

Intro to AFNI and FMRI data

Introduction, Concepts, Principles



National Institute
of Mental Health



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of Health

The image is a screenshot of the AFNI software splash screen. It features a background image of a natural rock archway with two people standing on the ledge. The text on the screen reads: "Analysis of Functional NeuroImages by Robert W Cox, PhD". Below this, it states "Released under the GNU General Public License Version 2 (GPL) [or any later GPL version]". A small portrait of Robert W. Cox is shown with the text "RW Cox" and "AFNI USER" below it. The screen also includes the statement "AFNI is a research tool. Clinical uses are not supported or advised." and a humorous note at the bottom: "Today is: National Applesauce Cake Day".

Analysis of Functional NeuroImages
by
Robert W Cox, PhD

Released under the GNU General
Public License Version 2 (GPL)
[or any later GPL version]

AFNI is a research tool.
Clinical uses are *not* supported or advised.

Today is:
National Applesauce Cake Day



<https://afni.nimh.nih.gov/pub/dist/doc/html/doc/>

AFNI: Analysis of Functional NeuroImages

- Started in 1994 by Bob Cox to provide tools for FMRI analyses
 - Has expanded to include DTI, structure, group analysis and more
- [AFNI](#) refers to both the visualization GUI and the entire package
 - More than 750 programs, written in C, Python, tcsh, R
 - Free, open source & continually developed (maybe even improved)
- Important principles in the development of AFNI:
 - Help users stay close to the data and view it in many different ways
 - Give users the power to assemble pieces for customized analyses
 - Educate users on processing choices, consequences and checks
 - “With great power comes great responsibility”
 - We teach regular "Bootcamps" to understand analyses and tools
 - We provide mechanism, not policy (but we *do* have helpful ideas)
 - Allow other programmers to add features that can interact with the rest of the package

Getting to know the programs

The doc pages contain two types of AFNI package program lists:

- 1) a page with all programs listed (click to go to help)
- 2) a page of “classified” lists: programs grouped into “classes of functionality and briefly described



4. All program helps


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 - 4.2. **Classified program list**
5. AFNI GUI (afni)
6. SUMA GUI (suma)
7. FATCAT
8. NIFTI

- **4.1. Alphabetical list of program helps**
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 - 4.1.2. Links to program manuals
- **4.2. Classified program list**
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 - 4.2.2. Voxelwise calcs, esp. stats and tests
 - 4.2.3. Get info/stats within ROIs
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 - 4.2.9. Make/edit/evaluate stimulus timing files

Tutorials and educational recordings

The **AFNI Academy** channel contains Bootcamp recordings and extra tutorials, often with scripts.



The image shows a screenshot of the YouTube channel page for 'AFNI Bootcamp'. The page layout includes a left-hand navigation menu with icons for Home, Shorts, Subscriptions, You, and History. At the top, there is a search bar and a 'Sign in' button. The main content area features a large group photo of people, the channel's profile picture (a circular logo with 'AFNI!' in colorful letters), and the channel name 'AFNI Bootcamp' with its handle '@AFNIBootcamp', 932 subscribers, and 74 videos. Below this is a 'Subscribe' button and a short description: 'Welcome to the AFNI software package video documentation-- the AFNI Academy. These ...more'. A video player is visible, showing a thumbnail for 'Welcome to the AFNI Academy' with 3,863 views and posted 5 years ago. The video description states: 'The AFNI Academy is a collection of videos describing the theory/concepts of processing MRI data with AFNI, and showing hands-on usage of the graphical tools in the AFNI package. There are playlists of videos covering many plethora of topics, and more videos are being created.'

<https://www.youtube.com/c/afnibootcamp>

Getting additional help: The AFNI Message Board

Ask advice, how-tos, troubleshooting analysis, post code, check about data visualization, get announcements, and more.

AFNI Discuss Sign Up Log In

Welcome to AFNI Discuss

Getting Started
Setup Discuss | AFNI installation | Starting with AFNI

AFNI
Documentation | AFNI Academy videos | Tutorials | Github | Citing | Contributors | SCC staff page

TORTOISE
Documentation | Downloads | Github | Citing | Contributors | LQMI staff page

categories tags Categories Latest Top

Category Latest

Announcements
News about Bootcamps, job postings, papers, and more

AFNI Message Board
Questions and discussions about AFNI, SUMA and FATCAT software

Regressors are overlapping even when formatted in local times 2 7d
AFNI Message Board

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AFNI Message Board

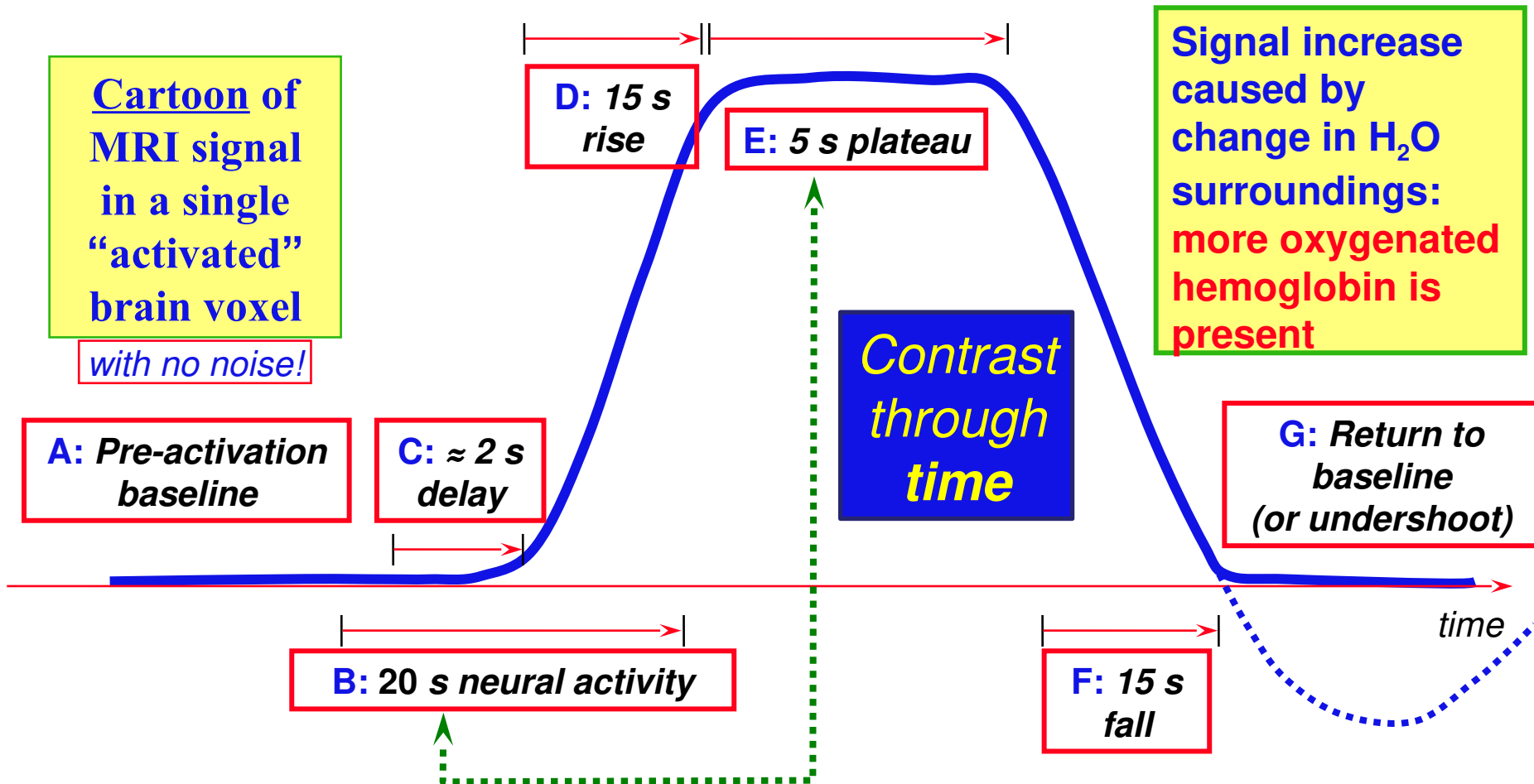
<https://discuss.afni.nimh.nih.gov/>

Before We Really Start

- AFNI has many programs and they have many options
- Assembling the programs to do something useful and good seems confusing (OK, *is* confusing) when you start
- To help overcome this problem, we have “super-scripts” that carry out important tasks
 - Each script runs multiple AFNI programs
 - We recommend using these as the basis for FMRI work
 - When you need help, it will make things simpler for us *and* for you if you are using these scripts
- **afni_proc.py** = Single subject FMRI pre-processing and time series analysis for functional activation
- **align_epi_anat.py** = Image alignment (registration), including anatomical-EPI, anatomical-anatomical, EPI-EPI, and alignment to atlas space (Talairach/MNI)

What is Functional MRI?

