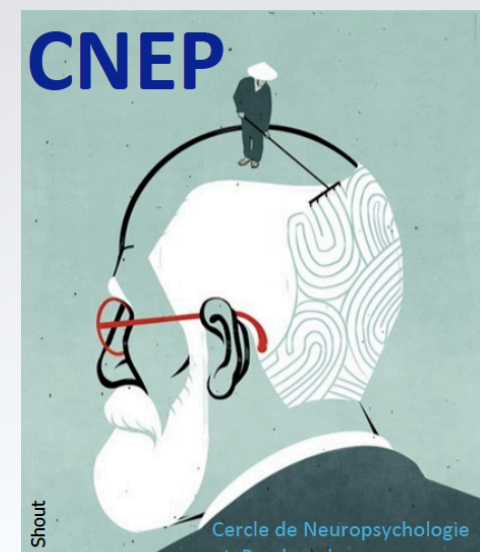


# ALPHA SYNCHRONIZATION as a brain model for unconscious defense: Evidence from clinical-ERP studies

{ Mexico City, August 31, 2018  
{ Ariane Bazan, Université Libre de Bruxelles (ULB)

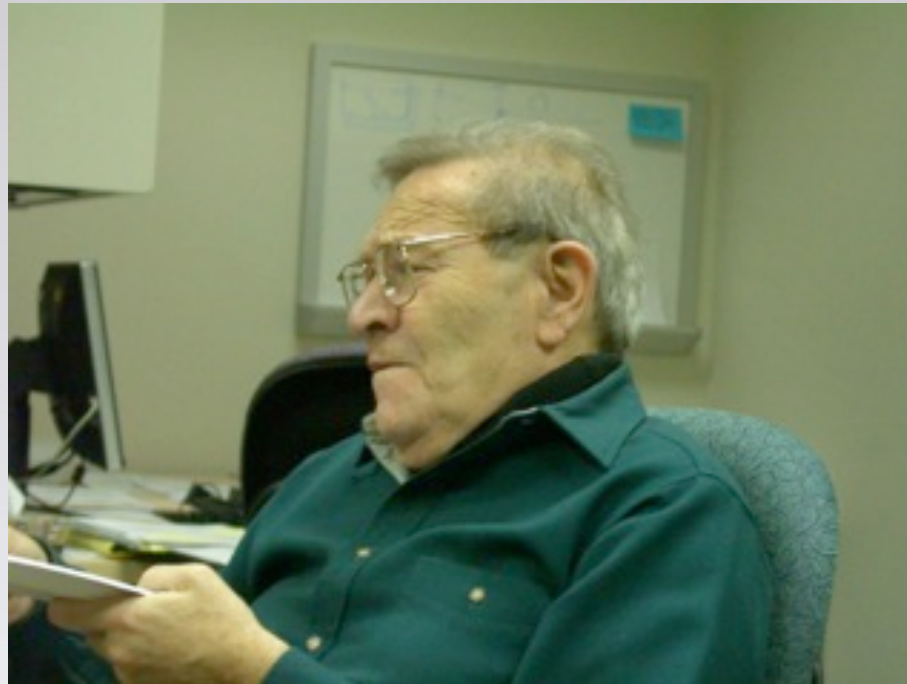


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# Howard Shevrin

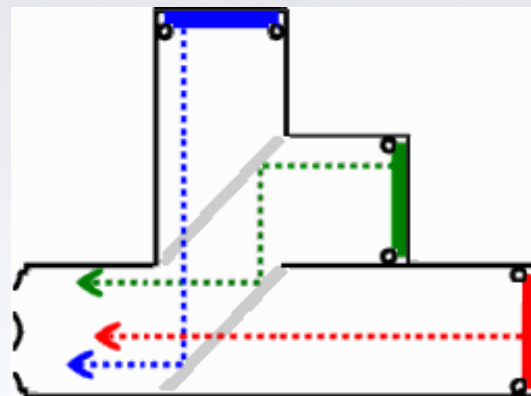
*clinical studies showing  
a neural correlate for unconscious defense*



1. First Clinical Study
2. Phobia Study
3. Second Clinical Study



tachistoscopic subliminal priming: 1ms without mask



# STUDY 1: CLIN 1

{ brain time-frequency  
{ indications for repression



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# CONSCIOUS AND UNCONSCIOUS PROCESSES

Psychodynamic, Cognitive, and  
Neurophysiological Convergences

Howard Shevrin

James A. Bond

Linda A. W. Brakel

Richard K. Hertel

William J. Williams

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# event-related potentials





Critical Acclaim for

## CONSCIOUS AND UNCONSCIOUS PROCESSES

"This is not just one of the best studies on this topic; it is *the* best since the theory of the dynamic unconscious appeared 100 years ago. It demonstrates the operation of dynamic unconscious processes, and it does this by the most natural method—by simultaneous examination of three facets: phenomenological, cognitive, and psychophysiological. This is the heart of the procedure: Each person is shown subliminally and then supraliminally individually selected *conscious symptom words, unconscious conflict words, ordinary unpleasant words, and ordinary pleasant words*. During each exposure a recording is made of the brain response's *event-related potential*, which is then examined by time–frequency analysis....This brief essence of Shevrin et. al.'s work should tempt readers to read this beautiful narrative about the study and to see for themselves the unique achievement of capturing unconscious processes that are correlated with brain responses."

