Psikohizkuntzalaritza
Gillen Mtz de la Hidalga
2019-2020

2. Hizkuntza burmuinean

c. Hizkuntza neuroirudietan

eman ta zabal zazu
Universidad del País Vasco
Euskal Herriko Unibertsitatea

The Bilingual Mind

Metodologia Esperimentalak:

- Metodo konduktualak

- **Neuroirudiak**

Metodologia Esperimentalak:

Metodo konduktualak

Erreakzio Denborak

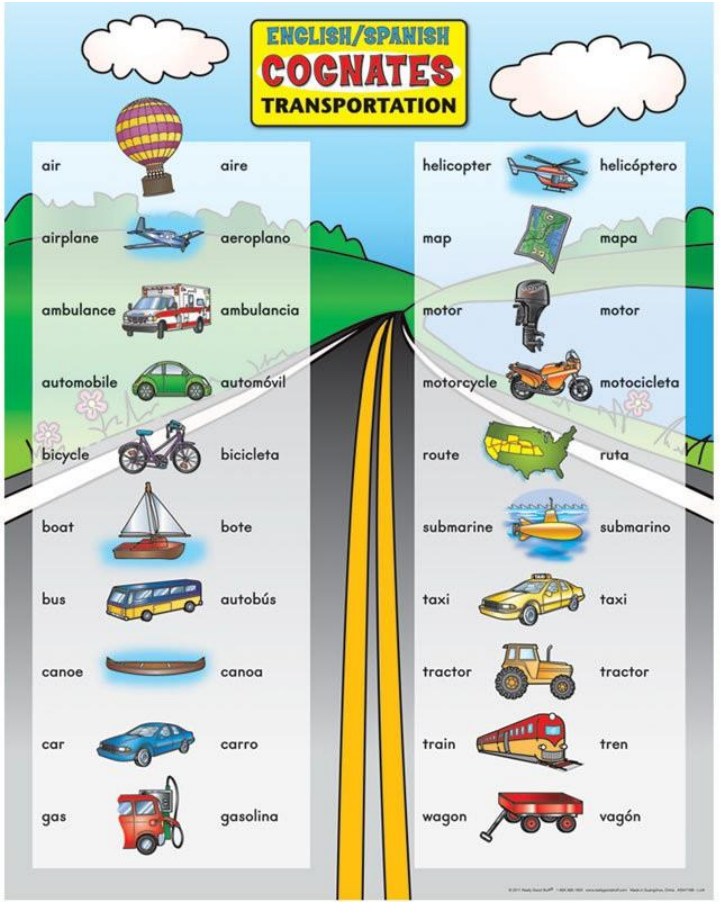
- Erabaki lexikoa
- Irudien izendapena (*picture naming*)
- Priming
- Irakurketa denbora

Eye-tracking

Erreakzio Denborak

Erabaki lexikoa

- Lexikorako sarbidea (*Lexical access*) neurtzeko gehien erabiltzen den teknika da.
- Oso eraginkorra izan da hitzen irakurketan datzaten prozesu mentalak aztertzeko
- Lehen aldiz Rubenstein-ek erabili zuen 1970ean.
- Hitzen **maiztasun efektuak**, Jabekuntza adinak, hitz kognatuak elebidunetan, etab aztertzeko oso egokia.



SAGARRA

LOSARA

ASTROLABIOA

DORTOKA

ZAKURRA

BETUKA

Erreakzio Denborak

Irudiak izendatzea (*Picture naming*)

- Ordenagailu pantailan irudi bat erakusten da.
- Partaideak ahalik eta azkarren esan beharko du ikusten duen irudiaren izena.
- Hitzen **maiztasun efektuak**, Jabekuntza adinak, hitz kognatuak elebidunetan, etab aztertzeko oso egokia.


GM43
GM43

Erreakzio Denborak

Priming esperimentuak

- Denboran banatuta dauden bi estimulu aurkezten dira
- Lehenengo estimuluak (*prime* deitzen zaio) bigarren estimuluarengan (*target* edo helburu-hitza) eragiten du testuinguru gisa.
- Priming teknikak oso eraginkorrak dira prozesamenduan zehar gertatzen diren atal linguistiko desberdinen arteko erlazioa ezartzeko.
- Normalean beste ariketa konduktualekin batera erabiltzen dira (erabaki lexikoa, izendapena...).

Izenda itzazu hurrengo hitzak

- MOTORRA
- MOTOTXA
- IZARA
- URDINA
- BERDEA


GM43
GM43

Irakurketa denbora

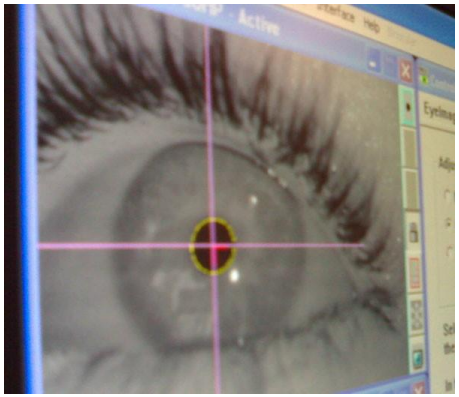
Irakurketa denbora

—— —— ditu ——

Norberak gidatutako irakurketa (*Self Paced Reading*)

- Zapalketen bidez, perpausetako hitzak irakurtzeko zenbat denbora behar dugun neur dezakegu.
- Hitz bakoitzaren irakurketa denborak batuz, perpaus osoaren irakurketa denbora daukagu.
- Egitura batzuk beste batzuk baino konplexuagoak badira, azken hauek irakurketa denbora luzeagoak izatea espero dugu.
- Irakurketa denbora desberdintasunek, egitura batzuk beste batzuk baino baliabide gehiago behar dituztela esanahi du.

Begi Mugimenduak (*Eye Tracking*)



Begi mugimenduak

- Partaidearen eta honek prozesatzen duen itemaren arteko erlazioaren berri ematen du denbora errealean.
- *Fijazioak* estimuluaren zein zatitan egiten diren y eta zenbat denbora irauten duten jakin daiteke
- Begi mugimendu sakadikoen ondorioz gertatzen diren fijazio anitzen hurrenkera neurtu daiteke
- Aurreranzko eta atzeranzko begi mugimenduak neur daitezke

Metodo Konduktualak: Alde eta Kontra

Metodo Konduktualak: Alde

- Erraz jaso eta aztertzen dira
- Burmuinaren funtzionamenduari buruz **inferentziak** egiteko lanabes egokia dira

Metodo Konduktualak: Kontra

- Ezin da frogatu burmuinak nola jokatzen duen arazoak konpontzeko garaian
- Ez dago konexiorik gertaera eta azpian dagoen alderdi neuroanatomikoaren artean

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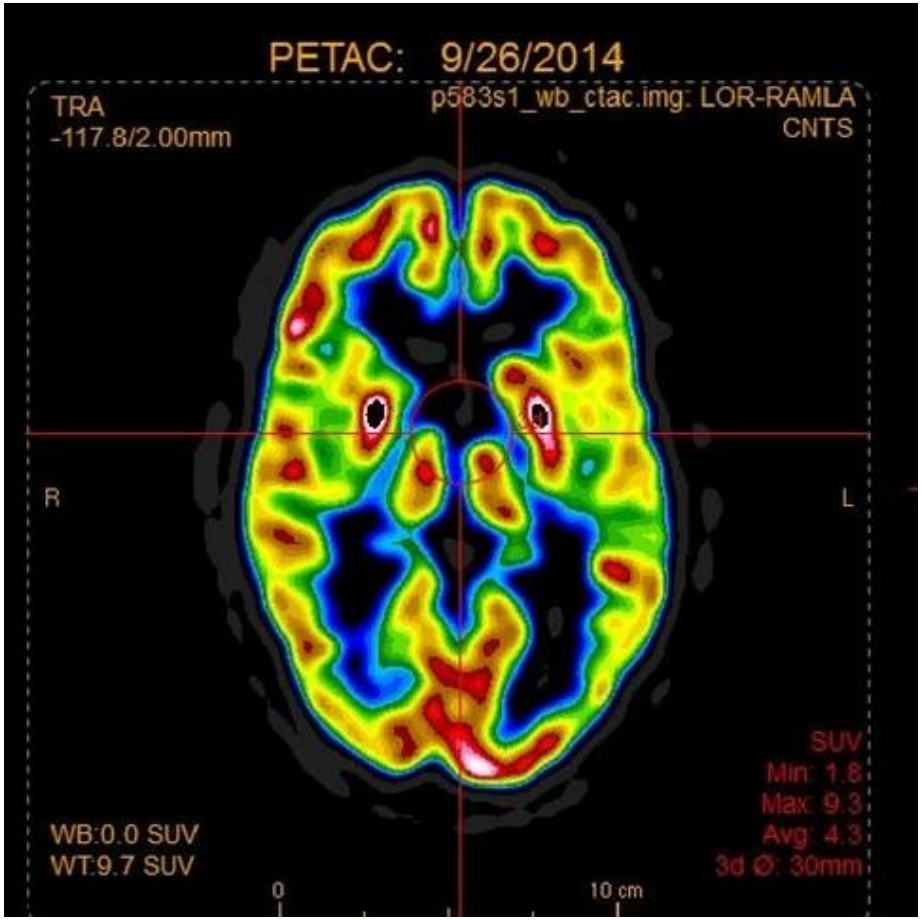
Metodologiak

- Positroi-igorpen bitartezko tomografia (**PET**)
- Erresonantzia magnetiko funtzional bidezko irudigintza (**fMRI**)
- Elektroentzefalografia (**EEG**)
  - Gertaerei loturiko potentzialak **(ERP)**
- Magnetoentzefalografia (**MEG**)

Positroi-igorpen bitartezko tomografia (**PET**)



Positroi-igorpen bitartezko tomografia (**PET**)

- Odolean injektatzen den aztarnari erradioaktibo bat erabiltzen da.
- Zenbat eta odol emari handiagoa eremu batean, orduan eta handiagoa izango da aztarnari horrek emititutako seinalea eremu horretan.
- Aztarnaria desegiten edo desintegratzen denean, neutroi eta positroi bat emititzen ditu. Positroiak elektroia jotzen duenean, biak deuseztatu egiten dira eta ondorioz bi gamma-izpi igortzen dira.
- Makinan dauden izpi detektatzaileek gamma-izpi hauek igorri dituen tokia zein den grabatu egiten dute eta horrela garunaren irudi funtzionala lortzen da.

Positroi-igorpen bitartezko tomografia (**PET**)

