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We provide in the present document additional information regarding the fixations detection in eye-tracking calibrations, as complementary material of the article: *Brilhault A, Neuenschwander S, Rios RA, "A New Robust Multivariate Mode Estimator for Eye-tracking Calibration", 2021, Behavior Research Methods (submitted)*.

1 Datasets

The tests presented in this report were conducted on the same three real-world datasets used in the manuscript *"A New Robust Multivariate Mode Estimator for Eye-tracking Calibration"*. The dataset named *Set1*, of low contamination, corresponds to the session *juj011a00*; *Set2*, of average contamination, to the session *ded00800*; and, finally, *Set3*, of high contamination, to the session *ded005a01*.

Calibrations included 50 trials, with a duration of 1700ms in Set1, 1200ms in Set2, and 3000ms in Set3. In each trial, one of five calibration targets was randomly selected and presented. Targets were positioned at the coordinates (0,0), (100,-100), (-100,-100),(-100,100), (100,100), respectively.

Eye positions were recorded using the eye-tracking setup developed by Matsuda Keiji et al.[1]. The system relies on a PointGrey Grasshopper3 infrared camera (GS3-U3-41C6NIR-C). Image acquisition was set at a frequency of 235Hz. The eye coordinate signals generated by the system were recorded through an acquisition board (National Instruments E-Series board), at a sampling frequency of 1000 samples/s. The dataset is available on the repository https://adrienbrilhault.github.io/BRIL/. A video[2] also presents the gaze samples recorded for every trial of the calibrations.

Ground truth coordinates were annotated using an interactive visualization and selection procedure. Taking into account the geometrical expectations relative to the calibration points, i.e., the first target, at coordinates (0,0), being at the center of the square formed by the 4 others (at the positions (100,-100), (-100,-100), (-100,100), (100,100), respectively), we were able to visually assess the overall calibration area, and the regions corresponding to each calibration point. For every session and target, the samples located inside the selected bounding boxes were furtherly filtered based on their local density, by setting a minimum density threshold after visual inspection. Finally, the remaining data points were averaged and the resulting position used as ground truth. The source code of this procedure is also available on the repository https://adrienbrilhault.github.io/BRIL/, with an illustrative video[3].

The distance to the screen was 57cm, such that 1 cm on the screen plane corresponds to approximately 1 visual degree ($atan(\frac{1}{57}) \times \frac{180}{\pi} = 1.005086$). The screen being $40cm$ wide, for $30cm$ high, with a resolution of $1024 \times 768px$, 1 visual degree therefore translates to around $25px$ ($\frac{1024}{40 \times 1.005086} = 25.470$). The data recorded was raw, uncalibrated. All of our methods were ran on uncalibrated data, and the errors, measured in the original referential, were converted a posteriori to meaningful units, i.e., in screen pixels (which can then be converted to visual degree with the values above). This conversion was based on the ground truth reference coordinates of each calibration target (in the same uncalibrated referential). Since the calibration screen positions were (0,0), (100,-100), (-100,-100), (-100,100), and (100,100), each of the four outer points having a distance of $\sqrt{100^2 + 100^2} = 141.4214$ pixels to the central one (the first calibration point, at (0,0)), the corrective factor applied to raw errors was therefore 141.4214 divided by the average of the distances from the first point to each of the 4 others.

[1] https://staff.aist.go.jp/k.matsuda/iRecHS2/index_e.html
[2] https://www.youtube.com/watch?v=ZQzThht0VMw (gaze coordinates by trial)
[3] https://www.youtube.com/watch?v=10ZapuMvK1s (ground truth procedure)

2 Implementation

To detect saccades and fixations, we employed one of the most common techniques, relying on saccade velocity thresholds. When using calibrated eye-tracking data, this threshold can be set to a fixed value based on physiological constraints (for humans for instance, $100°/sec$ is often used). This is evidently not possible with uncalibrated data, since the gaze coordinates (and therefore velocities) are not expressed in visual degrees. In this context, the threshold can either be set manually, after visual inspection, or automatically, deriving summary statistics directly from the signal. We opted for the latter, since the objective of our work was to propose a method requiring no user input. We thus set the velocity threshold to the root mean square (RMS) of all the velocities, a common estimate in eye-tracking research. Note that this value was computed from the signals of the entire calibration, rather than within each trial. Many trials only include one long fixation, without any saccade. In such scenario, a trial-based RMS threshold would be extremely low, resulting in numerous false detections of saccades (see examples in Figure 6).

This straightforward approach, applied to our raw datasets, proved to be to unreliable, with poor identification of saccades and fixations. A series of standard improvements were therefore added, described below.

- Raw X and Y signals were pre-processed, by:
  1. Replacing invalid coordinates (error codes from the system and out of range values, e.g., in our data, the values -32768 and 32767) by the last correct position received. These values were also flagged, in order to be skipped in the later fixations detection process;
  2. Applying a 30hz low-pass filter;
  3. Computing velocities from these corrected horizontal and vertical signals (the filtered values were used as well for the saccade threshold, when computing the root mean square velocity within the entire session).
- Fixations and saccades detection was then carried out by the following steps:
  1. Marking as saccades all the samples with velocities above the session's RMS threshold.
  2. Propagating these saccades on both ends to strictly decreasing velocities (to include the initial and final parts of the saccade, below the minimum velocity threshold).
  3. Marking as saccades the invalid data points identified in the pre-processing step (to remove these samples from candidate fixations).
  4. Classifying the fixations of physiologically implausible durations (below 100ms) as saccades.
  5. Discarding the events in first 200ms of the trial (to account for reaction times after stimulus display).

The fixation of longest duration within each trial was used as reference, averaging the positions of all the samples belonging to it. Three different methods were implemented to select the final reference coordinates for each target: (i) selecting the longest fixation among all trials; (ii) averaging the longest fixations from each of the trials with the same target; (iii) averaging the very first fixation (after the initial 200ms delay) across all trials of a given target, which would relate to the standard automatic calibration procedure offered by many eye-trackers, terminating each trial after the detection of a long-enough fixation. For more details regarding the implementation, the code is available on the repository `https://github.com/adrienbrilhault/BRIL` (files *FixationsDetection.R* and *utils_fixations.R* in the folder *benchmark*).

3 Results

The results on a sample trial is provided in Figure 1. The second and third columns of the figure present the X and Y gaze coordinates, as well as the velocity. In the last column, these values are shown as recorded by the system, without alteration. In the central one, the signals were filtered with the method described in the previous section. The left plot, in cartesian coordinates, show the samples from each trial with colors corresponding to their category[4] (main fixation, fixation, saccade, and skipped). The average position of the main fixation is depicted in cyan. The samples from the other trials of the calibration in light gray. The ground

