



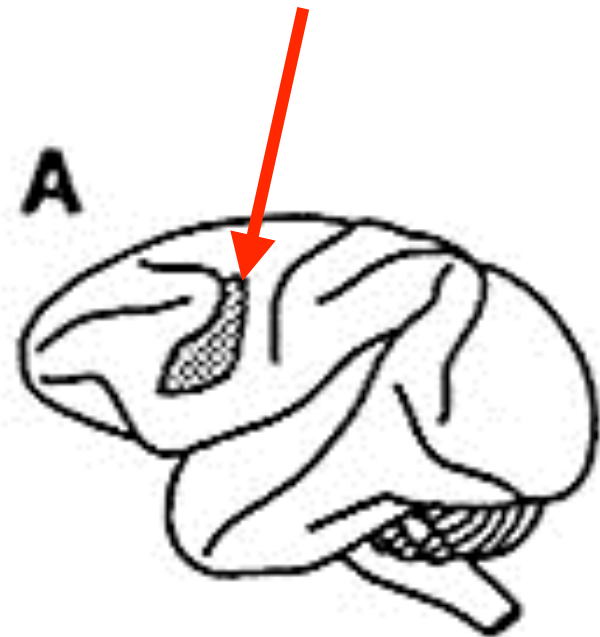
Coding of Visual Space by Premotor Neurons

Presentation by Shannon Lozinsky

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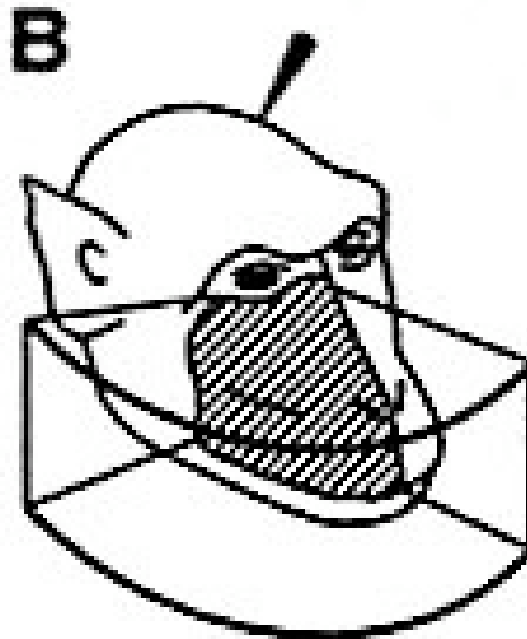
Background

- Premotor cortex-
preparation and
guidance of
movement
 - Ventral premotor
cortex
 - Neurons respond to
visual stimuli
 - May play role in visual
guidance of
movement



Background

- Visual neurons- different receptive fields
 - Tactile RFs- face and arms
 - Visual RFs- extend from tactile RF





Background

- Bimodal neurons
 - Tactile RFs somatotopically organized
 - Corresponding visual RFs- map of visual space near the body
- Whole population could specify location of targets for limb and body movements



Purpose

- To determine how visual responses of bimodal neurons in the ventral premotor cortex encode space near the body
- Are RFs of these neurons retinocentric or are they attached to some other part of the body?

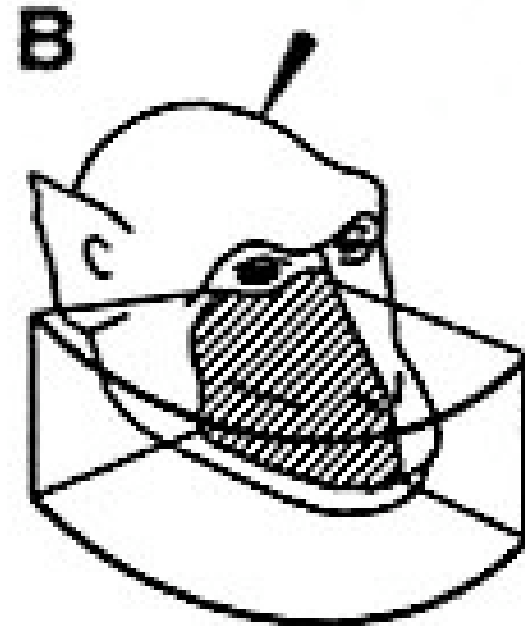


Experimental Setup

- Single neuron responses recorded in ventral premotor cortex of 2 male monkeys (*Macaca fascicularis*)
 - Monkey #1- weekly recordings
 - anesthetized and immobilized
 - Monkey #2- daily recordings
 - unanesthetized and trained to fixate

