

Postsaccadic Sensitivity Dynamics at different eccentricities

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1 Introduction

To understand dynamics of visual sensitivity following saccades as in Boi et al at different eccentricities ...

2 Experimental Procedure

Contrast sensitivity is measured for low and high spatial frequencies (2, 10 cpd) and three eccentricities (0, 4, 8) using a Yes/No detection task and compared between two different stimulus durations (i.e. 50 and 500ms). Hence, there will be a total of 12 different conditions/instances arising from the different parameters.

For each trial the parameters (spatial frequency, eccentricity, stimulus duration) will vary randomly during the block and the contrast for each condition (total 12 conditions) will vary according to PEST. Catch-trials (no stimulus) are mixed into each block occurring on 50% of trials in a block.

2.1 Params

```
contrastback = .5 # Noise amplitude
pestTarget = 0.75, pestStep = 2 # step size for pest procedure
respTime = 4000 # time to wait for response
loadTime = 500 # maximum load time
fixTime = 1250 # average peripheral fixation time
fixTimeRange = 500 # range to add to fixTime
fixEcc = 400 # Eccentricity of the peripheral fixation dot
fixAreaC = 67.5 # central fixation area
fixAreaP = 100 #peripheral fixation area
fixLocNo = 1 # number of fixation locations
backgroundGray= 127
screenW = 1920
screenH = 1080
screenR = 200
GratingType = radial wave
annulusWidth = 1; # degree
gaussianSD = .2; # degree
```

```

24
25 void main(void)
26 {
27     // Get the coordinate
28     float x = gl_FragCoord.x - (screenOffsetX + cx);
29     float y = gl_FragCoord.y - (screenOffsetY + cy);
30
31     float r = sqrt((x - rcx)*(x-rcx) + (y-rcy) * (y-rcy)) * pixelAngle / 60;
32
33     float signal;
34
35     // Raised cosine envelope (JI 11-26-2018). In this case let gaussSD be half
36     // the period of the cosine
37     if (eccentricity == 0) {
38         //gaussSD = gaussSD2; // JI: we probably don't need this option
39     }
40
41     if ((r >= eccentricity - width/2) && (r <= eccentricity+width/2)) {
42         signal = sin(2 * M_PI * SpatialFreq * r + phase);
43     } else if (r > eccentricity + width/2 && r <= eccentricity + width/2 + gaussSD) {
44         signal = sin(2 * M_PI * SpatialFreq * r + phase)*
45             (cos(M_PI / gaussSD * (r - eccentricity - width / 2))+ 1) / 2;
46
47     } else if (r < eccentricity - width/2 && r >= eccentricity - width/2 - gaussSD) {
48         signal = sin(2 * M_PI * SpatialFreq * r + phase)*
49             (cos(M_PI / gaussSD * (r - eccentricity + width / 2))+ 1) / 2;
50
51     } else {
52         signal = 0.f;
53     }
54
55     // Get color from the texture
56     vec4 Color = texture2D(texture_0, vec2(gl_TexCoord[0]));
57
58     //Modify color of object by the position of pixel
59     // First we do (noise-.5)*2 -> range(-1,1)
60     // then we do noise_amp * noise
61     // For the signal we do (signalAmp*signal)
62     // We then add noise_amp * noise and signalAmp*signal. Note that both have mean 0 and is when they should be added to avoid out of bound effects
63     // Finally we divide the resultant image by 2 and add 0.5 to bring the range to (0,1). Note that you divide when mean is 0 and then add
64     gl_FragColor.x = (((noiseAmp * ((Color.x-0.5f)*2.f)) + (signalAmp*signal))/2.f)+0.5f;
65     gl_FragColor.y = (((noiseAmp * ((Color.y-0.5f)*2.f)) + (signalAmp*signal))/2.f)+0.5f;
66     gl_FragColor.z = (((noiseAmp * ((Color.z-0.5f)*2.f)) + (signalAmp*signal))/2.f)+0.5f;
67     gl_FragColor.a = Color.a;
68 }

```

Figure 1: Shader code

2.2 Status

In the first run of data collection, 4600 trials were collected without an Eye Mask, i.e. the data was collected binocularly.

In the second run of data collection, 2000 trials were collected but an issue was found where the debug mode was always 1. Hence, both the first and second run of data collection are not usable.

In the third run of data collection, 3272 trials were collected but an issue with contrast saturation was found due to erroneous addition of noise and grating and discretization at a early stage.

Subsequently, corrections were made to the method of using noise and shader such that the discretization and addition of noise and grating were done at the last stage. Currently, the data collection is at 2819 trials. All the trials have been collected on the experimenter himself.

3 additional subjects have been recruited for the study.

Subject A013 - 2652 trials

Subject A092 - 3683 trials Subject A036 - 2895 trials

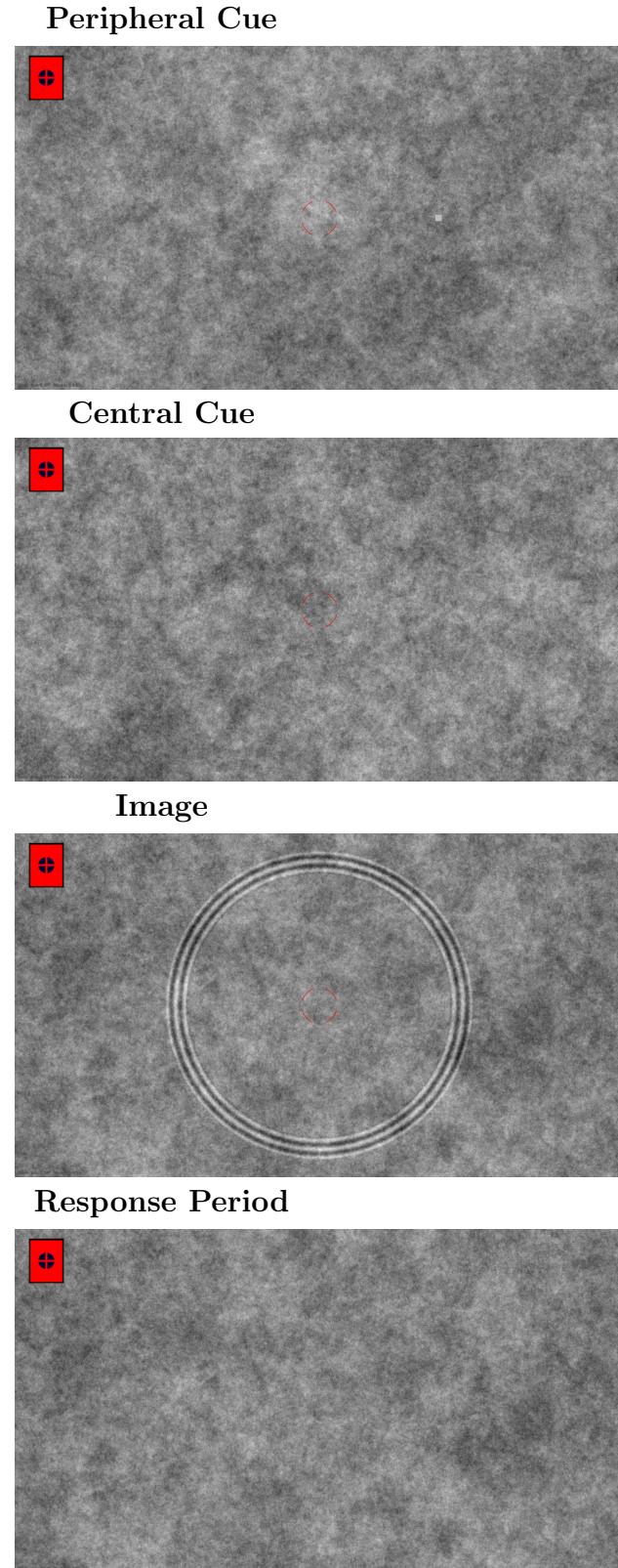


Figure 2: Experimental paradigm. Fixation is enforced at a **peripheral cue**. There is no **central cue** as such, only that the peripheral cue turns off and the subject initiates a saccade. As soon as a saccade is detected there is a flashed **image** or no image (catch-trial) for a fixed period of time before vanishing to initiate the **response period**, during which subjects report whether or not the radial wave was present or not.

3 Data Analysis

3.1 Sample EM plots

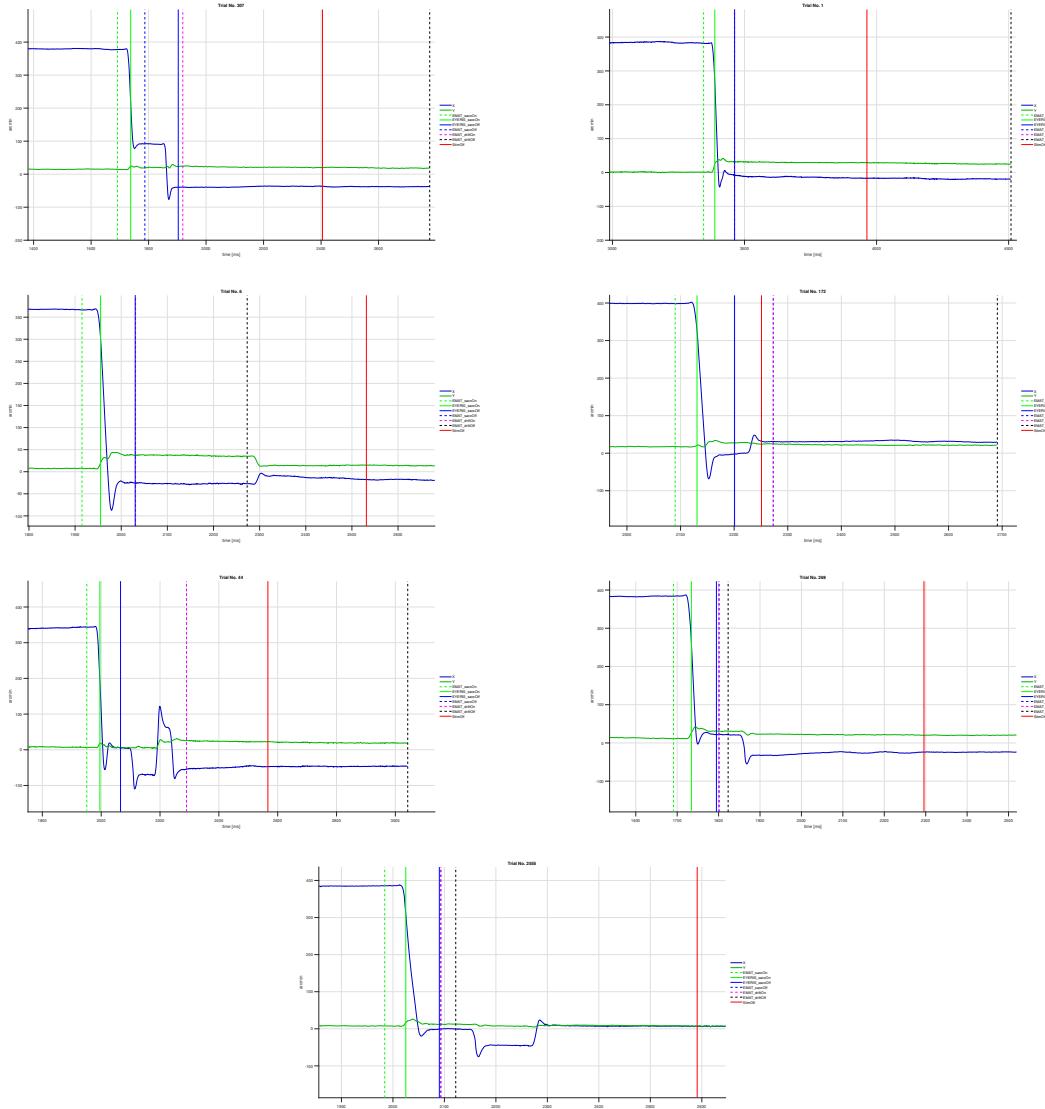


Figure 3: From left to right: Mistagged trial EM plot (DISCARDED), Drift only trial (VALID), 1 microsaccade trial (MS1 in the table -> VALID), 1 saccade trial concatenated (S1 in the table -> VALID), 1 saccade trial concatenated (S1 in the table-> VALID),1 saccade trial UNconcatenated (S1 in the table-> VALID),2 Saccade trial (S2 in the table-> VALID)

3.2 PEST and Table

3.2.1 SUBJECT:NIKUNJ

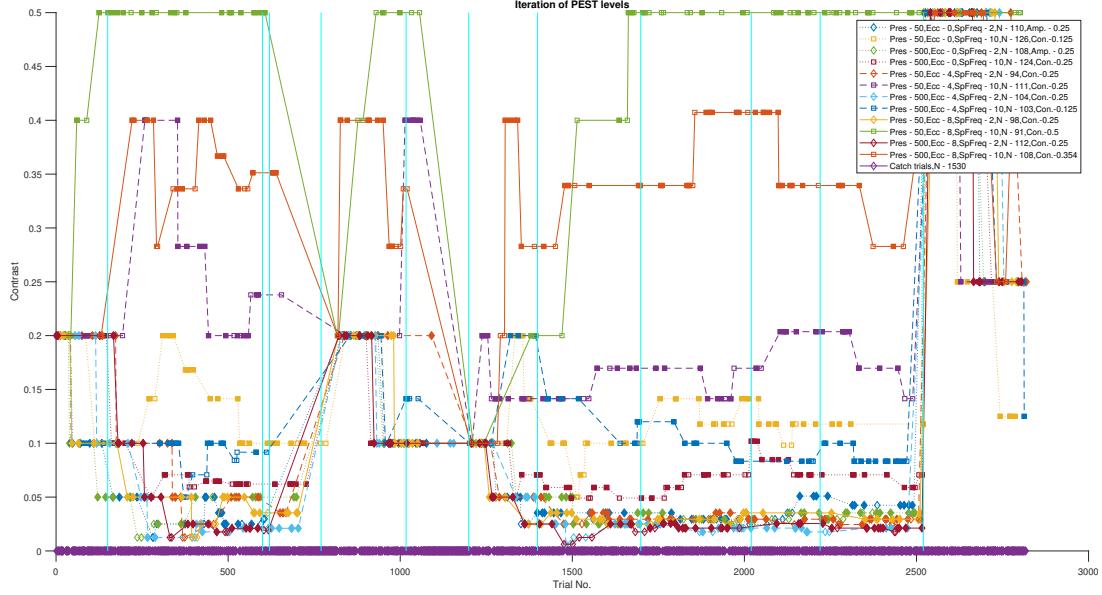


Figure 4: SUBJECT: NIKUNJ. Change in PEST contrast levels for different conditions/instances over the course of trials. Vertical lines denote start of a new session. Filled dots are trials where the response was correct and vice versa. In the legend, 'N' denotes total number of trials with that condition/instance and 'Con.' denotes the final contrast at that condition/instance.

Disc_Blinks_Track -> Trials discarded because of blinks or no-tracks during stimulus exposure.

Disc_Tags_Land -> Trials discarded because of misTags (see Figure 3) or the initial saccade landing distance from the centre surpassed threshold of 60arcmin.

ValidTrials -> Valid trials that include DriftOnly and MS/S trials.

DriftOnly -> Valid trials that have only drift after the initial saccade.

MS/S -> Valid trials that have a microsaccade or saccade after the initial saccade.

MS_1,MS_2 -> Valid trials that have 1, 2 microsaccades.

S_1,S_2 -> Valid trials that have 1, 2 saccades.

Exposure -> Mean and Stdev of stimulus exposure duration.

Vel_less_3 -> Mean and Stdev of duration when the subject was exposed to the stimulus and the eye movement speed was less than 3 deg/s.

Condition	Total	Disc_Blinks_Track	Disc_Tags_Land	Valid	Drift	MS_S	MS_1	MS_2	S_1	S_2	Exposure	Vel_less_3
Ecc-0, Pres-50, SpFreq-2	110	0	2	108	101	7	3	0	4	0	112.9907 ± 14.4368	50.213 ± 12.3266
Ecc-0, Pres-50, SpFreq-10	126	0	3	123	109	14	6	0	8	0	113.1463 ± 15.9022	49 ± 13.4079
Ecc-0, Pres-500, SpFreq-2	108	0	7	101	65	36	19	0	16	1	564.2871 ± 15.0269	479.8614 ± 38.5043
Ecc-0, Pres-500, SpFreq-10	124	0	6	118	76	42	22	0	14	6	561.4068 ± 19.752	474.178 ± 49.2603
Ecc-4, Pres-50, SpFreq-2	94	0	3	91	81	10	2	0	8	0	118.044 ± 22.174	54.011 ± 13.1246
Ecc-4, Pres-50, SpFreq-10	111	0	4	107	99	8	1	0	7	0	116.1121 ± 20.3819	51.5047 ± 15.9198
Ecc-4, Pres-500, SpFreq-2	104	0	4	100	85	15	4	0	11	0	562.62 ± 17.9886	486.46 ± 38.2576
Ecc-4, Pres-500, SpFreq-10	103	0	5	98	77	21	6	0	15	0	563.0204 ± 14.6203	482.3061 ± 42.3487
Ecc-8, Pres-50, SpFreq-2	98	0	4	94	89	5	1	0	4	0	113.4787 ± 12.6514	49.1596 ± 12.2653
Ecc-8, Pres-50, SpFreq-10	91	0	6	85	78	7	3	0	4	0	118.3647 ± 24.5201	54.5882 ± 15.9905
Ecc-8, Pres-500, SpFreq-2	112	0	4	108	88	20	3	0	16	1	563.9815 ± 16.7494	485.9907 ± 37.9344
Ecc-8, Pres-500, SpFreq-10	108	0	3	105	83	22	7	0	11	4	562.8571 ± 18.4325	480.2667 ± 46.6192
Ecc-, Pres-50, SpFreq-	737	0	24	713	667	46	12	0	34	0	114.1473 ± 17.1879	51.2651 ± 14.3558
Ecc-, Pres-500, SpFreq-	793	0	38	755	571	184	59	1	106	18	563.7391 ± 17.6537	479.004 ± 46.0178

Table 1: Note the number of microsaccades/saccades is in ADDITION to the initial saccade

3.2.2 SUBJECT:A013

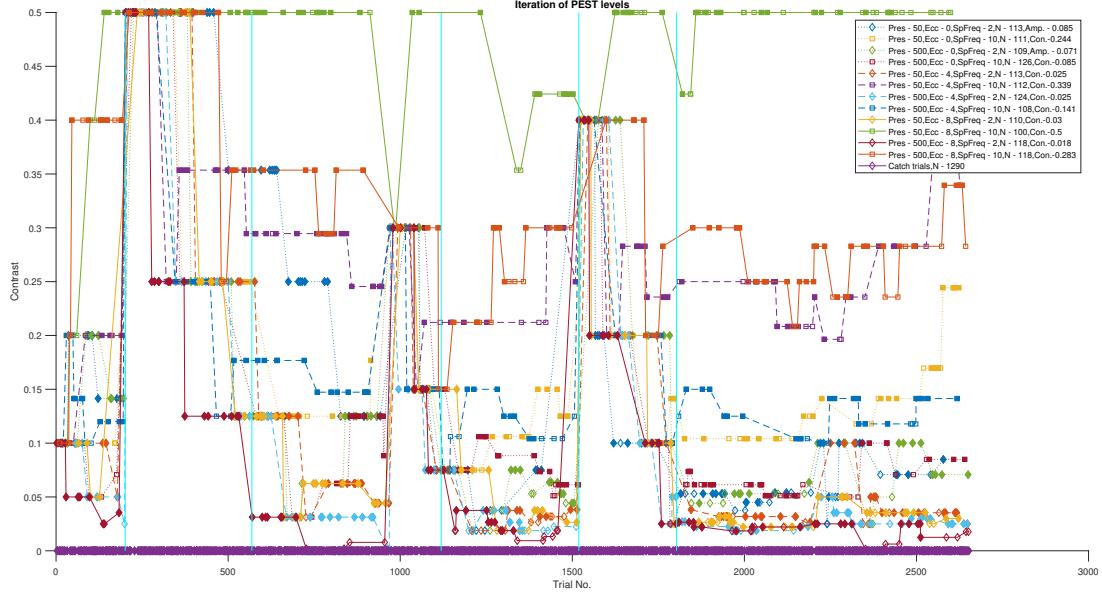


Figure 5: SUBJECT: A013. Change in PEST contrast levels for different conditions/instances over the course of trials. Vertical lines denote start of a new session. Filled dots are trials where the response was correct and vice versa. In the legend, 'N' denotes total number of trials with that condition/instance and 'Con.' denotes the final contrast at that condition/instance.

Disc_Blinks_Track -> Trials discarded because of blinks or no-tracks during stimulus exposure.

Disc_Tags_Land -> Trials discarded because of misTags (see Figure 5) or the initial saccade landing distance from the centre surpassed threshold of 60arcmin.

ValidTrials -> Valid trials that include DriftOnly and MS/S trials.

DriftOnly -> Valid trials that have only drift after the initial saccade.

MS/S -> Valid trials that have a microsaccade or saccade after the initial saccade.

MS_1,MS_2 -> Valid trials that have 1, 2 microsaccades.

S_1,S_2 -> Valid trials that have 1, 2 saccades.

Exposure -> Mean and Stdev of stimulus exposure duration.

Vel_less_3 -> Mean and Stdev of duration when the subject was exposed to the stimulus and the eye movement speed was less than 3 deg/s.

Condition	Total	Disc_Blinks_Track	Disc_Tags_Land	Valid	Drift	MS_S	MS_1	MS_2	S_1	S_2	Exposure	Vel_less_3
Ecc-0, Pres-50, SpFreq-2	113	0	15	98	93	5	2	0	3	0	123.9592 ± 23.8837	54.7245 ± 15.7243
Ecc-0, Pres-50, SpFreq-10	111	0	10	101	94	7	3	0	4	0	123.6238 ± 22.1069	49.9901 ± 15.4916
Ecc-0, Pres-500, SpFreq-2	109	0	12	97	85	12	6	0	6	0	567.8763 ± 11.7724	493.8247 ± 21.5581
Ecc-0, Pres-500, SpFreq-10	126	0	14	112	102	10	6	0	4	0	572.1786 ± 19.9401	499.3214 ± 23.8082
Ecc-4, Pres-50, SpFreq-2	113	0	9	104	101	3	0	0	3	0	123.1058 ± 22.795	54.3558 ± 18.2336
Ecc-4, Pres-50, SpFreq-10	112	0	9	103	97	6	0	0	6	0	123.3981 ± 21.8916	51.4951 ± 19.3395
Ecc-4, Pres-500, SpFreq-2	124	0	14	110	104	6	5	0	1	0	570 ± 20.0975	498.3273 ± 22.0766
Ecc-4, Pres-500, SpFreq-10	108	0	9	99	90	9	6	0	2	0	571.6162 ± 13.4761	497.1212 ± 24.3349
Ecc-8, Pres-50, SpFreq-2	110	0	9	101	94	7	0	0	7	0	125.6337 ± 24.9246	54.5842 ± 19.428
Ecc-8, Pres-50, SpFreq-10	100	0	15	85	81	4	3	0	1	0	126.8824 ± 27.179	56.9647 ± 17.9732
Ecc-8, Pres-500, SpFreq-2	118	0	10	108	89	19	11	1	7	0	573.2315 ± 23.2984	494.0741 ± 32.6539
Ecc-8, Pres-500, SpFreq-10	118	0	11	107	95	12	5	1	5	1	570.6542 ± 17.5042	492.514 ± 40.0741
Ecc-, Pres-50, SpFreq-	674	0	71	603	575	28	11	0	17	0	122.9403 ± 20.5093	53.5871 ± 17.7822
Ecc-, Pres-500, SpFreq-	616	0	76	540	489	51	26	3	20	0	570.8204 ± 17.6613	495.8481 ± 25.1717

Table 2: Note the number of microsaccades/saccades is in ADDITION to the initial saccade

3.2.3 SUBJECT:A092

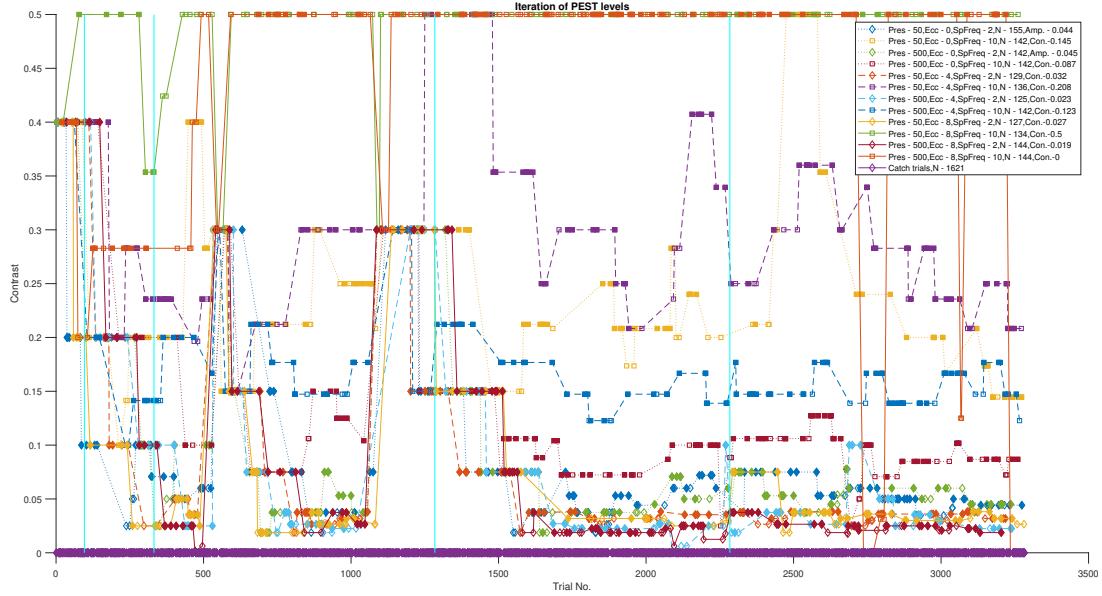


Figure 6: SUBJECT: A092. Change in PEST contrast levels for different conditions/instances over the course of trials. Vertical lines denote start of a new session. Filled dots are trials where the response was correct and vice versa. In the legend, 'N' denotes total number of trials with that condition/instance and 'Con.' denotes the final contrast at that condition/instance.

Disc_Blinks_Track -> Trials discarded because of blinks or no-tracks during stimulus exposure.

Disc_Tags_Land -> Trials discarded because of misTags (see Figure 5) or the initial saccade landing distance from the centre surpassed threshold of 60arcmin.

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MS_1,MS_2 -> Valid trials that have 1, 2 microsaccades.

S_1,S_2 -> Valid trials that have 1, 2 saccades.

Exposure -> Mean and Stdev of stimulus exposure duration.

Vel_less_3 -> Mean and Stdev of duration when the subject was exposed to the stimulus and the eye movement speed was less than 3 deg/s.

Condition	Total	Disc_Blinks_Track	Disc_Tags_Land	Valid	Drift	MS_S	MS_1	MS_2	S_1	S_2	Exposure	Vel_less_3
Ecc-0, Pres-50, SpFreq-2	1.55	0	9	146	130	16	3	0	13	0	131.7671 ± 15.183	43.0479 ± 20.6305
Ecc-0, Pres-50, SpFreq-10	142	0	7	135	118	17	2	0	15	0	128.2148 ± 14.9947	41.0074 ± 20.6222
Ecc-0, Pres-500, SpFreq-2	142	0	2	140	111	29	3	0	26	0	578.5214 ± 14.5456	474.5714 ± 32.1881
Ecc-0, Pres-500, SpFreq-10	142	0	5	137	105	32	9	0	22	1	577.3212 ± 14.4995	474.3212 ± 30.8824
Ecc-4, Pres-50, SpFreq-2	129	0	4	125	114	11	1	0	10	0	128.2116 ± 12.5631	39.752 ± 19.1242
Ecc-4, Pres-50, SpFreq-10	136	0	8	128	117	11	3	0	8	0	129.5703 ± 15.8634	43.0391 ± 20.5413
Ecc-4, Pres-500, SpFreq-2	125	0	3	122	111	11	3	0	8	0	579.5246 ± 16.9068	484.9918 ± 26.2343
Ecc-4, Pres-500, SpFreq-10	142	0	5	137	123	14	3	0	11	0	577.6204 ± 13.339	483.073 ± 30.702
Ecc-8, Pres-50, SpFreq-2	127	0	7	120	105	15	3	0	12	0	129.1917 ± 13.7323	40.2833 ± 19.8529
Ecc-8, Pres-50, SpFreq-10	134	0	8	126	110	16	4	0	12	0	129.3571 ± 13.5679	39.4286 ± 18.1043
Ecc-8, Pres-500, SpFreq-2	144	0	8	136	122	14	2	0	12	0	579.5735 ± 13.8021	483.3824 ± 26.3959
Ecc-8, Pres-500, SpFreq-10	144	0	5	139	124	15	3	0	12	0	580.1079 ± 14.9573	481.8345 ± 31.0772
Ecc-, Pres-50, SpFreq-	814	0	38	776	671	105	13	0	92	0	129.0399 ± 15.8422	38.6753 ± 19.5551
Ecc-, Pres-500, SpFreq-	807	0	37	770	651	119	25	1	92	0	578.3182 ± 16.4423	479.4403 ± 33.2725

Table 3: Note the number of microsaccades/saccades is in ADDITION to the initial saccade

3.2.4 SUBJECT:A036

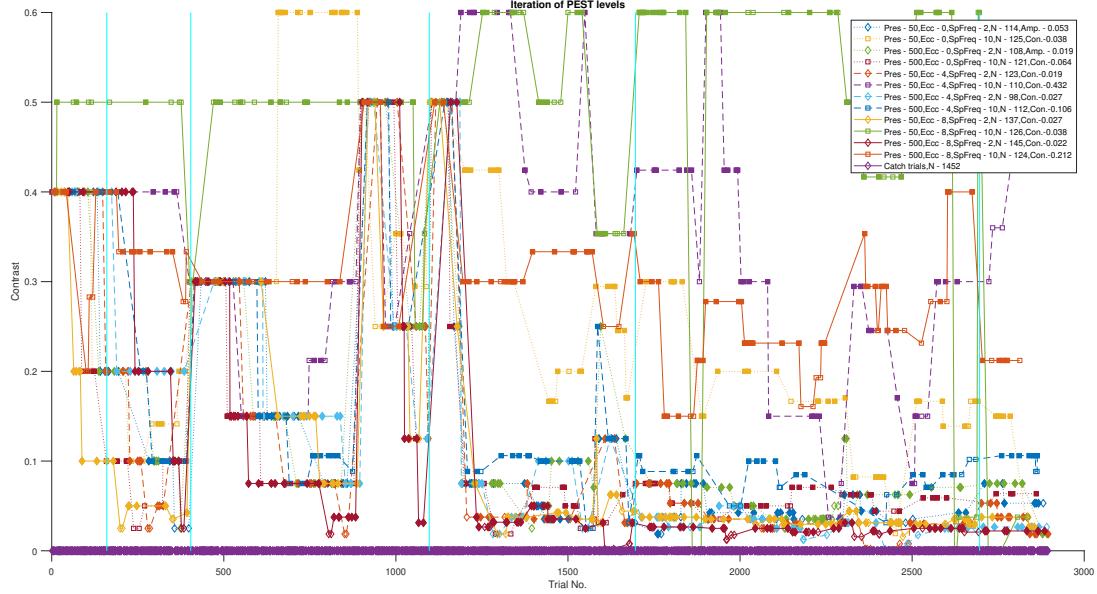


Figure 7: SUBJECT: A092. Change in PEST contrast levels for different conditions/instances over the course of trials. Vertical lines denote start of a new session. Filled dots are trials where the response was correct and vice versa. In the legend, 'N' denotes total number of trials with that condition/instance and 'Con.' denotes the final contrast at that condition/instance.

Disc_Blinks_Track -> Trials discarded because of blinks or no-tracks during stimulus exposure.

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MS/S -> Valid trials that have a microsaccade or saccade after the initial saccade.

MS_1,MS_2 -> Valid trials that have 1, 2 microsaccades.

S_1,S_2 -> Valid trials that have 1, 2 saccades.

Exposure -> Mean and Stdev of stimulus exposure duration.

Vel_less_3 -> Mean and Stdev of duration when the subject was exposed to the stimulus and the eye movement speed was less than 3 deg/s.

Condition	Total	Disc_Blinks_Track	Disc_Tags_Land	Valid	Drift	MS_S	MS_1	MS_2	S_1	S_2	Exposure	Vel_less_3
Ecc-0, Pres-50, SpFreq-2	114	0	33	81	74	7	1	0	6	0	119.4938 ± 19.8583	40.5062 ± 15.3225
Ecc-0, Pres-50, SpFreq-10	125	0	40	85	80	5	1	0	4	0	120.6118 ± 21.9421	40.0118 ± 16.6458
Ecc-0, Pres-500, SpFreq-2	108	0	22	86	37	49	20	3	24	1	571.9651 ± 23.7454	448.8953 ± 51.9611
Ecc-0, Pres-500, SpFreq-10	121	0	25	96	52	44	23	0	20	0	576.0729 ± 35.8621	464.2813 ± 50.6267
Ecc-4, Pres-50, SpFreq-2	123	0	44	79	67	12	5	0	7	0	120.557 ± 18.3971	39.557 ± 17.9242
Ecc-4, Pres-50, SpFreq-10	110	0	17	93	83	10	2	0	8	0	119.4301 ± 18.9469	39.3548 ± 16.203
Ecc-4, Pres-500, SpFreq-2	98	0	28	70	39	31	12	0	19	0	570.8429 ± 21.6042	458.5143 ± 43.2468
Ecc-4, Pres-500, SpFreq-10	112	0	27	85	45	40	18	1	20	1	571.1412 ± 34.4163	451.3647 ± 49.9511
Ecc-8, Pres-50, SpFreq-2	137	0	31	106	88	18	2	0	16	0	123.5094 ± 26.9243	39.0377 ± 20.8933
Ecc-8, Pres-50, SpFreq-10	126	0	31	95	77	18	5	0	13	0	127.1895 ± 36.0087	39.4421 ± 27.1233
Ecc-8, Pres-500, SpFreq-2	0	40	105	68	37	13	1	23	0	569.9429 ± 23.6057	465.3905 ± 39.7958	
Ecc-8, Pres-500, SpFreq-10	124	0	23	101	43	58	24	0	33	1	572.7426 ± 35.1422	457.4059 ± 45.7533
Ecc-, Pres-50, SpFreq-	711	0	178	533	473	60	20	0	40	0	122.3696 ± 30.2607	42.5141 ± 24.2447
Ecc-, Pres-500, SpFreq-	741	1	190	550	270	280	107	12	151	8	570.8109 ± 25.2609	453.7927 ± 45.4032

Table 4: Note the number of microsaccades/saccades is in ADDITION to the initial saccade

3.3 Landing distance by eccentricity

3.3.1 SUBJECT:Nikunj

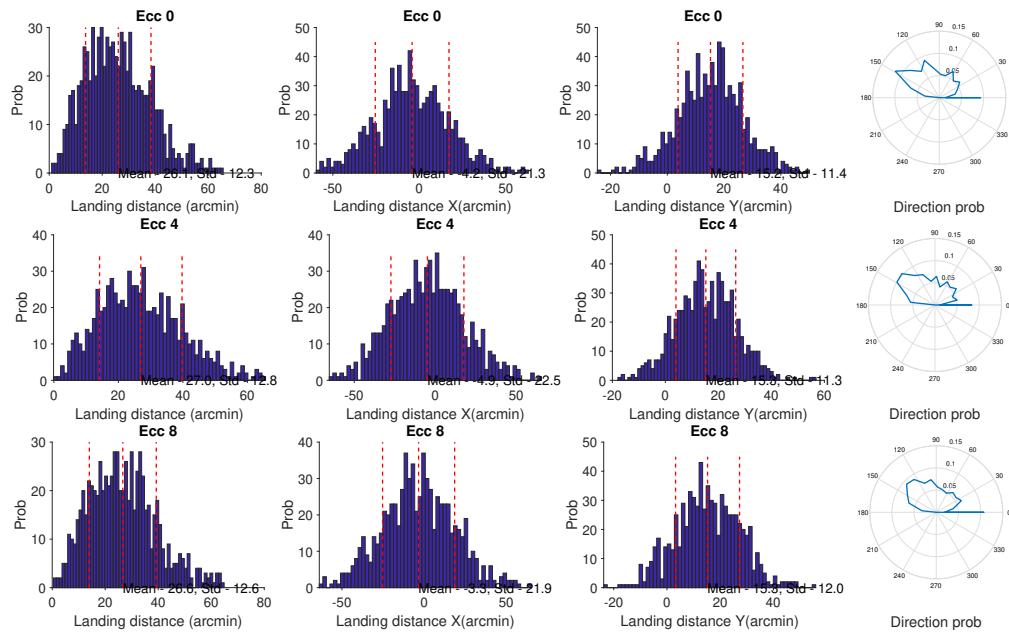


Figure 8: Landing distance distribution at different eccentricities.

3.3.2 SUBJECT:A013

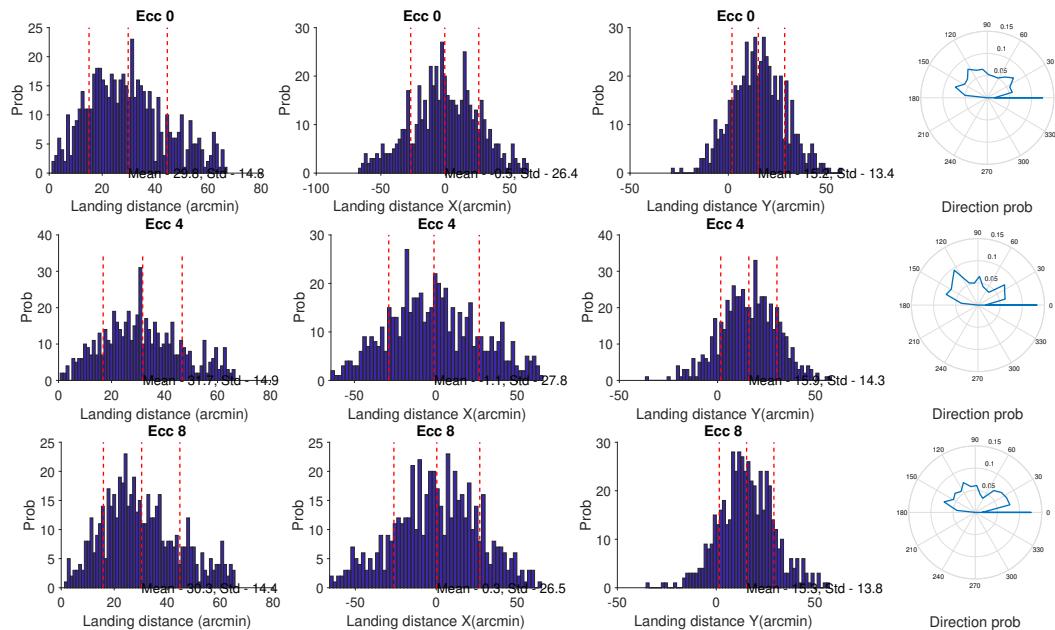


Figure 9: Landing distance distribution at different eccentricities.

3.3.3 SUBJECT:A092

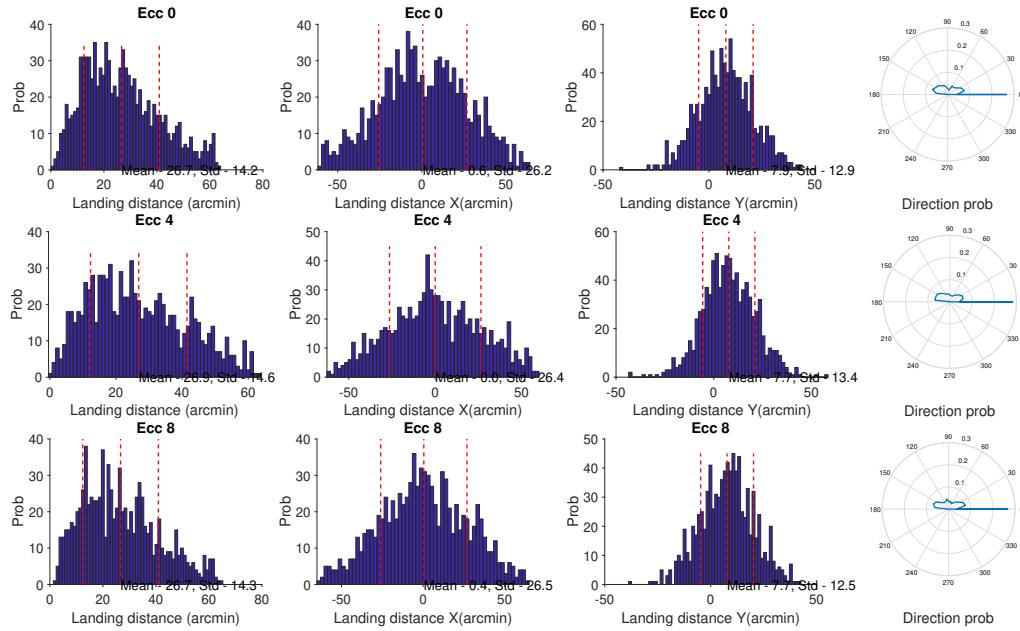


Figure 10: Landing distance distribution at different eccentricities.

3.3.4 SUBJECT:A036

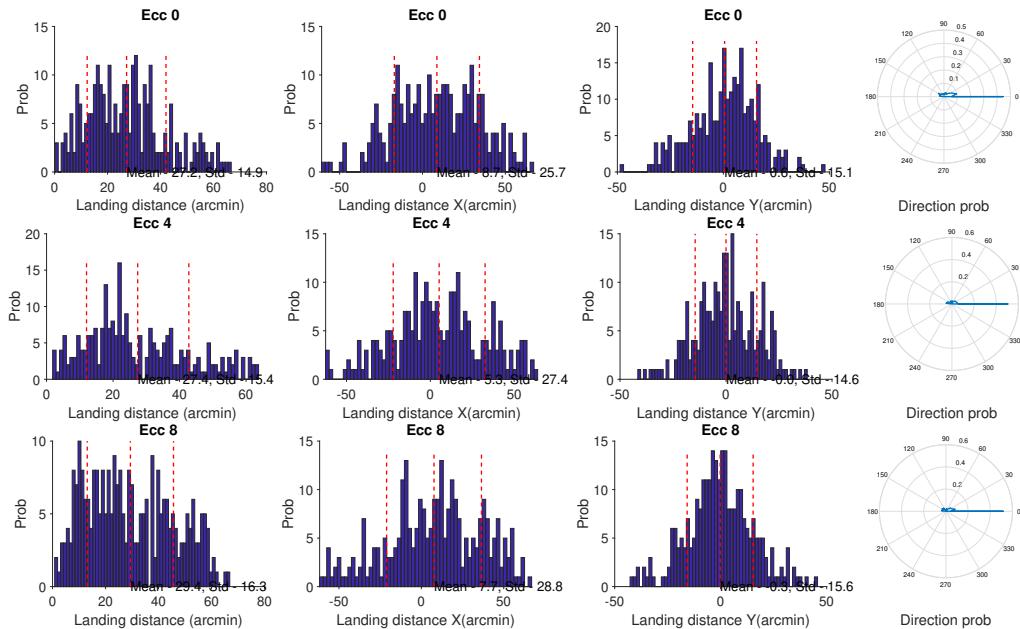


Figure 11: Landing distance distribution at different eccentricities.

3.4 Eye movement analysis

3.4.1 SUBJECT:Nikunj

The analysis has been done using VALID trials i.e. including microsaccade/saccade trials.

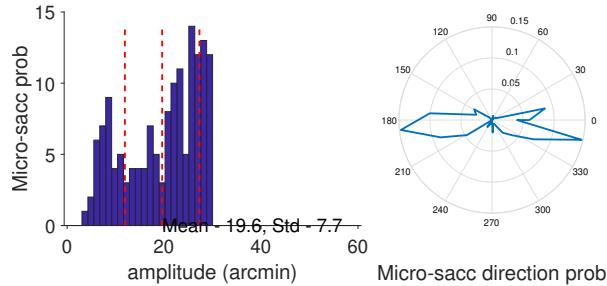


Figure 12: Left: Microsaccade **amplitude** distribution, Right: Microsaccade **angle** polar distribution at fixation centre after initial saccade (post-sac period, all valid trials)

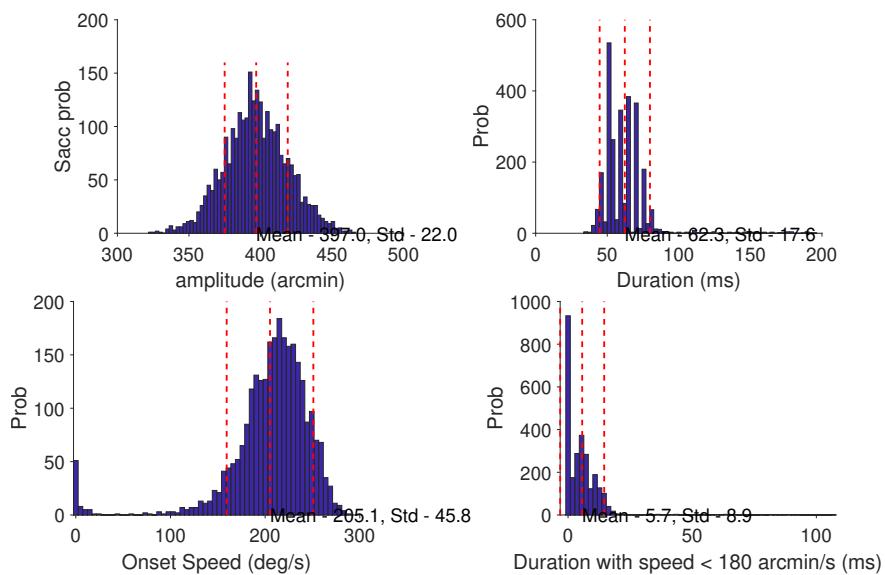


Figure 13: From left to right: Initial saccade **amplitude**, Initial saccade **duration**, Initial saccade **onset speed** (saccade onset time is the time at which the stimulus appears), **amount of time** in which the eye moved less than **180arcmin/s** during the saccade as defined by EyeRIS.

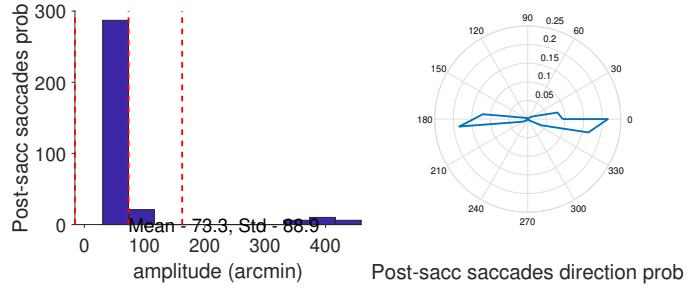


Figure 14: Left: Post-saccade saccade **amplitude** distribution. Right: Post-saccade saccade **angle** polar distribution (saccades after initial saccade)

3.4.2 SUBJECT:A013

The analysis has been done using VALID trials i.e. including microsaccade/saccade trials.

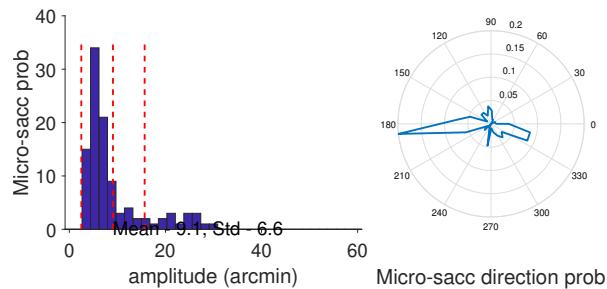


Figure 15: Left: Microsaccade **amplitude** distribution, Right: Microsaccade **angle** polar distribution at fixation centre after initial saccade (post-sac period, all valid trials)

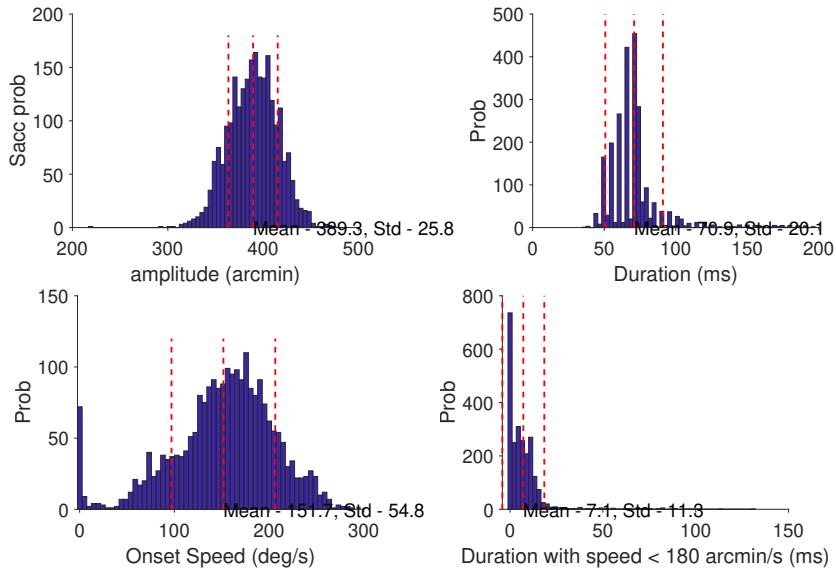


Figure 16: From left to right: Initial saccade **amplitude**, Initial saccade **duration**, Initial saccade **onset speed** (saccade onset time is the time at which the stimulus appears), **amount of time** in which the eye moved less than **180arcmin/s** during the saccade as defined by EyeRIS.

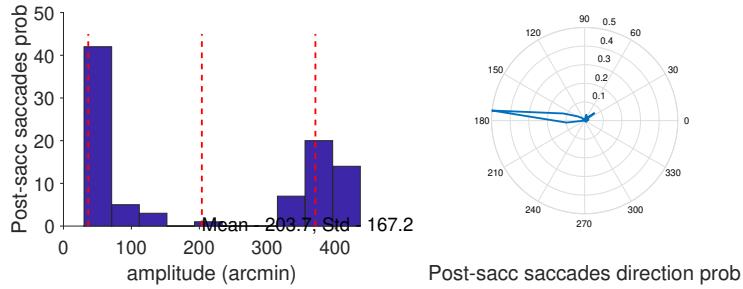


Figure 17: Left: Post-saccade saccade **amplitude** distribution. Right: Post-saccade saccade **angle** polar distribution (saccades after initial saccade)

3.4.3 SUBJECT:A092

The analysis has been done using VALID trials i.e. including microsaccade/saccade trials.

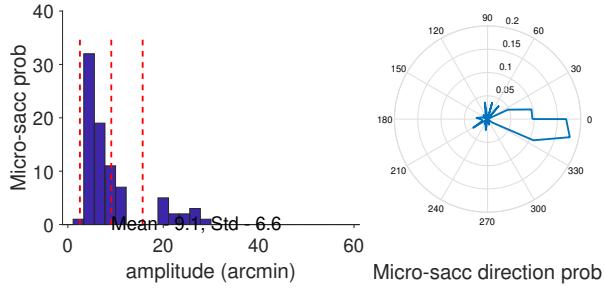


Figure 18: Left: Microsaccade **amplitude** distribution, Right: Microsaccade **angle** polar distribution at fixation centre after initial saccade (post-sac period, all valid trials)

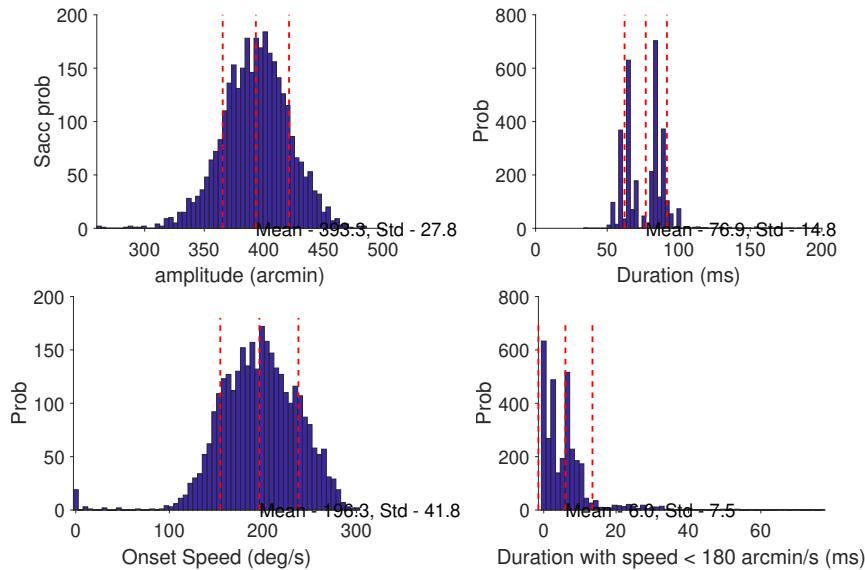


Figure 19: From left to right: Initial saccade **amplitude**, Initial saccade **duration**, Initial saccade **onset speed** (saccade onset time is the time at which the stimulus appears), **amount of time** in which the eye moved less than **180arcmin/s** during the saccade as defined by EyeRIS.

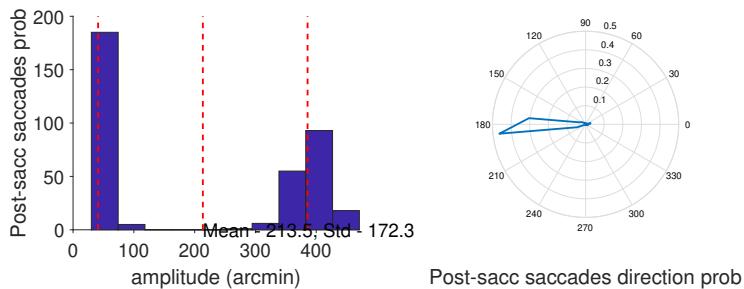


Figure 20: Left: Post-saccade saccade **amplitude** distribution. Right: Post-saccade saccade **angle** polar distribution (saccades after initial saccade)

3.4.4 SUBJECT:A036

The analysis has been done using VALID trials i.e. including microsaccade/saccade trials.

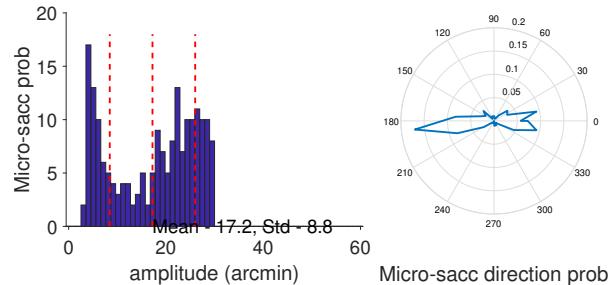


Figure 21: Left: Microsaccade **amplitude** distribution, Right: Microsaccade **angle** polar distribution at fixation centre after initial saccade (post-sac period, all valid trials)

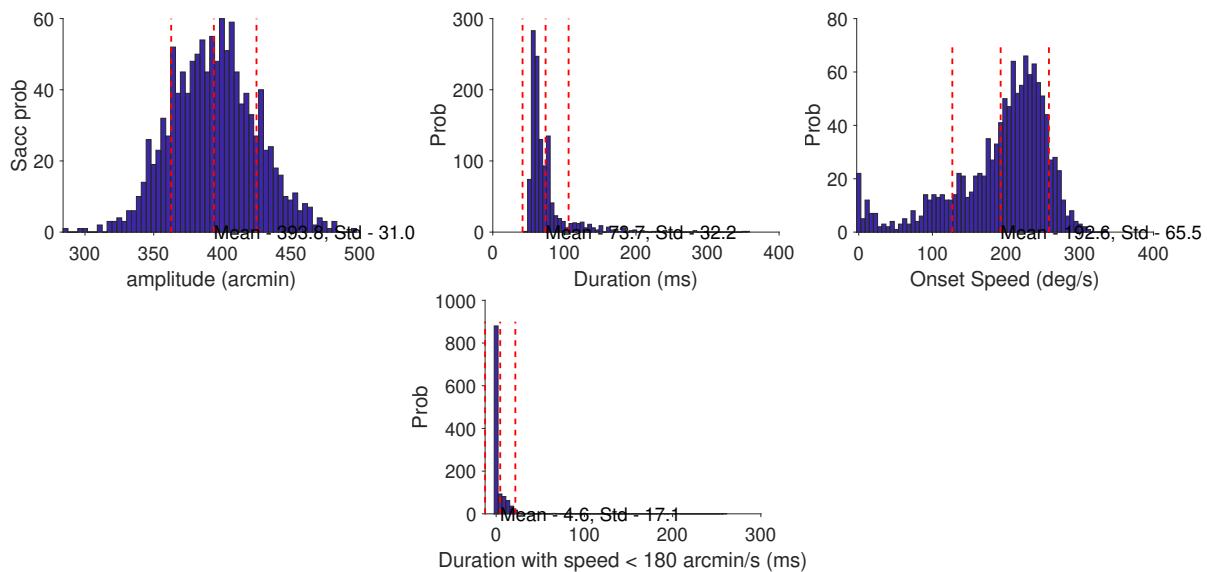


Figure 22: From left to right: Initial saccade **amplitude**, Initial saccade **duration**, Initial saccade **onset speed** (saccade onset time is the time at which the stimulus appears), **amount of time** in which the eye moved less than **180arcmin/s** during the saccade as defined by EyeRIS.

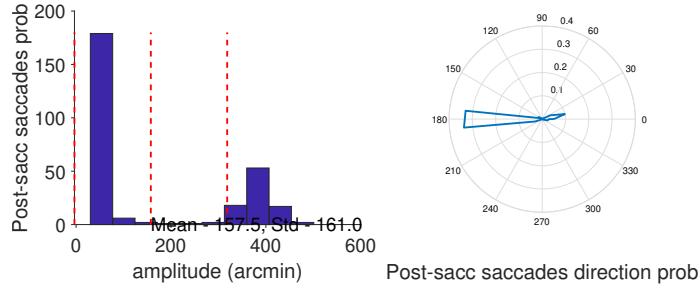


Figure 23: Left: Post-saccade saccade **amplitude** distribution. Right: Post-saccade saccade **angle** polar distribution (saccades after initial saccade)

3.5 Drift Analysis

3.5.1 SUBJECT:Nikunj

Using DRIFT trials and VALID trials i.e. including microsaccade/saccade trials. Savitzky-Golay filter was used.

smoothing = 31 # Window Size

maxSpeed = 300 # to compute drift speed

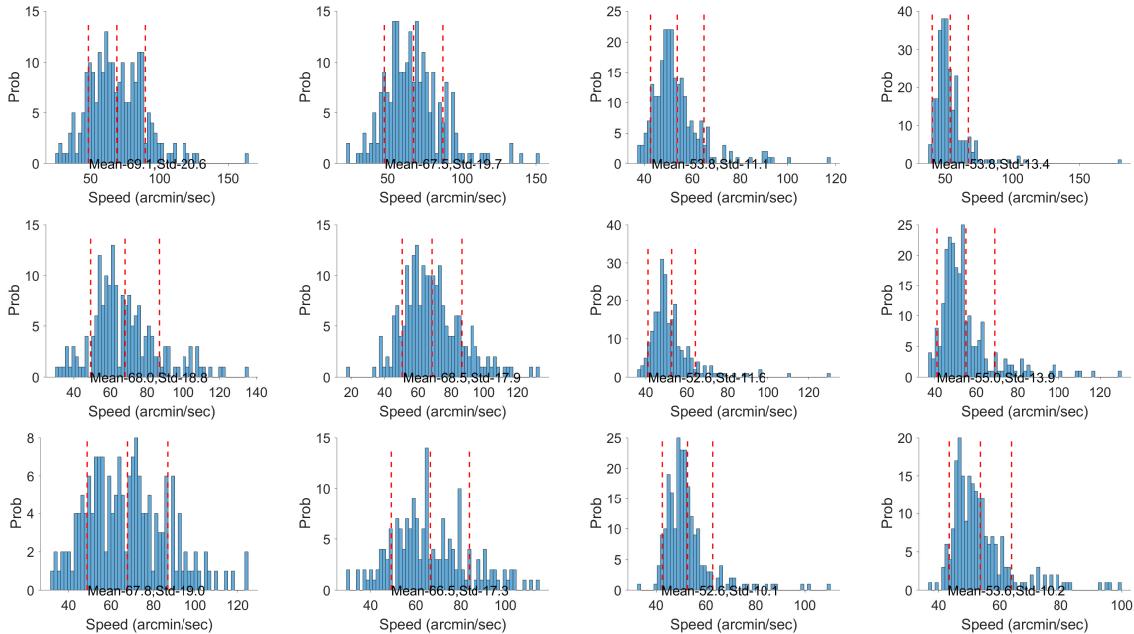


Figure 24: Drift Speed. Top to bottom row: Ecc 0,4,8. Left to right: SpFreq 2,10,2,10. Left to right: PresTime 50,50,500,500.

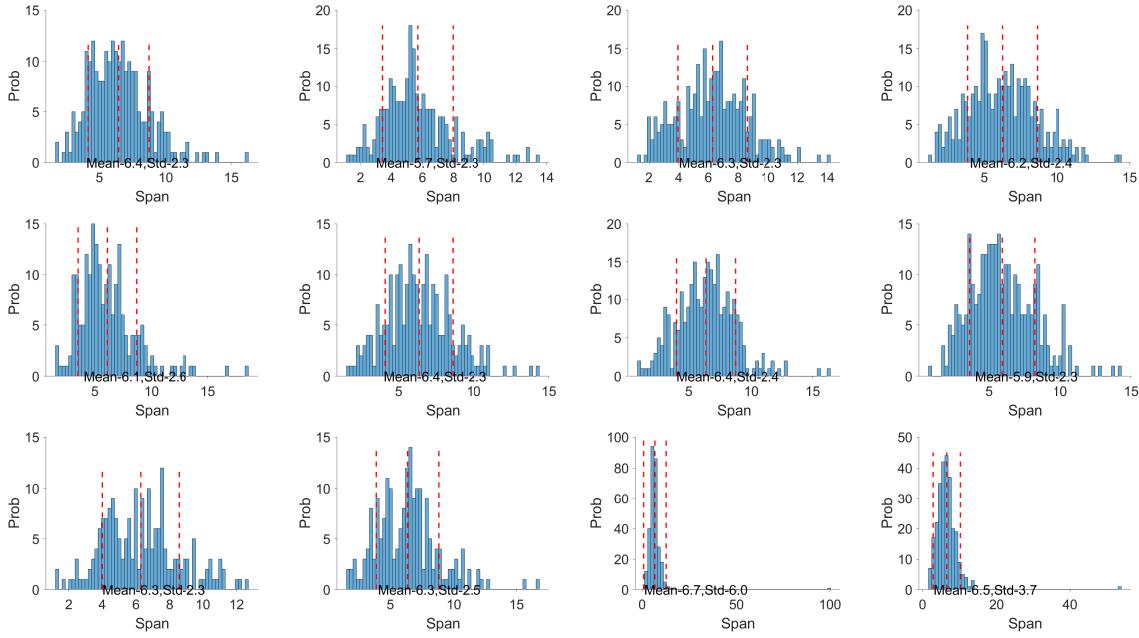


Figure 25: Drift Span. Top to bottom row: Ecc 0,4,8. Left to right: SpFreq 2,10,2,10. Left to right: PresTime 50,50,500,500.

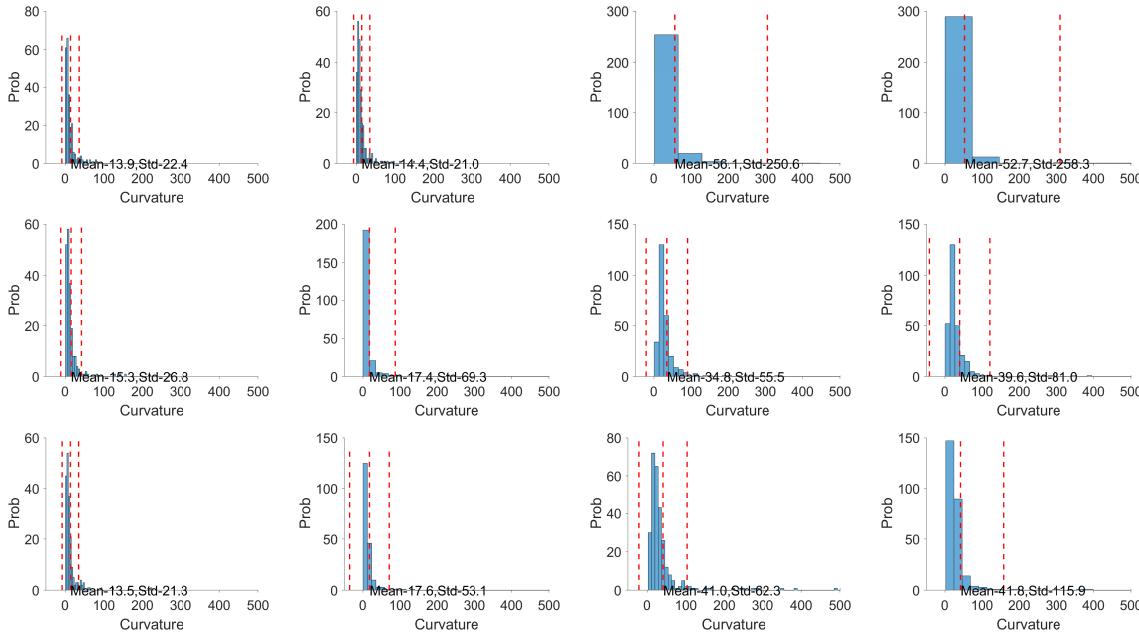


Figure 26: Drift Curvature. Top to bottom row: Ecc 0,4,8. Left to right: SpFreq 2,10,2,10. Left to right: PresTime 50,50,500,500.

3.5.2 SUBJECT:A013

Using DRIFT trials and VALID trials i.e. including microsaccade/saccade trials. Savitzky-Golay filter was used.

smoothing = 31 # Window Size
maxSpeed = 300 # to compute drift speed

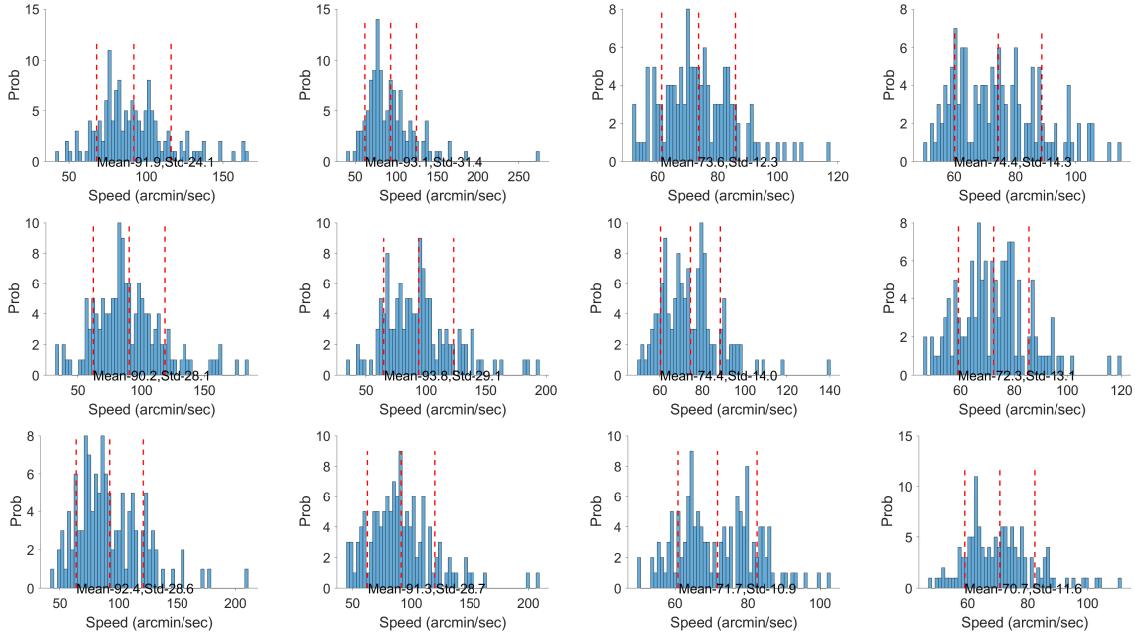


Figure 27: Drift Speed. Top to bottom row: Ecc 0,4,8. Left to right: SpFreq 2,10,2,10. Left to right: PresTime 50,500,500.

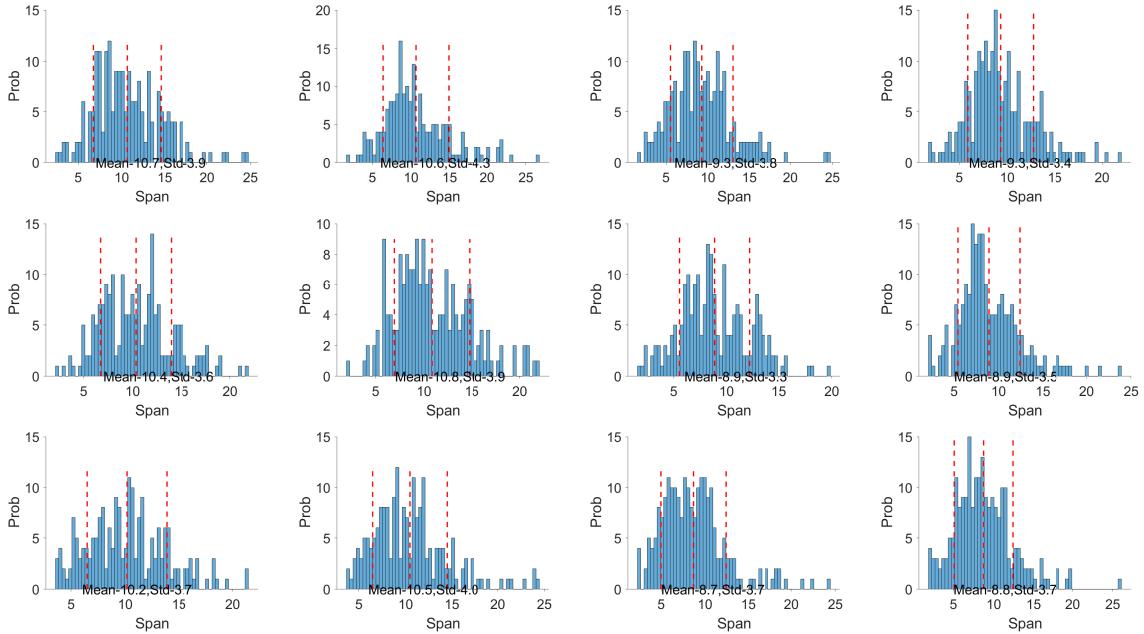


Figure 28: Drift Span. Top to bottom row: Ecc 0,4,8. Left to right: SpFreq 2,10,2,10. Left to right: PresTime 50,500,500.

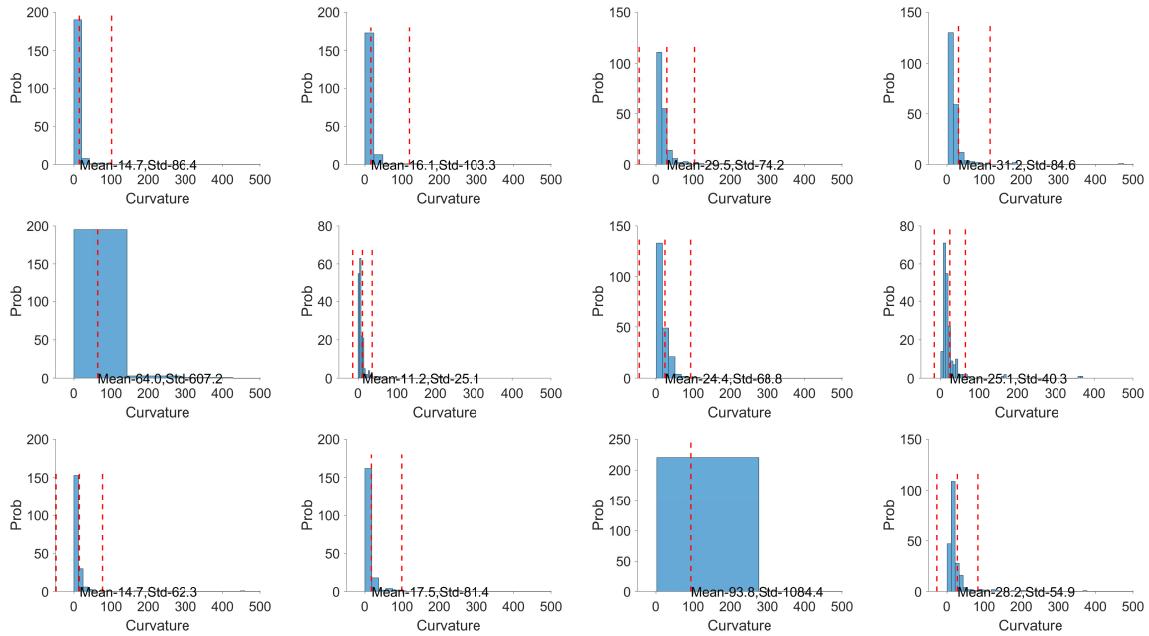


Figure 29: Drift Curvature. Top to bottom row: Ecc 0,4,8. Left to right: SpFreq 2,10,2,10. Left to right: PresTime 50,500,5000.

