

Sensory gating in psychiatry



Rikus Knegtering 2015



Schizofrenie bestaat niet

Het heet psychosegevoeligheid.

En je kunt er goed mee leren omgaan.

Deze site is bedoeld voor iedereen die met een psychose te maken krijgt (en zijn omgeving). We geven je de meest nuchtere en hoopvolle informatie die er is, over psychosegevoeligheid. Want onze maatschappij én veel hulpverleners lopen achter. Bij een psychose valt al gauw de term schizofrenie. En bij schizofrenie denkt iedereen aan een verwoestende hersenziekte. Maar dat is onjuist.

Waarom

Psychose en hersteltips

Interviews

Goede Hulp

Blog

E-mailspreekuur

Herstelwoordenboek

Contact

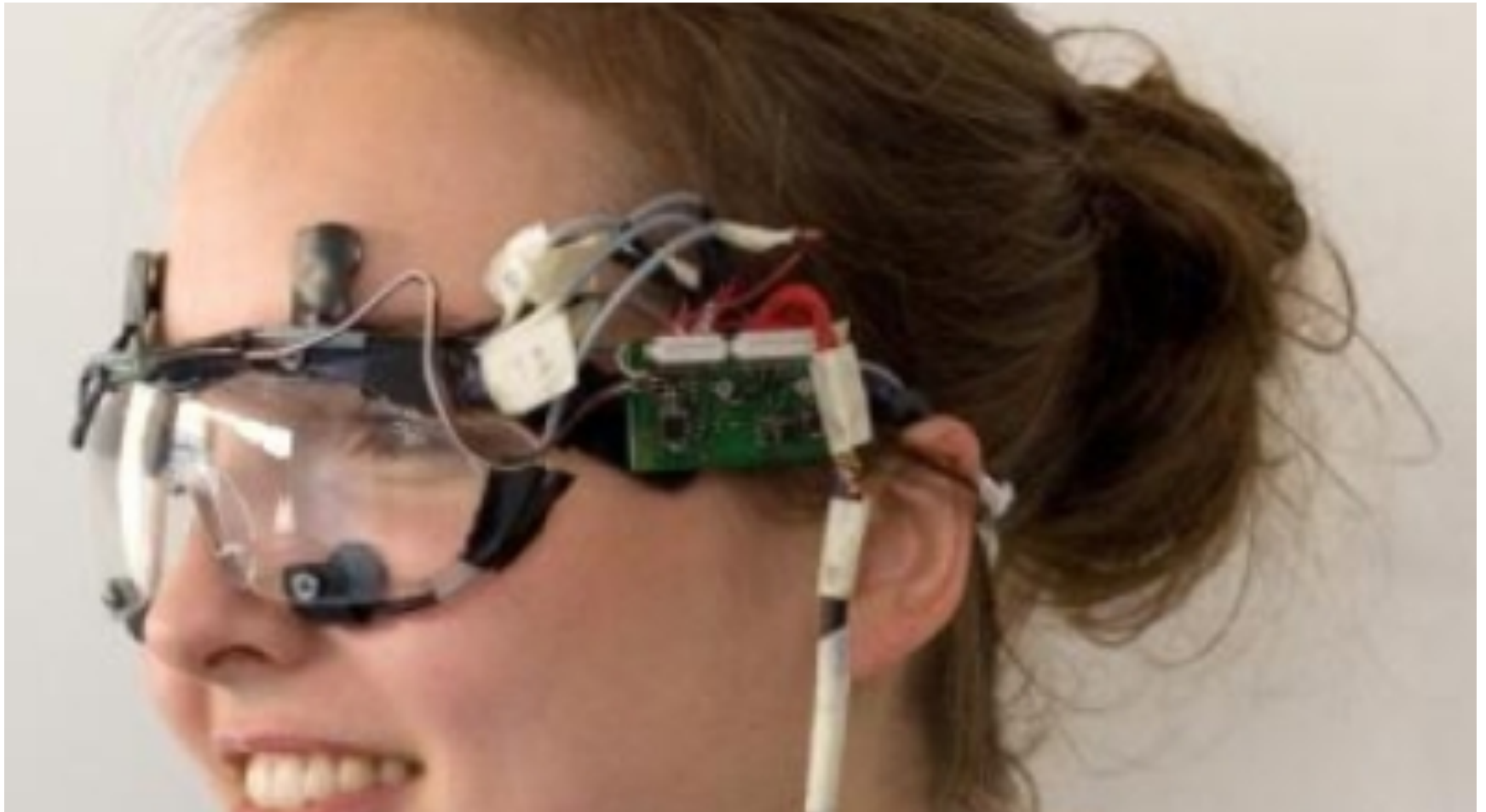
Stel een vraag in het e-mailspreekuur



- Eye movement disorders
- Sensory Gating
- P 50
- P 300
- Prepulse Inhibition, startle reflex
- Clinical correlated
- Importance for understanding psychopharmacology

Turetsky et al Schizophrenia Bulletin vol. 33 no. 1 pp. 69–94, 2007
Potter et al Schizophrenia Bulletin vol. 32 no. 4 pp. 692–700, 2006

Gladde oogvolgbewegingen



From: **Dependence of Impaired Eye Tracking on Deficient Velocity Discrimination in Schizophrenia**

Arch Gen Psychiatry. 1999;56(2):155-161. doi:10.1001/archpsyc.56.2.155

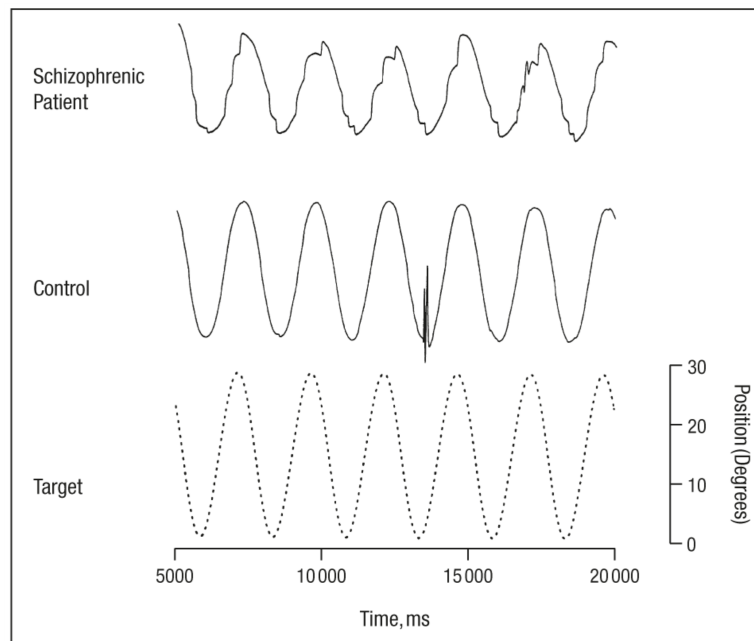


Figure Legend:

Sample tracings of smooth pursuit eye movements of a schizophrenic patient (top) and a normal control (middle) following a 0.4-Hz sine wave (bottom, dashed line). Note that the normal control record is smooth except for a blink at about 12 seconds into the record. The record of the schizophrenic patient shows a very irregular pattern, suggestive of low gain pursuit with frequent saccadic eye movements.

Critical Flicker fusion Frequency (threshold) CFFt





Parameter (Hz)	Patients	Controls	p-value*	Effect size (Cohen <i>d</i>)
Without AP: CFFT ASC	30.7 (SD 3.5)	32.5 (SD 2.8)	0.026	0.57
Without AP: CFFT DES	31.6 (SD 3.4)	33.9 (SD 2.7)	0.002	0.75
Without AP: CFFT	31.2 (SD 3.1)	33.2 (SD 2.3)	0.002	0.73
With AP: CFFT ASC	25.1 (SD 2.6)	27.8 (SD 3.1)	0.005	0.94
With AP: CFFT DES	24.2 (SD 3.8)	27.3 (SD 2.8)	0.005	0.93
With AP: CFFT	24.6 (SD 2.6)	27.5 (SD 2.6)	0.001	1.12

