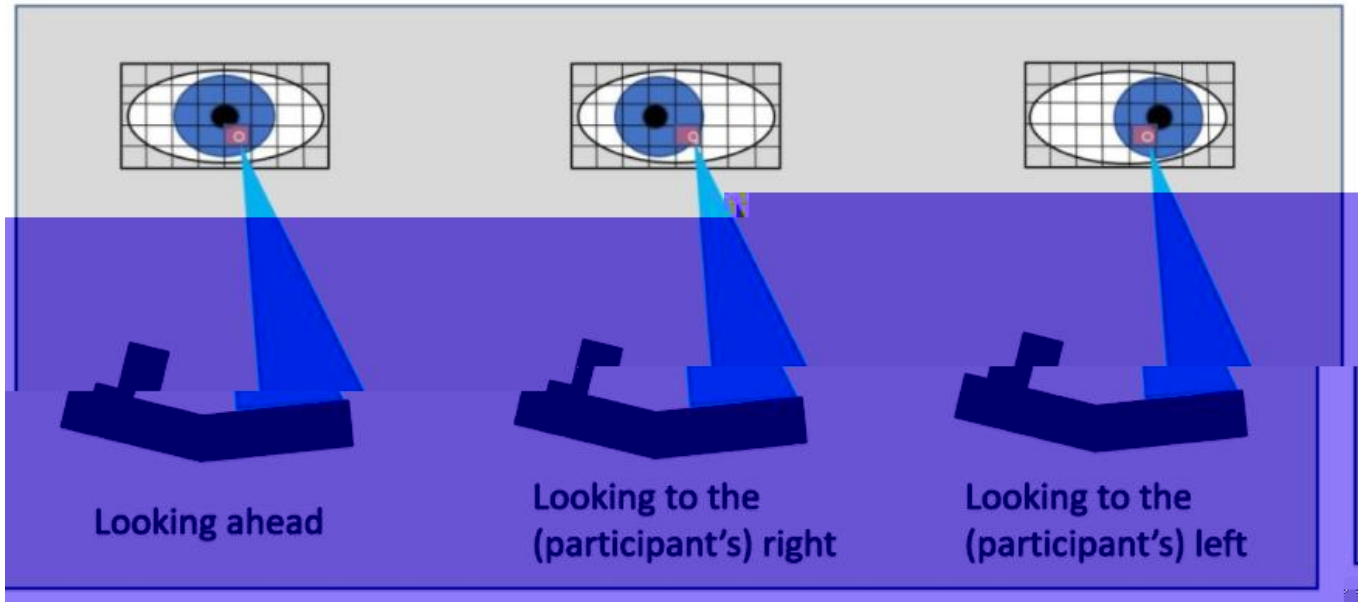
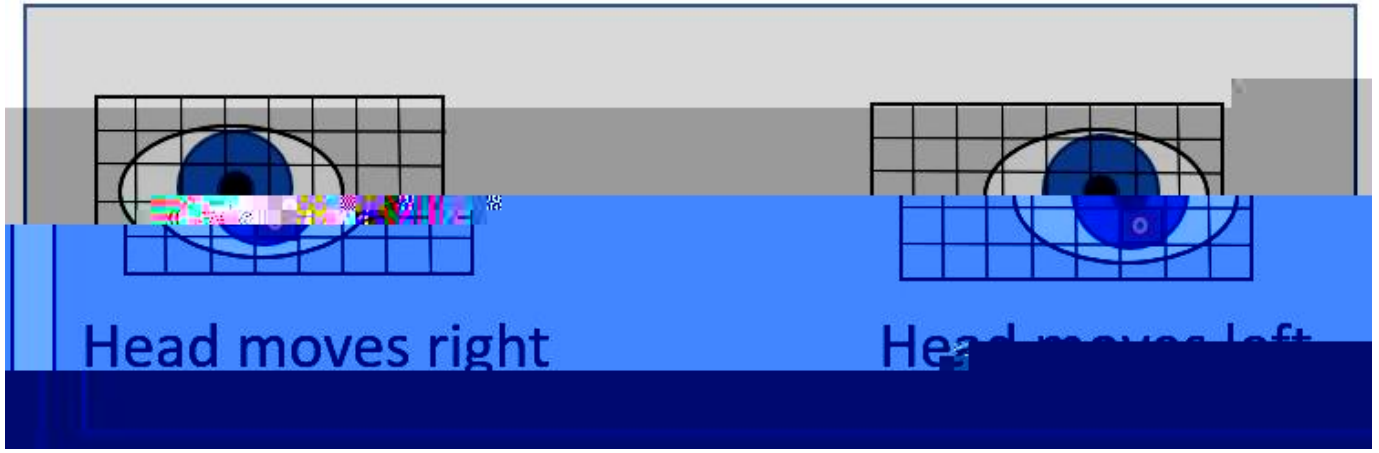

Looking ahead
Looking to the (participant's) right
Looking to the (participant's) left

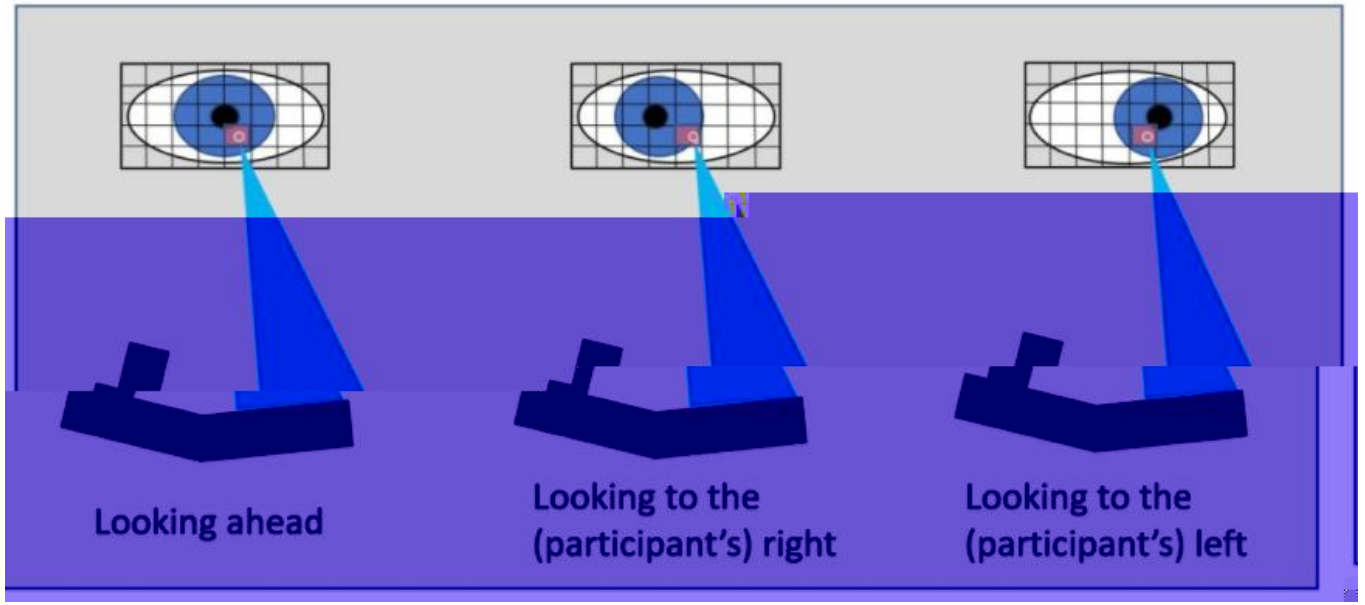
CR


Head moves right


Looking ahead
Looking to the (participant's) right
Looking to the (participant's) left

CR


Head moves right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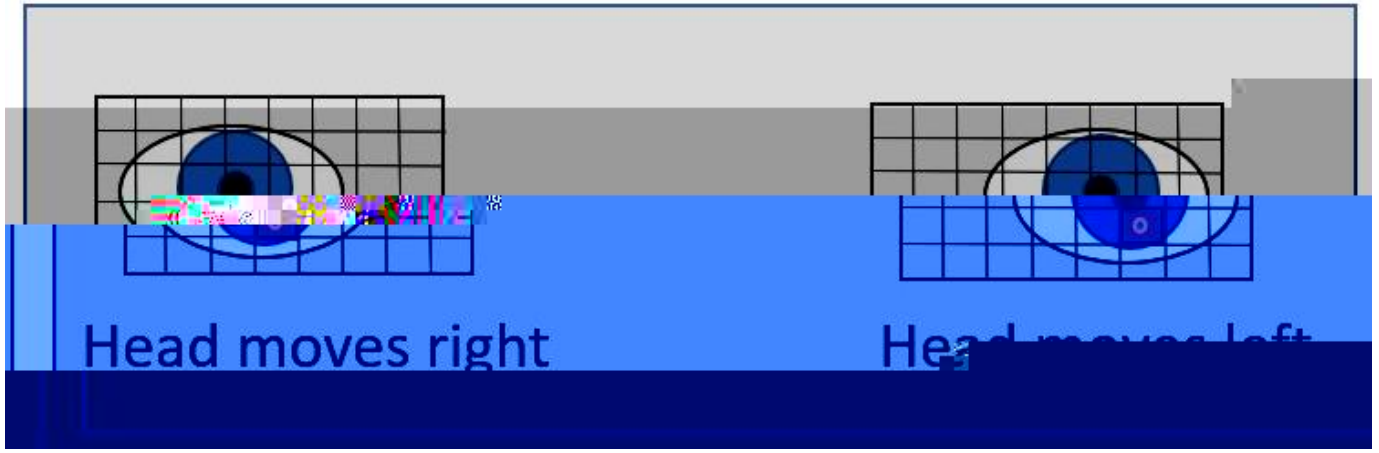
Looking to the (participant's) right
Looking to the (participant's) left

