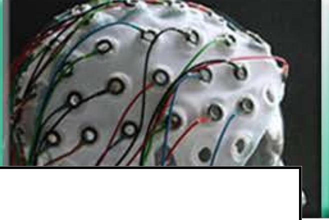
Kognitive Neuropsychologie

03.11.	Geschichte der kognitiven Neurowissenschaft
10.11.	Funktionelle Neuroanatomie
17.11.	**Methoden der kognitiven Neuropsychologie I**
24.11.	Methoden der kognitiven Neuropsychologie II
01.12.	Visuelle Wahrnehmung
08.12.	Objekterkennung
15.12.	Auditive Wahrnehmung
05.01.	Sprache
12.01.	Aufmerksamkeit und Selektion
19.01.	Kognitive Kontrolle
26.01.	Gedächtnis & Lernen
02.02.	Kognitives Altern



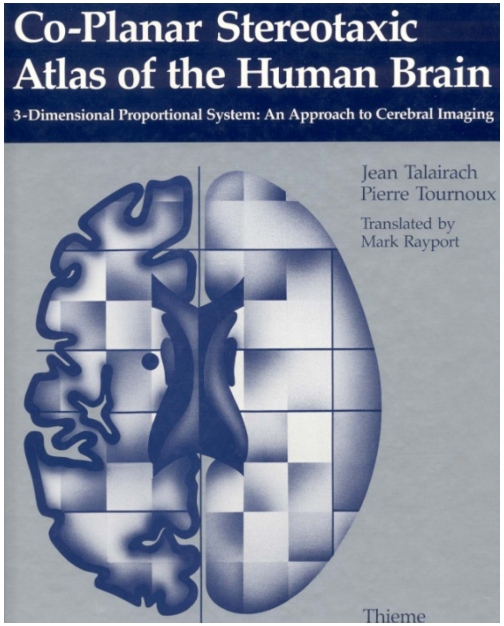
Brain Tutor (3.0)
Brainvoyager.com

Wo genau liegt das BA 41?

Wo liegt die Insula? Welche Funktion hat sie?

Was ist ein Fasiculus Uncinatus?

Das Koordinatensystem von Talairach & Tournoux



Co-Planar Stereotaxic Atlas of the Human Brain

3-Dimensional Proportional System: An Approach to Cerebral Imaging

Jean Talairach
Pierre Tournoux

Translated by
Mark Rayport

Thieme

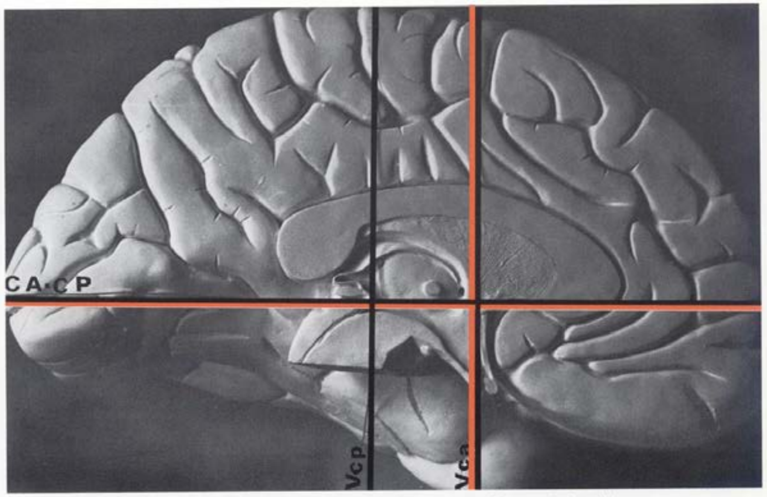


Figure 4 Basic Reference System. The three dimensions are:
- CA-CP line (anterior commissure-posterior commissure) = horizontal plane
- Vertical line VCA = verticofrontal plane
- Midline = sagittal plane

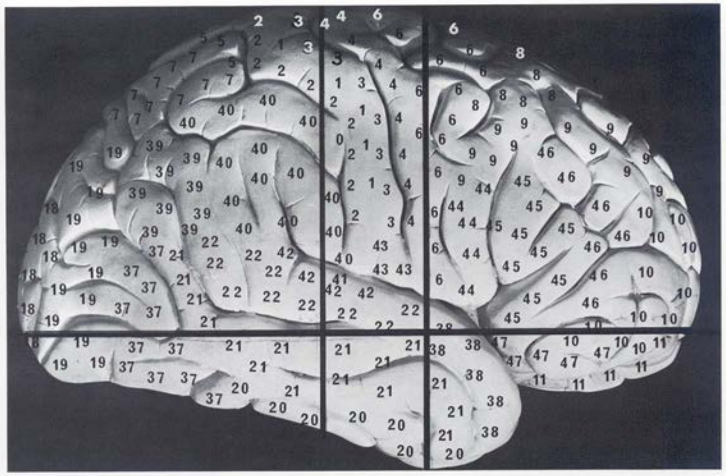


Figure 10 Right hemisphere (lateral surface). Areas of Brodmann and basal lines.

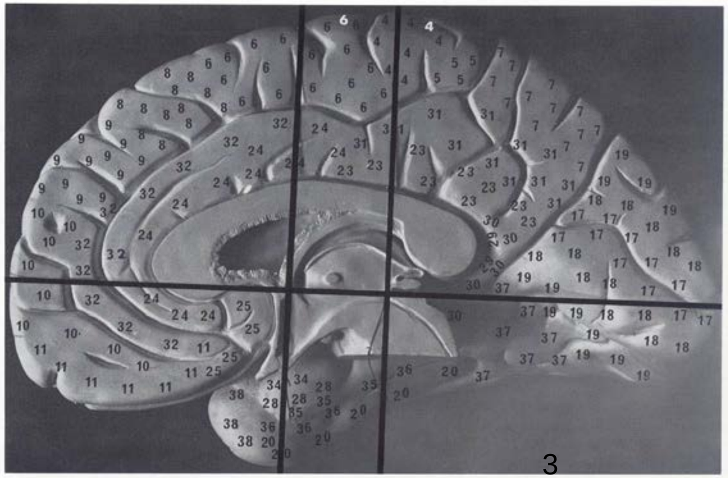
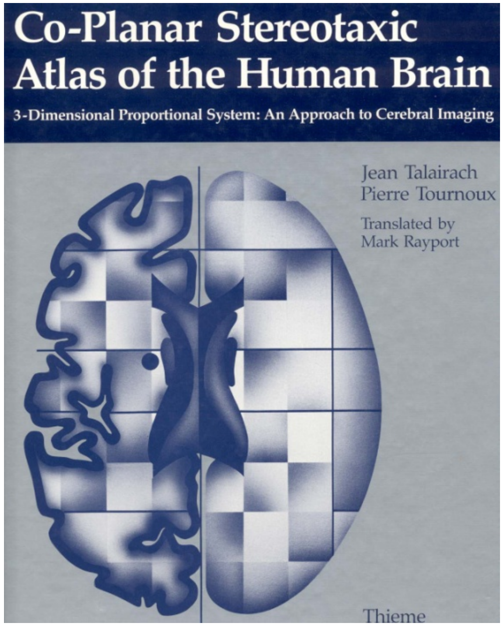


Figure 9 Right hemisphere (medial surface). Areas of Brodmann and basal lines.

Das Koordinatensystem von Talairach & Tournoux



Co-Planar Stereotaxic Atlas of the Human Brain

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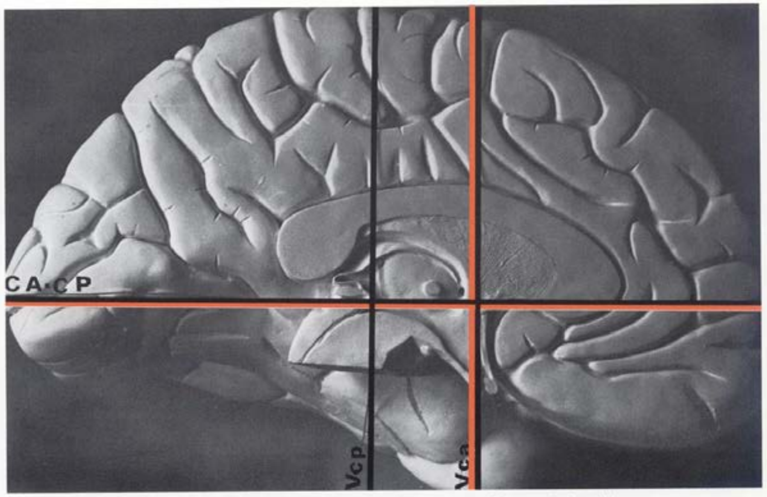

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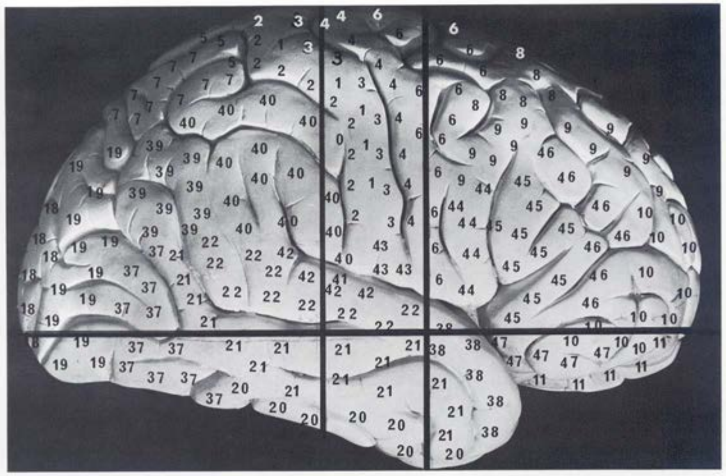

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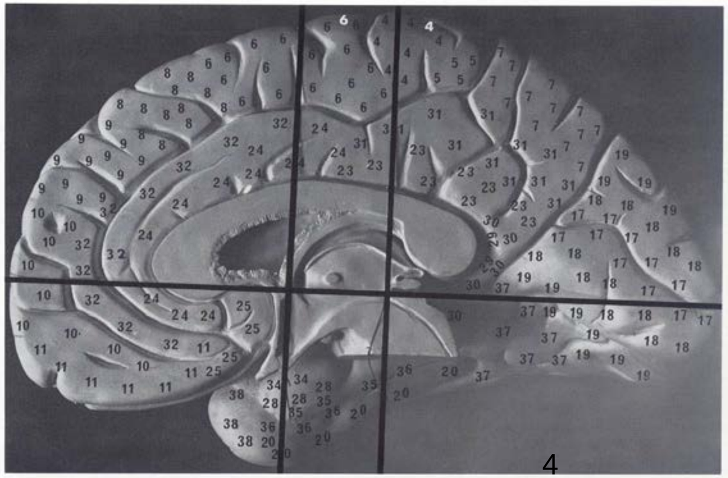

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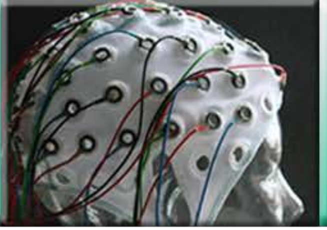

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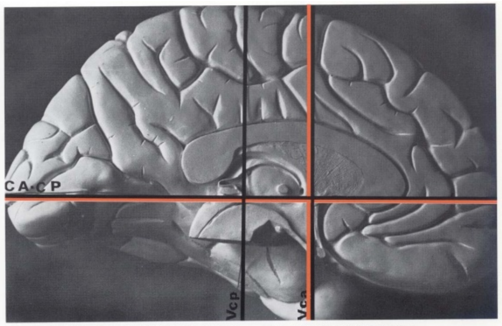

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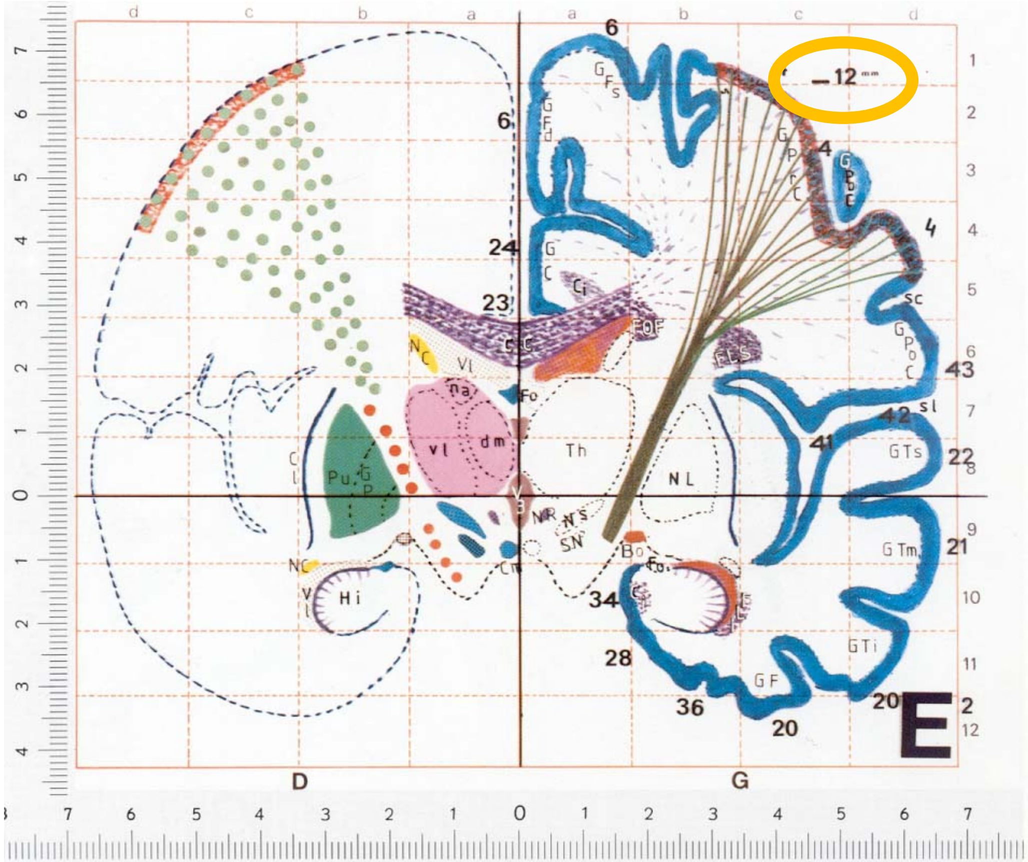

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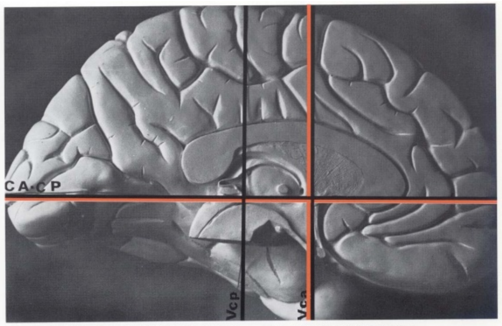

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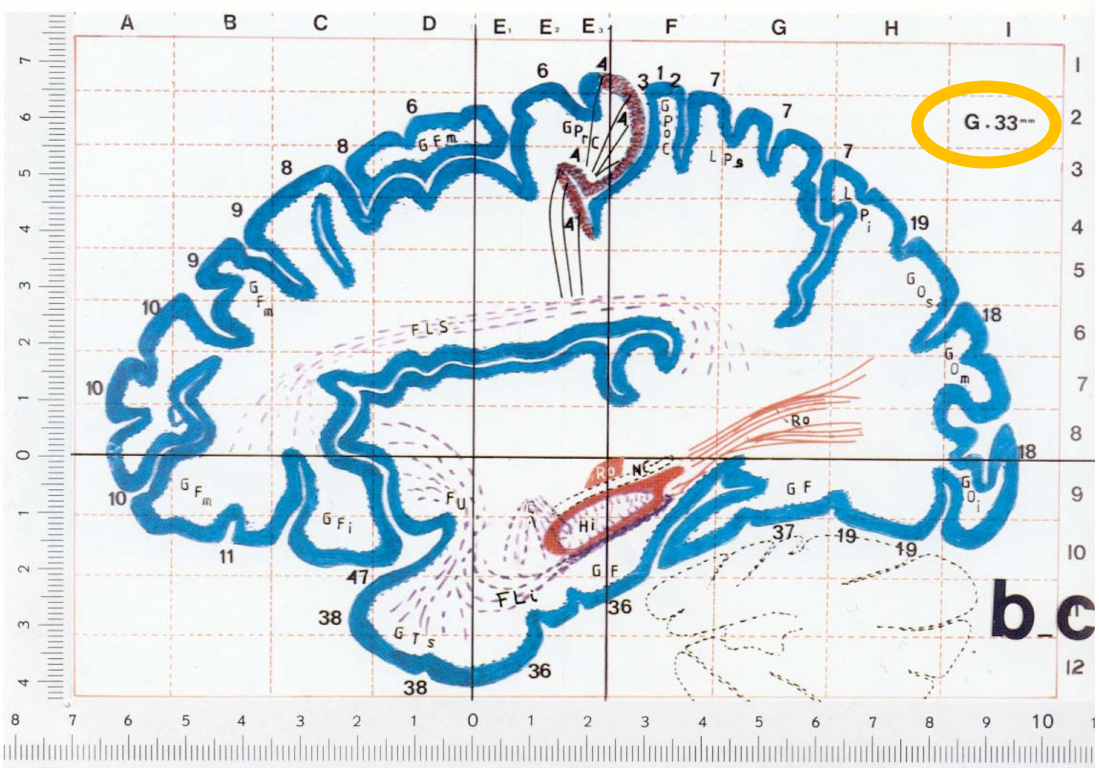