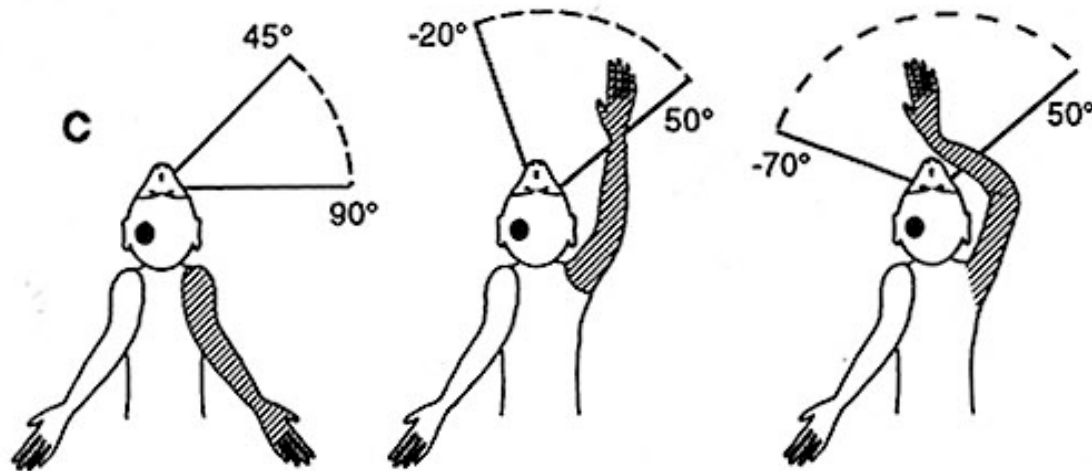
Experiment #1A- Anesthetized

- Studied 141 neurons
 - 27% (n=38) bimodal
- A. Recorded response of single cell with tactile RF on face
 - Visual stim w/in 10cm of tactile RF
 - Cell responded
 - Approached face from various angles
 - Determined extent of visual RF in 3-D

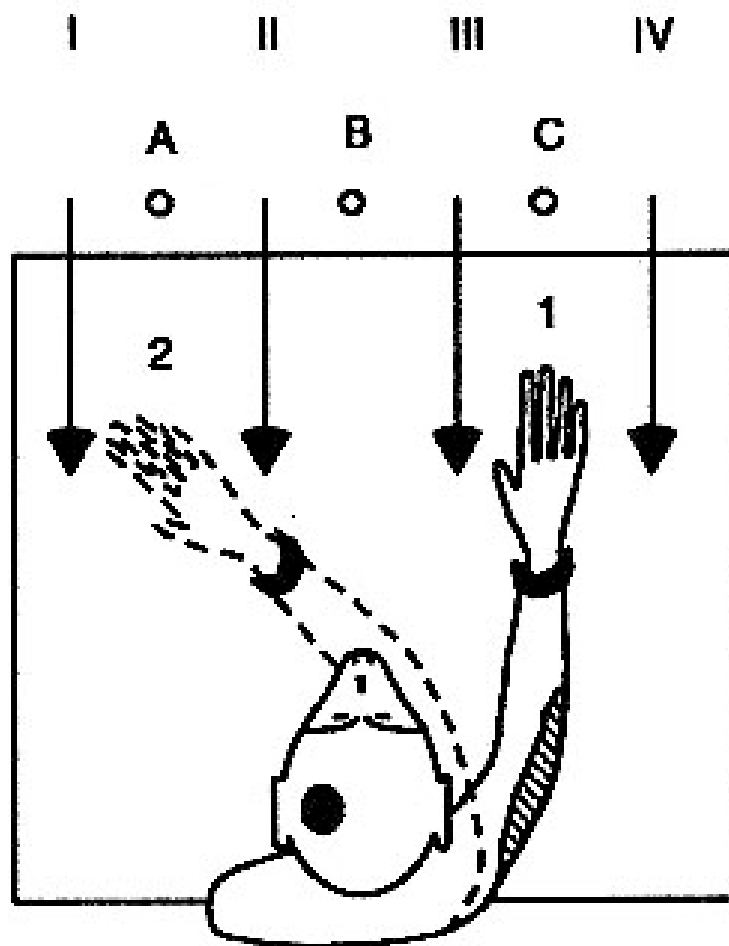


Experiment #1B- Anesthetized

- B. Recorded response of single cell with tactile RF on contralateral arm
 - Arm moved ipsilateral
 - visual RF moved into ipsilateral field of view even though eyes remained fixed
- Conclusion: visual RF not retinocentric but arm-centered



