Thesis: Literature Review

**Classification of neurons**

Simple and complex cells

Original classification:

**By Hubel and Wiesel: Simple and complex cells- Hierarchical model of the cortex- simple cells to complex cells.**

Simple cells: a) spatially segregated on and off regions, b) summation within each region, c) had ON and OFF subregions that were antagonistic d) it was possible to predict the neuron’s response to any stimulus

Not simple = complex

Key idea being tested = **linearity of spatial summation**- summation within each region, on and off subregions that were antagonistic, possible to predict neuron’s response.

F1/F0 – First harmonic od the response and the mean spike rate

Mechler and Ringach- 2002 Neural rectification due to spike response acts as a non-linear ‘ruler’ which gives an artificial grouping of neurons into simple and complex cells.

**Idea: There are not really two separate classes of neurons.**

Bimodality of F1/F0 should not necessarily mean that there are two discrete classes of cells in the primary visual cortex. Cells could still be on a continuum.

Is there a dichotomy of simple and complex cells in the tree shrew cortex?

Subfield segregation using moving bars: confounds temporal and spatial aspects. A ‘biphasic’ response can be mistaken for a segregation of subfields.

A spectrum of properties rather than bimodal distribution- investigate this idea further: What does it mean? That there are no simple and complex cells?

Establish a standard for reporting then. Perhaps Henry et al? Again classifies in to distinct groups rather than anything else. Perhaps not define things? No need to classify? But no simplification= complex models with too many variables. Some ‘assumptions’ need to be made! Is a simple/complex classification enough of a simplification to make any conclusions. Does it then allow the possibility that we can use the classification when we need and drop it when it’s inconvenient?

Chance et al., 1999 nature neuroscience: Any manipulation that decreases the effect of intracortical excitation will make complex cells act like simple cells and any thing that will increase the effect of intracortical excitation will make simple cells more complex- Intracortical excitation 🡪 More complex.

Blocking inhibition makes simple cells more complex like- could be due to making recurrent excitation more active!

Orientation selectivity and cortical hierarchy: Idea- Hubel and wiesel.

Why am I so interested in linearity?

1. To increase the number of units I have in my final chapter.
2. To give me something to write about?
3. I think linearity is often ignored and may play an important role in vision?

Solution: Try and report both?

Priebe and Ferster 2008 Neuron

**Idea: non-linearity emulates inhibition. So things that looked like they needed inhibition may not.**

Chapter 3:

Insights from the tree shrew primary visual cortex: Orientation selectivity, spatial frequency tuning and linearity in layer 2/3 and layer 4.

Literature Review:

Orientation Selectivity- Models + what has been done in the primary visual cortex of tree shrews so far (quite a bit but not so much)- how does it compare to cat and macaque data?