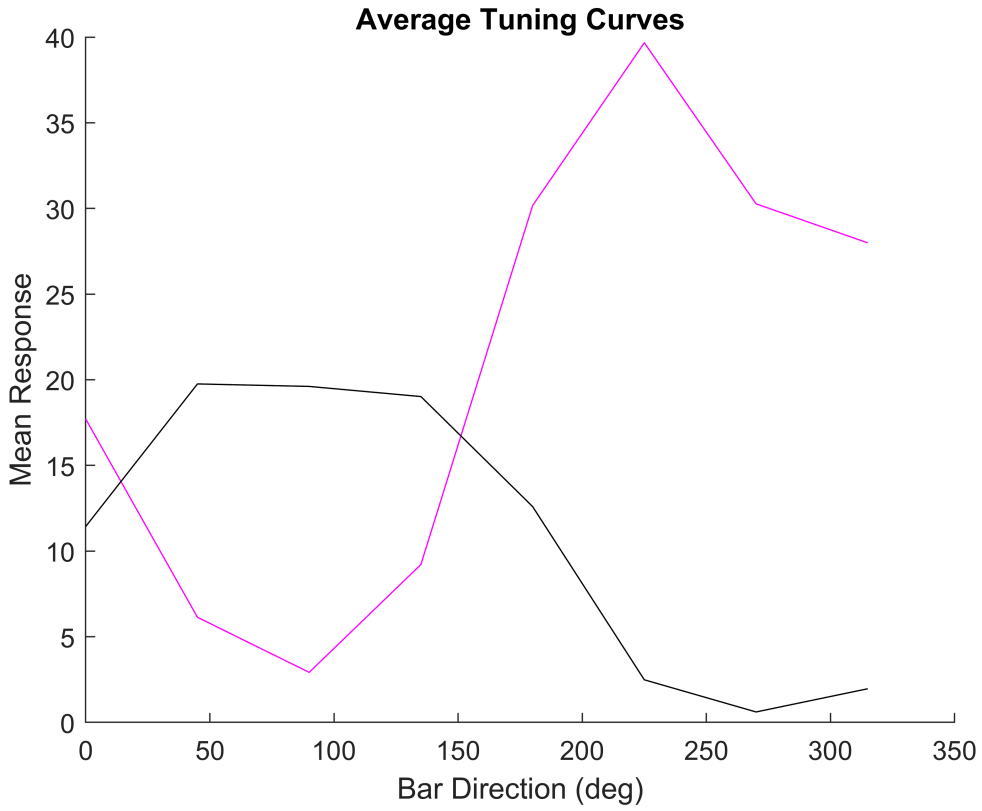
Signal Space and Noise from Unpaired ON DSGC recordings