- 1991: Discovery that MRI-measurable signal increases a few % *locally* in the brain subsequent to increases in neuronal activity (Kwong, *et al.*)

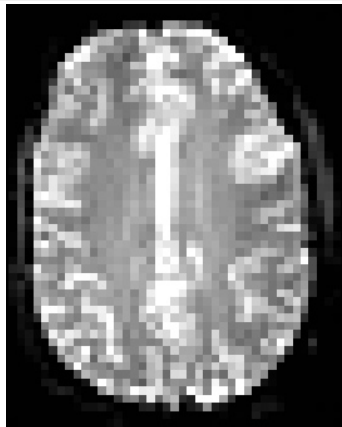
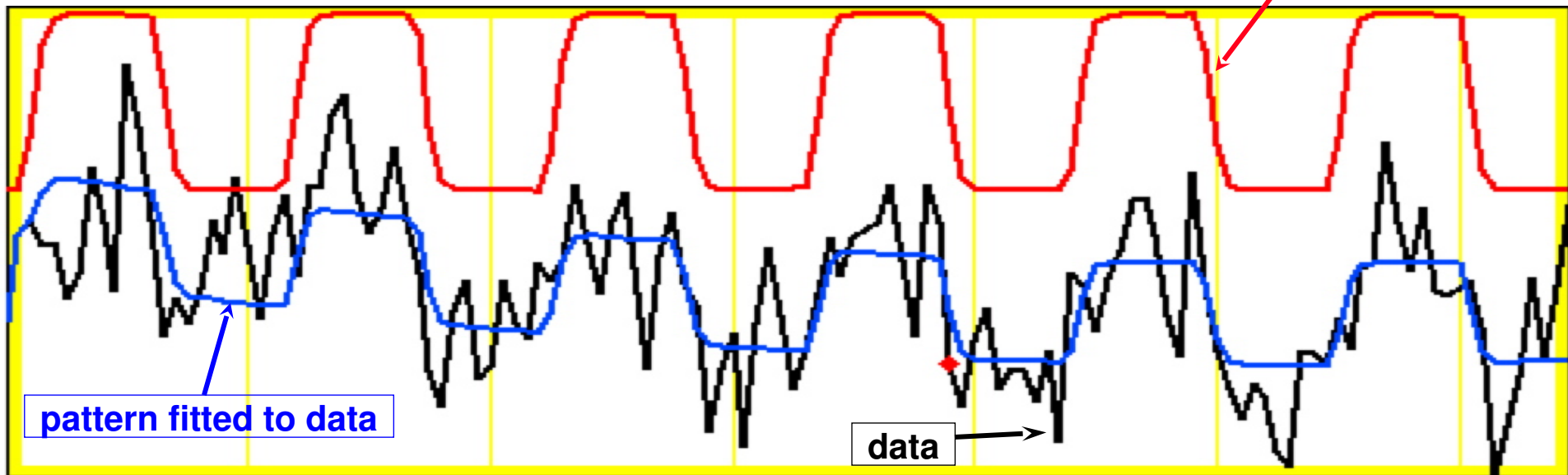


How fMRI Experiments Are Done

- Alternate subject's neural state between 2 (or more) conditions using sensory stimuli, tasks to perform, ...
 - Can only measure relative signals, so must look for *changes* in the signal between the conditions
- Acquire MR images repeatedly during this process
- Search for voxels whose NMR signal time series (up-and-down) matches the stimulus time series pattern (on-and-off)
 - fMRI data analysis is basically pattern matching *in time*
- Signal changes due to neural activity are small
 - Need hundreds or more points in time series
 - Usually break image acquisition into shorter “runs” to give the subject and scanner some break time
 - Other small effects can corrupt the results post-process the data to reduce these effects & *be vigilant*
- Lengthy computations for image recon and temporal pattern matching data analysis usually done offline

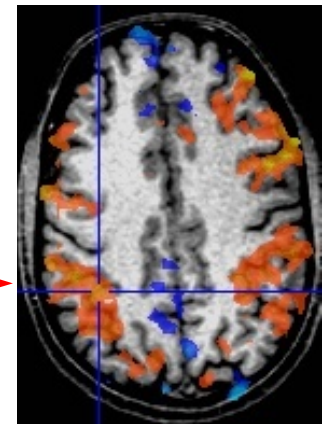
Sample Data Time Series

- 64×64 matrix (TR=2.5 s; 130 time points per imaging run)
- Somatosensory task: 27 s “on”, 27 s “rest”
- Note that this is *really* good data



One echo-planar image

One anatomical image, with voxels that match the pattern given a color overlay



What is a volumetric data set?
How do I get one?

Abbrevs used here

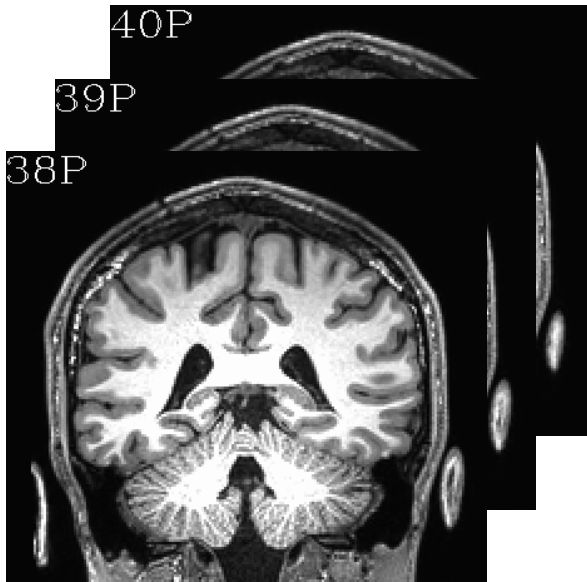
abbrev	= abbreviation
AKA	= also known as
anat	= anatomical
diff	= difference
dset	= dataset
e.g.	= exempli gratia (= “for example”)
EPI	= echo planar image
Ex	= example
FOV	= field of view
i.e.	= id est (= “that is”)
ijk	= coordinate indices (integer)
NB	= nota bene (= “note well”)
phys	= physics or physical
ref	= reference
subj	= subject
vol	= volume
vox	= voxel(s)
xyz	= physical coordinates (units of mm)

Creating dsets from DICOM files

- Data are often aquired as DICOM files
- AFNI has several programs for creating BRIK-HEAD and NIFTI files from DICOMs
- One has to be careful with DICOMs- not really standardized (booo!), fields/structure can change across scanner vendor, across version numbers, across acquisition sequences, and on the 3rd Tuesday after a blue moon.
- Some AFNI programs:
 - + **dcm2niix_afni**: Chris Rorden's popular program, distributed in AFNI (thx, Chris!)
 - very general use, can create whole collection of dsets
 - NB: NIFTI does *not* store complicated slice timings, so even if dcm2niix_afni can find it, it can't be stored
 - AFNI's 3drefit can be used to add slice timing info to the AFNI header extension
 - + **Dimon**: R Reynold's creation, originally for sending "realtime FMRI" direct to AFNI
 - + **fat_proc_convert_dcm_{anat,dwis}**: wrappers of dcm2niix_afni for DWI proc
 - + **and**: https://afni.nimh.nih.gov/pub/dist/doc/html/doc/educational/classified_progs.html#dicom-info-and-conversion
- ****Always* check your results carefully (left-right flips!) when converting from DICOM!***

Volumetric data structure

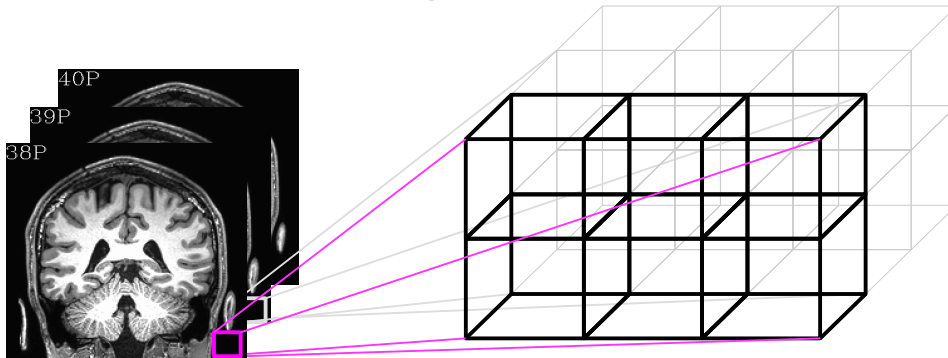
- What is a volumetric data set?



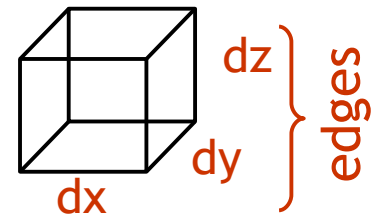
Volumetric data structure

- What is a volumetric data set?
→ *It a grid made up of voxels (basic case: 3D).*

3D grid

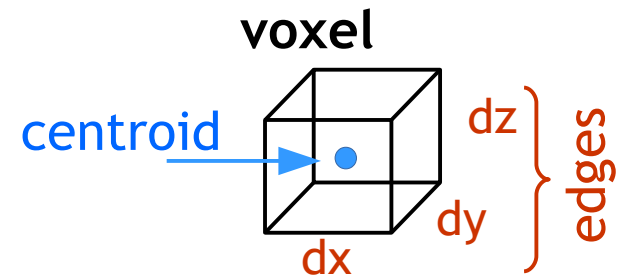
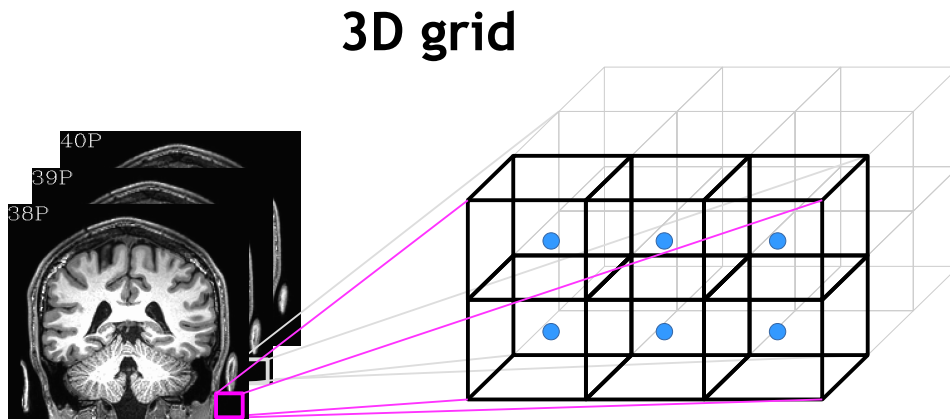


voxel



Volumetric data structure

- What is a volumetric data set?
→ It a *grid* made up of voxels (basic case: 3D).

