

Euro-BioImaging Proof-of-Concept Studies Perspective

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Bergen fMRI group
University of Bergen**

Current challenges in life-science

- What are causes of dementia?
- What are the neuronal correlates (and causes) of psychiatric disorders?
- Which prognostic parameter are accessible with neuroimaging, e.g. in stroke patients?
- Individualized therapy and therapy monitoring with neuroimaging

Current challenges in neuroimaging

- Limited sensitivity to subtle processing differences
- Limitation in imaging and analysis infrastructure

Possible solution

- Improved (f)MRI techniques
- Connectivity and network measures
- Multimodal integration
- New analysis tools
- Longitudinal studies

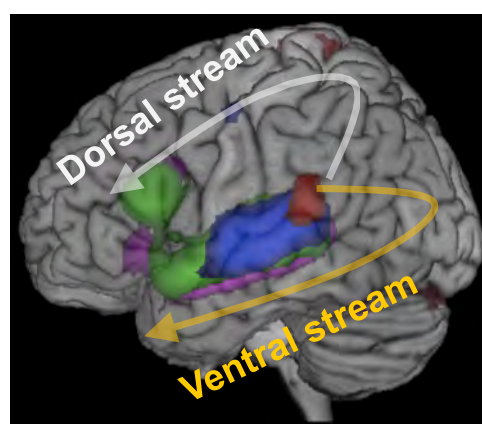
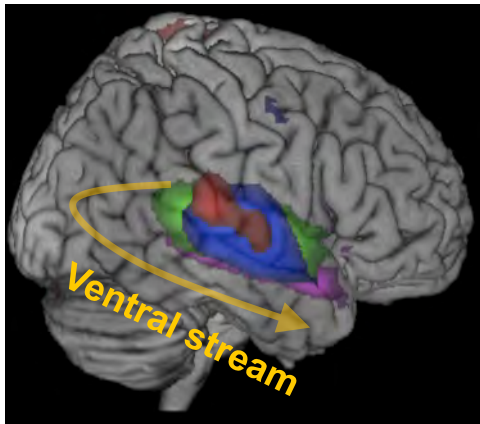
→ Open Access Facilities

Proof of Concept Study

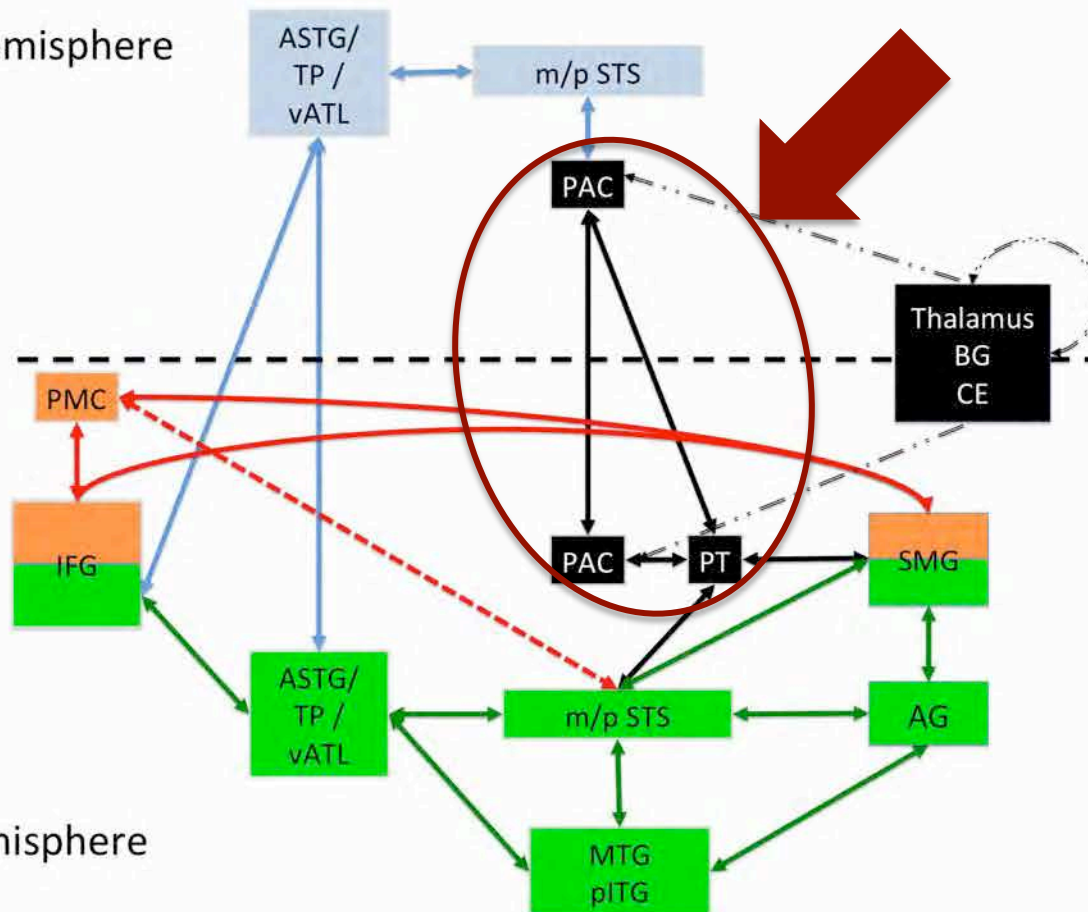
- Speech perception depends on an interplay of the left and right auditory cortex
- Left and right auditory cortex processes different aspects of a speech signal
- Transcallosal connections provide structural basis for information integration
- Clinical background:
 - Disturbed phonological processing in dyslexia
 - pSTG atrophy in patients with auditory verbal hallucinations
 - Rehabilitation after sudden, unilateral hearing loss
 - Temporal lobe stroke & Recovery

