Module 6:
fMRI Data Structure

fMRI Data

- 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

- 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

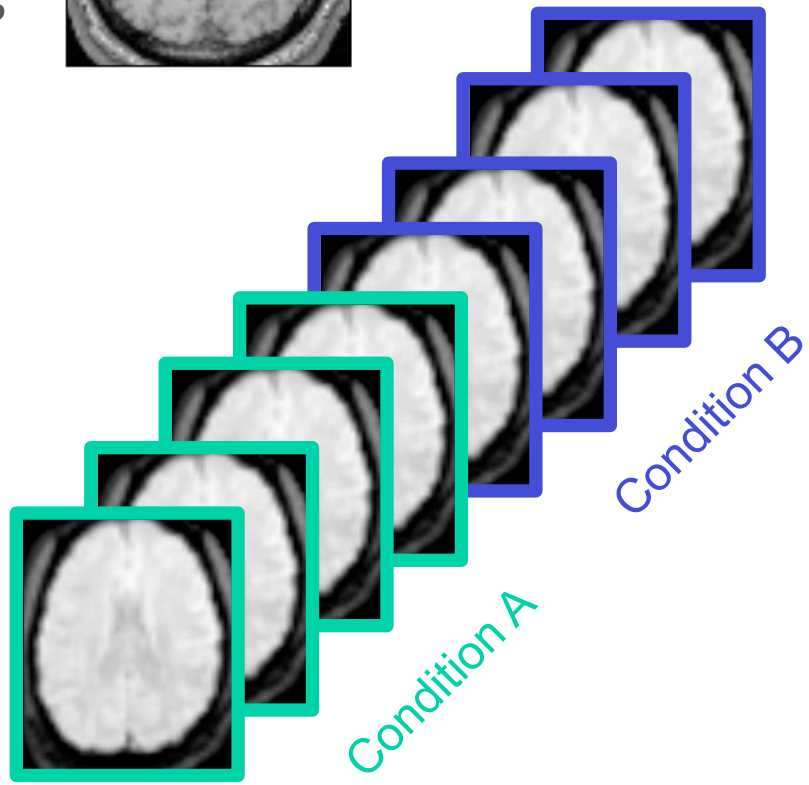
Terminology

Structural (T1) images:

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

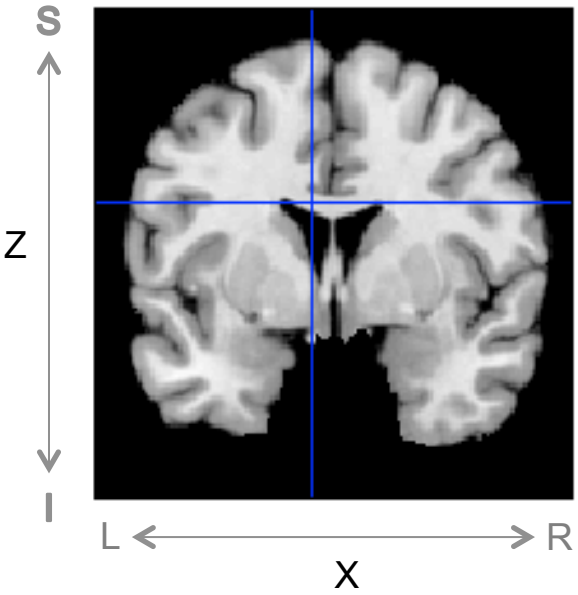
Functional (T2*) images:

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

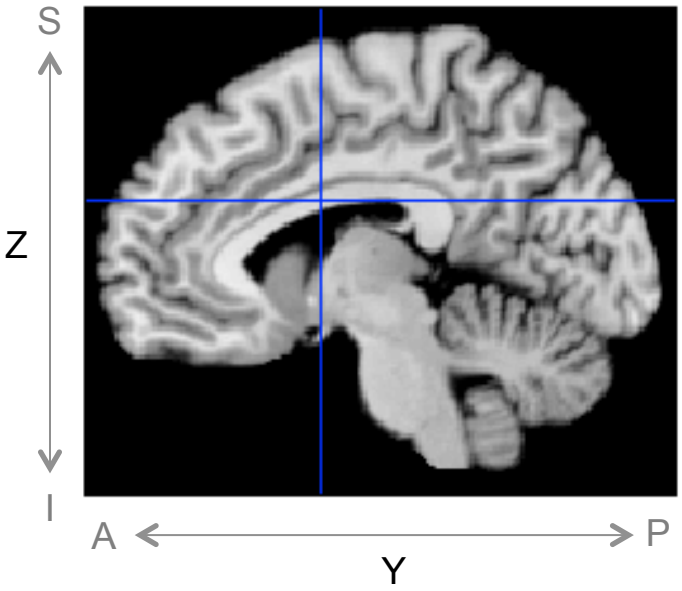


Terminology

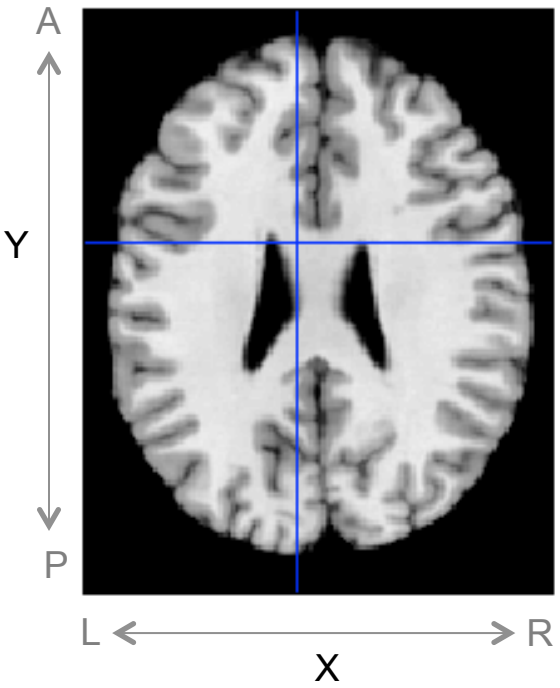
Coronal



Saggital



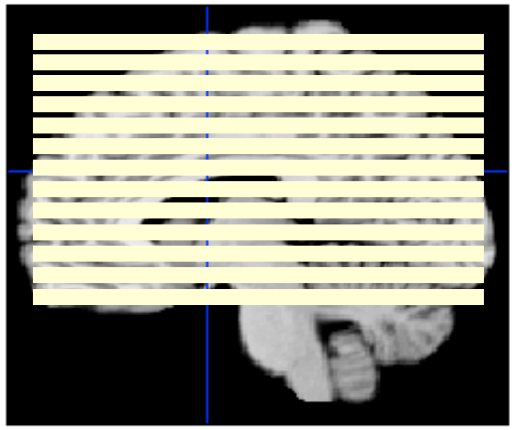
Axial



S = Superior
I = Inferior
L = Left
R = Right
P = Posterior
A = Anterior

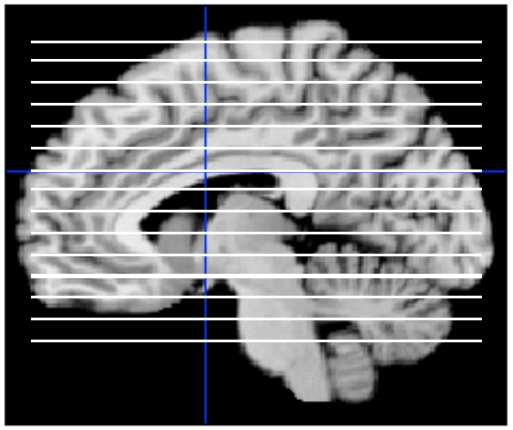
Terminology

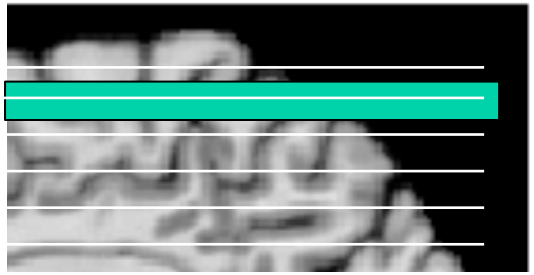
- MRI images are typically acquired in axial slices - one at a time.
- This can be performed in either a sequential or interleaved manner.
- Together the slices make up a 3 dimensional brain volume.



