Tutorial: Introduction to The Decoding Toolbox

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NIMH

Usefulness of “The Decoding Toolbox”

Accessible

- Input requires minimal programming, but advanced functionality can be used with little programming experience

Flexible

- Many different types of MVPA analyses can be run with small changes to input script (many classifiers, regression approaches, feature selection, parameter selection, …)

Fast

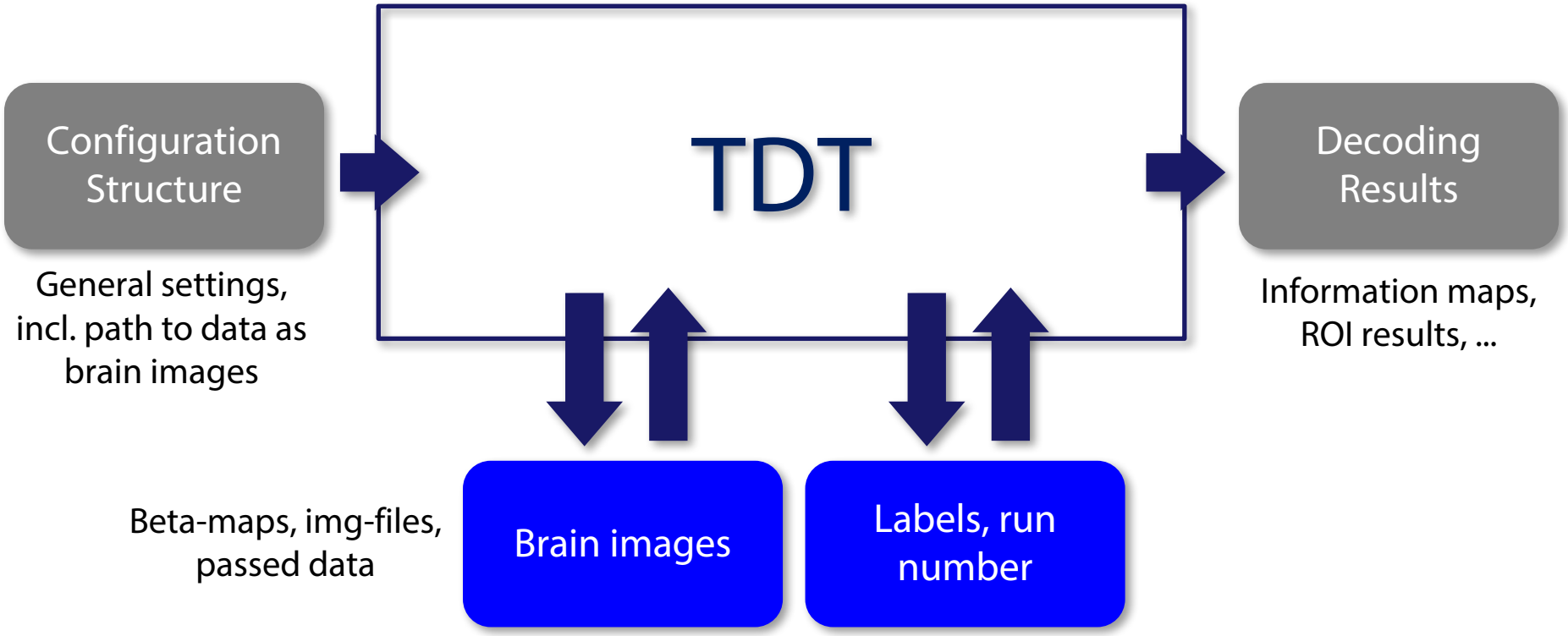
- One of the fastest toolboxes for MVPA

User friendly

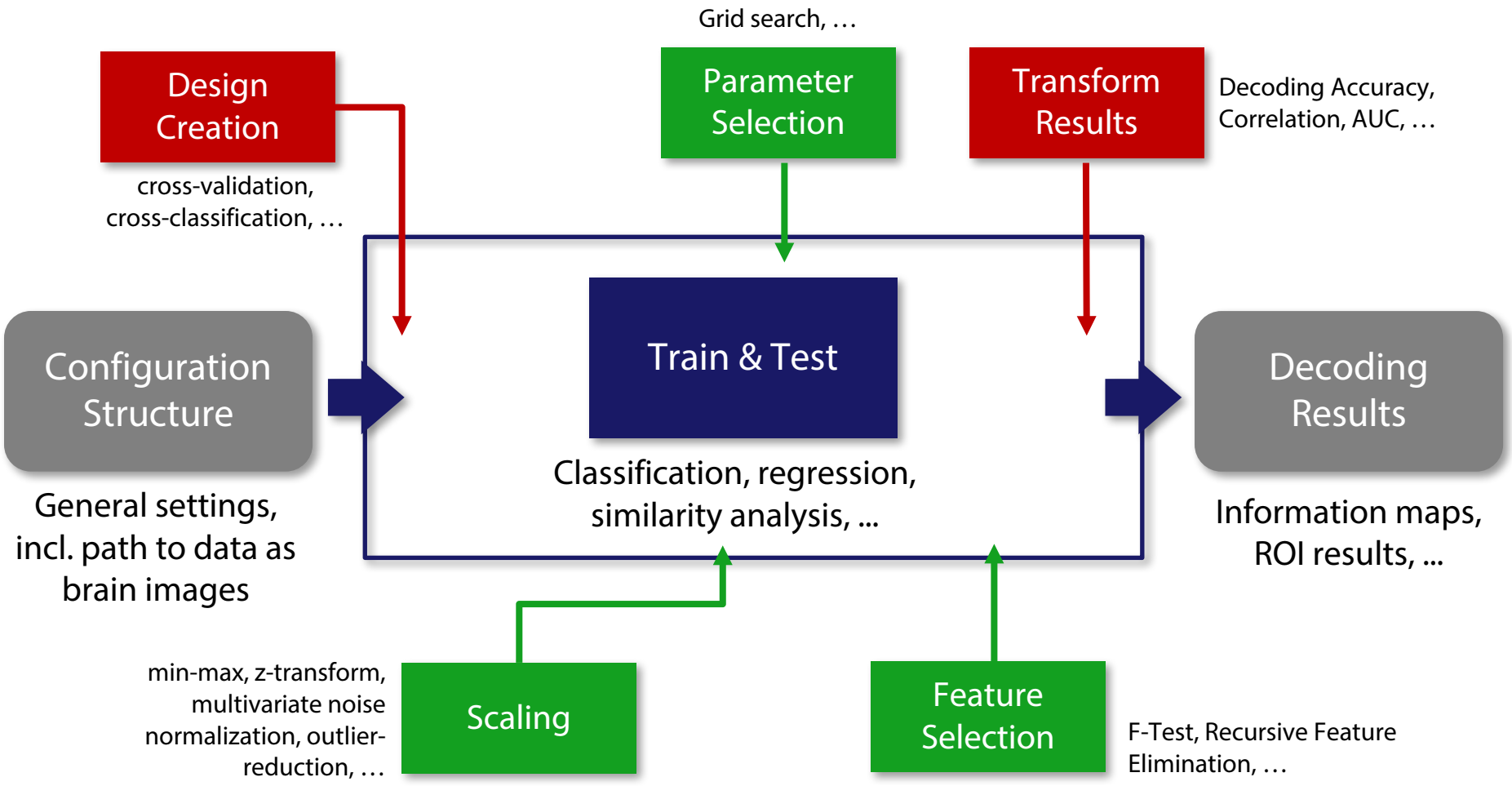
- Errors from user side often easily interpretable
- Code well-commented
- No explicit documentation but not needed?

