La neuropsicologia: stato attuale e prospettive

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Come nei film…

- Le opinioni e valutazione qui espresse sono di SFC e **non** riflettono posizioni ufficiali di organi accademici, ordini professionale o società professionali/scientifiche

La neuropsicologia come scienza

- Lo studio scientifico del rapporto tra mente e cervello è stato per decenni identificato con la neuropsicologia
- Strumento privilegiato era lo studio dei pazienti affetti da patologie del sistema nervoso
- Negli ultimi anni, lo sviluppo di altre metodologie (come l'imaging) hanno portato alla ridefinizione del campo come « neuroscienze cognitive ». In questo senso, la neuropsicologia ne rappresenta un settore specifico (studio dei pazienti)

- Il campo delle neuroscienze cognitive è per definizione interdisciplinare. Vi fanno riferimento:
  - Neurobiologi
  - Neurologi
  - Psicologi
  - Linguisti
  - Filosofi
  - Psichiatri
  - Informatici
  - Fisici
  - …

Franz-Joseph Gall

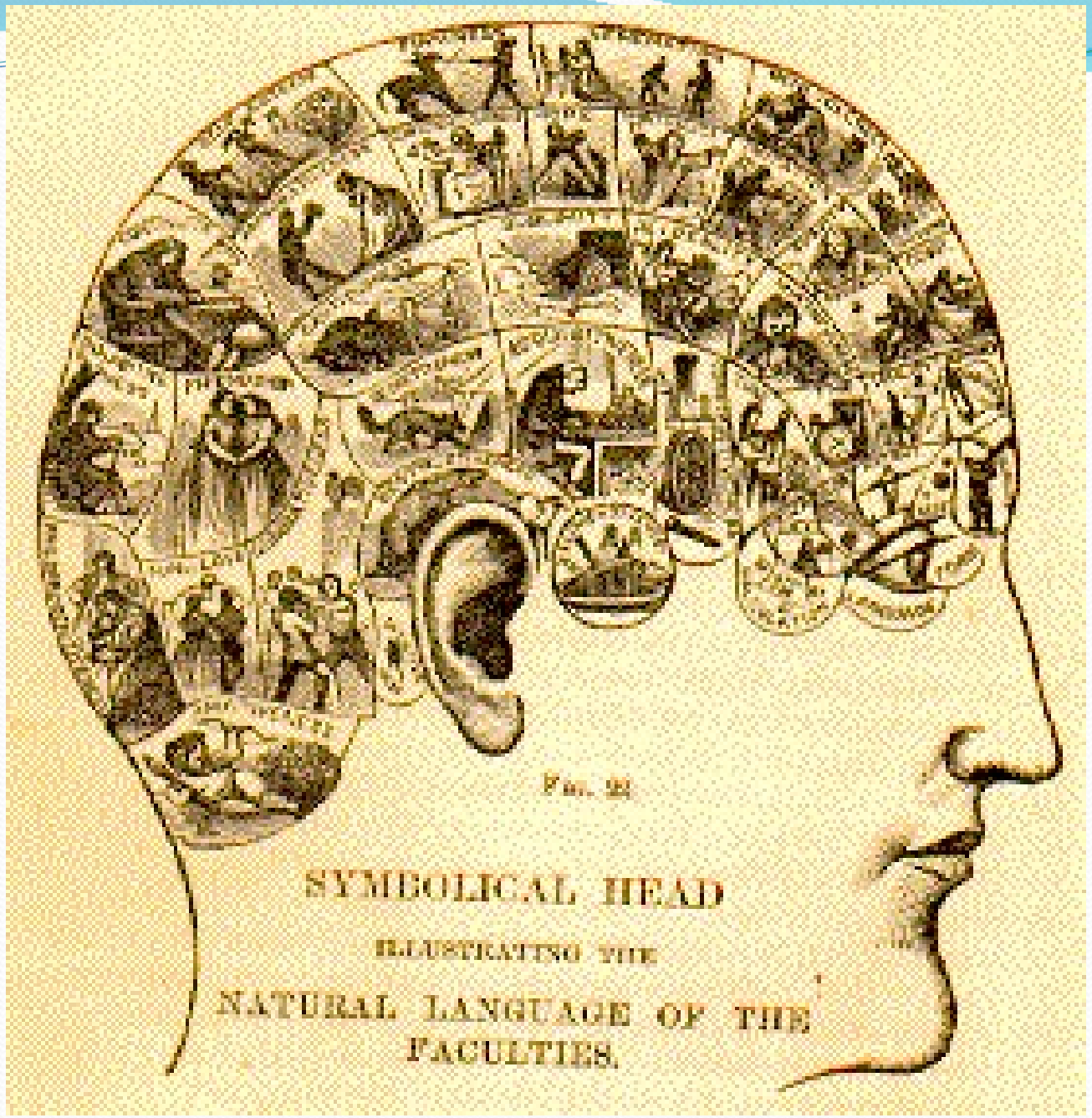


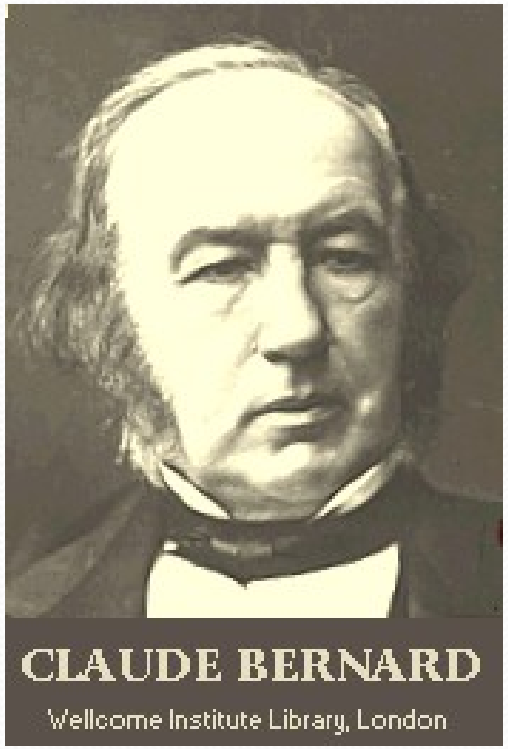
Fig. 21.

SYMBOLICAL HEAD

ILLUSTRATING THE

NATURAL LANGUAGE OF THE FACULTIES.

La tradizione medica: la medicina sperimentale

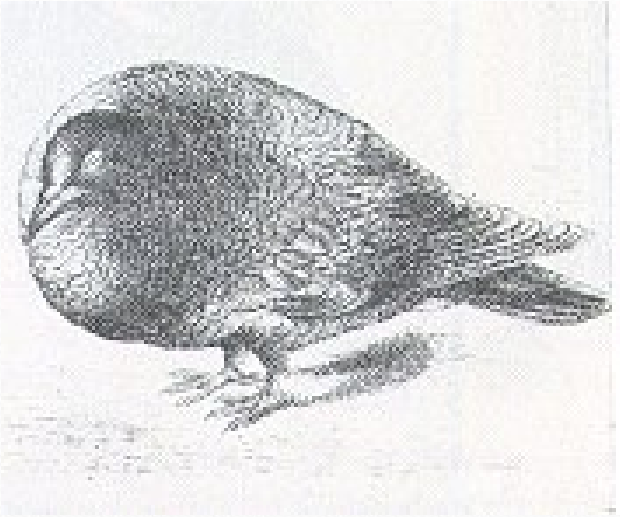


(1813-1878)

“è quello che pensiamo di sapere già che ci impedisce di imparare”

Jean Pierre Flourens: la neurofisiologia sperimentale

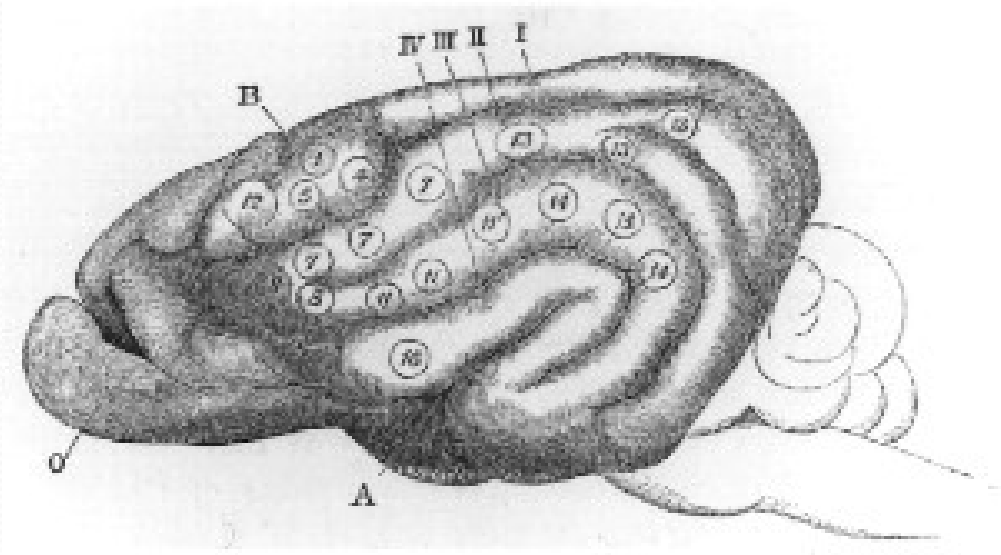
(1794-1867)



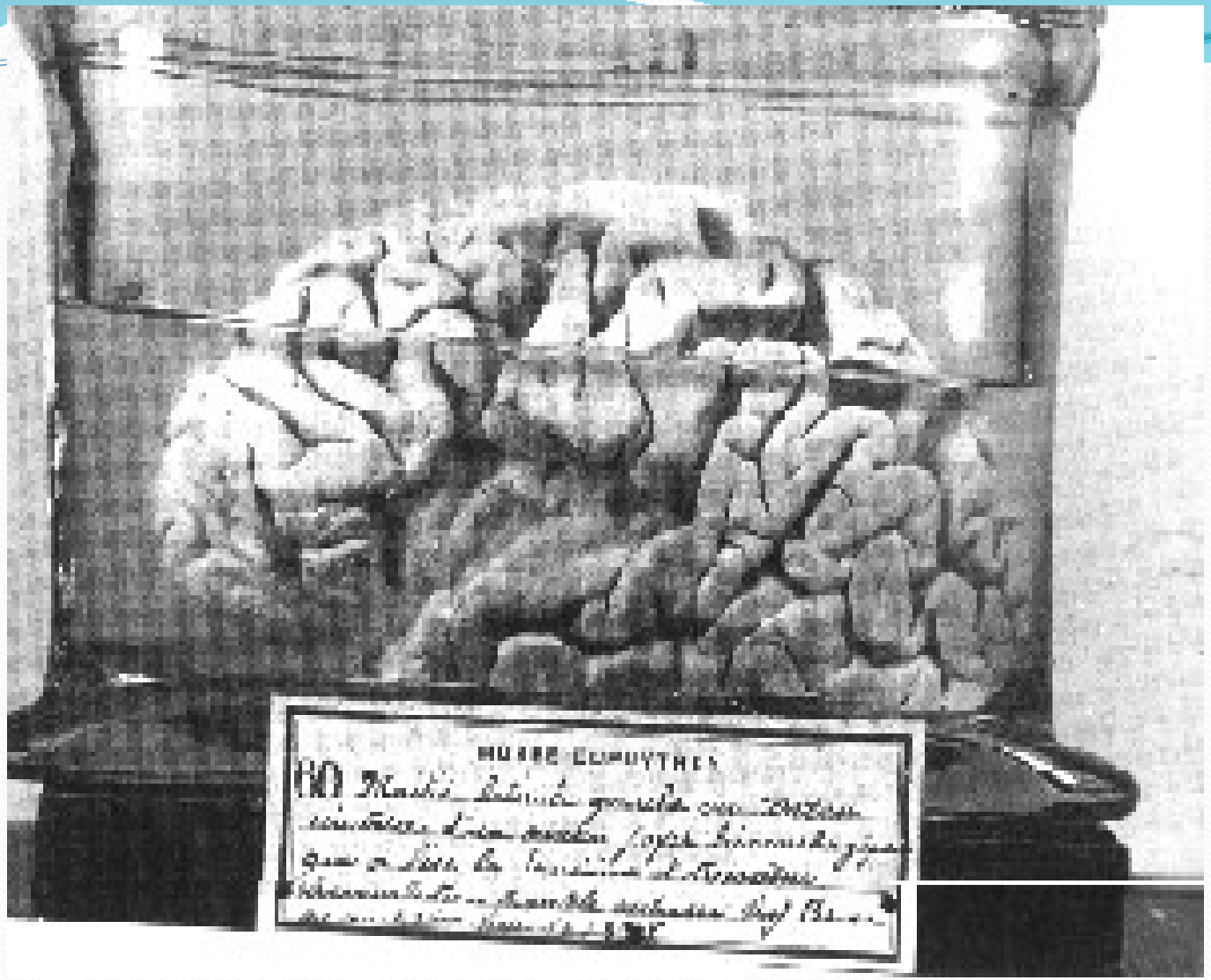
“A part of the convexity of the hemisphere of the brain of the dog is motor . . . another part is not motor. The motor part, in general, is more in front, the non-motor part more behind. By electrical stimulation of the motor part, one obtains combined muscular contractions of the opposite side of the body”

1870, Gustav Fritsch and Eduard Hitzig

David Ferrier (1843-1924)



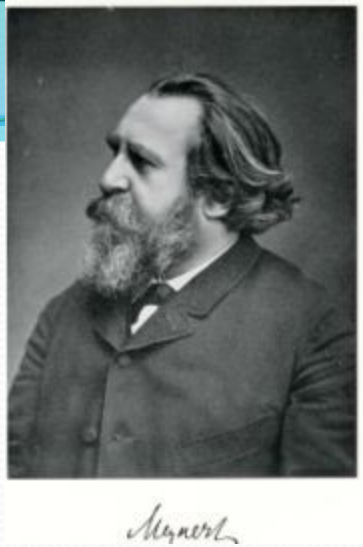
Paul Broca (1824-1880)

