Advanced Neuroscience

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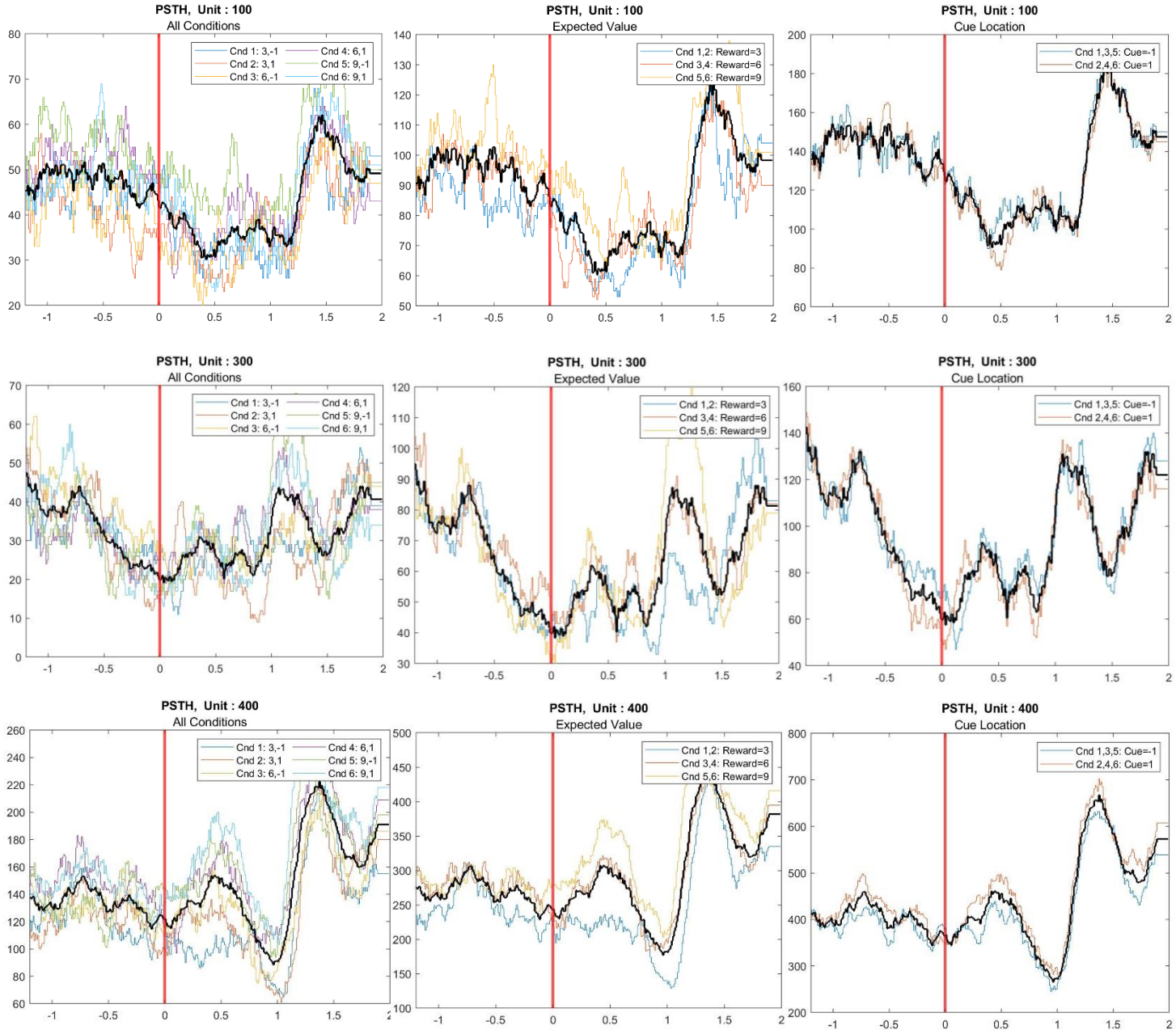
Homework #2

- **1-**



Q1: Are the PSTH of different units act in the same way?

Yes, some units/conditions look similar in specific time windows. Specially 1 second after cue.

Q2: Could you infer the encoding of task parameters from the average PSTH?

Not if we average over units, not all units have significant role in the task. Averaging over each conditions can show increase in firing rate 1 second after cue.

