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Driver Distraction and Inattention
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Effects of anger state on driving performance and attention

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IFSTTAR

Introduction



Context

Impact of anger on driving behavior

Anger
expression

*Deffenbacher et al.
2001; 2003*

Traffic
offenses

Abdu et al. 2012

Driving
performance

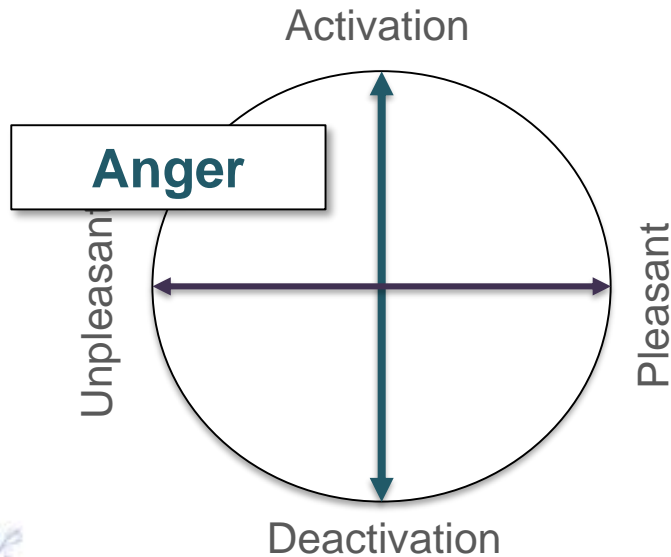
*Stephens et al.
2011; 2012*



Context

Valence & Arousal

Russell, 1980



Distraction

Negative valence

Smallwood 2015

Mind wandering

Increased risk of accident

Lagarde et al., 2004; Galéra et al., 2012

Alertness

Improve the benefits of alerting signals

Techer et al, 2015

Questions

Impact of anger on driving performance?

Impact of anger on alerting signals processing?



Event-Related Potentials (ERP)

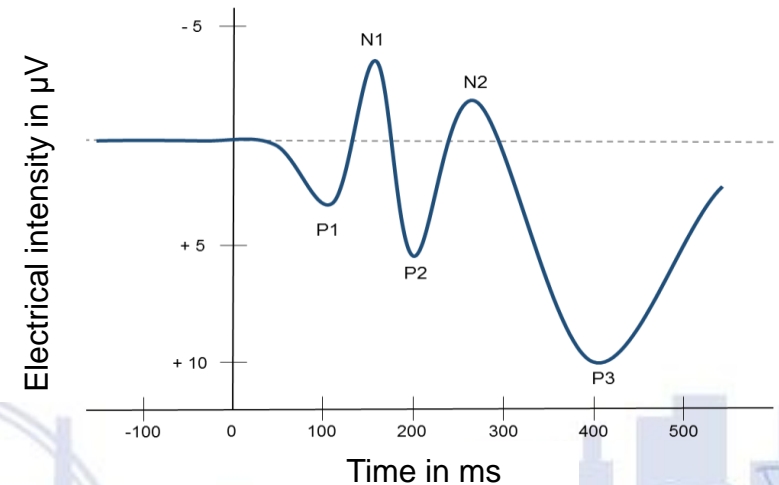
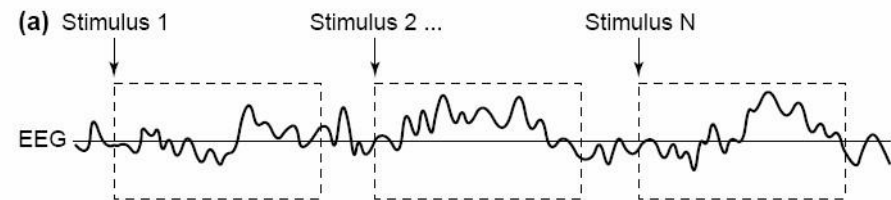
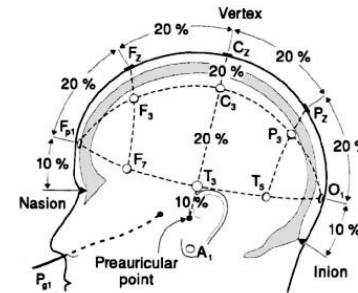
Measure of cerebral activity

