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| |  | | --- | |  | | primer: Coordinate systems | |  | |

# ESSENTIAL CONCEPTS

* **Image Spaces (associated with distinct coordinate system)**
  + Native space – coordinates unique to subject’s head placement in MRI scanner
  + Standard space – standard defined world coordinates across all images in this space define anatomy location (images in this space can have differ resolutions)
* **Coordinate Systems**
  + Voxel coordinates
    - no units; integers
    - voxel count in each dimension reflecting matrix size
    - Origin: corner of image (e.g., 0,0,0 or 1,1,1)
    - Origin and axes naming conventions differ in programs
  + World coordinates
    - Have units in mm; floating values
    - Denote anatomy
      * Handedness system
        + Right-handed (RAS) system

x+ Left-Right

y+ Posterior-Anterior

z+ Inferior-Superior

Default for: MNI152 space, NifTi

* + - * + LPS system

Default for: Dicom

* + - Origin: can differ in programs, standard space (e.g., MNI152 space origin at anterior commissure)
* **qform and sform Matrices**

PURPOSE: Used to convert voxel coordinates into world coordinates

* + qform & sform stored in the Nifti File
  + Historically, both matrices in a file to keep track of scanner coordinate system (qform) and standard space coordinates (sform); in practice not used; one matrix usually set to 0)
  + Meaningful only if have a NON-ZERO code (0=unknown)

# QUESTIONS (PLEASE ADDRESS)

* **How is the origin of world coordinates originally set?**
* **How can origins be redefined in different software/command line?**

# SOFTWARE CONVENTIONS (PLEASE DEFINE)

* **FSLeyes**
  + Voxel coordinates origin =
  + World coordinates origin =
  + Default coordinate system visualize when open file =
  + Special notes:
* **MRIcron**
* **DSI Studio**
* **TrackVis**