ddpi-mk2 & eyeris testing

Janis Intoy

November 2021

Contents

1 Purpose

This report examines (1) the frequency and durations of dropped frame occurrences and (2) magnification of the mk2 cameras across tasks and subjects.

2 Resources: Data and Code

Data are shown from five different experimental tasks and the calibration tasks (if available).

Task	Load	analysis periods	Notes
csmap	heavy	stim on	monocular stabilization, shader gratings/solids
corrugations	heavy	stim on	binocular stabilization, random dot stimulus
mssupression	medium	stim on	monocular stabilization sometimes
oddball	light	fixation and stim on	w and w/o eeg
saccade amp	medium	stim on	large texture stimulus
smooth pursuit	medium	target on	moving stimulus
vernier3d	medium	fixation and stim on	binocular stabilization, simple stimulus
auto cal	light	9 fixations	computation done between trials
manual cal	heavy	all	coefficient computation for every button press

- Data are loaded from their respective folders in the shared aplab box folder.
- Code and saved results are on box: `Box/APlab-Projects/Equipment/DDPI/MK2/Testing/SystemAnalysis`

3 Dropped Frames

3.1 Dropped Frames: Summary of Results

- Frame drops occur less than once per second and prevent the monitor from updating for $< 1\%$ of the experiment time (Figure 4).
- The system "freezes" about 5 times minute - preventing the frame from refreshing for $\geq$50 ms.
- Are they related to something in the experiments? Button presses, loss of eye-tracking,...
- Can we determine the latency of the monitor refresh?

3.2 Method

Data are acquired by the photocell recording at $\sim$1.4kHz.

As of October 20, 2021, the photocell data (from channel 0) are somewhat noisy so the number of dropped frames here are calculated offline and shown with some post-processing (e.g. interpolation through noisy samples). Frame drops are detected by finding periods in which the photocell voltage exceeded or fell below some thresholds (4V and 1V) for a significantly large amount of time compared to other durations in the session.