3.5.3 SUBJECT:A092

Using DRIFT trials and VALID trials i.e. including microsaccade/saccade trials. Savitzky-Golay filter was used.

smoothing = 31 # Window Size

maxSpeed = 300 # to compute drift speed

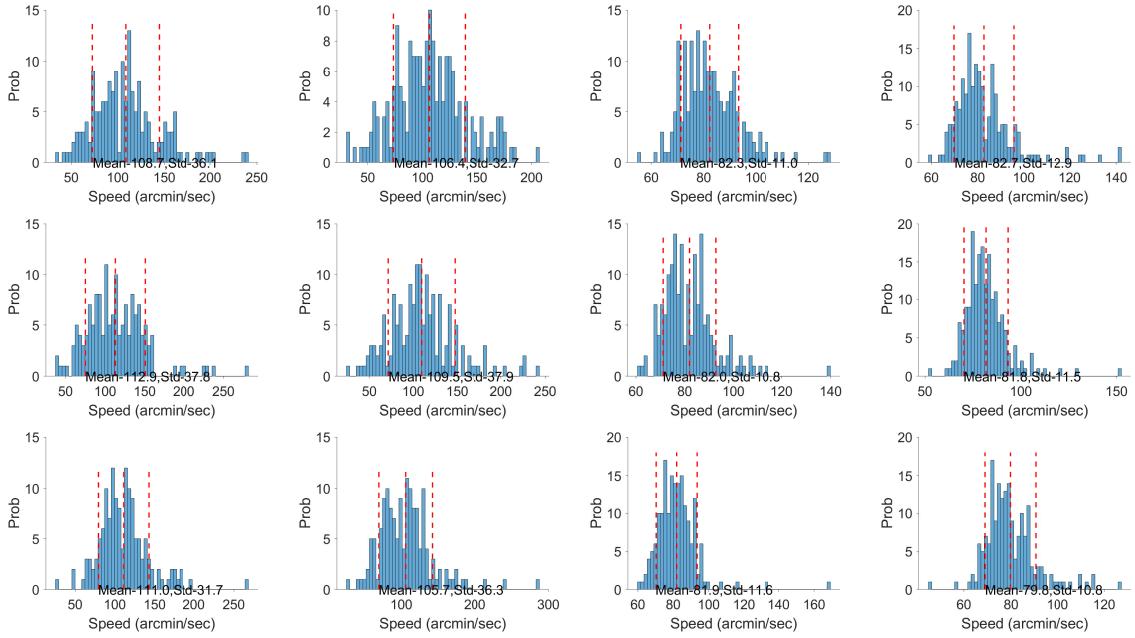


Figure 30: Drift Speed. Top to bottom row: Ecc 0,4,8. Left to right: SpFreq 2,10,2,10. Left to right: PresTime 50,50,500,500.

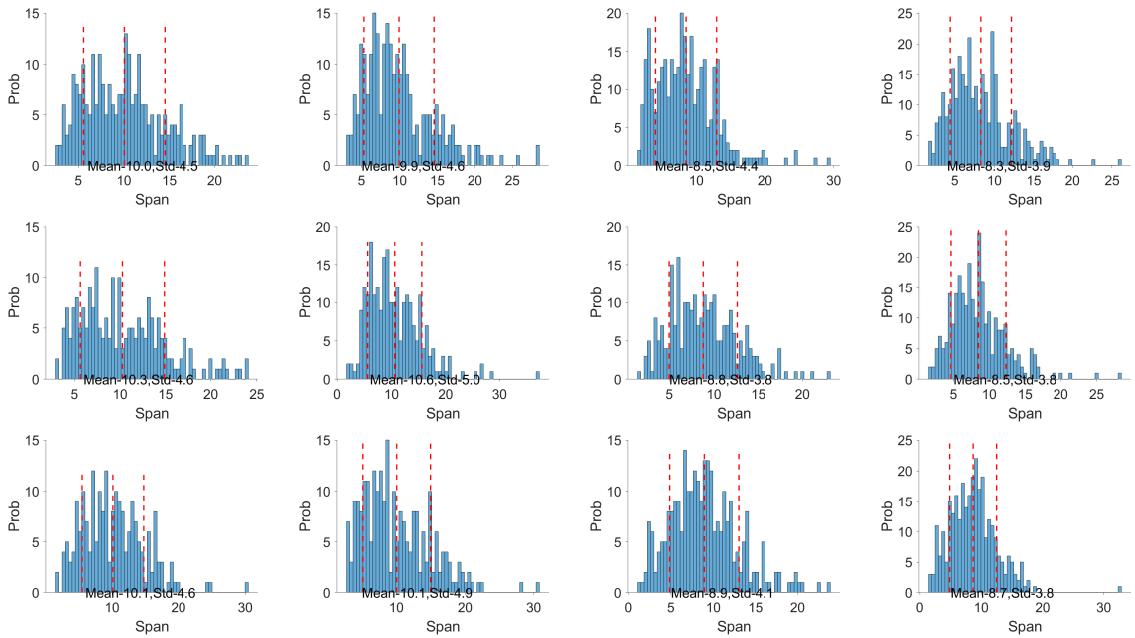


Figure 31: Drift Span. Top to bottom row: Ecc 0,4,8. Left to right: SpFreq 2,10,2,10. Left to right: PresTime 50,50,500,500.

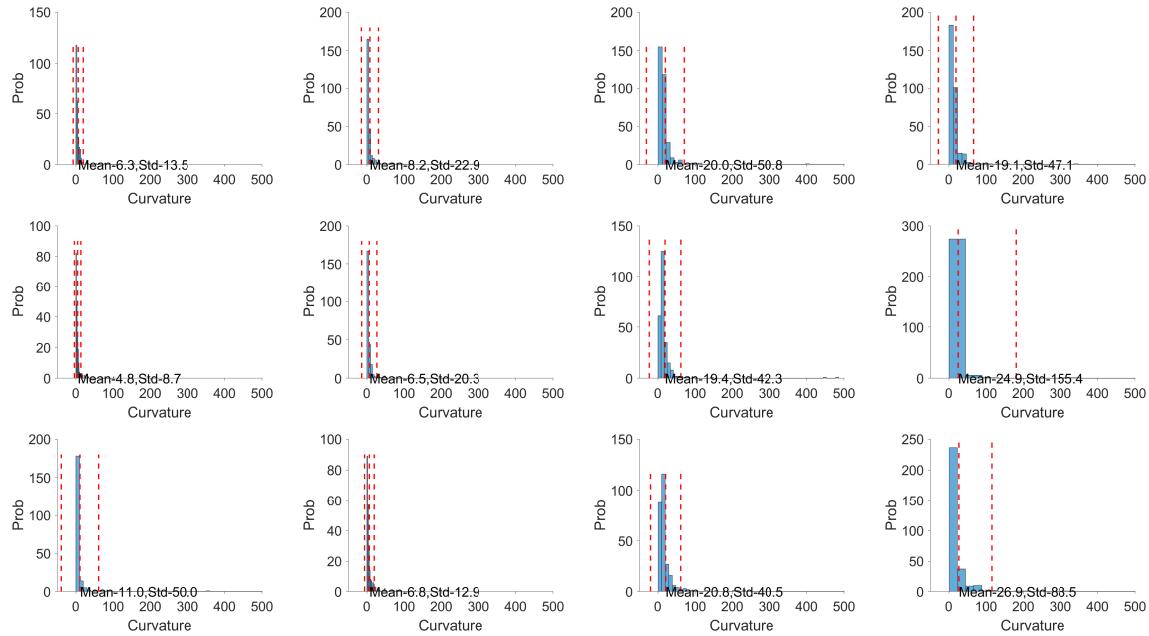


Figure 32: Drift Curvature. Top to bottom row: Ecc 0,4,8. Left to right: SpFreq 2,10,2,10. Left to right: PresTime 50,500,5000.

3.5.4 SUBJECT:A036

Using DRIFT trials and VALID trials i.e. including microsaccade/saccade trials. Savitzky-Golay filter was used.

smoothing = 31 # Window Size

maxSpeed = 300 # to compute drift speed

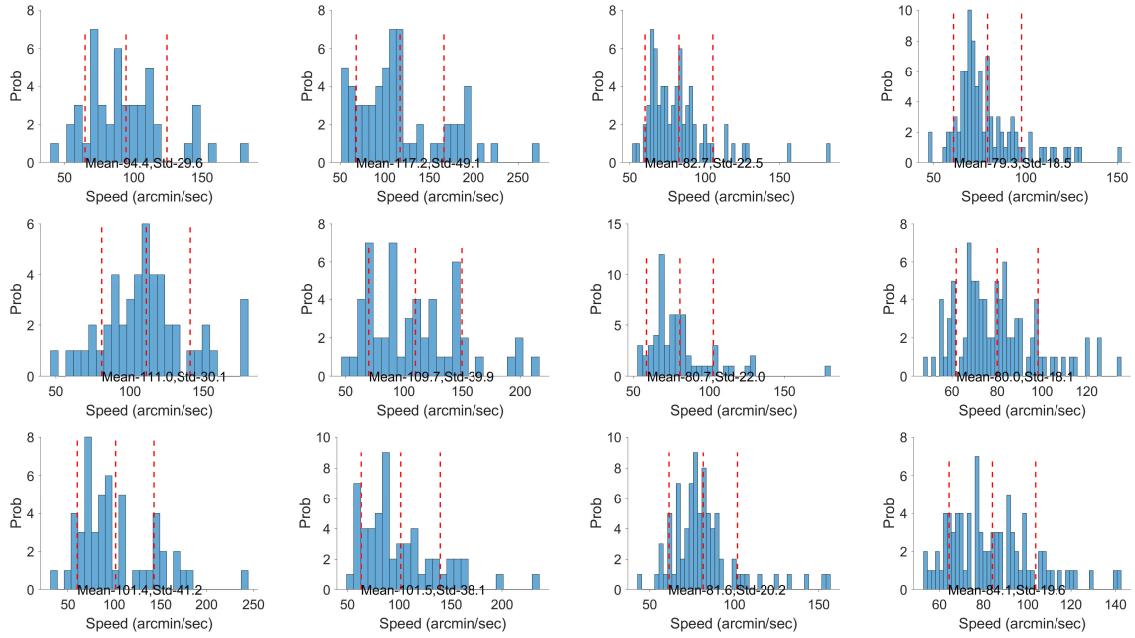


Figure 33: Drift Speed. Top to bottom row: Ecc 0,4,8. Left to right: SpFreq 2,10,2,10. Left to right: PresTime 50,50,500,500.

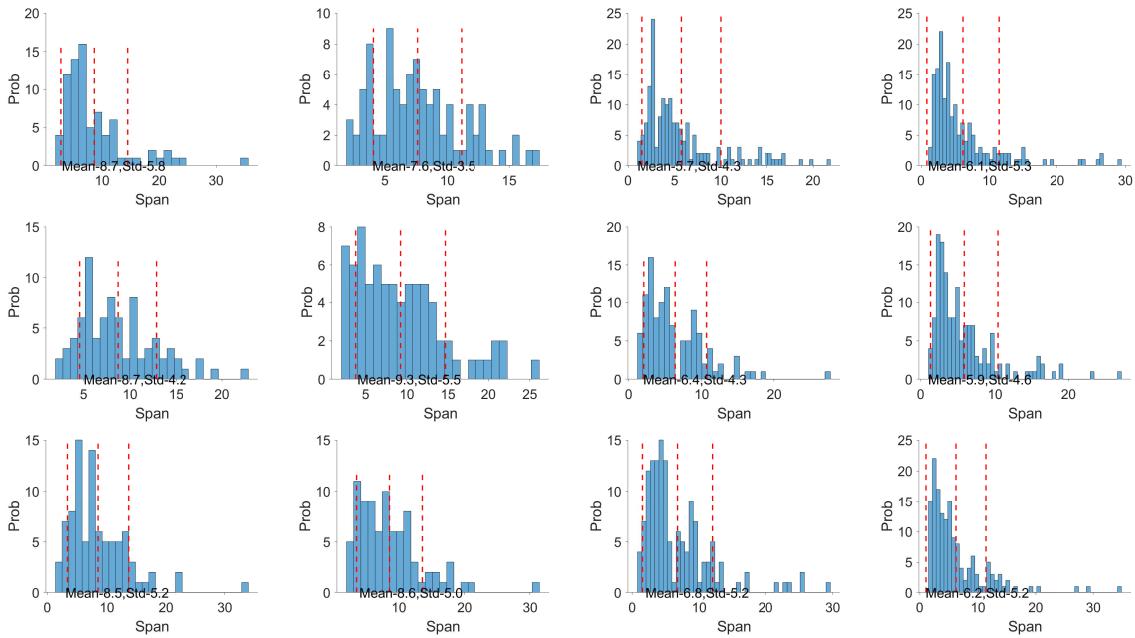


Figure 34: Drift Span. Top to bottom row: Ecc 0,4,8. Left to right: SpFreq 2,10,2,10. Left to right: PresTime 50,50,500,500.

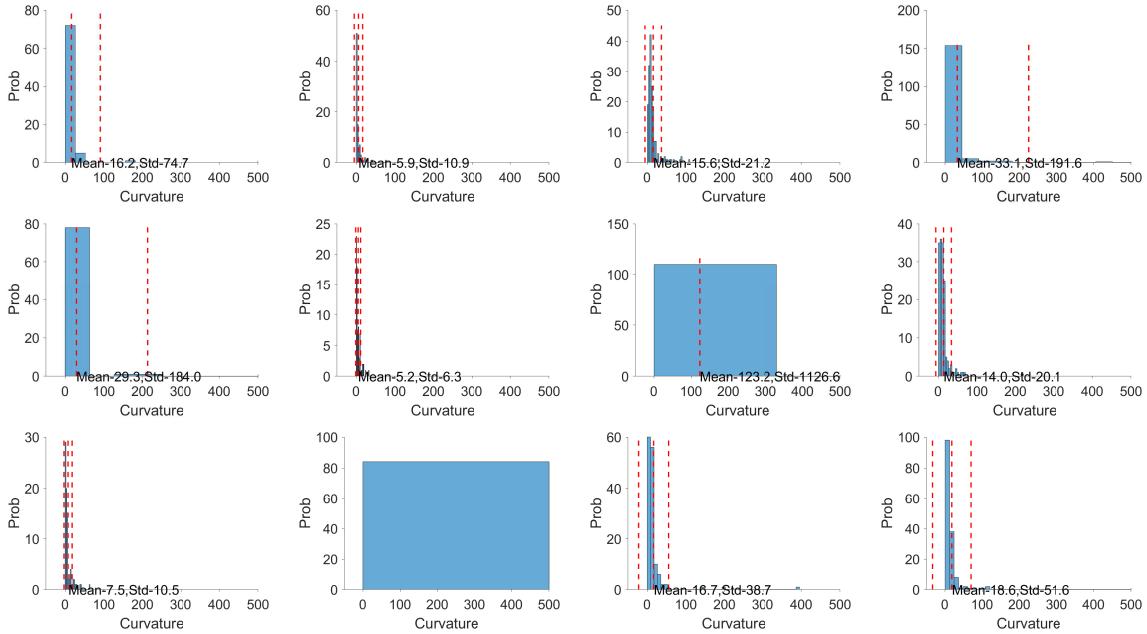


Figure 35: Drift Curvature. Top to bottom row: Ecc 0,4,8. Left to right: SpFreq 2,10,2,10. Left to right: PresTime 50,50,500,500.

3.6 D-prime

3.6.1 SUBJECT:Nikunj

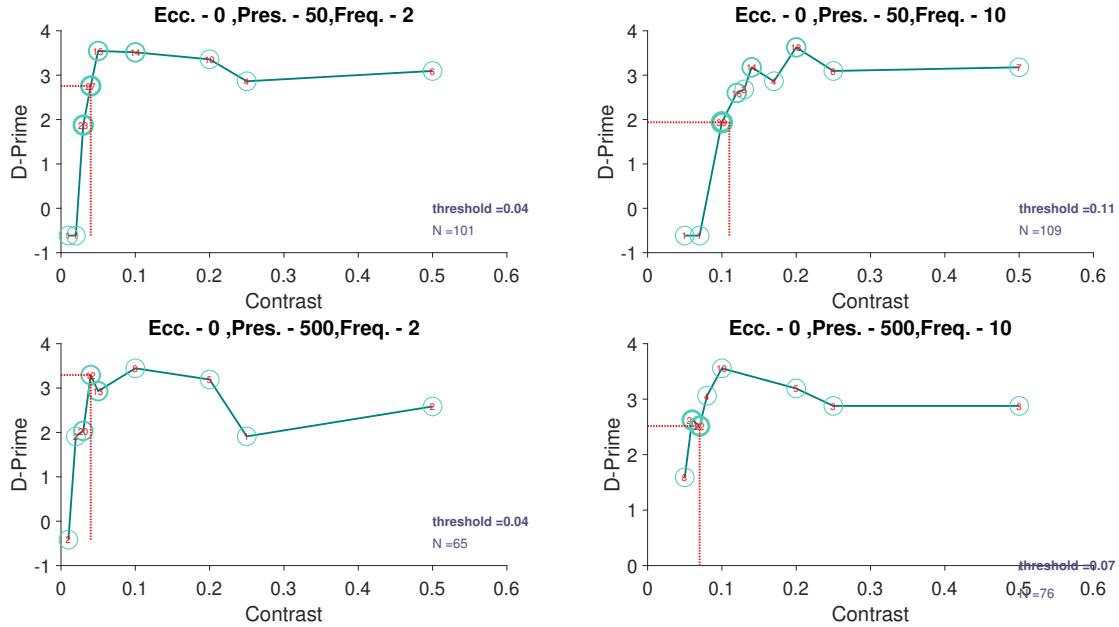
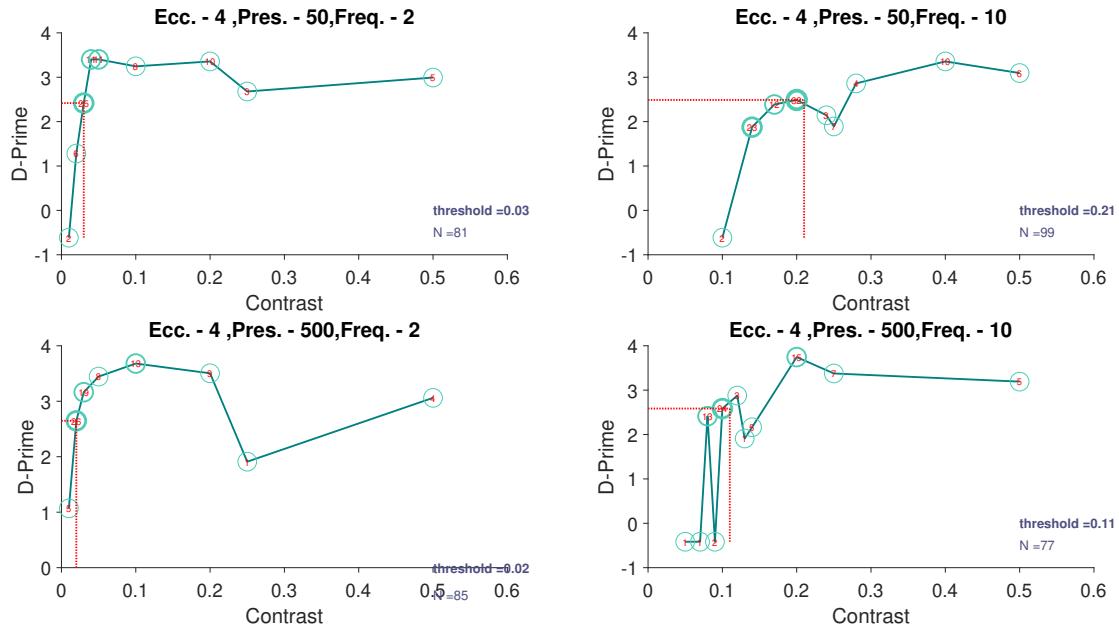
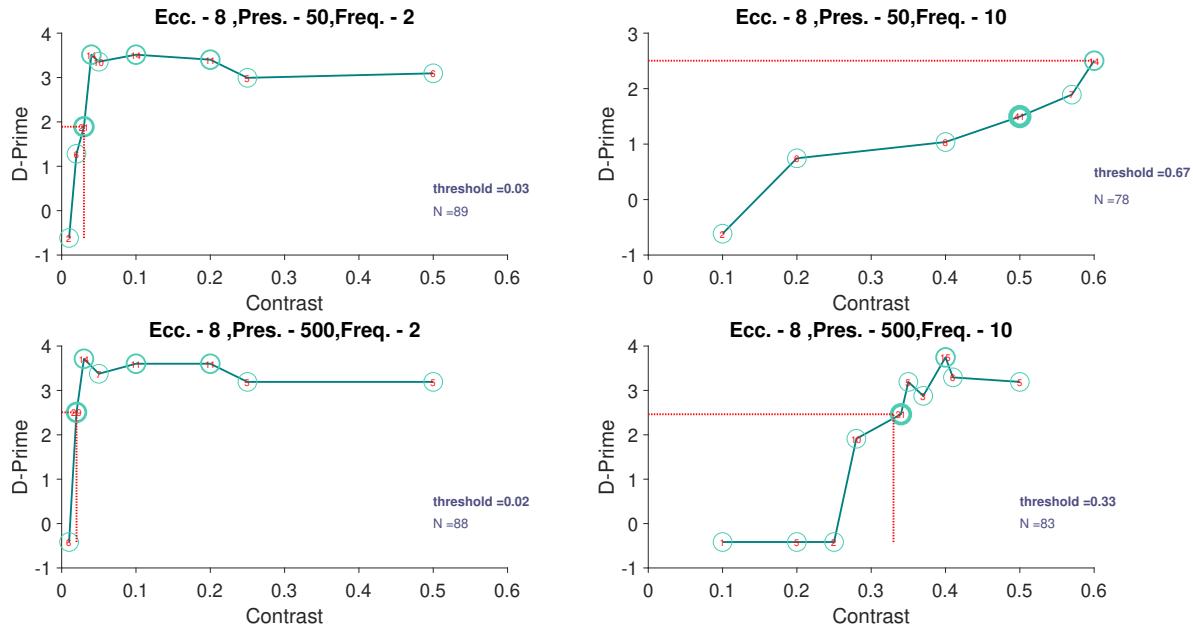


Figure 36: D-prime vs contrast at **Eccentricity 0**.

Figure 37: D-prime vs contrast at **Eccentricity 4**.Figure 38: D-prime vs contrast at **Eccentricity 8**.

3.6.2 SUBJECT:A013

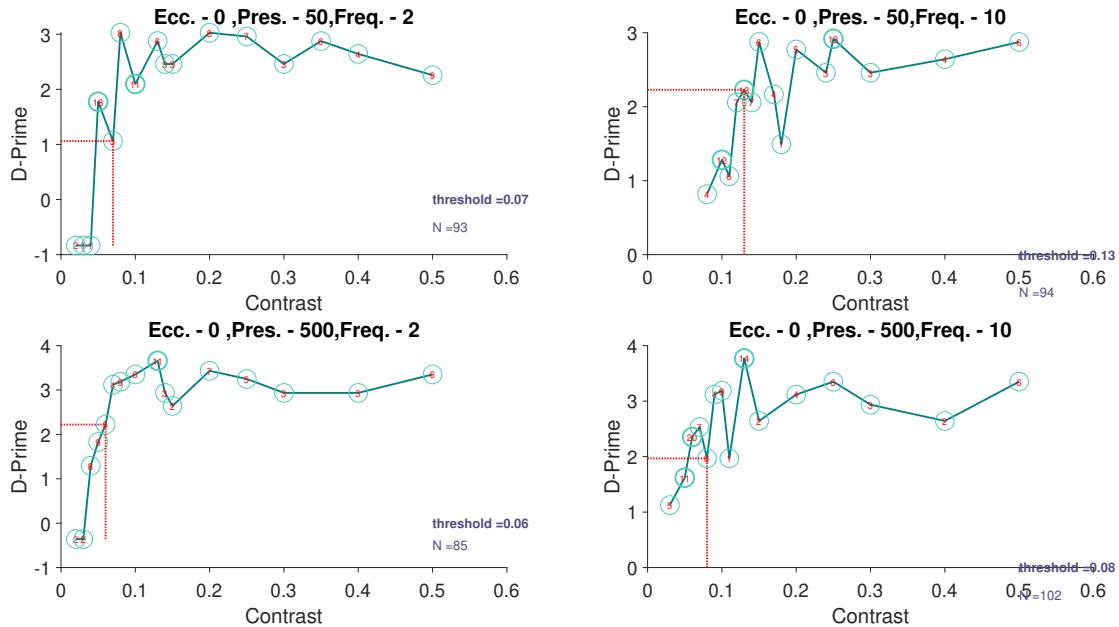


Figure 39: D-prime vs contrast at **Eccentricity 0**.

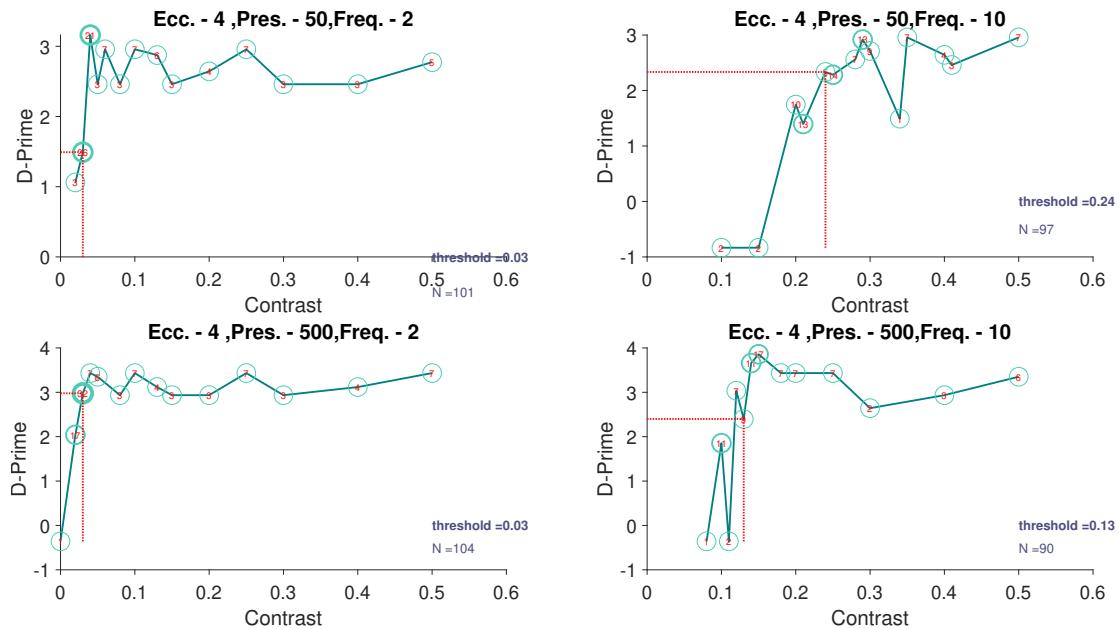
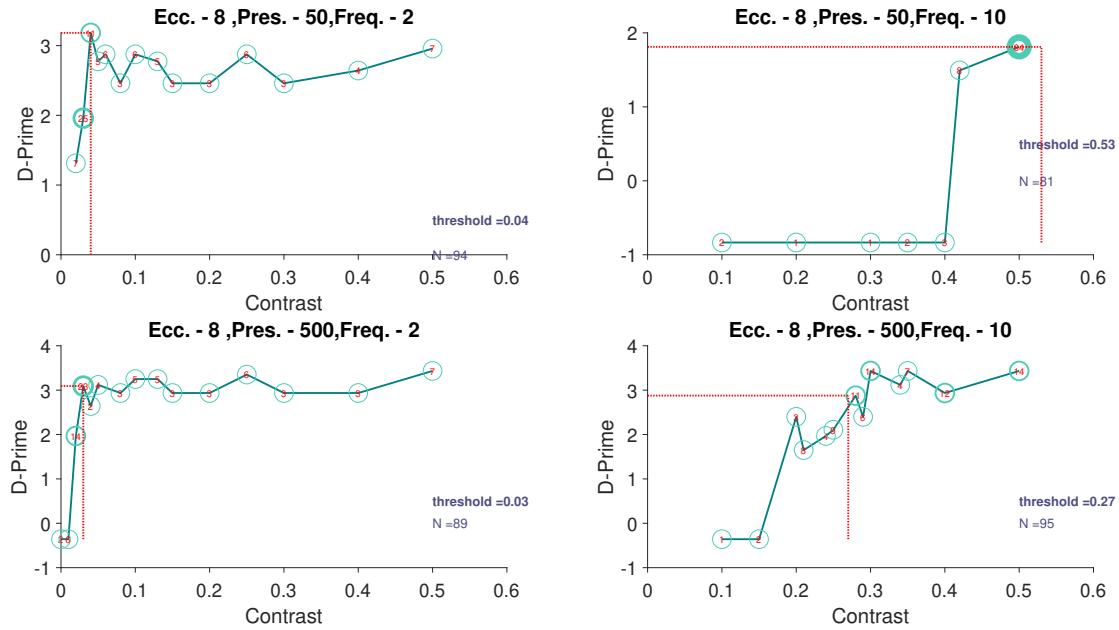
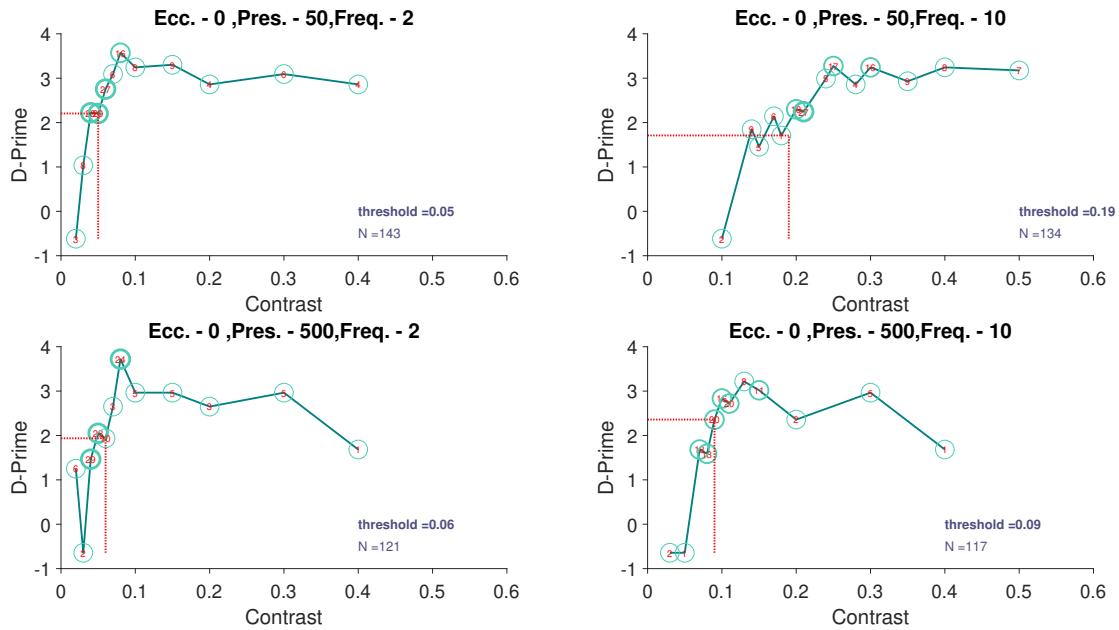
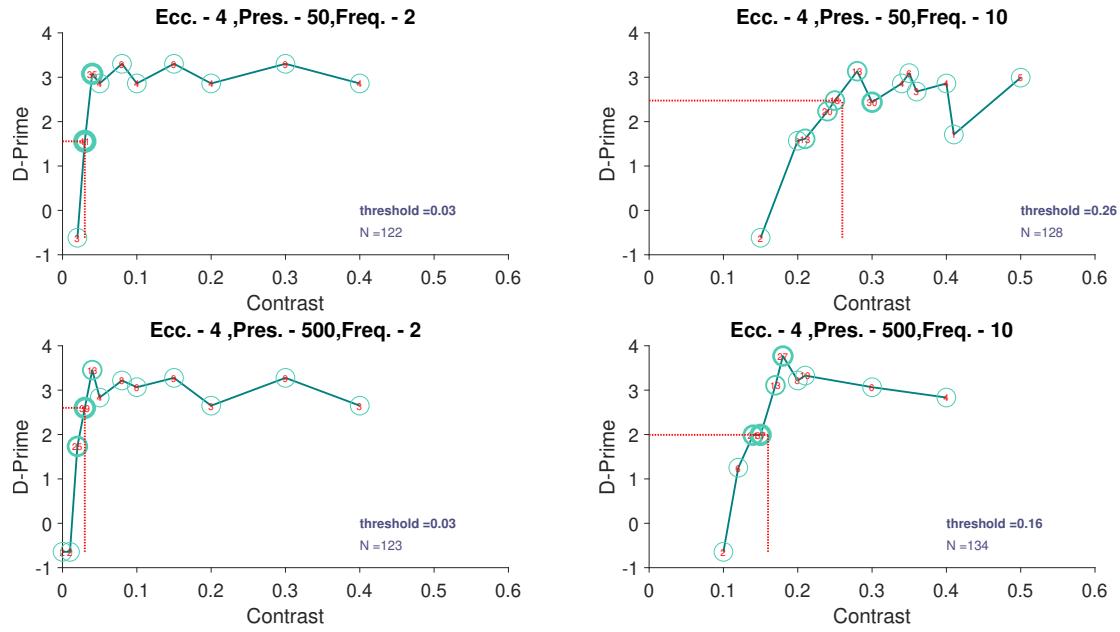
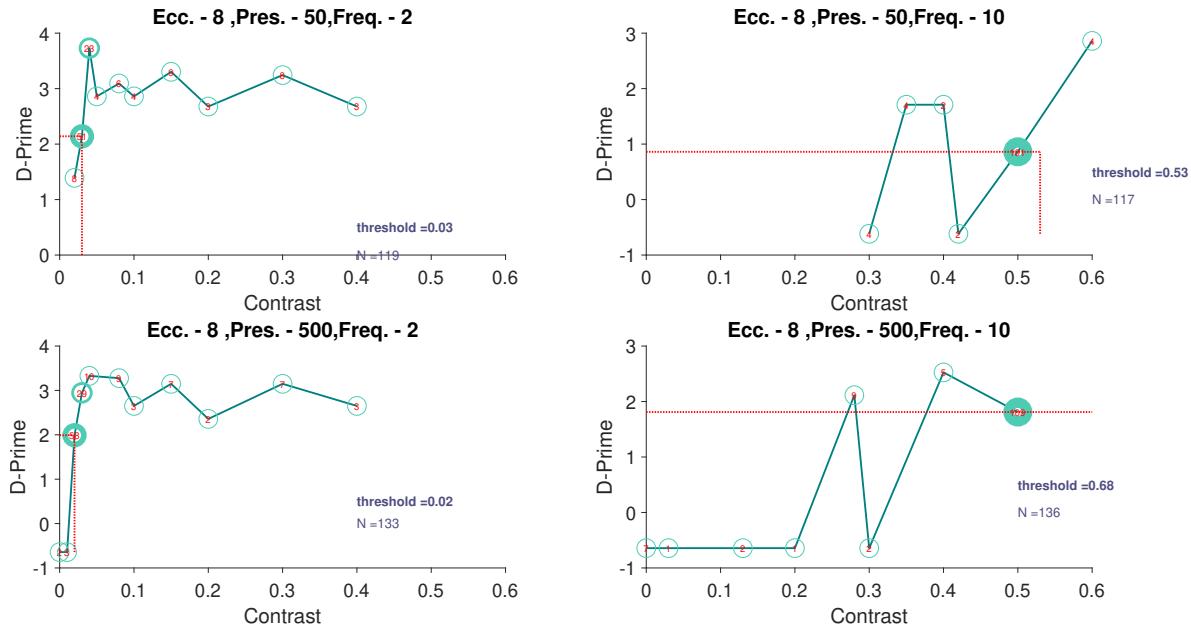


Figure 40: D-prime vs contrast at **Eccentricity 4**.

Figure 41: D-prime vs contrast at **Eccentricity 8**.

3.6.3 SUBJECT:A092

Figure 42: D-prime vs contrast at **Eccentricity 0**.

Figure 43: D-prime vs contrast at **Eccentricity 4**.Figure 44: D-prime vs contrast at **Eccentricity 8**.

3.6.4 SUBJECT:A036

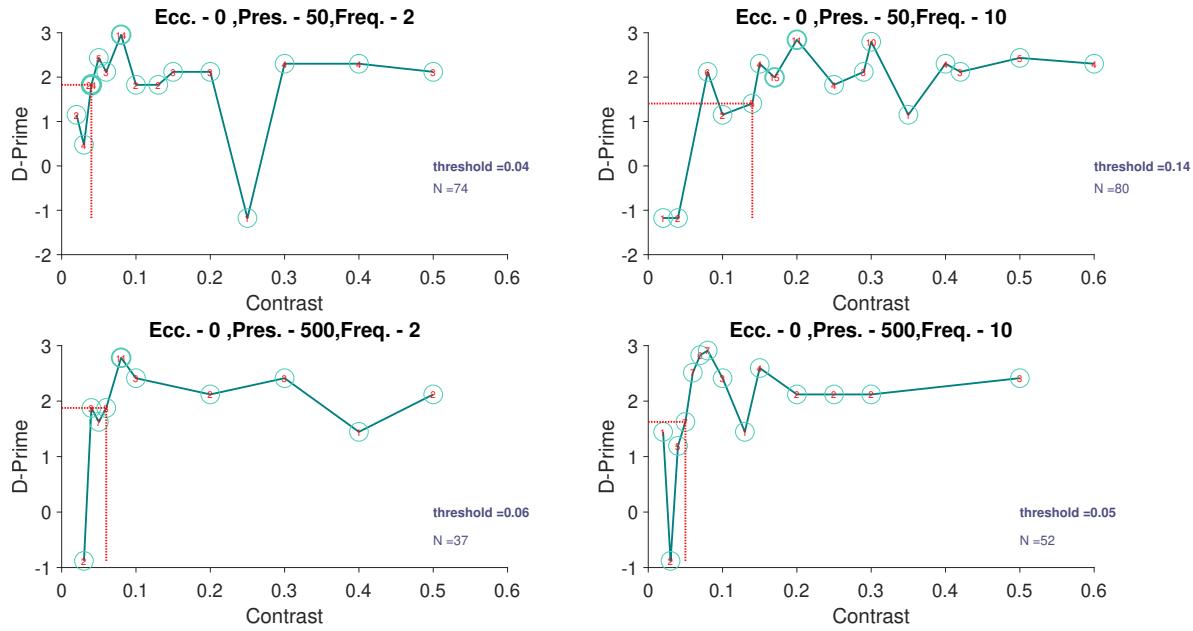


Figure 45: D-prime vs contrast at **Eccentricity 0**.

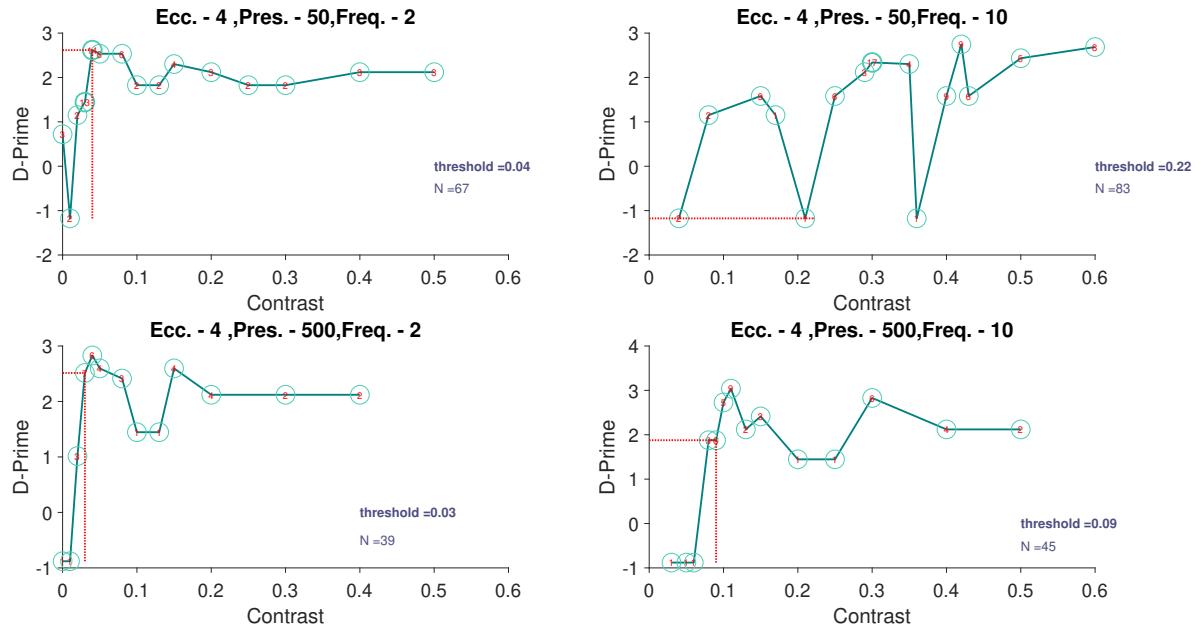
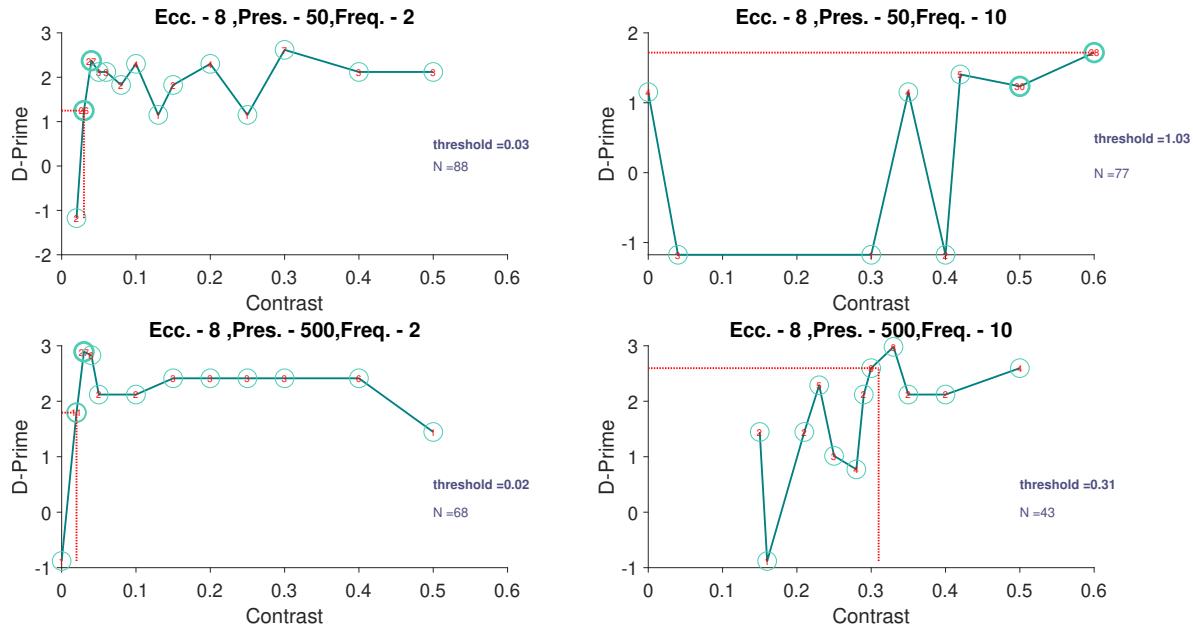


Figure 46: D-prime vs contrast at **Eccentricity 4**.

Figure 47: D-prime vs contrast at **Eccentricity 8**.

3.7 30arcmin Landing Distance Threshold

3.7.1 SUBJECT:Nikunj

For the following analysis, trials which had a landing distance more than 30arcmins were excluded.

Condition	Total	Disc_Blinks_Track	Disc_Tags_Land	Valid	Drift	MS_S	MS_1	MS_2	S_1	S_2	Exposure	Vel_less_3
Ecc-0, Pres-50, SpFreq-2	110	0	48	62	60	2	2	0	0	0	112.4194 ± 16.5901	50.2097 ± 12.5778
Ecc-0, Pres-50, SpFreq-10	126	0	59	67	59	8	4	0	4	0	111.597 ± 17.4686	46.4478 ± 14.0522
Ecc-0, Pres-500, SpFreq-2	108	0	48	60	49	11	10	0	1	0	564.3333 ± 17.8123	490.65 ± 31.9835
Ecc-0, Pres-500, SpFreq-10	124	0	48	76	59	17	11	0	3	3	564.0132 ± 23.2772	484.6974 ± 44.7243
Ecc-4, Pres-50, SpFreq-2	94	0	48	46	45	1	0	0	1	0	118.1304 ± 22.4852	56.087 ± 11.3291
Ecc-4, Pres-50, SpFreq-10	111	0	49	62	59	3	1	0	2	0	112.4677 ± 13.1133	51.0806 ± 11.6328
Ecc-4, Pres-500, SpFreq-2	104	0	58	46	45	1	0	0	1	0	562.8043 ± 18.9016	499.9565 ± 16.5958
Ecc-4, Pres-500, SpFreq-10	103	0	44	59	51	8	6	0	2	0	562.3898 ± 10.0927	485.4915 ± 41.483
Ecc-8, Pres-50, SpFreq-2	98	0	45	53	51	2	0	0	2	0	113.1887 ± 12.9393	49.1132 ± 12.1997
Ecc-8, Pres-50, SpFreq-10	91	0	40	51	48	3	3	0	0	0	118.6275 ± 28.3485	54.9216 ± 17.9163
Ecc-8, Pres-500, SpFreq-2	112	0	44	68	61	7	3	0	4	0	564.1029 ± 17.6746	491.6176 ± 33.6528
Ecc-8, Pres-500, SpFreq-10	108	0	44	64	54	10	3	0	5	2	561.0625 ± 18.9459	481.2813 ± 48.1642
Ecc-, Pres-50, SpFreq-	737	0	312	425	408	17	6	0	11	0	114.2588 ± 17.2879	51.92 ± 13.7629
Ecc-, Pres-500, SpFreq-	793	0	331	462	394	68	32	0	27	9	563.3355 ± 16.8332	486.4632 ± 42.1635

Table 5: Note the number of microsaccades/saccades is in ADDITION to the initial saccade

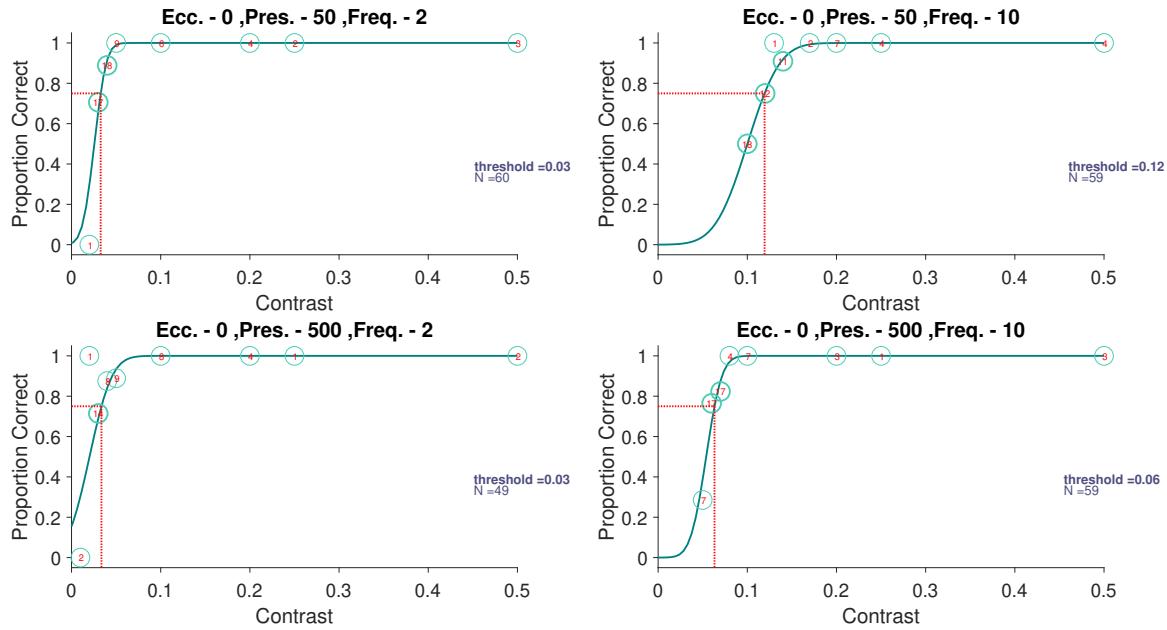


Figure 48: Psychometric curve at **Eccentricity 0** with **binned** contrast (rounded to 2 decimals).

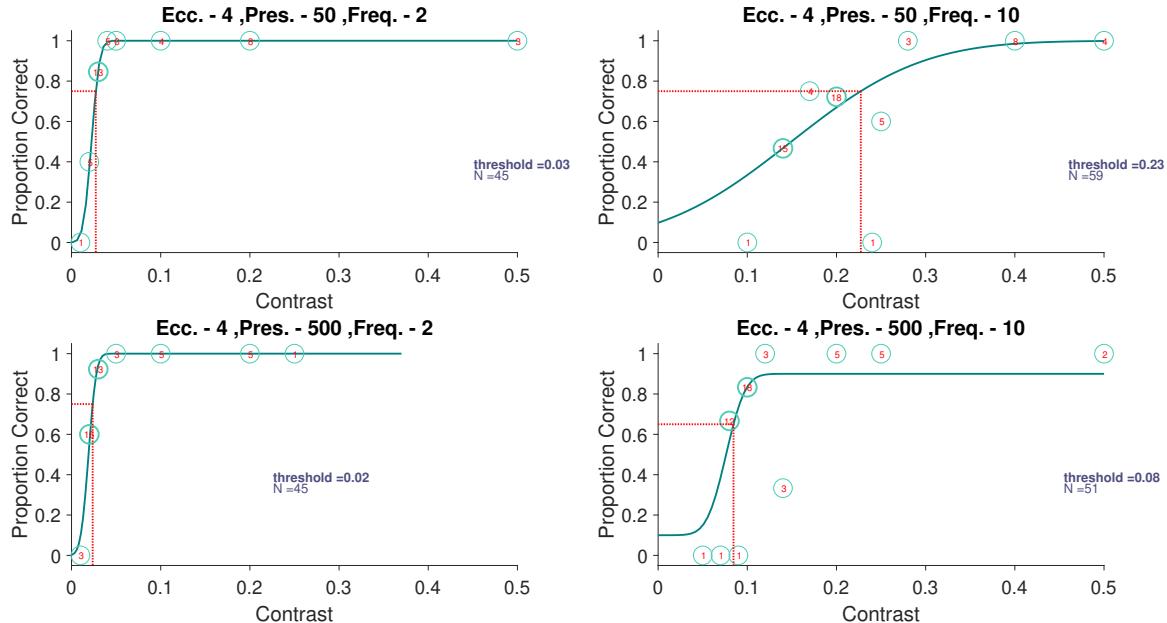


Figure 49: Psychometric curve at **Eccentricity 4** with **binned** contrast (rounded to 2 decimals).

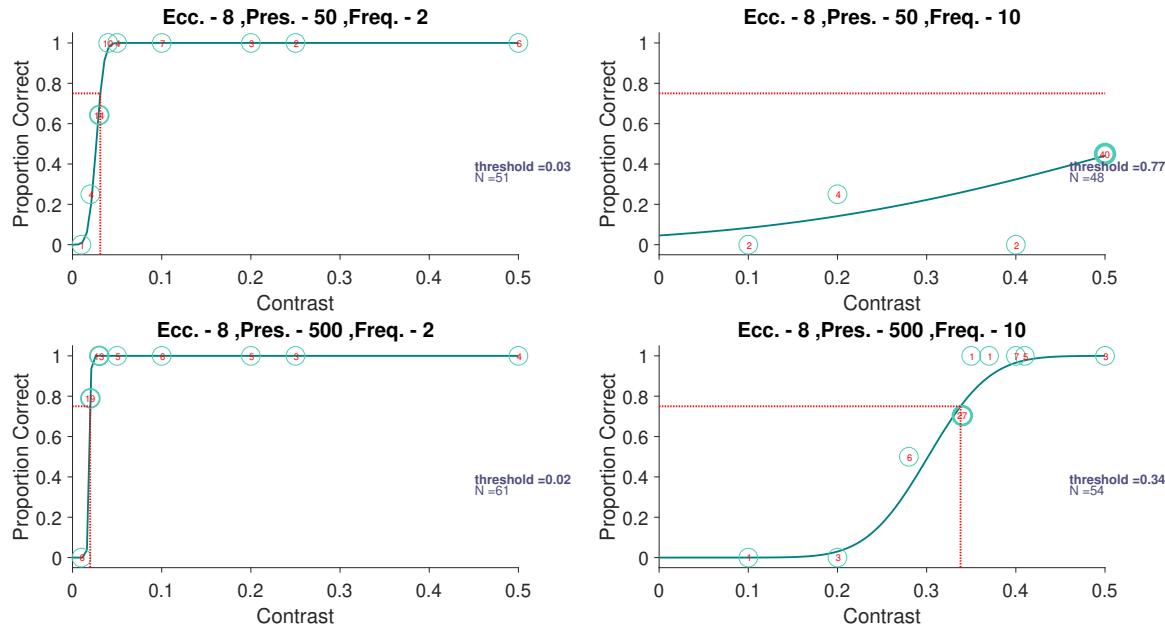


Figure 50: Psychometric curve at **Eccentricity 8** with **binned** contrast (rounded to 2 decimals).

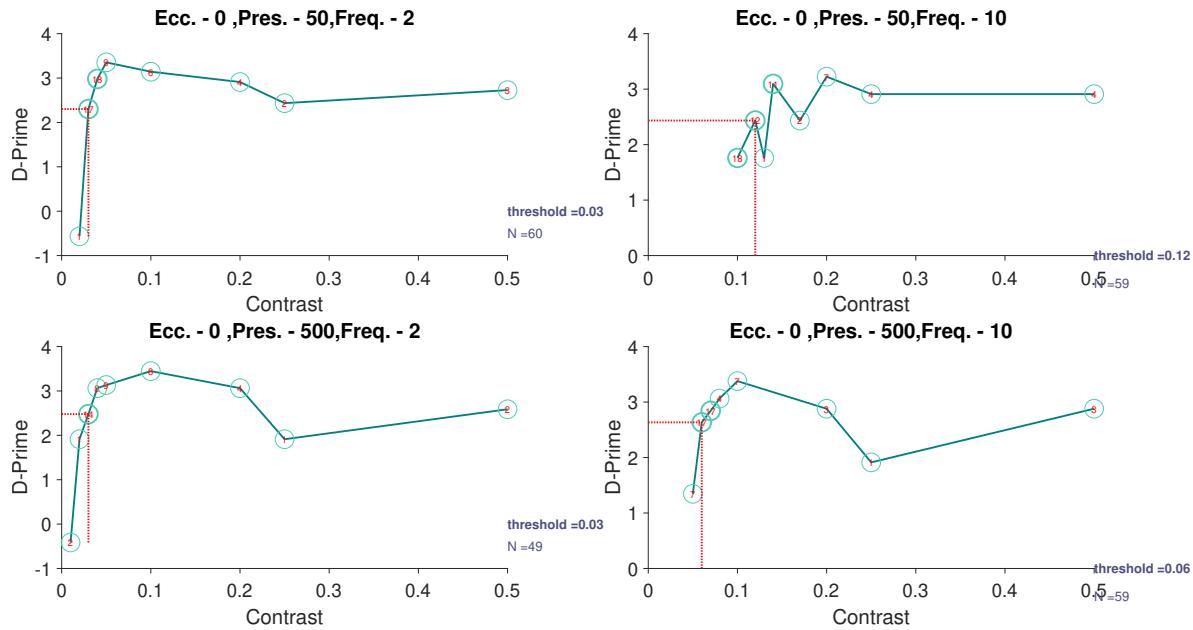
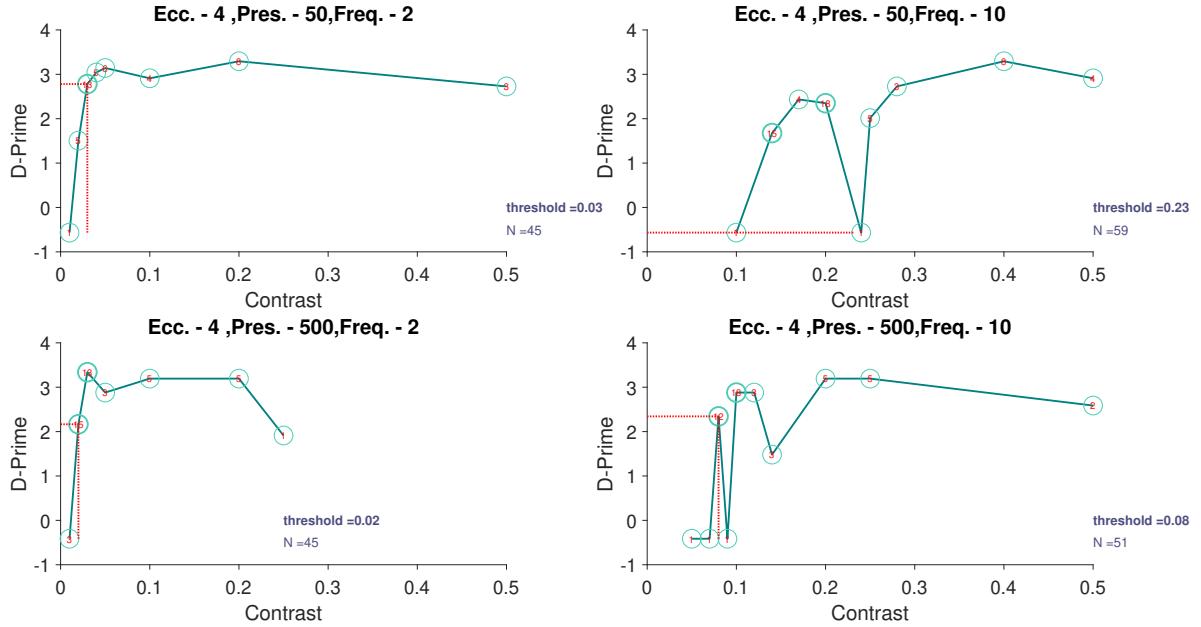
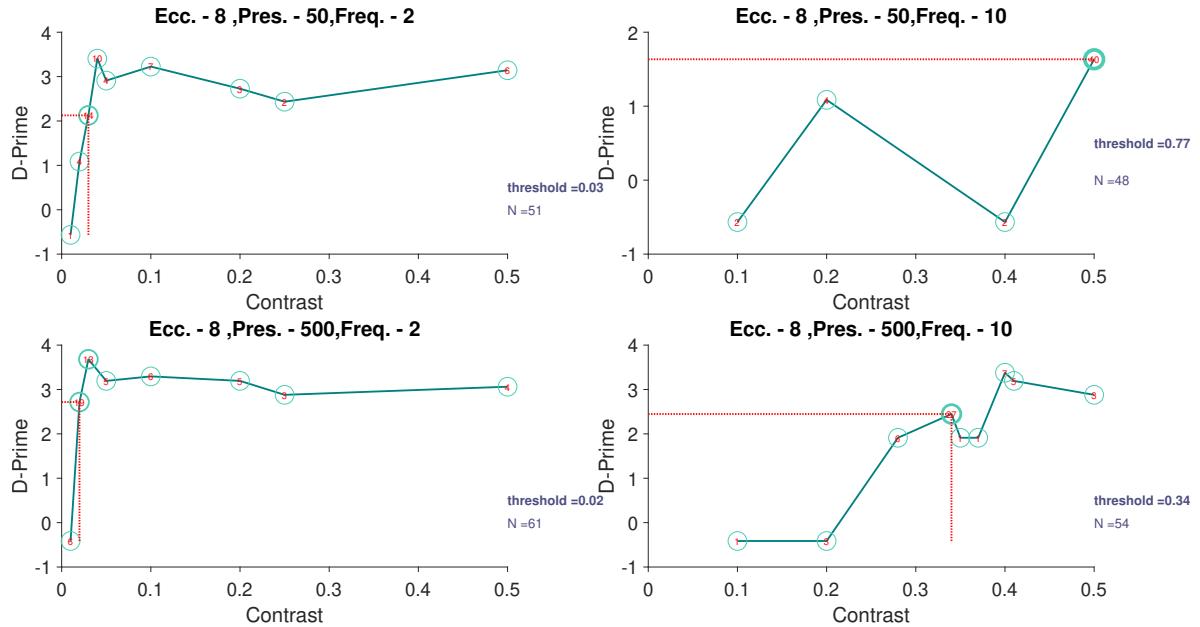


Figure 51: D-prime vs contrast at **Eccentricity 0**.

Figure 52: D-prime vs contrast at **Eccentricity 4**.Figure 53: D-prime vs contrast at **Eccentricity 8**.

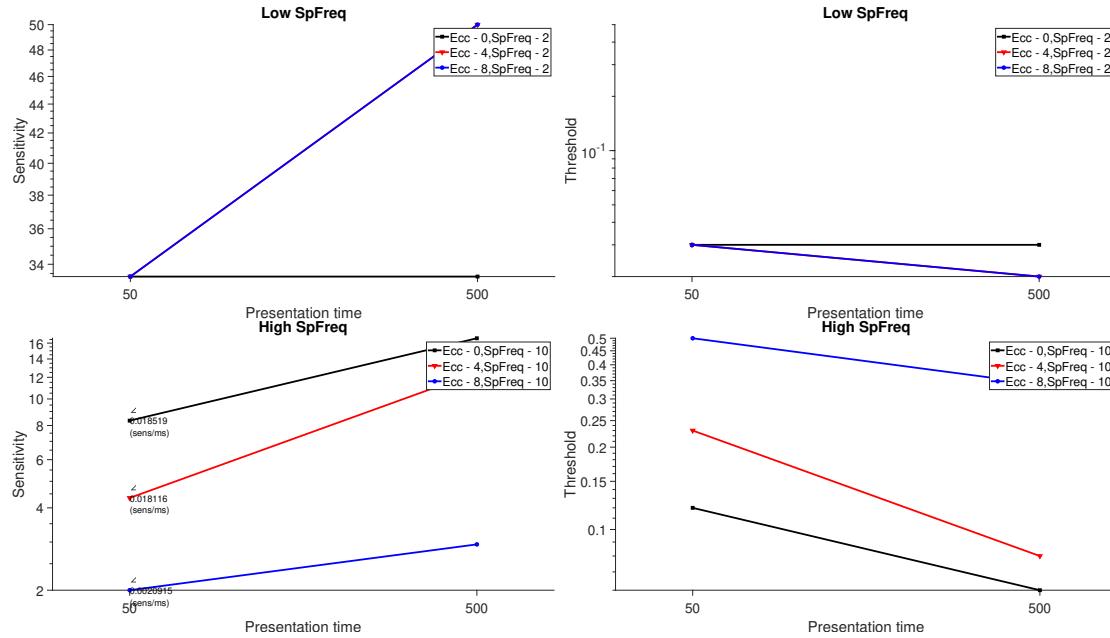


Figure 54: Threshold/Sensitivity summary plots

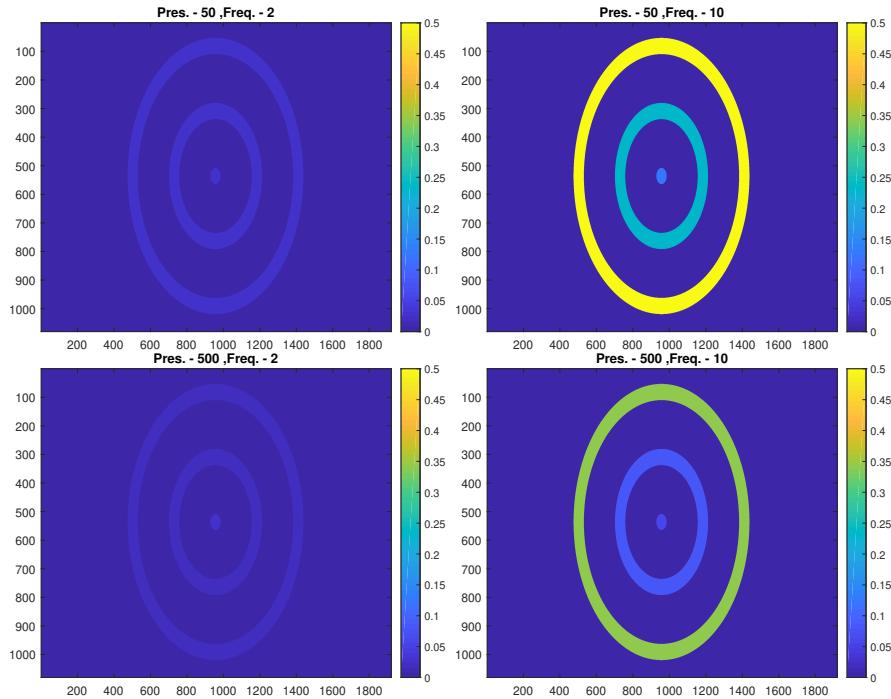


Figure 55: Threshold colorbar plots

3.7.2 SUBJECT:A013

For the following analysis, trials which had a landing distance more than 30arcmins were excluded.

Condition	Total	Disc_Blinks_Track	Disc_Tags_Land	Valid	Drift	MS_S	MS_1	MS_2	S_1	S_2	Exposure	Vel_less_3
Ecc-0, Pres-50, SpFreq-2	113	0	53	60	56	4	1	0	3	0	122.9833 ± 24.4966	54.0667 ± 18.0863
Ecc-0, Pres-50, SpFreq-10	111	0	65	46	41	5	2	0	3	0	119.8261 ± 14.5836	48.0435 ± 15.8282
Ecc-0, Pres-500, SpFreq-2	109	0	60	49	41	8	4	0	4	0	565.8571 ± 11.3137	493.4898 ± 20.6973
Ecc-0, Pres-500, SpFreq-10	126	0	76	50	45	5	2	0	3	0	574.4 ± 26.2779	501.62 ± 25.2715
Ecc-4, Pres-50, SpFreq-2	113	0	65	48	48	0	0	0	0	0	119.2292 ± 18.4763	53 ± 13.968
Ecc-4, Pres-50, SpFreq-10	112	0	67	45	42	3	0	0	3	0	125.1111 ± 27.7507	51.5111 ± 23.0362
Ecc-4, Pres-500, SpFreq-2	124	0	67	57	54	3	3	0	0	0	570.3158 ± 21.9221	499.4035 ± 18.4351
Ecc-4, Pres-500, SpFreq-10	108	0	59	49	44	5	4	0	1	0	569.0612 ± 12.7351	497.2857 ± 20.4175
Ecc-8, Pres-50, SpFreq-2	110	0	58	52	50	2	0	0	2	0	127.8654 ± 27.6008	56.4615 ± 18.9896
Ecc-8, Pres-50, SpFreq-10	100	0	47	53	52	1	1	0	0	0	123.3962 ± 20.9893	56.717 ± 13.3782
Ecc-8, Pres-500, SpFreq-2	118	0	60	58	53	5	4	1	0	0	567.0345 ± 10.2014	499.6207 ± 13.0247
Ecc-8, Pres-500, SpFreq-10	118	0	74	44	41	3	2	0	1	0	571.5682 ± 13.7881	493.8864 ± 25.5563
Ecc-, Pres-50, SpFreq-	674	0	359	315	305	10	2	0	8	0	123.5683 ± 19.9155	54.3111 ± 16.5406
Ecc-, Pres-500, SpFreq-	616	0	335	281	265	16	11	0	4	0	569.1352 ± 15.7878	498.7616 ± 19.0055

Table 6: Note the number of microsaccades/saccades is in ADDITION to the initial saccade

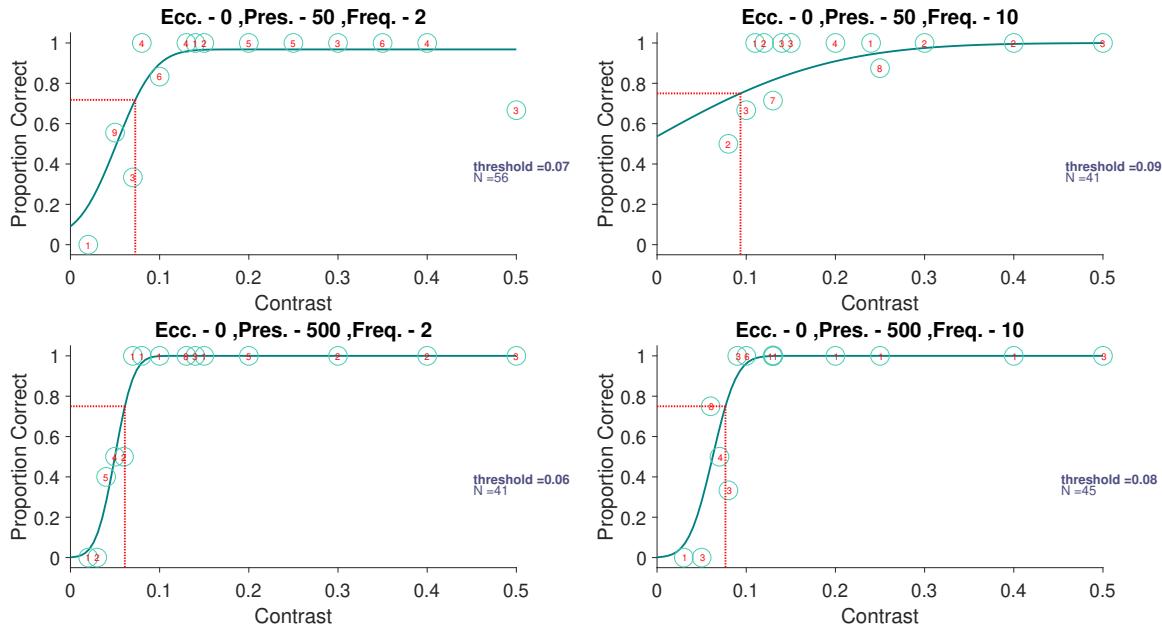


Figure 56: Psychometric curve at **Eccentricity 0** with **binned** contrast (rounded to 2 decimals).

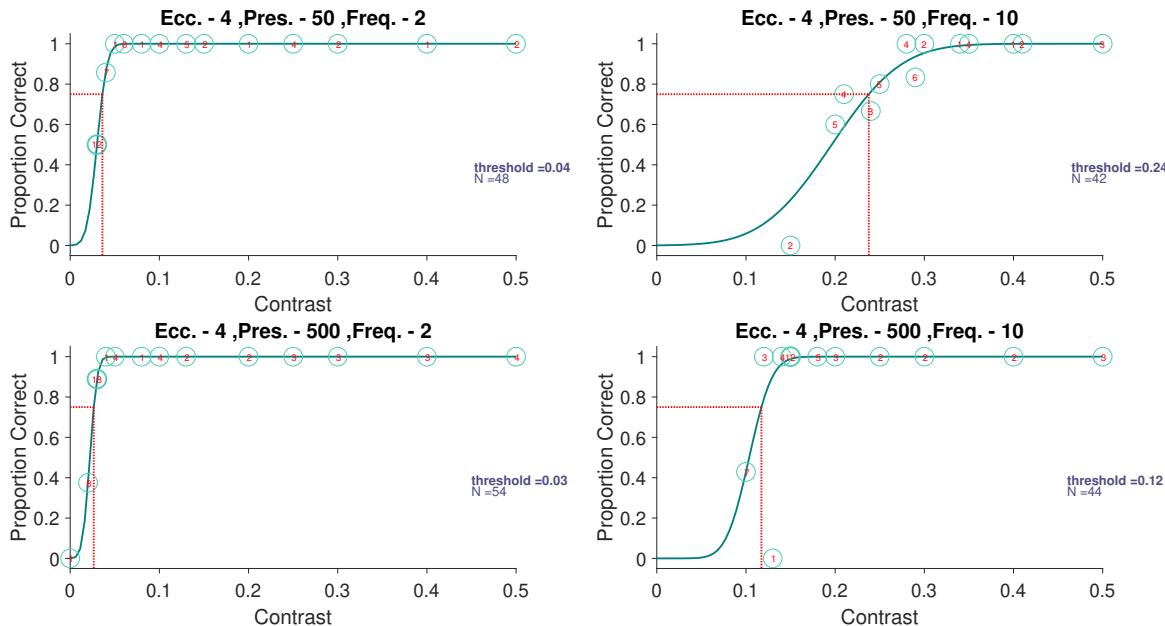


Figure 57: Psychometric curve at **Eccentricity 4** with **binned** contrast (rounded to 2 decimals).

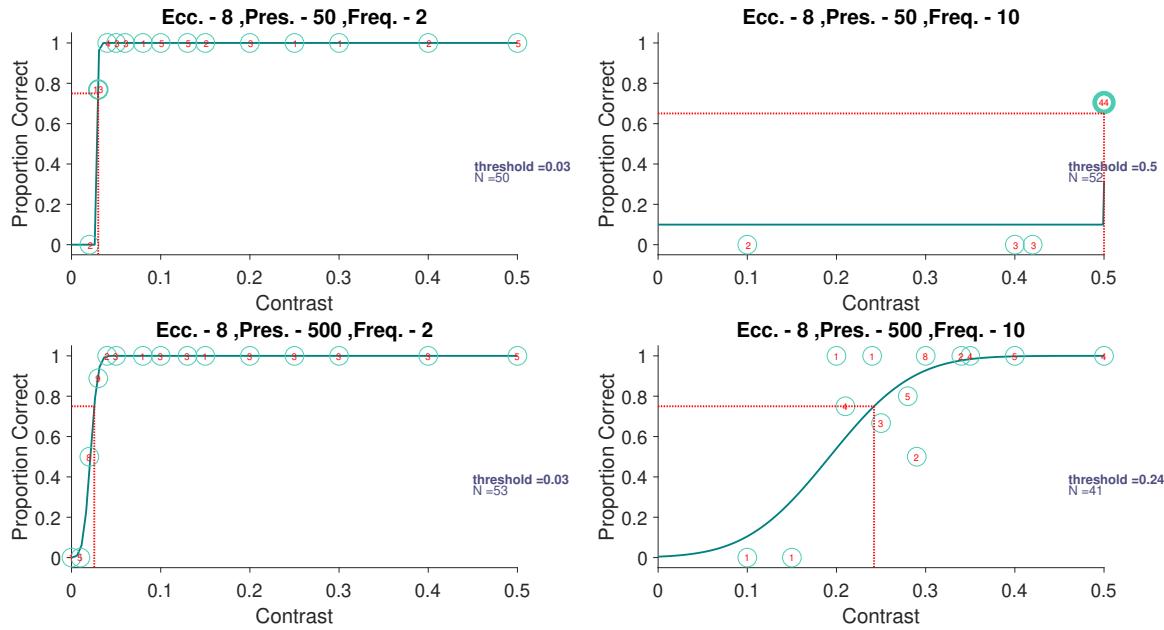


Figure 58: Psychometric curve at **Eccentricity 8** with **binned** contrast (rounded to 2 decimals).

