

Introduction

How much data is needed for Multivariate Pattern Analysis (MVPA)?

To reduce noise, psychological paradigms commonly average responses across multiple trials. Two common schemes:

- 1) Average the responses to many **items** belonging to the same experimental condition
- 2) Average the responses to many **repetitions** of the same items

We compare the effects of including more **items** per condition to including more **repetitions** of each item in multivariate analyses of empirical fMRI and E/MEG data.

Design

12 experimental conditions (6 verbs in short phrases, 6 "Musical Rain" (MR) acoustically-matched baselines which cannot be interpreted as speech¹)

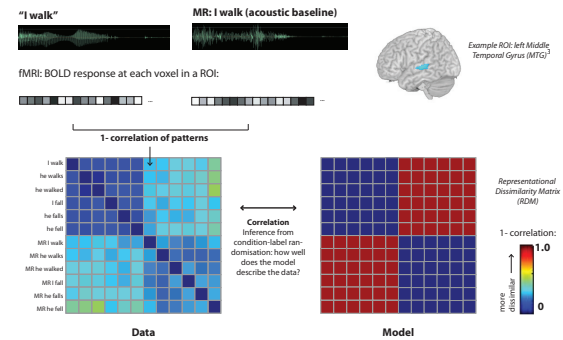
10 items per condition

8 repetitions of each item (fMRI), **12 repetitions** of each item (E/MEG)

20 participants, acoustic presentation: infrequent semantic completion task

fMRI: 3T, continuous "quiet" sequence, TR = 2, event-related GLM using HRF in SPM5
 E/MEG: 306-channel vector view MEG, simultaneous 70 channel EEG, eyeblink artefacts removed with ICA, source level estimation from minimum norm estimation (MNE) using individual structural MRIs

Representational Similarity Analysis²



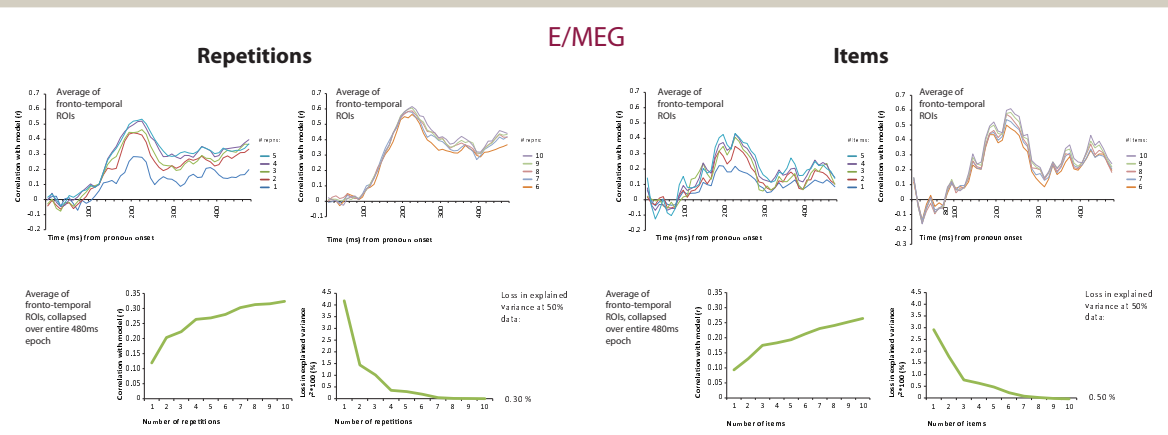
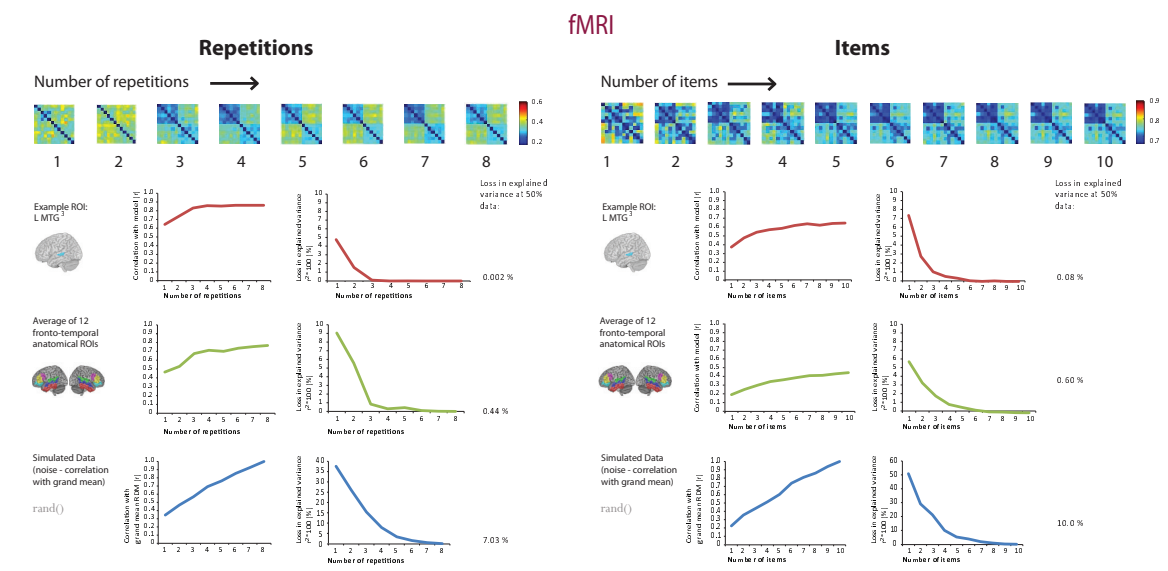
fMRI: model - data correlation for each ROI
 E/MEG: model - data correlation for each ROI, at each time point⁴

Repetitions:

- Estimate response to each condition for each repetition (collapse items)
- Randomly sample from 1 to n repetitions

Items:

- Estimate response to each item separately (collapse blocks)
- Randomly sample from 1 to 10 items
- Compare to **simulated** data (random noise)



Summary

fMRI

- Repetitions: correlation with model reached a plateau after ~4 repetitions, or 40 stimulus presentations.
- Similar effect for including more items, though less pronounced. Plateau at ~6 items, or 48 presentations.

E/MEG

- More data needed to reach plateau: 6 repetitions or 60 presentations.
- Items: did not reach a plateau within the number of items included.

Conclusion

The optimal number of presentations was around 40 for fMRI, and 60 for MEG in this design. The effects of including more repetitions and more items was similar, although responses tended to plateau earlier after additional repetitions.

References:

- 1 Uppenkamp et al 2006, NI
- 2 Kreigeskorte et al 2006, PNAS
- 3 Bozic et al 2011, ICON
- 4 Su et al 2012, PRNI

See also posters Bozic et al **327 MT** and Su et al **637 MT**

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