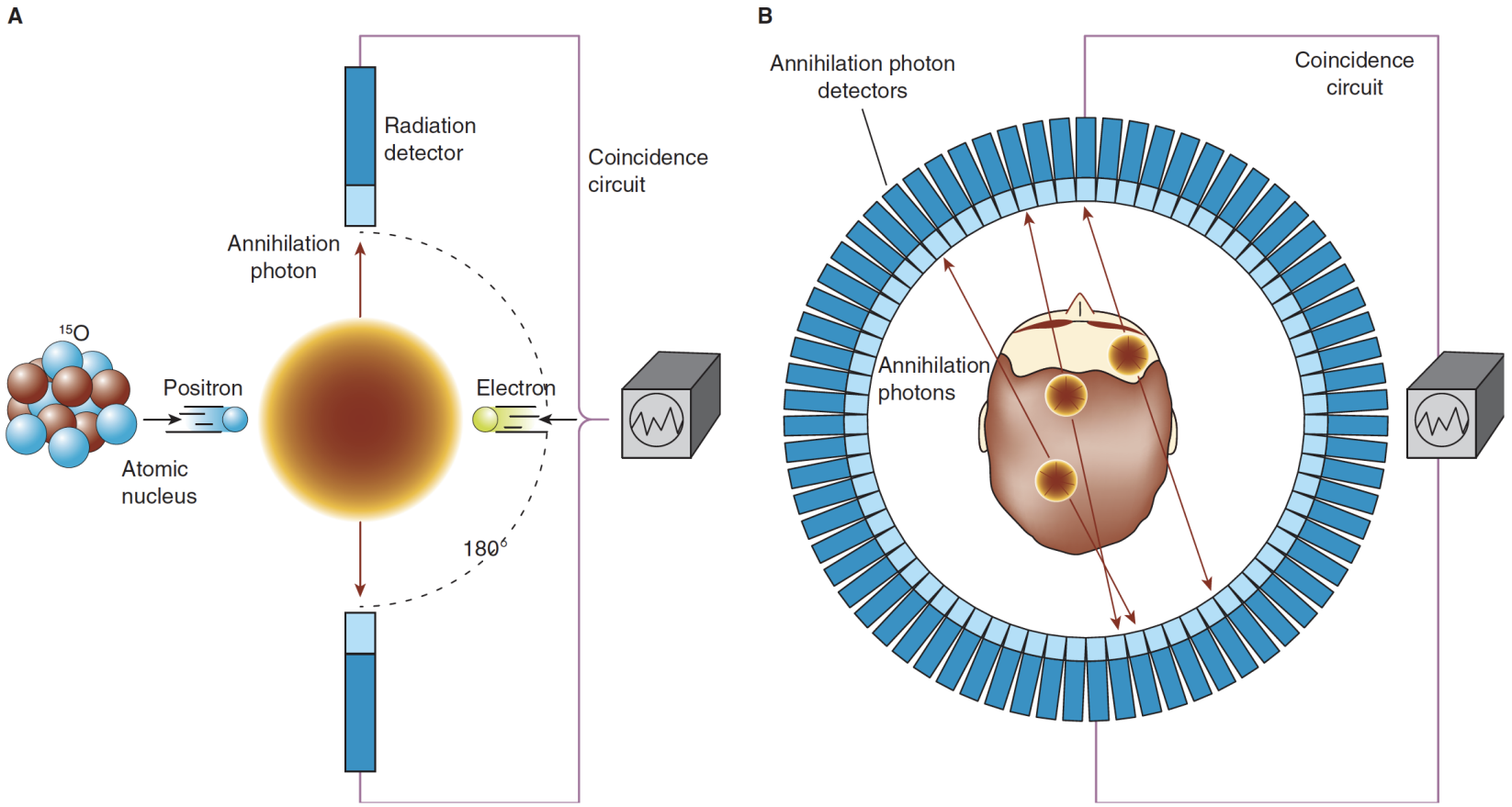
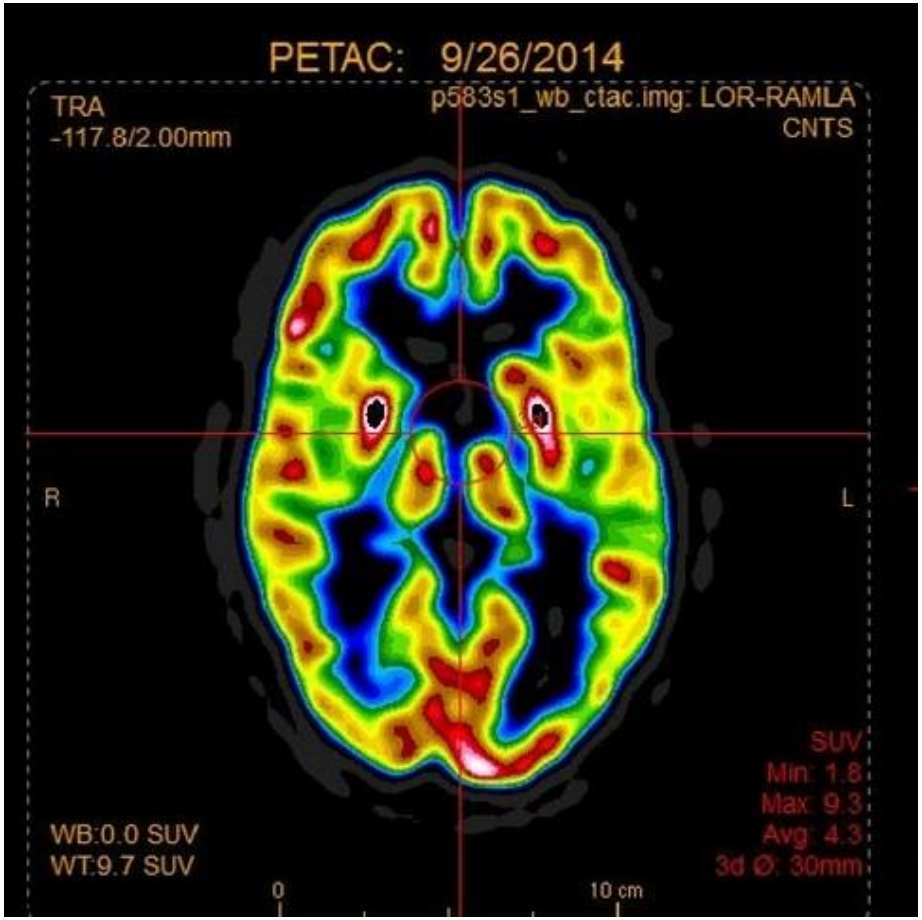


Figure 2.13 Basic principles of PET. (A) As ^{15}O decays, it emits a positron. This particle travels only 2-3 mm before it collides with an electron, causing an annihilation event that sends photons off in opposite directions at the speed of light. The photons are picked up by radiation detectors, and the location of the annihilation event is reconstructed by a computer. (B) Where the number of such events is relatively large, there is greater blood flow and hence greater neural activity. (From Posner & Raichle, 1994, pp. 62-63.)

PET


PETAC: 9/26/2014
TRA
-117.8/2.00mm
p583s1_wb_ctac.img: LOR-RAMLA
CNTS
R
L
SUV
Min: 1.8
Max: 9.3
Avg: 4.3
3d Ø: 30mm
WB:0.0 SUV
WT:9.7 SUV
0
10 cm

PET

Familial Parkinson's Disease: Clinical and Genetic Analysis of Four Basque Families

Coro Paisàn-Ruìz, BSc,[1,2] Amets Sàenz, PhD,[2] Adolfo Lòpez de Munain, MD, PhD,[2,3] Itxaso Martì, MD,[3] Angel Martìnez Gil, MD,[4] Josè F. Martì-Massò, MD, PhD,[3] and Jordi Pèrez-Tur, PhD[1]

During the last few years several loci have been linked to Mendelian forms of Parkinson's disease (PD). To date, 5 causative genes of 10 identified loci are known, and they have provided enormous insight into the molecular pathways involved in this common neurodegenerative disorder. One of the recently identified loci, PARK8, causes autosomal dominant PD with, apparently, various degrees of abnormal deposition of α-synuclein or τ in the neuronal cells in the pedigrees currently reported. We genetically characterized four Basque families and found evidence for linkage of autosomal dominant PD to the PARK8 locus, with a maximum 2-point logarithm of odds score of 3.21 (θ = 0.00) for marker D12S345. The clinical features of these families are those of typical PD, including good response to levodopa therapy, rigidity, and akinesia, and a mean age of 55 years at disease onset.

Ann Neurol 2005;57:365–372

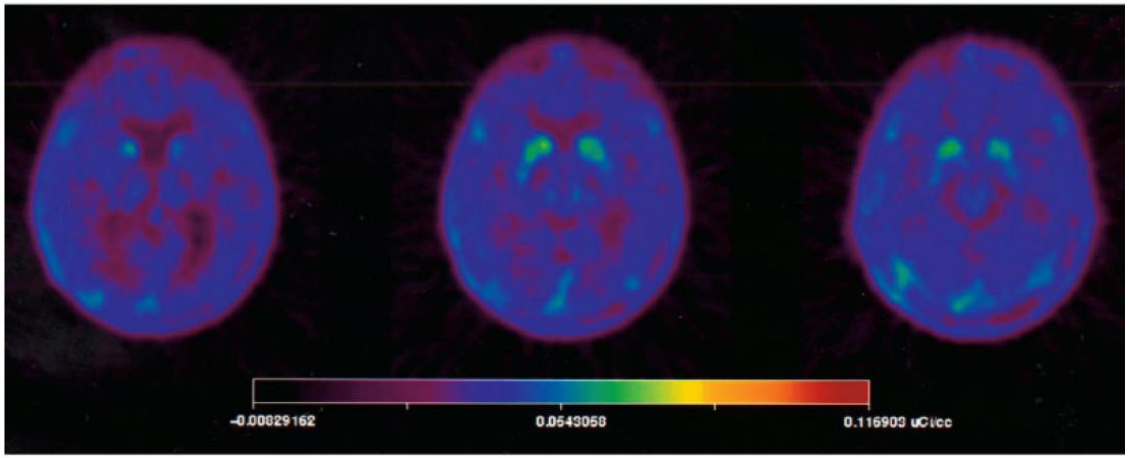


Fig 2. ^{18}F-fluorodopa positron emission tomography scan of Case III:18 of Family UGM03. The scan shows the nigrostriatal dysfunction typical of Parkinson's disease.

Erresonantzia magnetiko funtzional bidezko irudigintza (**fMRI**)

(Iturria: https://news.stanford.edu/news/2013/march/brain-imaging-inaccuracies-030713.html)

Erresonantzia magnetiko funtzional bidezko irudigintza (**fMRI**)

- fMRI medologiak MRI ekipamendua erabiltzen du, eta PETak ez bezala, ez du radiazio ionizagailuren beharrik.

- Neuronek oxigenoa kontsumitzen dute, eta hori egitean, oxihemoglobina deoxihemoglobinan konbertitzen dute.

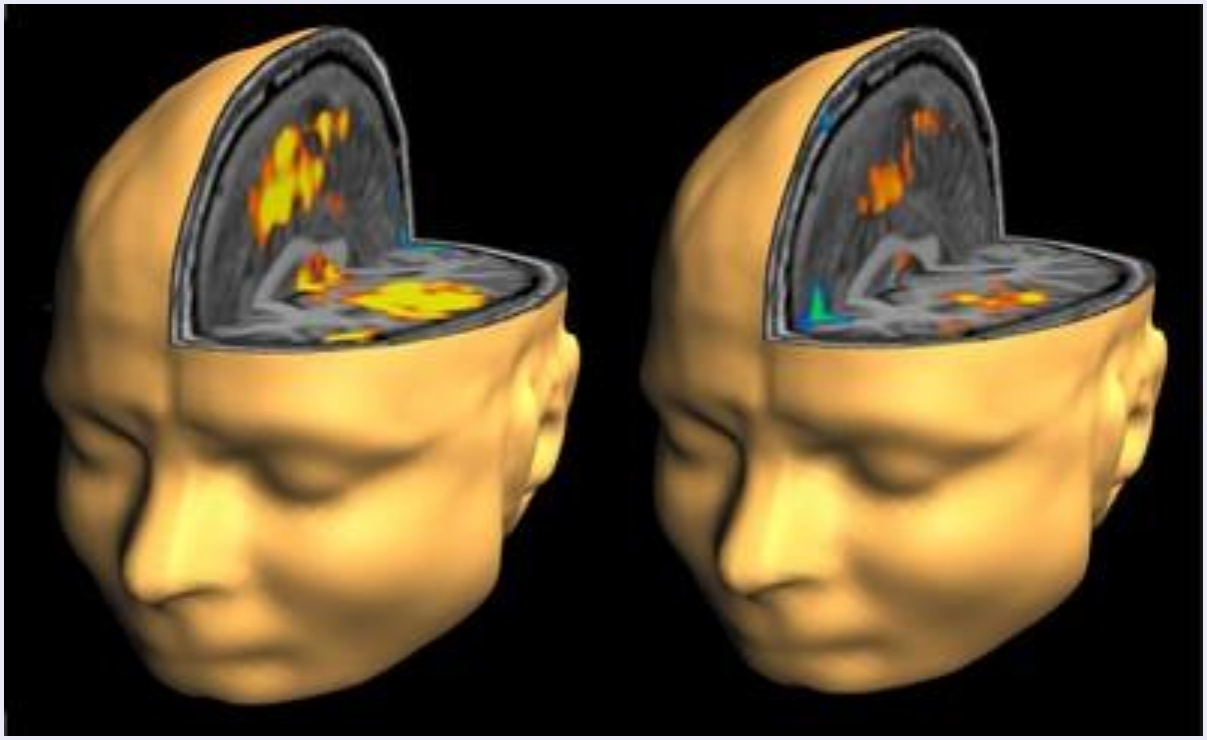
- BOLD (ing. blood oxygenation level dependence)

