A meta-analytic perspective on data sharing and reproducibility in cognitive neuroscience of sign language

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Pre-TISLR13 Workshop "Doing Reproducible and Rigorous Science with Deaf Children, Deaf Communities, and Sign Languages: Challenges and Opportunities", Humboldt-Universität zu Berlin, 23rd September 2019

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Why carry out meta-analyses?

Meta analyses quantitatively consolidate effects across studies.

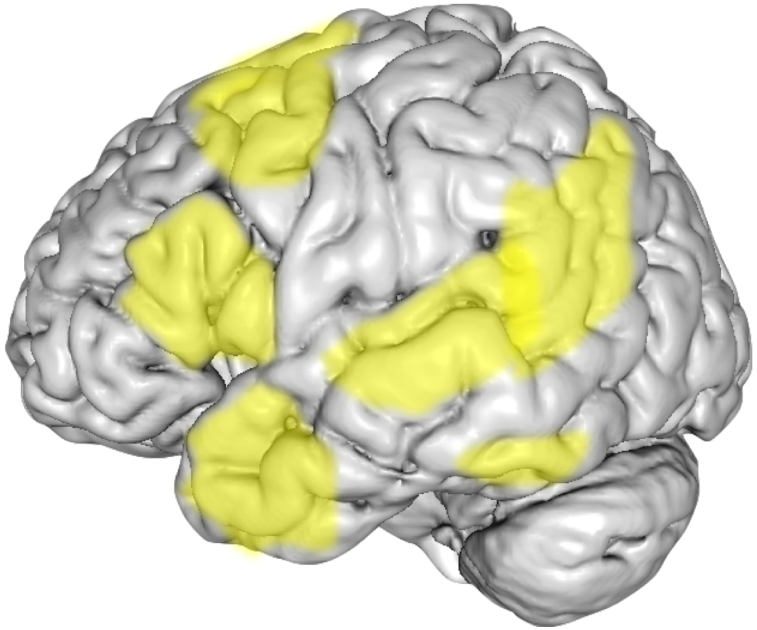
Single studies are …

- frequently underpowered (small *N*);
- strongly influenced by experimental and analysis procedures;
- replications are rare.

Müller et al., 2018; Turner et al., 2018

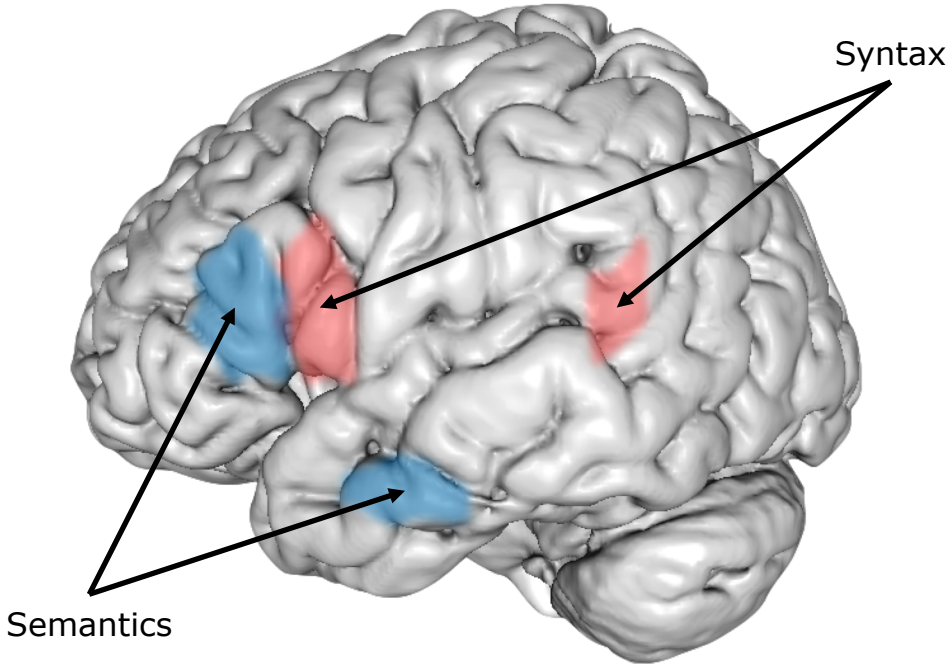
Example: Meta-analyses of verbal language processing