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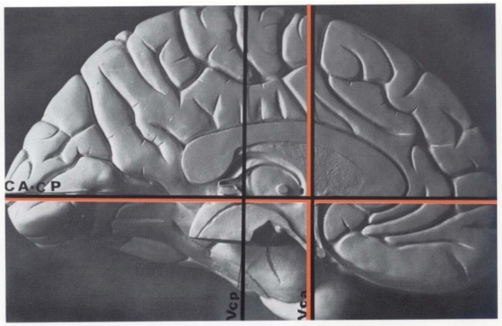

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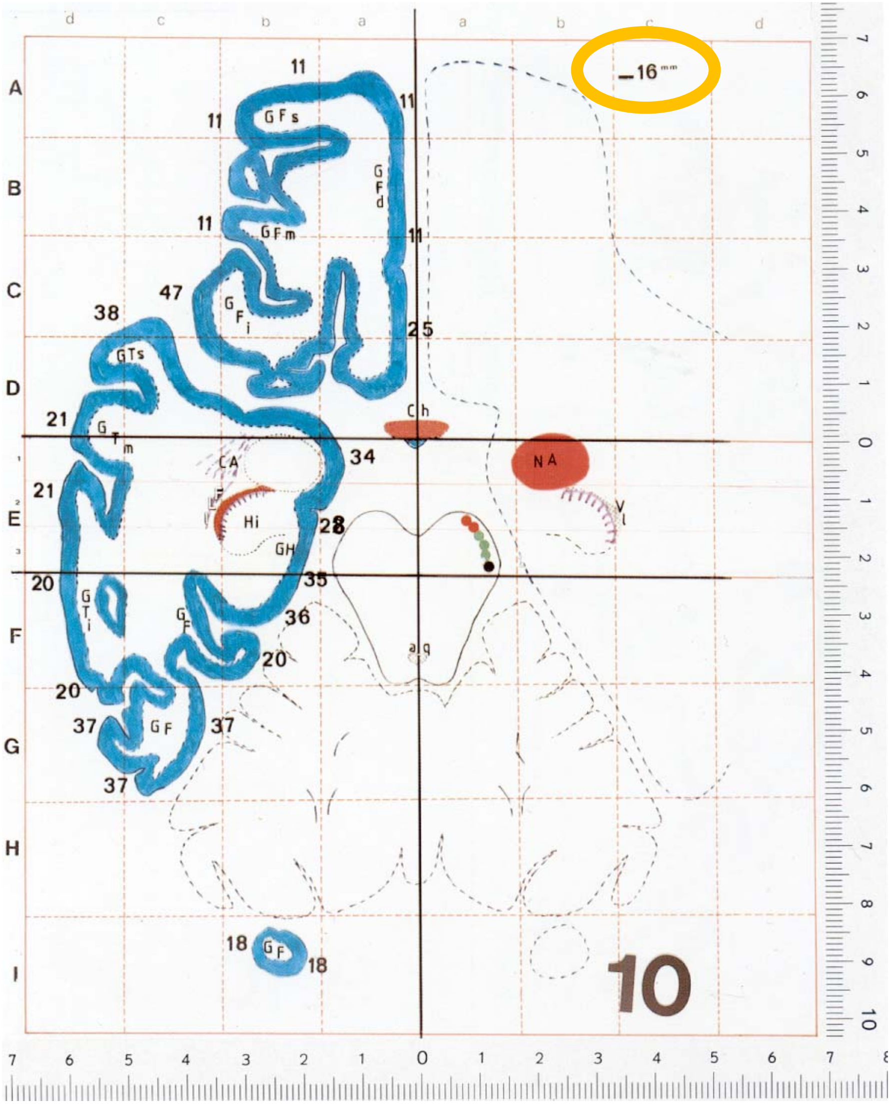
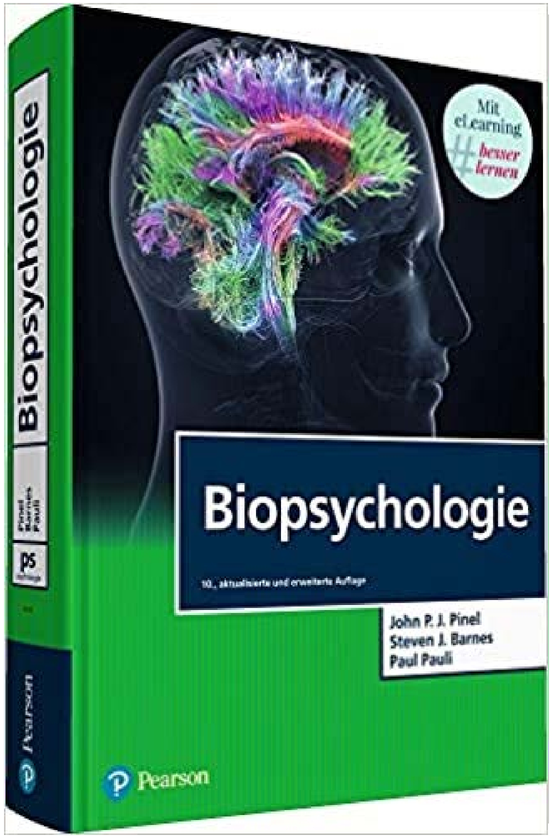


- Ursachen von Gehirnerkrankungen ☺
- Läsionsstudien ☺
- Virtuelle Läsionen ☺
- Strukturelle Bildgebung
- Funktionelle Bildgebung
- Elektrophysiolgie

Literatur



Pinel, J.P.J., Barnes, S.J. & Pauli, P. (2018). *Biopsychologie.* Pearson Studium: München (Kap. 11)

Ward, J. (2010). The student's guide to cognitive neuroscience. (2nd Edition) Psychology Press. New York. (Kap. 5)

Nieuwenhuys, R., Voogd, J & van Huijzen, Chr (1991). Das Zentralnervensystem des Menschen. Springer: Berlin

Hirnschädigungen des Menschen

Ursachen:

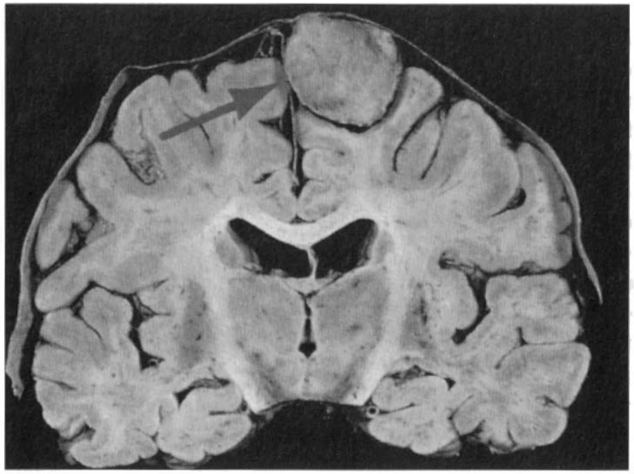
- Tumoren
- Cerebrovaskuläre Störungen
- Schädel-Hirn-Trauma
- Gehirninfektionen

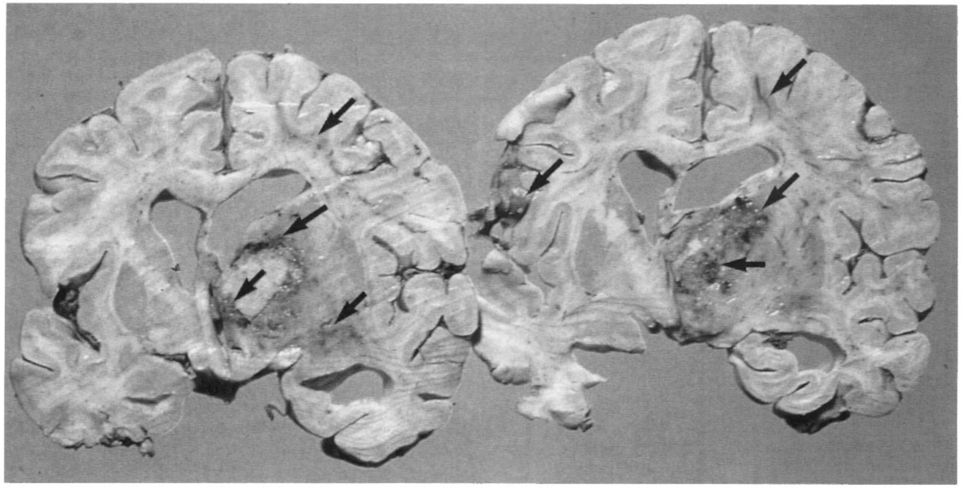
- Demenz

(1) Tumoren

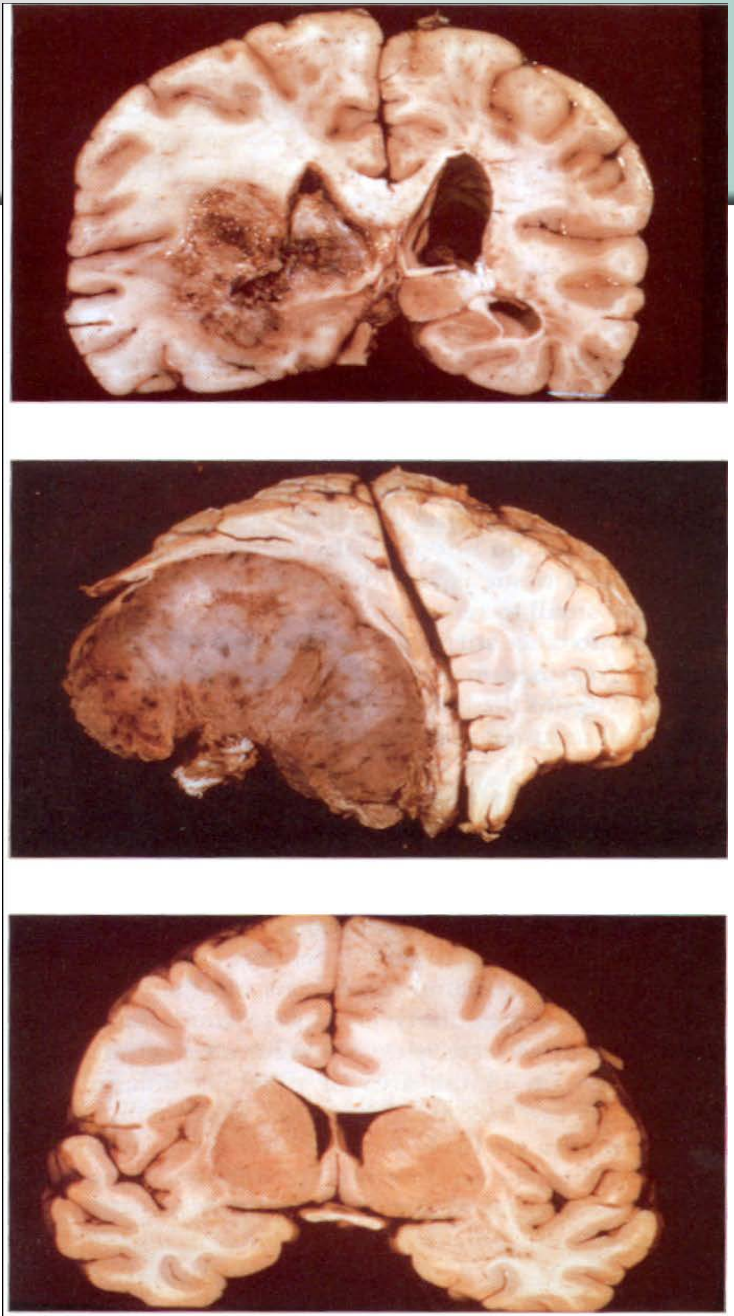
- Enthemmtes Überschußwachstum …
- Benigne / maligne Tumoren
- Bezeichnung anhand des Gehirngewebes
- Meningiome (20% aller Gehirntumore)
- Primärtumore & metastasierende Tumore
- Wachstum & Behandlung

  (Strahlen - & Chemotherapie)





6.2 Multiple metastasierende Hirntumoren. Die Pfeile weisen auf einige der geschädigten Bereiche hin.



- Malignes Gliom
- Meningom
- Metastasierender Tumor

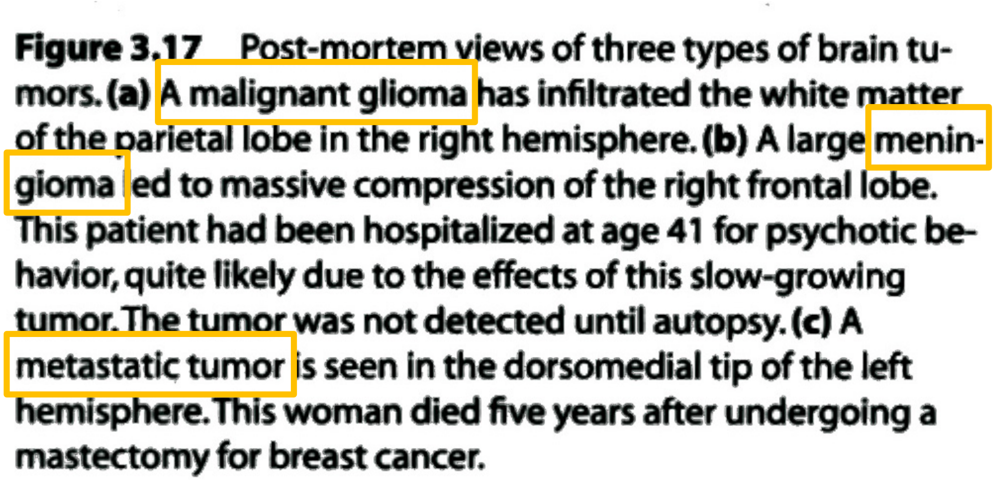


Figure 3.17 Post-mortem views of three types of brain tumors. **(a)** A malignant glioma has infiltrated the white matter of the parietal lobe in the right hemisphere. **(b)** A large meningioma led to massive compression of the right frontal lobe. This patient had been hospitalized at age 41 for psychotic behavior, quite likely due to the effects of this slow-growing tumor. The tumor was not detected until autopsy. **(c)** A metastatic tumor is seen in the dorsomedial tip of the left hemisphere. This woman died five years after undergoing a mastectomy for breast cancer.

(2) Cerebrovaskuläre Störungen

Schlaganfälle

Cerebrale Hämorrhagie (Hirnblutung) (10%)

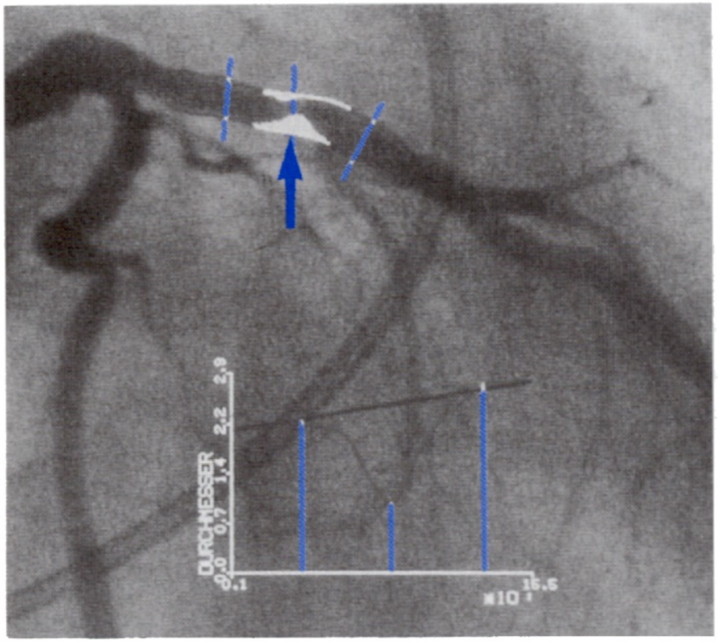
- Aneurysmen

Cerebrale Ischämie (90%)