—Lester Luborsky, Ph.D.

"Howard Shevrin and his colleagues have come through with a *tour de force* in the difficult and contentious area of psychoanalytic theory and its relation to the 'hard sciences.' The presentation is an authoritative one: The authors have themselves been pioneers and major contributors to our knowledge bridging clinical psychoanalysis, cognitive psychology, and cerebral electrophysiology. Assumptions and alternative views are clearly spelled out; the reader is not asked simply to accept potentially biased proposals. The book should be a 'must' for those seeking a balanced and clear exposition of the issues in psychoanalytic theory and the 'unconscious,' and the scientific evidence bearing on these issues."

—Benjamin Libet, Ph.D.

- 1) 11 social phobics; interviews by 4 analysts
  - unstructured dialogues: talk freely about complaints, relationships (including the relationship to the interviewer) and early experiences
- 2) analysts choose words
  - CS: *conscious symptom words*  
conscious symptom experience
  - UC: *unconscious conflict words*  
presumed unconscious conflict
- 3) subliminally (1ms) and supraliminally (40ms)
- 4) *time-frequency features* derived from ERPs: *time, frequency and power (or amplitude<sup>2</sup>) as dimensions*



### **Supplement 3: example of stimuli words**

#### **Unconscious Conflict**

mad at dad

paddle me

favorite son

cut it off

trouble maker

stubborn

grandpa

#### **Conscious Symptom**

cold calling

public talks

voice shaking

seminars

upset stomach

stuttering

parties

#### **Osgood Negative Valence**

air pollution

atomic bomb

earthquake

non-believers

crying

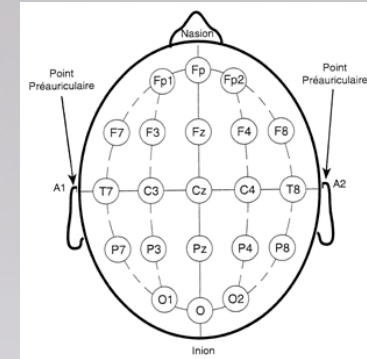
noise

poison

## Event-Related Potential Indicators of the Dynamic Unconscious

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RICHARD K. HERTEL, JAMES A. BOND, AND LINDA A. BRAKEL

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## results

### t-f features at CzPz/P3

- & UC: more mutually similar **sub**liminal > supraliminal
- & CS: more mutually similar **supra**liminal > subliminal

$$r(20) = 2.82; p < .05$$

greater information flow between electrodes when  
UC subliminal > supraliminal

an inhibitory repressive process is at work when the unconscious conflict words are presented supraliminally, inhibiting conscious recognition of their unconscious significance

the more repressive the subject was on the HOQ, the better the ERP features correctly classified the UC words subliminally over supraliminally