Verbal language comprehension



N studies = , N subjects = 742

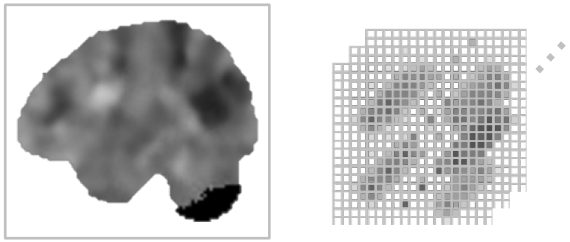
Linguistic subsystems revealed



N studies = 19, N subjects = 295

Walenski et al., 2019; Zaccarella et al., 2017

Meta-analysis techniques in neuroimaging

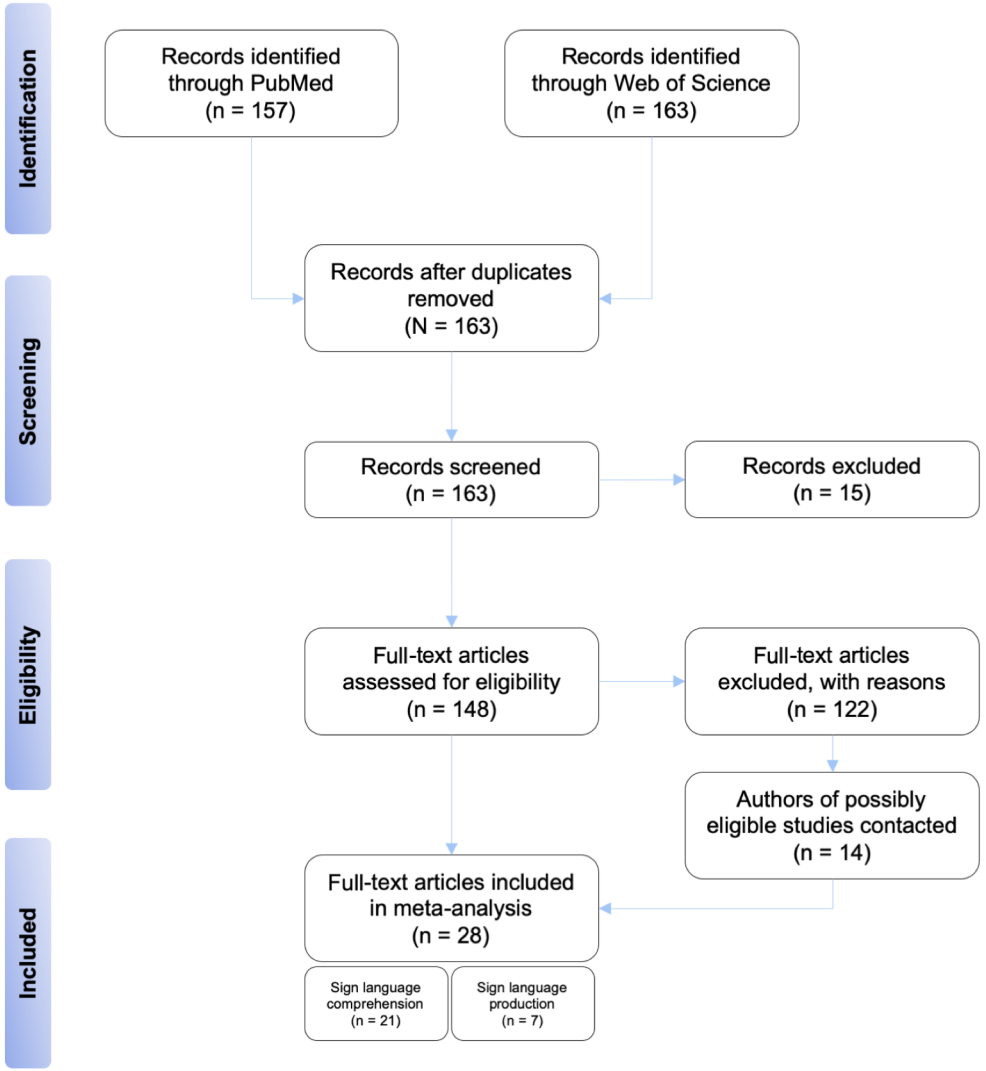
	Image-based	Coordinate-based
Data:	Full statistical images from original studies 	Peak coordinates reported in papers