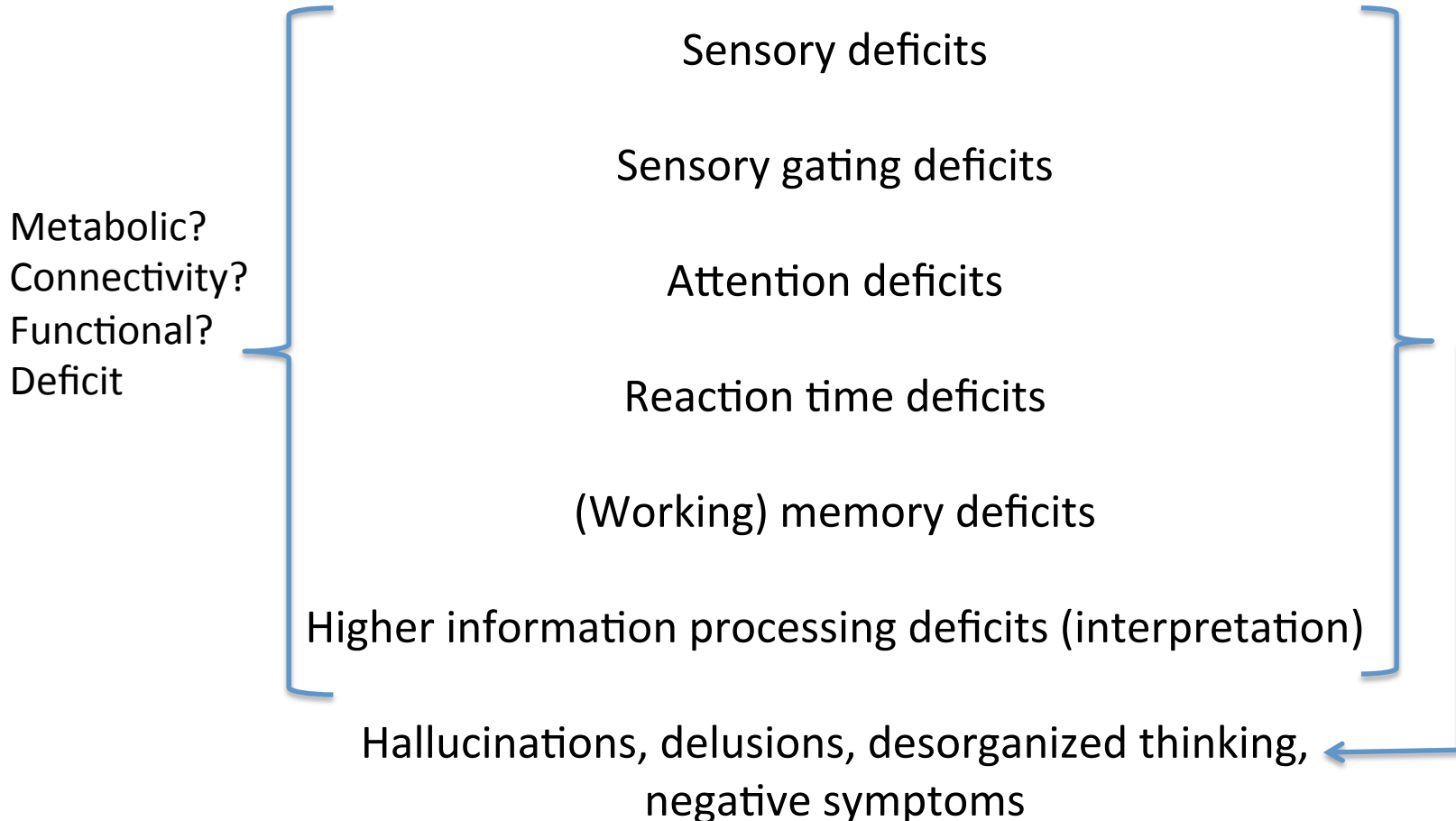
Jozarni Dlabáč-de Lange MD., Marc Kuipers, Mike Vervoort MD., Gerben Duisterwinkel MD., Sjoerd Sytema MSc. PhD. Henderikus Knegtering MD. PhD. (2010). Schizophrenia can be diagnosed in the blink of an eye; it lowers the critical flicker fusion frequency threshold.



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Cognitive deficits in schizophrenia 2



P 300



P 300



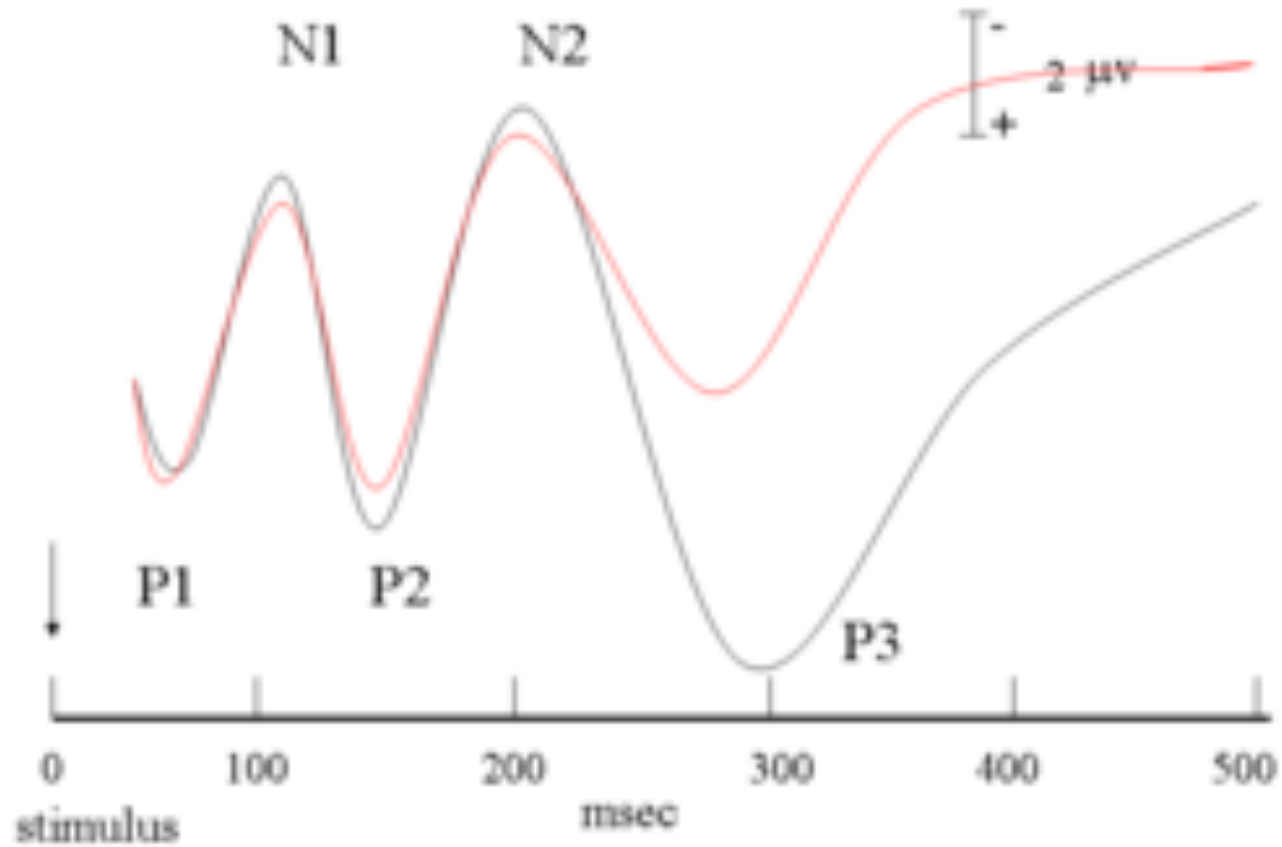
- **P300**, soms ook P3 of P3b genoemd, is een positieve elektrische golf in het EEG die op ongeveer 300 ms na een stimulus optreedt.
- Event Related Potential (ERP)

P 300



- P300 is het duidelijkst waarneembaar boven de pariëtale (achterste) locaties op de schedel
- Na aanbieding van infrequent voorkomende en onverwachte signalen die een bepaalde reactie van de proefpersoon vragen. Men krijgt bijvoorbeeld lage (500 Hz) en hoge tonen (1000 Hz) te horen die onvoorspelbaar zijn, maar met een ongelijke frequentie van respectievelijk 80% en 20% voorkomen. Dit wordt ook wel een oddballtaak genoemd.