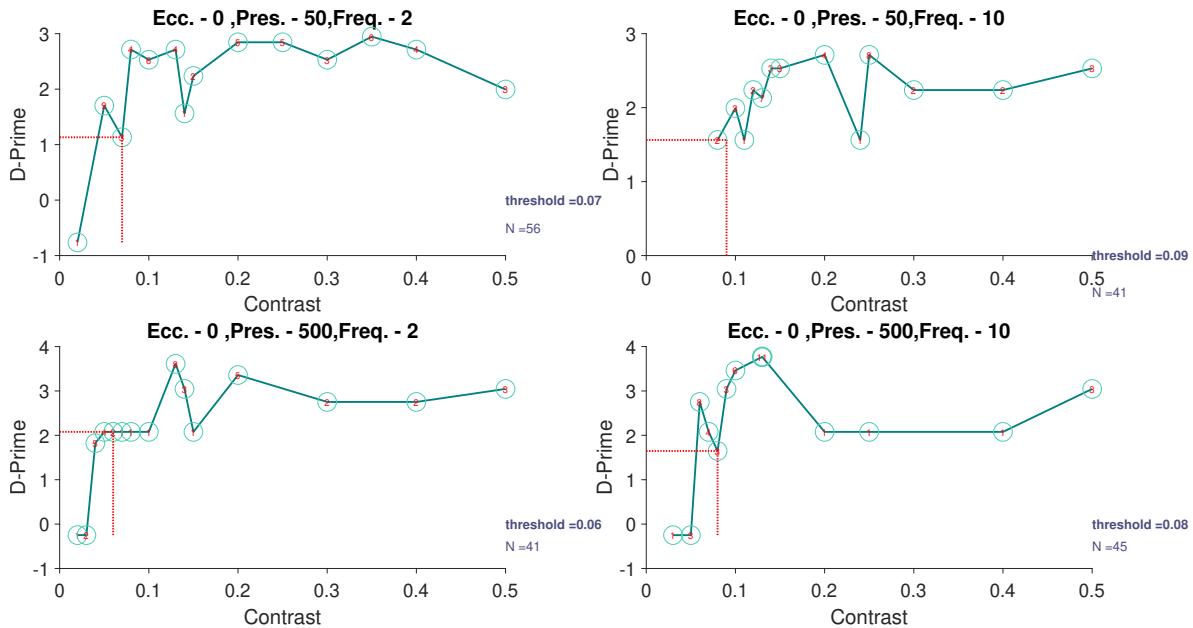
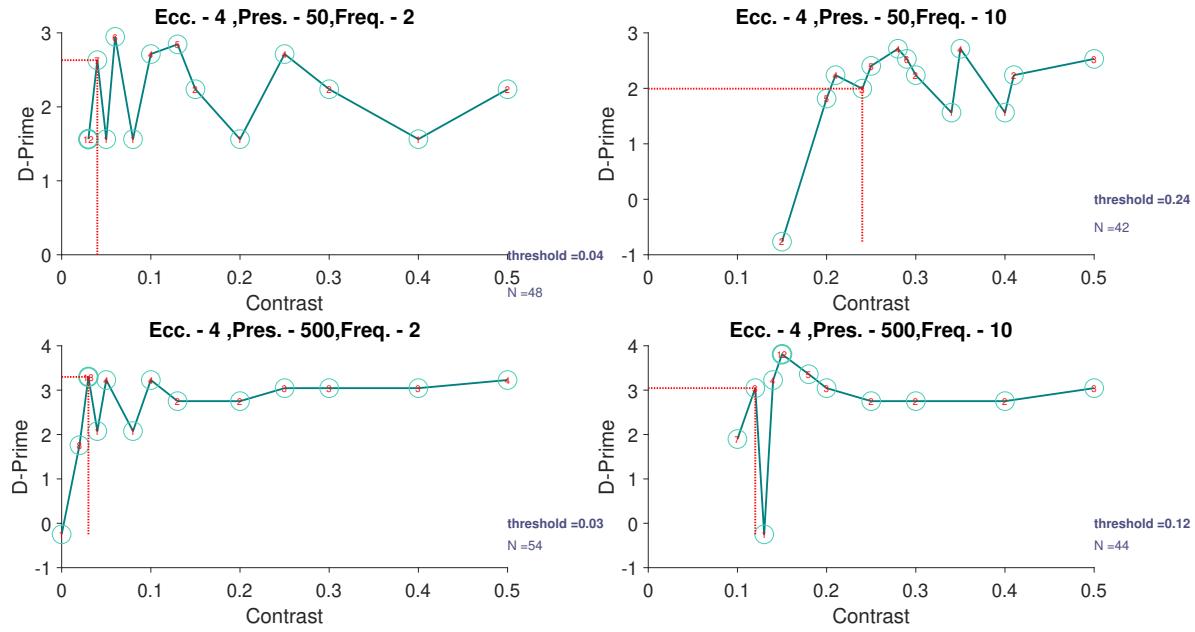
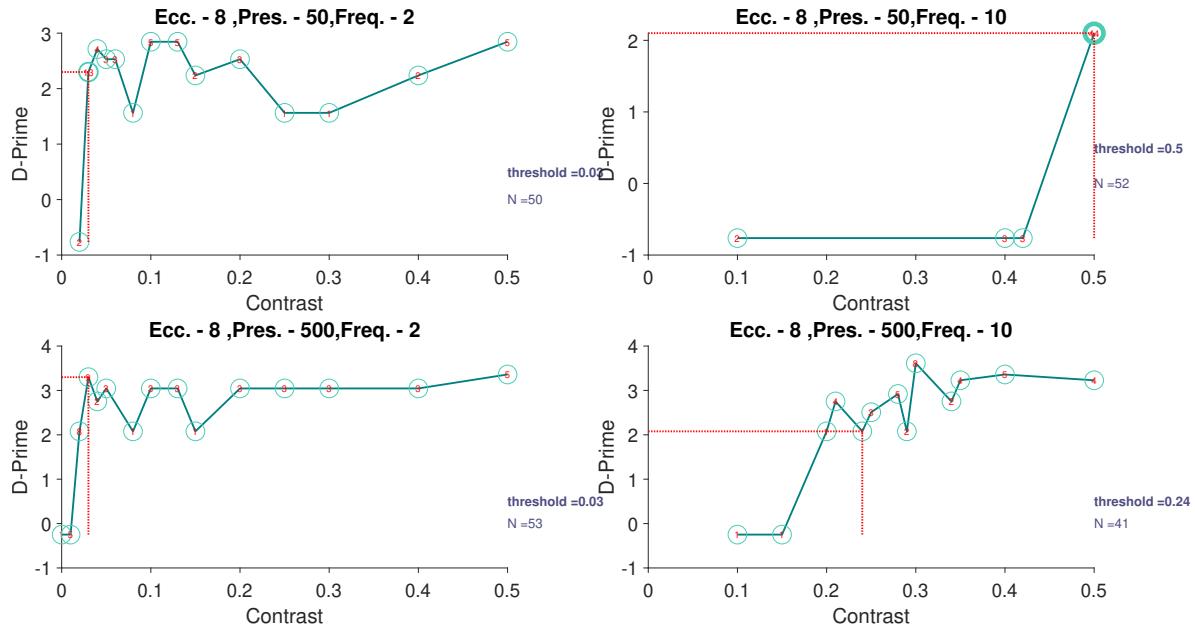


Figure 59: D-prime vs contrast at **Eccentricity 0**.

Figure 60: D-prime vs contrast at **Eccentricity 4**.Figure 61: D-prime vs contrast at **Eccentricity 8**.

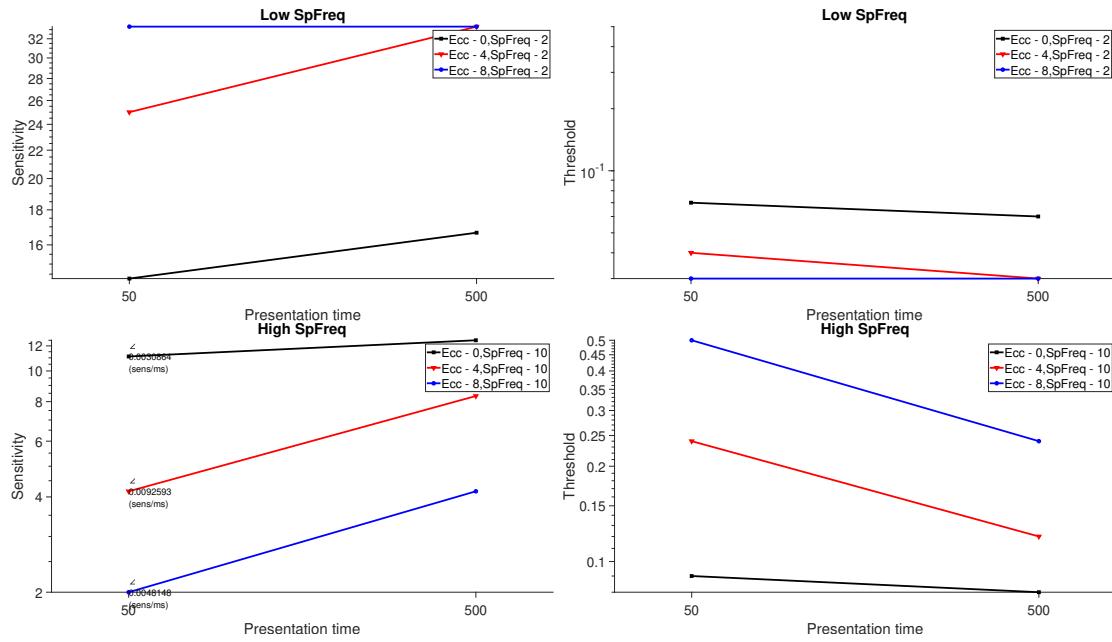


Figure 62: Threshold/Sensitivity summary plots

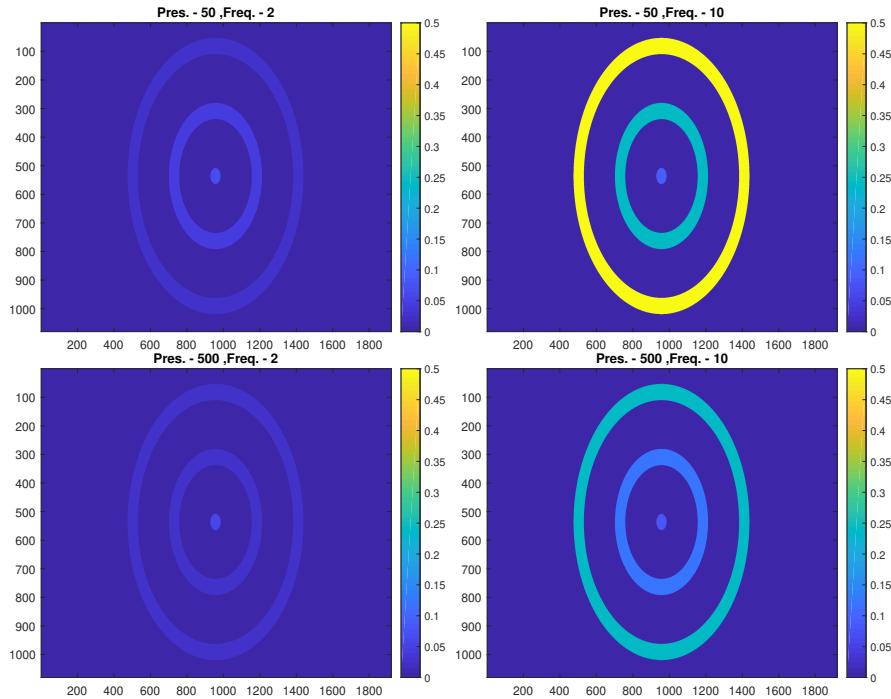


Figure 63: Threshold colorbar plots

3.7.3 SUBJECT:A092

For the following analysis, trials which had a landing distance more than 30arcmins were excluded.

Condition	Total	Disc_Blinks_Track	Disc_Tags_Land	Valid	Drift	MS_S	MS_1	MS_2	S_1	S_2	Exposure	Vel_Less_3
Ecc-0, Pres-50, SpFreq-2	1.55	0	60	95	85	10	2	0	8	0	131.7684 ± 15.4785	41.9368 ± 19.913
Ecc-0, Pres-50, SpFreq-10	142	0	55	87	77	10	1	0	9	0	128.9195 ± 13.57	42.1264 ± 20.643
Ecc-0, Pres-500, SpFreq-2	142	0	58	84	72	12	2	0	10	0	578.3333 ± 12.0244	479.1667 ± 28.1724
Ecc-0, Pres-500, SpFreq-10	142	0	60	82	70	12	8	0	4	0	577.3293 ± 13.0838	481.3049 ± 22.2509
Ecc-4, Pres-50, SpFreq-2	129	0	54	75	67	8	0	0	8	0	126.6533 ± 12.0433	39.3067 ± 20.3144
Ecc-4, Pres-50, SpFreq-10	136	0	67	69	63	6	2	0	4	0	127.4928 ± 13.1771	41.3043 ± 18.3482
Ecc-4, Pres-500, SpFreq-2	125	0	42	83	79	4	2	0	2	0	579.1084 ± 16.7113	487.8554 ± 22.3591
Ecc-4, Pres-500, SpFreq-10	142	0	67	75	72	3	2	0	1	0	577.7733 ± 12.7009	488.04 ± 22.2154
Ecc-8, Pres-50, SpFreq-2	127	0	55	72	61	11	2	0	9	0	128.8889 ± 13.7314	39.75 ± 20.3869
Ecc-8, Pres-50, SpFreq-10	134	0	51	83	74	9	2	0	7	0	128.7711 ± 14.0681	38.3253 ± 17.8251
Ecc-8, Pres-500, SpFreq-2	144	0	60	84	78	6	1	0	5	0	579.7976 ± 14.4687	487.8929 ± 21.893
Ecc-8, Pres-500, SpFreq-10	144	0	59	85	82	3	0	0	3	0	580.6353 ± 14.0398	487.2118 ± 24.3365
Ecc-, Pres-50, SpFreq-	814	0	361	453	394	59	10	0	49	0	128.9801 ± 15.6262	38.2362 ± 19.1931
Ecc-, Pres-500, SpFreq-	807	0	336	471	437	34	13	0	21	0	577.7367 ± 15.4348	484.6497 ± 26.0551

Table 7: Note the number of microsaccades/saccades is in ADDITION to the initial saccade

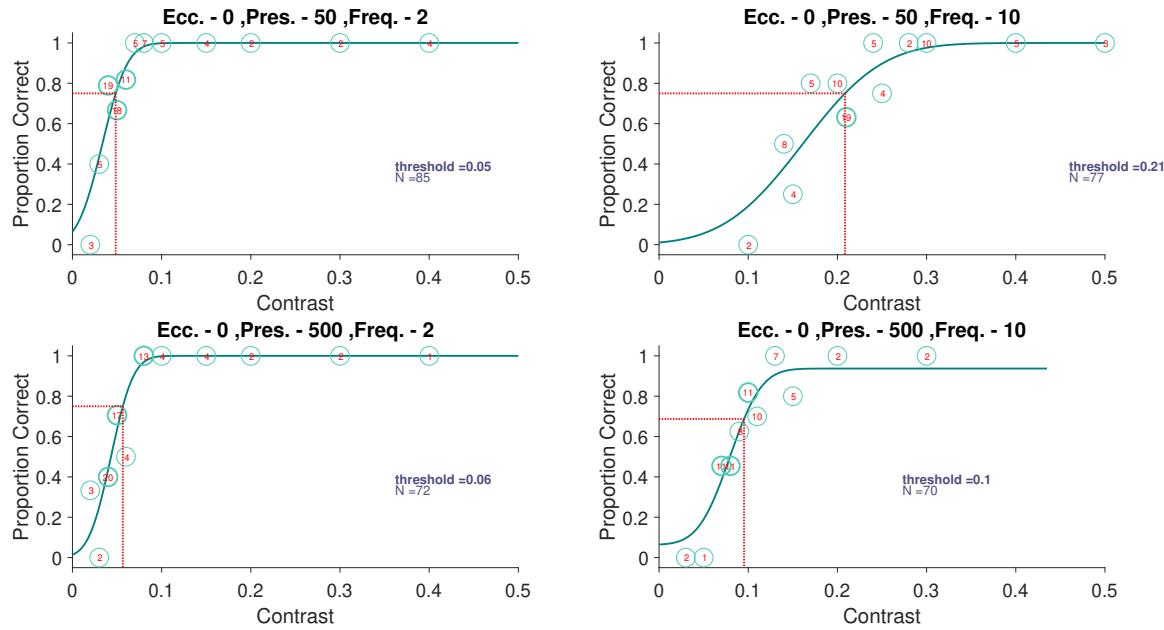


Figure 64: Psychometric curve at **Eccentricity 0** with **binned** contrast (rounded to 2 decimals).

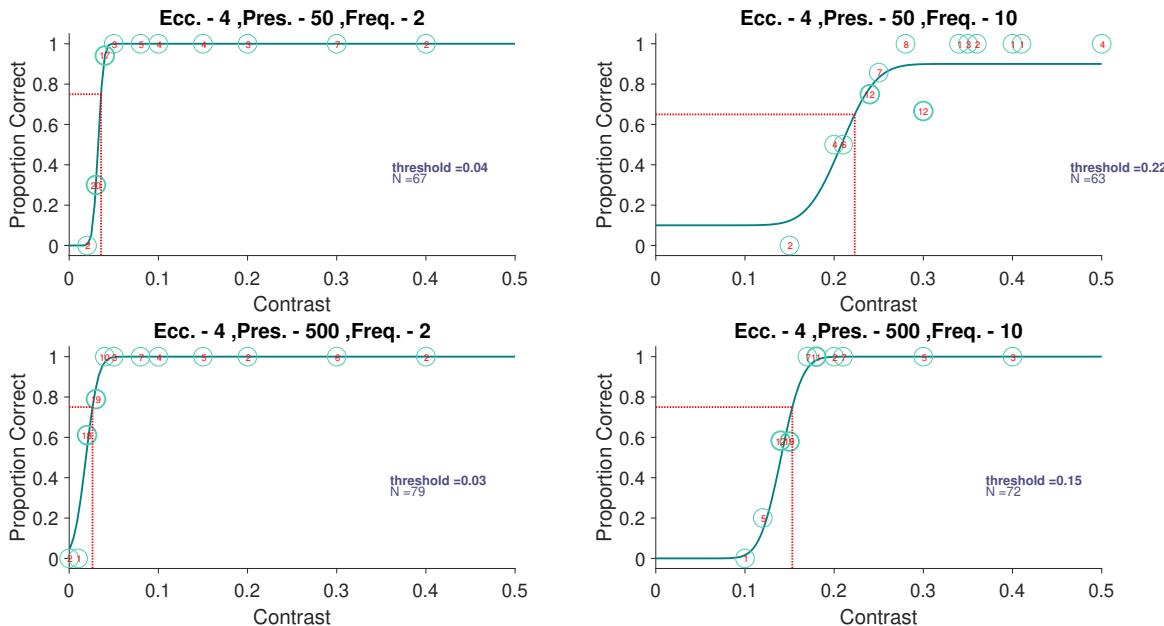


Figure 65: Psychometric curve at **Eccentricity 4** with **binned** contrast (rounded to 2 decimals).

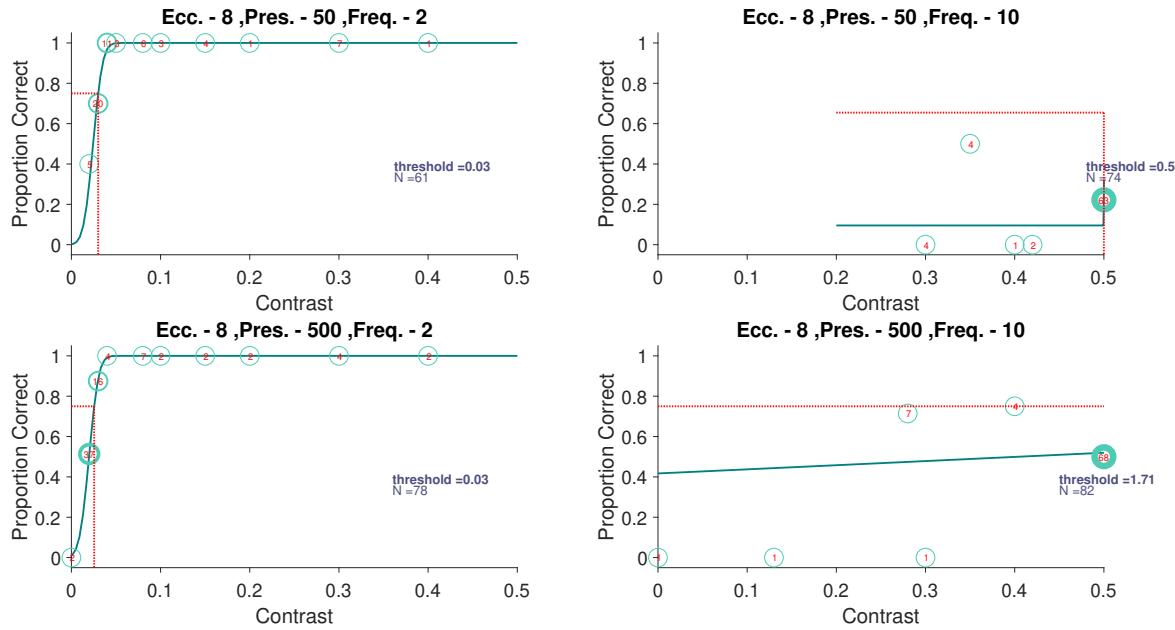


Figure 66: Psychometric curve at **Eccentricity 8** with **binned** contrast (rounded to 2 decimals).

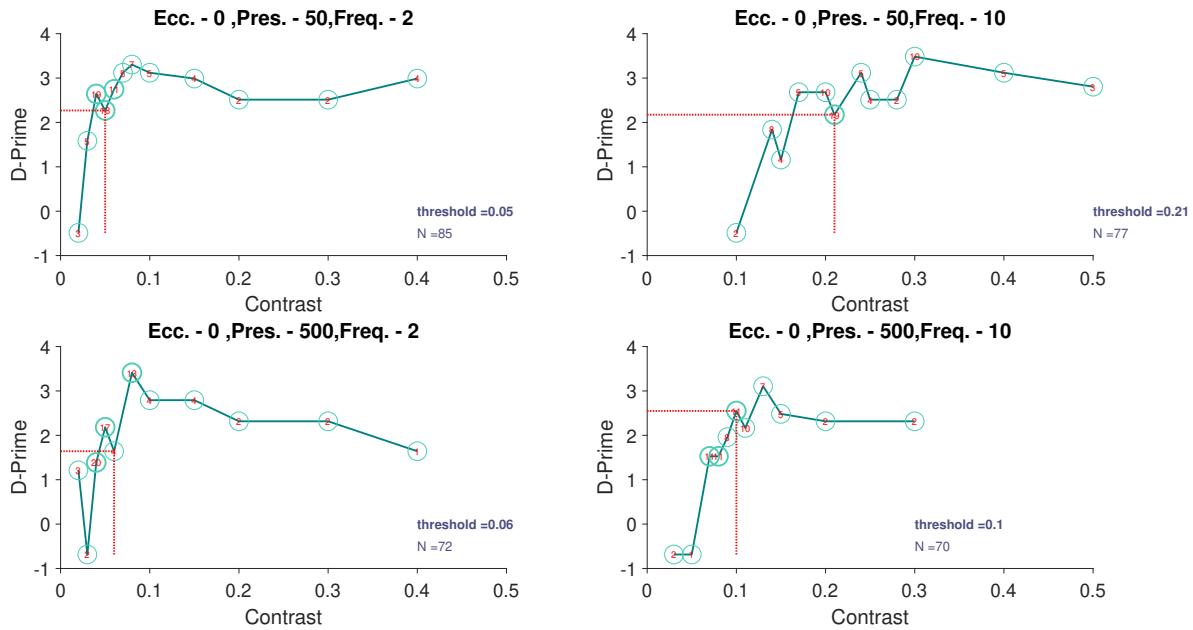
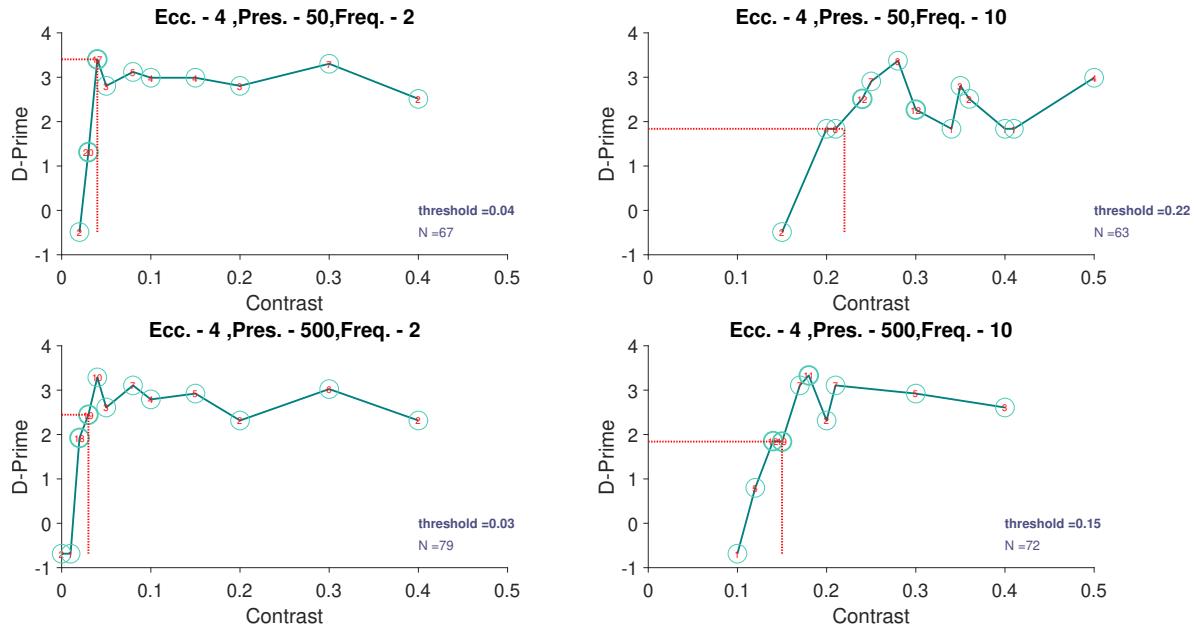
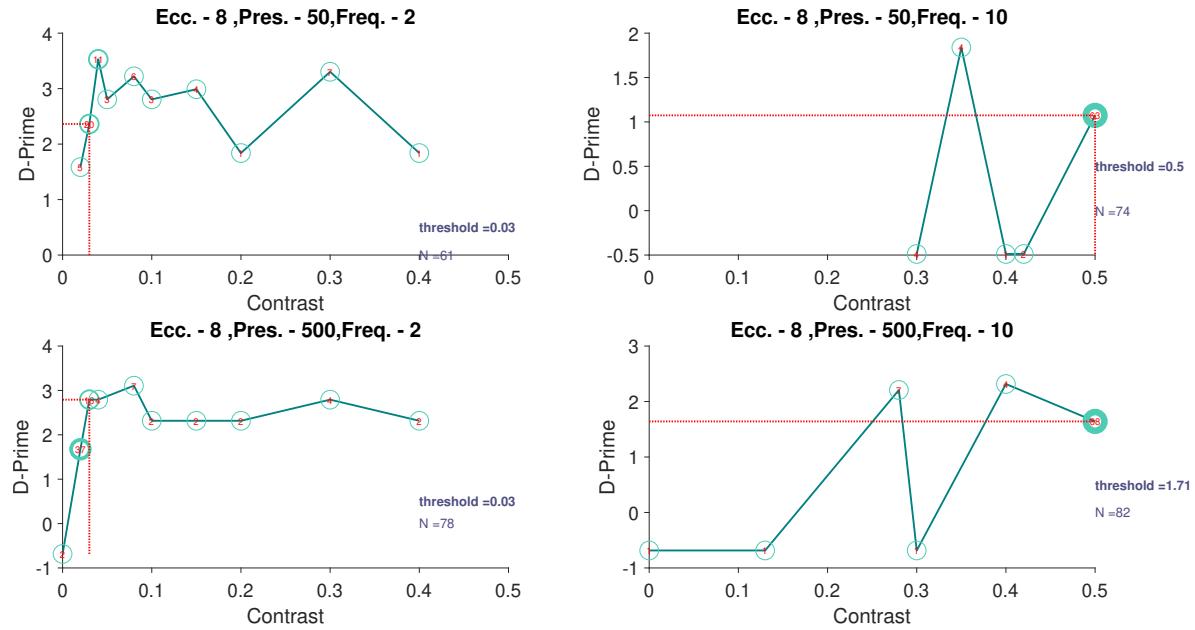


Figure 67: D-prime vs contrast at **Eccentricity 0**.

Figure 68: D-prime vs contrast at **Eccentricity 4**.Figure 69: D-prime vs contrast at **Eccentricity 8**.

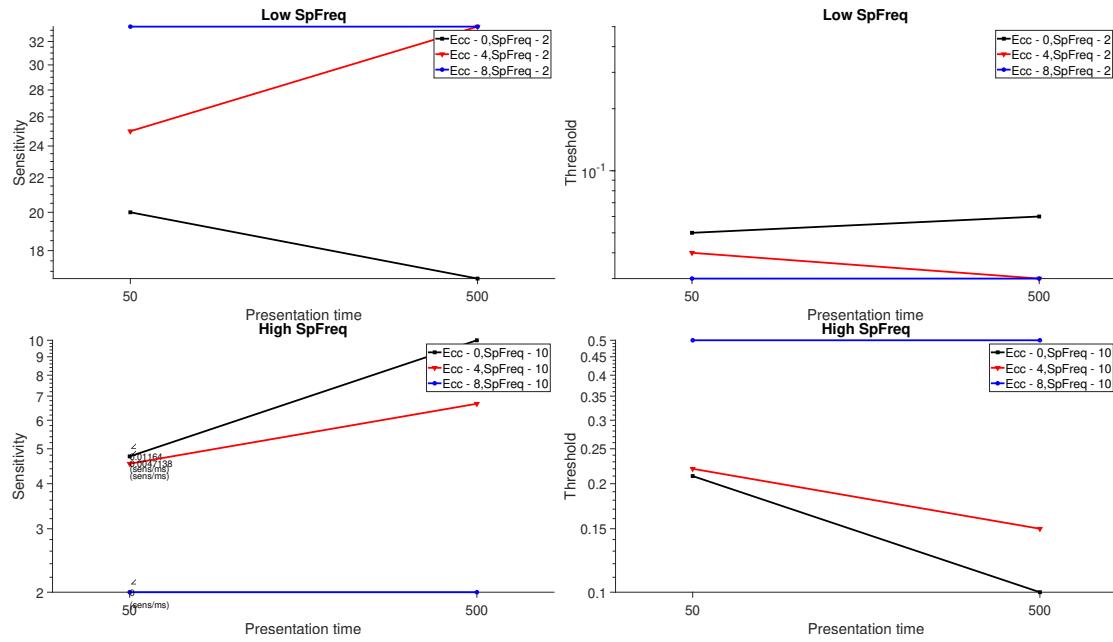


Figure 70: Threshold/Sensitivity summary plots

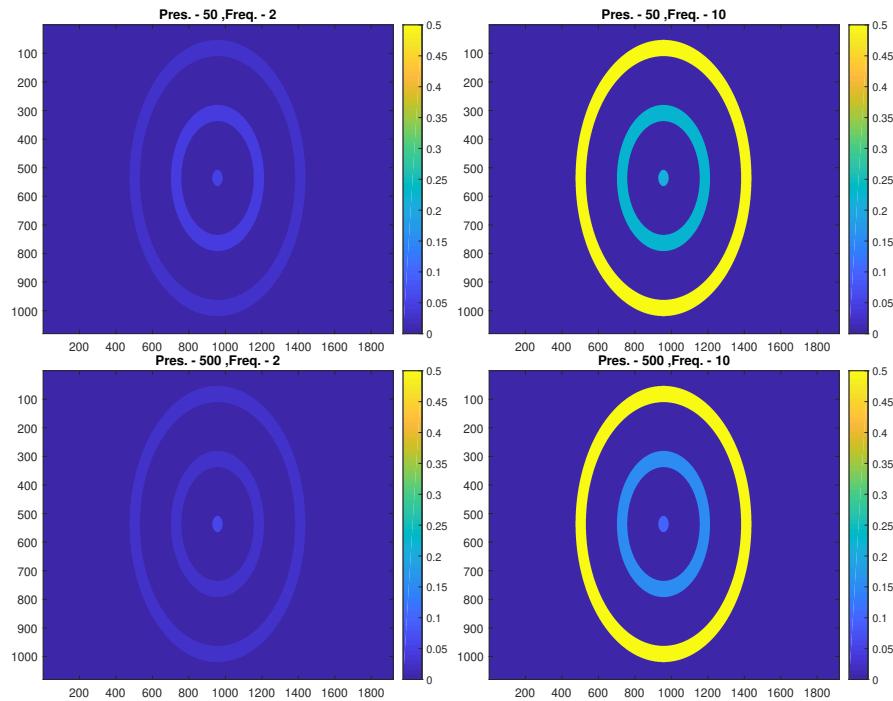


Figure 71: Threshold colorbar plots

3.8 Psychometric analysis

3.8.1 Comparison by Eccentricity

3.8.1.1 SUBJECT:Nikunj The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

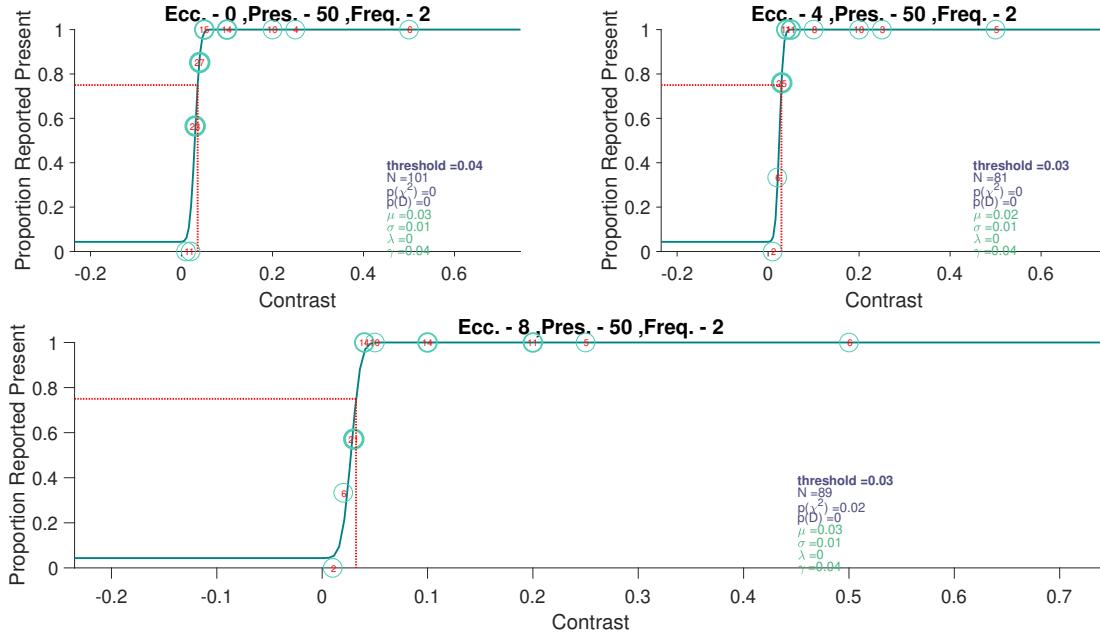


Figure 72: Psychometric curves at different eccentricities.

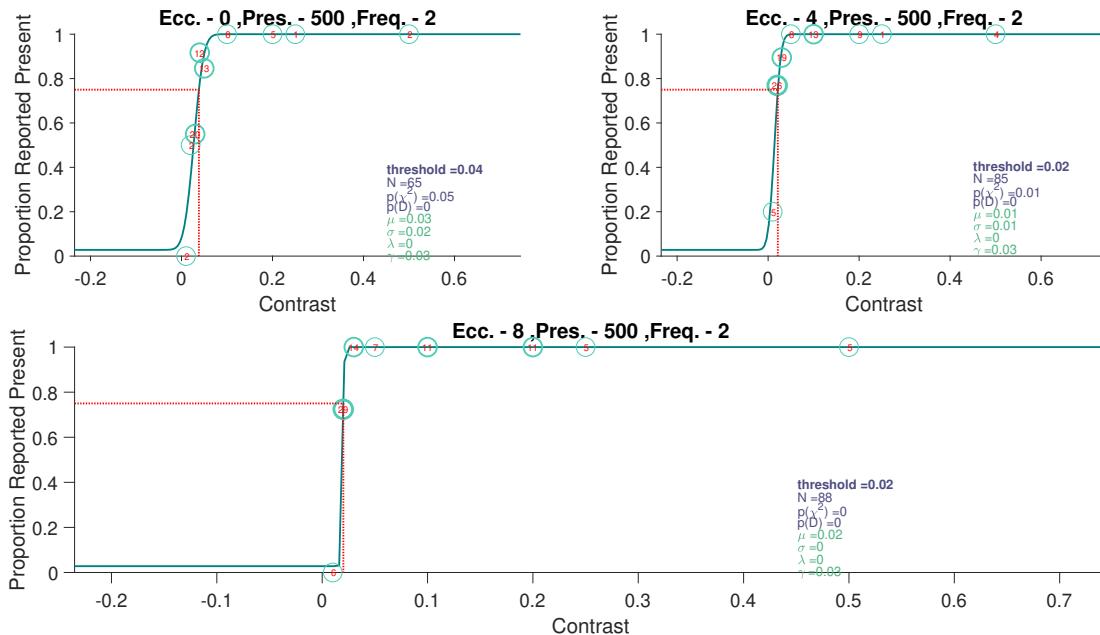


Figure 73: Psychometric curves at different eccentricities.

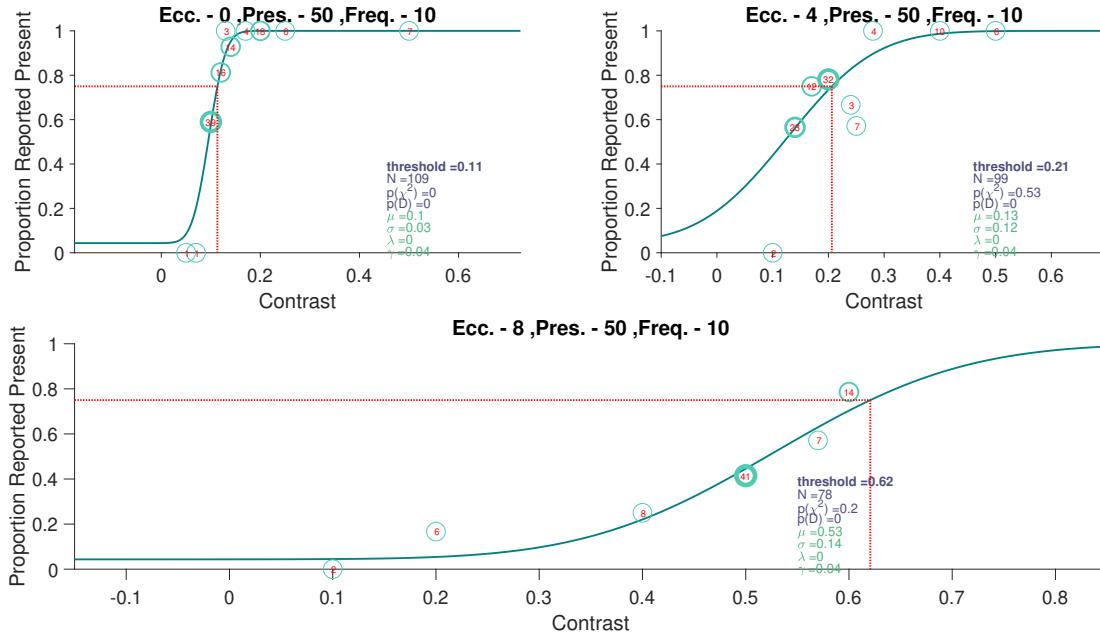


Figure 74: Psychometric curves at different eccentricities.

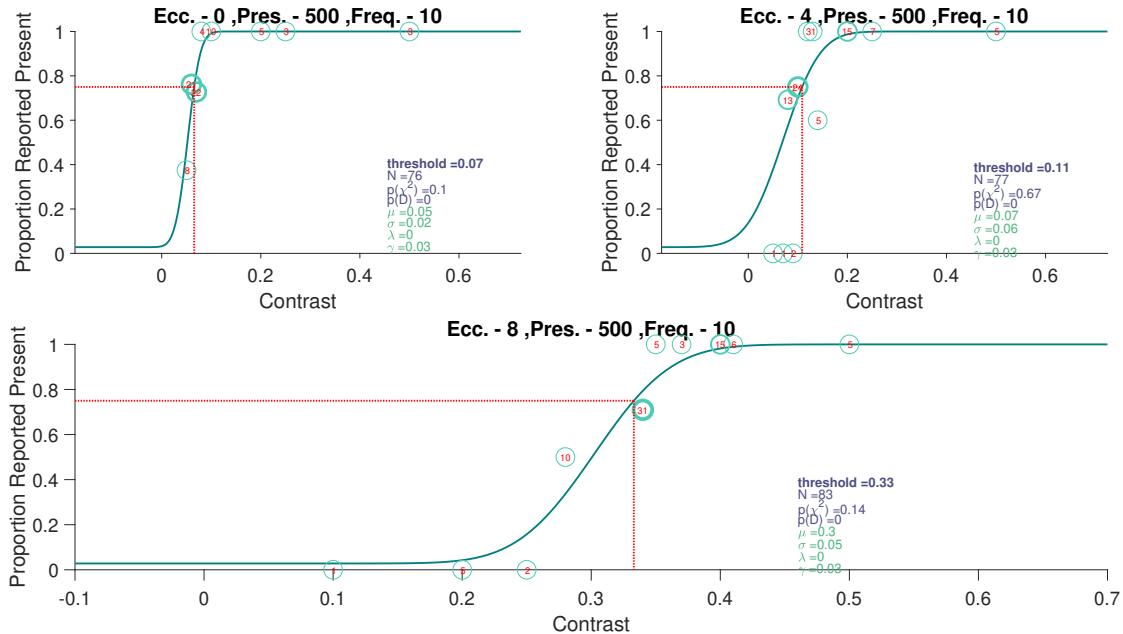


Figure 75: Psychometric curves at different eccentricities.

3.8.1.2 SUBJECT:A013 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

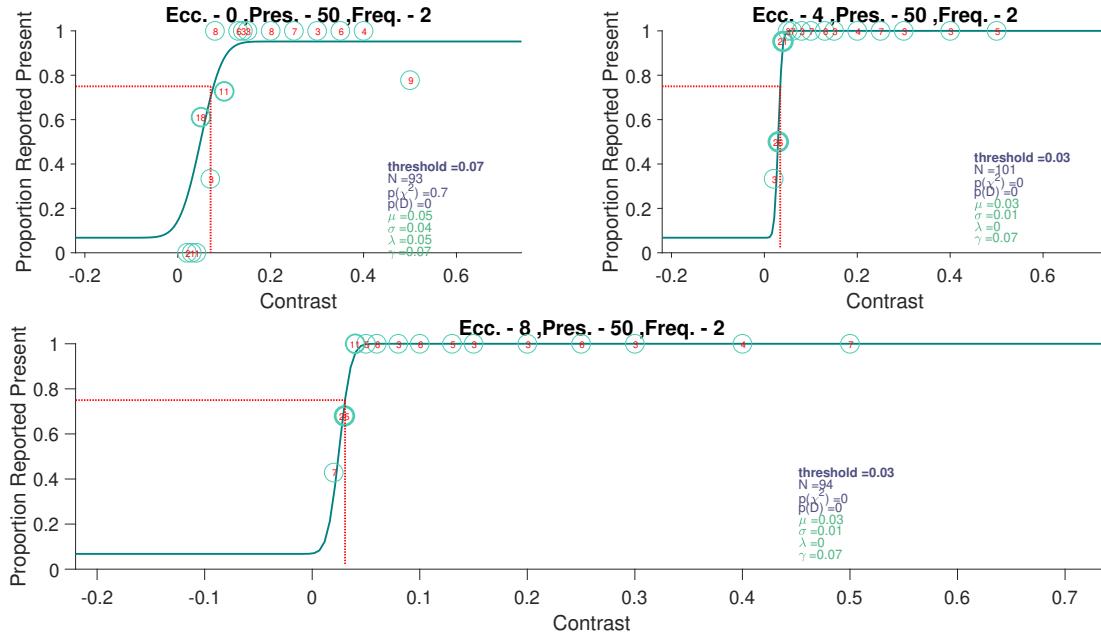


Figure 76: Psychometric curves at different eccentricities.

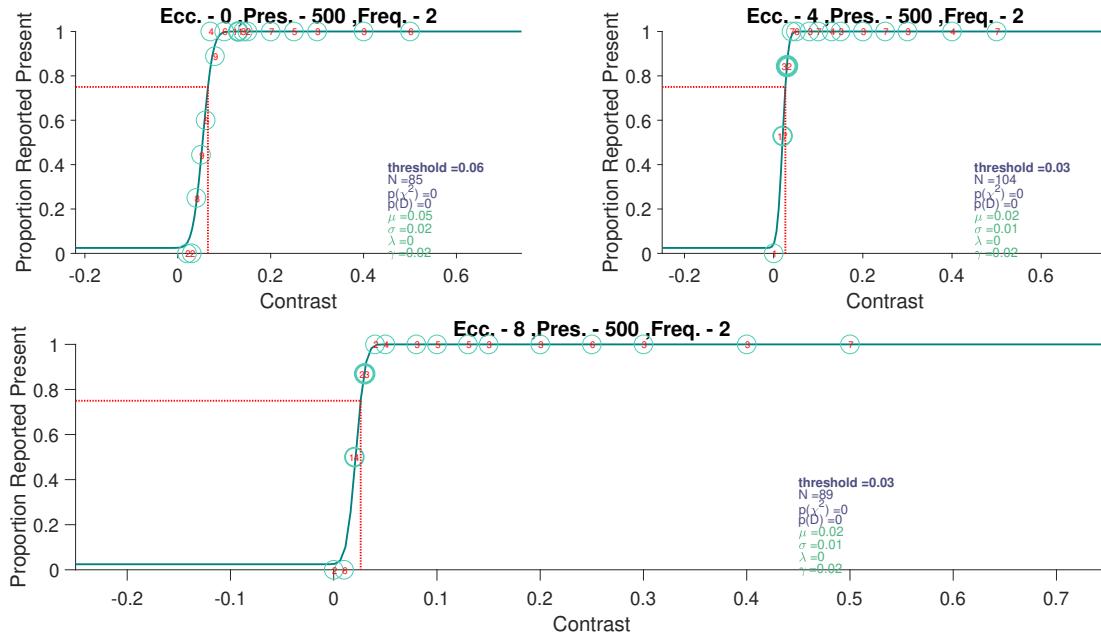


Figure 77: Psychometric curves at different eccentricities.

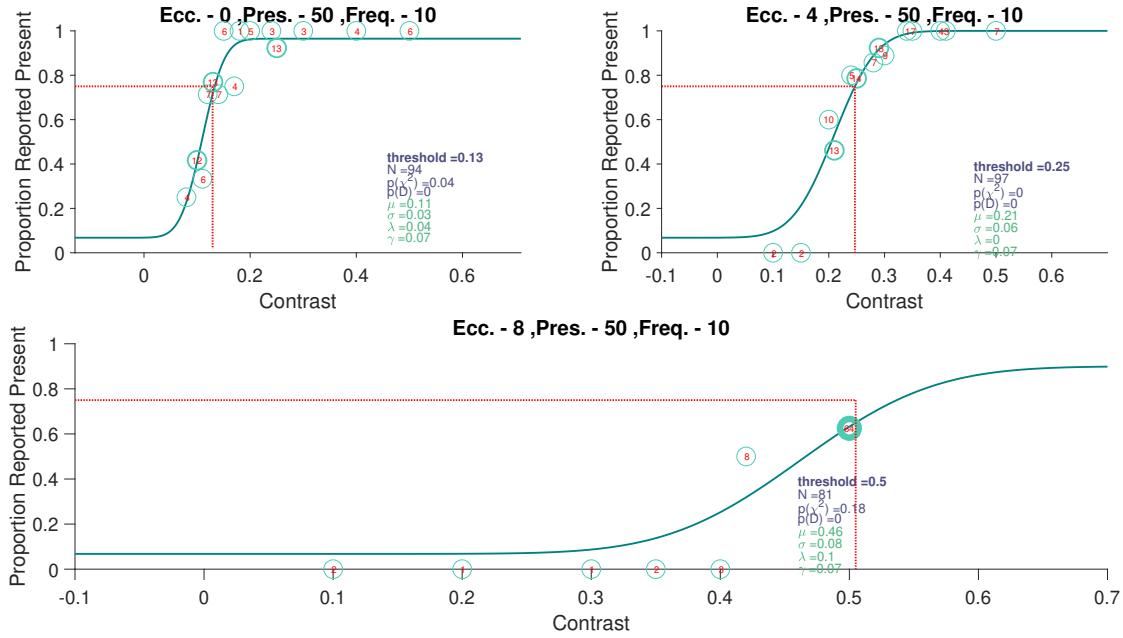


Figure 78: Psychometric curves at different eccentricities.

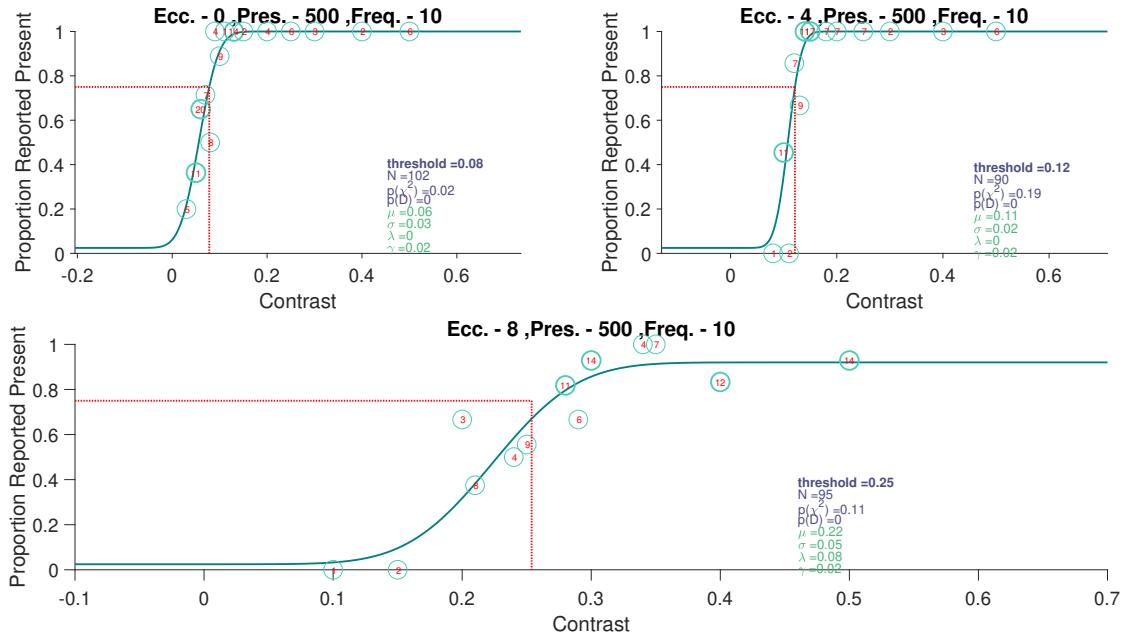


Figure 79: Psychometric curves at different eccentricities.

3.8.1.3 SUBJECT:A092 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

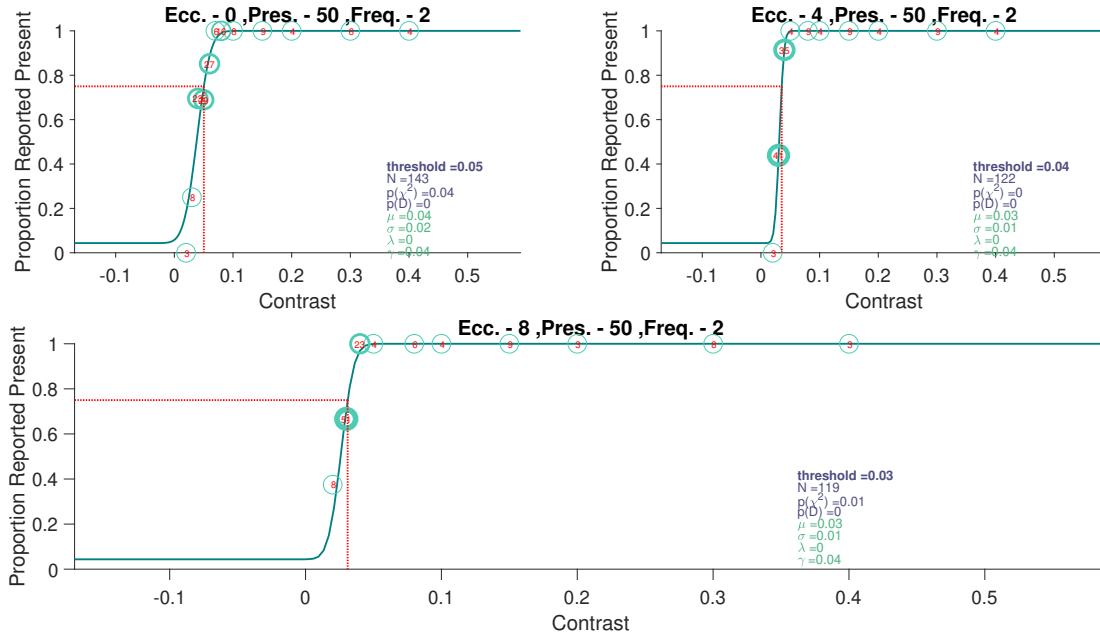


Figure 80: Psychometric curves at different eccentricities.

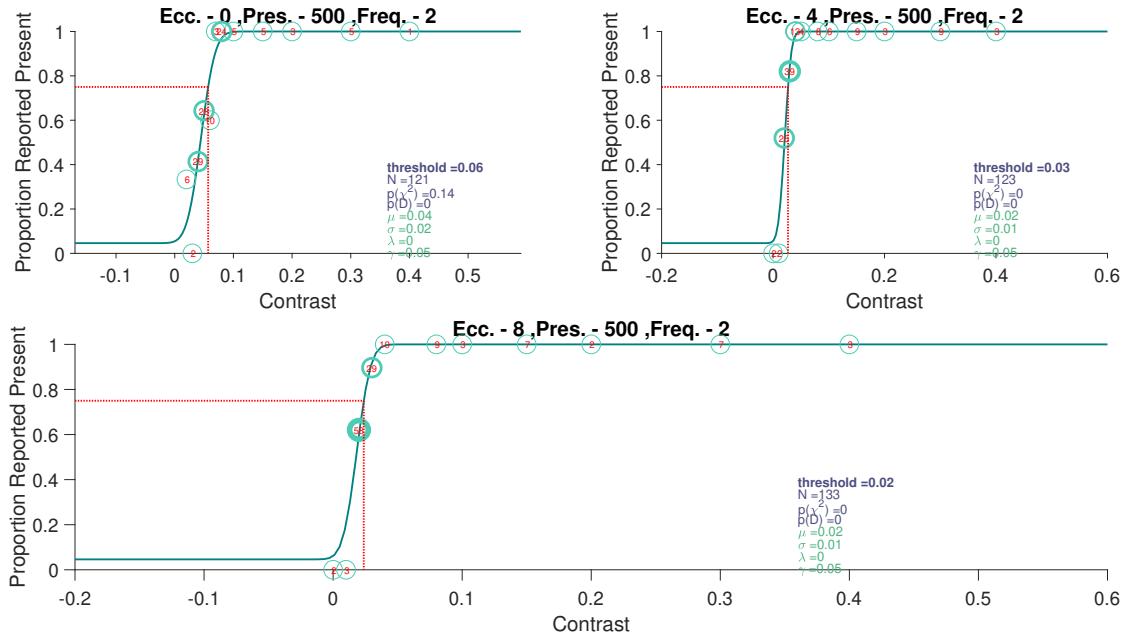


Figure 81: Psychometric curves at different eccentricities.

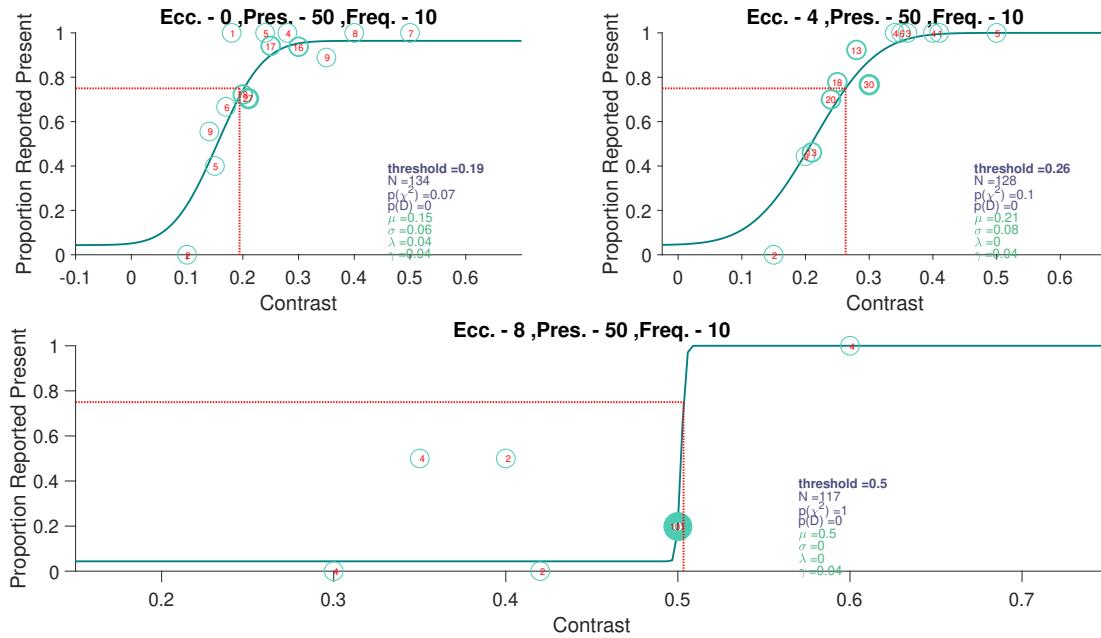


Figure 82: Psychometric curves at different eccentricities.

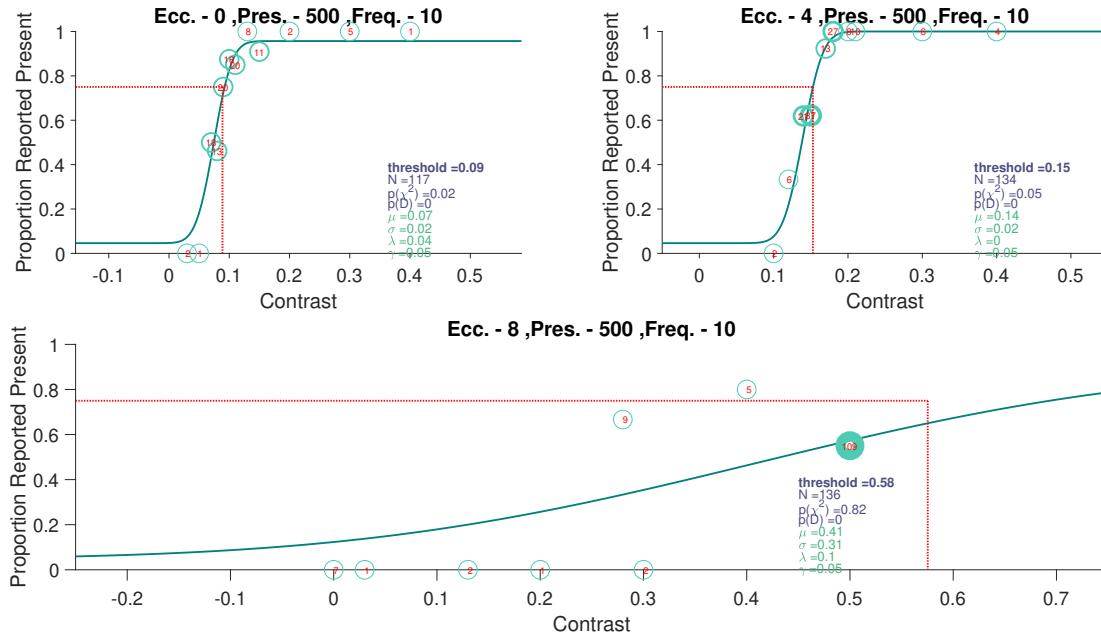


Figure 83: Psychometric curves at different eccentricities.

3.8.1.4 SUBJECT:A036 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

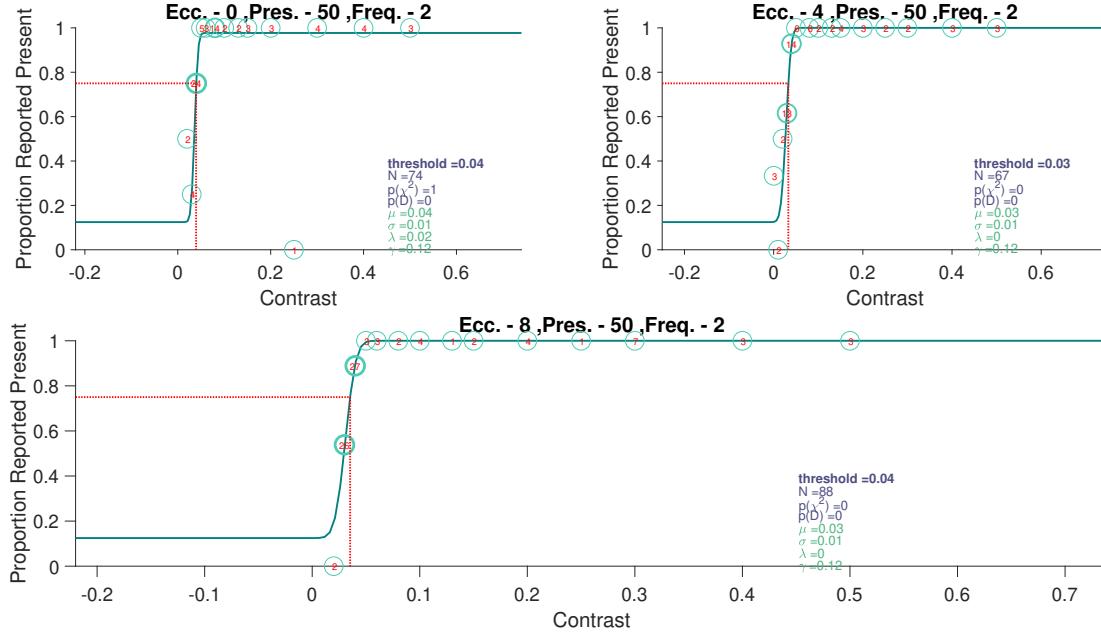


Figure 84: Psychometric curves at different eccentricities.

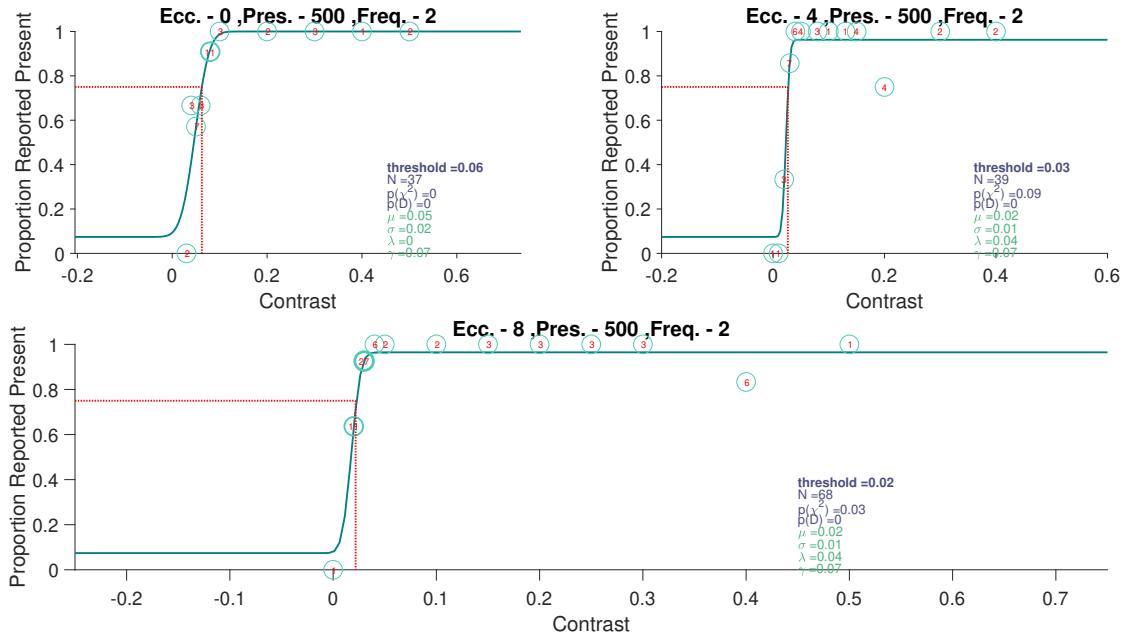


Figure 85: Psychometric curves at different eccentricities.

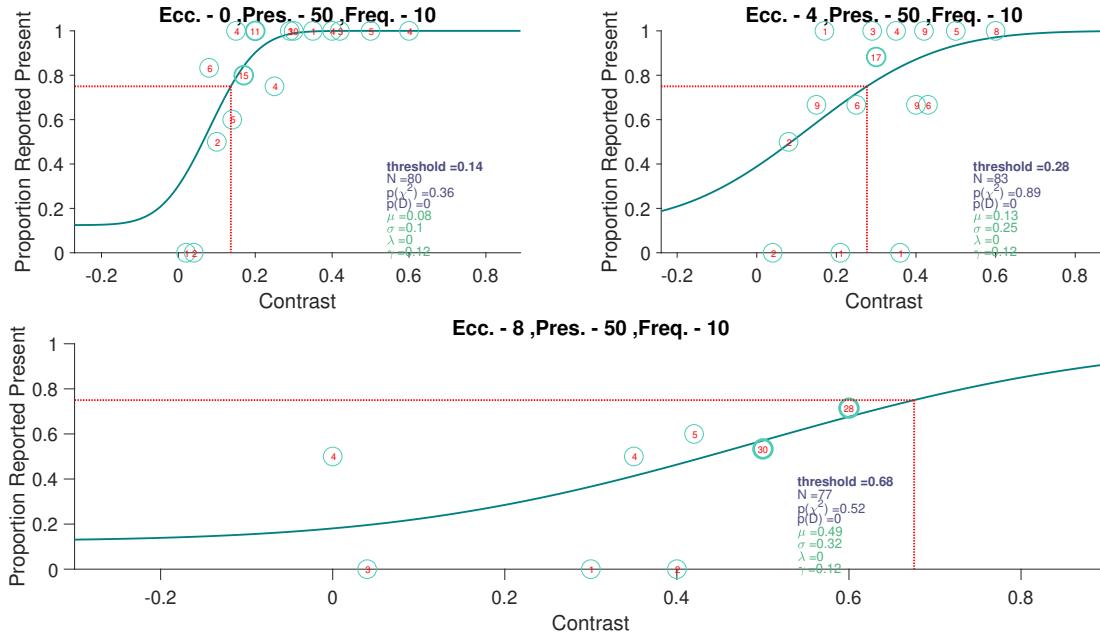


Figure 86: Psychometric curves at different eccentricities.

