



Illusory contour detection and receptive-field size



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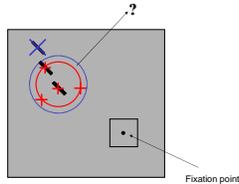
BACKGROUND

The concept of illusory contour detection

- One may look for special mechanisms to explain illusory border responses (von der Heydt, Peterhans et al. 1984) only if cells respond to illusory borders when the pacman figures do not infringe on the activating regions of their receptive fields

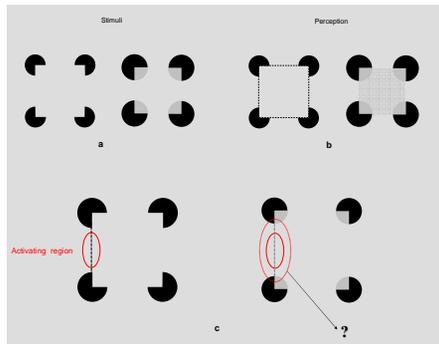
Receptive field size

- Measuring the size of the activating region of a receptive field border by ear has the potential of underestimating the receptive field size.



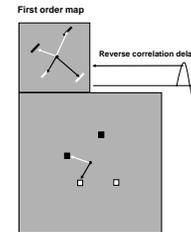
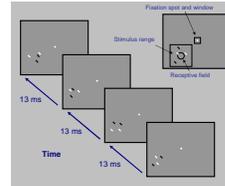
HYPOTHESIS

- We use a quantitative way to measure receptive-field size, in order to find out whether illusory border responses really do arise from outside the activating region of the receptive field.



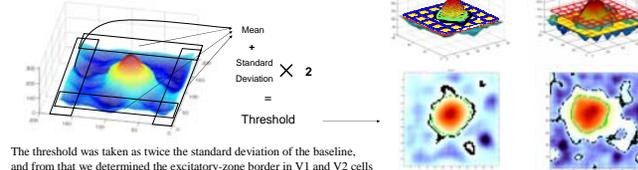
MATERIALS AND METHODS

We mapped the receptive-field activating region quantitatively using spike-triggered reverse correlation (Emerson, Citron et al. 1987; Livingstone, Pack et al. 2001).



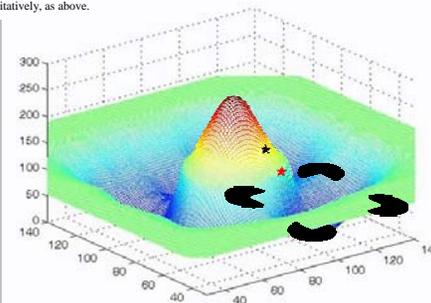
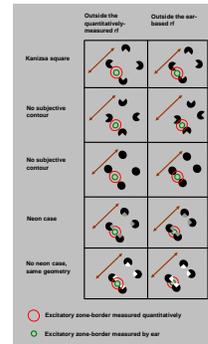
36 V1 cells and 39 V2 cells from 2 alert fixating macaques were recorded. Monkeys were prepared for chronic recording as described previously (Livingstone and Hubel, 1996).

The periphery of the first order map was used to determine the baseline firing rate.



The threshold was taken as twice the standard deviation of the baseline, and from that we determined the excitatory-zone border in V1 and V2 cells

We then we asked whether cells showed responses to illusory borders depending on whether the pacmen generating those illusory borders were inside or outside the receptive-field borders as measured either by ear or quantitatively, as above.



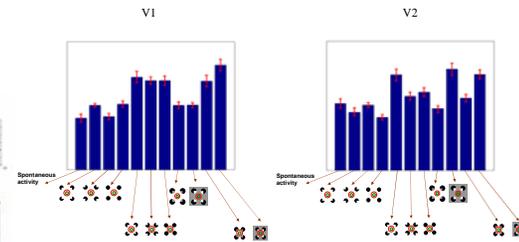
RESULTS

- In V1, there is a close correspondence between activating zone size measured quantitatively and by ear. In V2, the quantitatively measured activating region was invariably larger than the subjectively measured receptive field.

- Whenever the pacmen were positioned inside the quantitatively measured receptive field, the response was significantly higher than the spontaneous activity. This includes the condition in which the pacmen are inside the calculated receptive field and outside the ear-based receptive field.

- In V2, correctly aligned pacmen elicit more spikes than inverted pacmen or plain disks, suggesting facilitatory interactions between the borders.

- The no-neon condition activates V2 cells more strongly than the neon condition.



CONCLUSIONS

- The borders of the activating regions are less sharp in V2 than in V1, leading to an underestimation of the size of the activating region in V2 when measured by ear.
- Both V2 and V1 cells respond to illusory borders only when the inducers impinge on the activating region of the receptive field.
- Cells respond to local contrast, irrespective of the strength of the perceptual illusory border.

BIBLIOGRAPHY

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