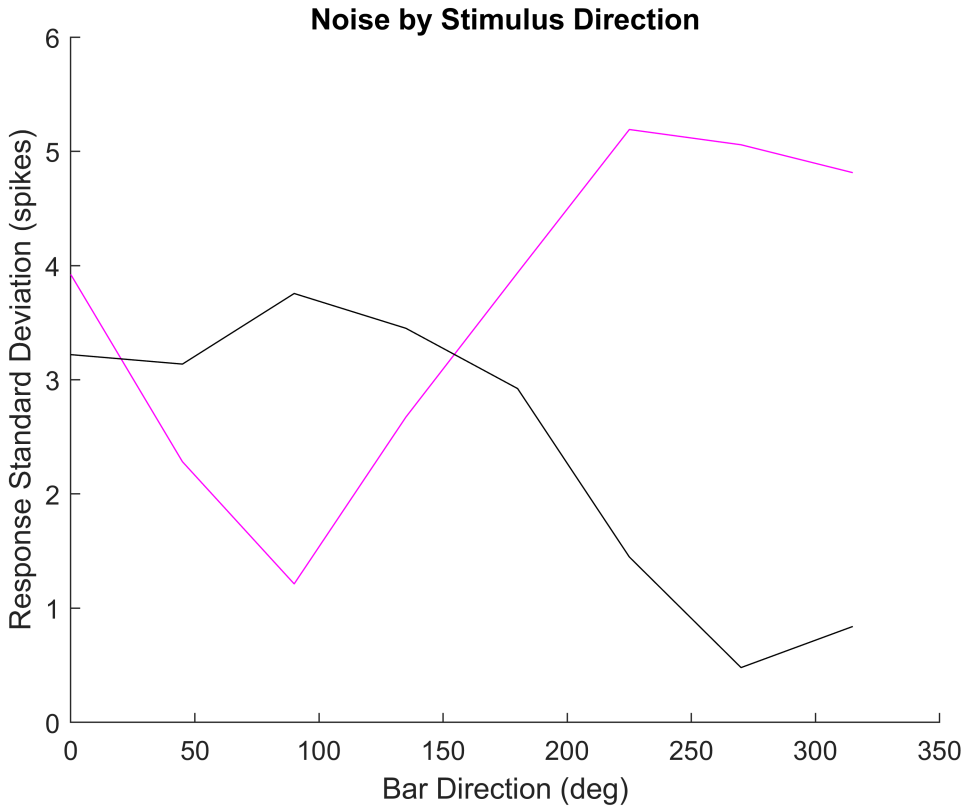
Looking at signal and noise from cell attached recordings of Superior and Inferior ON DSGCs. These data are not from paired recordings.

Mean Responses and Noise

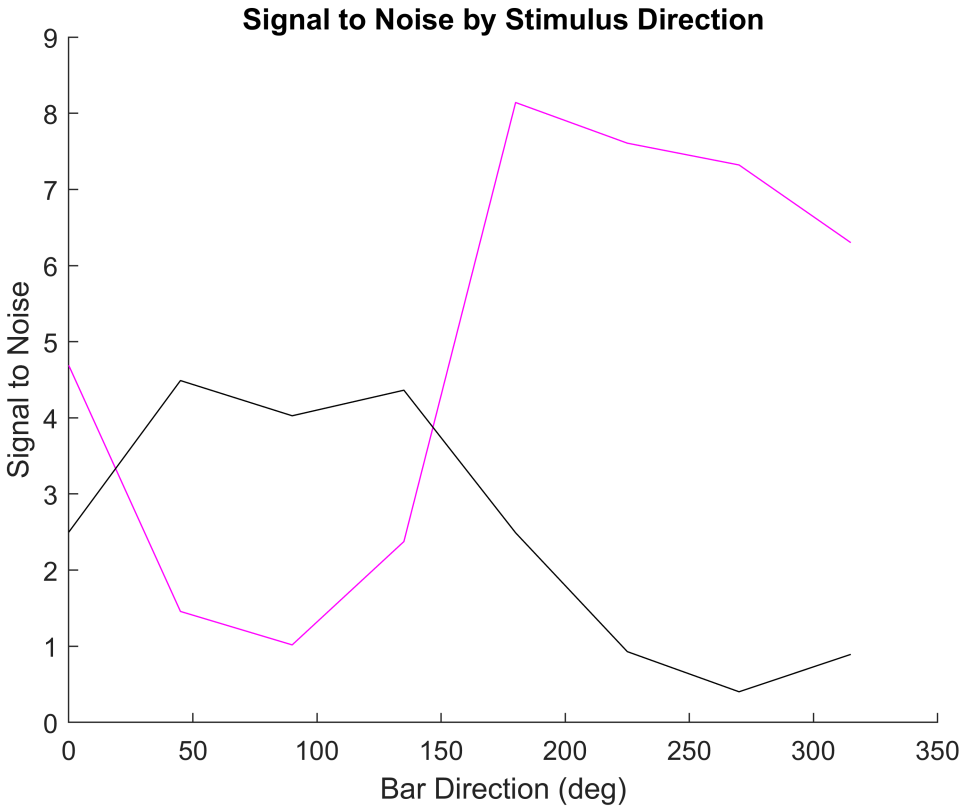
For every cell, I calculate it's average response and standard deviation for all 8 stimulus directions. From the average response I can plot the average tuning curve across the whole population (note stimulus directions on the x axis are not aligned: 90 deg = preferred direction for inferior cells, 270 = preferred direction for superior cells. Positive directions are counterclockwise).



