

# Positron-emission-tomography (PET) applications in neuroscience

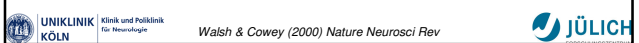
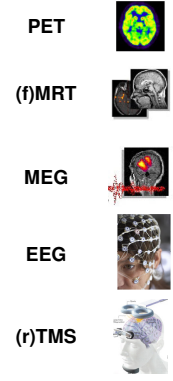
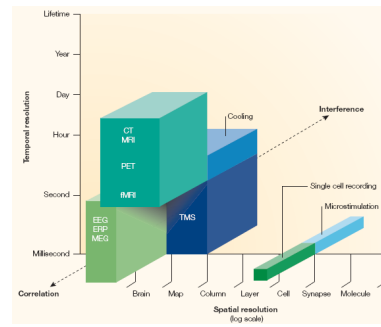


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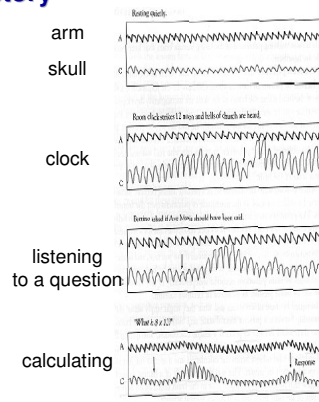
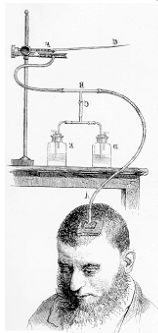


# Functional imaging: space, time and interference



# Functional imaging: history

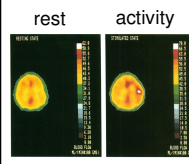
recordings of pulse waves in traumatic brain injury



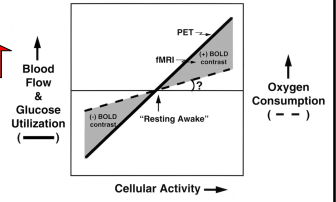
Angelo Mosso (1881)



# Functional imaging: physiology



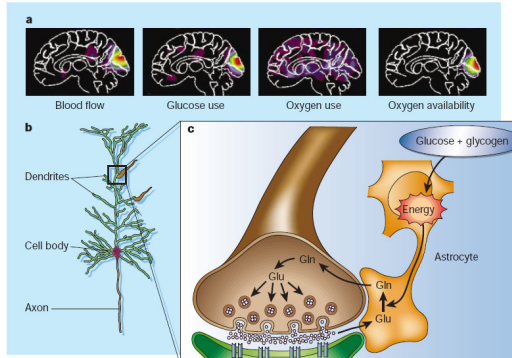
CBF (+29%)



⇒ uncoupling of CBF and CMRO<sub>2</sub>  
 ⇒ O<sub>2</sub>-concentration ↑ in active areas



## Functional imaging: physiology



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## Motor cognition: apraxia



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## Definition of apraxia

**Apraxias** are disorders of higher motor cognition, which cannot be (fully) explained by elementary motor deficits (like paresis), by disturbances of communication (e.g. aphasia) or by general cognitive deficits (as in dementia).



Typical clinical neuropsychological **symptoms of apraxia** are disturbed imitation of (abstract and/or symbolic) movements, deficits in the goal-directed use of objects and tools, and impaired dexterity during movement execution.