P300



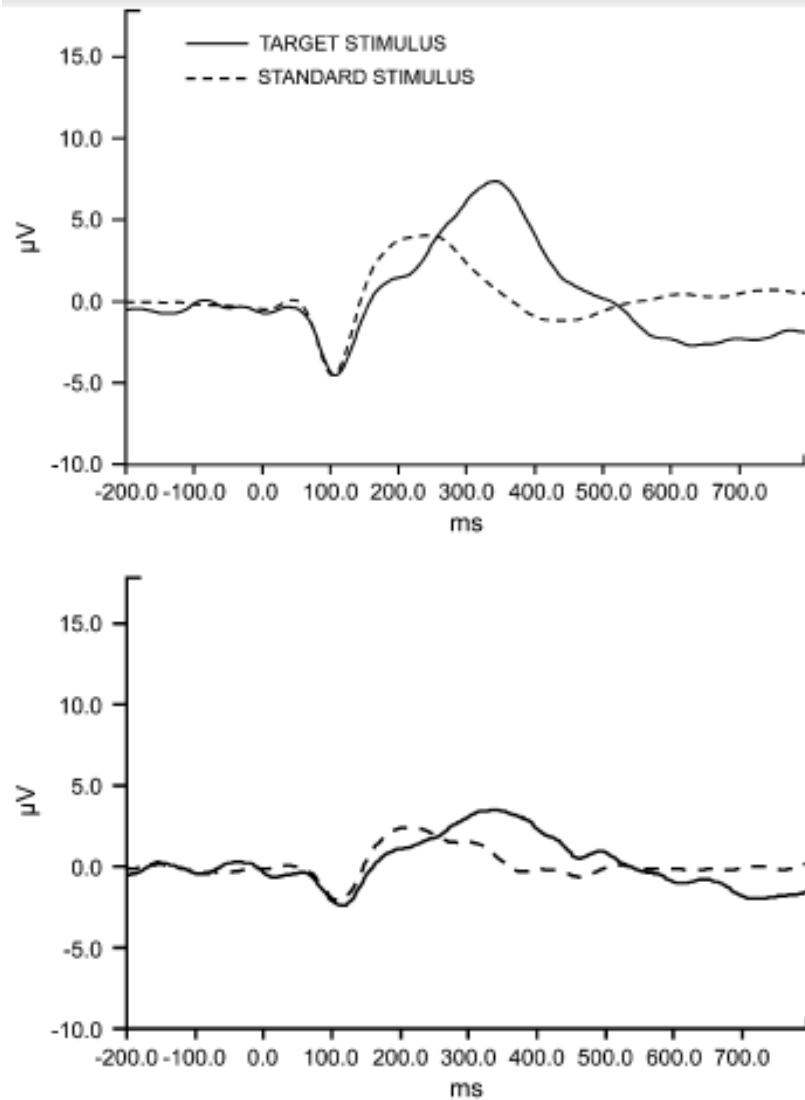


Fig. 5. P300 response to an infrequent salient auditory stimulus. The P300 response to a target stimulus appears as a broad positive ERP component between 300 and 400 ms poststimulus, with maximum amplitude at the Pz electrode. In this example, subjects made a button press to a 2000-Hz target tone. The standard tone was 1000 Hz. Tones were presented every 1.8 seconds. Top: grand average waveforms for 38 control subjects. Bottom: grand average waveforms for 52 patients. As shown, schizophrenia patients typically exhibit smaller P300 amplitudes than healthy subjects.

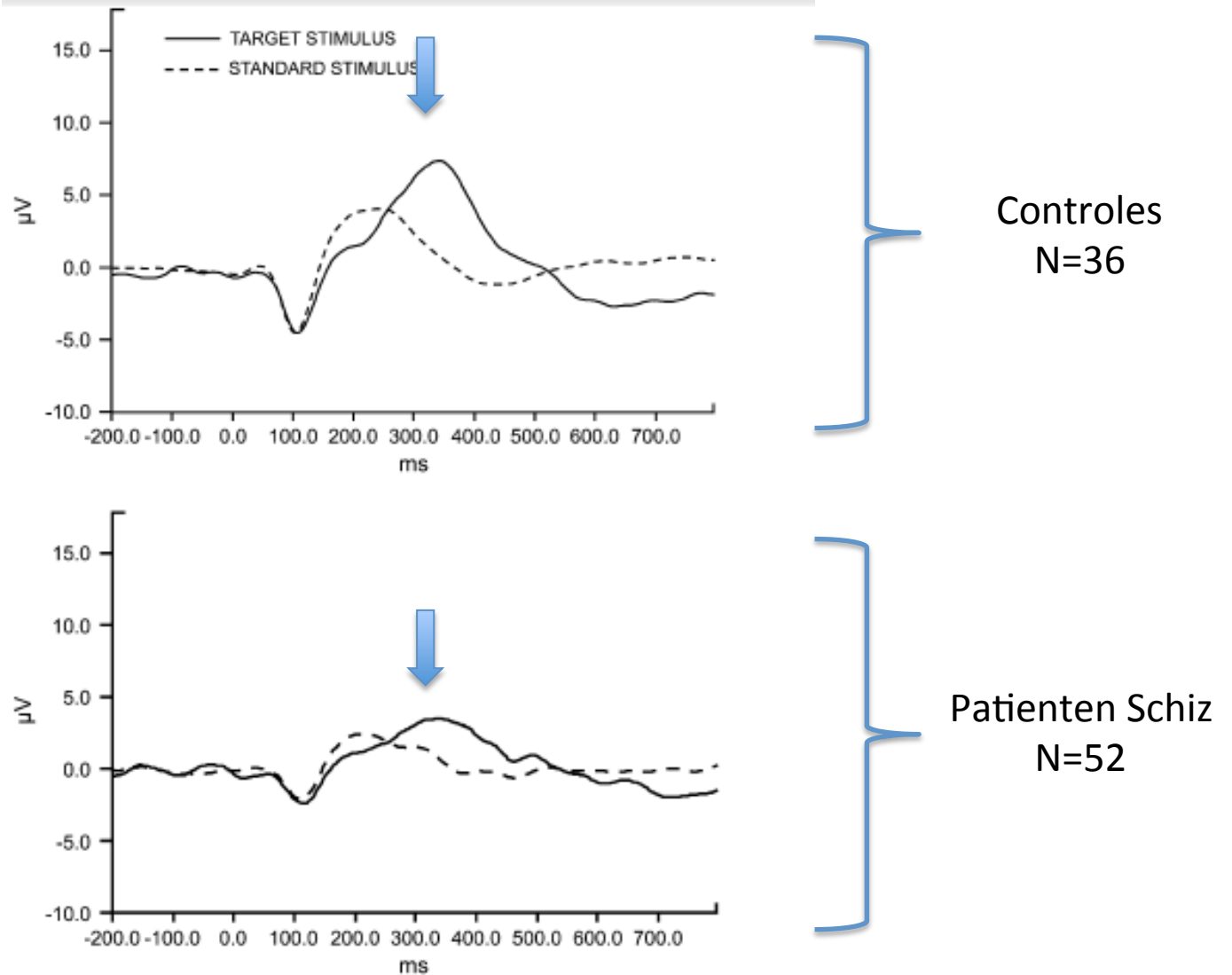


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Wat weerspiegelt P300?

- P300: reflectie van een mechanisme in de hersenen dat geactiveerd wordt als een relevante gebeurtenis bewust wordt verwerkt of herkend.

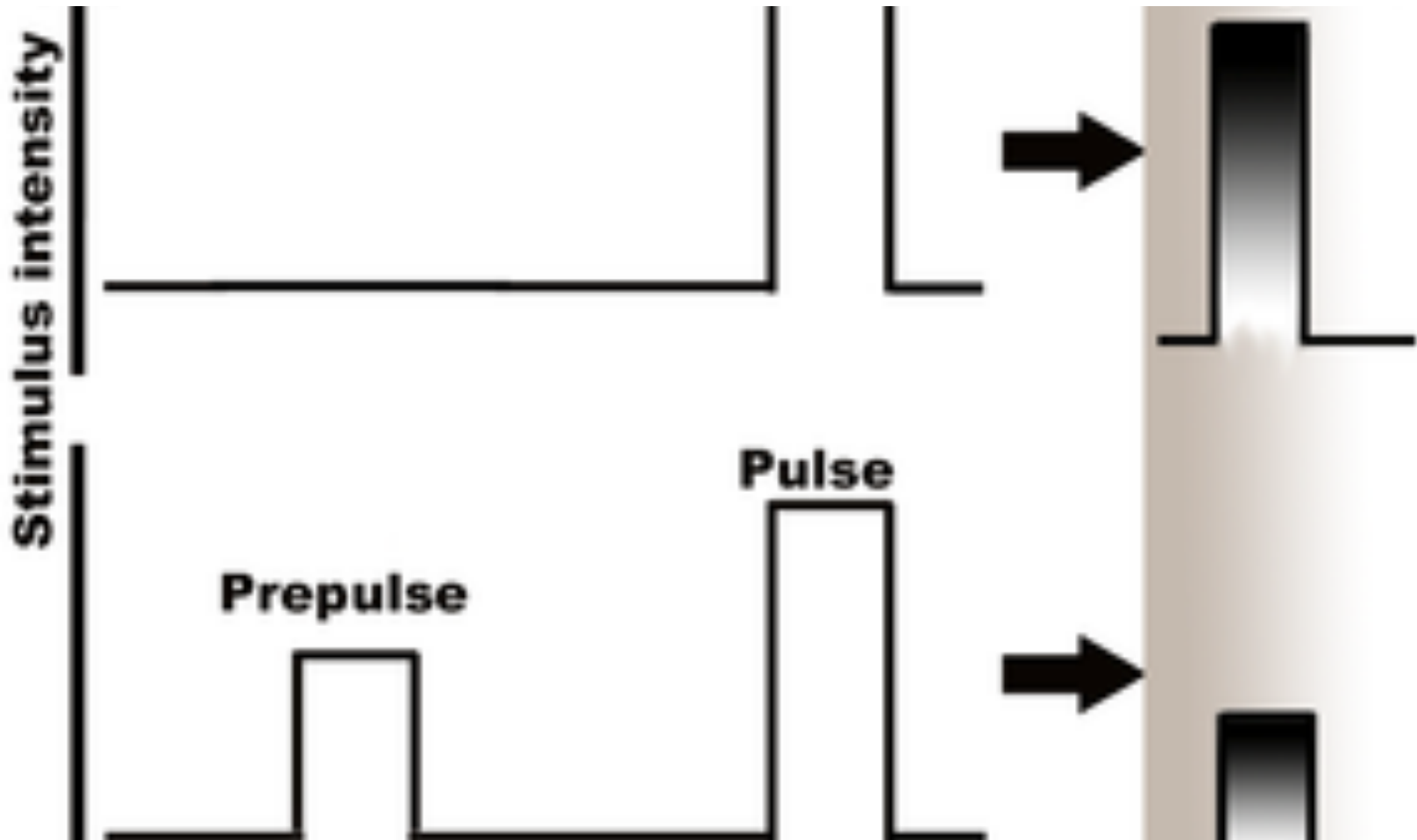


Sensory gating I

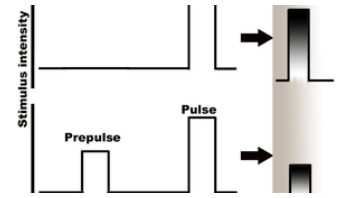
Cocktail party effect.