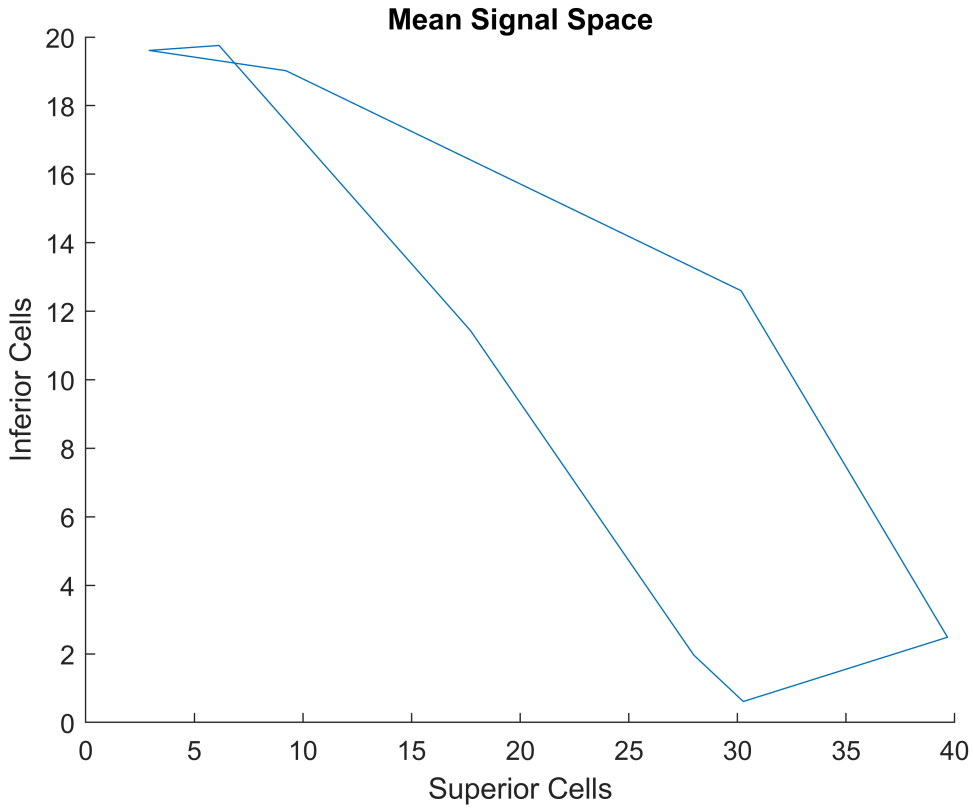
From the standard deviation of each cell's response I can plot the average noise to all 8 bar directions:



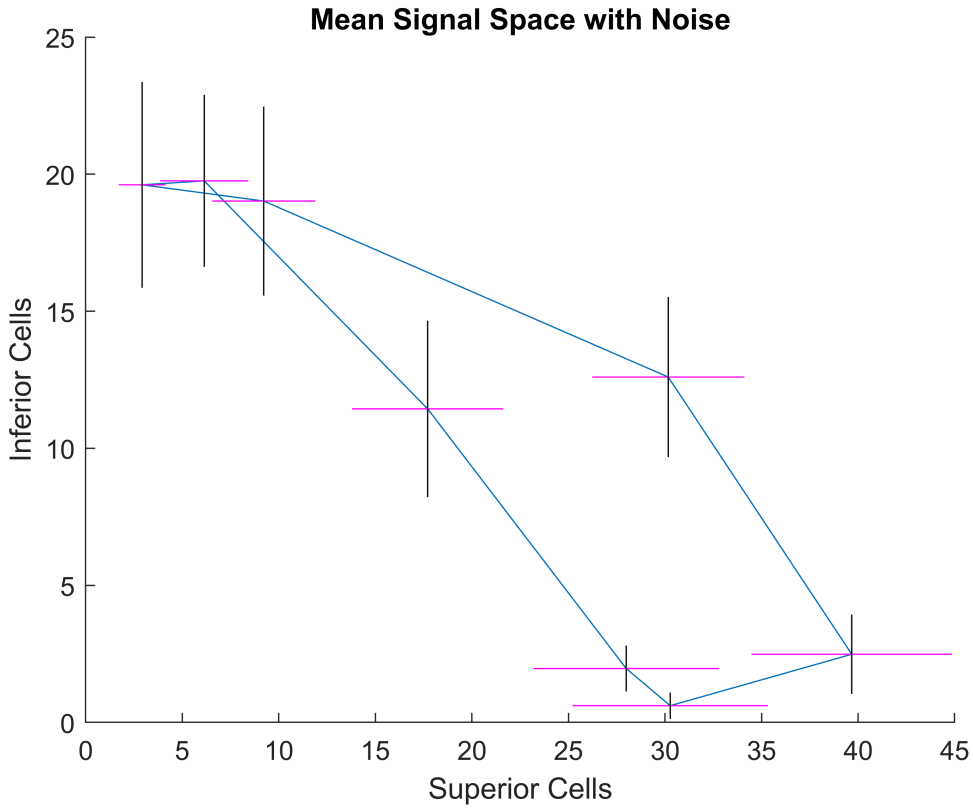
Dividing the average response (first figure) by the noise (second figure) for every cell gives the signal to noise for each stimulus direction. This plot shows the average signal to noise across populations:



Tuning curves can also be viewed in the signal space. Here is the signal space given the average responses shown in the first figure.