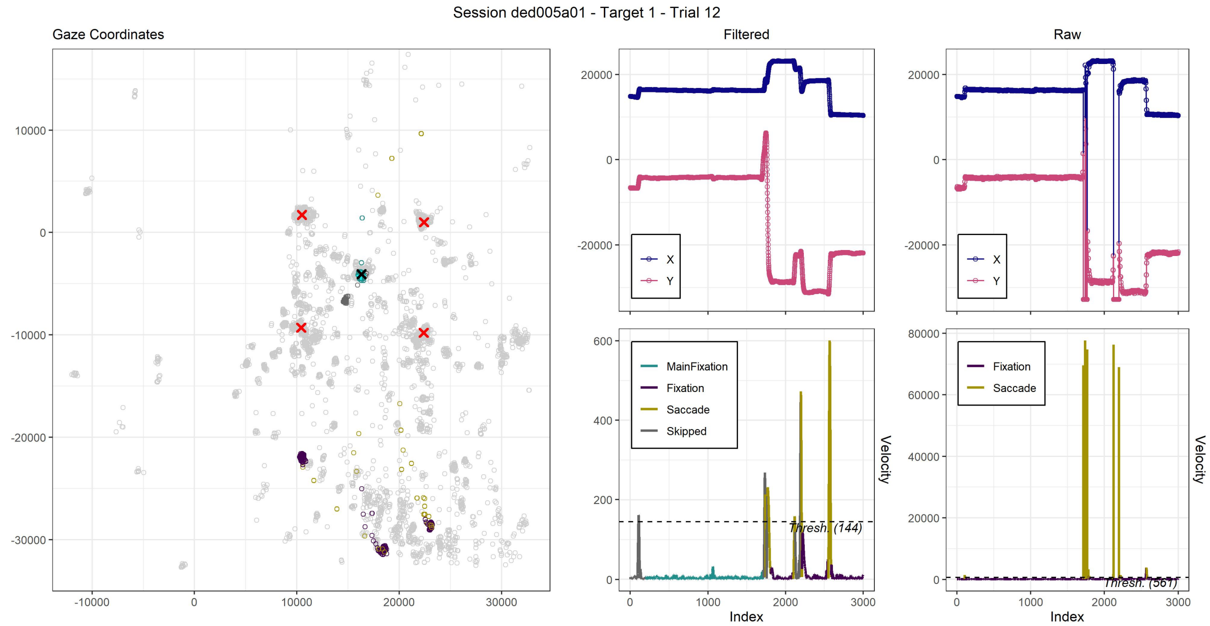

Figure 1: Raw and filtered signals with fixations detection for a sample trial from the dataset *ded005a01*.

truth coordinates for the target presented in the current trial are displayed as a black cross, and those from the 4 other targets in red.

In Figure 2 we present the results from the method based on first fixations, and in Figures 3 and 4 those from the two methods based on longest fixations (i.e., taking the coordinates of the longest fixations across trials for each target and session, or averaging the longest fixations from the different trials). Finally, the results from a sample execution of the BRIL algorithm are also showed as comparison in Figure 5.

Summary statistics for each session, and across sessions, are presented in Table 1. Detailed results for every target are available in Table 2. Errors are reported in both screen pixels and visual degrees. The averages and standard deviations were computed among the 5 targets for the individual sessions, and among the 15 estimates for the global measures.

Table 1: Global results for the 2 methods based on longest fixations, as well as the BRIL algorithm and average of first fixations. Errors are reported in pixels and in visual degrees, along with their standard deviation (across targets).

Method	Session	Error in Px (sd)		Error in Deg (sd)		SumSquaredErrorPx
BRIL	Set1 (juj011a00)	1.01	(0.40)	0.0395	(0.02)	5.03
LongestFixationAcrossTrials	Set1 (juj011a00)	5.26	(1.39)	0.2064	(0.05)	26.29
AvgFirstFixations	Set1 (juj011a00)	27.06	(33.63)	1.0624	(1.32)	135.29
AvgLongestFixations	Set1 (juj011a00)	29.18	(32.68)	1.1457	(1.28)	145.90
BRIL	Set2 (ded00800)	0.90	(0.58)	0.0353	(0.02)	4.50
AvgLongestFixations	Set2 (ded00800)	31.30	(16.89)	1.2290	(0.66)	156.52
AvgFirstFixations	Set2 (ded00800)	33.50	(20.24)	1.3151	(0.79)	167.48
LongestFixationAcrossTrials	Set2 (ded00800)	48.86	(102.08)	1.9182	(4.01)	244.28
BRIL	Set3 (ded005a01)	0.85	(0.58)	0.0333	(0.02)	4.24
AvgFirstFixations	Set3 (ded005a01)	23.38	(11.55)	0.9178	(0.45)	116.88
LongestFixationAcrossTrials	Set3 (ded005a01)	23.86	(44.57)	0.9366	(1.75)	119.28
AvgLongestFixations	Set3 (ded005a01)	40.66	(32.74)	1.5963	(1.29)	203.29
BRIL	All	0.92	(0.49)	0.0360	(0.02)	13.76
LongestFixationAcrossTrials	All	25.99	(62.35)	1.0204	(2.45)	389.85
AvgFirstFixations	All	27.98	(22.29)	1.0984	(0.88)	419.66
AvgLongestFixations	All	33.71	(26.82)	1.3237	(1.05)	505.71

[4]Identified from the filtered velocities (computed on the pre-processed signals).

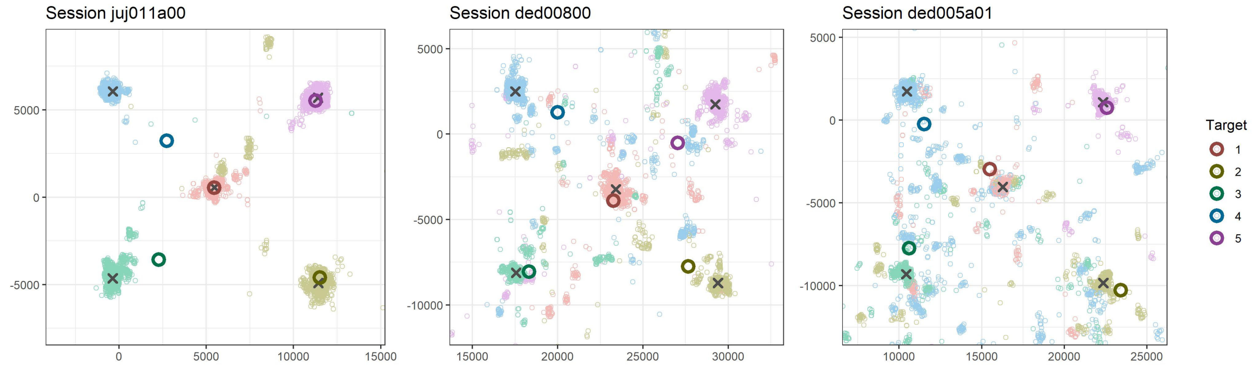

Figure 2: Reference coordinates (as bold circles) computed from the first fixations averaged across trials with the same target. Ground truth coordinates for each of the targets are displayed as crosses.

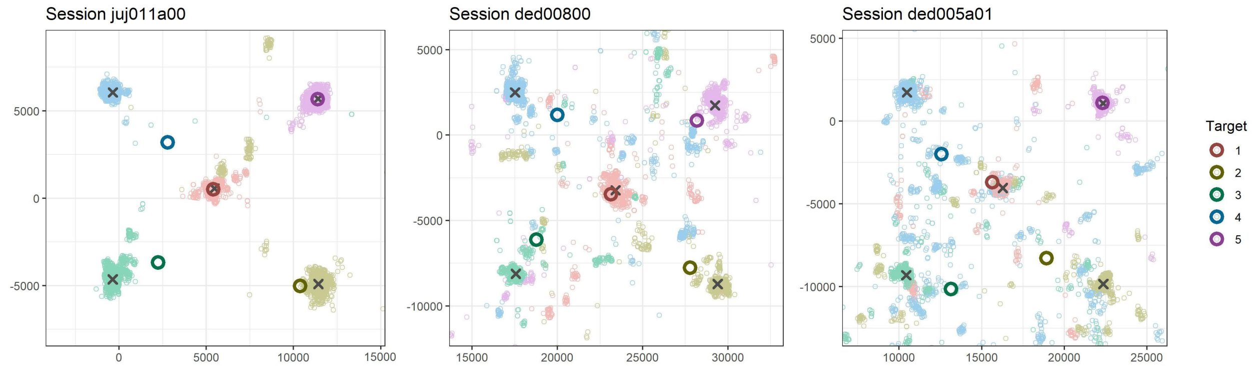

Figure 3: Reference coordinates (as bold circles) computed from the longest fixations averaged across trials with the same target. Ground truth coordinates for each of the targets are displayed as crosses.