Enabling Excellent Research

model



Right hemisphere



Ventral stream (R):

- Voice processing
- Prosody

Dorsal stream (L):

- Auditory-motor integration

Ventral stream (L):

- Sub-lexical and lexical processing
- Semantics
- Syntax and combinatorial network

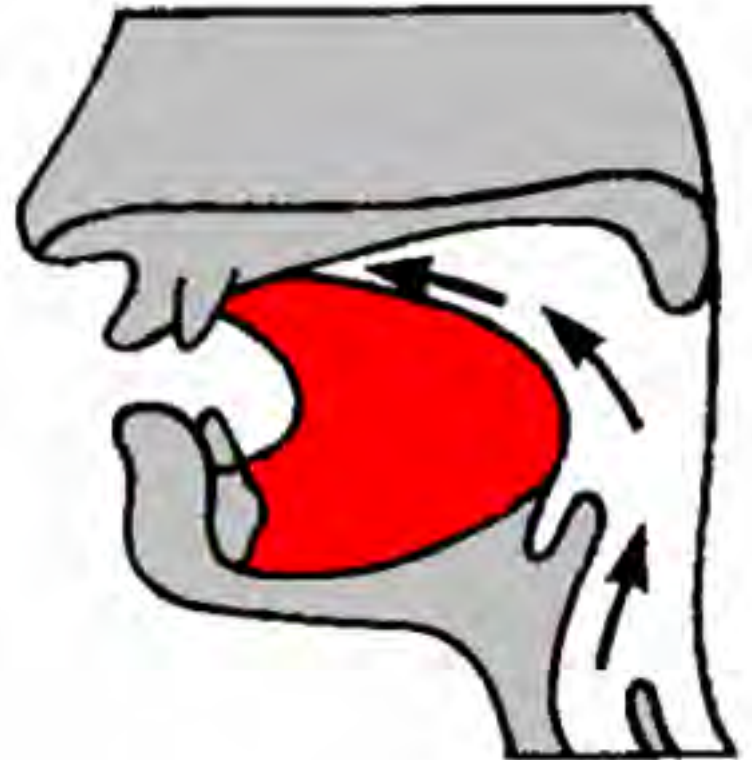
Left hemisphere

Place of articulation (PoA)