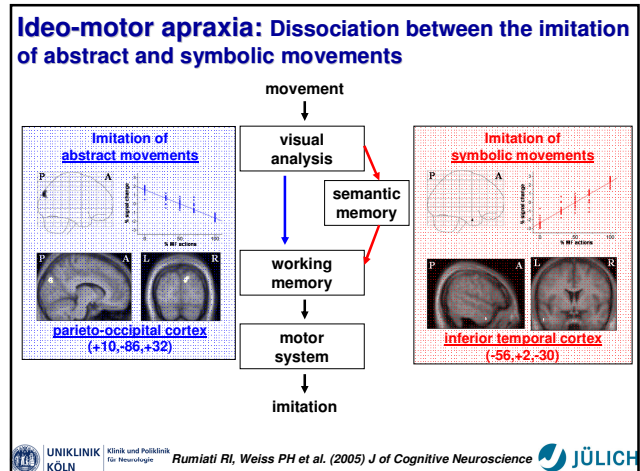
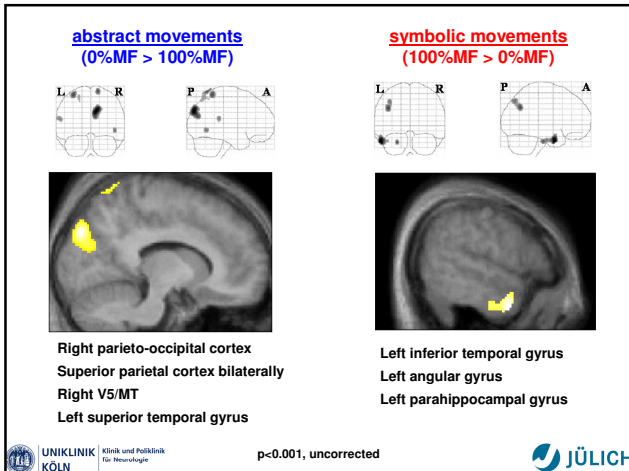
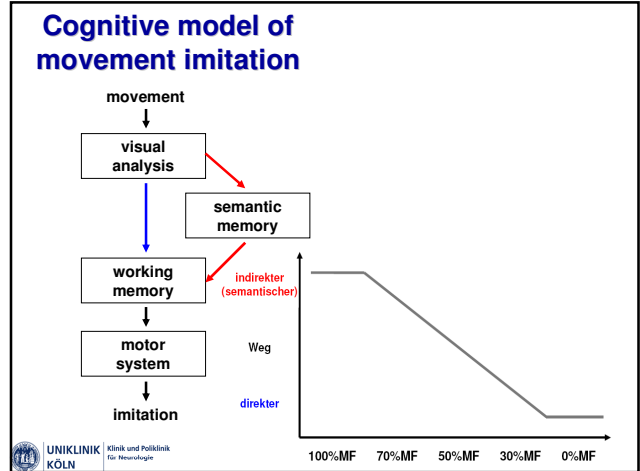
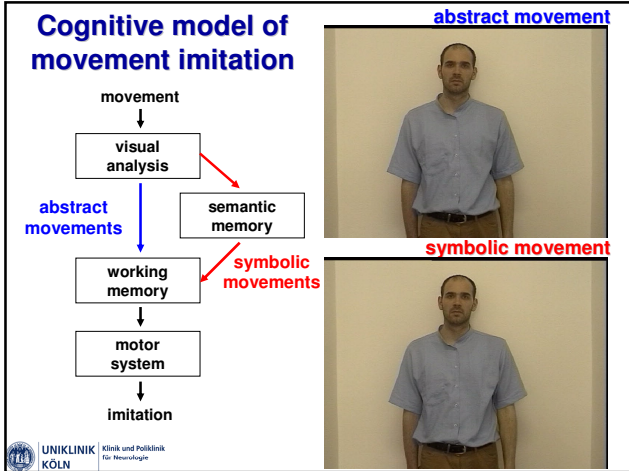
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## Ideo-motor apraxia

Disturbed movement planning („How to do“).  
Main symptom is the deficient imitation of abstract (> symbolic) movements





### Ideational apraxia

Disturbed movement concept („*What* to do“).

Main clinical symptom is the deficient object use (with preserved pantomime)



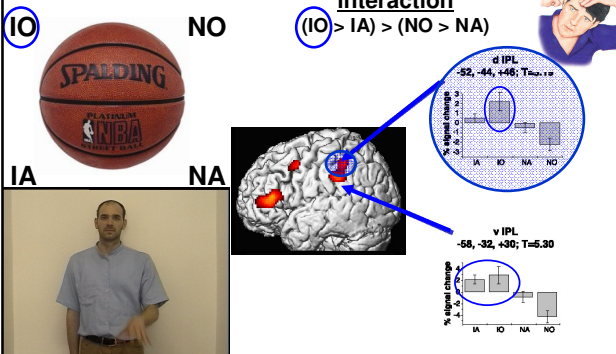
### Ideational apraxia

Disturbed movement concept („*What* to do“).

