



In The Name Of God  
**HW02**  
**Advanced Neuroscience**

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■ Step 1

□ Q1

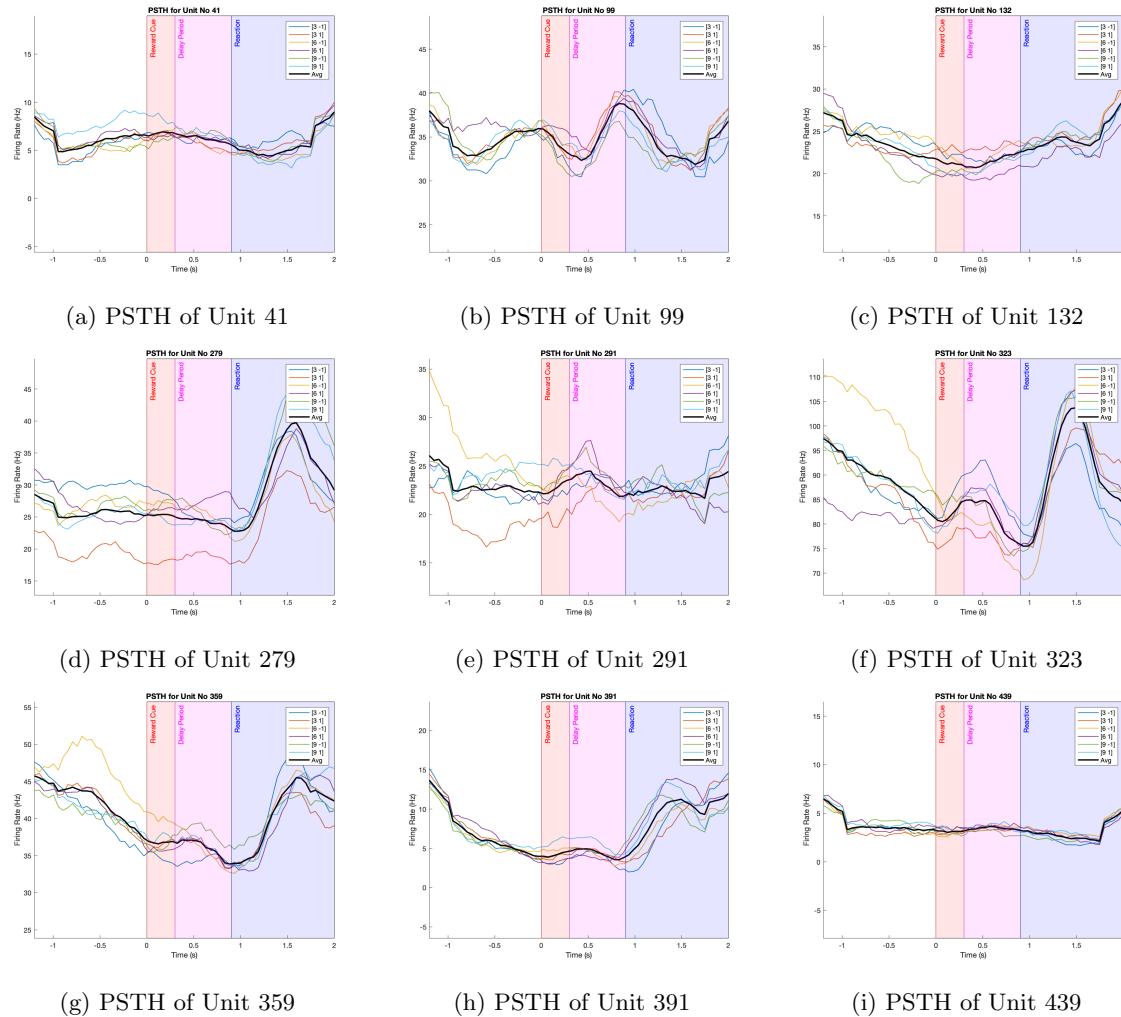


Figure 1: PSTH of Different Units

According to Figure 1, some units have similar PSTH plot shape, but their firing rates vary.