- **2-**

0 – 2 s

1	26	64	97	125	154	183	216	252	282	310	338	367	395	425	457
2	27	67	98	127	155	184	217	254	283	311	339	368	396	426	458
3	28	69	99	130	156	185	218	255	284	312	340	369	398	430	459
4	29	71	**100**	132	157	186	219	256	285	313	341	371	399	432	460
5	32	72	102	133	160	189	220	257	287	314	342	372	**400**	433	461
6	34	73	103	134	162	190	224	258	289	315	344	373	402	434	462
8	35	75	104	136	163	192	226	259	290	316	345	375	403	435	463
9	36	77	105	138	164	193	229	260	291	317	346	377	406	436	464
11	37	79	109	139	165	194	230	263	292	318	347	379	407	440	466
12	40	82	110	140	166	195	231	264	293	319	350	380	408	441	467
13	42	83	112	141	167	197	233	265	295	322	352	381	409	442	470
14	45	84	113	143	169	198	235	268	296	323	355	382	410	444	471
15	46	85	114	144	170	202	237	269	**300**	324	356	383	412	445	472
17	52	88	116	145	171	204	239	270	301	325	357	384	413	446	475
18	54	89	117	146	173	205	240	272	302	326	359	385	415	447	476
20	56	91	118	147	174	206	241	274	303	327	361	388	416	449	477
21	57	92	119	148	176	209	242	275	305	328	362	389	417	451	481
22	58	93	120	149	177	211	244	276	306	330	363	391	418	452	-
23	59	94	121	151	178	212	245	277	307	332	364	392	421	453	-
24	61	95	122	152	181	213	249	279	308	334	365	393	422	454	-
25	62	96	124	153	182	215	251	281	309	335	366	394	424	455	-

Units with averaged P-value, smaller than 0.05

(all 6 conditions)

0 – 1 s

1	42	69	105	143	175	209	235	278	311	347	382
6	43	70	108	144	176	211	236	279	313	348	384
9	45	71	109	146	179	212	237	280	314	349	385
11	46	72	110	149	182	213	242	281	315	350	388
15	47	75	114	151	184	214	245	282	318	352	390
17	48	78	116	152	186	216	252	283	325	354	393
18	49	79	117	153	187	218	253	285	326	355	394
19	50	80	118	154	188	219	254	286	327	356	396
20	51	83	119	155	189	220	255	289	328	360	398
21	52	86	121	156	190	221	256	290	329	364	399
22	53	88	122	157	191	223	257	292	330	365	**400**
25	55	89	125	160	192	224	261	293	332	366	401
28	56	90	126	161	193	225	262	296	334	368	403
29	57	91	129	163	194	226	264	297	335	369	407
31	58	94	130	165	195	228	267	298	337	370	409
32	62	96	132	166	197	229	269	**300**	338	371	411
37	63	97	133	168	198	230	270	301	340	372	413
38	65	99	134	171	199	231	273	302	341	374	415
39	66	**100**	137	172	201	232	274	304	344	375	419
40	67	101	139	173	207	233	275	306	345	379	421
41	68	104	142	174	208	234	277	308	346	381	422

Units with averaged P-value, smaller than 0.05

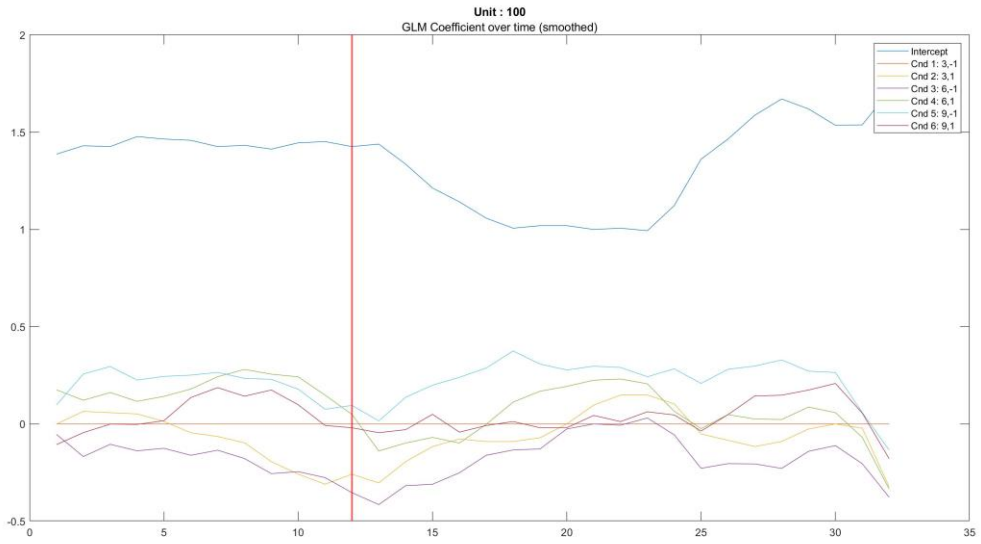
(all 6 conditions)