- Thrombosen
- Embolie
- Arteriosklerose

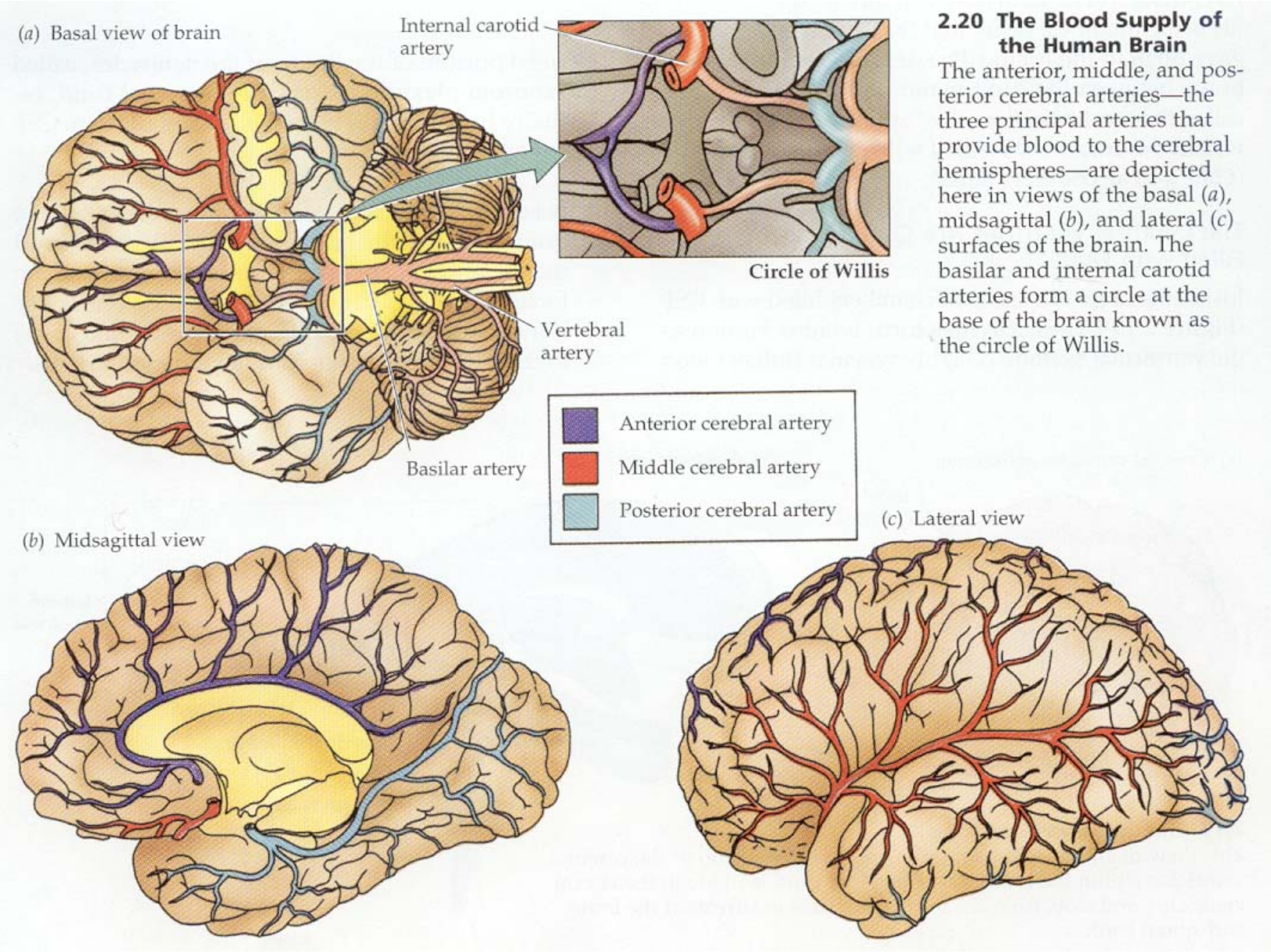
Transitorisch Ischämische Attackten

- Durchblutungsstörung mit < 24h Dauer



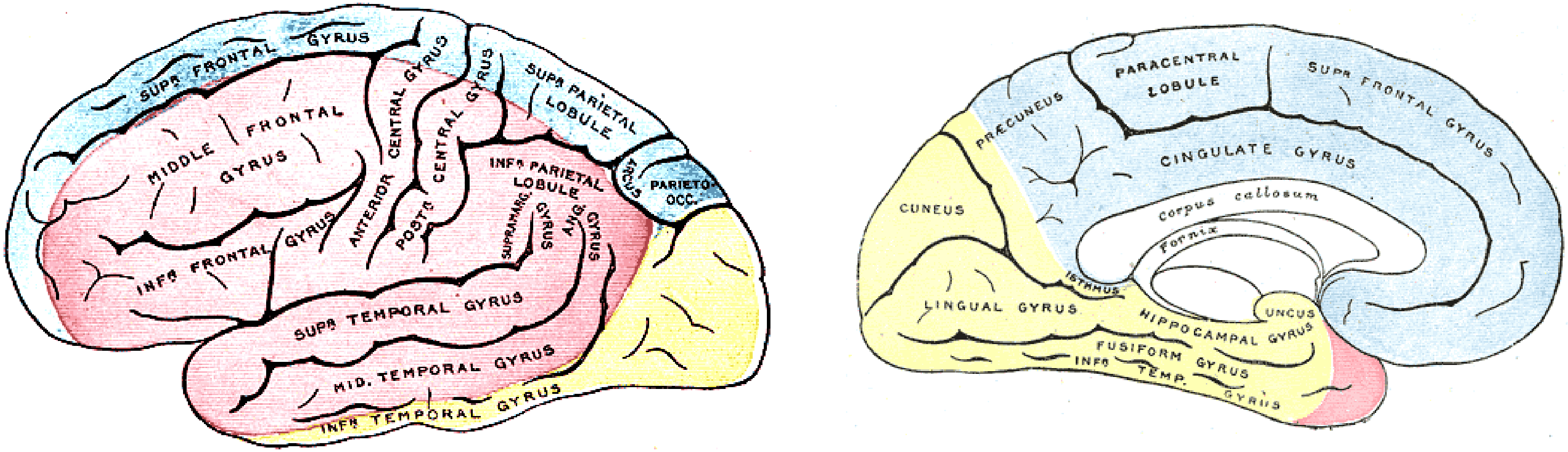
6.3 Ein Angiogramm, das die Verengung der Halsschlagader (Pfeile), der wichtigsten Blutversorgung des Kopfes, illustriert. Man vergleiche dieses Angiogramm mit dem normalen Angiogramm in Abbildung 5.1.

Die Blutversorgung des Vorderhirns



2.20 The Blood Supply of the Human Brain The anterior, middle, and posterior cerebral arteries—the three principal arteries that provide blood to the cerebral hemispheres—are depicted here in views of the basal (*a*), midsagittal (*b*), and lateral (*c*) surfaces of the brain. The basilar and internal carotid arteries form a circle at the base of the brain known as the circle of Willis.

Die Blutversorgung des Vorderhirns



Arteria cerebri anterior (blau unterlegt)
Arteria cerebri media (rot)
Arteria cerebri posterior (gelb)

Cerebrovaskuläre Störungen

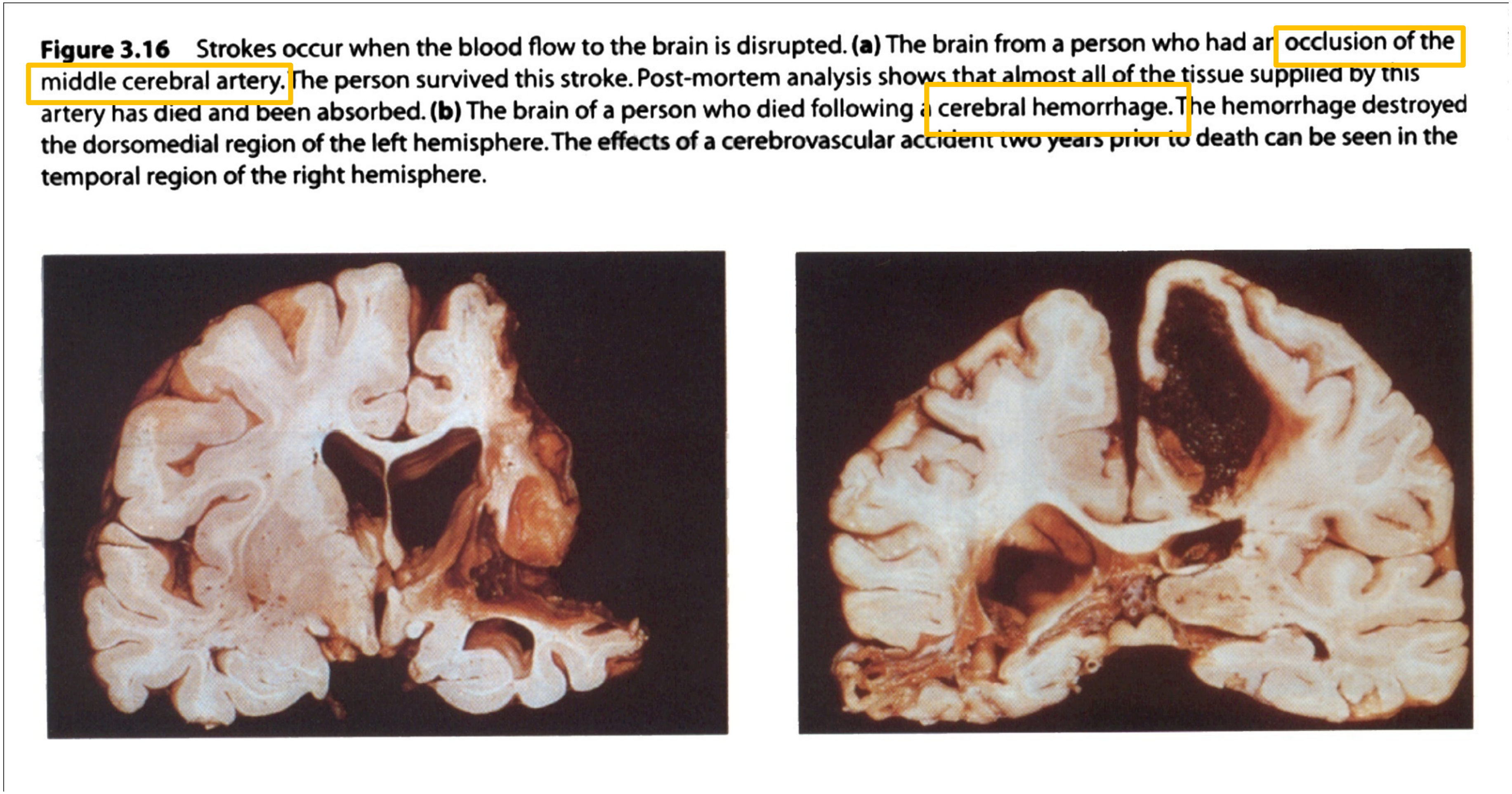
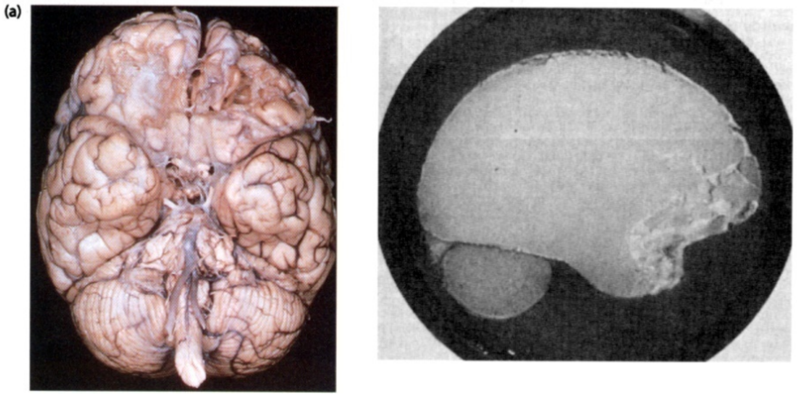


Figure 3.16 Strokes occur when the blood flow to the brain is disrupted. **(a)** The brain from a person who had an occlusion of the middle cerebral artery. The person survived this stroke. Post-mortem analysis shows that almost all of the tissue supplied by this artery has died and been absorbed. **(b)** The brain of a person who died following a cerebral hemorrhage. The hemorrhage destroyed the dorsomedial region of the left hemisphere. The effects of a cerebrovascular accident two years prior to death can be seen in the temporal region of the right hemisphere.

(3) Schädel-Hirn-Trauma

- Hirnquetschungen (Contusio cerebri)
- Hämatom
- Contre-Coup-Verletzungen
- Gehirnerschütterung (Commotio cerebri)
- Punch-drunk-Syndrom
  - (Demenz & Gehirnvernarbungen)

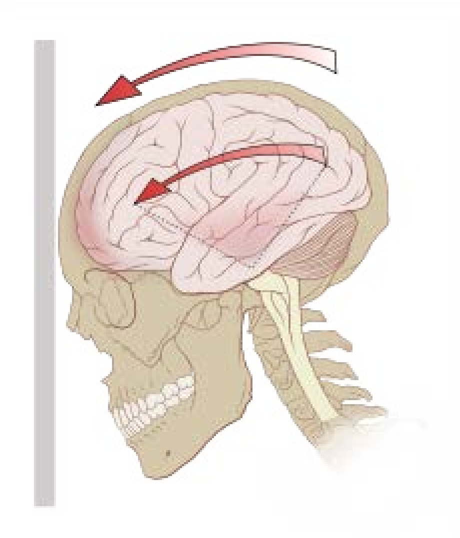
Figure 3.19 Trauma can produce extensive destruction of neural tissue. Damage can arise from the collision of the brain with the solid internal surface of the skull, especially along the jagged surface over the orbital region. In addition, accelerative forces created by the impact can cause extensive shearing of dendritic arbors. **(a)** The brain of a 54-year-old man who had sustained a severe head injury 24 years prior to death. Tissue damage is evident in orbitofrontal regions, and were associated with intellectual deterioration subsequent to the injury. **(b)** The suspectibility of this region to trauma was made clear by A. Holbourn of Oxford in 1943 who filled a skull with jello and then violently rotated the skull. While most of the brain retains its smooth appearance, the orbitofrontal region has been chewed up.



6.5 Ein Computertomogramm (CT) eines subduralen Hämatoms. Man beachte, daß sich der linke Seitenventrikel infolge des Druckes, den das Hämatom ausübt, verschoben hat (siehe Farbtafel IX).

Gedecktes Schädel-Hirn-Trauma

- Gehirnerschütterung (Commotio cerebri)
- Punch-drunk-Syndrom
  - (Demenz & Gehirnvernarbungen)

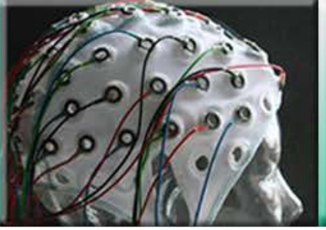


(4) Gehirninfektionen

Encephalitis

- Bakterieninfektionen
- Meningitis / FSME / Hirnabszesse / Syphilis

- Virusinfektionen
- Neurotrope / pantrope Infektionen
- Prionen (BSE)
- Toxiplasmose



(5) Neurodegenerative Erkrankungen

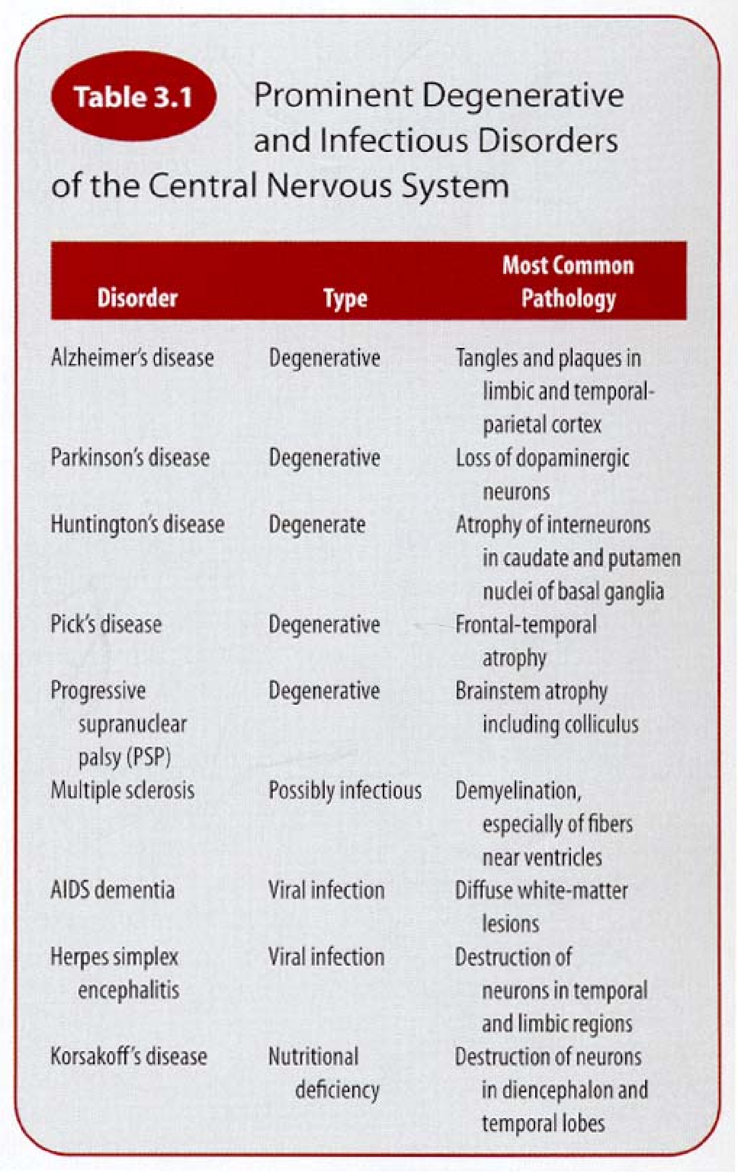


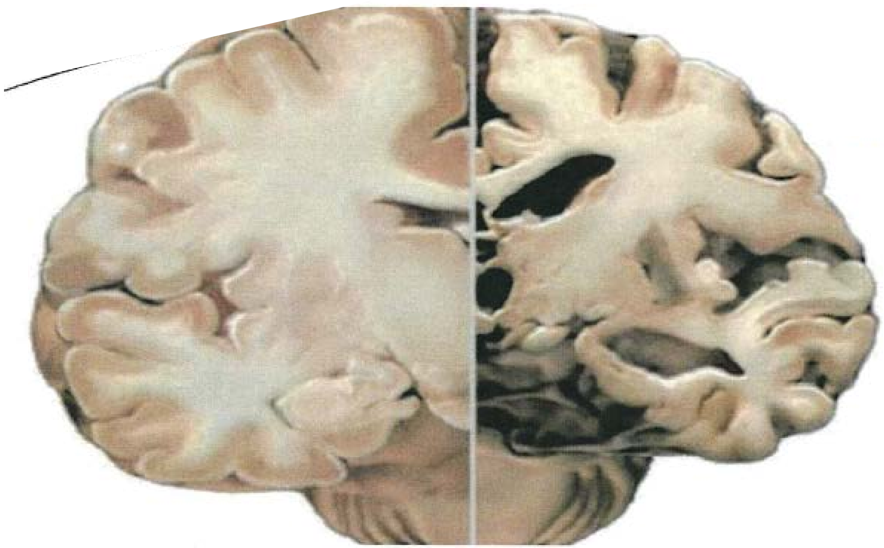
Table 3.1 Prominent Degenerative and Infectious Disorders of the Central Nervous System