Magnetic Resonance Imaging

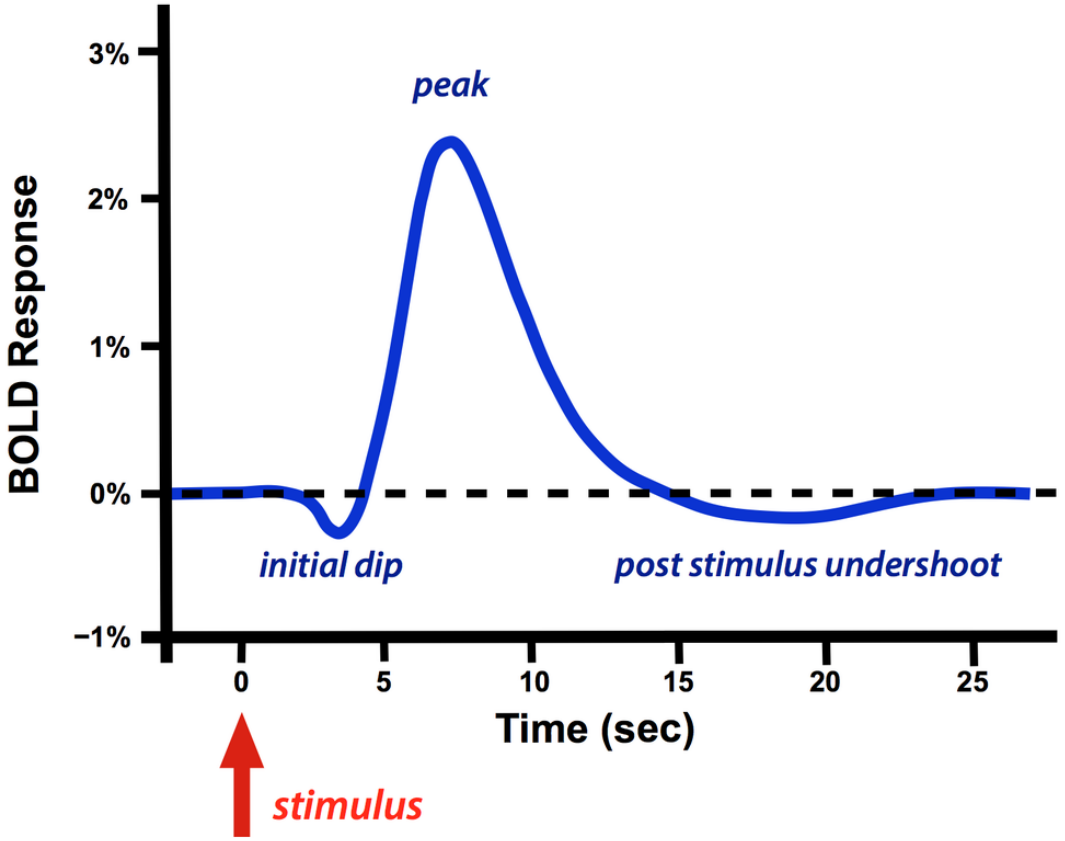
MRI

(functional) Magnetic Resonance Imaging

fMRI

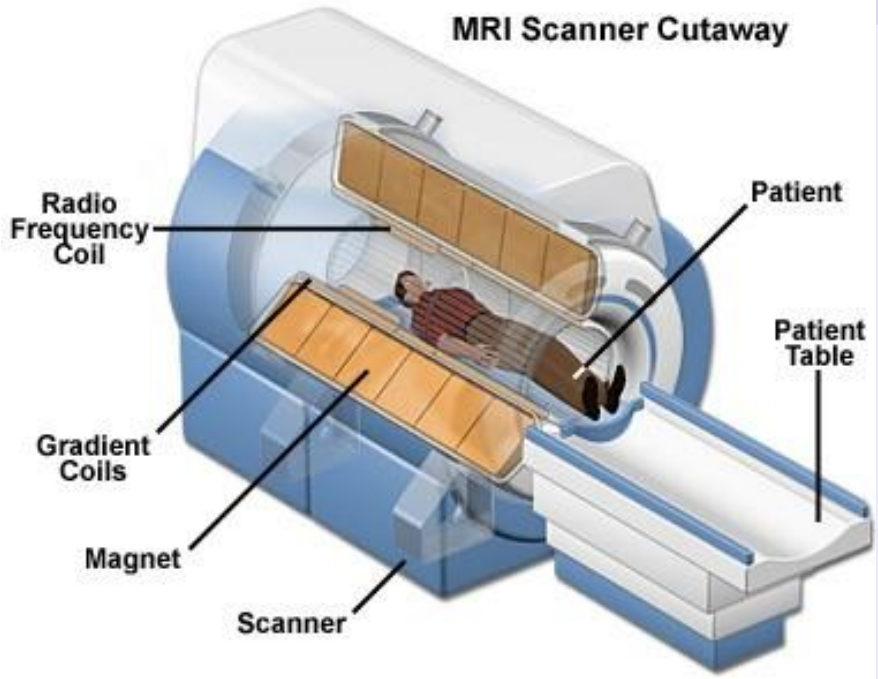


fMRI



Iturria: http://mriquestions.com/does-boldbrain-activity.html

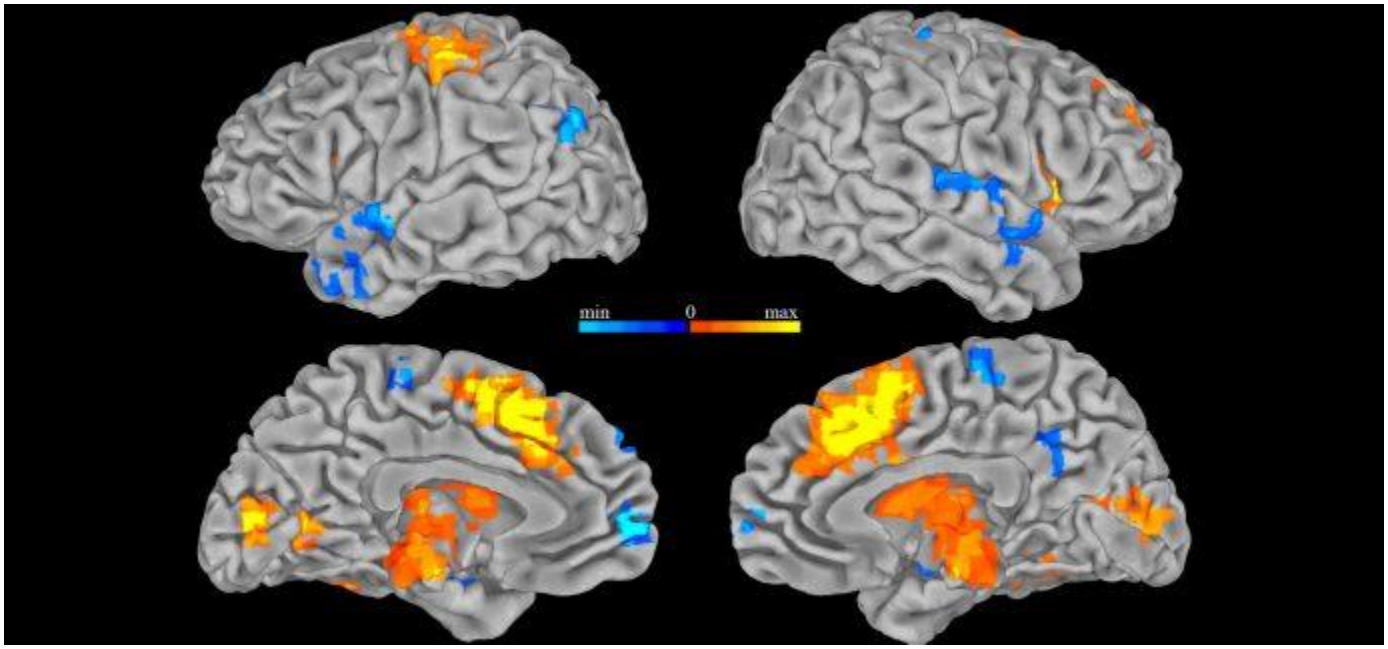
(functional) Magnetic Resonance Imaging



fMRI: Ezaugarriak

- **Azkartasuna:** Burmuin oso baten irudia lortu daiteke segundu gutxitan.
- **Sentiberatasun** handia seinalearen aldaketengan.
- **Prezisioa:** Irudiek objectuaren (gure kasuan burmuinaren) egitazko itxura adierazten dute.

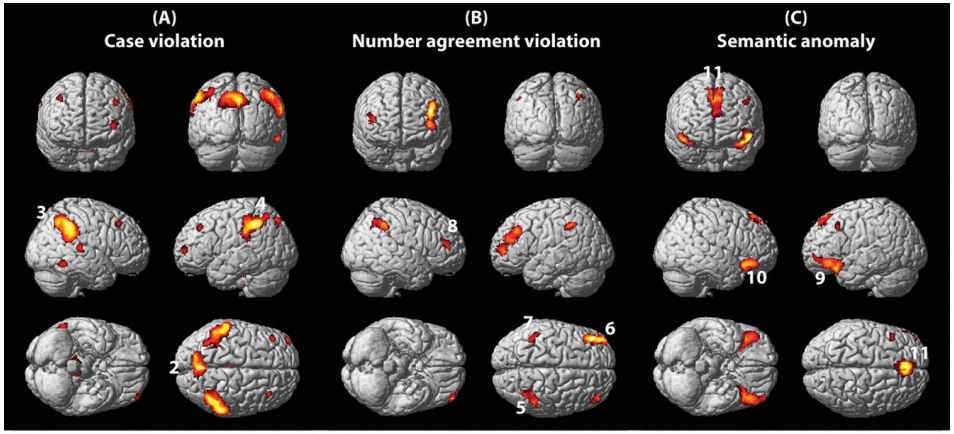
fMRI

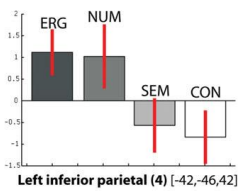


Brain Regions That Process Case: Evidence From Basque

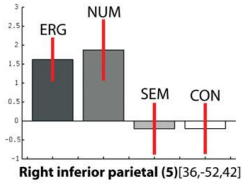
Mante S. Nieuwland,[1]* Andrea E. Martin,[1] and Manuel Carreiras[1,2,3]

[1]*Basque Center on Cognition, Brain, and Language, Donostia-San Sebastián, Spain*
[2]*Ikerbasque Foundation, Basque Foundation for Science, Bilbao, Spain*
[3]*Department of Basque Philology, Universidad de País Vasco, Bilbao, Spain*

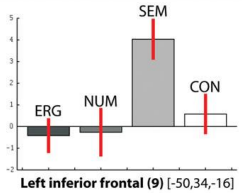




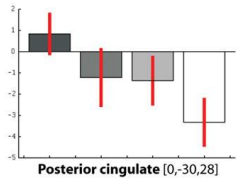
Left inferior parietal (4) [-42,-46,42]



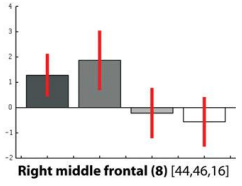
Right inferior parietal (5)[36,-52,42]



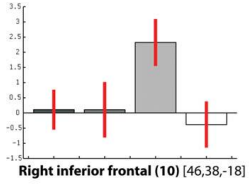
Left inferior frontal (9) [-50,34,-16]



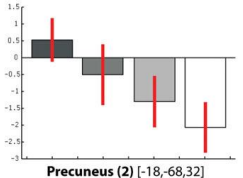
Posterior cingulate [0,-30,28]



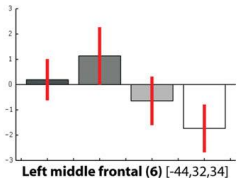
Right middle frontal (8) [44,46,16]



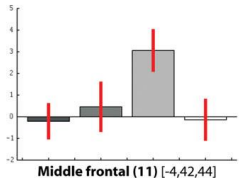
Right inferior frontal (10) [46,38,-18]



Precuneus (2) [-18,-68,32]



Left middle frontal (6) [-44,32,34]



Middle frontal (11) [-4,42,44]

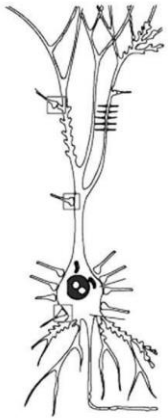
PET	fMRI
• Based on blood volume	• Based on blood oxygen concentration
• Involves radioactivity (signal depends on radioactive tracer)	• No radioactivity (signal depends on deoxyhemoglobin levels)
• Participants scanned only once	• Participants scanned many times
• Temporal resolution = 30 sec	• Temporal resolution = 1–4 sec
• Effective spatial resolution = 10 mm	• Spatial resolution = 1 mm
• Must use a blocked design	• Can use either blocked or event-related design
• Sensitive to the whole brain	• Some brain regions (e.g. near sinuses) are hard to image
• Can use pharmacological tracers	

Iturria: Ward (2015)

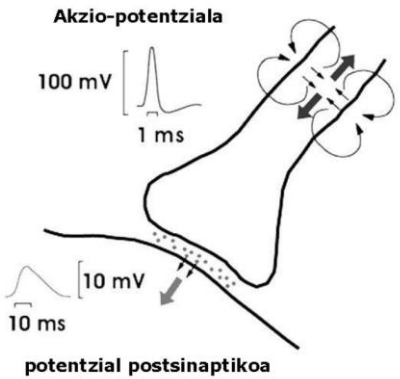
Elektroentzefalografia (EEG)