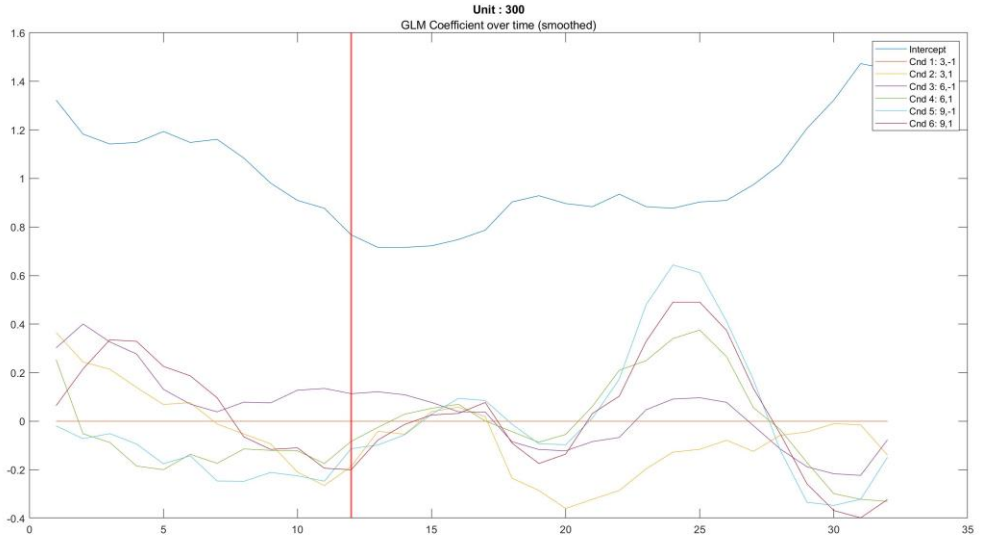
1 – 2 s

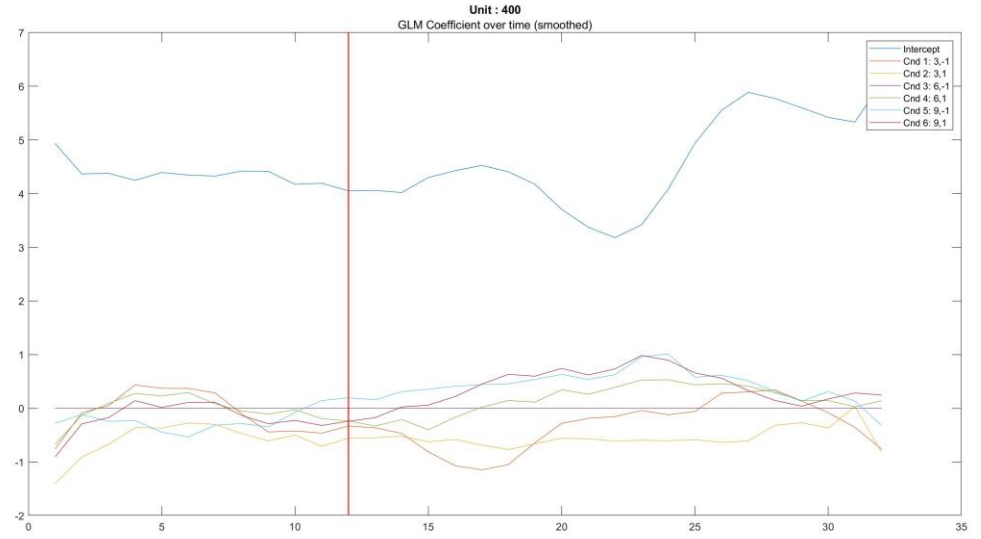
2	33	70	105	140	168	202	228	264	290	319	357	387	418	448
4	34	71	107	141	170	204	229	265	291	321	358	388	421	449
5	35	74	108	143	172	205	230	266	293	323	360	389	423	450
6	37	75	111	145	173	206	231	267	295	326	361	390	424	451
7	40	76	113	146	174	207	233	269	296	329	362	392	426	453
8	43	78	114	148	175	208	234	270	297	330	364	394	427	454
9	44	80	115	149	176	209	235	271	299	331	365	395	428	455
10	46	83	116	150	177	210	236	272	**300**	334	366	396	429	457
12	48	87	117	151	180	211	237	273	301	337	367	397	430	461
14	50	89	118	152	181	212	238	274	302	338	370	398	431	462
15	53	91	121	153	183	213	240	276	303	340	371	399	432	466
16	54	92	125	154	184	214	241	277	304	342	373	**400**	433	467
17	55	93	126	155	185	215	244	278	306	343	374	401	436	468
19	56	94	128	156	186	216	246	279	307	344	375	402	438	469
20	57	95	130	157	190	218	247	280	308	345	377	403	439	471
21	58	97	131	158	191	219	250	281	309	346	379	406	440	472
22	60	99	133	159	193	220	253	282	311	347	380	407	441	474
23	62	**100**	134	160	195	222	254	283	312	350	382	408	442	475
26	65	101	135	162	196	223	256	284	313	351	383	410	444	476
27	66	102	137	163	198	224	258	285	314	353	384	411	445	478
29	67	103	138	164	199	225	260	286	315	354	385	412	446	480
31	69	104	139	165	200	226	262	288	316	356	386	414	447	481