Experiment #2- Unanesthetized



- Studied 211 neurons
 - 31% (n=65) bimodal
- Studied the effect of changing position of both arm and gaze
 - Eyes fixed on one of 3 lights
 - Stimulus advanced along one of 4 trajectories
 - Arm fixed in one of 2 positions- R or L

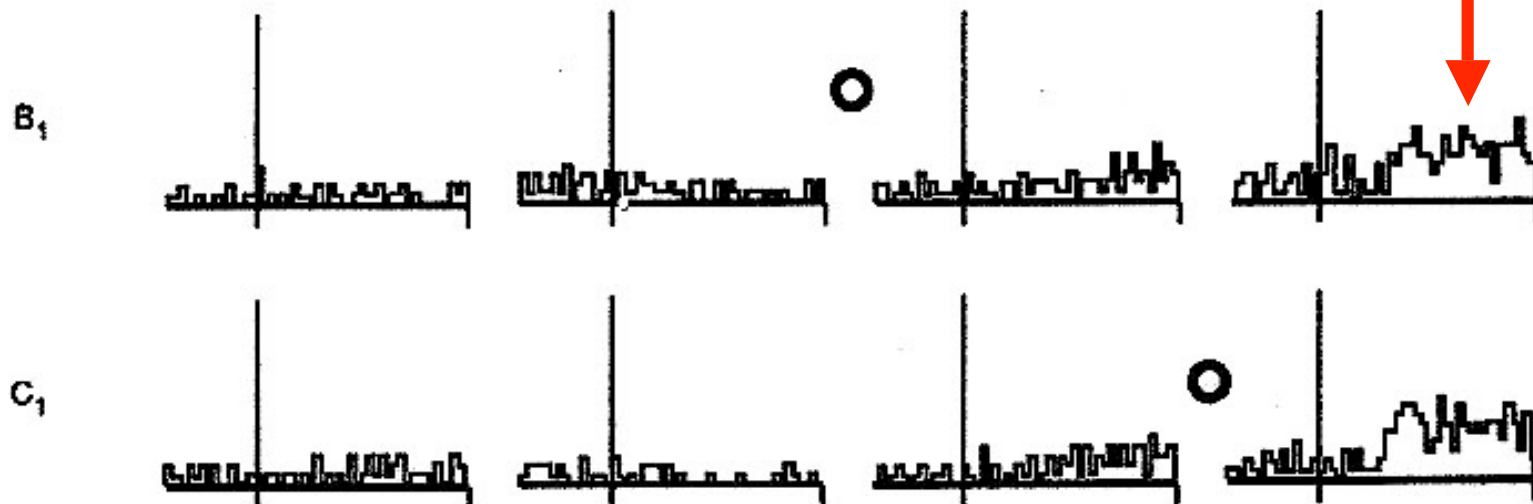
Experiment #2A- Unanesthetized

- A. Cell had a tactile RF on contralateral arm
 - Eyes fixed on light A and arm fixed to R
- Result: only significant response in the cell when stimulus presented on far R