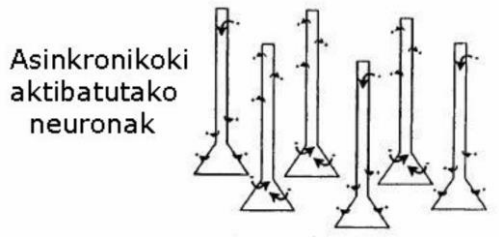
Hans Berger (1873-1941)

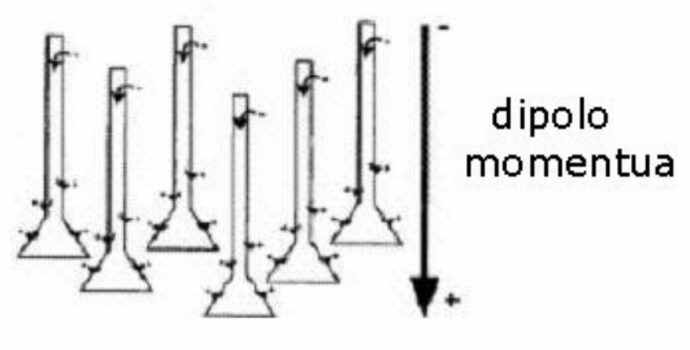
Korronte kortikalak

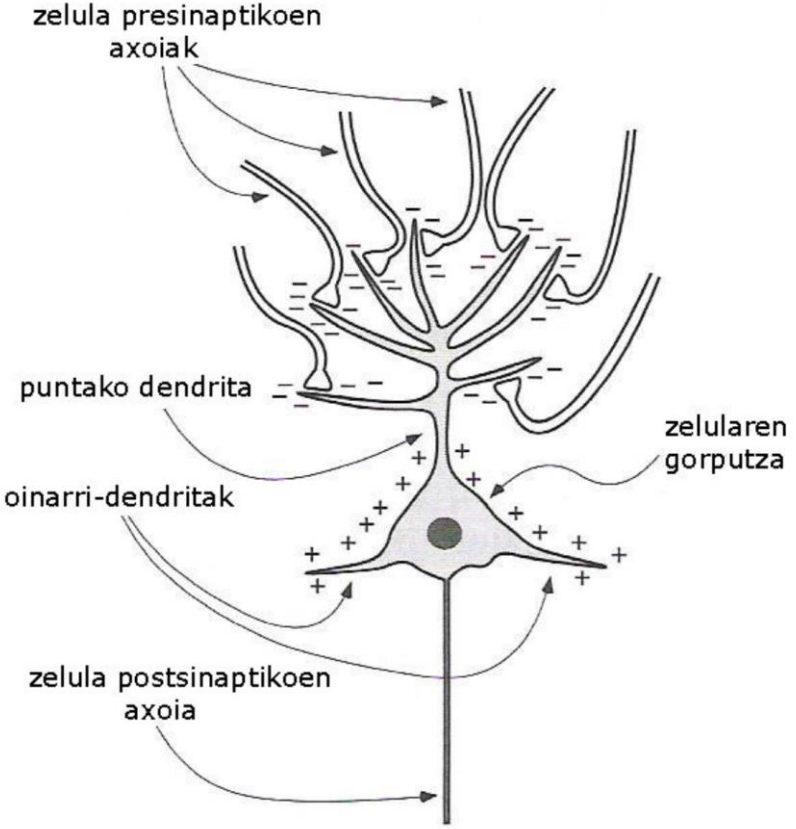


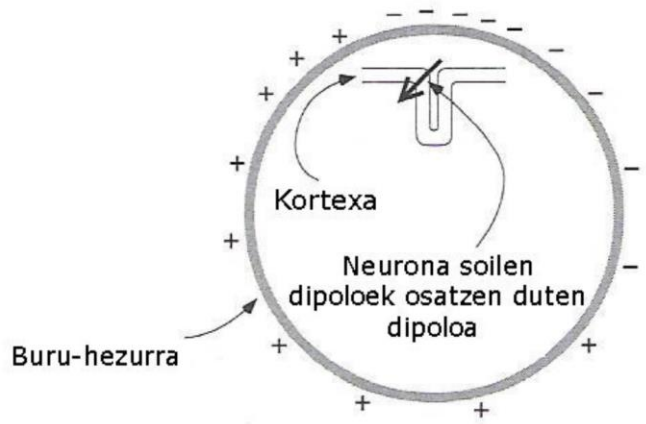
$>10^{14}$ sinapsi



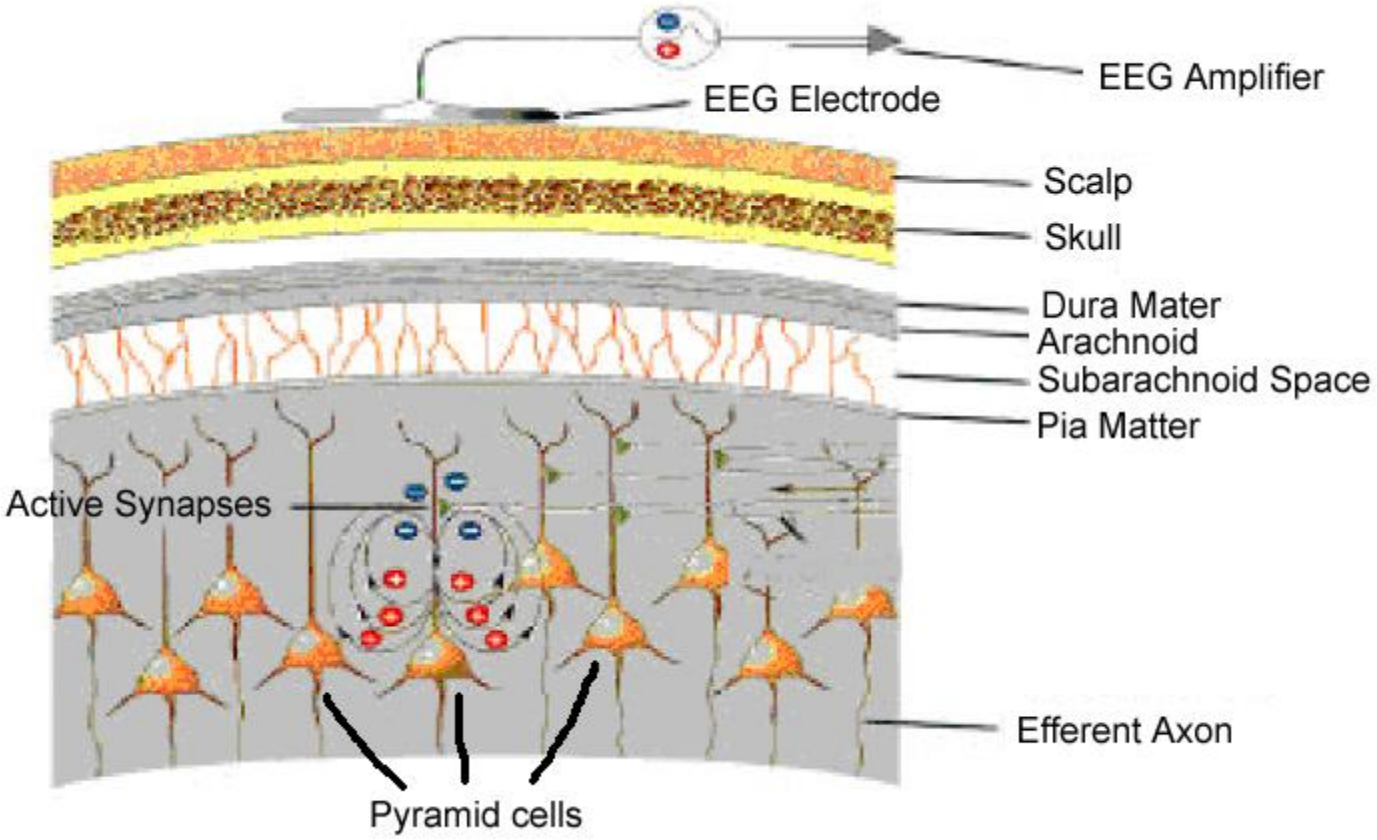




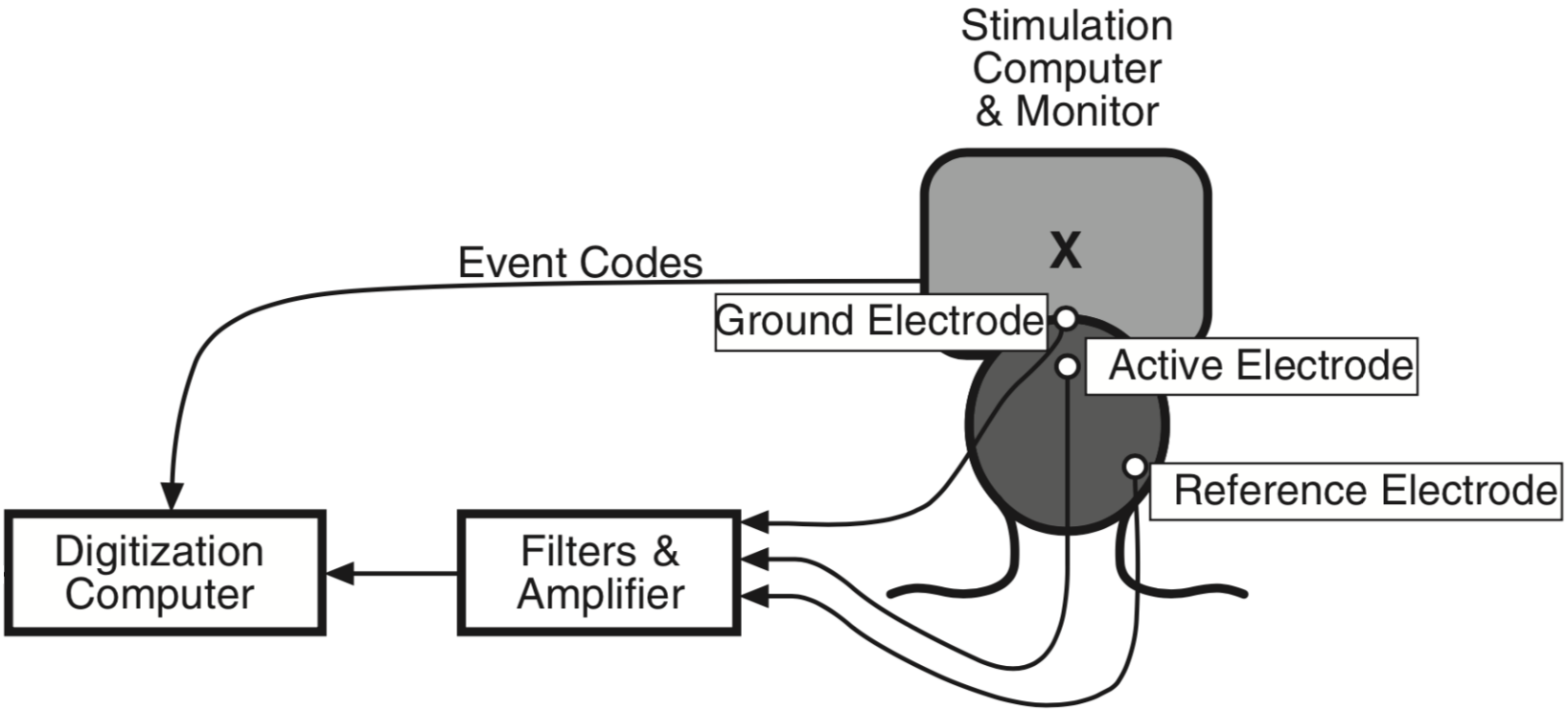


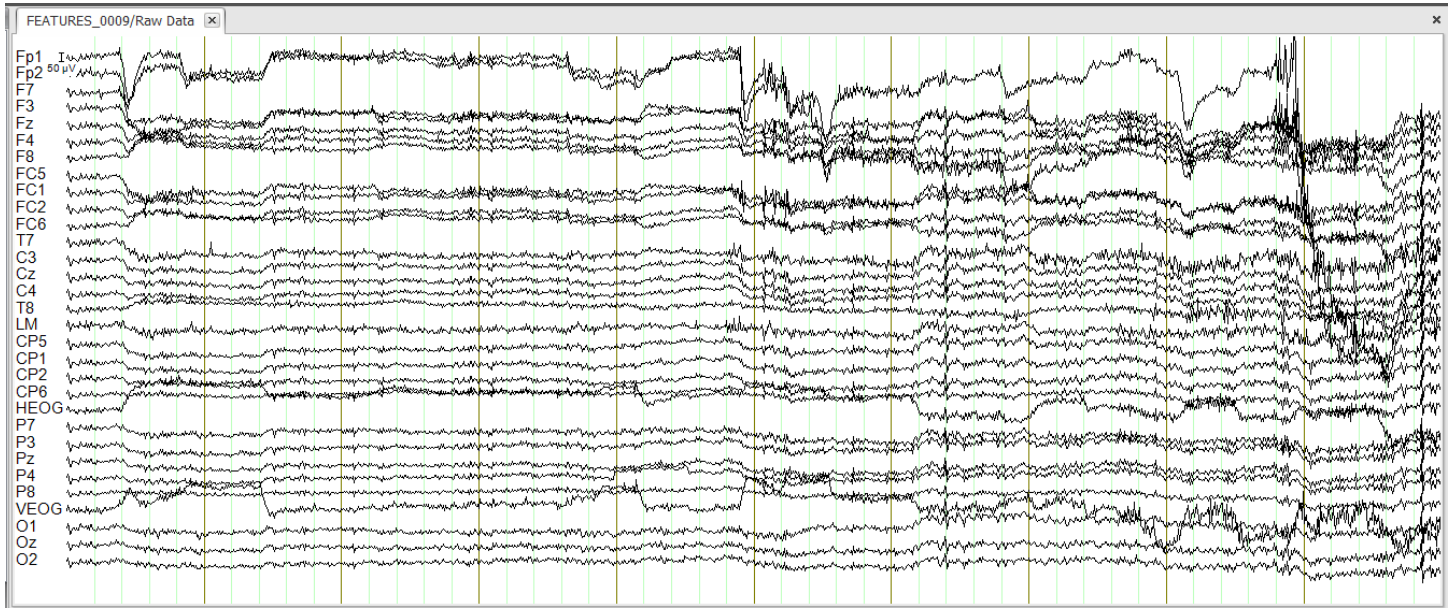


EEG


EEG Amplifier
EEG Electrode
Scalp
Skull
Dura Mater
Arachnoid
Subarachnoid Space
Pia Matter
Active Synapses
Efferent Axon
Pyramid cells

EEG


Stimulation
Computer
& Monitor
Event Codes
Ground Electrode