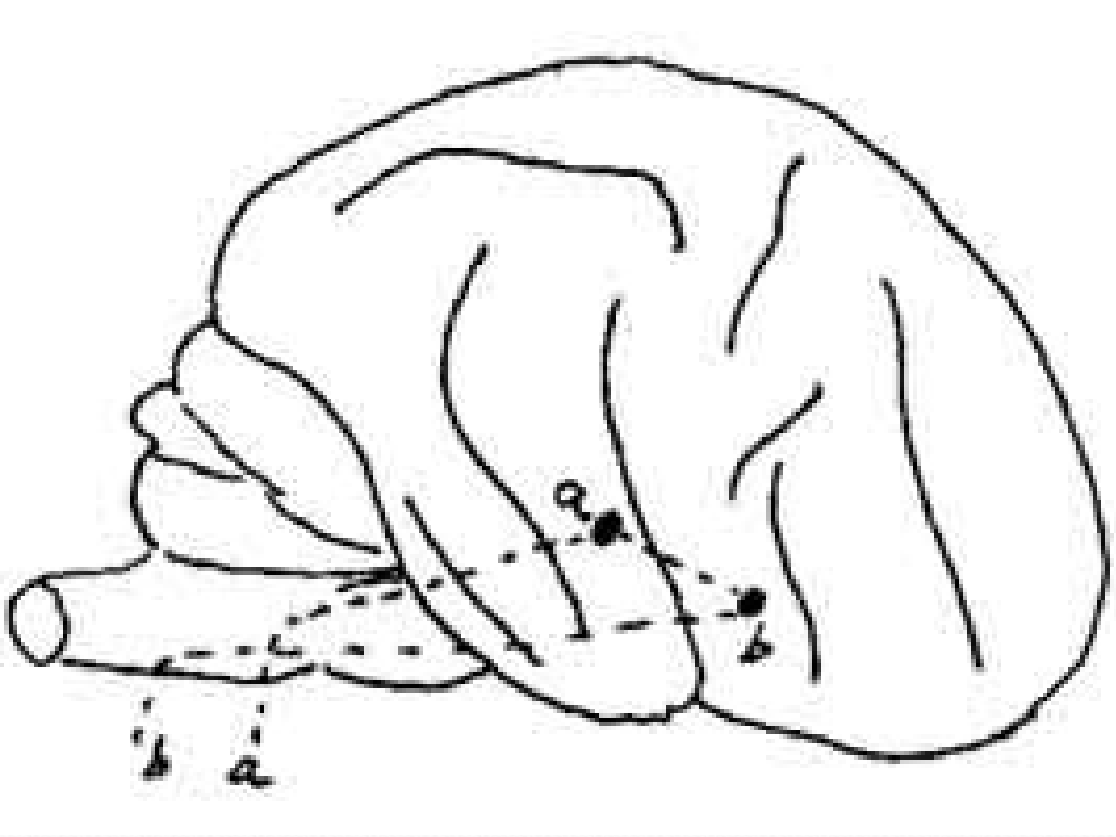


Leborgne (Tan)

Carl Wernicke (1848-1905)

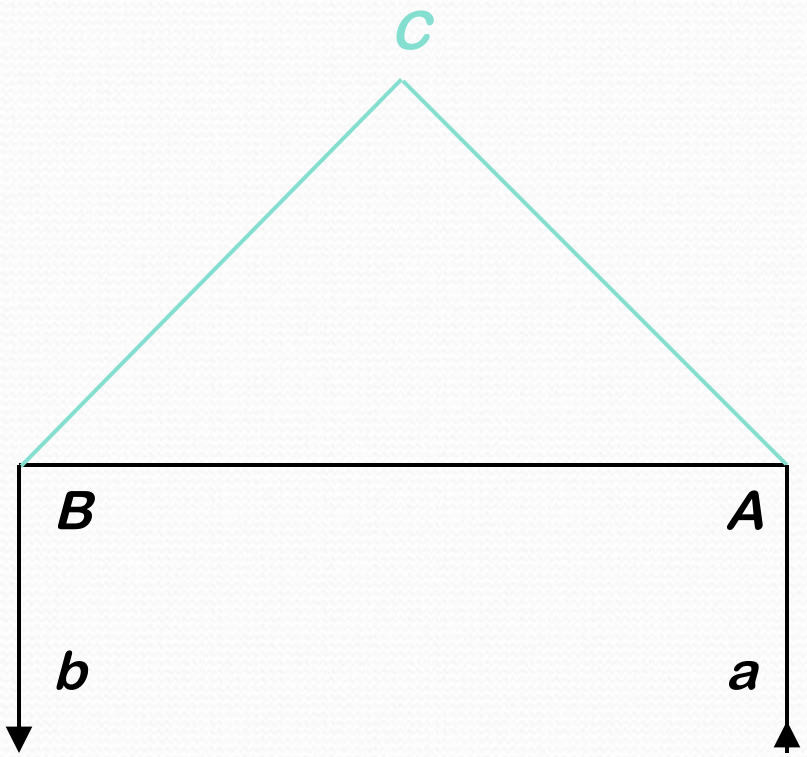
L’influsso di Meynert





“The reader will find no other definition of 'Psychiatry' in this book but the one given on the title page: Clinical Treatise on Diseases of the Forebrain. The historical term for psychiatry, i.e., 'treatment of the soul,' implies more than we can accomplish, and transcends the bounds of accurate scientific investigation”

Il modello di Lichtheim



A = rappresentazioni uditive delle parole

B = rappresentazioni motorie delle parole

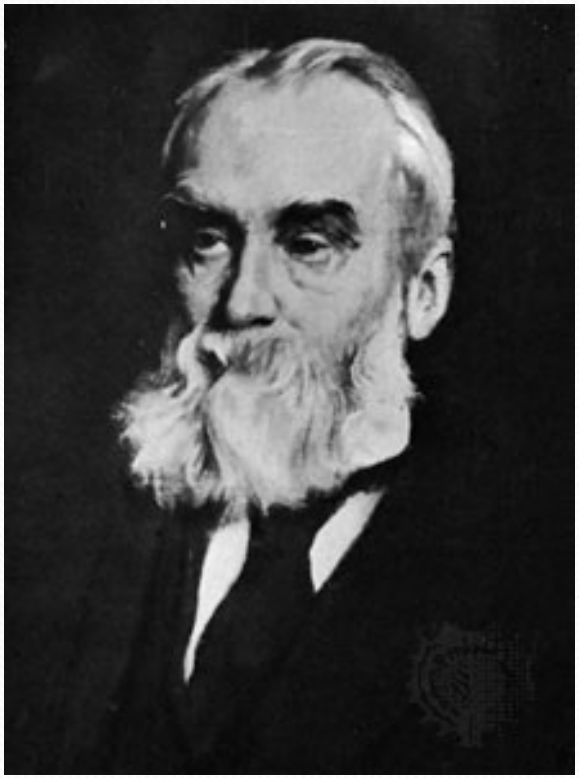
C = concetti

a = *analisi uditiva*

b = *programmi articolatori*

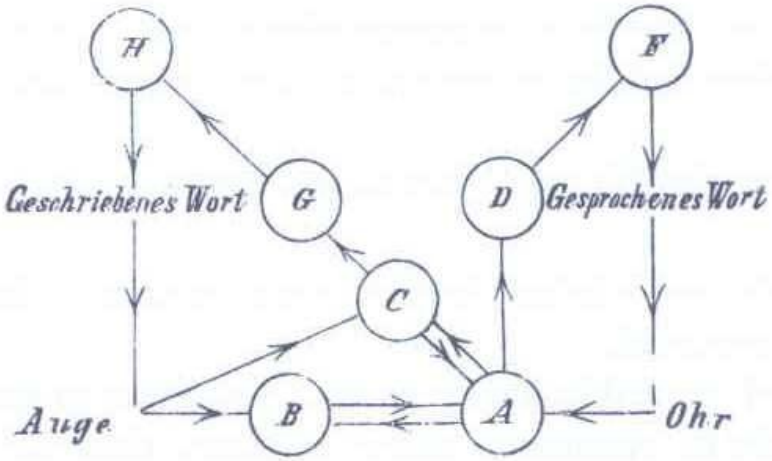
La tradizione psicologica

John Hughlings Jackson (1835-1911)



Evolution and dissolution of the nervous system

Modelli « funzionali »: Grashey (1881)

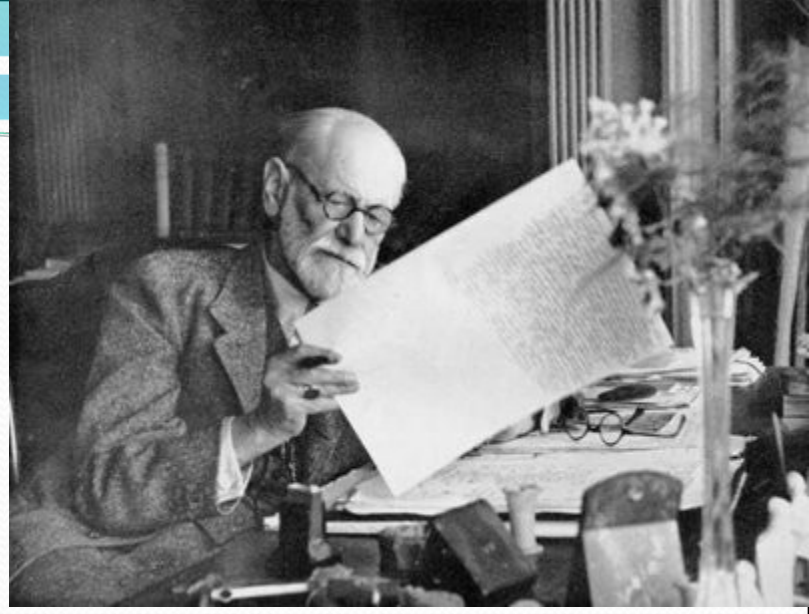


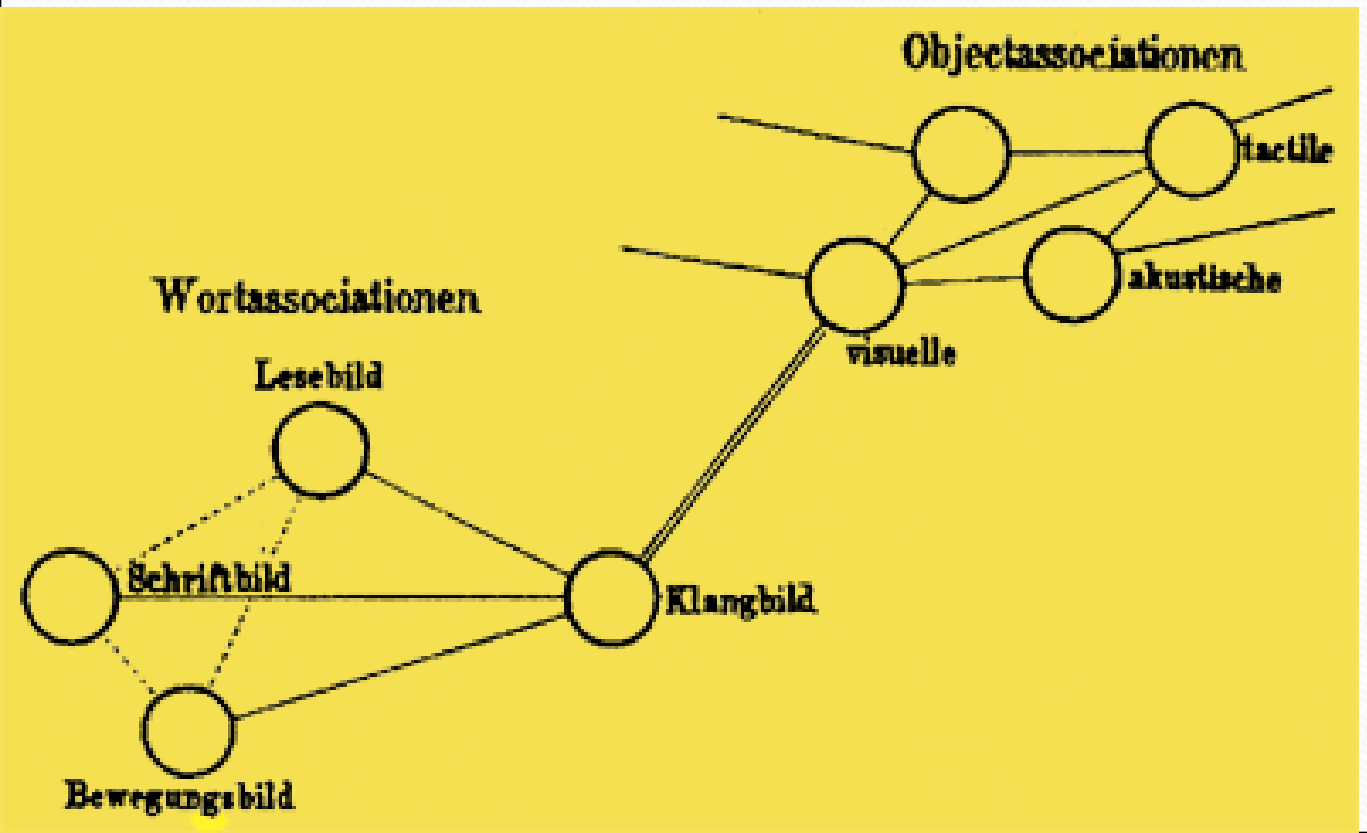
In demselben bedeutet:

A das Centrum für Klangbilder,
B » » » Objectbilder,
C » » » Symbole, d. h. für geschriebene oder gedruckte Buchstaben, Worte und Zahlen,
D das Centrum für die Bewegungsvorstellungen der Sprache,
F die Kerne der Phonations- und Articulationsnerven,
G das Centrum für die Bewegungsvorstellungen des Schreibens,
H Die Kerne der beim Schreiben fungirenden motorischen Nerven.