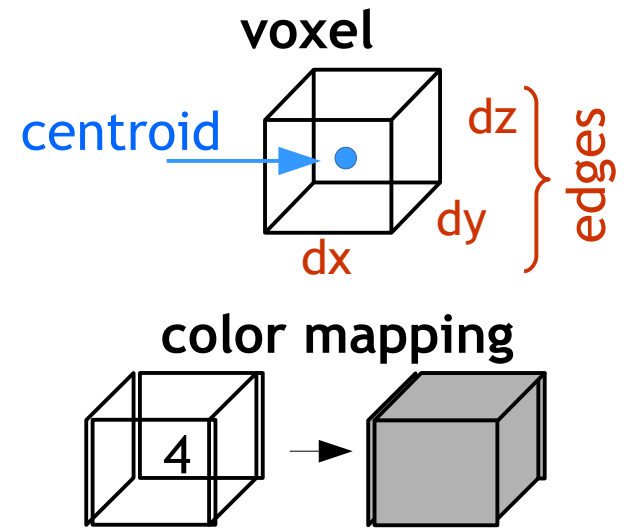
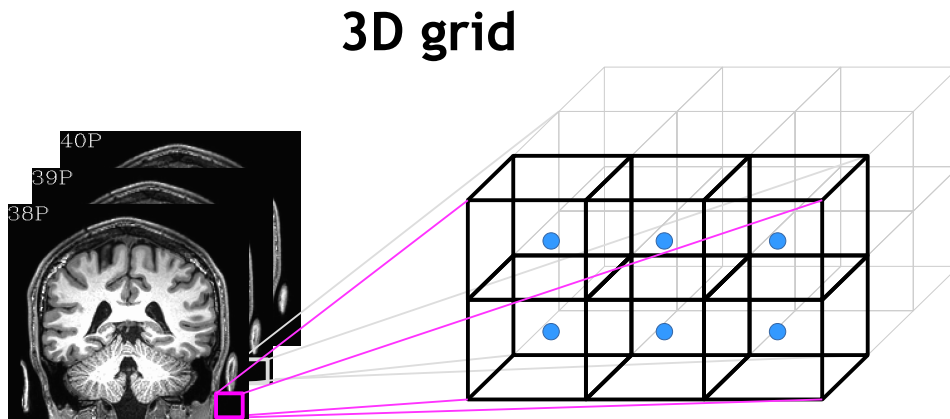


2 ways to describe each voxel location

- + “ i, j, k ”: integer indices, counting voxels from one corner
 - independent of voxel size (just storage indices on disk)
- + “ x, y, z ”: units of mm, physical location of voxel *centroid*
 - depends on voxel size (dx, dy, dz)

Volumetric data structure

- What is a volumetric data set?
 - It a **grid** made up of **voxels** (basic case: 3D).
 - Each voxel contains a number, which is represented by a color (gray, RGB, etc.).



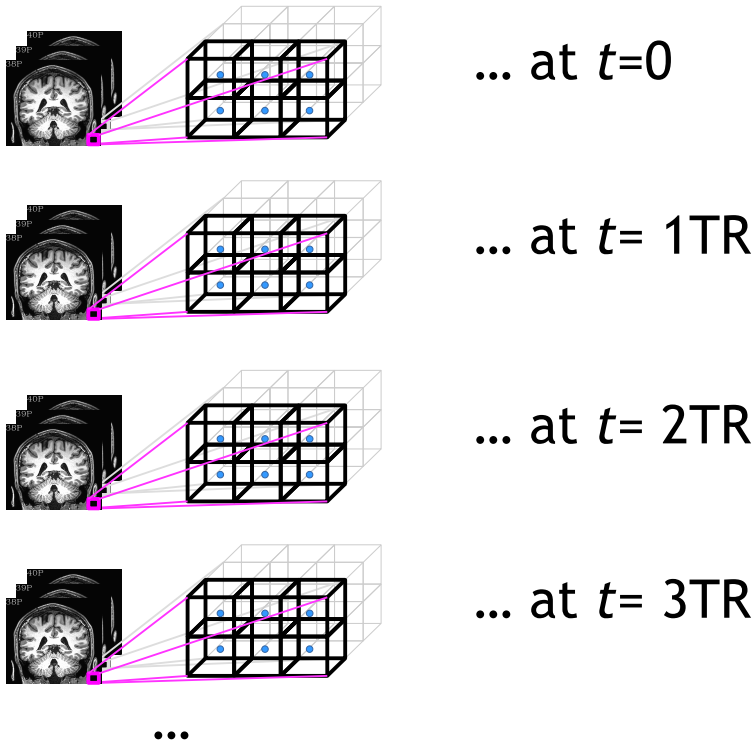
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Volumetric data structure

- What is a volumetric data set?
 - It a **grid** made up of voxels (basic case: 3D).
 - Each voxel contains a number, which is represented by a color (gray, RGB, etc.).
 - A time series data set is an ordered set of 3D vols (→ a '4D data set').

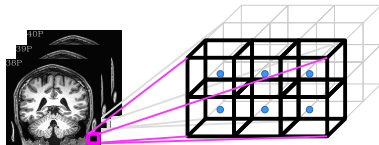
3D grid



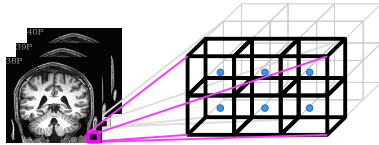
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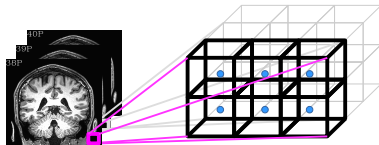
3D grid



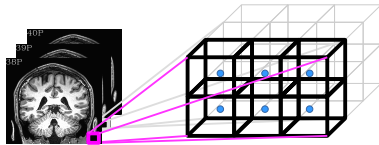
... at $t=0$



... at $t= 1TR$



... at $t= 2TR$



... at $t= 3TR$

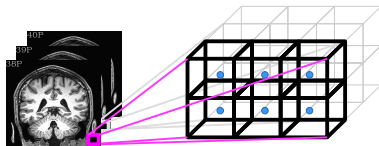
...

3D grid + time dimension
→ “4D data set”
+ Can talk about time as “ t ”
in physical units of seconds, or
as “ n ” in index units of simple
counting.

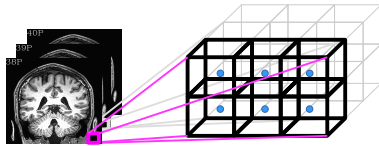
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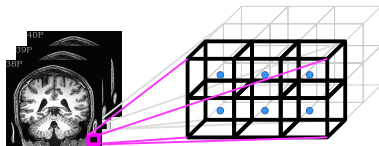
3D grid



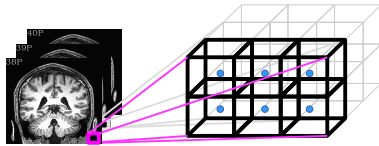
... at $t=0$



... at $t= 1TR$



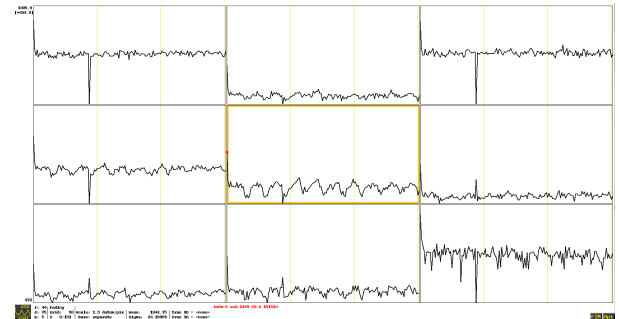
... at $t= 2TR$



... at $t= 3TR$

...

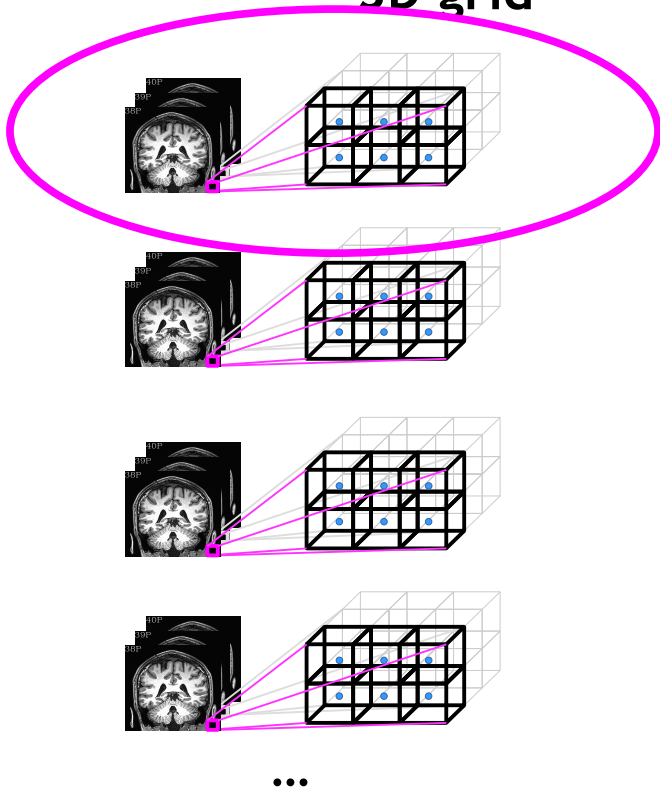
3D grid + time dimension
→ “4D data set”
+ Can talk about time as “ t ” in physical units of seconds, or as “ n ” in index units of simple counting.
+ Also say that each voxel contains a “time series”, e.g.:



AFNI terminology sidenote

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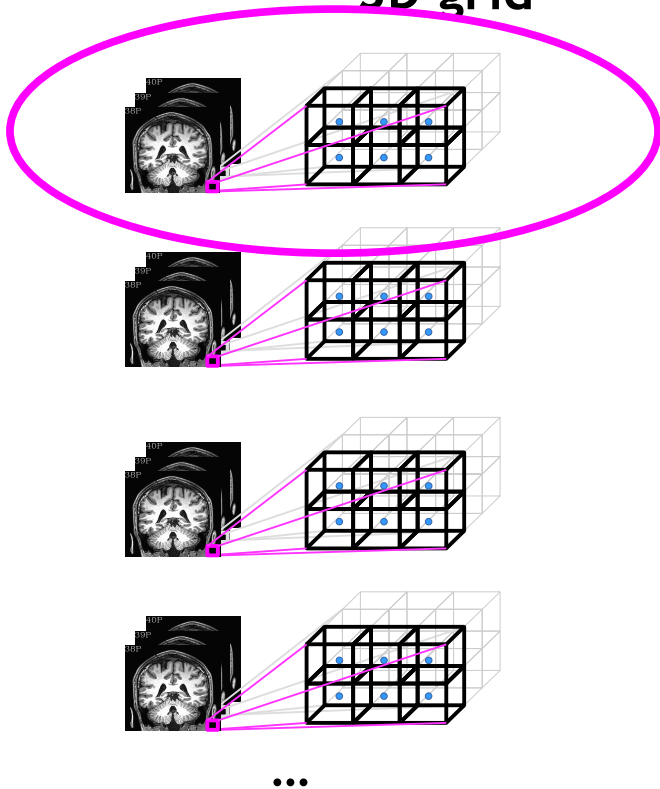


We often refer to a 3D volume as a **brick**, because, well, it is an example of a solid, similar-looking 3D shape.