3.3 Dropped Frames and "Freezes"

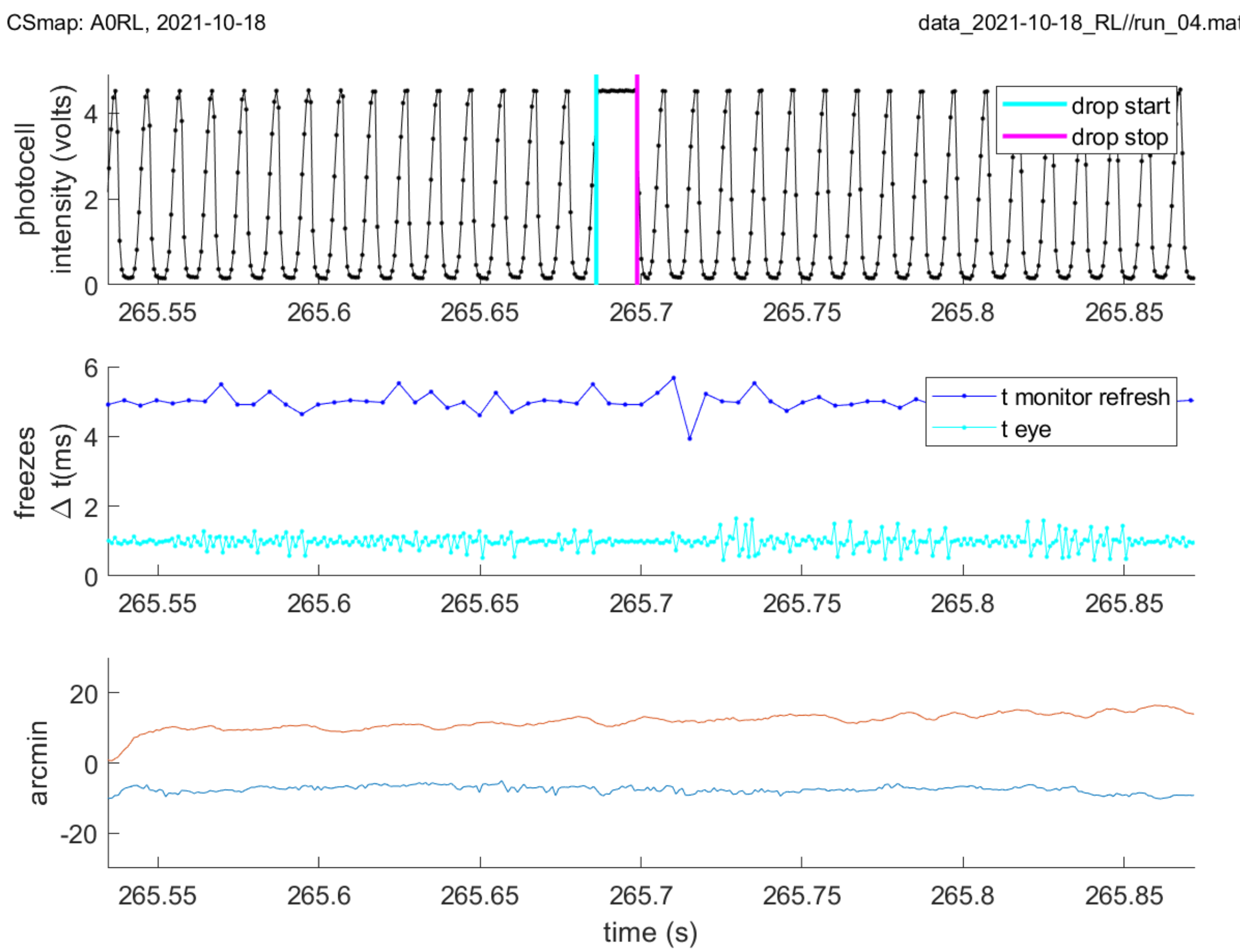

Figure 1: Example of a typical dropped frame. (TOP) Voltage of photocell intensity over time. (MIDDLE) Time between monitor refresh commands (blue, 200Hz) and received eye samples (cyan, ~1kHz). (BOTTOM) Horizontal and vertical eye traces.