Experiment #2A- Unanesthetized

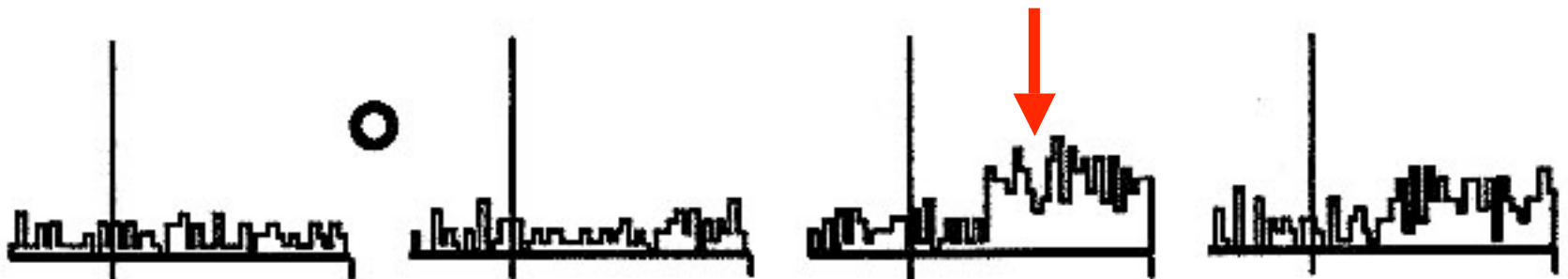
- Repeated with eyes fixed on B and C and arm still fixed to R
- Result: cell still responded best to trajectory IV stimulus



Experiment #2A- Unanesthetized

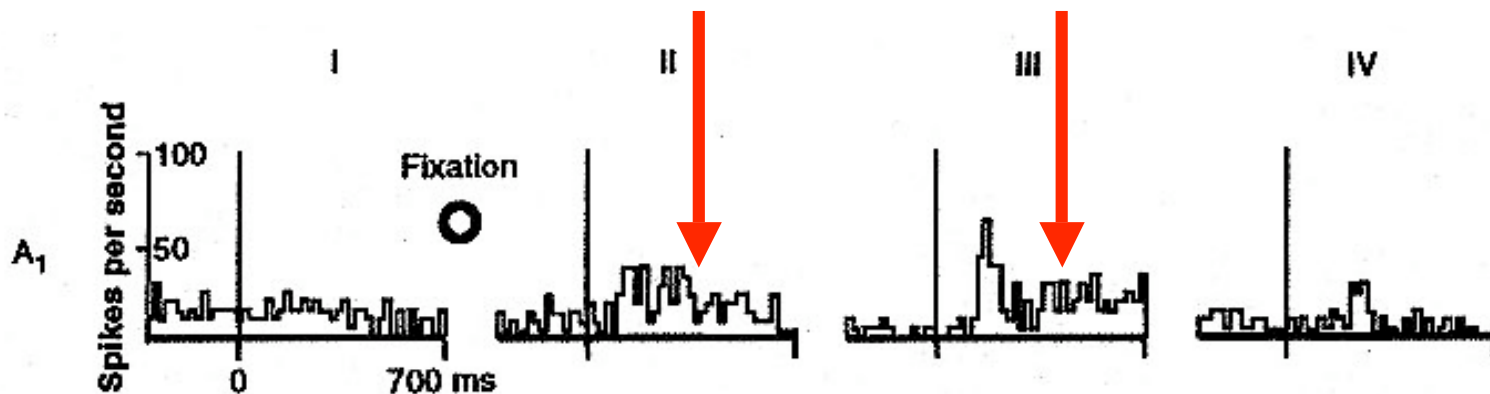
- Now arm fixed to the L
- Result: cell responded best to trajectory III stimulus- visual RF moved left with the tactile RF
- Conclusion: Arm position had a significant effect on the spatial location of the visual response but eye position did not
 - visual RF was arm-centered not retinocentric