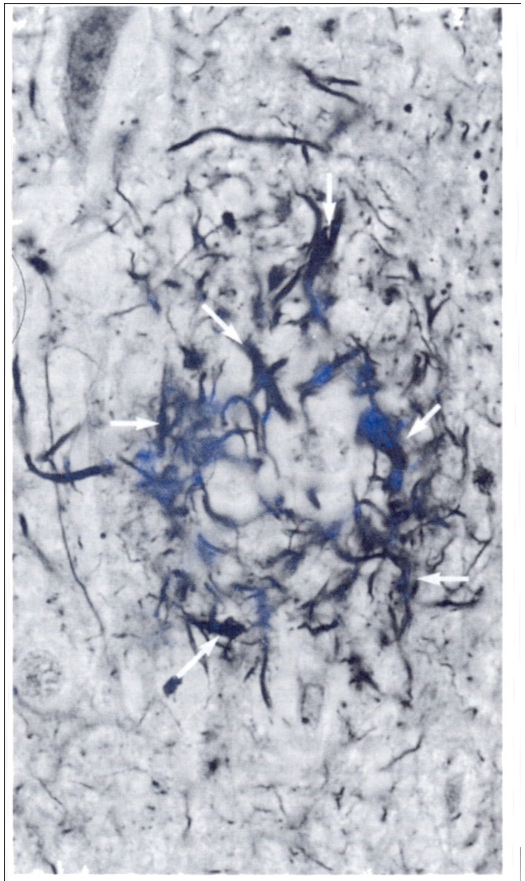
Disorder	Type	Most Common Pathology
Alzheimer's disease	Degenerative	Tangles and plaques in limbic and temporal-parietal cortex
Parkinson's disease	Degenerative	Loss of dopaminergic neurons
Huntington's disease	Degenerate	Atrophy of interneurons in caudate and putamen nuclei of basal ganglia
Pick's disease	Degenerative	Frontal-temporal atrophy
Progressive supranuclear palsy (PSP)	Degenerative	Brainstem atrophy including colliculus
Multiple sclerosis	Possibly infectious	Demyelination, especially of fibers near ventricles
AIDS dementia	Viral infection	Diffuse white-matter lesions
Herpes simplex encephalitis	Viral infection	Destruction of neurons in temporal and limbic regions
Korsakoff's disease	Nutritional deficiency	Destruction of neurons in diencephalon and temporal lobes

Die Alzheimer Krankheit

Häufigste Demenzursache

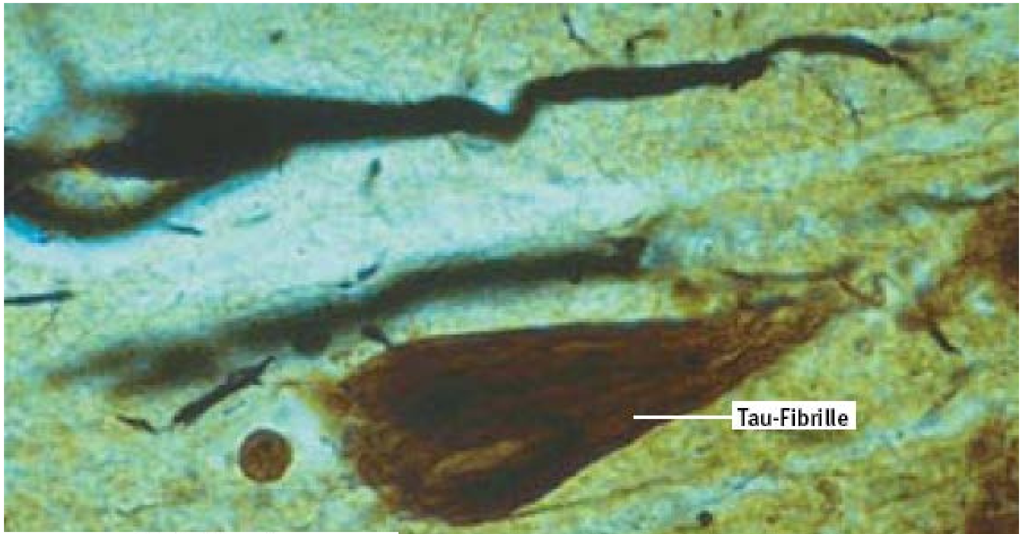
- Neurofibrillenknäuel
- Amyloidplaques
- Neuronenverlust

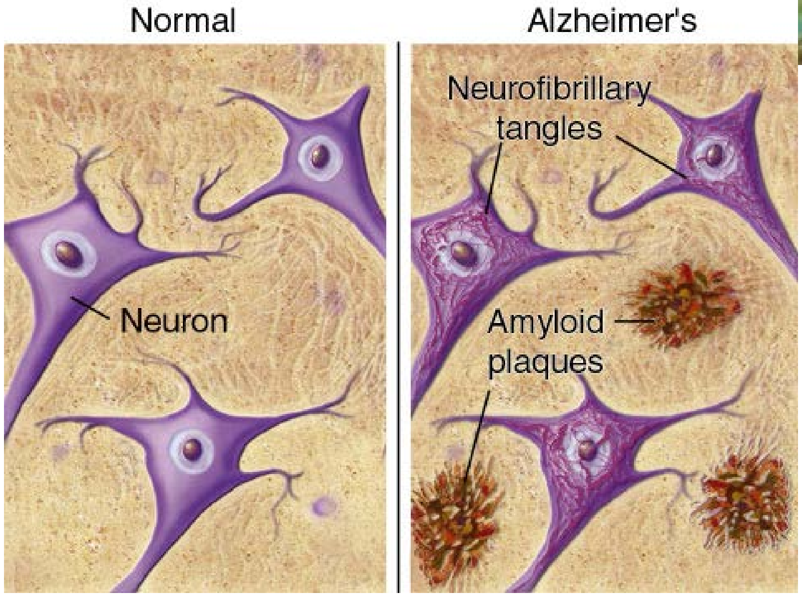


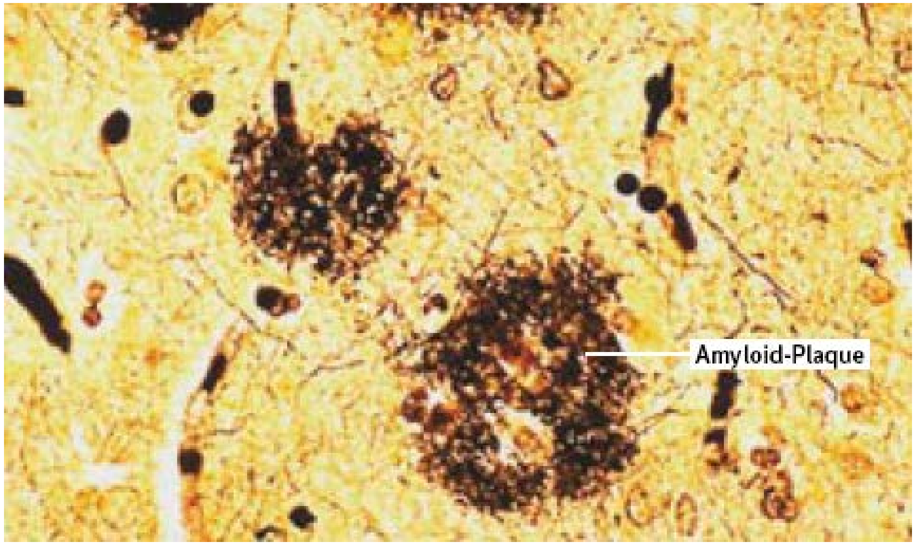


6.11 Amyloidplaques (Pfeile) im Gehirn eines Alzheimer-Patienten (siehe Farbtafel X).

Plaques und Neurofibrillen

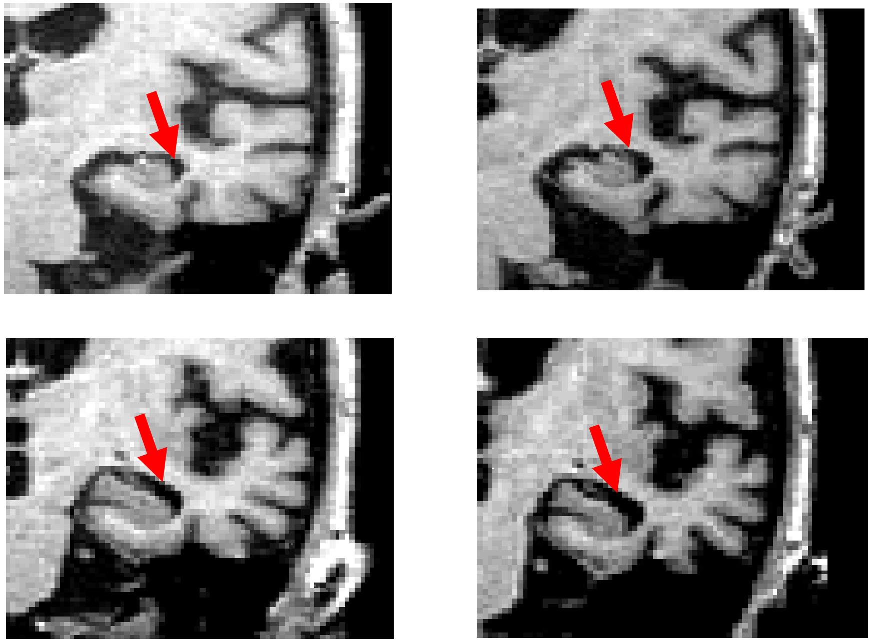






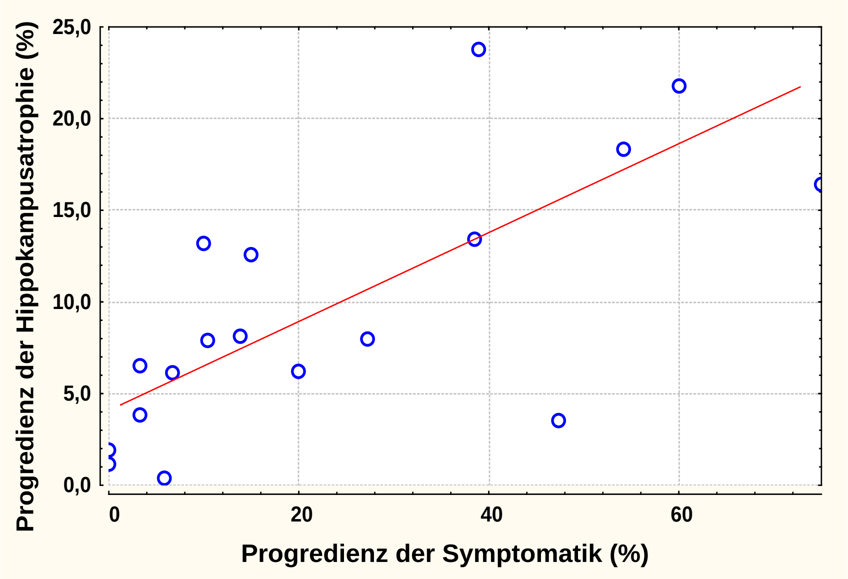
Atrophie des Gehirns

Hippocampusatrophie im Verlauf der Alzheimer Erkrankung

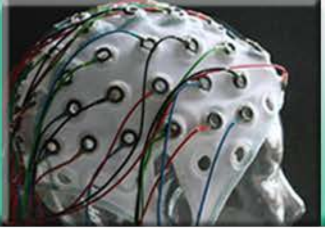


Baseline

1-Jahreskatamnese

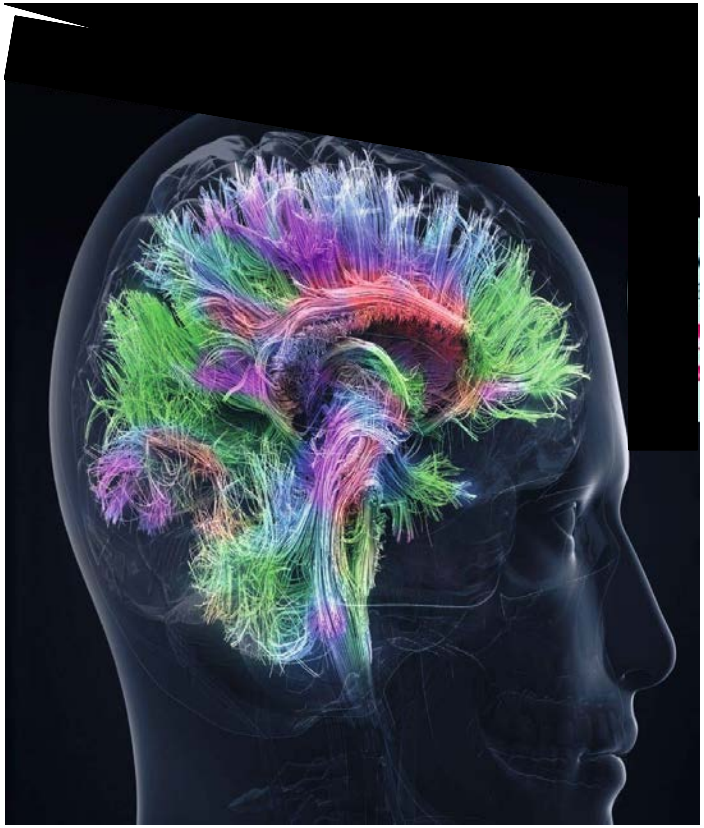


Pantel et al., 2002



Läsionsstudien

- Klassische Neuropsychologie
- Kognitive Neuropsychologie



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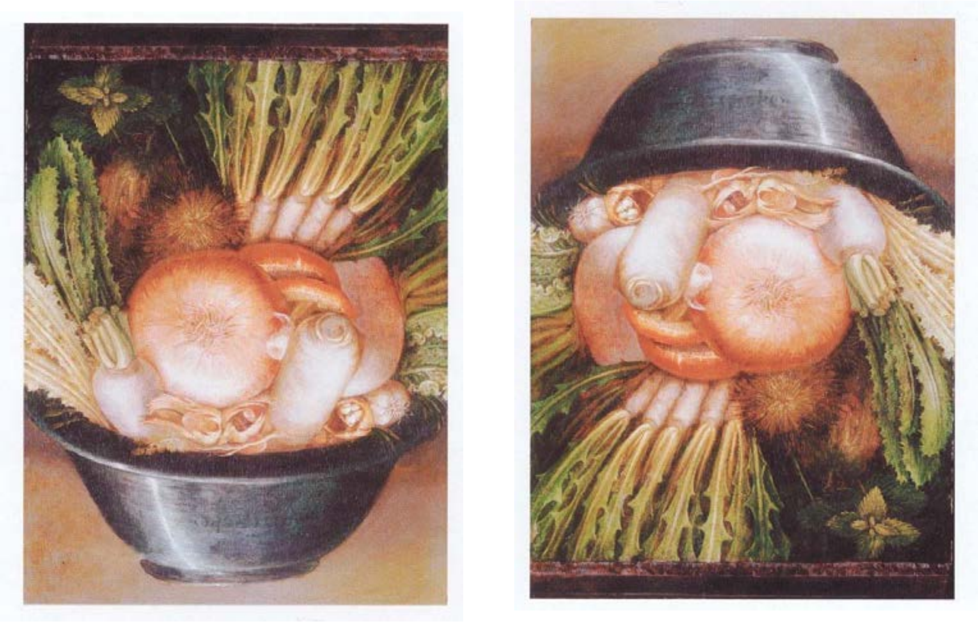
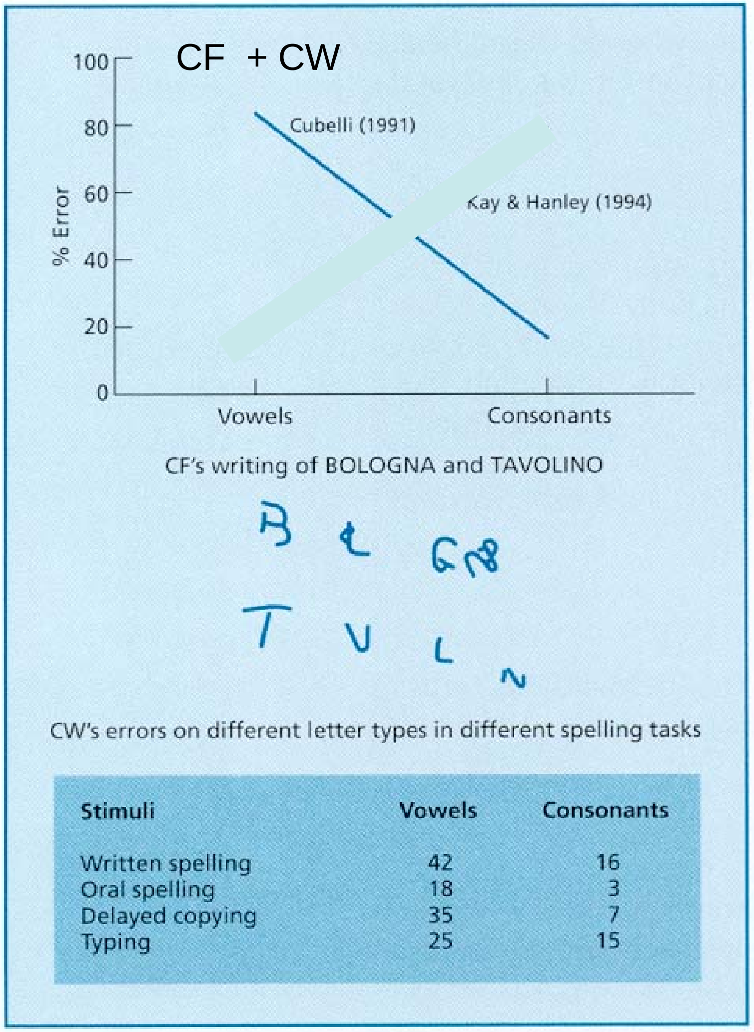