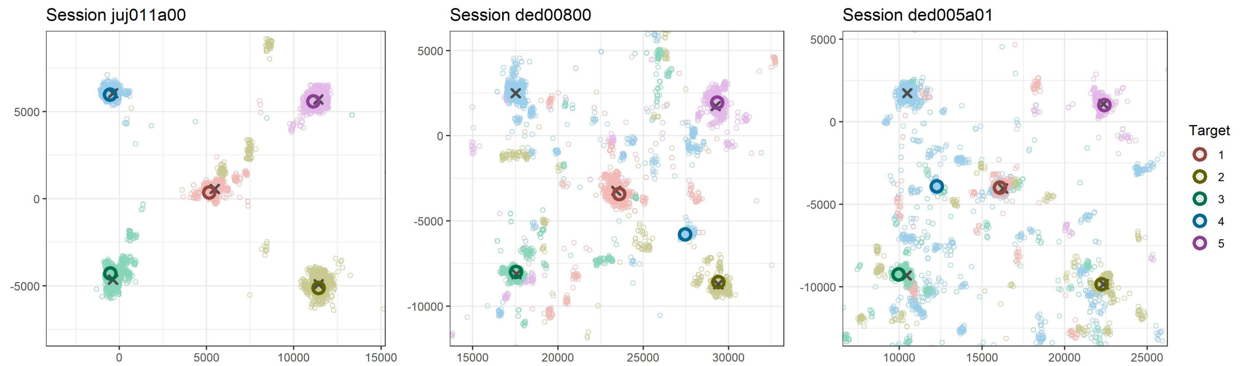

Figure 4: Reference coordinates (as bold circles) computed from the longest fixation among all the trials with the same target. Ground truth coordinates for each of the targets are displayed as crosses.

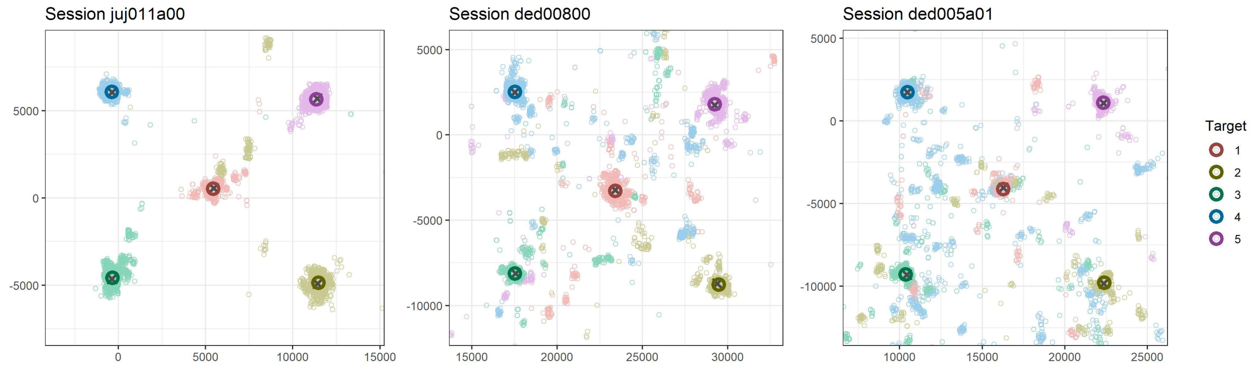

Figure 5: Reference coordinates (as bold circles) computed by the BRIL algorithm for each target. Ground truth coordinates for each of the targets are displayed as crosses.

4 Discussion

Detecting saccades and fixations in eye-tracking data can be a challenging task. Different methods have been developed, the most common ones relying on velocity/acceleration thresholds, others on dispersion, or even on more advanced techniques such as clustering, Markov models, or Minimal Spanning Tree. Yet, none of these methods is considered universally superior, the choice of a given algorithm and the reliability of its results will generally depends on the specificities of each dataset/scenario, as for instance: 1) the level of contamination (e.g., the frequency of failure in the pupil tracking); 2) the overall accuracy, precision and speed of the system; 3) the type of users (humans or animals, cooperative or not, lab research subjects or video-game users, ...); 4) the experimental protocol (free-viewing, saccadic choice paradigm, reading, smooth pursuits, etc). Some algorithms, for instance, are designed for high speed signals, generally above 200hz, focusing on saccades detection, while others perform better in low temporal resolutions, identifying fixations first. Moreover, most of these techniques require a set of parameters which are themselves dependent of the dataset.

For these reasons, relying on fixations detection for identifying reference coordinates in eye-tracking calibrations can raise multiple issues. Choices made regarding the detection algorithm and its parametrization might work in a given dataset, yet not transpose to another. Requiring the user to inspect the results obtained in each experiment, in order to tune the parameters, or even switch to a different algorithm, would defeat the purpose of having a generic and unsupervised method to process eye-tracking calibrations. In these conditions, the fixations detection process might be unreliable, and likely to add another source of errors.

To test the viability of these methods in a real-world scenario, we implemented the approaches described in Section 2, and tested them on our different datasets recorded with monkeys, comparing their results to those from our algorithm, BRIL. Our findings, presented in Section 3, show quite unequivocally that our method largely outperform the three different techniques relying on fixations detection. While the longest fixation across trials does provide some satisfying results on the less contaminated dataset (with an average error of $5.26\ (1.39)$ pixels, compared to $1.01\ (0.40)$ for our method on the same dataset), the errors grow dramatically in the two other sessions. Across all datasets, the average error of our method was $0.92\ (0.49)$ pixels, for the longest fixation across trials it was equal to $25.99\ (62.35)$, for the average of the longest fixation it raised to $33.71\ (26.82)$, and finally for the average of the first fixations the mean error was $27.98\ (22.29)$. In visual degrees, these values correspond to errors of 0.0360, 1.0204, 1.3237, and 1.0984, respectively.

The inaccuracies of the fixations-based methods can be explained, in part, by failings in the saccades/fixations detection. While relatively simple, the detection technique we implemented, with the few improvements listed, managed in overall good performances. Nonetheless, inspecting the individual trials, we saw that some of them still presented errors. Typical examples of these issues include:

1. Actual saccades that were not detected (i.e., classified as fixations). When part of the main fixation, this type of error can lead to incorrect reference coordinates, since the positions of the samples from different fixations were averaged (see example in Figure 7). Moreover, the grouping of several short fixations can also lead to the incorrect selection of the longest fixation, as their durations are combined.
2. False saccade detections. When these occur within the main fixation, splitting it into smaller ones, another fixation might be erroneously selected as the longest.
3. Imprecision in the fixation boundaries. The final part of the previous saccade, or the beginning of the

next, might at times get included as part of the fixation. As a result, the fixation average position might be affected by these samples. There errors are generally of small magnitude though, since the number of samples actually part of the fixation largely outweighs the few from the saccade(s) end(s), and as these are typically in the vicinity of the fixation.

Independently of the detection algorithm, other errors might arise from the eye-tracking system itself. If the device lost the pupil tracking in the intervals when the subject was actually looking at the target, a different fixation could end up being selected (see examples of signal loss in Figure 8).

Nonetheless, even assuming ideal conditions, i.e., a fail-proof fixations/saccades detection, and a fully reliable eye-tracking system (with very high precision, and no loss of signal), the fixation based approaches would still face issues related to subject's behavior. As observed in our datasets, uncooperative subjects are very unpredictable. While in some cases they will fixate the target for the whole duration of the trial, in others they might not look at the calibration target even once (see Figure 9 and Figure 10). It also occurs that they look at the target only briefly, having longest saccades in other locations (Figure 11). In these conditions, only one trial with a longest fixation to an irrelevant position will strongly affect the final averaged reference coordinates for that target, as seen in Figure 3. Selecting the longest fixation across all trials with a given target might mitigate this issue, however, if the trial selected happened to be one with a fixation not directed to the target, the results will be dramatically impaired (as observed for the Target 4 of the second and third calibration in Figure 4). In a similar way, it is hard to make any assumption in relation to the timing and order of the fixations, in some trials subjects might look at the target on their first fixation, in others in the middle of the trial, or even only at the end, after a long delay, as seen in Figures 12. To conclude, we believe that, in favorable conditions - e.g., experiments with cooperative subjects, or datasets with small contamination - the extraction of the longest fixations can be a viable option to estimate calibration coordinates. However, it is not in the case of contaminated datasets and uncooperative subjects, as we have seen in these seen in these examples and evaluations.