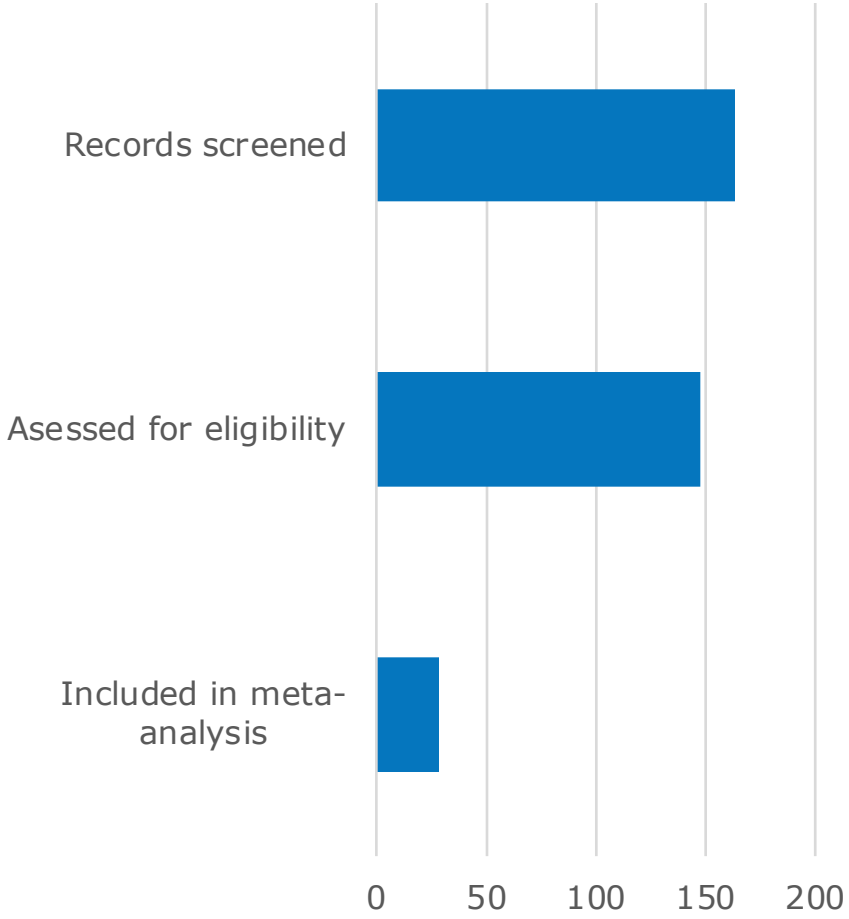
x	y	z
−44	34	−8
−52	28	10
−50	12	16
−46	22	22
−42	22	20

Analysis method:	Hierarchical mixed effects models (can account for intra-study variance and random inter-study variation)	• Activation Likelihood Estimation (ALE) • …

Eickhoff et al., 2009, 2012; Müller et al., 2018; Salimi-Khorshidi et al., 2009; Turkeltaub et al., 2002, 2012

What data can we get hold of?





Trettenbrein et al., submitted

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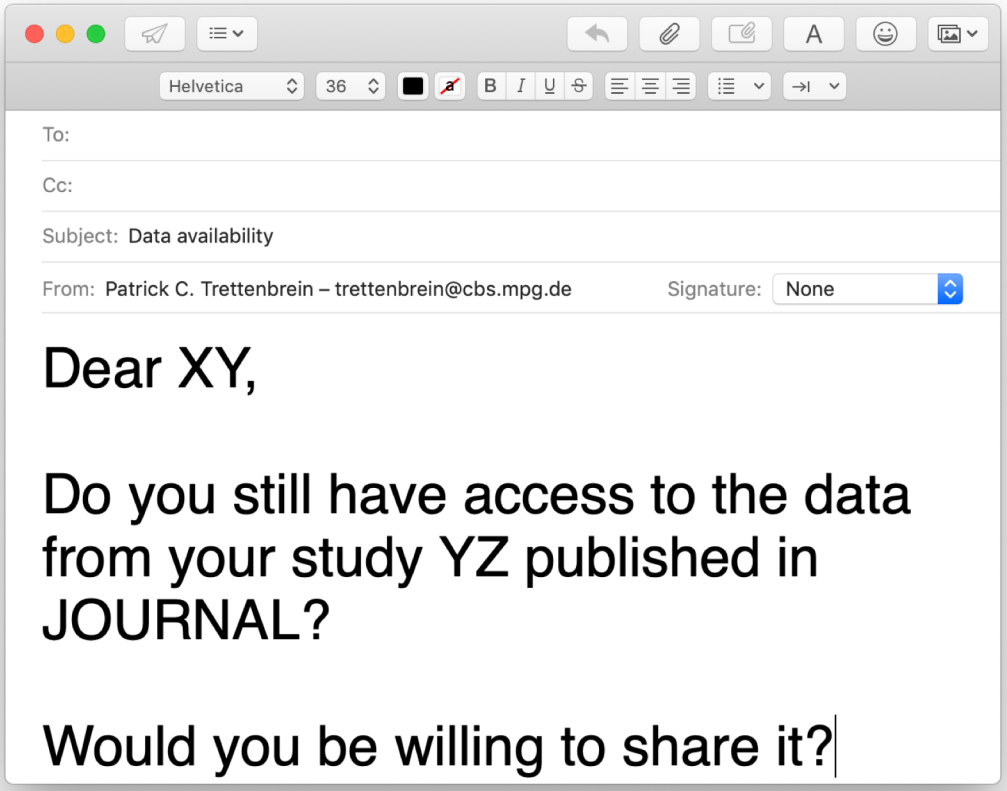