CR 2000 Hz…


Head moves right

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CR

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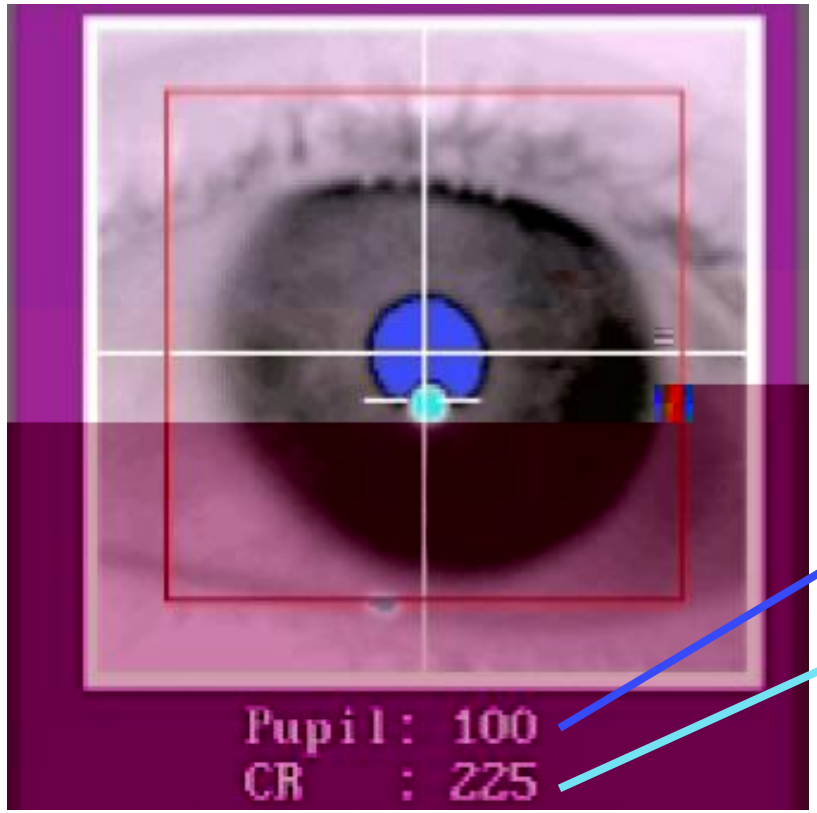
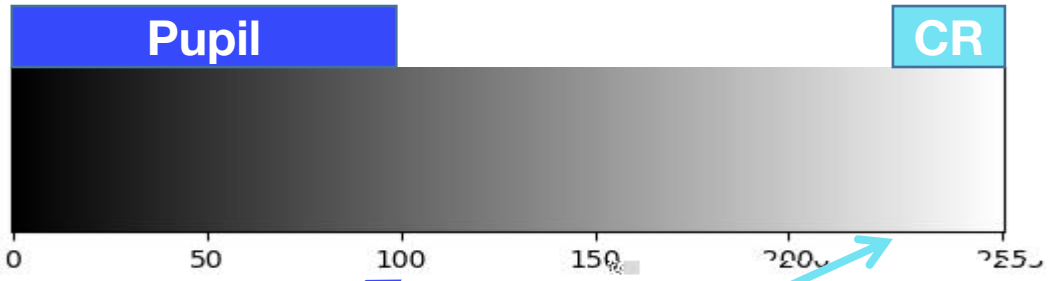
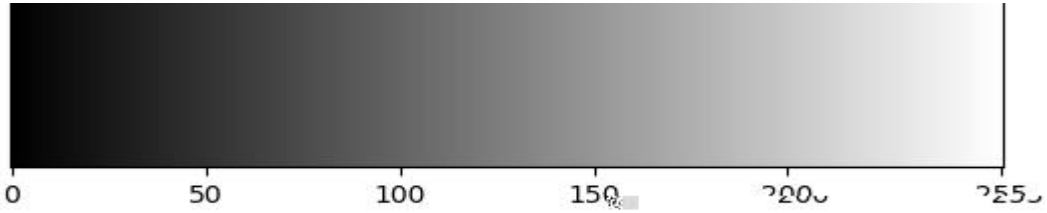
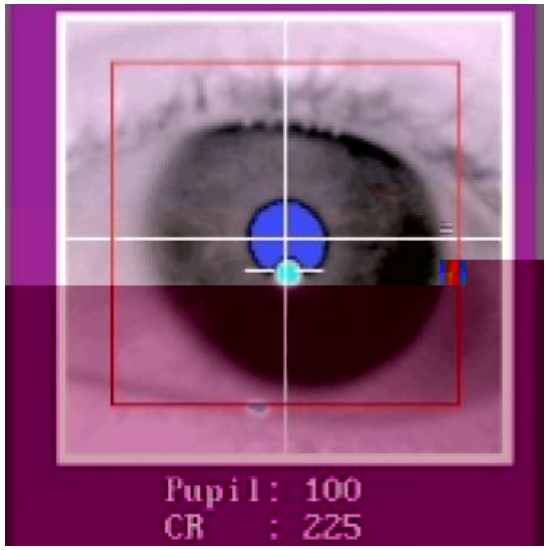




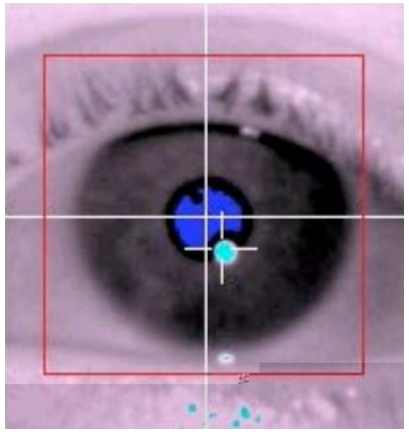
Why thresholds are so important

Pupil and CR thresholds are greyscale values that can vary from 0 (black) to 255 (white).

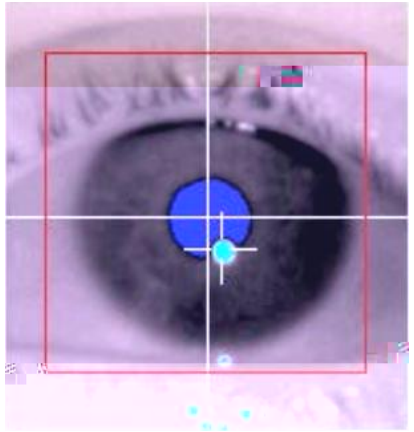




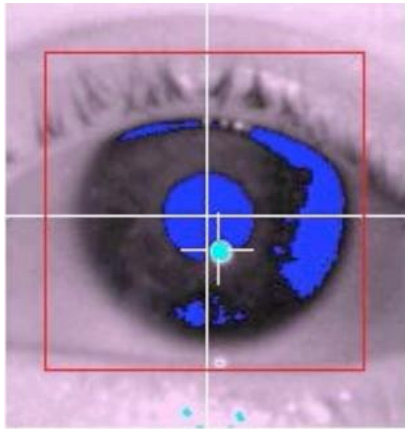
You are basically telling the host how "black" or "white" something has to be to be considered as either pupil or CR.