Bilabial: /ba/ & /pa/

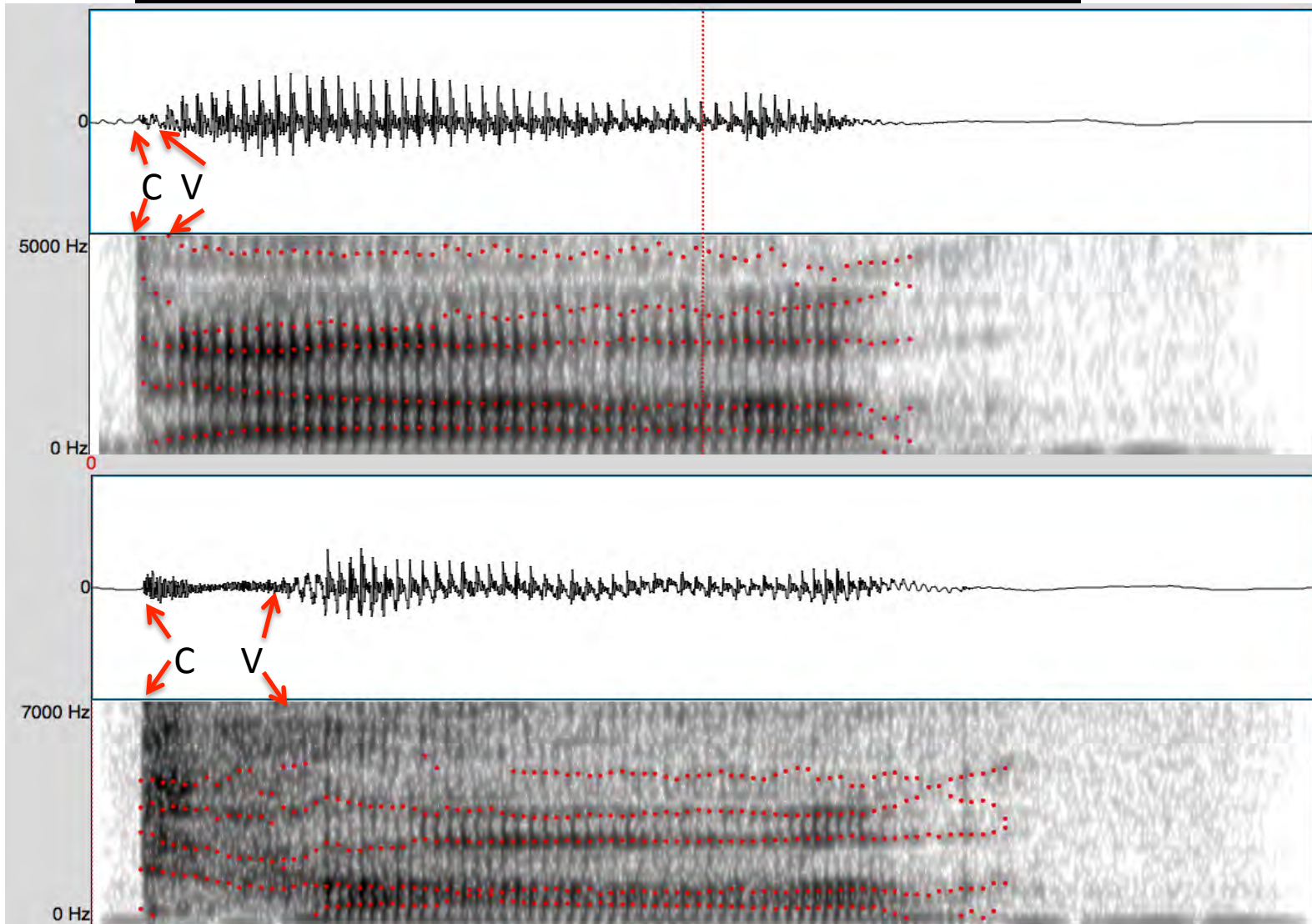


Alveolar: /da/ & /ta/



Voice Onset Time (VOT)

/da/



/ta/

Proof of Concept Study



Bergen fMRI group

- Research
 - Auditory perception / Speech perception
 - Lateralisation / Functional Asymmetry
 - Auditory hallucinations in schizophrenia
- Equipment:
 - 3T GE Signa
 - (MR compatible) EEG
 - TMS
- No human 7T in Norway

Proof of Concept Study



PCS partner institute:

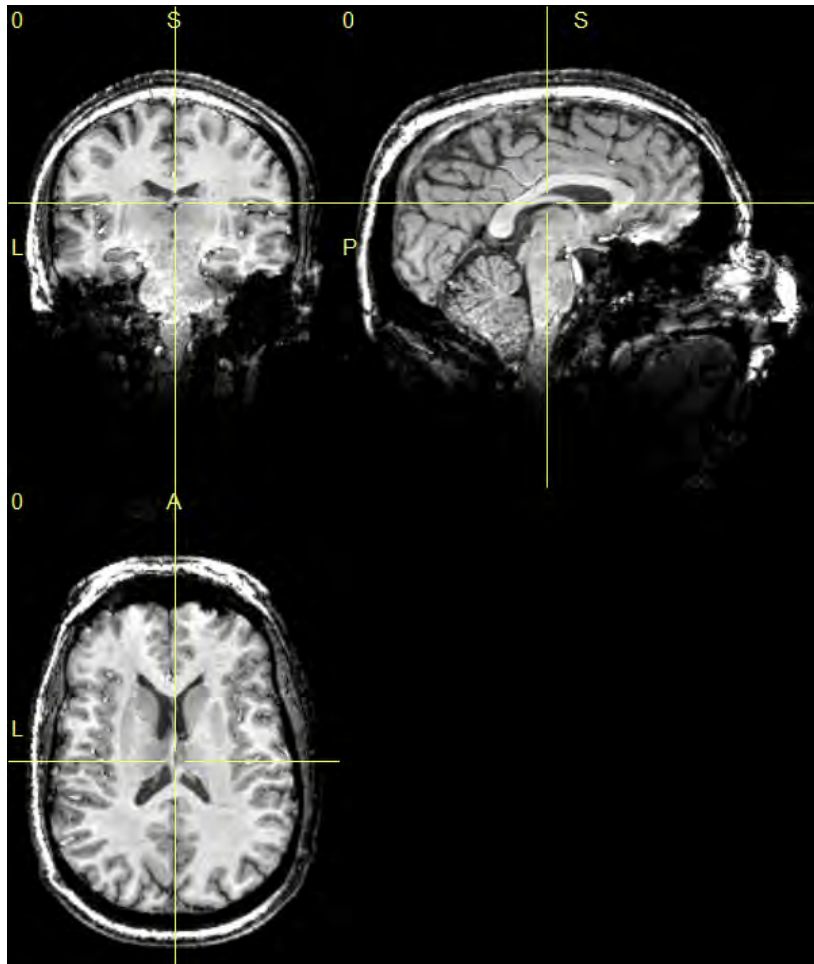
- 7T MRI facility in Magdeburg, Germany



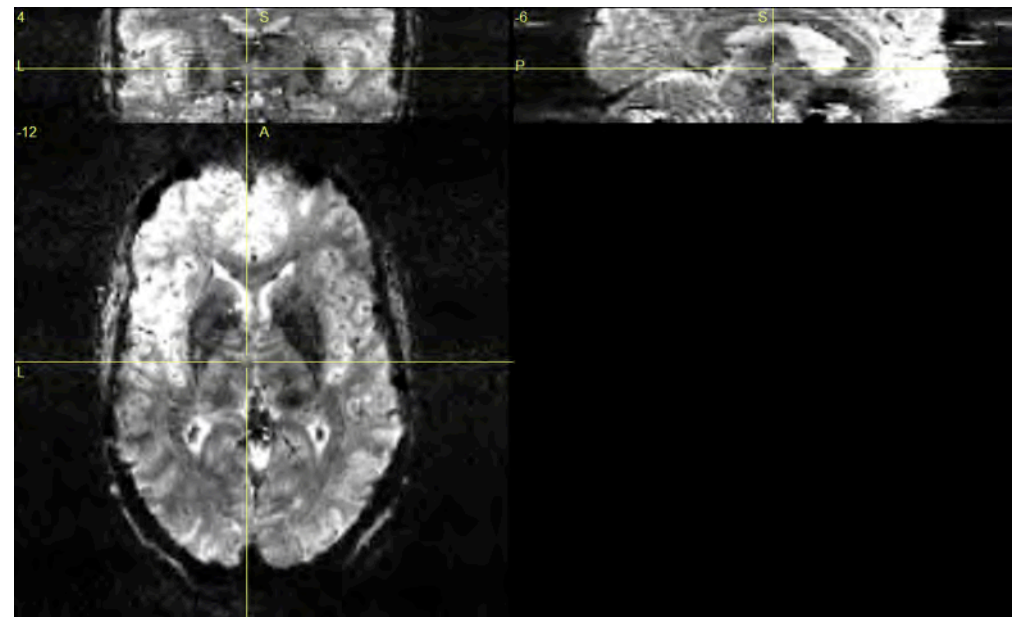
Proof of Concept Study

- 7T high-resolution fMRI with 1.5 mm voxel size
- 23 subjects
- Paradigm:
 - 8 Syllables: /ba/, /bo/, /da/, /do/, /pa/, /po/, /ta/, to/
 - 8 speaker (4 men, 4 women)