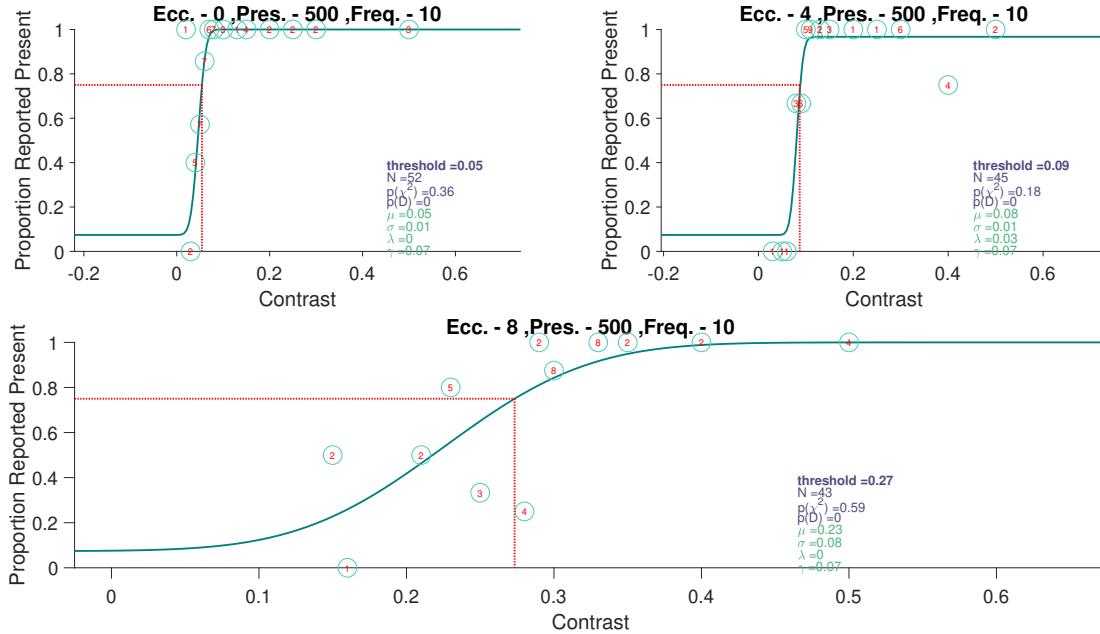
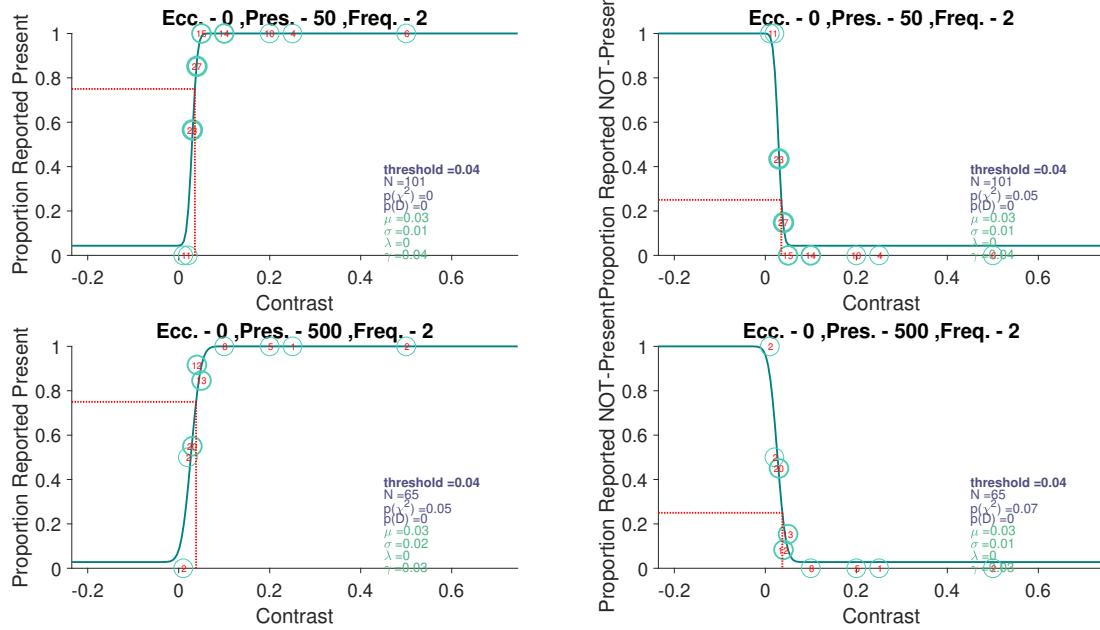
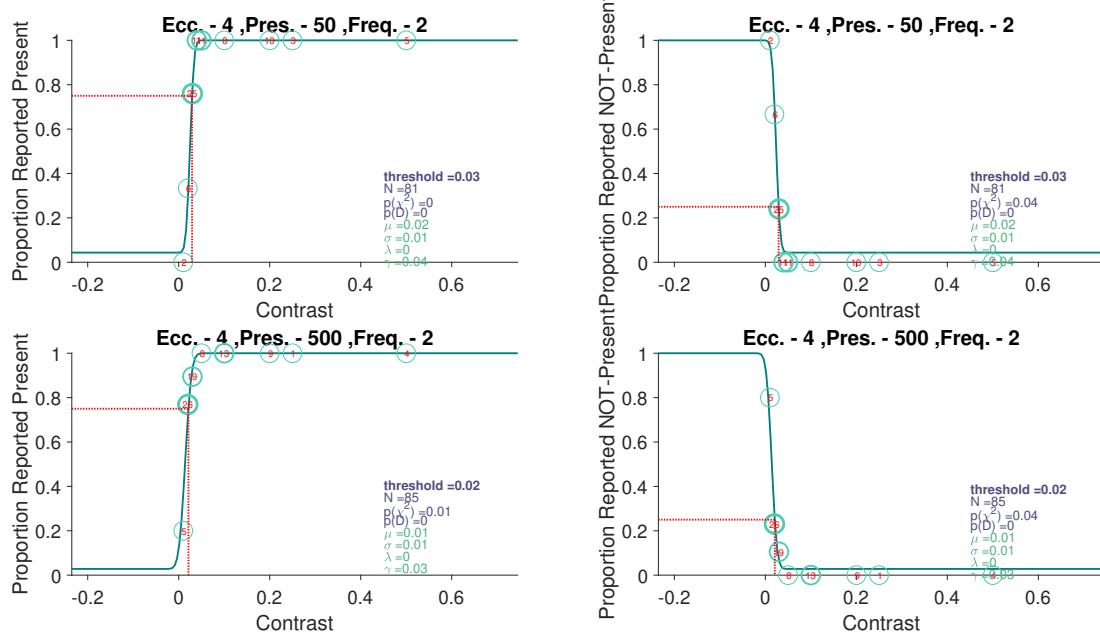
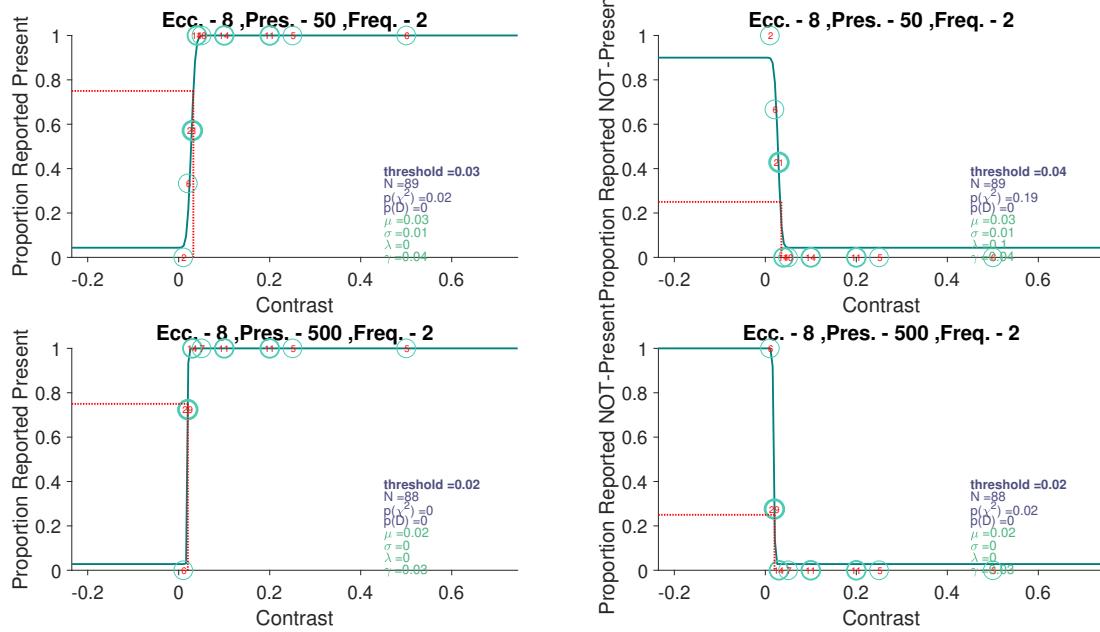
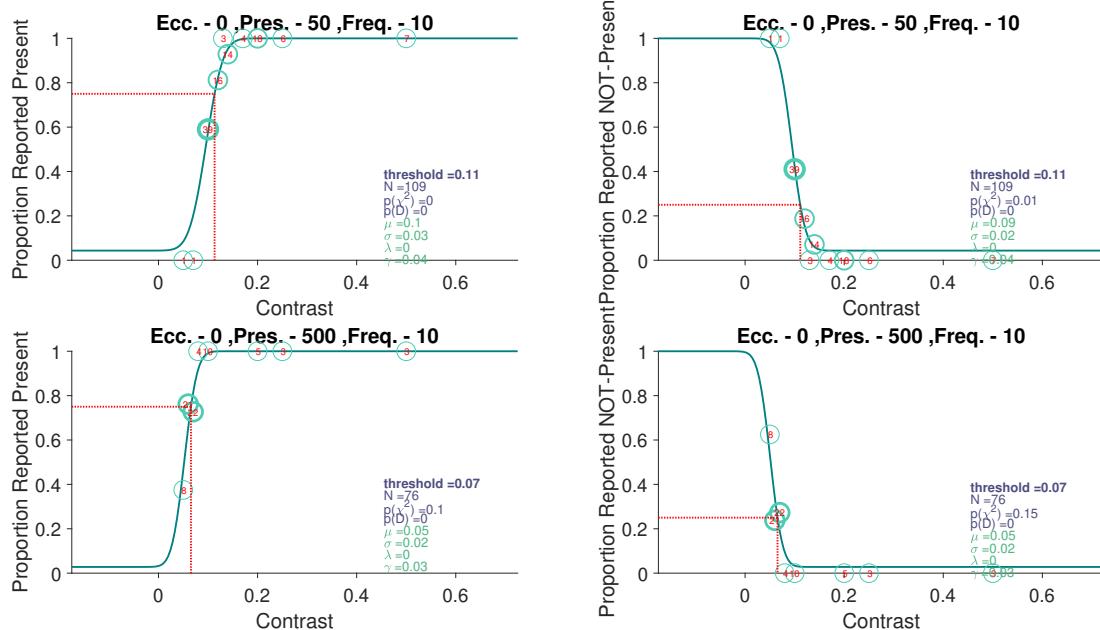


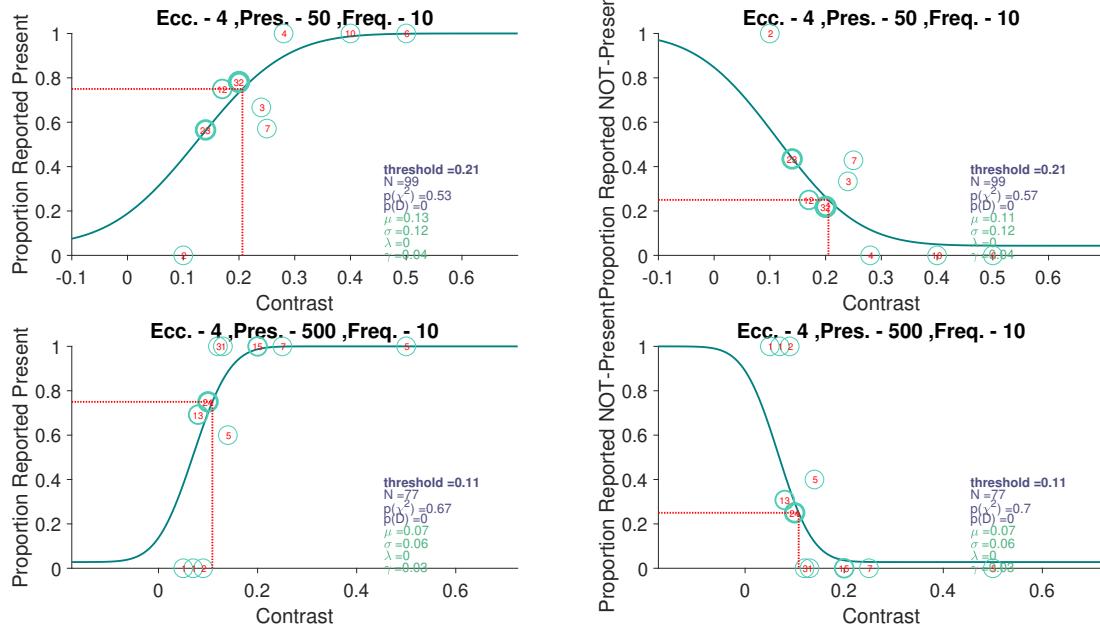
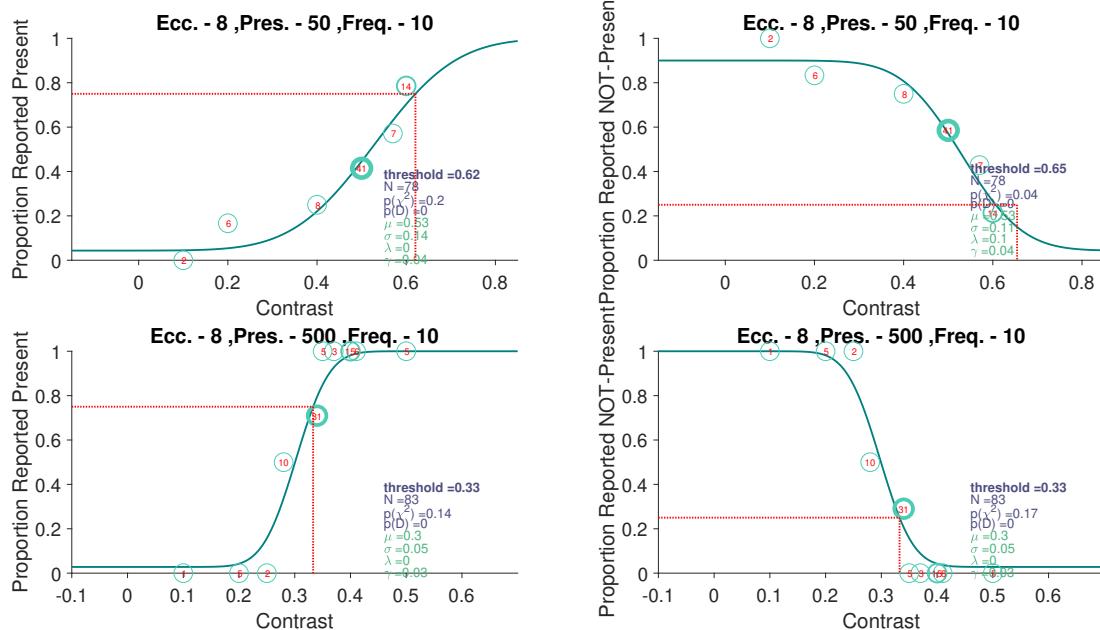
Figure 87: Psychometric curves at different eccentricities.

3.8.2 Alongside Flipped Psychfits

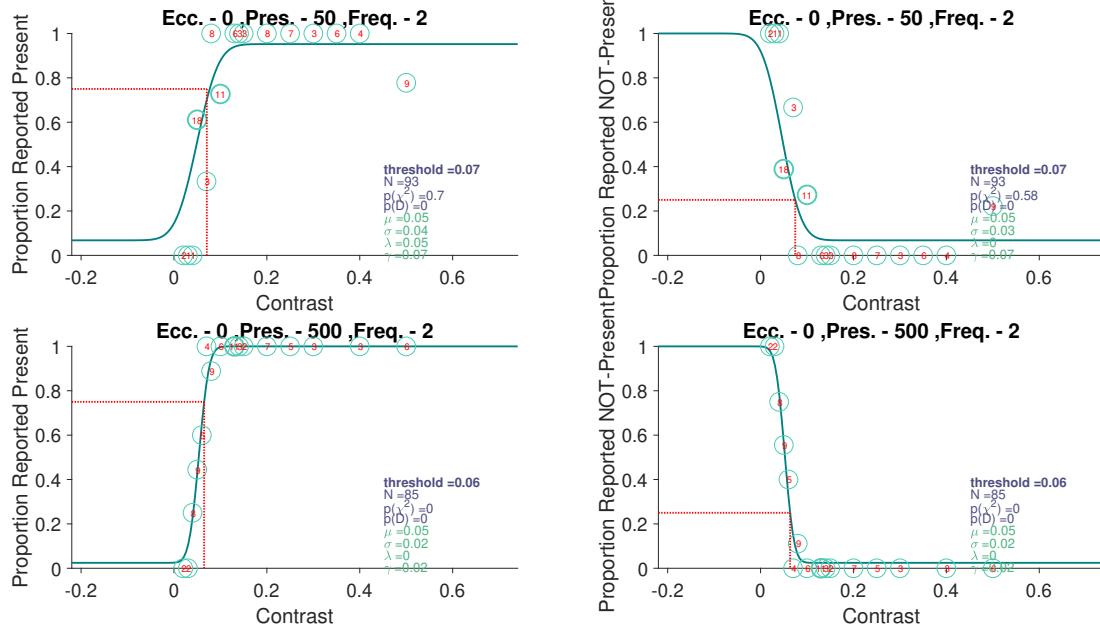
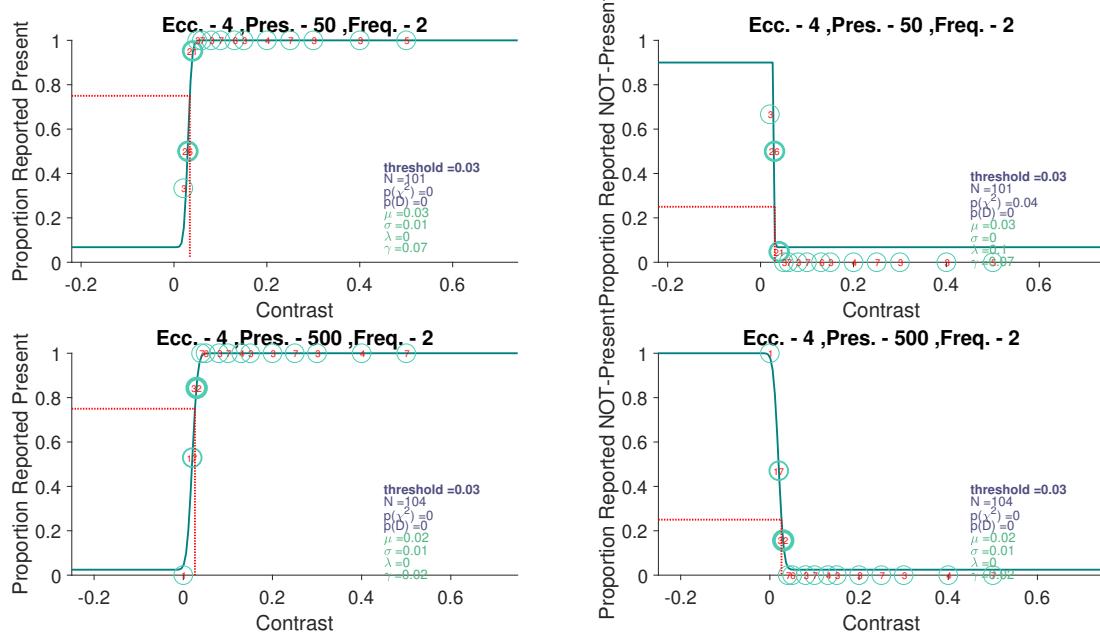
3.8.2.1 SUBJECT:Nikunj The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

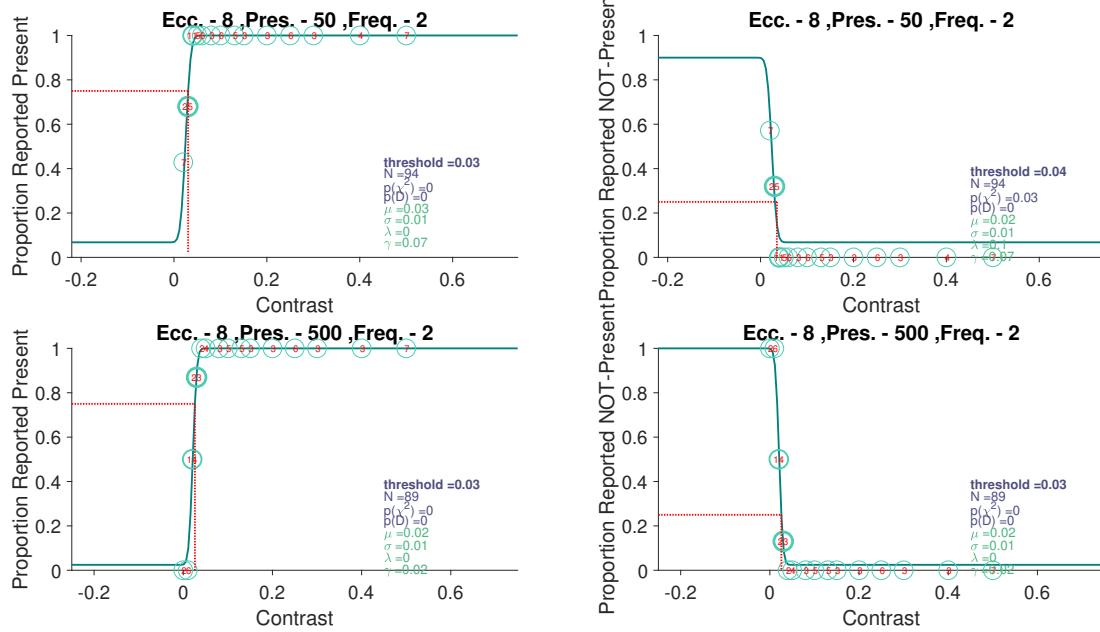
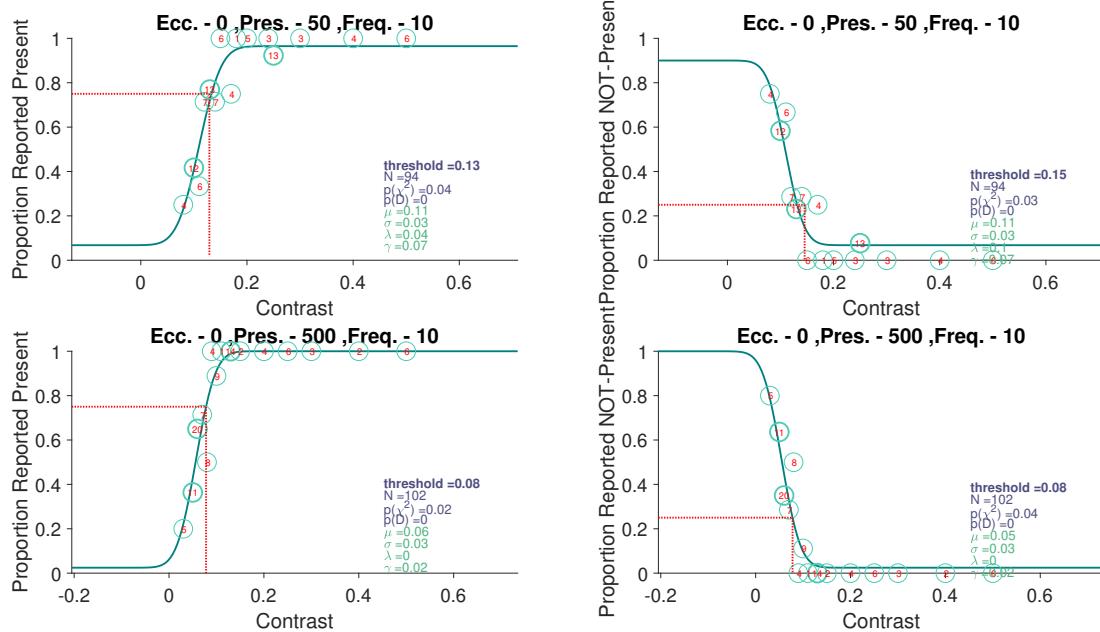
Figure 88: Psychometric curves at **Eccentricity 0**.Figure 89: Psychometric curves at **Eccentricity 4**.

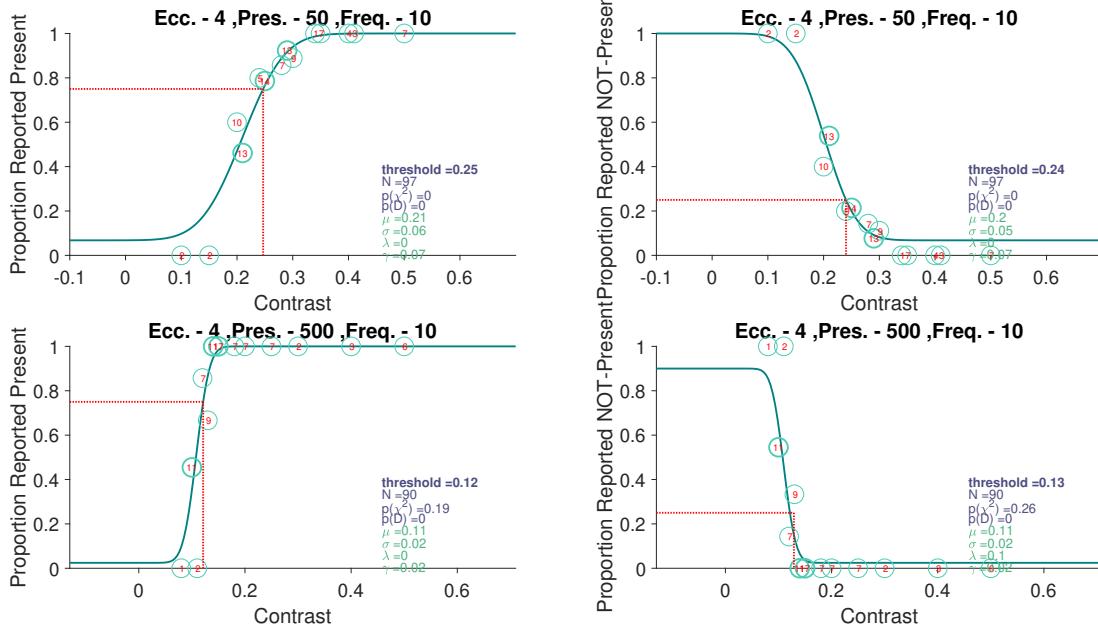
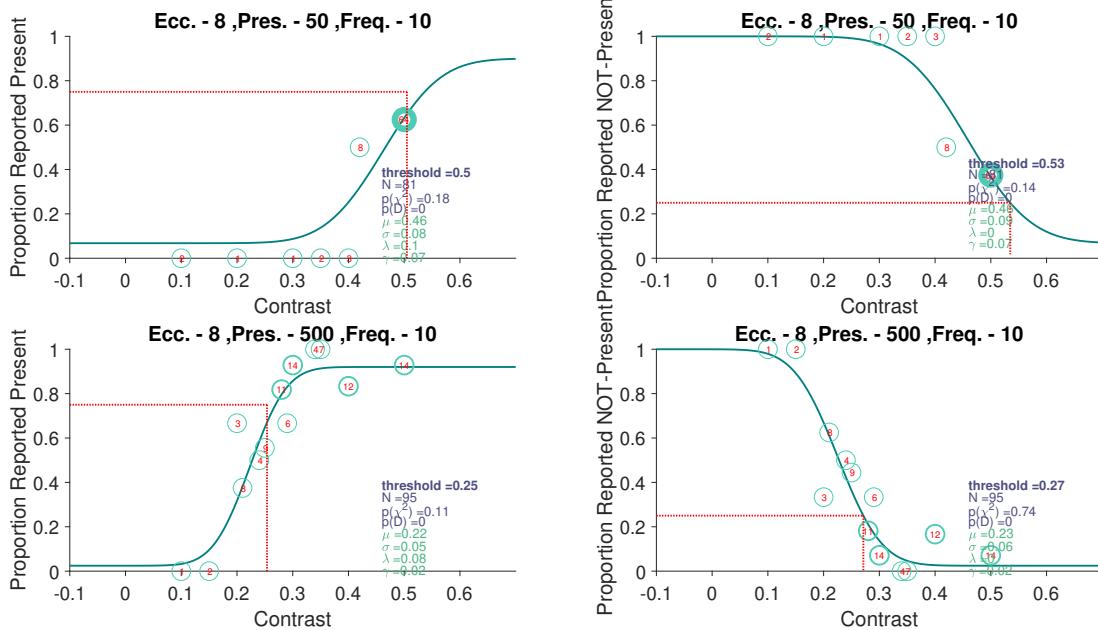
Figure 90: Psychometric curves at **Eccentricity 8**.Figure 91: Psychometric curves at **Eccentricity 0**.

Figure 92: Psychometric curves at **Eccentricity 4**.Figure 93: Psychometric curves at **Eccentricity 8**.

3.8.2.2 SUBJECT:A013 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

Figure 94: Psychometric curves at **Eccentricity 0**.Figure 95: Psychometric curves at **Eccentricity 4**.

Figure 96: Psychometric curves at **Eccentricity 8**.Figure 97: Psychometric curves at **Eccentricity 0**.

Figure 98: Psychometric curves at **Eccentricity 4**.Figure 99: Psychometric curves at **Eccentricity 8**.

3.8.2.3 SUBJECT:A092 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

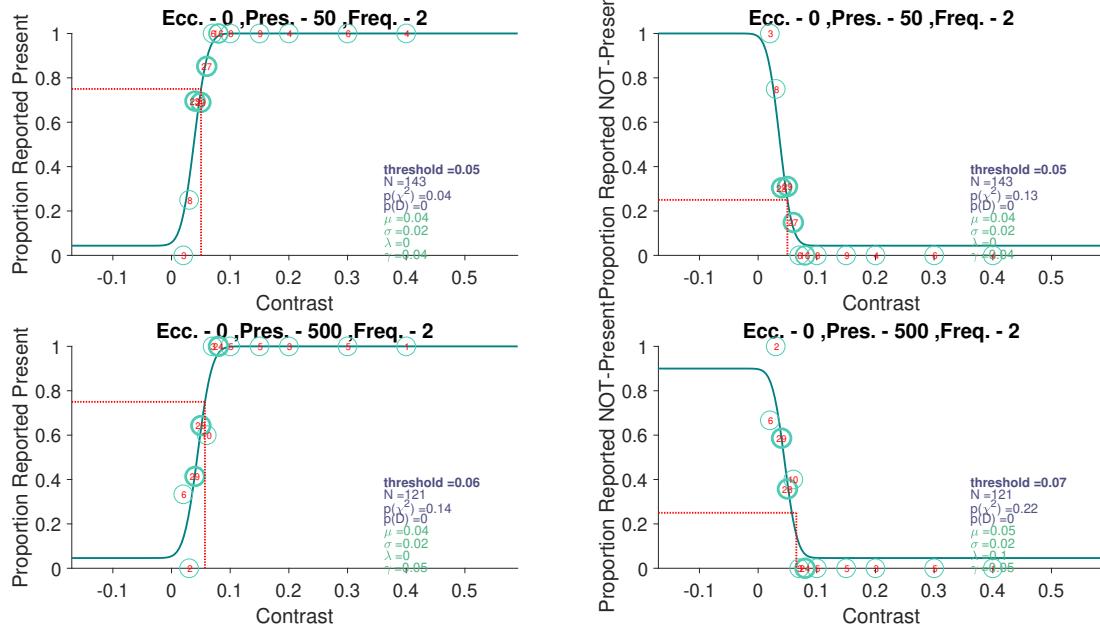


Figure 100: Psychometric curves at Eccentricity 0.

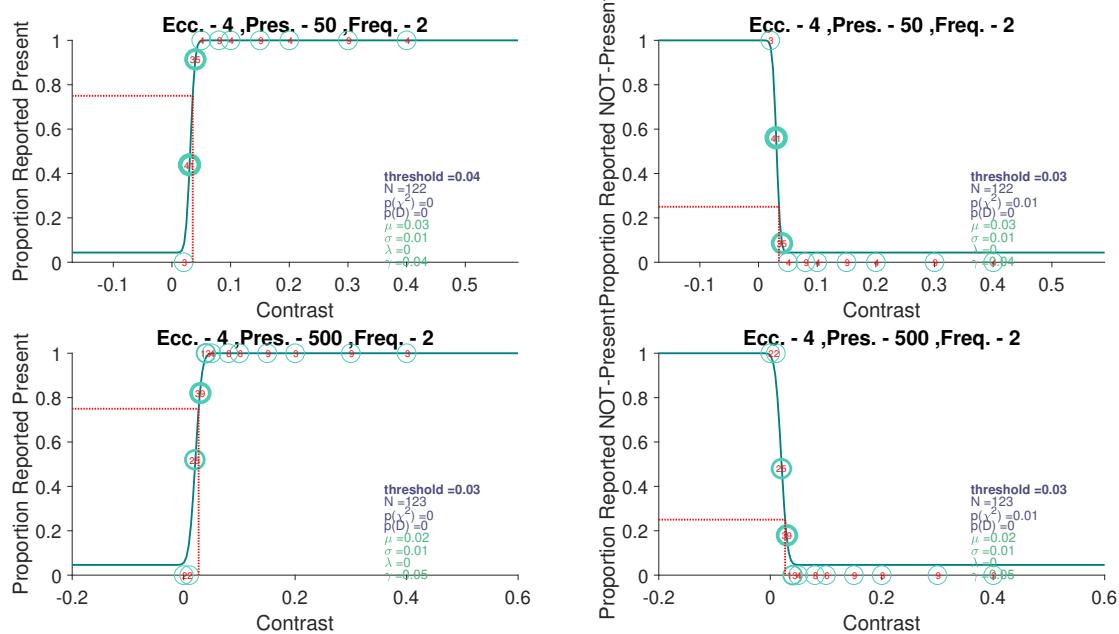


Figure 101: Psychometric curves at Eccentricity 4.

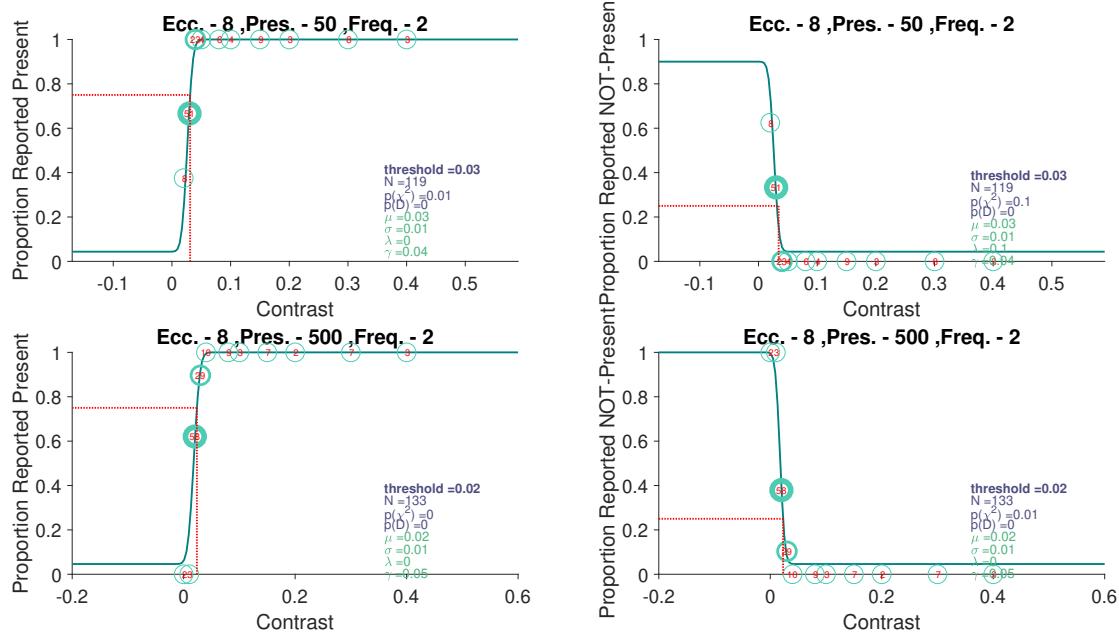


Figure 102: Psychometric curves at Eccentricity 8.

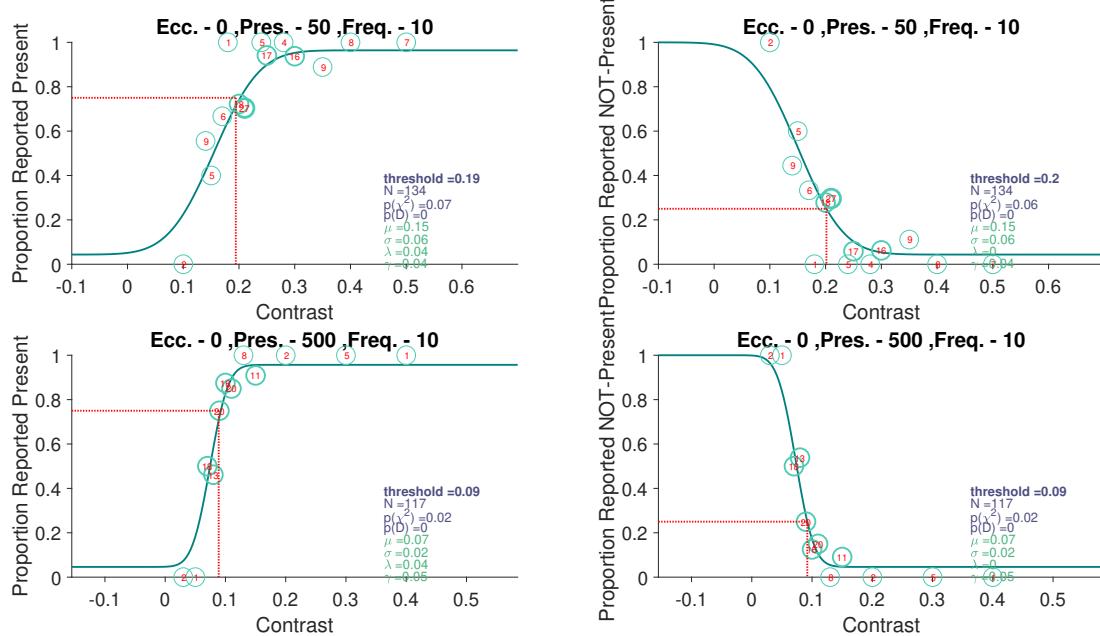


Figure 103: Psychometric curves at Eccentricity 0.

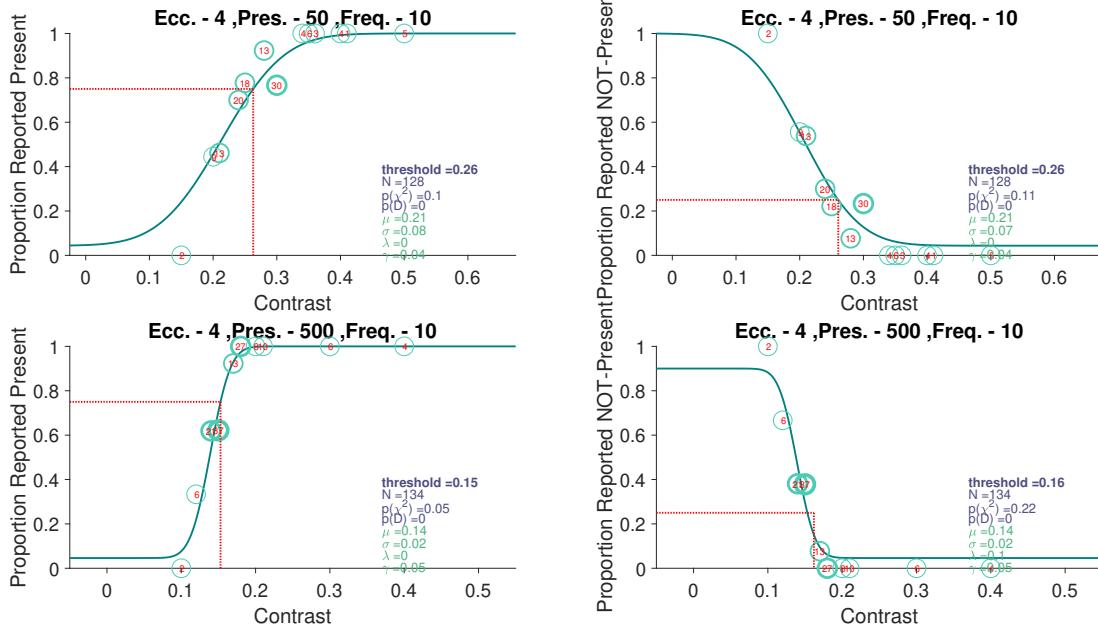


Figure 104: Psychometric curves at Eccentricity 4.

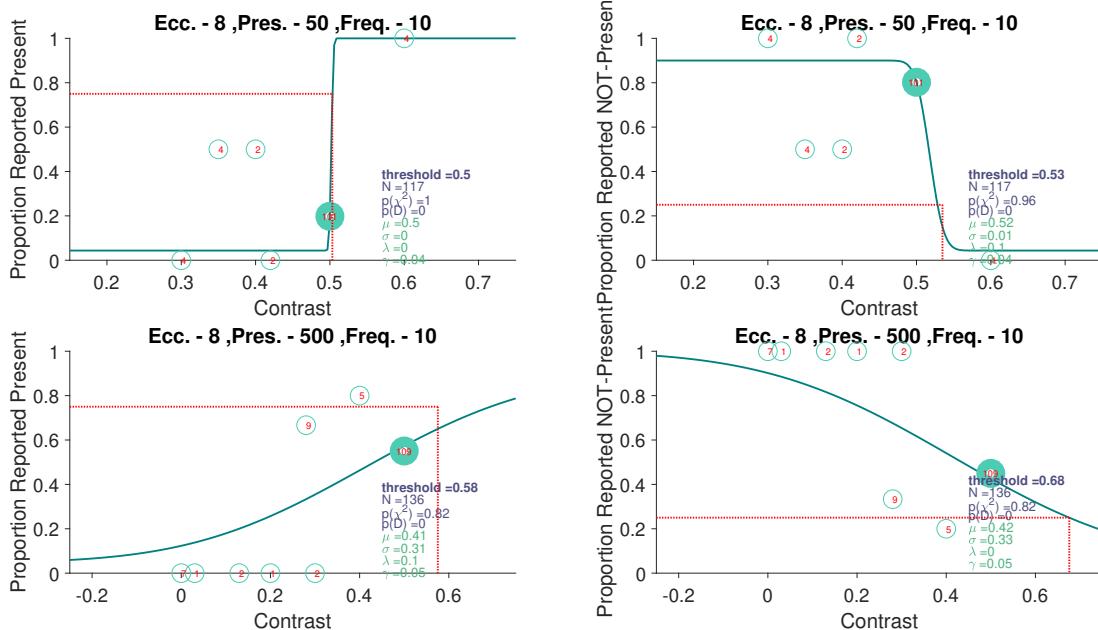


Figure 105: Psychometric curves at Eccentricity 8.

3.8.2.4 SUBJECT:A036 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

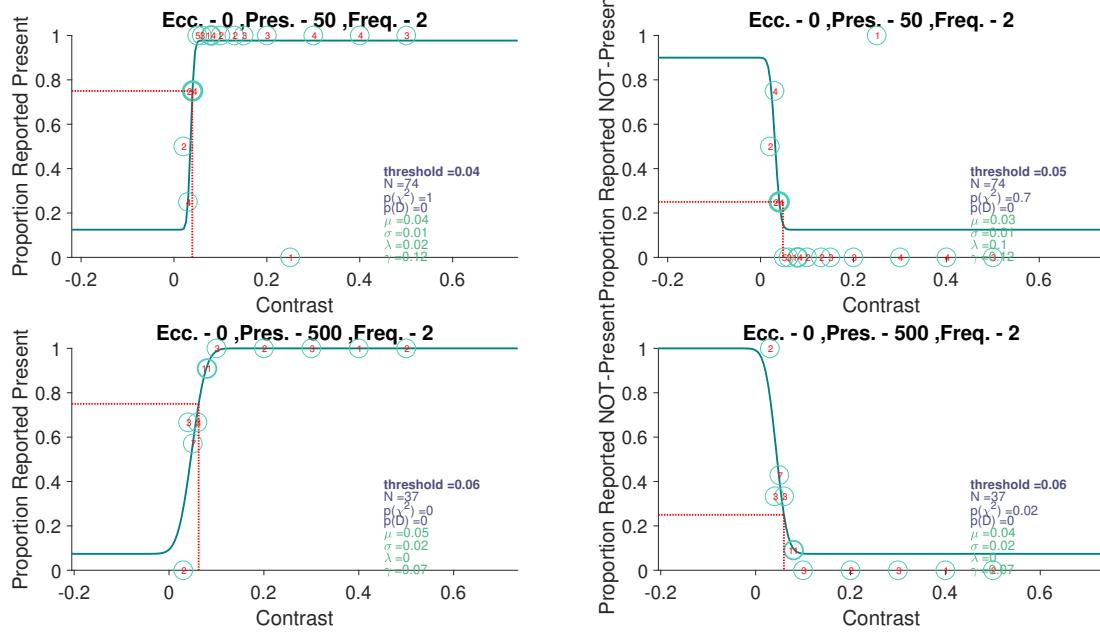


Figure 106: Psychometric curves at Eccentricity 0.

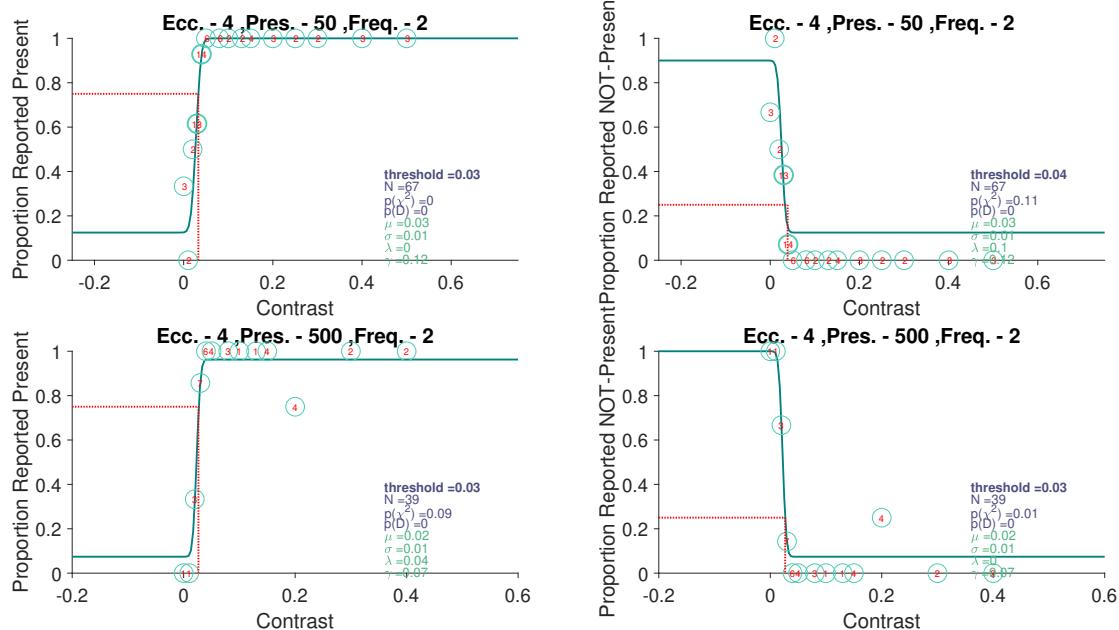


Figure 107: Psychometric curves at Eccentricity 4.

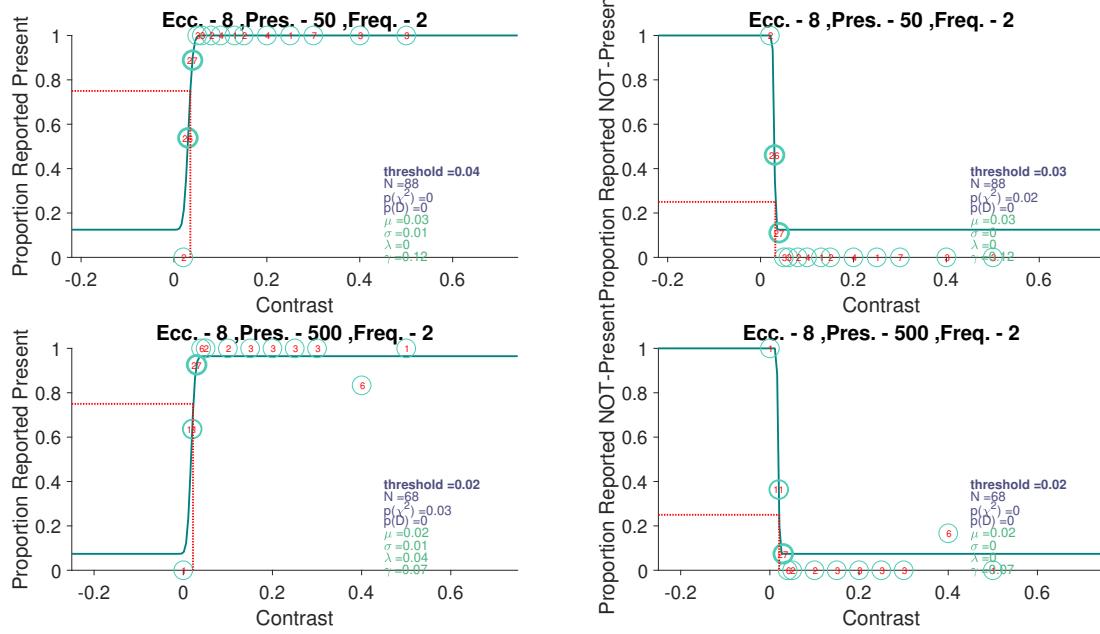


Figure 108: Psychometric curves at Eccentricity 8.

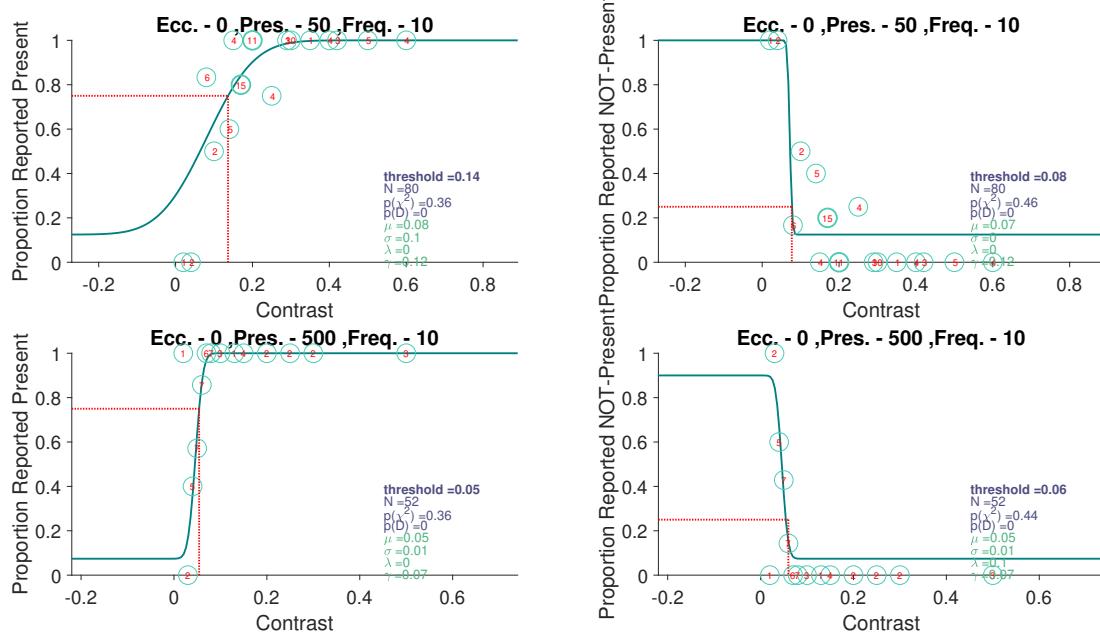


Figure 109: Psychometric curves at Eccentricity 0.

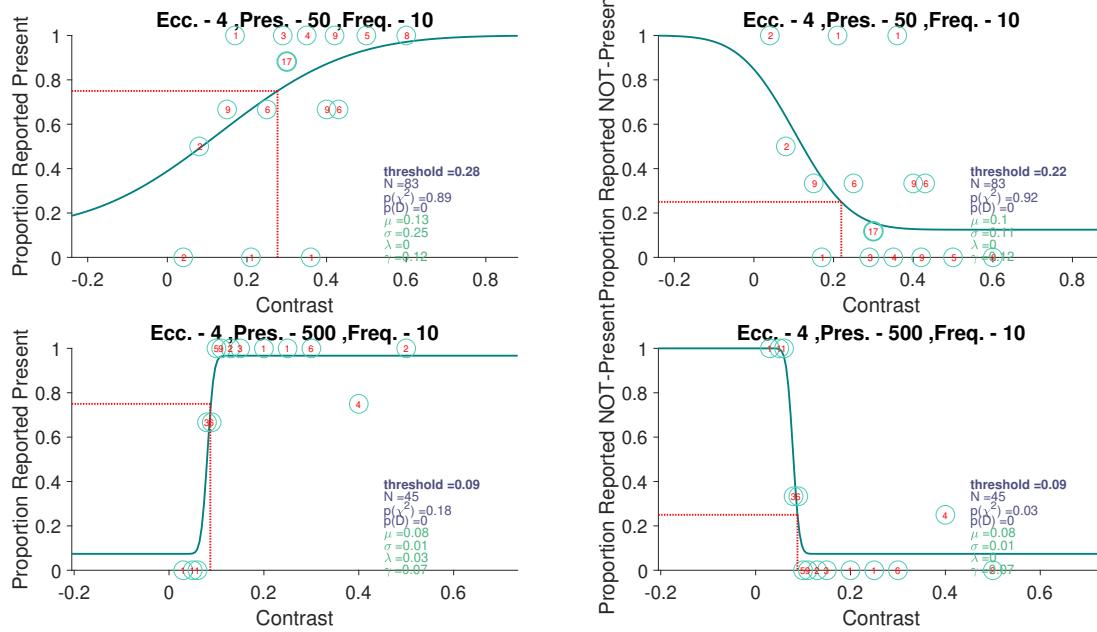


Figure 110: Psychometric curves at Eccentricity 4.

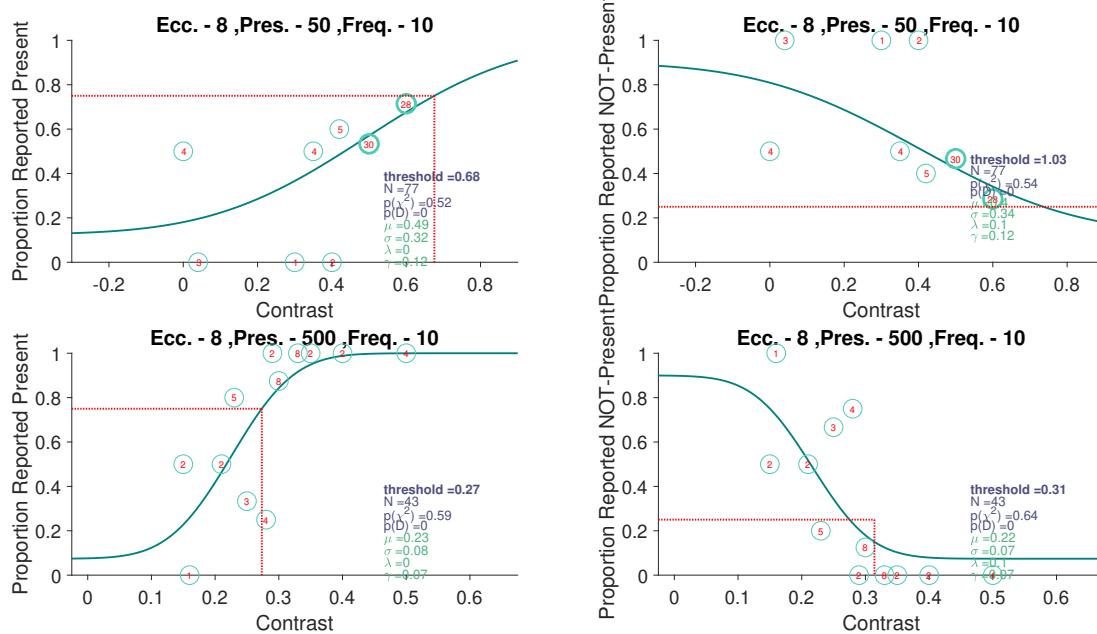


Figure 111: Psychometric curves at Eccentricity 8.

3.8.3 Original

3.8.3.1 SUBJECT:Nikunj The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

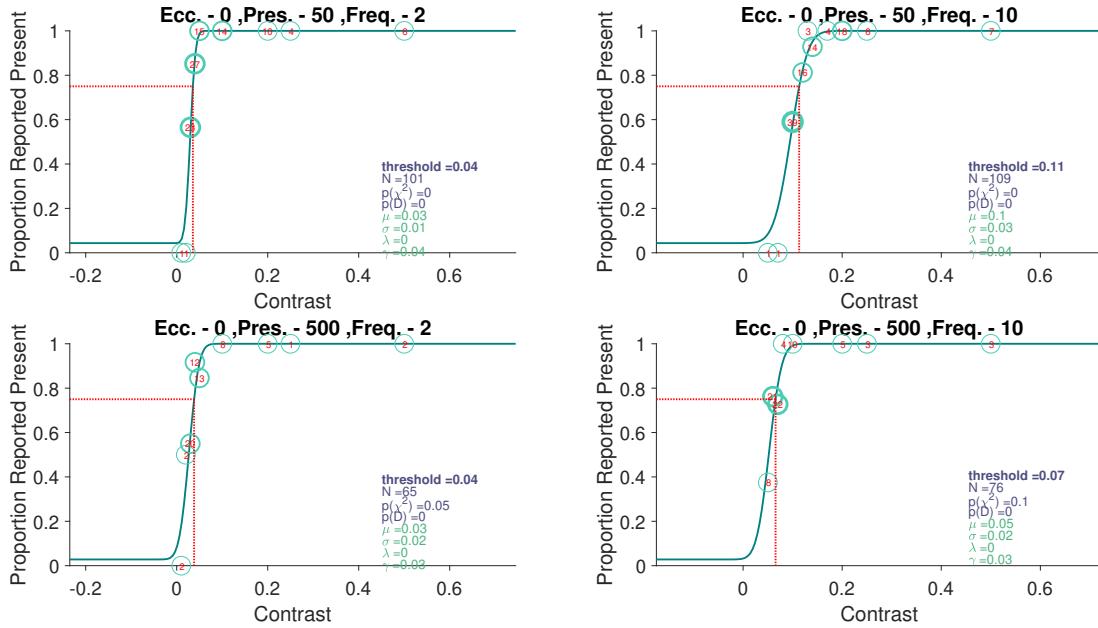


Figure 112: Psychometric curve at **Eccentricity 0** with **binned contrast** (rounded to 2 decimals).

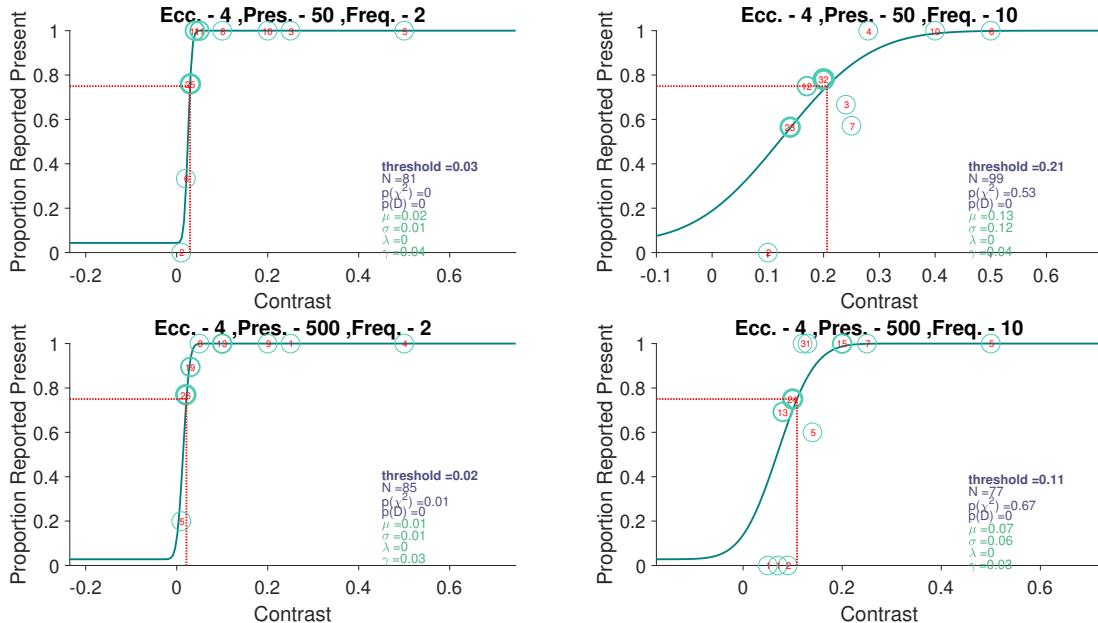


Figure 113: Psychometric curve at **Eccentricity 4** with **binned contrast** (rounded to 2 decimals).

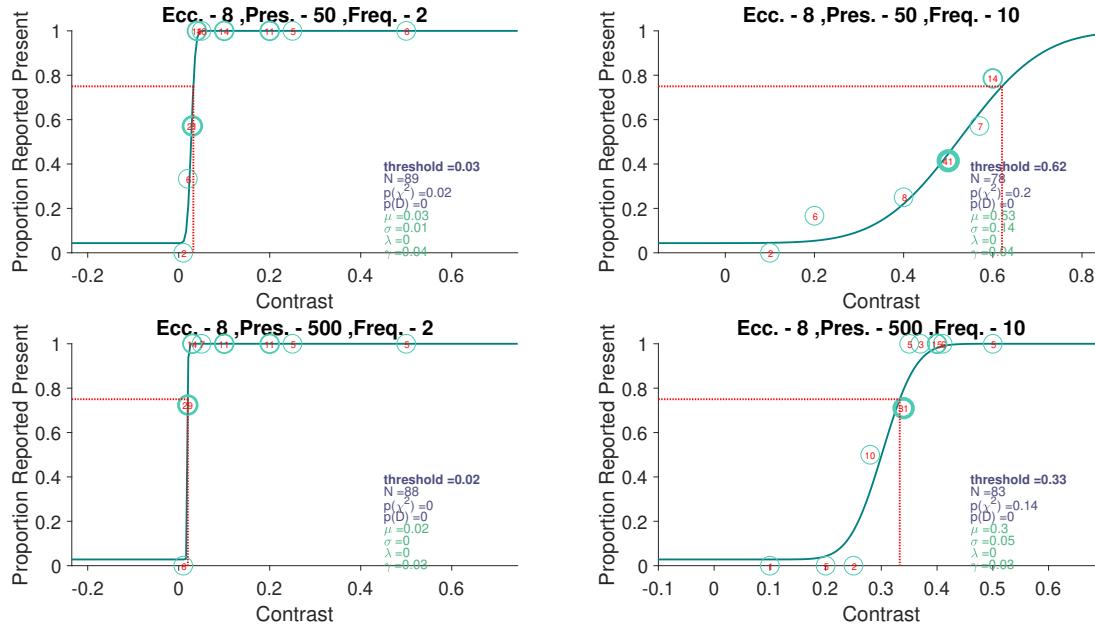


Figure 114: Psychometric curve at **Eccentricity 8** with binned contrast (rounded to 2 decimals).

3.8.3.2 SUBJECT:A013 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

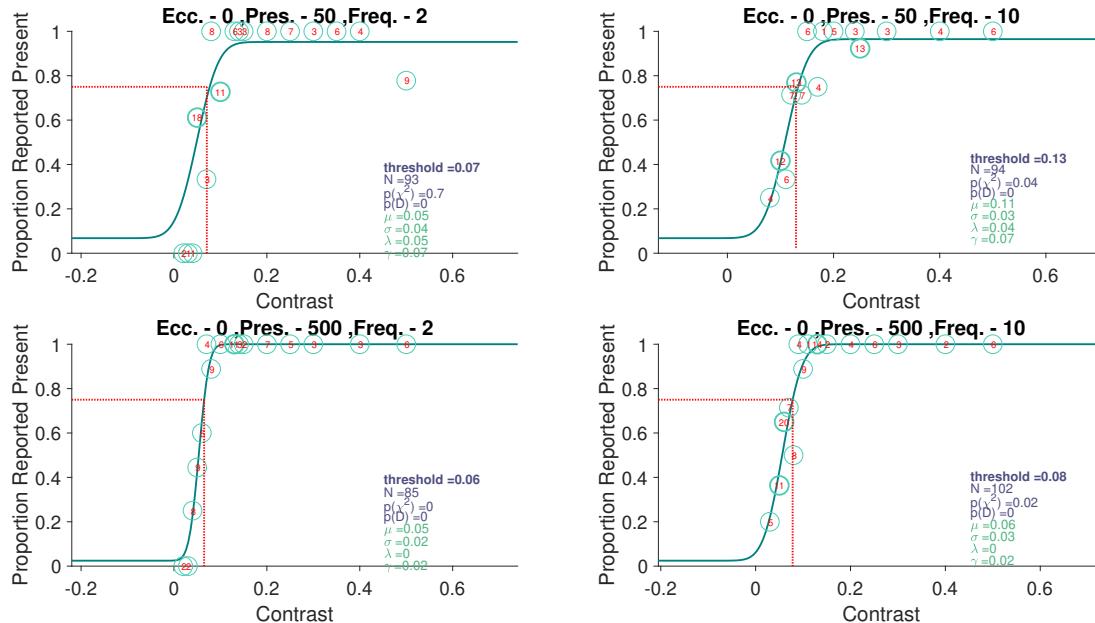


Figure 115: Psychometric curve at **Eccentricity 0** with binned contrast (rounded to 2 decimals).

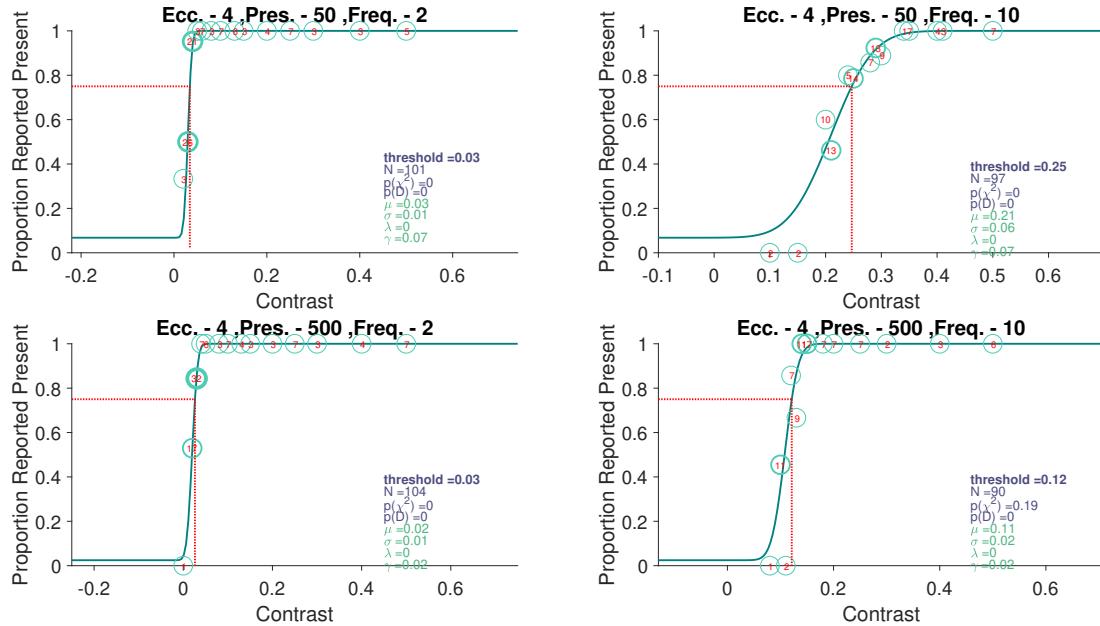


Figure 116: Psychometric curve at **Eccentricity 4** with binned contrast (rounded to 2 decimals).

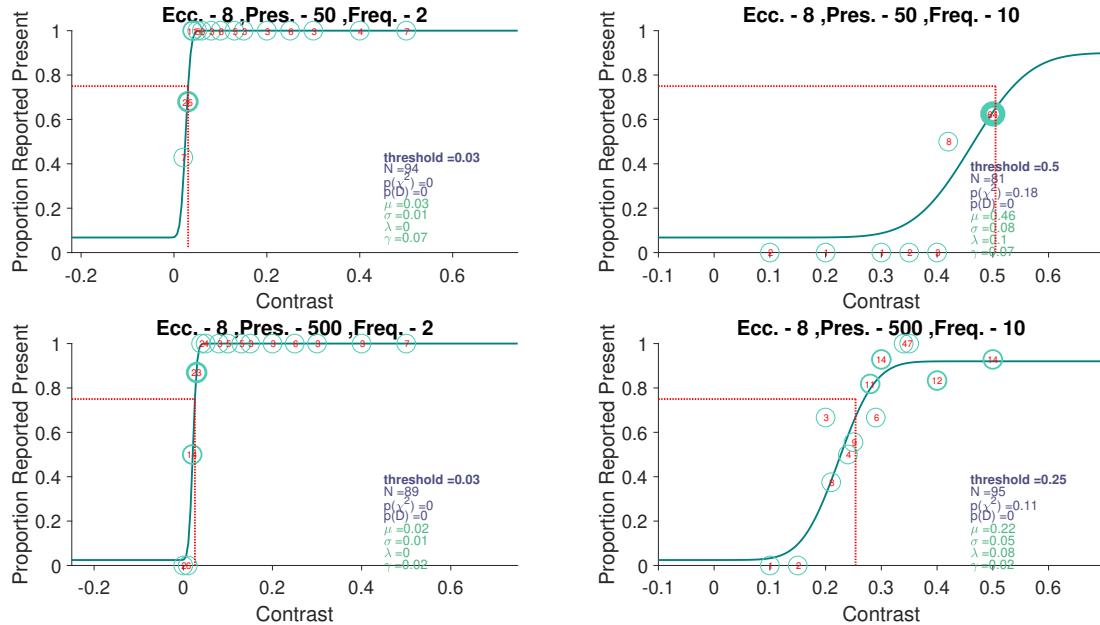


Figure 117: Psychometric curve at **Eccentricity 8** with binned contrast (rounded to 2 decimals).

3.8.3.3 SUBJECT:A092 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

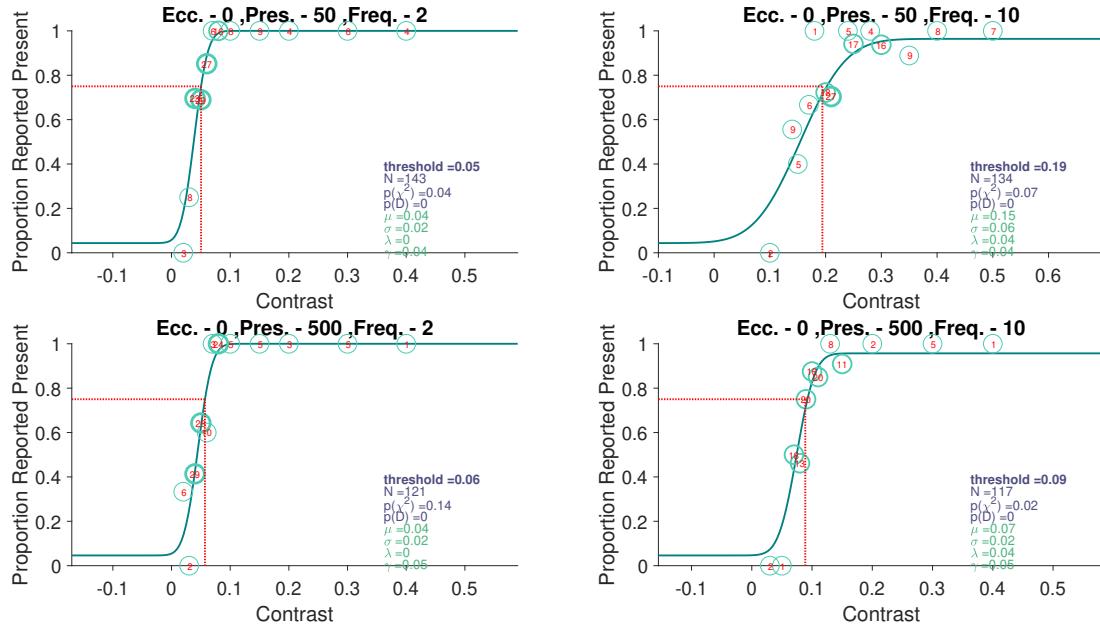


Figure 118: Psychometric curve at **Eccentricity 0** with **binned contrast** (rounded to 2 decimals).

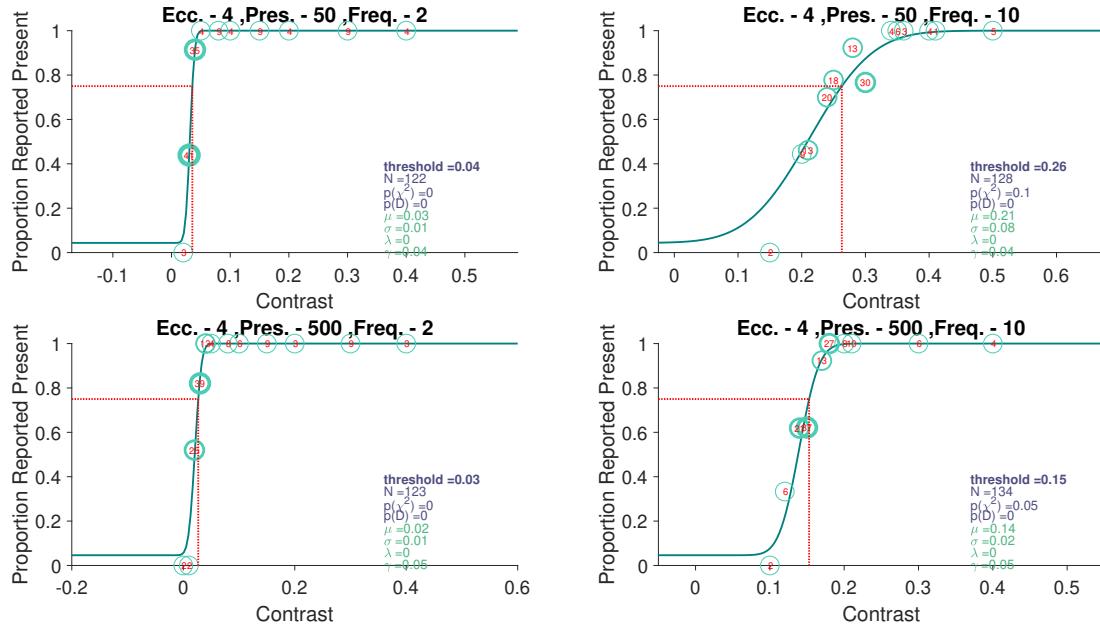


Figure 119: Psychometric curve at **Eccentricity 4** with **binned contrast** (rounded to 2 decimals).

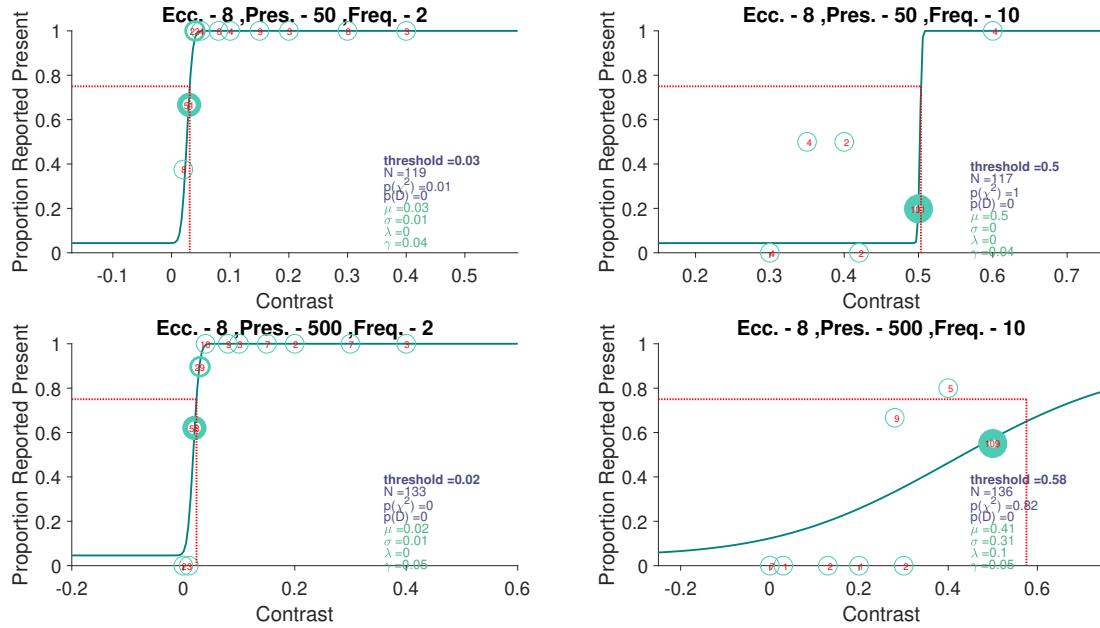


Figure 120: Psychometric curve at **Eccentricity 8** with binned contrast (rounded to 2 decimals).

3.8.3.4 SUBJECT:A036 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

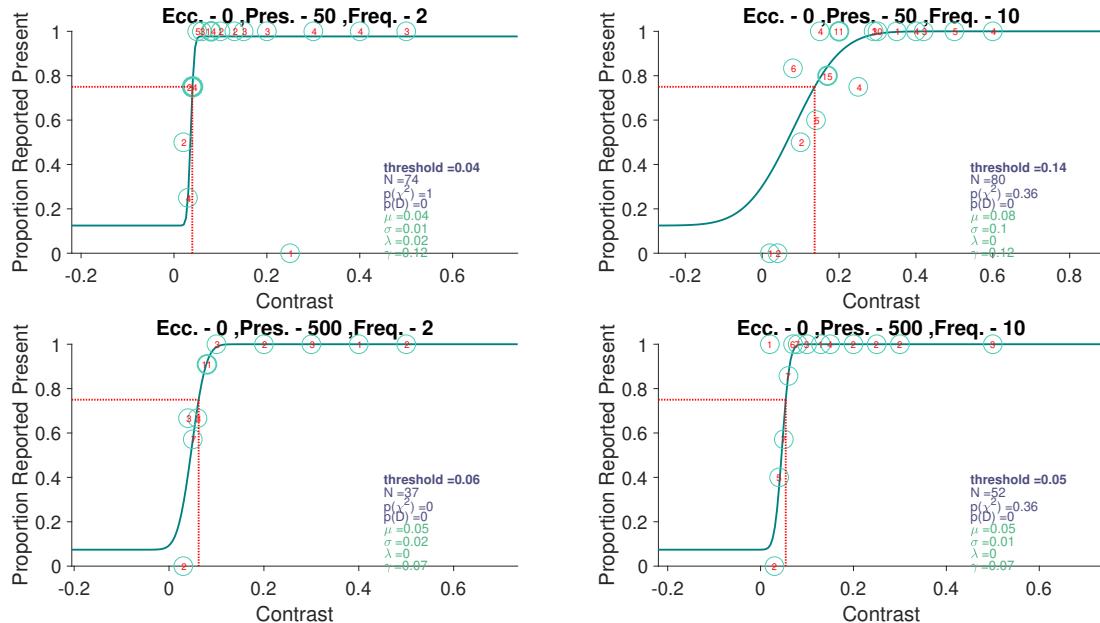


Figure 121: Psychometric curve at **Eccentricity 0** with binned contrast (rounded to 2 decimals).