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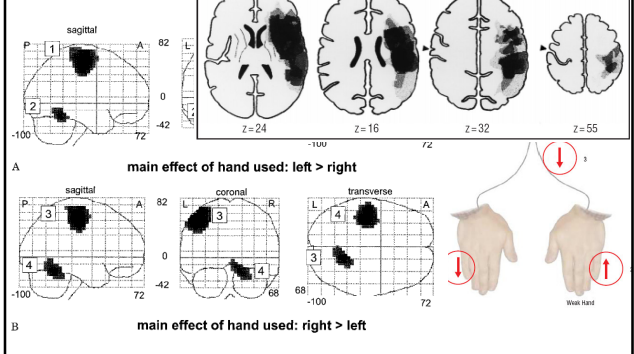


### Ideational apraxia: Neural basis of the object-trigger system

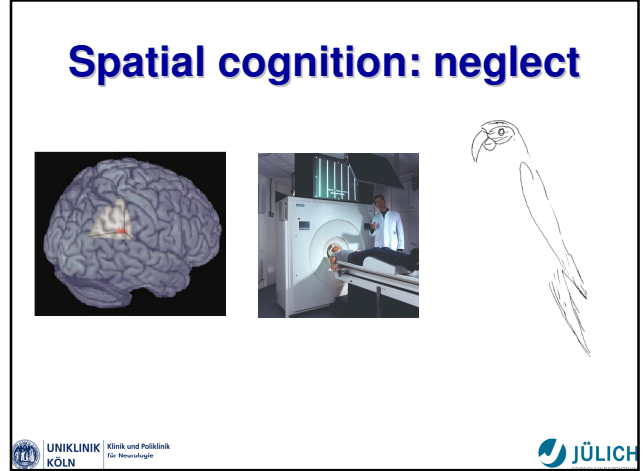
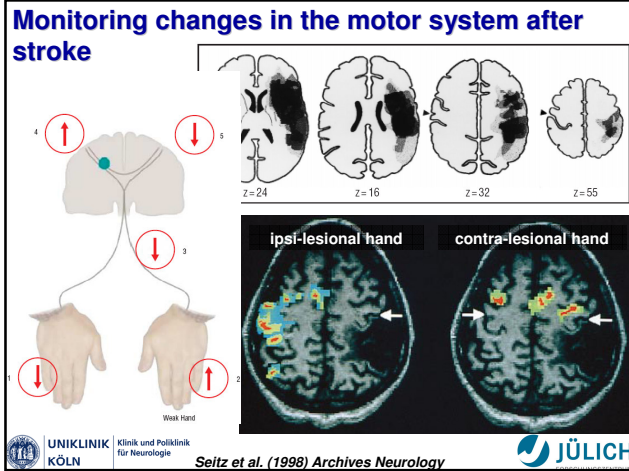


UNIKLINIK KÖLN Klinik und Poliklinik für Neurologie Rumiati RI, Weiss PH, et al. (2004) NeuroImage JÜLICH

### Monitoring changes in the motor system after stroke



UNIKLINIK KÖLN Klinik und Poliklinik für Neurologie Fink et al. (2000) Neurology Seitz et al. (1998) Archives Neurology JÜLICH



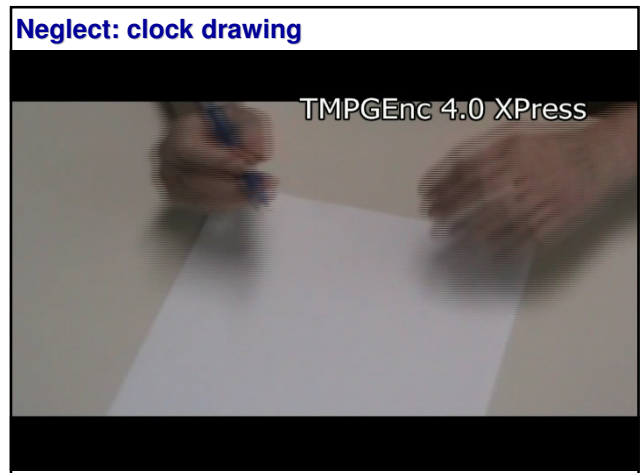
### Neglect

**Incidence** of cognitive deficits after stroke: 48% of patients with right-hemispheric stroke suffer from neglect, after 3 months still present in 17% of the patients