Einfache und doppelte Dissoziation



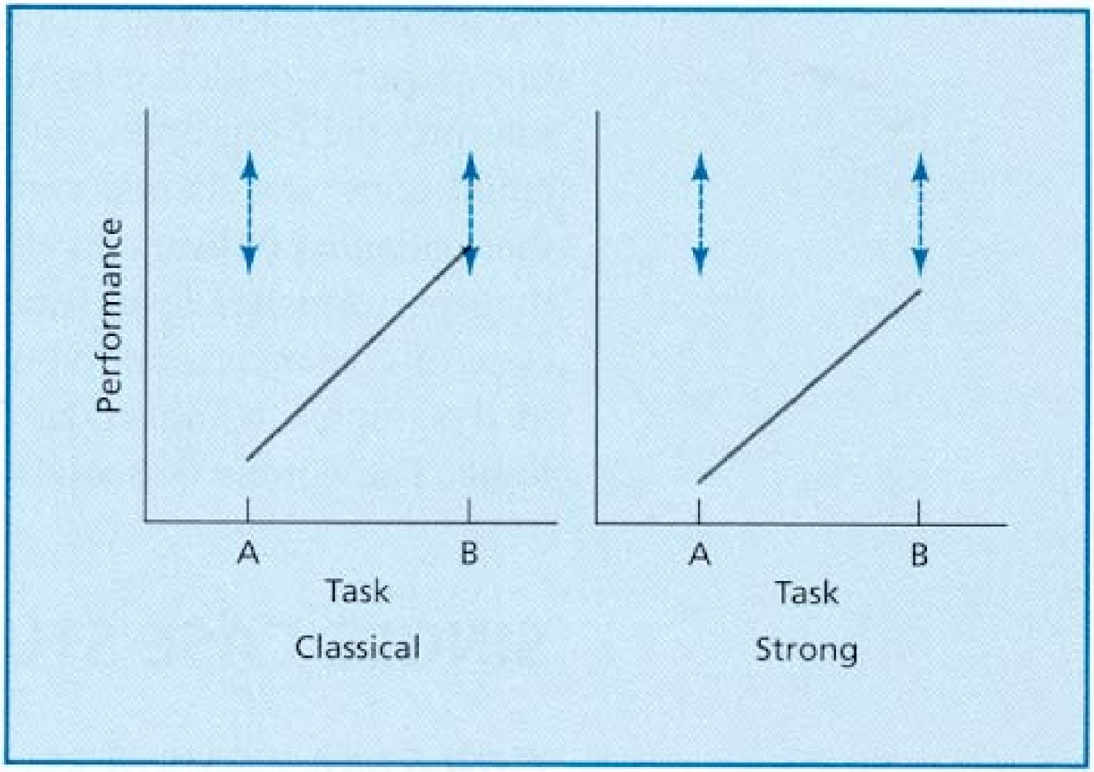
CF's writing of BOLOGNA and TAVOLINO

CW's errors on different letter types in different spelling tasks

Stimuli	Vowels	Consonants
Written spelling	42	16
Oral spelling	18	3
Delayed copying	35	7
Typing	25	15

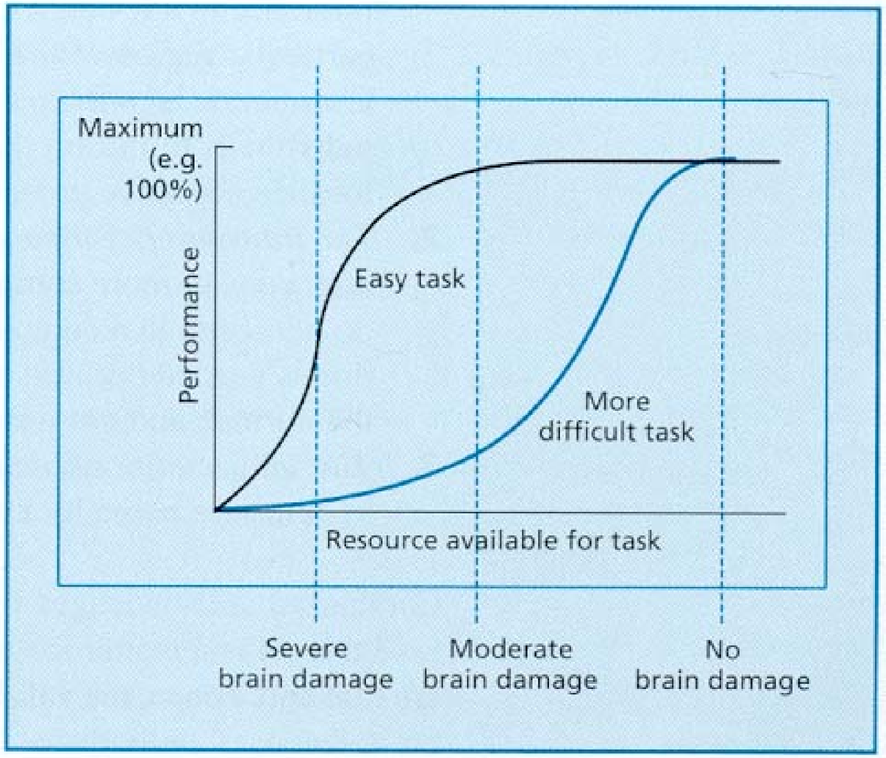
Some patients produce spelling errors selectively on either consonants or vowels. This may imply separate neural resources for coding consonants and vowels. Data from Cubelli, 1991.

Einfache Dissoziation



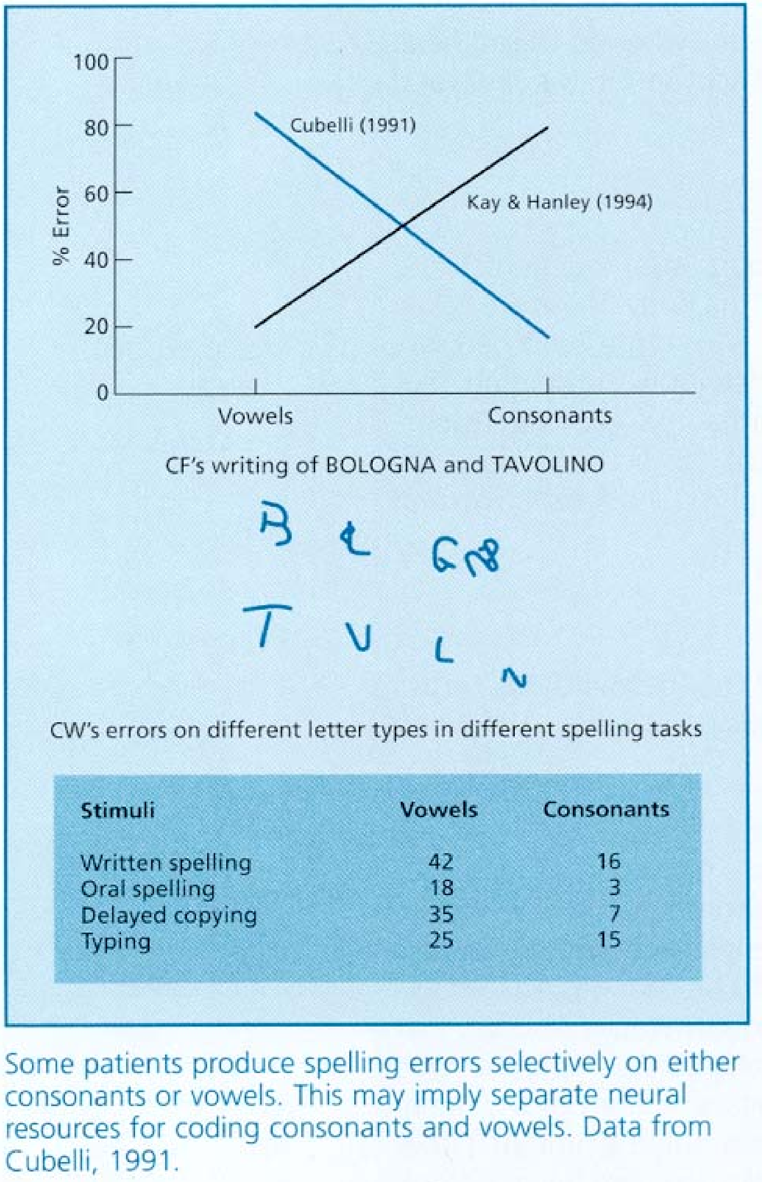
In a classical dissociation, performance on one task lies within the control range (shown by dotted lines). In a strong dissociation, both tasks fall outside the control range but one task is significantly more impaired than the other. Shallice, 1988. *From neuropsychology to mental structure.* Cambridge University Press.

Ein Aufgaben/Ressourcen Artefakt vs. Aufgaben-Anforderungs Artefakt ?



A task-resource artefact can arise because one task uses more of a cognitive/neural resource than the other (i.e. one task is harder). One could construe brain damage as depleting the amount of resource available. In this instance, at moderate brain damage the patient can still perform the easy task normally. A single dissociation need not reflect different cognitive/neural substrates for the tasks. Adapted from Shallice, 1988.

Doppelte Dissoziationen



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Dissoziation vs. Assoziation

- Syndrome statt Dissoziationen
- Zwei Einwände gegen DD (Tim Shallice):

  (1) Bekräftigung des Modularitätsprinzips

  Können nichtmodulare Systeme auch DD produzieren?

  (2) DD erfordern „pure cases“

- DD sind nur EIN Werkzeug der Neuropsychologie !!

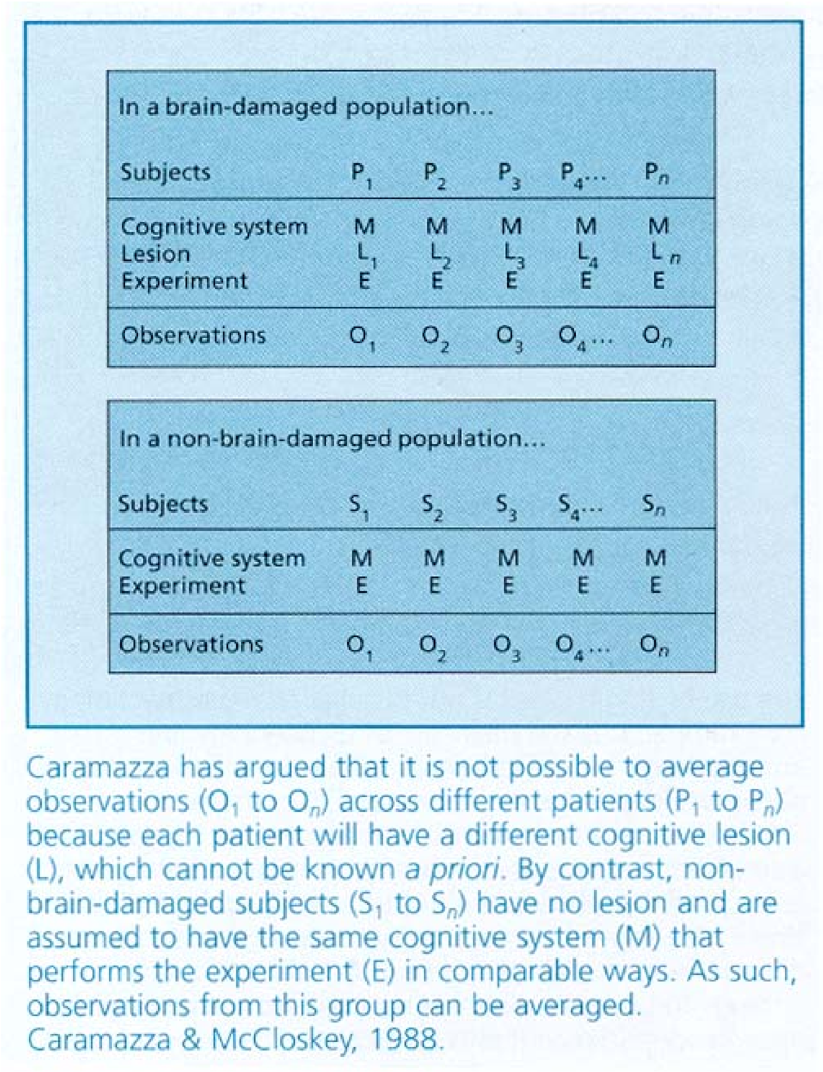
Einzelfallstudien

Die drei impliziten Annahmen des Einzelfallansatzes

(Alfonso Caramazza)

- Fractionation assumption
  (Cluster von Neuronen für spez. Funktionen?)
- Transparency assumption
  (Wiederherstellung des ursp. Systems?)
- Universality assumption
  (Generalisierbarkeit trotz interind. Differenzen?)

The case for single cases



In a brain-damaged population…

Subjects	P_1	P_2	P_3	P_4…	P_n
Cognitive system	M	M	M	M	M
Lesion	L_1	L_2	L_3	L_4	L_n
Experiment	E	E	E	E	E
Observations	O_1	O_2	O_3	O_4…	O_n

In a non-brain-damaged population…

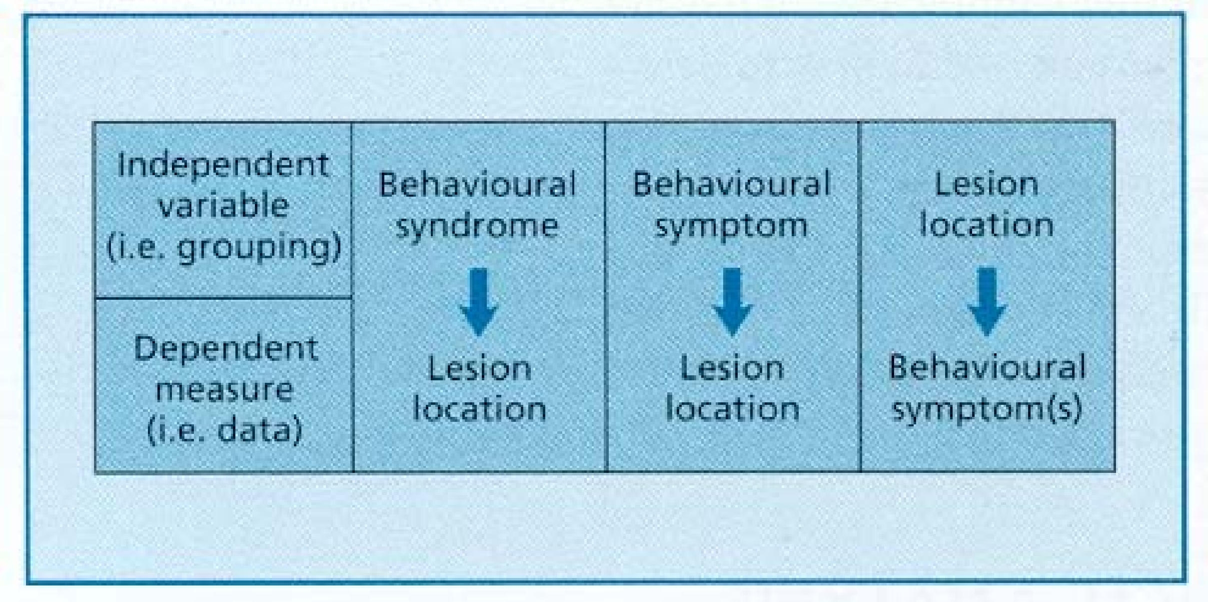
Subjects	S_1	S_2	S_3	S_4…	S_n
Cognitive system	M	M	M	M	M
Experiment	E	E	E	E	E
Observations	O_1	O_2	O_3	O_4…	O_n

Caramazza has argued that it is not possible to average observations (O_1 to O_n) across different patients (P_1 to P_n) because each patient will have a different cognitive lesion (L), which cannot be known *a priori*. By contrast, non-brain-damaged subjects (S_1 to S_n) have no lesion and are assumed to have the same cognitive system (M) that performs the experiment (E) in comparable ways. As such, observations from this group can be averaged. Caramazza & McCloskey, 1988.