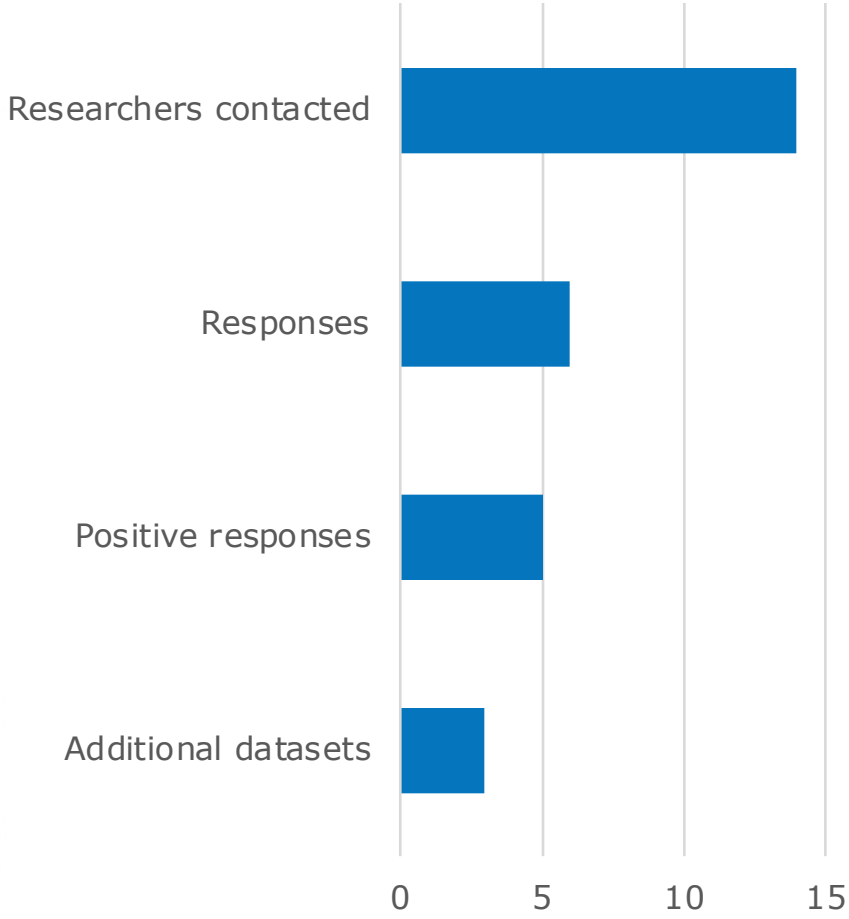

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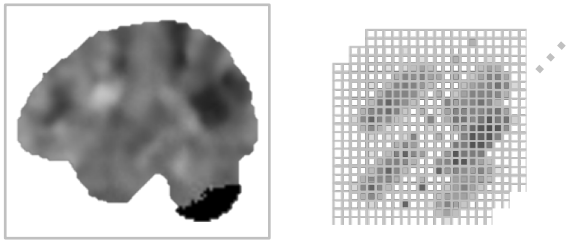
Data:	Full statistical images from original studies 	Peak coordinates reported in papers x y z −44 34 −8 −52 28 10 −50 12 16 −46 22 22 −42 22 20
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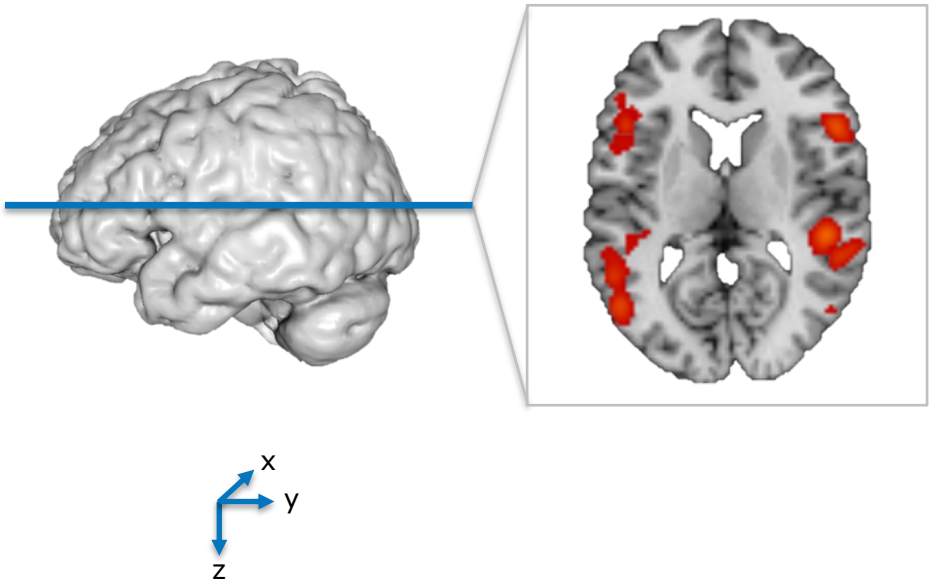
What data did we end up looking for?