**Relevance** for rehabilitation: neglect is an independent negative predictor for rehabilitation outcome

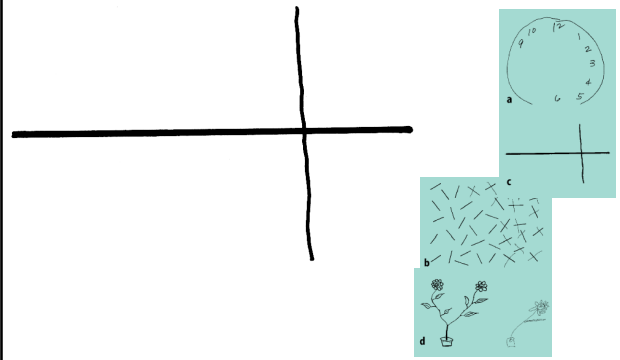
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Halligan et al. (2003) TICS; Binkofski & Fink (2005) Nervenarzt

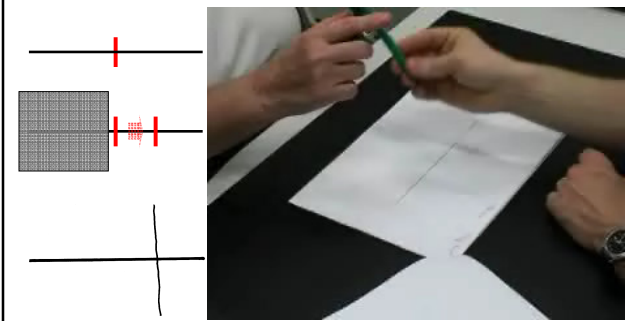


## Neglect: clinical picture

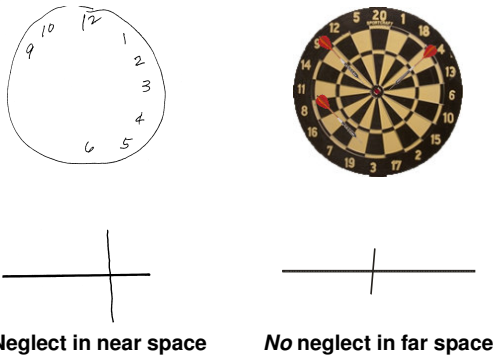
Spatial neglect: patients are impaired in actively orienting to the contralesional space and acting on stimuli in contralesional space.



## Neglect: Deficits in line bisection



## Neglect: clinical dissociations

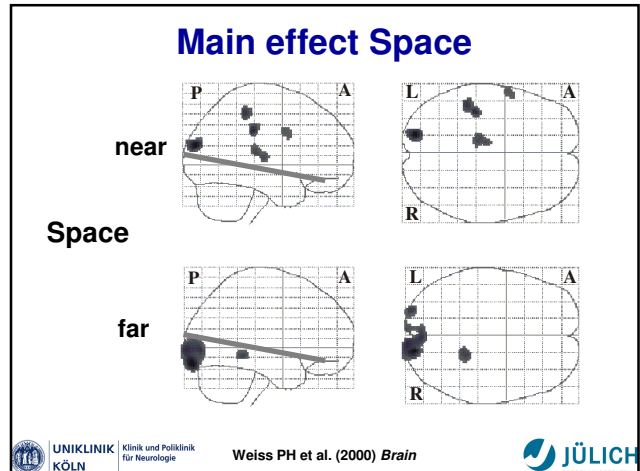
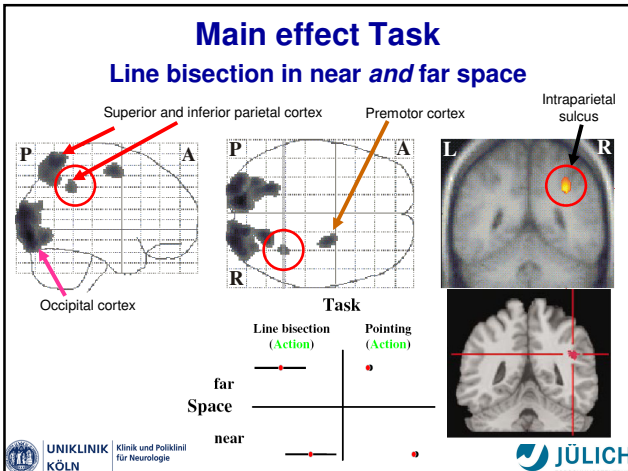
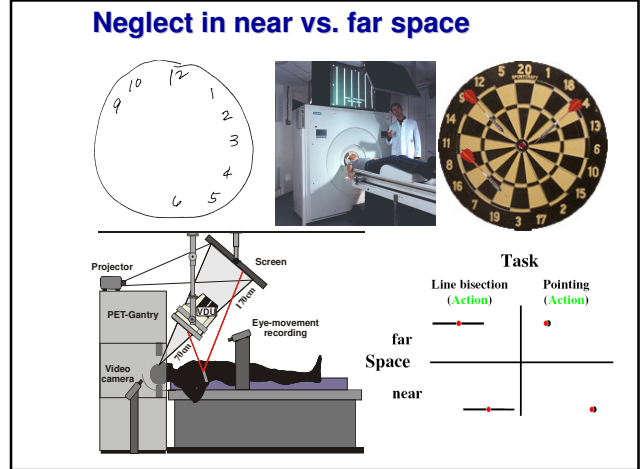