« rapido decadimento delle immagini sensoriali »

Zur Auffassung der Aphasien, Leipzig und Wien, Franz Deuticke, 1891





a. Agnosica

d. Asimbolica

g. Verbale

Observing mental states

- Mental states are not accessible to direct observation
- Possible solutions:
  - Introspection (Würzburg school)
  - Elimination (Behaviourism)
  - Mental chronometry (Donders)

The Würzburg school

O. Külpe (1862-1915)

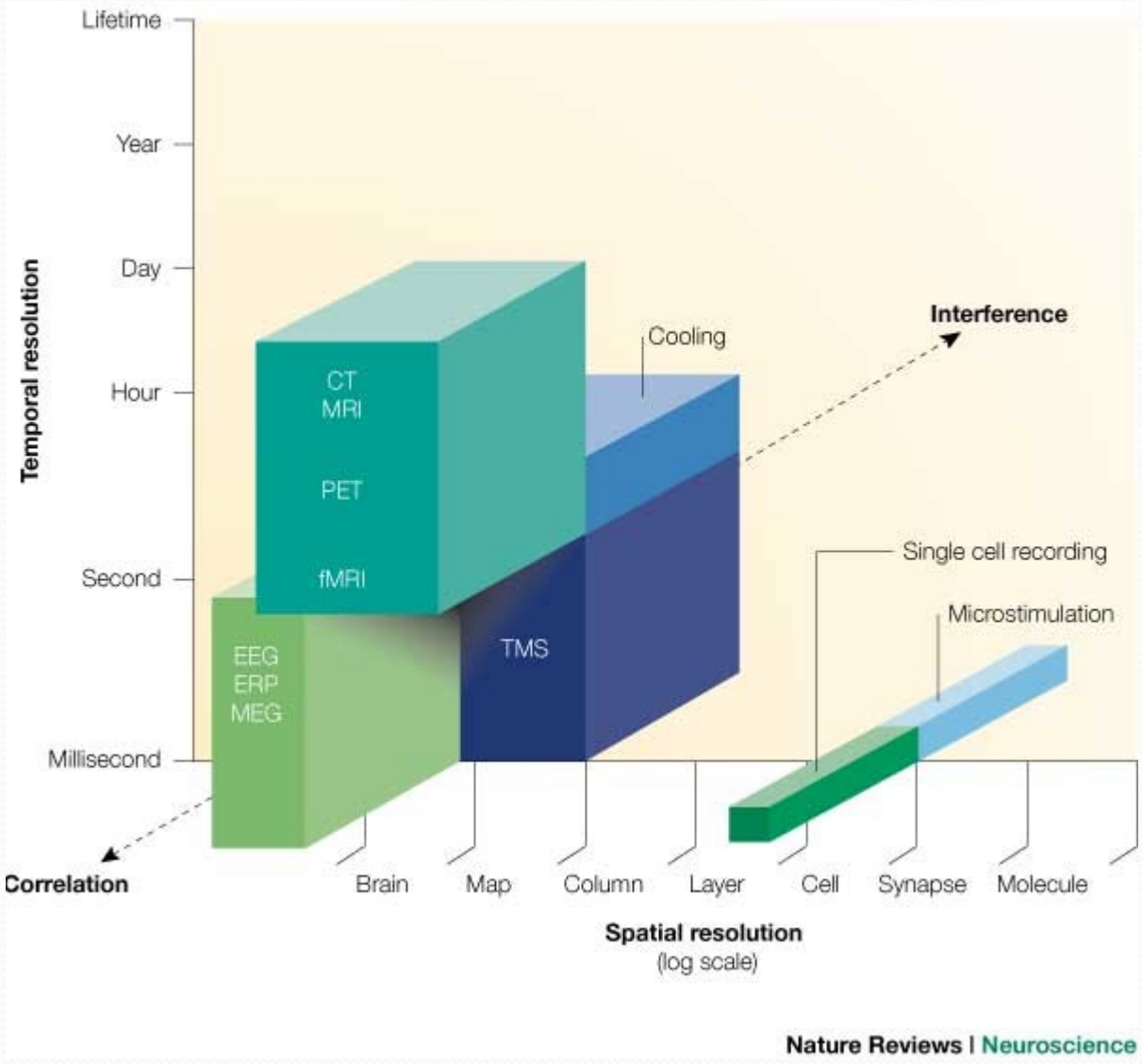
Behaviourism

Mental chronometry

Franciscus Cornelis Donders
(1818-1889)

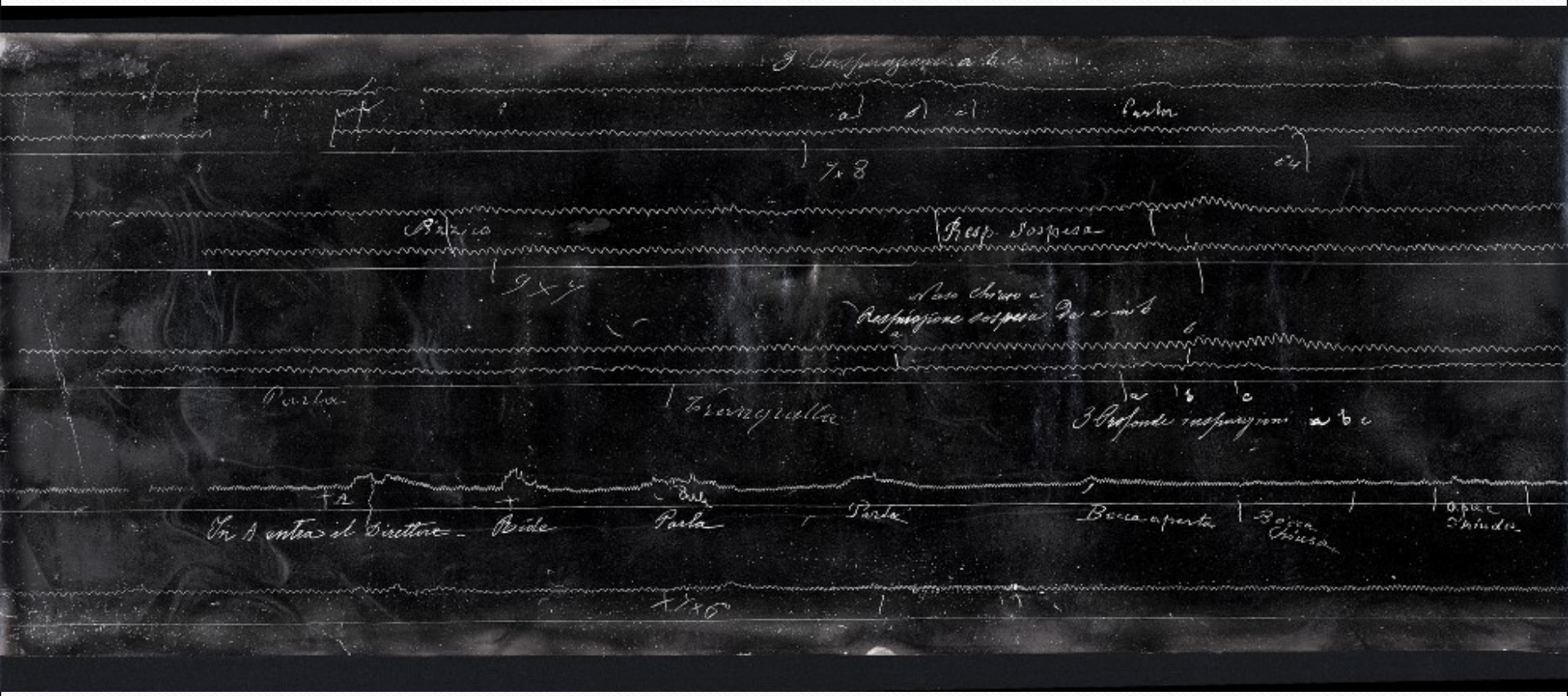
La neuropsicologia cognitiva

I metodi attuali: finestre sul cervello

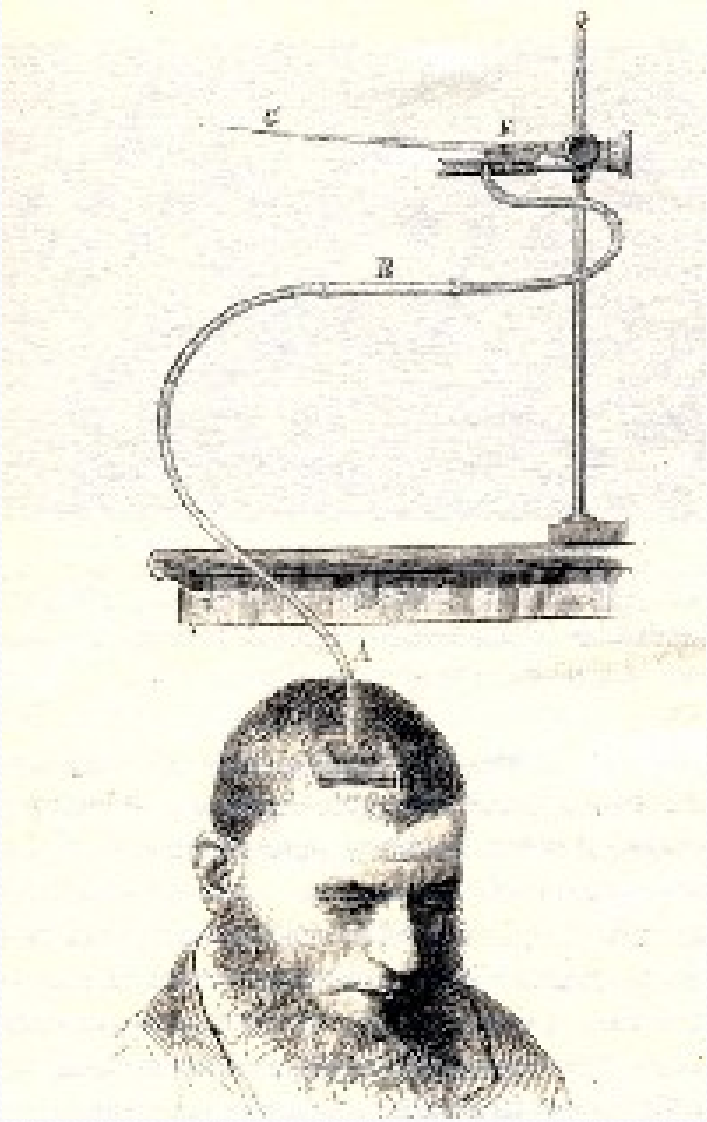


Lo studio funzionale del cervello intatto

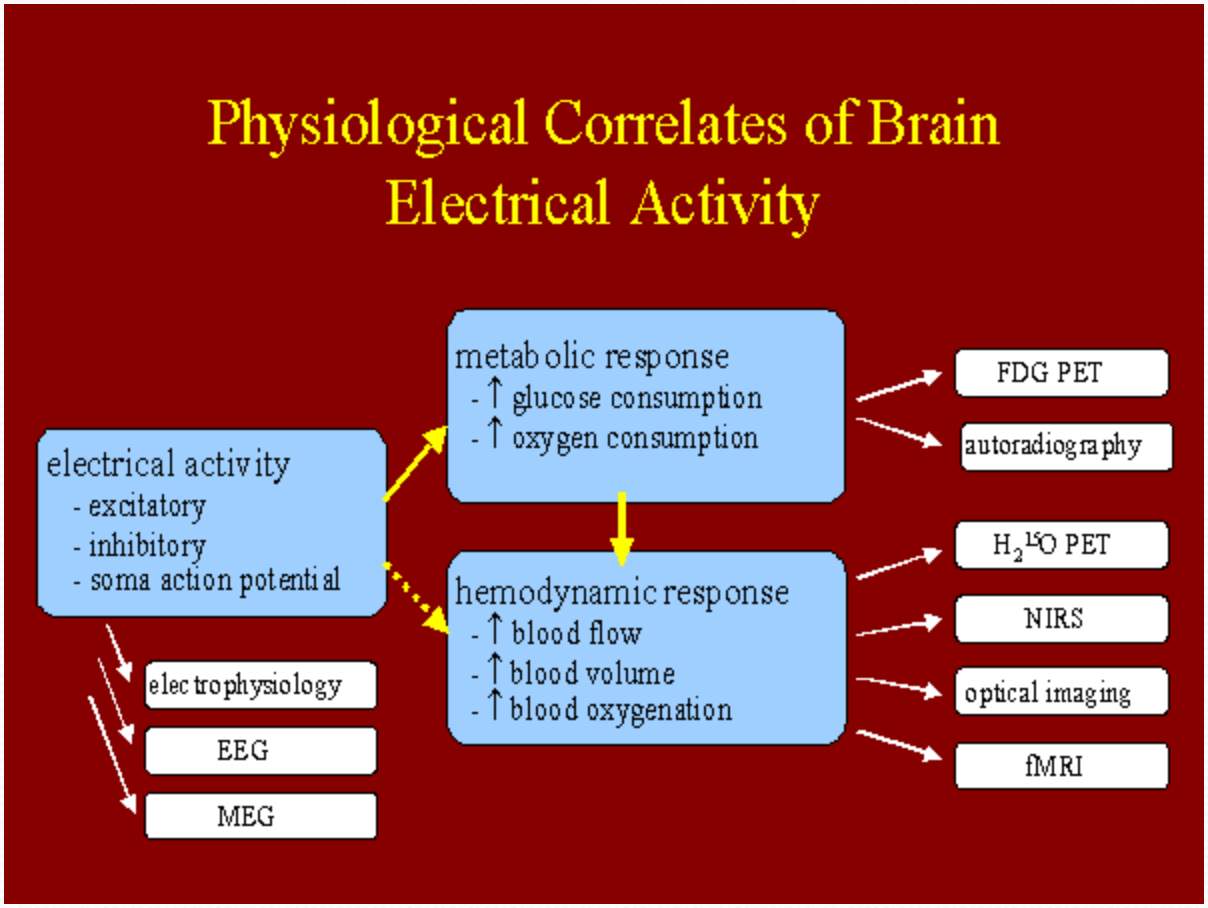
Angelo Mosso (1846-1910)