□ Q2

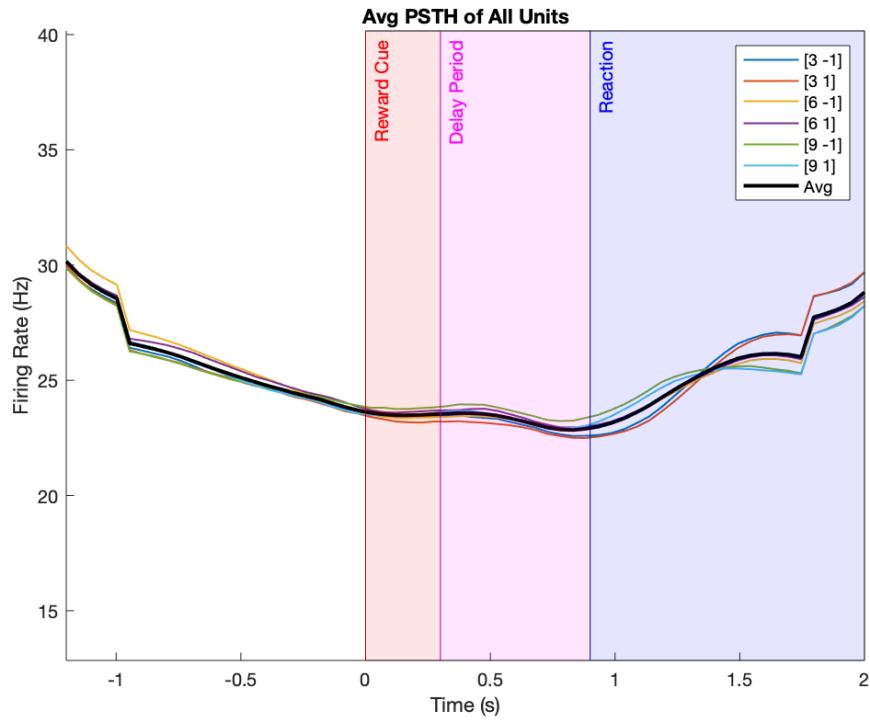


Figure 2: PSTH of Average of all Units

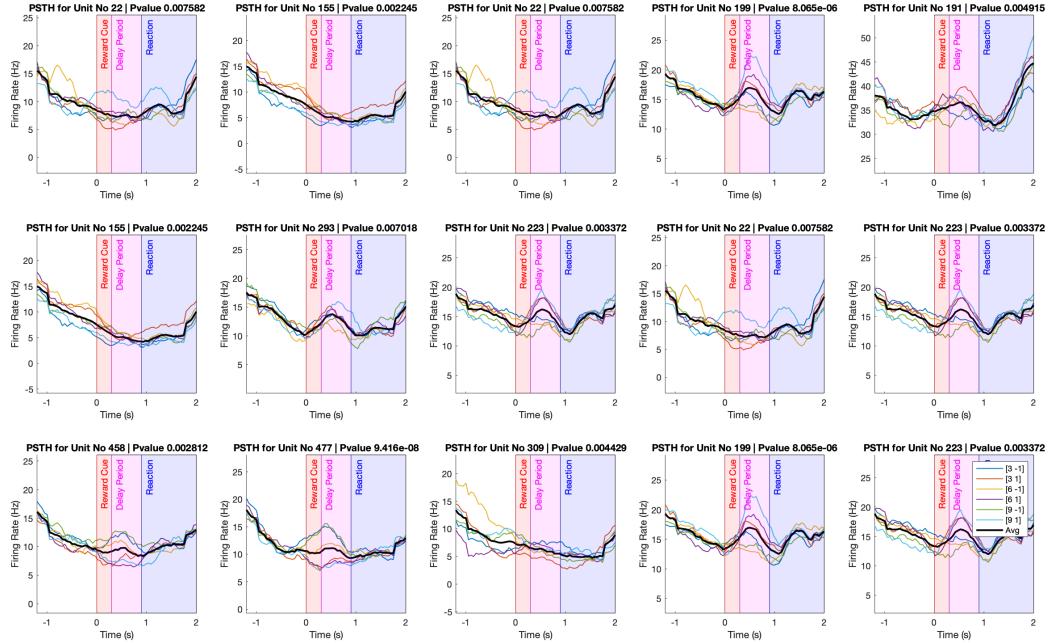
As can be seen in Figure 2, average PSTH of all the units differ from the PSTH of some units which are likely to encode the neural activity with their firing rate. So, I think that maybe just a few of the units are encoding the neural activity with their firing rate.