Cluster analysis on whole-brain statistical parametric map → Peak coordinates → Results reported in papers



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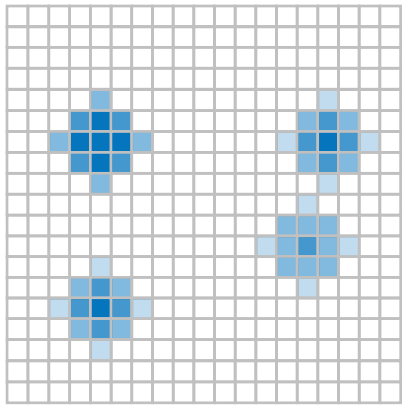
What can we do with this information?

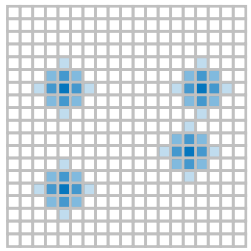
Fit Gaussian kernels to peaks → For all studies matching criteria → Compile data → (Activation Likelihood Estimation) → Thresholded ALE map

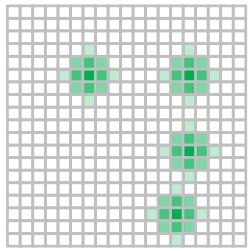


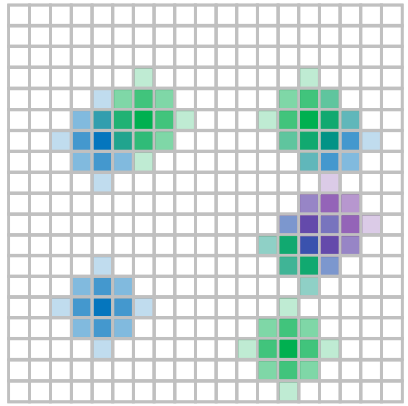