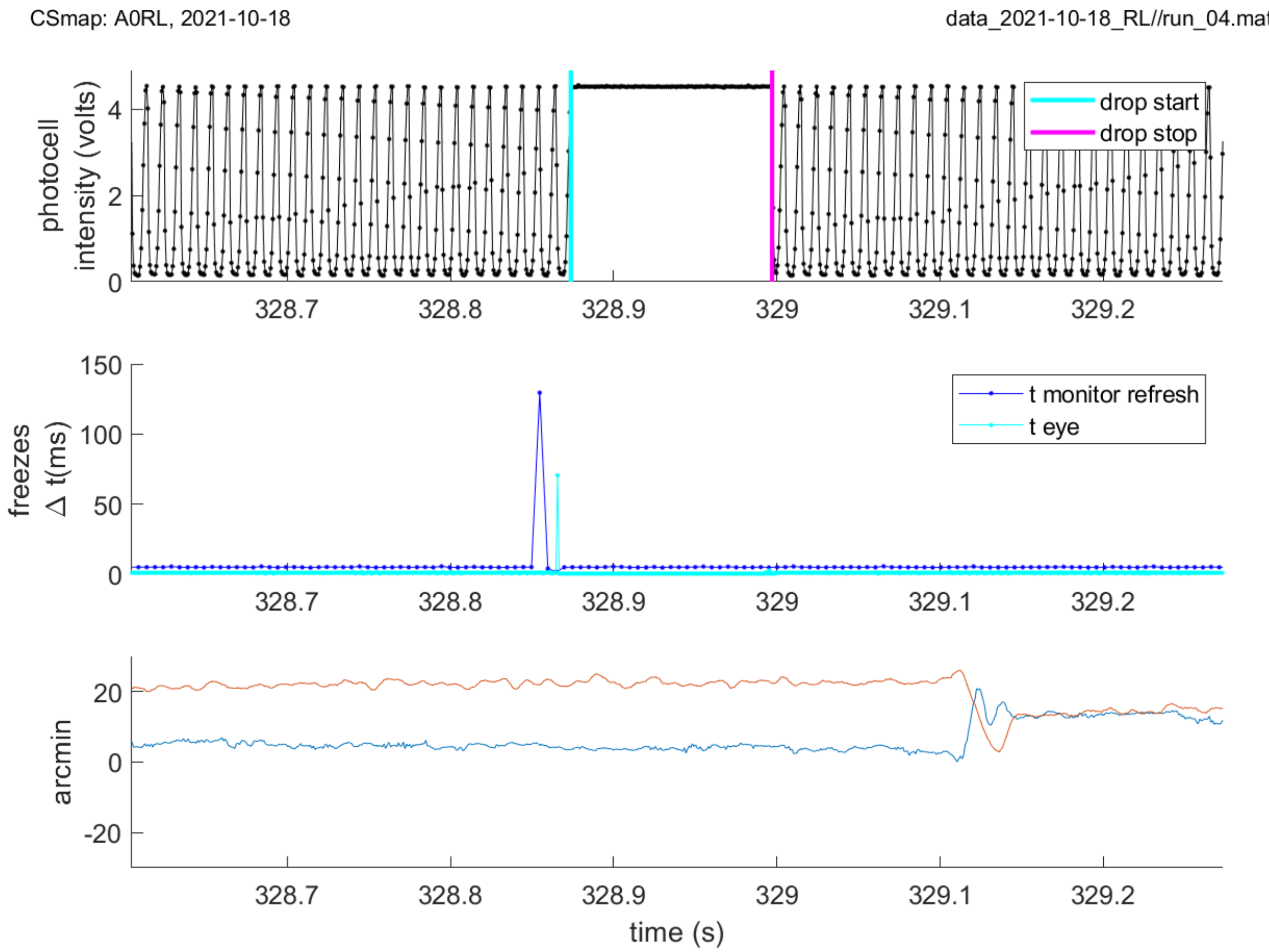

Figure 2: Example of a dropped frame due to "freezing", which is accompanied by a delay in eyeris acquiring and time-stamping data (shown by the spike in the middle plot). (TOP) Voltage of photocell intensity over time. (MIDDLE) Δt of time stamps of monitor refresh commands (blue, 200Hz) and received eye samples (cyan, $\sim$1kHz). (BOTTOM) Horizontal and vertical eye traces.

3.4 Frequency of "Freezes"

Since freezes can be detected in the data time stamps, they do not require photocell data. A Δt is flagged as a freeze when it exceeds the median + 15 mad for that session.

