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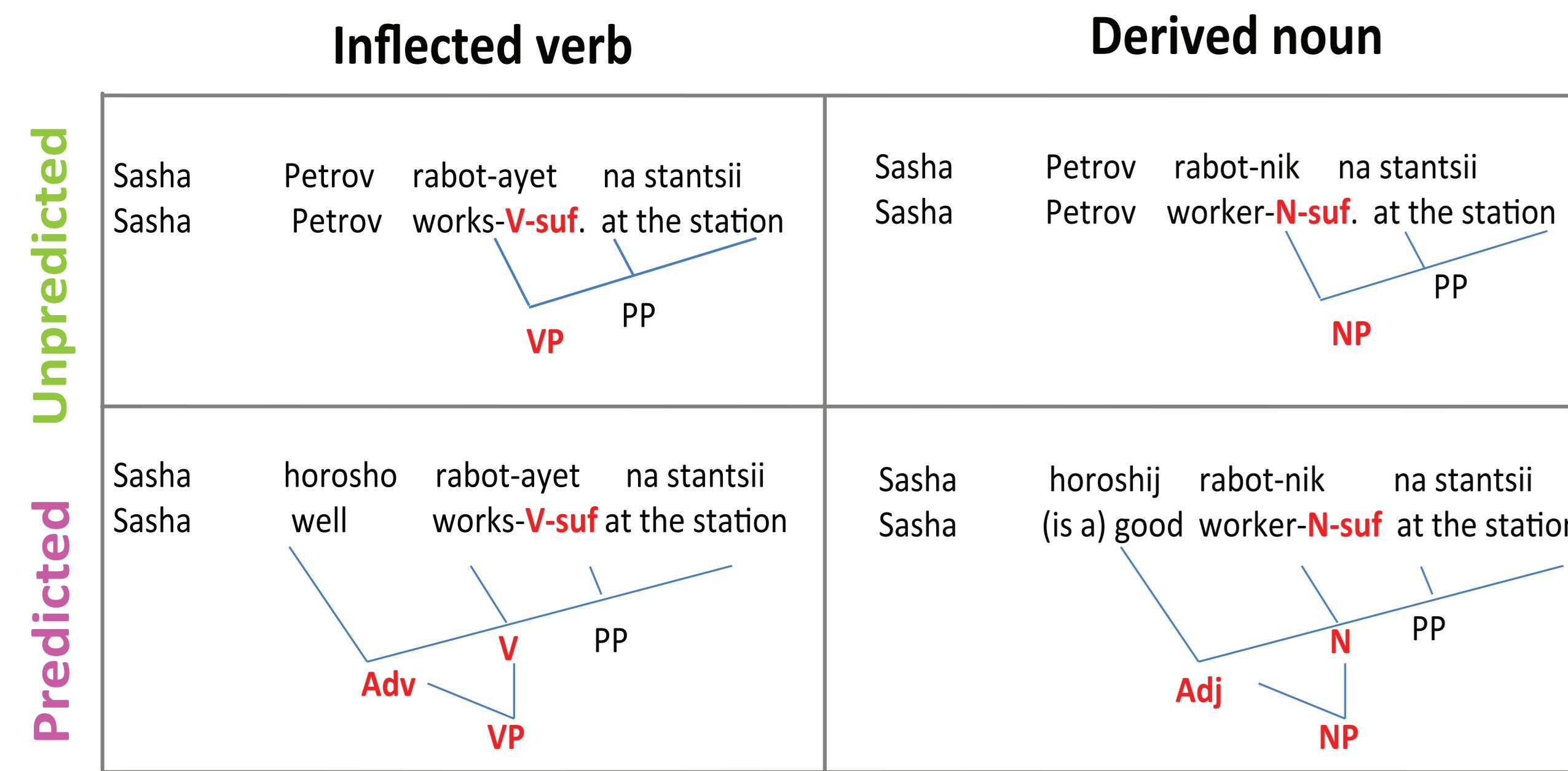
Experimental issues and design

- Predictive processing accounts [1,2,3] suggest that **information is predicted at multiple levels of representation**
- As a result **perceptual processing load is reduced**.
- In natural language comprehension **evidence for these claims is mixed**

We ask whether:

- (A) lexico-syntactic features of words can be pre-activated
- (B) words' decompositional processing strategies are affected

- The Russian language allows us to variably constrain linguistic features of upcoming words:



Predicted condition - target's grammatical class (noun or verb) and suffix type (inflectional or derivational) are constrained and predicted;

Unpredicted condition - grammatical class and suffix type are ambiguous until suffix onset;

Hypotheses:

(A) **Predictive feature retrieval:**

Verbs encode syntactic information [4] which in the predicted condition will be retrieved early (before suffix onset) in posterior temporal and inferior frontal areas [7,8] - tested with Parametric RSA models

(B) **Decompositional processing:**

Inflections are decompositional, derivations are accessed as whole forms [5,6]. **Options** (tested by RSA Detector models):

(b1) No effect - decompositional processing of inflections is obligatory - left frontotemporal engagement around suffix onset;

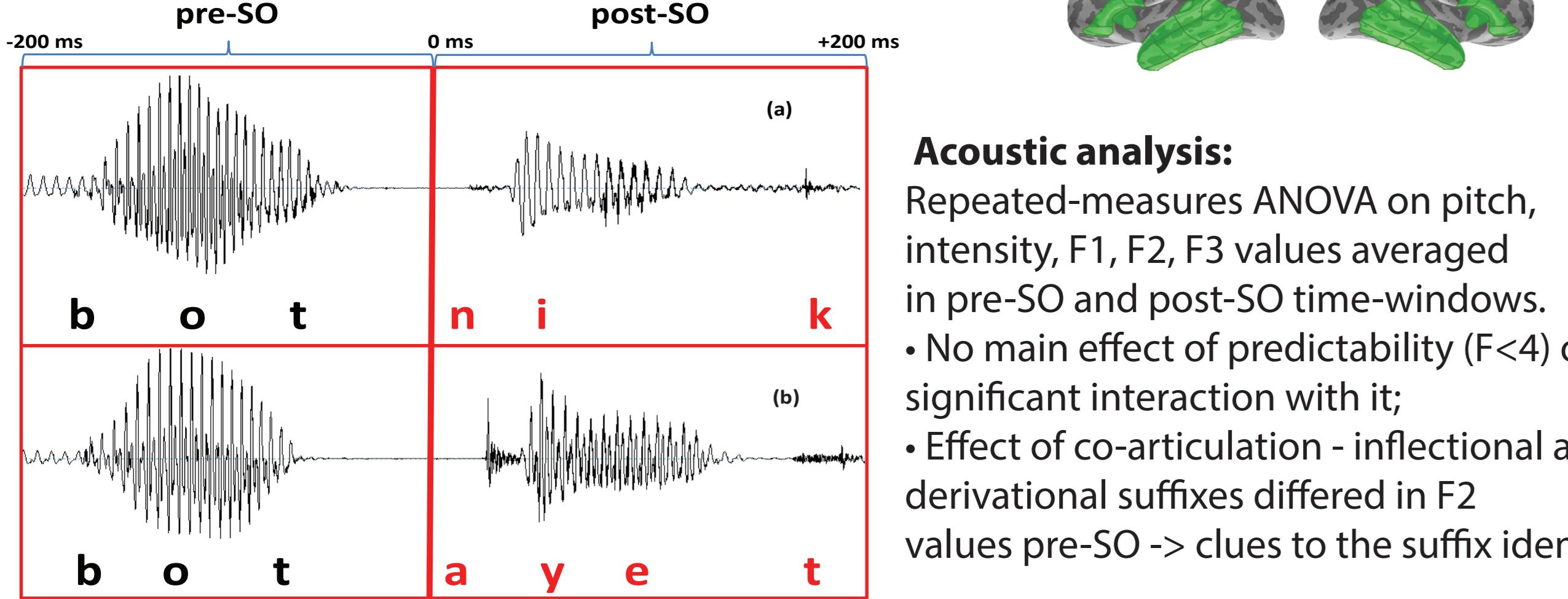
(b2) Predictability removes or reduces parsing activity

Methods

Design: Sentences composed with 60 stems repeated in 4 conditions (n trials=240); inflections and derivations matched on frequency. **Procedure:** passive listening + occasional (5%) 1-back memory task. N = 17 participants. 306 MEG +70 EEG. **Pre-processing:** Maxfilter, ICA (blinks).

Source space: Freesurfer (individual MRI), 3-layer BEM, minimum-norm solution. **Alignment point:** SO (suffix onset) - marked in red. **Analysis time-window** [from -200 to +200 ms].

Mask: frontotemporal language areas.

