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# fMRI Data Structure

# fMRI Data

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- A standard fMRI experiment gives rise to massive amounts of data.
  - Consists of both structural and functional data.
- Here we discuss the structure of the data and some general terminology associated with it.
- We also provide a brief overview of some of the characteristics of the data.



# Spatial and Temporal Resolution

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- When designing an fMRI experiment one must balance the need for adequate **spatial resolution** with that of adequate **temporal resolution**.
- The **temporal resolution** determines our ability to separate brain events in time.
  - In fMRI the temporal resolution is determined by how quickly each individual image is acquired (TR).
- The **spatial resolution** determines our ability to distinguish changes in an image across different spatial locations.

# Terminology

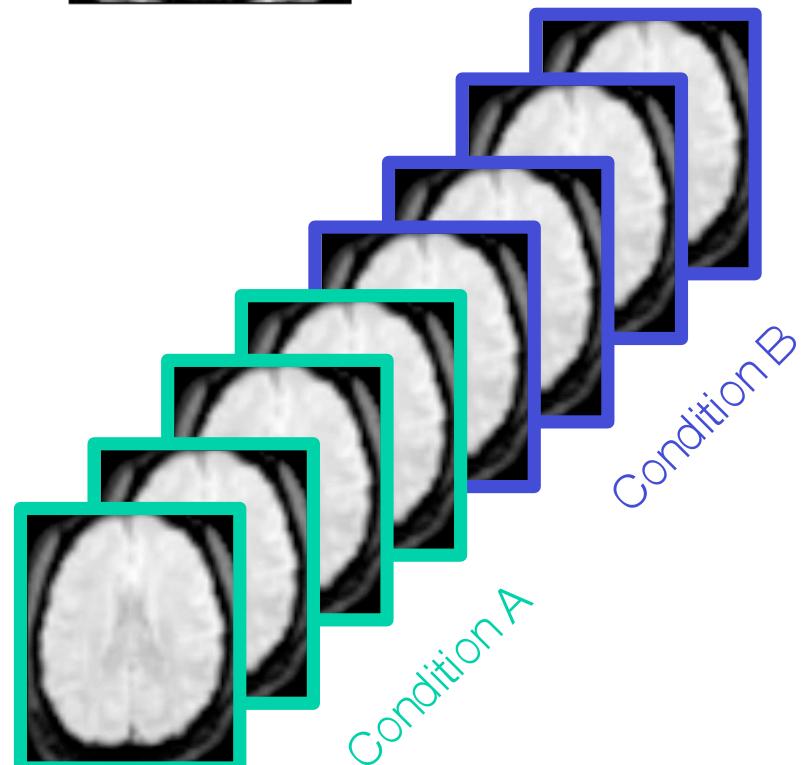
## Structural (T1) images:

- High spatial resolution
- Low temporal resolution
- Can distinguish different types of tissue