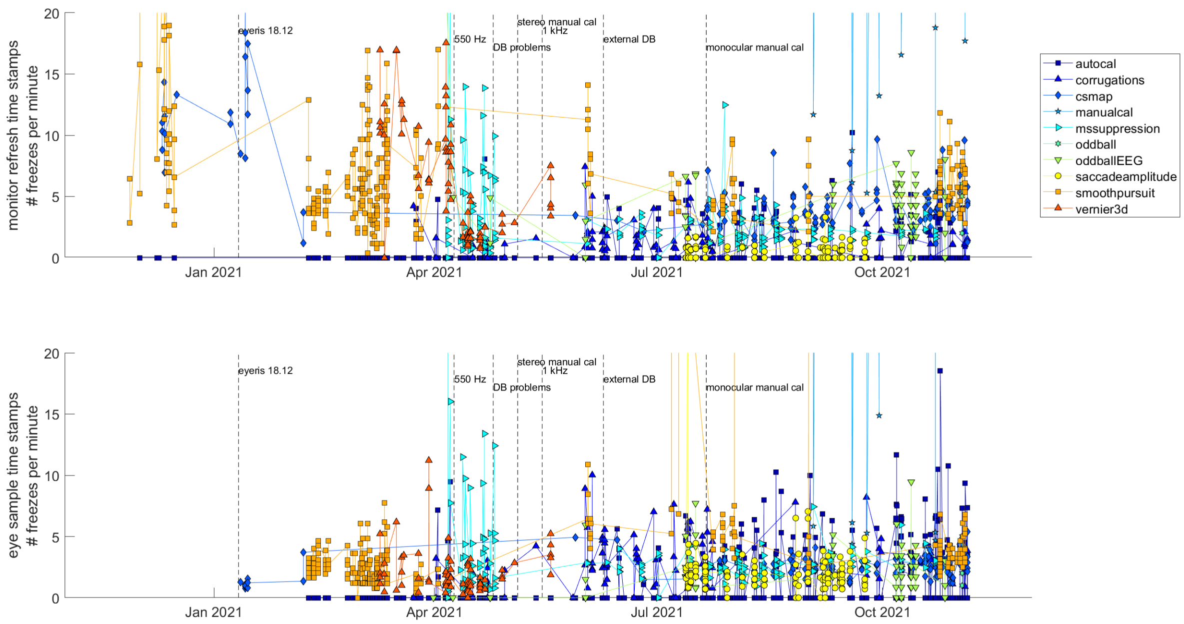

Figure 3: Frequency of freezes detected in the monitor (upper, 200Hz) and eye-sample (lower, ∼1kHz) time stamps. Data show the freeze rate (freezes per minute) over time for various experiments indicated by different colors and symbols. Freezing occurred frequently in spring 2021, when eyeris had to be run through CLion in development mode due to problems connecting to the database. Once this issue was resolved by connecting to a remote database in June 2021, the freeze rate was typically below 5 freezes per minute. Note that freezes during manual calibration are typically >20 per minute

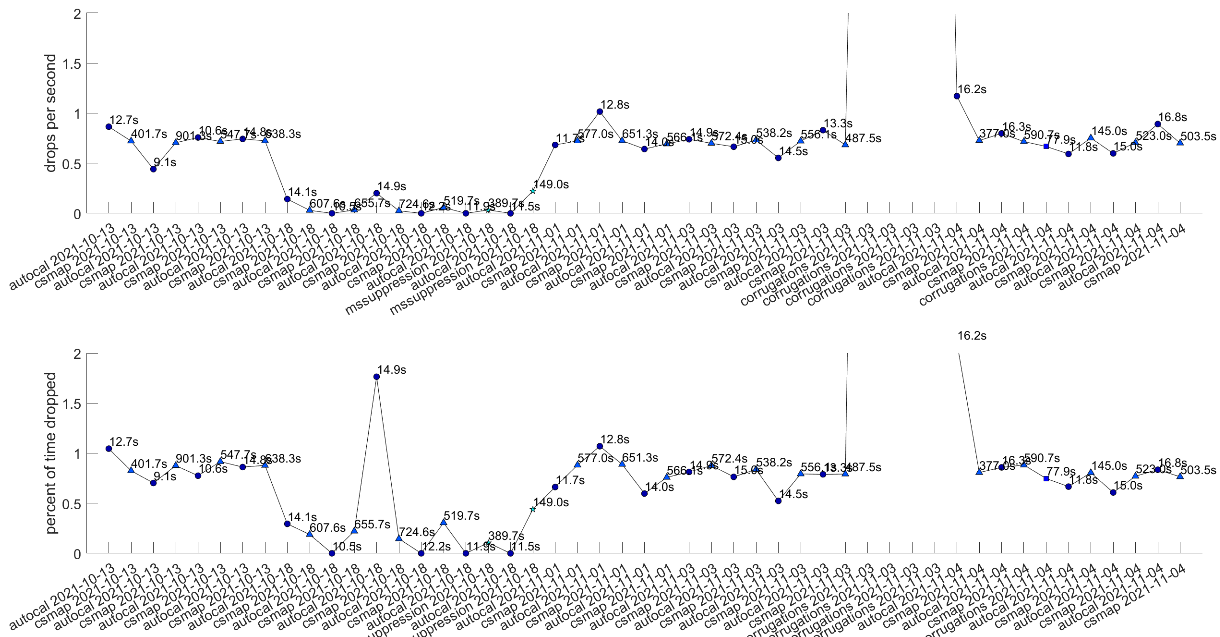

Figure 4: (TOP) Frequency of drop occurrences (drops per second) detected in the photocell data, and (BOTTOM) the percentage of time lost because of frame drops. See figure below for explanation of off-the-chart data.