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3D grid



We often refer to a 3D volume as a **brick**, because, well, it is an example of a solid, similar-looking 3D shape.

Particularly in the context of 4D data sets, we also call a 3D volume a **sub-brick**.

This is an odd lingual quirk. But to date, this appears to be the only quirk in the AFNI software (or its developers).

AFNI terminology sidenote

- Sub-brick selection by volume index

AFNI has a convenience feature of being able to select subset(s) of volumes for copying, calculation, etc. from a 4D set.

This works by putting the index or index range in square brackets *and* quotation marks "[]" ("" keep the terminal from interpreting the square brackets specially).

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A comma separates indices, and two dots .. specifies an (inclusive) range; \$ means final volume. *Ex.:*

```
DSET"[0]"           # initial subbrick (NB: count from 0!)
DSET"[0..5]"        # subbricks 0,1,2,3,4,5
DSET"[3,5..8,19]"   # subbricks 3,5,6,7,8,19
DSET"[1,14,29..$]"  # subbricks 1,14,29-to-the-last
DSET[0,4,5,15]      # ERROR in tcsh (no quotes); OK in bash
```

Ex. application, to copy out subset:

```
3dcalc -a DSET "[3,5..8,19]" -expr 'a' -prefix DSET_NEW
```

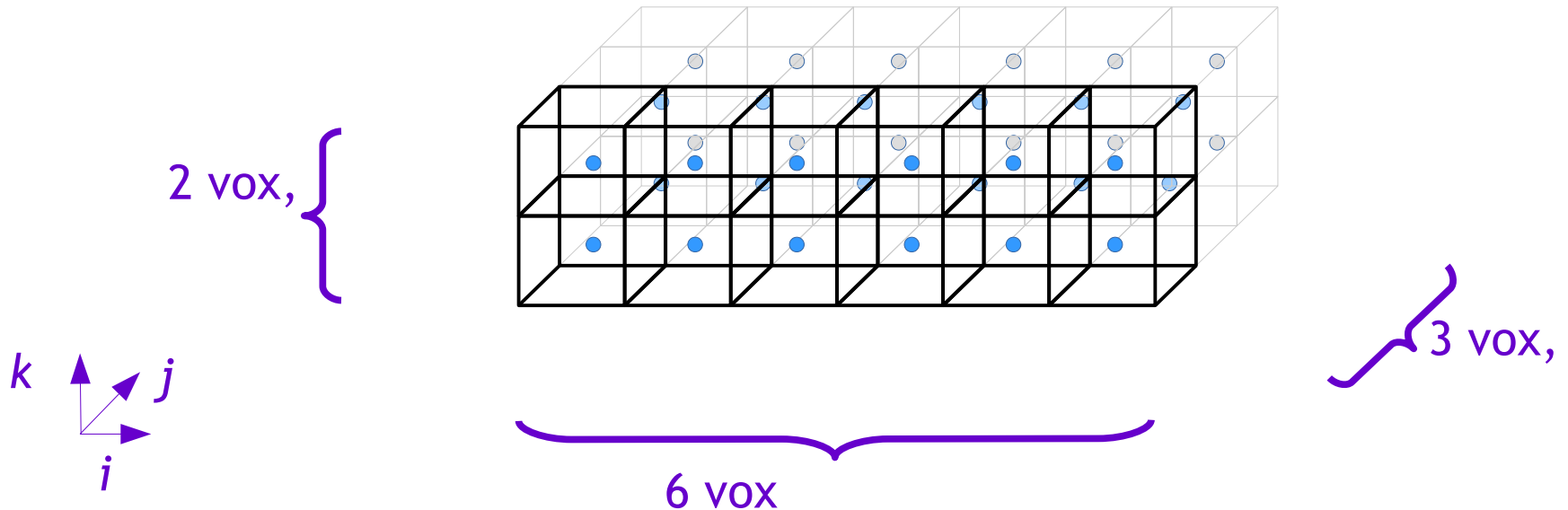
Fun fact: there are other forms of subbrick selection (brik label, voxel value...).

Grids

- What are the grid's properties?

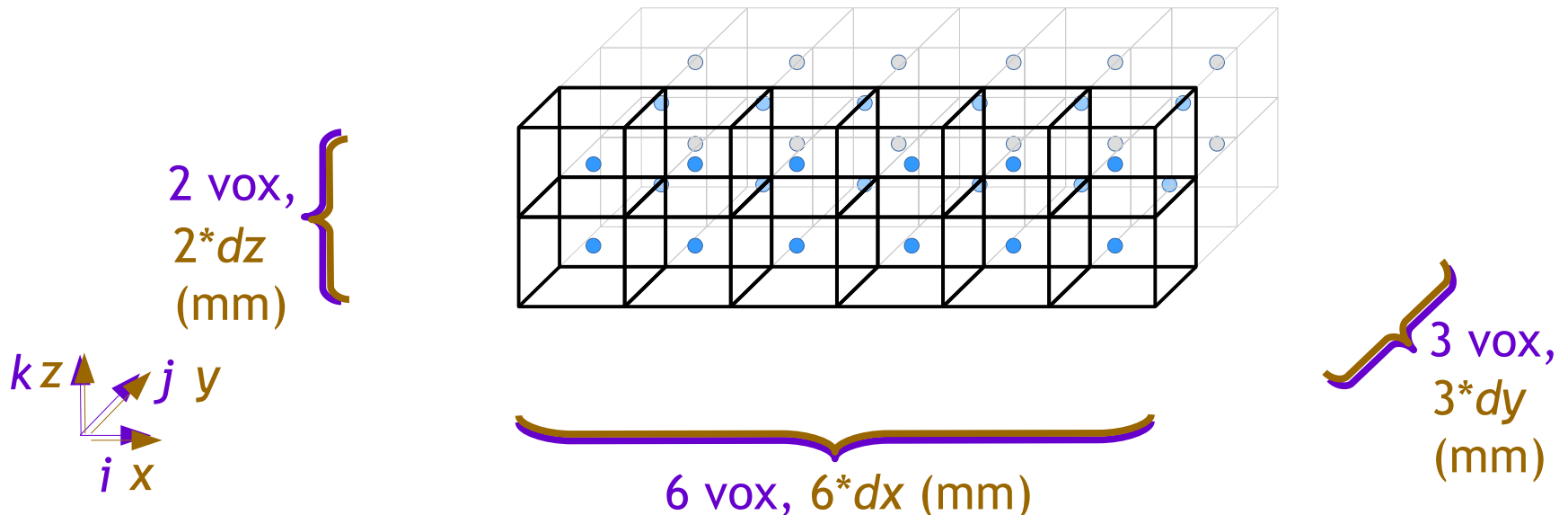
Grids

- What are the grid's properties?
→ One is "size." Three ways to describe it:
1) **matrix size**: count voxels in each dimension (n_i rows, n_j cols, n_k slices)
- independent of voxel size



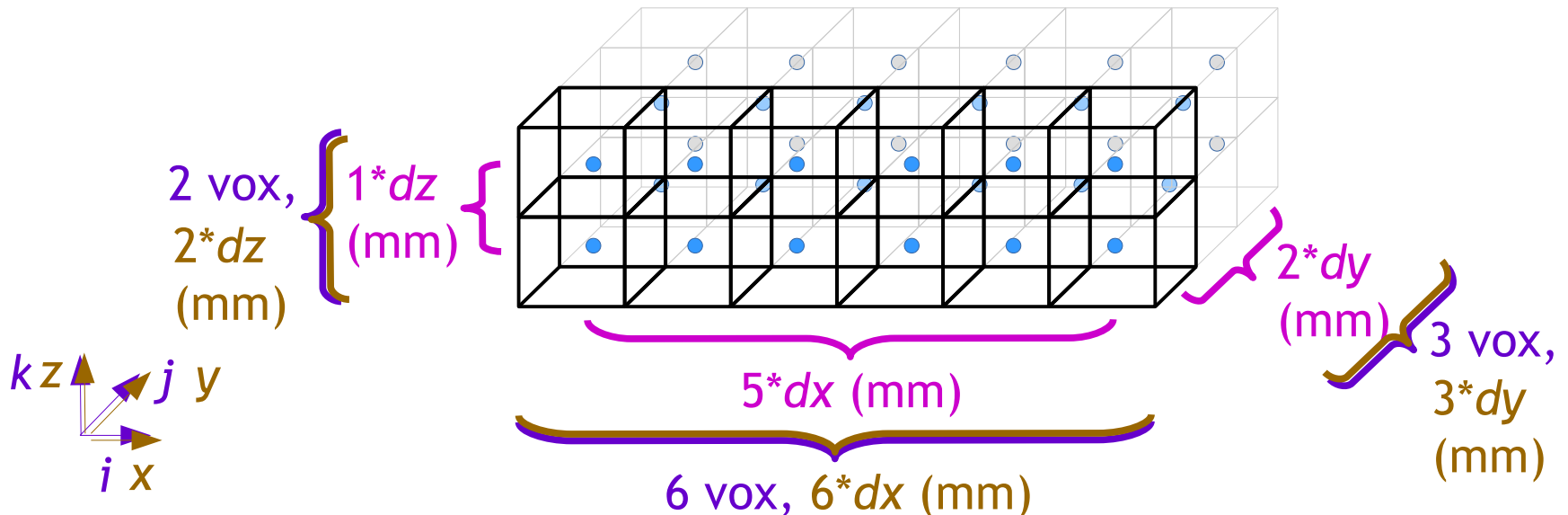
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 - 2) **field of view (FOV)**: units of mm, 3D phys vol of all voxels
 - depends on voxel size (dx , dy , dz)