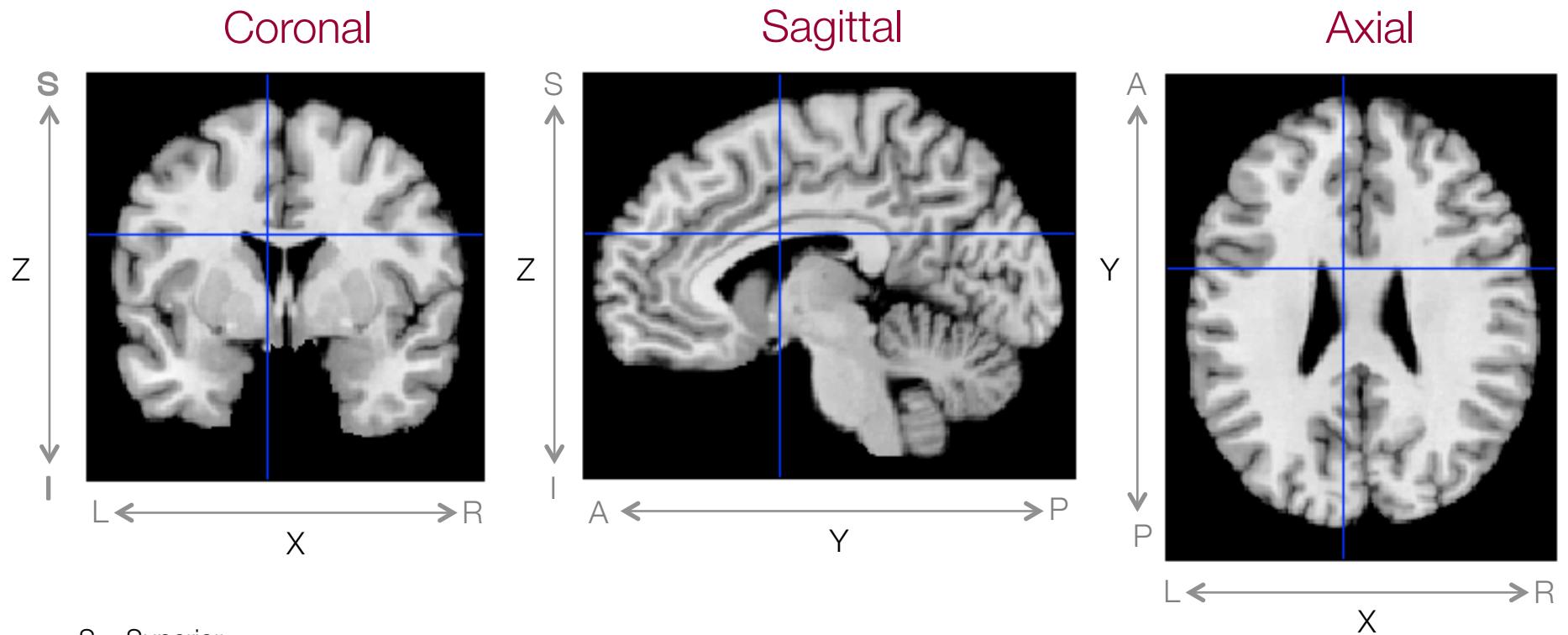


## Functional (T2\*) images:

- Lower spatial resolution
- Higher temporal resolution
- Can relate changes in signal to an experimental manipulation



# Terminology



S = Superior

I = Inferior

L = Left

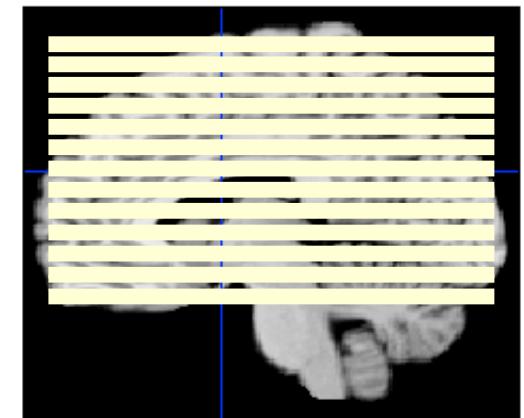
R = Right

P = Posterior

A = Anterior

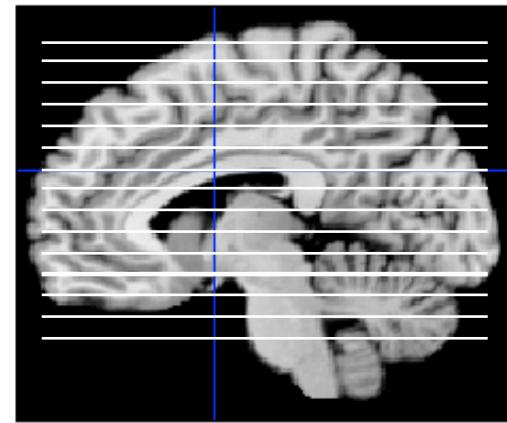
# Terminology

- MRI images are typically acquired in **axial slices**
  - one at a time.
- This can be performed in either a sequential or interleaved manner.
- Together the slices make up a 3 dimensional **brain volume**.