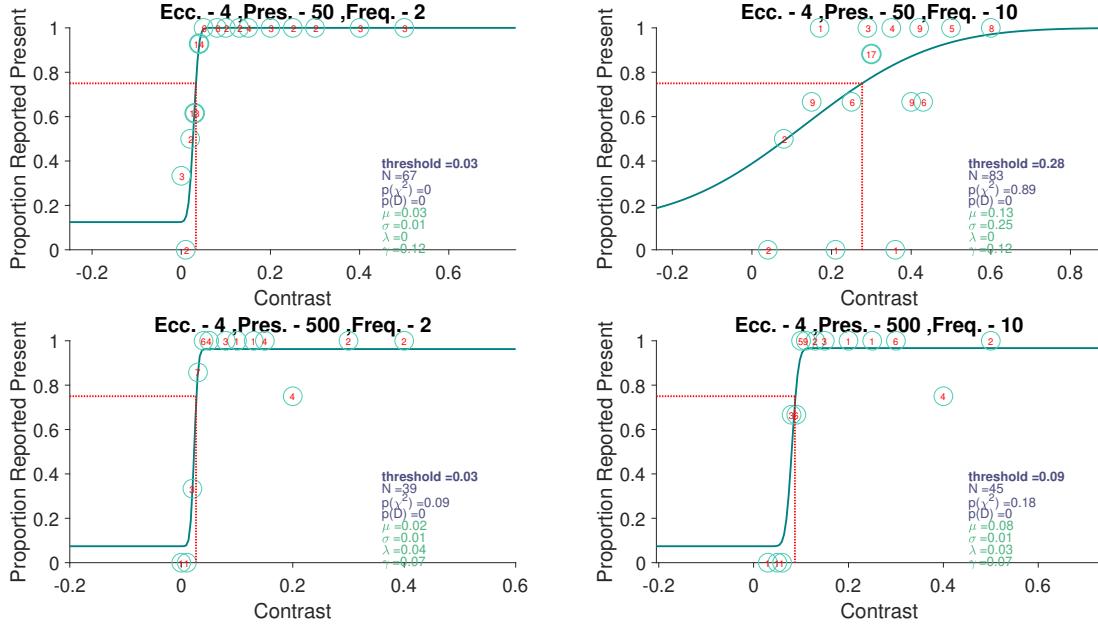


Figure 122: Psychometric curve at **Eccentricity 4** with binned contrast (rounded to 2 decimals).

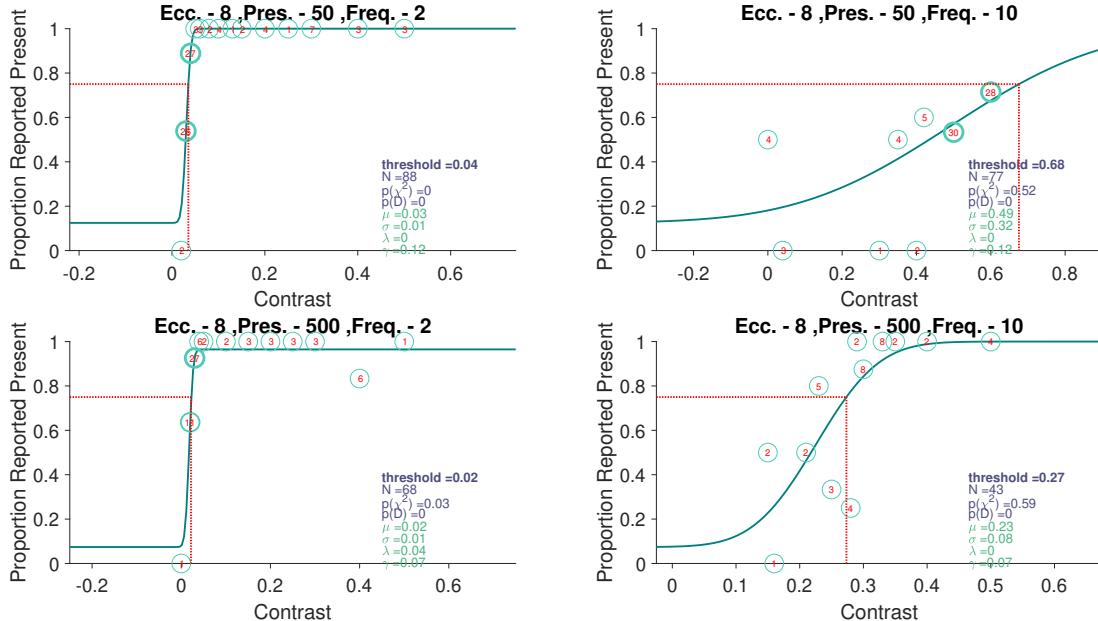


Figure 123: Psychometric curve at **Eccentricity 8** with binned contrast (rounded to 2 decimals).

3.8.4 Flipped

3.8.4.1 SUBJECT:Nikunj The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

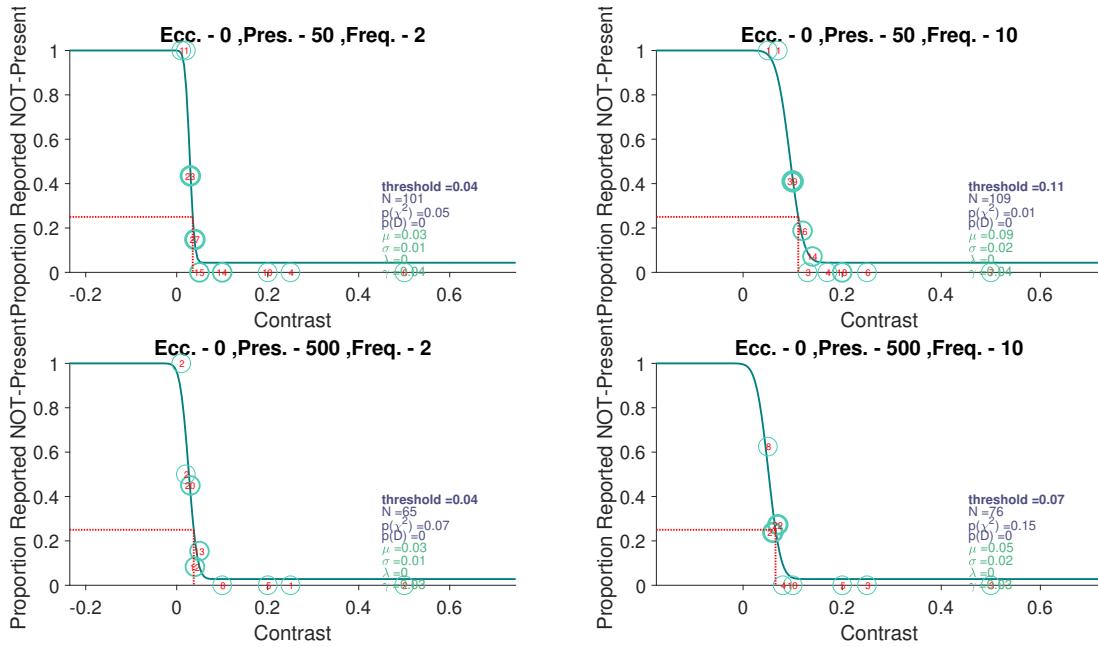


Figure 124: Psychometric curve at **Eccentricity 0** with binned contrast (rounded to 2 decimals).

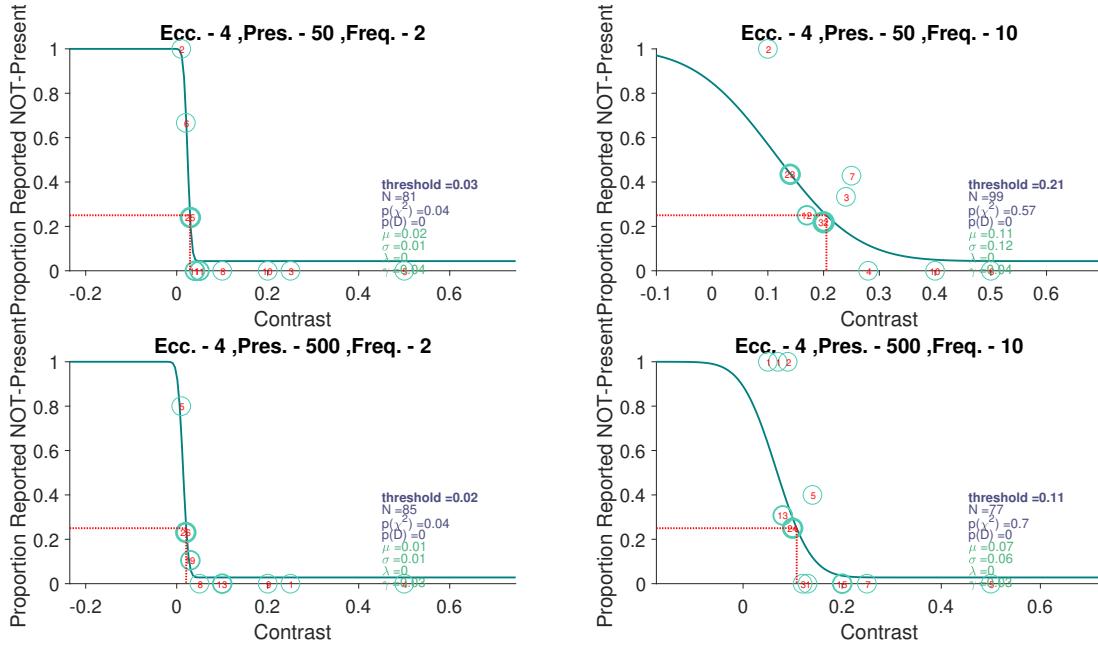


Figure 125: Psychometric curve at **Eccentricity 4** with binned contrast (rounded to 2 decimals).

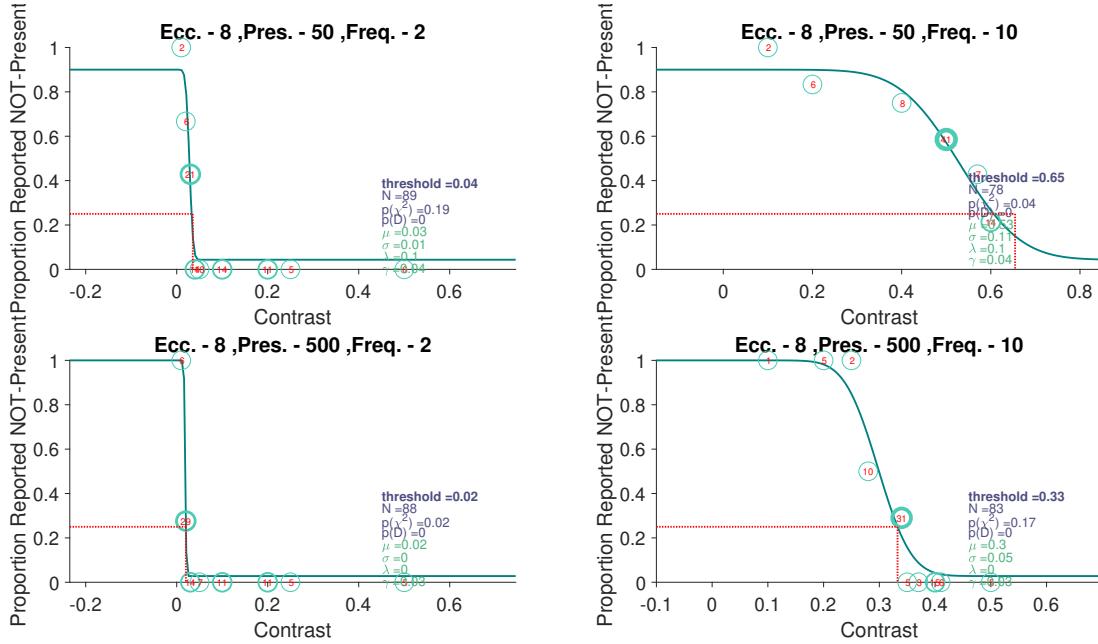


Figure 126: Psychometric curve at **Eccentricity 8** with binned contrast (rounded to 2 decimals).

3.8.4.2 SUBJECT:A013 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

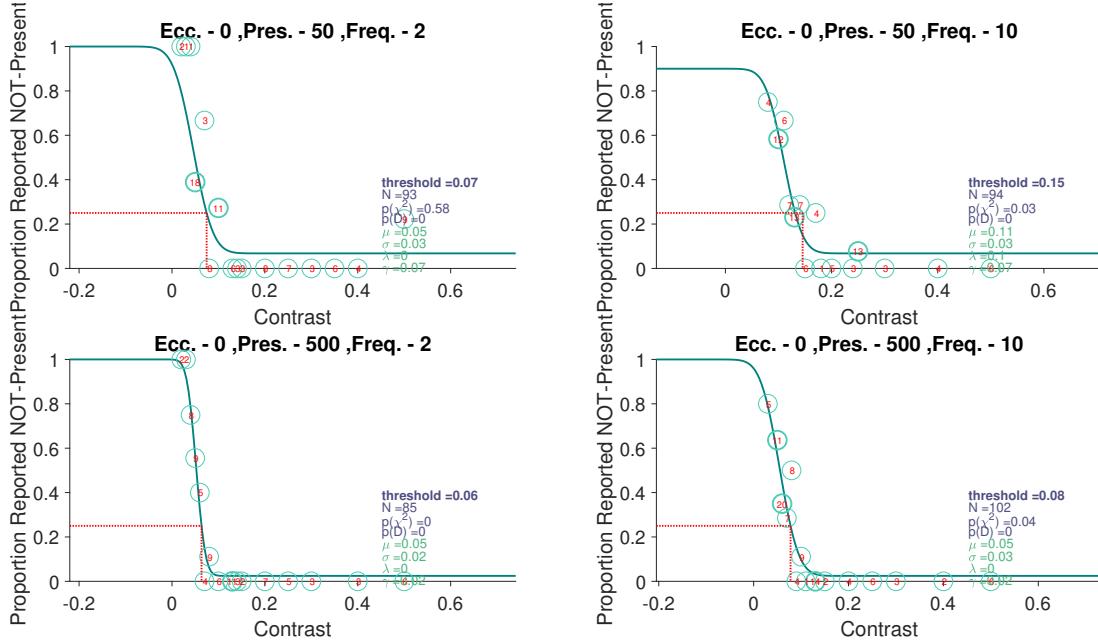


Figure 127: Psychometric curve at **Eccentricity 0** with binned contrast (rounded to 2 decimals).

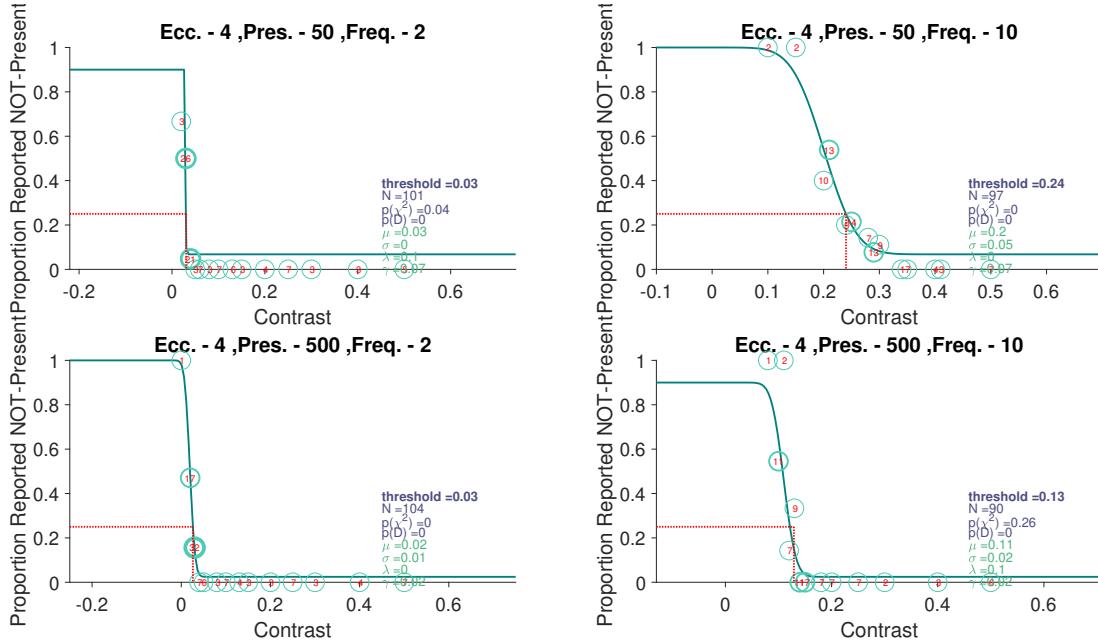


Figure 128: Psychometric curve at **Eccentricity 4** with binned contrast (rounded to 2 decimals).

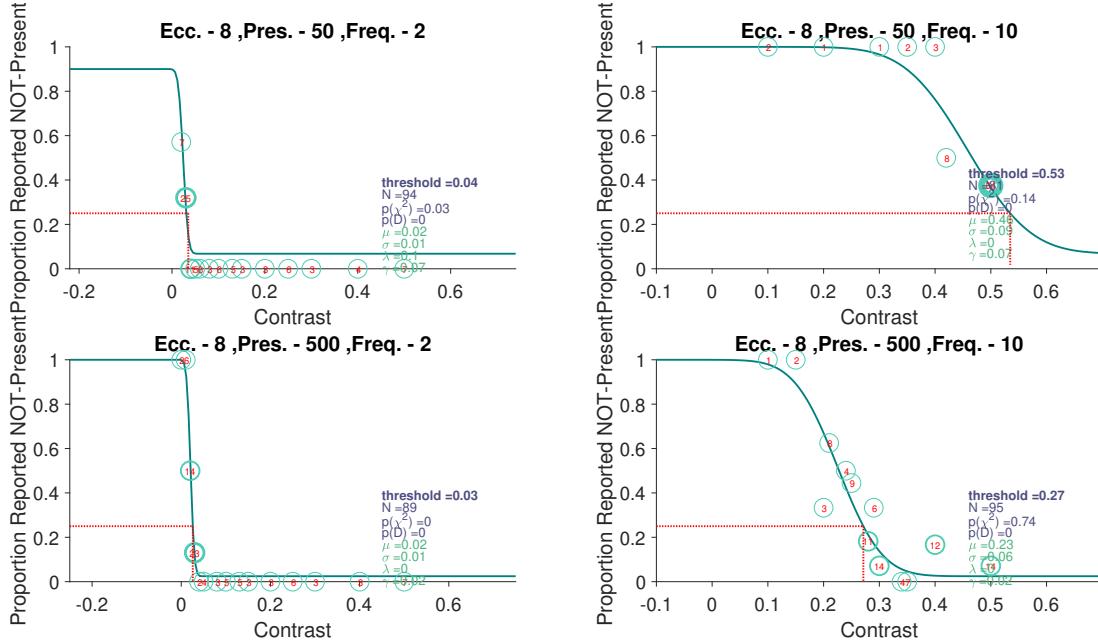


Figure 129: Psychometric curve at **Eccentricity 8** with binned contrast (rounded to 2 decimals).

3.8.4.3 SUBJECT:A092 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

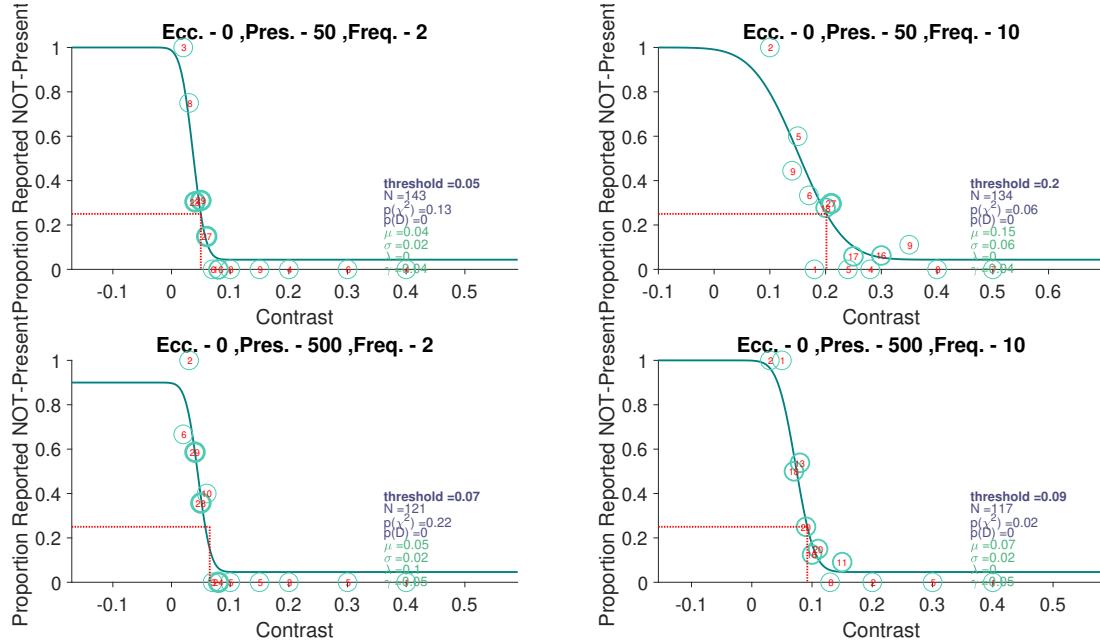


Figure 130: Psychometric curve at **Eccentricity 0** with binned contrast (rounded to 2 decimals).

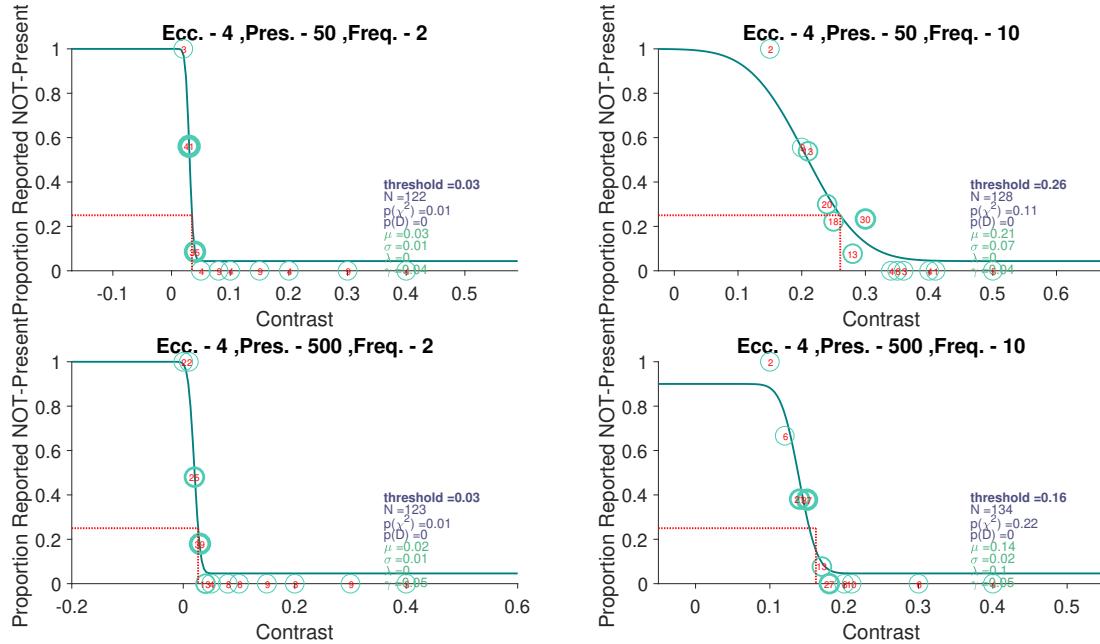


Figure 131: Psychometric curve at **Eccentricity 4** with binned contrast (rounded to 2 decimals).

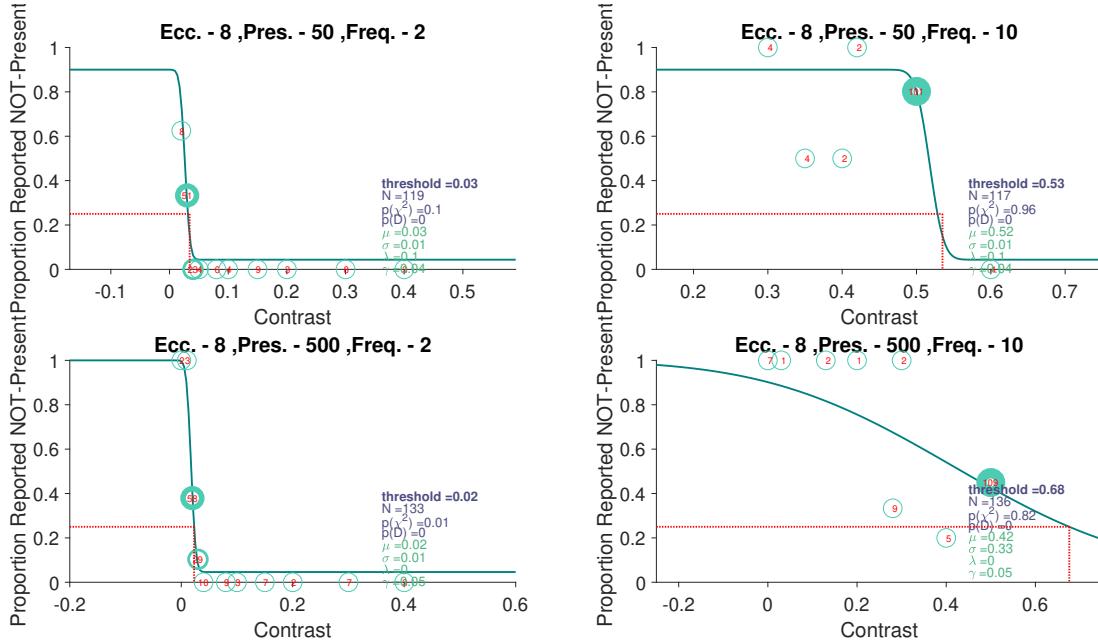


Figure 132: Psychometric curve at **Eccentricity 8** with binned contrast (rounded to 2 decimals).

3.8.4.4 SUBJECT:A036 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

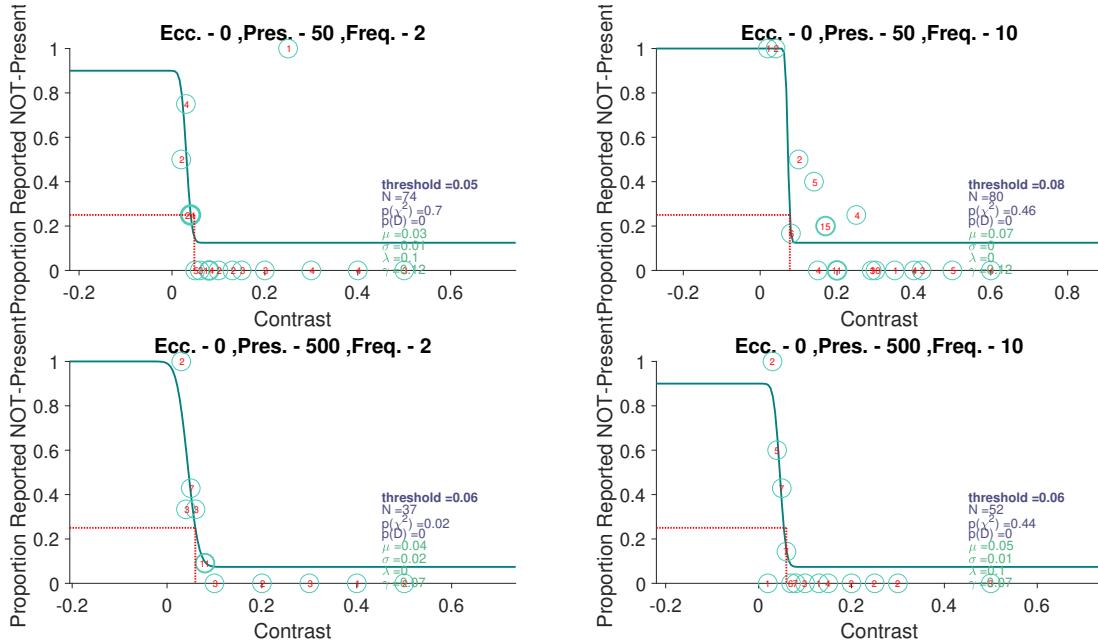


Figure 133: Psychometric curve at **Eccentricity 0** with binned contrast (rounded to 2 decimals).

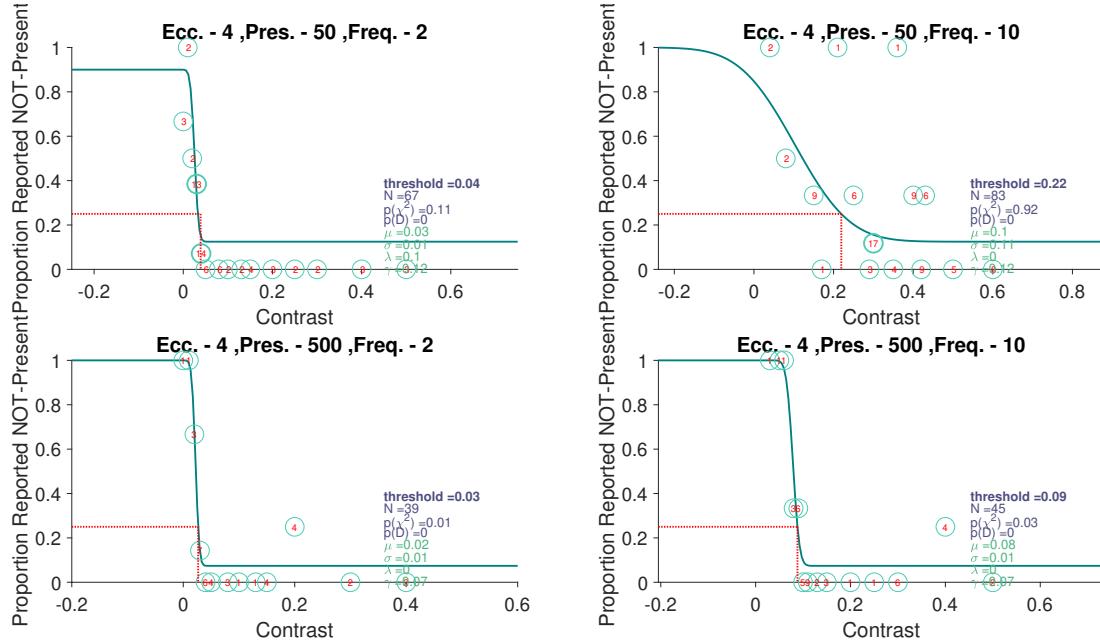


Figure 134: Psychometric curve at Eccentricity 4 with binned contrast (rounded to 2 decimals).

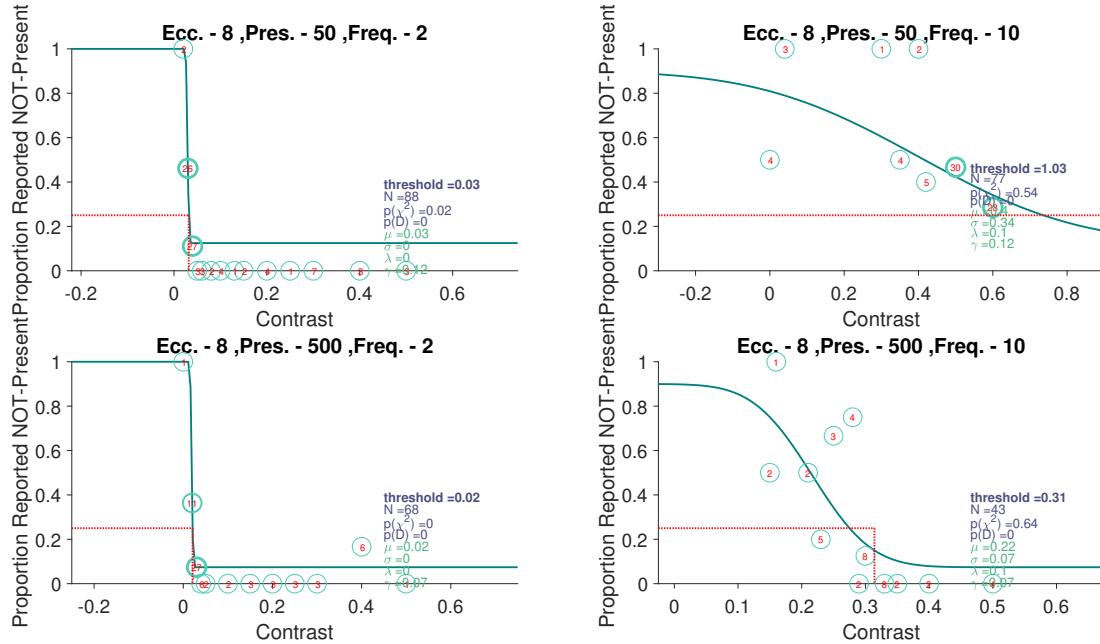


Figure 135: Psychometric curve at Eccentricity 8 with binned contrast (rounded to 2 decimals).

3.9 Psychometric analysis 50 percent thresh

3.9.1 Comparison by Eccentricity

3.9.1.1 SUBJECT:Nikunj The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

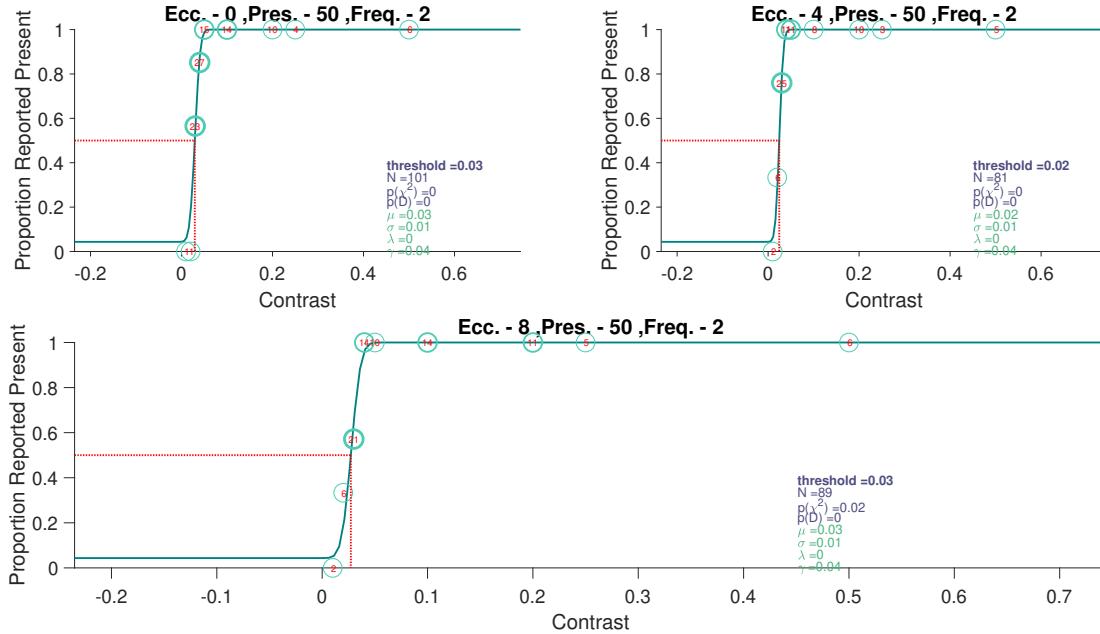


Figure 136: Psychometric curves at different eccentricities.

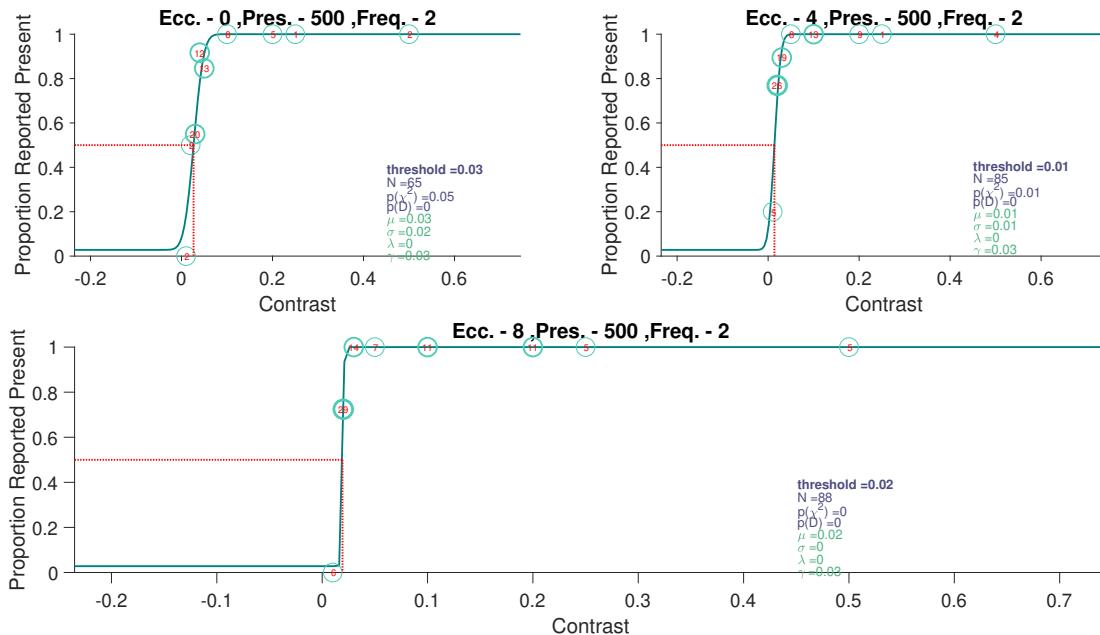


Figure 137: Psychometric curves at different eccentricities.

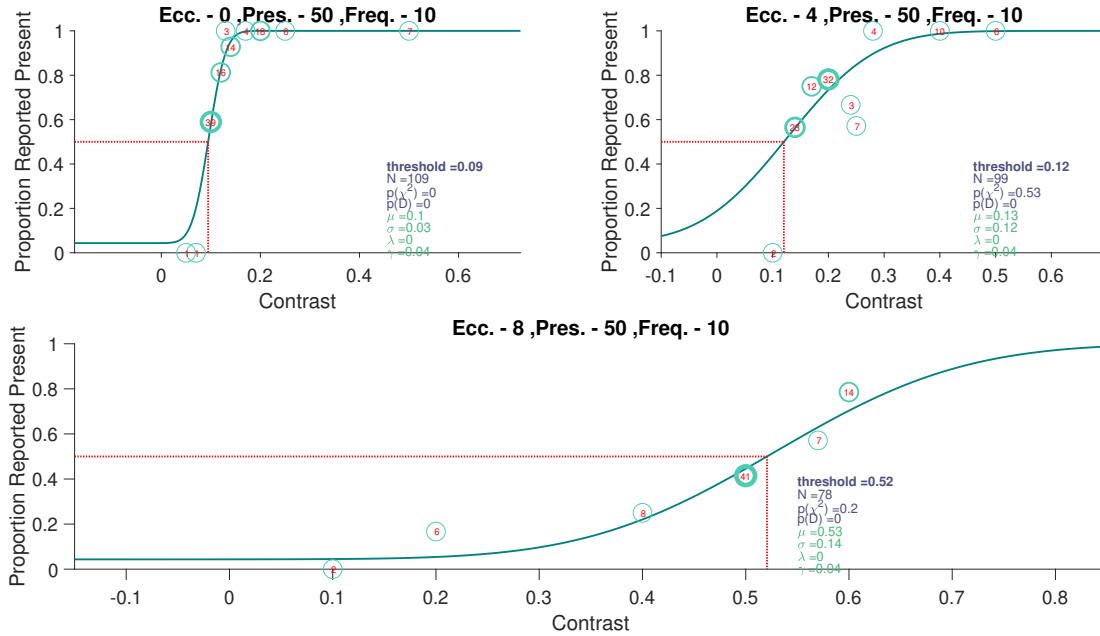


Figure 138: Psychometric curves at different eccentricities.

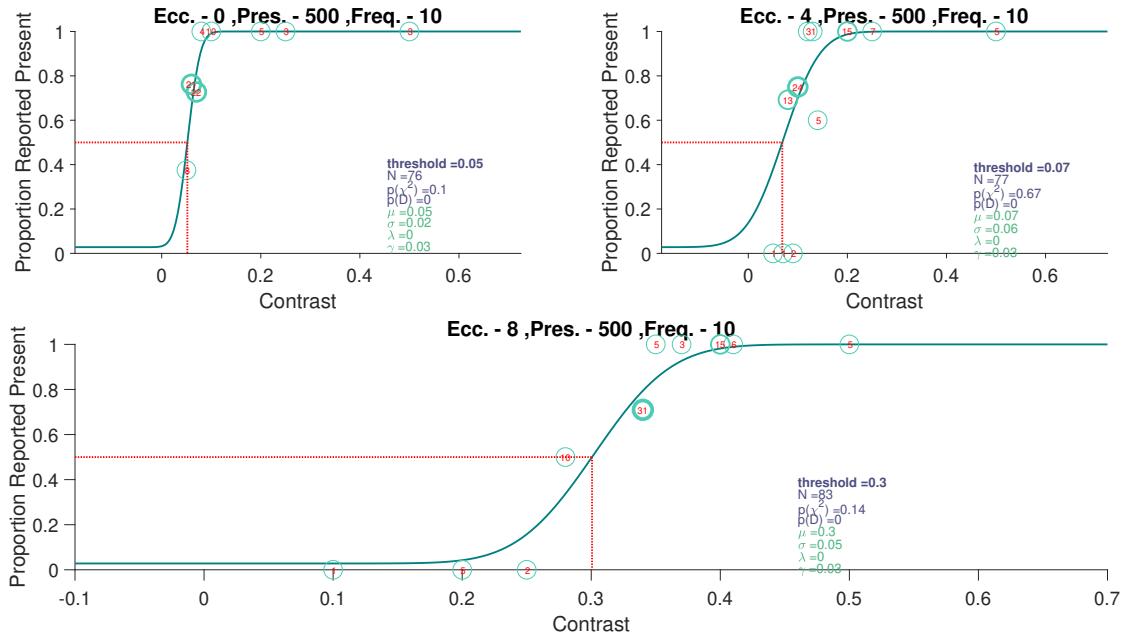


Figure 139: Psychometric curves at different eccentricities.

3.9.1.2 SUBJECT:A013 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

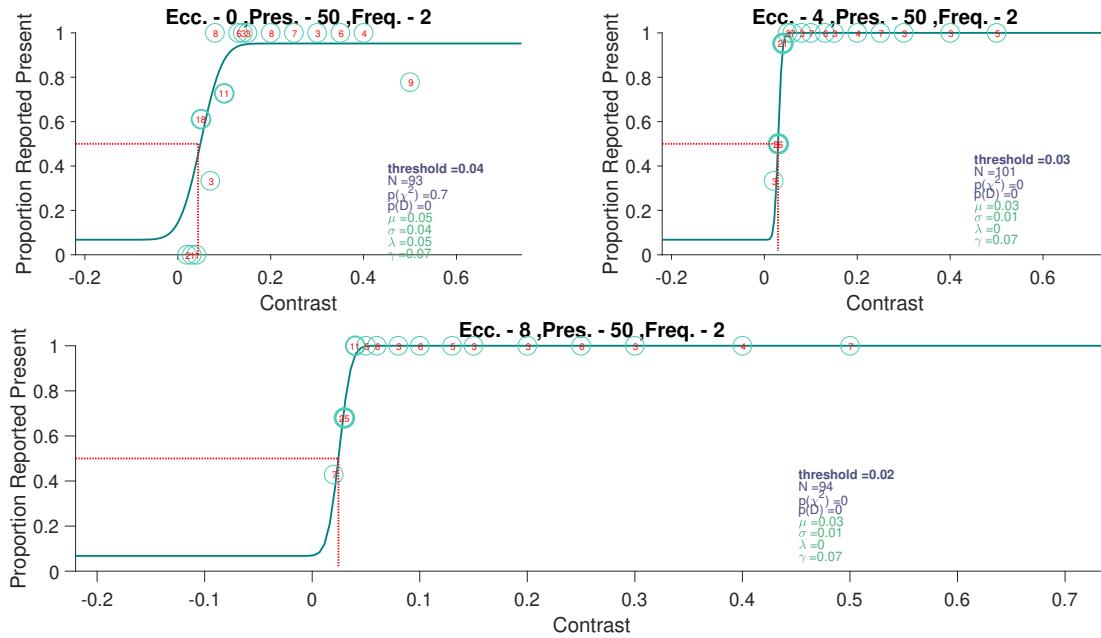


Figure 140: Psychometric curves at different eccentricities.

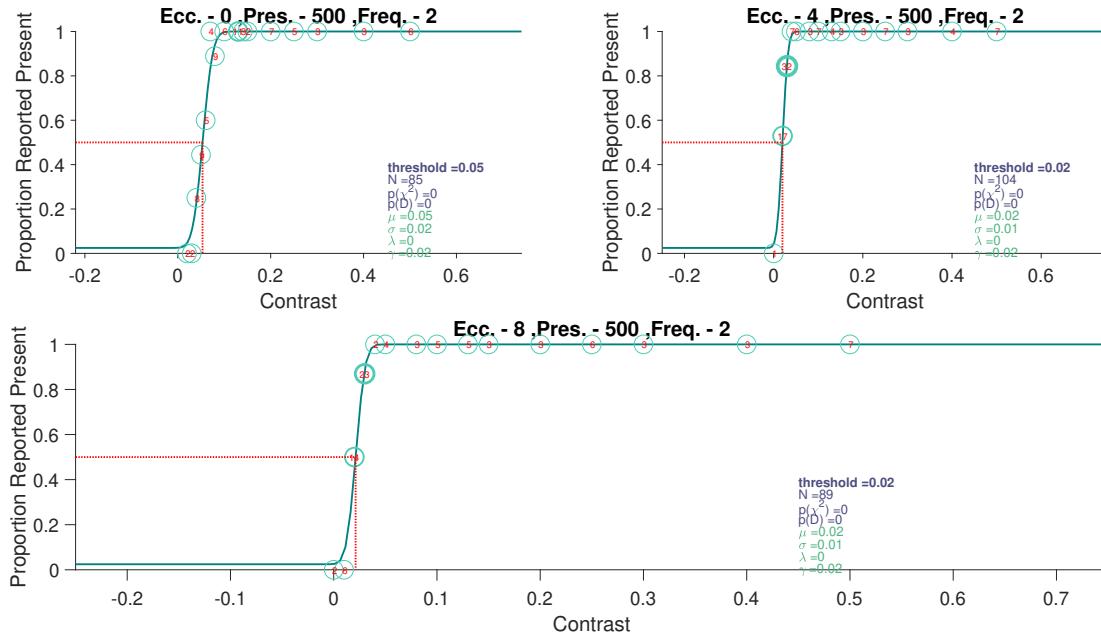


Figure 141: Psychometric curves at different eccentricities.

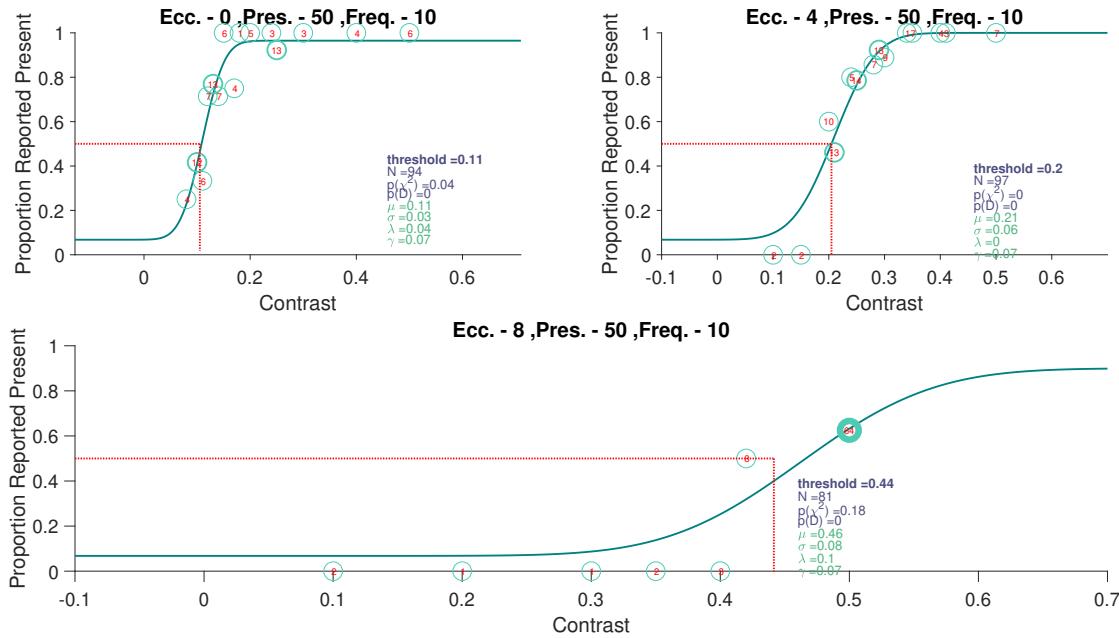


Figure 142: Psychometric curves at different eccentricities.

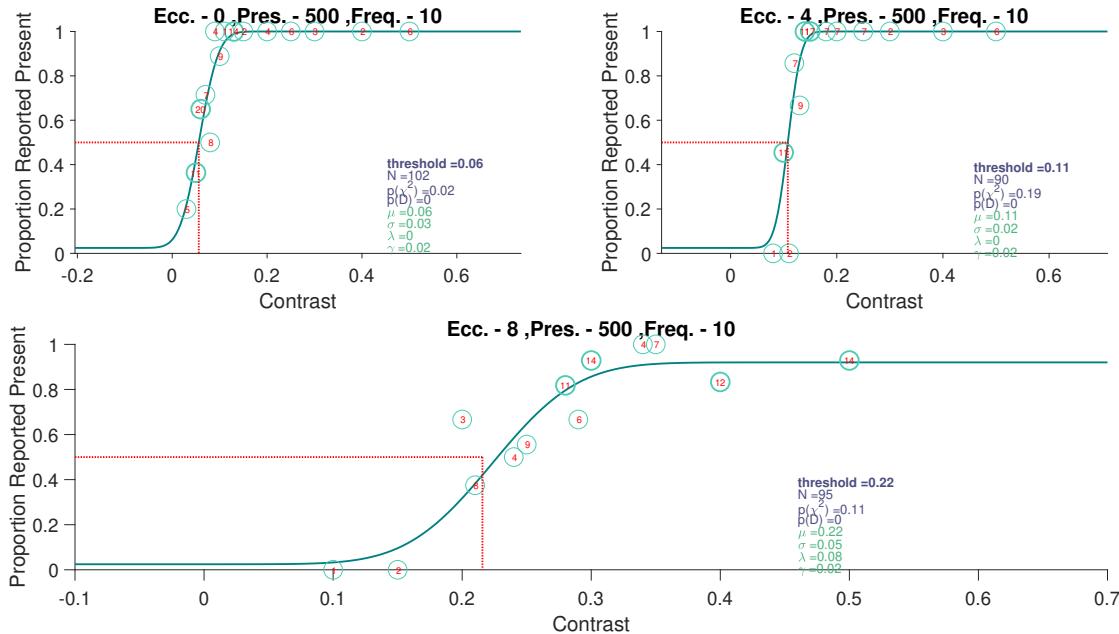


Figure 143: Psychometric curves at different eccentricities.

3.9.1.3 SUBJECT:A092 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

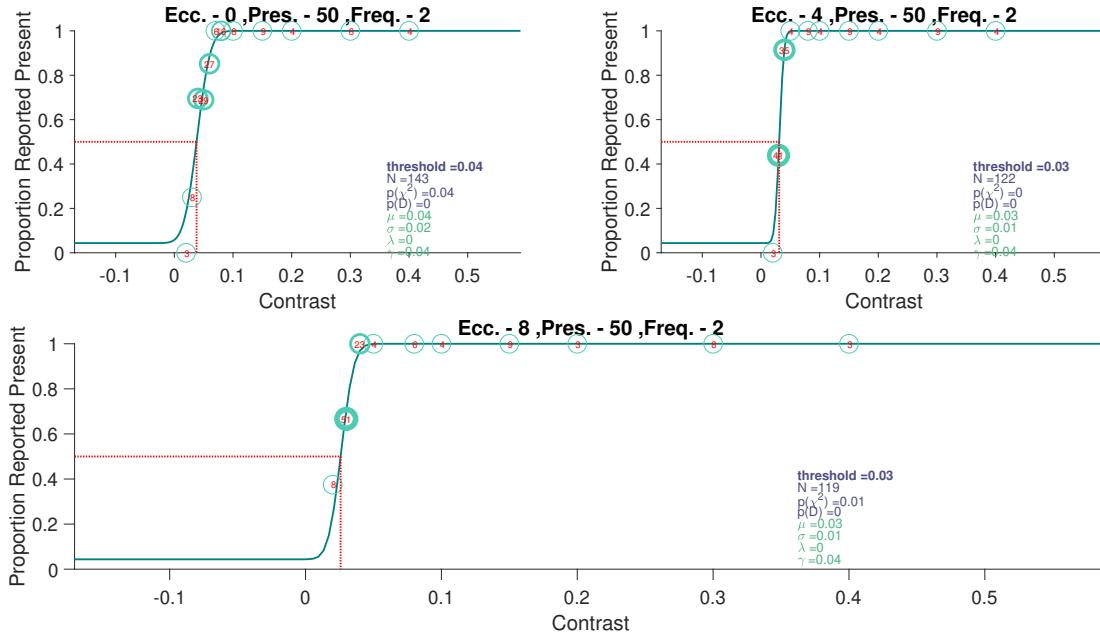


Figure 144: Psychometric curves at different eccentricities.

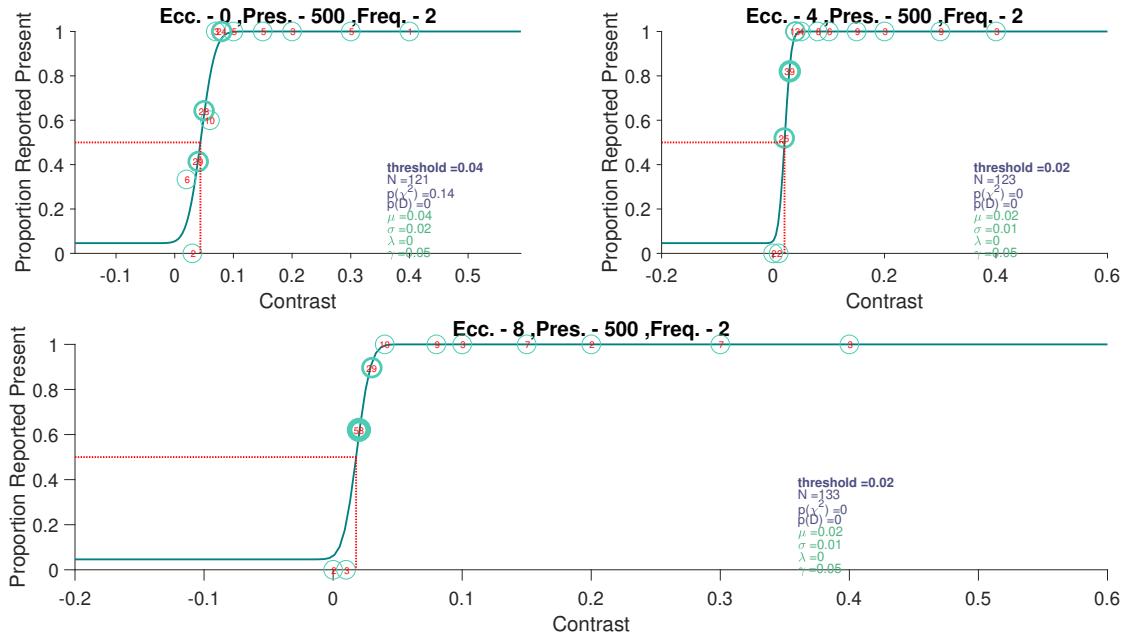


Figure 145: Psychometric curves at different eccentricities.

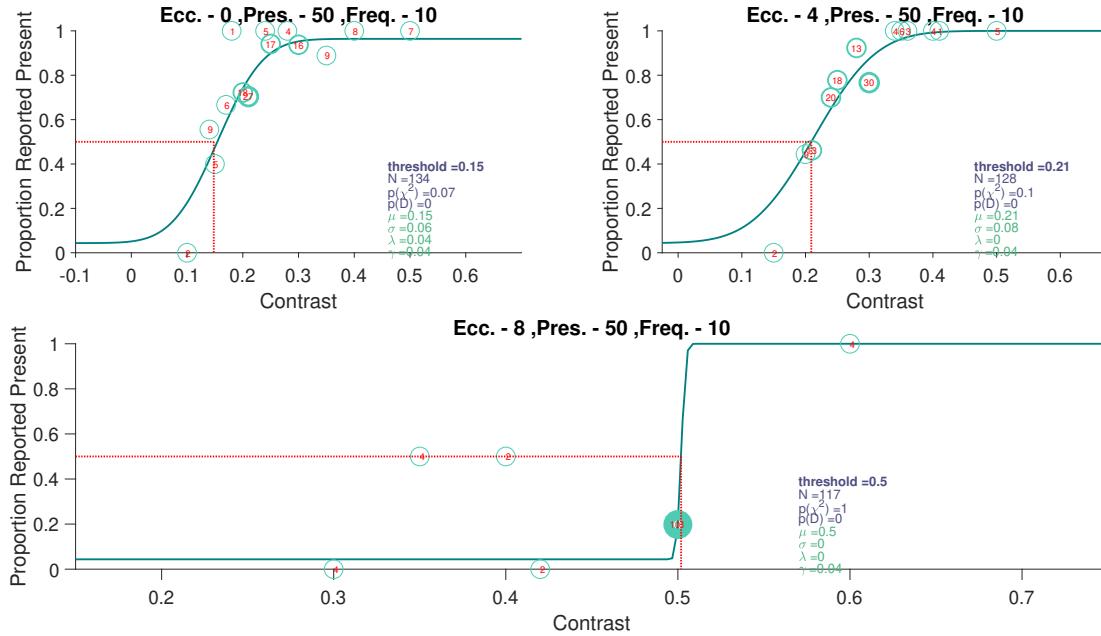


Figure 146: Psychometric curves at different eccentricities.

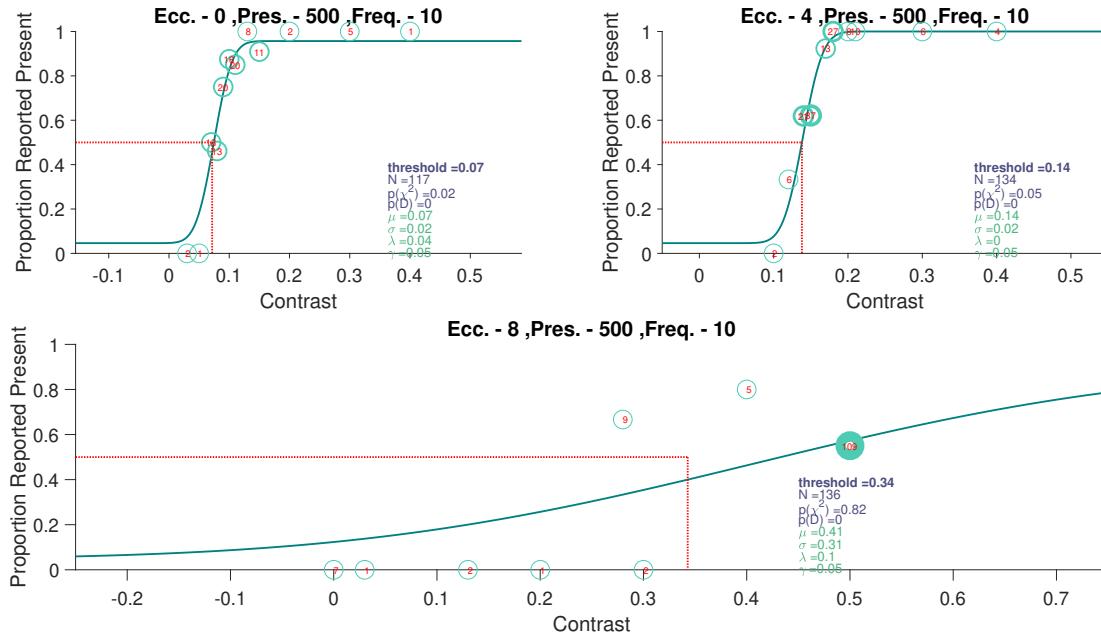


Figure 147: Psychometric curves at different eccentricities.

3.9.1.4 SUBJECT:A036 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

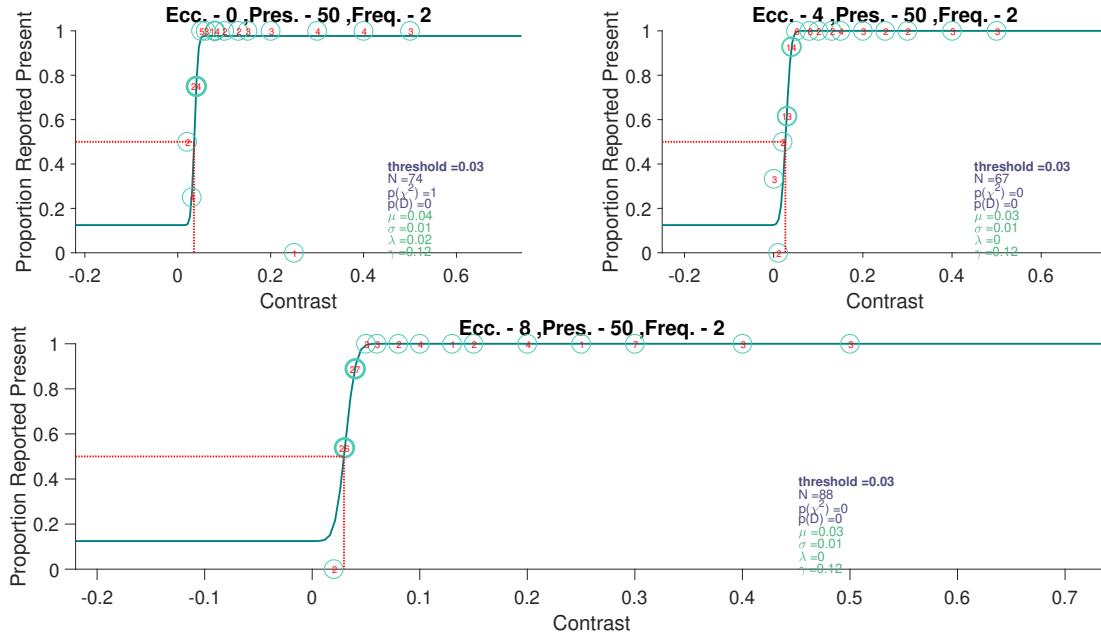


Figure 148: Psychometric curves at different eccentricities.

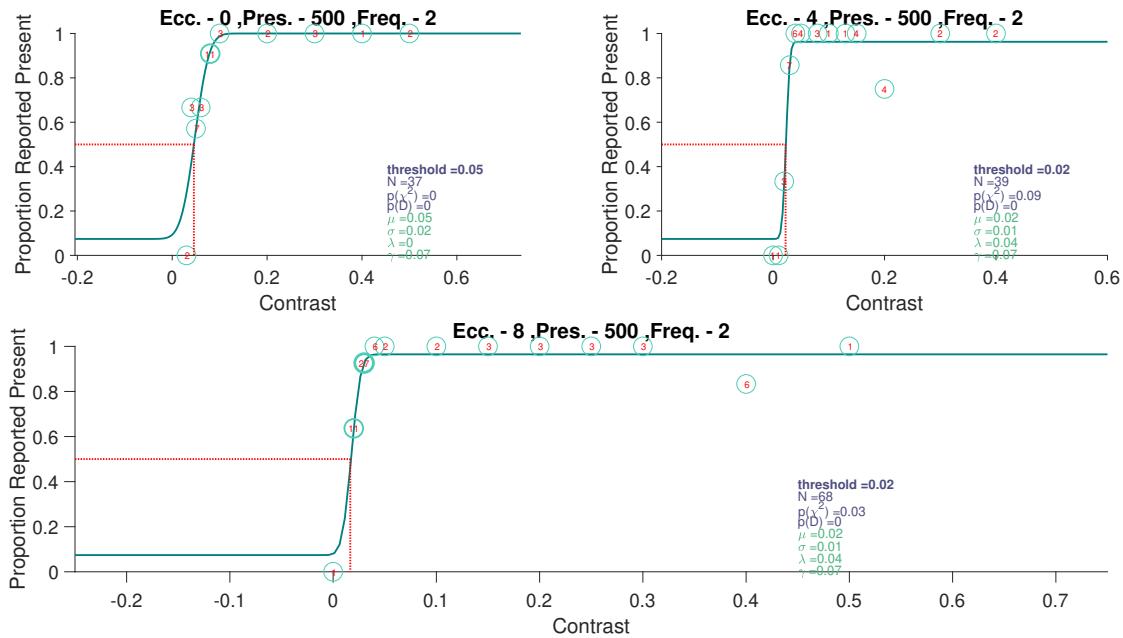


Figure 149: Psychometric curves at different eccentricities.

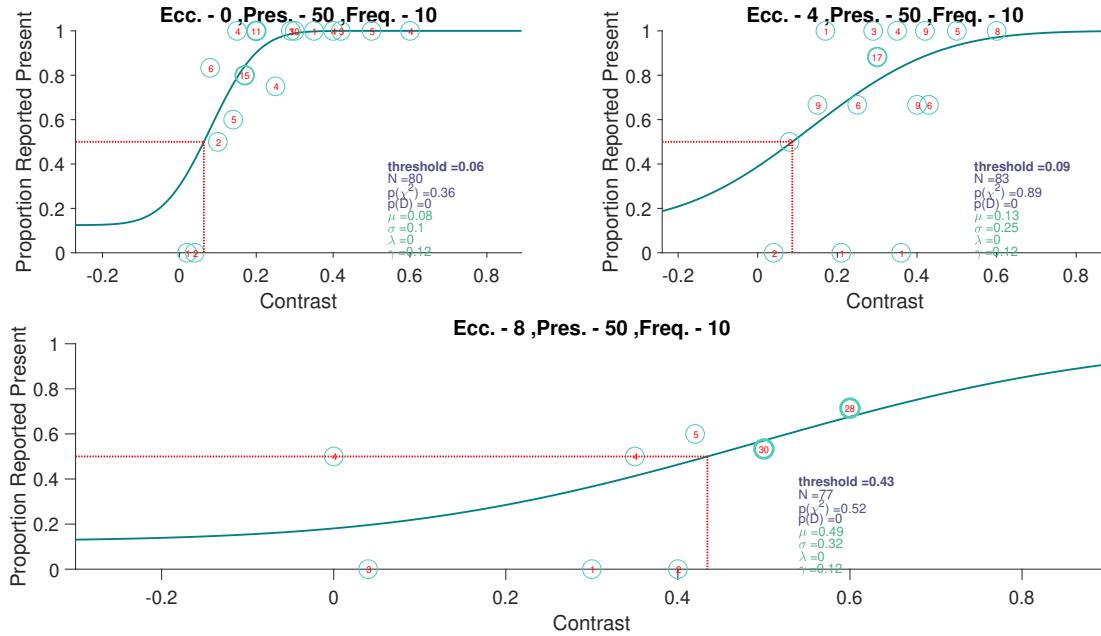


Figure 150: Psychometric curves at different eccentricities.

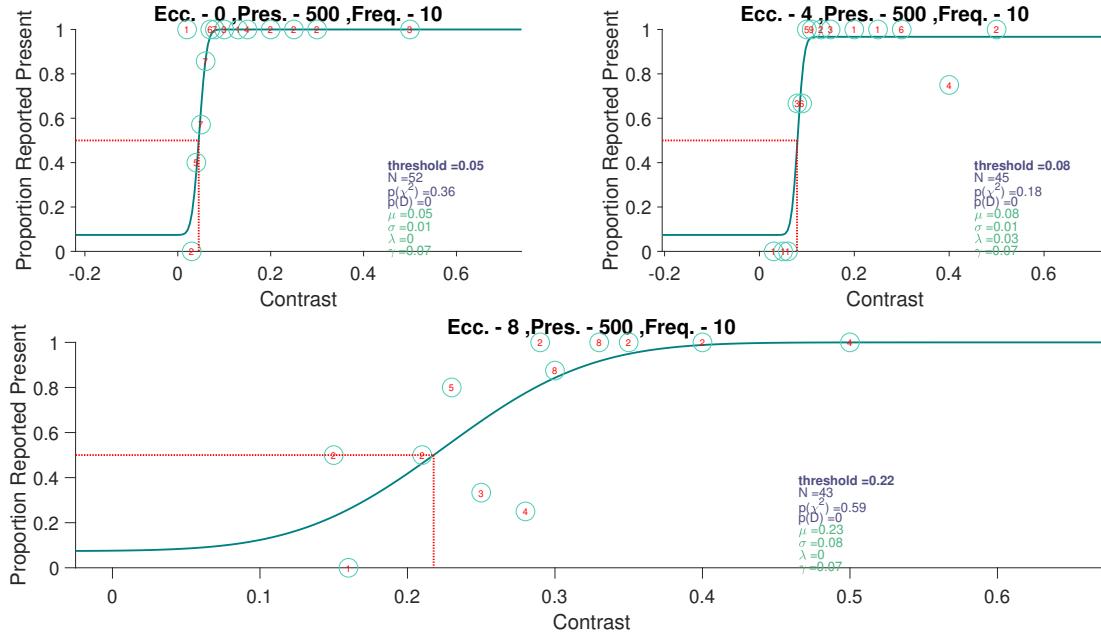


Figure 151: Psychometric curves at different eccentricities.

3.9.2 Alongside Flipped Psychfits

3.9.2.1 SUBJECT:Nikunj The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

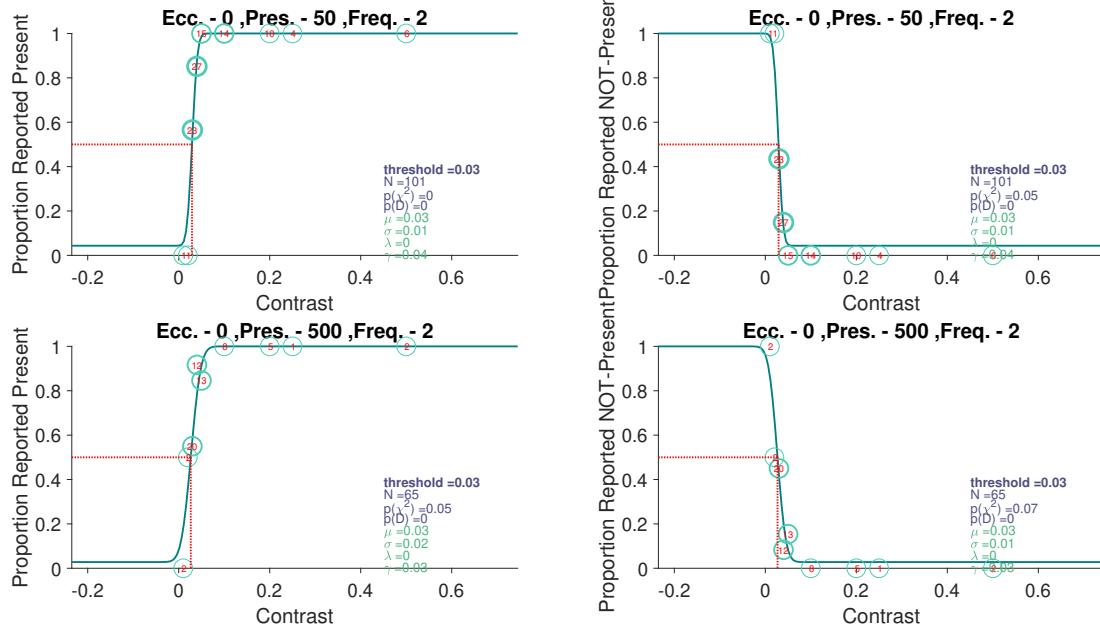


Figure 152: Psychometric curves at Eccentricity 0.

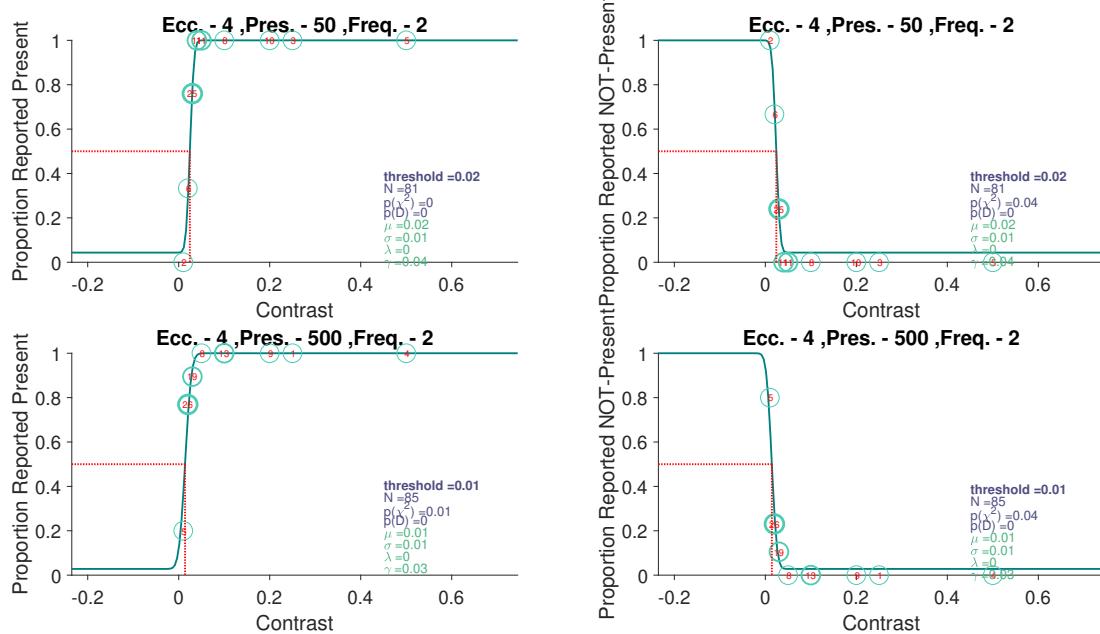


Figure 153: Psychometric curves at Eccentricity 4.