 - PoA, VOT, and side of presentation (left, central, right)
 - DL presentation
- Diffusion tensor imaging (DTI)
- Excellent support by the local staff !

Proof of Concept Study

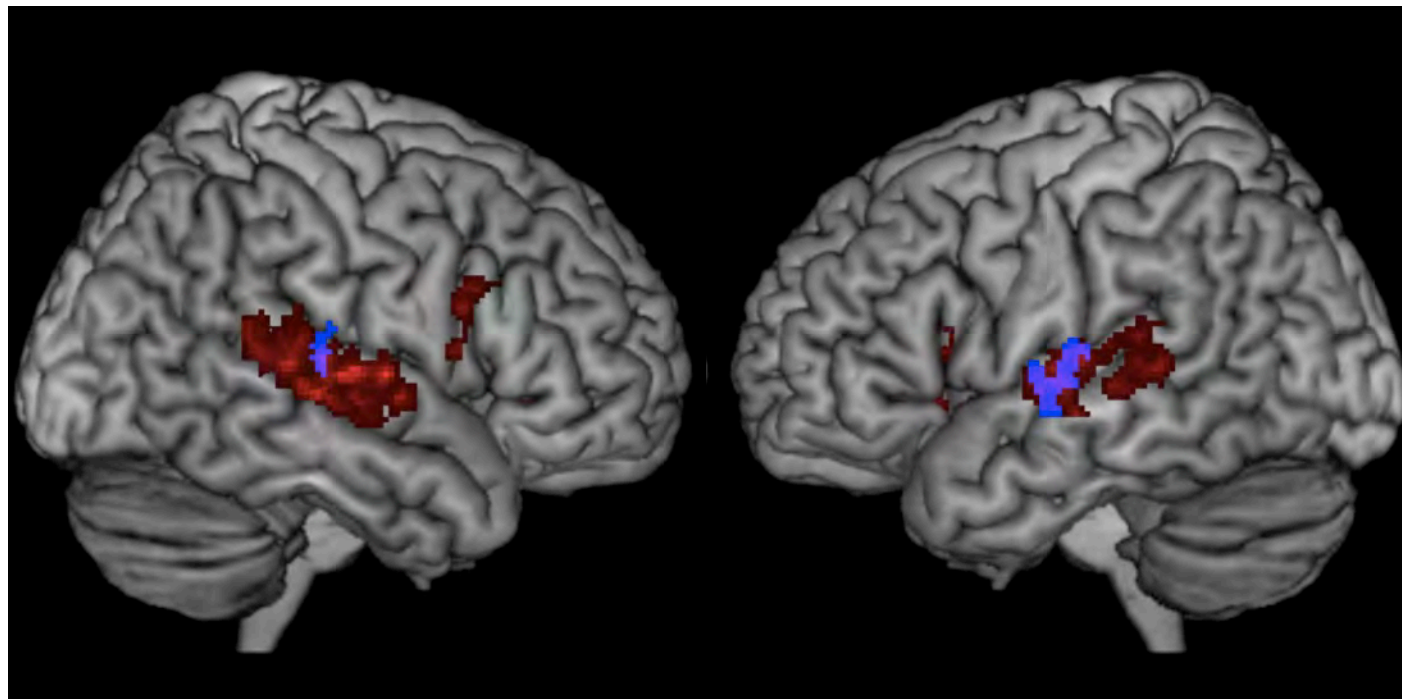


- High resolution fMRI with 1.4 x 1.4 x 1.4 mm voxel, 37 slices, and online movement and artefact correction