Parla
Respiro
Tremolio
Parla
Parla
Bocca aperta
Bocca chiusa

Il caso di Michele Bertino

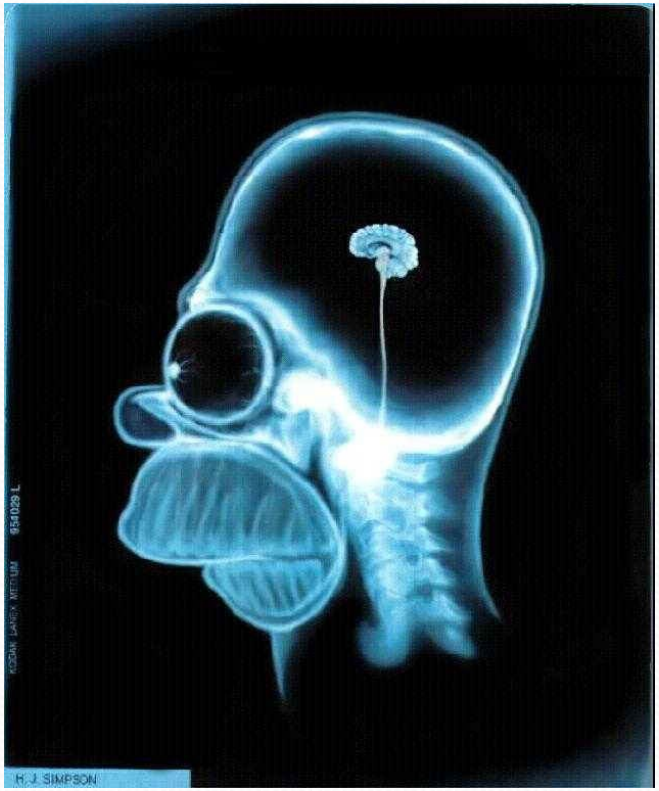


I metodi delle neuroscienze cognitive



MRI vs. fMRI

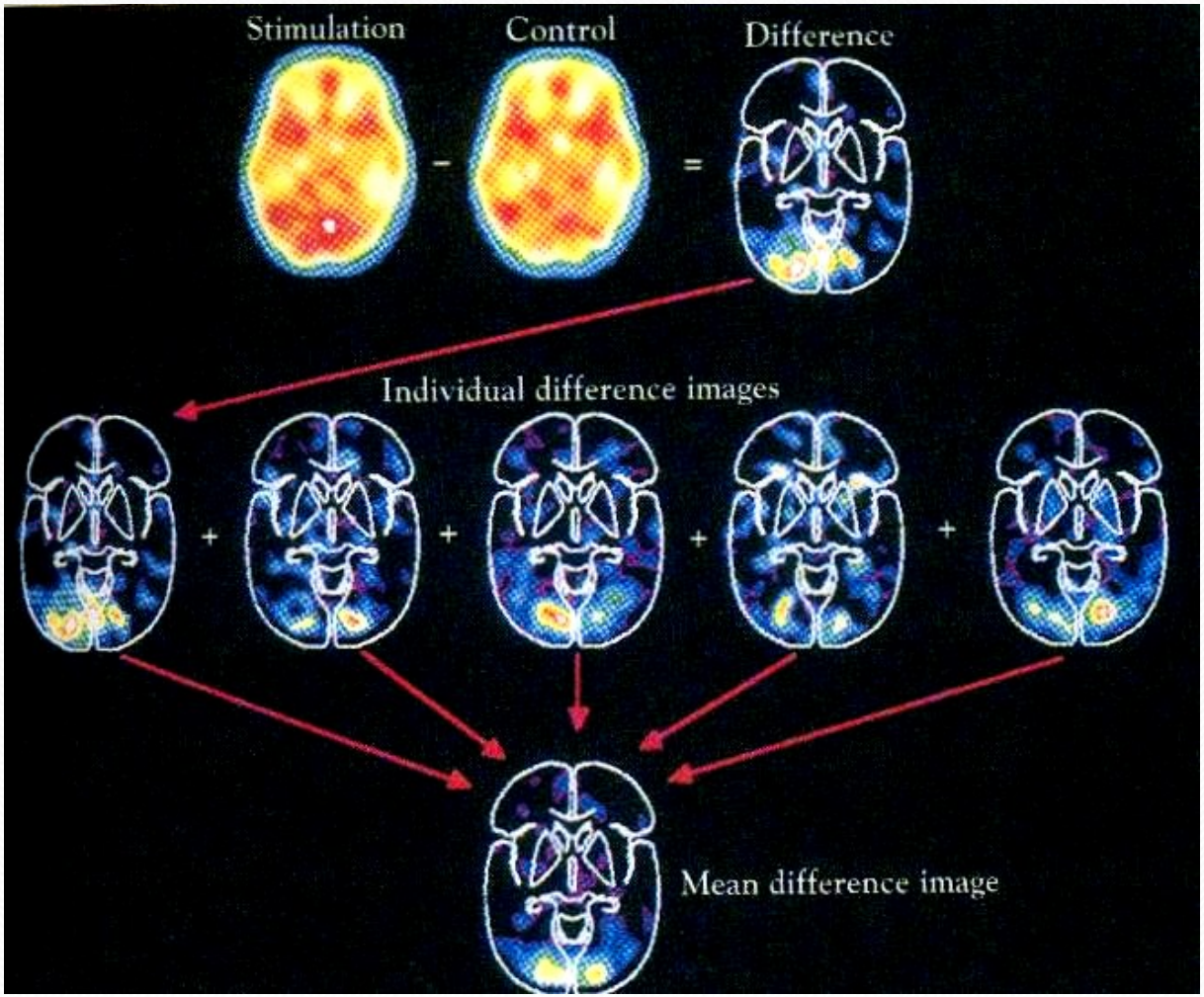
ANATOMIA



FISIOLOGIA

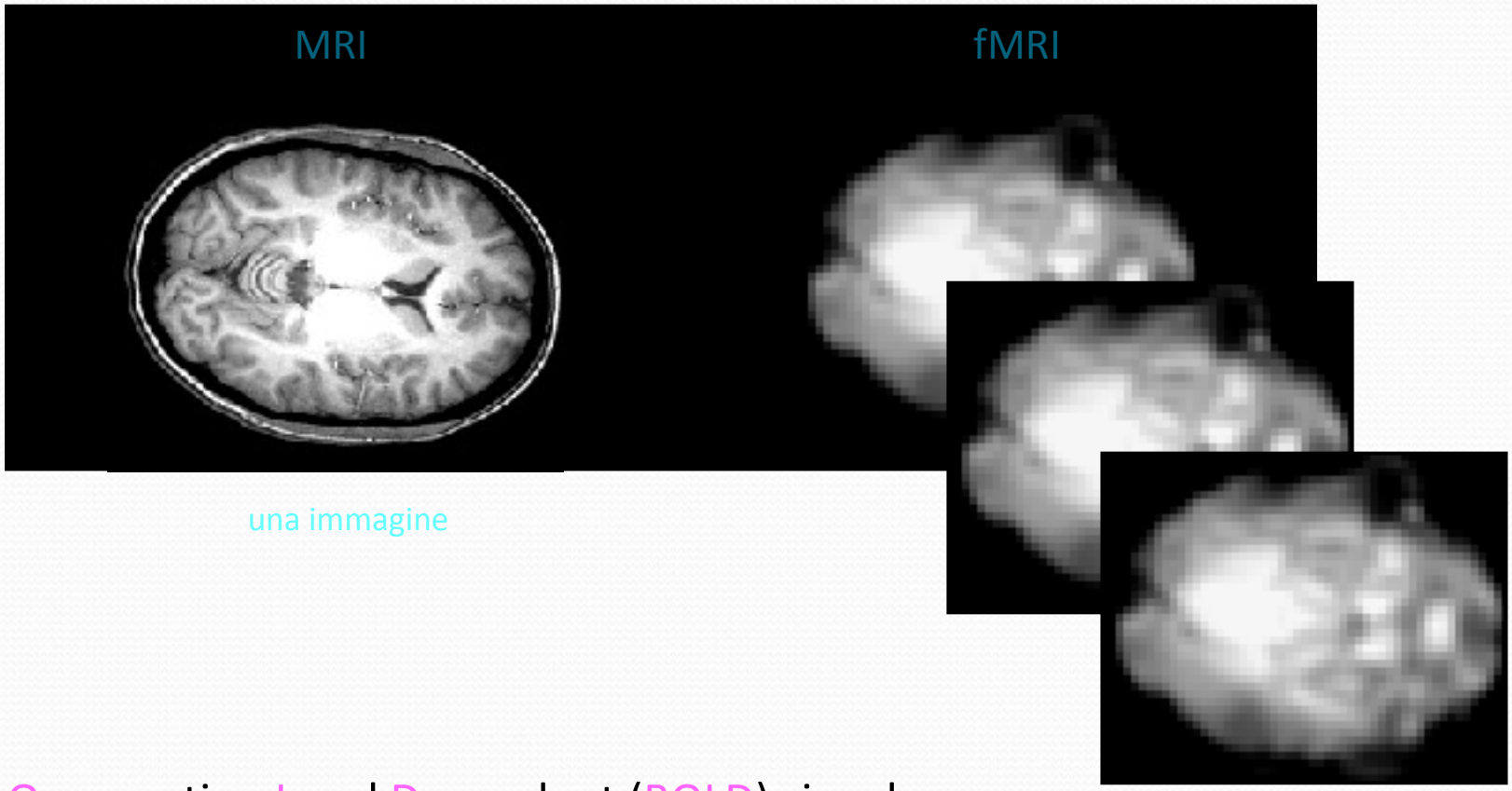
Source: Jody Culham's fMRI for Dummies web si

PET e fMRI



Source: Posner & Raichle, Images of Mind

MRI vs. fMRI



una immagine

molte immagini
(es ogni 2 sec per 5 min)

...

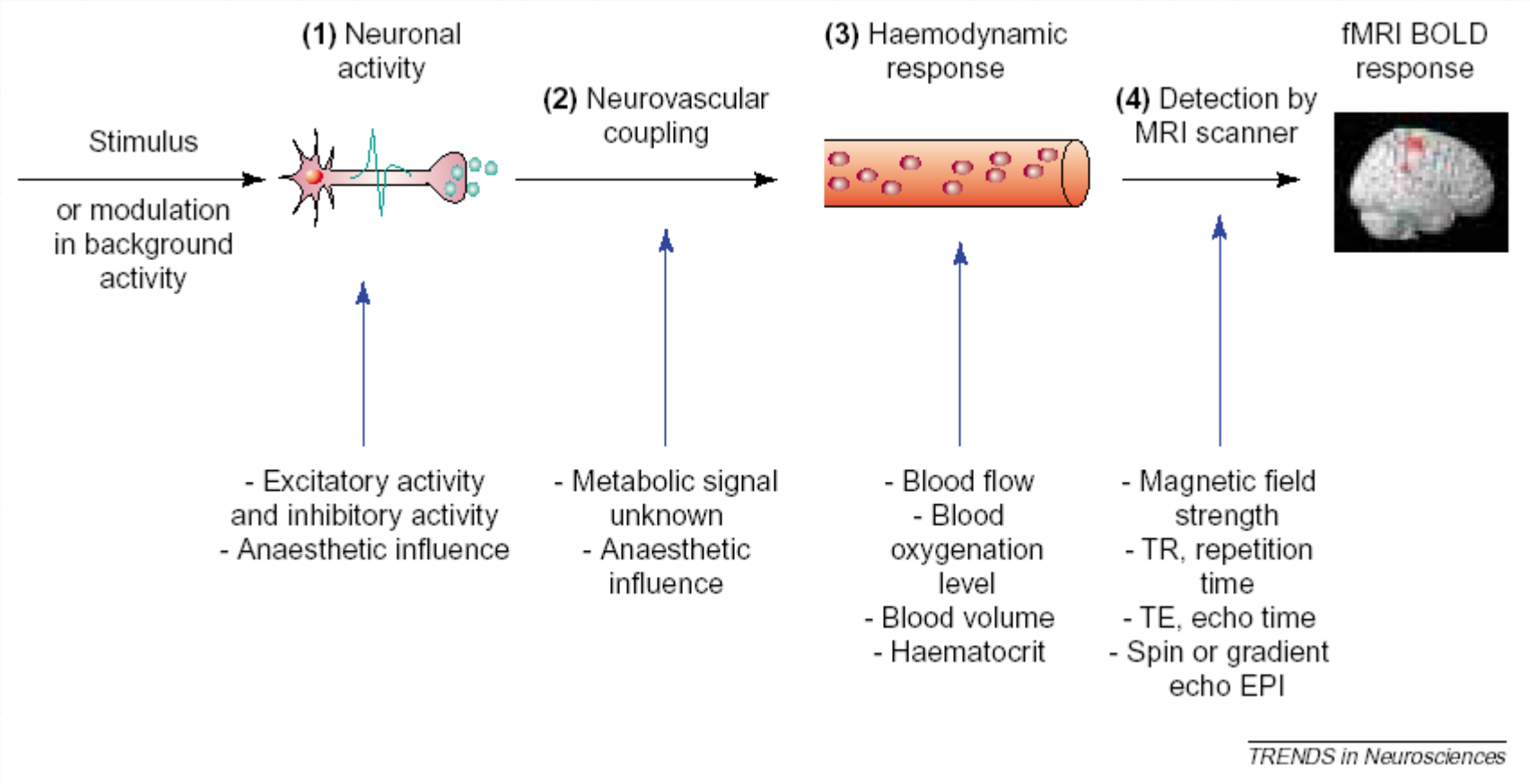
fMRI

Blood Oxygenation Level Dependent (BOLD) signal
misura indiretta di attività neurale