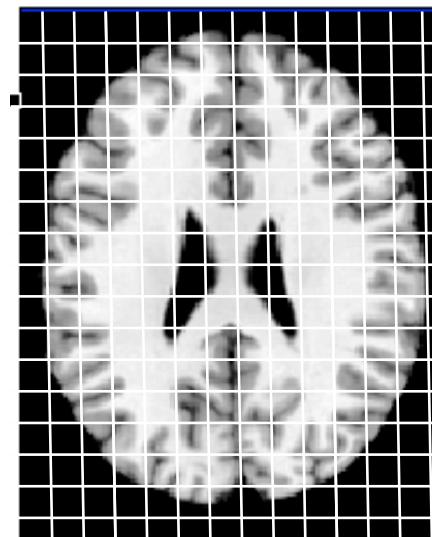
# Terminology

Field of View (FOV)  
(e.g. 192 mm)

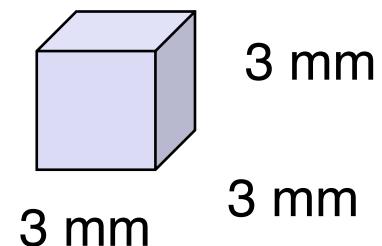


Slice thickness  
(e.g., 3 mm)

Matrix Size  
(e.g., 64 x 64)