Prepulse Inhibition (PPI)



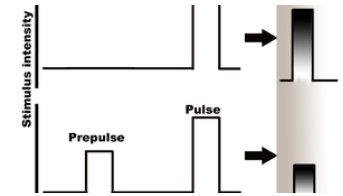
Prepulse Inhibition



- Modellen van schizofrenie:
- Amfetamine of fencyclidine.
- Deze stoffen blijken inderdaad in staat ppi, p50-gating, te verstoren

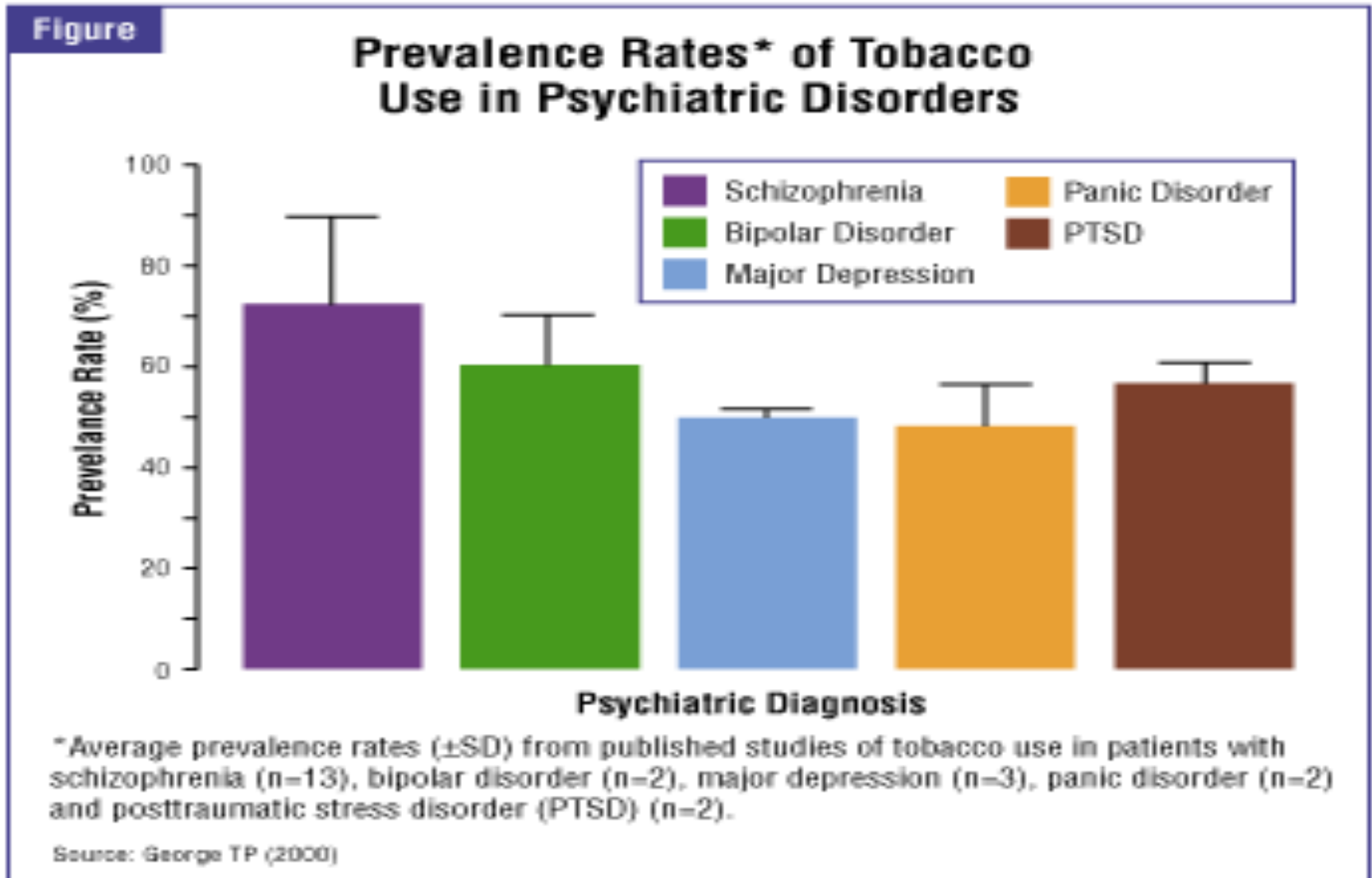
(Ellenbroek & Cools 2002).

Prepulse Inhibition

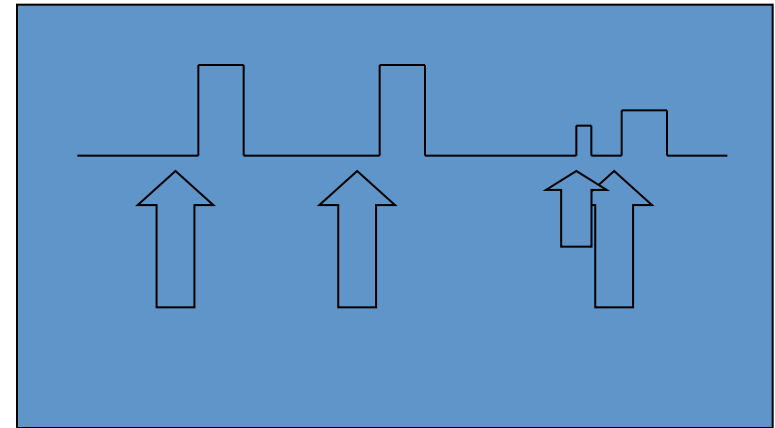
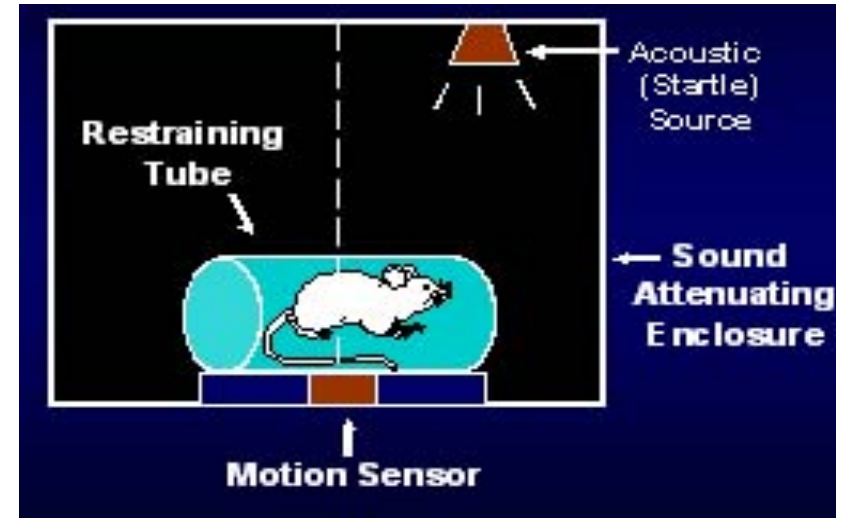
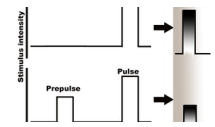


- Een aantal nieuwere diermodellen richt zich vooral op de lange termijn consequenties van vroege stressvolle factoren, zoals vroege hippocampale laesies en maternale deprivatie.
- In beide modellen blijken de ppi verminderd. Bovendien blijkt dat deze verstoring pas na de puberteit optreedt, terwijl de manipulatie reeds op hele jonge leeftijd (tweede week na de geboorte) plaatsvindt.