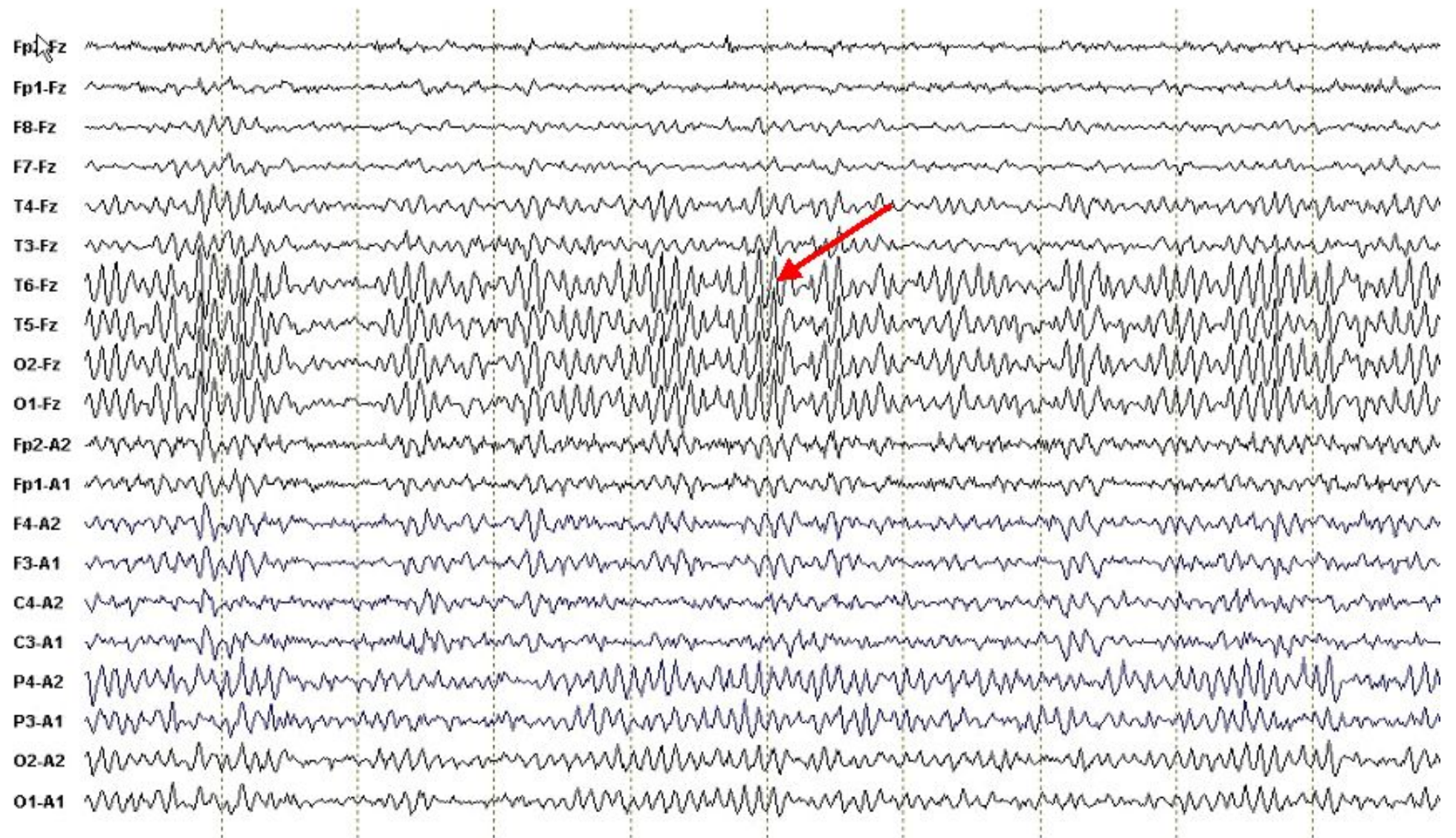
- ⌘ **post-experiment control**: participants are asked to classify their UC & CS words, written on pieces of paper, in as much categories as they wished:
- ⊘ the CS are easily grouped together
  - ⊘ the UC are nowhere!
  - however, the analysts inferred them as a category from their conscious story
  - the ERP signal analysis *provides an independent objective indicator that this inference has an existence independent of the clinician's subjectivity*

# STUDY 2: PHOBIA

{ alpha synchronization as a  
brain model for repression!



# Alpha - Wellen: 8 - 13/s

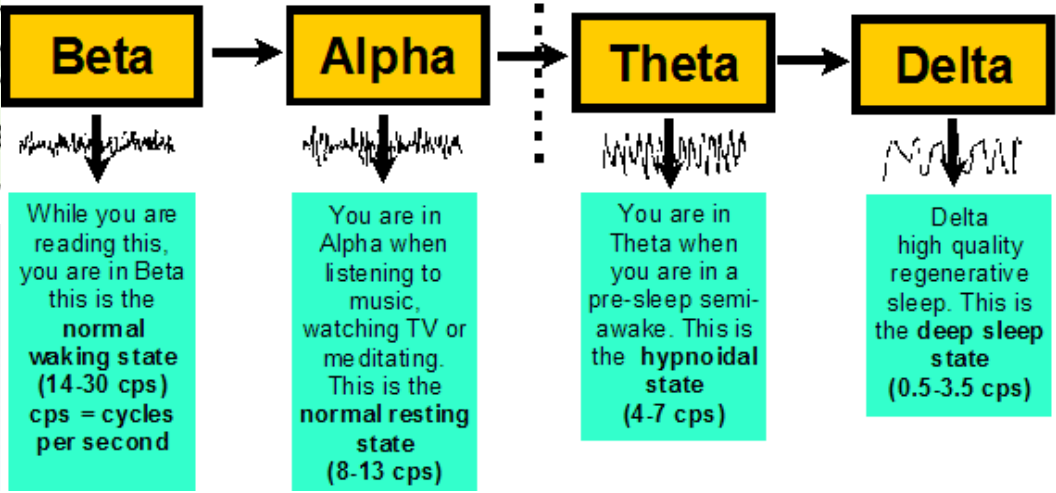




Brain Waves	Frequency	Mental Condition
Delta wave	0.5 - 3 Hz	deep sleep
Theta wave	4 - 7 Hz	light sleep
Alpha wave	8 - 13 Hz	awake, relaxed
Beta wave	14 Hz	awake, excited