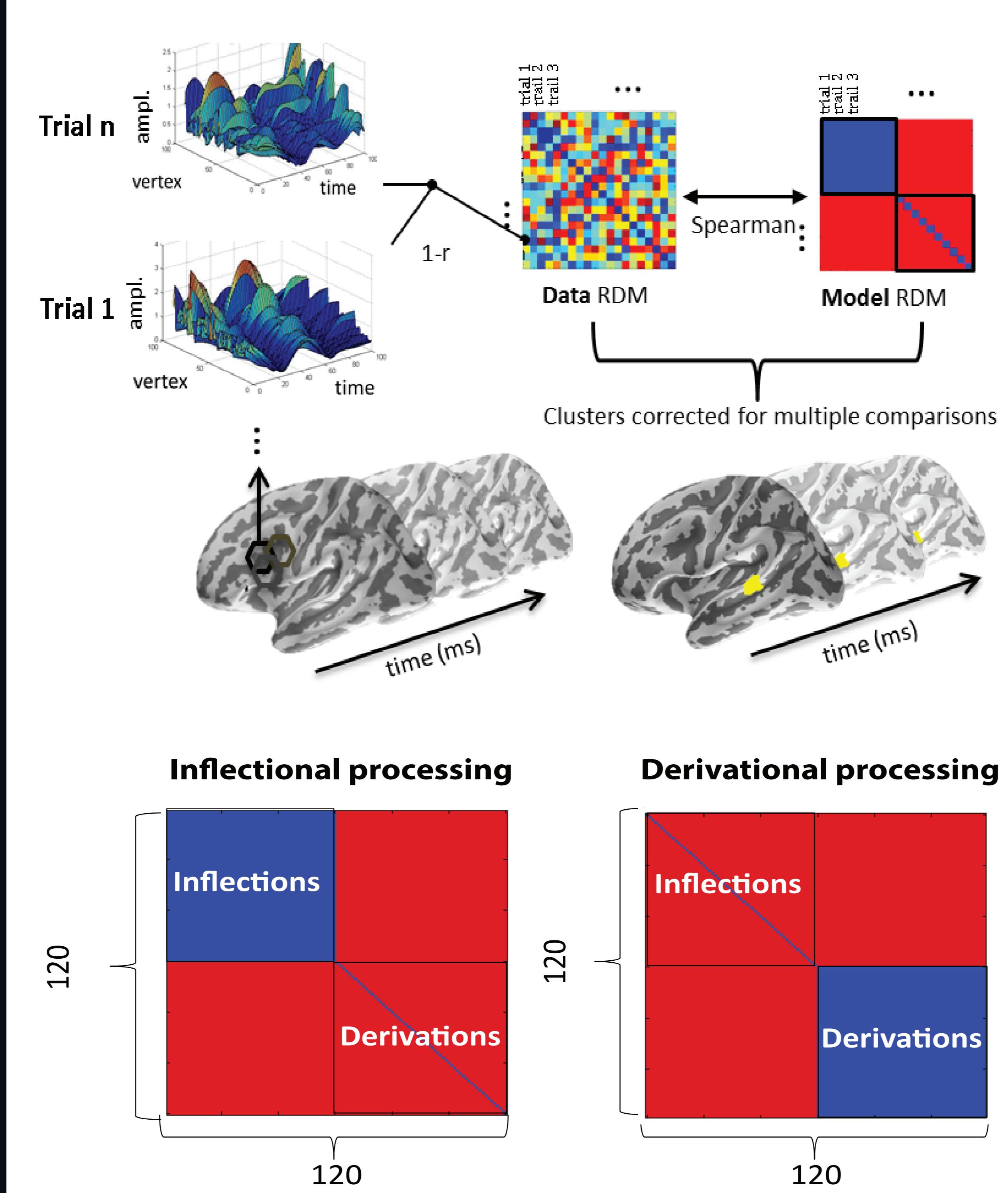


Cortical multivariate analysis: RSA trial-level Searchlight [9] allows us to explore the information encoded within the spatiotemporal activity patterns of different trials.

See **Schematic overview of the RSA** for details. RSA parameters used: 50 ms time-window, 20 mm radius and 10 ms time-step.

