**CRCNS.org stc-1 data description**  
Version 0.6 (Sept 5, 2018)

Extracellular recordings from areas MSTd and VIP of macaque monkeys

during a heading discrimination task

Yong Gu, Aihua Chen, Sheng Liu, Christopher Fetsch, Yang Y, Adhira Sunkara, Kaushik J Lakshminarasimhan, Xaq Pitkow, Gregory DeAngelis, Dora Angelaki

**Summary**

This dataset contains neural recordings carried out from two different brain areas – dorsal Medial superior temporal cortex (MSTd) and ventral intraparietal cortex (VIP) – of eleven rhesus macaques. The data include recordings carried out using three different types of experiments: (1) Single-cell recordings during passive heading, (2) Single-cell recordings during active heading discrimination, and (3) Simultaneous recordings from pairs of neurons during passive heading. In each experiment, heading stimuli were delivered visually (optic flow) as well as vestibularly (platform). Experiment (2) contains an additional condition where we used a combination of visual and vestibular stimuli.

* The stimulus used for the three experiments are as follows:

**Experiment (1)**: Monkeys passively fixated at a central fixation dot on the screen

while experiencing one of 8 possible headings, spanning 0 to 360° on the horizontal plane (azimuth)

**Experiment (2)**: Monkeys fixated at a central fixation dot on the screen

while experiencing one of 9 possible headings around straight ahead, spanning ±9° or ±16° (in some sessions) on the horizontal plane (azimuth). At the end of the stimulus presentation, monkeys had to indicate their perceived heading (right / left) by means of a saccade

**Experiment (3)**: Monkeys passively fixated at a central fixation dot on the screen

while experiencing one of 8 possible headings, spanning 0 to 360° on the horizontal plane (azimuth)

* The derived data for the three experiments include the following aspects of the neural response:

**Experiment (1)**: Global tuning function of individual neurons to heading (0 to 360°)

**Experiment (2)**: Local tuning function of individual neurons to heading around straight ahead; choice probability of individual neurons; neuronal threshold of each neuron

**Experiment (3)**: Signal correlation and noise correlation between each pair of neurons; preferred heading angle of each pair of neurons

* The number of neurons/neuronal pairs are as follows:

**Experiment (1)**: 129 neurons from MSTd (monkeys ‘2’ and ‘5’) and 95 neurons from VIP (monkeys ‘5’ and ‘14’)

**Experiment (2)**: 129 neurons from MSTd (monkeys ‘2’ and ‘5’) and 95 neurons from VIP (monkeys ‘5’ and ‘14’)

**Experiment (3)**: 127 neuronal pairs from MSTd (monkeys ‘1’, ‘2’, ‘3’, ‘5’, ‘17’, ‘18’, ‘19’) and 139 pairs from VIP (monkeys ‘5’, ‘7’, ‘14’, ‘15’, ‘16’)

Note that experiments (1) and (2) were performed back-to-back during the same recording session. So these two single-cell experiments contain data from the same set of neurons. The derived data are shared as ‘mat’ files that can be easily loaded and analysed using MATLAB. Please look at the demo file (‘demo.m’) for an example script showing how to load and plot the data.

Results from the experiments are described in:

Neural correlates of multisensory cue integration in macaque MSTd

Yong Gu, Dora Angelaki, Gregory DeAngelis

*Nature Neuroscience* 11(10), 1201–10 (Oct 2008) doi: [10.1038/nn2191](https://doi.org/10.1038/nature14178)

Perceptual leaning reduces interneuronal correlations in macaque visual cortex

Yong Gu, Sheng Liu, Christopher Fetsch, Yang Y, Adhira Sunkara, Gregory DeAngelis, Dora Angelaki*. Neuron* 71(4), 750–61 (25 Aug 2011) doi: [10.1016/j.neuron.2011.06.015](https://doi.org/10.1038/nature14178)

Functional specializations of the ventral intraparietal area for multisensory heading discrimination. Chen Aihua, Gregory DeAngelis, Dora Angelaki

*J Neurosci* 33(8), 3567–81 (20 Feb 2013) doi: [10.1523/JNEUROSCI.4522-12.2013](https://doi.org/10.1038/nature14178)

Inferring decoding strategies for multiple correlated neural populations

Kaushik Lakshminarasimhan, Alexandre Pouget, Gregory DeAngelis, Dora Angelaki, Xaq Pitkow*. bioRxiv* doi: [10.1101/108019](https://doi.org/10.1038/nature14178)

**Conditions for using the data**

There are no restrictions. You’re free to use these data and publish your findings. Depending on the subset of the data you use for publication, please cite one of the above papers as you see fit. Please also cite the data set using the following:

Yong Gu, Aihua Chen, Sheng Liu, Christopher Fetsch, Yang Y, Adhira Sunkara, Kaushik J Lakshminarasimhan, Xaq Pitkow, Gregory DeAngelis, Dora Angelaki (2018); Extracellular recordings from areas MSTd and VIP of macaque monkeys during a heading discrimination task. CRCNS.org.