blurred by *N*

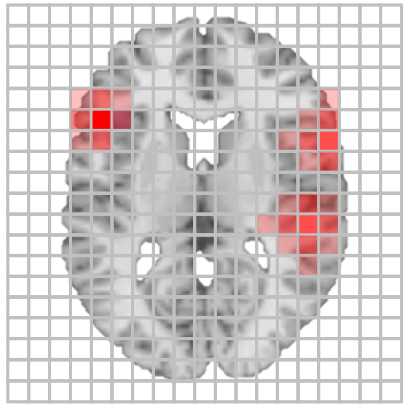
study 1

study 2



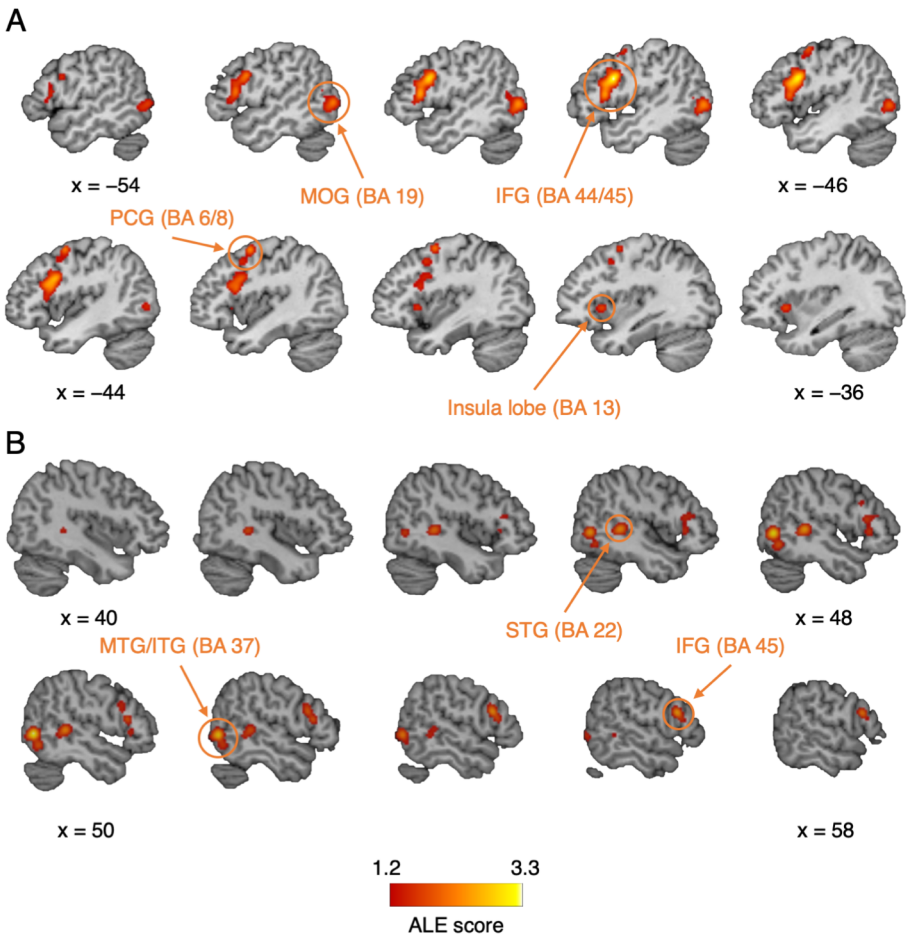






Eickhoff et al., 2009, 2012, 2017; Turkeltaub et al., 2012

Example ALE results: Sign language comprehension



For details visit our poster @TISLR13:

"The neural basis of sign language processing in deaf signers: An Activation Likelihood Estimation meta-analysis"

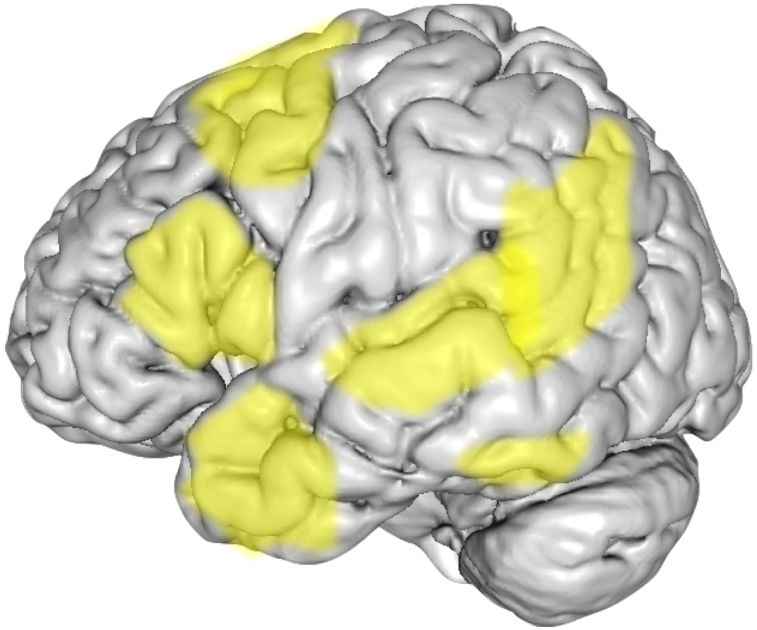
Poster number: 50

Poster session 3 (Saturday, 28th September 2019, 16:30-17:30)