Our method, on the other hand, is much more robust to these scenarios. Firstly, because it does not require any preprocessing, smoothing, nor saccades/fixations detection, therefore avoiding potential additional errors, and facing the difficulties related to the choice of an algorithm and its parametrization. Secondly, because we pool all the gaze coordinates from the different trials corresponding to each target. That way, it allows to find the correct reference coordinates even when the subject did not look at the calibration target in a few trials, as long as the combined durations of the fixations to the target, across trials, exceed those from any other *given* location. Considering that the actual fixations to the target will share the same spatial position, and that the incorrect fixations - as well as the samples from saccades and technical artefacts - are typically spread at different locations, the likelihood to identify the correct reference coordinates is therefore relatively high, even if the subject attended the target for small intervals only. In other words, the combined durations to the target can be much lower than the fixations to other positions, our method solely requires that one *specific* incorrect location do not totalize more fixations than those to the target. To illustrate, if we have one fixation of 500ms to the target, and 5 fixations of 300ms each to other distinct locations, our method will be able to reliably identify the reference coordinates (despite the fixation representing only 25% of the samples). The same way, if there were 2 separate fixations of 250ms each to the target, and the same 5 fixations of 300ms to other locations, it will be sufficient to estimate the correct coordinates (in this case not only does it account for merely 25% of the data, but it is not even the longest individual fixation). For these reasons, our approach is more accurate and reliable than fixations-based methods, beside being non-parametric, making it more generic to different conditions/datasets, and easier to use.

5 Additional materials

Table 2: Detailed results for the 2 methods based on longest fixations, as well as the BRIL algorithm and average of first fixations, for each of the calibration target within each session. Errors are reported in pixels and in visual degrees. For fixation-based methods, the number of fixations, as well as duration of the 3 first or longest fixations are also provided.

Method	Session	Target	DurTrial	X	Y	ErrorRaw	ErrorPx	ErrorDeg	NbFix	Fix1Dur	Fix2Dur	Fix3Dur
AvgFirstFixations	juj011a00	1	1700	5456.50	544.03	15.61	0.28	0.0109	1.14	1340.57	1093.00	#N/A
AvgLongestFixations	juj011a00	1	1700	5405.05	503.57	80.40	1.43	0.0562	1.14	1442.71	378.00	#N/A
LongestFixationAcrossTrials	juj011a00	1	1700	5156.90	353.87	369.12	6.57	0.2581	1.00	1501.00	#N/A	#N/A
BRIL	juj011a00	1	1700	5427.71	531.41	45.31	0.81	0.0317	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	juj011a00	2	1700	11518.17	-4602.79	318.67	5.68	0.2228	1.64	1129.64	632.80	183.00
AvgLongestFixations	juj011a00	2	1700	10384.04	-5016.93	1042.14	18.56	0.7288	1.64	1280.21	225.20	159.67
LongestFixationAcrossTrials	juj011a00	2	1700	11417.71	-5132.96	226.93	4.04	0.1587	1.00	1501.00	#N/A	#N/A
BRIL	juj011a00	2	1700	11479.62	-4854.55	78.57	1.40	0.0549	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	juj011a00	3	1700	2273.37	-3578.67	2849.34	50.75	1.9925	1.33	1321.17	608.33	153.00
AvgLongestFixations	juj011a00	3	1700	2236.63	-3685.77	2776.53	49.45	1.9416	1.33	1395.17	312.33	153.00
LongestFixationAcrossTrials	juj011a00	3	1700	-517.92	-4304.75	370.70	6.60	0.2592	1.00	1501.00	#N/A	#N/A
BRIL	juj011a00	3	1700	-337.81	-4578.84	72.60	1.29	0.0508	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	juj011a00	4	1700	2727.02	3225.60	4186.36	74.56	2.9275	1.33	1135.83	311.00	695.00
AvgLongestFixations	juj011a00	4	1700	2788.48	3193.99	4253.06	75.75	2.9741	1.33	1179.67	432.00	311.00
LongestFixationAcrossTrials	juj011a00	4	1700	-539.34	5962.36	203.32	3.62	0.1422	1.00	1501.00	#N/A	#N/A
BRIL	juj011a00	4	1700	-380.06	6061.52	22.62	0.40	0.0158	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	juj011a00	5	1700	11255.85	5525.98	226.09	4.03	0.1581	1.09	1368.27	1426.00	#N/A
AvgLongestFixations	juj011a00	5	1700	11386.46	5660.75	39.77	0.71	0.0278	1.09	1494.18	41.00	#N/A
LongestFixationAcrossTrials	juj011a00	5	1700	11122.74	5577.39	306.07	5.45	0.2140	1.00	1501.00	#N/A	#N/A
BRIL	juj011a00	5	1700	11358.62	5652.84	63.27	1.13	0.0442	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	juj011a00	All	1700	#N/A	#N/A	1519.21	27.06	1.0624	1.31	1259.10	814.23	343.67
AvgLongestFixations	juj011a00	All	1700	#N/A	#N/A	1638.38	29.18	1.1457	1.31	1358.39	277.71	207.89
LongestFixationAcrossTrials	juj011a00	All	1700	#N/A	#N/A	295.23	5.26	0.2064	1.00	1501.00	#N/A	#N/A
BRIL	juj011a00	All	1700	#N/A	#N/A	56.48	1.01	0.0395	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	ded00800	1	1200	23266.15	-3894.02	683.25	12.22	0.4797	1.25	673.00	263.50	365.00
AvgLongestFixations	ded00800	1	1200	23145.33	-3454.79	350.91	6.27	0.2464	1.25	691.17	263.50	147.00
LongestFixationAcrossTrials	ded00800	1	1200	23588.44	-3430.88	270.17	4.83	0.1897	1.00	1001.00	#N/A	#N/A
BRIL	ded00800	1	1200	23403.42	-3280.06	54.24	0.97	0.0381	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	ded00800	2	1200	27664.20	-7746.64	1988.28	35.55	1.3959	1.20	781.80	627.00	#N/A
AvgLongestFixations	ded00800	2	1200	27777.70	-7760.99	1882.55	33.66	1.3216	1.20	851.20	280.00	#N/A
LongestFixationAcrossTrials	ded00800	2	1200	29413.51	-8600.38	111.24	1.99	0.0781	1.00	1001.00	#N/A	#N/A
BRIL	ded00800	2	1200	29478.61	-8773.68	98.22	1.76	0.0690	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	ded00800	3	1200	18314.79	-8058.87	762.27	13.63	0.5351	1.14	800.86	441.00	#N/A
AvgLongestFixations	ded00800	3	1200	18764.75	-6121.09	2331.79	41.69	1.6370	1.14	804.29	417.00	#N/A
LongestFixationAcrossTrials	ded00800	3	1200	17538.08	-8002.91	112.54	2.01	0.0790	1.00	983.00	#N/A	#N/A
BRIL	ded00800	3	1200	17511.95	-8120.90	43.10	0.77	0.0303	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	ded00800	4	1200	19997.41	1267.11	2773.18	49.59	1.9469	1.18	841.82	175.00	462.00
AvgLongestFixations	ded00800	4	1200	19995.57	1189.09	2807.17	50.20	1.9708	1.18	859.64	266.00	175.00
LongestFixationAcrossTrials	ded00800	4	1200	27453.52	-5789.16	12943.42	231.44	9.0868	1.00	1001.00	#N/A	#N/A
BRIL	ded00800	4	1200	17516.05	2508.67	6.60	0.12	0.0046	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	ded00800	5	1200	27034.47	-514.16	3159.36	56.49	2.2180	1.30	726.20	538.50	746.00
AvgLongestFixations	ded00800	5	1200	28185.42	857.61	1380.90	24.69	0.9694	1.30	883.50	122.00	6.00
LongestFixationAcrossTrials	ded00800	5	1200	29346.70	1942.70	224.19	4.01	0.1574	1.00	1001.00	#N/A	#N/A
BRIL	ded00800	5	1200	29251.34	1791.61	49.23	0.88	0.0346	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	ded00800	All	1200	#N/A	#N/A	1873.27	33.50	1.3151	1.21	764.74	409.00	524.33
AvgLongestFixations	ded00800	All	1200	#N/A	#N/A	1750.66	31.30	1.2290	1.21	817.96	269.70	109.33
LongestFixationAcrossTrials	ded00800	All	1200	#N/A	#N/A	2732.31	48.86	1.9182	1.00	997.40	#N/A	#N/A
BRIL	ded00800	All	1200	#N/A	#N/A	50.28	0.90	0.0353	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	ded005a01	1	3000	15494.10	-2961.40	1324.81	23.15	0.9089	4.00	1069.17	470.83	415.00
AvgLongestFixations	ded005a01	1	3000	15636.38	-3687.27	723.08	12.64	0.4961	4.00	1365.83	432.00	263.17
LongestFixationAcrossTrials	ded005a01	1	3000	16077.78	-3994.05	196.90	3.44	0.1351	5.00	1541.00	221.00	339.00
BRIL	ded005a01	1	3000	16279.42	-4124.11	89.61	1.57	0.0615	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	ded005a01	2	3000	23417.30	-10279.26	1150.39	20.10	0.7893	4.25	1076.75	354.50	263.17
AvgLongestFixations	ded005a01	2	3000	18921.40	-8270.77	3774.12	65.95	2.5893	4.25	1227.63	496.63	311.50
LongestFixationAcrossTrials	ded005a01	2	3000	22231.07	-9837.19	125.76	2.20	0.0863	2.00	1557.00	335.00	#N/A
BRIL	ded005a01	2	3000	22380.13	-9790.03	49.35	0.86	0.0339	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	ded005a01	3	3000	10612.37	-7743.19	1567.21	27.39	1.0752	4.30	1110.60	327.50	478.44
AvgLongestFixations	ded005a01	3	3000	13136.48	-10139.44	2827.81	49.41	1.9401	4.30	1338.20	442.60	300.00
LongestFixationAcrossTrials	ded005a01	3	3000	9963.50	-9250.94	475.10	8.30	0.3260	4.00	1614.00	131.00	264.00
BRIL	ded005a01	3	3000	10365.39	-9291.81	71.15	1.24	0.0488	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	ded005a01	4	3000	11516.85	-244.01	2234.25	39.04	1.5329	3.74	1055.42	397.11	492.00
AvgLongestFixations	ded005a01	4	3000	12568.47	-2003.76	4282.75	74.84	2.9383	3.74	1248.37	463.56	284.25
LongestFixationAcrossTrials	ded005a01	4	3000	12268.67	-3909.90	5920.59	103.46	4.0620	3.00	1692.00	244.00	189.00
BRIL	ded005a01	4	3000	10478.69	1722.90	10.24	0.18	0.0070	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	ded005a01	5	3000	22566.33	736.06	412.16	7.20	0.2828	4.00	1308.00	413.14	370.67
AvgLongestFixations	ded005a01	5	3000	22312.16	1090.02	25.70	0.45	0.0176	4.00	1496.14	419.71	258.50
LongestFixationAcrossTrials	ded005a01	5	3000	22405.67	996.54	107.38	1.88	0.0737	4.00	1564.00	231.00	273.00
BRIL	ded005a01	5	3000	22327.44	1097.71	22.19	0.39	0.0152	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	ded005a01	All	3000	#N/A	#N/A	1337.77	23.38	0.9178	4.06	1123.99	392.62	403.86
AvgLongestFixations	ded005a01	All	3000	#N/A	#N/A	2326.69	40.66	1.5963	4.06	1335.23	450.90	283.48
LongestFixationAcrossTrials	ded005a01	All	3000	#N/A	#N/A	1365.14	23.86	0.9366	3.60	1593.60	232.40	266.25
BRIL	ded005a01	All	3000	#N/A	#N/A	48.51	0.85	0.0333	#N/A	#N/A	#N/A	#N/A
AvgFirstFixations	All	All	#N/A	#N/A	#N/A	1576.75	27.98	1.0984	2.19	1049.27	538.61	423.95
AvgLongestFixations	All	All	#N/A	#N/A	#N/A	1905.25	33.71	1.3237	2.19	1170.53	332.77	200.24
LongestFixationAcrossTrials	All	All	#N/A	#N/A	#N/A	1464.23	25.99	1.0204	1.87	1364.00	232.40	266.25
BRIL	All	All	#N/A	#N/A	#N/A	51.75	0.92	0.0360	#N/A	#N/A	#N/A	#N/A