**Brain wave frequencies relating to sleep**

**Fig. 1.** Classification of brain waves on a car, states increase from such as caffeine, suppress T leading to increased stress,

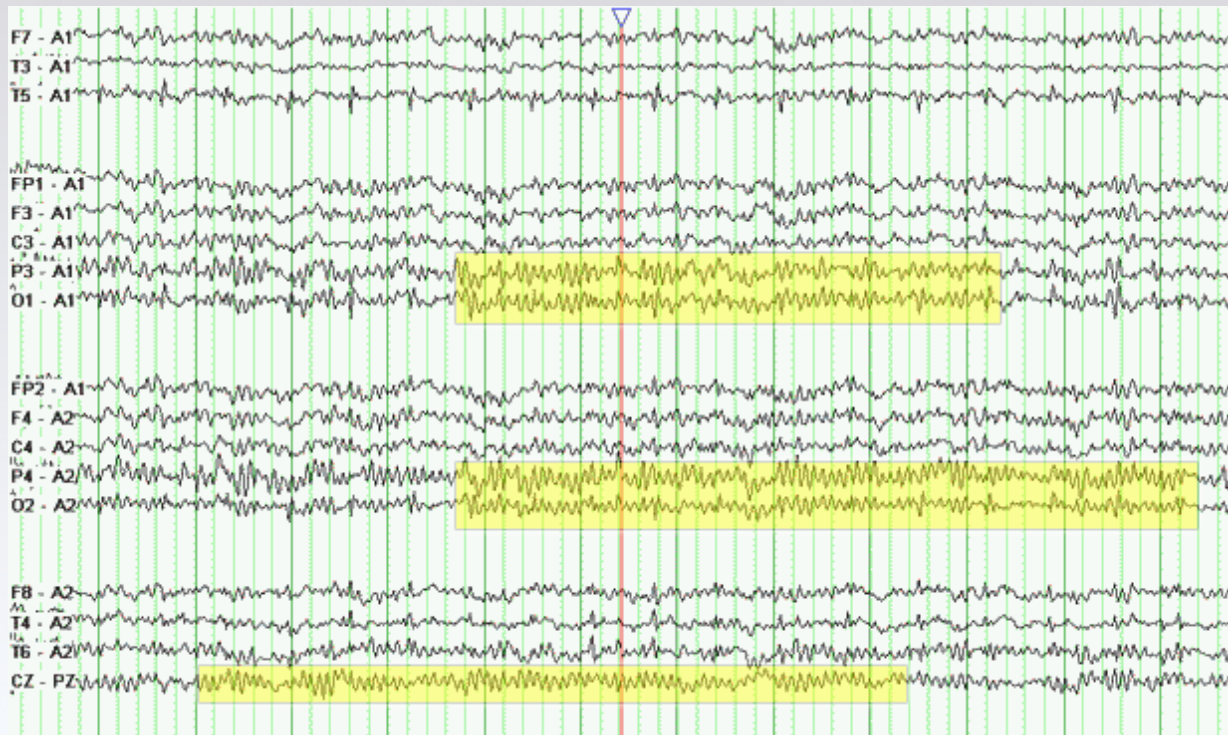


↳ synchronized- $\alpha$  plays an **inhibitory** role

↳ withdrawing attention from a distracting stimulus (Kelly et al., 2006)

↳ suppressing memory retrieval (Klimesch, 1996)

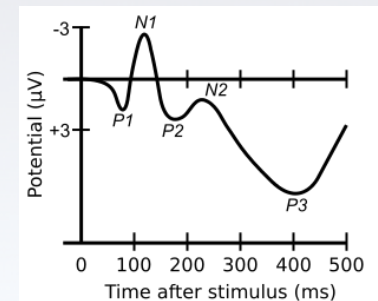
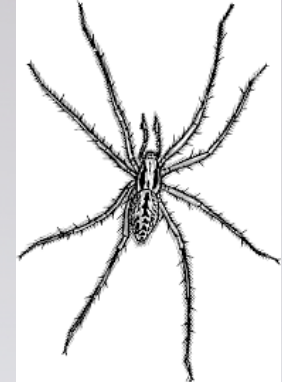
↳ inhibiting task irrelevant stimuli (Klimesch et al., 2007)





Shevrin, H., Snodgrass, M., Abelson, J., Brakel, L., Kushwaha, R., Briggs, H., Bazan, A. (2010). Evidence for Unconscious, Perceptual Avoidance in Phobic Fear. *Biological Psychiatry*, 67, 33S.