Trettenbrein et al., submitted

Recall meta-analyses of verbal language processing

Verbal language comprehension



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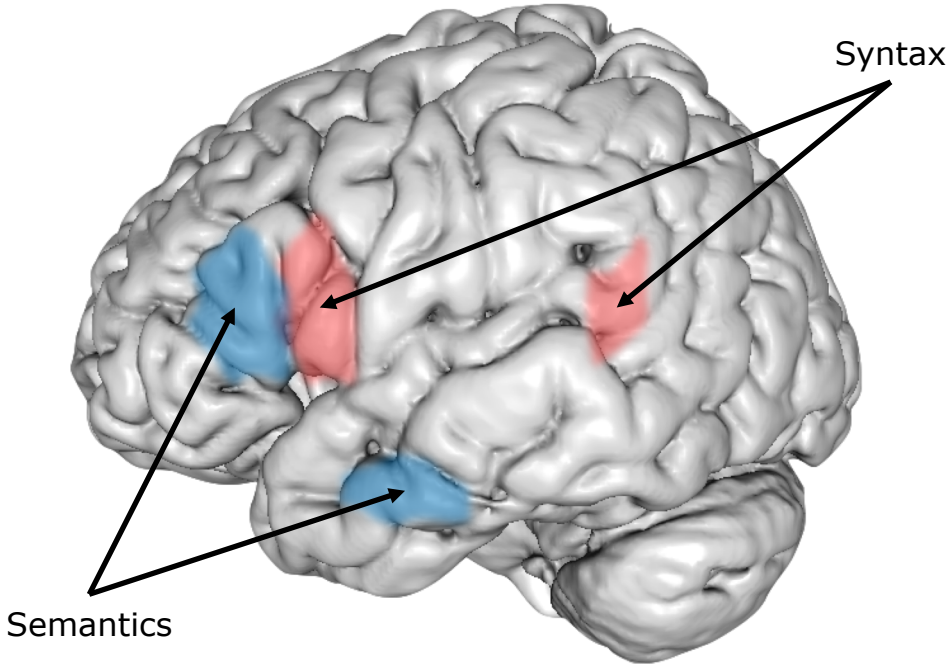

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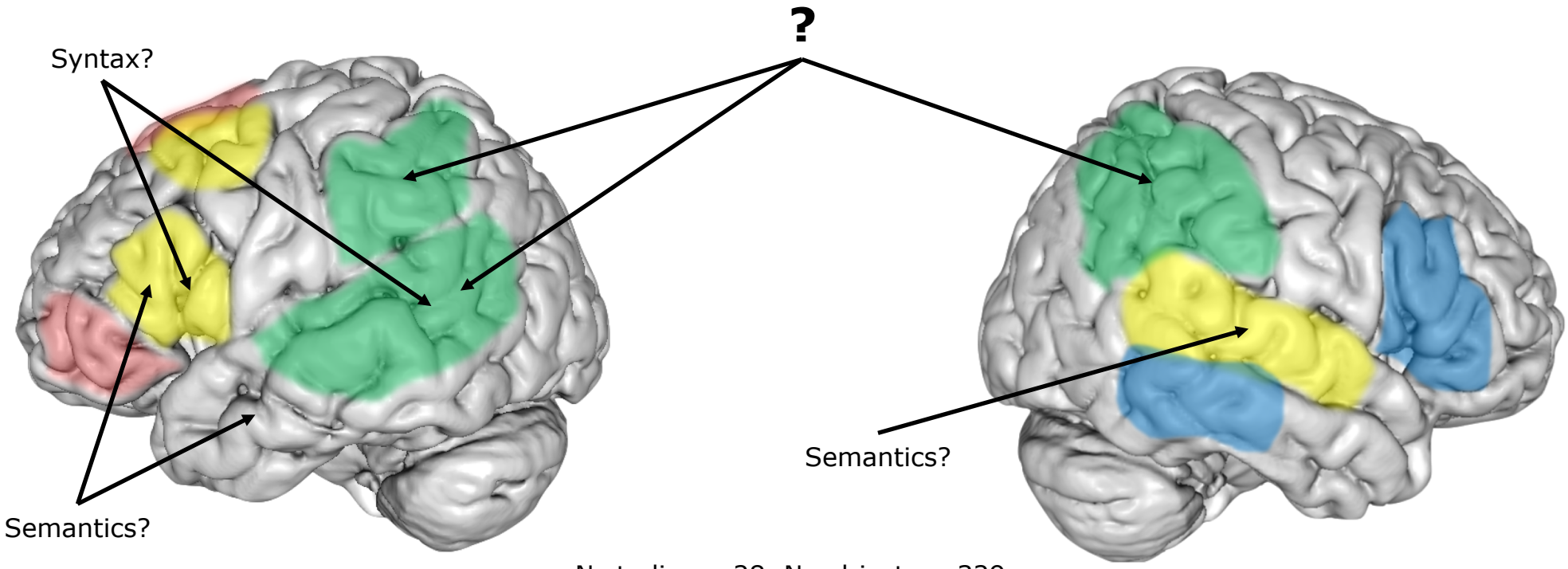
What would we like to know about sign language?



Emmorey, 2015; MacSweeney et al., 2008; Trettenbrein et al., submitted

Some suggestions: Legal prerequisites

Make getting subjects' consent for data sharing the standard practice for your project (even better: in your lab).