Signal averaging

Interpretation of ERP

N1 = Sensorial processing

P3 = Cognitive processing



ERP & emotions

Emotional stimuli

Valence effect is not usually observed

Rozenkrants et al., 2008

High arousal increases the amplitude of cognitive components

Rozenkrants et al., 2008 ; Van Strien et al., 2009 ; Xu et al., 2015



ERP & mind wandering

Perceptual decoupling

Focus on internal thoughts

Smallwood et al. 2015

Reduction of N1 amplitude evoked by external stimuli

Henriquez Chaparro 2015

Influence of an anger state on ERPs during
neutral stimulus processing?



Hypotheses

Anger should disrupt driving performance

Anger should impact ERPs while processing target stimuli



Method

33 participants

19 Females

Aged 25 to 40 (M =32)

2 within subject sessions

Anger

Control

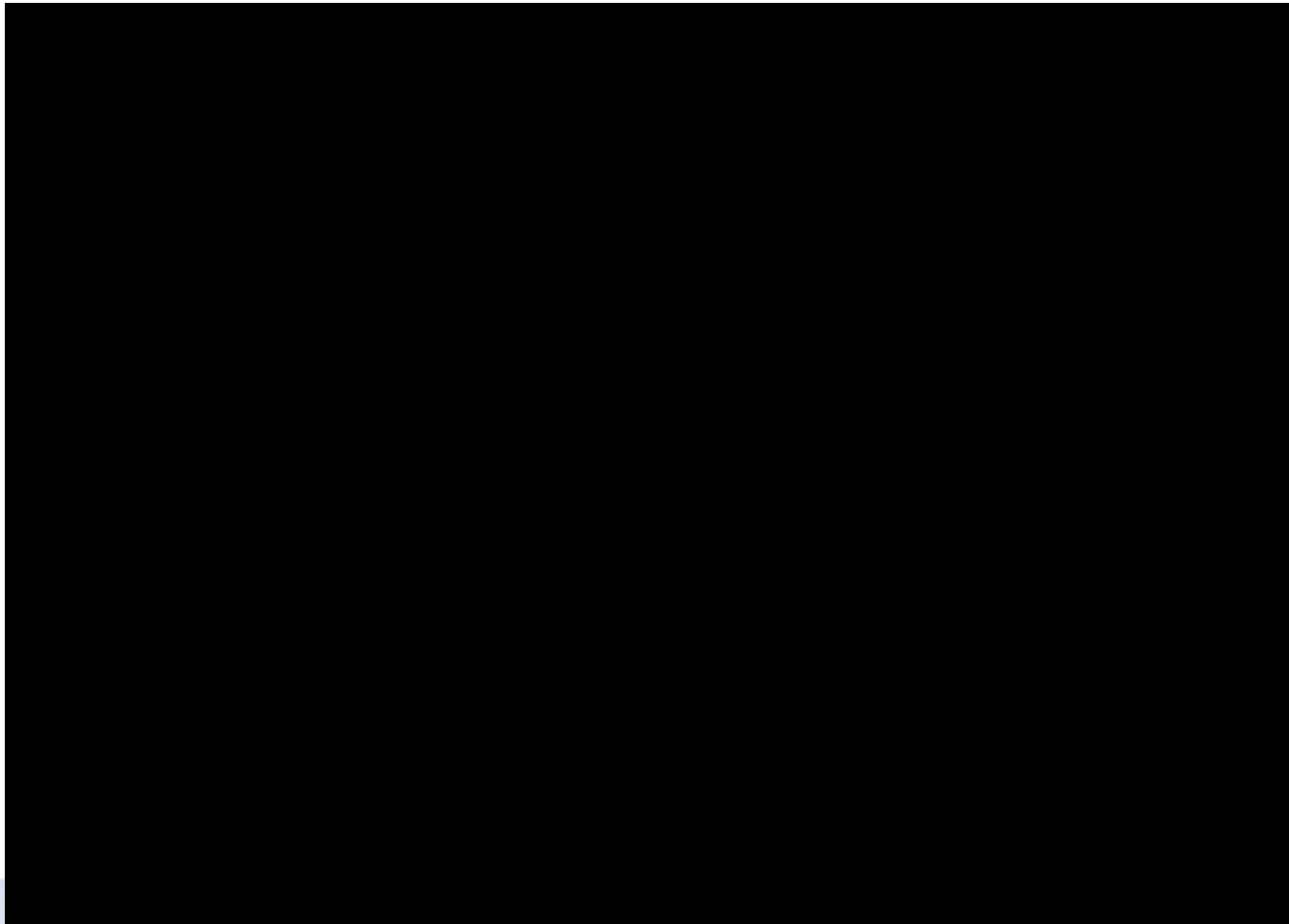


Anger induced by
autobiographical recall

Motorcycle following task

see Bueno et al. 2012

Scenario



Measures

Driving behavior indicators

Reaction times, speed variations, lateral variations

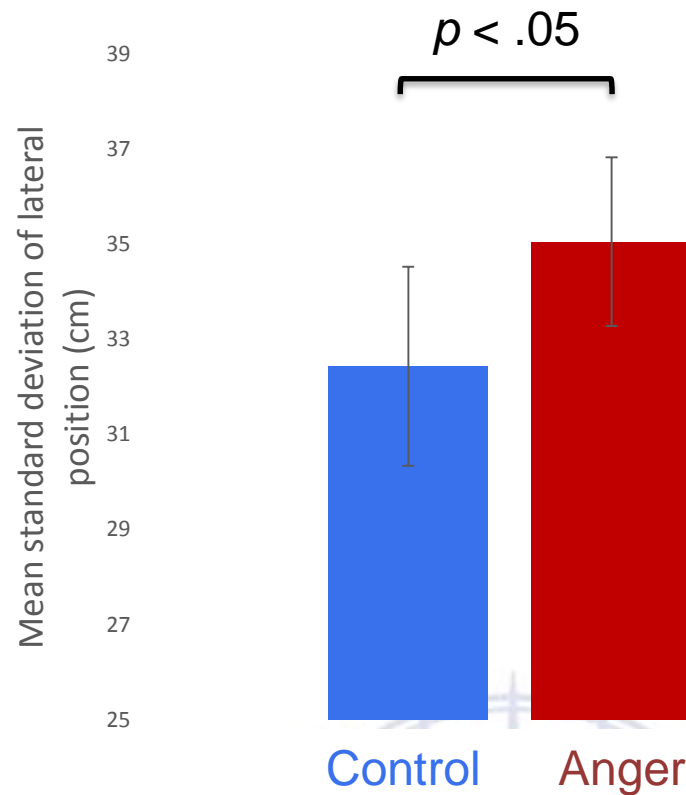
ERPs provoked by the motorcycle braking lights and by the auditory alert