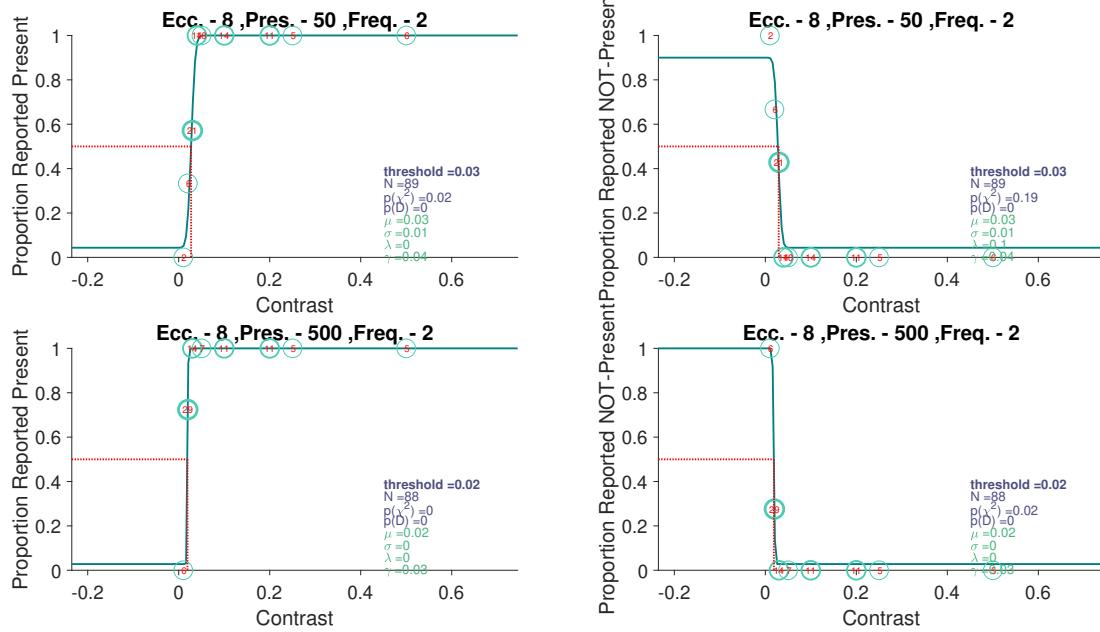


Figure 154: Psychometric curves at Eccentricity 8.

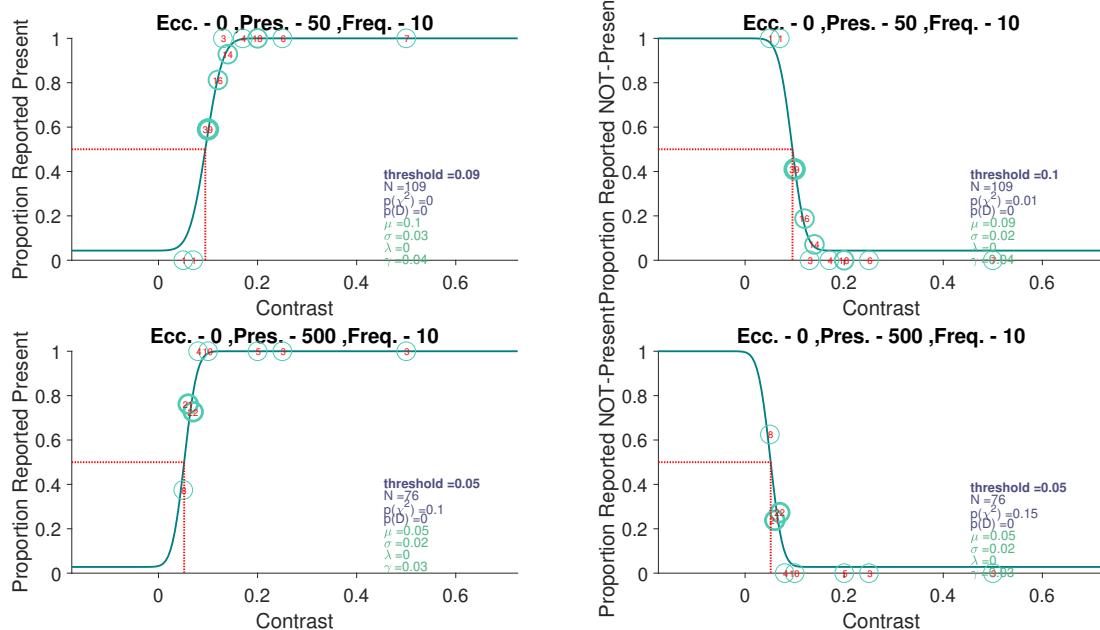


Figure 155: Psychometric curves at Eccentricity 0.

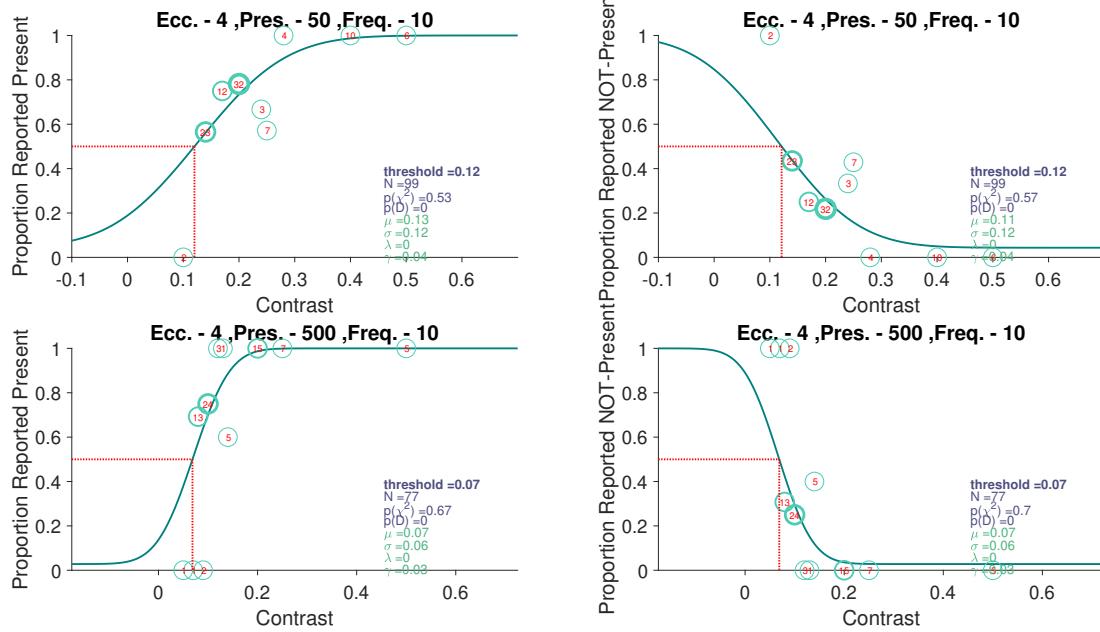


Figure 156: Psychometric curves at Eccentricity 4.

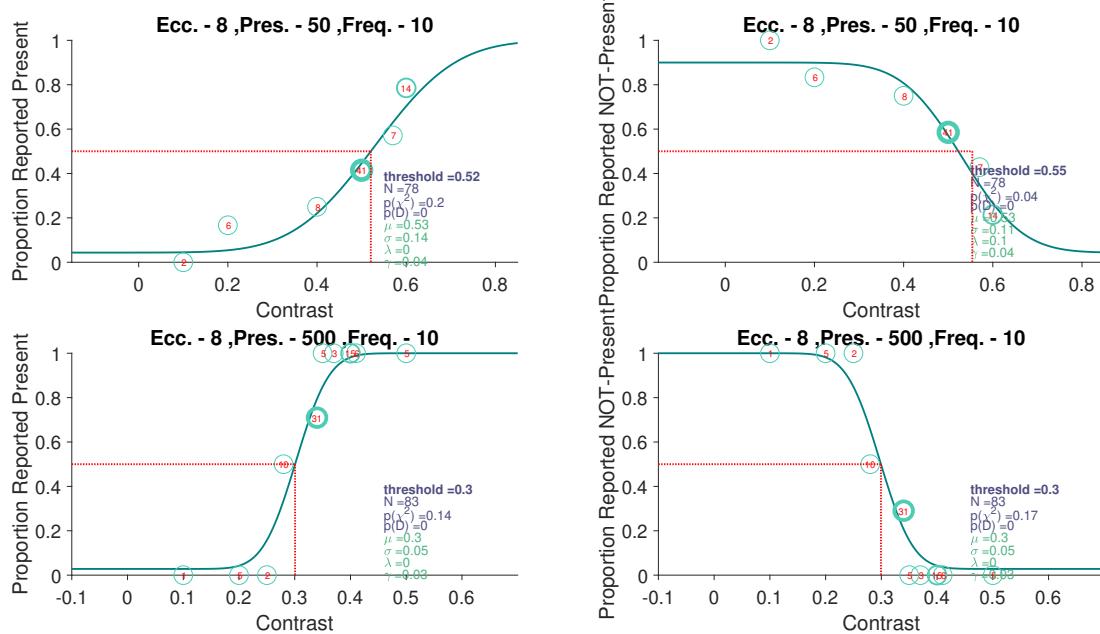


Figure 157: Psychometric curves at Eccentricity 8.

3.9.2.2 SUBJECT:A013 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

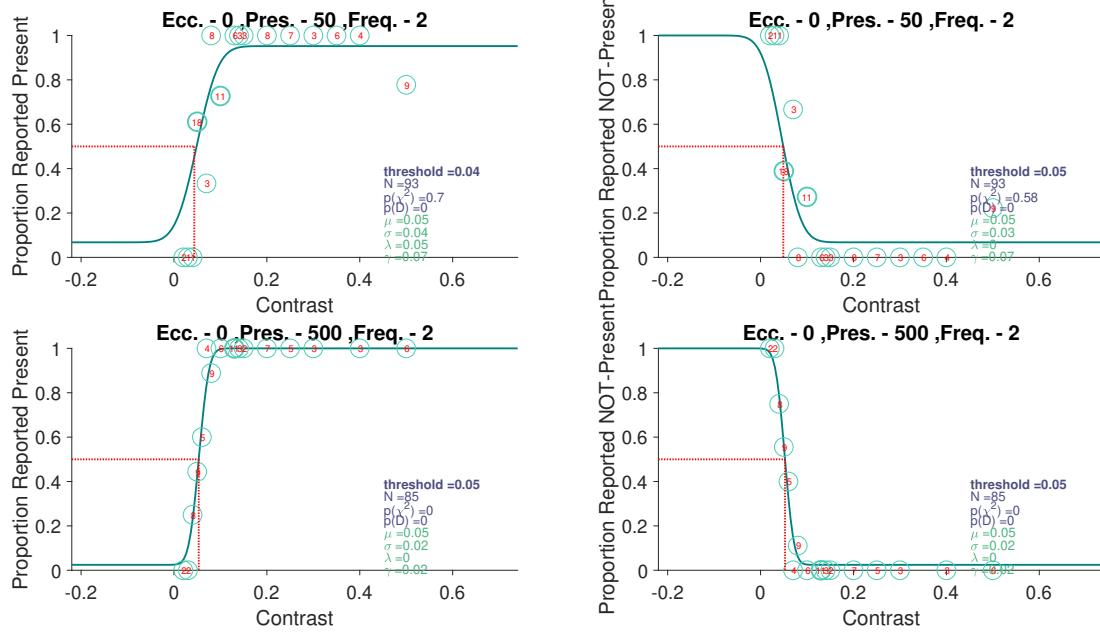


Figure 158: Psychometric curves at Eccentricity 0.

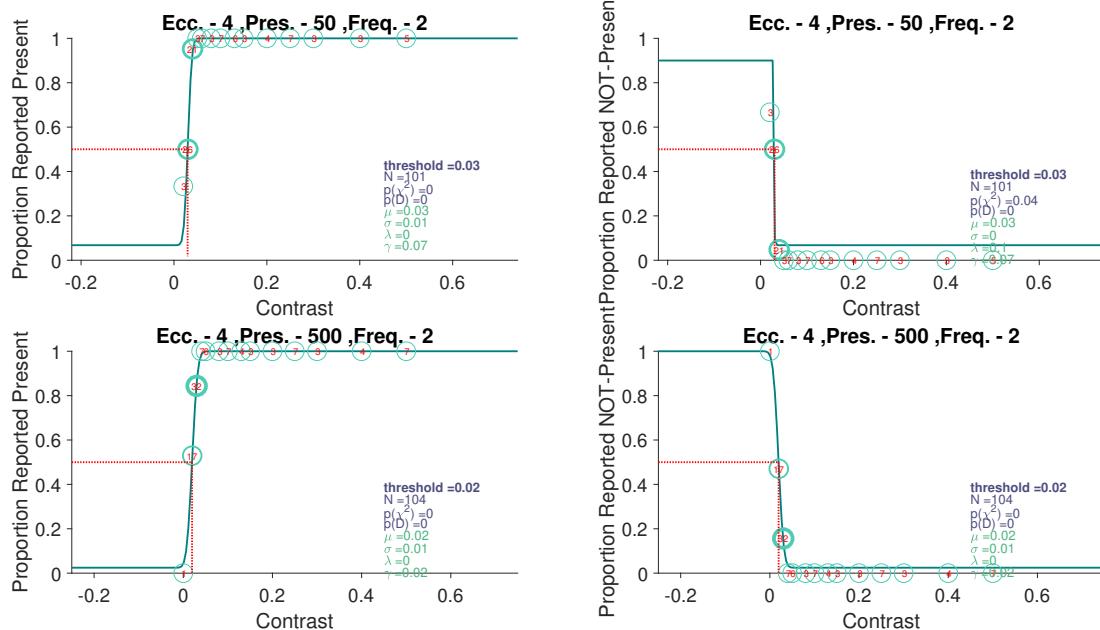


Figure 159: Psychometric curves at Eccentricity 4.

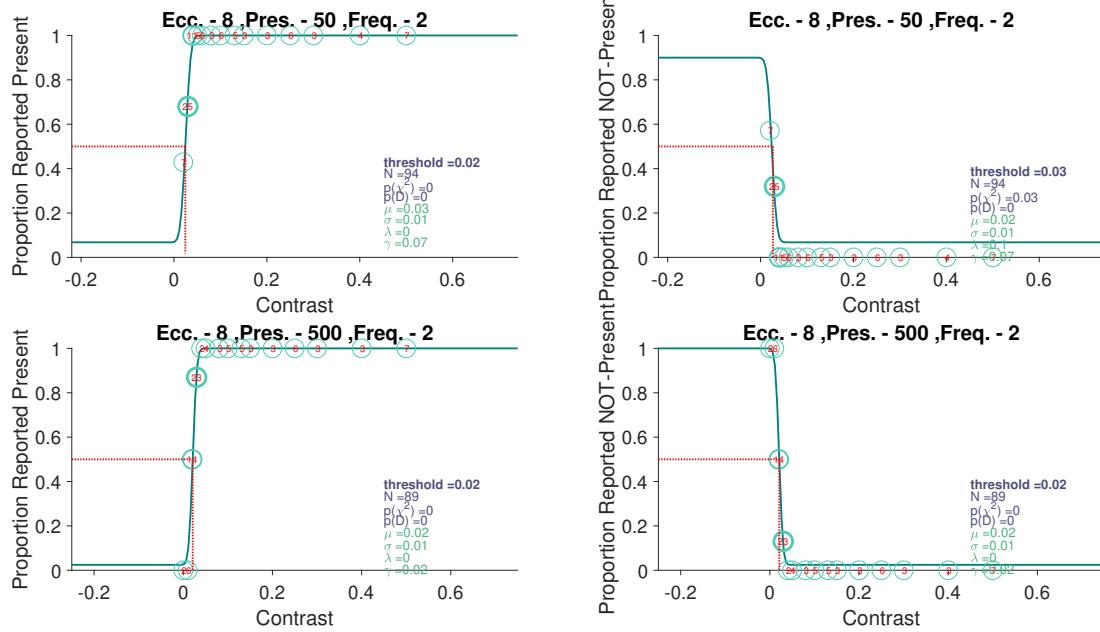


Figure 160: Psychometric curves at Eccentricity 8.

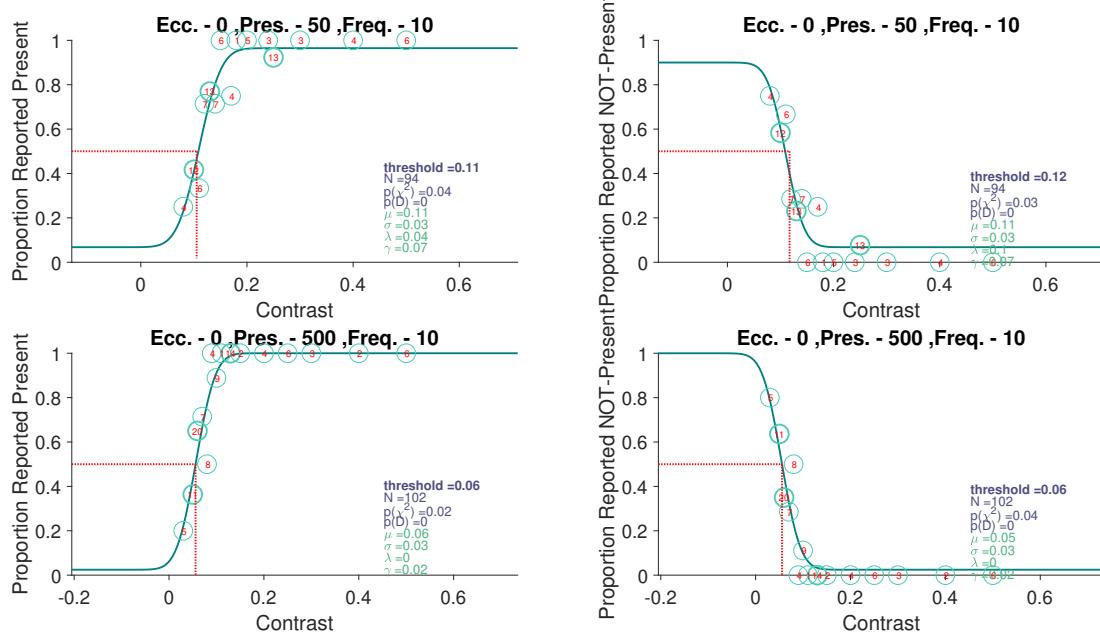


Figure 161: Psychometric curves at Eccentricity 0.

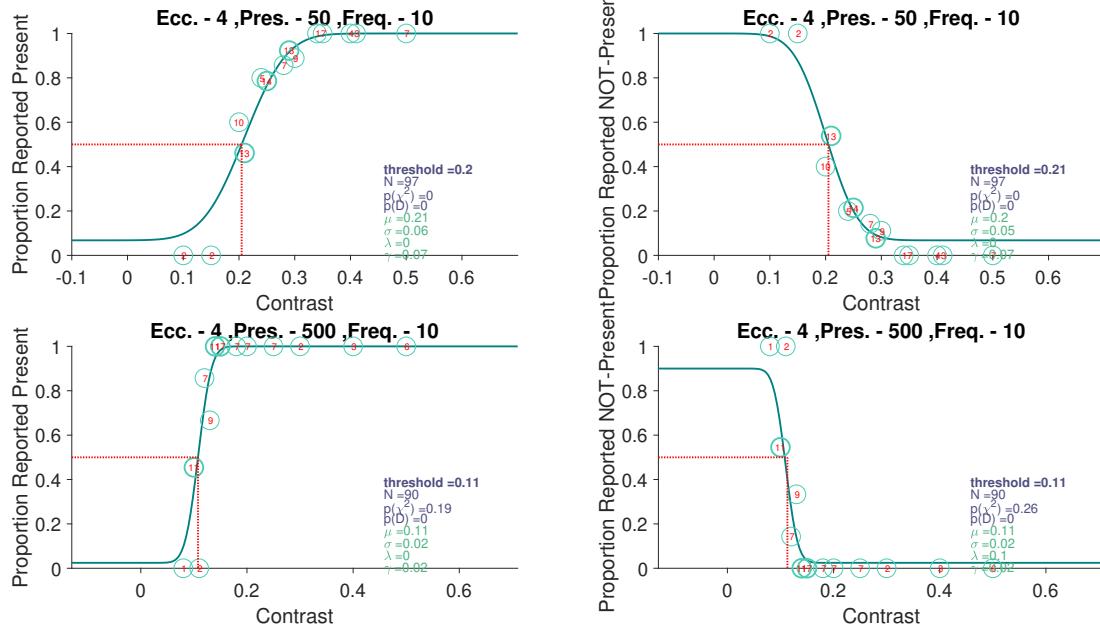


Figure 162: Psychometric curves at Eccentricity 4.

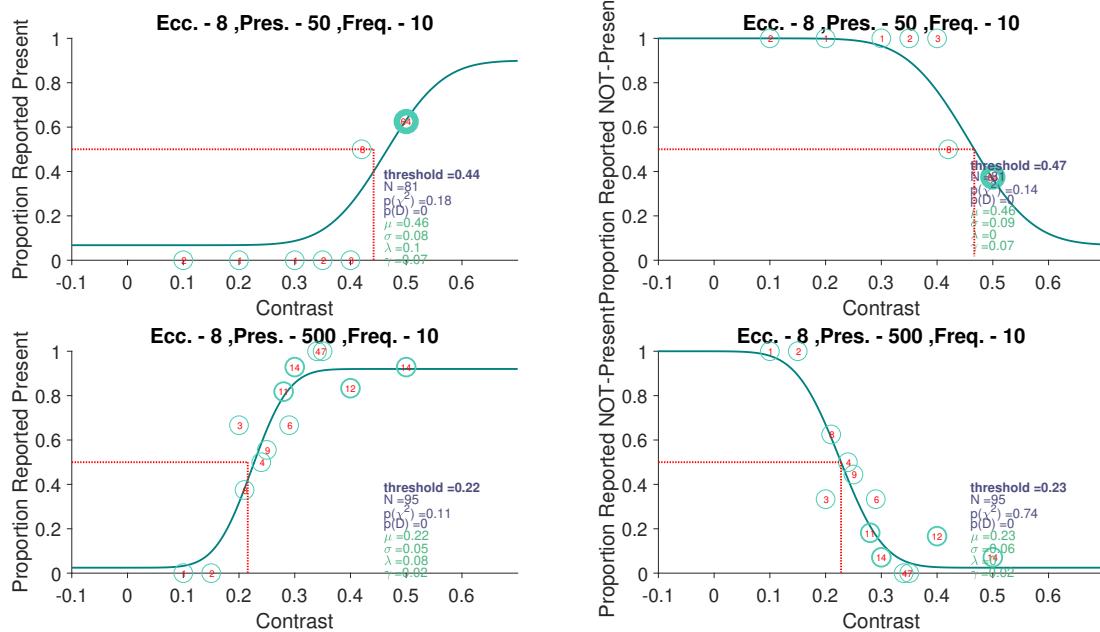


Figure 163: Psychometric curves at Eccentricity 8.

3.9.2.3 SUBJECT:A092 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

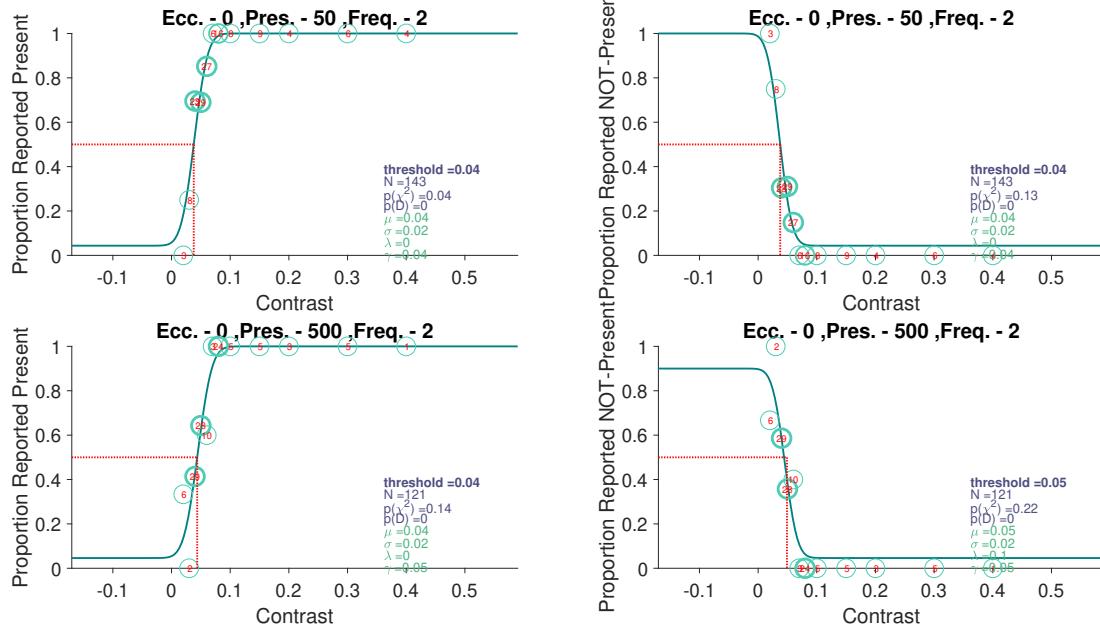


Figure 164: Psychometric curves at Eccentricity 0.

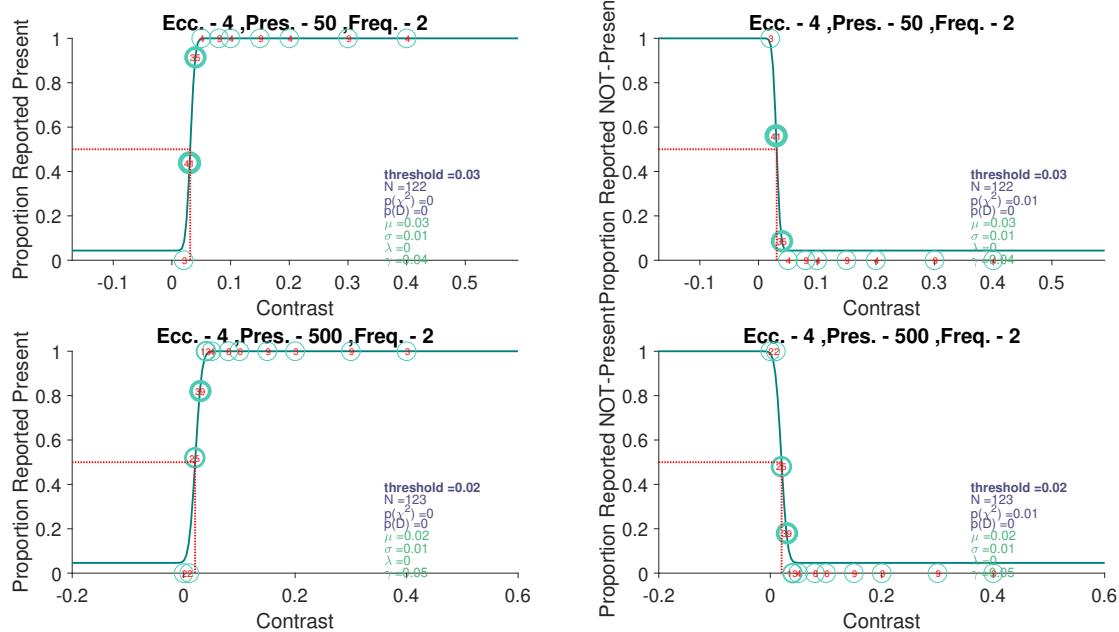


Figure 165: Psychometric curves at Eccentricity 4.

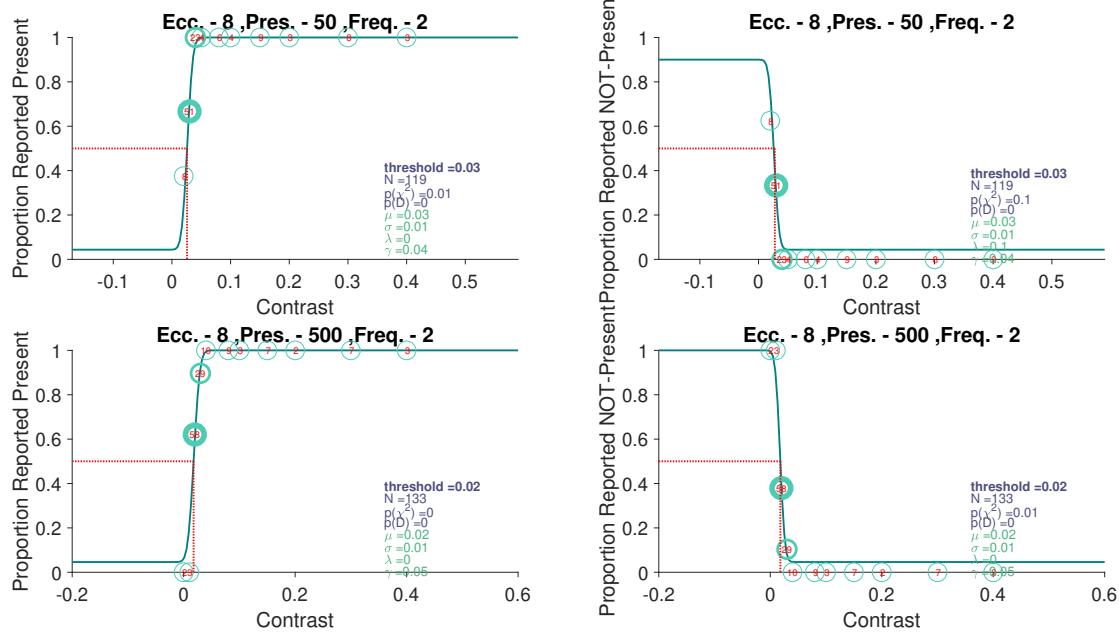


Figure 166: Psychometric curves at Eccentricity 8.

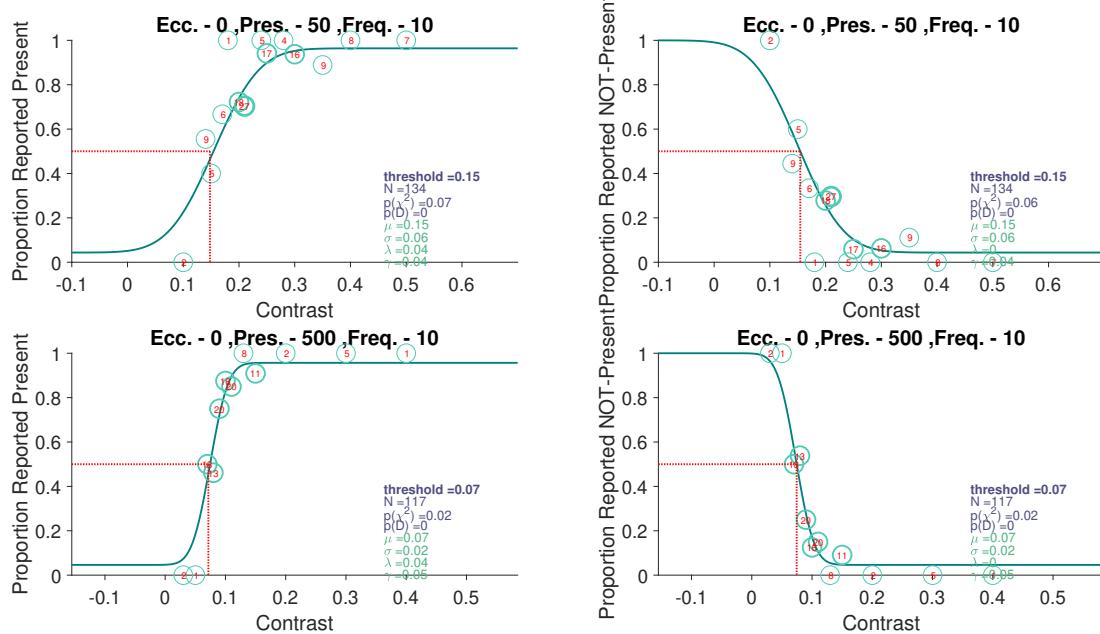


Figure 167: Psychometric curves at Eccentricity 0.

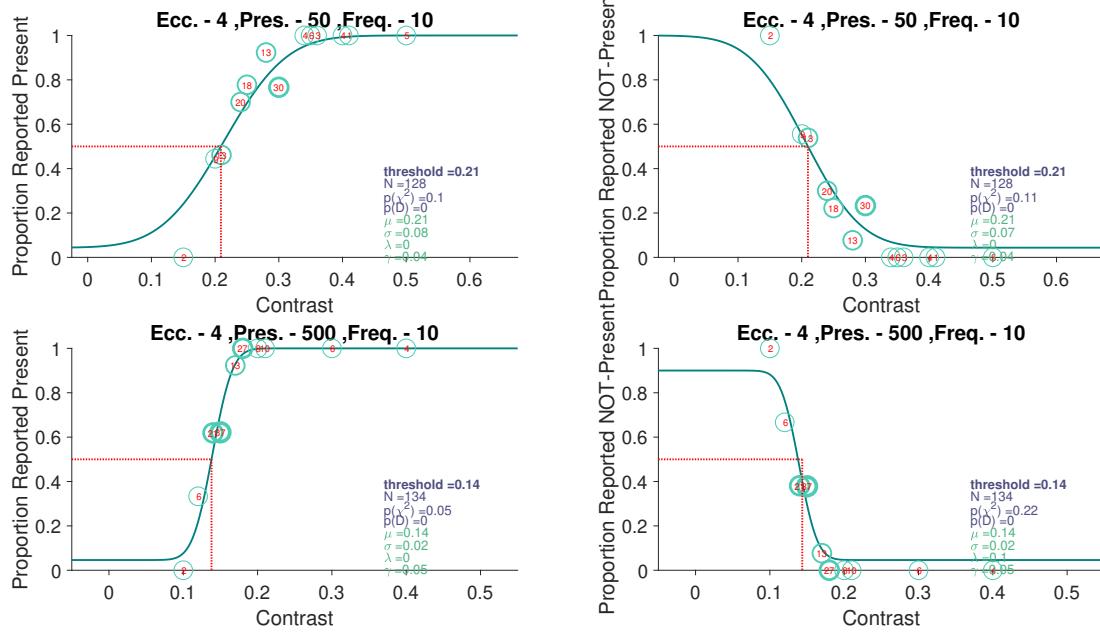


Figure 168: Psychometric curves at Eccentricity 4.

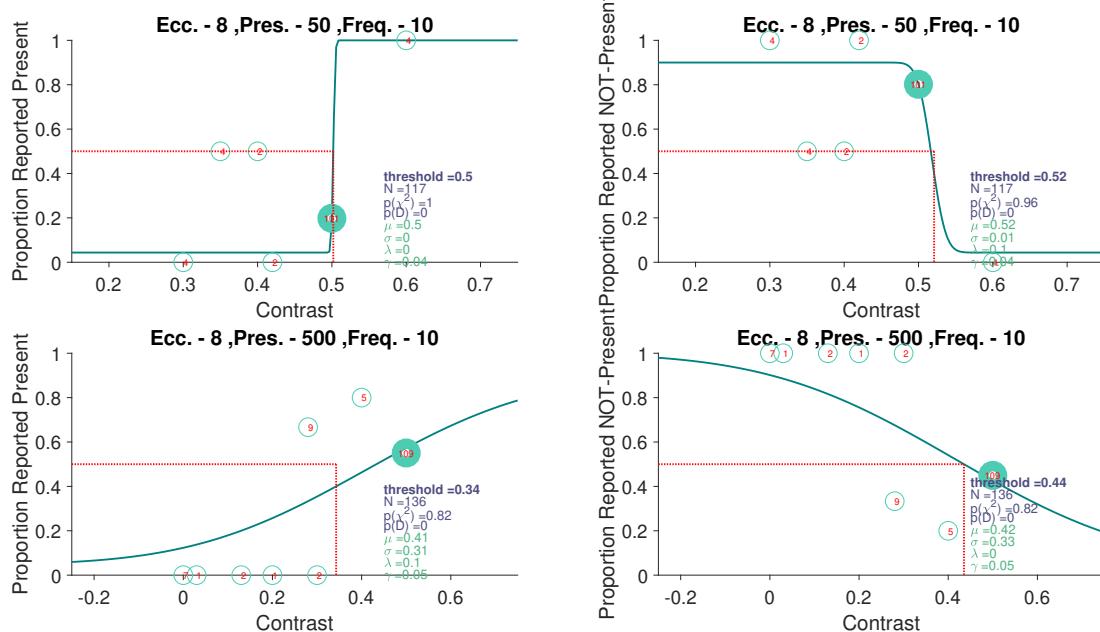


Figure 169: Psychometric curves at Eccentricity 8.

3.9.2.4 SUBJECT:A036 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

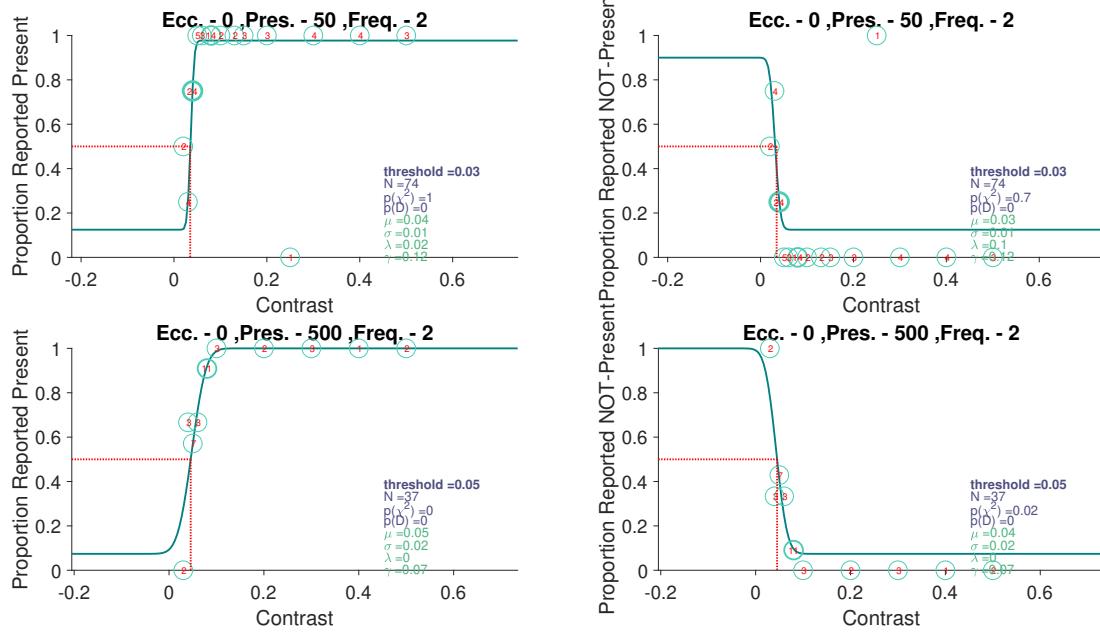


Figure 170: Psychometric curves at Eccentricity 0.

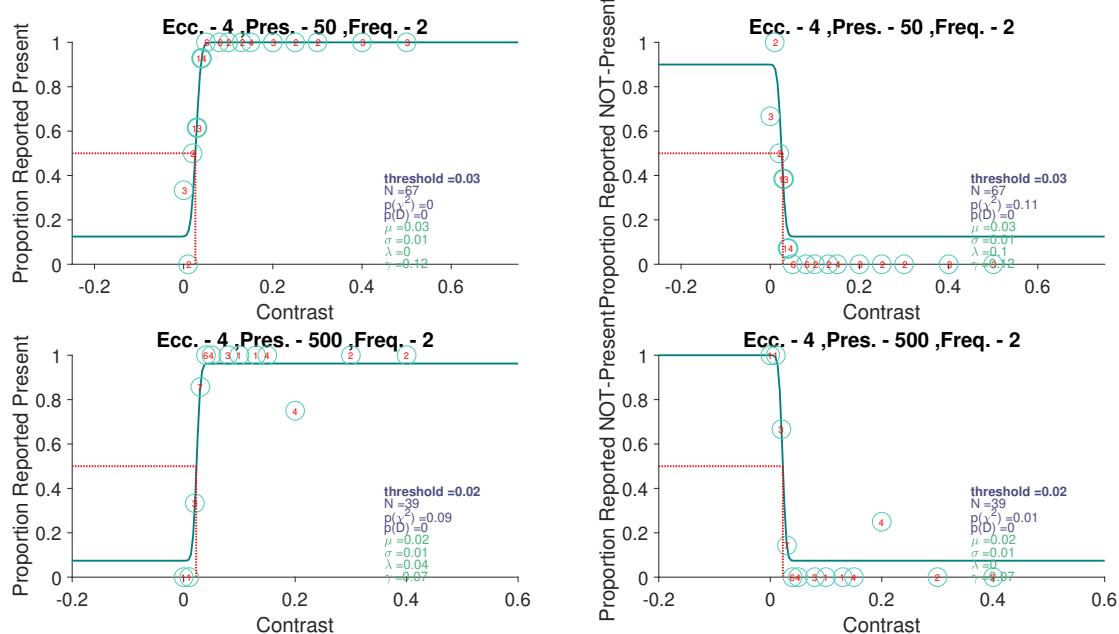


Figure 171: Psychometric curves at Eccentricity 4.

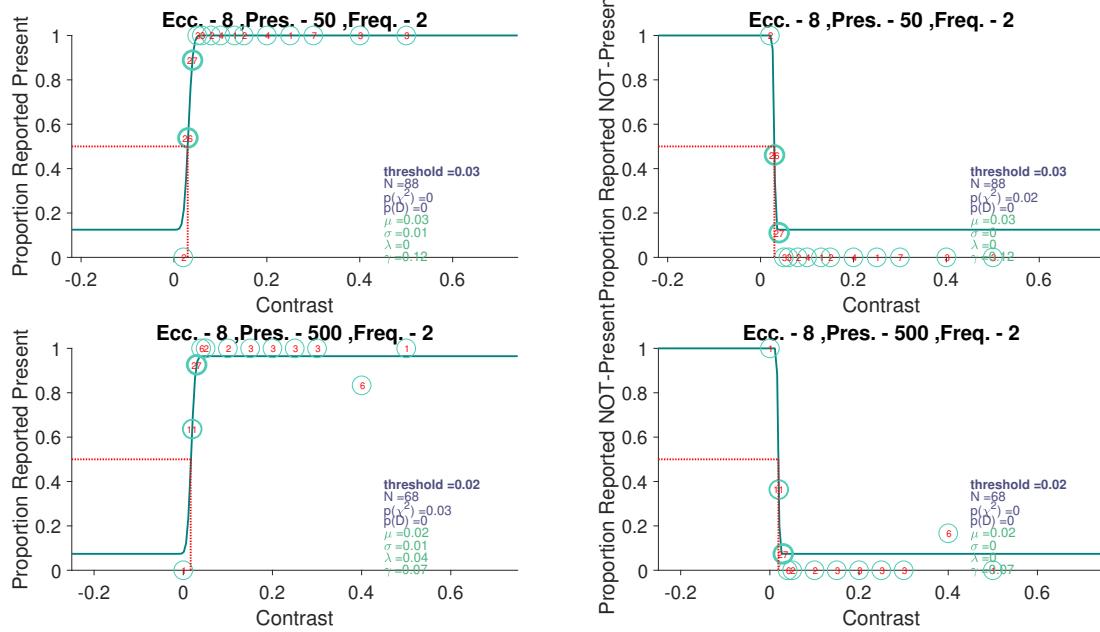


Figure 172: Psychometric curves at Eccentricity 8.

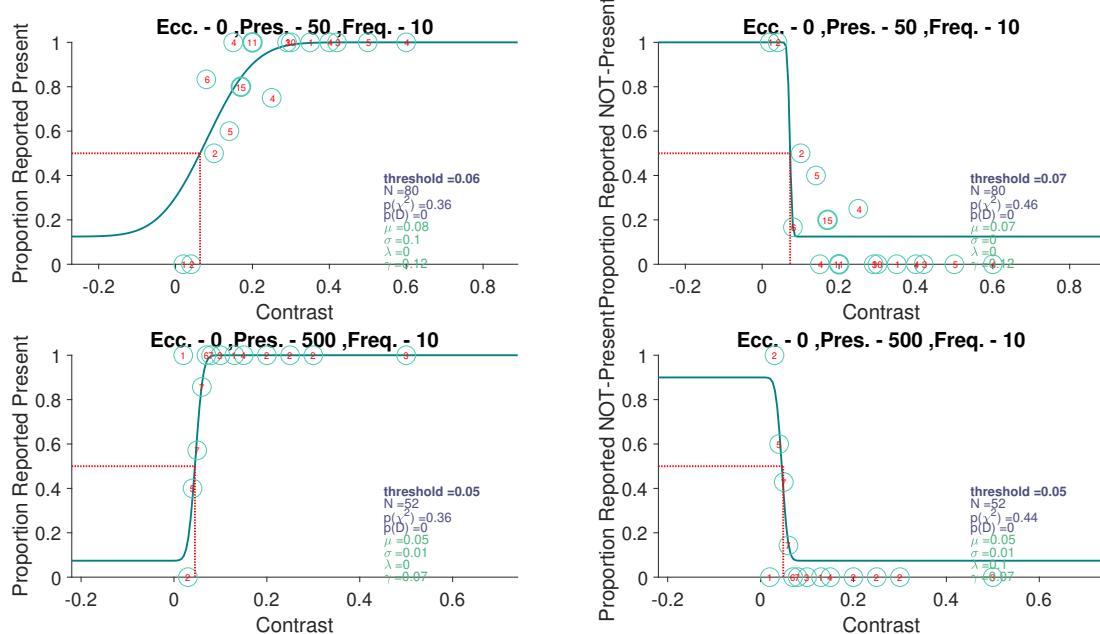


Figure 173: Psychometric curves at Eccentricity 0.

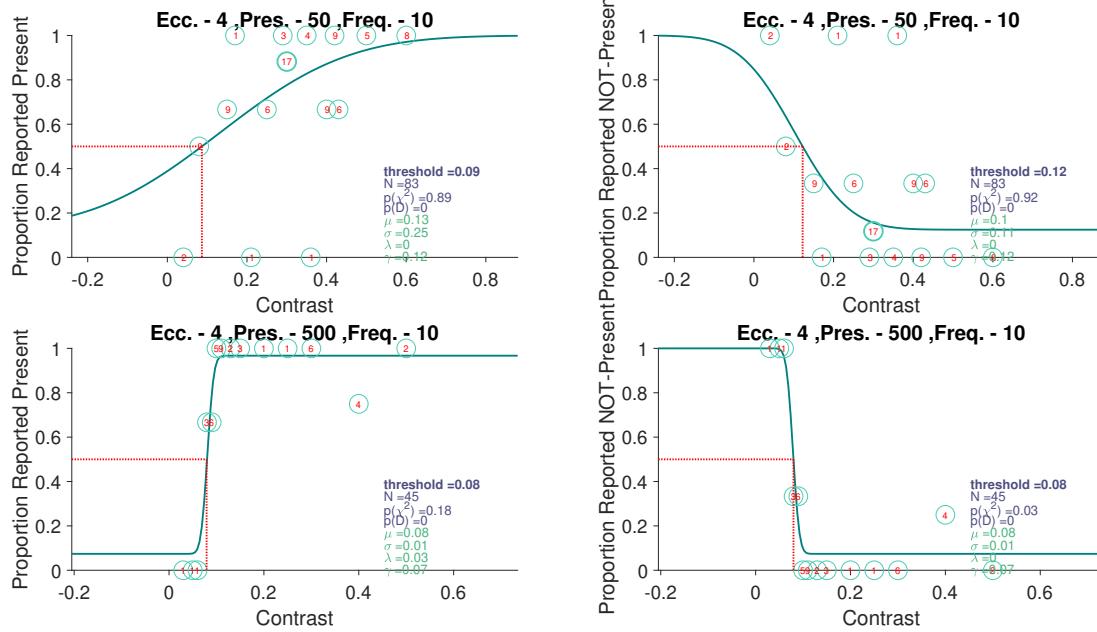


Figure 174: Psychometric curves at Eccentricity 4.

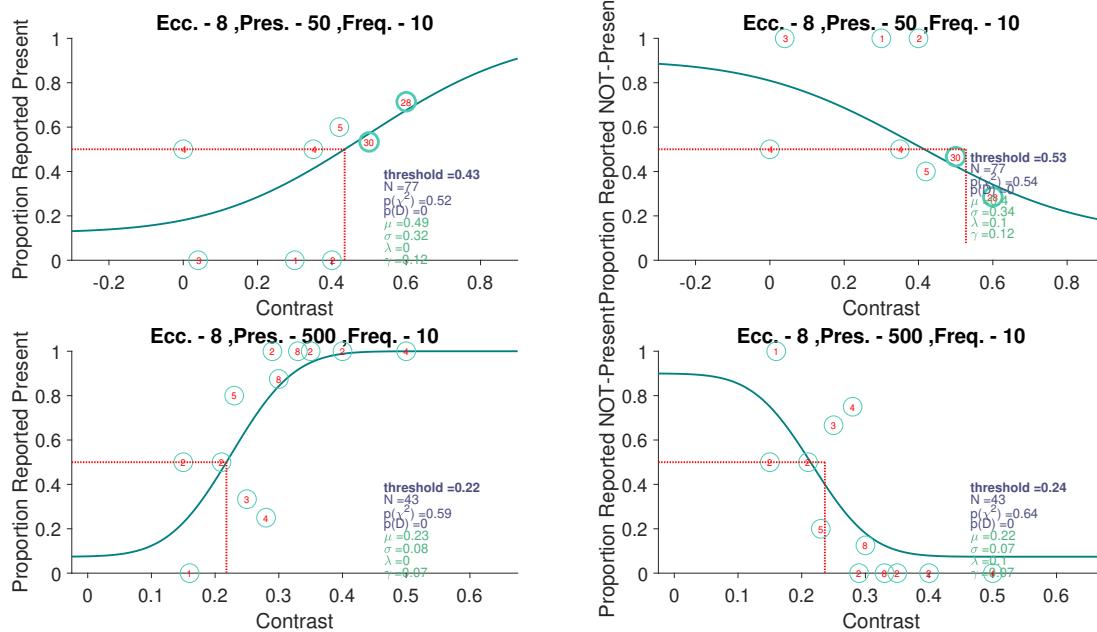


Figure 175: Psychometric curves at Eccentricity 8.

3.9.3 Original

3.9.3.1 SUBJECT:Nikunj The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

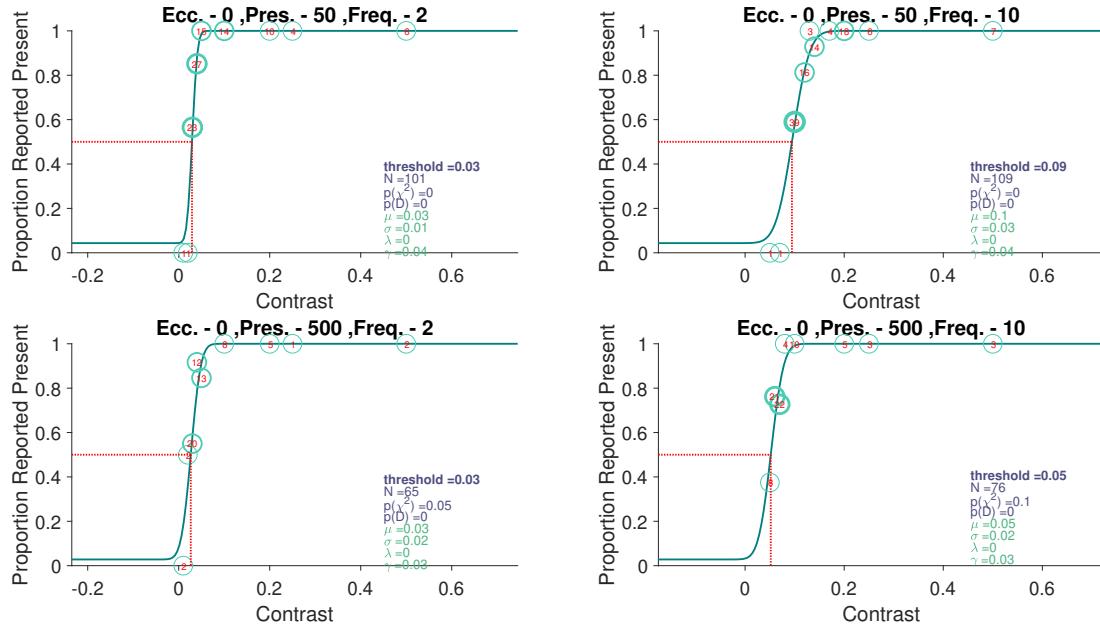


Figure 176: Psychometric curve at **Eccentricity 0** with **binned contrast** (rounded to 2 decimals).

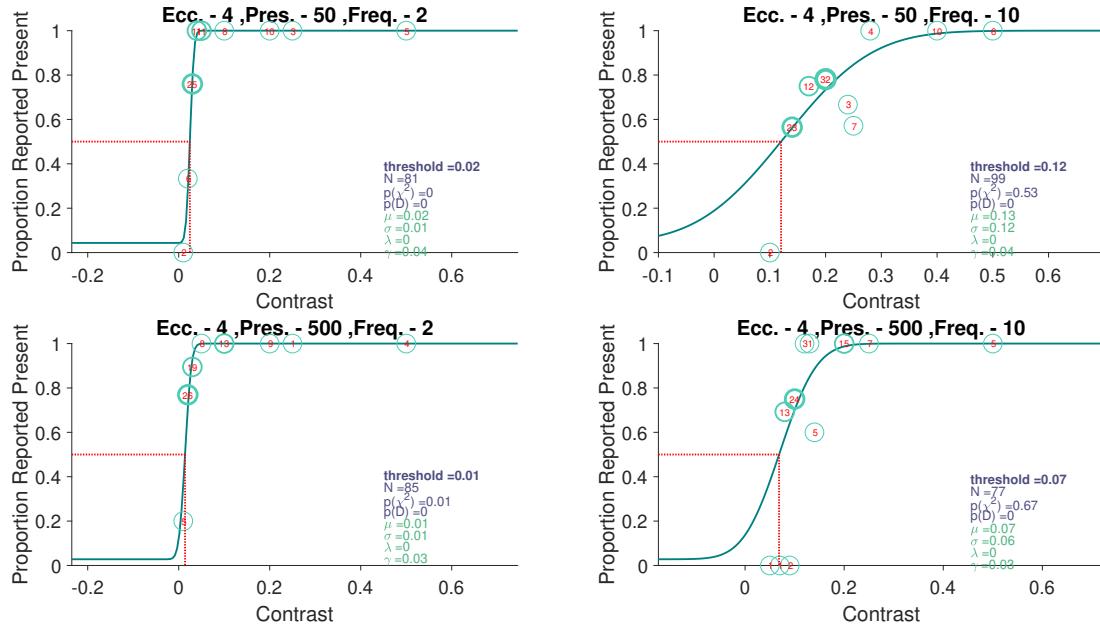


Figure 177: Psychometric curve at **Eccentricity 4** with **binned contrast** (rounded to 2 decimals).

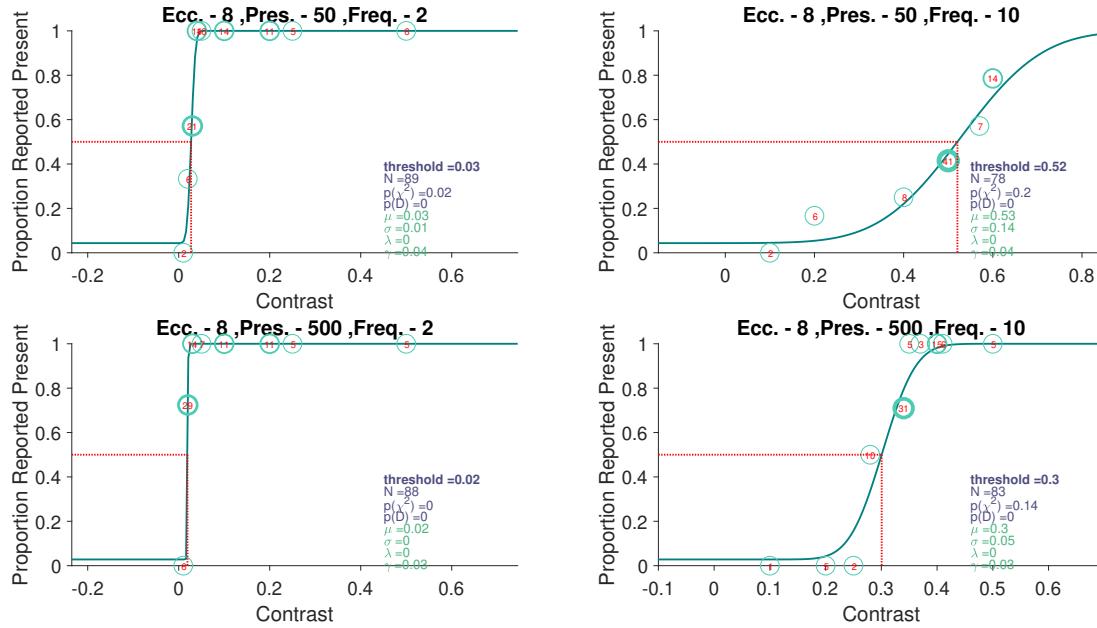


Figure 178: Psychometric curve at **Eccentricity 8** with binned contrast (rounded to 2 decimals).

3.9.3.2 SUBJECT:A013 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

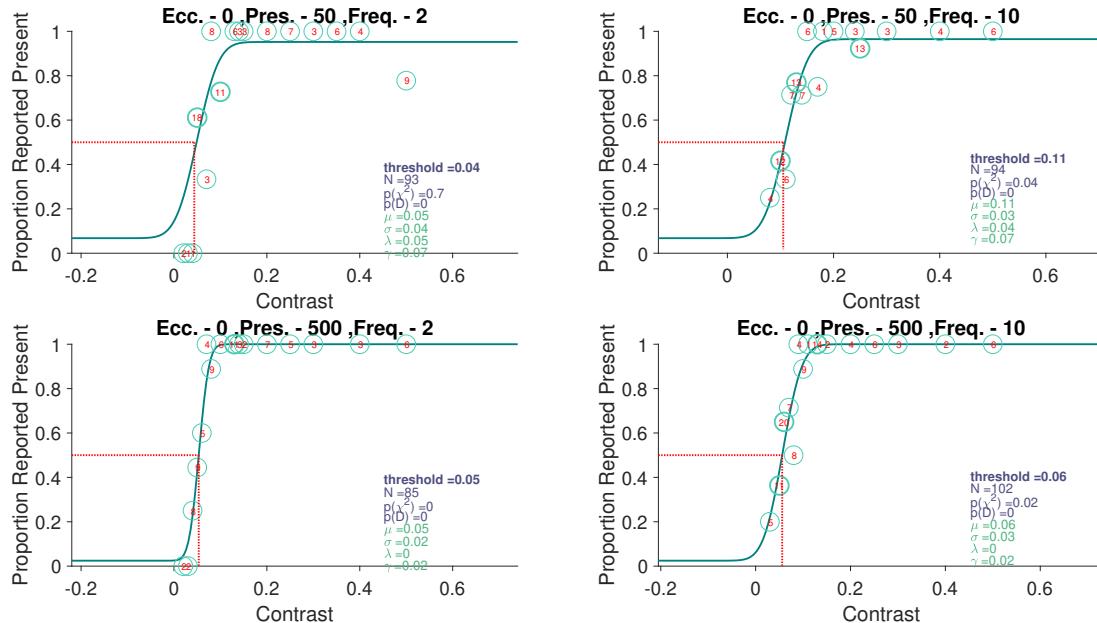


Figure 179: Psychometric curve at **Eccentricity 0** with binned contrast (rounded to 2 decimals).

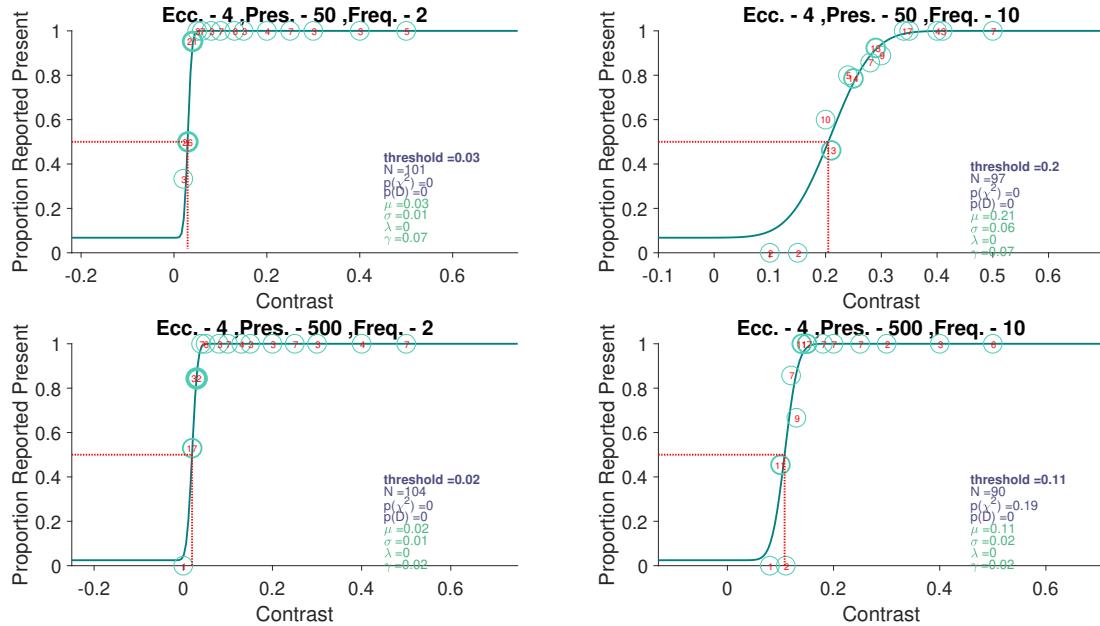


Figure 180: Psychometric curve at **Eccentricity 4** with binned contrast (rounded to 2 decimals).

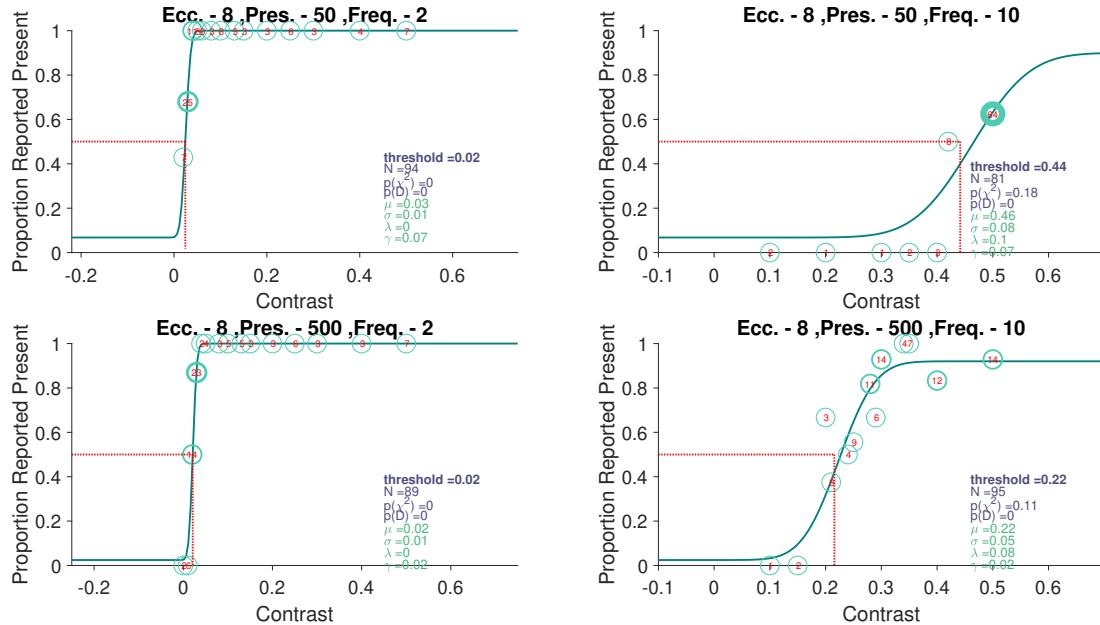


Figure 181: Psychometric curve at **Eccentricity 8** with binned contrast (rounded to 2 decimals).

3.9.3.3 SUBJECT:A092 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

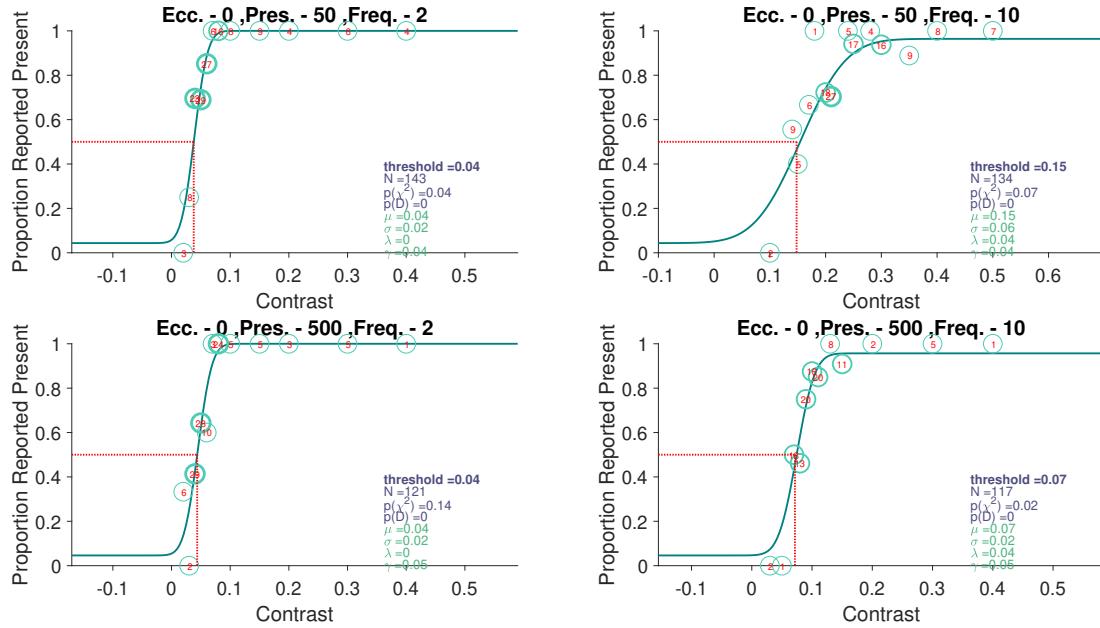


Figure 182: Psychometric curve at **Eccentricity 0** with **binned contrast** (rounded to 2 decimals).

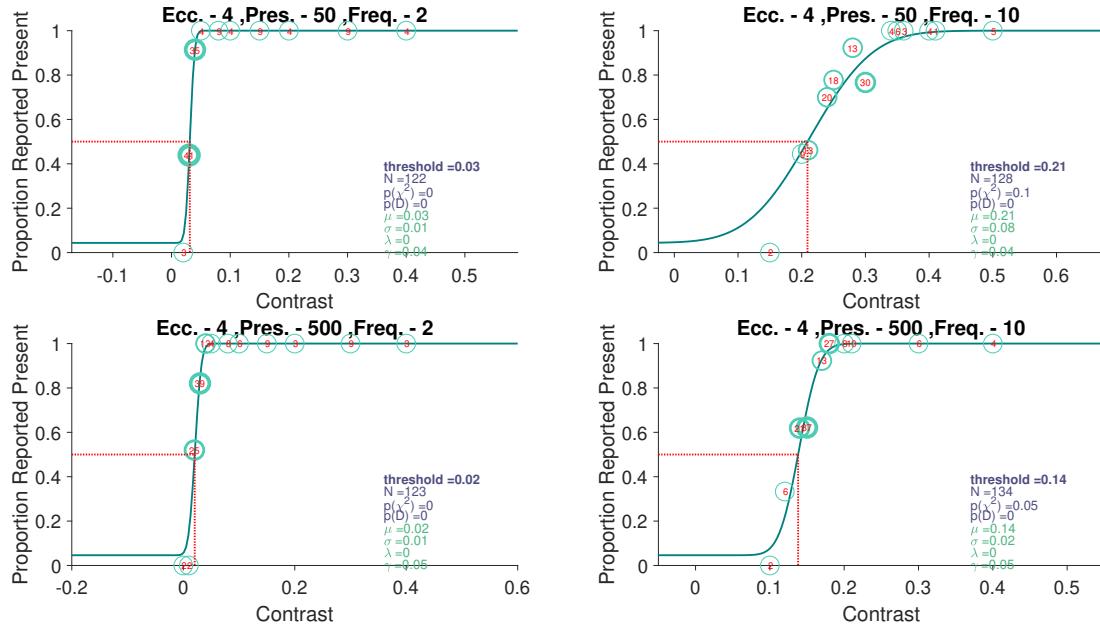


Figure 183: Psychometric curve at **Eccentricity 4** with **binned contrast** (rounded to 2 decimals).

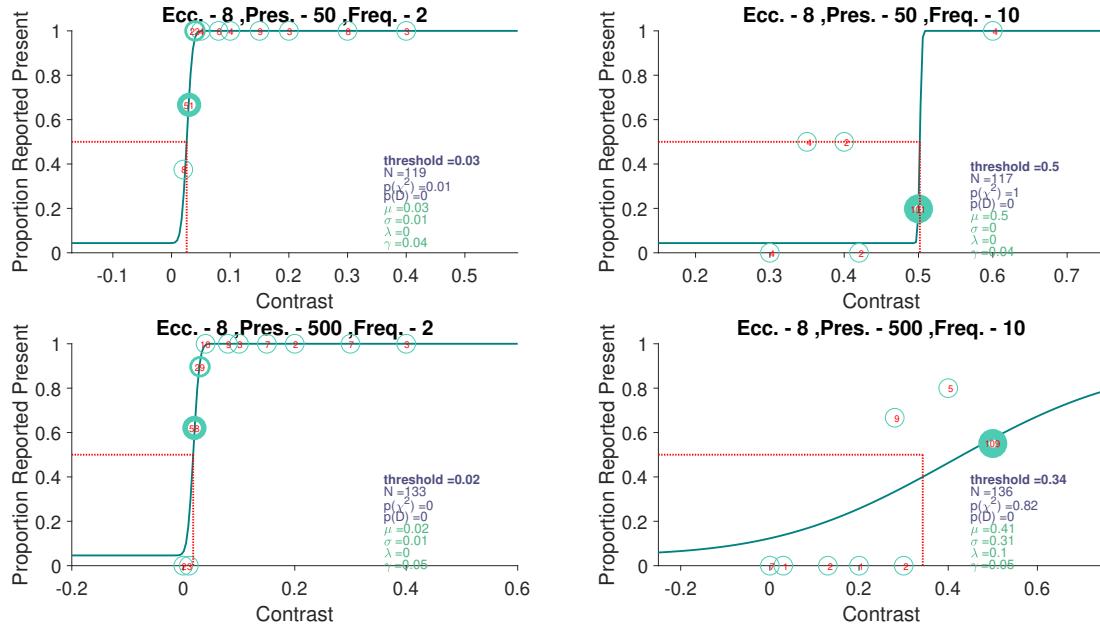


Figure 184: Psychometric curve at **Eccentricity 8** with binned contrast (rounded to 2 decimals).

3.9.3.4 SUBJECT:A036 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

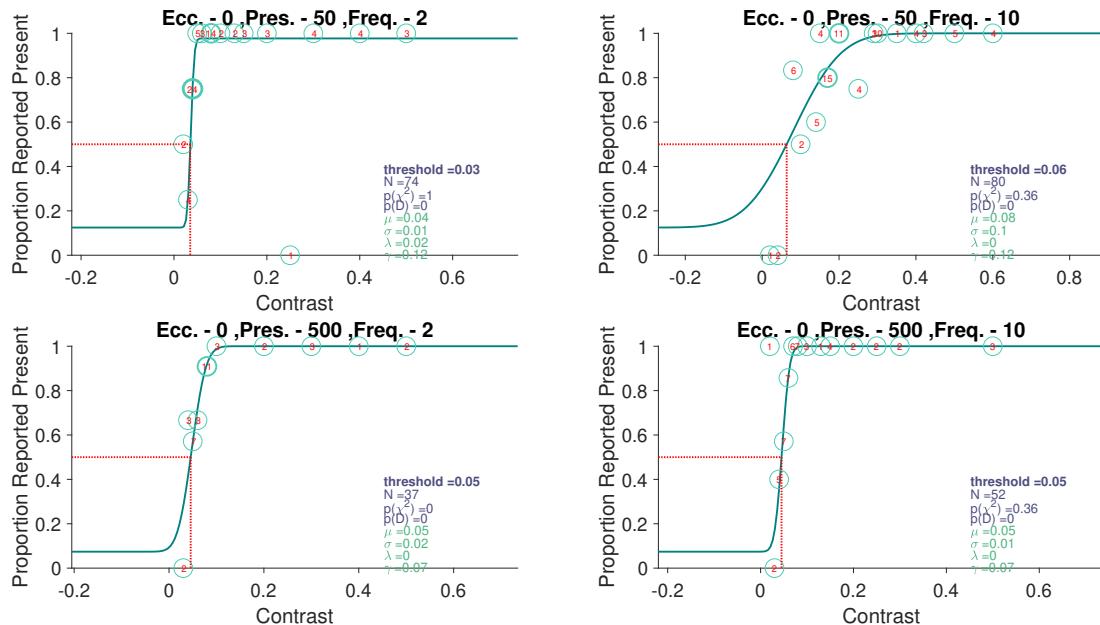


Figure 185: Psychometric curve at **Eccentricity 0** with binned contrast (rounded to 2 decimals).