Active Electrode
Reference Electrode
Digitization
Computer
Filters &
Amplifier


FEATURES_0009/Raw Data
Fp1
Fp2
F7
F3
Fz
F4
F8
FC5
FC1
FC2
FC6
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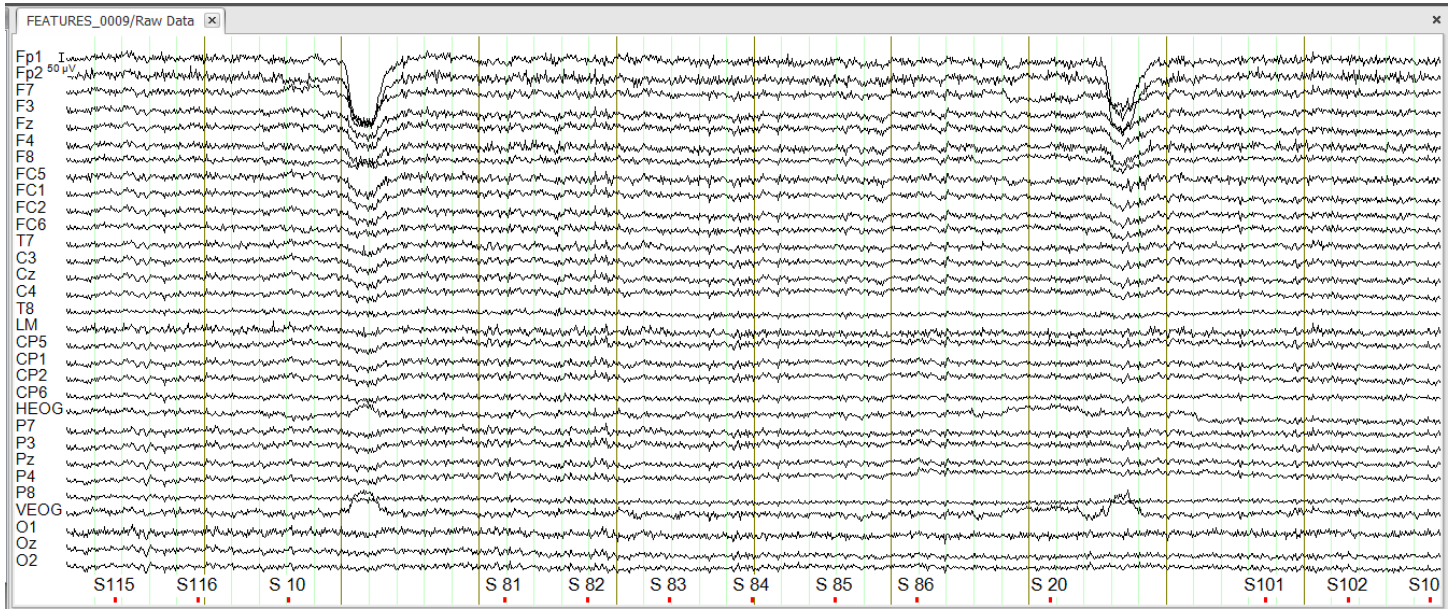
C3
Cz
C4
T8
LM
CP5
CP1
CP2
CP6
HEOG
P7
P3
Pz
P4
P8
VEOG
O1
Oz
O2


FEATURES_0009/Raw Data
Fp1
Fp2
F7
F3
Fz
F4
F8
FC5
FC1
FC2
FC6
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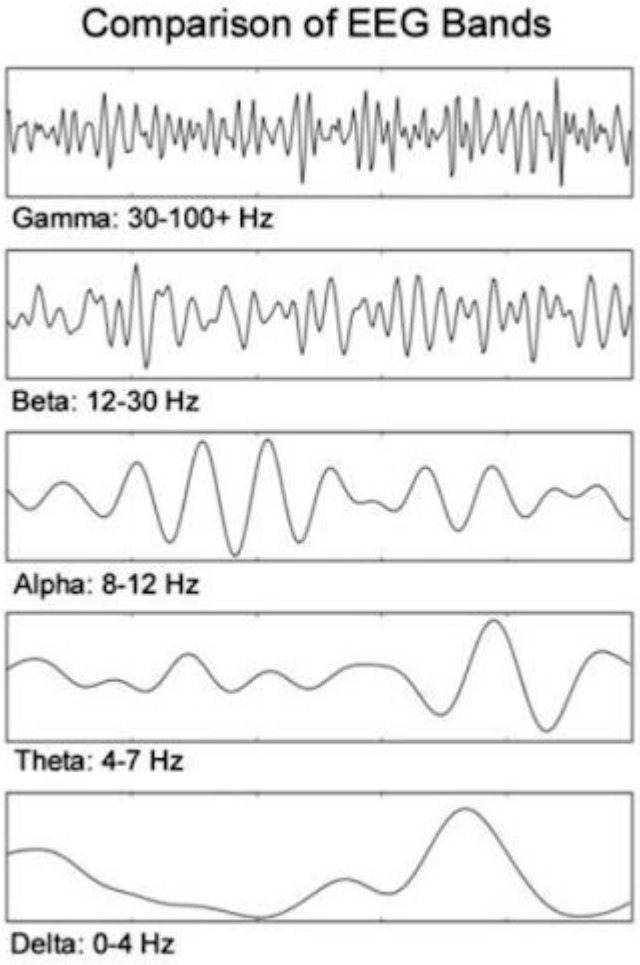
C3
Cz
C4
T8
LM
CP5
CP1
CP2
CP6
HEOG
P7
P3
Pz
P4
P8
VEOG
O1
Oz
O2
S115
S116
S 10
S 81
S 82
S 83
S 84
S 85
S 86
S 20
S101
S102
S10