In-plane resolution  
 $192 \text{ mm} / 64 = 3 \text{ mm}$



Voxel Size

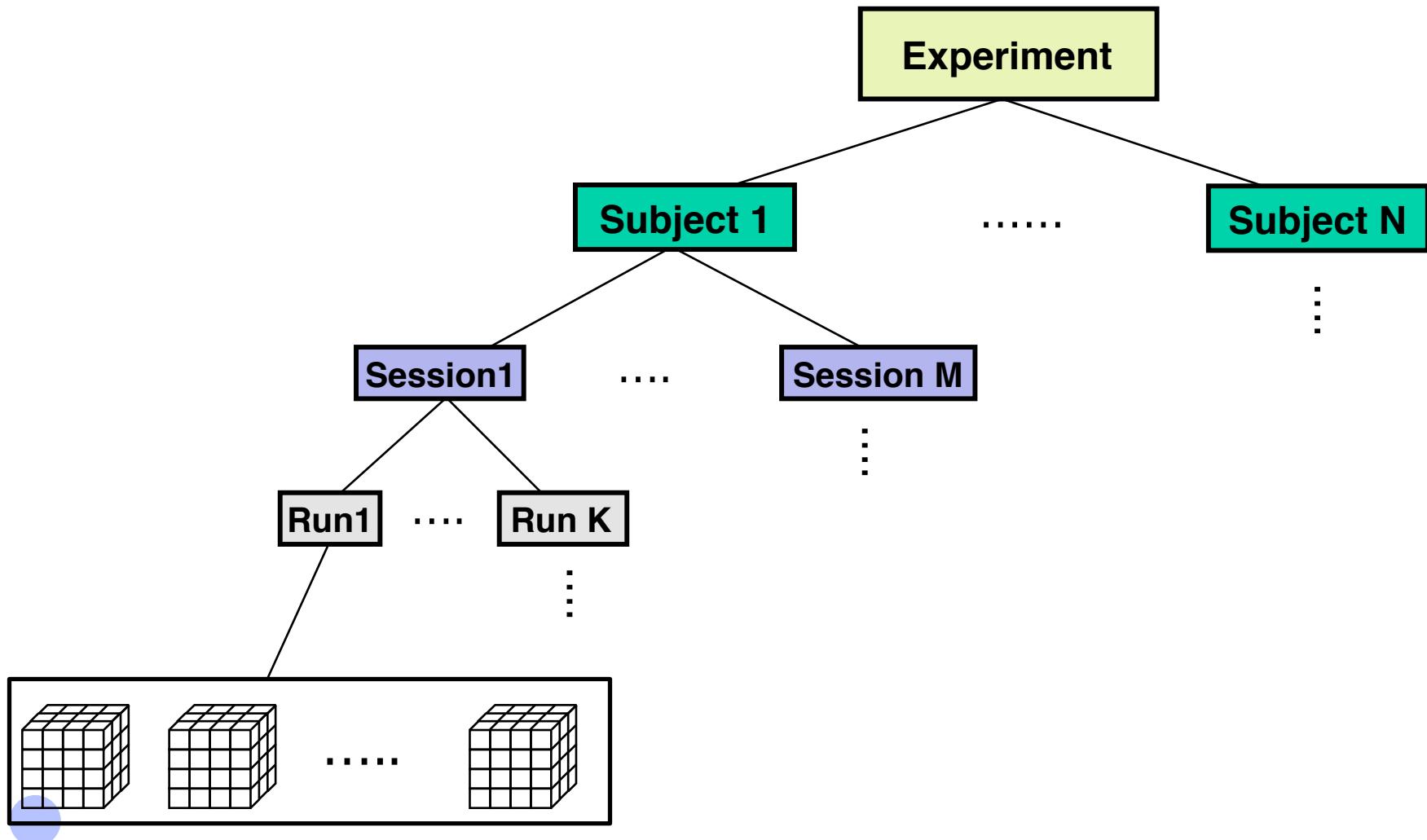
# Terminology

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- An **experiment** studies many subjects.
- Each **subject** may be scanned during multiple sessions.
- Each **session** consists of several runs.
- Each **run** consists of a series of brain volumes.
- Each **volume** is made up of multiple slices.
- Each **slice** contains many voxels.
- Each **voxel** has an intensity associated with it.

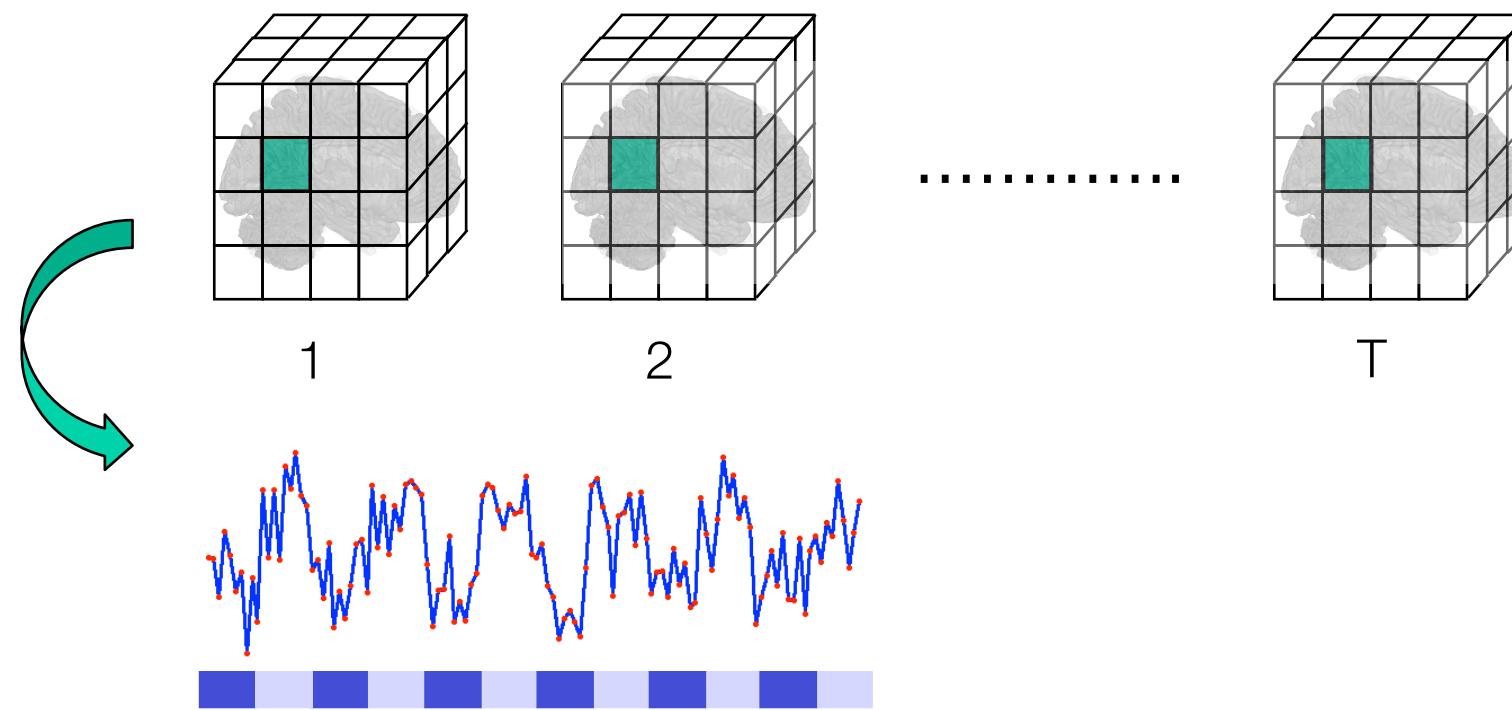


# Hierarchical Structure



# fMRI Data

- Each voxel has a corresponding time course.



# End of Module



@fMRIstats