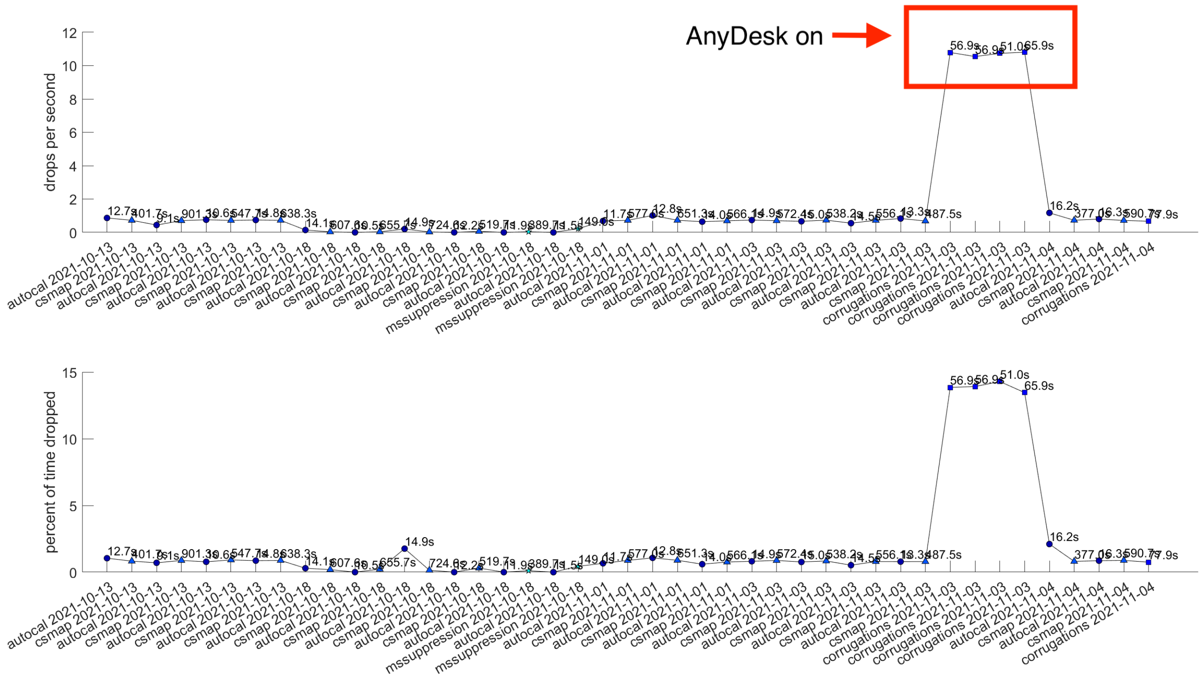

Figure 5: (TOP) Frequency of drop occurrences (drops per second) detected in the photocell data, and (BOTTOM) the percentage of time lost because of frame drops.

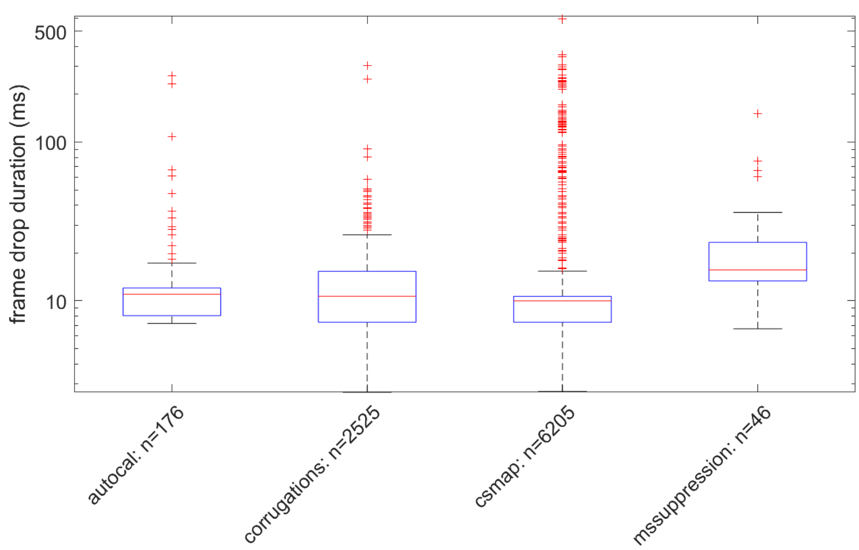

Figure 6: Duration of frame drops in three tasks. Box Plots show the interquartile ranges for each task. n indicates the number of detected drops. **Note that these durations are probably overestimated based on the way that I defined drop starts and stops. This number is probably better described as duration of no monitor update**

4 Magnification (arcmin per camera pixel)

4.1 Magnification: Summary of Results

- Magnification for a single subject is consistent across experimental days and sessions (Figure 8).
- Magnification is variable across subjects, ranging from 1.5 - 3 arcmin per pixel (Figures 9).
- Magnification is correlated between the right and left eyes (Figure 10).