Analisi motak

- Gertaerei loturiko potentzialak **(ERP)**

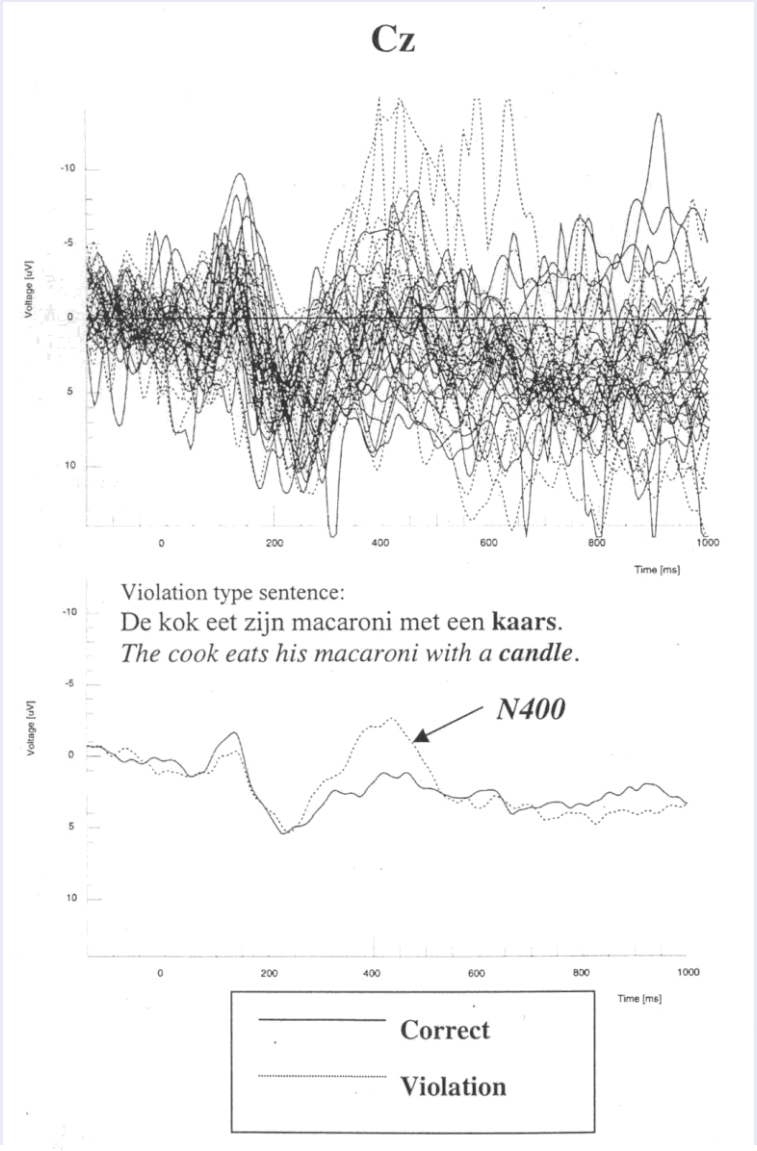
- Oszilazio erritmikoak EEG seinalean

Oszilazio erritmikoak EEG seinalean

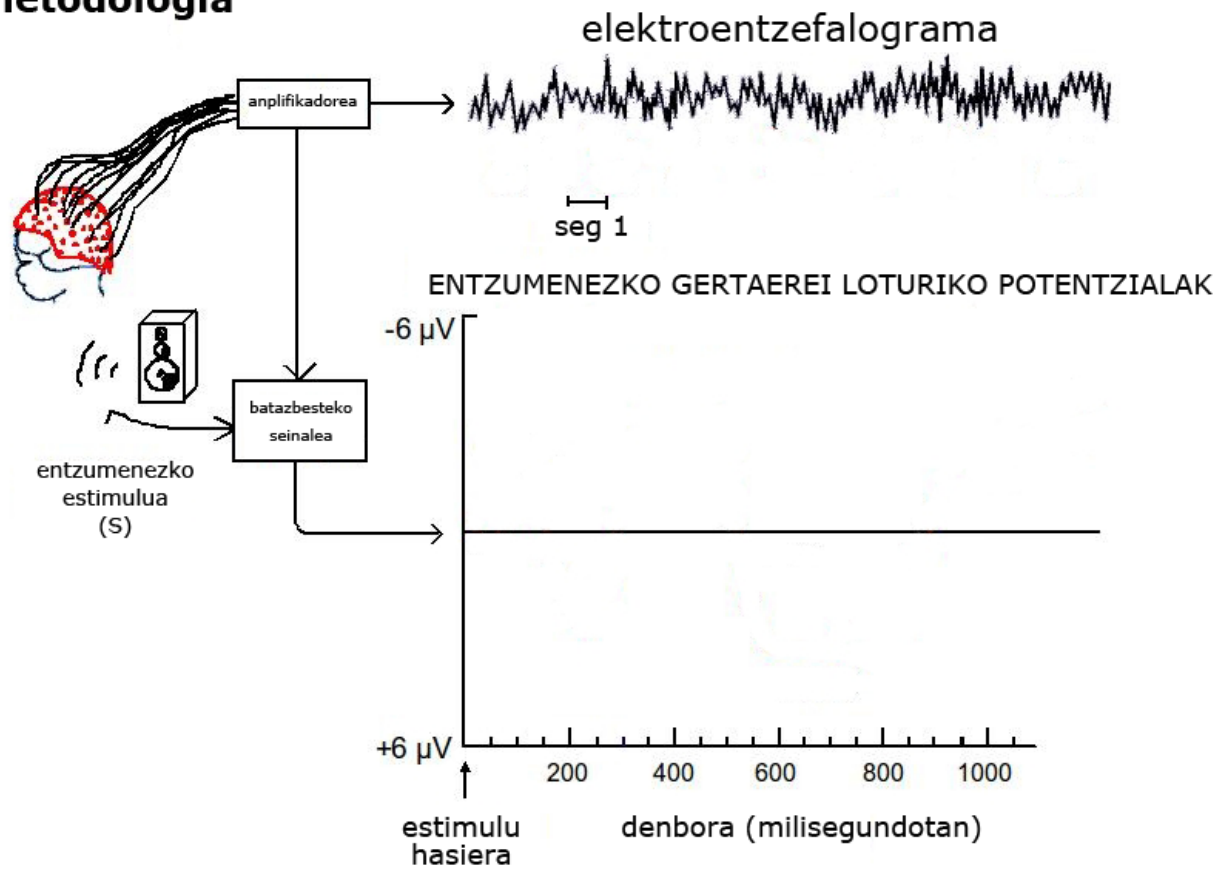


EEG-tik ERP-ra

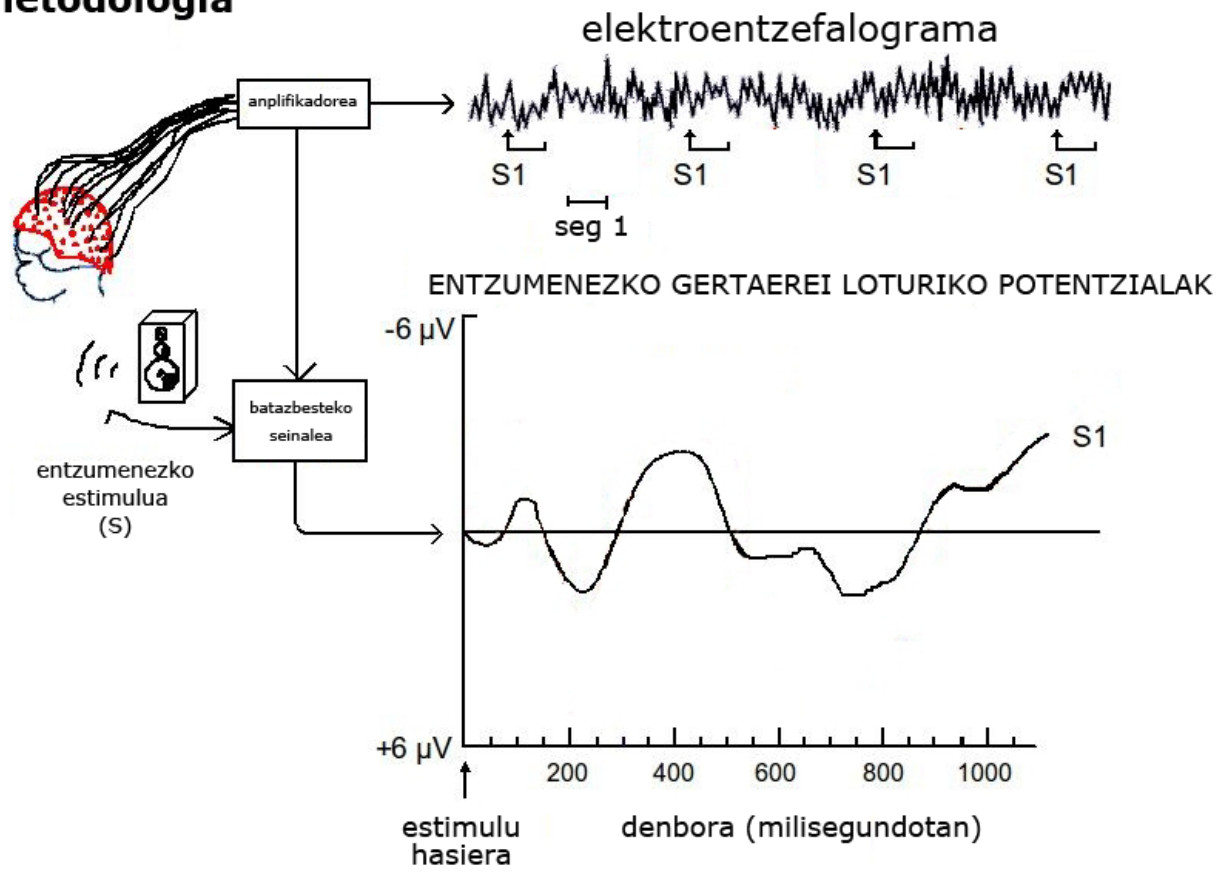
Uhinen bataz bestekoak



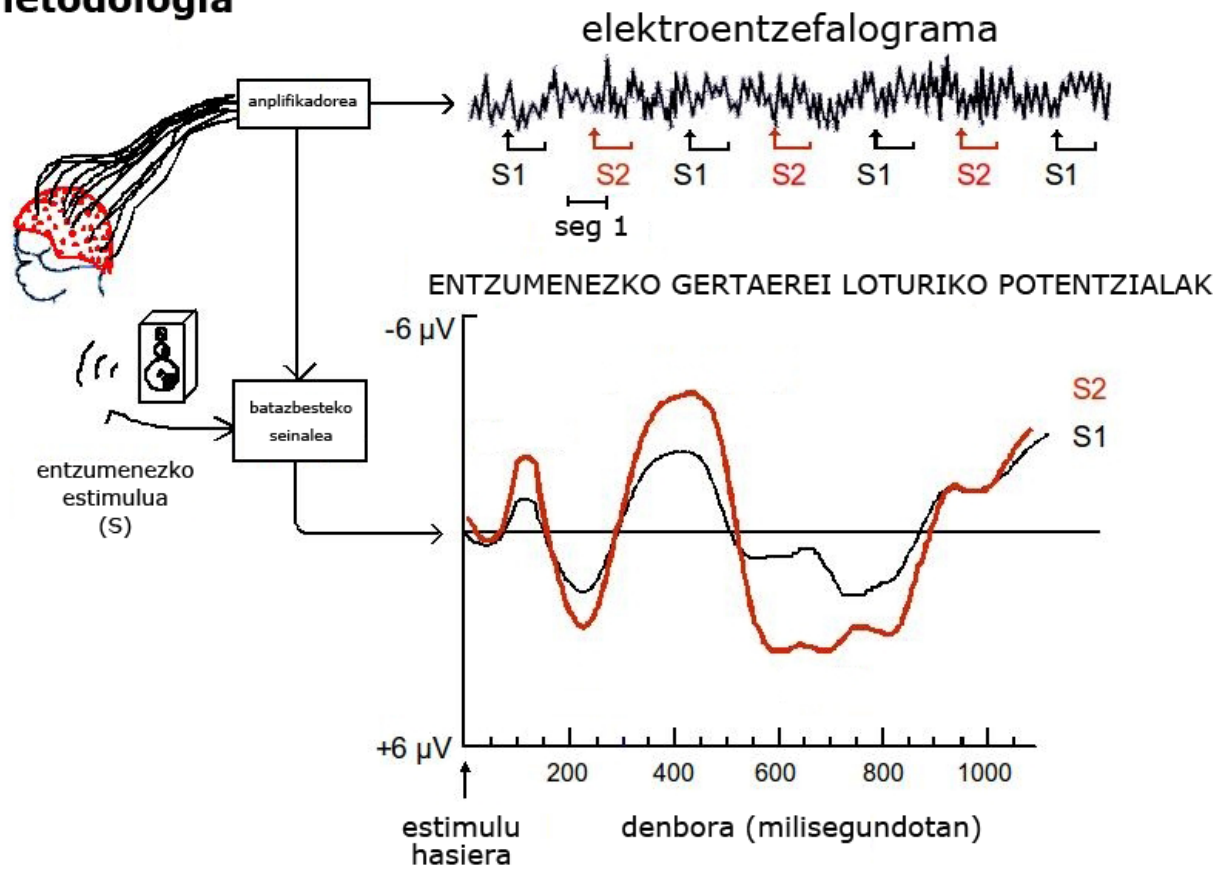
ERP metodologia



ERP metodologia



ERP metodologia



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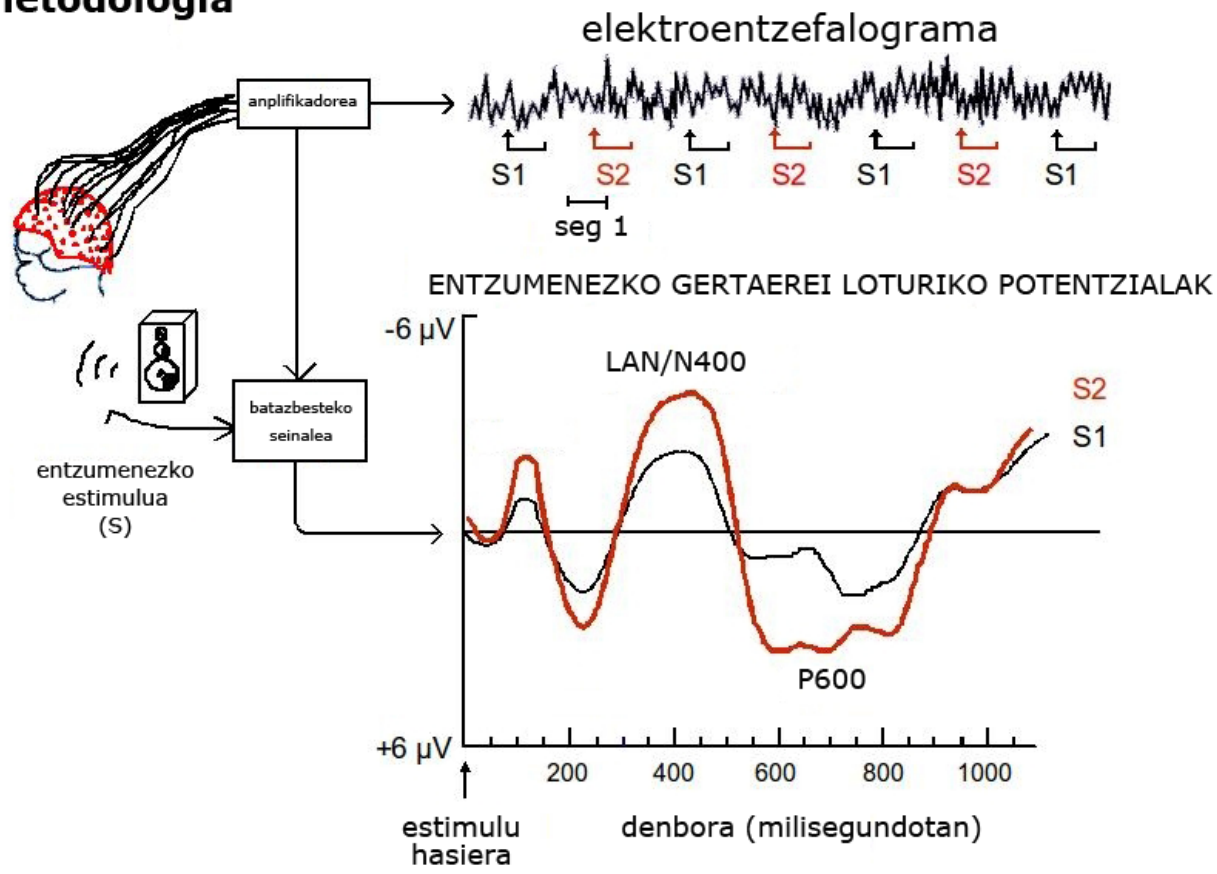

