

## **SPATIAL AND TEMPORAL DYNAMICS OF NEURAL CODING IN THE CENTRAL VISUAL SYSTEM**

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We have explored the way feedback systems influence the temporal structure of neuronal responses to visual stimuli and the spatial organisation of the zones driving these responses. These two patterns of effect are interlinked and indicative of different coding strategies. We have previously reported that the use of micro-iontophoretic application of drugs to produce a focal enhancement of visual responses of cells in layer 6 of the cat primary visual cortex (V1) produces changes in response magnitude, receptive field shape and receptive field size in LGN cells (Wang et al 2000). Here we show that this focal enhancement of layer 6 cell visual responses in V1 changes the balance of burst and tonic components of LGN cell responses to flashed stimuli. We compared the responses of LGN cells to a stationary flashing stimulus of varying diameter and contrast, centred on their receptive field, before during and after focal enhancement of layer 6 cell visual responses. Of the cells so far studied 50% showed a relative enhancement of the burst versus the tonic component of the response during drug application in layer 6 and 28% showed the converse. Throughout our data these two components made differential contributions to the area summation curve and shifting the balance between the two changed the shape and focus of the curve. The data suggest a capacity for a stimulus linked, focal and cortically initiated switch in LGN cell transmission mode.

We have explored MT feedback effects in V1 in the primate using the same micro-iontophoretic techniques to produce a focal enhancement or decrement of visual responses in MT whilst recording from electrode arrays in V1. The focal changes in MT response level produced highly significant changes in responses of V1 cells with receptive fields both overlapping and to the side of the MT field. Amongst groups of simultaneously recorded V1 cells some exhibited increases in response magnitude and others decreases. This suggested a “push-pull” pattern of influence. Many of the effects of focal gain shifts in MT were linked to changes in the extent, often asymmetric, of the response zones of individual V1 cells. Feedback from layers 3, 5 and 6 in visual area MT provides input to layers 1, 4B and 6 in primate V1, however, effects of focal gain shifts in MT were not restricted to laminae receiving feedback connections in V1 but were found through all layers. Presumably, this reflects the inter-connectivity between layers in primate V1. Similarly we observed focal changes in visual responsiveness in layers 2, 3, 4, 5 or 6 of MT provoked changes in V1 responses.

The focal changes in MT thus seemed to produce changes in the dynamic behavior of the circuitry (and hence visual responses) via the reciprocal interconnections linking different layers and levels of the system, which must include the potential of changes

in the behaviour of LGN cells. The implication is that facets of an image that appear to be extracted in the MT circuitry involve a seamless propagation of interactions between MT, V1 and the LGN with shifts in the pattern of interaction throughout the networks in V1 and LGN.