Gruppenstudien

Gruppierungsverfahren:

- Syndrome (z.B. Schizophrenie)
- Kognitive Symptome (z.B. Dysgraphie; Amnesie)
- Anatomische Läsionen (z.B. linker präfrontaler Cortex)



Independent variable (i.e. grouping)	Behavioural syndrome	Behavioural symptom	Lesion location
	↓	↓	↓
Dependent measure (i.e. data)	Lesion location	Lesion location	Behavioural symptom(s)

Gruppierung nach Läsionsort

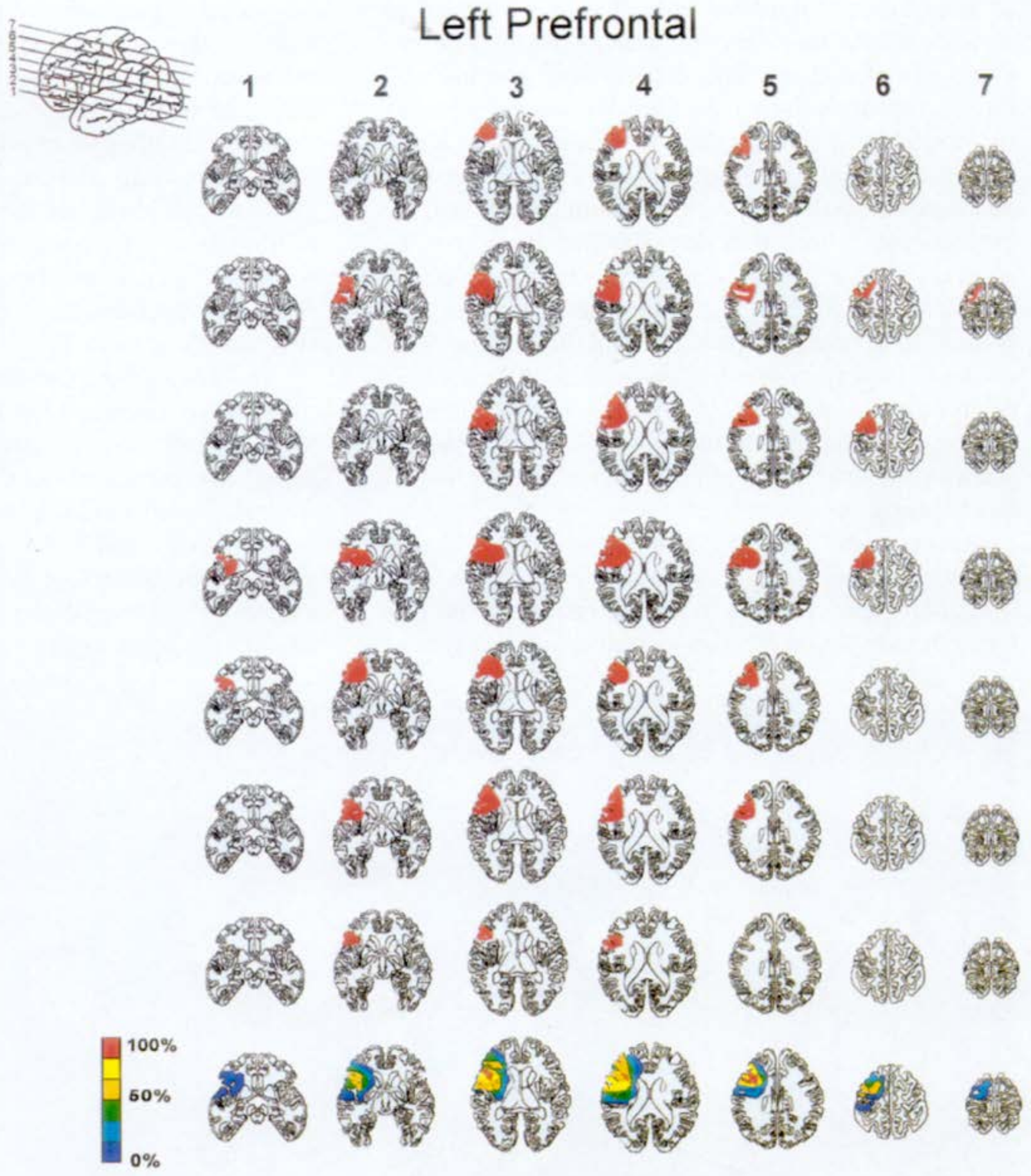
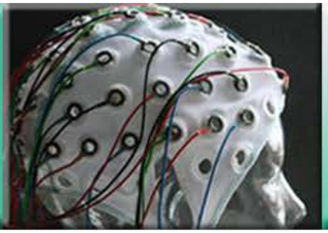
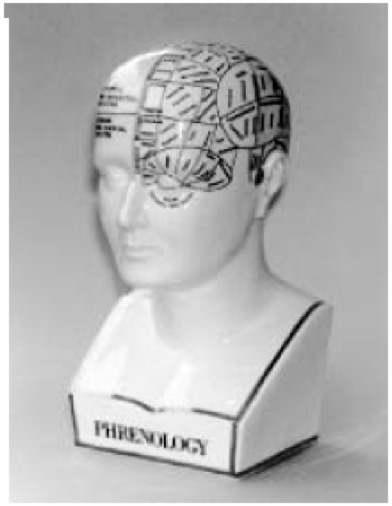


Figure 4.22 Drawing inferences from the study of humans with brain damage is difficult since naturally occurring brain lesions are never identical. Group studies can facilitate the functional analysis of brain structures by identifying regions of lesion overlap. Shown here are sketches of the extent of lesions in the left frontal cortex in a series of patients. The individual patients are represented in each row, with the transverse slices going from inferior to superior (as shown in the diagram in the upper left corner). The bottom row shows the extent of damage for the group in composite form.

Läsionsort Analysen: Vorsicht! (I)



- Läsions-Defizit-Assoziationen und die Gefahr der Neophrenologie



- F ist unterbrochen nach Läsion X
- Ist F lokalisiert in X?
- Ist der Zweck von X, F zu realisieren?

- Ist nur Region X relevant für F ?
- Hängt F noch an anderen Strukturen?

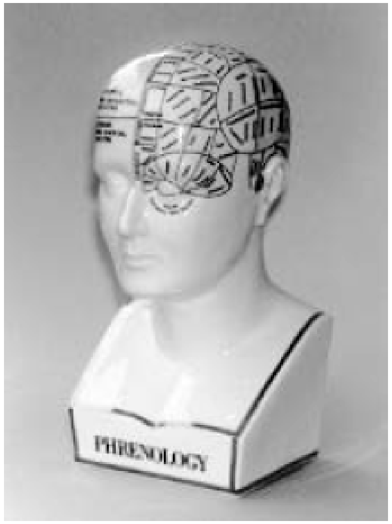
X ist relevant für einzelne Aspekte von F

Läsionsort Analysen: Vorsicht! (I)

- Läsions-Defizit-Assoziationen und die Gefahr der Neophrenologie

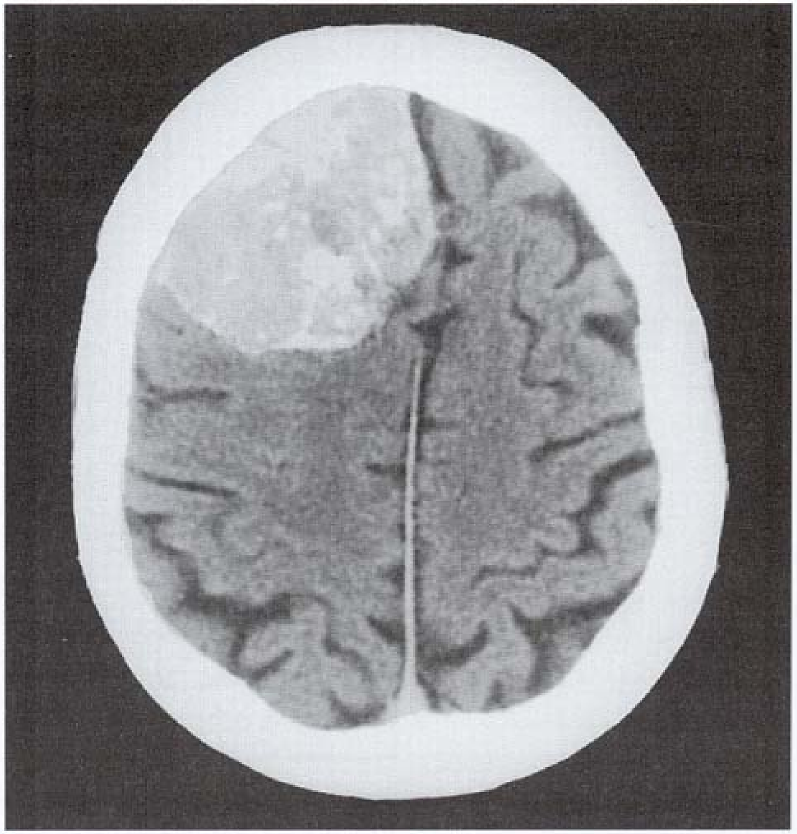
1) Gehirnregionen können verschiedene Funktionen realisieren.

2) Eine Funktion kann von mehr als einer Gehirnregion realisiert werden.



diaschisis

ungspr



A tumour (here shown on a CT scan) can make it hard to estimate lesion size, and the distortion in the shape of the brain makes it hard to map onto a standard atlas. Sovereign, ISM/Science Photo Library.

6.5 Ein Computertomogramm (CT) eines subduralen Hämatoms. Man beachte, daß sich der linke Seitenventrikel infolge des Druckes, den das Hämatom ausübt, verschoben hat (siehe Farbtafel IX).

Läsionsort Analysen: Vorsicht! (II)

1977 1983 2015

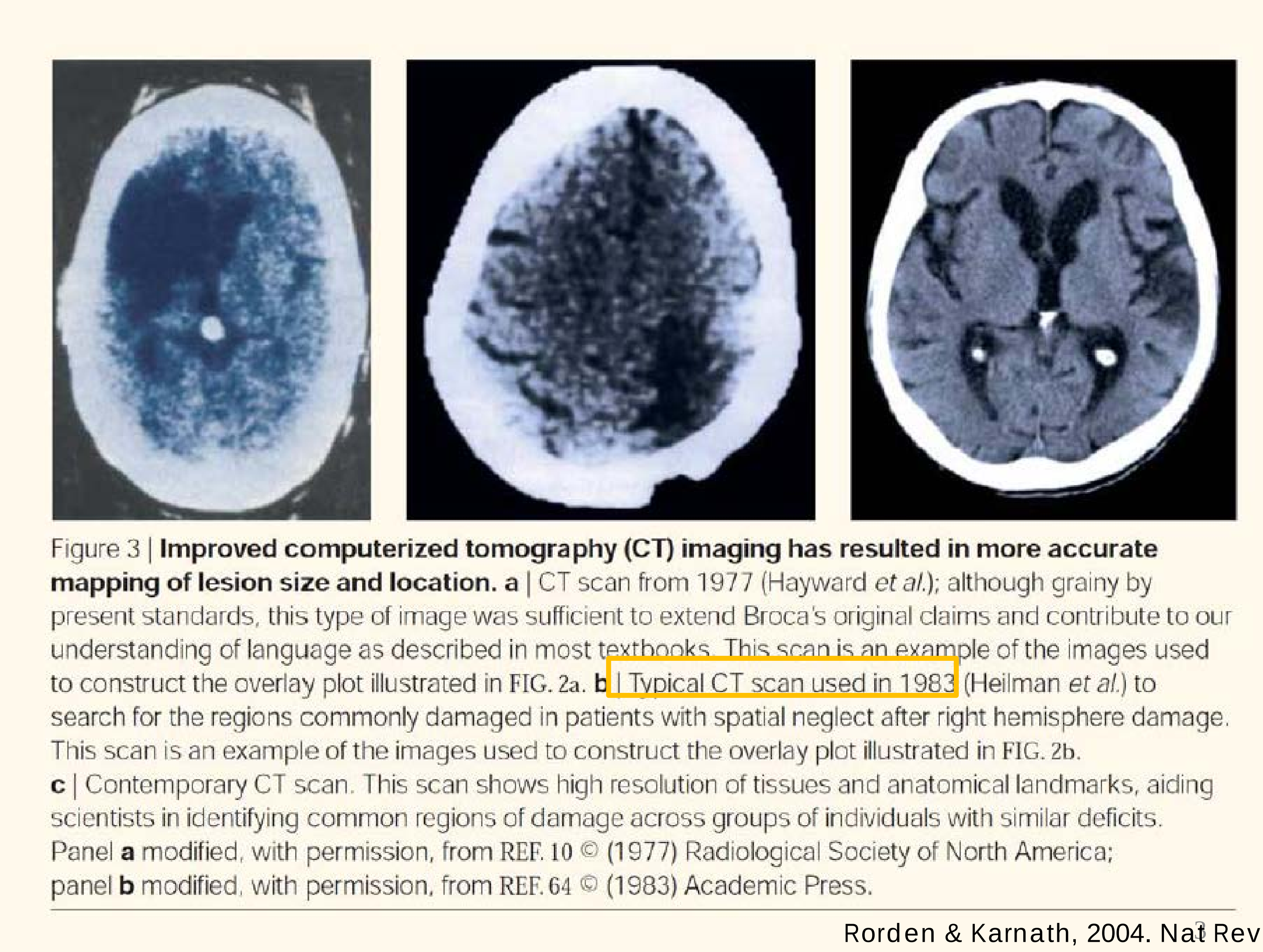


Figure 3 | **Improved computerized tomography (CT) imaging has resulted in more accurate mapping of lesion size and location. a** | CT scan from 1977 (Hayward *et al.*); although grainy by present standards, this type of image was sufficient to extend Broca's original claims and contribute to our understanding of language as described in most textbooks. This scan is an example of the images used to construct the overlay plot illustrated in FIG. 2a. **b** | Typical CT scan used in 1983 (Heilman *et al.*) to search for the regions commonly damaged in patients with spatial neglect after right hemisphere damage. This scan is an example of the images used to construct the overlay plot illustrated in FIG. 2b. **c** | Contemporary CT scan. This scan shows high resolution of tissues and anatomical landmarks, aiding scientists in identifying common regions of damage across groups of individuals with similar deficits. Panel **a** modified, with permission, from REF. 10 © (1977) Radiological Society of North America; panel **b** modified, with permission, from REF. 64 © (1983) Academic Press.

Rorden & Karnath, 2004. Nat Rev. NS

Läsionsort Analysen

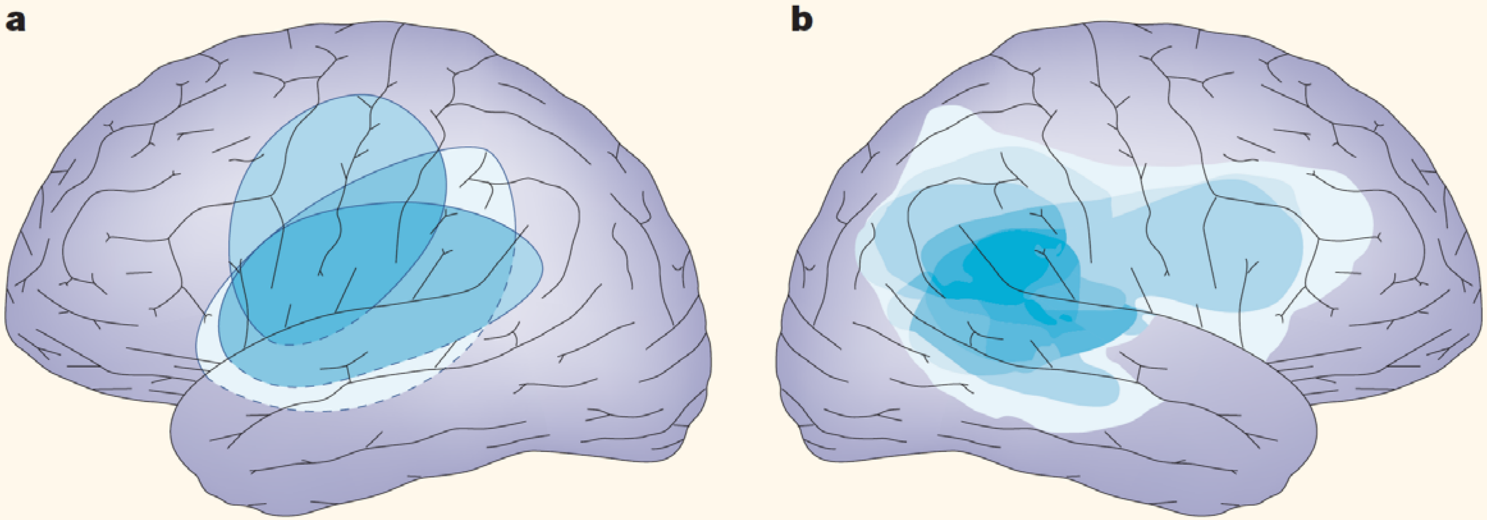


Figure 2 | **Overlay plots.** Examples of overlay plots. Regions that are commonly damaged in (**a**) three patients with Broca's aphasia after left hemisphere lesion[10] and (**b**) ten patients with spatial neglect after right hemisphere lesion[64]. Note that these overlay style images fail to take advantage of the information offered by control groups with brain damage. This style of lesion overlay plot has been adopted by many textbook chapters describing the anatomical basis of language processes in the left hemisphere and spatial attention in the right hemisphere, respectively. Panel **a** modified, with permission, from REF. 10 © (1977) Radiological Society of North America; panel **b** modified, with permission, from REF. 64 © (1983) Academic Press. Anatomical image adapted, with permission, from REF. 65 © (1996) Appleton & Lange.

Rorden & Karnath, 2004. Nat Rev. NS

Läsionsort Analysen: Die Relevanz der Kontrolgruppe

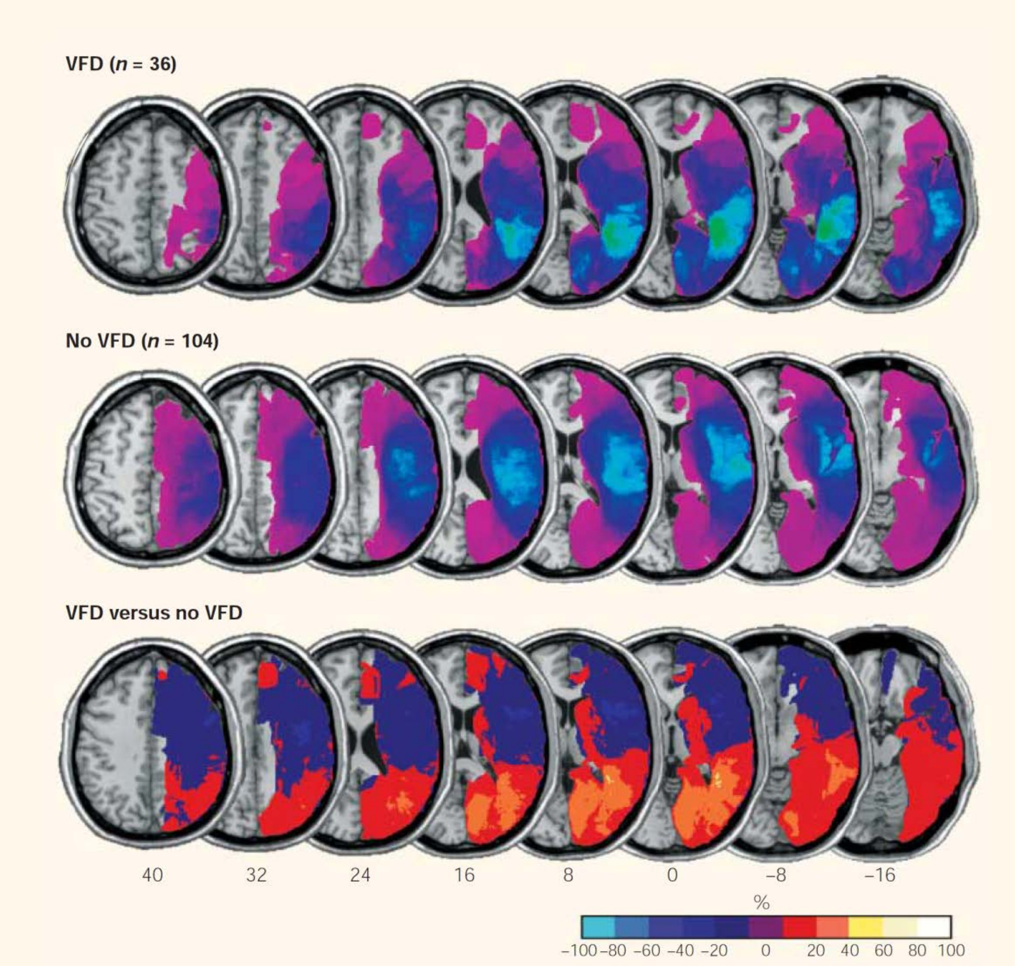


Figure 4 | **The importance of using control groups in lesion studies.** In this example, we explore the anatomy that correlates with primary visual field defects (VFD). We conducted a new analysis based on data from 140 patients with right hemisphere damage, reported in REF. 66. The top row shows a classical lesion overlay plot (similar to those in FIG. 2) for 36 consecutively admitted patients with VFD. This strategy could lead us to (erroneously) believe that primary vision is a function of subcortical white matter and the surrounding cortical region at the temporo-parietal junction. The panel in the middle shows the distribution of lesion frequency in the remaining 104 patients admitted in the same time period. They also had right hemisphere brain lesions but did not show VFD (control group). The bottom row shows a subtraction image: patients showing VFD minus controls (no VFD). The percentage of overlapping lesions after subtraction is illustrated by different colours, which code increasing frequencies, from dark red (difference = 1% to 20%) to white-yellow (difference = 81% to 100%). The colours from dark blue (difference = –1% to –20%) to light blue (difference = –81% to –100%) indicate regions damaged more frequently in control patients than in patients showing VFD. This subtraction image now accurately highlights the optic radiation and primary visual cortex as being typically damaged in patients with VFD and spared in control patients.

