Types of Scaling

· **Session scaling; global mean scaling; block effect; mean intensity scaling**

- Purpose – remove intensity differences between runs (i.e., the mean of the whole time series).
  - whole time series may have different mean value – must compensate for between run variance
- Usually scaled to mean of 100 (or 50 or similar).

Types of Scaling

· **Global scaling; proportional scaling; scaling**

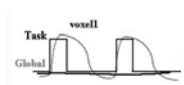
- i.e. dividing the intensity values for each scan by the mean value for all voxels (or the global brain mean intensity) for this scan.
- Purpose: remove global drifts and improve sensitivity.

• Danger to applying global scaling. The global brain mean must be independent of the task activity (i.e., does not correlate with it).

- If violated, applying global scaling can dramatically the outcome of the statistical analysis, and can be the cause of multiple Type I and Type II errors.

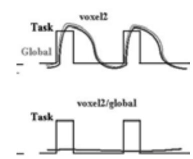
Proportional Scaling

• Consider **voxel1**: a voxel of no interest that is not influenced by the task.
• If the **global** brain mean correlates with the task and voxels1 is divided by it, then **voxel1/global**, the transformed voxel's timecourse, would appear to negatively correlate with the task and its significant deactivation may lead us to identify it as a voxel of interest (Type I error).



Proportional Scaling

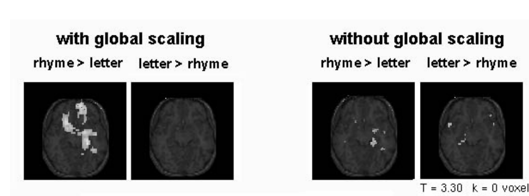
• Consider **voxel2**, a voxel of interest that correlates with the **task,** and that we would like to identify.
• If the **global** brain mean correlates with the task and voxels2 is divided by it, then **voxel2/global**, the transformed voxel's timecourse, would no longer correlate with the task (in fact, it would look more like a flat line) and we would therefore fail to identify it (Type II error).



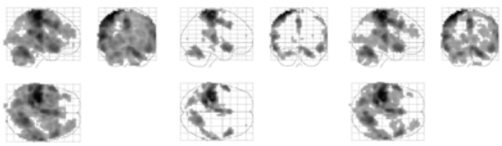
Proportional Scaling Example

Condition	Pearson's R	p value
rhyme	-.54	.00
letter	.49	.00
line	.20	.23

Proportional Scaling Example



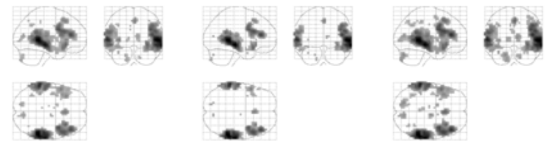
Proportional Scaling



a b c

FIG. 1. SPM{t}'s for target responses a) no scaling, b) proportional scaling, and c) adjusted proportional scaling. SPM{t}'s are set at a corrected voxel-level threshold of $p < 0.05$.

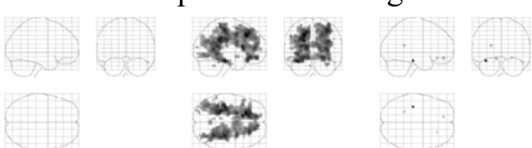
Proportional Scaling



a b c

FIG. 2. SPM{t}'s for novel activations with a) no scaling, b) proportional scaling, and c) adjusted proportional scaling.

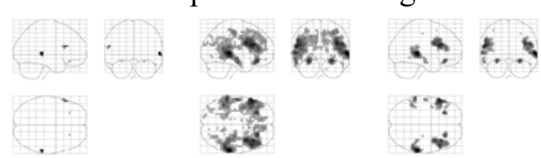
Proportional Scaling



a b c

FIG. 4. SPM{t}'s for target deactivations obtained from analyses with a) no scaling, b) proportional scaling, and c) adjusted proportional scaling.

Proportional Scaling



a b c

FIG. 5. SPM{t}'s for novel responses relative to target responses with a) no scaling, b) proportional scaling, and c) adjusted proportional scaling.

Proportional Scaling

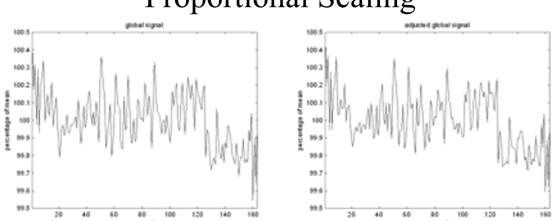


FIG. 3. Global signal and adjusted global signal of a representative session from Experiment 1. The standard deviation of the global signal is 0.157% of the mean. These figures illustrate that the component of the global signal that was removed by orthogonalization with respect to the non-constant covariates of interest was small relative to the variations about the mean: the standard deviation of the difference between the global signal and the adjusted global signal is only 0.0328%

Table 1. Representative Z-scores from Experiment 1.

Location [x y z]	Z-scores from analyses of target responses relative to baseline: no scaling	proportional scaling	adjusted proportional scaling
Right Anterior Temporal Lobe [48 16 -16]	10.98	9.87	11.42
Left Anterior Temporal Lobe [-56 12 -16]	11.59	10.90	12.28
Supplementary Motor Area [-4 -12 52]	12.79	10.39	13.17
Right Cerebellum [16 -56 -24]	12.60	9.26	12.62

References

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