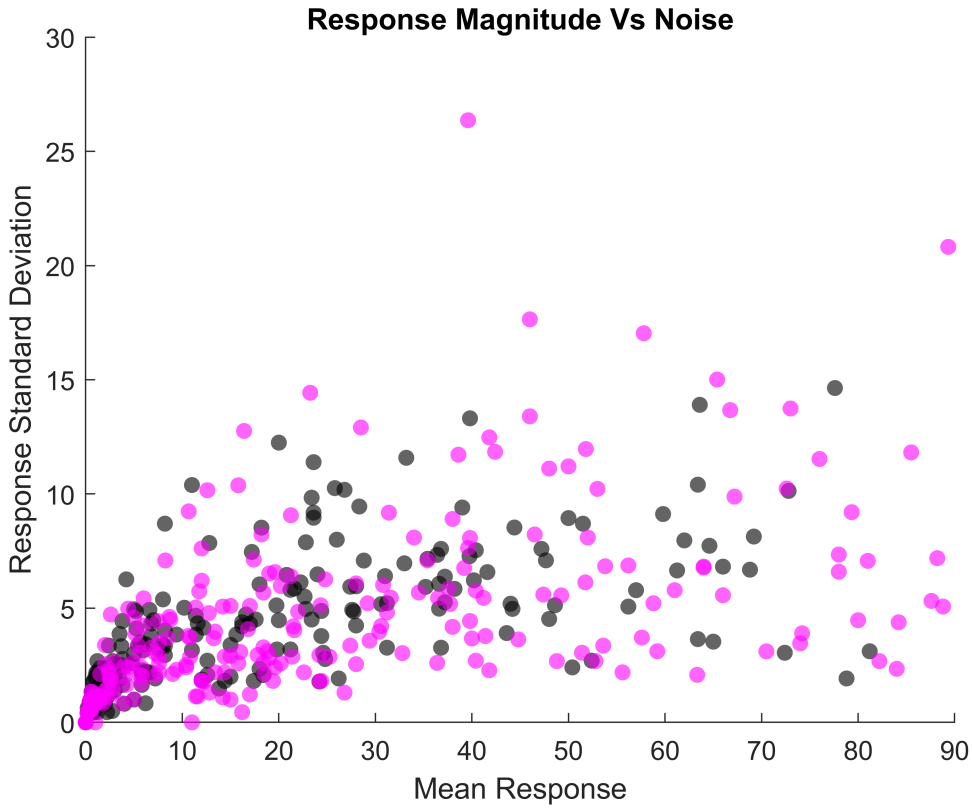


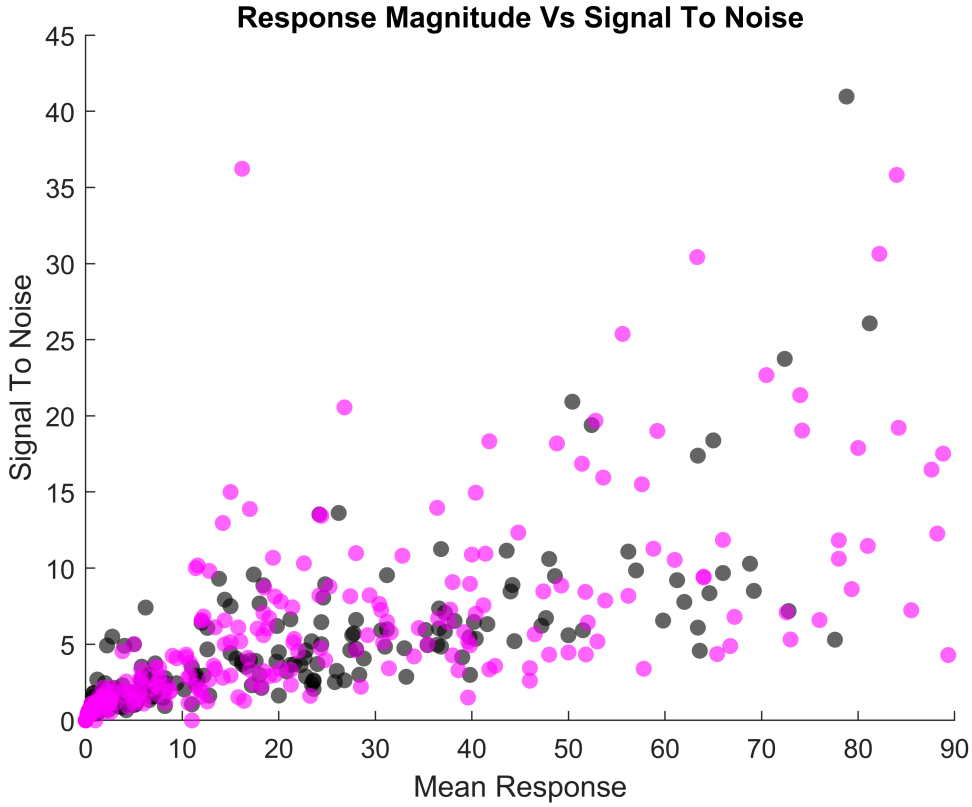
I can then plot the noise (from the second figure) as error bars on the average response shown in signal space. Because we haven't done paired recordings, this plot does not tell us about whether there are correlations or if noise points in a certain direction. It only gives the magnitude of noise for each cell type. Still, it might be somewhat meaningful as it sort of places an upper and lower bound on the possible effects of noise on decoding (encoding?). Again, the noise here is a standard deviation, so visually it under estimates the full width of the distributions.



Response Magnitude Versus Noise

Finally, I plotted the magnitude of responses against the magnitude of noise and the signal to noise. It looks like there is a positive correlation between these metrics. I think this was also observed in salamander OFF DSGCs.


Response Magnitude Vs Noise
Response Standard Deviation
Mean Response
0
5
10
15
20
25
30
0
10
20
30
40
50
60
70
80
90


Response Magnitude Vs Signal To Noise
Signal To Noise
Mean Response
0
5
10
15
20
25
30
35
40
45
0
10
20
30
40
50
60
70
80
90

The relationship between noise and signal to noise is strange, but clearly contains a lot of structure