Units with averaged P-value, smaller than 0.05

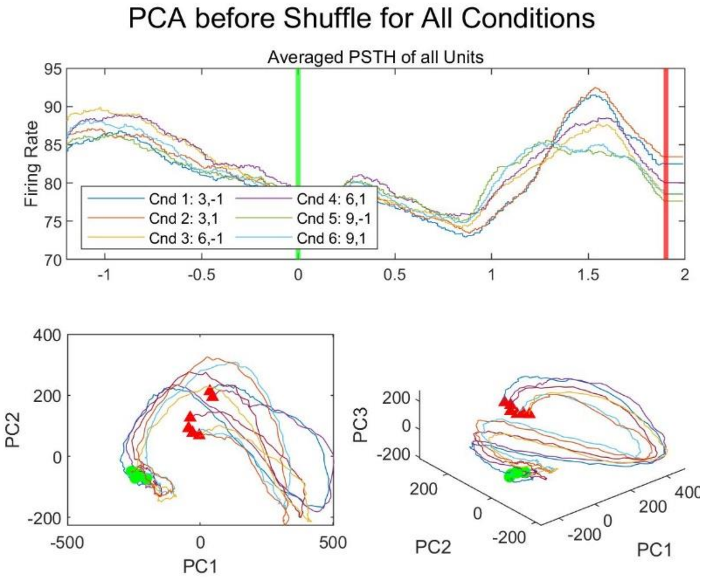
(all 6 conditions)


Unit : 100
GLM Coefficient over time (smoothed)
Intercept
Cnd 1: 3,-1
Cnd 2: 3,1
Cnd 3: 6,-1
Cnd 4: 6,1
Cnd 5: 9,-1
Cnd 6: 9,1

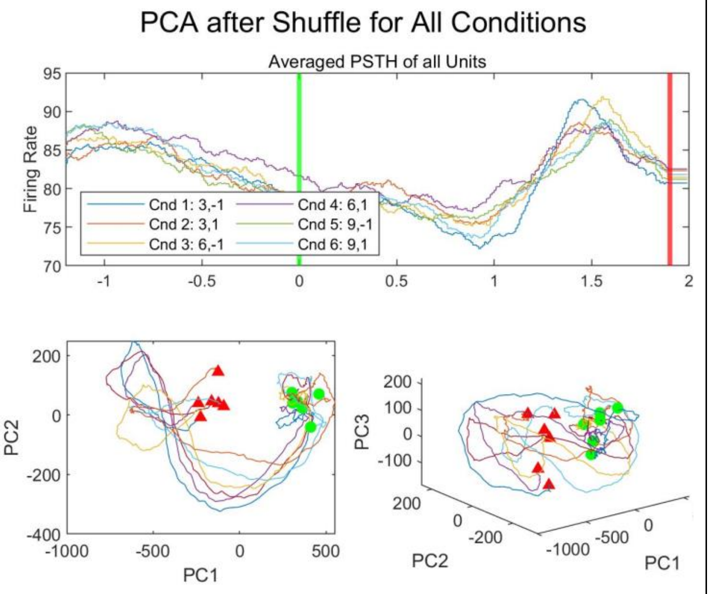

Unit : 300
GLM Coefficient over time (smoothed)
Intercept
Cnd 1: 3,-1
Cnd 2: 3,1
Cnd 3: 6,-1
Cnd 4: 6,1
Cnd 5: 9,-1
Cnd 6: 9,1