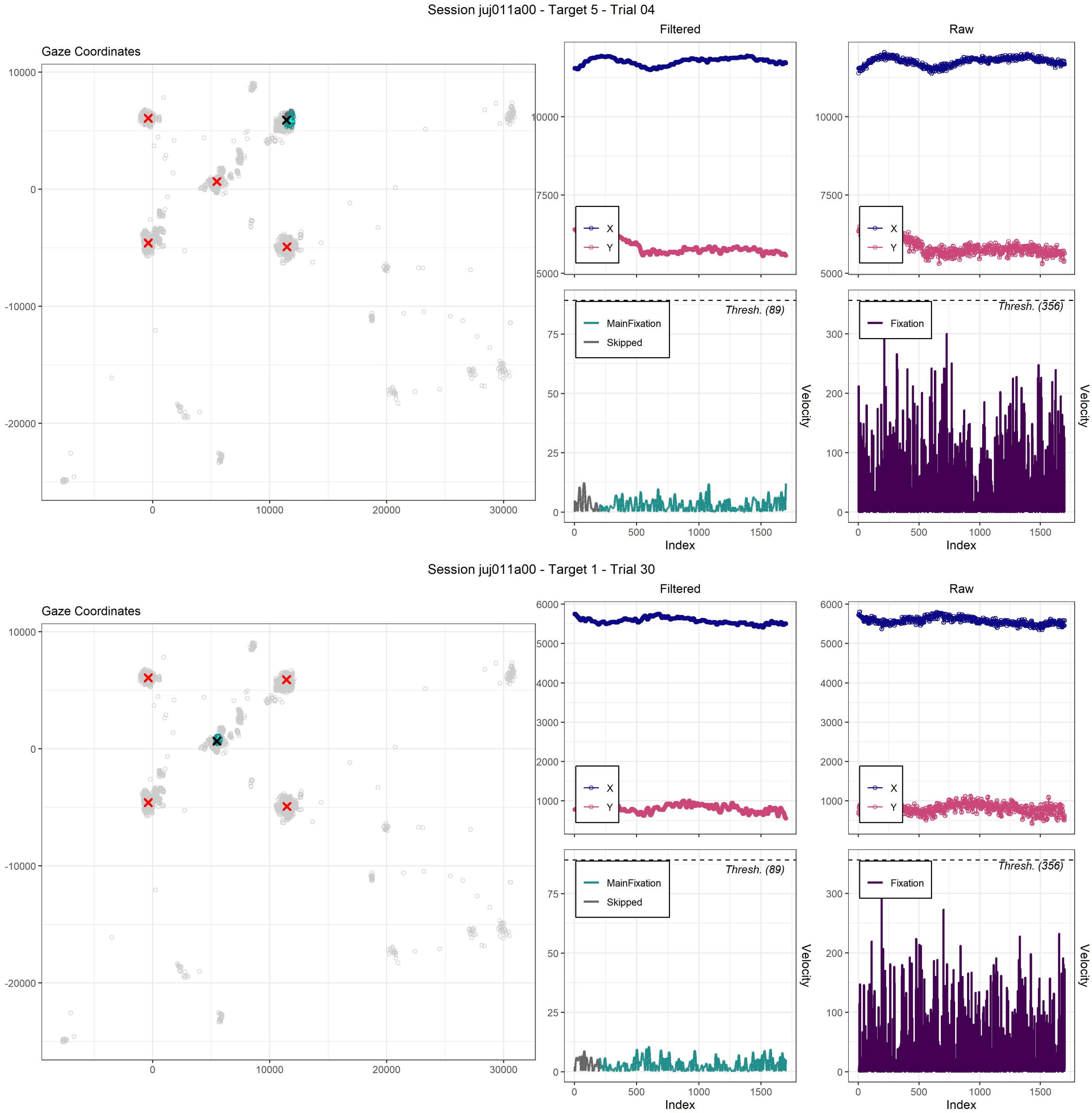

Figure 6: Trials with no saccade, which would result in false detections if the threshold was set to the RMS value computed from the current trial alone.