Einwilligungserklärung zum Datenschutz

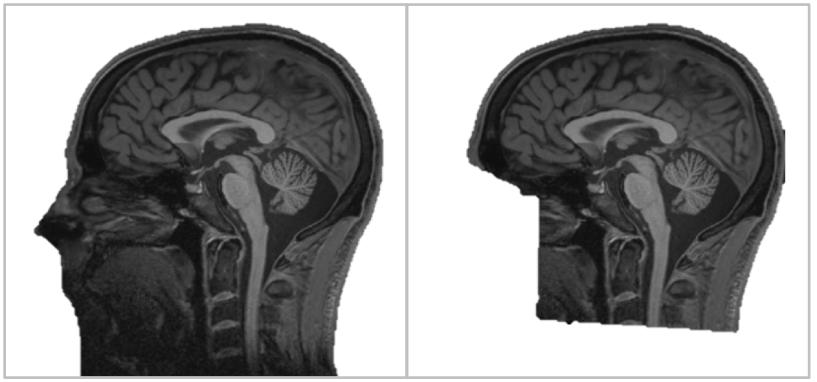
1. Die von mir in dieser Studie erhobenen Daten dürfen vom Max-Planck-Institut für Kognitions- und Neurowissenschaften (MPI-CBS) im Rahmen wissenschaftlicher Forschung genutzt werden.

2. Die erhobenen Daten werden unter Wahrung der datenschutzrechtlichen Bestimmungen pseudonymisiert in Papier- oder digitaler Form aufgezeichnet, gespeichert und wissenschaftlich ausgewertet. Die Zuordnung von Daten zu meinem Namen und meinen Kontaktdaten kann nur über die interne Datenbank des MPI-CBS hergestellt werden. Diese Datenbank ist nach aktuellen Standards gesichert und unterliegt einer strikten Zugangskontrolle.

General Data Protection Regulation (GDPR) of the European Union

Some suggestions: Prepare you data for sharing

- Anonymize your data.
- Deface your images (e.g., Freesurfer, pydeface).
- Organize your data in a way that is accessible to others and your later self (e.g., BIDS)



BIDS
BRAIN IMAGING DATA STRUCTURE

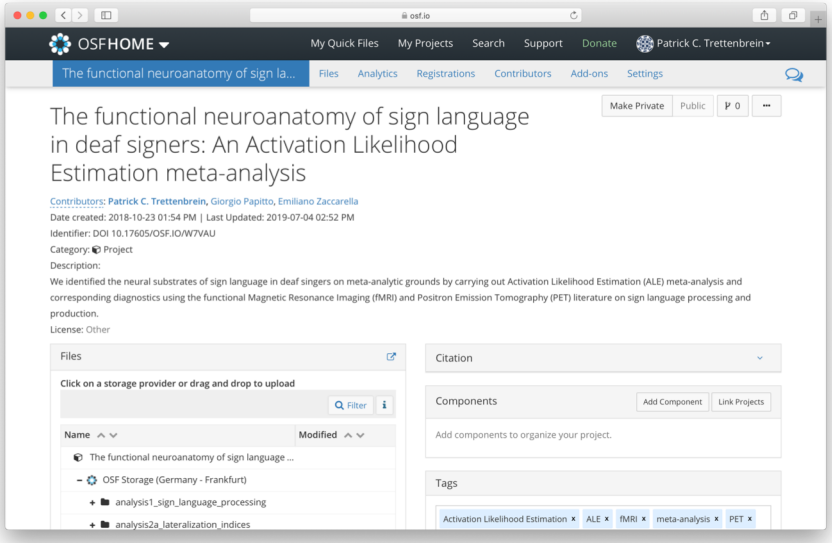
https://bids.neuroimaging.io

Gorgolewski et al., 2016

Some suggestions: Share your data

Use the Open Science Framework (OSF) to share your data with others.

- It's free!
- Data is publicly archived.
- OSF has funds and a plan to guarantee data availability.
- You can share any kind of data, scripts, etc. that you think are relevant for others to reproduce your science.



DOI: 10.17605/OSF.IO/W7VAU

Summary

- Old original data are ”lost”.
- ALE method allows to use published peaks of activation retrieved from publications.
- In the future, the availability of publicly archived full statistical images is highly desirable.
- We should set up our projects in an “open data spirit” from the very beginning.

Take-home message

Public availability of full statistical images will …

(i) allow others to reproduce your analysis and results;

(ii) allow others to re-analyze your data (e.g., using uniform analysis pipelines and thresholds in future meta analyses).

(iii) help to generate a more complete meta-analytic picture of the signing brain by integrating image-based methods with current findings from ALE.

MAX PLANCK INSTITUTE FOR HUMAN COGNITIVE AND BRAIN SCIENCES LEIPZIG

Thank you!

Anna Bliß
Anna Carthaus
Angela D. Friederici
Astrid Graessner
Josephine Hoffmann
Matteo Maran
Giorgio Papitto