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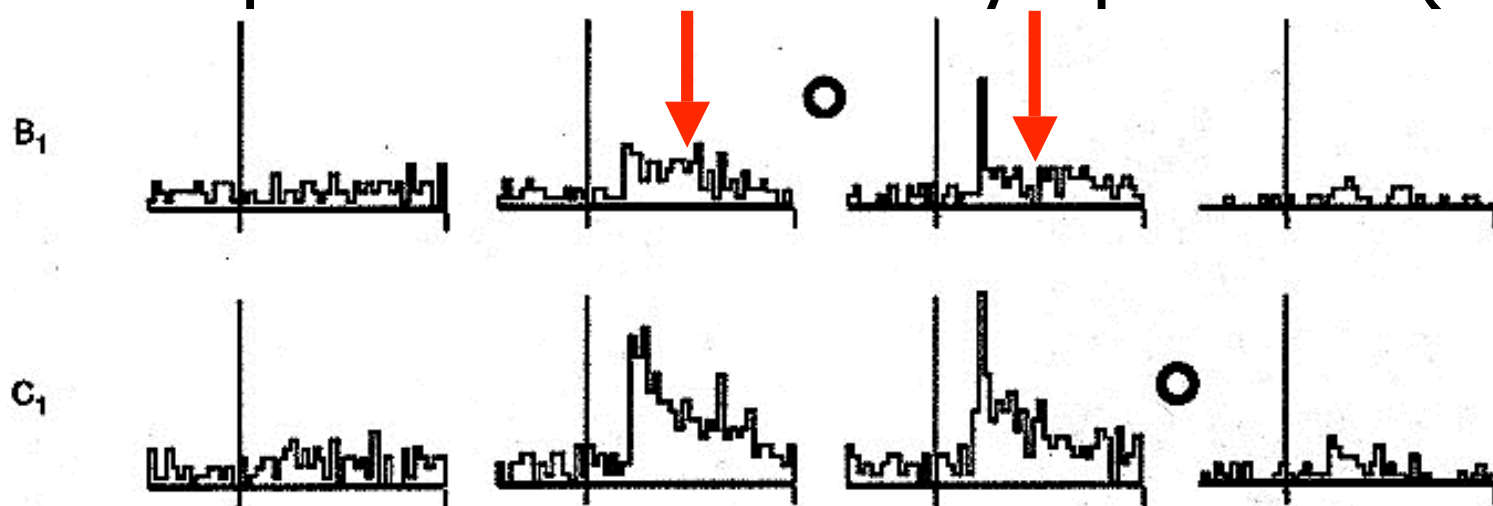
Experiment #2B- Unanesthetized

- B. Cell had a tactile RF on eyebrow
 - Arm fixed R and eyes fixed on light A
- Result: cell responded best when stimulus near midline (trajectory II and III), matching location of tactile RF



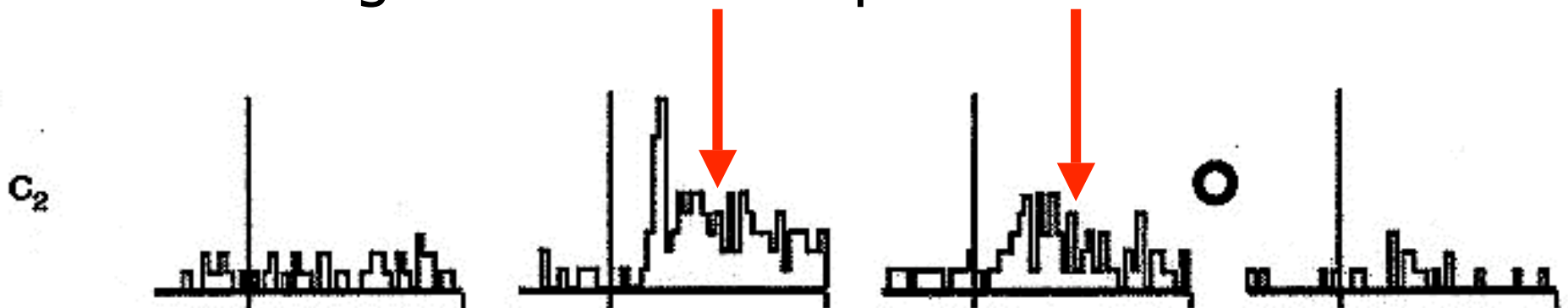
Experiment #2B- Unanesthetized

- Repeated with eyes fixed on B and C and arm still fixed to R
- Result: visual RF remained in same location (midline) but magnitude of response varied with eye position ($\uparrow C$)



Experiment #2B- Unanesthetized

- Now arm fixed to the L
- Result: visual response remained same- visual RF did not move with arm b/c corresponds to tactile RF on eyebrow not arm
- Conclusion: Location of the visual response was independent of eye position but magnitude of the response was not





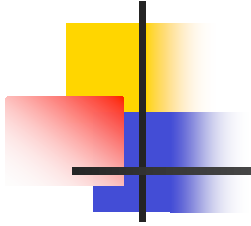
Summary of Conclusions

- Visual RFs of bimodal neurons in ventral premotor cortex remained at same location regardless of direction of gaze- not retinocentric
- Rather they were associated with tactile RFs on the arm and moved with them- arm centered



Discussion

- RFs of certain neurons in the ventral premotor cortex provide a representation of space near the body
- This type of body-centered coordinate system may be useful for guidance of movement within that space (i.e. hand-eye coordination)



The End