## Neglect: clinical dissociations



No neglect in near space Neglect in far space





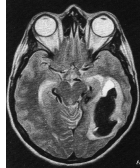
## Far space > Near space

### PET-study



Weiss PH et al.  
*Brain*  
(2000)

### Patient



Vuilleumier P et al.  
*Annals of Neurology*  
(1998)

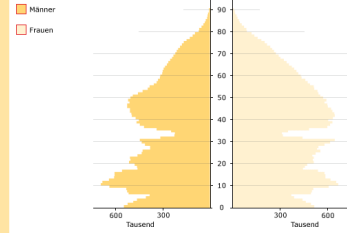
## Neurodegeneration

METRO Group

### Alterspyramide Deutschland 1950-2050

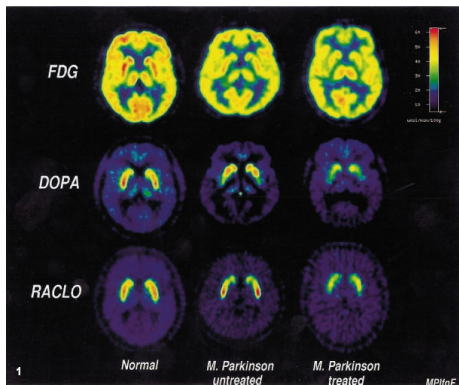
Der Altersaufbau der Bevölkerung wird sich bis 2050 stark verändern.