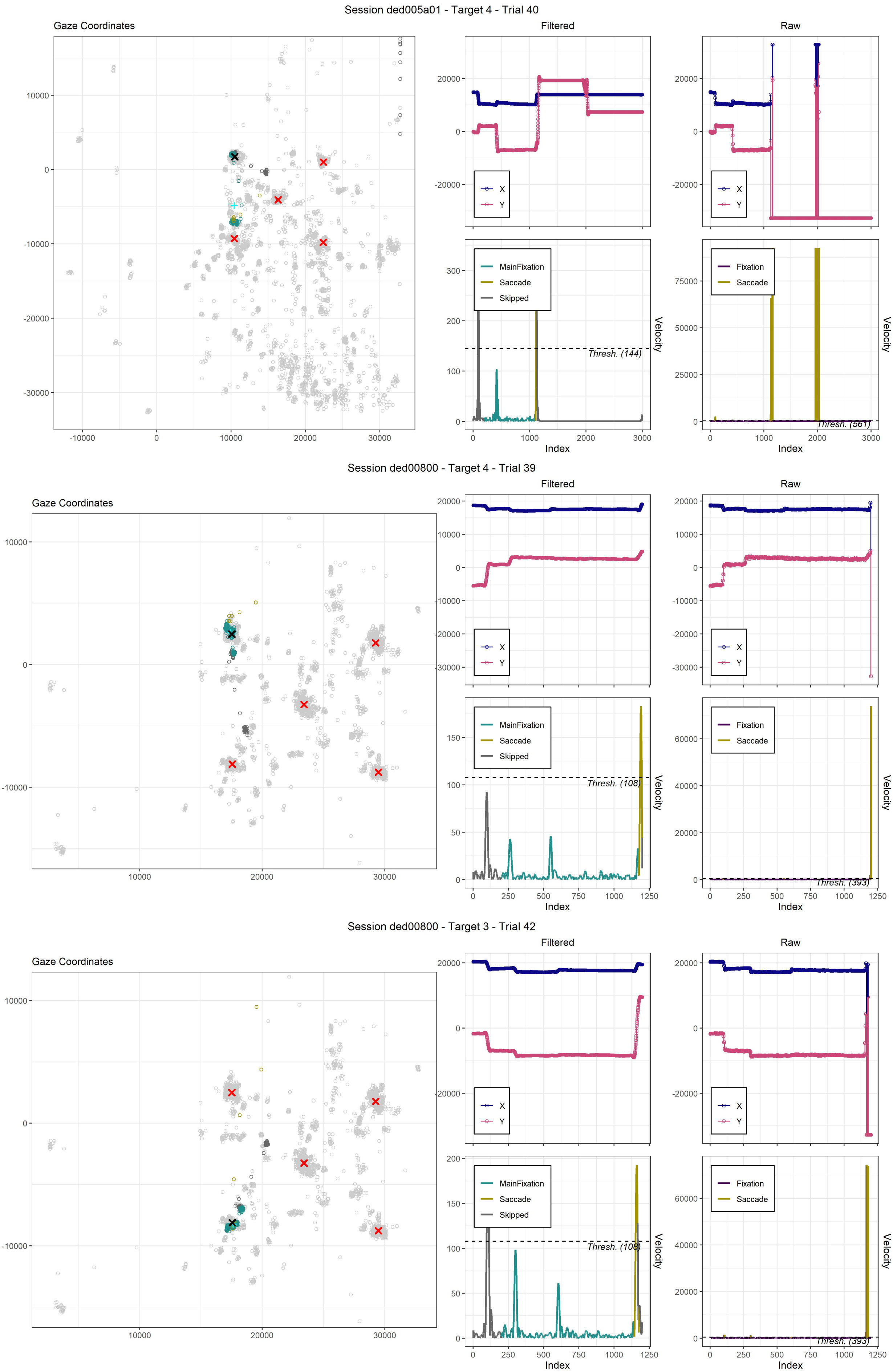

Figure 7: Missed saccade(s) in the main fixation.

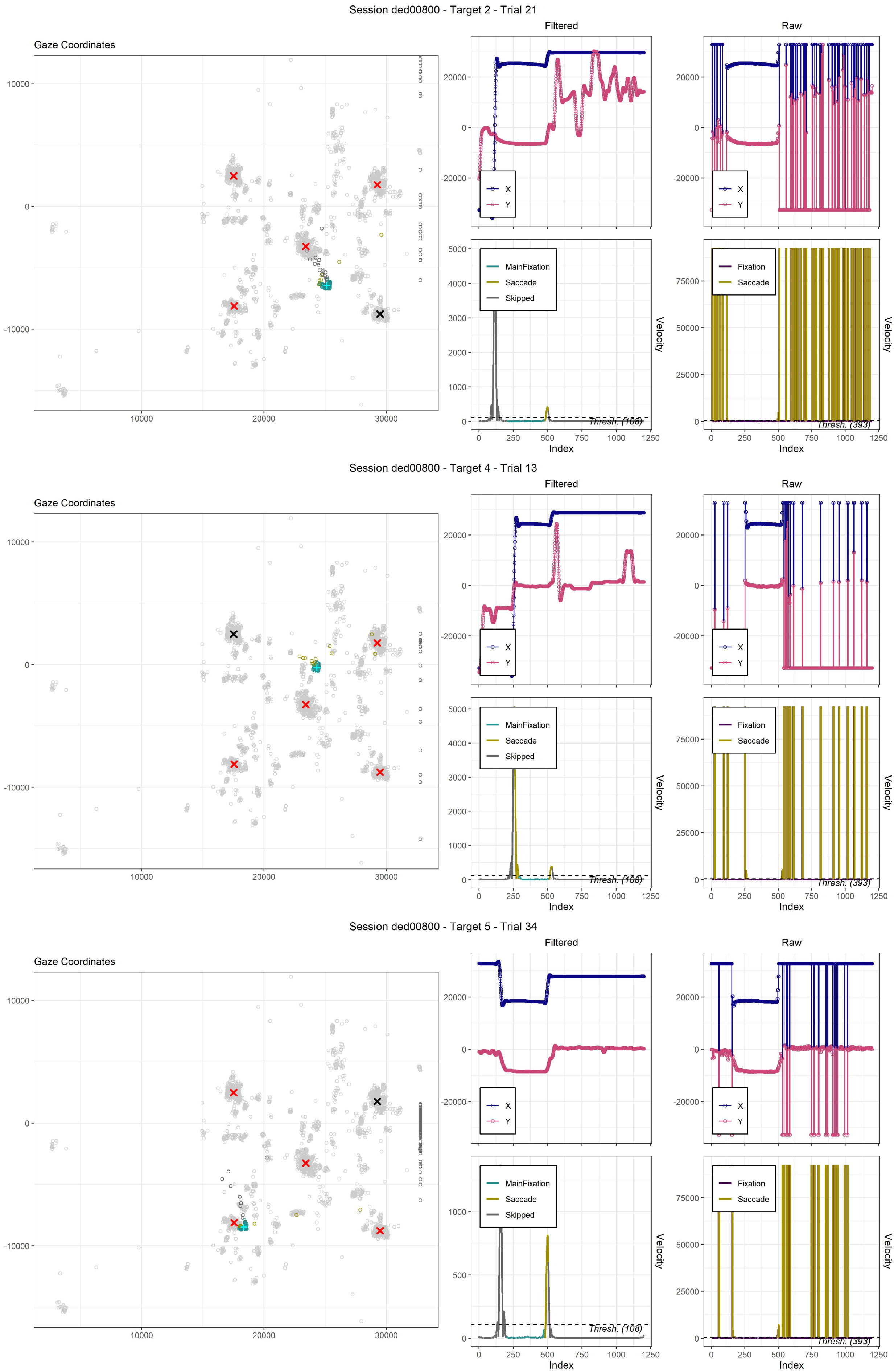

Figure 8: Prolonged losses of signal.