- ⌘ 10 spider versus 7 snake phobics (controls)
- ⌘ line drawings of spiders and rectangles
- ⌘ 1ms subliminal presentations
- ⌘ measures:
  1. “visual analogue scales” (VAS) as a fear index
  2.  $\alpha$ -synchronization
  3. N100 (indicator of early attentional processes)





## *results*

⊗ F3, C3, P3

⊗ only in spider phobics: increased  $\alpha$ -power for the spider stimulus relative to the control stimulus correlated with:

1. greater self-reported levels of spider fear
2. inhibited detection of spider stimuli in the detection task
3. smaller N100 amplitude

*the more the phobic spider elicits an inhibitory  $\alpha$ -synchronization, the smaller the attentional response to this spider stimulus*

Fig. 4

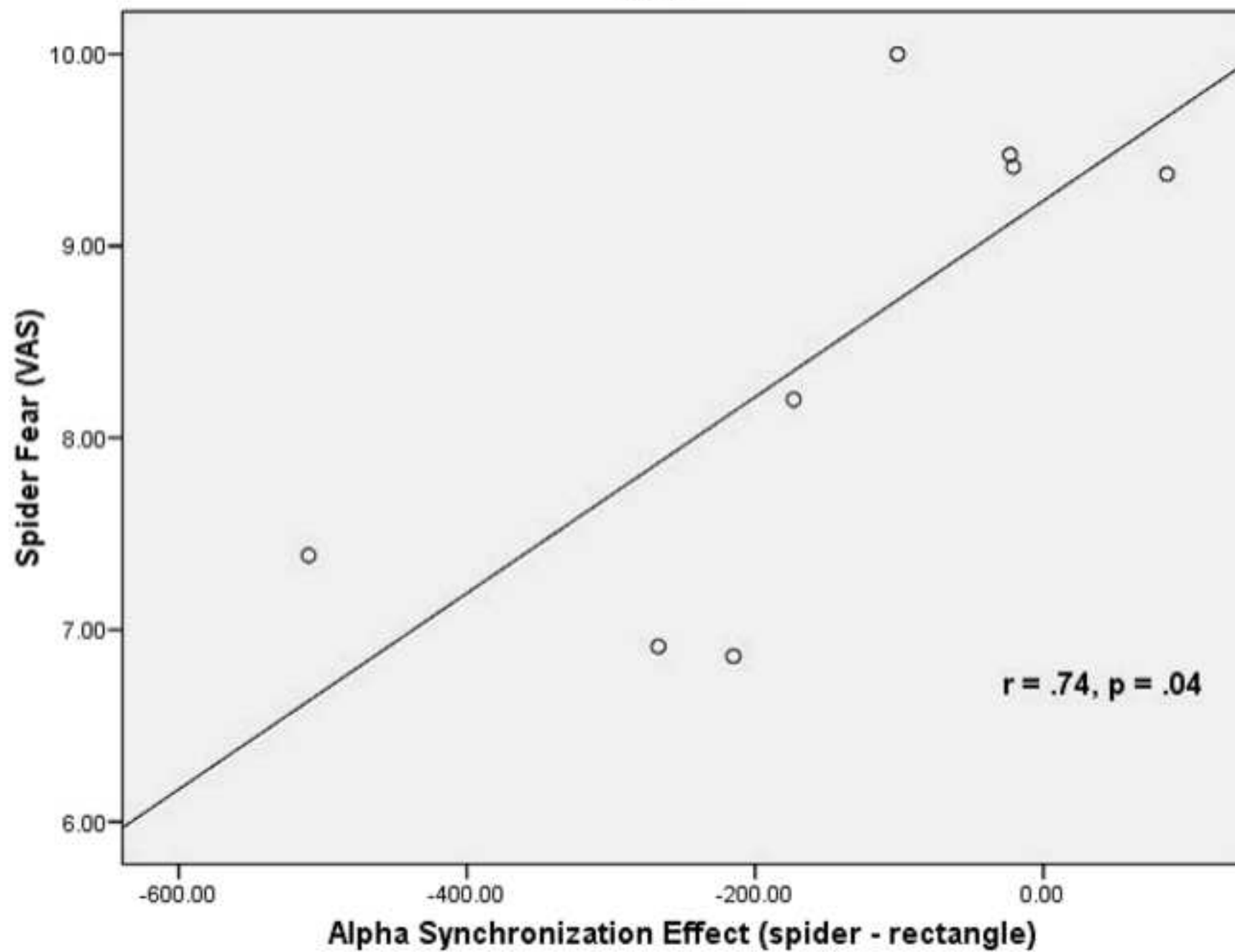