Proof of Concept Study

- 1. Bilateral activations for phonetic perception, but stronger left lateralised for alveolar syllables



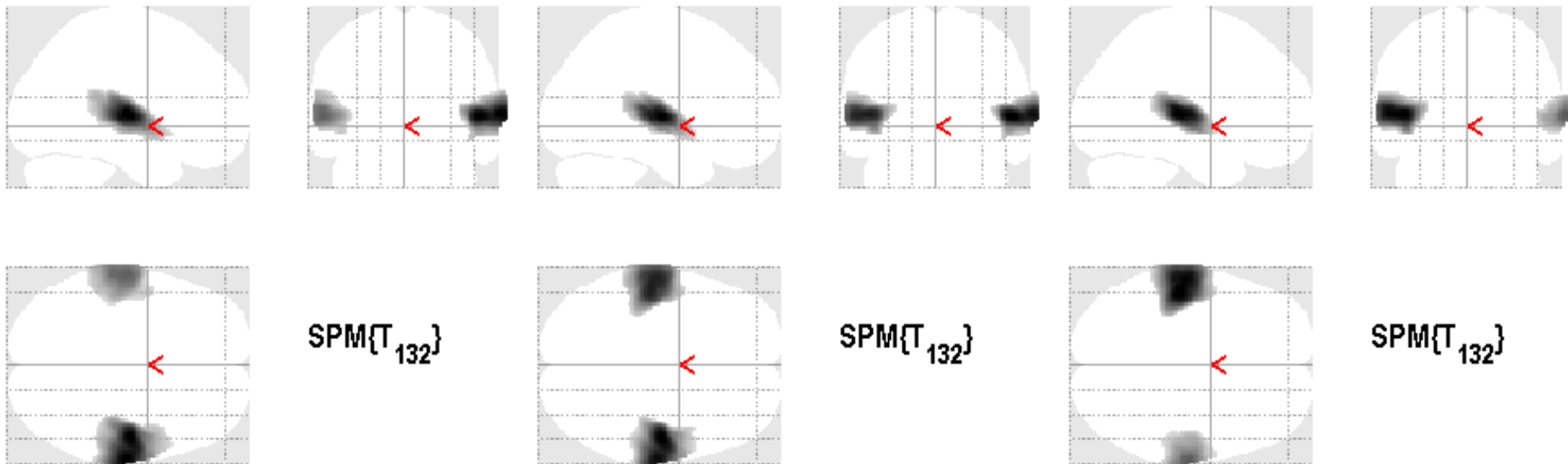
Proof of Concept Study

- 2. Bilateral activations for left, central and right sided presentations

Left

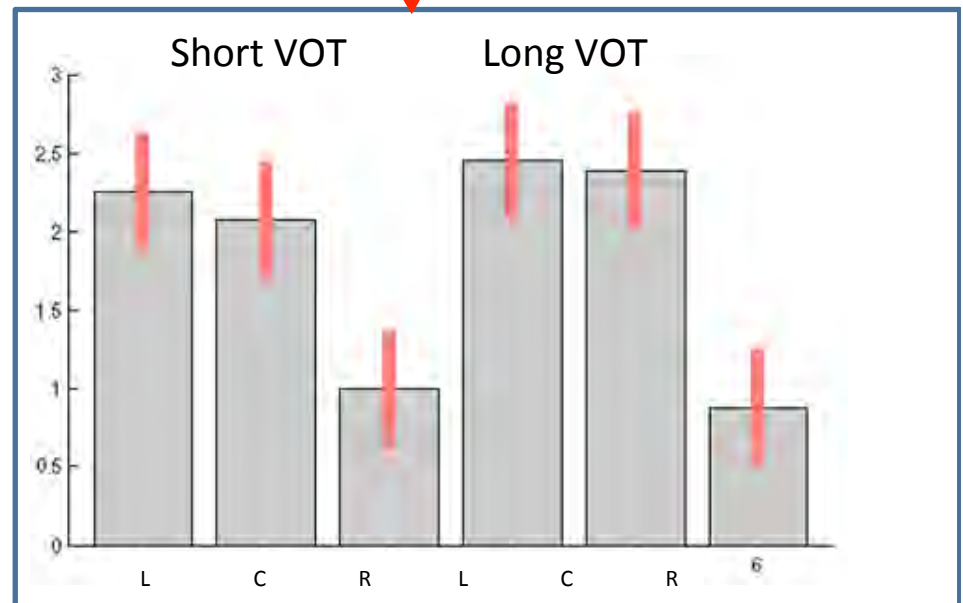
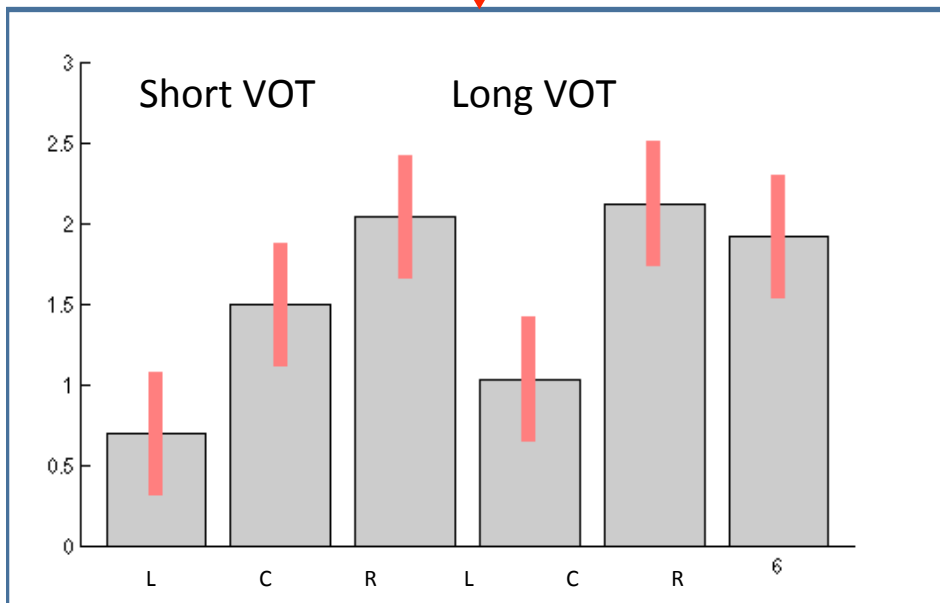
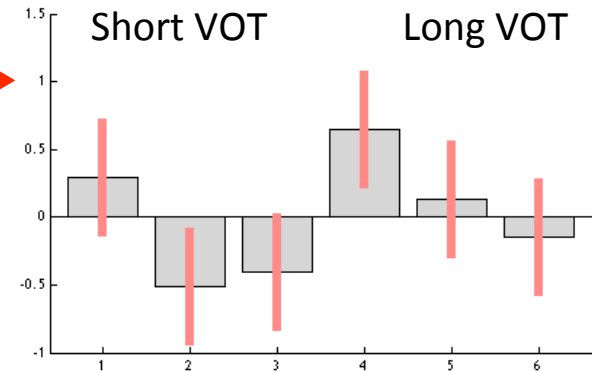
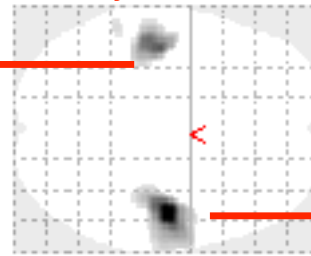
Central