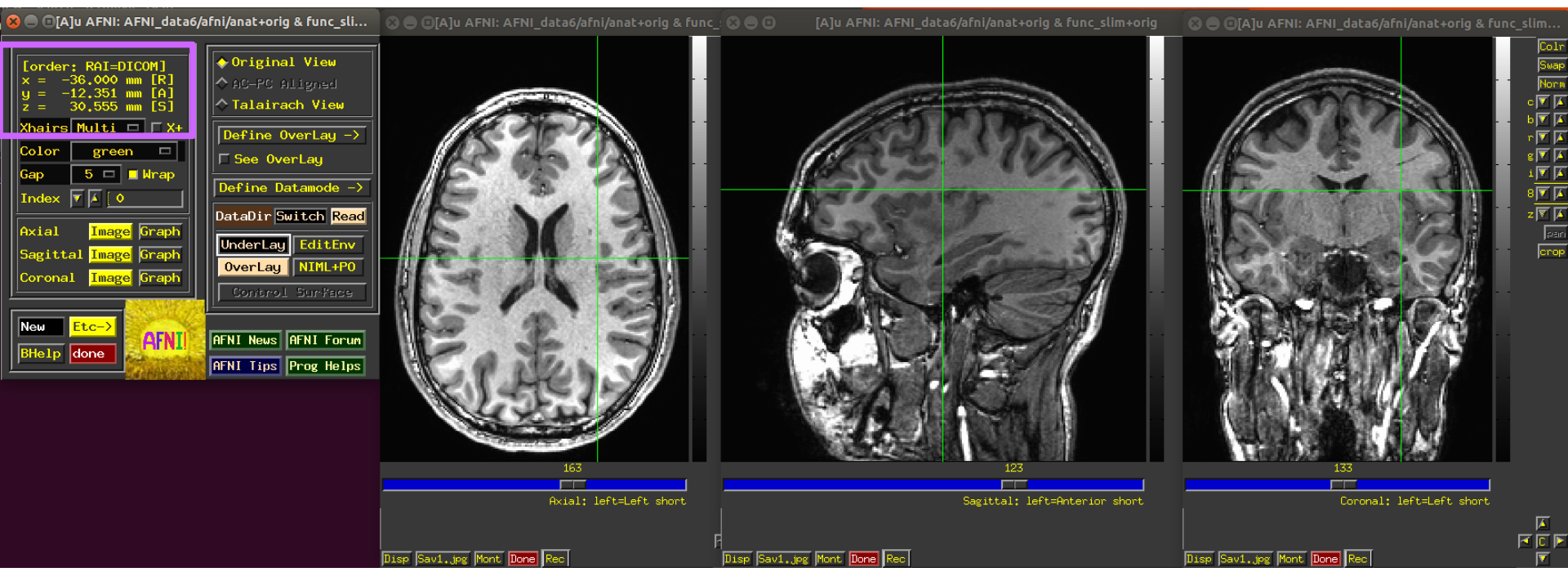
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 - independent of voxel size
 - 2) **field of view (FOV)**: units of mm, 3D phys vol of all voxels
 - depends on voxel size (dx , dy , dz)
 - 3) **slab**: units of mm, phys dist between first & last **centroids**
 - e.g., dist between [0]th and [n_i-1]th centroid



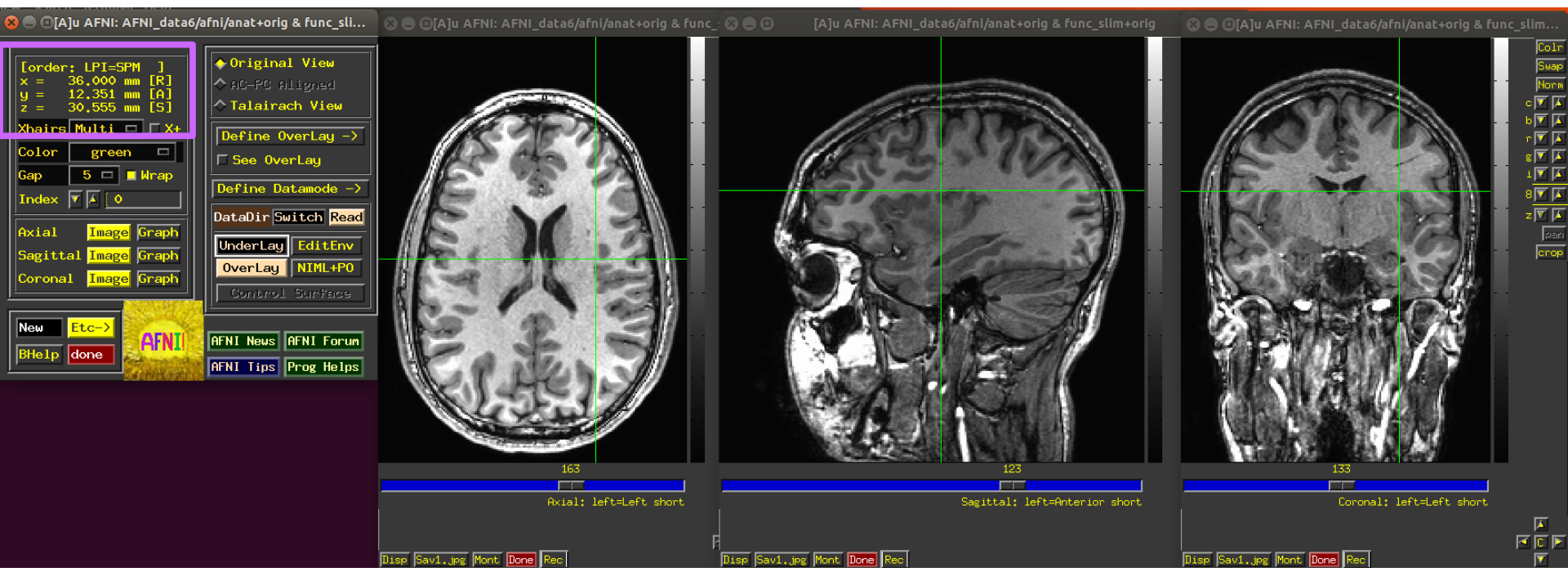
Describing location in dsets

- When reporting location of interest-- e.g., cluster peak-- one can't just provide (x, y, z) values. One also has to provide the *coordinate order* being used.
 - Two main families of coordinate order in the literature:
 - RAI (DICOM): negative numbers are to the right, anterior and inferior
 - LPI (SPM): negative numbers are to the left, posterior and inferior
- e.g.: in RAI order, cross-hair coordinates are (-36, -12, 31)



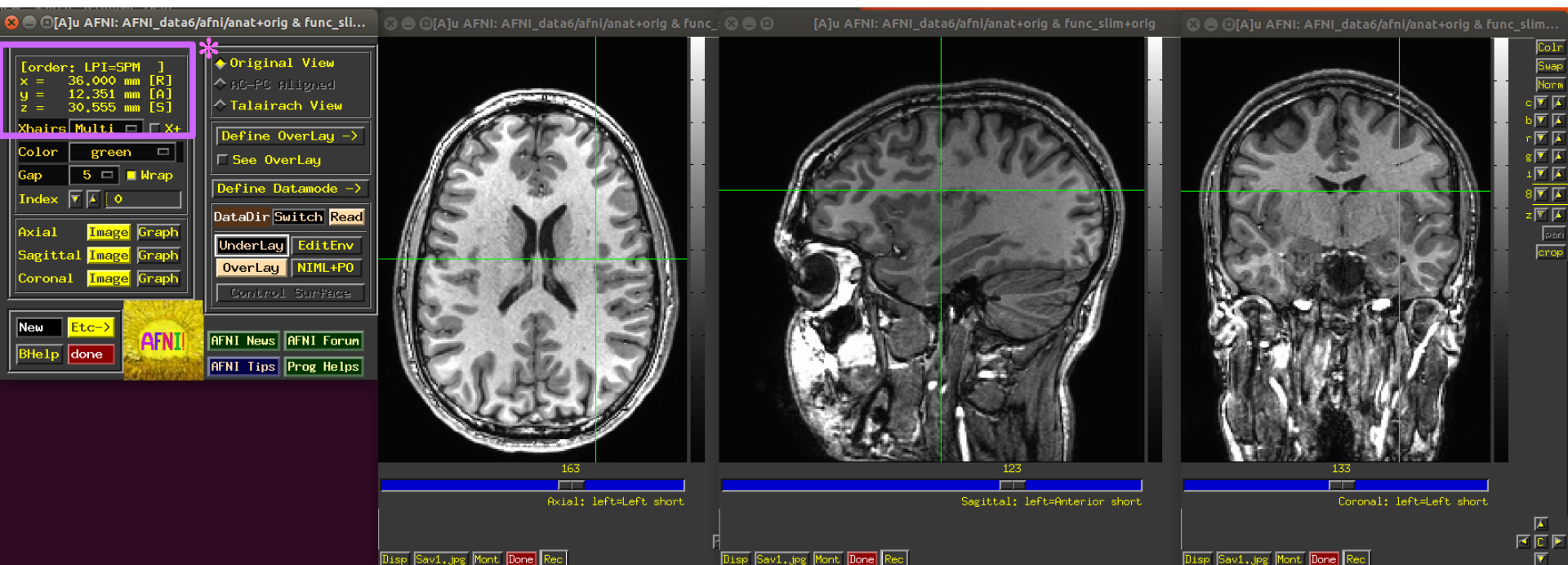
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* The GUI default coordinate order can be set in the ~/.afnirc file.