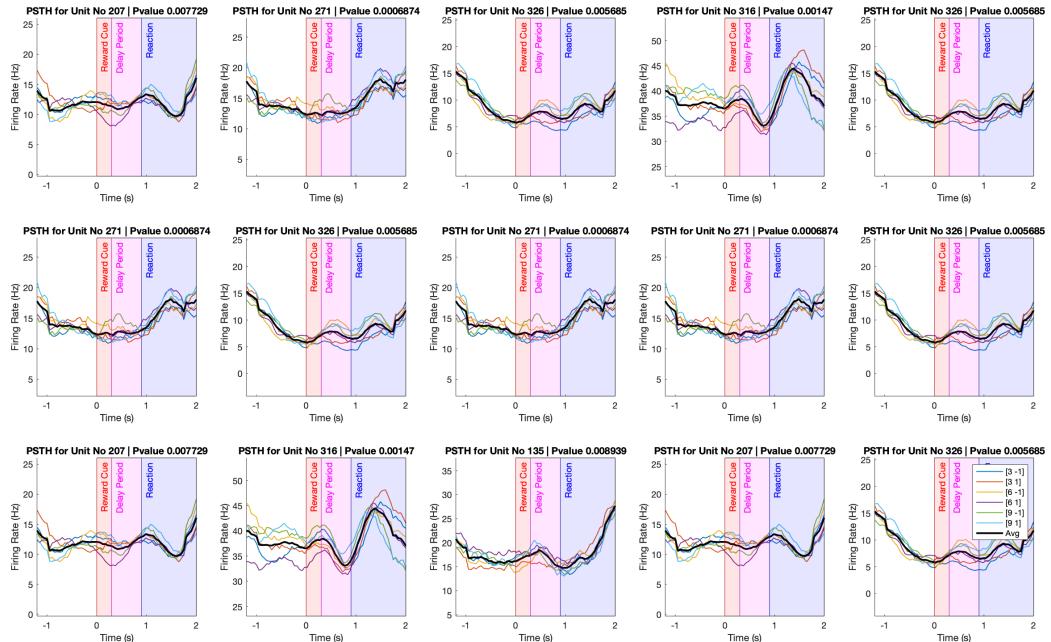
## ■ Step 2

### □ Single Units

#### Left and Right Cue



(a) No Shuffling



(b) Shuffled

Figure 3: PSTH of Some Units with pValue < 0.01

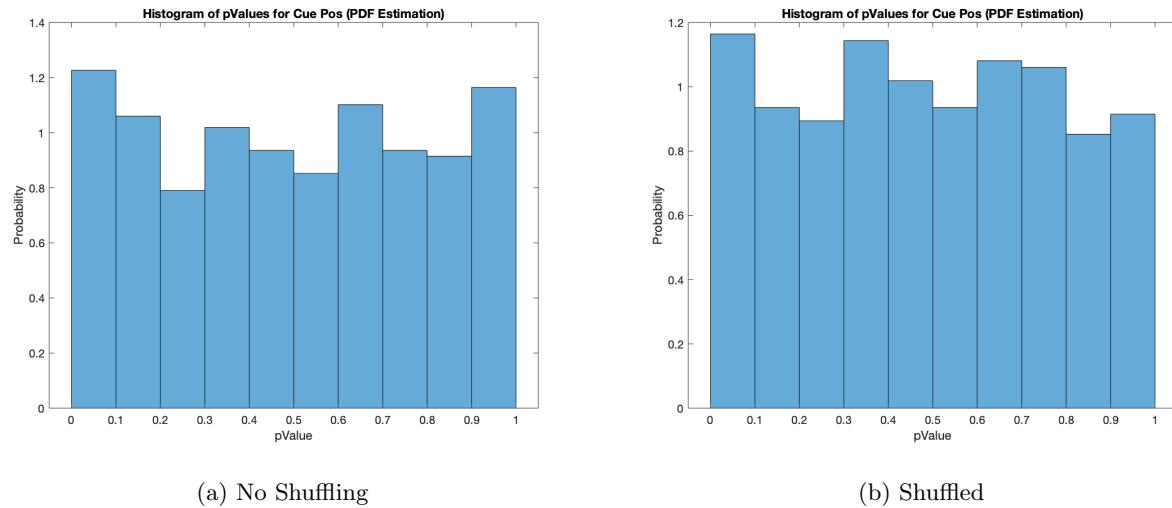


Figure 4: Histogram (PDF) of pValues for Cue Left/Right

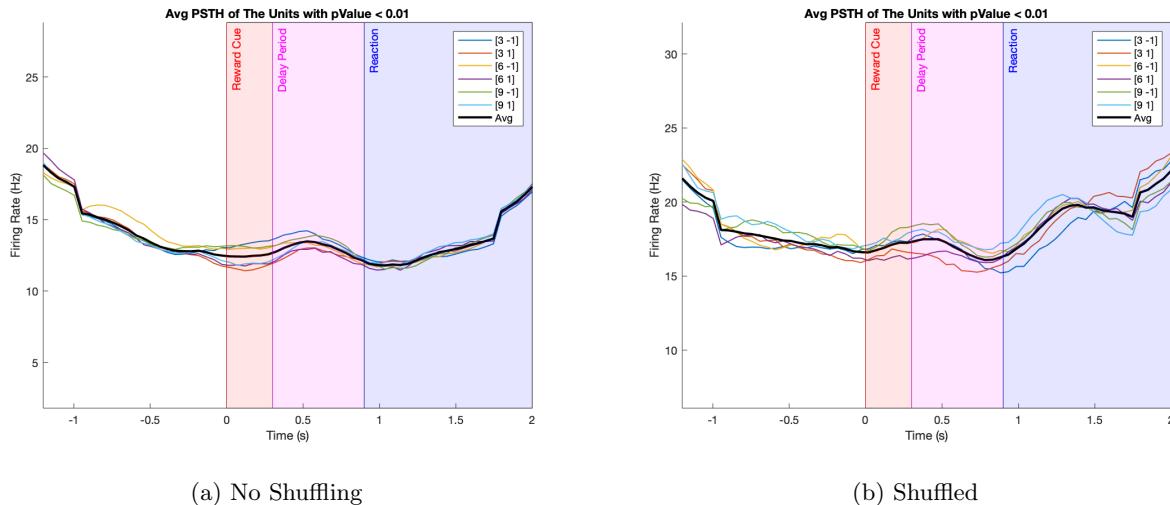


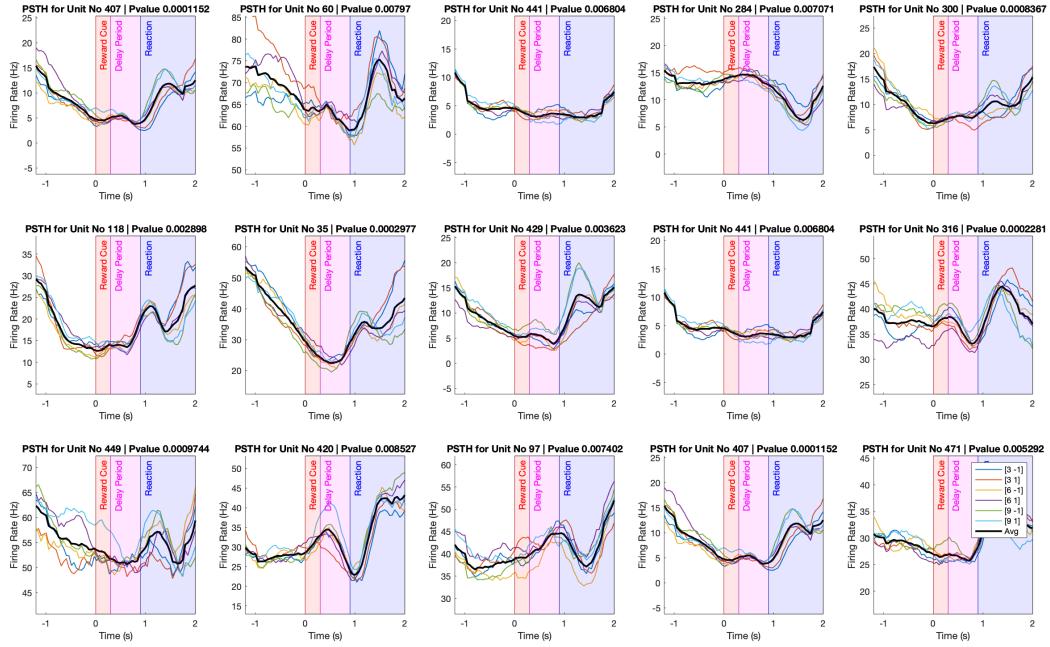
Figure 5: Average PSTH of The Units with pValue < 0.01