Right



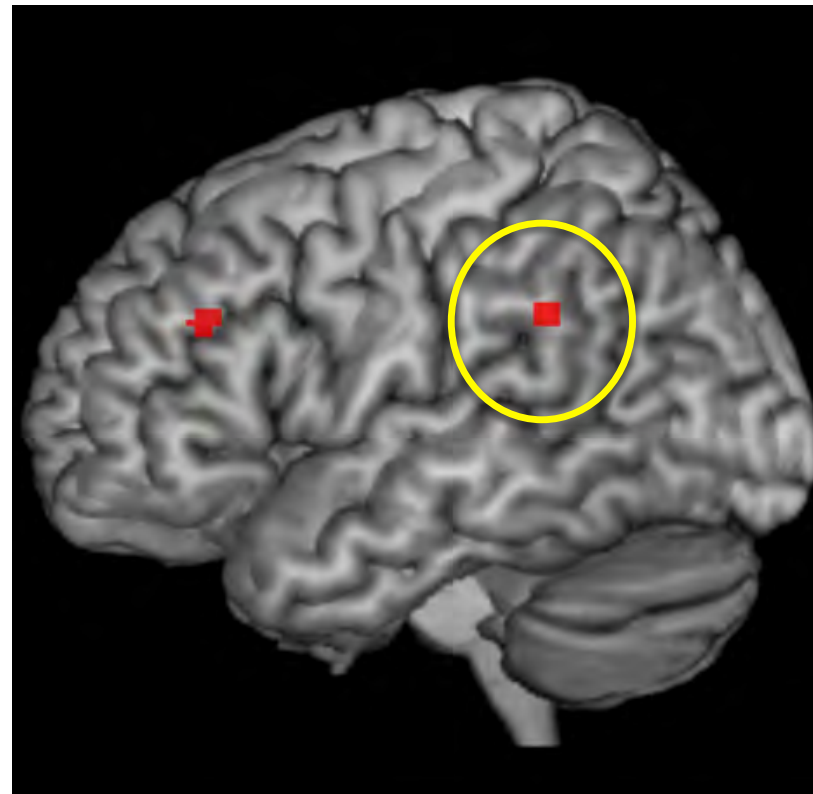
Proof of Concept Study

3. Main effect side

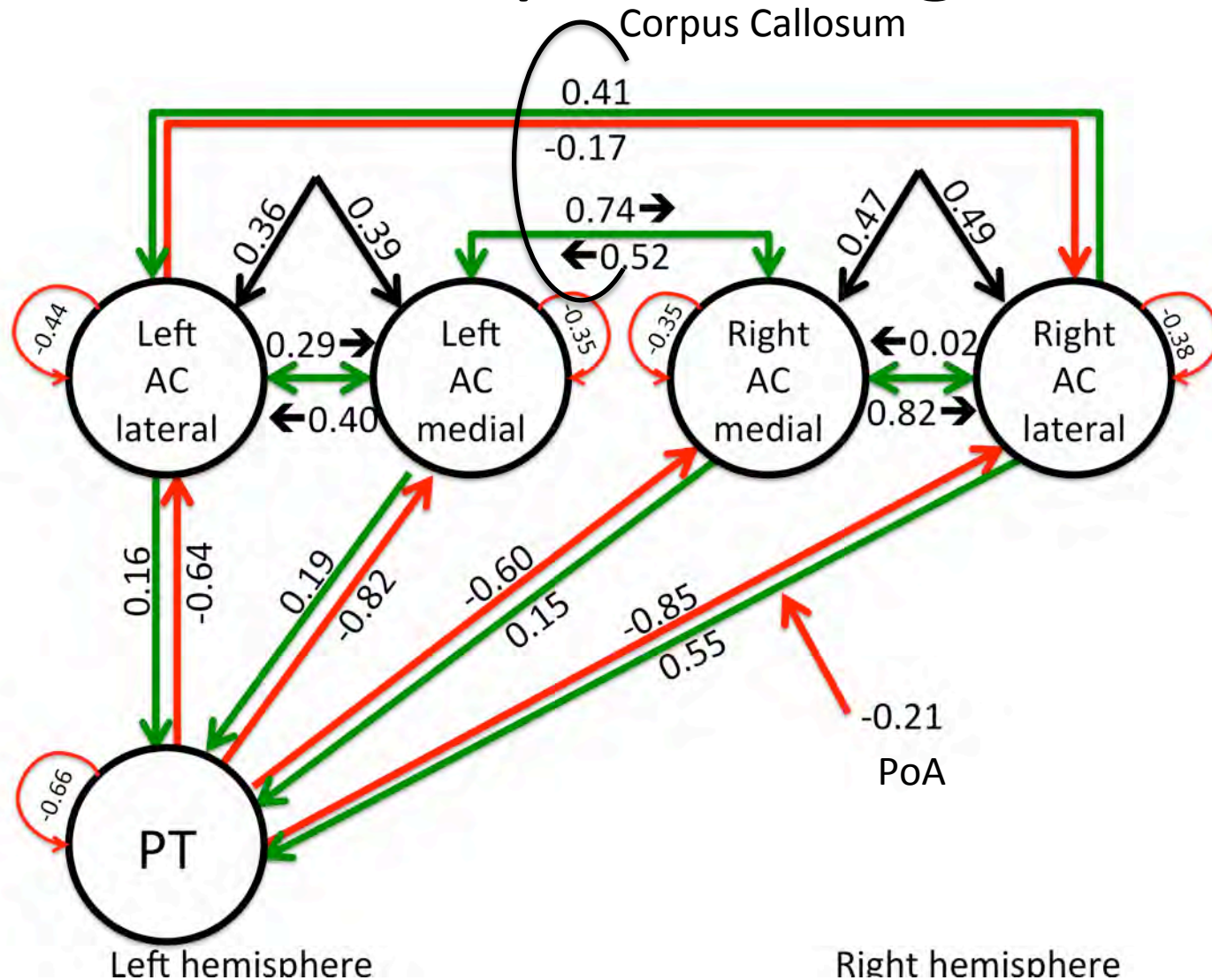


Proof of Concept Study

4. Strongest activation of left PT/SMG when processing CV-syllables, presented to the ipsilateral ear



Differential processing of PoA



Open Access Facilities

- Open Access Facilities (OAF) bridge the gap between required and locally available resources
- It provides options for in-depth analyses
- It allows “higher-order” hypothesis testing
- It is a cost efficient extension of ongoing research
- It enables small research groups to conduct high impact research