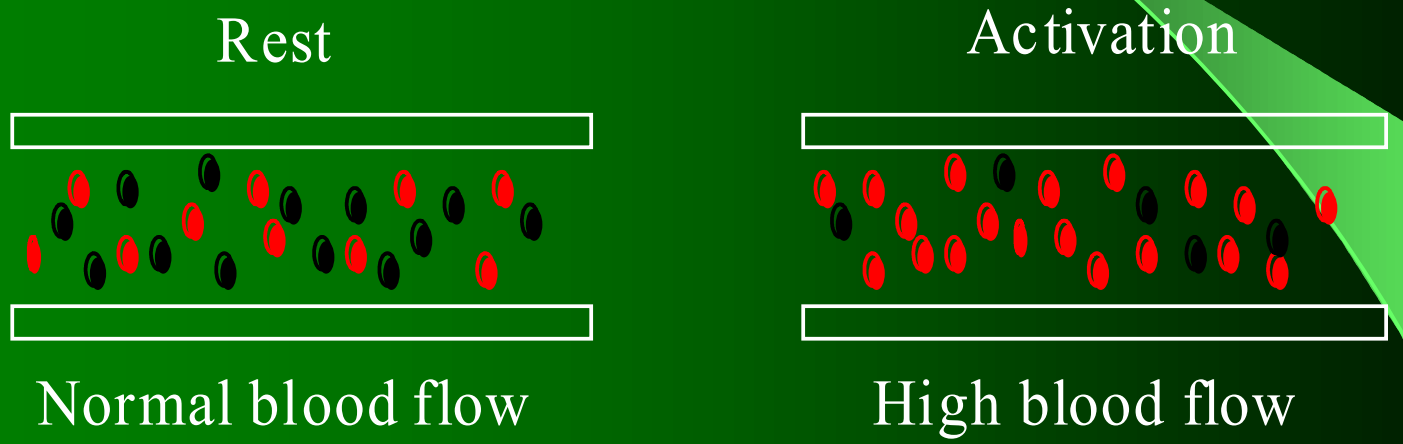
↑ attività neurale ➔ ↑ ossigenazione del sangue ➔ ↑ segnale fMRI

Source: Jody Culham's fMRI for Dummies web si

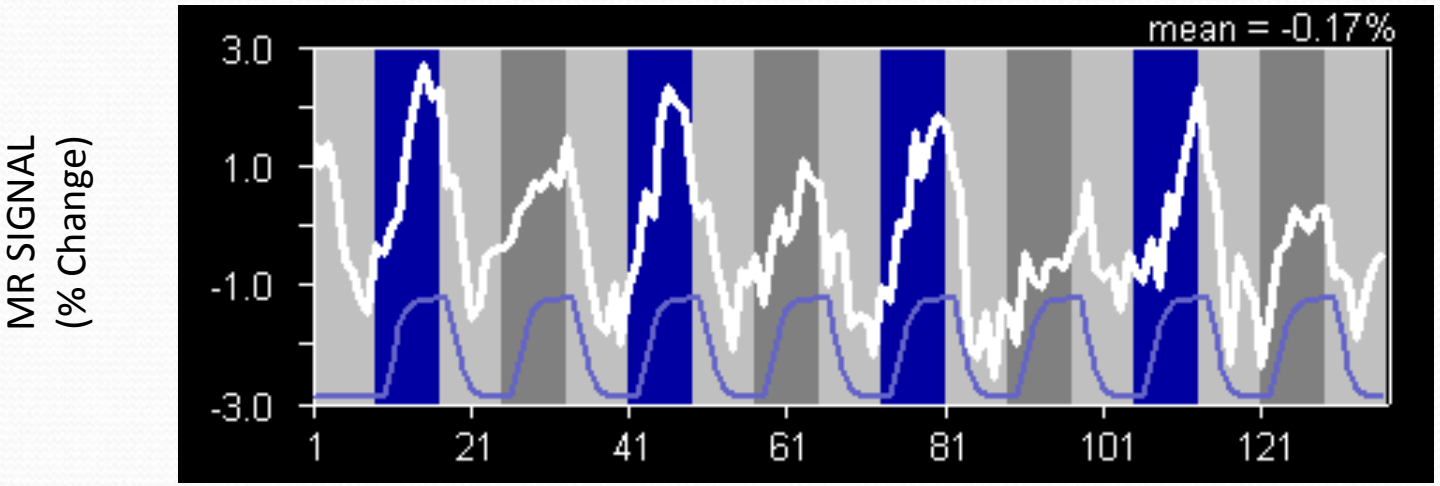
Dallo stimolo al BOLD



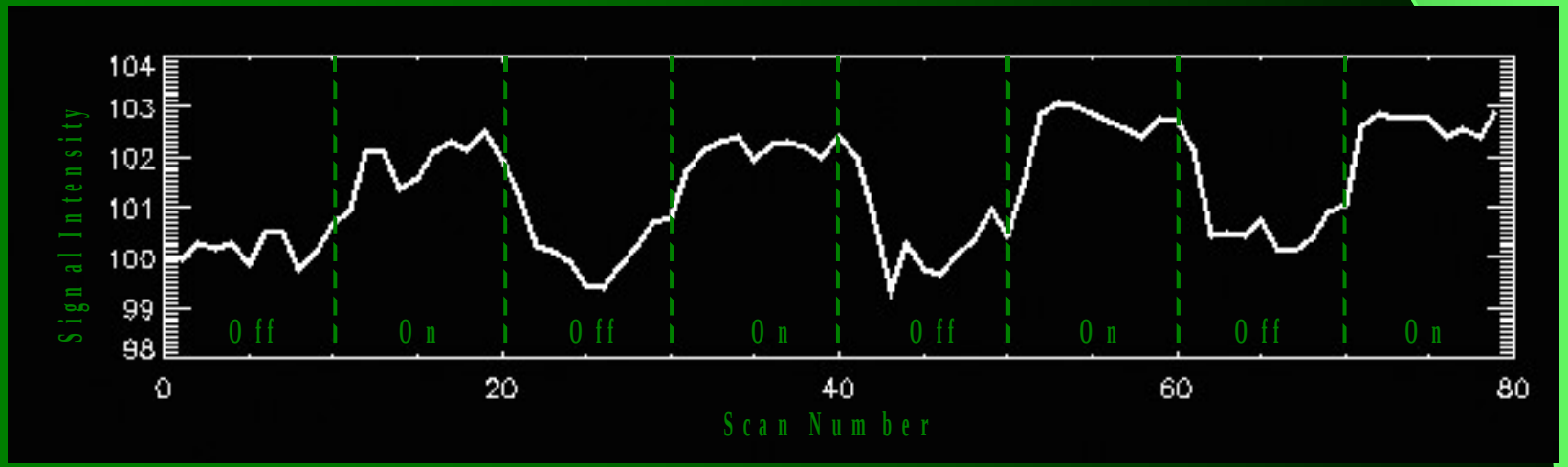
Oxyhemoglobin and Deoxyhemoglobin in Veins during Brain Activation