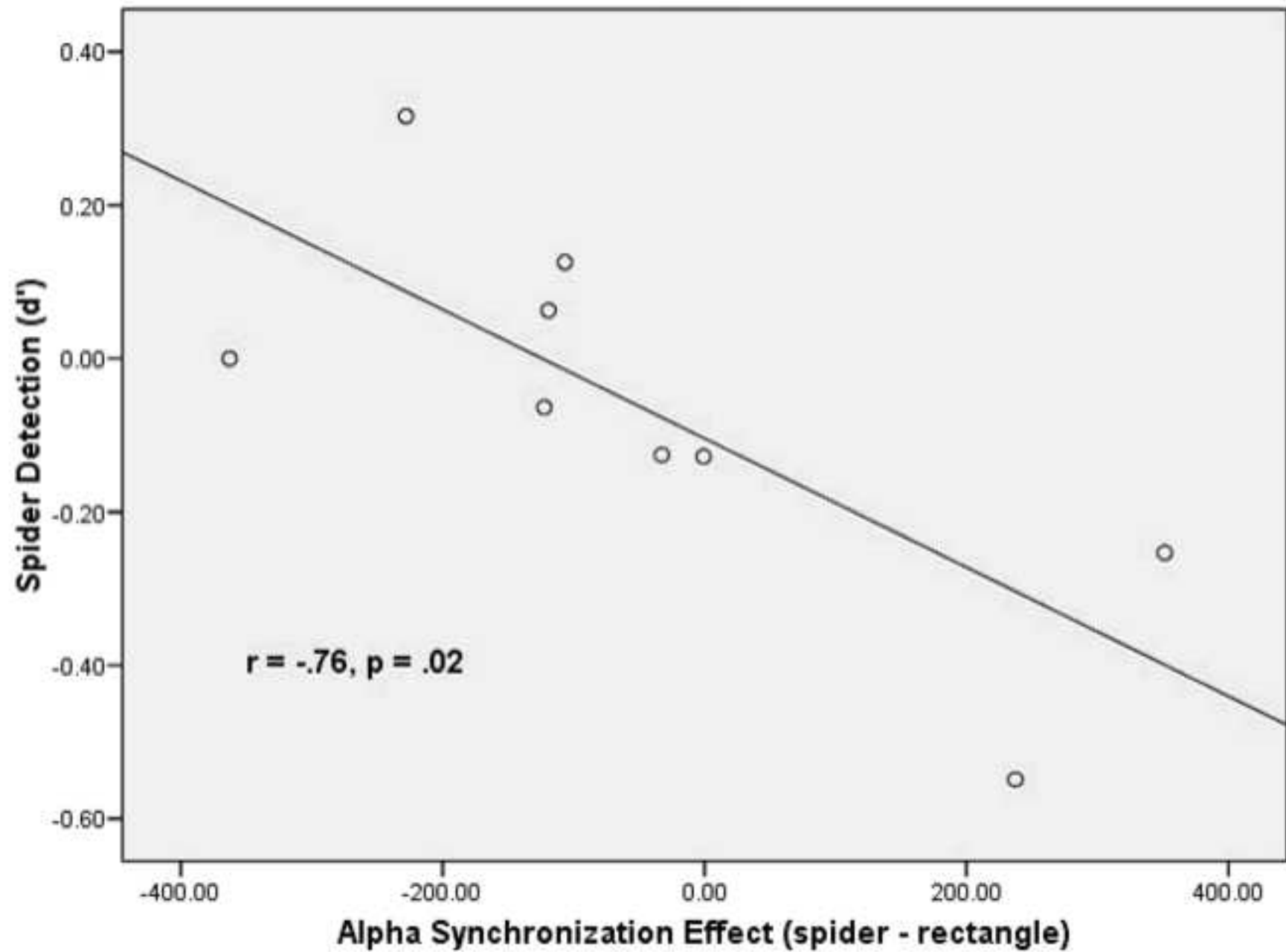


Fig. 3





- ⌘ a diminished attention to the phobic spider stimulus in spider phobics with high alpha power
- ⌘  $\alpha$ -power goes far beyond inhibition of distracting or irrelevant stimuli to inhibiting relevant but emotionally disturbing stimuli
  - ➔ *resembles an (unconscious) defense mechanism*

# STUDY 3: CLIN2

**{ brain evidence for conflict-  
induced unconscious  
inhibition**



## Subliminal unconscious conflict alpha power inhibits supraliminal conscious symptom experience

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*Would the inhibitory repressive process triggered by the activation of unconscious conflict also lead to inhibition related to the conscious symptom experience?*