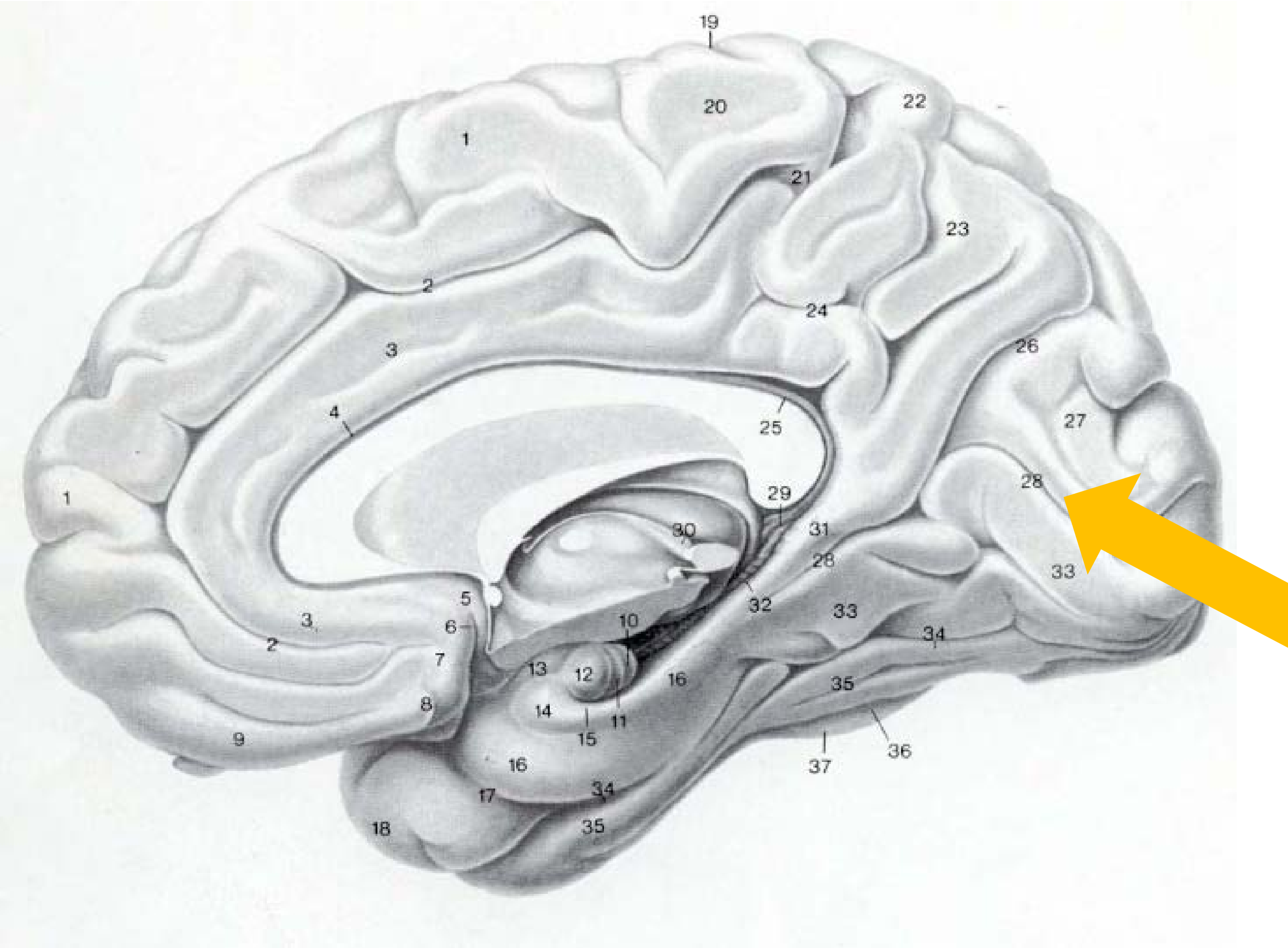
Läsionsort Analysen:
Voxel basierte Analysen (VAL)

Figure 5 | **Voxel-based analysis of lesions (VAL)** applied to the data described in figure 4. This figure shows the χ^2-distribution which resulted when patients with visual field cuts were compared with patients with intact visual fields. The regions of the occipital cortex and optic radiation shown in orange, yellow and white are statistically significant predictors of visual field cuts (controlled for dependent multiple comparisons using a 1% false discovery rate threshold).

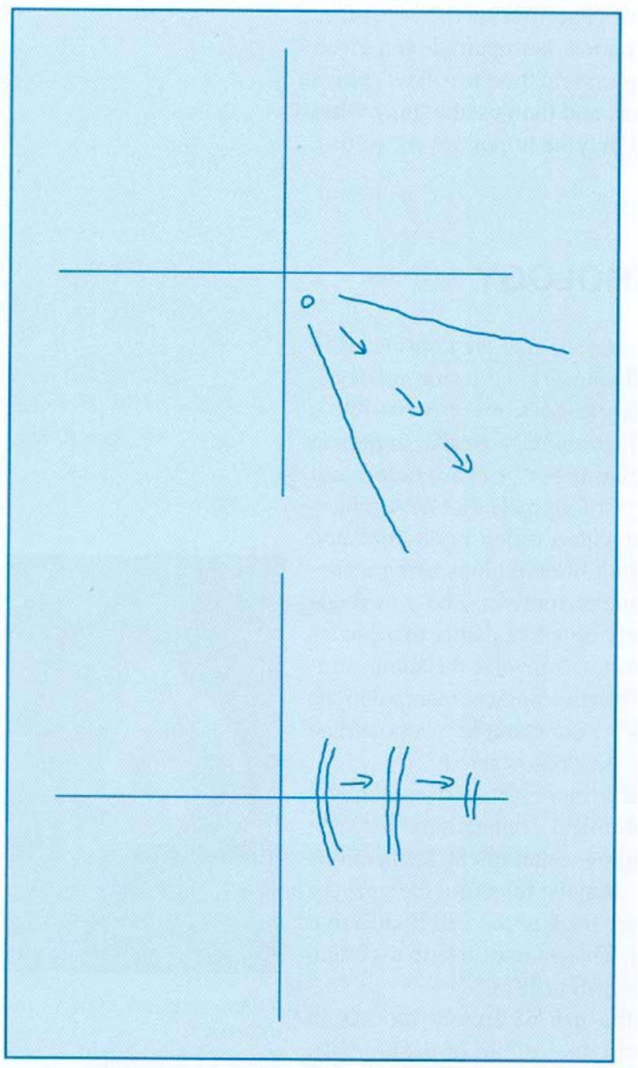
Zooming in ...

1 Gyrus frontalis superior
2 Sulcus cinguli
3 Gyrus cinguli
4 Sulcus corporis callosi
5 Gyrus paraterminalis
6 Sulcus parolfactorius posterior
7 Area subcallosa
8 Sulcus parolfactorius anterior
9 Gyrus rectus
10 Gyrus intralimbicus
11 Limbus Giacomini } Uncus
12 Gyrus uncinatus
13 Gyrus semilunaris
14 Gyrus ambiens
15 Incisura unci
16 Gyrus parahippocampalis
17 Sulcus rhinalis
18 Gyrus temporalis superior

19 Sulcus centralis
20 Lobulus paracentralis
21 Sulcus cinguli, pars marginalis
22 Lobulus parietalis superior
23 Precuneus
24 Sulcus subparietalis
25 Indusium griseum
26 Sulcus parieto-occipitalis
27 Cuneus
28 Sulcus calcarinus
29 Gyrus fasciolaris
30 Taenia thalami
31 Isthmus gyri cinguli
32 Gyrus dentatus
33 Gyrus occipitotemporalis medialis
34 Sulcus collateralis
35 Gyrus occipitotemporalis lateralis
36 Sulcus occipitotemporalis
37 Gyrus temporalis inferior



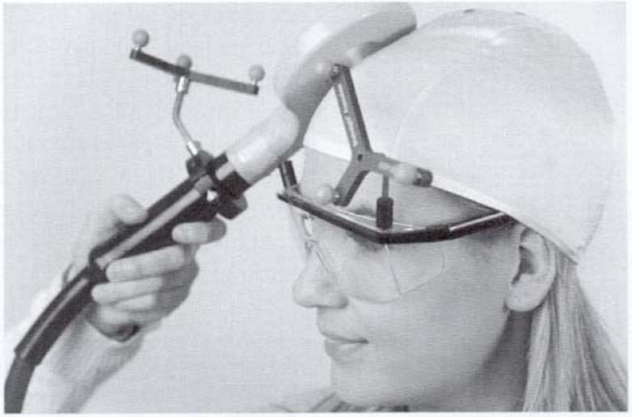
Virtuelle Läsionen (TMS):
(Phosphene)



An example of two phosphenes produced by stimulating area V5. Left hemisphere V5 stimulation produces right visual field phosphenes moving away from the centre. The first was described as "movement of a single point in a static field" and the second as "drifting right, not continuous". Reprinted from *Electroencephalography and Clinical Neurophysiology*, 3, Stewart et al., Motion perception and perceptual learning studied by magnetic stimulation, 334–350, Copyright 1999, with permission from Elsevier.

Virtuelle Läsionen (Transcranielle Magnetstimulation TMS)

Elektromagnetische Induktion führt zu einem Doppelaufgaben-Interferenz-Effekt



The coil is held against the participant's head, and a localized magnetic field is generated during performance of the task. University of Durham/ Simon Fraser/Science Photo Library.

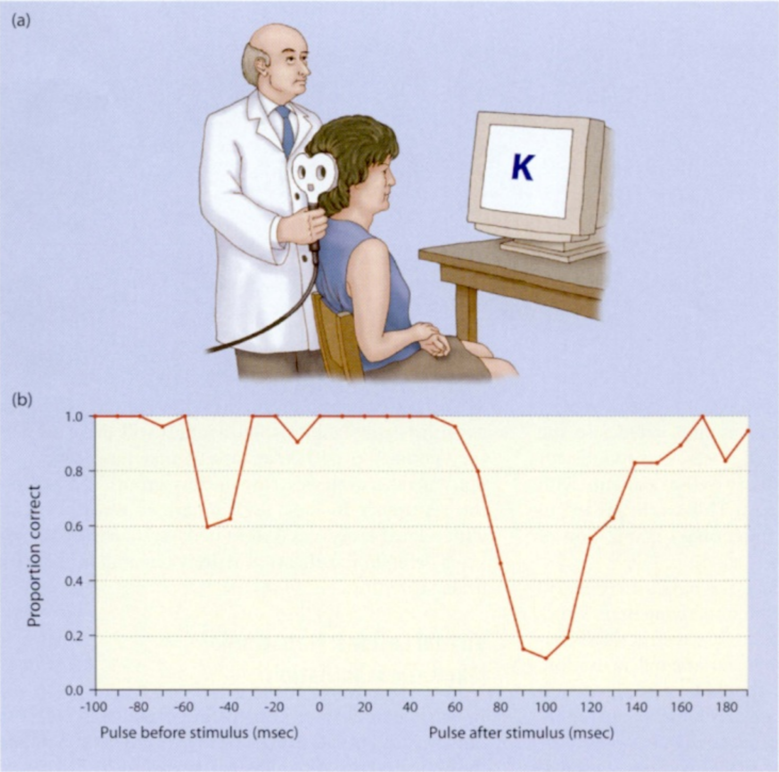
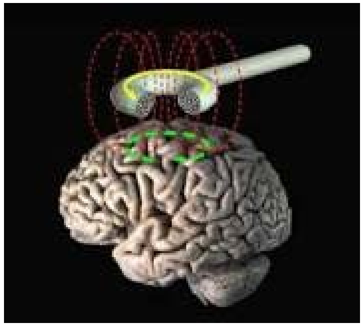
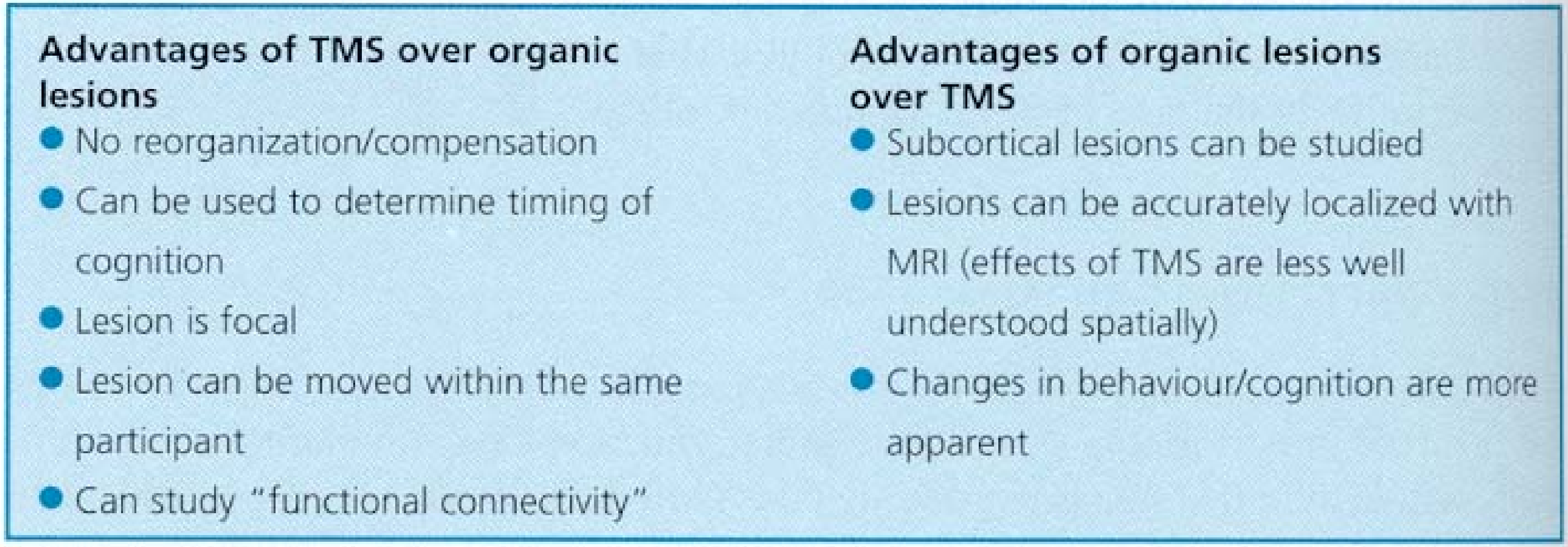


Figure 4.23 Transcranial magnetic stimulation (TMS) over the occipital lobe. **(a)** The center of the figure-8 coil is placed over the targeted area. When a large electrical field is passed through the coil, a magnetic pulse is generated and passes through the skull. This pulse activates neurons in the underlying cortex. **(b)** The time between the onset of the letter stimulus and the pulse is varied. When the pulse follows the stimulus by 70 to 130 msec, the subject fails to identify the stimulus on all trials. Note the failures when the pulse precedes the letter. These occur because the subject briefly blinks on some trials after the pulse. (b) Adapted from Corthout et al. (1999).