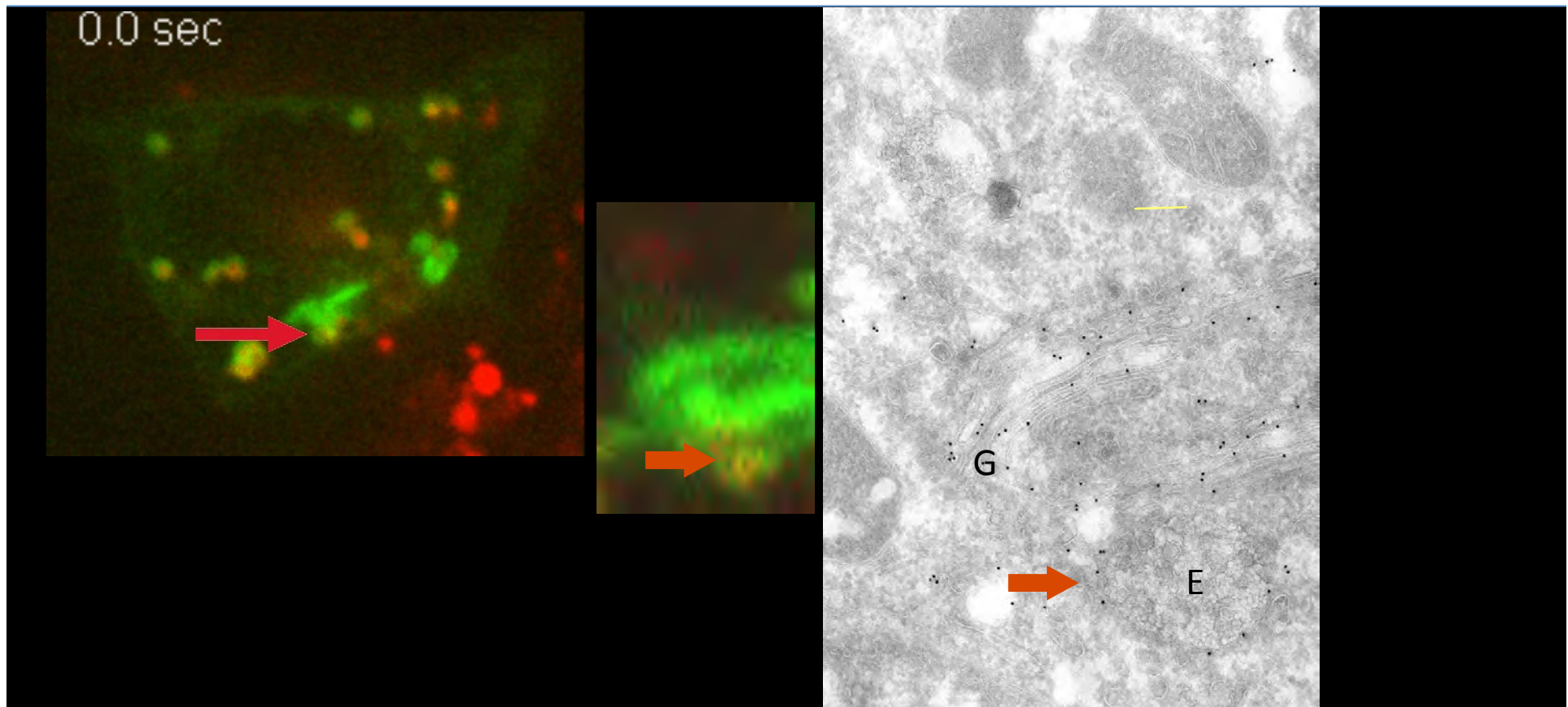
Thank you

Euro-BioImaging Proof-of-Concept Studies Perspective

**Judith Klumperman
University Medical Centre Utrecht**

Proof Of Concept (POC) node for Correlative Light and Electron Microscopy (CLEM)

Integration of light or live cell imaging with and electron microscopy on the same sample



Proof Of Concept (POC) node for Correlative Light and Electron Microscopy (CLEM)

- Inventory of possible Proof Of Concept sites; 13 approached; 10 applied

In consultancy with the EuroBioImaging staff 4 sites selected based on:

- technological excellence, leading in Europe
- ability to provide open access
- complementarity
- geographical distribution

Proof Of Concept (POC) node for Correlative Light and Electron Microscopy (CLEM)

Facility	Scientific Director
Cell Microscopy Centre UMC Utrecht & Department of Molecular Cell Biology UMC Leiden NETHERLANDS	Judith Klumperman & Bram Koster
Wolfson Bioimaging Facility University of Bristol, UK	Paul Verkade
Telethon Electron Microscopy Core Facility Napoli, ITALY	Alberto Luini & Roman Polishchuk
Imaging Center IGBMC-CERBM Strasbourg-Illkirch FRANCE	Yannick Schwab (Now EMBL)

Why is microscopy important?

Microscopy is a key enabling tool for top level research in the Life and Health sciences

Many Medical and Life Science research questions apply to processes that cannot be seen by the human eye, this makes the microscope probably the most widely used scientific instrument in the world



Why is open access to microscopy important?

Modern microscopy encompasses a wide range of techniques; each of which requires specific equipment and expertise

- microscopy infrastructure is expensive
- science is multidisciplinary; 1 project often requires multiple microscopy techniques
- the ultimate yield and quality of microscopy research is determined by expert operators and scientific environment

⇒ not affordable by one lab or even one institute

⇒ **sharing dedicated equipment and expertise is crucial to enable future Life and Health sciences research**

Interest from scientific community

Interest in CLEM within EuroBioImaging

- EuroBioImaging POC CLEM node; 12% of WP7 requests (11 out of 91)
- Flagship CLEM node in the Netherlands
Klumperman, Gerritsen, Koster, Giepmans, Plitzko
17 Letters of Interest (Netherlands, Belgium, Spain, Germany, USA, UK, Sweden)

Open access at the CMC Utrecht

- Since 2007: 22 collaborations; 26 publications

Lessons learned: bottlenecks & solutions

1. Users are not always aware what a technique can do or which technique to choose => suboptimal use of possibilities => **Create one website as entry portal**
2. Users lack specific technical expertise => substantial practical input from provider required => **organize on-site user courses; enable hiring expert personnel dedicated to facility work**
3. Preliminary studies sometimes too limited; questions too broad
=> **Questionnaire; intake interview**
4. Expectation management: Users and Providers should have a clear understanding of what is expected and required => **set priorities, define Deliverables & Milestones, discuss time schedule**
5. Make clear and upfront agreements on division of costs.

Why would you want to provide open access?

- share your technology with others,
- broadens your network and visibility
- brings in new projects and techniques
- creates more grant possibilities
- eventually.....brings in more money for maintenance and upgrades
- it is fun and inspiring

Needed

A sound financial scheme that :

- allows Nodes to maintain and develop specific advanced microscopy technology available to a wide range of users
- provides funding to recruit a critical mass of expert operators
- offers a good balance between Institutional, National and International interests

Providers have now limited resources

Expert personnel cannot be hired ad hoc

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