Describing location in dsets

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 - RAI (DICOM)*: negative numbers are to the right, anterior and inferior
 - LPI (SPM)*: negative numbers are to the left, posterior and inferiore.g.: in LPI order, cross-hair coordinates are (36, 12, 31)
- **A better way to report coordinates**, which avoids this hassle (and chance for error), is to report *directionalized* coordinates, e.g., (36R, 12A, 31S). That way, there is not ambiguity/mental calculation.

Volumetric data sets: files

- Where is information stored in files?
 - *A file contains two categories of information:*
 - data block: the numbers stored at each voxel
 - header: organizational information about the dset, like:
 - origin, orient, dimensions, voxel size, TR, labeltables, etc.
 - use **3dinfo** to see all header info, or individual parts

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 - use **3dinfo** to see all header info, or individual parts
- *There are multiple volumetric file formats. In AFNI, we mostly use two:*
 - BRIK-HEAD: pair of files, e.g., DSET+orig.HEAD and DSET+orig.BRIK
 - BRIK file contains data block (only); is binary format
 - HEAD file contains header info (only); is text format
 - NIFTI: single file, e.g., DSET.nii, or (compressed) DSET.nii.gz
 - both header and data block in the same file; is binary format

AFNI terminology sidenote

- VIEW and SPACE properties in a header
- BRIK/HEAD file names contain more info than just names (for NII, just in header):
DSET+**orig**.HEAD and DSET+**orig**.BRIK, or
DSET+**tlrc**.HEAD and DSET+**tlrc**.BRIK, etc.
- This is the (AFNI) **view**. It describes if the `dset` is in original/native/acquired coordinates, or if it has been aligned to a template space (or AC-PC aligned).

AFNI terminology sidenote

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- This is the (AFNI) **view**. It describes if the dset is in original/native/acquired coordinates, or if it has been aligned to a template space (or AC-PC aligned).
- The **space** property carries the specific name of *which* space (MNI, etc.) it is in.
`3dinfo -space -av_space DSET`

– Hands-on time!

AFNI terminology sidenote

- VIEW and SPACE properties in a header

BRICK/HEAD file names contain more info than just names (for NII, just in header):

DSET+orig.HEAD and DSET+orig.BRICK, or

DSET+tlrc.HEAD and DSET+tlrc.BRICK, etc.

- This is the (AFNI) **view**. It describes if the dset is in original/native/acquired coordinates, or if it has been aligned to a template space (or AC-PC aligned).
- The **space** property carries the specific name of *which* space (MNI, etc.) it is in.

```
3dinfo -space -av_space DSET
```

- In the GUI, **tlrc** dsets have special features like "whereami" and atlas access.
- Dsets of different **spaces** cannot be overlaid in the GUI.

AFNI terminology sidenote

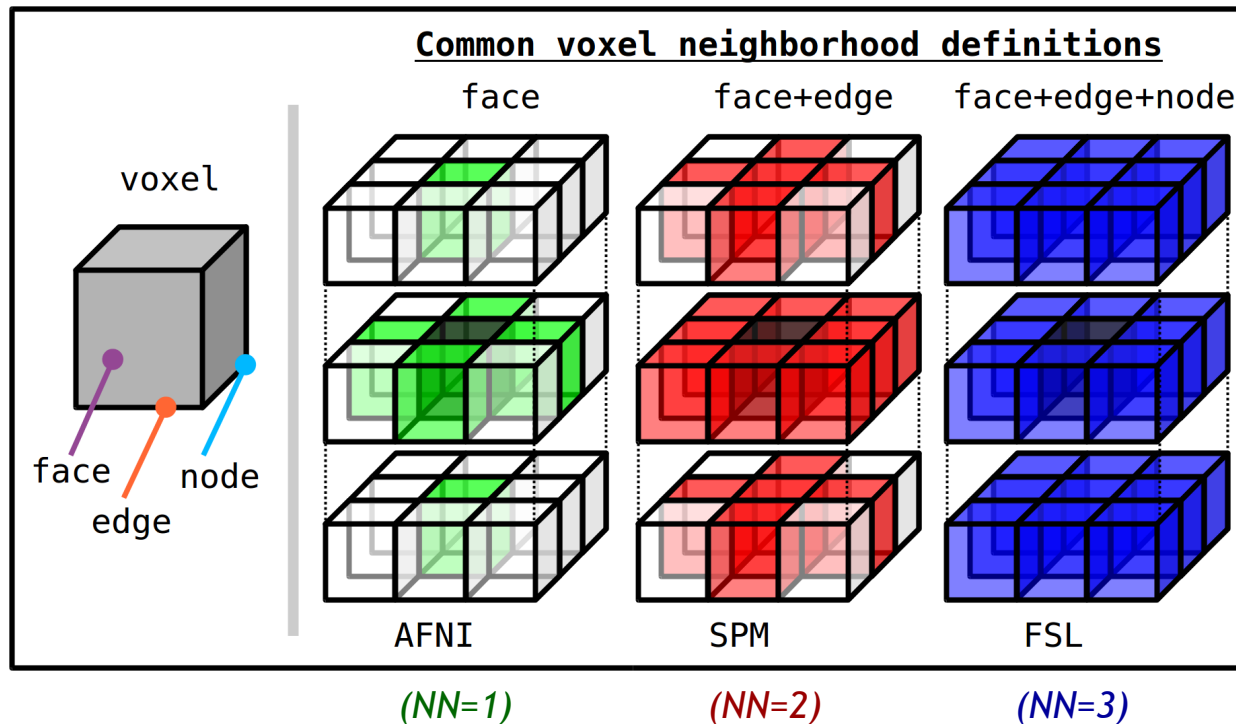
- VIEW and SPACE properties in a header
- BRIK/HEAD file names contain more info than just names (for NII, just in header):
DSET+**orig**.HEAD and DSET+**orig**.BRIK, or
DSET+**tlrc**.HEAD and DSET+**tlrc**.BRIK, etc.
- This is the (AFNI) **view**. It describes if the dset is in original/native/acquired coordinates, or if it has been aligned to a template space (or AC-PC aligned).
- The **space** property carries the specific name of *which* space (MNI, etc.) it is in.
`3dinfo -space -av_space DSET`
- In the GUI, **tlrc** dsets have special features like "whereami" and atlas access.
- Dsets of different **spaces** cannot be overlaid in the GUI.
- Ex.: VIEW SPACE
orig **ORIG** # some original space
orig **TLRC** # mapped to a template space, called TLRC
orig **MNI** # mapped to a template space, called MNI
orig **HaskinsPeds** # mapped to a template space, called HaskinsPeds
- Note: **tlrc** is generic view, while **TLRC** name is specific to a template **space**.
Fun fact: these properties also map onto NIFTI sform and qform codes directly.

Sidenote: Getting to know your neighbors

- Who are a voxel's neighbors?

Sidenote: Getting to know your neighbors

- Who are a voxel's neighbors?
 - This is used for blurring, dilating, clustering and several other steps.
 - Different softwares define this differently by default (o-o-o-of course...).



NB: in AFNI, one can **choose** any of these three definitions, typically with the “NN” specification. Just be consistent.

Other data set formats

- AFNI can read/transform other data set formats
 - + ANALYZE (.hdr/ .img file pairs), such as from SPM, FSL; e.g., *3dcopy*
 - + MINC-1 (.mnc), such as from mntools [but not MINC-2]; e.g., *3dMINCtoAFNI*
 - + CTF (.mri, .svl), from MEG analysis volumes
 - + BrainVoyager (.vmr), from BrainVoyager; e.g., *3dBRAIN_VOYAGERtoAFNI*
 - + ASCII text (.1D): just numbers arranged into columns; e.g., *3dUndump*
- Note: these other formats may be missing some standard header information, which may need to be borrowed/used from other known files in NII or BRIK/HEAD format (e.g., *3dUndump* to get grid)
- AFNI can **convert** volumes to MINC-1, ANALYZE, text file of coordinates (*3dAFNItoMINC*, *3dAFNItoANALYZE*, *3dmaskdump*, etc.)
- For fuller related program list, see:
https://afni.nimh.nih.gov/pub/dist/doc/html/doc/educational/classified_progs.html#copy-convert-manipulate-dsets
- ***Always check your results carefully when converting to other format/software!***

Appendix 1: non-volumetric files

*.1D files

1D files: text file, columns and/or rows of numbers

+ can represent time series, alignment/motion parameters, voxel locations, etc.

+ might include "# commented regions" at the top

Ways to view

+ open in text editor: "afni_open -t FILE.1D"

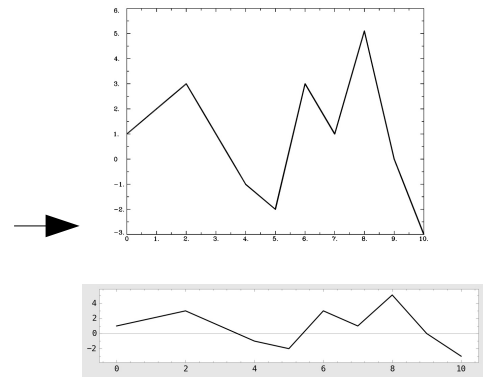
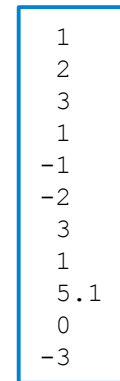
+ view in terminal: less, cat

+ plot: AFNI's 1dplot or 1dplot.py

- each column is one time series

- *Ex.:* 1dplot file.1D

```
1dplot.py -infile file.1D -prefix OUT.jpg
```



Useful programs for these types of dsets

+ 1dcat, 1dtranspose, 1d_tool.py, cat_matvec, 1deval, ...