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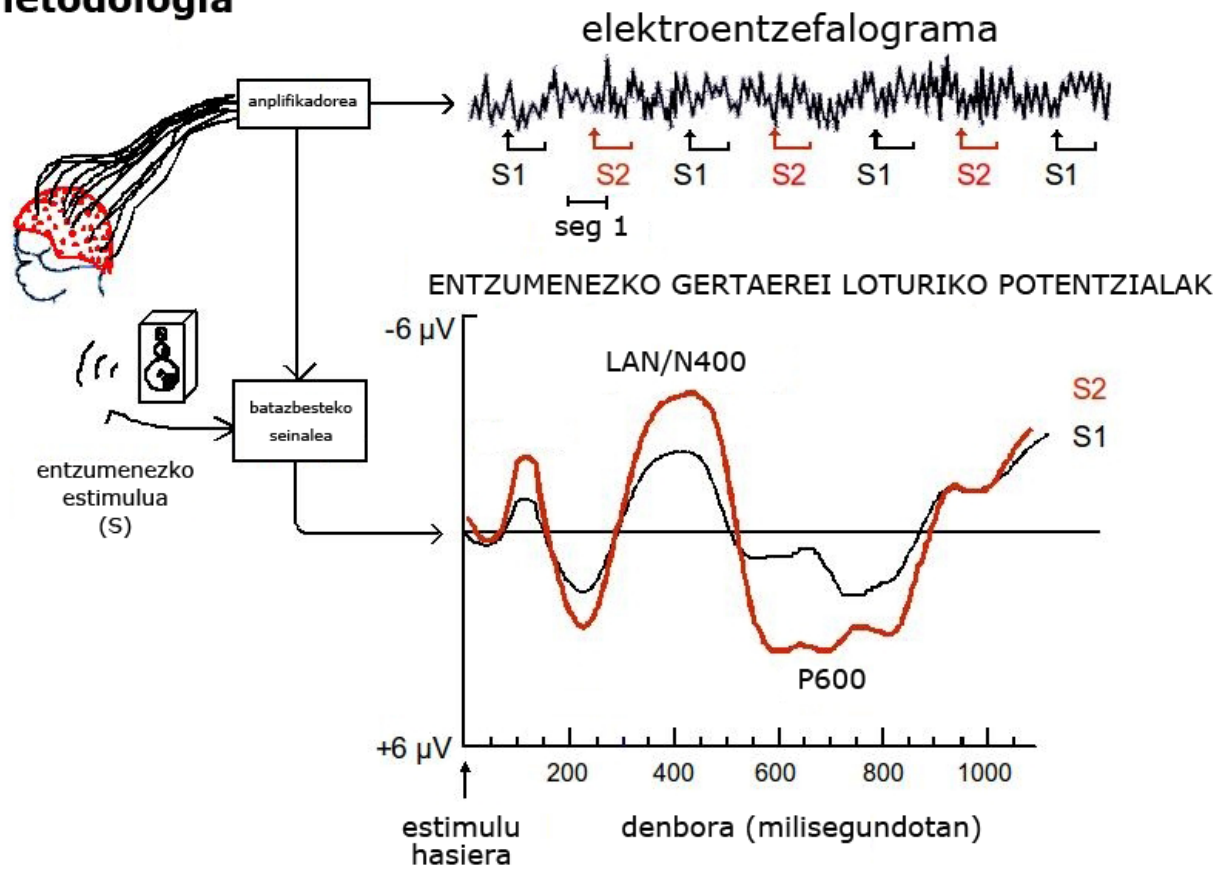

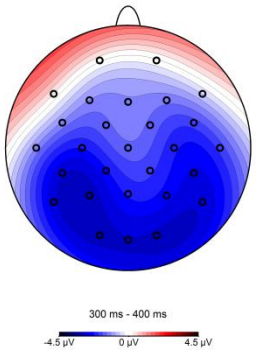

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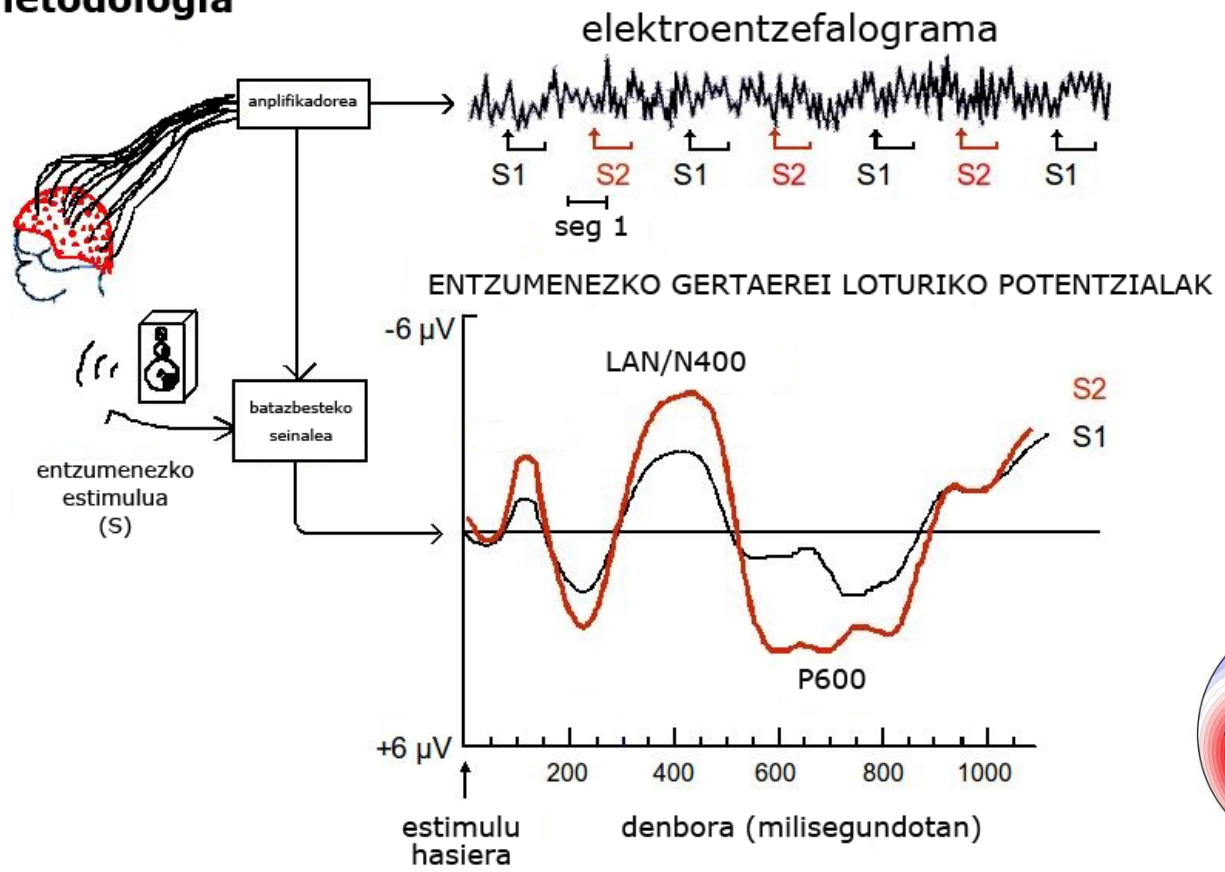
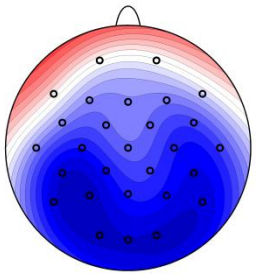
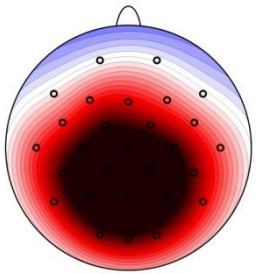






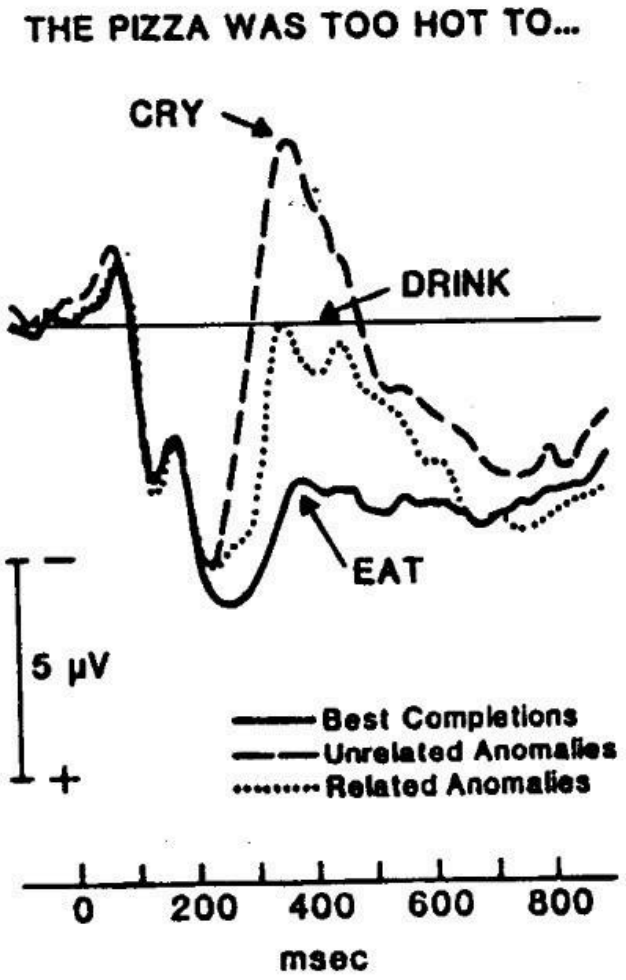
Dimentsio anitzeko informazioa

ERPek dimentsio anitzeko informazioa ematen digute

- **Polaritatea:**
  EEG seinalea polaritate positiboko eta negatiboko oszilazioak dira. Burmuineko korronte elektrikoa mikrovoltetan neurtzen da.
- **Latentzia:**
  ERPek duten bereizmen tenporalak ahalbidetzen du estimulua jaso eta oso milisegundu gutxira desberdinatasunak ikustea (50ms.)
- **Anplitudea:**
  Efektu eta populazio batzuk anplitude desberdintasunak erakusten dituzte
- **Banaketa Topografikoa:**
  ERPen bereizpen espaziala oso ona ez bada ere, osagai (efektu) ezberdinen kokagunea alda daiteke estimulazioaren ondorioz gertatzen diren prozesu kognitiboen arabera.

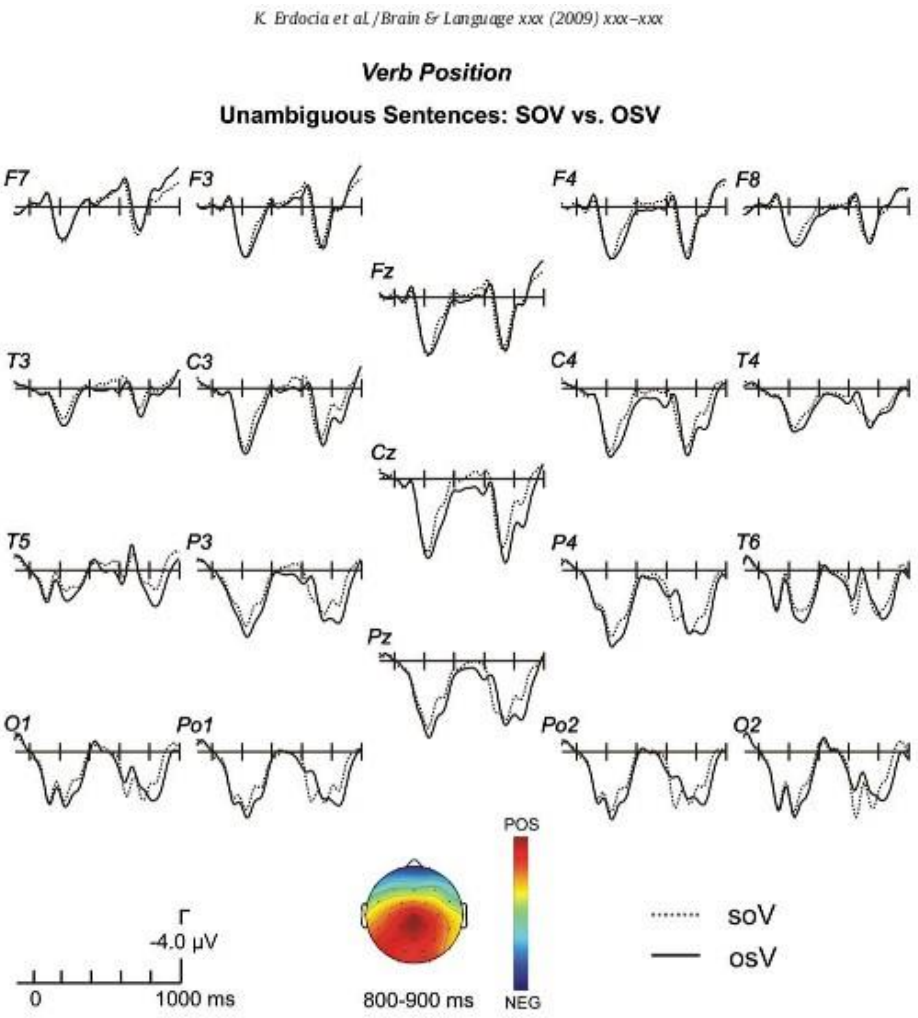
Osagai Linguistikoak: N400

- Polaritate: negatiboa
- Latentzia: 300-500 ms.
- Osagai Semantikoa
- Baina baita prozesamendu morfologikoa (Kasua, anbiguitateak...).