Table 1: Average pValue of all Units

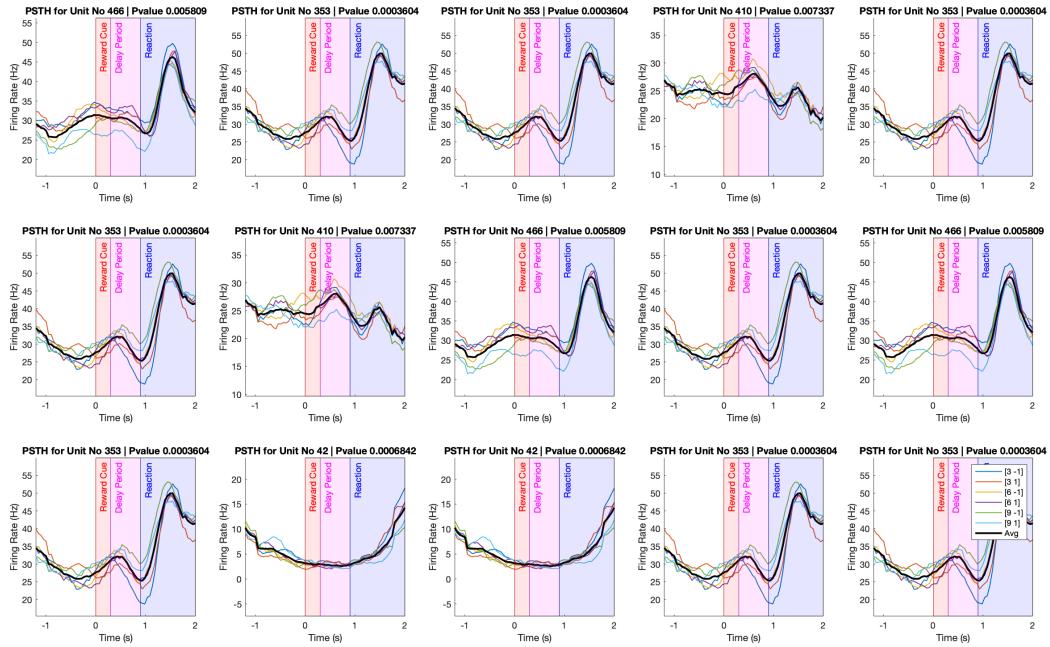
No Shuffling	Shuffled
0.4944	0.4880



## Reward Expected Value



(a) No Shuffling



(b) Shuffled

Figure 6: PSTH of Some Units with pValue < 0.01

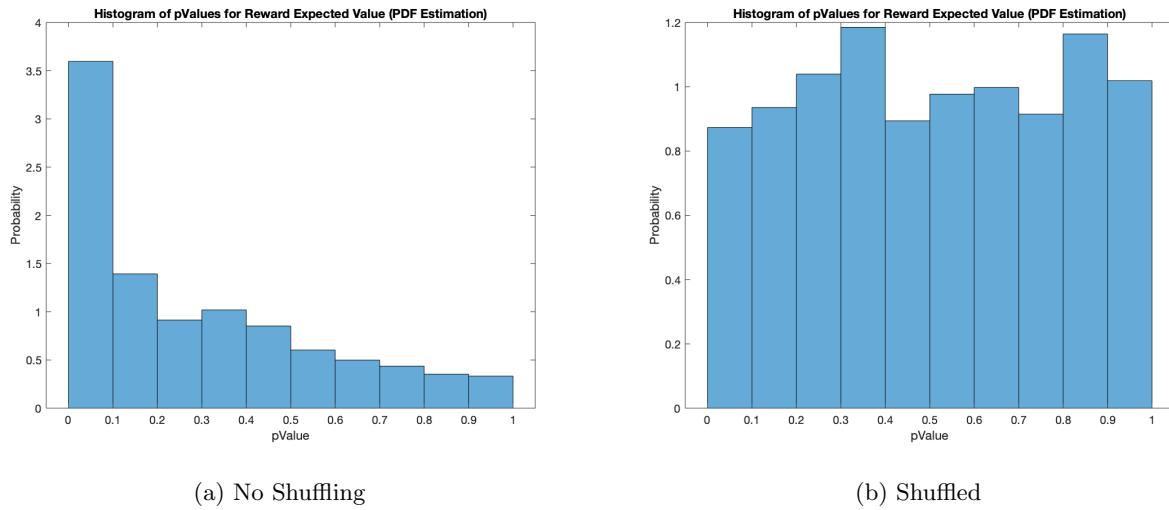


Figure 7: Histogram (PDF) of pValues for Reward Expected Value

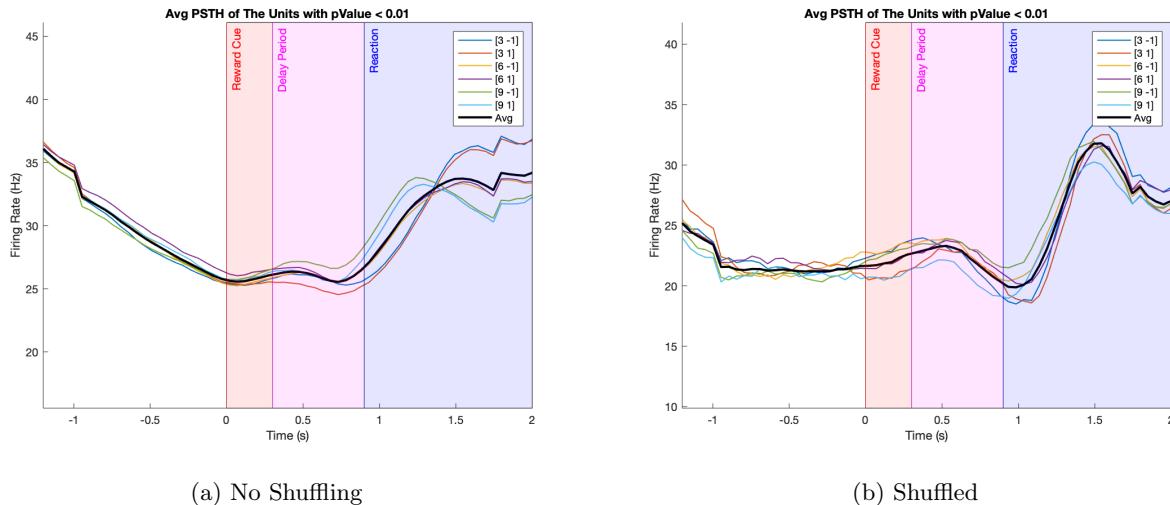


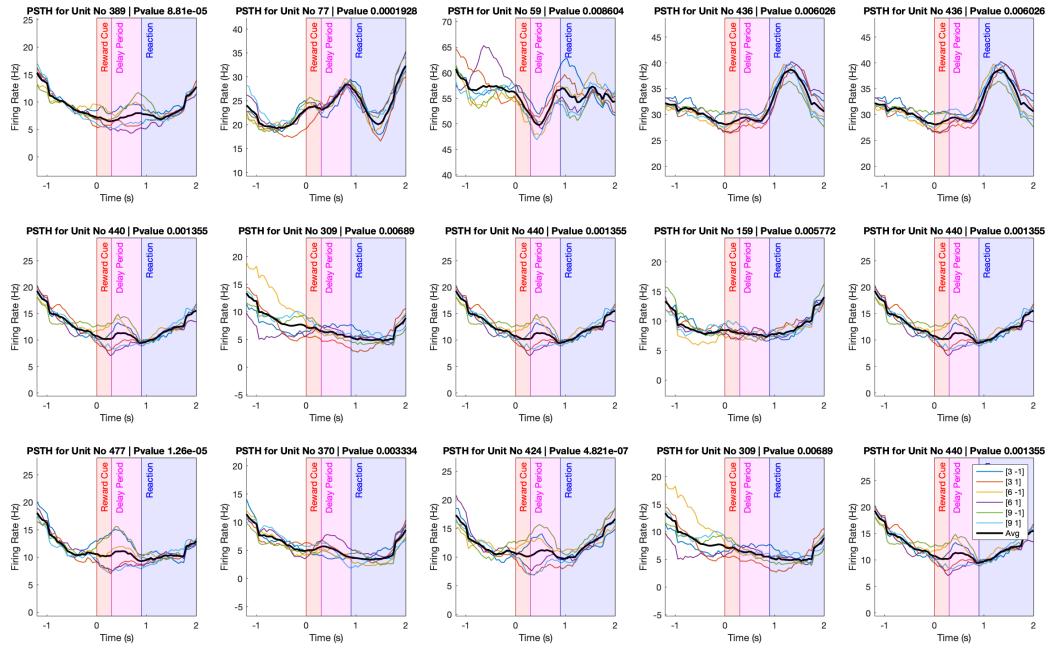
Figure 8: Average PSTH of The Units with  $pValue < 0.01$