Too Low

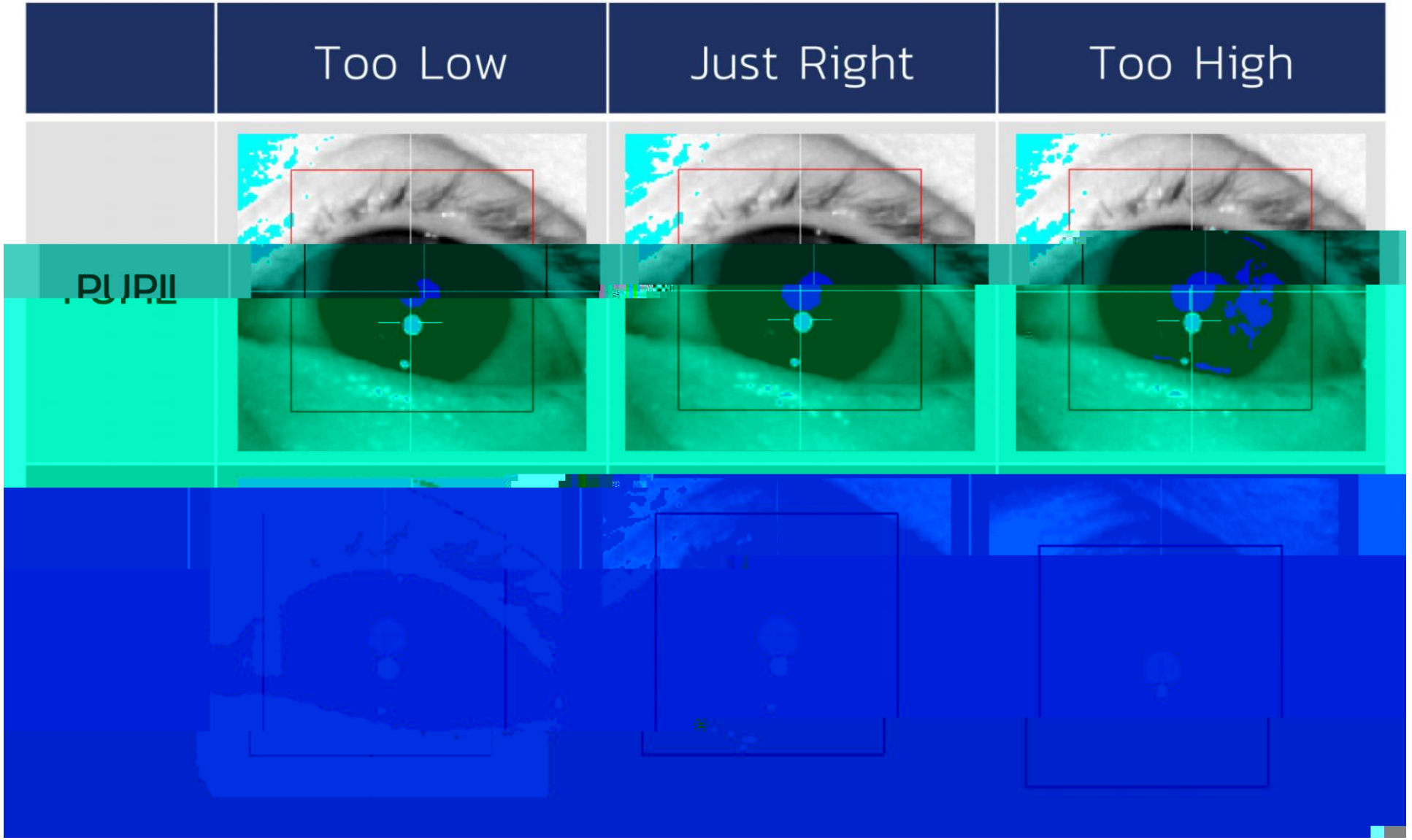


Good



Too High

Why thresholds are so important



Pupil - CR

EYELINK

EyeLink 1000 Plus Installation Guide

EyeLink 1000 Plus User Manual

EyeLink 1000 Plus Quick Start Guide

EYELINK

Eyelink 1000 Plus

- Camera Mount
- Host PC

eyelink

- Display PC

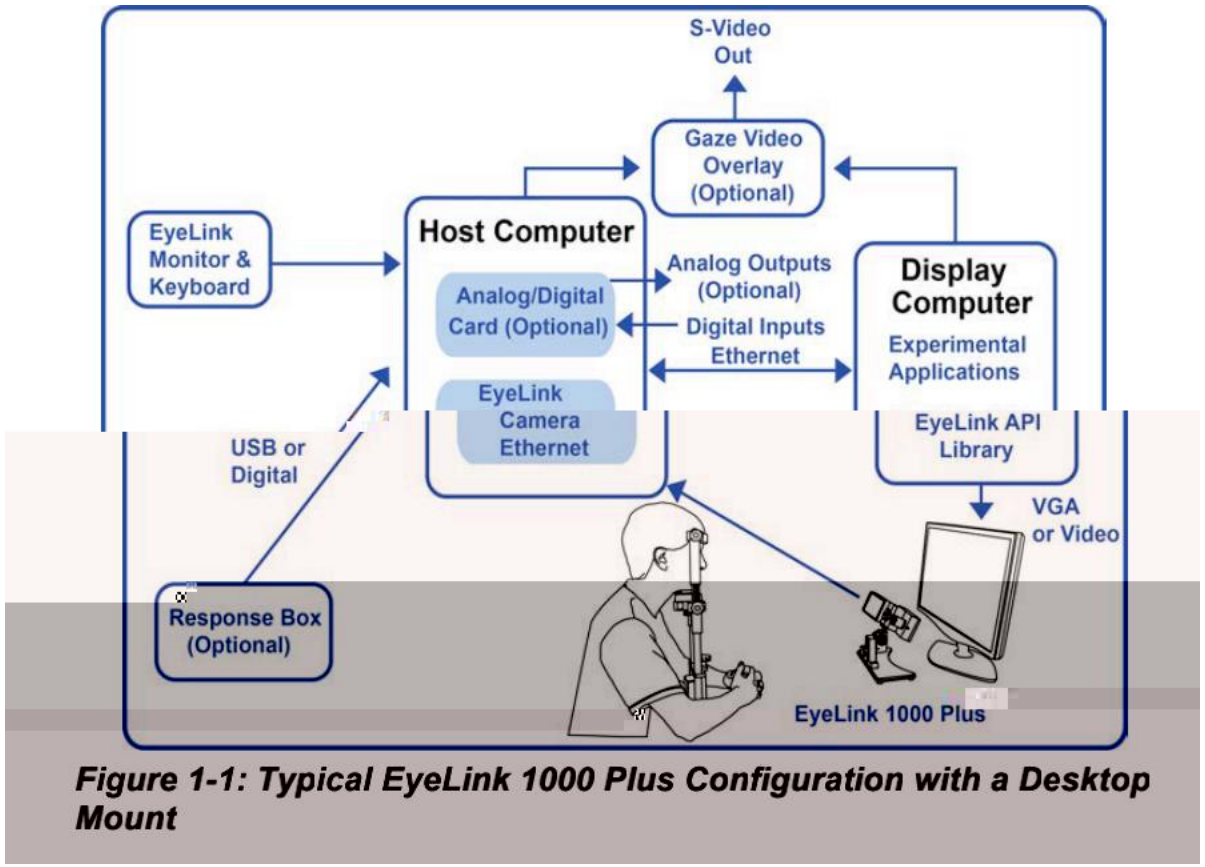
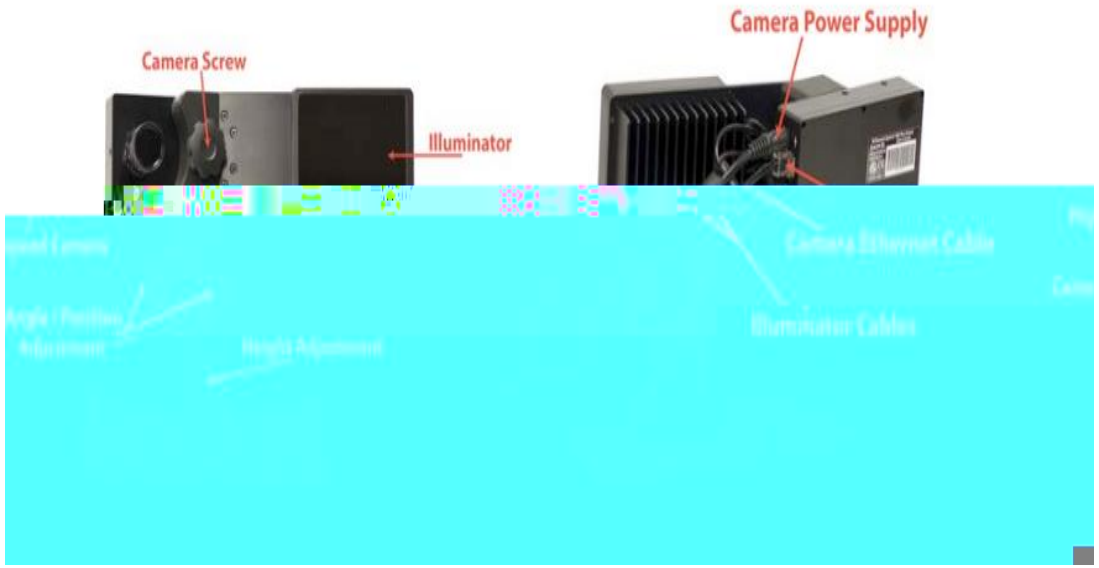
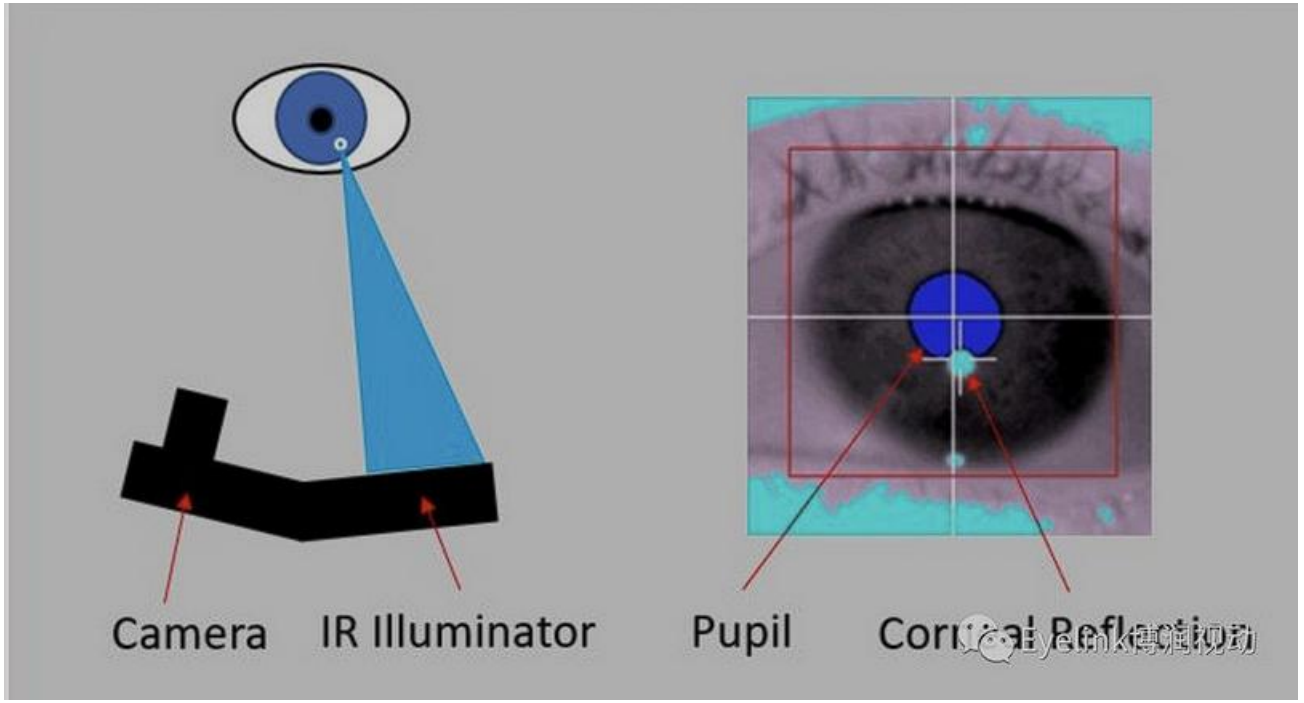


Figure 1-1: Typical EyeLink 1000 Plus Configuration with a Desktop Mount

Camera Mount





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Eyelink 1000 Plus

Host PC

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- 250 500 1000
  2000
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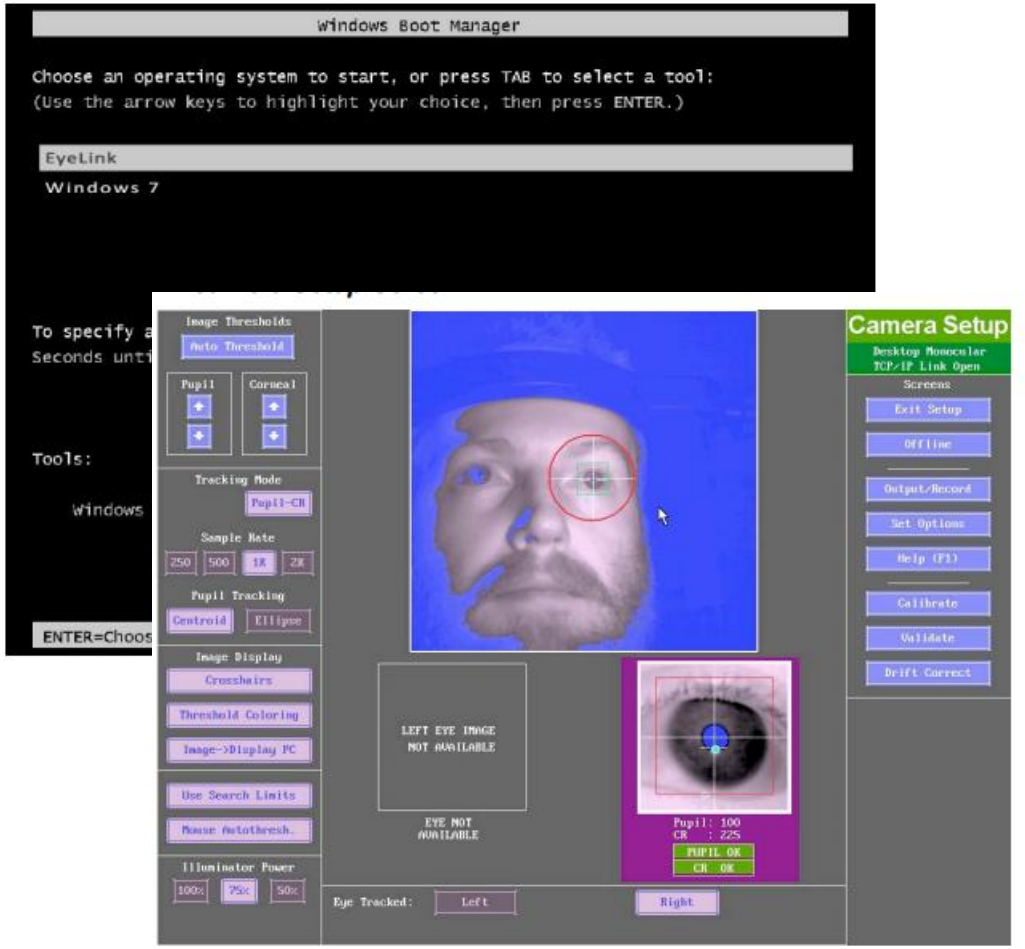