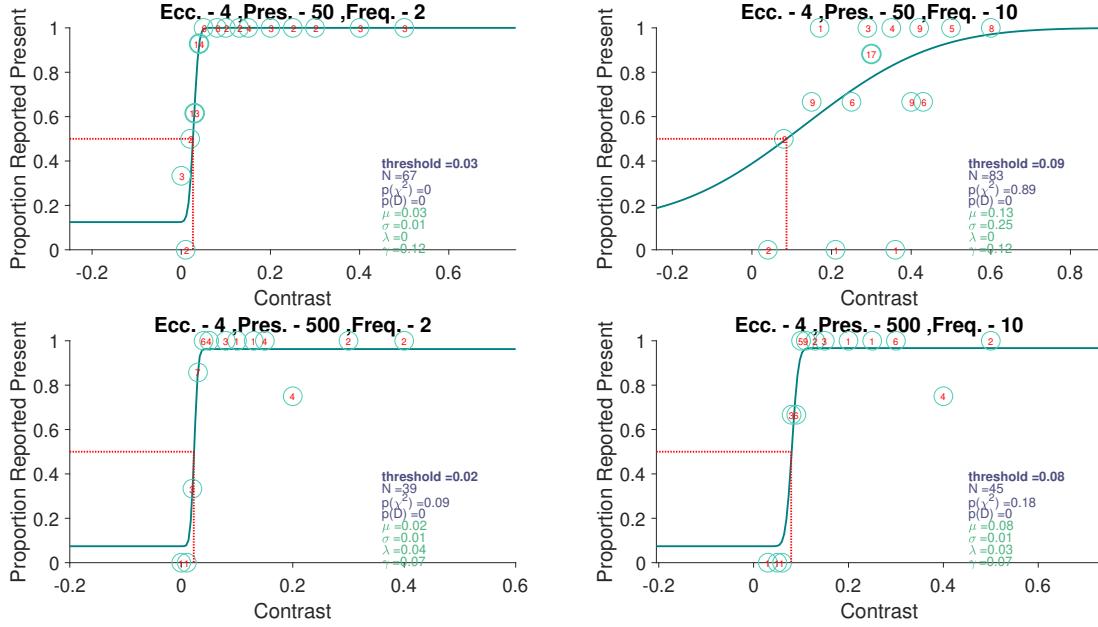
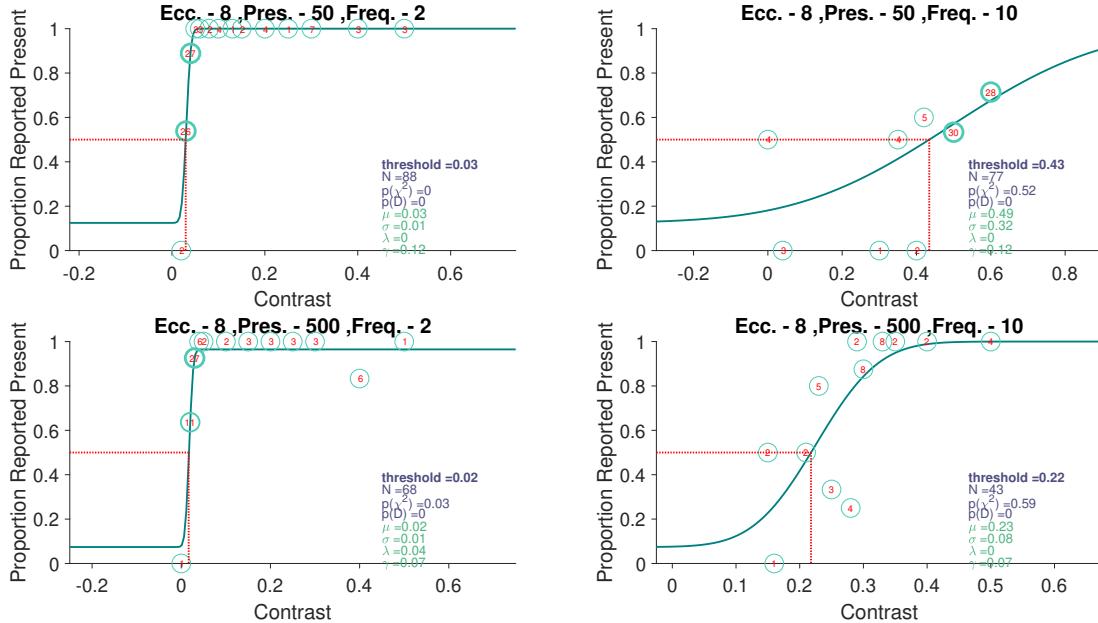


Figure 186: Psychometric curve at **Eccentricity 4** with binned contrast (rounded to 2 decimals).



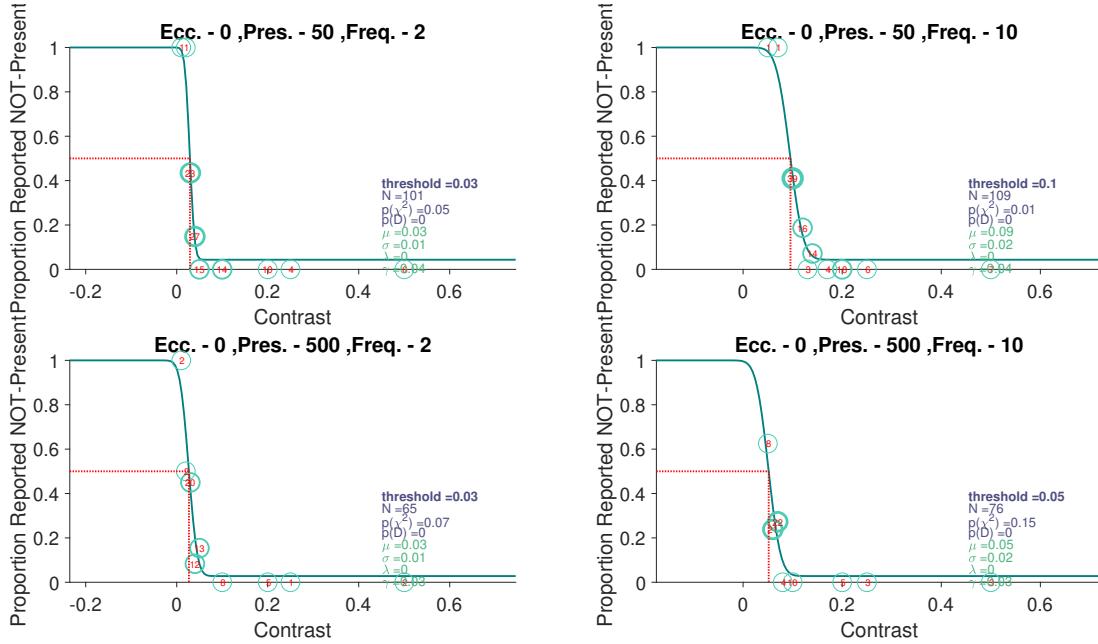


Figure 188: Psychometric curve at **Eccentricity 0** with binned contrast (rounded to 2 decimals).

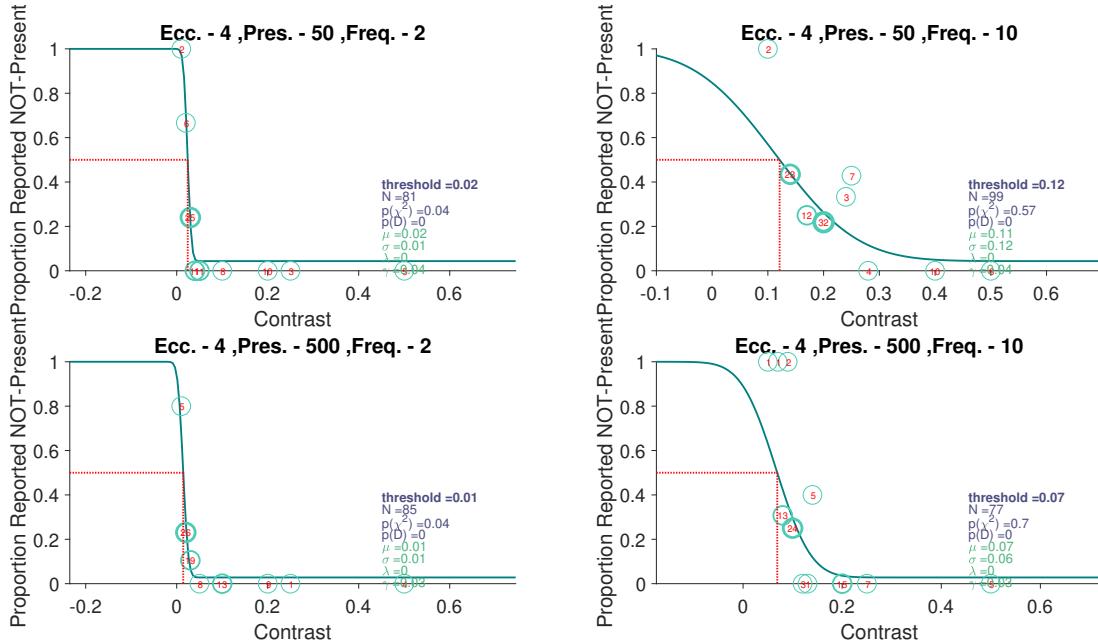


Figure 189: Psychometric curve at **Eccentricity 4** with binned contrast (rounded to 2 decimals).

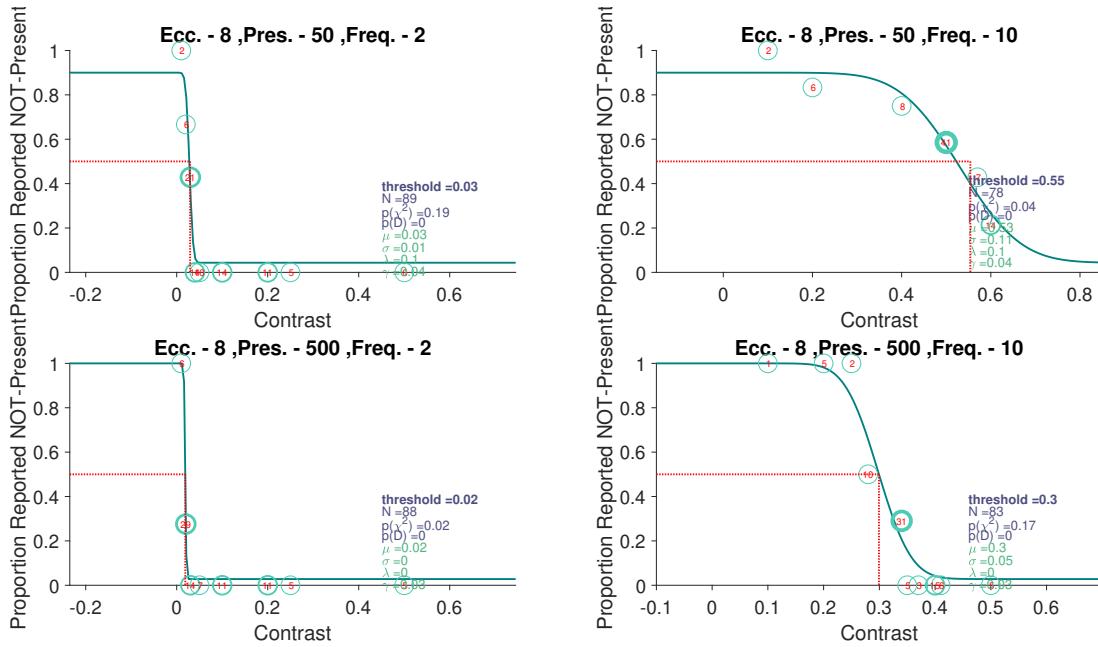


Figure 190: Psychometric curve at **Eccentricity 8** with binned contrast (rounded to 2 decimals).

3.9.4.2 SUBJECT:A013 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

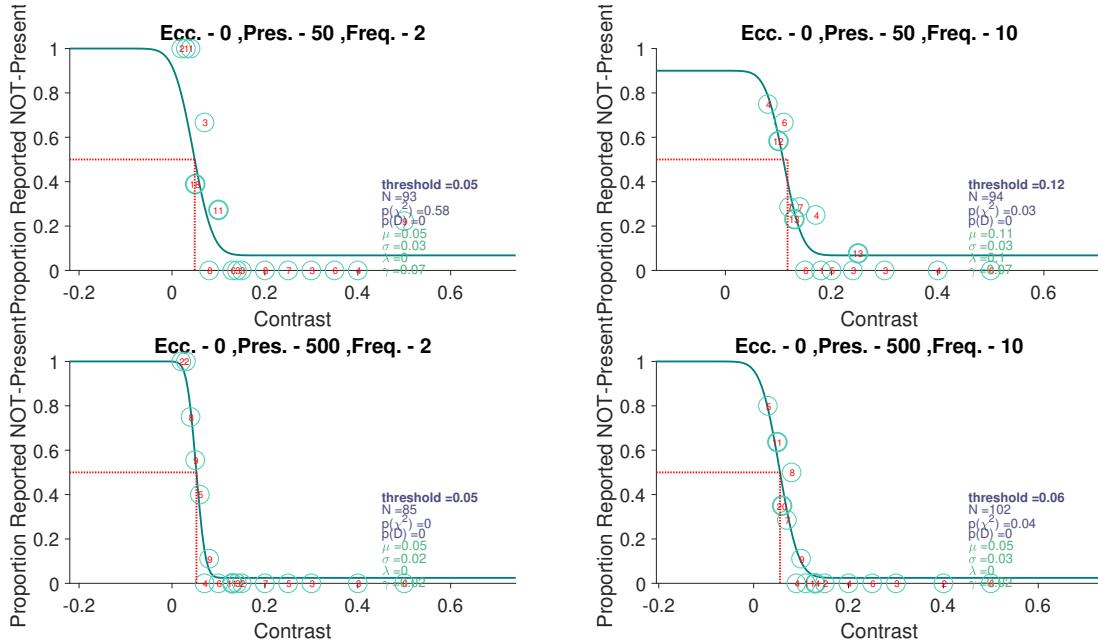


Figure 191: Psychometric curve at **Eccentricity 0** with binned contrast (rounded to 2 decimals).

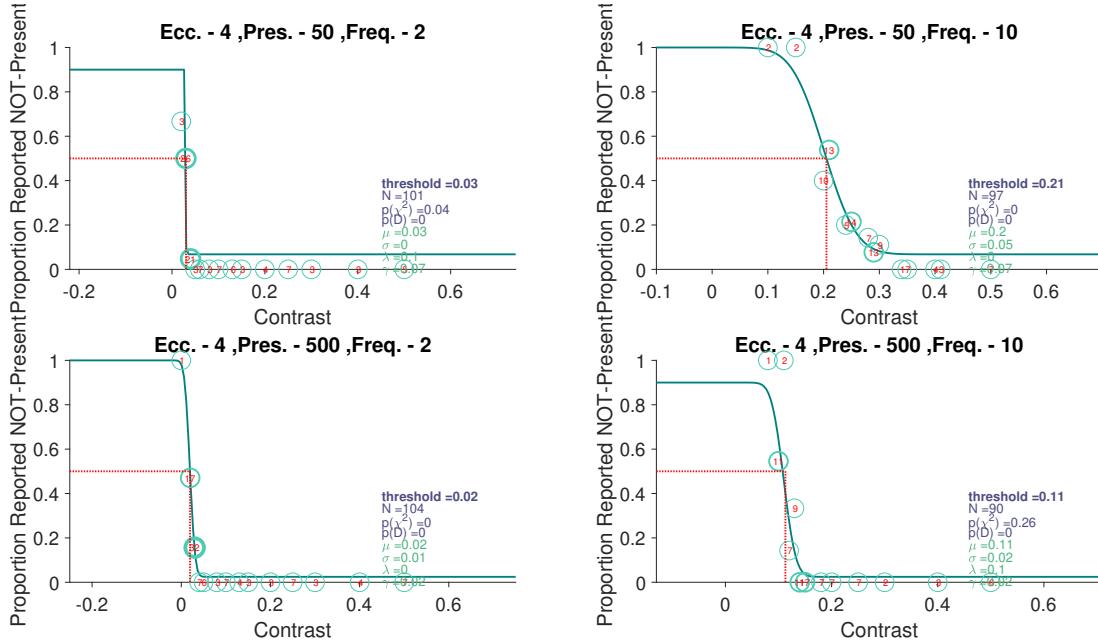


Figure 192: Psychometric curve at **Eccentricity 4** with binned contrast (rounded to 2 decimals).

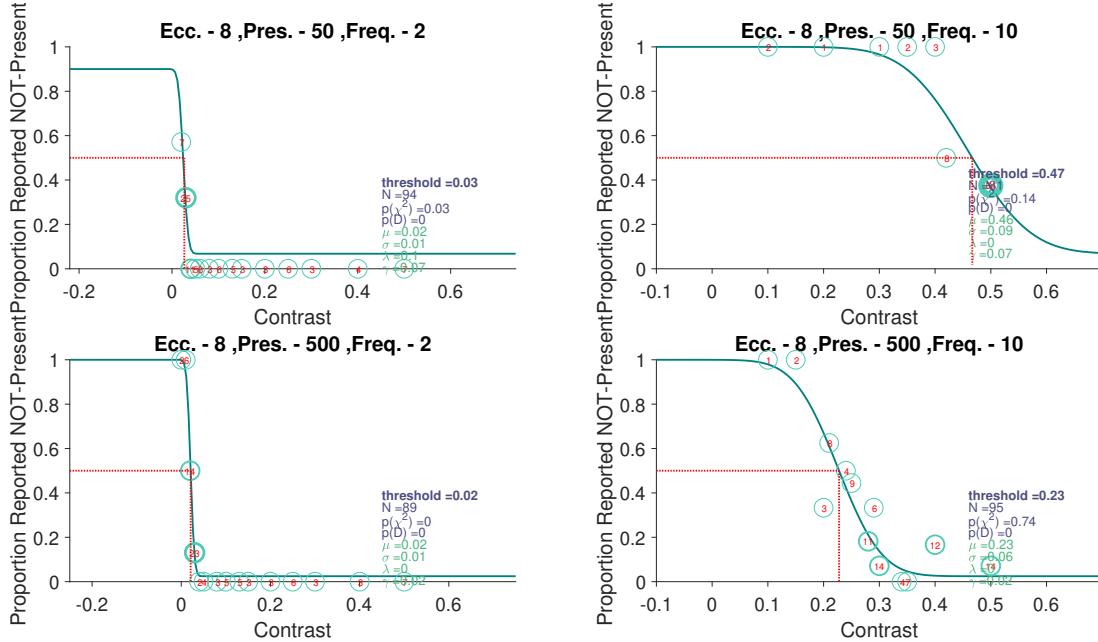


Figure 193: Psychometric curve at **Eccentricity 8** with binned contrast (rounded to 2 decimals).

3.9.4.3 SUBJECT:A092 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

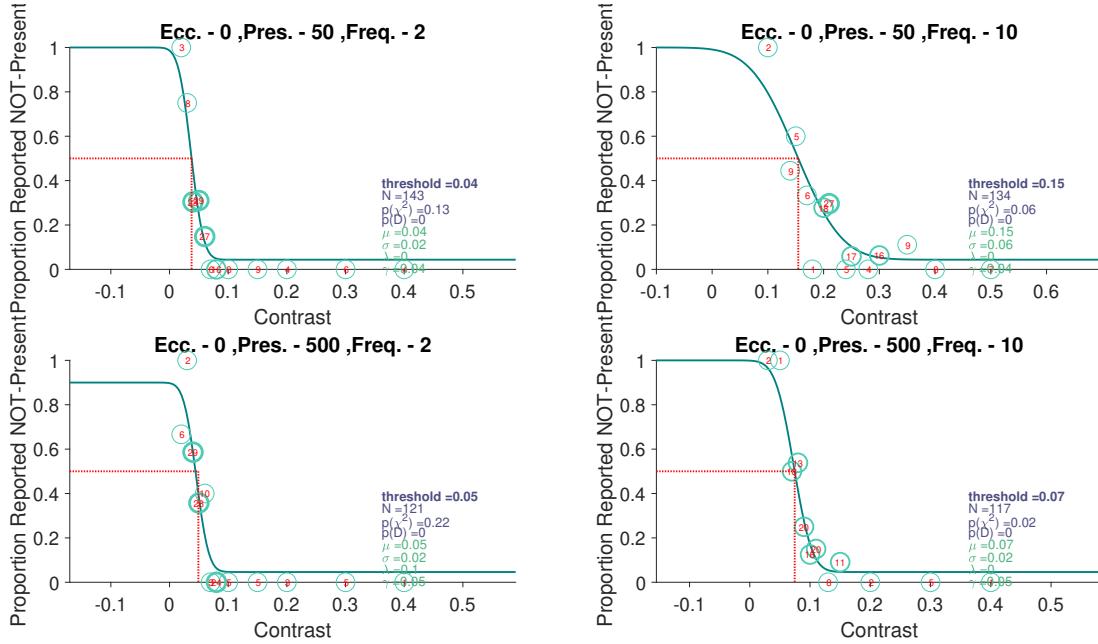


Figure 194: Psychometric curve at **Eccentricity 0** with **binned** contrast (rounded to 2 decimals).

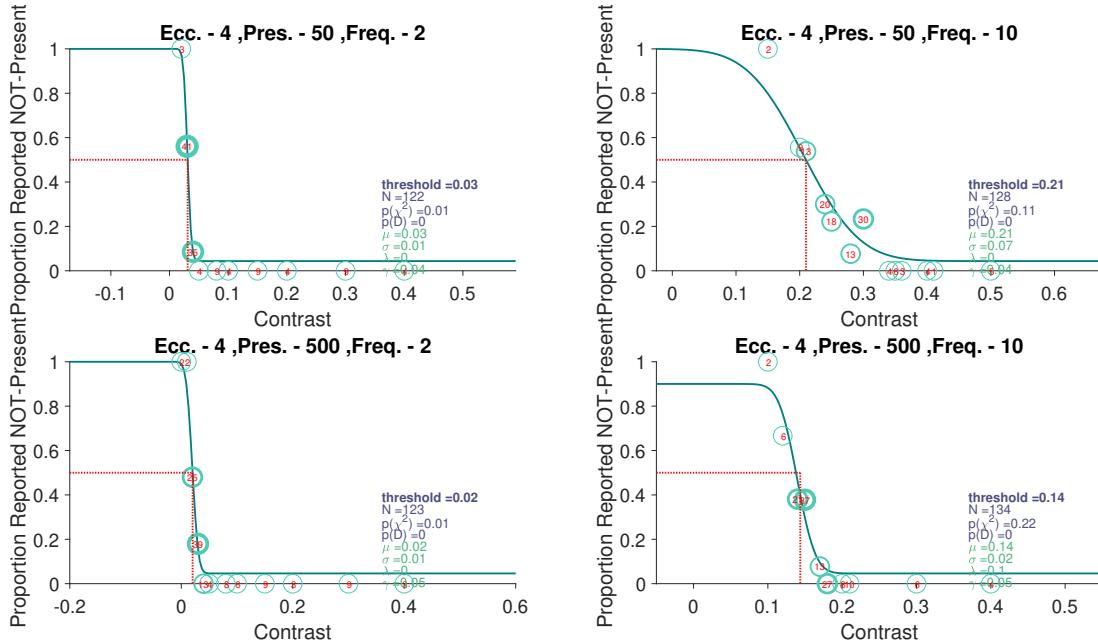


Figure 195: Psychometric curve at **Eccentricity 4** with **binned** contrast (rounded to 2 decimals).

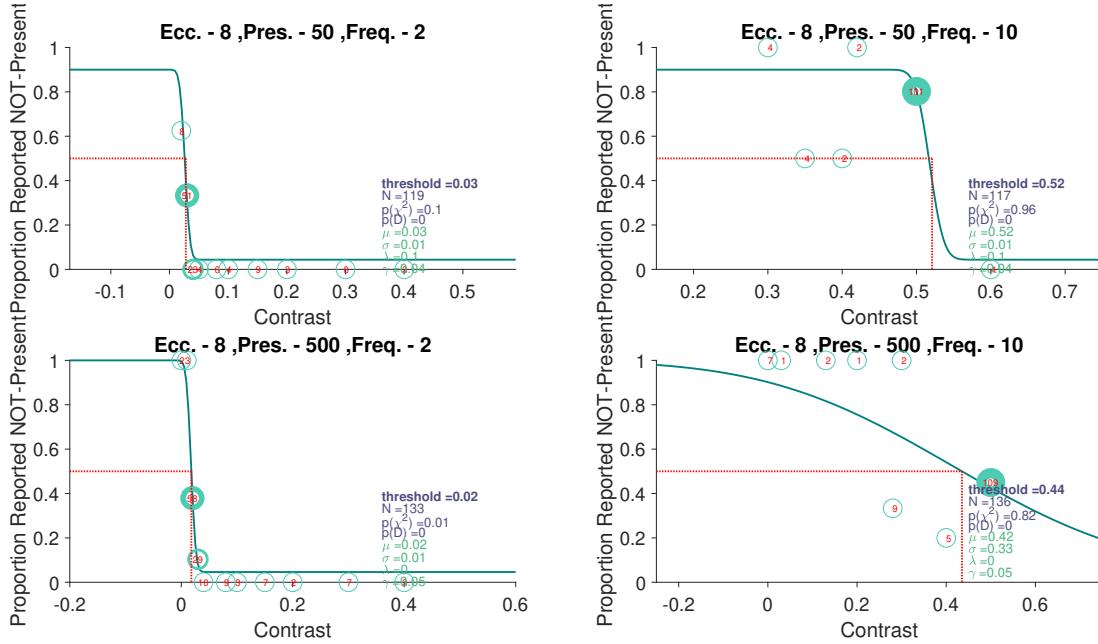


Figure 196: Psychometric curve at **Eccentricity 8** with binned contrast (rounded to 2 decimals).

3.9.4.4 SUBJECT:A036 The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

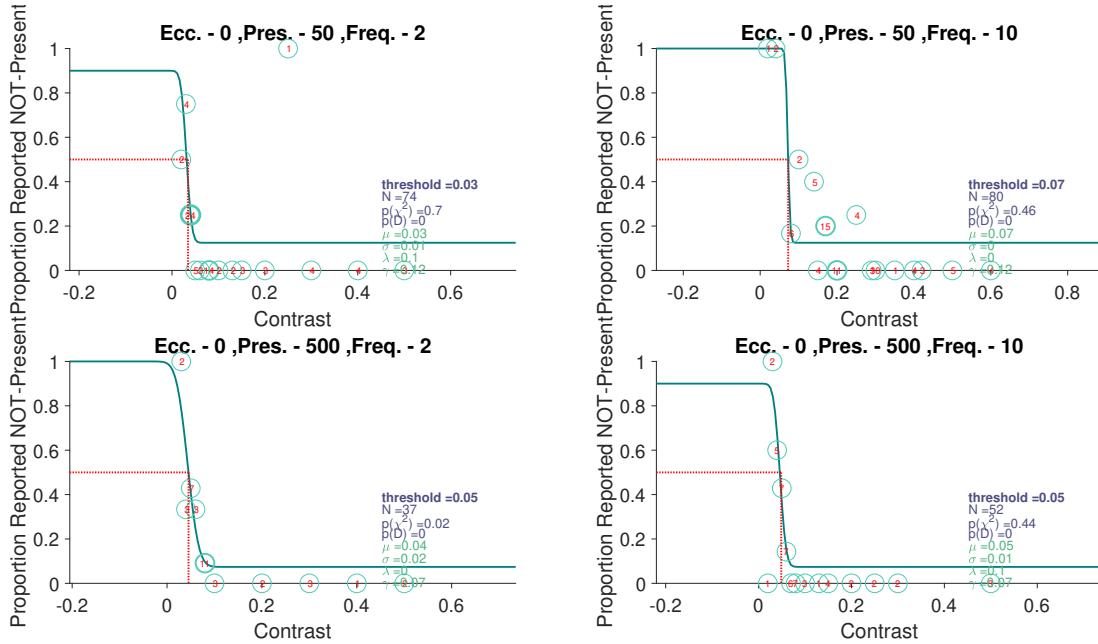


Figure 197: Psychometric curve at **Eccentricity 0** with binned contrast (rounded to 2 decimals).

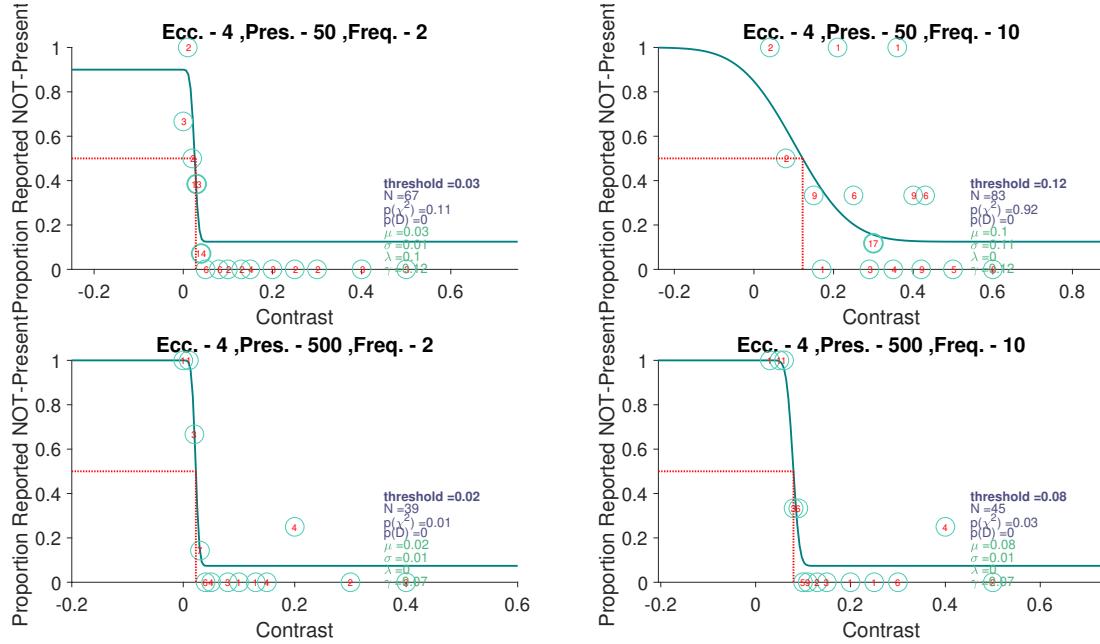


Figure 198: Psychometric curve at **Eccentricity 4** with binned contrast (rounded to 2 decimals).

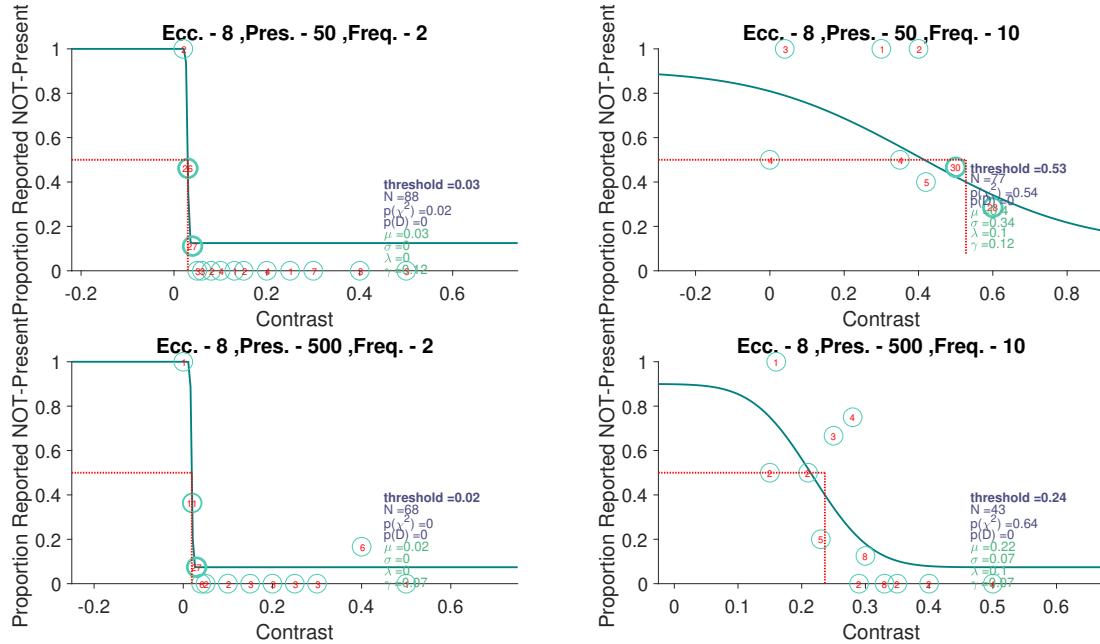


Figure 199: Psychometric curve at **Eccentricity 8** with binned contrast (rounded to 2 decimals).

3.10 Summary Plots

3.10.1 Nikunj

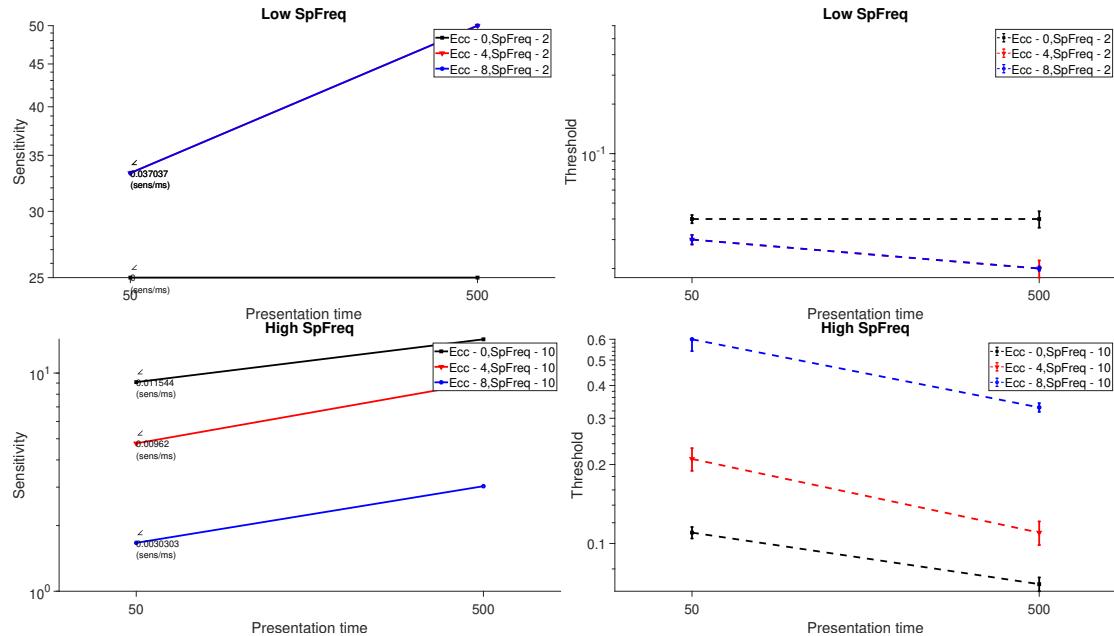


Figure 200: Threshold/Sensitivity summary plots

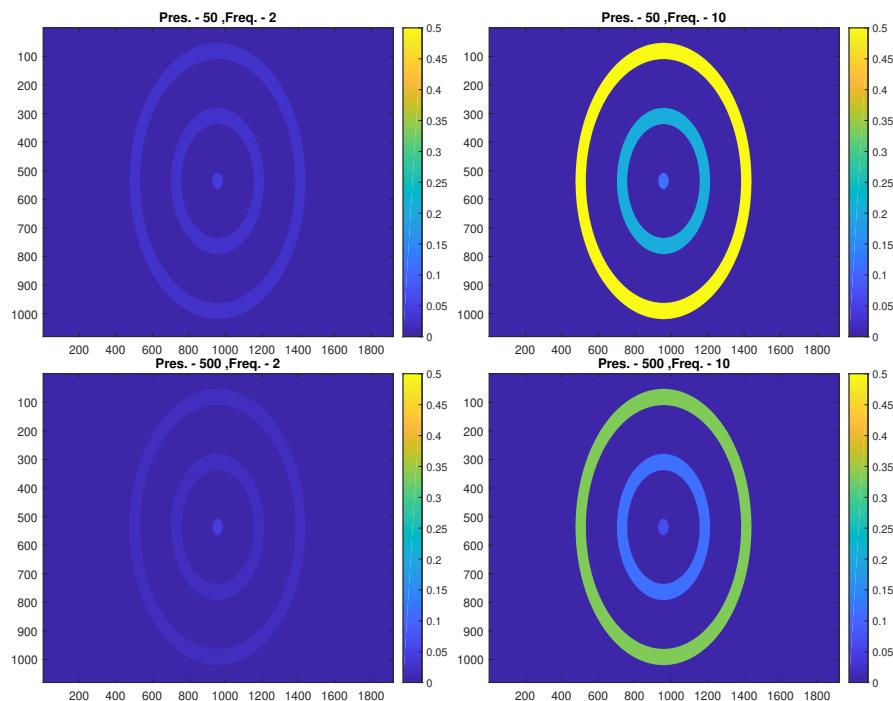


Figure 201: Threshold colorbar plots

3.10.2 A013

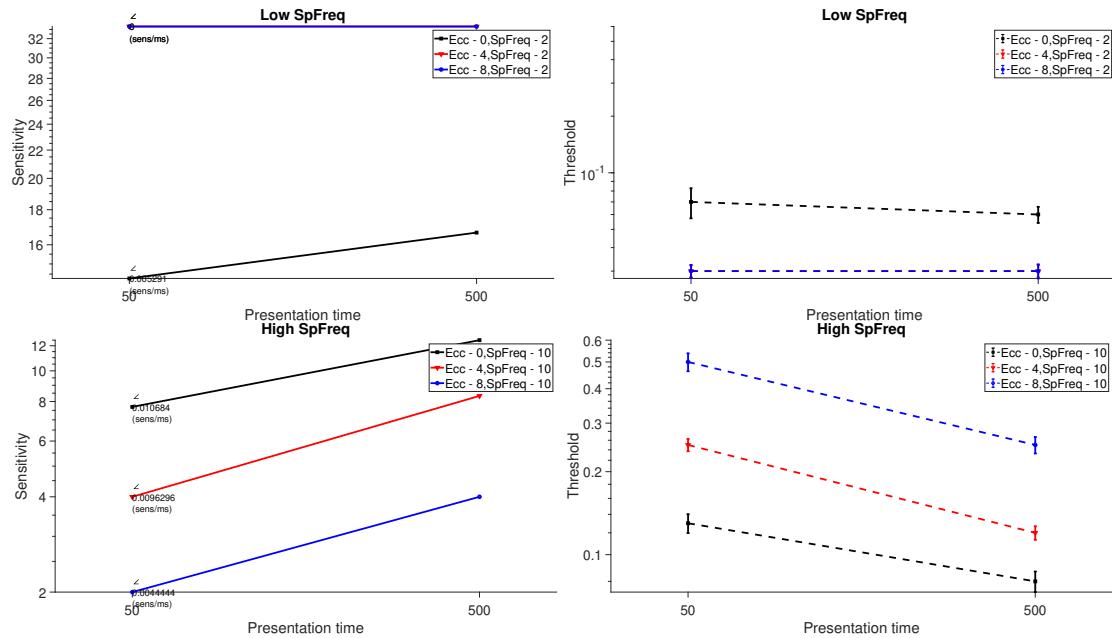


Figure 202: Threshold/Sensitivity summary plots

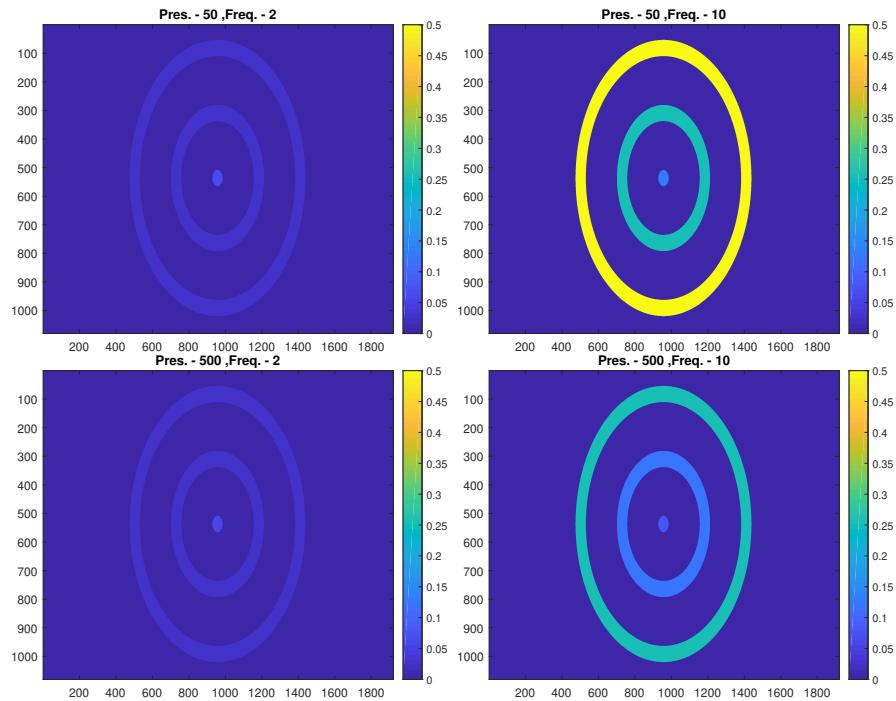


Figure 203: Threshold colorbar plots

3.10.3 A092

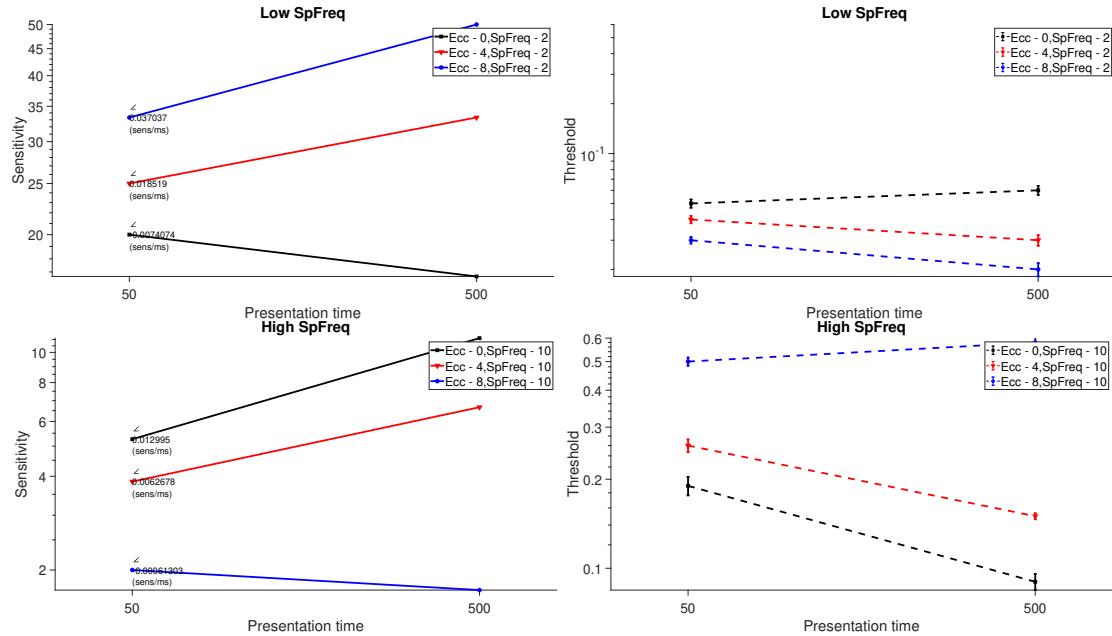


Figure 204: Threshold/Sensitivity summary plots

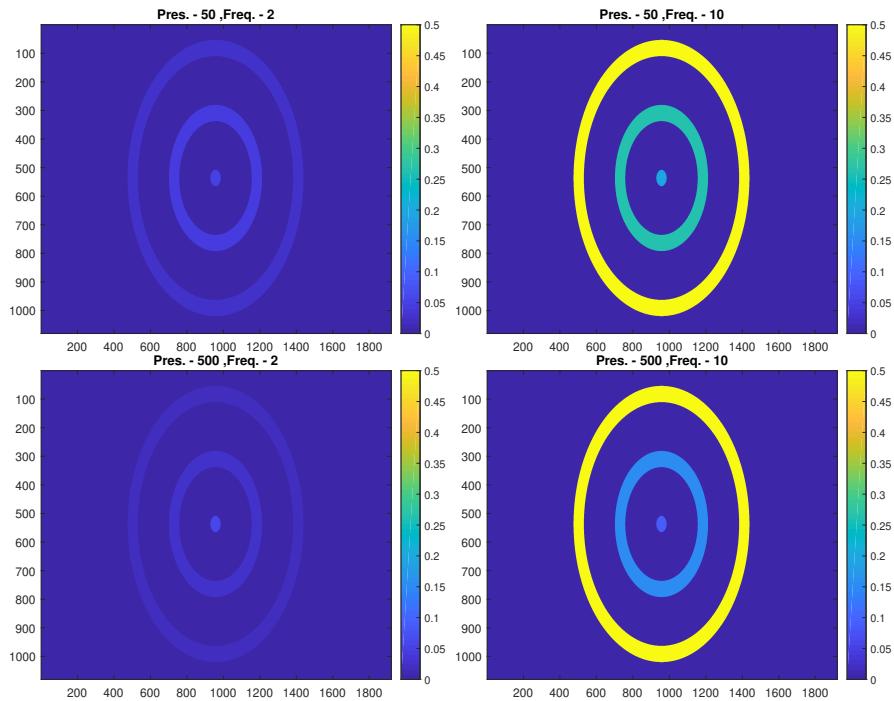


Figure 205: Threshold colorbar plots

3.10.4 A036

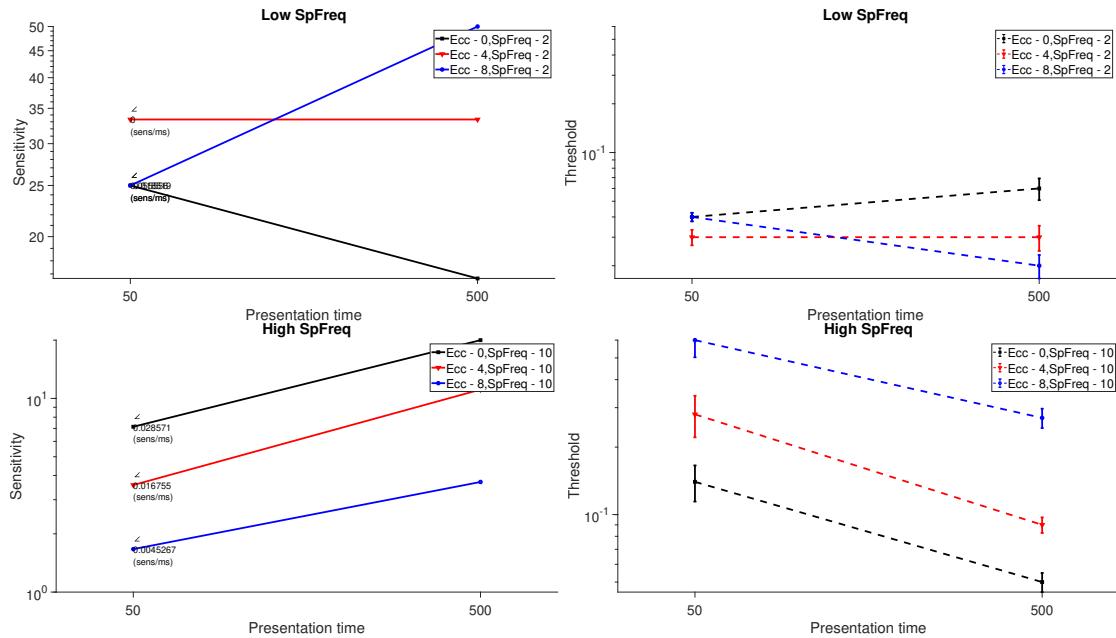


Figure 206: Threshold/Sensitivity summary plots

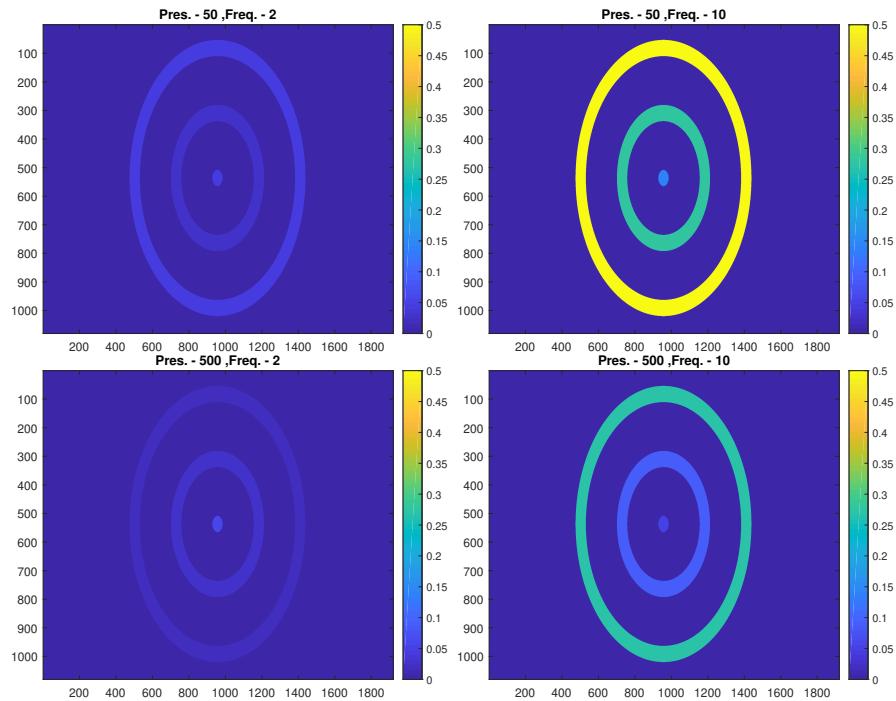


Figure 207: Threshold colorbar plots

3.11 ALL SUBJECTS

3.11.1 75 percent thresh

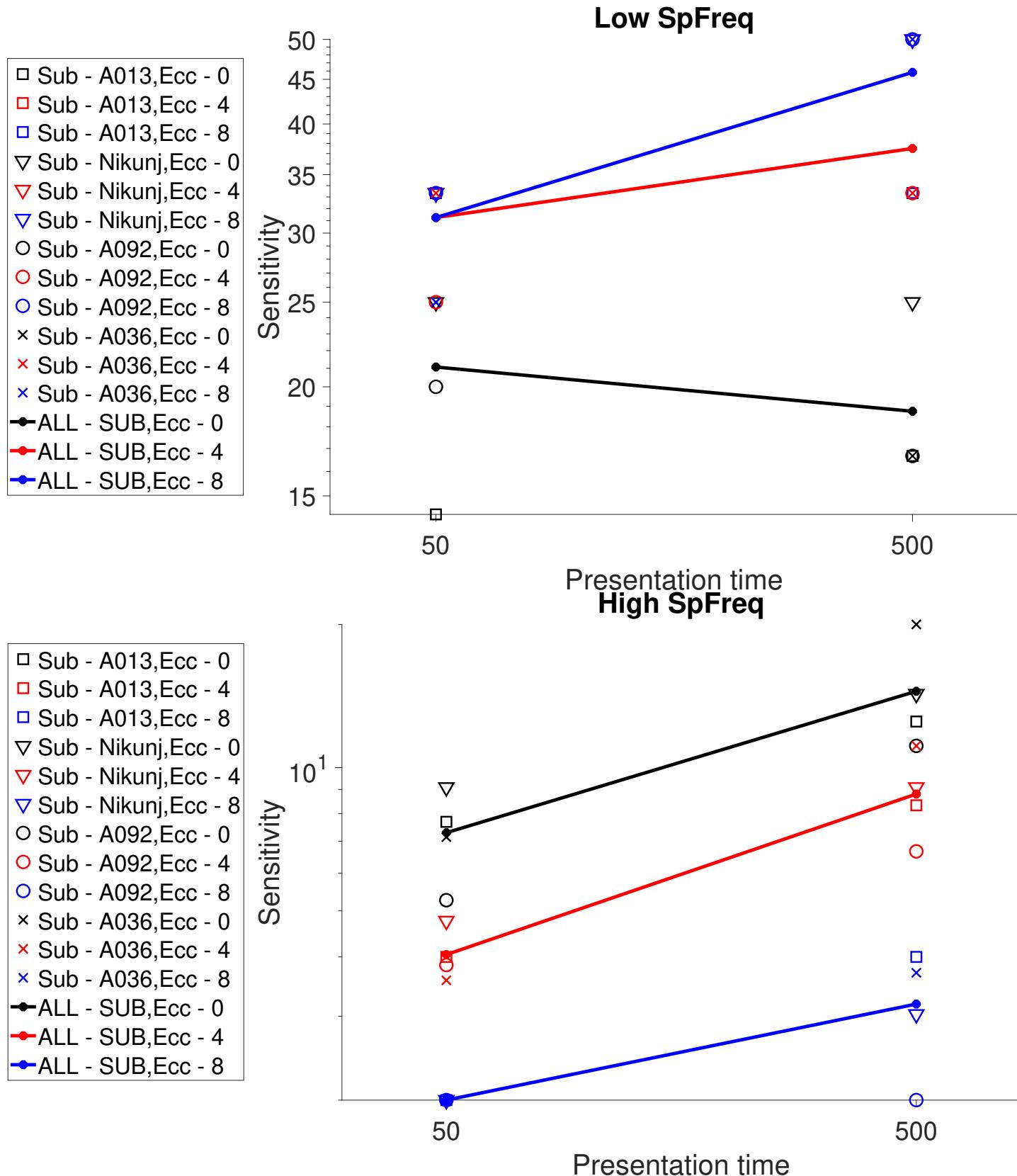


Figure 208: Sensitivity summary plots

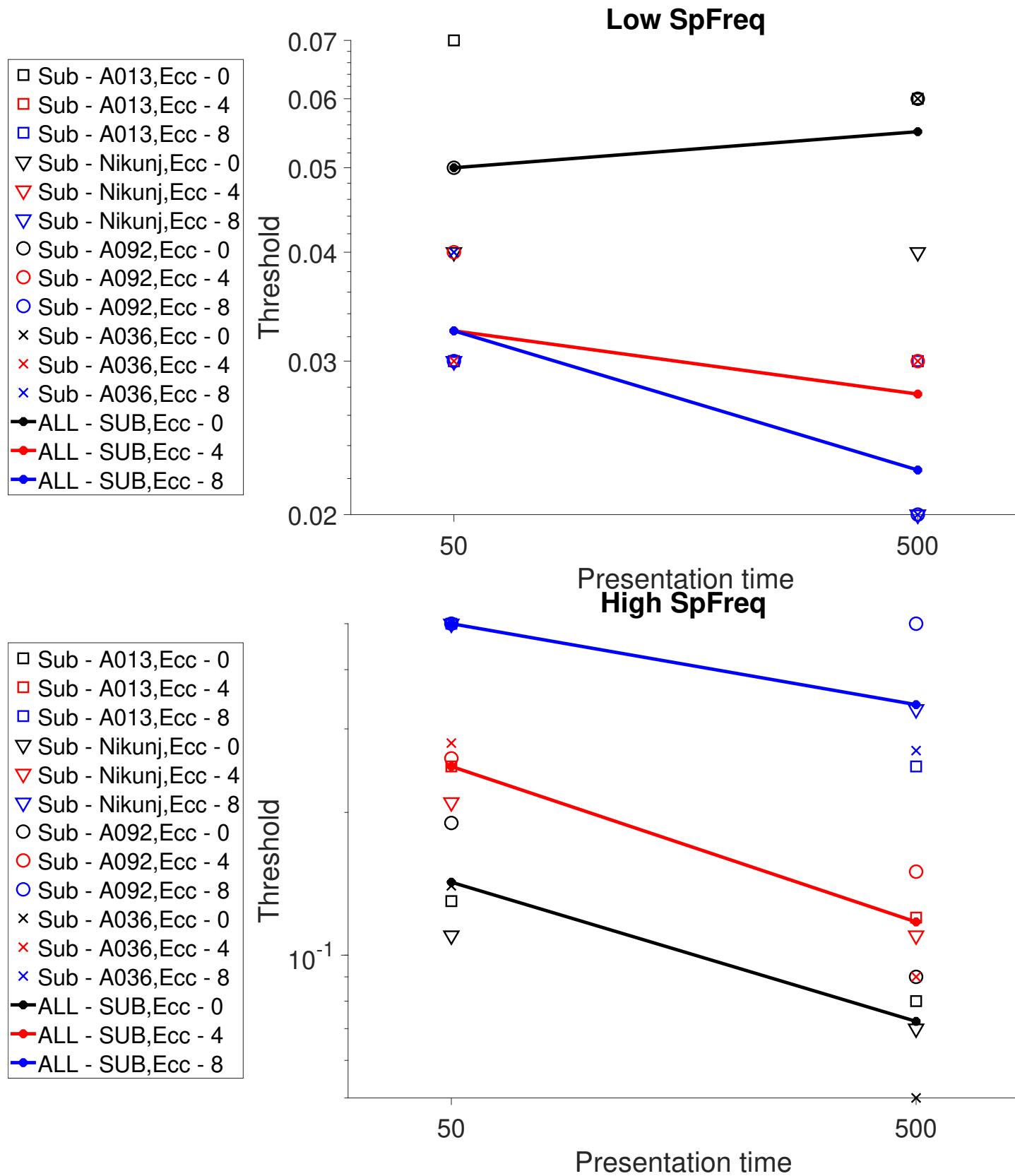


Figure 209: Threshold summary plots

3.11.2 50 percent thresh

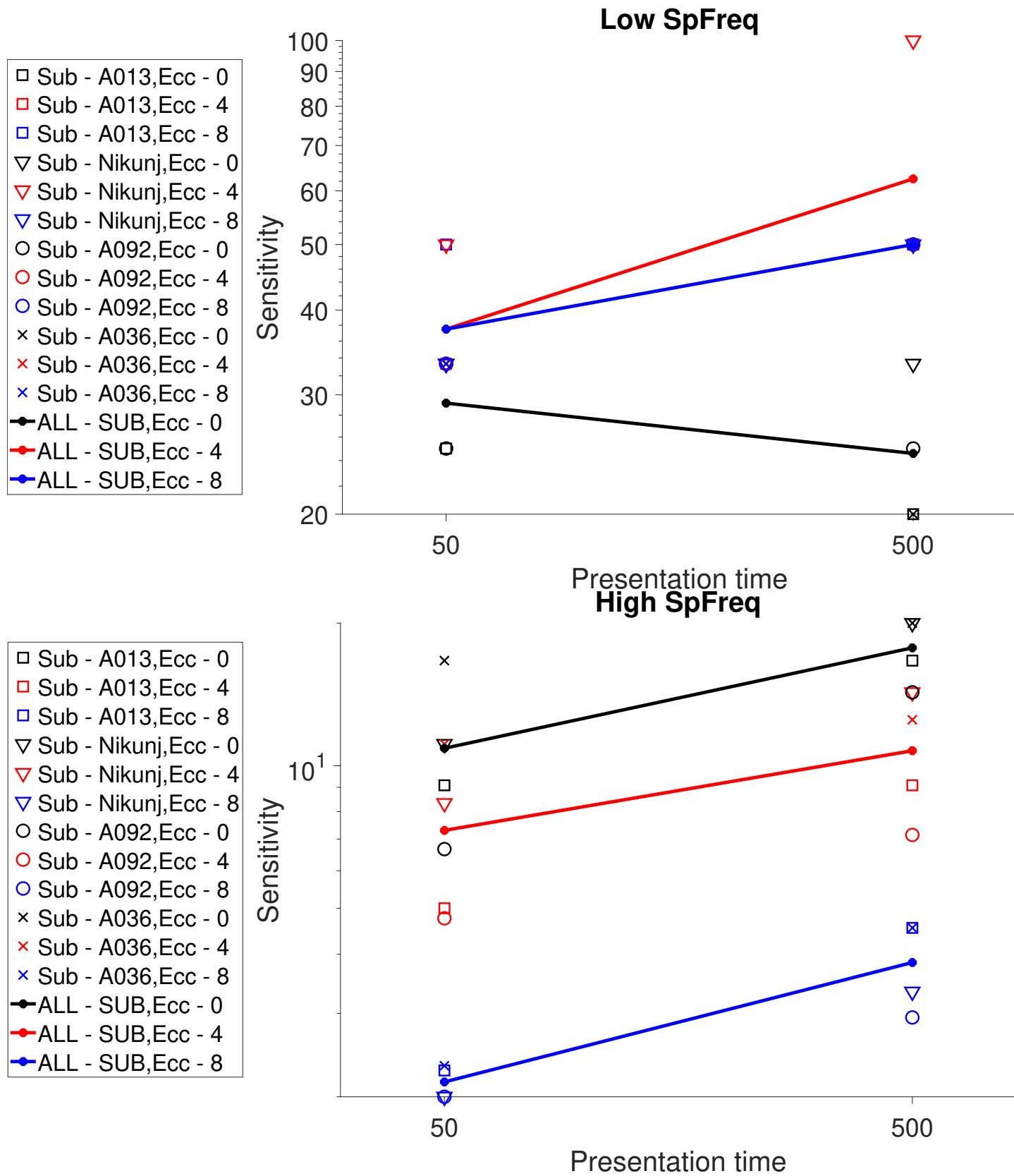


Figure 210: Sensitivity summary plots

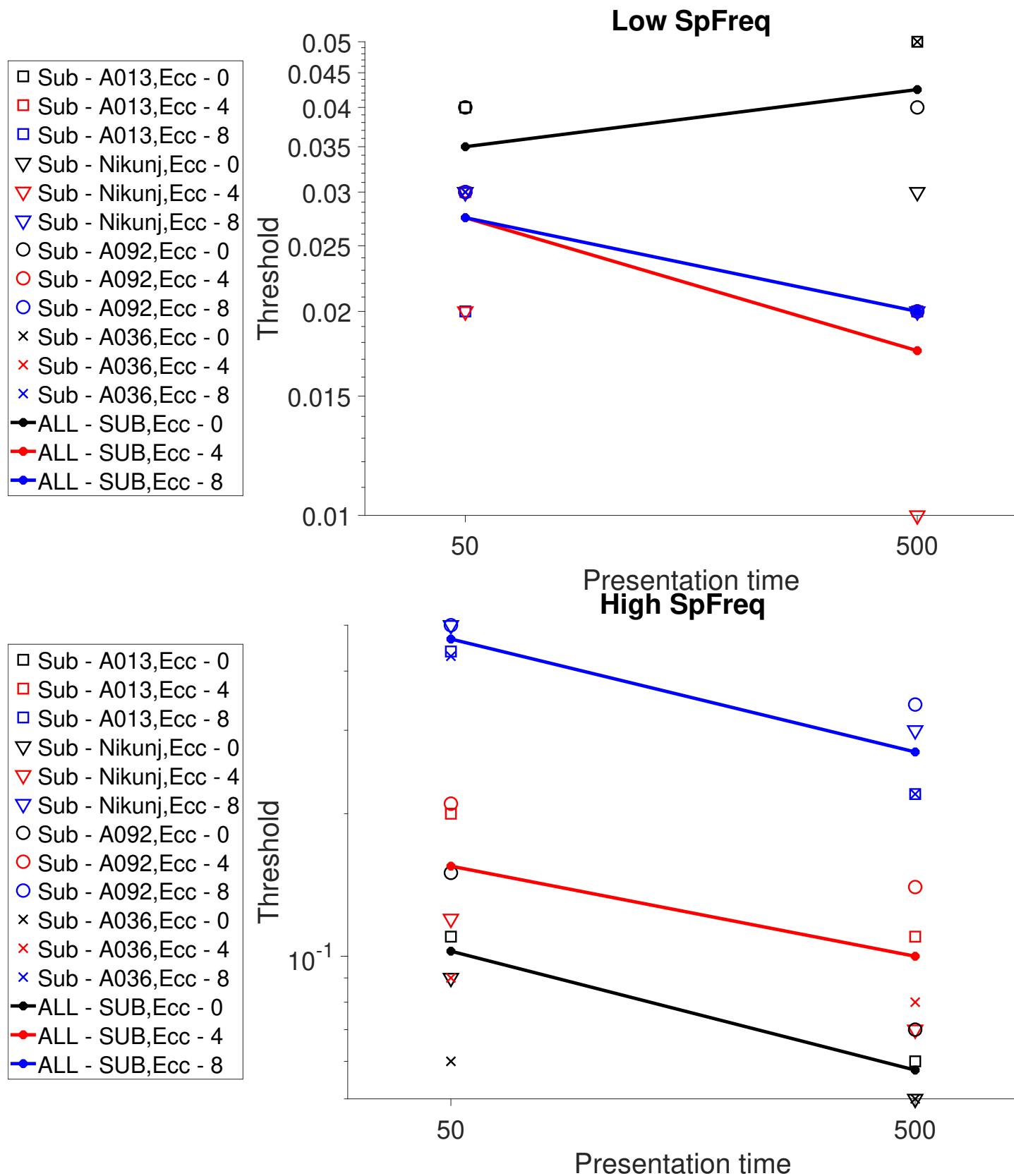


Figure 211: Threshold summary plots

4 Data Analysis - TIME Experiment

In this experiment the contrast is fixed for a particular eccentricity and stimuli spatial frequency while presentation time is varied using PEST. The contrast level is chosen as the mean of the estimated thresholds at 50 and 500ms from previous experiment. If this mean contrast was more than 0.5 it was set to 0.5.

4.1 PEST

4.1.1 SUBJECT:A092

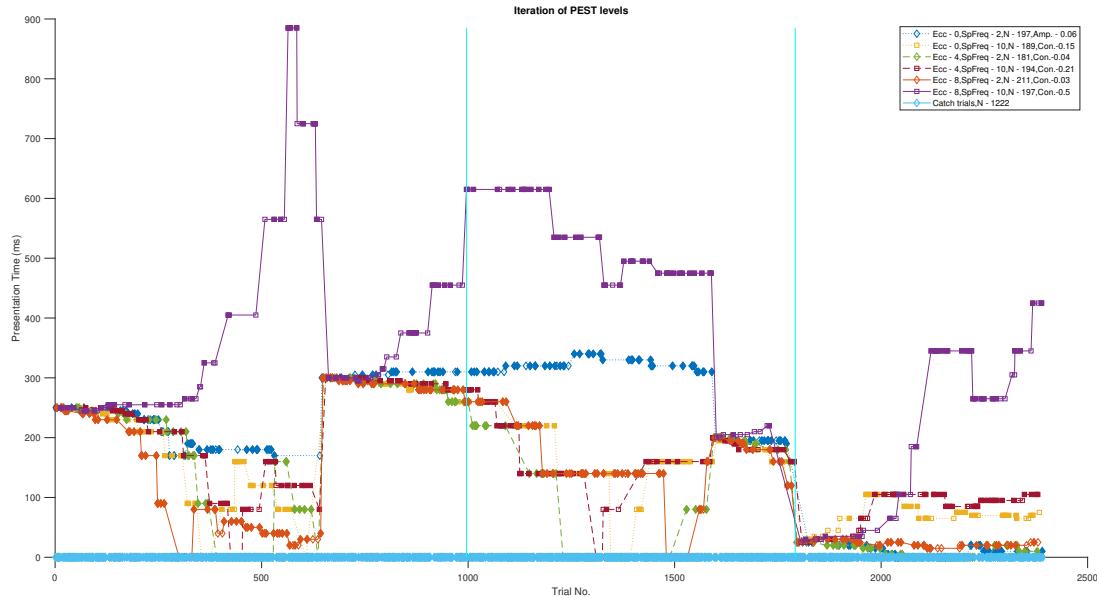


Figure 212: SUBJECT: A092. Change in PEST contrast levels for different conditions/instances over the course of trials. Vertical lines denote start of a new session. Filled dots are trials where the response was correct and vice versa. In the legend, 'N' denotes total number of trials with that condition/instance and 'Con.' denotes the fixed contrast level at that condition/instance.

4.1.2 SUBJECT:Nikunj

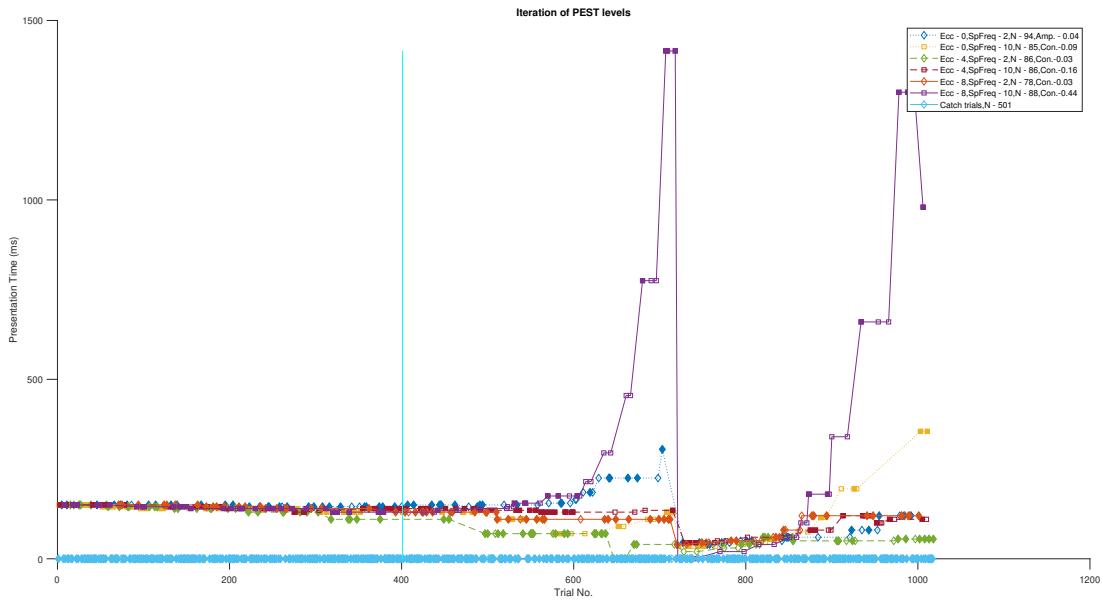


Figure 213: SUBJECT: Nikunj. Change in PEST contrast levels for different conditions/instances over the course of trials. Vertical lines denote start of a new session. Filled dots are trials where the response was correct and vice versa. In the legend, 'N' denotes total number of trials with that condition/instance and 'Con.' denotes the fixed contrast level at that condition/instance.

4.1.3 SUBJECT:A036

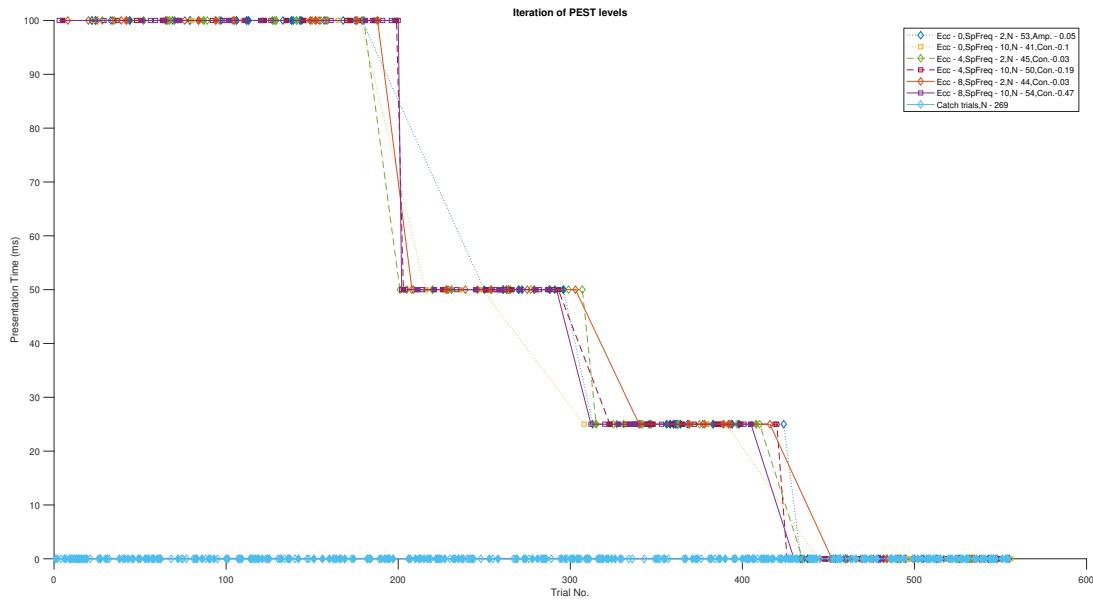


Figure 214: SUBJECT: A036. Change in PEST contrast levels for different conditions/instances over the course of trials. Vertical lines denote start of a new session. Filled dots are trials where the response was correct and vice versa. In the legend, 'N' denotes total number of trials with that condition/instance and 'Con.' denotes the fixed contrast level at that condition/instance.

4.2 FA Rate

4.2.1 SUBJECT:A092

The analysis has been done using VALID trials for trials in which the stimulus was present.

