- Friday, September 13, 1996
  Auditory Localization and Space

5.0 Laurence Harris (Psychology, York) "Auditory localization and the representation of space" (Fri 13th Sept 1996)

5.1 I was delighted to be able to use the group to help polish my NSERC proposal, due in Nov!! Anyone else who would like to try this trick is welcome to propose an extraordinary meeting! I found it quite useful. I have added references here - if you want any of them expanded, send me mail.

5.2 As we move around the world we need to update our representation of our position in space. By looking at our ability to localize sounds during movements, I am hoping to follow how this might happen. Sound localization is based, at least at some level, on the head, as opposed to the eye-referenced visual system.

5.3 Auditory and visual cues combine to define our spatial world. We can orient to either and cells in the superior colliculus respond to both within a retinally-organized map over its surface. As the eyes move in the head these systems are theoretically pulled apart. Some early work of mine (Harris et al., 1980) showed that in the cat, this is indeed the case. More recent work by others in both the cat (Hartline et al., 1995) and monkey (Jay and Sparks, 1984) have suggested that the auditory fields can, amazingly, move with the eyes. The fields rarely move far enough to be of much use, though. These papers led to a lot of excited discussion.

5.4 Visual deprivation can lead to the appearance of more auditory cells in the colliculus of cats (not less visual cells, by the way) (Rauschecker and Harris, 1983).

5.5.0 Saccadic suppression is the fact that vision is much reduced during a saccadic eye movement. This can be most convincingly demonstrated by looking in a mirror and changing your gaze from the image of one eye to the image of the other. You cannot see your eyes move. The phenomenon is due to a number of factors including, primarily the blur of the image and also backward masking by the retinal image corresponding to the post-saccadic position of the eyes. When other factors are controlled for, however, there remains a small amount of suppression that must be due to some central inhibitory mechanism. Does this central suppression extend to other senses? Is there suppression of auditory processing during saccadic eye movements?

5.5.1 I measured detection thresholds and frequency discrimination thresholds and they were the same whether the sounds were presented during a saccade or with eyes stationary. So the answer is NO. (Harris and Leiberman, in press).

5.5.2 But saccadic suppression is primarily for spatial features (Burr et al., 1994) so I also measured the ability to localize sounds. Still no effect. Answer still NO.

5.5.3 Some more sensitive tests were discussed which I still might try.

5.6 Conclusions: Auditory and visual cues both contribute to the definition of space. However, they are, at least initially in different coordinate systems. Collicular work hints that vision might dominate in the orienting system. The saccadic suppression experiments indicate that vision and hearing are treated differently during reorienting, though. When vision is suppressed, either by being brought up in the dark, or by the suppressive mechanisms associated with saccades, audition dominates. Looking at auditory cues to spatial location will be a fruitful way of looking at our dynamic representation of space.

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