Roken en schizofrenie

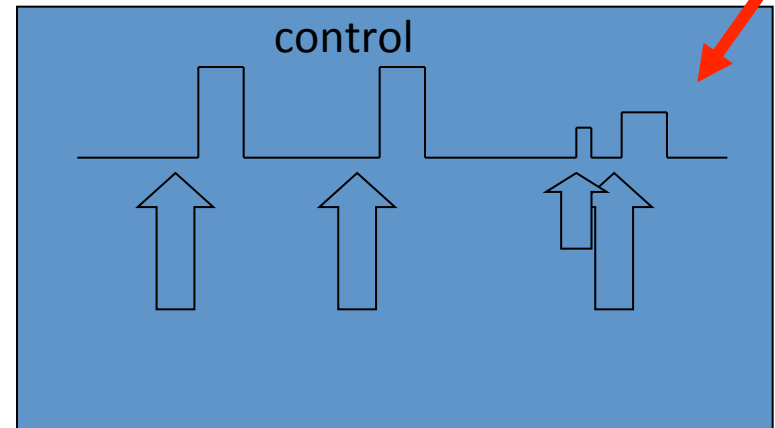
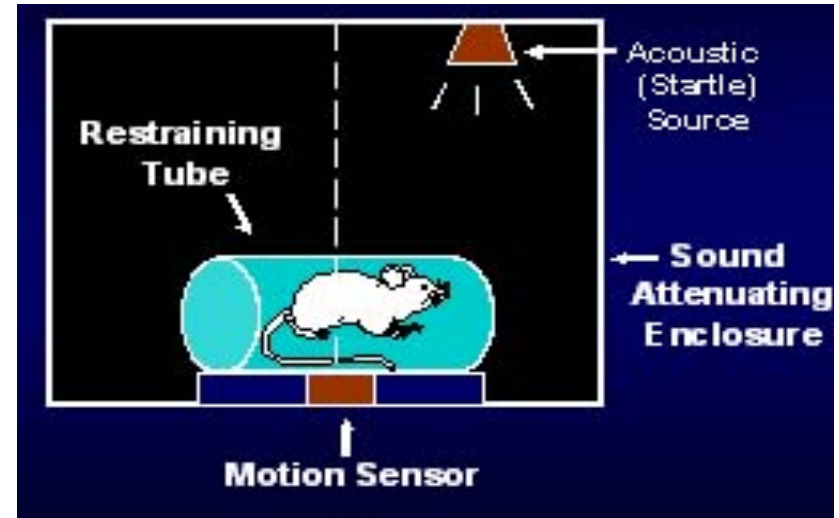
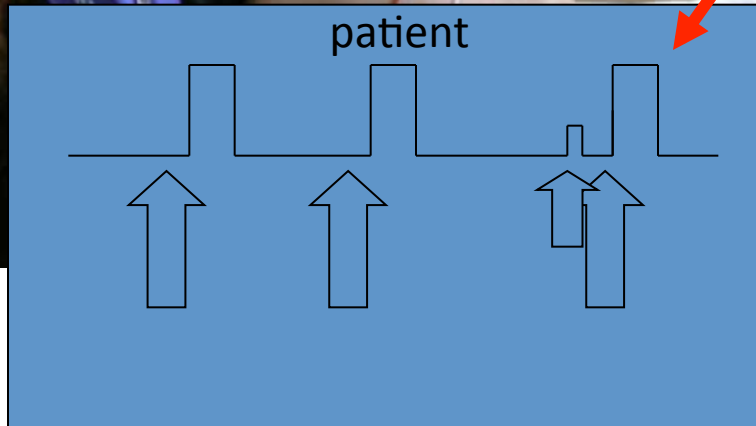
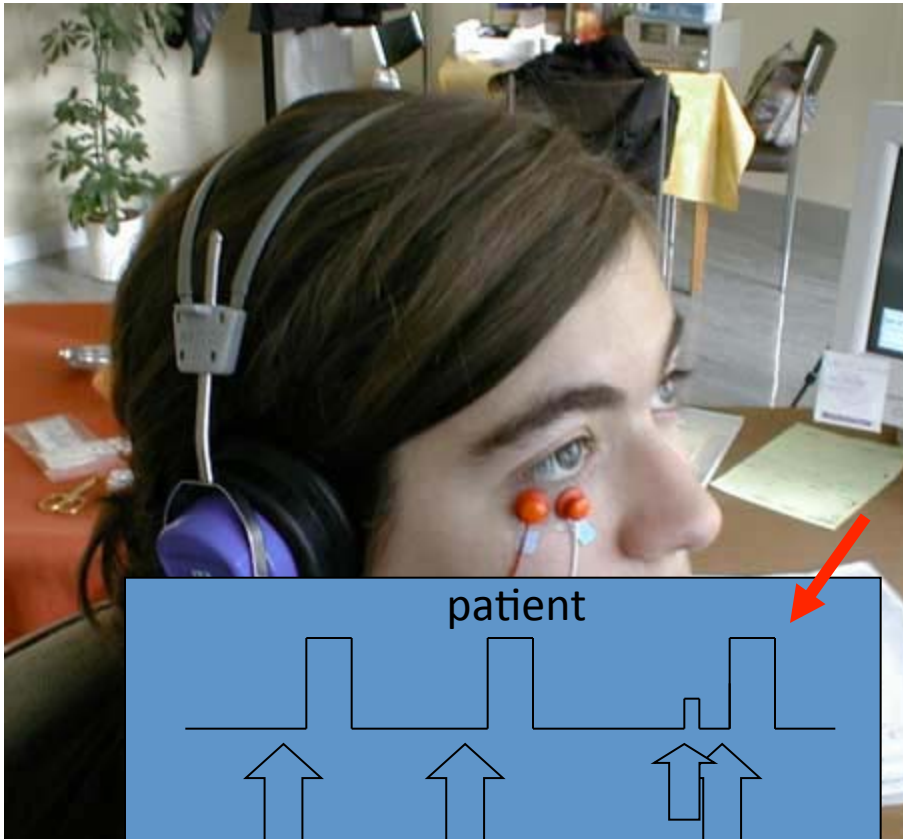
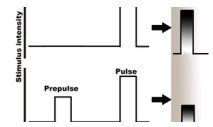


Prepulse Inhibition (PPI), = startle responses



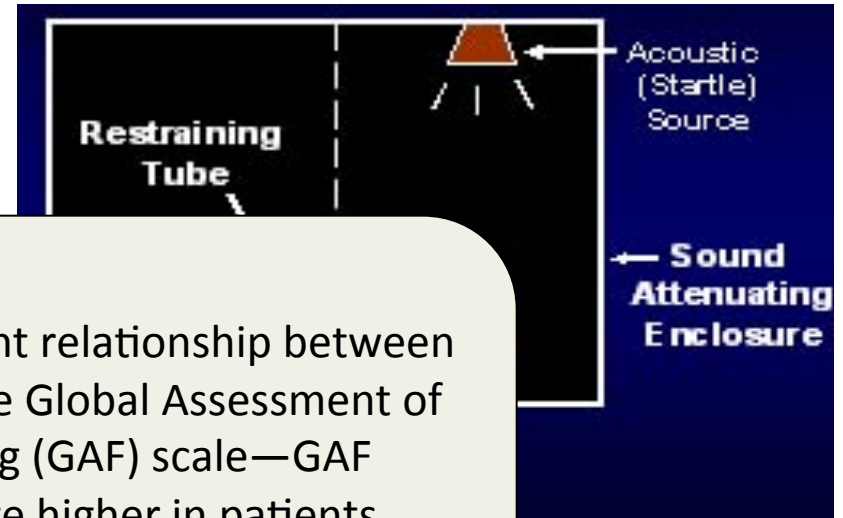
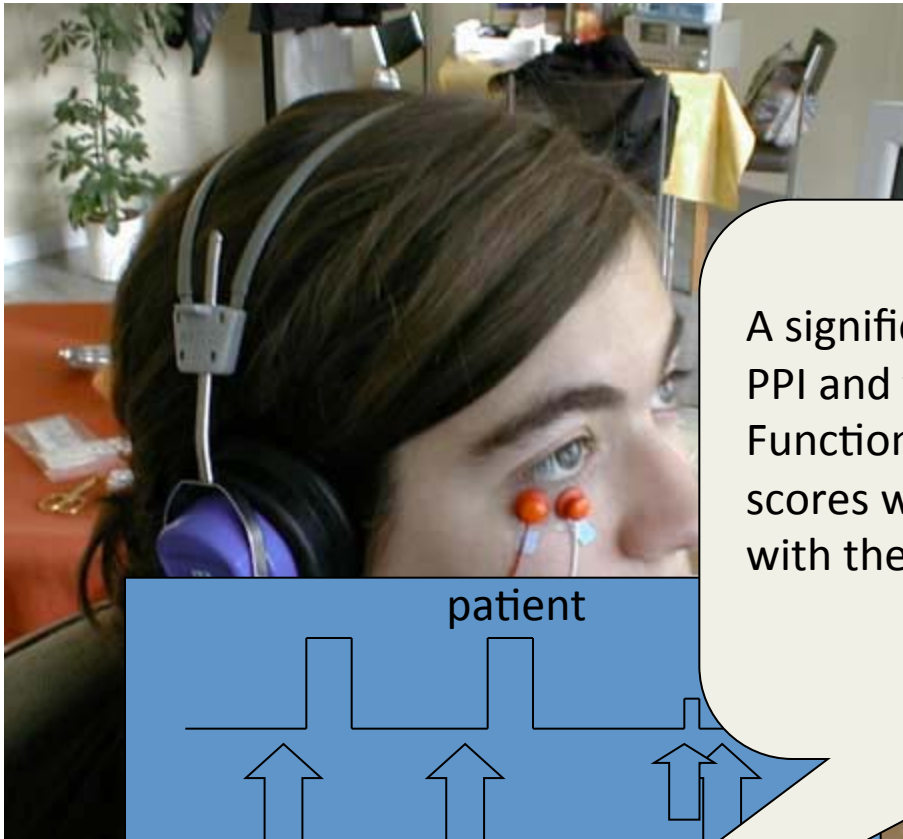
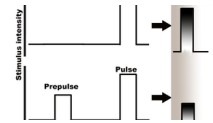
A weak sound preceding the loud acoustic stimulus inhibits the startle reflex; this is called **pre-pulse inhibition**. Prepulse inhibition (**PPI**) is the decrease of startle amplitude by a prepulse presented shortly before the startle stimulus that does not elicit a startle response itself. Pre-pulse inhibition (PPI) is impaired in schizophrenic patients.