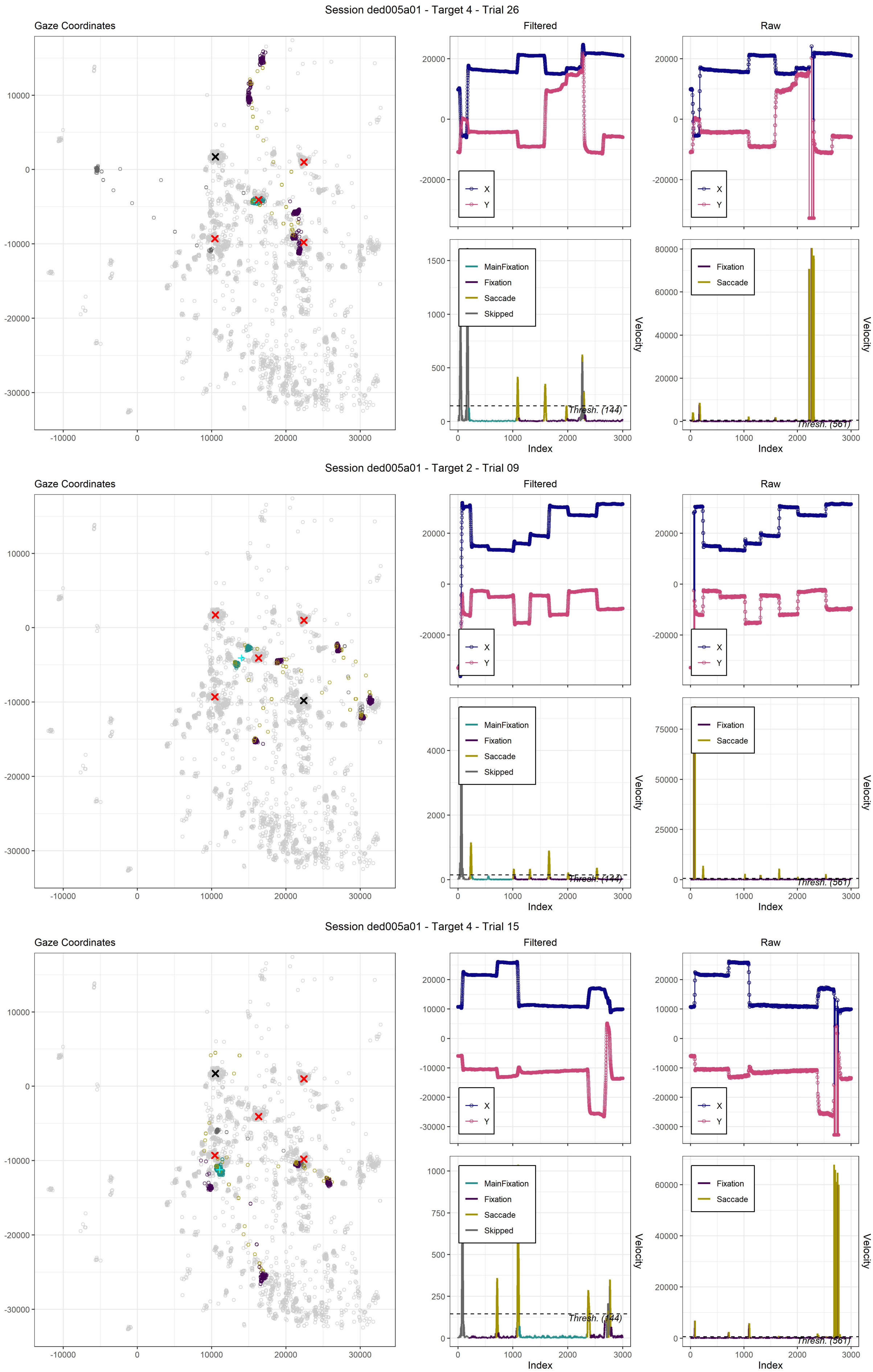

Figure 9: Trials where the subject did not attend the target once.

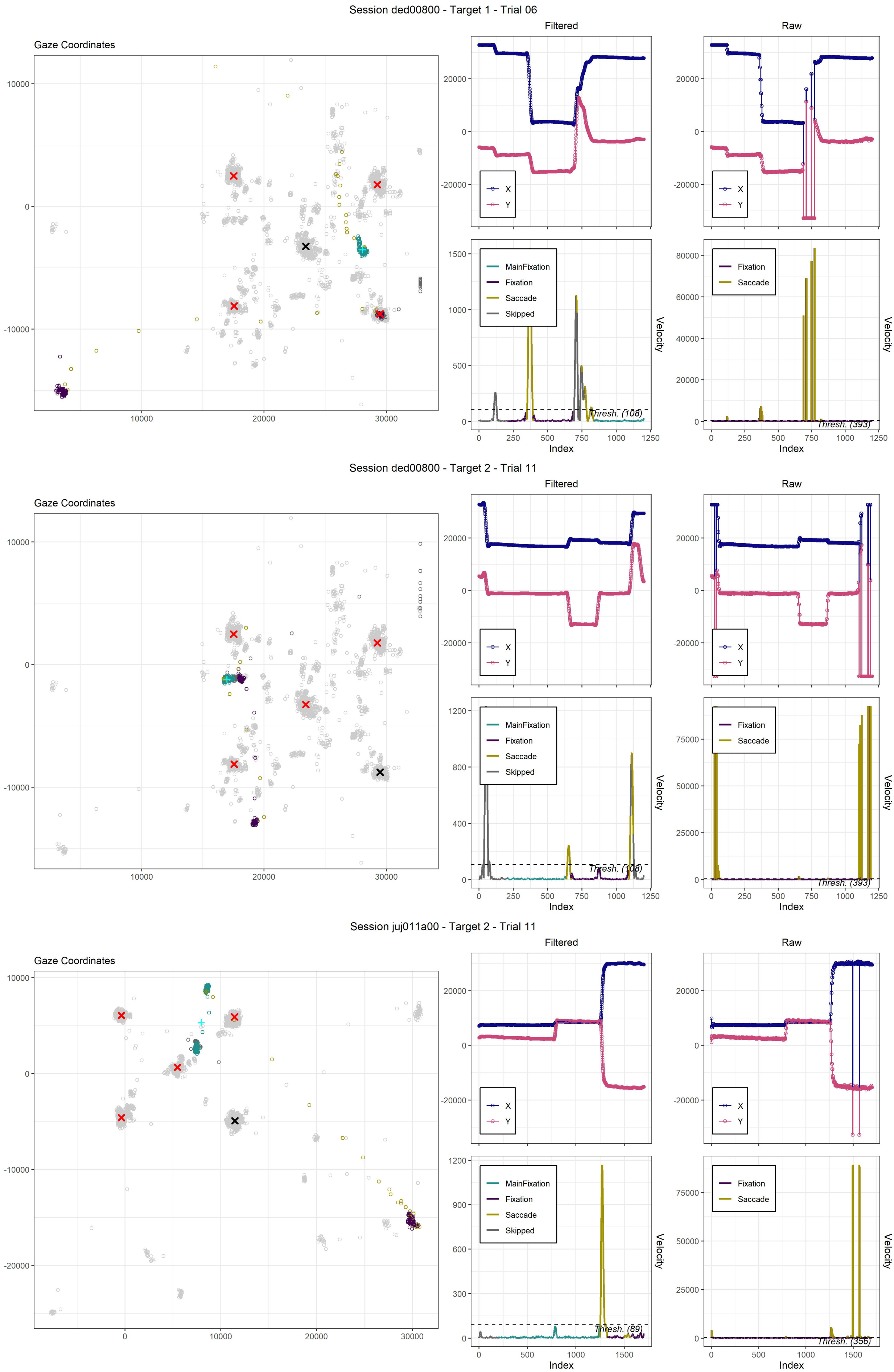

Figure 10: Trials where the subject did not attend the target once.