4.2 Calculation of Magnification

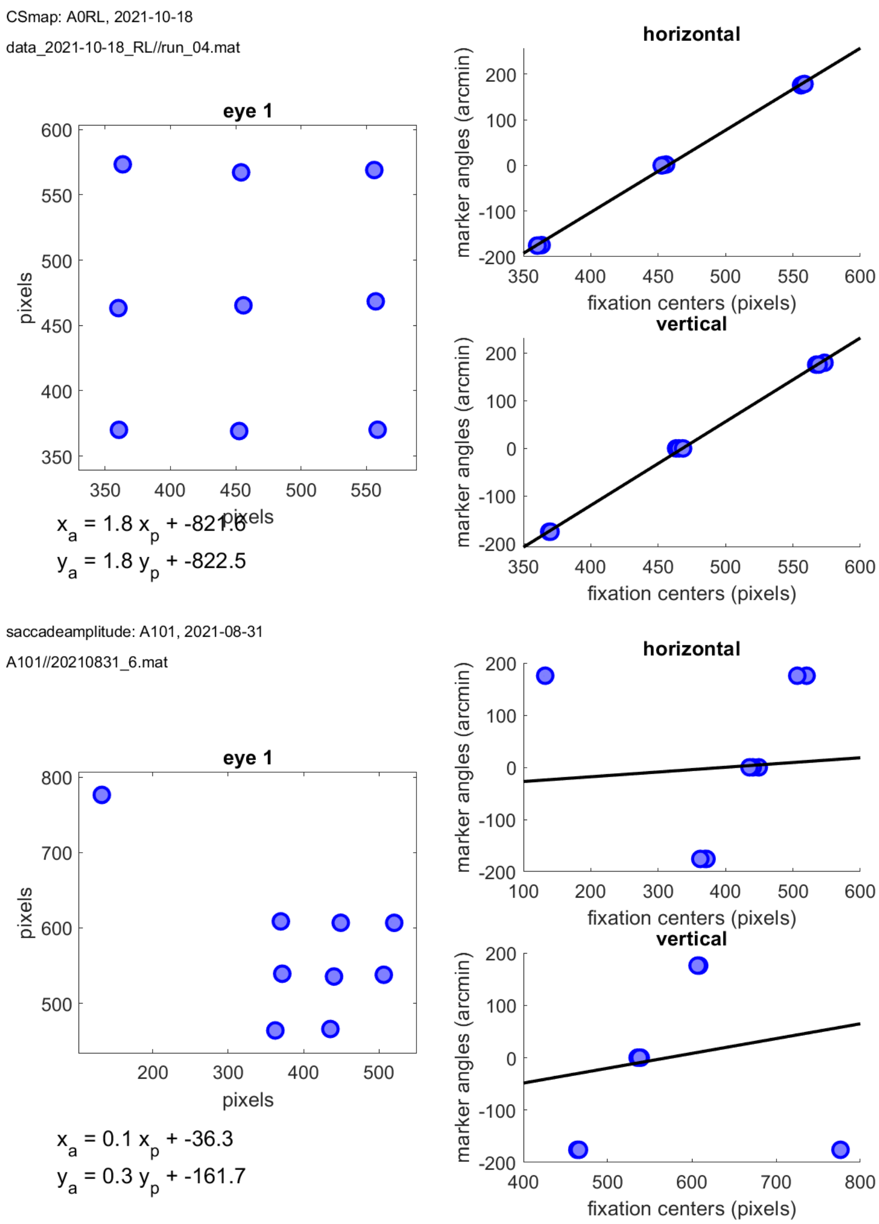

Figure 7: Magnification (arcmin per camera pixel) was computed for the horizontal and vertical axes for each experimental run. Magnification here was calculated by means of linear regression between the visual angle of the 9 calibration markers and the recorded centers of the corresponding fixations. Two examples, a good (upper) and bad (lower) calibration, are shown with their best fit regression lines. Bad calibrations occurred most frequently before manual calibrations were implemented and are excluded from the following results.