TIME

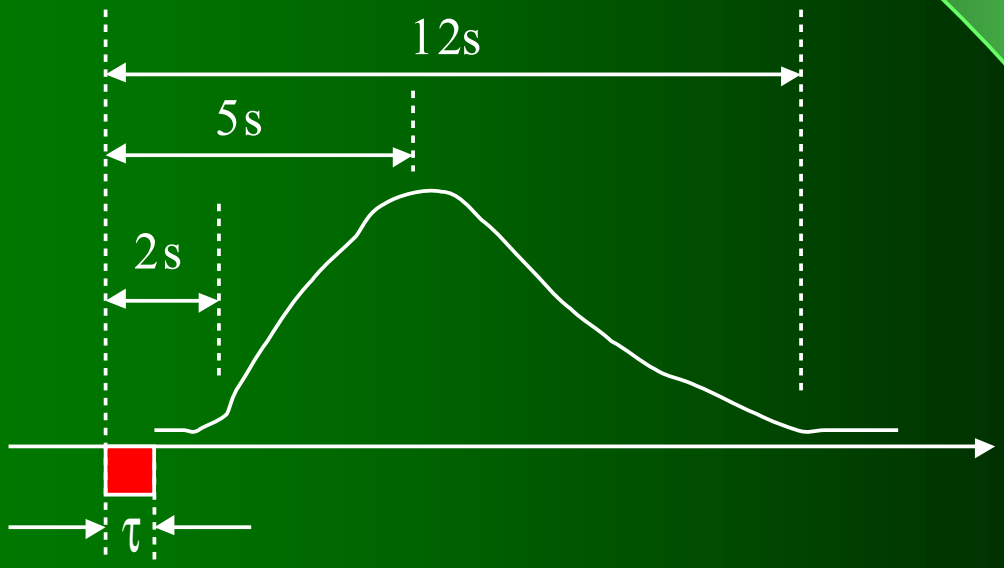


Time Series and Activation Maps

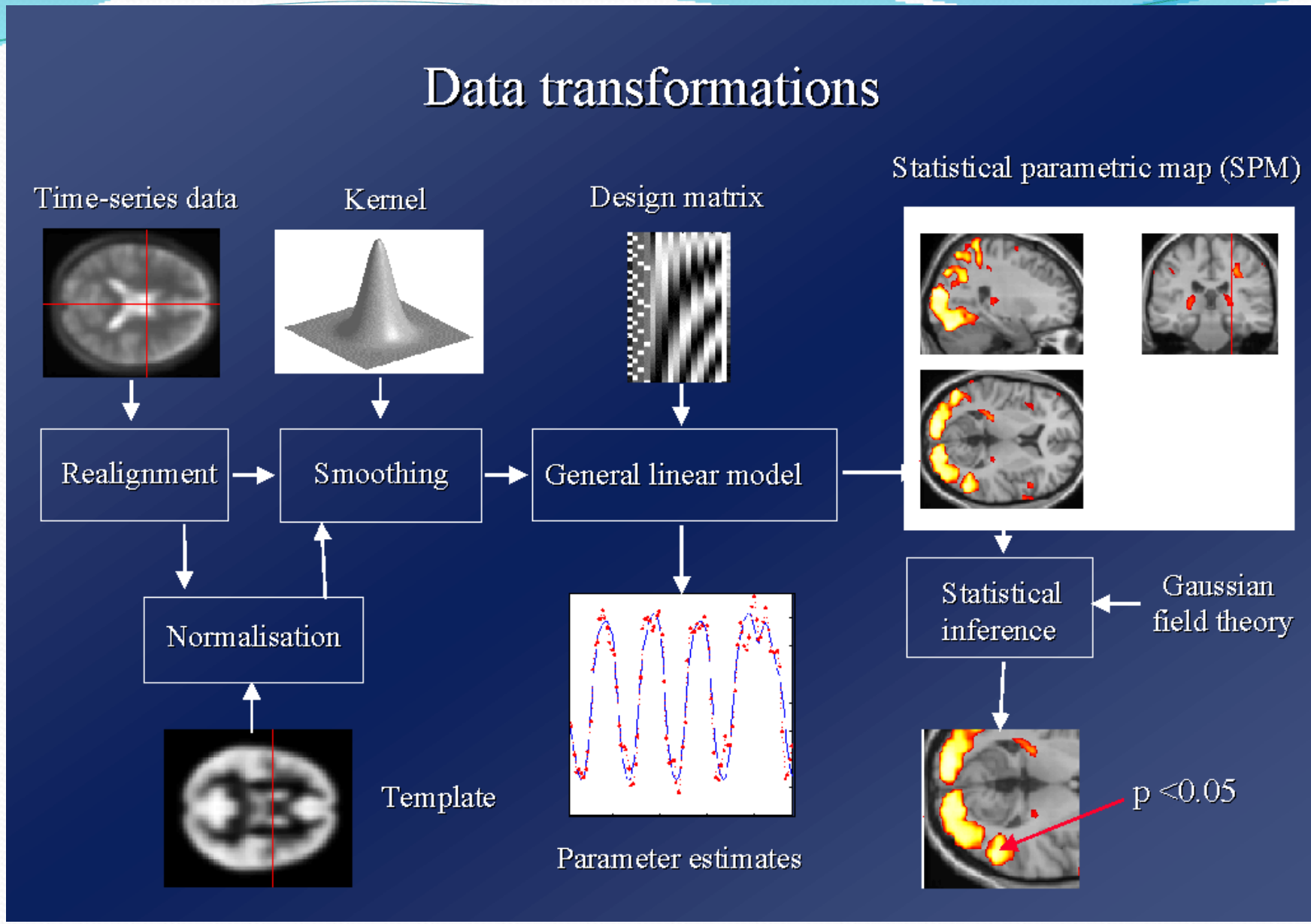


Temporal resolution

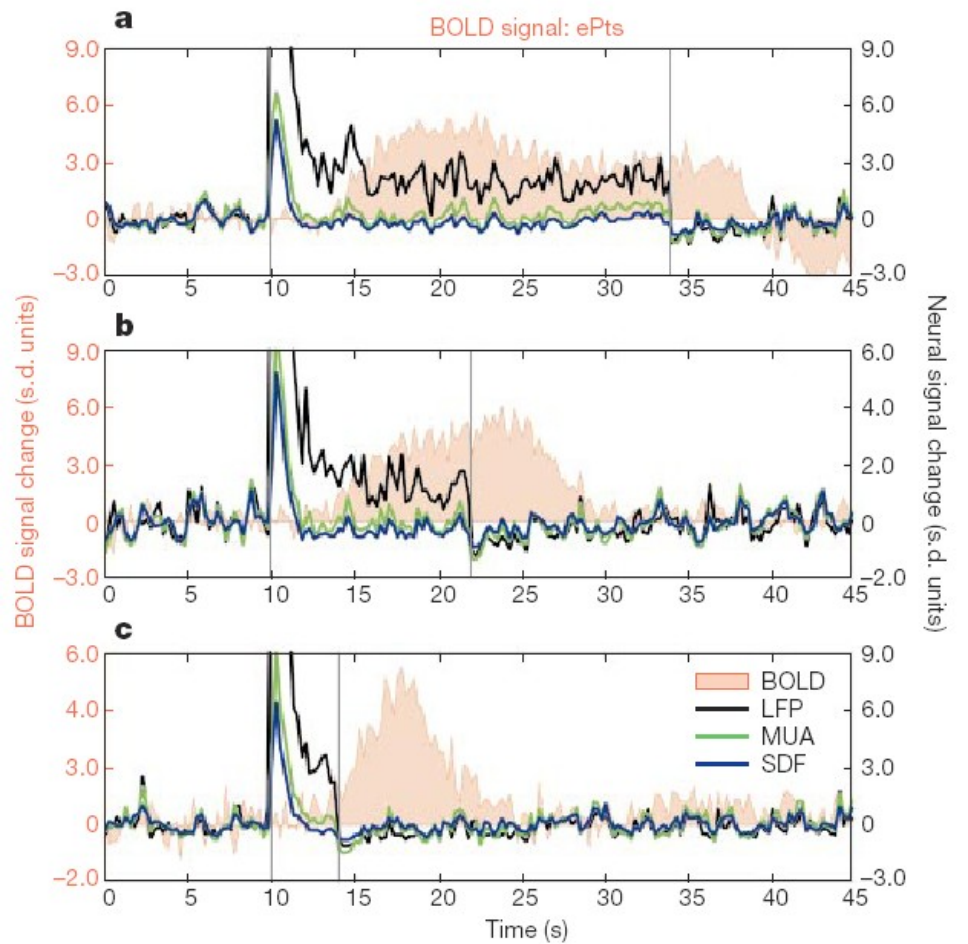
Impulse-response function

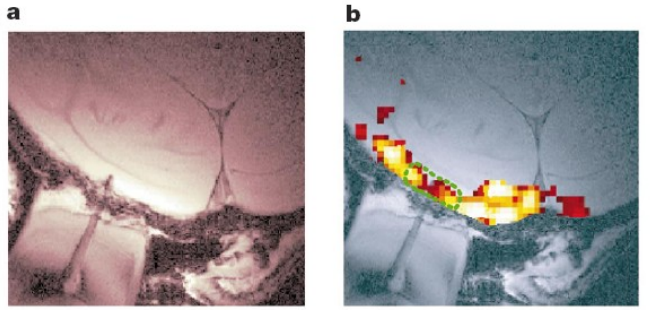


Data transformations



I correlati del segnale BOLD





Local Field Potentials (LFP)

- **reflect post-synaptic potentials**

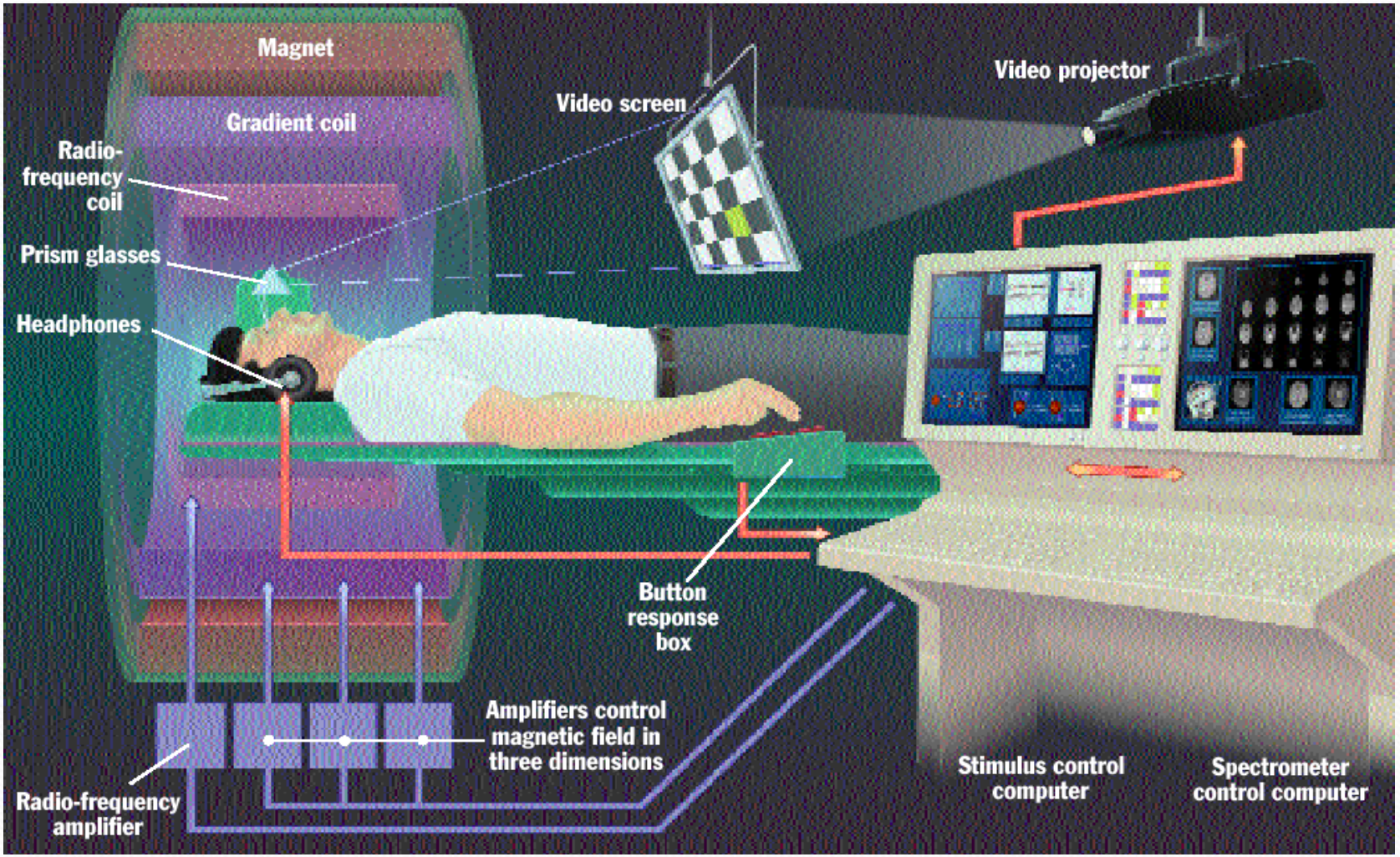
Multi-Unit Activity (MUA)

- **reflects action potentials**

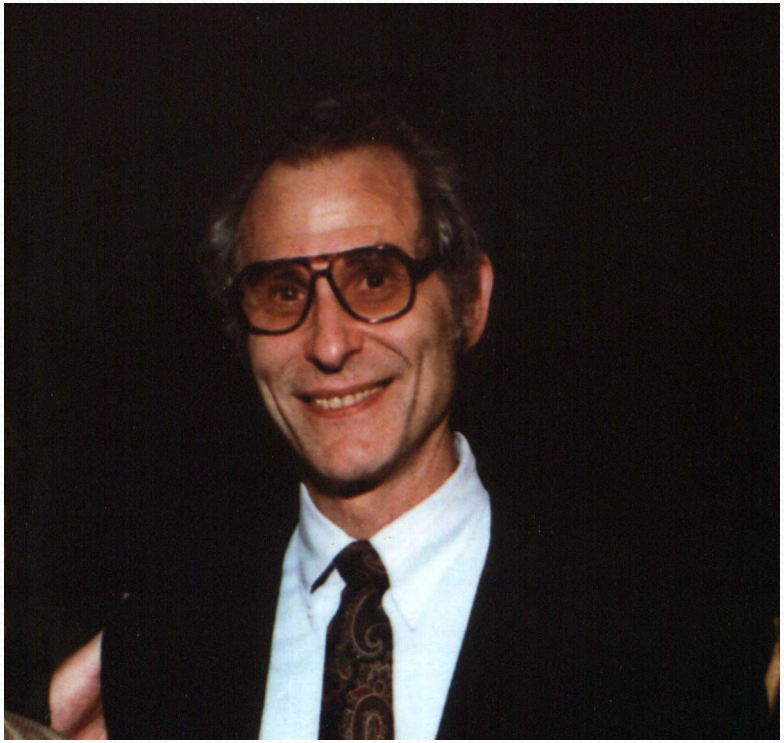
Logothetis et al. (2001)

- **combined BOLD fMRI and electrophysiological recordings**
- **found that BOLD activity is more closely related to LFPs than MUA**

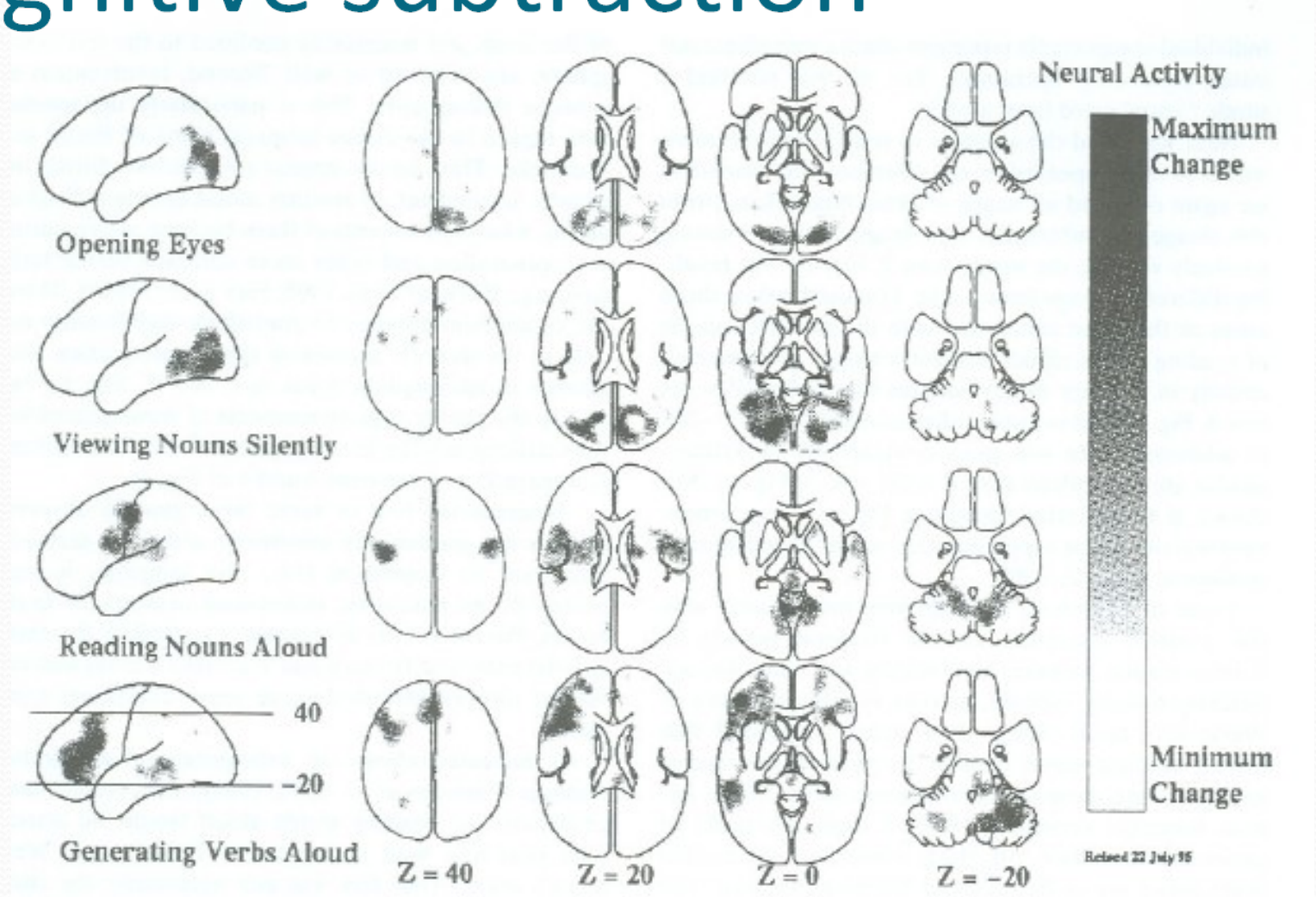
come si acquisisce uno studio fMRI



Il metodo “sottrattivo”



Cognitive subtraction



Parametric analysis

926 *C. J. Price* et al.