Terminology

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

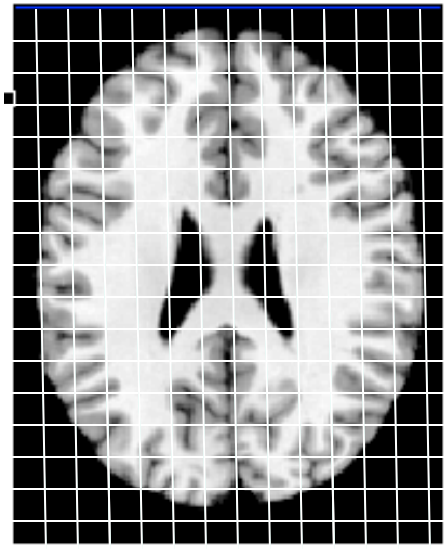


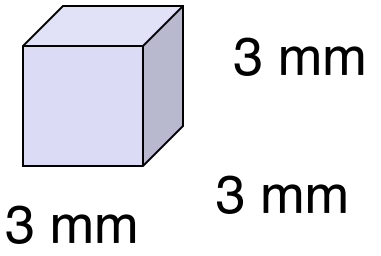


Slice thickness
(e.g., 3 mm)

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

In-plane resolution
192 mm / 64 = 3 mm



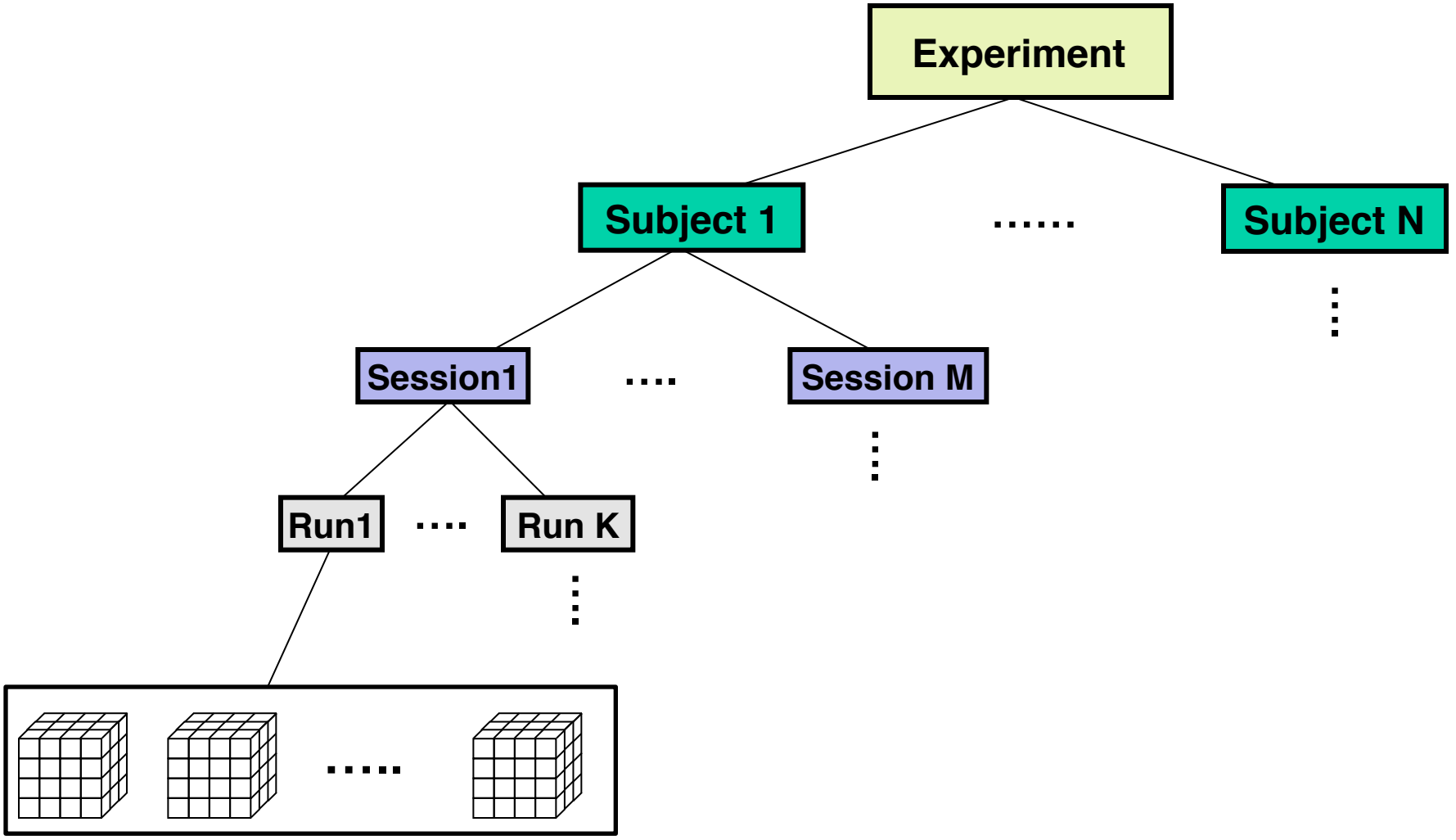


Voxel Size

Terminology

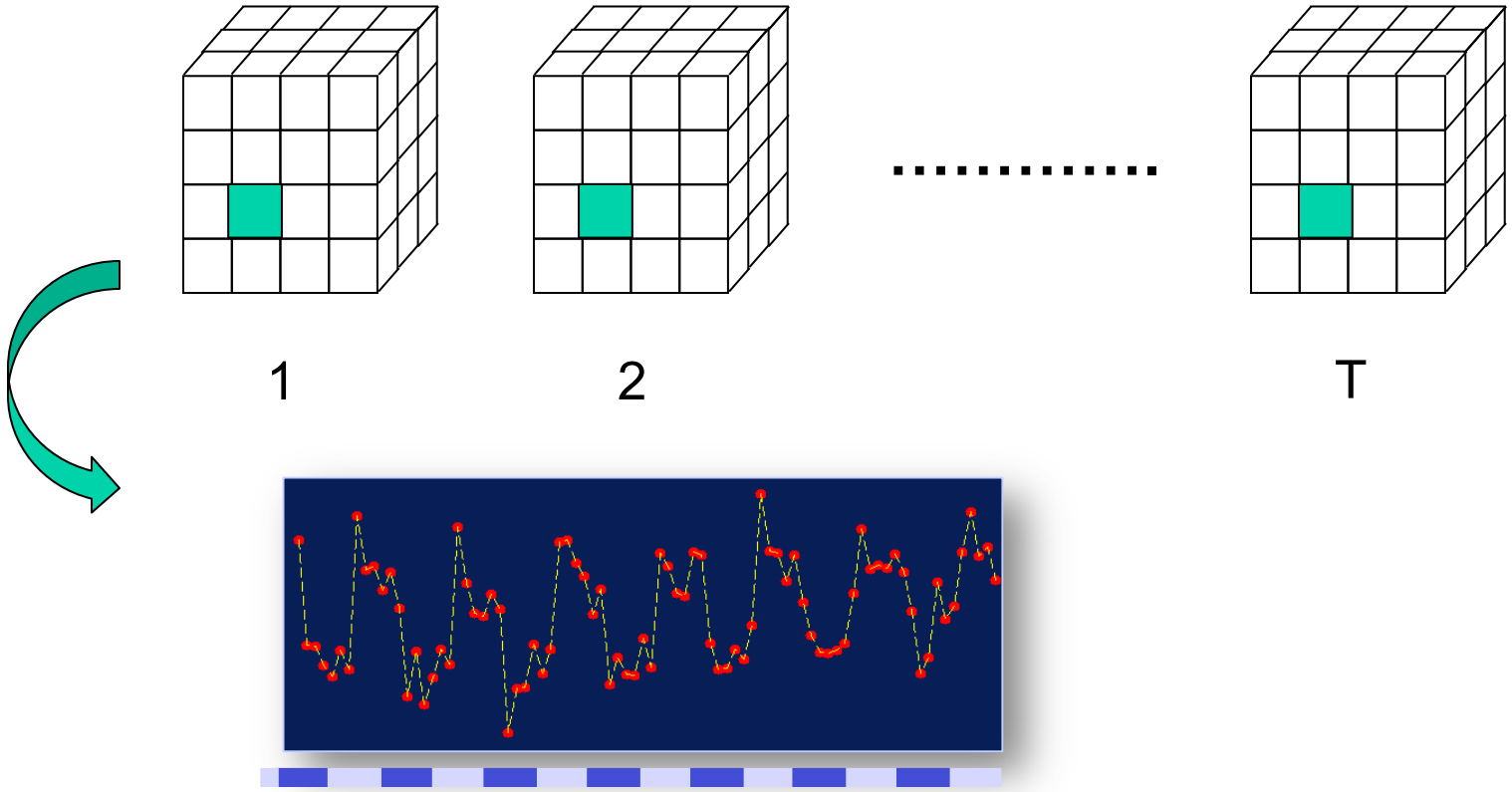
- An experiment studies many subjects.
- Each subjects many be scanned during multiple sessions.
- Each session consists a several runs.
- Each run consists of a series of brain volumes.
- Each volume is made up of multiple slices.
- Each slice contains many voxels.
- Each voxel has an intensity associate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