Prepulse Inhibition (PPI), = startle responses

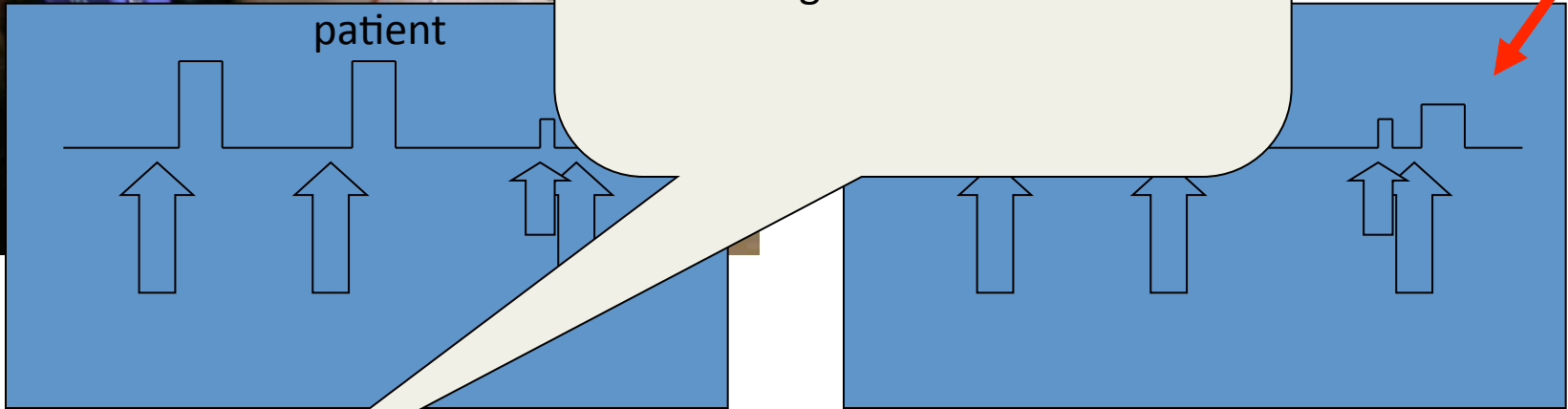


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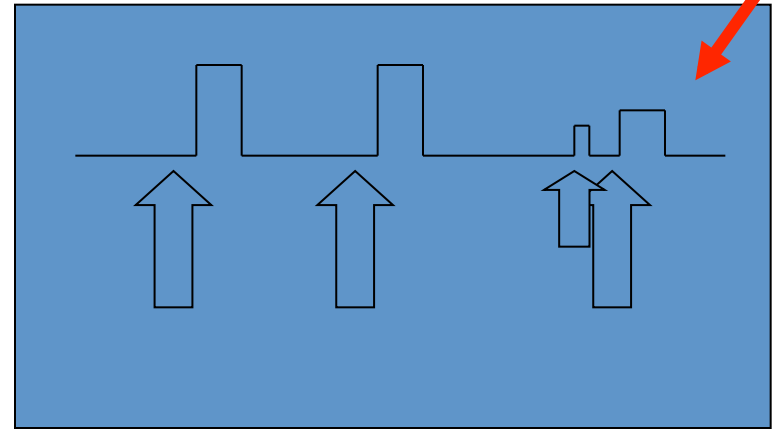
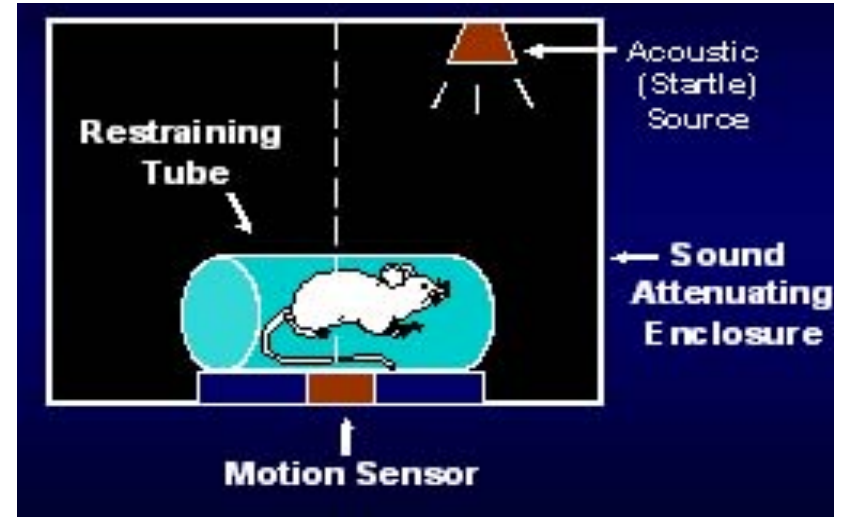
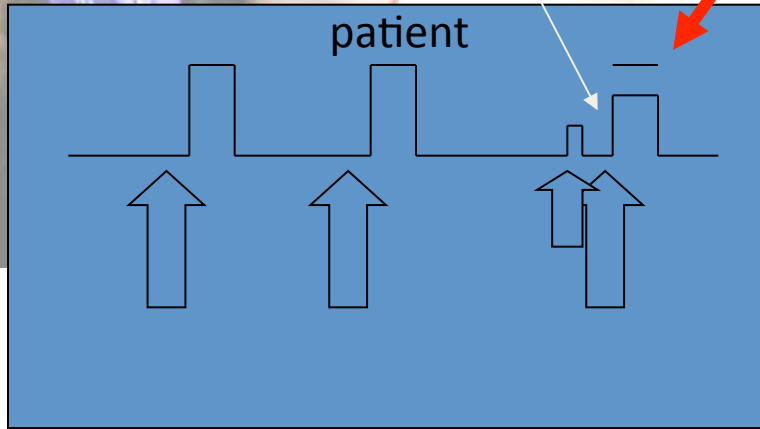
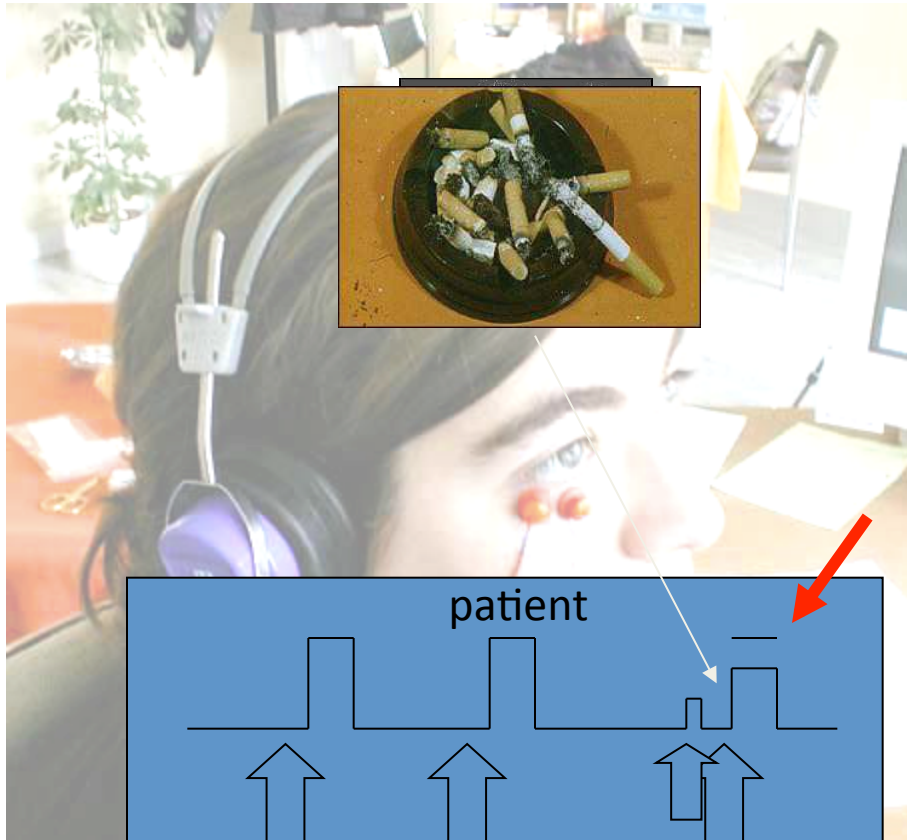
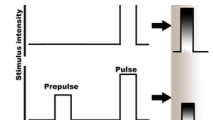
Prepulse Inhibition (PPI)