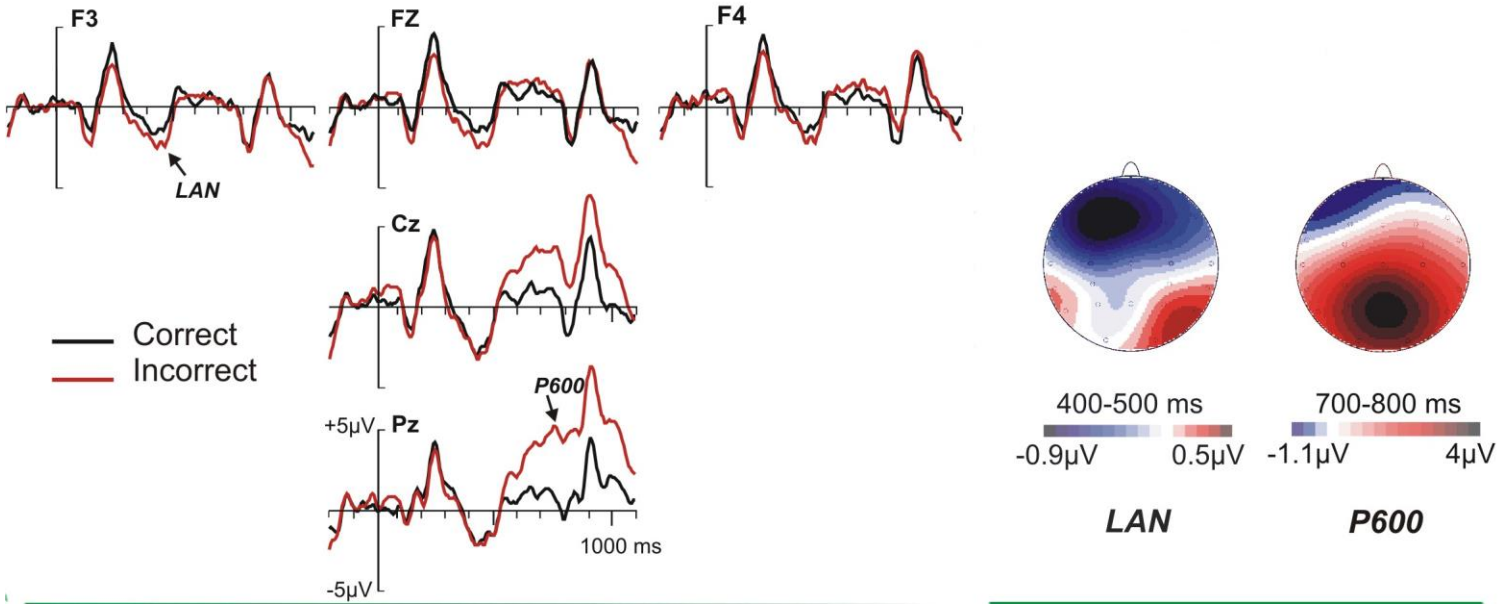


Osagai Linguistikoak: P600

- Polaritate: Positiboa
- Latentzia: 600-900 ms.
- Urraketa Sintaktikoak
- Berranalisi Sintaktikoak



Konponente bifasikoa: LAN + P600



Izen eta adjektiboaren arteko genero komuztadura (Jimenez-Ortega et al., 2012)

ERPak: Alde eta Kontra

Alde

- Dimensio anitzeko seinalea
- Seinale jarraikorra
- Ez du ariketa extrarik behar
- Prozesu kognitiboen unea eta iraupena neurtzeko oso egokia.

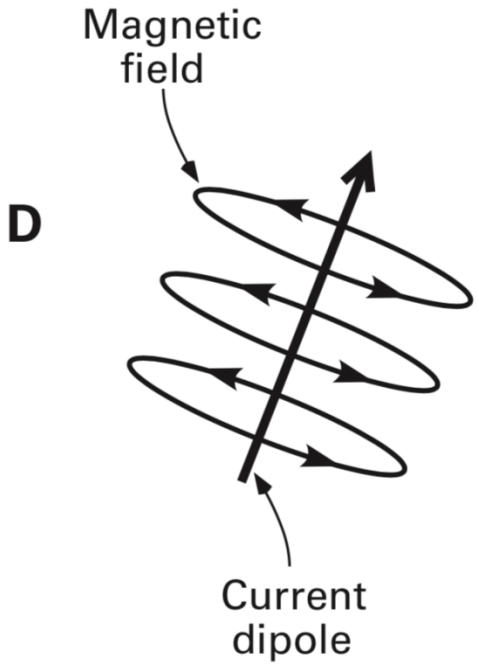
Kontra

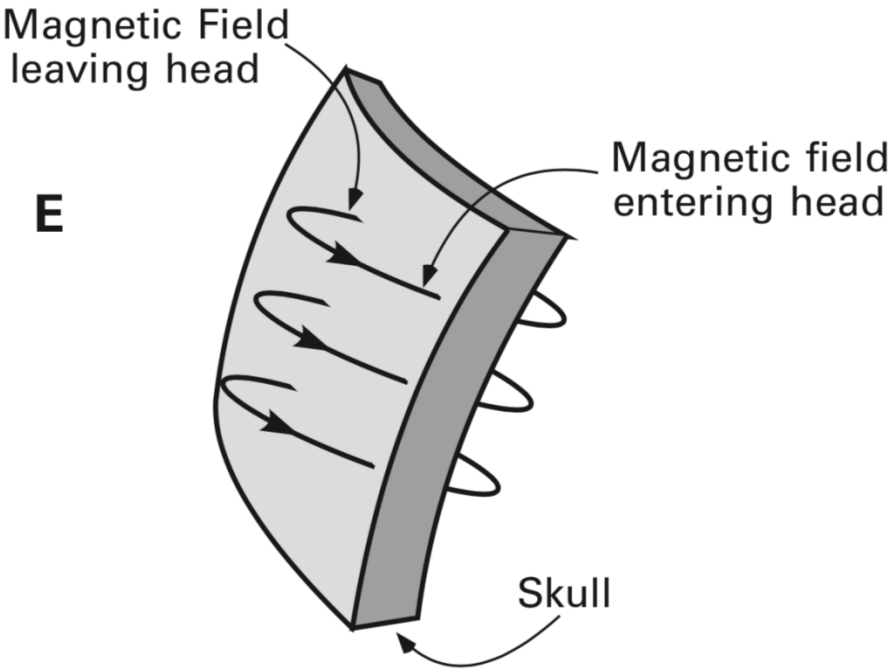
- Lokalizazio aldetik eskasa

Magnetoentzefalografia **(MEG)**

Magnetoentzefalografia (MEG)

- Garuneko neuronek sortarazitako eremu magnetikoa neurtzen du.





MEG

Burmuin aktibitatearen aldaketak helduen hizkuntza ikasketan, magnetoentzefalografia bidez neurtuta

Changes in brain activity during language learning in adults measured by magnetoencephalography

Ainhoa Bastarrika Iriarte

Euskal Hizkuntza eta Komunikazio Saila
Euskal Herriko Unibertsitatea

Supervised by
Douglas J. Davidson and César Caballero-Gaudes

A thesis submitted for the degree of
Doctor of Philosophy
Donostia 2017

MEG

The role of magnetoencephalography in epilepsy surgery

Zulma S. Tovar-Spinoza, M.D.,[1] Ayako Ochi, M.D., Ph.D.,[2] James T. Rutka, M.D., Ph.D.,[1] Cristina Go, M.D.,[2] and Hiroshi Otsubo, M.D.[2]

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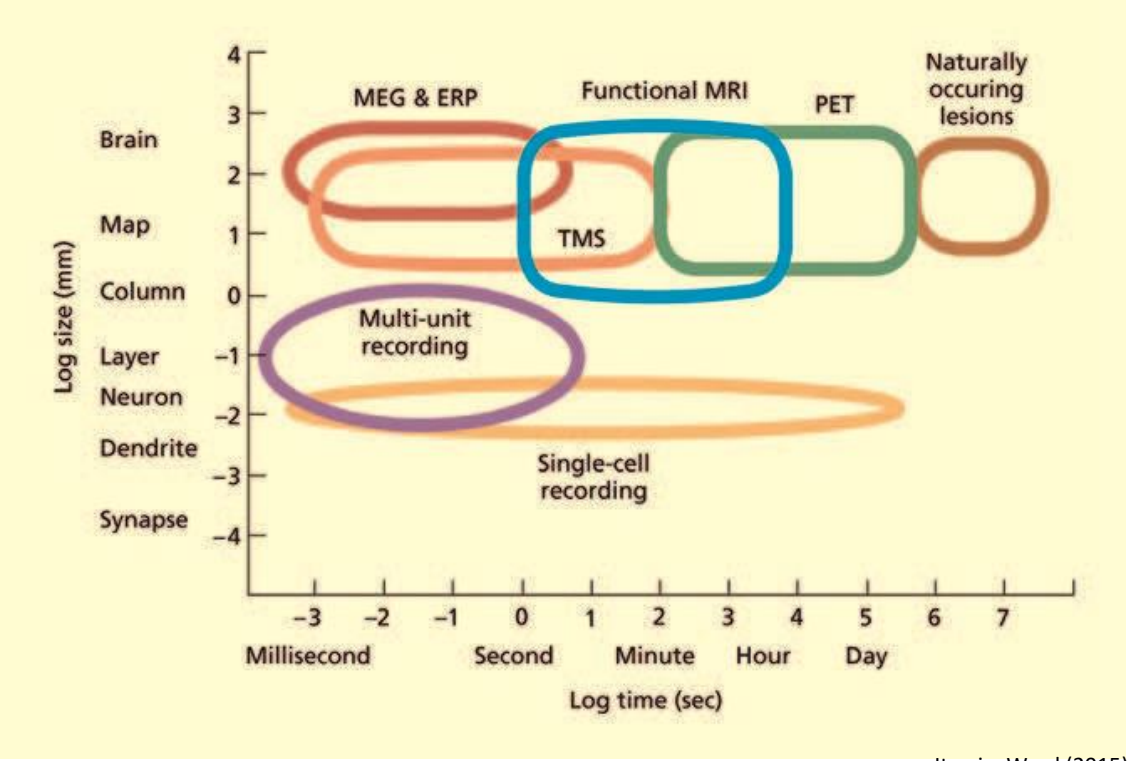
Epilepsy surgery requires the precise localization of the epileptogenic zone and the anatomical localization of eloquent cortex so that these areas can be preserved during cortical resection. Magnetoencephalography (MEG) is a technique that maps interictal magnetic dipole sources onto MR imaging to produce a magnetic source image. Magnetoencephalographic spike sources can be used to localize the epileptogenic zone and be part of the workup of the patient for epilepsy surgery in conjunction with data derived from an analysis of seizure semiology, scalp video electroencephalography, PET, functional MR imaging, and neuropsychological testing. In addition, magnetoencephalographic spike sources can be linked to neuronavigation platforms for use in the neurosurgical field. Finally, paradigms have been developed so that MEG can be used to identify functional areas of the cerebral cortex including the somatosensory, motor, language, and visual evoked fields.

The authors review the basic principles of MEG and the utility of MEG for presurgical planning as well as intraoperative mapping and discuss future applications of MEG technology. *(DOI: 10.3171/FOC/2008/25/9/E16)*

Key Words • children • epilepsy surgery • magnetoencephalography

Laburpena



Iturria: Ward (2015)

EEG vs. MRI vs. fMRI

The main differences

IMOTIONS

Each imaging methodology has distinct advantages and disadvantages, some of which are summarized below.

	EEG	MRI	fMRI
Temporal resolution	High	Low	Low
Spatial resolution	Low	High	High
Measures brain activity?	Directly	Only structure	Indirectly (BOLD response)
Level of expertise needed	Some training	Extensive training	Extensive training
Cost	Accessible to many researchers	Requires extensive funding	Requires extensive funding
Portability	Both fully portable and semi-portable devices available	Not portable	Not portable

Iturria: https://imotions.com/blog/eeg-vs-mri-vs-fmri-differences/

Laburpena

	Inbasiboa	Bereizmen espaziala	Bereizmen tenporala	Prezioa
PET	−	+ + +	+	€€€
fMRI	−	+ + +	+	€€€
MEG	−	+ +	+ + +	€€
EEG	−	+	+ + +	€

Oinarrizko bibliografia

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