4.3 Magnification over time

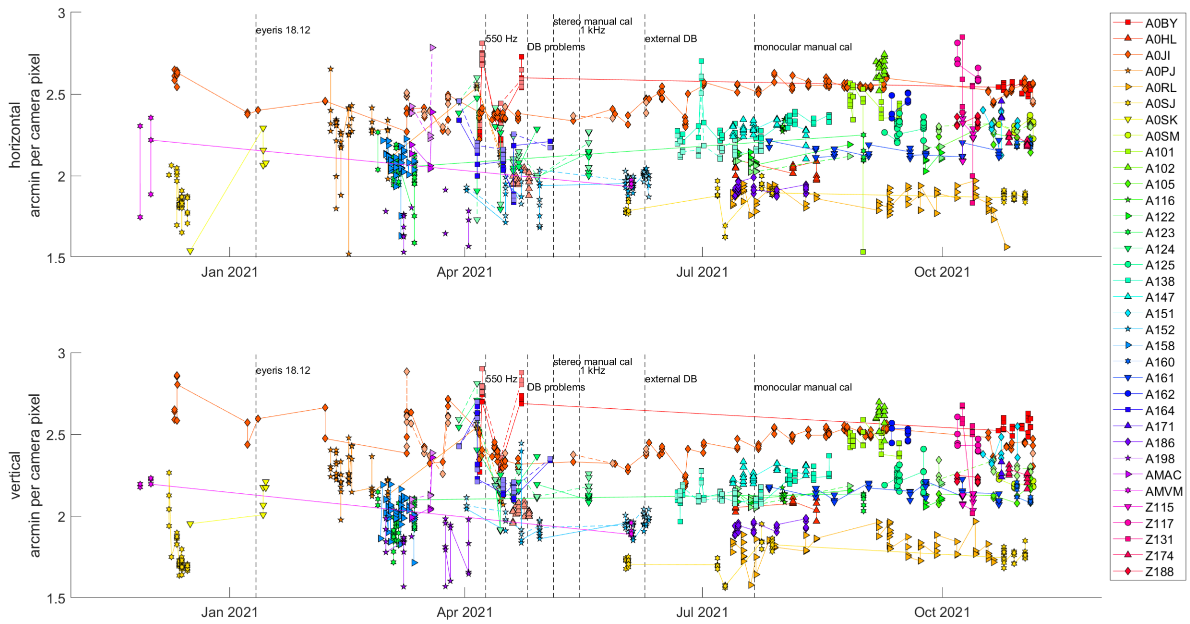

Figure 8: Horizontal (upper) and vertical (lower) magnification factors over the past year. Different colors and symbols indicate different subjects (who may have participated in more than one experiment).