Table 2: Average pValue of all Units

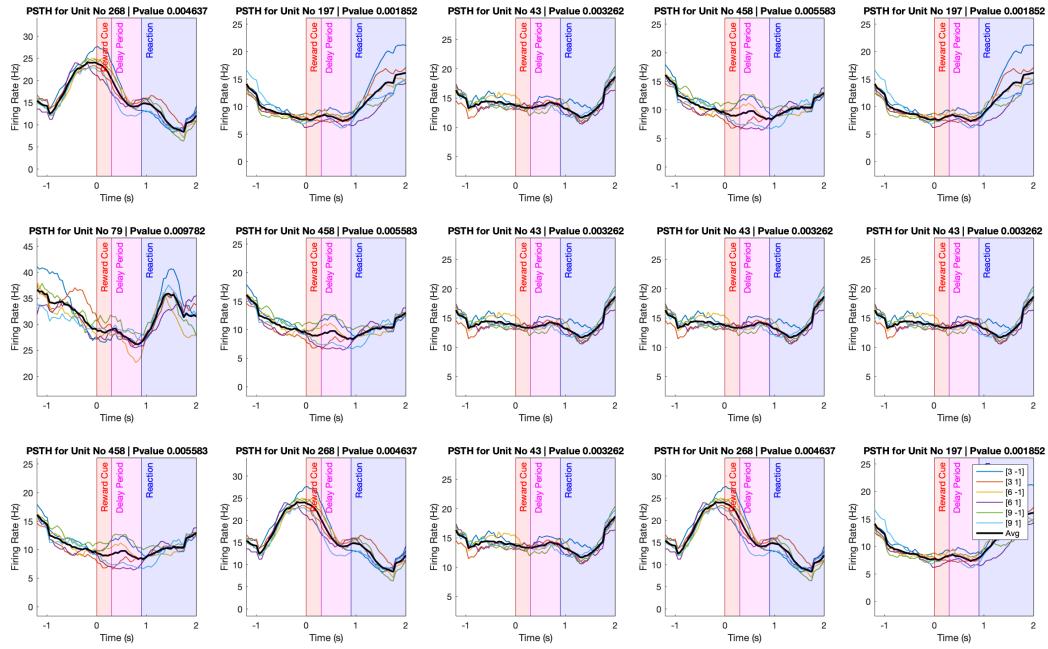
No Shuffling	Shuffled
0.2883	0.4976



## All 6 Conditions



(a) No Shuffling



(b) Shuffled

Figure 9: PSTH of Some Units with pValue < 0.01

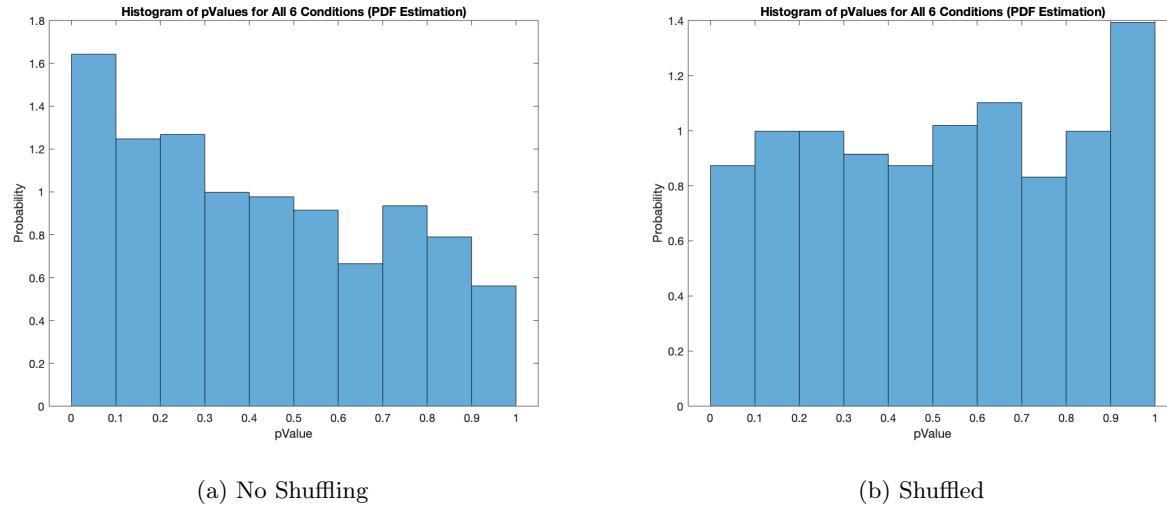


Figure 10: Histogram (PDF) of pValues for All 6 Conditions

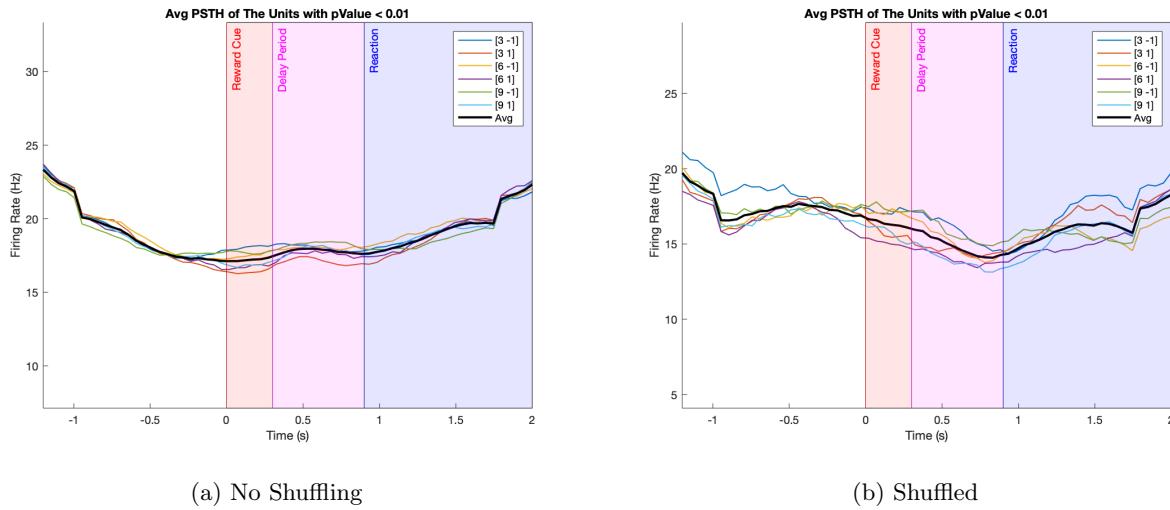


Figure 11: Average PSTH of The Units with pValue < 0.01

Table 3: Average pValue of all Units

No Shuffling	Shuffled
0.4215	0.5060



## Population

For a population, there is just a number as pValue so I have not any figures but I will compare average pValues of single units with pValue of population in different conditions.

Table 4: Average pValue of all Units — Summary of all

Conditions Type	Cue Left/Right		Reward Expected Value		All Conditions	
	No	Yes	No	Yes	No	Yes
<i>Single Units</i>	<b>0.4944</b>	0.4880	<b>0.2883</b>	0.4976	0.4215	0.5060
<i>Population</i>	<b>0.4944</b>	0.4880	<b>0.2883</b>	0.4976	0.4215	0.5060

As can be seen in Table 4, units code reward expected value better than all conditions or left/right cue. Also, cue left/right has the worst average pValue.