Figure 2-4: Example Camera Setup Screen

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Eyelink 1000 Plus

Display PC

Experiment Builder
e-prime psychtoolbox

Data Viewer EDF2ASC

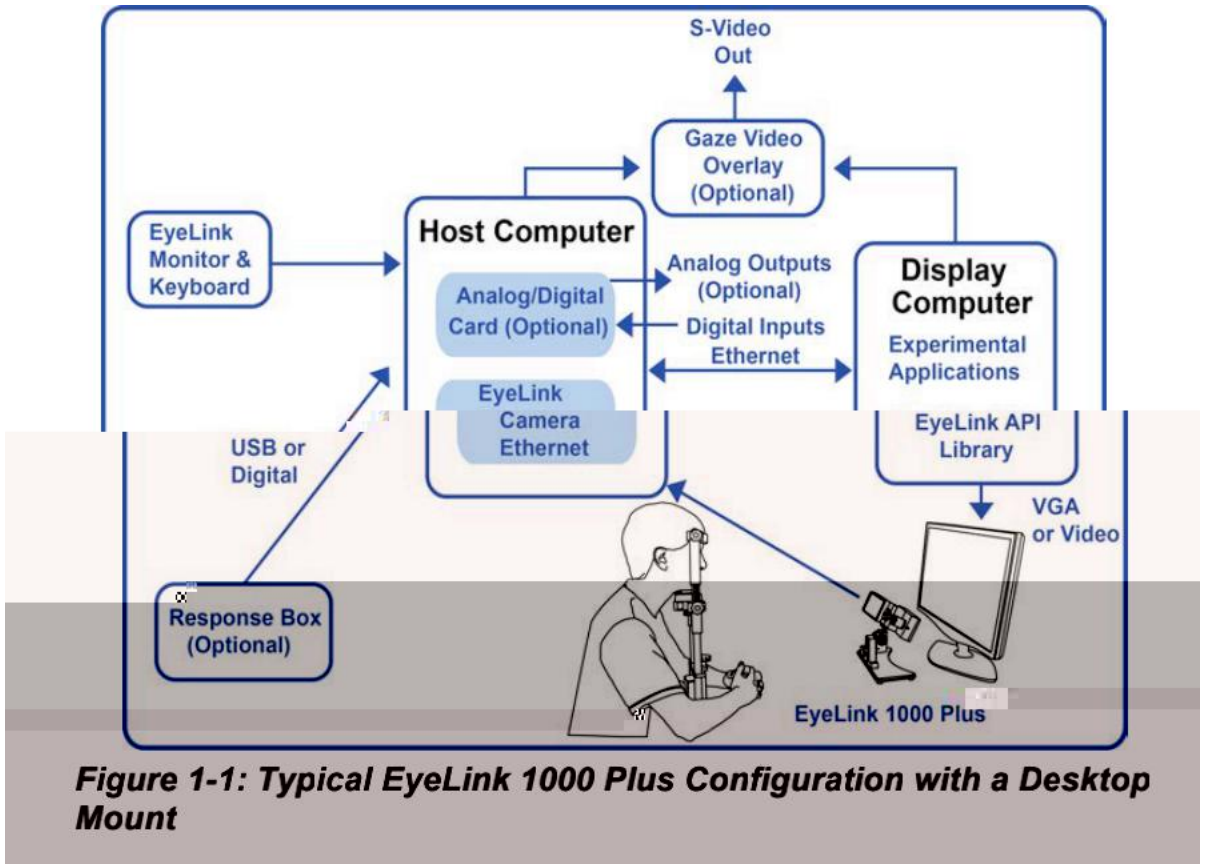

Figure 1-1: Typical EyeLink 1000 Plus Configuration with a Desktop Mount

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1.3 System Specifications

1.3.1 Operational / Functional Specifications

	Tower Mount /Primate Mount	Desktop and LCD Arm Mounts	
		Base System	Remote Tracking (Remote Camera Upgrade required)
Average Accuracy[1]	Down to 0.15° (0.25° to 0.5° typical)		0.25-0.5° typical
Sampling rate[2]	Monocular: 250,500,1000,2000 Hz Binocular: 250,500,1000,2000 Hz		Monocular: 250,500,1000 Hz Binocular: 250,500,1000 Hz
End-to-End Sample Delay[3]	1000 Hz: M = 1.97 ms, SD = 0.39 ms 2000 Hz: M = 1.34 ms, SD = 0.20 ms		500 Hz: M = 3.29 ms, SD = 0.58 ms 1000 Hz: M= 2.19 ms, SD = 0.30 ms
Blink/Occlusion Recovery	1.0 ms @ 1000 Hz 0.5 ms @ 2000 Hz		2.0 ms @ 500 Hz 1.0 ms @ 1000 Hz
Spatial Resolution[4]	0.01°		
Noise with Participants[5]	Filter (Off/Normal/High) 1000 Hz: 0.02°/ 0.01°/ 0.01° 2000 Hz (monoc): 0.03°/ 0.02°/ 0.01° 2000 Hz (binoc): 0.04°/ 0.02°/ 0.02°		Filter (Off/Normal/High) 500 Hz: 0.03°/0.02°/0.01° (25 mm lens) 0.06°/0.03°/0.01° (16 mm lens) 1000 Hz 0.05°/0.03°/0.01° (25 mm lens) 0.08°/0.04°/0.02° (16 mm lens)
Eye Tracking Principle[6]	Dark Pupil - Corneal Reflection		
Pupil Detection Models	Centroid or Ellipse Fitting		Ellipse Fitting
Pupil Size Resolution[5]	0.1% of diameter		0.2% of diameter (16 mm lens) 0.1% of diameter (25 mm lens)
Gaze Tracking Range	60° horizontally, 40° vertically		Customizable Default is 32 ° horizontally × 25° vertical
Allowed Head Movements Without Accuracy Reduction	±25 mm horizontal or vertical		16 mm lens: 35×35 cm at 60 cm 40×40 cm at 70 cm 25 mm lens: 22×22 cm at 60 cm 25×25 cm at 70 cm
Optimal Camera-Eye Distance	Tower: 48 cm Primate: 30 - 45 cm	40 - 70 cm	
Infrared Wavelength	Tower: 940 nm Primate: 910 /940 nm	850 to 940 nm	
Glasses Compatibility	Good	Excellent	Good
On-line Event Parsing	Fixation / Saccade / Blink / Fixation Update		
EDF File and Link Data Types	Gaze, Raw, and HREF eye position data/ Pupil size / Online event Buttons / Messages / Digital inputs		
Real-Time Operator Feedback	Eye position gaze cursor superimposed on static image or positio traces with camera images and tracking status.		

Specifications are preliminary and subject to change without notice.

[1] Measured with real eye fixations at multiple screen positions on a per subject basis.
[2] Availability depends on having the appropriate hardware and camera programming.
[3] Time from physical event until first registered sample is available via Ethern or Analog output. Option
filter algorithm adds one sample delay for each filtering level.
[4] Measured with an artificial eye.
[5] Measured with real subject fixations.
[6] Pupil-Only tracking mode is available for use in head fixed conditions.

1.3.2 Physical Specifications

Physical	Anodized aluminum enclosu
GL (EyeLink 1000 Plus Camera)	Standard thread (¼"-20) centered on optical axis from 3 sides. M8 thread on front for DM and AM mounts. Power requirements: +12VDC, 800 mA for camera alone, 1.2 A maximum when used with illuminator(s). Imaging rates up to 2000 fps.
OC (Fiber Optic Camera Head)	M3 tapped holes on body. Adapter for ¼"-20 mounting available. Supply: 3.6-5.7VDC, 700mA via LEMO connector and power harness. Imaging rates up to 2000 fps. Non-magnetic (< 0.5g of iron or nickel). Radio-quiet case and cable design for use in research environments.
FL-890, FL-940	Standard thread (¼"-20) at center and sides.
90/940 nm Fresnel luminator Module)	Adjustable focus and beamwidth. Wavelength: 890 or 940 nm. Supply: 3.6-5.7VDC, 1.1A via LEMO connector and power harness. Non-magnetic (< 0.5g of iron or nickel). Radio-quiet case and cable design for use in research environments.
M-910, PM-940 10/940 nm luminator Module)	Wavelength: 910 or 940 nm. Eye illumination level: less than 1 mW/cm² at >200mm from illuminator. Illuminators powered from camera through supplied cables.
M-850W, DM-850L--, DM-890, DM-940,	Wavelength: 850 or 940 nm. Eye illumination level: less than 1 mW/cm² at >450mm from
	5.6VDC@2A minimum. When used with supplied power harness, DB-9 connector is required (contact SR Research for pinout). Power supply must have EN 60950, UL 950, CSA 22.2 No. 950, or other equivalent safety approval, with LPS or Class 2 rating.
Operating conditions	10°C to 30°C, 10%-80% humidity (non-condensing) For indoor use only.
Storage conditions	-10°C to 60°C, 10% humidity (non-condensing). Allow to warm to room temperature before unpacking or use after storage at temperatu below 20°C to prevent condensation.
Safety Standards	IEC 60950-1:2005 (2nd Ed.) + Am 1:2009

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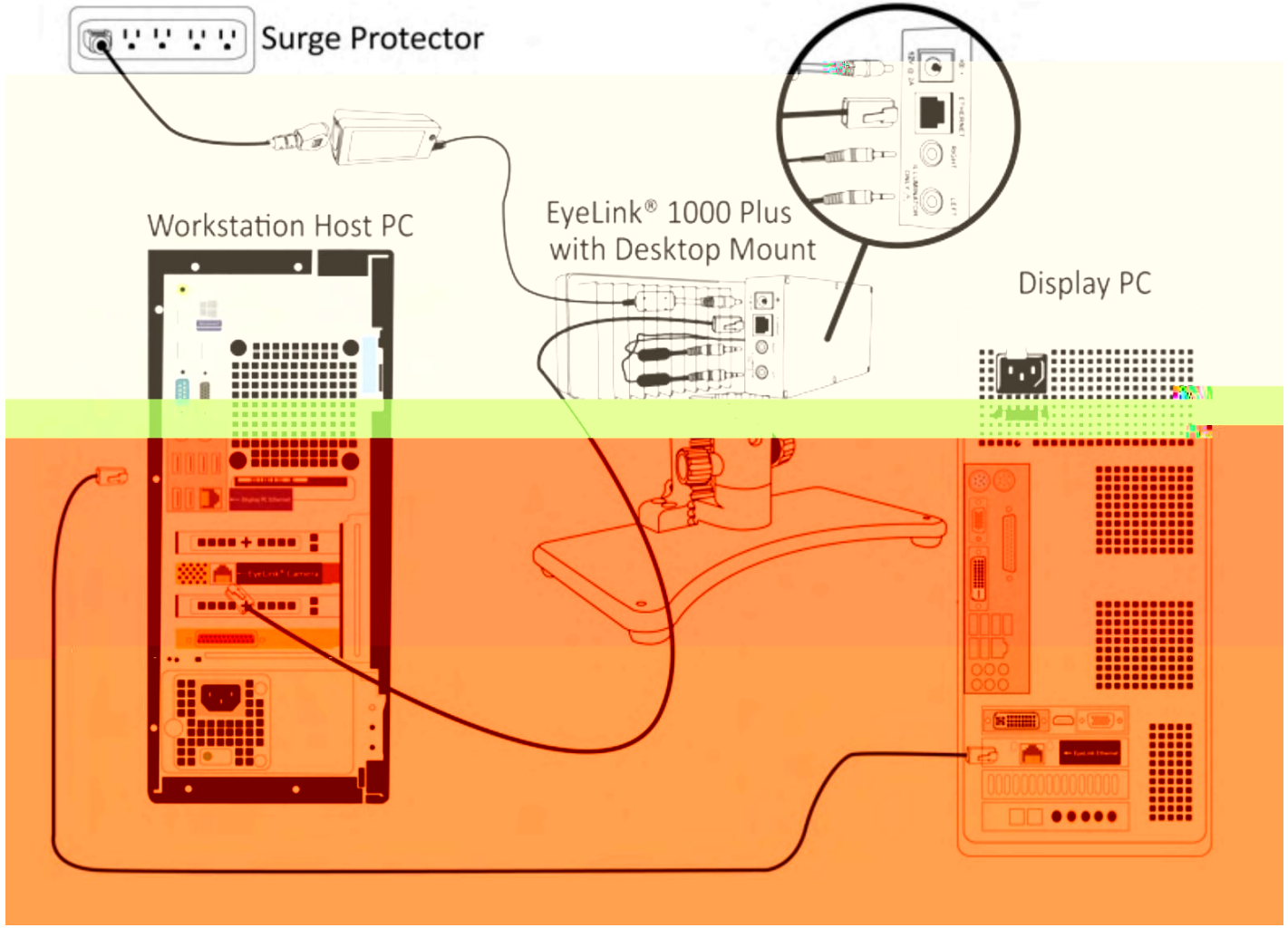
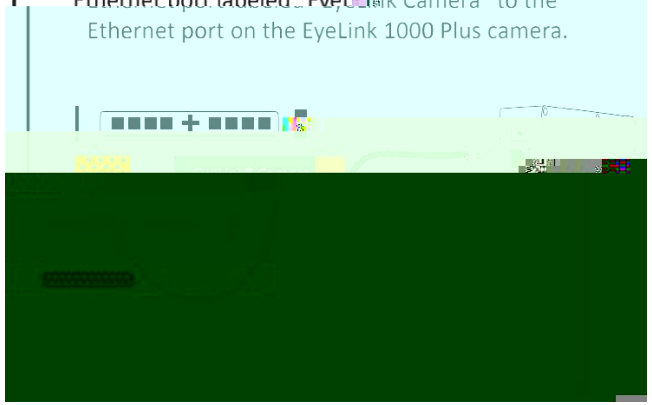


2 Camera Connection

Using the **black** Ethernet cable, connect the Host PC Ethernet port labeled "EyeLink Camera" to the Ethernet port on the EyeLink 1000 Plus camera.