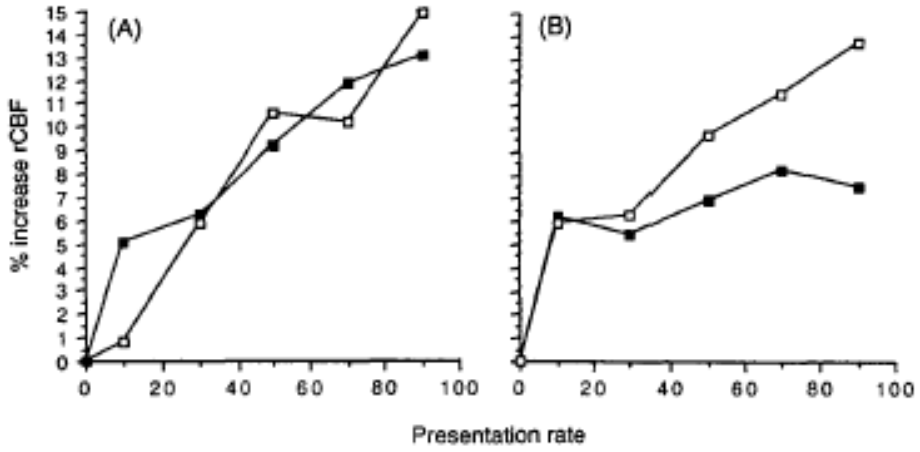
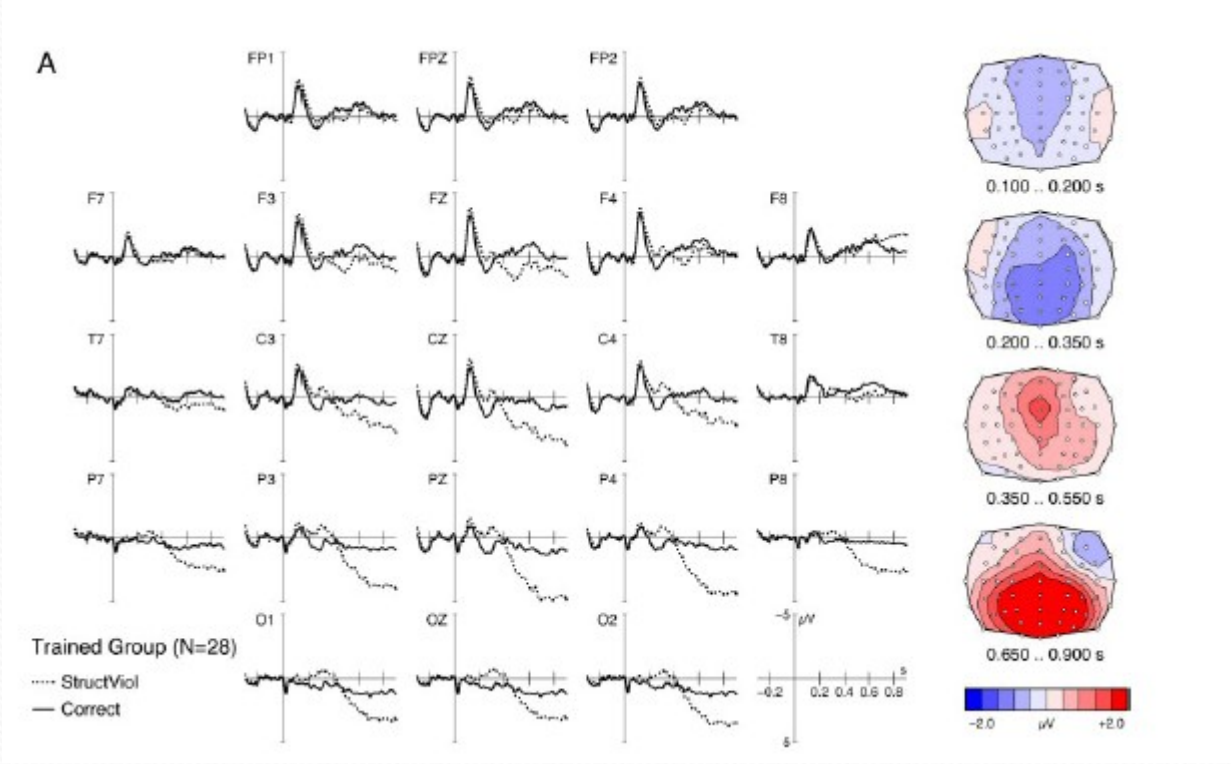
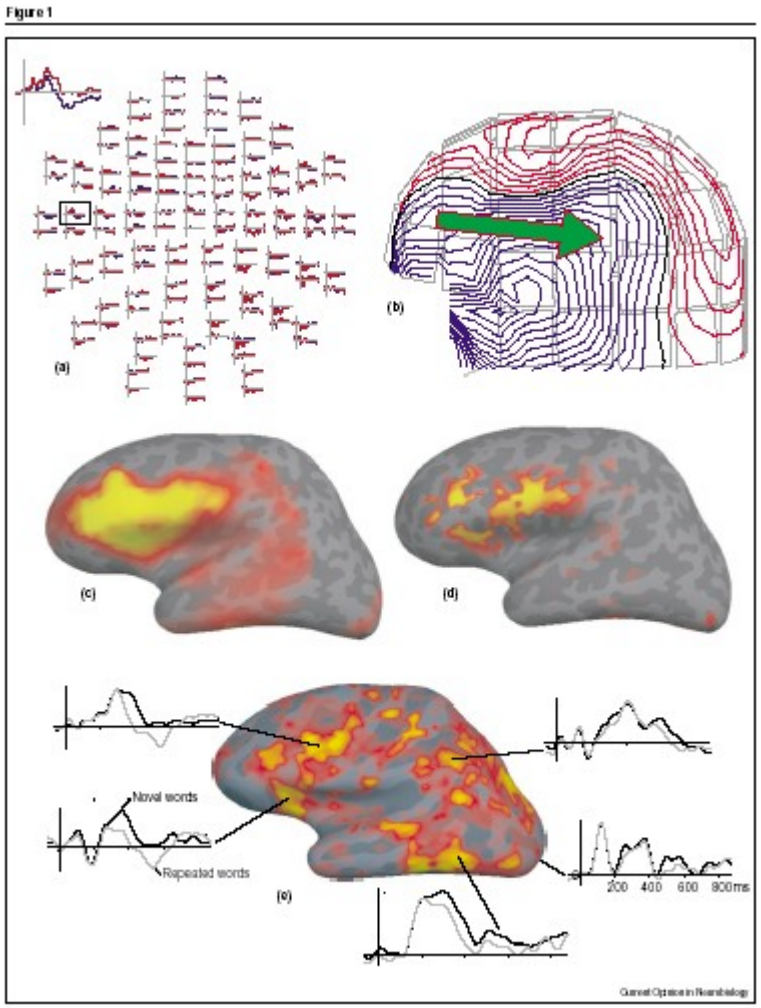


Fig. 2 Graphs of percentage increase in rCBF relative to rest as word presentation increases from rest (0 w.p.m.) to 90 w.p.m. (Experiment 4) in the left and right mid- (**A**) and posterior (**B**) temporal regions. Filled squares = left hemisphere; open squares = right hemisphere.

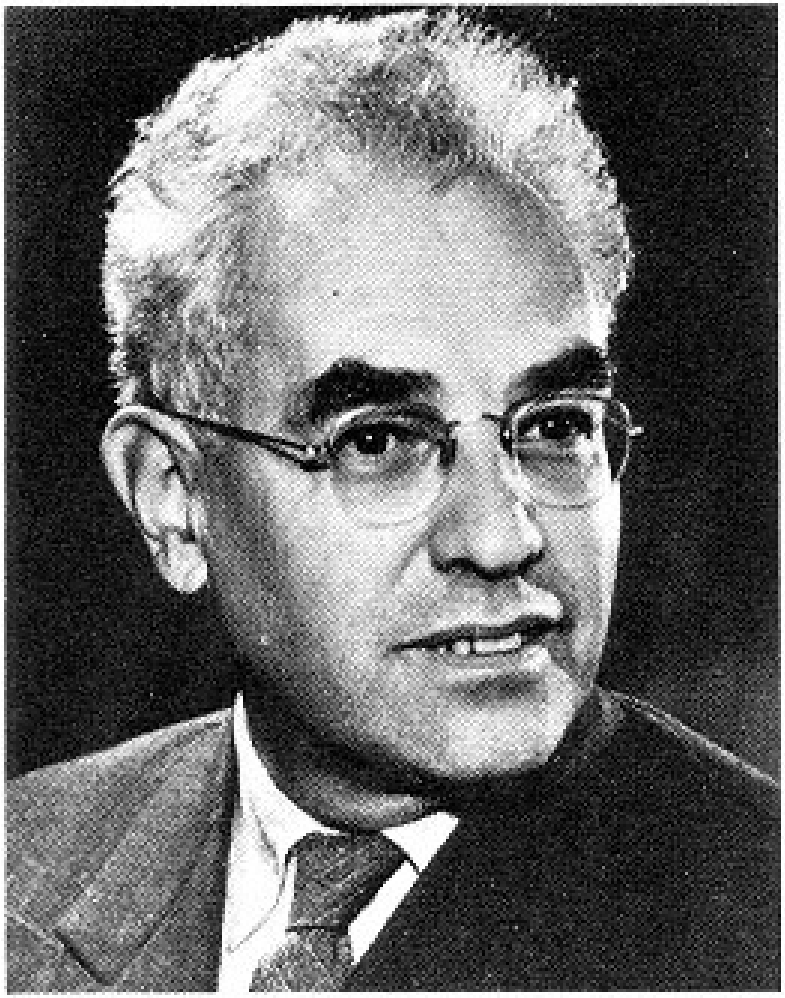
L’andamento temporale della elaborazione cognitiva



Integrazione multimodale



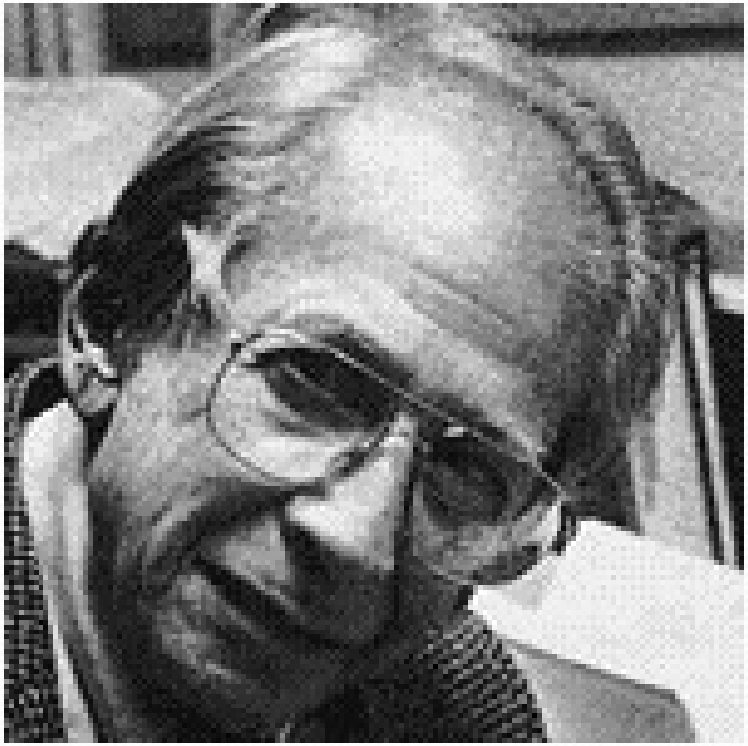
La neuropsicologia come attività clinica: Diagnosi e riabilitazione



Alexander Luria.

Arthur Benton

Harold Goodglass



I differenti “livelli” della valutazione neuropsicologica

- Esame neuropsicologico clinico (“al letto del malato”, “carta e matita”)
- Test neuropsicologici di screening
- Batterie neuropsicologiche
  - standard
  - modulari
- Test “sperimentali”

L’esame neuropsicologico clinico

- **Si basa sulla competenza clinica dell’esaminatore**
- **Non fa riferimento a dati normativi**
- **Non richiede materiale particolare**
- **Ha lo scopo fondamentale di orientare sulla eventuale fase testistica**

Test di screening

- **Si propongono di effettuare una valutazione “rapida” delle principali aree di funzionamento cognitivo**
- **Fanno riferimento a dati normativi**
- **Sono particolarmente utili (come supplemento all’esame clinico) nel caso delle demenze**

Esempi di test di screening

- **MMSE**
- **Test di Blessed-Roth**
- **MODA**
- **ADAS**
- **CAMDEX**
- **MATTIS**
- **...**

BATTERIE DI TEST NEUROPSICOLOGICI

- **Si compongono di numerosi test, che mirano a valutare aspetti diversi delle funzioni cognitive in modo esauriente**
- **Fanno riferimento a dettagliati dati normativi**
- **Hanno carattere “fisso”, e possono quindi essere somministrati da un operatore limitatamente qualificato o da un computer**

Esempi di batterie standard

- **Halstead-Reitan**
- **Luria-Nebraska**
- **Mental Deterioration Battery**
- **Gruppo Italiano per lo Studio Neuropsicologico dell'Invecchiamento**

Test di attenzione e vigilanza

- **Test di barrage (matrici attenzionali)**
- **PASAT**
- **TEA**

Test per la memoria

- **Digit span**
- **Span di Corsi**
- **Memoria di prosa**
- **Coppie di parole**
- **Apprendimento di liste**
- **Corsi sopraspan**
- **Rievocazione figura di Rey**
- **Questionari di memoria autobiografica e di memoria retrograda**
- **Questionario di memoria semantica**

Test di Linguaggio

- **Token test**
- **Associazioni controllate**
- **Test dell'afasia di Aachen**
- **Batteria per l'Analisi del Deficit Afasico**

Test di calcolo

- **Test per l’acalculia**
- **Batteria di esame del sistema dei numeri e del calcolo**

Test dell'aprassia

- **Test per l'aprassia ideomotoria**
- **Test per l'aprassia ideativa**
- **Test per l'aprassia bucco-facciale**

Test visuo-percettivi

- **Test di Benton**
- **Visual Object and Space Perception Battery**
- **BORB**
- **Figura di Rey**
- **Test dell'aprassia costruttiva**

Esplorazione e cognizione spaziale

- **Batteria per l'emi-inattenzione**
- **test di Wundt-Jastrow**

Ragionamento e “test frontali”

- **Matrici di Raven**
- **test di Weigl**
- **Wisconsin Card Sorting**
- **Torri di Hanoi**

I risultati dei test

- **Dati quantitativi**
  - **punteggio**
  - **analisi degli errori**
- **Dati qualitativi**
  - **analisi delle strategie**
  - **testing the limits**

TABLE 4. Means and standard deviations at two education levels for animal naming task in 1 minute

	English	Chinese	Spanish	Vietnamese
Low Education (0-8 years)				
M	14.0	13.0	11.9	15.4
(*SD*)	(2.4)	(5.0)	(3.8)	(5.4)
(*N*)	25	22	40	25
High Education (9-20 years)				
M	16.5	16.6	13.9	18.7
(*SD*)	(4.6)	(4.8)	(3.9)	(4.6)
(*N*)	87	45	37	35