+ **see:** https://afni.nimh.nih.gov/pub/dist/doc/html/doc/educational/classified_progs.html#deal-with-1d-time-series

*.txt and/or *.dat files

TXT/DAT files: text file, could be numbers, could be words/strings
+ e.g., stimulus timing files with numbers and symbols
+ might include "# commented regions" at the top

Ways to view

- + open in text editor: "afni_open -t FILE.1D"
- + view in terminal: less, cat

*.json files

- JSON files: text file, stores dictionaries and lists of information
- + general/standard file format, stands for **JavaScript Object Notation**
 - + increasingly commonly used in neuroimaging to include extra/meta information about datasets

Ways to view

- + open in text editor: "afni_open -t FILE.1D"
- + view in terminal: less, cat
- ++ but to read/write/use: very common to use Python functionality

*.niml.dset and *.gii files

GII (GifTI): surface equivalent of NifTI files; standard format

NIML-DSET: surface data file format used in AFNI

→ for both, will deal more with these in the SUMA talks

(SUMA also has other intermediate/useful files *.niml*)

Useful programs for these types of dsets

+ See:

https://afni.nimh.nih.gov/pub/dist/doc/html/doc/educational/classified_progs.html#suma-surface-calculations-formats-and-viewing

*.niml.lt files

“labeltable” files made by and used in AFNI

- + files to associate a label (text string) with an ROI value (integer)
- + e.g., store names of ROIs in an atlas, such as FS parcellation
- + discussed more in the ROI talks

If you can't wait to read more

+ See *@MakeLabelTable*'s help:

https://afni.nimh.nih.gov/pub/dist/doc/html/doc/programs/@MakeLabelTable_sphx.html#ahelp-makelabeltable

+ See ROI demo examples in AFNI doc tutorials:

https://afni.nimh.nih.gov/pub/dist/doc/html/doc/tutorials/rois_corr_vis/main_toc.html

Appendix 2: data storage on disk (+ set origin/orient)

Dataset storage: origin and orientation

- How is a 3D vol stored on the computer?

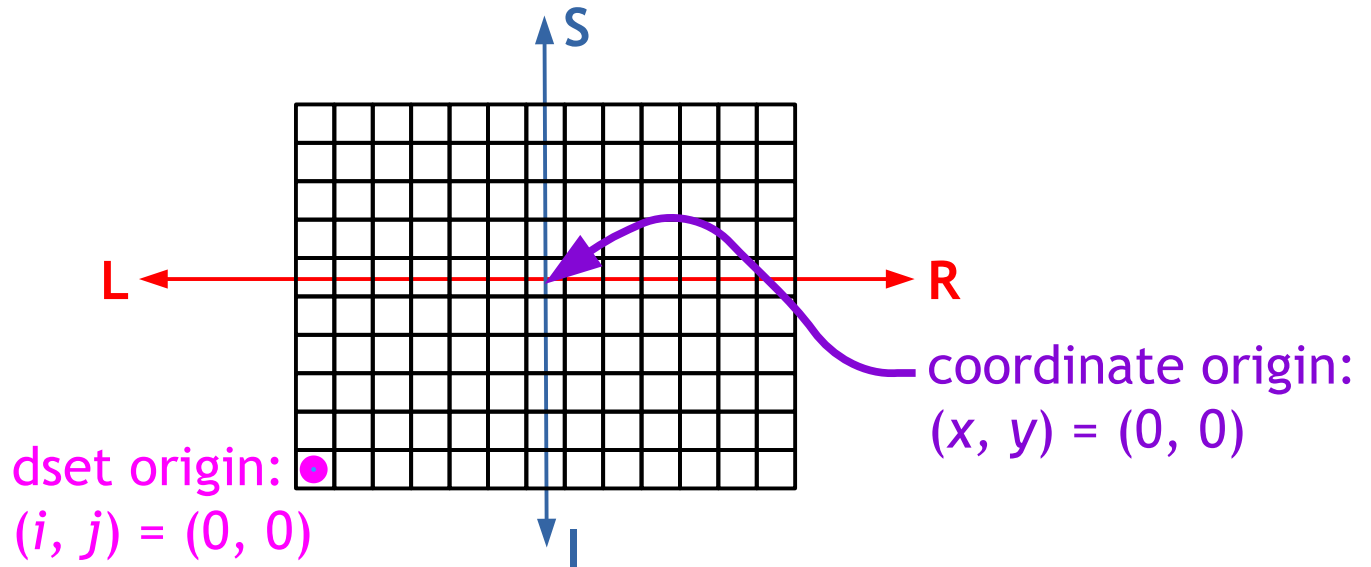
Dataset storage: origin and orientation

- How is a 3D vol stored on the computer?
 - *Row by row (as a flattened matrix), starting from one corner called the **origin**.*
 - Orientation** states which corner, and in which order the rows are read (e.g., RPI).*
 - At dset origin $(i, j, k) = (0, 0, 0)$; at coordinate origin $(x, y, z) = (0, 0, 0)$!*

Dataset storage: origin and orientation

- How is a 3D vol stored on the computer?
 - Row by row (as a flattened matrix), starting from one corner called the **origin**.
 - Orientation** states which corner, and in which order the rows are read (e.g., RPI).
 - At dset origin $(i, j, k) = (0, 0, 0)$; at coordinate origin $(x, y, z) = (0, 0, 0)$!

Example,
2D grid



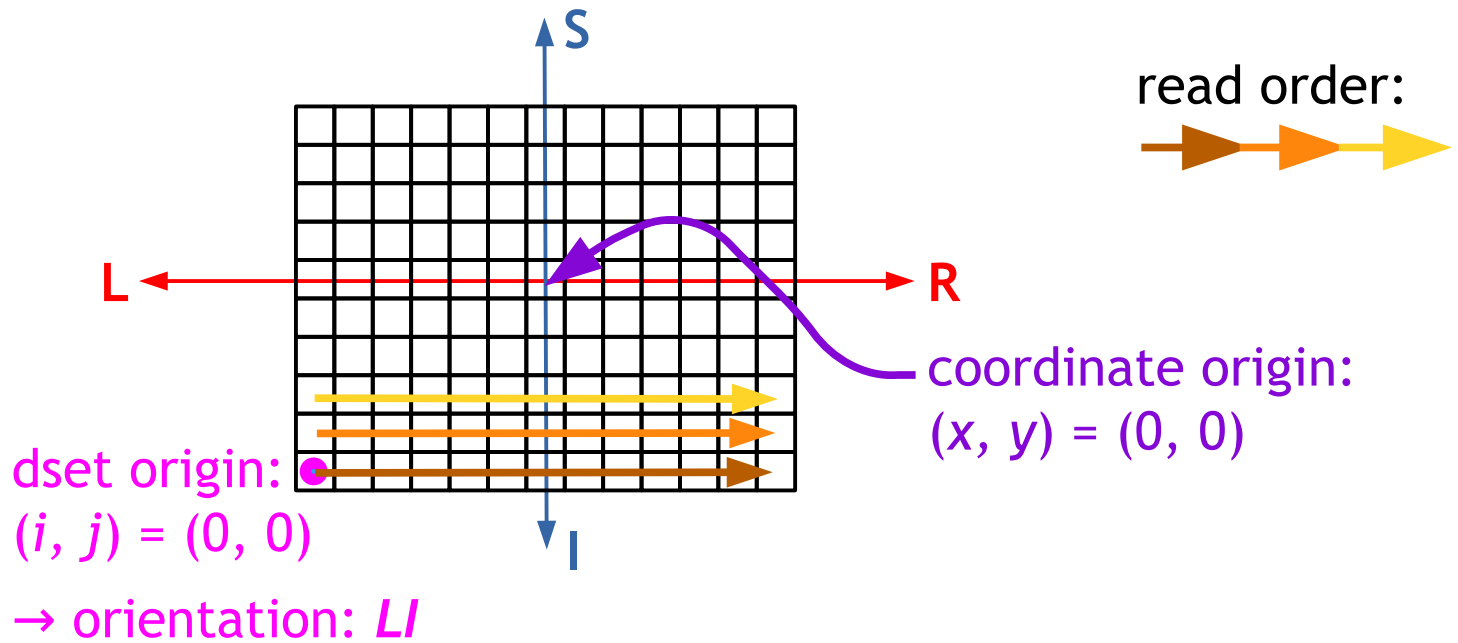
→ stored on comp:



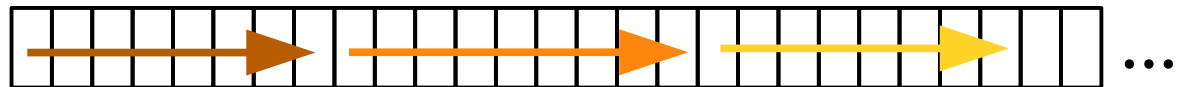
Dataset storage: origin and orientation

- How is a 3D vol stored on the computer?
 - Row by row (as a flattened matrix), starting from one corner called the **origin**.
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 - At dset origin $(i, j, k) = (0, 0, 0)$; at coordinate origin $(x, y, z) = (0, 0, 0)$!