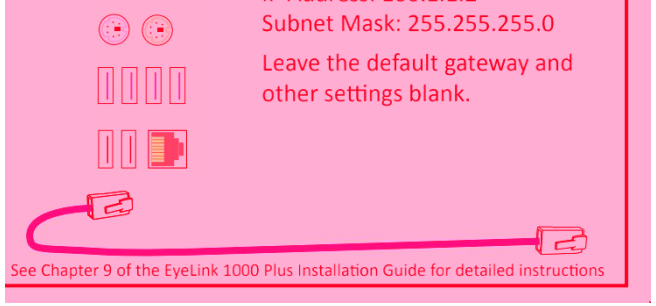


3 Host PC to Display PC Connection

Using the **blue** Ethernet cable, connect the Host PC Ethernet port labeled "Display PC Ethernet" to an Ethernet port on your Display PC. Configure that port with the following static IP address:

IP Address: 100.1.1.2
Subnet Mask: 255.255.255.0

Leave the default gateway and other settings blank.



See Chapter 9 of the EyeLink 1000 Plus Installation Guide for detailed instructions

IP address

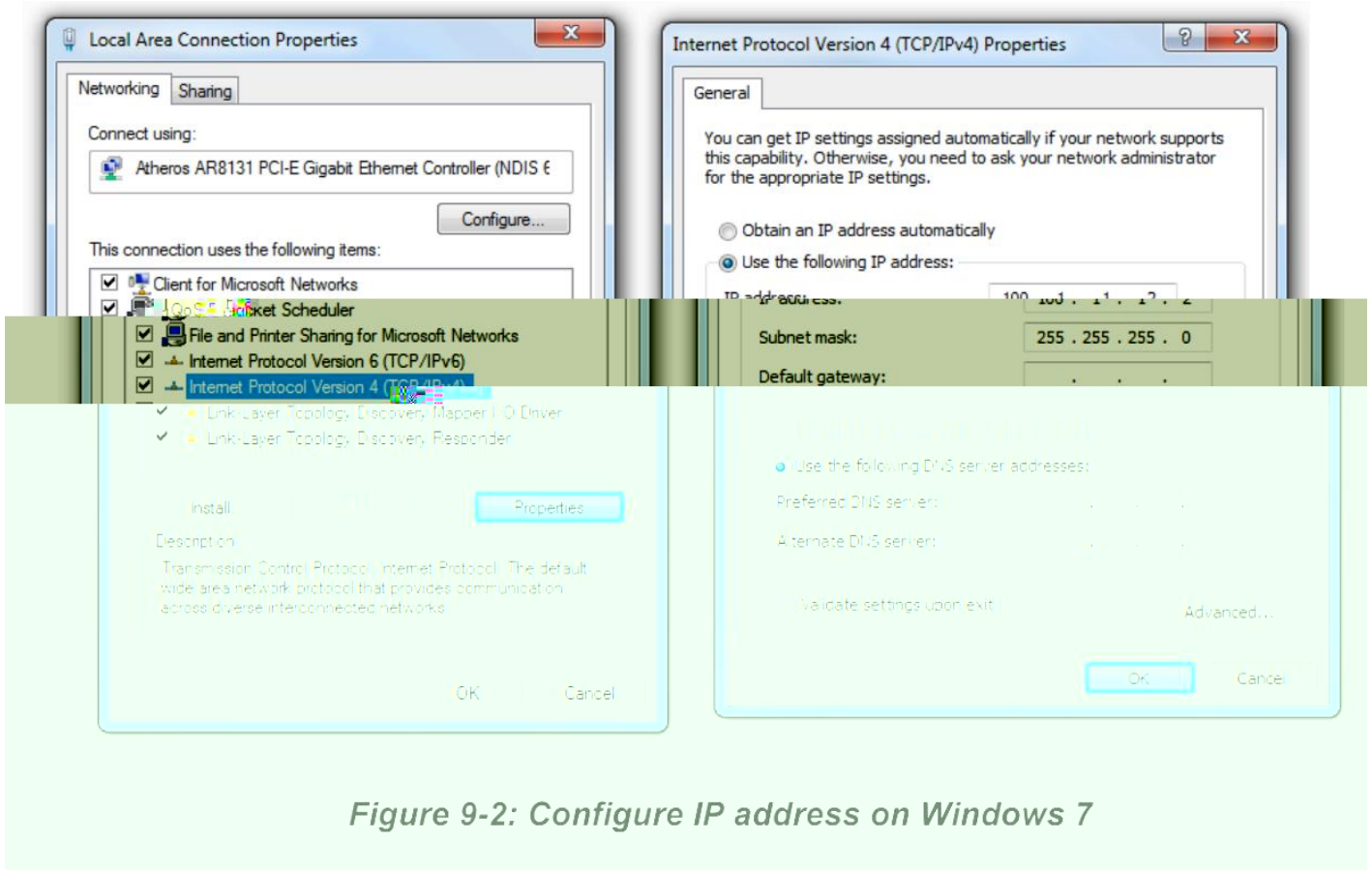
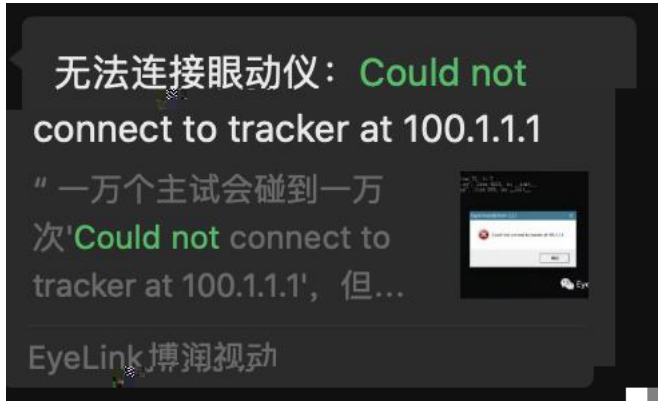


Figure 9-2: Configure IP address on Windows 7



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eyelink

EyeLink Developers Kit / API
https://www.sr-support.com/thread-13.html

Experiment Builder
https://www.sr-support.com/thread-1.html

Data Viewer
https://www.sr-support.com/thread-7.html

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EyeLink 1000 Plus Installation Guide
EyeLink 1000 Plus User Manual
EyeLink 1000 Plus Quick Start Guide

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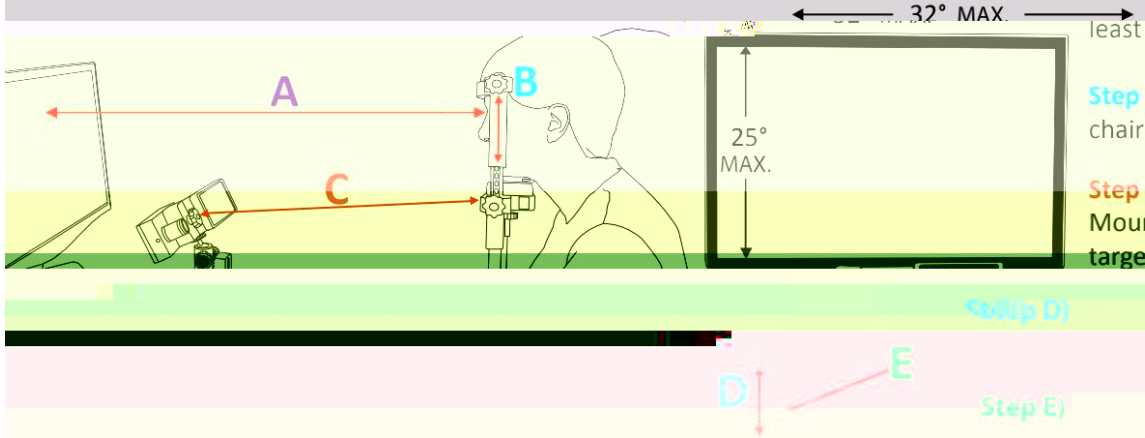

Step A) Position the monitor so that it subtends no more than 32 degrees of visual angle horizontally and 25 degrees of visual angle vertically for the participant. The eye-to-monitor distance should be at least 1.75 times the display width to ensure that it falls within the trackable range.

Step B) Position the participant so that the eyes align with the top quarter of the monitor – adjust the chair and/or head support to ensure this alignment.

Step C) Position the eye tracker so that the distance from the top knob on the front of the Desktop Mount to the front of the chinrest is 50-55 cm. If using Remote Mode, make sure that the reported target distance on the Host PC is around 60 cm (55-60 cm is ideal for calibration).

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EyeLink 1000 Plus User Manual

EyeLink 1000Plus

Pupil

CR

Calibration

Validation

SR Research

Track.exe

EyeLink Developers Kit / API

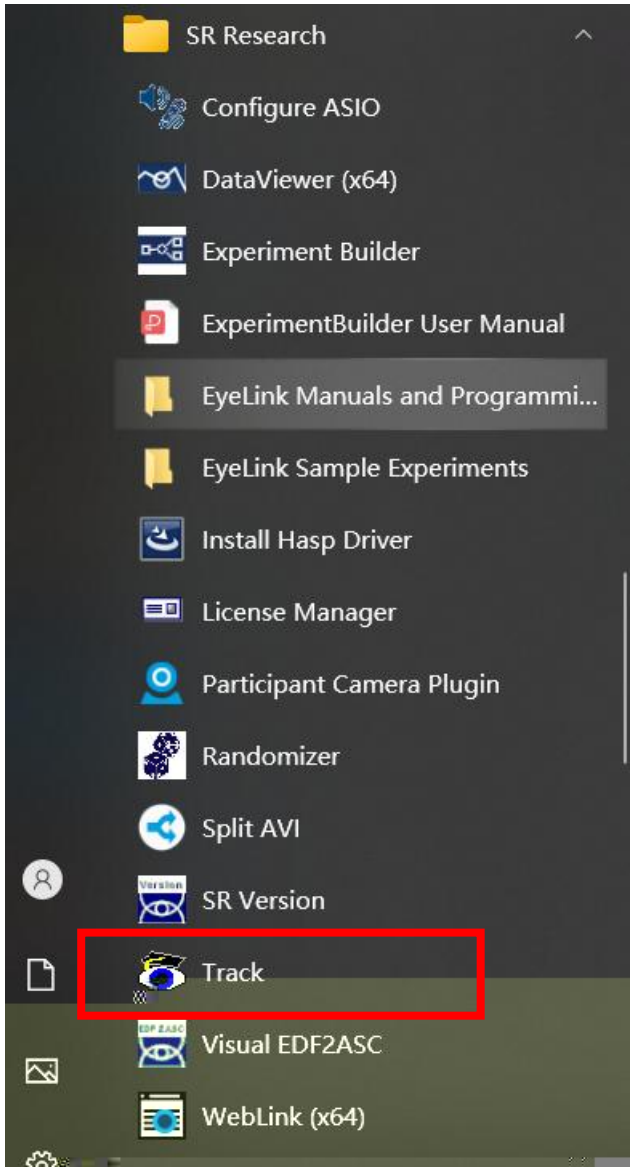

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Image Thresholds
Pupil
Corneal
Tracking Mode
Sample Rate
250
500
1K
2K
Pupil Tracking
Ellipse
Image Display
Illumination Power
100%
50%
LEFT EYE IMAGE
NOT AVAILABLE
EYE NOT
AVAILABLE
Zoom View
Pupil: 115
CR : 219
Eye Tracked:
Left
Camera Setup
Desktop Monocular
TCP/IP Link Open
Screens

