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Independent Small Group Discussion Write-up

1. What was the motivation for this study? (e.g. big picture questions motivating experiments, prior work motivating experiments, etc)

The motivation was to find the specific rule governing the connectivity of the thalamus and cortical neurons as well as to find how the receptive fields respond to light to dark edge in the cortical areas and retina. This is experiment means to show that cortical orientation sensitivity and the elongated simple receptive field at the thalamic afferents can be at the level of the first synapse.

2. List the key methodological details (species, preparation, recording/ anatomical techniques, data analysis methods)

Spatiotemporal white noise was used to record receptive fields of neurons recorded simultaneously- as was used in previous papers. The degree of overlap was measured through the X-cell receptive field size and the on-center geniculate neuron shows a high degree of overlap- marked by the red circle. The cross correlational analysis showed monosynaptic connections between the the geniculate and cortical cells. The cortical neuron fired with high latencies and rise times. The neuron was more likely to fire at 1-4.5ms- the strength of at this time scale showed the monosynaptic peak but this created a problem with finding cells had an opposite response signature. Cats were put under with ketamine and micro electrodes were used to to record cell activity. The refractive error was measured with slit ophthalmology and the eccentricities at the sites of neuron recordings was measured.

3. For each figure, describe the important points including how the authors interpret the findings and what the findings may actually show.

Figure 1)

Figure 1 shows the receptive field of a geniculate X cell and a simple cell.

1a) The red shows on for response and the blue indicate the cell was an "off" subregion. The blue region- the off surround- was more likely to be excited by a dark stimulus, whereas the red was likely to show higher firing rate given a light stimuli.

1b)The black shows areas where the neuron is indifferent to light, and the other two colors mentioned above are shown with significant areas being tilted- this my show orientation selectivity.

1c) The cortical receptive field is elongated and Gabor function shows these receptive field maps, also displayed in figures b and d. The center is marked with a red circle and has a radius of 1.5 SD of the center gaussian.

1d) This shows the orientation selectivity marked in the red and green for a particular cell- this shows a clear image for edge-detection in these cells.

Table one displays a summary of connection between overlapping X cells and simple cells. The geniculate X cells were put into three categories- same sign , border, opposite sign, and the bottom of the table indicates the total. 50% of these simple subregion had the same response signature and was defined as same-sign . Opposite sign cells were defined be the opposite response signature for darker subregions. simple cells had 40% width and half a standard deviation of the peak in its length. The Strength(mean/median) column shows the positive correlation in each category.

Figure 2)

This shows the spike at each time scale for the lateral geniculate and cortical neurons, the cross-correlation between and the ordinate produces the cortical firing rate as a function of the delay between the geniculate and cortical firing. The cortical cells was mostly likely to fire between 1-4.5 ms and the percentage of cortical spikes was above baseline- showing the monosynaptic peak. The data was collected during the white-noise stimulus. The cross-correlations show that periods of visual stimulation with white noise or orientation gratings. The strength was calculated using the shuffle-subtractions- the bandpass filtering captured the strongest monosynaptic connections and the stimulus-dependent correlation were thus removed from this- likewise with the shuffle subtraction method.

Figure 3)

The spatial relations are shown with 23 functionally connected cell pairs- with receptive fields fitted for each simple cells. The geniculate centers were shown with red (indicating a strong subregion in the center) and blue (indicating flanks of unequal strength). The thickness of the line of the circle indicates the strength of the correlation and the diameter indicates receptive field size. figure B indicates that that the spatial relation of simple and geniculate cells pairs showed that not all are functionally connected.

4. What is your assessment of the overall findings? Did the experimental data support the authors' interpretation? Why or why not?

The connectivity between the geniculate X cells and the simple cells is specific to the subregion. If a geniculate receptive field had overlapped, the probability of connection was more likely. If the geniculate subregion overlapped completely the connectivity was even stronger. The specific thalamic and cortical projections have a role inn the connection and the strengthening off orientation selection- the geniculate output is important to create these simple receptive fields.

5. Describe new insights that you gained from the small group discussion of this paper.

I learned more about cell recording was my group's experience with neurological recording and we found this paper a bit outdated in some of the recording and methods used. The statistical methods are also outdated- modern methods might yield different results. They use circular logic to choose the time scale of 1-4.5 milliseconds. 74 neurons may not be a large sample enough to draw any certain conclusions.

6. List all of your questions and/or points in the paper that you did not understand.

Why was a cells superimposed to the wrong response sign, how does this fit with the rules given in the article? I also did not understand how they generalized measured to disincline certain info- I would believe that information would be important to their their overall conclusion. They didn't do multi-electrode recordings for this experiment, how would it change if they did use electrodes to record these cells?