Structure of The Decoding Toolbox

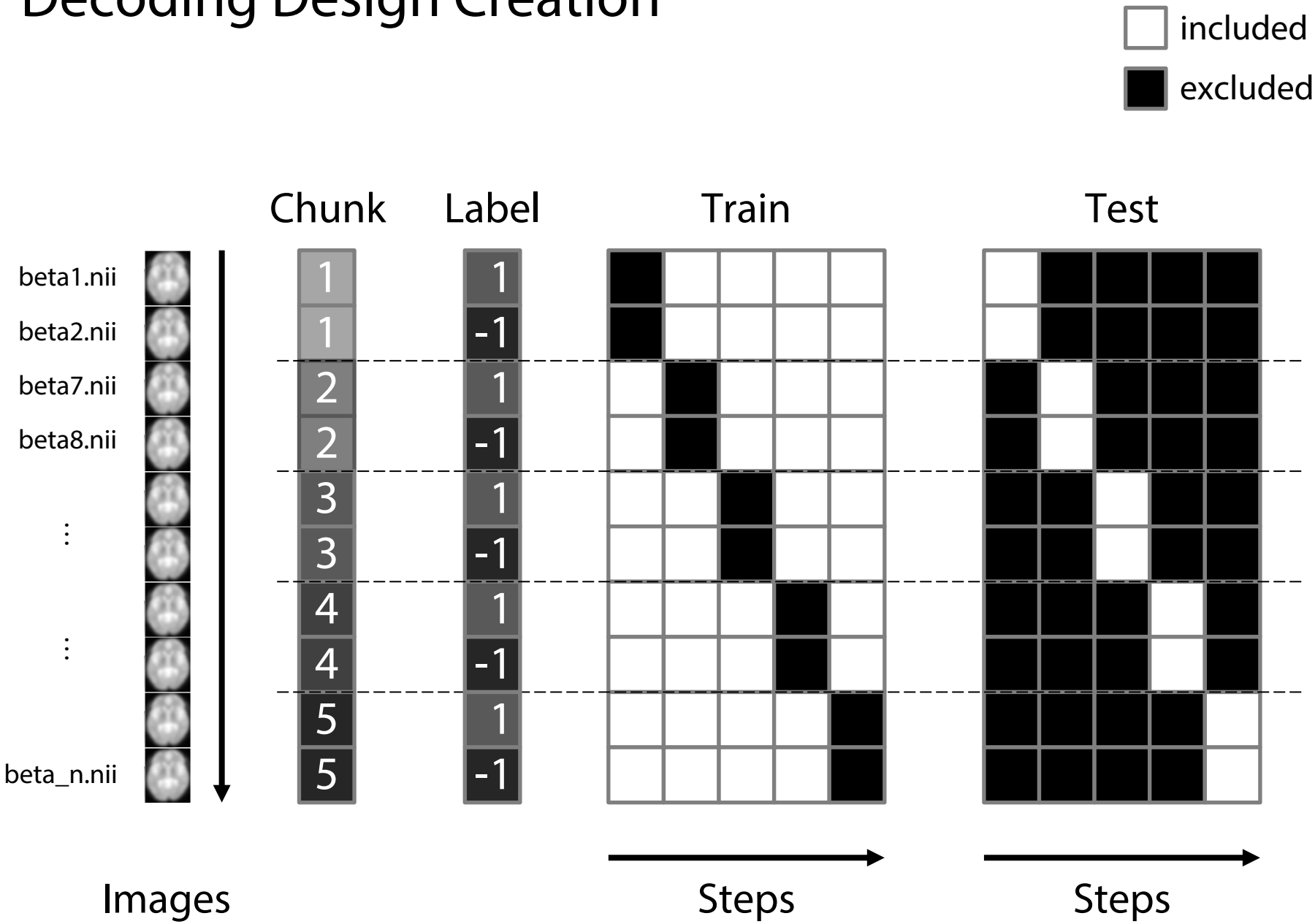
```
results = decoding(cfg);
```



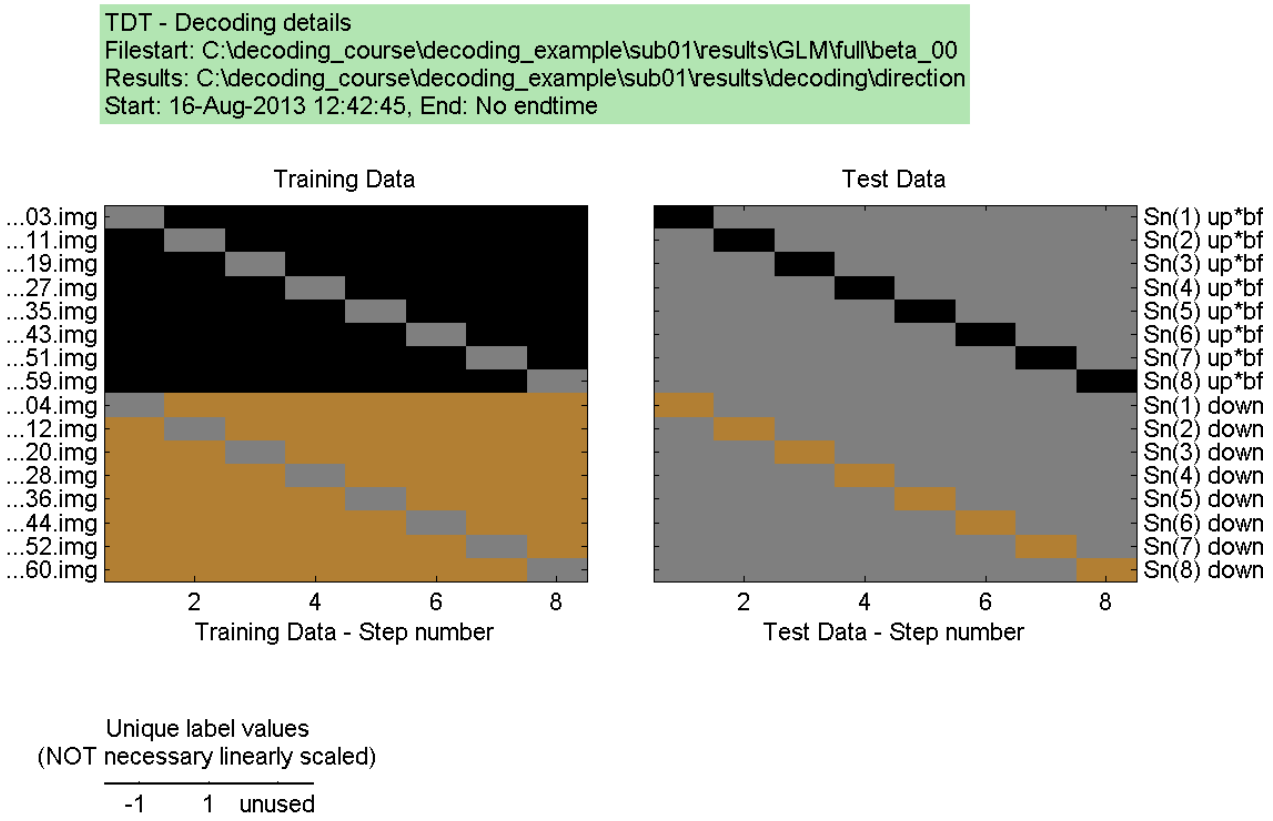
Structure of The Decoding Toolbox



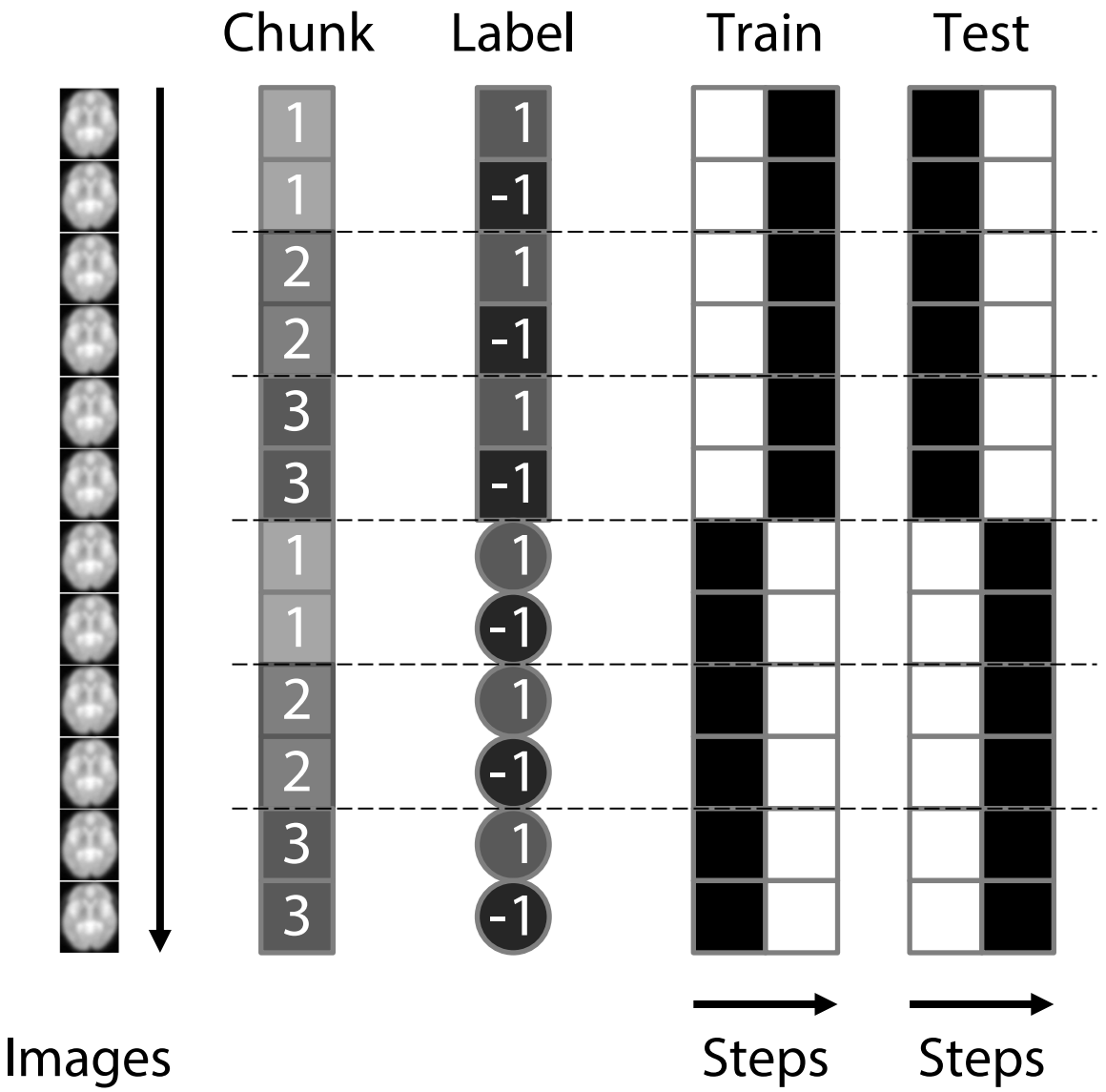
Decoding Design Creation



Design Matrix in TDT



Example: Simple two-way cross-classification



Key functions in TDT with relevant help files

Basic:

- *decoding* → central function where everything is run
- *make_design_xxxxx* → decoding design creation functions (in subfolder)
- *decoding_transform_results* → selection of results measures
- *decoding_defaults* → overview over default settings

Advanced

- *decoding_scale* → scaling / data normalization function
- *decoding_parameter_selection* → parameter selection function
- *decoding_feature_selection* → feature selection function