Unit : 400
GLM Coefficient over time (smoothed)
Intercept
Cnd 1: 3,-1
Cnd 2: 3,1
Cnd 3: 6,-1
Cnd 4: 6,1
Cnd 5: 9,-1
Cnd 6: 9,1

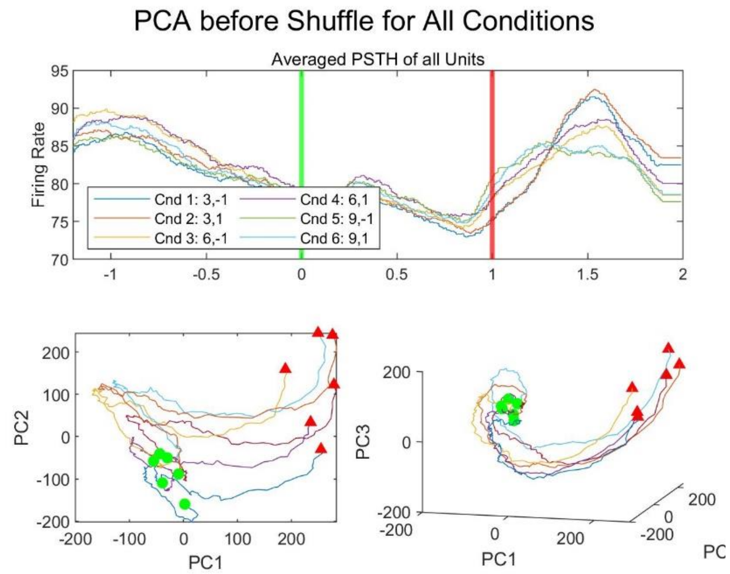
- **3 & 4-**



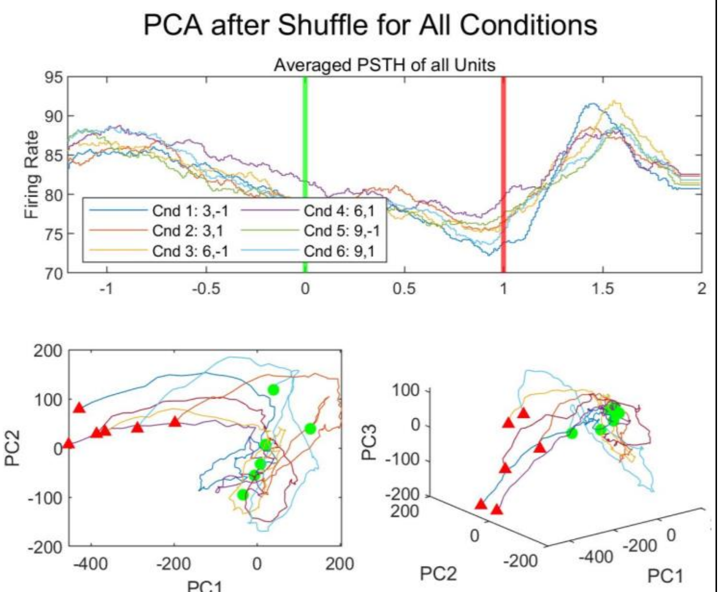
PCA before Shuffle for All Conditions
Averaged PSTH of all Units
Firing Rate
Cnd 1: 3,-1
Cnd 2: 3,1
Cnd 3: 6,-1
Cnd 4: 6,1
Cnd 5: 9,-1
Cnd 6: 9,1
PC1
PC2
PC3