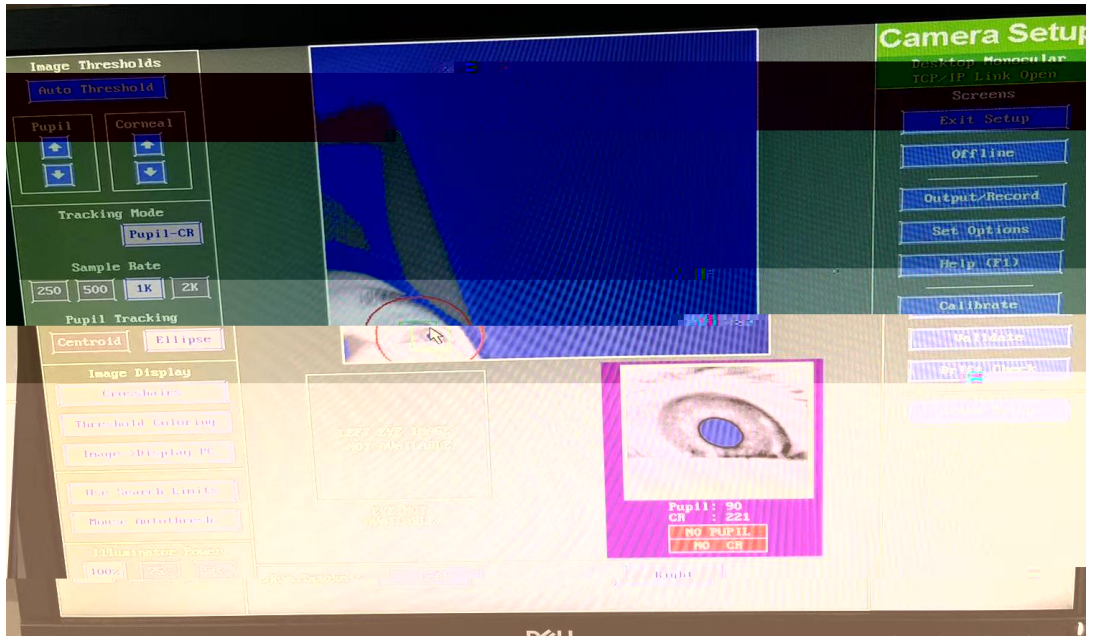
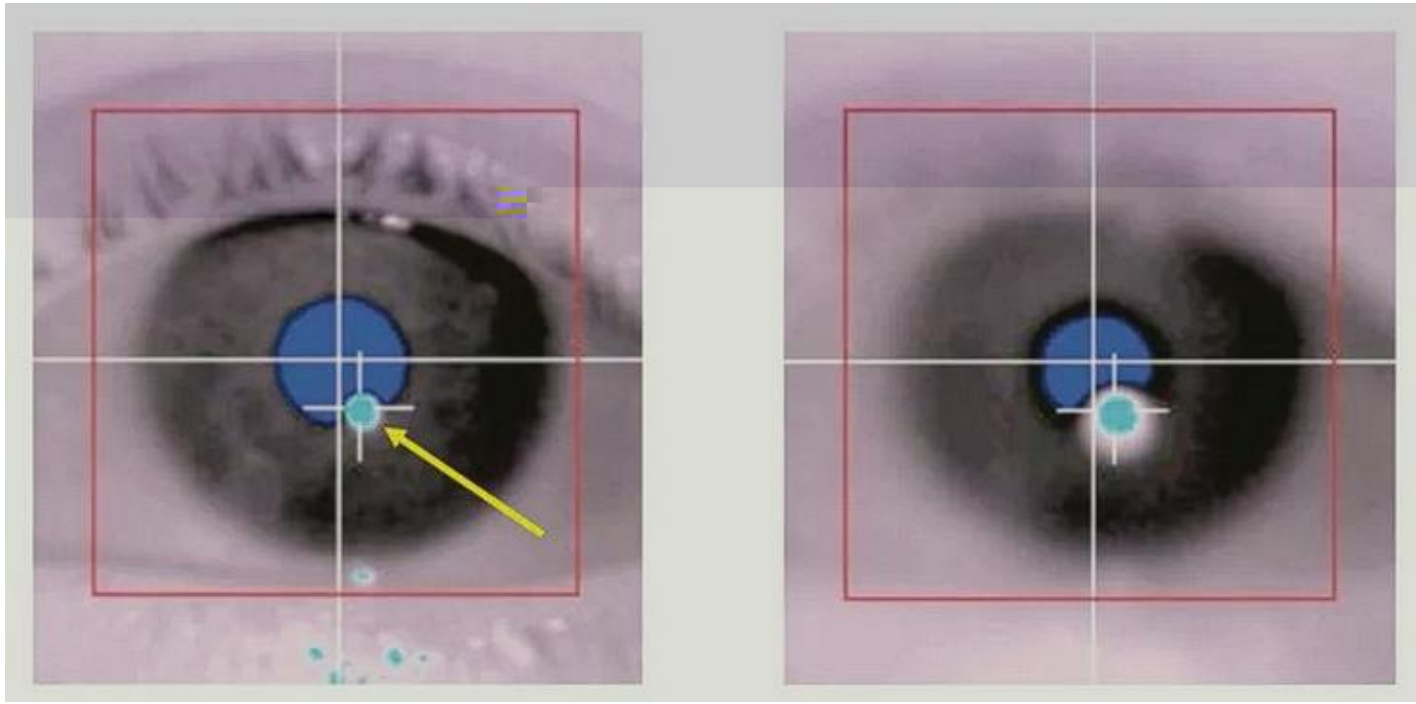


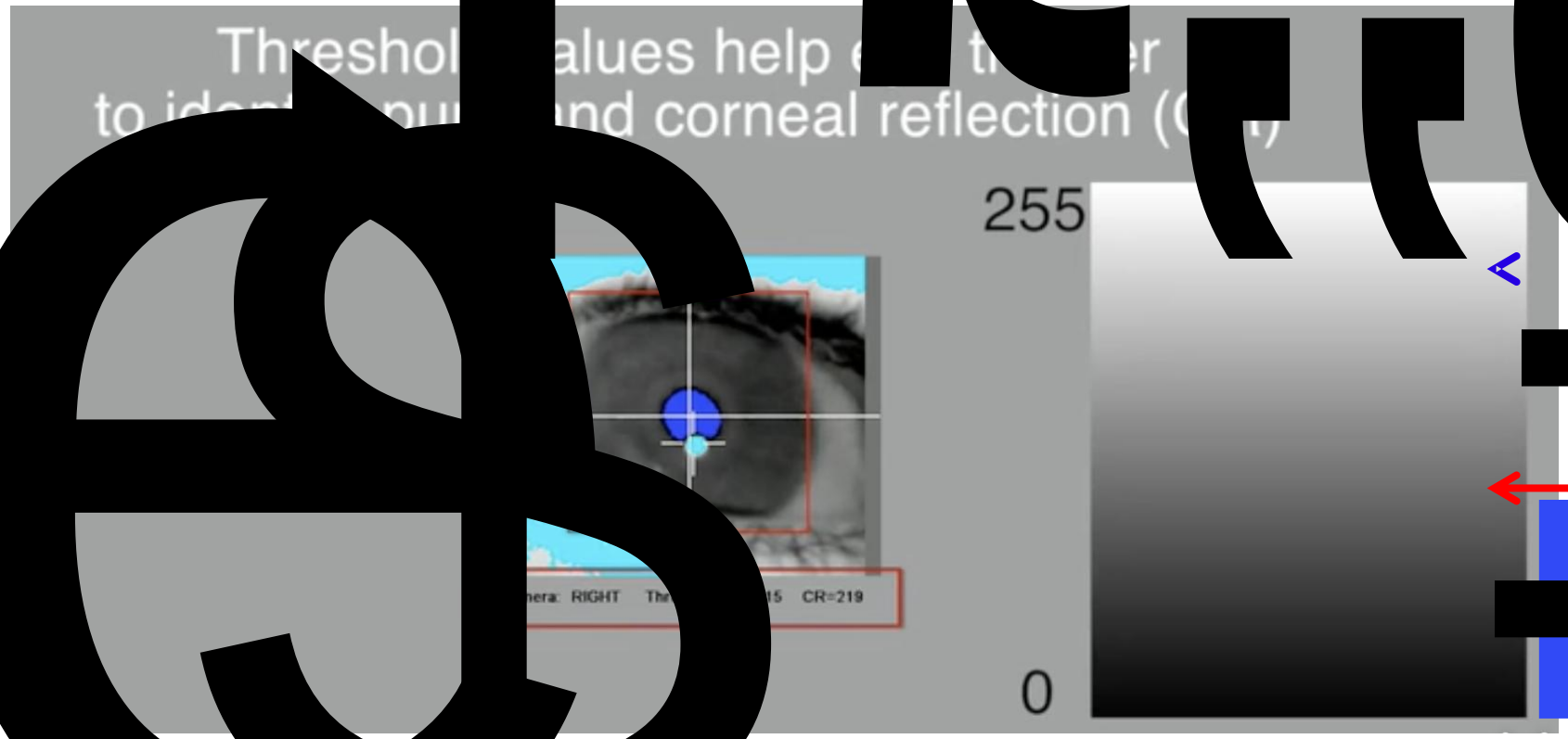
Image Thresholds
Auto Threshold
Pupil
Corneal
Tracking Mode
Pupil-CR
Sample Rate
250
500
1K
2K
Pupil Tracking
Centroid
Ellipse
Image Display
Pupil: 90
CR : 221
NO PUPIL
NO CR
Camera Setup
TCP/IP Link Open
Screens
Exit Setup
Offline
Output/Record
Set Options
Help (F1)
Calibrate