## ■ Steps 3 and 4

### □ All 6 Conditions

Reducing num of Units to 1 using PCA

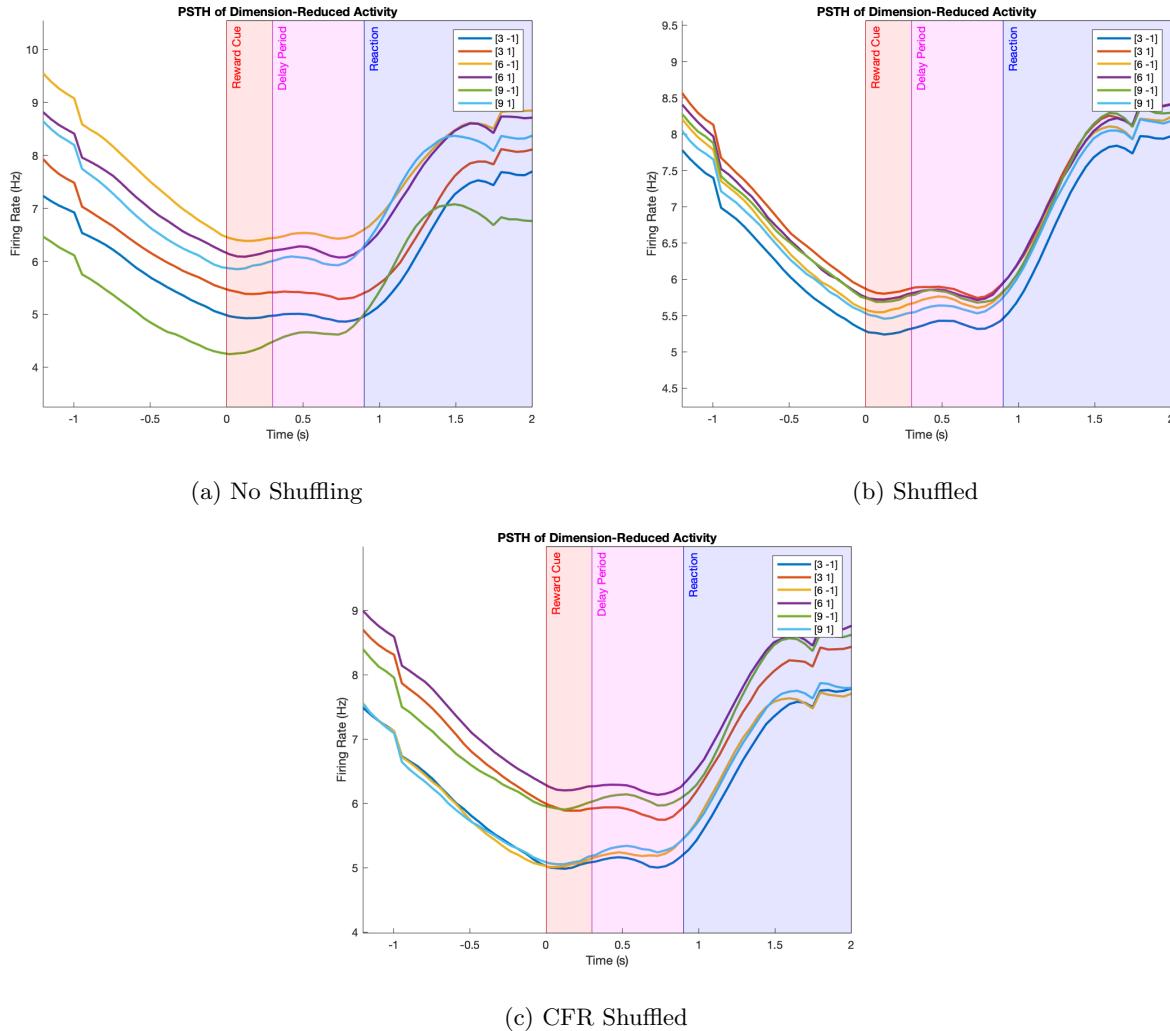


Figure 12: PSTH Plot



### Reducing num of Units to 2 using PCA

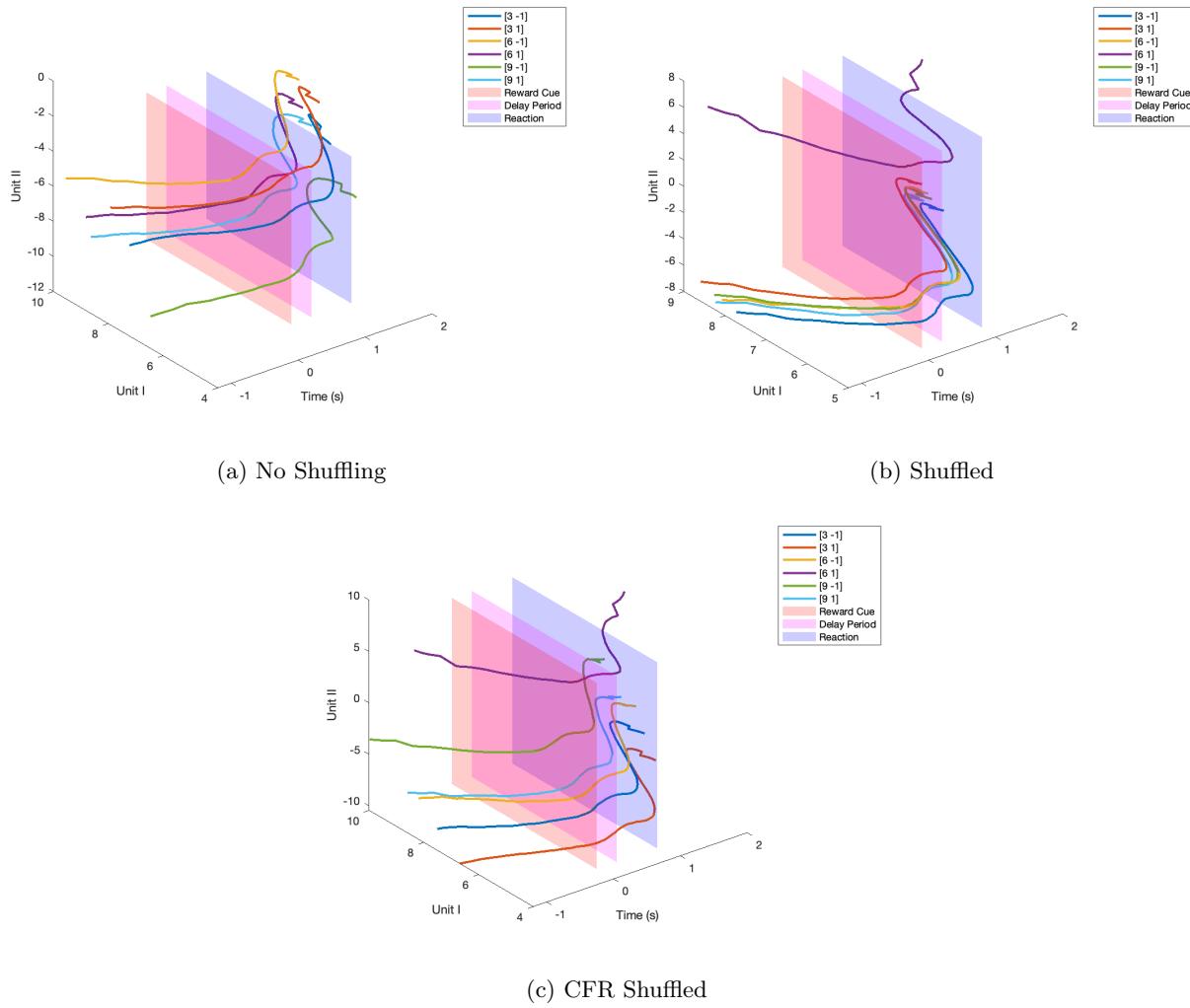


Figure 13: Unit I vs Unit II vs Time