4.4 Magnification across subjects

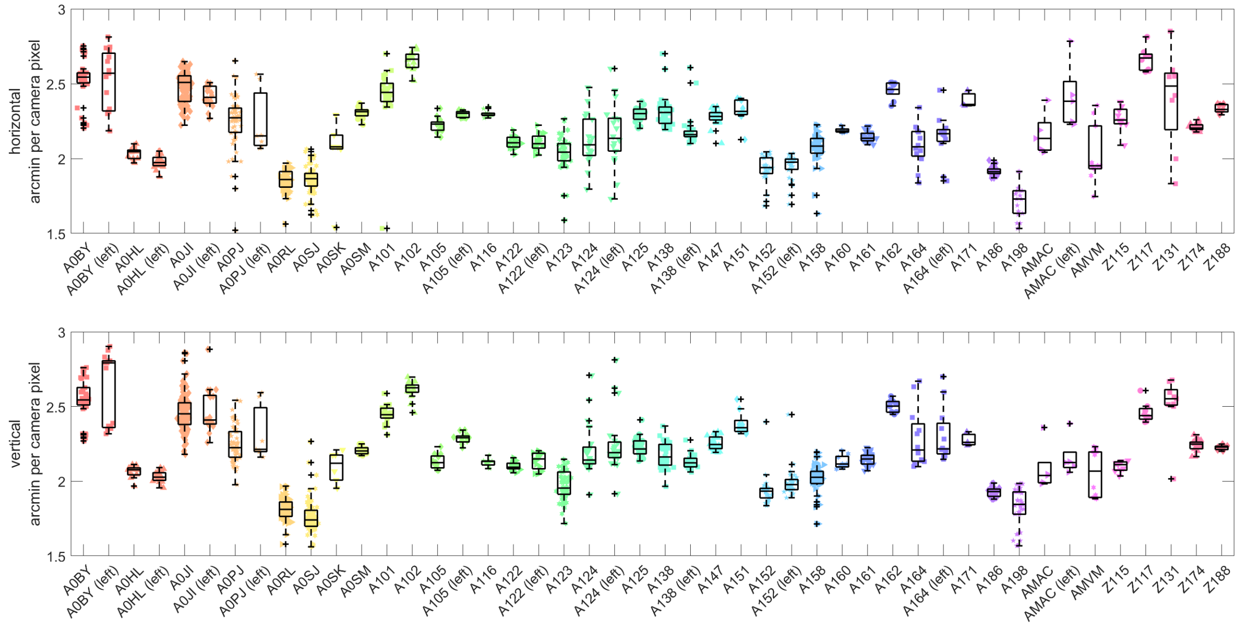

Figure 9: Magnification distributions for each subject. Box plots mark interquartile regions, and colored markers indicate magnification from single experimental runs.

4.5 Magnification: Right and Left Cameras

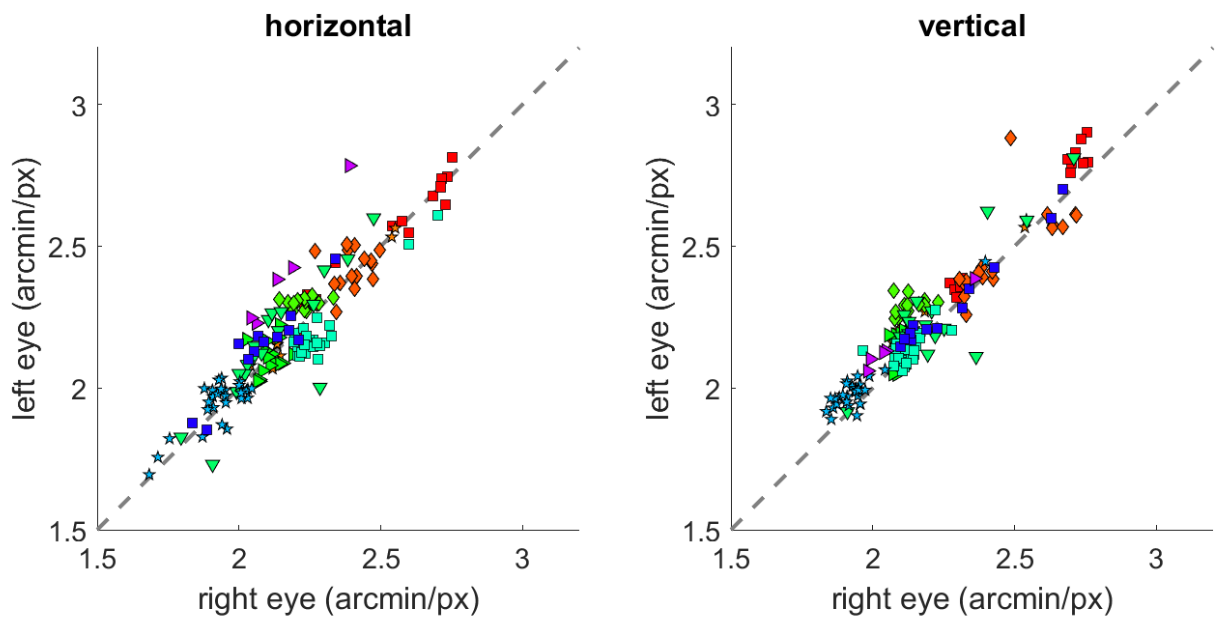

Figure 10: Magnification of left and right eyes are correlated. Magnification was calculated for each eye in the same experimental run.