Hierarchical Structure

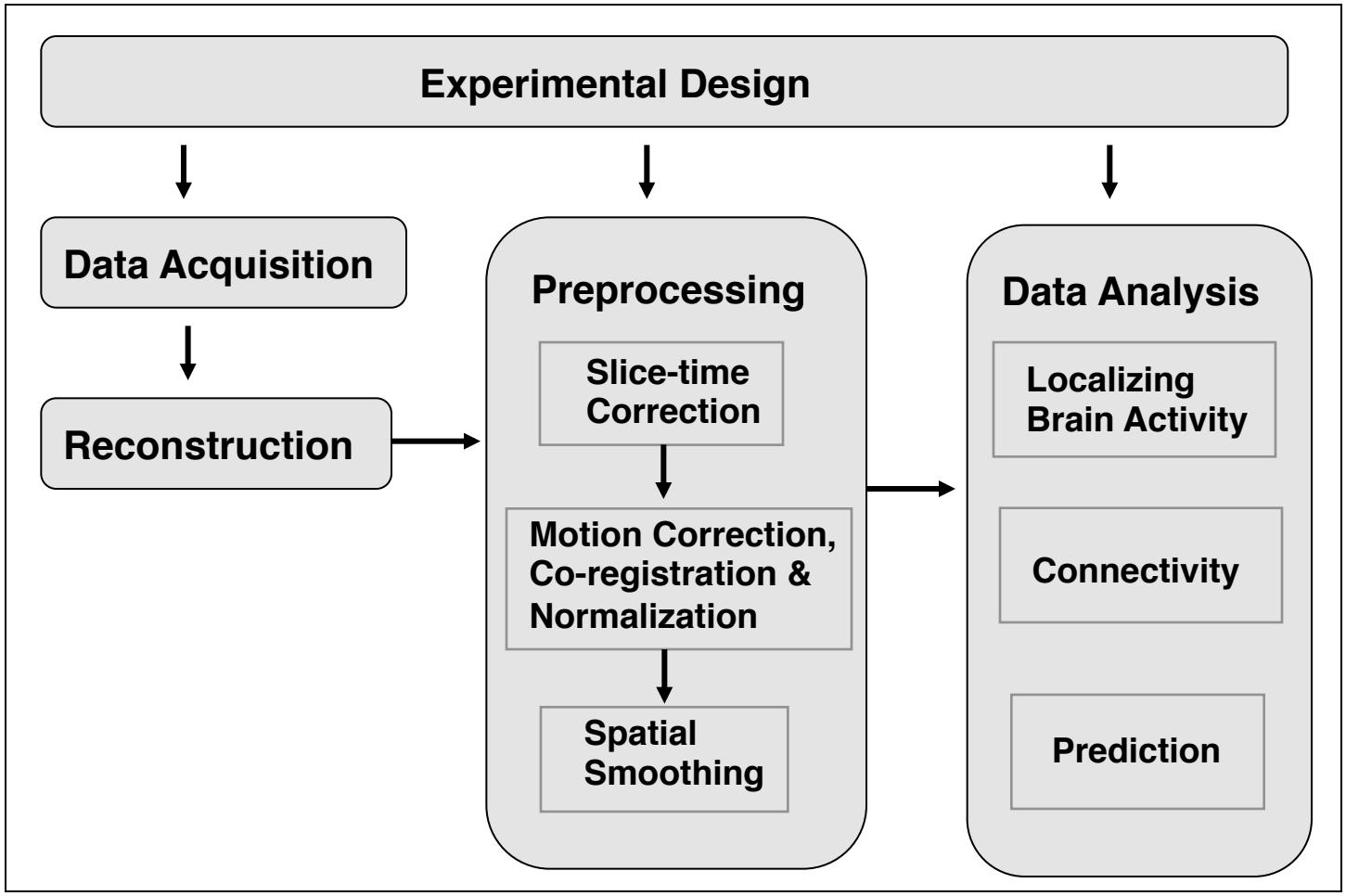


fMRI Data

- Each voxel has a corresponding time course.



Data Processing Pipeline



End of Module

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