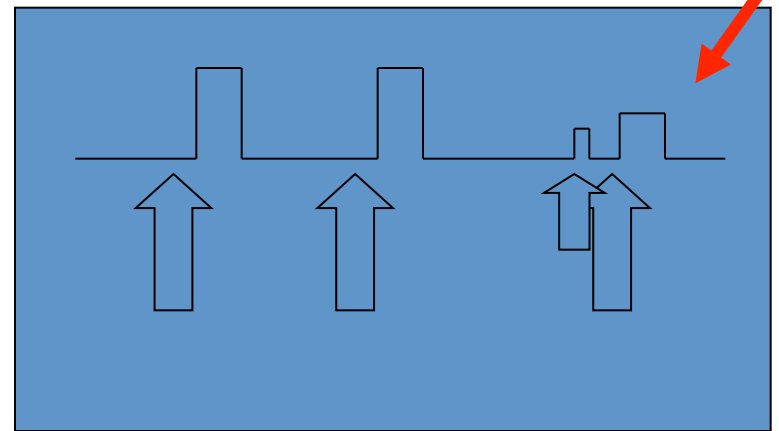
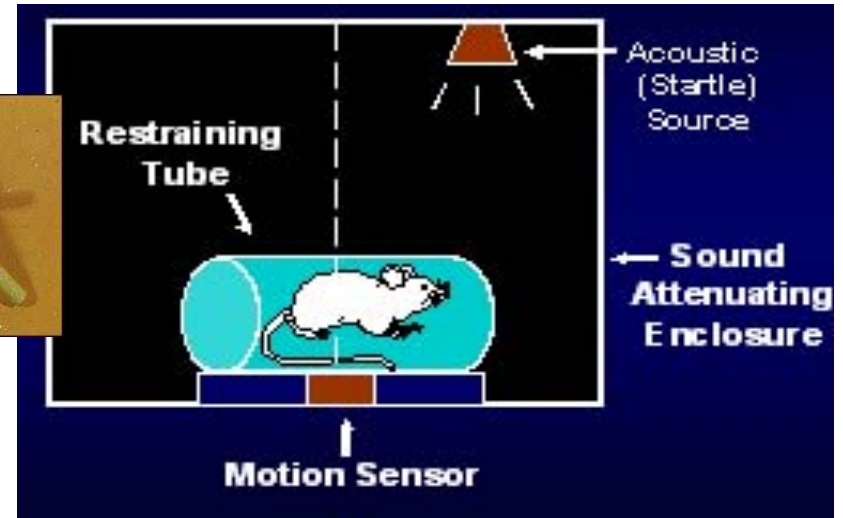
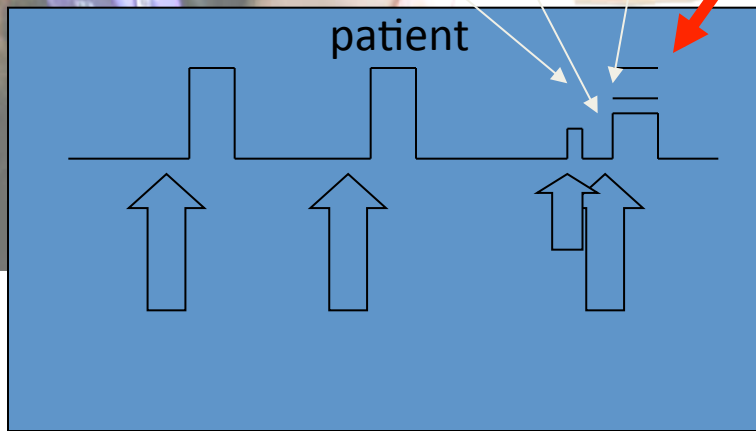
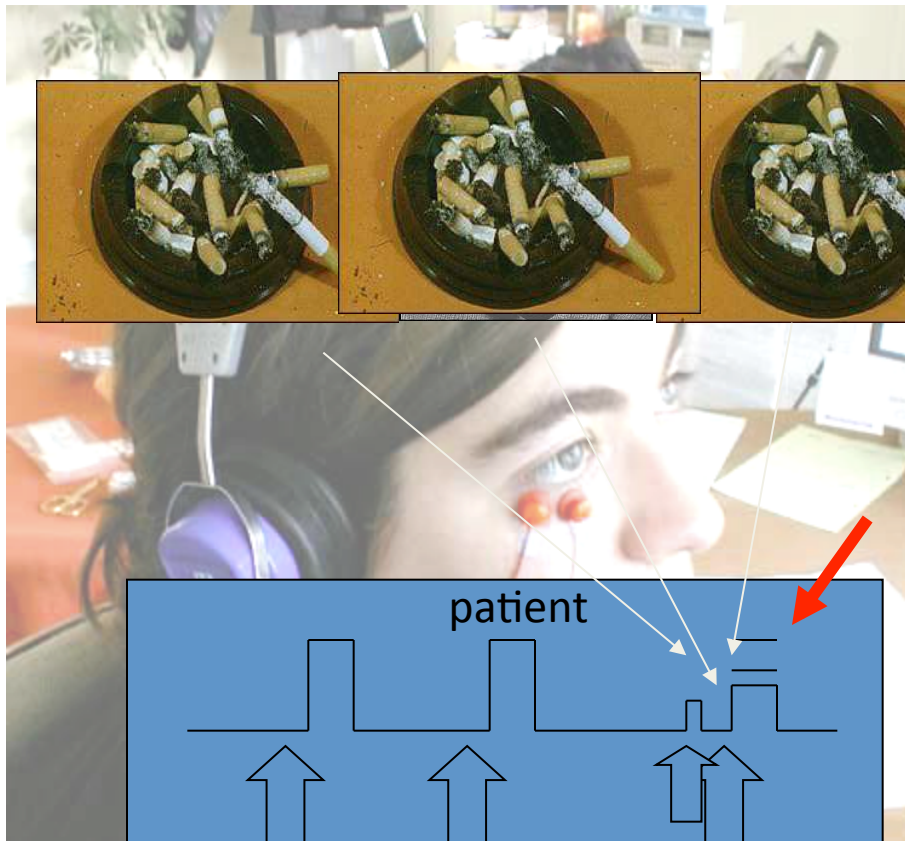
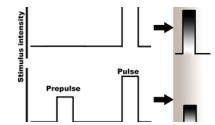
A significant relationship between PPI and the Global Assessment of Functioning (GAF) scale—GAF scores were higher in patients with the highest PPI.



Prepulse Inhibition (PPI)



Prepulse Inhibition (PPI)

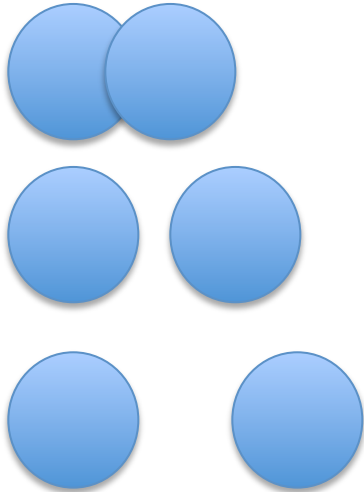


Sensory gating II



- The Cocktail Party Effect illustrates how the brain inhibits input from environmental stimuli, while still processing sensory input from the attended stimulus.
- The cocktail party effect demonstrates sensory gating in hearing, but the other senses also go through the same process protecting primary cortical areas from being overwhelmed.

