Perception Without a Perceiver

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"Life is an art, and like perfect art it should be self-forgetting" (Suzuki, 1964)

Conventional models of human perception assume that sensory experience involves a critical interplay between activity in sensory cortex representing the stimulus and pre-frontal cortex which serves as an "observer" system- receiving and interpreting the patterns of activity originating in posterior, sensory cortex.

However, recent fMRI results from our research appear to challenge this accepted view. In an fMRI study in which individuals were exposed to a highly engaging popular movie- we have found a surprisingly robust and wide-spread activation of most of the posterior part of the brain- which was remarkably "synchronized" across individuals watching the same movie. These results attest to the massive engagement of sensory cortex by naturalistic sensory stimuli. However, in contrast to this wide-spread activation in sensory cortex- we have found a remarkably little activation in frontal areas of the brain. This lack of activation could not be attributed to individual variability- since it was apparent in repeated presentations of the same movie even within a single individual (see fig. 1).These results were consistent across a number of experimental paradigms involving passive sensory perception - all showed that prefrontal cortex failed to be significantly activated. It could be argued that the lack of activity in prefrontal areas was simply a consequence of a general lack of fMRI activity in these parts of cortex. For example, it could be that the strong coupling between neuronal activity and BOLD signals which we have recently demonstrated in human sensory cortex (Mukamel et. al., 05) changes at pre-frontal levels. To examine this issue, and also to start mapping in more detail the functional organization of the various networks of pre-frontal cortex, we have conducted a series of experiments in which we mapped brain activity during tasks that were explicitly targeted at eliciting "self-related" brain activity- such as introspection to visual and auditory modalities, or self-judgment evaluations. Although these were high level cognitive tasks of extreme complexity- our results show a remarkably consistent pattern of activity focused primarily on pre-frontal cortex (see yellow patches in figure 2). Clearly, pre-frontal cortical areas can be activated consistently if the tasks involve self-awareness. The critical question was now- how do hese areas behave when the task shifts to a purely perceptual one? The results were clear cut- the activity shifted now to a different set of areas- located more posteriorly in sensorymotor cortex (green patches in fig. 2).

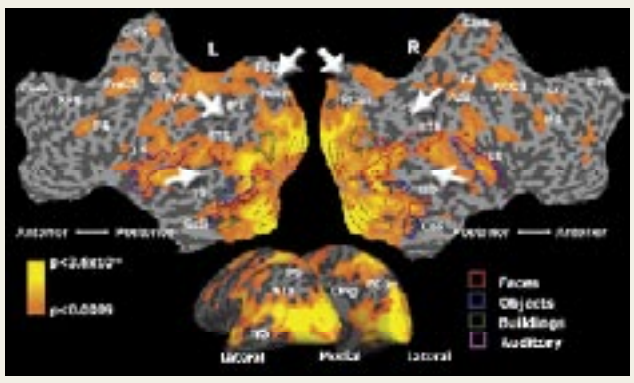

Fig. 1 Brain activation during repeated movie presentation. Yellow regions show highly activated areas in poseterior, sensory cortex. Note lack of activation in frontal areas and in the intriguing "intrinsic" islands in posterior cortex (arrows). Modified from Golland et. al. 2006

No cortical area appeared to be co-active during both selfrelated and sensory perception tasks. Furthermore, examining the activity of the pre-frontal system during the rapid perceptual tasks revealed significant *inhibition* in these areas below the resting base-line. So not only are prefrontal areas disengaged from perceptual awareness, they are actually inhibited during conscious perceptual awareness.

The results are actually compatible with the strong intuitive sense we have of «losing our selves» in a highly engaging sensory-motor act. They are intriguingly reminiscent of recurrent eastern philosophical themes which emphasize the 'silencing» of the self during intense engagement with the outside world.

Fig. 2 Comparing brain activity during reflective self-related tasks and during intense perception. Prefrontal areas (yellow patches) showed significant activation during self-related introspection and self judgment tasks. However a completely different and highly segregated network of more posterior areas were active during engaging perceptual tasks (green patches). No overlap was found between the two networks, and the prefrontal cortex was actually inhibited during intense perception. The results clearly rule-out the need for an "observer" function in self-related ortex during perception.

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