

behavior. In contrast, Nr neurons did not exhibit such selectivity nor correlation. These results suggest that different classes of parietal neurons contribute differently to the visual grouping of discrete elements.

doi:10.1016/j.neures.2009.09.484

P1-h03 Contribution of color signals to ocular following responses
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Ocular following responses (OFRs) are elicited with ultra-short latencies (~60 ms) by sudden motion of a visual scene. It is known that the OFRs are largely influenced by luminance signals which are mediated by the magno system. However, little is known whether the OFRs are influenced by color signals which are processed by the parvo system. First, we made vertical isoluminant color sinusoidal gratings with minimum motion technique and recorded the OFRs to horizontal motion of the gratings in monkeys. We found that the isoluminant color gratings did elicit the OFRs. Then, we recorded the OFRs to moving color-gratings and luminance-gratings at 6 spatial (0.07–2.3 cpd) and 5 temporal frequencies (1.56–25 Hz). We found that the high spatial and low temporal frequencies were more suitable for the color-gratings to elicit the OFRs than for the luminance-gratings. These results suggest that the OFRs can also be driven by the signals mediated by the parvo system whose visual responses show high spatial and low temporal resolution.

doi:10.1016/j.neures.2009.09.485

P1-h04 Spatial resolution of direction discrimination: comparison of MT neurons and behavior
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Observers have difficulty in identifying a target in the presence of surrounding distracters. To understand the neuronal mechanisms underlying this phenomenon, known as 'crowding', we recorded activities of single MT neurons from a monkey performing direction discrimination in a bipartite center/surround motion display. The monkey was required to discriminate direction of the center patch of moving random dots, of which parameters were tailored to selectivity of the neuron under study, and to ignore the surrounding noise of varying diameter. Psychophysical threshold first increased then decreased as the noise diameter increased, suggesting an improvement of spatial resolution of direction discrimination at the large noise condition ('anti-crowding'). Neuronal threshold of MT neurons also first increased then decreased with increasing surround size. The increased sensitivity with a large surround is due to increased differences of mean responses, not reduced variability. The results suggest that changes of sensitivities in MT neurons underlie the changes of sensitivities observed psychophysically.

doi:10.1016/j.neures.2009.09.486

P1-h05 Categorization of ambiguous visual objects by macaque monkeys
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Here we examined monkeys' performance in categorizing ambiguous visual objects. We trained monkeys to perform a two-alternative forced-choice body/object categorization task. Stimuli were presented in 5 noise levels. After monkey fixated on a monitor for 400 ms, a noisy image was presented for 70 ms, followed by 500 ms blank interval and then two response targets in the left and right of the screen centre, indicating body and object responses, respectively. Monkeys had to make a saccade to the correct target no later than 300 ms after target onset. Behavioral analysis showed a linear decline of performance as noisier stimuli were presented. But for a given noise level there was a difference in the amount of performance decline between body and object. Also there was a correlation between performance and reaction time. Although there was a 500 ms time delay between stimuli and targets, reaction time increased significantly as noisier images were presented. Mean difference between reaction time of the least and most noisy images was about 30 ms. These results advance our understanding of the nature of visual object categorization in non-human primates.

doi:10.1016/j.neures.2009.09.487

P1-h06 Automatic extraction of visual image bases from fMRI response patterns

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Image bases provide a framework for understanding neural representation of visual perception. We have recently shown that arbitrary contrast-defined visual images can be reconstructed from fMRI activity patterns of early visual cortex, by a combination of multi-scale local image bases (Miyawaki et al., Neuron 2008). Our model assumed fixed multi-scale image bases, whose contrasts were estimated from fMRI activity patterns. Such heuristically determined image bases may not be optimal for reconstruction. Here, we propose a method for automatically extracting image bases from fMRI data. We constructed a probabilistic model that relates the fMRI activity space to the visual image space via an intermediate representation. The mapping from the intermediate representation to the visual image space can be regarded as a set of image bases. The proposed model was trained with fMRI data measured while a subject viewed random images. As a result, spatially localized image bases were obtained around the foveal region and able to reconstruct novel visual images.

doi:10.1016/j.neures.2009.09.488

P1-h07 Understanding brain information processing in the visual system following flickering stimulation

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Our main purpose is to understand brain information processing in the visual system following to flickering stimulation. In order to do so, subjects were stimulated during fMRI and EEG experimentation. During stimulation, the subject sees a flickering white/black light, displayed using Silent Vision goggles (visual angle 18 × 24 degrees), generated with a Shutter to control high frequencies. During fixation the subject sees a gray background, isoluminant with the stimulus. Experiments are performed for 21 different frequencies from 1 to 100 Hz. Frequencies are pseudo-randomized and the same sequence of frequencies is presented to all subjects. We report specific effects (location and dynamics) for low, medium, and high frequencies; and particularly investigate the outcome of flickering frequencies in very low (<5 Hz) and very high (>40 Hz) subbands

doi:10.1016/j.neures.2009.09.489

P1-h08 Receptive field extraction in free viewing condition

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Electrophysiological multi-neuron recordings in free viewing monkeys are limited in time and therefore make a reliable extraction of visual receptive fields (RF) difficult, since this normally requires a large set of well controlled stimuli (~10,000). However, knowledge of the RFs is highly relevant in order to relate neuronal responses to behavior. Here, we propose a method inspired by [Vidal-Naquet et al., COSYNE'09] to extract V1 receptive fields in conditions of freely viewing natural scenes, when the number of stimuli observed by the subject is significantly smaller (~100). Using simulations, we show that our method can recover the structure and spatial location of noisy, non-linear receptive fields from the recorded saccade point locations on observed natural stimuli together with the related neural activity. Our method relies on the use of a statistical test that can reliably predict whether the estimated receptive field is significant or not. Finally, we present receptive fields extracted using our method from real physiological recordings.

doi:10.1016/j.neures.2009.09.490

P1-h09 Visual experience modifies the neural dynamics for orientation processing in cat visual cortex

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Orientation selectivity of visual cortex is highly adaptive to visual experience in early postnatal life. Orientation-restricted environment during the critical period can transform the orientation representation to respond to the exposed orientation preferably. It remains unclear, however, how orientation signals are processed by the altered visual cortical circuits. In this study, we examined spatiotemporal dynamics