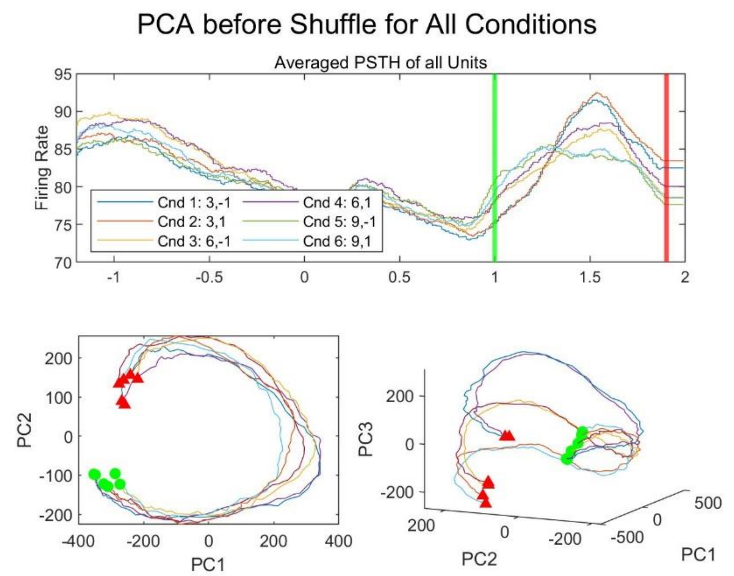
PCA after Shuffle for All Conditions
Averaged PSTH of all Units
Firing Rate
Cnd 1: 3,-1
Cnd 2: 3,1
Cnd 3: 6,-1
Cnd 4: 6,1
Cnd 5: 9,-1
Cnd 6: 9,1
PC1
PC2
PC3



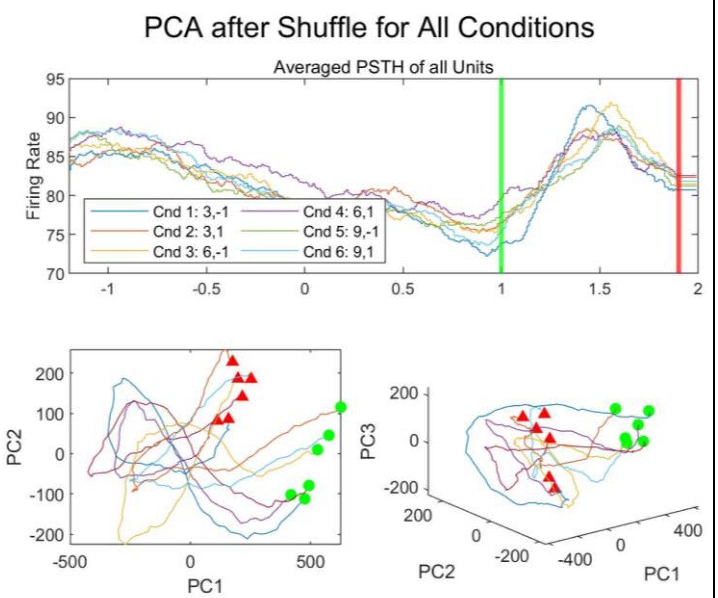
PCA before Shuffle for All Conditions
Averaged PSTH of all Units
Firing Rate
Cnd 1: 3,-1
Cnd 2: 3,1
Cnd 3: 6,-1
Cnd 4: 6,1
Cnd 5: 9,-1
Cnd 6: 9,1
PC1
PC2
PC3



PCA after Shuffle for All Conditions
Averaged PSTH of all Units
Firing Rate
Cnd 1: 3,-1
Cnd 2: 3,1
Cnd 3: 6,-1
Cnd 4: 6,1
Cnd 5: 9,-1
Cnd 6: 9,1
PC1
PC2
PC3



PCA before Shuffle for All Conditions
Averaged PSTH of all Units
Firing Rate
Cnd 1: 3,-1
Cnd 2: 3,1
Cnd 3: 6,-1
Cnd 4: 6,1
Cnd 5: 9,-1
Cnd 6: 9,1
PC1
PC2
PC3



PCA after Shuffle for All Conditions
Averaged PSTH of all Units
Firing Rate
Cnd 1: 3,-1
Cnd 2: 3,1
Cnd 3: 6,-1
Cnd 4: 6,1
Cnd 5: 9,-1
Cnd 6: 9,1
PC1
PC2
PC3

Based on your shuffling does the population data teach us more than what is expected from single unit analysis?

Yes the population can tell us more than a single unit analysis. Each unit has different response but in population space they are periodic even for non-periodic actions. But after shuffling we cant see dynamics of neurons anymore and we lose information.