#### Altersaufbau 1950

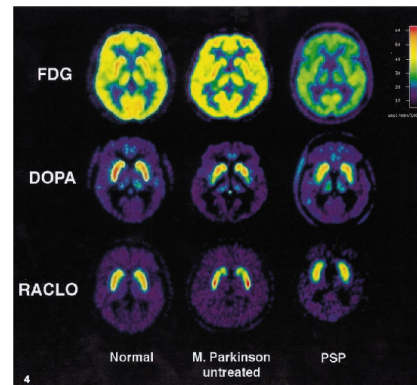


Quelle: Statistisches Bundesamt, 2003

## PET-imaging in Parkinson's disease: diagnosis

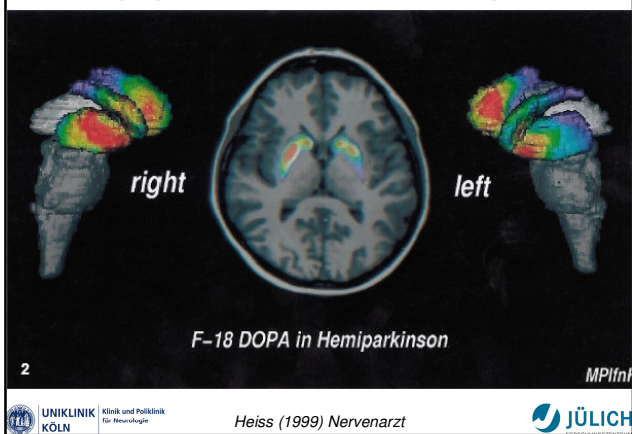


## PET-imaging in Parkinson's disease: diagnosis

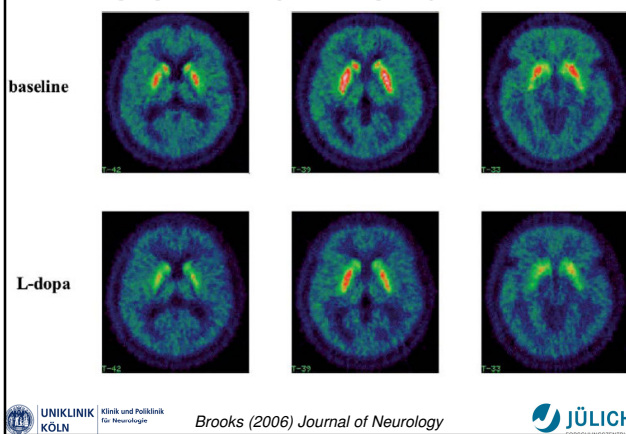




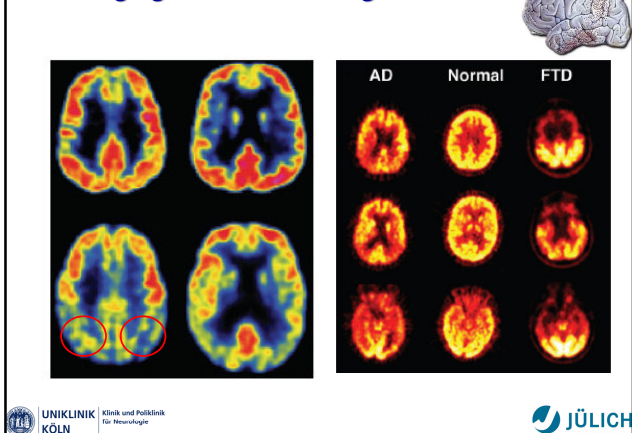
### PET-imaging in Parkinson's disease: *diagnosis*



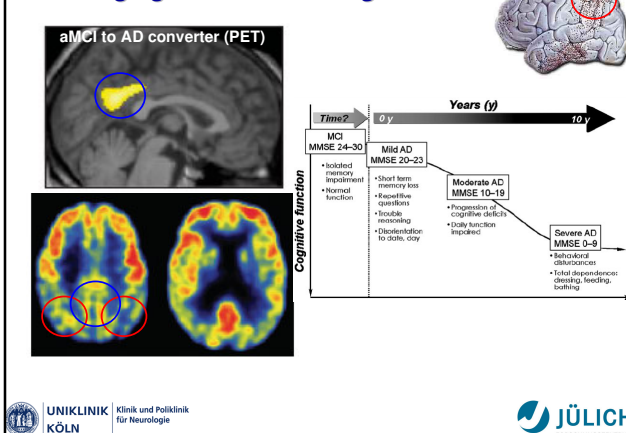
### PET-imaging of the dopaminergic system



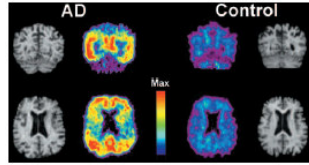
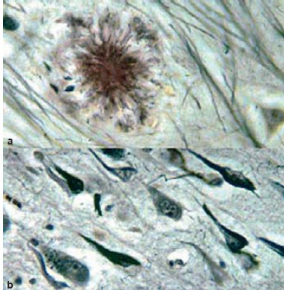
### PET-imaging in Dementia: *diagnosis of AD*



### PET-imaging in Dementia: *diagnosis of AD*



**PET-imaging in Dementia: *diagnosis of AD***



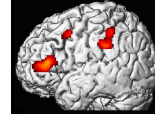
$\beta$ -Amyloid-PET-marker: Pittsburgh compound B (PIB)

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**Thanks to:**

- Ann Assmus
- Gereon R. Fink**
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- Raffaella Rumiati
- Tim Shallice
- Karl Zilles



**... and Thank you for your attention!**

Kognitive Neurologie AACHEN

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