CR



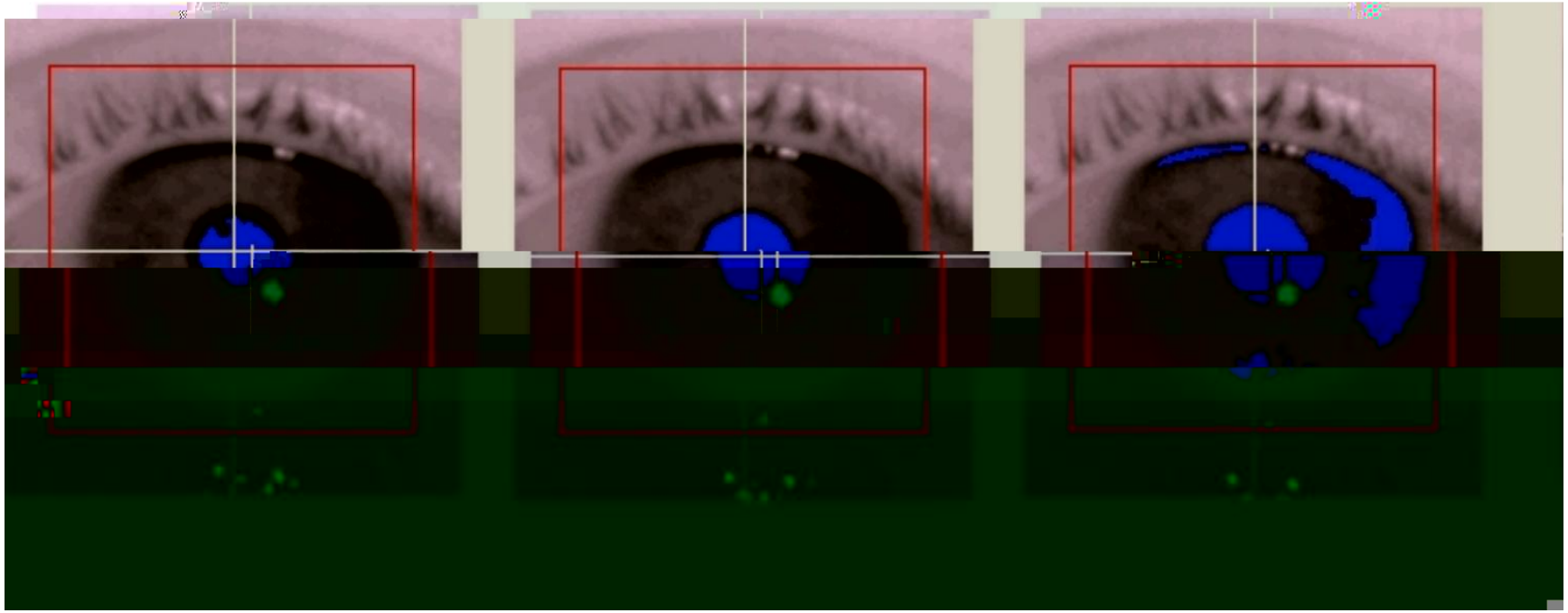
Pupil

a



Pupil **CR**

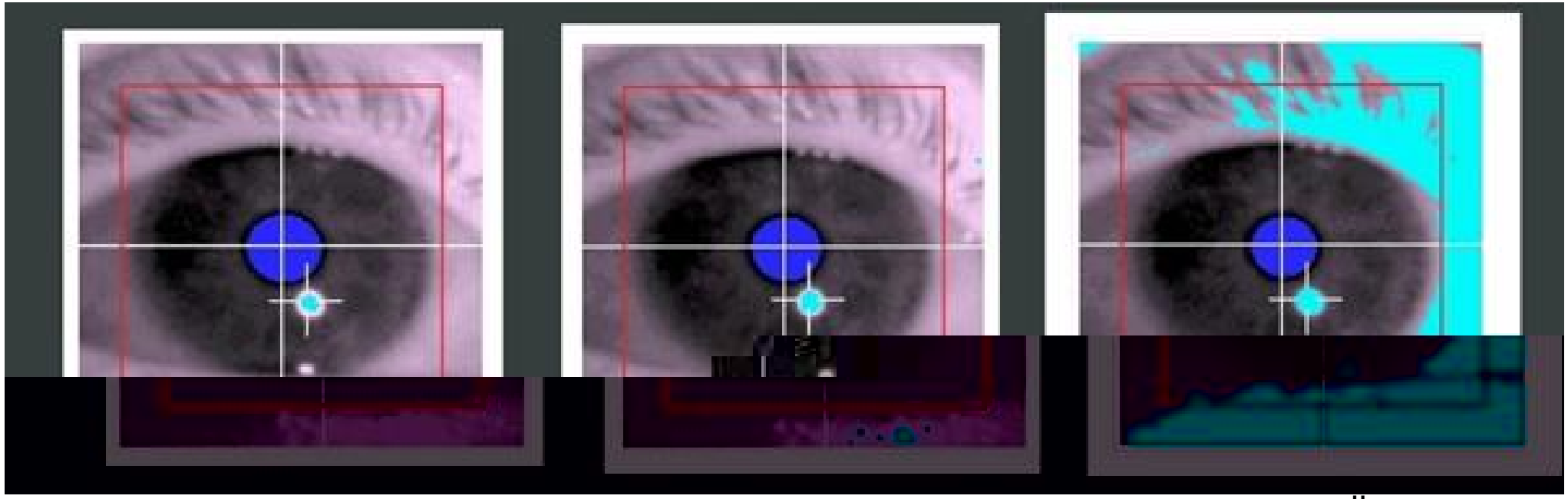
“ A ”