### Plotting PCs instead of Dimension Reduced Data

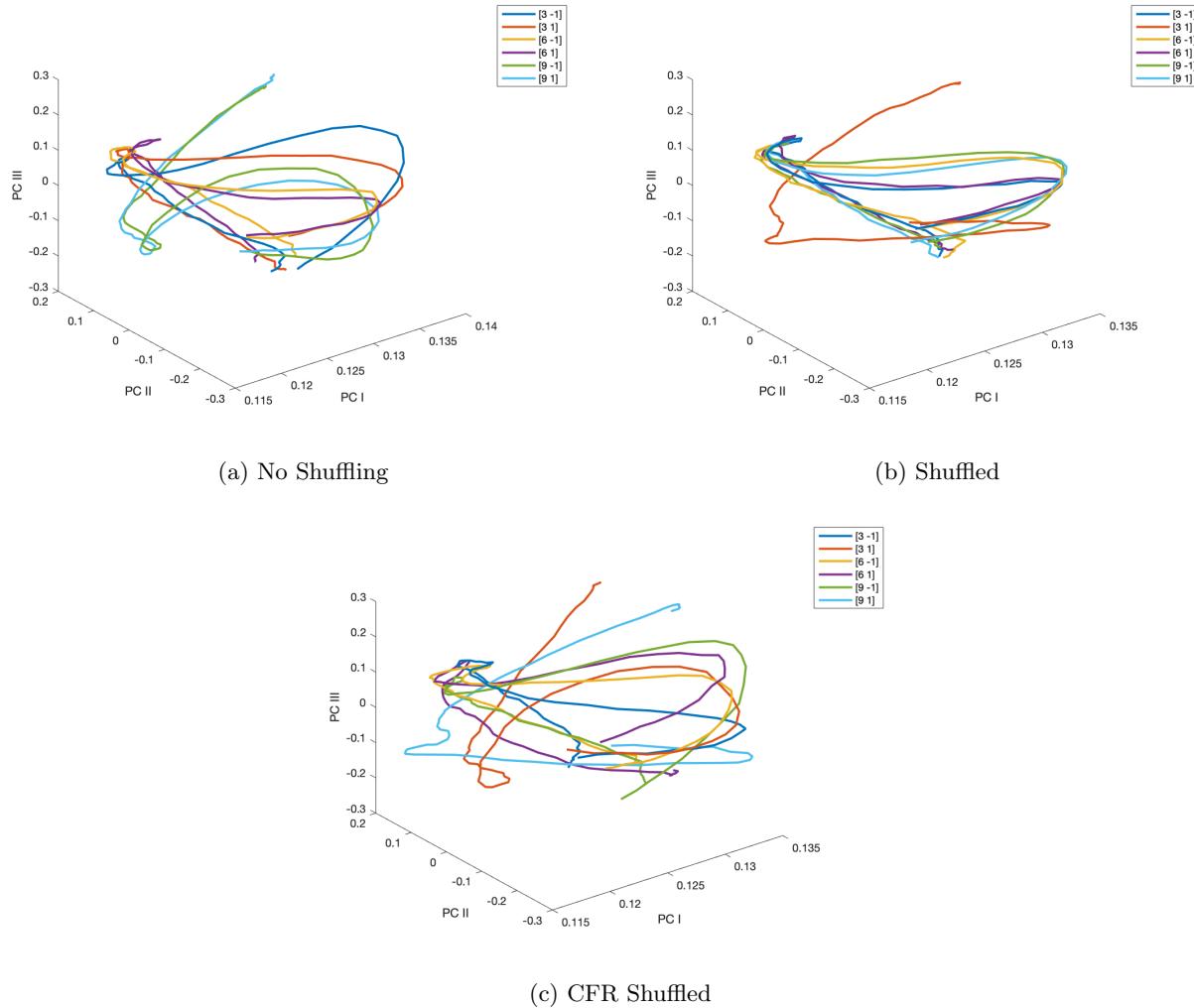


Figure 14: PC I vs PC II vs PC III



Just Expected Value

Reducing num of Units to 1 using PCA

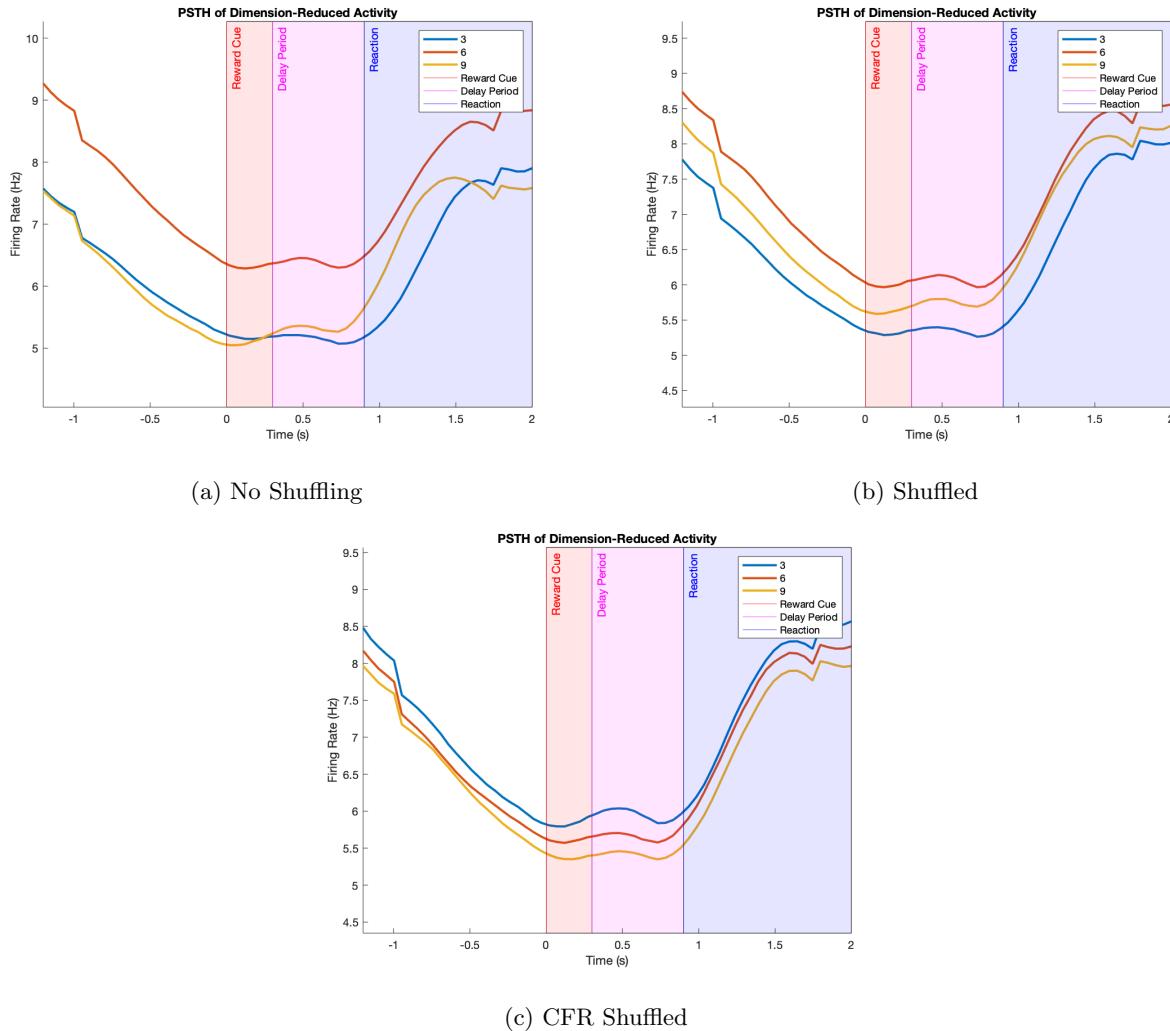


Figure 15: PSTH Plot



### Reducing num of Units to 2 using PCA

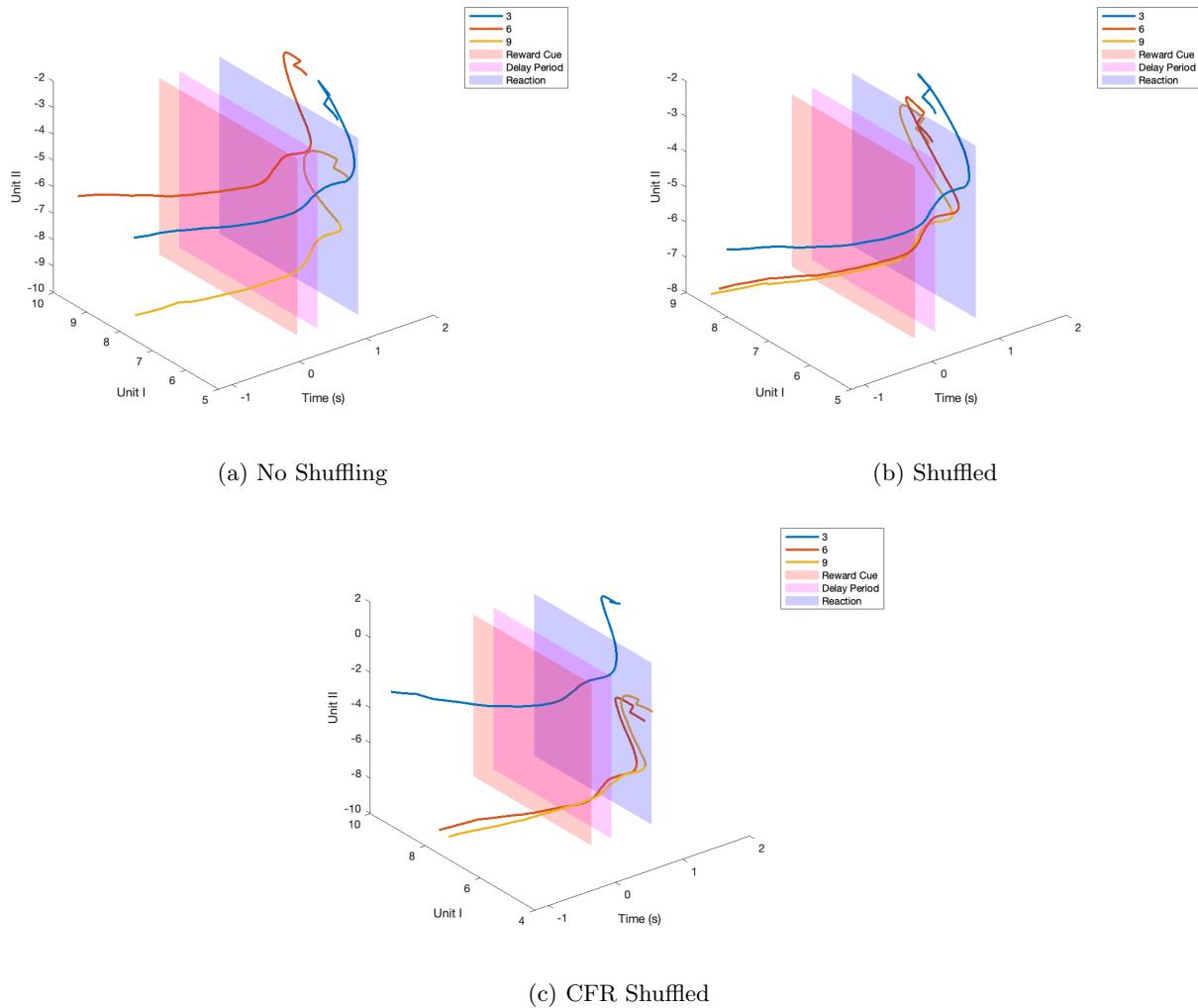