Table 2 Global score on WCST, determined as n° of administered trials - (n° of achieved categories x 10). **a** Mean values per age and education group over 205 subjects (standard deviations) are reported; general mean score: 41.2 (SD = 28.4). **b** Correction grid. **c** Equivalent score

a Means

		Age, years						
		15-29	30-39	40-49	50-59	60-69	70-85	Total
Education, years								
	M	–	–	–	47.8 (35.9)	77.6 (15.9)	4.0 (48.1)	57.2 (33.2)
5-7	F	–	–	69.3 (19.6)	51.0 (27.0)	75.4 (22.8)	79.5 (18.9)	66.7 (24.2)
	M	21.2 (13.4)	37.8 (25.3)	49.6 (32.3)	44.3 (28.6)	58.3 (33.3)	38.0 (0.0)	39.0 (27.8)
8-12	F	28.2 (23.1)	41.1 (14.3)	39.4 (27.8)	60.3 (34.7)	59.1 (37.2)	80.0 (25.9)	47.4 (30.7)
	M	33.5 (26.0)	36.8 (21.0)	17.0 (0.0)	34.0 (27.6)	33.8 (15.9)	57.5 (57.3)	35.8 (25.1)
13-16	F	30.5 (21.6)	42.5 (27.4)	18.3 (4.1)	25.3 (20.5)	31.8 (16.4)	–	30.0 (19.6)
	M	13.8 (3.5)	23.4 (18.0)	20.8 (9.4)	24.0 (2.8)	38.6 (28.3)	23.0 (0.0)	24.2 (17.5)
17-24	F	38.3 (20.6)	21.8 (22.8)	30.0 (16.1)	27.0 (16.6)	19.8 (9.7)	88.0 (0.0)	29.8 (21.5)
	M	21.7 (15.6)	33.3 (22.1)	39.7 (30.0)	40.6 (29.5)	53.3 (29.2)	44.0 (35.9)	37.8 (27.7)
Total	F	30.5 (21.3)	36.3 (21.1)	42.8 (27.5)	45.2 (29.2)	49.9 (32.7)	80.7 (19.8)	44.5 (28.9)

b Correction grid

	Age, years						
Education, years	20	30	40	50	60	70	80
5	1.3	-4.0	-9.3	-14.6	-19.9	-25.2	-30.5
8	7.3	2.0	-3.3	-8.6	-13.9	-19.2	-24.5
13	17.1	11.8	6.5	1.2	-4.1	-9.4	-14.7
17	25.0	19.7	14.4	9.1	3.8	-1.5	-6.8

c Equivalent scores

	Score interval	Density	Cumulative frequency
0	128 - 90.6	5	5
1	90.5 - 81.5	14	19
2	81.4 - 59.4	33	52
3	59.3 - 37.2	50	102
4	37.1 - 0	103	205

La riabilitazione neuropsicologica

- Attività terapeutiche svolte da personale professionale mirate al recupero e/o al mantenimento di funzioni cognitive specifiche e/o del livello di funzionamento nella vita quotidiana, rivolte a singoli pazienti o a gruppi
- Secondo alcuni, da tenere distinta dalla “stimolazione cognitiva generale”, che può essere svolta anche da personale non professionale

Principali aree applicative della riabilitazione cognitiva dell'adulto

- Lesioni cerebrali focali
  - Lesioni cerebrovascolari
- Lesioni multifocali
  - Traumi cranici
  - Sclerosi multipla
- Demenze
- Schizofrenia

REVIEW ARTICLE

Evidence-Based Cognitive Rehabilitation: Updated Review of the Literature From 1998 Through 2002

Keith D. Cicerone, PhD, Cynthia Dahlberg, MA, CCC-SLP, James F. Malec, PhD, Donna M. Langenbahn, PhD, Thomas Felicetti, PhD, Sally Kneipp, PhD, Wendy Ellmo, MS, CCC-SLP, Kathleen Kalmar, PhD, Joseph T. Giacino, PhD, J. Preston Harley, PhD, Linda Laatsch, PhD, Philip A. Morse, PhD, Jeanne Catanese, MA, CCC-SLP

APPENDIX 1: DEFINITION OF LEVELS OF RECOMMENDATIONS

Practice standards	Based on at least 1 well-designed class I study with an adequate sample, with support from class II or class III evidence, that directly addresses the effectiveness of the treatment in question, providing substantive evidence of effectiveness to support a recommendation that the treatment be specifically considered for people with acquired neurocognitive impairments and disability.
Practice guidelines	Based on 1 or more class I studies with methodologic limitations, or well-designed class II studies with adequate samples, that directly address the effectiveness of the treatment in question, providing evidence of probable effectiveness to support a recommendation that the treatment be specifically considered for people with acquired neurocognitive impairments and disability.
Practice options	Based on class II or class III studies that directly address the effectiveness of the treatment in question, providing evidence of possible effectiveness to support a recommendation that the treatment be specifically considered for people with acquired neurocognitive impairments and disability.

Table 2: Evidence-Based Recommendations for Cognitive Rehabilitation: Practice Standards

Intervention	Recommendations
Visuospatial rehabilitation	Recommended for persons with visuoperceptual deficits associated with visual neglect after right hemisphere stroke
Cognitive-linguistic therapies	Recommended during acute and postacute rehabilitation for persons with language deficits secondary to left hemisphere stroke
Specific interventions for functional communication deficits, including pragmatic conversational skills	Recommended for persons with TBI
Specific gestural or strategy training for apraxia	Recommended for persons with apraxia after left hemisphere stroke during acute rehabilitation
Memory strategy training	Recommended for persons with mild memory impairments from TBI, including the use of internalized strategies (eg, visual imagery) and external memory compensations (eg, notebooks)
Strategy training for attention deficits	Recommended during postacute rehabilitation for persons with TBI. Insufficient evidence exists to distinguish the effects of specific attention training during acute recovery and rehabilitation from spontaneous recovery or from more general cognitive interventions.

Table 3: Evidence-Based Recommendations for Cognitive Rehabilitation: Practice Guidelines

Intervention	Recommendations
Scanning training	Recommended as an important, even critical, element for persons with severe visuoperceptual impairment that includes visual neglect after right hemisphere stroke
Cognitive interventions for specific language impairments such as reading comprehension and language formulation	Recommended after left hemisphere stroke or TBI
Treatment intensity	Should be considered as a key factor in the rehabilitation of language skills after left hemisphere stroke
Use of external compensations with direct application to functional activities	Recommended for persons with severe memory impairment after TBI or stroke
Training in formal problem-solving strategies and their application to everyday situations and functional activities	Recommended during postacute rehabilitation for persons with stroke or TBI
Comprehensive-holistic neuropsychologic rehabilitation	Recommended during postacute rehabilitation to reduce cognitive and functional disability for persons with moderate to severe TBI or stroke
Isolated microcomputer exercises to treat unilateral left neglect	NOT recommended; does not appear effective

Table 4: Evidence-Based Recommendations for Cognitive Rehabilitation: Practice Options

Intervention	Recommendations
Systematic training of visuospatial and organizational skills	May be considered for persons with visual perceptual deficits, without visual neglect, after right hemisphere stroke as part of acute rehabilitation. NOT recommended for persons with left hemisphere stroke or TBI who do not exhibit unilateral spatial inattention.
Inclusion of limb activation or electronic technologies for visual scanning training	May be included in treatment of visual neglect after right hemisphere stroke
Computer-based interventions intended to produce extension of damaged visual fields	May be considered for persons with TBI or stroke
Computer-based interventions as an adjunct to clinician-guided treatment	May be considered for cognitive and linguistic impairments
Sole reliance on repeated exposure and practice on computer-based tasks without *some* involvement and intervention by a therapist	NOT recommended
Interventions that promote internalization of self-regulation strategies through self-instruction and self-monitoring	May be considered for persons with deficits in executive functioning after TBI, including impairments of emotional self-regulation, and as a component of interventions for deficits in attention, neglect, and memory
Integrated treatment of individualized cognitive and interpersonal therapies	May improve functioning within the context of a comprehensive neuropsychologic rehabilitation program, and facilitate effectiveness of specific interventions

European Journal of Neurology 2004, 11: 1–6

SPECIAL ARTICLE

Guidance for the preparation of neurological management guidelines by EFNS scientific task forces – revised recommendations 2004*

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Table 1 Evidence classification scheme for a therapeutic intervention

Class I: An adequately powered prospective, randomized, controlled clinical trial with masked outcome assessment in a representative population or an adequately powered systematic review of prospective randomized controlled clinical trials with masked outcome assessment in representative populations. The following are required:

(a) randomization concealment
(b) primary outcome(s) is/are clearly defined
(c) exclusion/inclusion criteria are clearly defined
(d) adequate accounting for dropouts and crossovers with numbers sufficiently low to have minimal potential for bias
(e) relevant baseline characteristics are presented and substantially equivalent among treatment groups or there is appropriate statistical adjustment for differences

Class II: Prospective matched-group cohort study in a representative population with masked outcome assessment that meets a–e above *or* a randomized, controlled trial in a representative population that lacks one criteria a–e

Class III: All other controlled trials (including well-defined natural history controls or patients serving as own controls) in a representative population, where outcome assessment is independent of patient treatment

Class IV: Evidence from uncontrolled studies, case series, case reports, or expert opinion

Rating of recommendations

Level A rating (established as effective, ineffective, or harmful) requires at least one convincing class I study or at least two consistent, convincing class II studies

Level B rating (probably effective, ineffective, or harmful) requires at least one convincing class II study or overwhelming class III evidence

Level C (possibly effective, ineffective, or harmful) rating requires at least two convincing class III studies

European Journal of Neurology 2005, **12:** 665–680

EFNS TASK FORCE/CME ARTICLE

EFNS guidelines on cognitive rehabilitation: report of an EFNS task force

Members of the Task Force on Cognitive Rehabilitation: S. F. Cappa[a], T. Benke[b], S. Clarke[c], B. Rossi[d], B. Stemmer[e] and C. M. van Heugten[f]

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Riabilitazione dei deficit conseguenti a lesione focale

- **Afasia**
- **Aprassia**
- **Acalculia**

- **Emi-inattenzione e disturbi associati**

Cochrane review of aphasia rehabilitation (Greener et al.)

Conclusions: The main conclusion of this review is that speech and language therapy treatment for people with aphasia after a stroke has not been shown either to be clearly effective or clearly ineffective within a RCT. Decisions about the management of patients must therefore be based on other forms of evidence. Further research is required to find out if effectiveness of speech and language therapy for aphasic patients is effective. If researchers choose to do a trial, this must be large enough to have adequate statistical power, and be clearly reported

“The overall available evidence is compatible with Grade B recommendation for aphasia therapy, even if the recommendation of further studies by the Cochrane group deserves serious consideration.

In particular, the evidence of effectiveness of pragmatic-conversational therapy after TBI is based on a limited number of studies on small samples, and appears in need of confirmation”

Robey et al., 1999

- **In una meta-analisi di 12 studi di caso singolo, le dimensioni dell'effetto del trattamento erano in generale elevate, sia per terapie "tradizionali" (stimolazione) , che per training mirato su aspetti linguistici (produzione di frasi interrogative)**

TABLE 3. Comparing Intensity of Therapy Between Positive and Negative Resultant Studies

	Therapy Measures Mean (SD)			Outcome Measures Mean (SD)	
	Length (weeks)	Hours (per week)	Total (hours)	PICA	Token Test
Positive studies n=259	11.2 (1.7)	8.8 (2.0)	98.4 (28.2)	15.1 (3.1)	13.74 (6.67)
Negative studies n=574	22.9 (2.3)	2.0	43.6 (8.3)	1.37 (1.37)	0.59 (0.79)
t statistic	12.80	8.72	5.61	8.79	2.561
P value	0.001	0.001	0.001	0.001	0.05

Bhogal et al., 2003

Riabilitazione dell'emi-inattenzione

Treatments (Pierce and Buxbaum, 2002)

- Targeting arousal deficits
- Targeting visual attention deficits
- Targeting spatial representation deficits

The Role of Unilateral Spatial Neglect in Rehabilitation of Right Brain–Damaged Ischemic Stroke Patients: A Matched Comparison

Stefano Paolucci, MD, Gabriella Antonucci, PhD, Maria Grazia Grasso, MD, PhD, Luigi Pizzamiglio, PhD

Table 5: Results of Multiple Regression Analyses

Independent Variables	Dependent Variables: Effectiveness on Barthel Index β	Effectiveness on Barthel Index p	Effectiveness on RMI β	Effectiveness on RMI p	Efficiency on Barthel Index β	Efficiency on Barthel Index p	Efficiency on RMI β	Efficiency on RMI p	LOS β	LOS p
Neglect	−.20	<.01	−.23	<.005	−.33	<.001	−.31	<.001	.32	<.001
Severity (CNS)	.43	<.001	.31	<.005	.20	<.05	.22	<.005	NE	
Heart disease	−.20	<.005	−.19	<.01	−.21	<.005	−.19	<.01	NE	
Lacunar lesions	−.14	<.05	NE		NE		NE		NE	
Depression	NE		NE		.15	<.05	.15	<.05	NE	
Adjusted R^2	.33		.27		.20		.27		.10	

NOTE. Only variables that significantly entered the equations are shown.
Abbreviation: NE, not entered.

Efficacia

- Campioni piccoli
- Effetti a breve termine
- Insufficiente evidenza di impatto funzionale

Riabilitazione del danno multifocale

- **Esiti traumi cranici**
- **Sclerosi multipla**

Efficacia

- Evidenza sufficiente solo per:
  - Deficit di memoria lievi in esiti di TBI in fase postacuta (metodi “protesici”)
  - Deficit di attenzione in esiti di TBI in fase postacuta (attentional training) (da confermare)

“Riabilitazione” delle demenze

Strategie possibili

- **Adattamento ambientale**
- **Utilizzo funzioni residue (es. memoria procedurale)**
- **Stimolazione-training funzioni colpite**
  - **Linguaggio**
  - **Memoria episodica**

Conclusioni (personali)

- La ricchezza principale della neuropsicologia come scienza è il suo carattere multidisciplinare
- Sul piano della applicazione professionale, la figura del neuropsicologo si sta definendo come specializzazione all'interno dell'area della psicologia
- Tale collocazione è motivata dalle principali aree di attività clinica del neuropsicologo (psicometria, counseling, riabilitazione, psicoterapia)