Example,
2D grid



→ stored on comp:



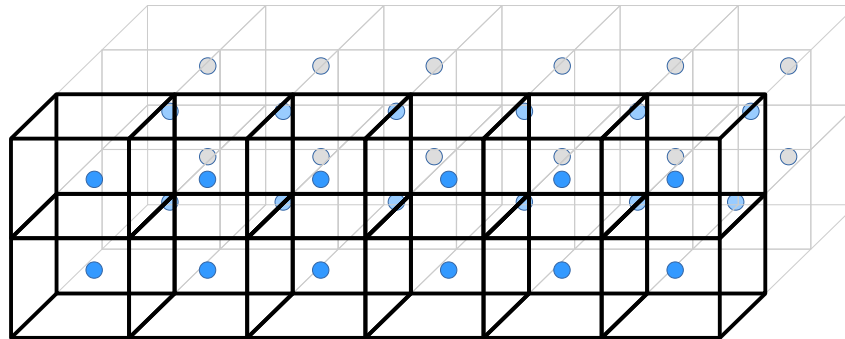
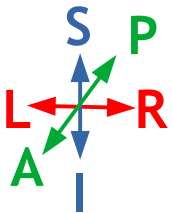
Dataset storage: origin and orientation

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 - Row by row (as a flattened matrix), starting from one corner called the **origin**.
 - Orientation** states which corner, and in which order the rows are read (e.g., RPI).
 - At dset origin $(i, j, k) = (0, 0, 0)$; at coordinate origin $(x, y, z) = (0, 0, 0)$!

Ex: orientation = LAI
Q1: So where is the origin here?



3D vol grid:



→ stored on comp:



See this in a vol with: `3dinfo -orient -origin DSET`

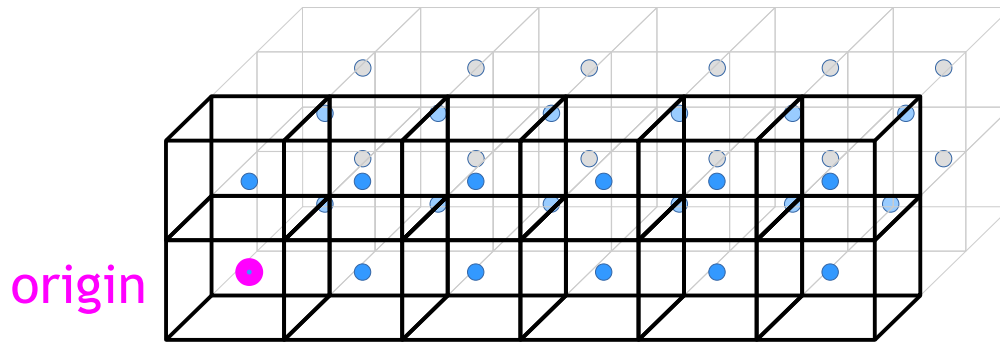
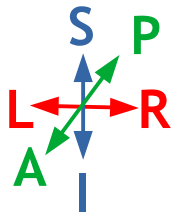
Dataset storage: origin and orientation

- How is a 3D vol stored on the computer?
 - Row by row (as a flattened matrix), starting from one corner called the **origin**.
 - Orientation** states which corner, and in which order the rows are read (e.g., RPI).
 - At dset origin $(i, j, k) = (0, 0, 0)$; at coordinate origin $(x, y, z) = (0, 0, 0)$!

Ex: orientation = LAI



3D vol grid:



Q2: So how is the data read into storage?

→ stored on comp:



See this in a vol with: `3dinfo -orient -origin DSET`

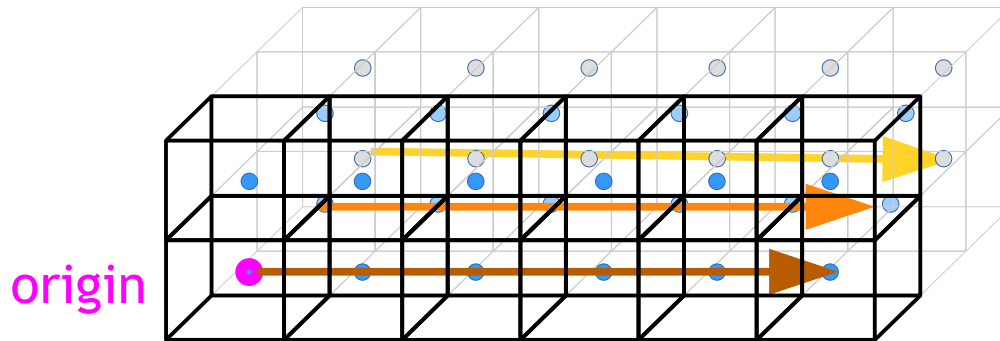
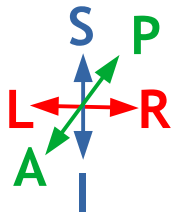
Dataset storage: origin and orientation

- How is a 3D vol stored on the computer?
 - Row by row (as a flattened matrix), starting from one corner called the **origin**.
 - Orientation** states which corner, and in which order the rows are read (e.g., RPI).
 - At dset origin $(i, j, k) = (0, 0, 0)$; at coordinate origin $(x, y, z) = (0, 0, 0)$!

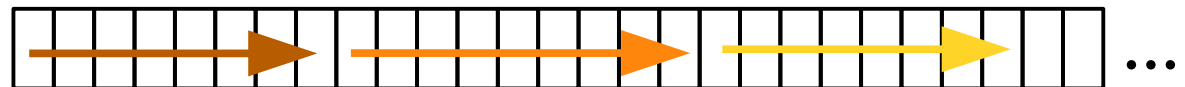
Ex: orientation = LAI

read order:


3D vol grid:



→ stored on comp:



See this in a vol with: `3dinfo -orient -origin DSET`

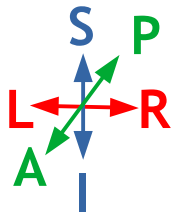
Dataset storage: origin and orientation

- How is a 3D vol stored on the computer?
 - Row by row (as a flattened matrix), starting from one corner called the **origin**.
 - Orientation** states which corner, and in which order the rows are read (e.g., RPI).
 - At dset origin $(i, j, k) = (0, 0, 0)$; at coordinate origin $(x, y, z) = (0, 0, 0)$!

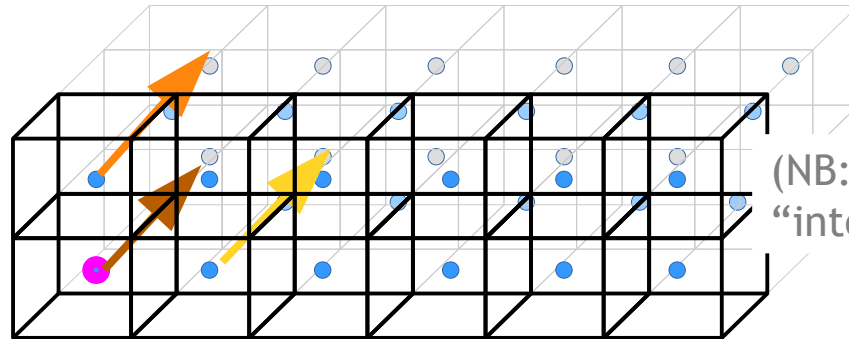
Ex: orientation = AIL

read order:

3D vol grid:



origin



(NB: the arrows point “into” slide here...)

→ stored on comp:



See this in a vol with: `3dinfo -orient -origin DSET`

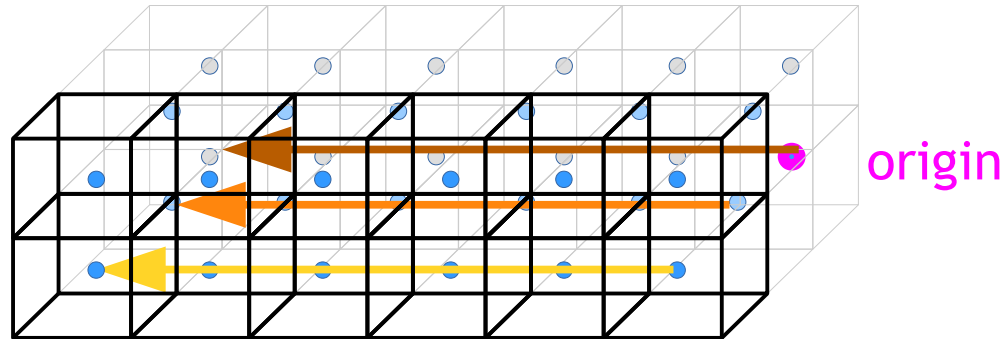
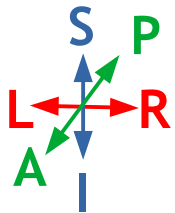
Dataset storage: origin and orientation

- How is a 3D vol stored on the computer?
 - Row by row (as a flattened matrix), starting from one corner called the **origin**.
 - Orientation** states which corner, and in which order the rows are read (e.g., RPI).
 - At dset origin $(i, j, k) = (0, 0, 0)$; at coordinate origin $(x, y, z) = (0, 0, 0)$!

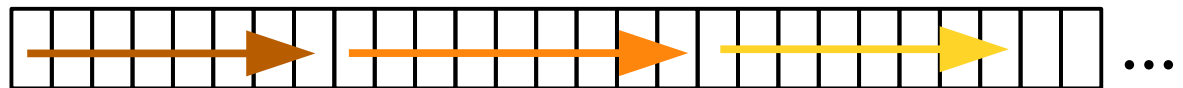
Ex: orientation = RPI

read order:

3D vol grid:



→ stored on comp:



See this in a vol with: `3dinfo -orient -origin DSET`

AFNI program note on dset and grid properties

To simply find out what the dset's grid, orientation, origin, etc. properties are, ***3dinfo*** is the way to go. *Ex.:*

```
3dinfo -orient -o3 DSET
```

AFNI program note on dset and grid properties

To simply find out what the dset's grid, orientation, origin, etc. properties are, ***3dinfo*** is the way to go. *Ex.:*

```
3dinfo -orient -o3 DSET
```

To alter dset/grid properties:

In AFNI, the program ***3dresample*** is useful for starting with one input and making a dset with a new grid, orientation, origin, etc. The program assumes that the starting information (both header and brick info) are correct. *Ex.:*

```
3dresample -orient RAI -prefix DSET_NEW -inset DSET
```

To change grid, orientation, origin, etc. properties when the header information is incorrect, then the program ***3drefit*** is useful. *Ex.:*

```
3drefit -orient RAI -inset DSET
```

Note the different purposes of ***3dresample*** and ***3drefit***.