→ **priming model** in which the UC preceded the CS



- ⌘ 10 subjects with social phobia
- ⌘ 4 hour interviews for word selection
- ⌘ 7 UC and 7 CS words, selected individually
- ⌘ 7 control Osgood Negative Valence (ON) words
- ⌘ primes subliminally (1 ms) as well as supraliminally (30 ms); targets (CS or ON) always supraliminal
- ⌘ four conditions: UC-CS, UC-ON, CS-CS and UC-ON
- ⌘ participants simply attend to the stimuli

influence of prime- $\alpha$  on target- $\alpha$

*the degree of  $\alpha$ -power-related brain activity  
in the UC primes*

*should predict increased  $\alpha$ -power in the CS targets*



## *results*

⊗ parietal **subliminal UC** prime- $\alpha$  predicts CS target- $\alpha$ :

$$r = 0.81; p < 0.01$$

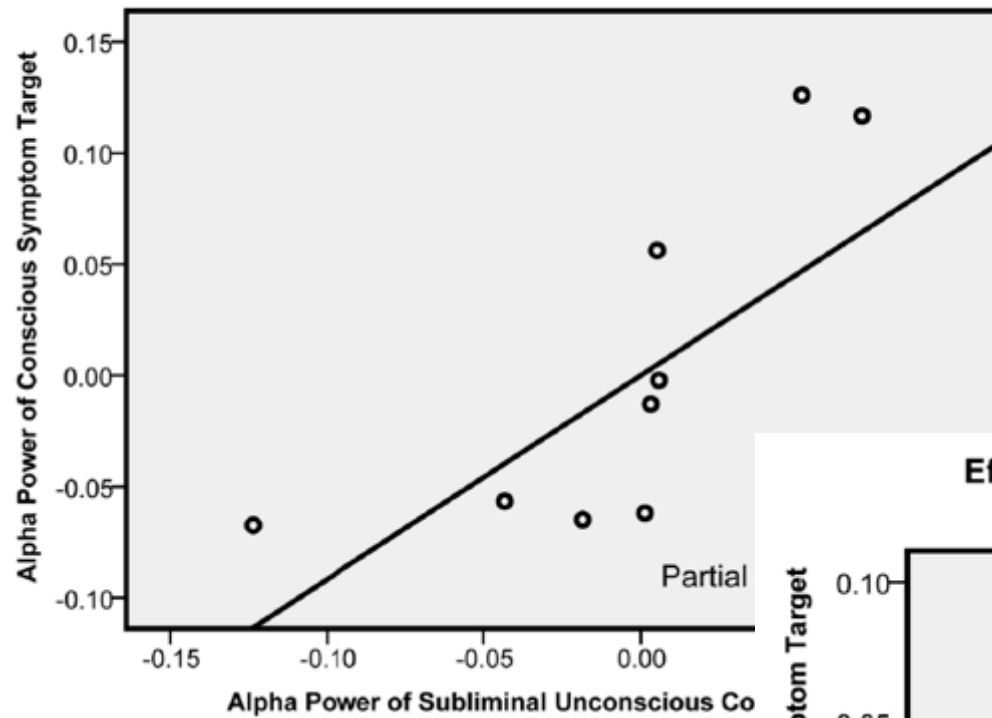
⊗ subliminal UC prime- $\alpha$  no effect on ON target- $\alpha$

⊗ supraliminal UC prime- $\alpha$  no effect on CS nor ON target- $\alpha$

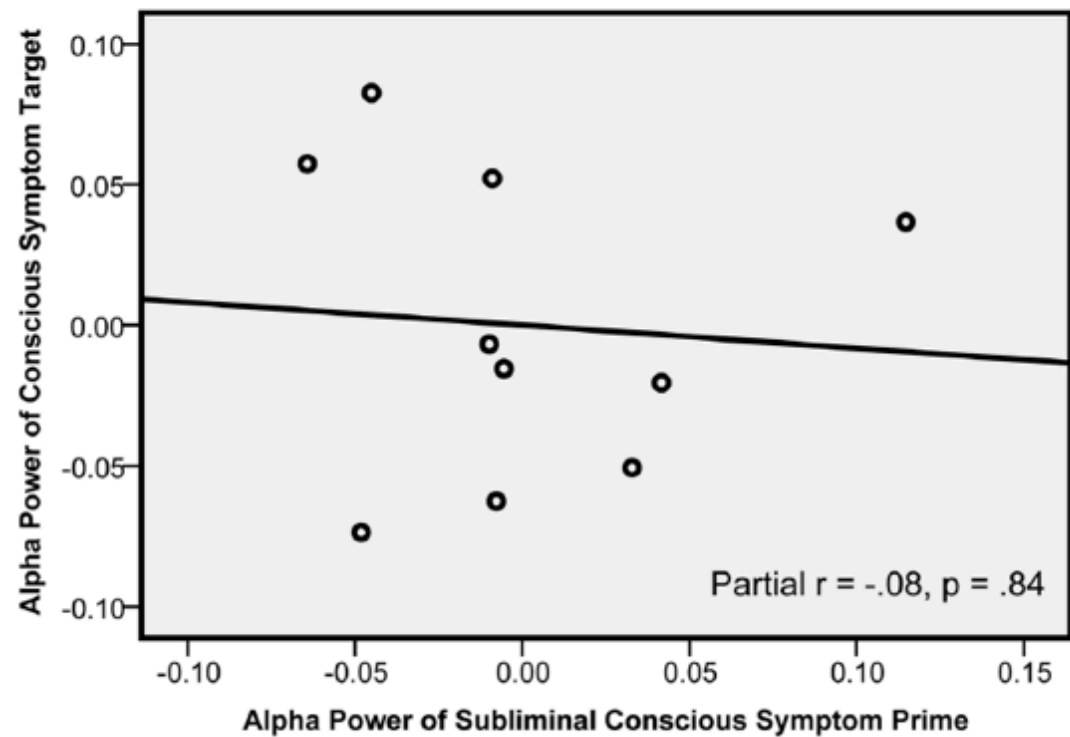
> **only when UC primes were subliminal, and only when they preceded CS targets, did they produce enhanced  $\alpha$**