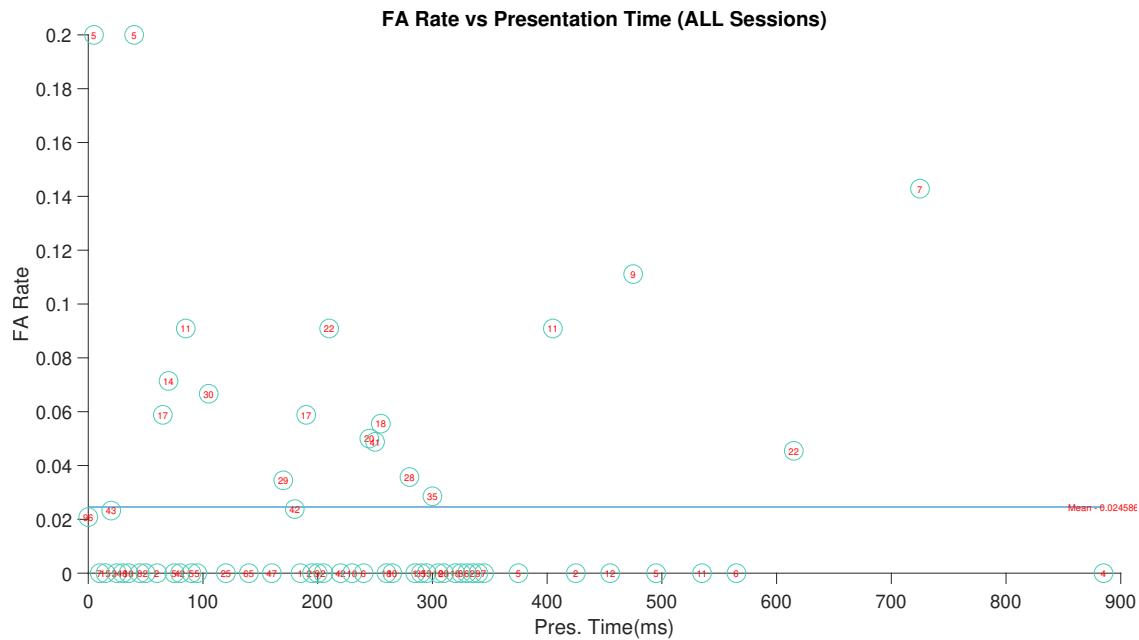


Figure 215: FA rate vs Presentation time for all sessions.

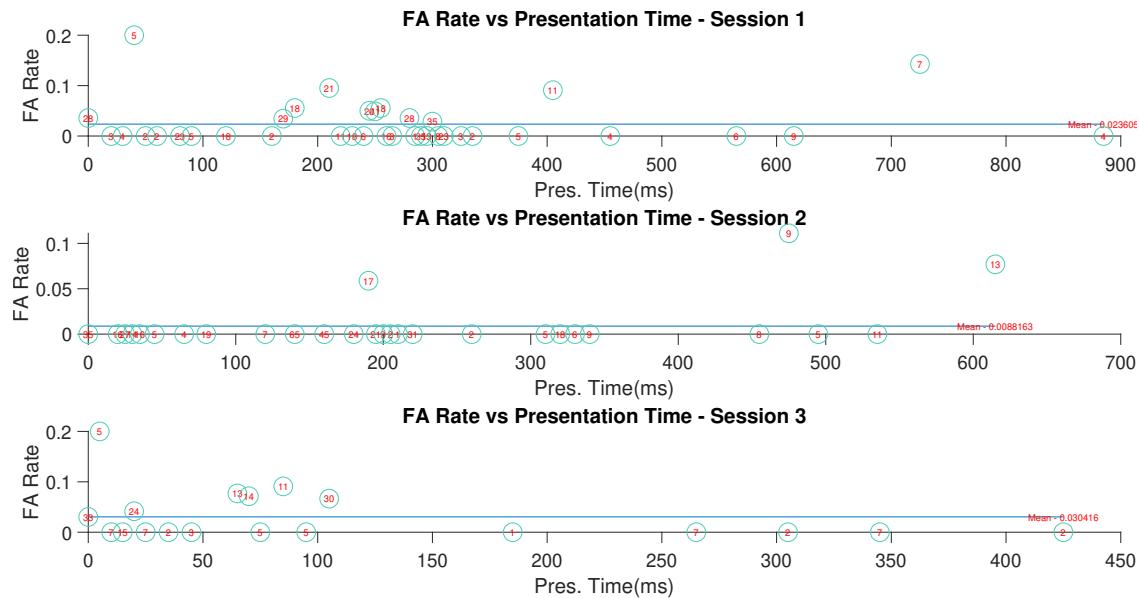


Figure 216: FA rate vs Presentation time for different sessions.

4.2.2 SUBJECT:Nikunj

The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

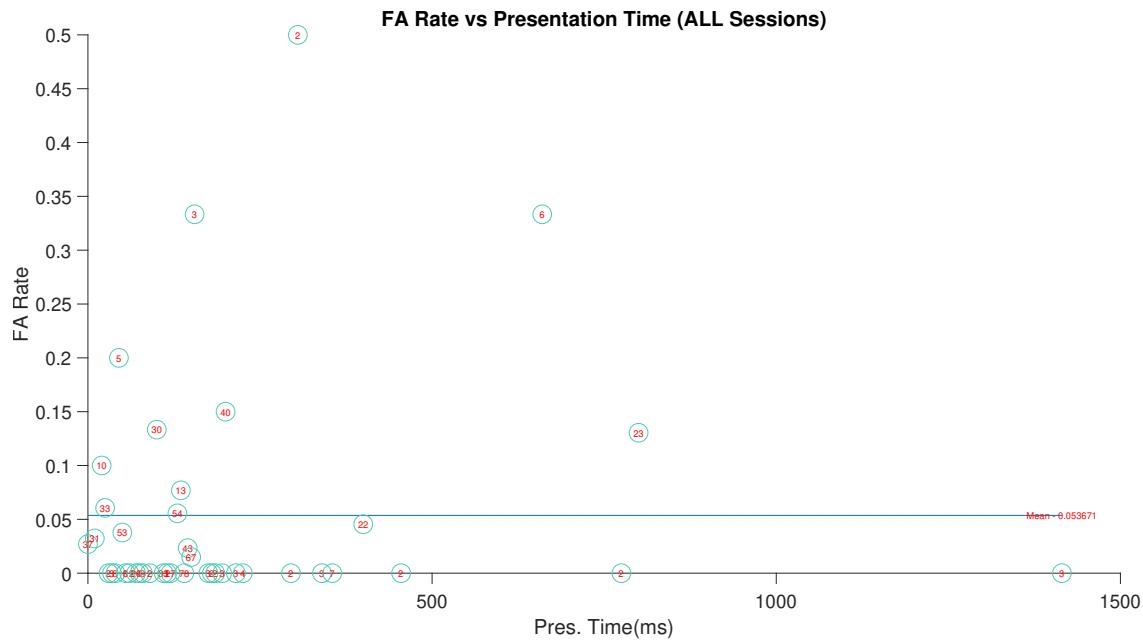


Figure 217: FA rate vs Presentation time for all sessions.

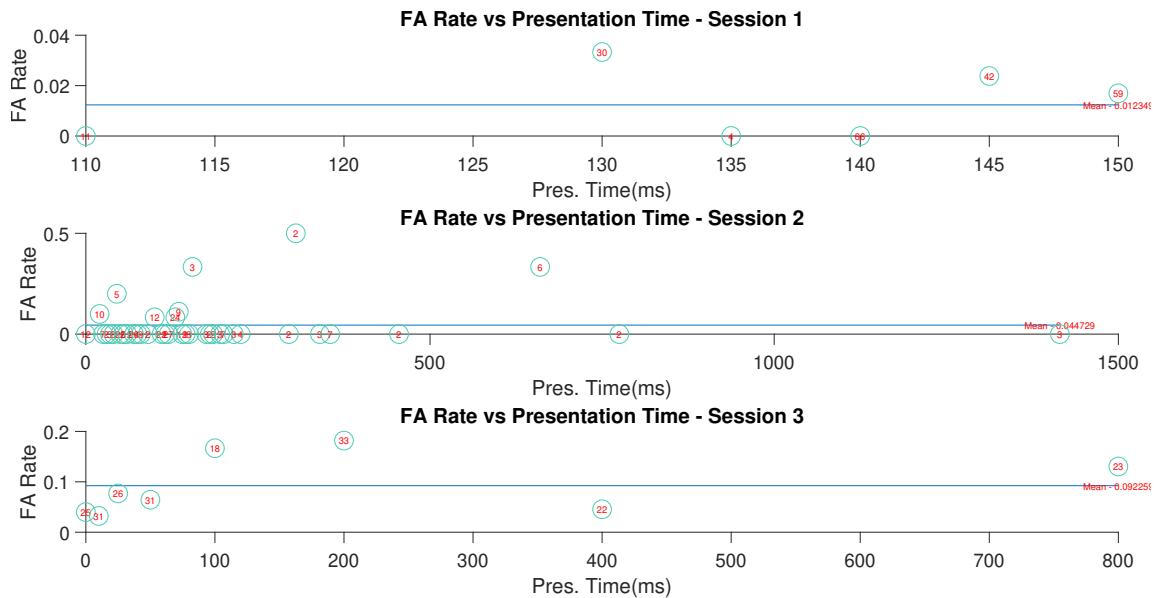


Figure 218: FA rate vs Presentation time for different sessions.

4.2.3 SUBJECT:A036

The analysis has been done using VALID trials for trials in which the stimulus was present.

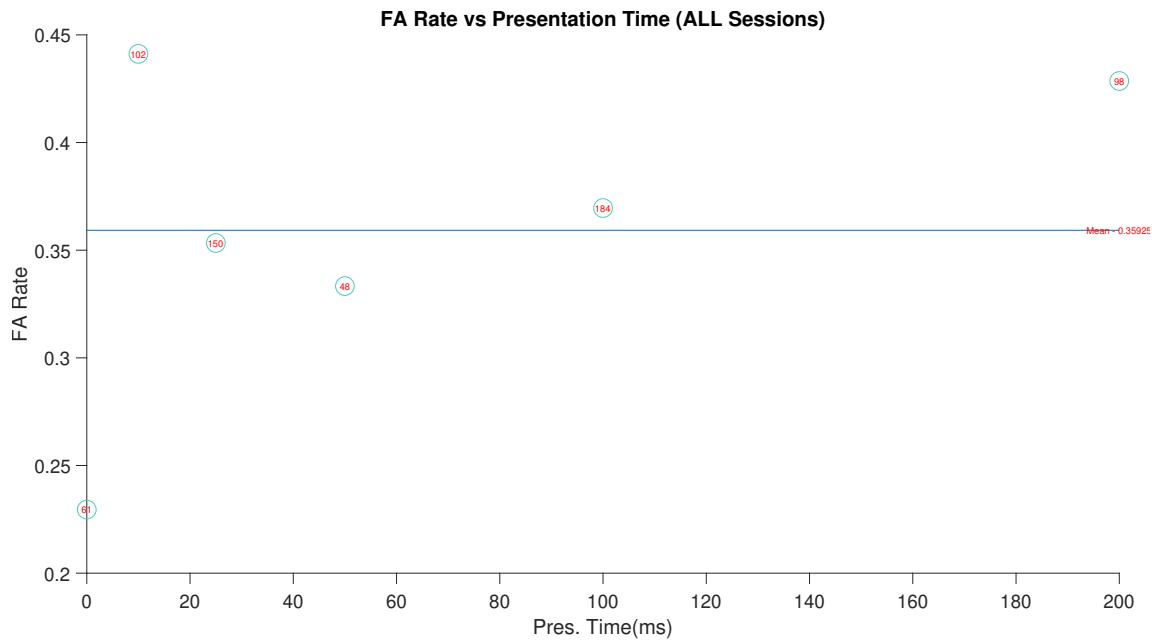


Figure 219: FA rate vs Presentation time for all sessions.

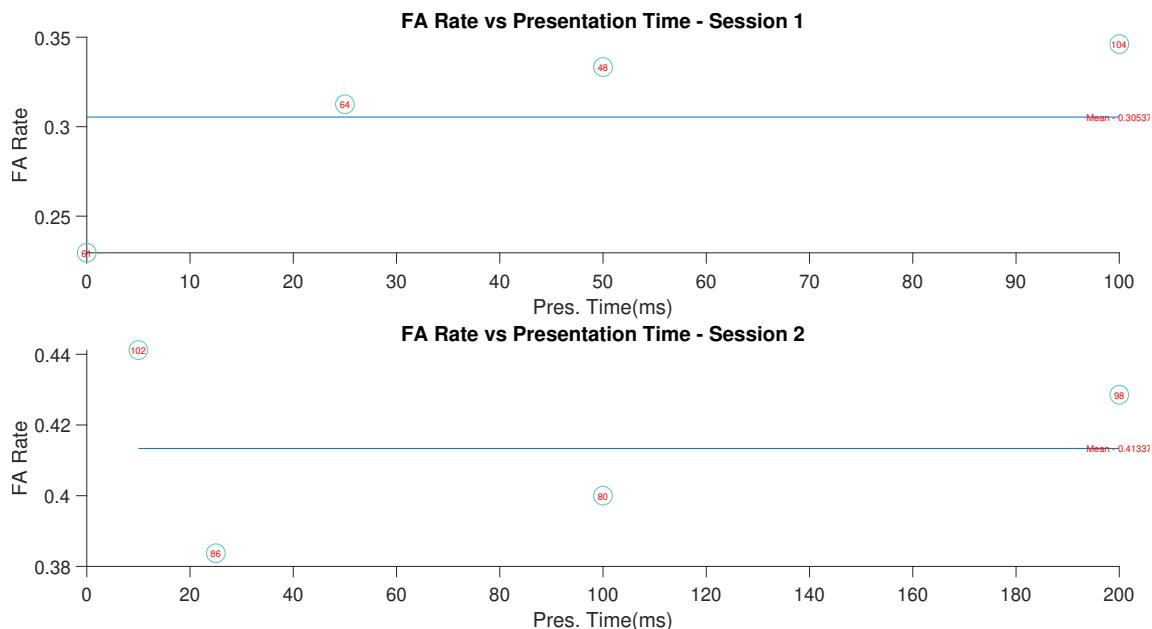


Figure 220: FA rate vs Presentation time for different sessions.

4.3 Performance Plots

4.3.1 SUBJECT:A092

The analysis has been done using VALID trials for trials in which the stimulus was present.

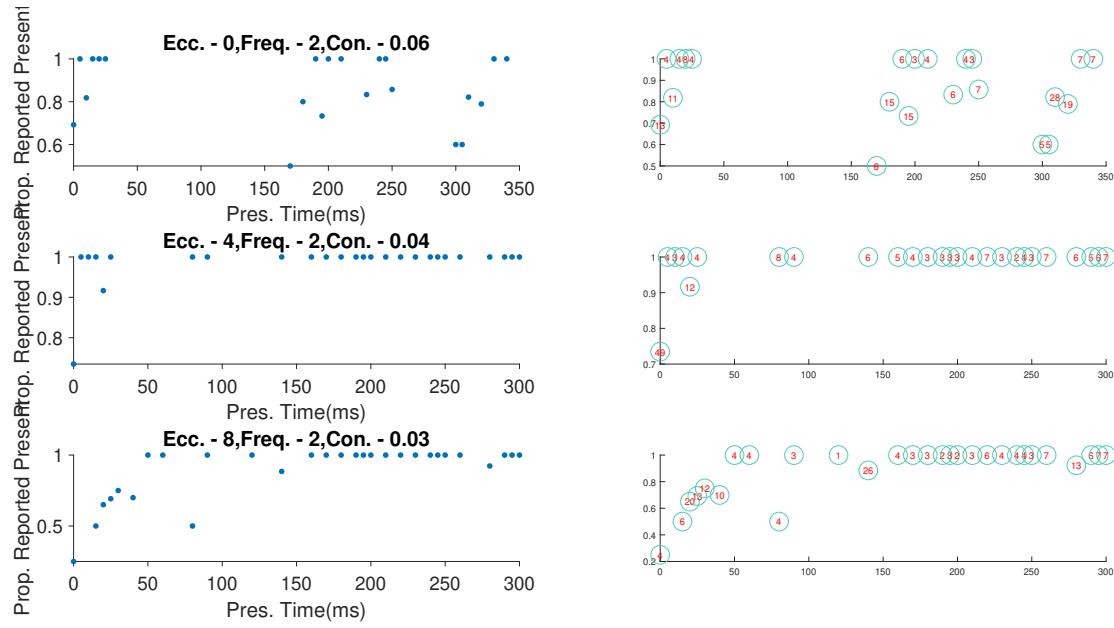


Figure 221: Proportion reported yes vs Presentation time for all eccentricities at Spatial Freq 2.

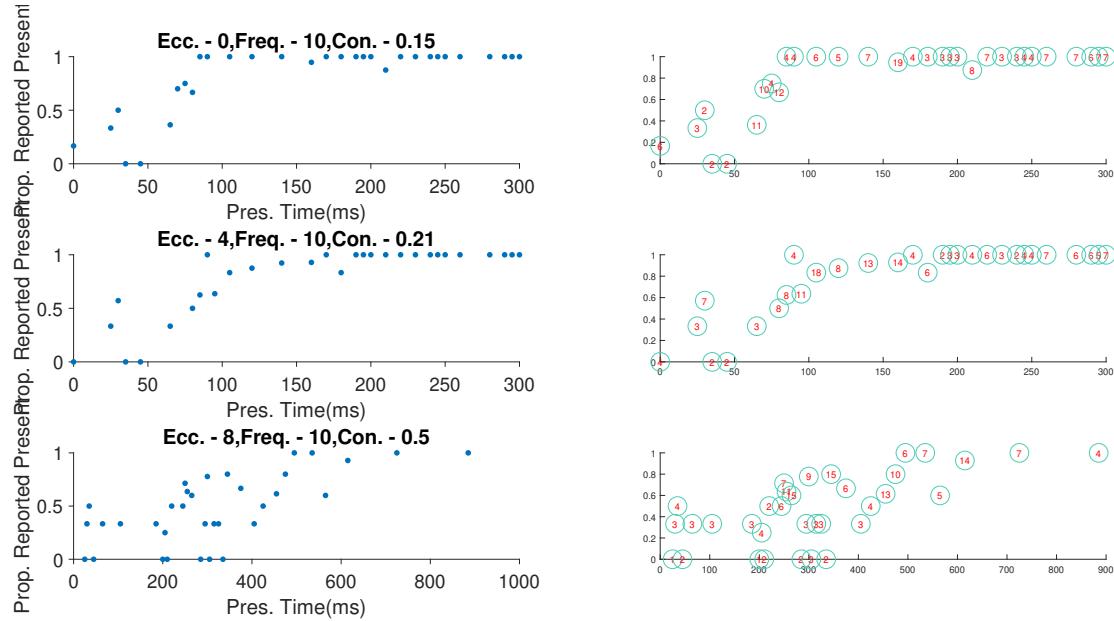


Figure 222: Proportion reported yes vs Presentation time for all eccentricities at Spatial Freq 10.

4.3.2 SUBJECT:Nikunj

The analysis has been done using only DRIFT trials for trials in which the stimulus was present.

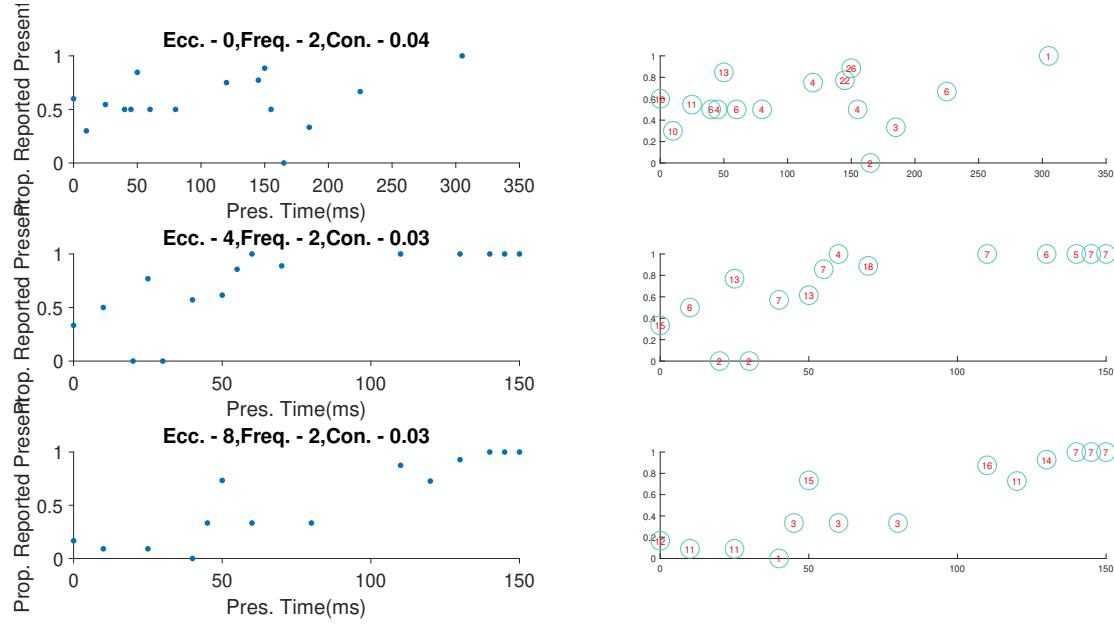


Figure 223: Proportion reported yes vs Presentation time for all eccentricities at Spatial Freq 2.

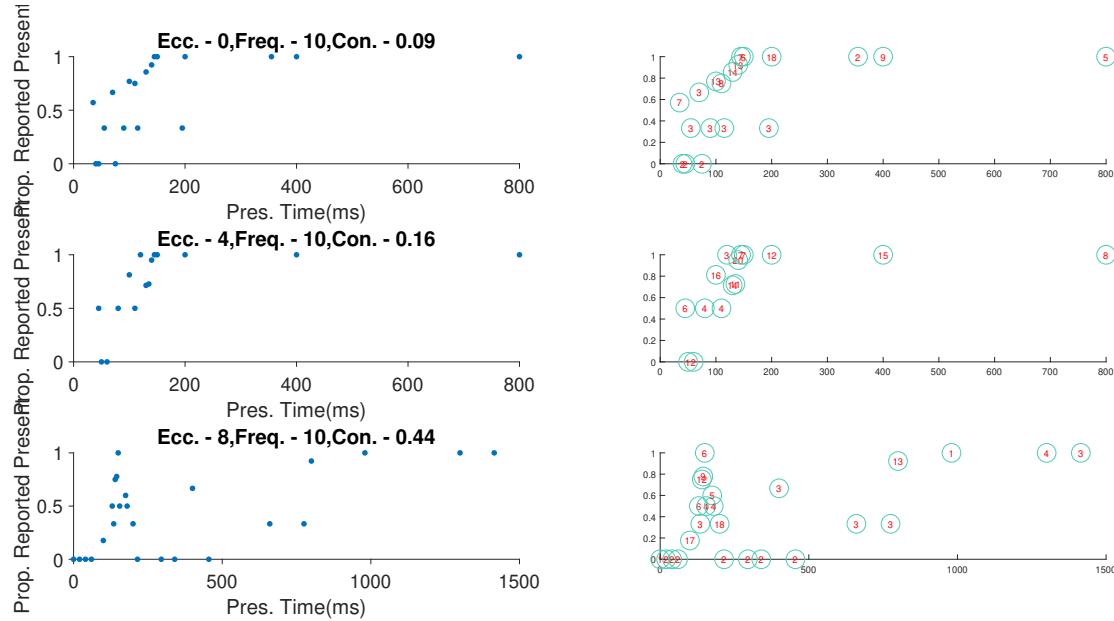


Figure 224: Proportion reported yes vs Presentation time for all eccentricities at Spatial Freq 10.

4.3.3 SUBJECT:A036

The analysis has been done using VALID trials for trials in which the stimulus was present.

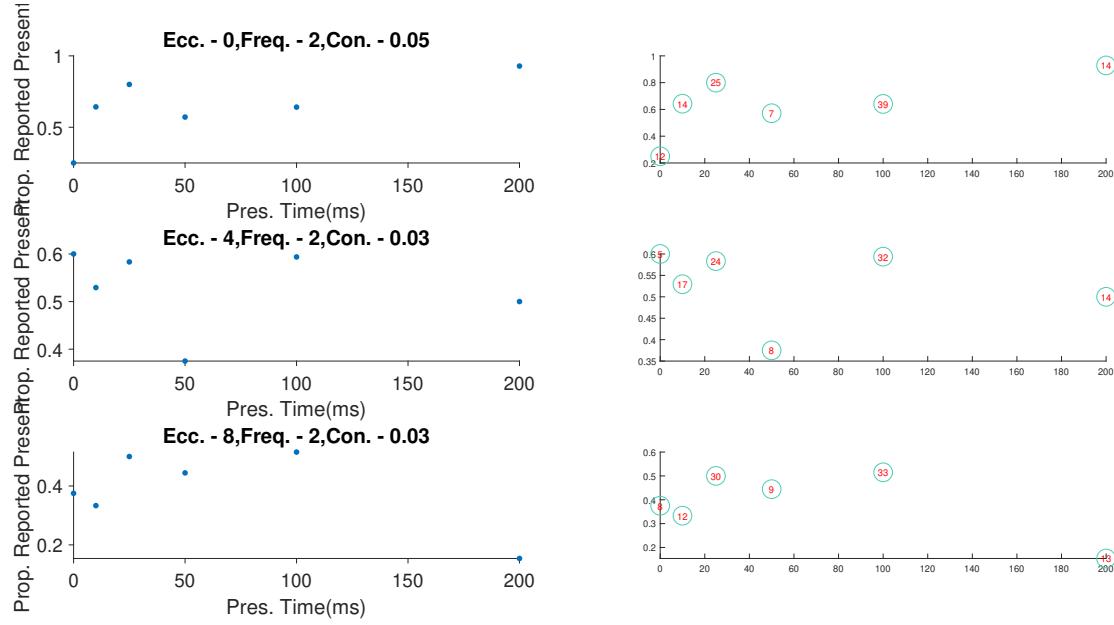


Figure 225: Proportion reported yes vs Presentation time for all eccentricities at Spatial Freq 2.

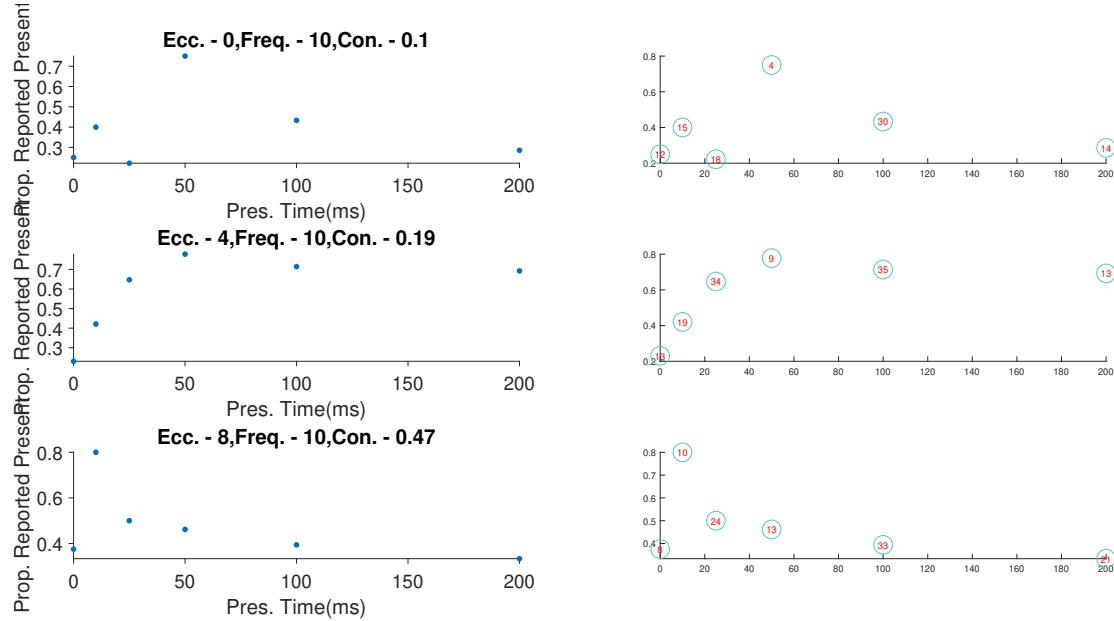


Figure 226: Proportion reported yes vs Presentation time for all eccentricities at Spatial Freq 10.

4.4 Psychometric analysis

4.4.1 SUBJECT:A092

The analysis has been done using VALID trials for trials in which the stimulus was present.

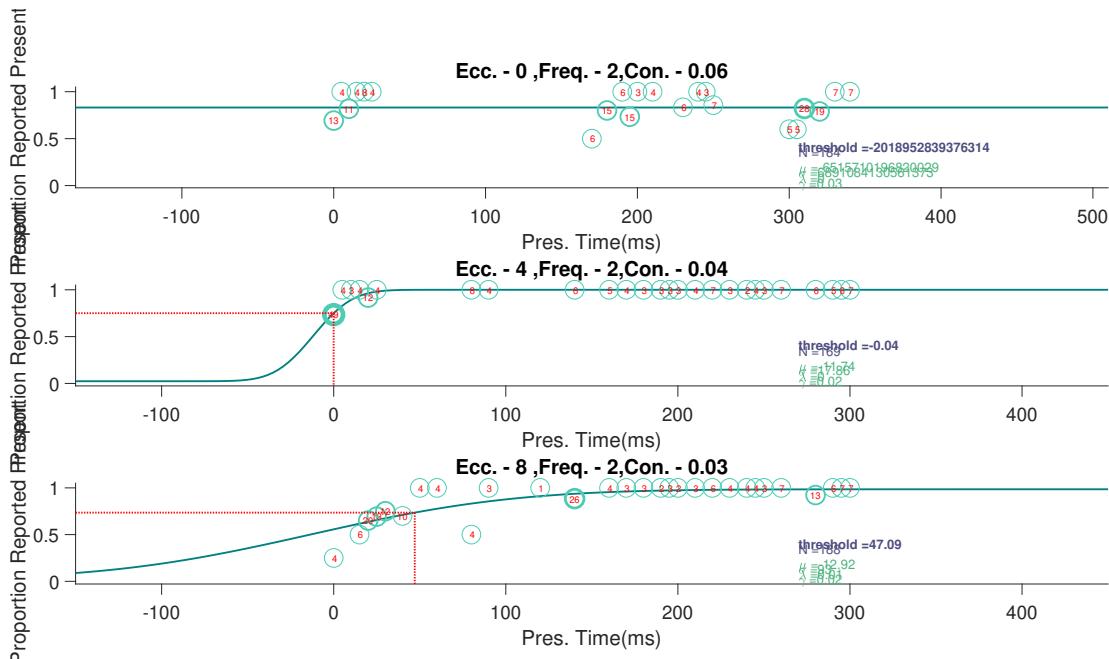


Figure 227: Psychometric curve at SpFreq 2.

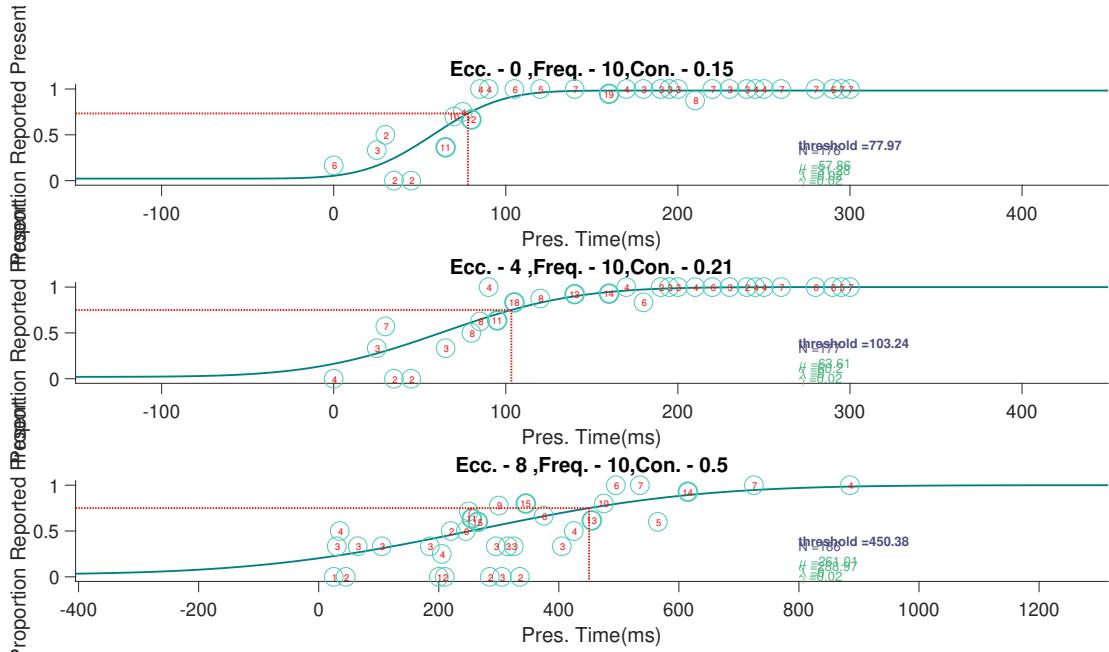


Figure 228: Psychometric curve at SpFreq 10.

4.4.2 SUBJECT:Nikunj

The analysis has been done using VALID trials for trials in which the stimulus was present.

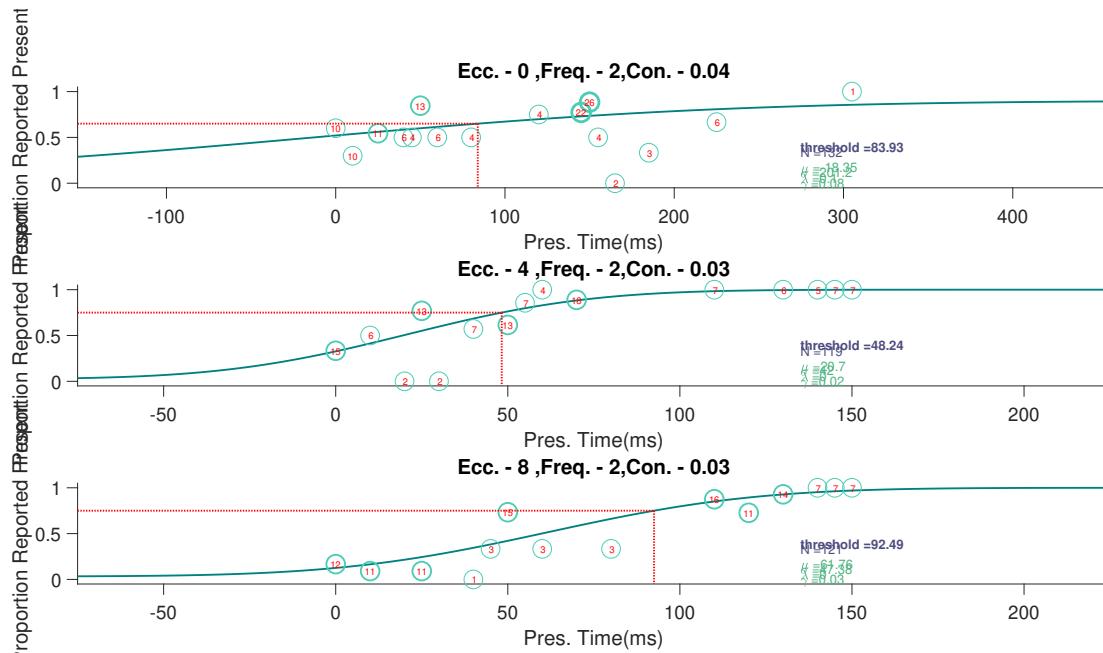


Figure 229: Psychometric curve at SpFreq 2.

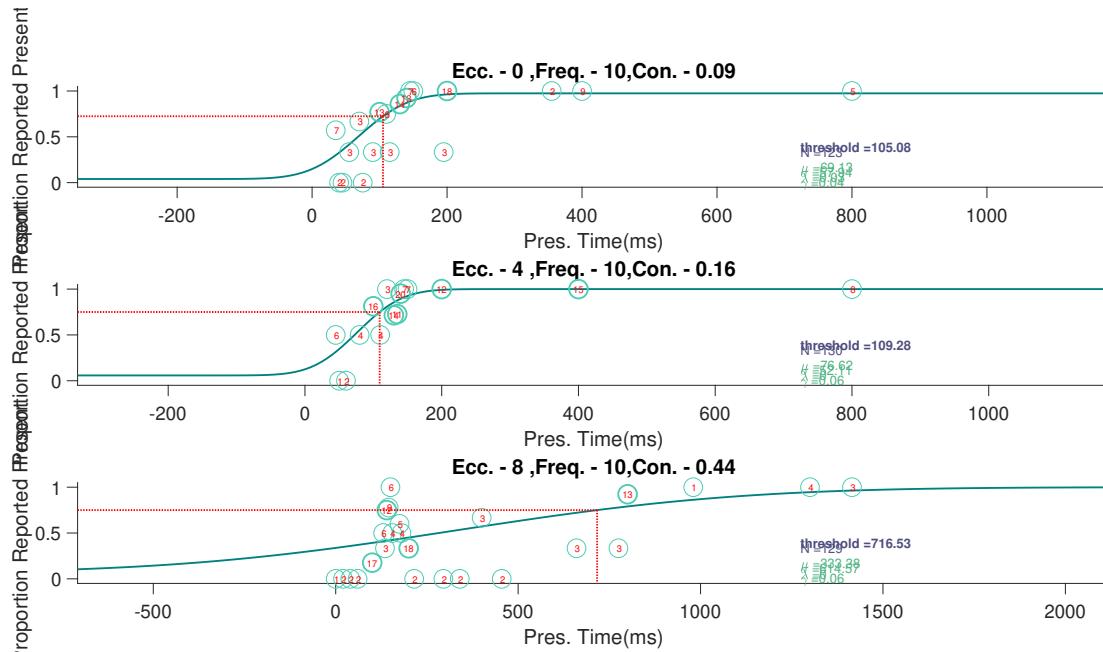
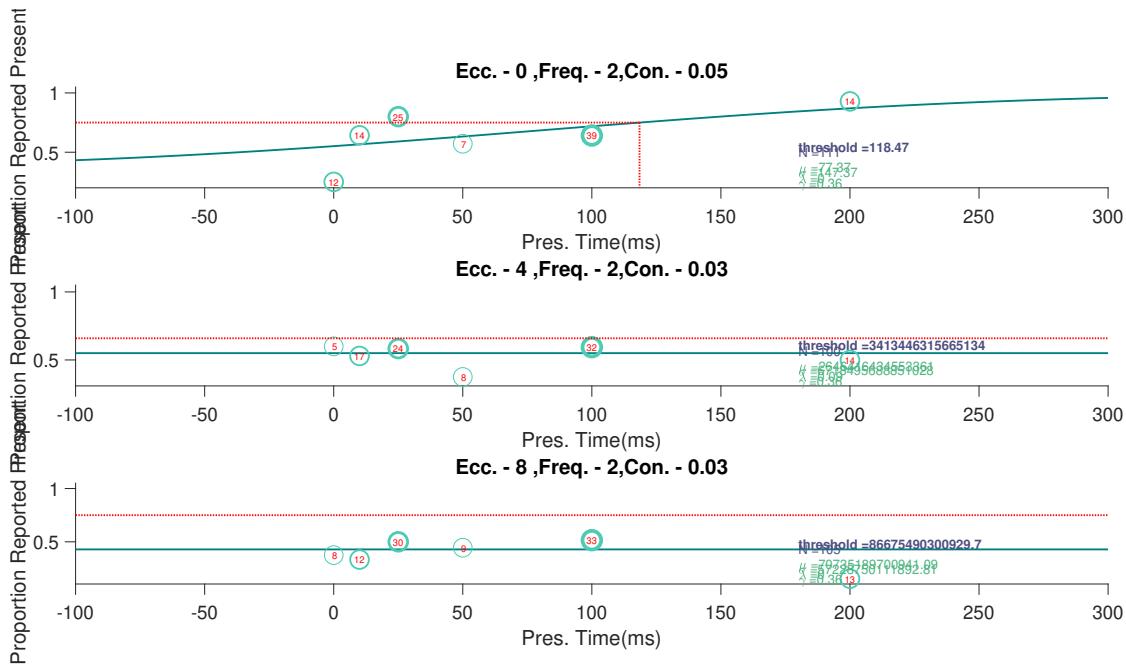
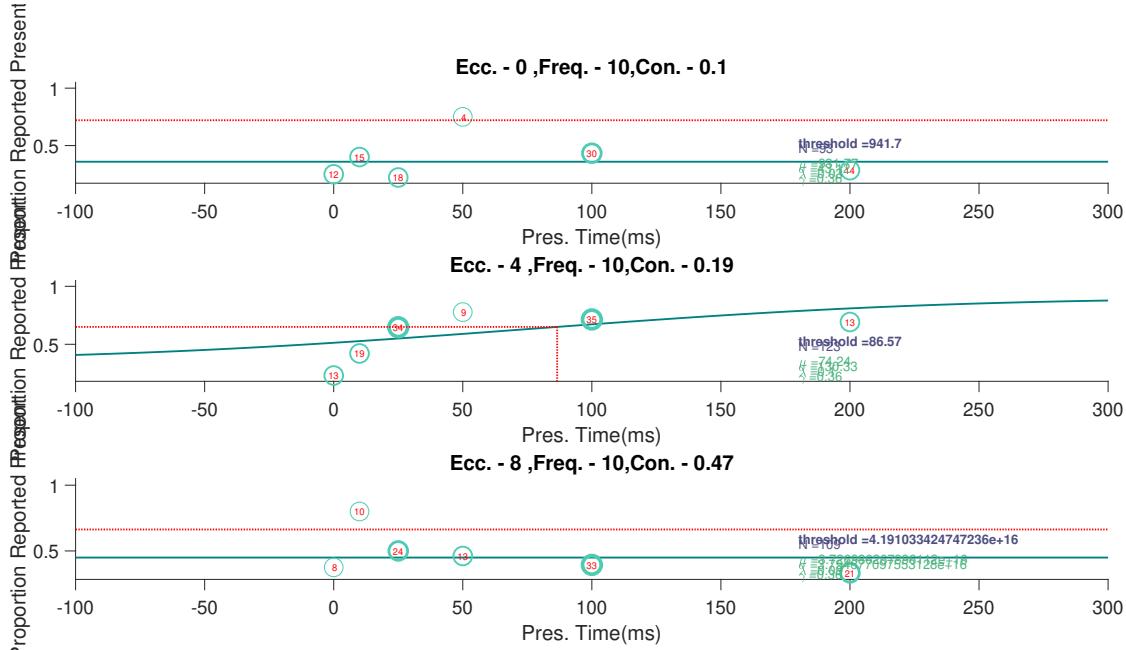


Figure 230: Psychometric curve at SpFreq 10.

4.4.3 SUBJECT:A036

The analysis has been done using VALID trials for trials in which the stimulus was present.

Figure 231: Psychometric curve at **SpFreq 2**.Figure 232: Psychometric curve at **SpFreq 10**.

4.5 3D Scatter plots

4.5.1 SUBJECT:A092

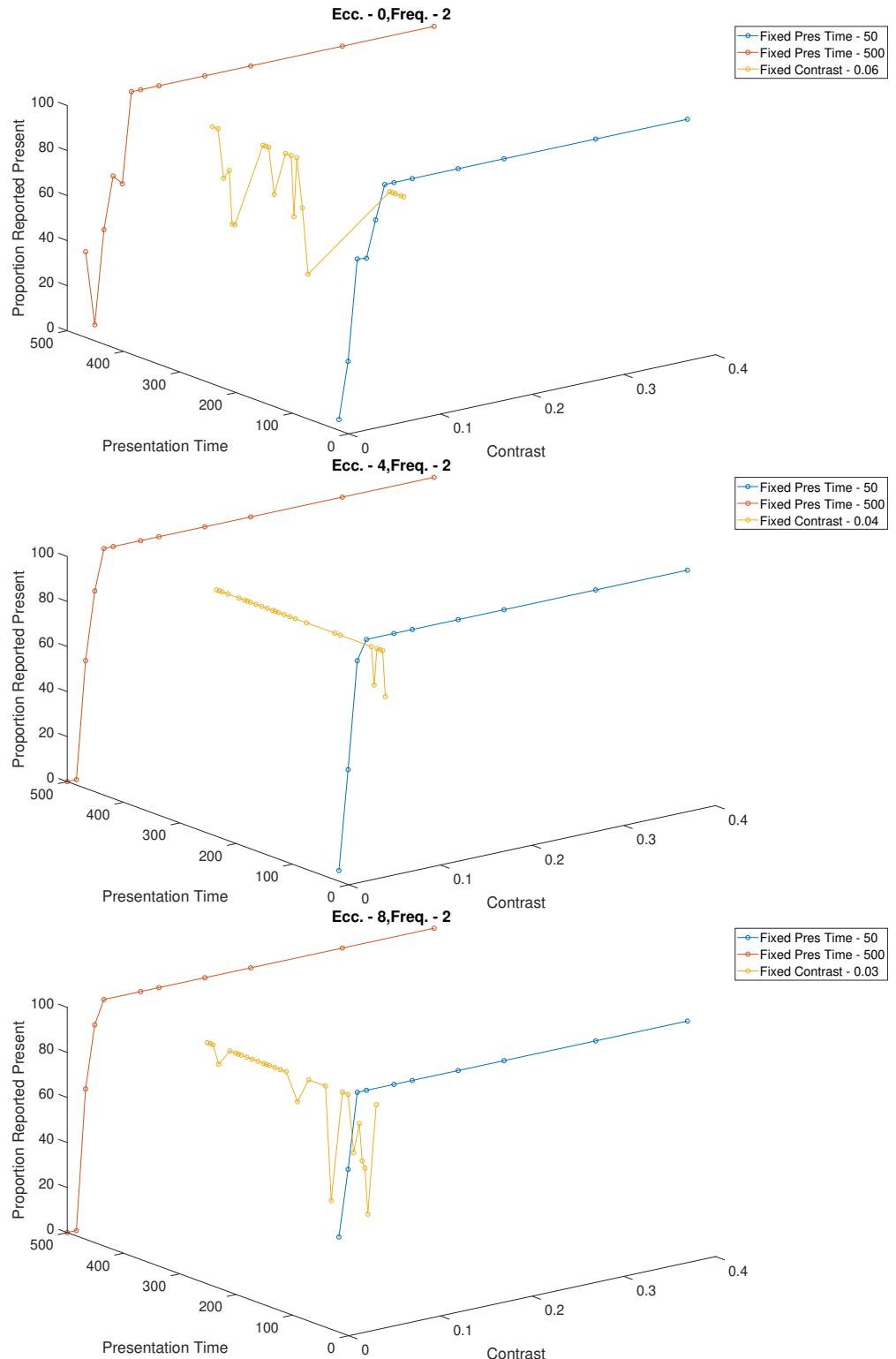


Figure 233: Scatter 3D at SpFreq 2.

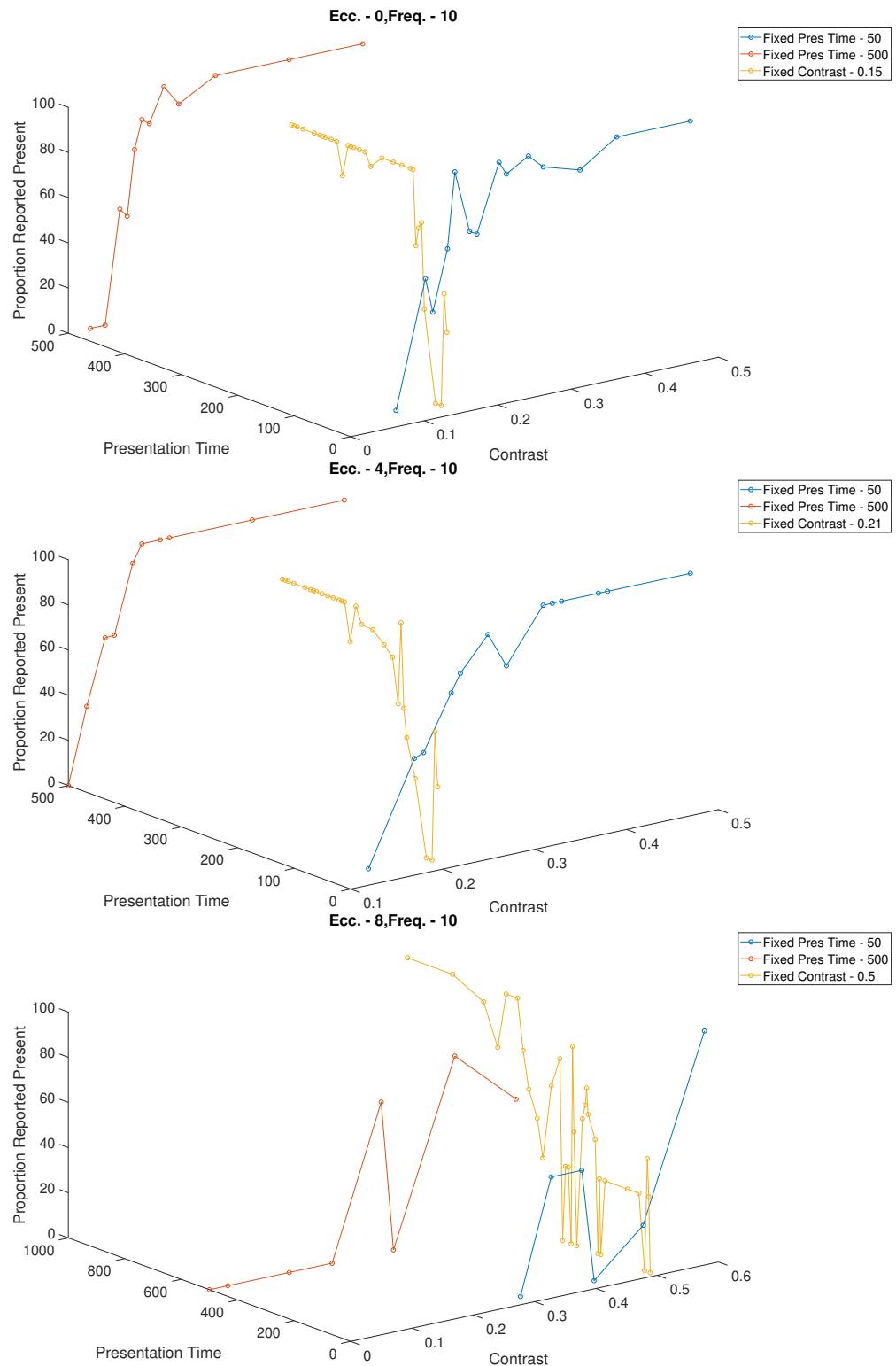


Figure 234: Scatter 3D at SpFreq 10.

4.5.2 SUBJECT:Nikunj

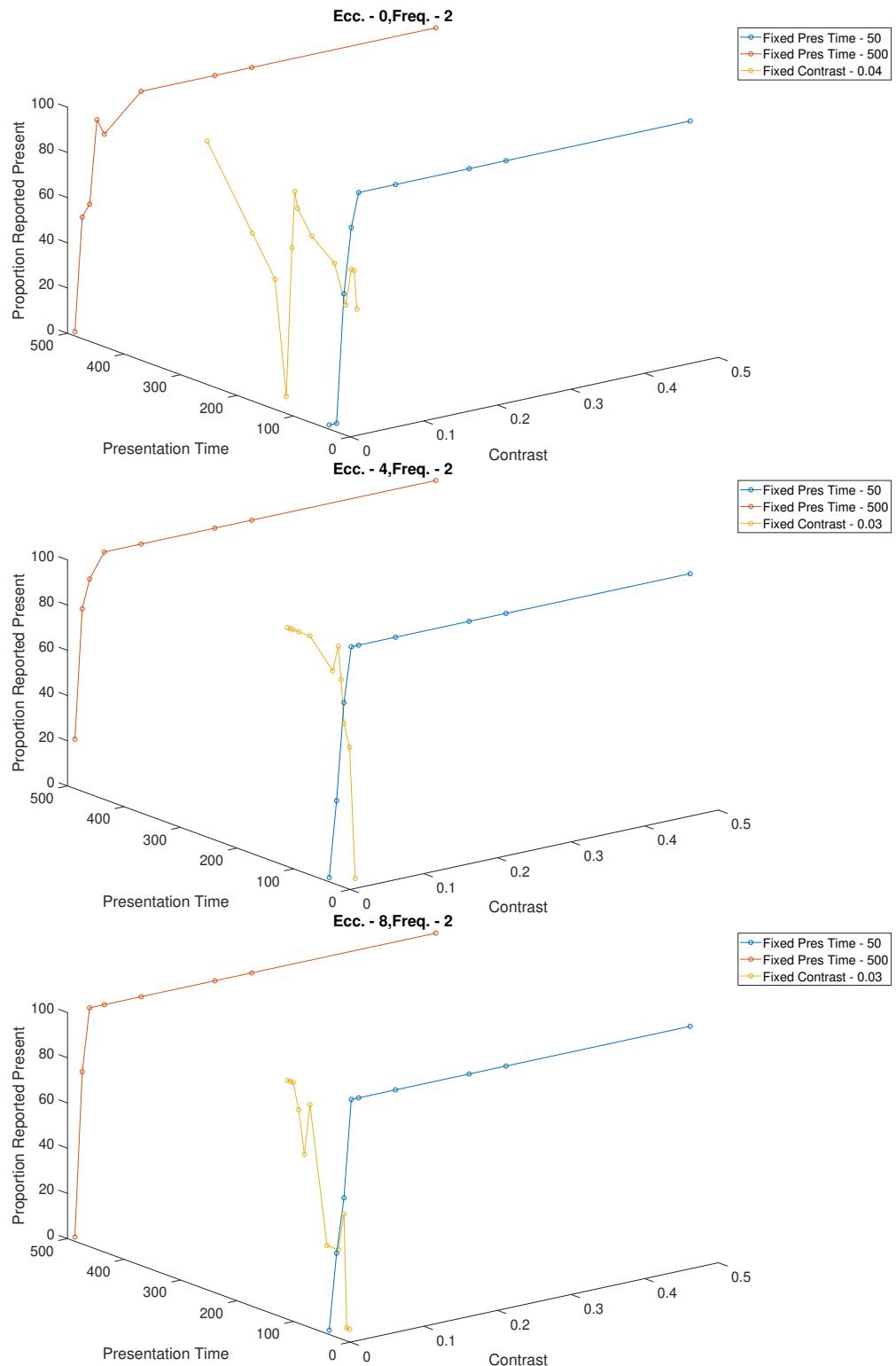


Figure 235: Scatter 3D at SpFreq 2.

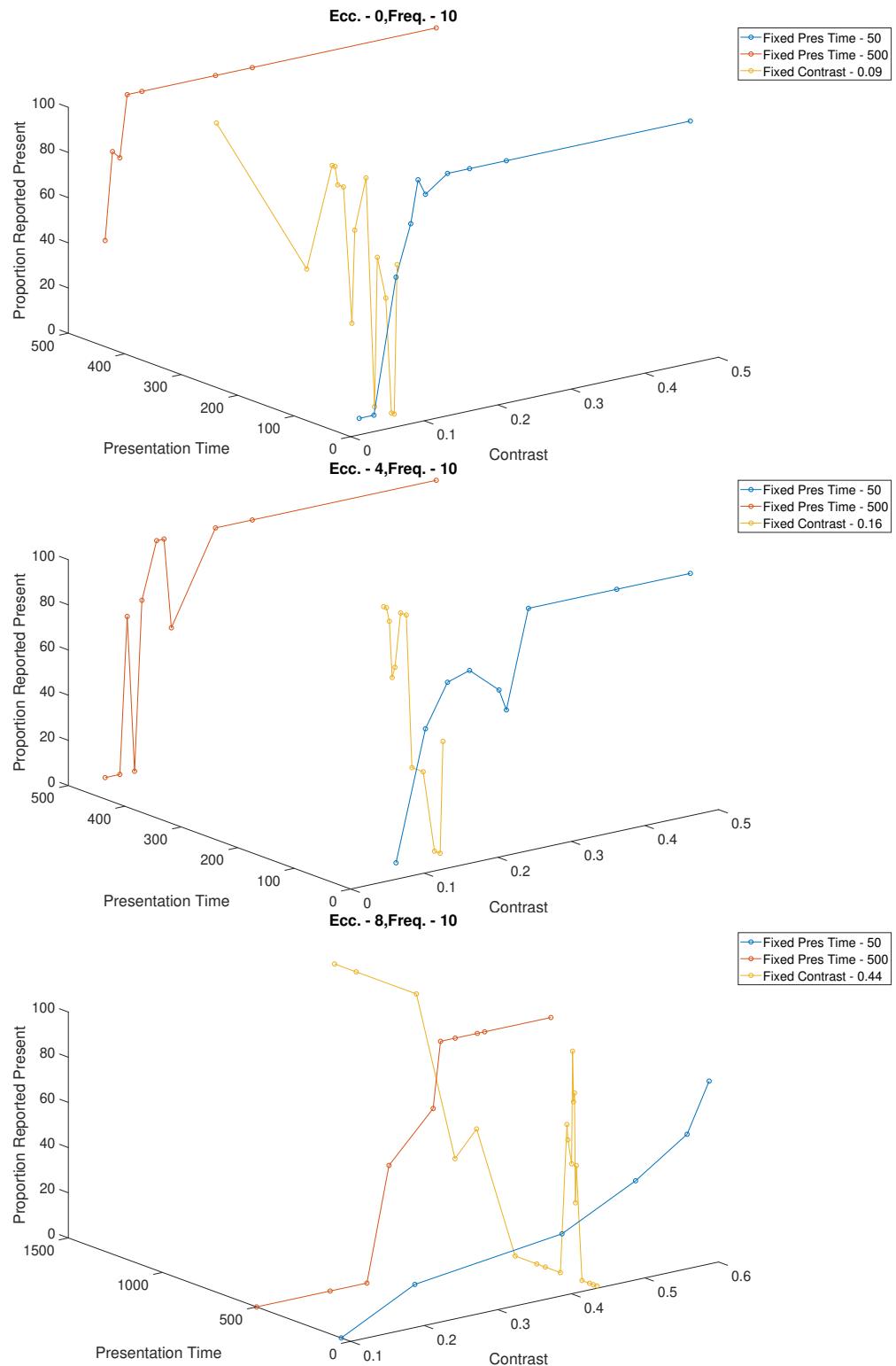


Figure 236: Scatter 3D at SpFreq 10.

4.5.3 SUBJECT:A036

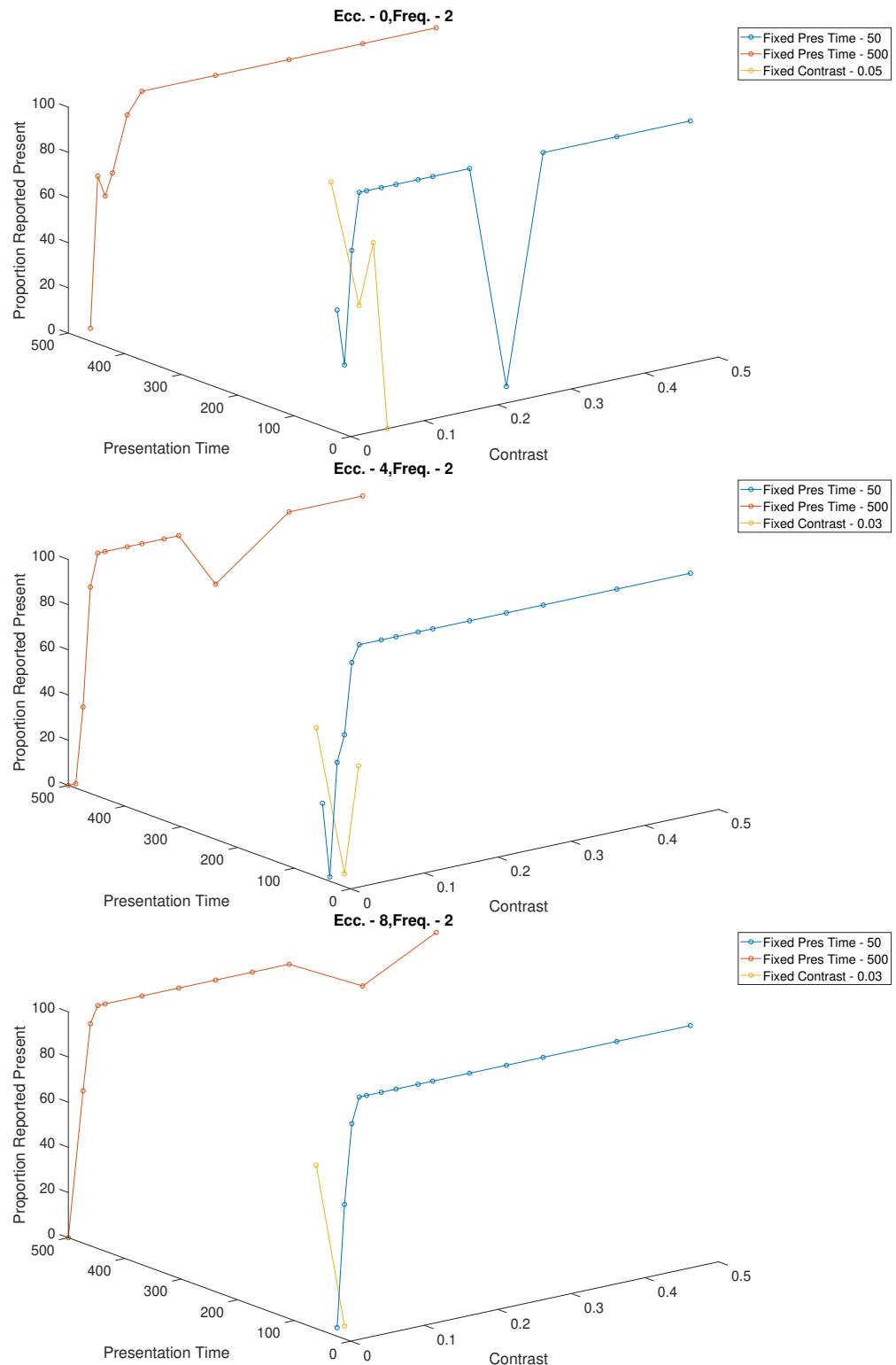


Figure 237: Scatter 3D at SpFreq 2.

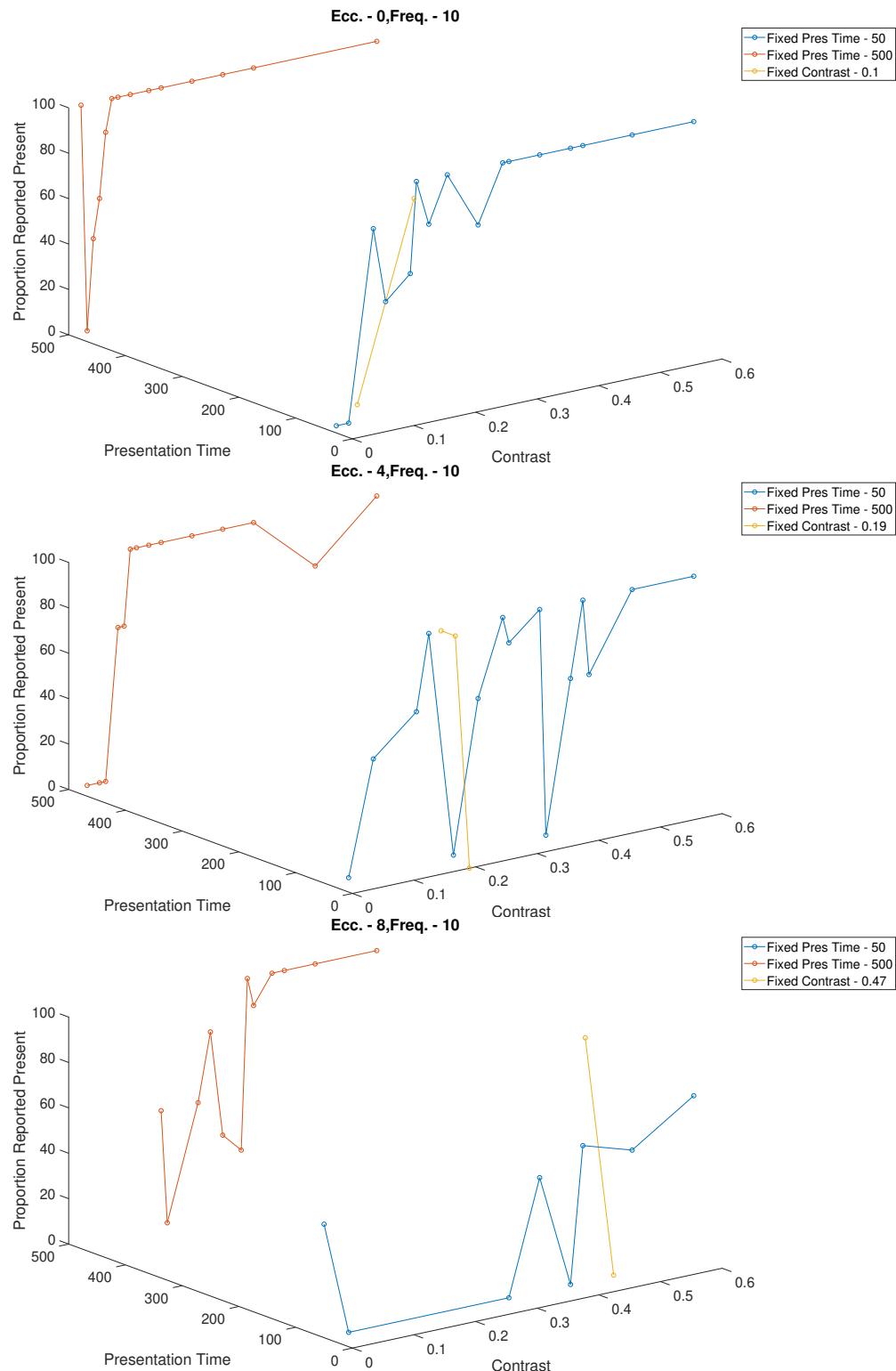


Figure 238: Scatter 3D at SpFreq 10.

5 Conclusions

The sensitivity to low spatial frequency remains high and similar when increasing the presentation time to 500ms. This indicates that 50ms was enough of a time to detect low spatial frequency stimuli across eccentricities. For high spatial frequency stimuli, contrast sensitivity decreases with increasing eccentricity. Increasing the presentation time to 500ms increases sensitivity for all eccentricities.

6 Neural Modelling

The gray level values around the gaze are used as the retinal input. A retinal input is taken that is large enough to cover the whole Macaque M-type retinal ganglion cell at Eccentricity 0 sensitive to spatial frequency determined by the stimulus spatial frequency. The retinal input is mapped (dot product) to the spatial kernel followed by convolution (frequency filter) with the temporal kernel to get the neuronal response.

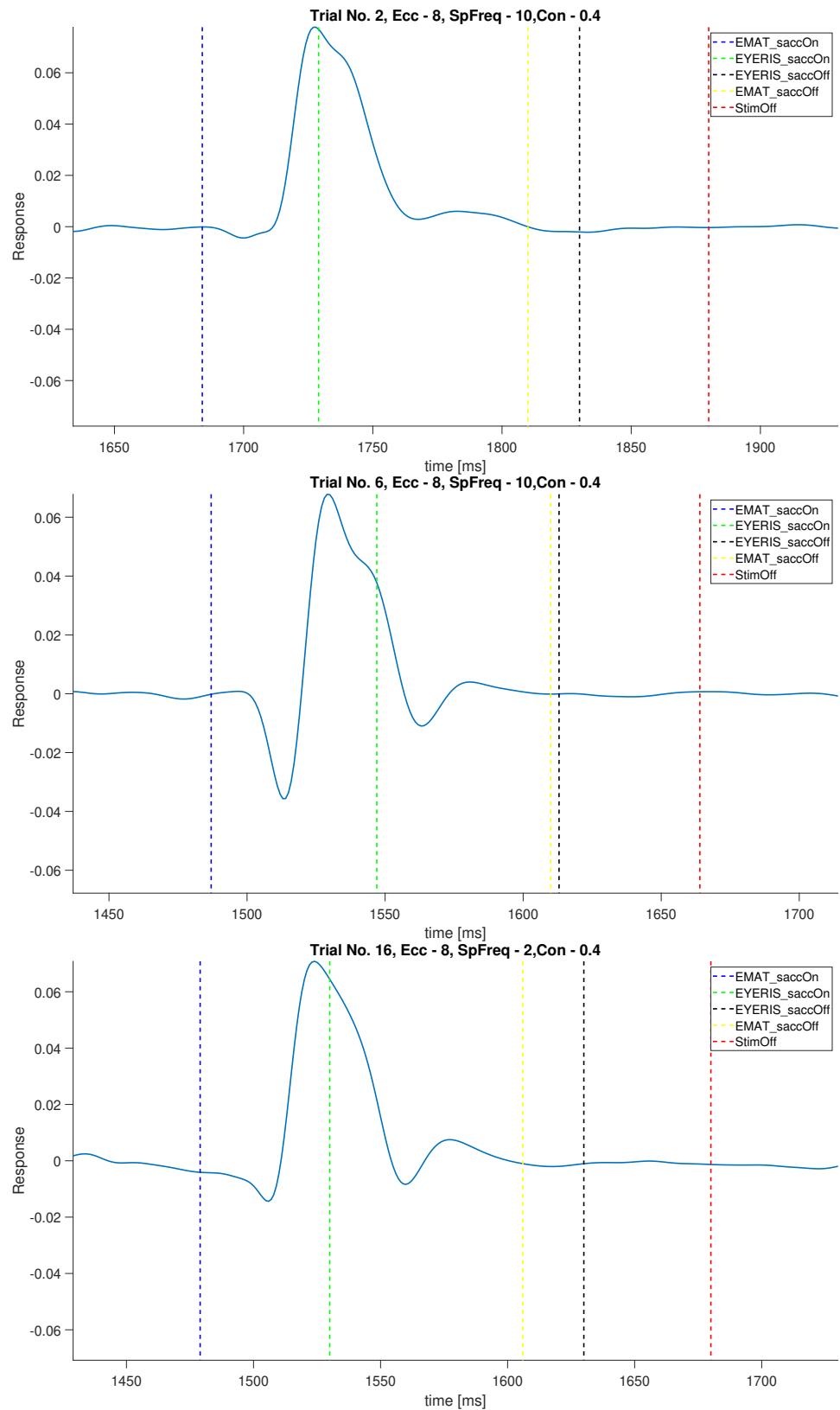


Figure 239: Neuronal responses

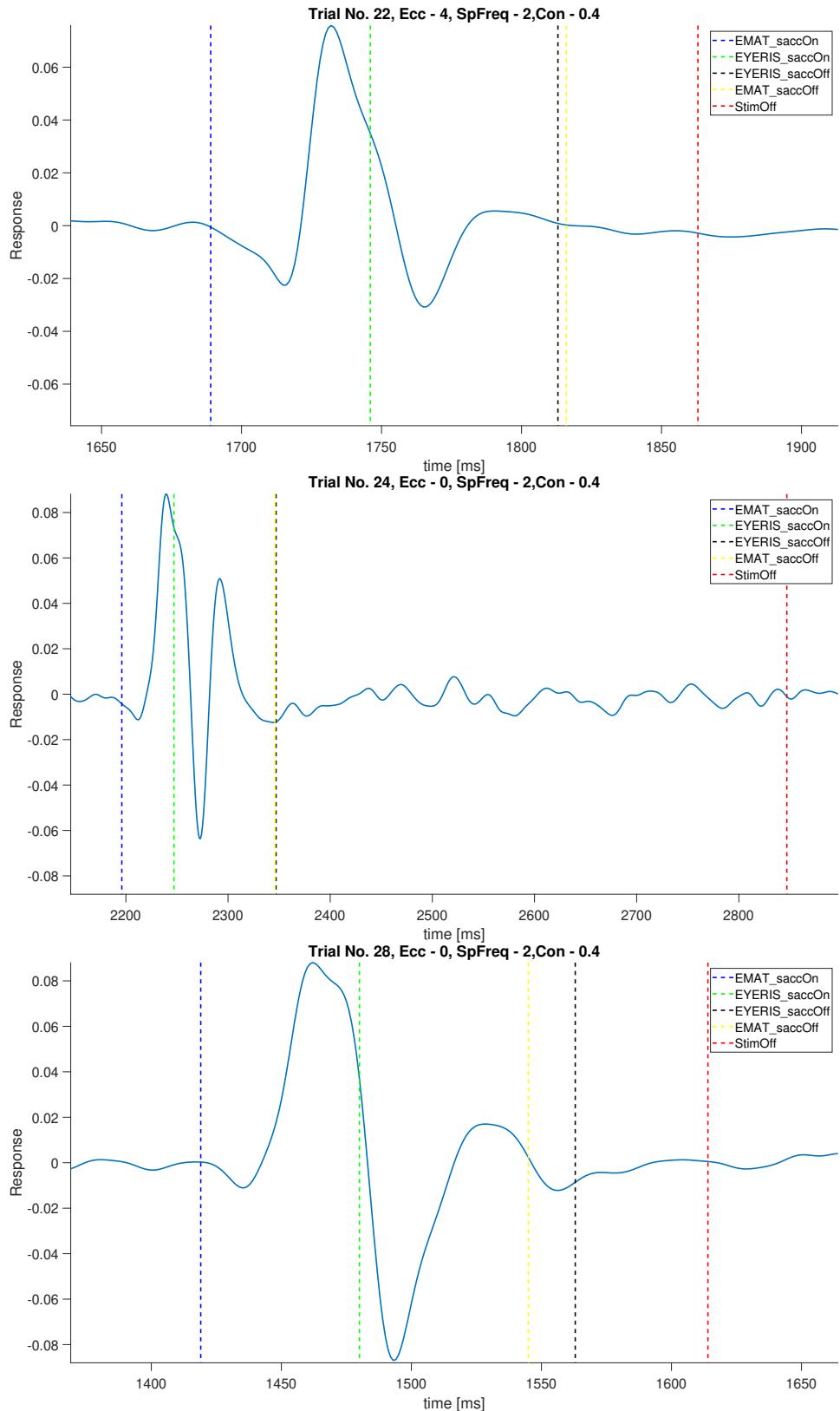


Figure 240: Neuronal responses

7 Resources

- marco Boi's original experiment code is backed up on OPUS and available on gitlab (not running): https://gitlab.com/jintoy/postsaccsens_boiorig
- The current implementation of the experiment is on gitlab: https://gitlab.com/jintoy/postsaccsens_ecc
- Analysis code is on gitlab: https://gitlab.com/nikunj_khetan/matlab-analysis
- Data can be accessed on OPUS in NikunjData folder
- All the data, analysis and experiment code at: <https://rochester.box.com/s/w8q1r4w25zvdnnbax>