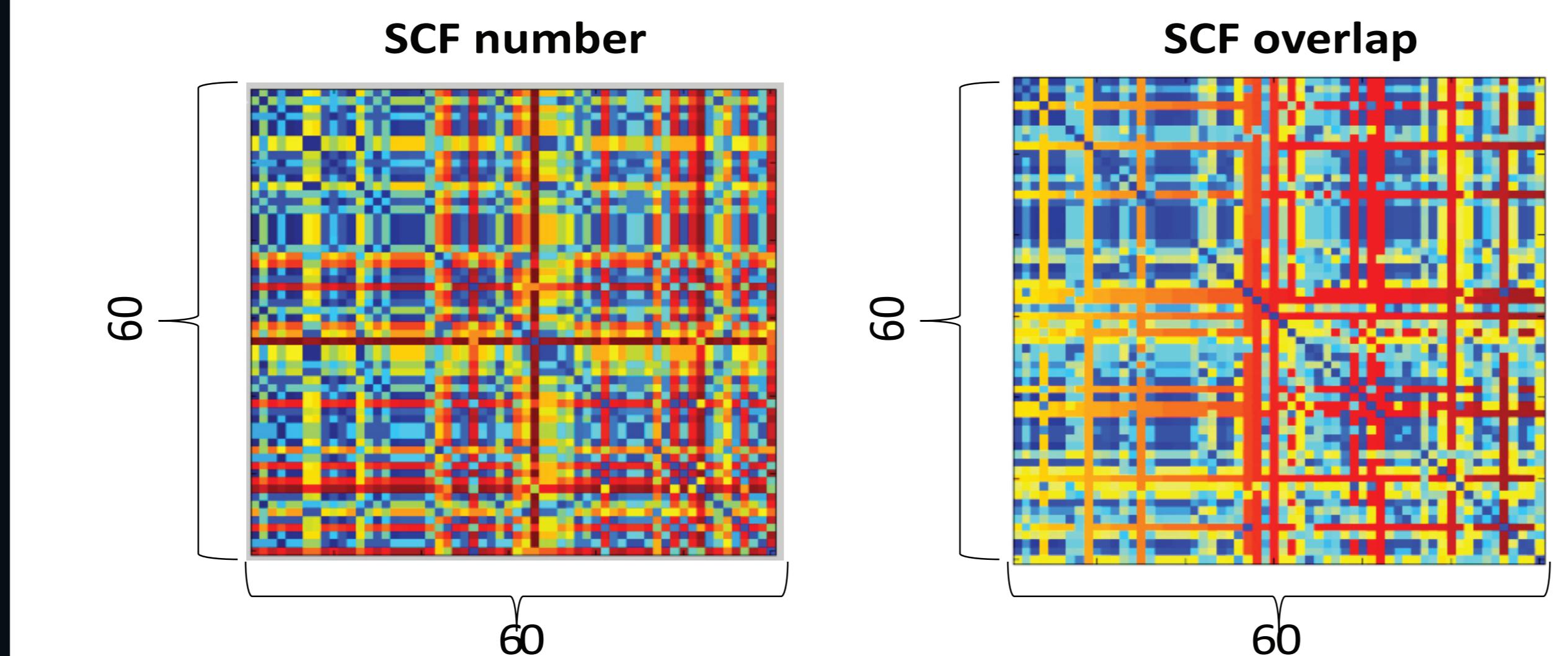
RSA Method and Models

Schematic overview of the RSA 'Searchlight' for EMEG data



Detector models:

- **Inflectional processing** - all inflections evoke a similar processing strategy
- **Derivational processing** - all derivations evoke a similar processing strategy



Parametric models (run on verbal trials only):

Tests when the information about verbs' subcategorisation frames (SCFs) is accessed;

- **SCF number** - information about the number of SCFs associated with verbs; (similar number = similar activation);
- **SCF overlap** - measures similarity in SCFs between pairs of verbs; more overlap = more similar activation;
- All models were tested on Predicted and Unpredicted trials separately.

Conclusions

Predicted and Unpredicted inflections evoke distinct processing strategies:

- Unpredicted inflections are similar to inflections presented in isolation [5,6,9] - undergo decompositional processing involving LH frontotemporal areas after suffix onset;
- For Predicted inflections post-suffix decompositional processing was not detectable (consistent with predictive processing accounts).

Searchlight RSA showed that specific syntactic (SCF) information related to verbs can be activated predictively before it is confirmed auditorily:

- Syntactic information was accessed early in LH posterior temporal areas (STG/MTG), SMG and LIFG (BA 47, 45), starting -160 ms before suffix onset. These LH areas are related to various aspects of lexico-syntactic information processing [7,8].

References

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