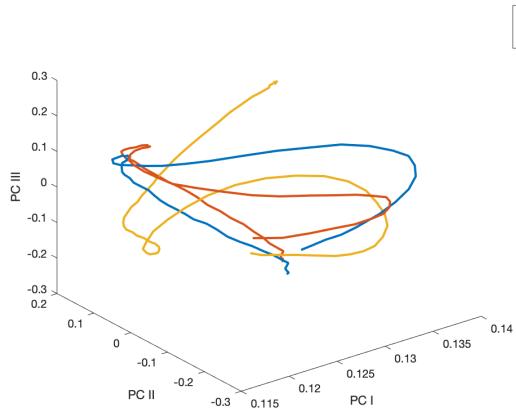


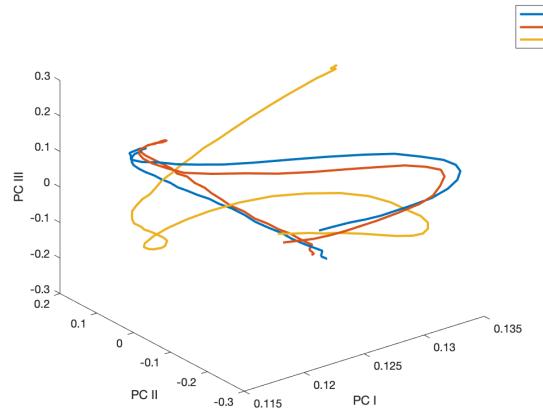
Figure 16: Unit I vs Unit II vs Time



### Plotting PCs instead of Dimension Reduced Data



(a) No Shuffling



(b) Shuffled

Figure 17: PC I vs PC II vs PC III