Paired-click paradigm

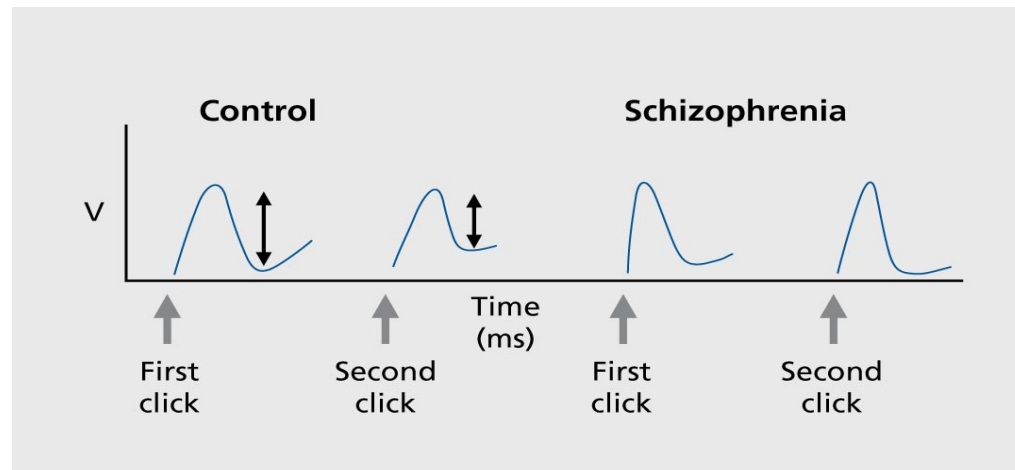
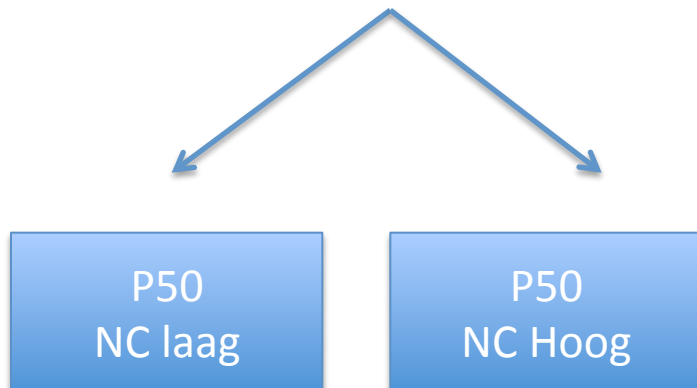


1 klik waargenomen

1 klik waargenomen

2 klik waargenomen door control

2 klikken door mensen met schizofrenie



Sensory gating deficits and mental illness

- **Nicotine and sensory gating**
 - Nicotine aids selective attention.
 - Nicotine can correct sensory gating deficits for individuals with schizophrenia, but the effects only last about thirty minutes after nicotine intake.
 - The same self-medication may be present among those with attention-deficit/hyperactivity disorder.
-
- Adler, L. E., Olieicy, A., Waldo, M., Harris, j. G., Griffith, J., Stevens, K., Flach, K., Nagamoto, H., Bickford, P., Leonard, S., Freedman, R. (1998). Schizophrenia, Sensory Gating, and Nicotinic Receptors. *Schizophrenia Bulletin*, 24(2):189-202.
 - Perry, W., Minassian, A., Lopex, B., Lincoln, A. (2007). Sensorimotor Gating Deficits in Adults with Autism. *Society of Biological Psychiatry*, 61: 482-496.

P 50 Sensory Gating Abnormalities in Schizophrenia

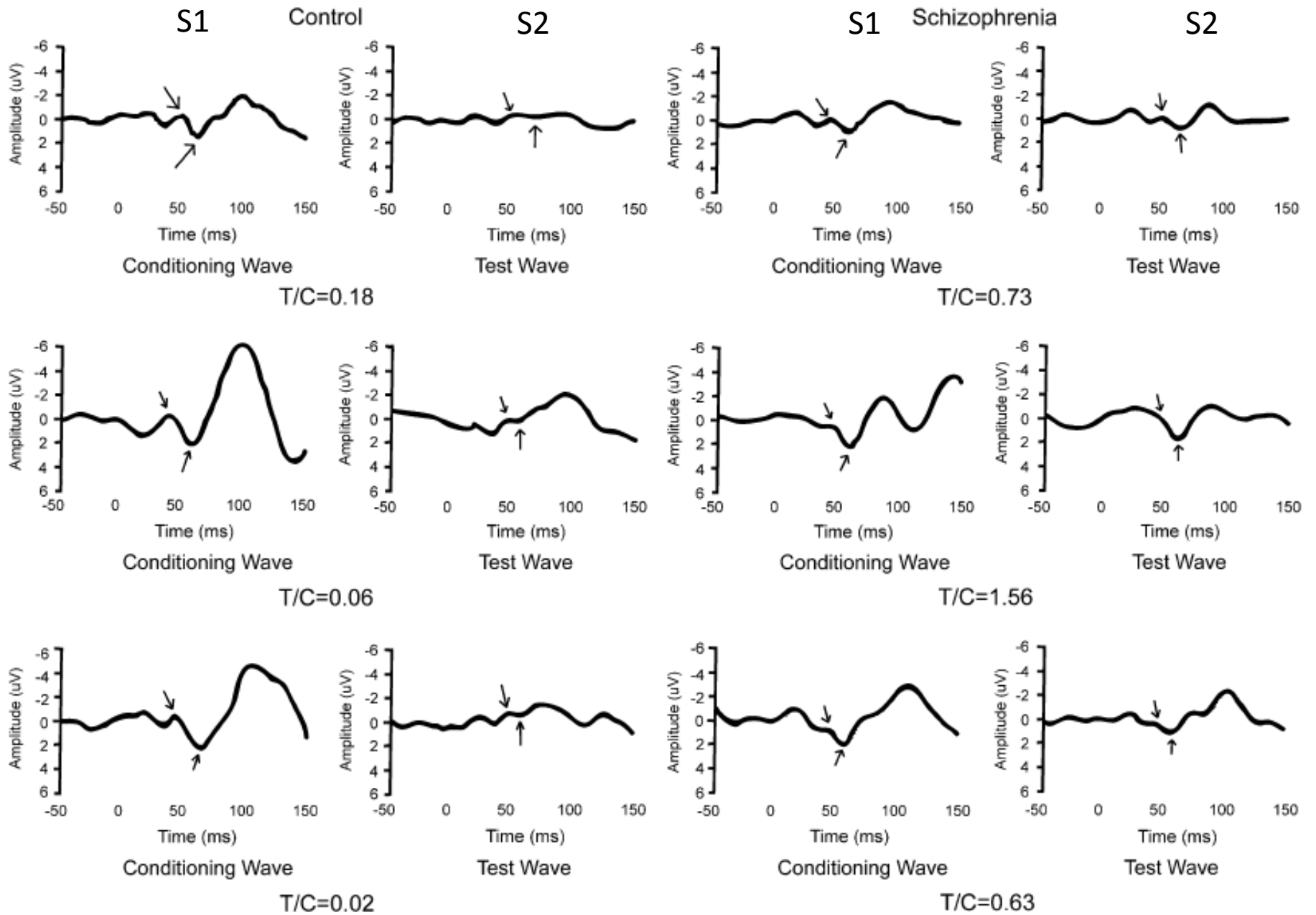
- Positive and perhaps the negative symptoms of schizophrenia are a result of sensory overload and/or an impairment in the response to sensory input within the central nervous system?
- Sensory gating abnormalities have also been hypothesized to be associated with various cognitive impairments?

P 50 Sensory Gating Abnormalities in Schizophrenia

- Pharmacological studies: importance of the cholinergic system in regulating the diminished response to repeated stimuli, through stimulation of the α -7 nicotinic receptor.
- In patients with schizophrenia, nicotine can transiently reverse the P50 sensory gating deficits.

P 50 Sensory Gating Abnormalities in Schizophrenia

- A marker of the gene for the α -7 nicotinic receptor has been linked to schizophrenia and P50 abnormalities (Freedman et al 1997-2001).
- Polymorphisms in the promotor region of the gene for the α -7 nicotinic receptor may be related to abnormal sensory gating (Leonard et al 2002).
- Sensory gating abnormality in schizophrenia has been evidence that family members of people with schizophrenia also have deficits in P50 sensory gating inhibition



Sensory Gating, P50 Clinical correlates

- Correlations are suggested between P50 abnormalities in schizophrenia
 - Sustained attention (CPT)
 - Processing speed (digit symbol)
- Possible association with severity of symptoms (positive and negative) in schizophrenia, but many studies could not confirm an association

Sensory Gating, P 50, Psychopharmacology I

- First and second generation antipsychotics seems not to influence sensory gating expressed as a reverse P50 T/C ratio differences in schizophrenia

Sensory Gating, P 50, Psychopharmacology II

- Clozapine and nicotine may reverse P50 T/C ratio differences in schizophrenia
- Nicotine lowers P50 T/C ratio through diminished S2 amplitude, which is thought to reflect enhanced sensory gating through activation of the $\alpha 7$ nicotinic receptor.



Conclusies



- Veel mensen die voldoen aan DSM criteria van schizofrenie (en deels ook hun verwanten) hebben een veranderde verwerking van sensorische input en motorisch output wat o.a. blijkt uit
- Afwijkingen in gladde oogbewegingen maar ook andere aspecten van motoriek (tijdschrift psychiatrie febr 2015)
- PPI
- P50, P300
- En vele andere testen (o.a. mismatch negativity, CFFF)
- Wat betekent dit voor het dagelijks bestaan?