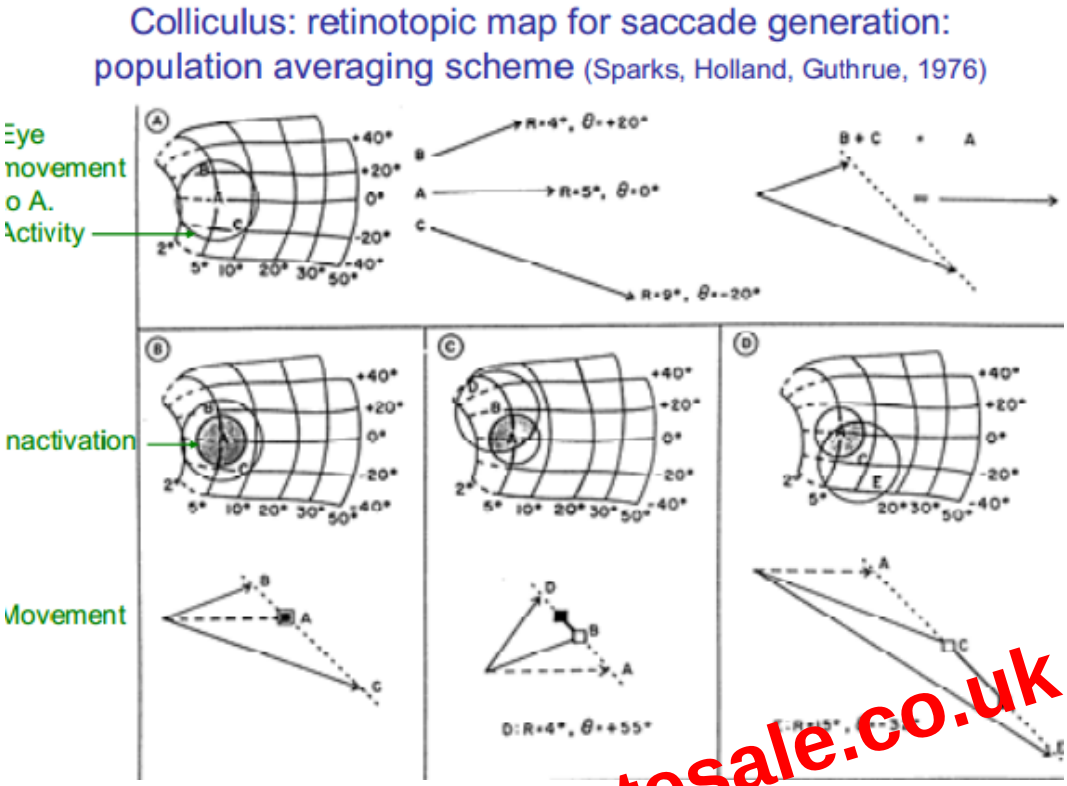
Colliculus generating an eye movement is a nice example of population vectors. The inferior colliculus generates eye movement in a population vector sort of way. Quite a long time ago, people working on eye movement realised that the inferior colliculus generate eye movement in a population average sort of way.



Make eye movement to retinal position A, there is a bump of activity in all the neurons around A centred on A. So the population vector, or the average firing rate weighted average vector location will be where you move your eye to. This was shown by inactivating the sheet of neurons in the colliculus and then have animals generating eye movements to different locations (Sparks et al. 1976). So the location marked A is anaesthetised. When animal tried to move to A, the movement was normal because the average sum of the neurons that was remaining still had a population vector towards A. But if animal had to make eye movement to B, the eye is deflected upwards because the firing rate weighted average vector is biased upwards as the area around A is inactivated. Movement to C is deflected downwards. So they realised that there was a population vector averaging scheme in the colliculus.

Temporal processing in olfaction

Odour masking problem (Ambrose-Ingerson et al. 1990): rodents can detect weak smells that are important to them, e.g. smell of chocolate for food or smell of cat signifying predator. They have a sniff cycle which is 3 to 5 sniffs at 10 Hz and whiskers move at the same frequency. This rhythm is related to the theta rhythm in the hippocampus and olfactory bulb.

In the olfactory bulb: Triangles are mitral cells (excitatory), circles are granule cells (inhibitory). The activity has cyclic inhibition via medial septum at 10 Hz. Total amount of activity is normalised, whether it is a weak or strong smell you tend to get the total amount of activity which implies there is feedback inhibition.

Mitral cells project to piriform cortex, which is the first part of neocortex that gets olfactory input. There is layer II pyramidal cells (excitatory) and various interneurons. Mitral cells project to layer 2 pyramidal cells with excitatory connectivity. Then layer II pyramidal cells in the piriform cortex projects back to olfactory bulb onto the inhibitory granule cells. This is inhibitory feedback. So they thought the excitatory connections between the layer II cells in the piriform cortex could form an associative memory or a positive feedback