Virtuelle Läsionen (TMS)





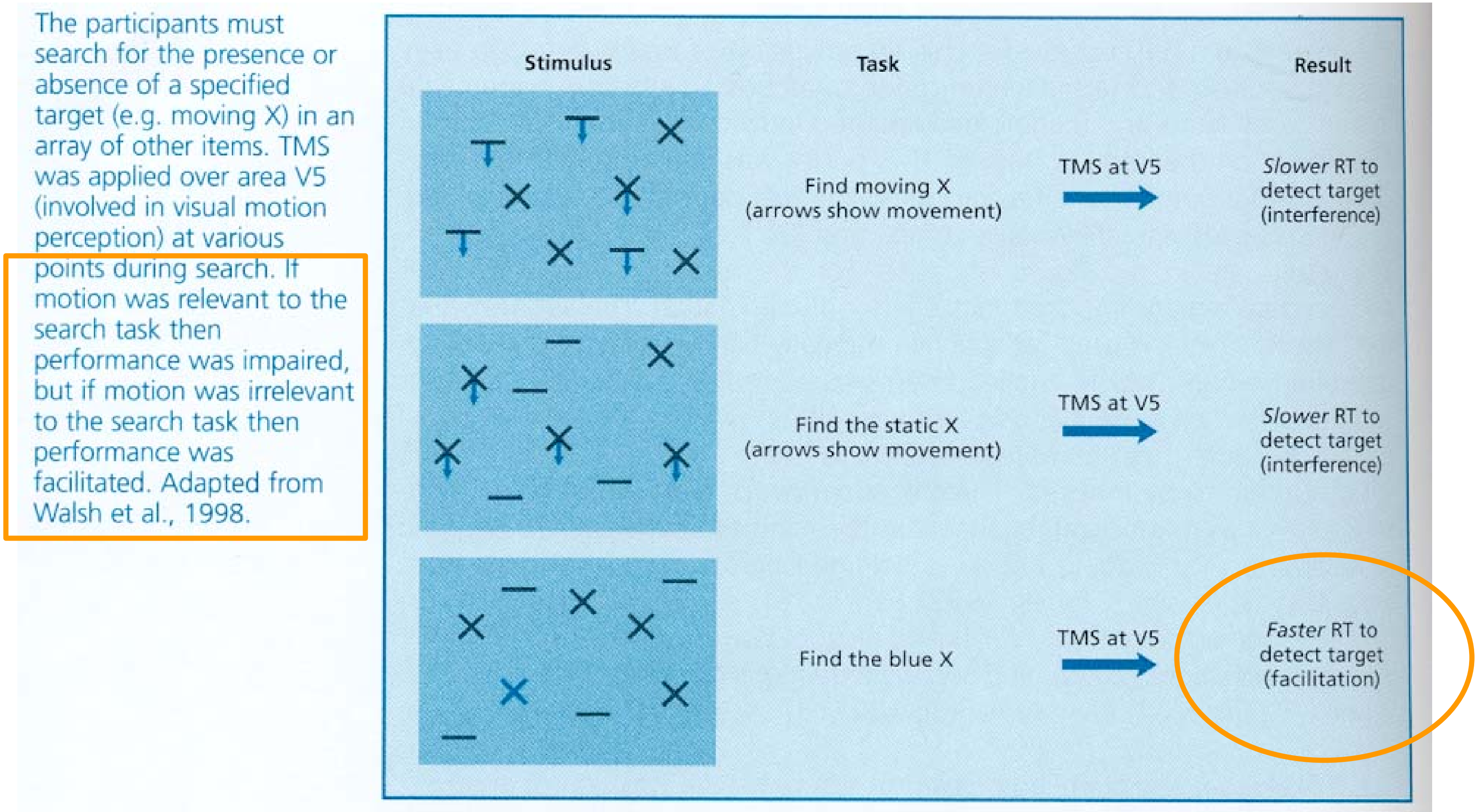
Advantages of TMS over organic lesions

- No reorganization/compensation
- Can be used to determine timing of cognition
- Lesion is focal
- Lesion can be moved within the same participant
- Can study "functional connectivity"

Advantages of organic lesions over TMS

- Subcortical lesions can be studied
- Lesions can be accurately localized with MRI (effects of TMS are less well understood spatially)
- Changes in behaviour/cognition are more apparent

Verhaltensverbesserung durch TMS ?

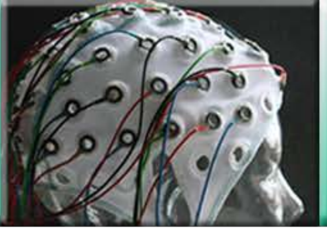


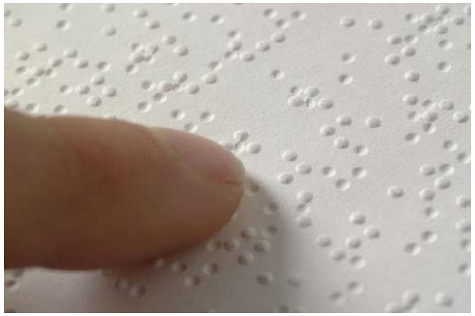
The participants must search for the presence or absence of a specified target (e.g. moving X) in an array of other items. TMS was applied over area V5 (involved in visual motion perception) at various points during search. If motion was relevant to the search task then performance was impaired, but if motion was irrelevant to the search task then performance was facilitated. Adapted from Walsh et al., 1998.

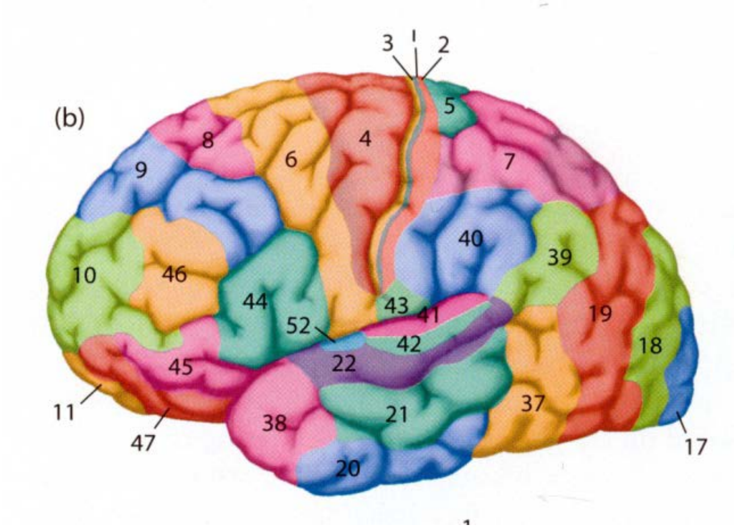
Stimulus	Task		Result
	Find moving X (arrows show movement)	TMS at V5 →	*Slower* RT to detect target (interference)
	Find the static X (arrows show movement)	TMS at V5 →	*Slower* RT to detect target (interference)
	Find the blue X	TMS at V5 →	*Faster* RT to detect target (facilitation)

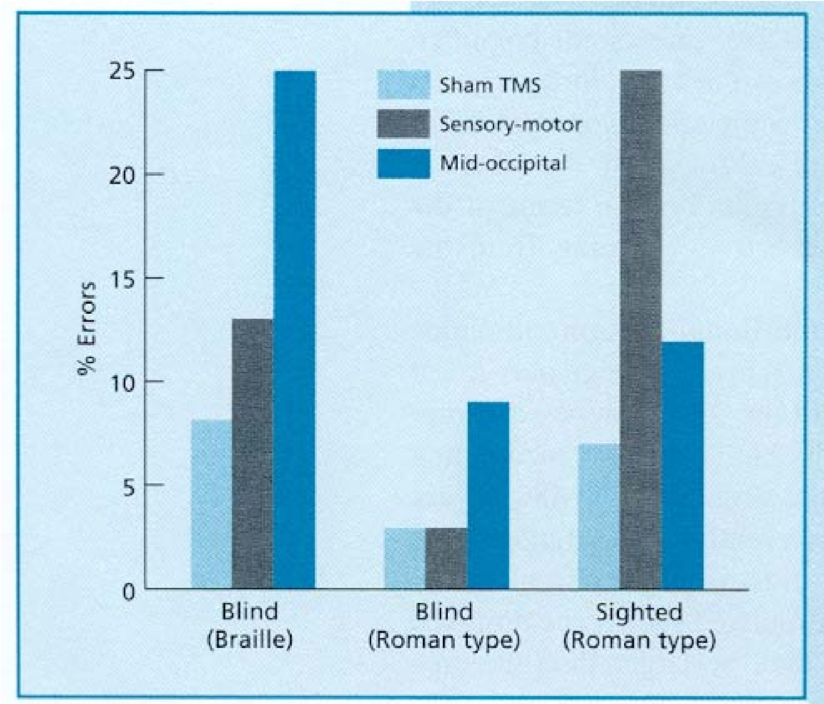
Virtuelle Läsionen (TMS)

Effekte ähneln einer Doppelaufgaben-interferenz



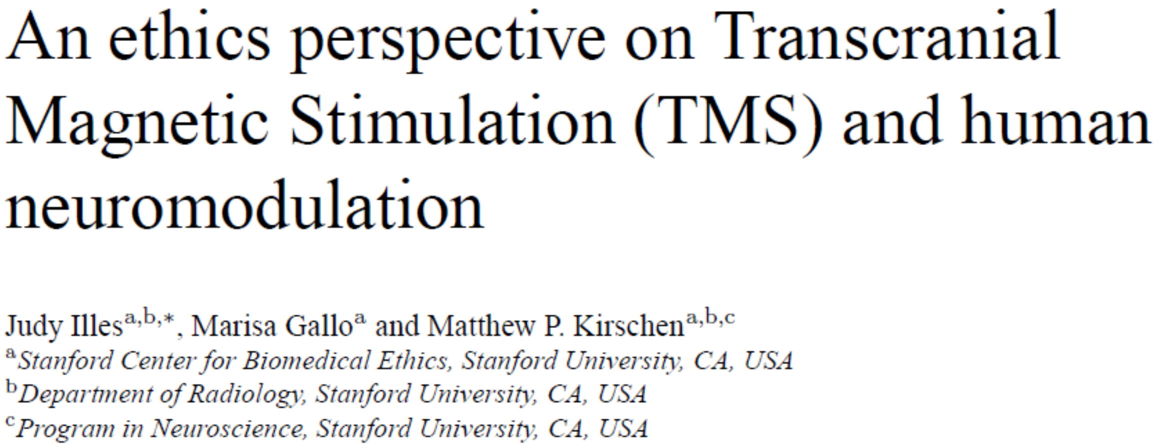






TMS over mid-occipital "visual" cortex impairs tactile identification in the blind but not in blindfolded sighted people, whereas TMS over sensory-motor (tactile) cortex impairs tactile discrimination in sighted individuals. Reprinted by permission of Macmillan Publishers Ltd. *Nature*, *389*, Cohen et al., Functional relevance of cross-modal plasticity in blind humans, 180–183, Copyright 1997.

Ethische Aspekte der TMS



An ethics perspective on Transcranial Magnetic Stimulation (TMS) and human neuromodulation

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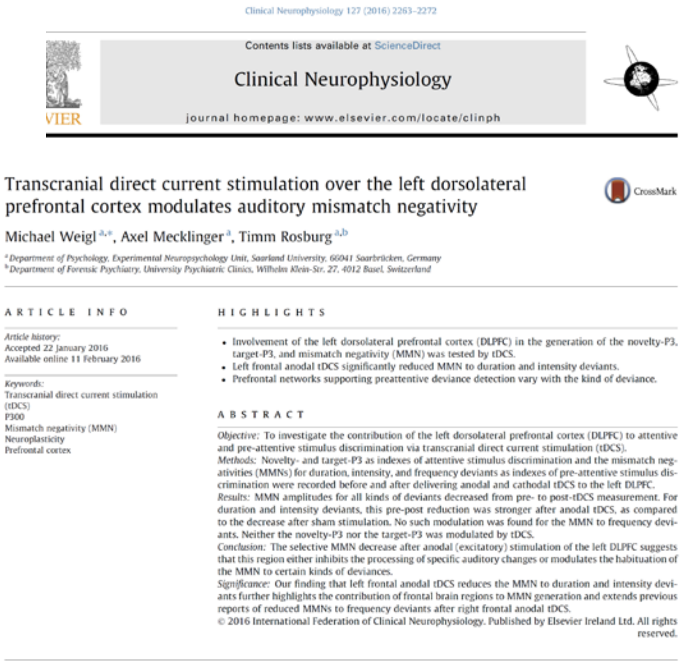
[a]*Stanford Center for Biomedical Ethics, Stanford University, CA, USA*
[b]*Department of Radiology, Stanford University, CA, USA*
[c]*Program in Neuroscience, Stanford University, CA, USA*

- Repetitive TMS has small risk of seizure induction
- Only certain number of pulses per VP
- Ear protection
- Facial twitch/ear protection
- Long-term consequences?

Transient Direct (Alternating) Current Stimulation tDCs / tACs



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Transcranial direct current stimulation over the left dorsolateral prefrontal cortex modulates auditory mismatch negativity

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Keywords:
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Mismatch negativity (MMN)
Neuroplasticity
Prefrontal cortex

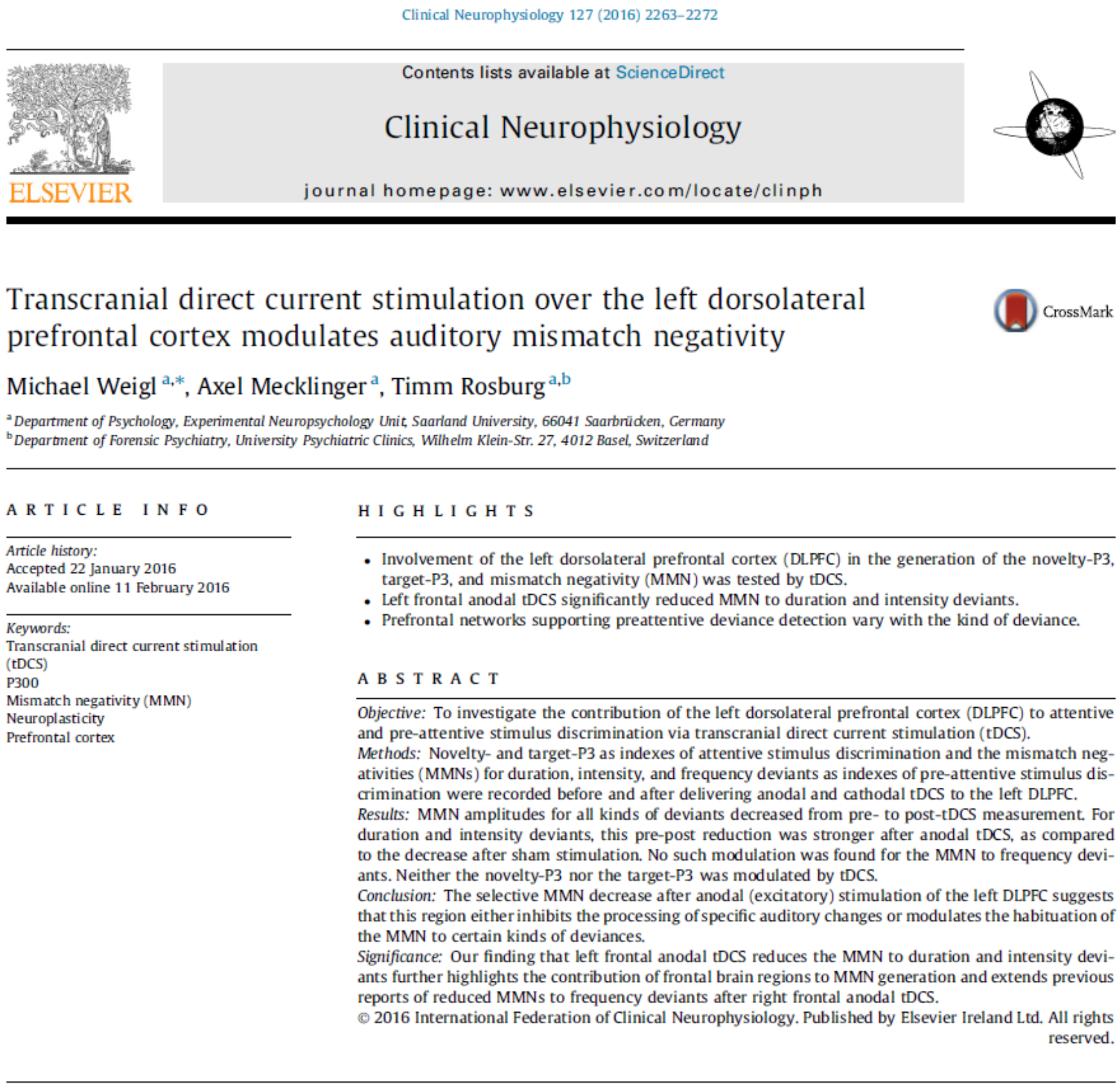
HIGHLIGHTS

- Involvement of the left dorsolateral prefrontal cortex (DLPFC) in the generation of the novelty-P3, target-P3, and mismatch negativity (MMN) was tested by tDCS.
- Left frontal anodal tDCS significantly reduced MMN to duration and intensity deviants.
- Prefrontal networks supporting preattentive deviance detection vary with the kind of deviance.

ABSTRACT

Objective: To investigate the contribution of the left dorsolateral prefrontal cortex (DLPFC) to attentive and pre-attentive stimulus discrimination via transcranial direct current stimulation (tDCS).
Methods: Novelty- and target-P3 as indexes of attentive stimulus discrimination and the mismatch negativities (MMNs) for duration, intensity, and frequency deviants as indexes of pre-attentive stimulus discrimination were recorded before and after delivering anodal and cathodal tDCS to the left DLPFC.
Results: MMN amplitudes for all kinds of deviants decreased from pre- to post-tDCS measurement. For duration and intensity deviants, this pre-post reduction was stronger after anodal tDCS, as compared to the decrease after sham stimulation. No such modulation was found for the MMN to frequency deviants. Neither the novelty-P3 nor the target-P3 was modulated by tDCS.
Conclusion: The selective MMN decrease after anodal (excitatory) stimulation of the left DLPFC suggests that this region either inhibits the processing of specific auditory changes or modulates the habituation of the MMN to certain kinds of deviances.
Significance: Our finding that left frontal anodal tDCS reduces the MMN to duration and intensity deviants further highlights the contribution of frontal brain regions to MMN generation and extends previous reports of reduced MMNs to frequency deviants after right frontal anodal tDCS.

Transient Direct (Alternating) Current stimulation tDCs / tACs



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Danke für Ihre Aufmerksamkeit!

Brain Tutor (3.0)
Brainvoyager.com

Wo genau liegt das BA 41?

Wo liegt die Insula? Welche Funktion hat sie?

Was ist ein Fasiculus Uncinatus?

▶