↑ ↓

Pupil CR

CR



pupil

\+ - CR CR

CR

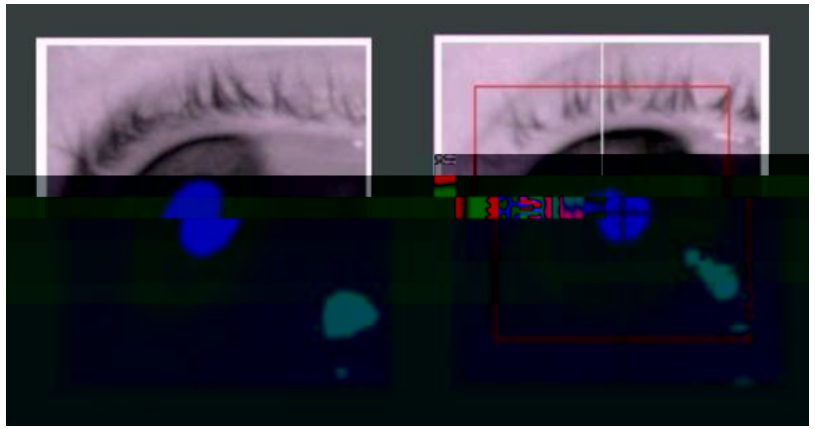
“ …… “ -> CR Pupil

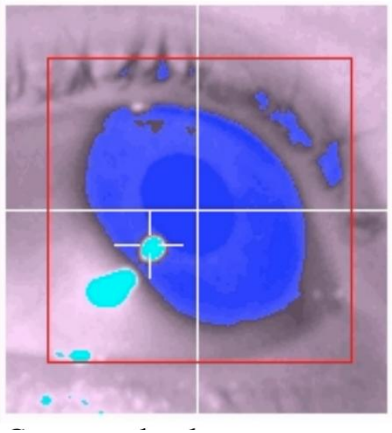
” …… “ -> CR Pupil

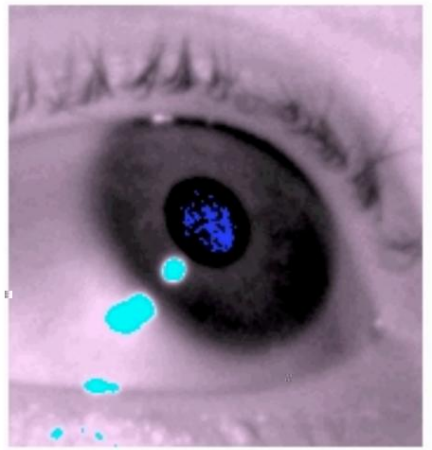
” …… “ -> CR Pupil

” …… “ -> CR Pupil

Pupil CR





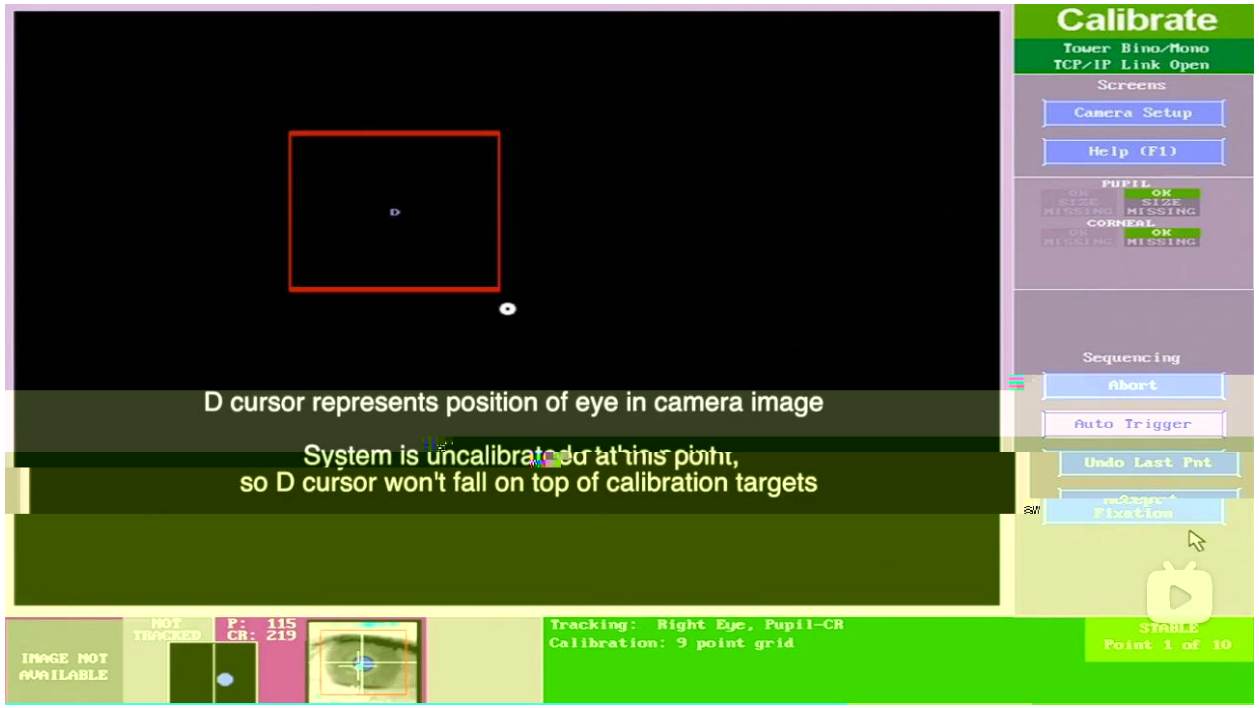


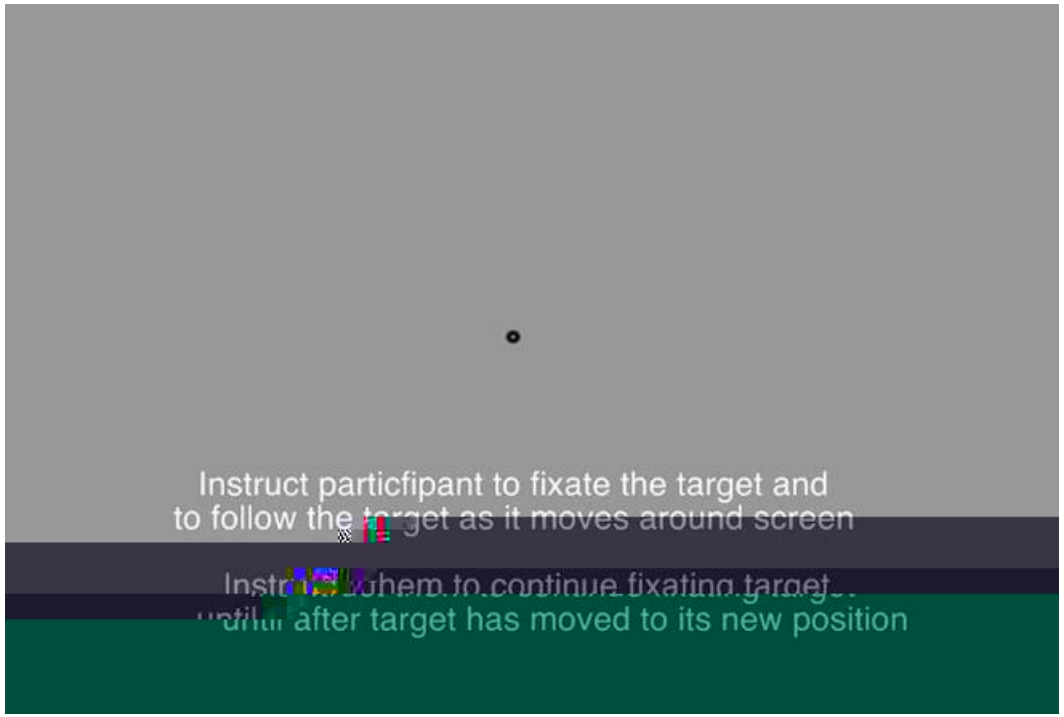
Calibration

Camera Setup

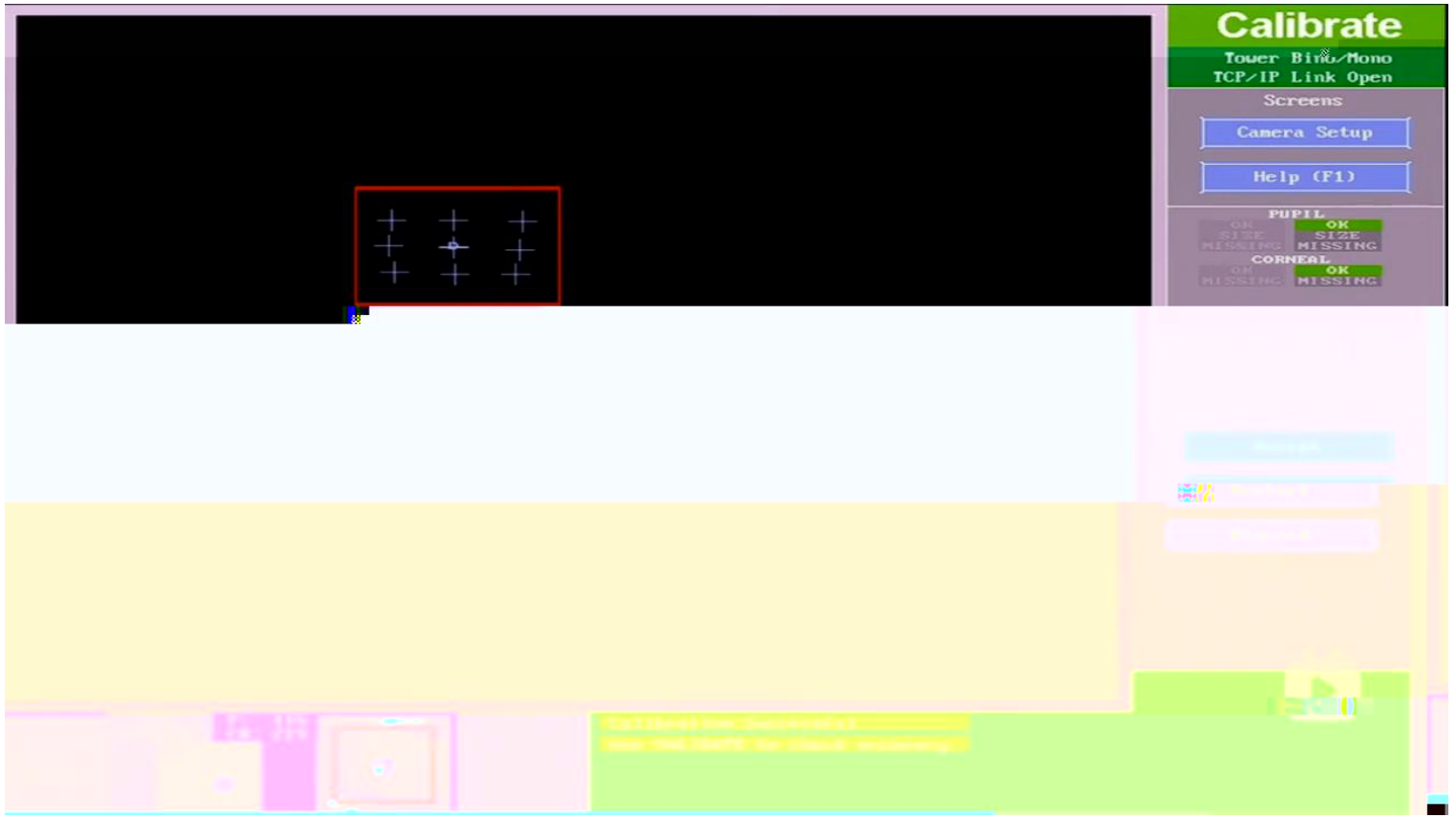
Calibration

C





Calibration



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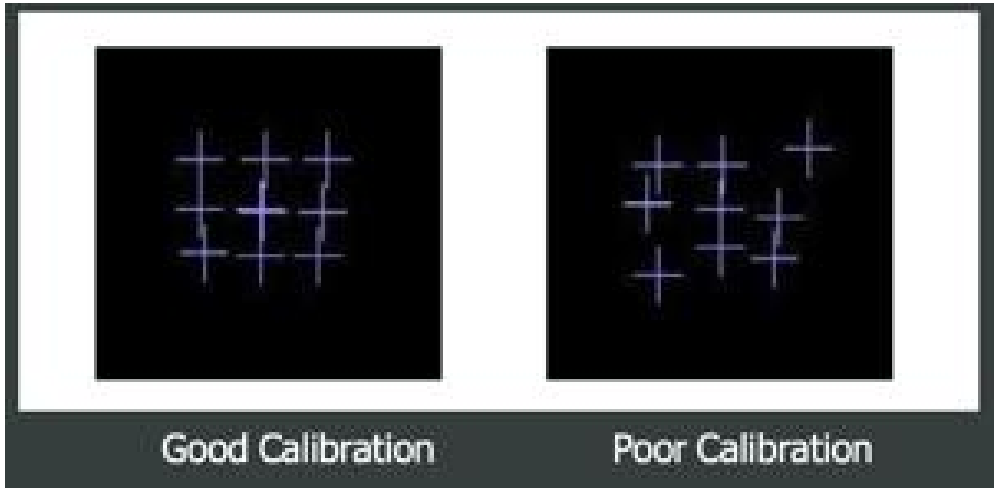
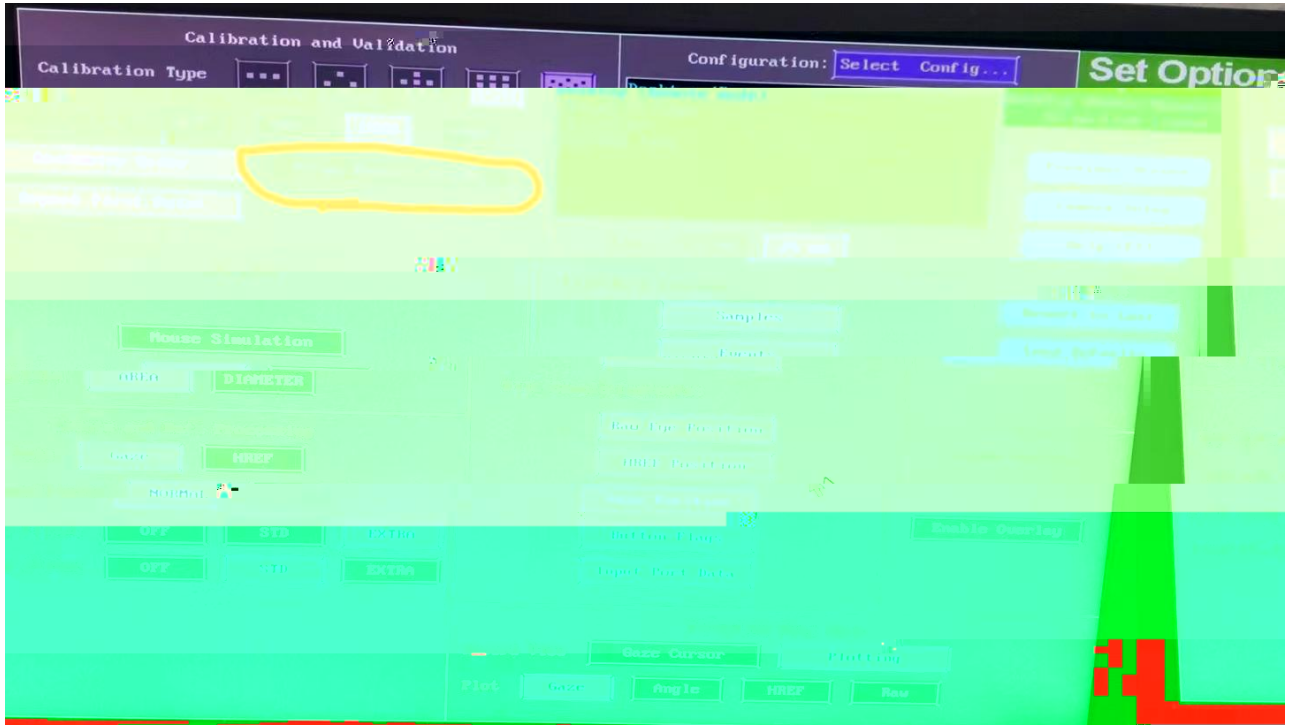
Calibration

accept





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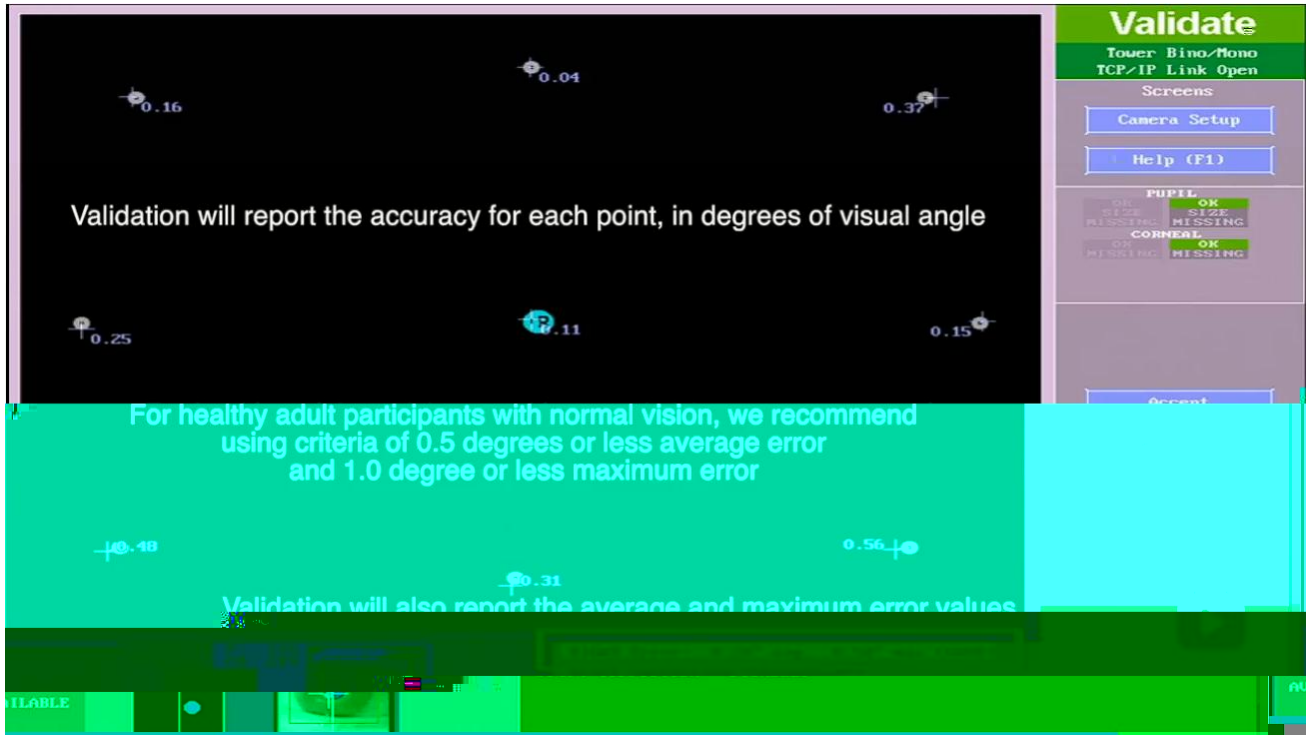
Camera Setup

Validation

V



0.5 °

1 °

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