⊗ subliminal CS prim- $\alpha$  did not predict CS nor ON target- $\alpha$

**Effect of Subliminal Unconscious Conflict Prime on Conscious Symptom Target**



**Effect of Subliminal Conscious Symptom Prime on Conscious Symptom Target**





⌘ Only when the subliminal unconscious conflict primes were followed by supraliminal conscious symptom targets did they significantly enhance conscious symptom target  $\alpha$ .

⌘ unconscious meaning of the UC primes unconsciously elicits an inhibition on the conscious CS targets:  
a cause-and-effect relationship between UC and CS

# III. Conclusion

{ Clin1, Phobia, Clin2

## The Alpha Model

⊗ **synchronization of  $\alpha$ , known for its inhibitory function, is also induced by subliminally presented conflictual subject-specific stimuli**

**$\alpha$  synchronization serves a general inhibitory function and could also serve as an inhibitory brain mechanism of unconscious defense**



## *functional principle*

⊗ ‘Pulsed out of awareness: EEG alpha oscillations represent a pulsed-inhibition of ongoing cortical processing’ (Mathewson et al., 2011):  
**“alpha oscillations act as a pulsed-inhibition of neural processing”**

“ When there is less synchronization, inhibitory periods are random and signals processed in the area can stand out against the noise. However, when oscillations become highly synchronized, periods of inhibition occur simultaneously across the population of cells, drowning out any signal representation . . . .

To portray the theory in a metaphor, we imagine the oscillatory activity in a processing area as a large crowd at a football stadium. When the individual fans cheer at random times, any loud person can be heard over the hum of the crowd (e.g., ‘COLD BEER!’). However, when the same applause becomes synchronized in a unified cheer, brief periods of widespread sound drown out any other important sounds. Similarly, we propose that inhibition acts on sensory areas by synchronizing the oscillatory excitability cycles of neurons in those areas, drowning out incoming signals.”

⊗ “defensive inhibition is not so much an emotional subcortically driven process influencing global areas of functioning, but rather *a precisely targeted neocortically decision steered form of intentionality*”

Mathewson et al. (2011, p. 6): when inhibition of some part of a visual element “is needed, top-down signals . . . control the level of  $\alpha$  oscillations”.

$\alpha$  synchronization  $\approx$  ‘steerable fire hose’

⊗ ‘drowns out any signal representation’: it isolates the signal representation from being integrated into associative networks  $\approx$  it prevents the signal representation from *acquiring a subjective meaning*



⌘ external objective validity for clinical inferences based on psychological meaning, a priori made by psychoanalysts on the basis of clinical data, with brain data

### Grunbaum's circularity criticism

⌘ looking at the brain phenomena exclusively, no difference emerges between unconscious and conscious inhibition: it takes a psychological – psychoanalytical – theory, and an experimental operationalization of this theory, to reveal it.

(psychoanalysis as a way to get out of brain circularity!)



In Clin1, supraliminally presented UC words do not elicit ERP features which allow them to be grouped together, and in Clin2, alpha power upon supraliminally presented UC words does not correlate with alpha power upon CS targets. *Why is it that the supraliminal primes are not able to induce alpha pulses, if a signal with exactly the same content, albeit at much lesser intensity, is thought to elicit this vivid brain reaction?*

Repressive border control by  
sensorimotor inhibition and return of  
the repressed as phoneme phantoms

Saturday, 3.20 pm

~ thank you

[ariane@ulb.ac.be](mailto:ariane@ulb.ac.be)