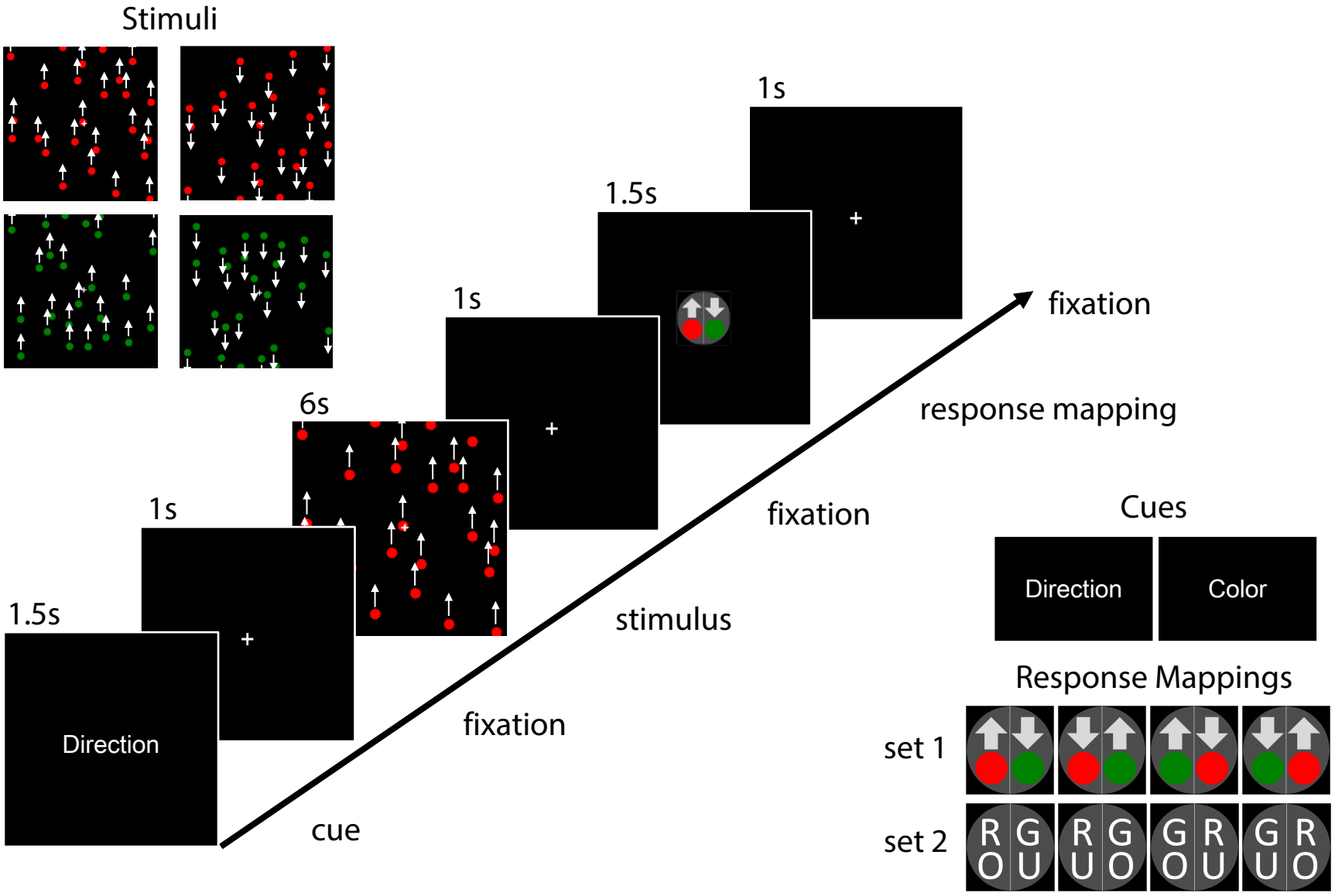
Templates

- *decoding_tutorial* → walkthrough for 2-class classification
- *decoding_template_xxxxx* → templates for all sorts of analyses (in subfolder)

TDT-Lingo

- **chunk**: Data that should not be split for cross-validation but should stay together (e.g. because of non-independence within run), often run in classification
- **label name**: Name for each label (e.g. “label 1” for “button left”)
- **label**: Target variable for prediction, categorical in classification (often 1 and -1), continuous in regression
- **feature:** A measured variable for a decoding analysis, spans a dimension (usually voxel)
- **sample**: Elements of a decoding analysis
- **decoding step**: An iteration of a decoding analysis of training and testing (e.g. a cross-validation iteration)
- **decoding set**: Groups of decoding steps that should be saved separately

Example Experiment (available from TDT website)



Useful Parameters for Experiment

- Buttonpress right index / middle finger
- TR: 2s
- 39 slices, descending acquisition
- Resolution: 2x2x3 mm (of that: 0.5 mm gap)
- Trial duration: 12 s
- 8 runs of 32 trials each, fully counterbalanced within run
- Response mapping sets across runs: [1 2 2 1 2 1 1 2]
- Separate motion localizer and color localizer