Visual N1, Auditory N1, P3



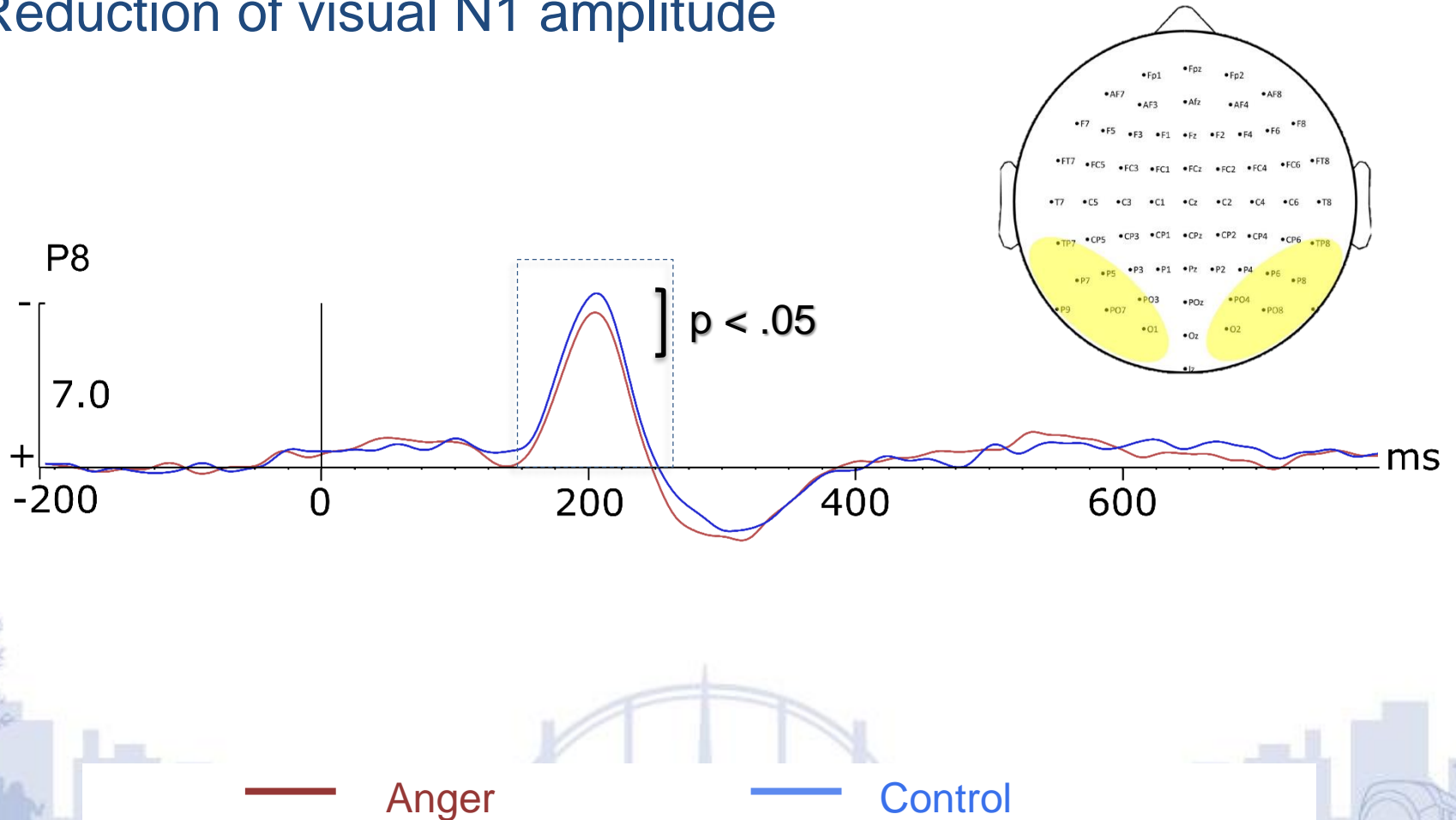
Results

Increased variations of lateral position



Results

Reduction of visual N1 amplitude



Discussion

Perturbation of lateral control

Unusual amount of attentional resources allocated to lateral control

Logan et al., 2009

Increased arousal due to anger

Reduction of visual N1 amplitude in the anger session

Mind wandering associated with negative emotional states

Chaparro, 2015 ; Smallwood et al., 2015



Conclusion & perspectives



Need to go further with more studies

ERPs coupled with behavioral data enriched our interpretations

Real-time adaptation of the vehicle and assistance systems to driver's needs



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Thank you for your attention

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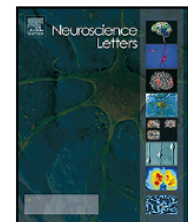


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Research article

Attention and driving performance modulations due to anger state: Contribution of electroencephalographic data

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Mood induction