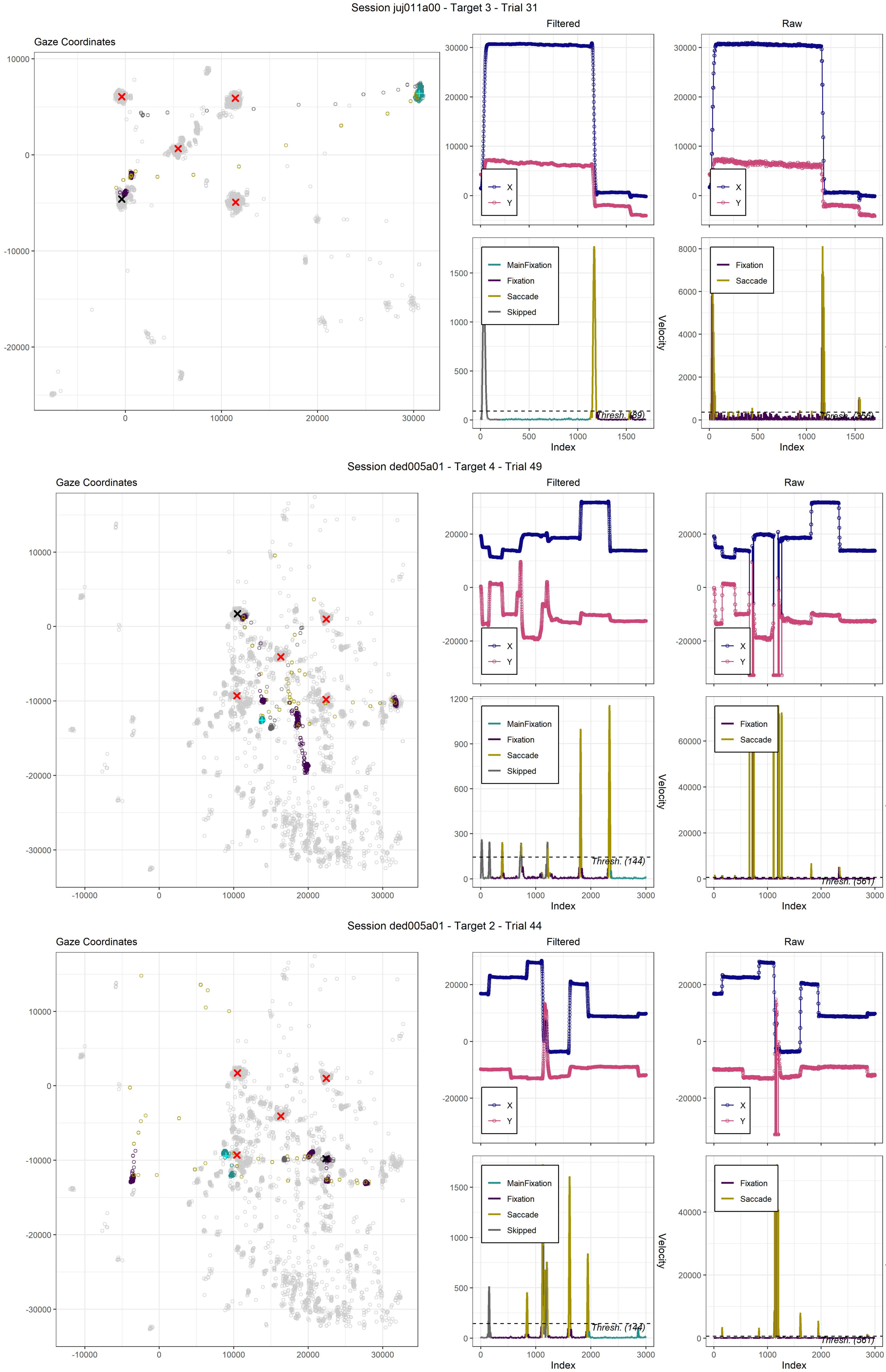

Figure 11: Trials where the subject had a fixation to the calibration target, but longer one(s) to other locations.

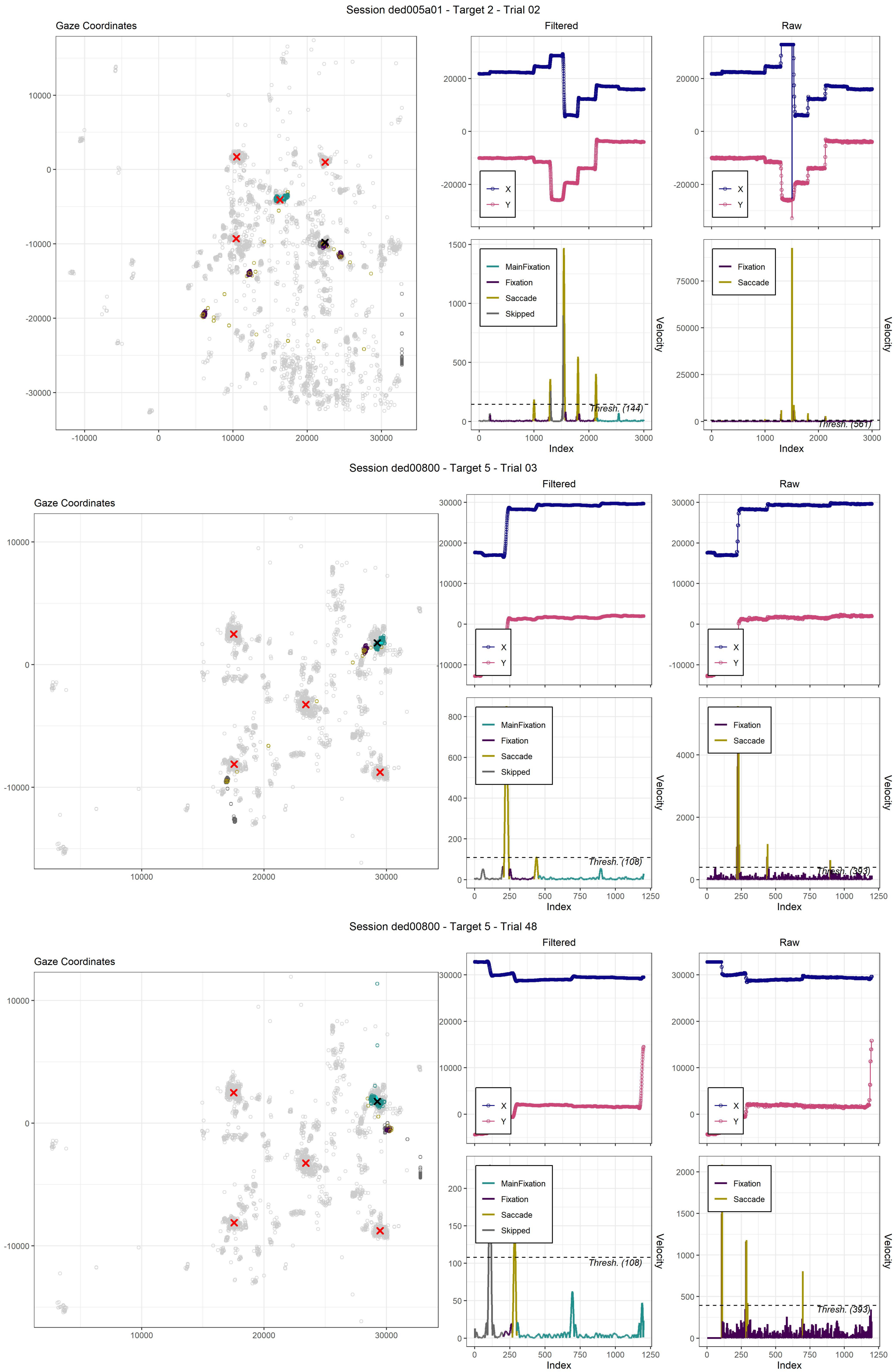

Figure 12: Trials where the fixation to the target was the last.