<http://dx.doi.org/10.6080/K07P8WKF>

**Methods**

All experimental methods including surgical techniques, stimulus rendering, recording apparatus, and statistical analyses used to obtain derived data from the raw data are extensively documented in the Methods section of the following publications:

Neural correlates of multisensory cue integration in macaque MSTd

Yong Gu, Dora Angelaki, Gregory DeAngelis

*Nature Neuroscience* 11(10), 1201–10 (Oct 2008) doi: [10.1038/nn2191](https://doi.org/10.1038/nature14178)

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Functional specializations of the ventral intraparietal area for multisensory heading discrimination

Chen Aihua, Gregory DeAngelis, Dora Angelaki

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**Data format**

All the derived data are shared in two ‘mat’ files – “MSTd.mat” and “VIP.mat” for recordings carried out in area MSTd and VIP respectively. The data are organized identically in the two files, so the same structure holds for both files. Each file contains three variables: experiment1, experiment2, and experiment3

The contents of each of these variables are hierarchically structured as follows. A description of the contents is provided against each fieldname (following the ‘%’ sign)

experiment1 % structure containing dataset from experiment 1

|

|--- name % name of the experiment

|--- units % structural array of single-units ([[1]](#footnote-1))

|

|--- file\_id % identifier of the file containing corresponding raw data

|--- ves % structure with data from the vestibular stimulus condition

|--- vis % structure with data from the visual stimulus condition ([[2]](#footnote-2))

|

|--- stim\_global % vector of heading angles

|--- resp\_global % vector of trial-averaged responses

experiment2 % structure containing dataset from experiment 2

|

|--- name % name of the experiment

|--- units % structural array of single-units

| |

| |--- file\_id % identifier of the file containing corresponding raw data

| |--- ves % structure with data from the vestibular stimulus condition

| |--- vis % structure with data from the visual stimulus condition

| |--- com % structure with data from the combined visual/vestib condition

| |

| |--- stim\_local % vector of heading angles

| |--- resp\_local % vector of trial-averaged responses

| |--- cp % choice probability of the single-unit

| |--- thresh % discrimination threshold of the single-unit

|

|--- behv

|

|--- subj % structural array of animal subjects

|

|--- monk\_id % subject identifier

|--- ves % structure with data from the vestibular condition

|--- vis % structure with data from the visual condition

|

|--- thresh % behavioural threshold of the subject

experiment3 % structure containing dataset from experiment 3

|

|--- name % name of the experiment

|--- pairs % structural array of data from pairs of single-units ([[3]](#footnote-3))

|

|--- file\_id % identifier of the file containing corresponding raw data

|--- ves % structure with data from the vestibular stimulus condition

|--- vis % structure with data from the visual stimulus condition

|

|--- heading\_pref % 1x2 vector of preferred heading angles

of the pair of single-units

|--- corr\_signal % signal correlation between the pair of units

|--- corr\_noise % noise correlation between the pair of units

**How to get started**

* Download the dataset folder and add to the folder to your MATLAB path.
* Load one of the datasets (“MSTd.mat” and “VIP.mat”) and navigate through the contents of the variables that were loaded.
* In parallel, familiarize yourself with the organization of the derived data using information in the previous section.
* Take a look at the ‘demo.m’ code to see how the quantities of interest are accessed.
* Run the code to see how the data looks.
* Once you complete the above steps, you should be ready to perform your own analysis by loading the data files into MATLAB.

**How to get help**

To get help with the data set post any questions on the forum at CRCNS.org. You can also contact me at [jklakshm[AT]bcm.edu](mailto:jklakshm@bcm.edu) but please reserve this method for questions that you feel are beyond the scope of the CRCNS forum.

**Change history**

Version 0.6 (Sept 5, 2018) – Original version.

1. The contents of units(1), units(2), … are all organized in the same way as shown above. [↑](#footnote-ref-1)
2. The structure of the other stimulus condition(s) is organized in the same way. [↑](#footnote-ref-2)
3. The contents of pairs(1), pairs(2), … are all organized in the same way as shown above. [↑](#footnote-ref-3)