



# CAN TALKING ON THE PHONE KEEP THE DRIVER AWAKE?

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# Theoretical background

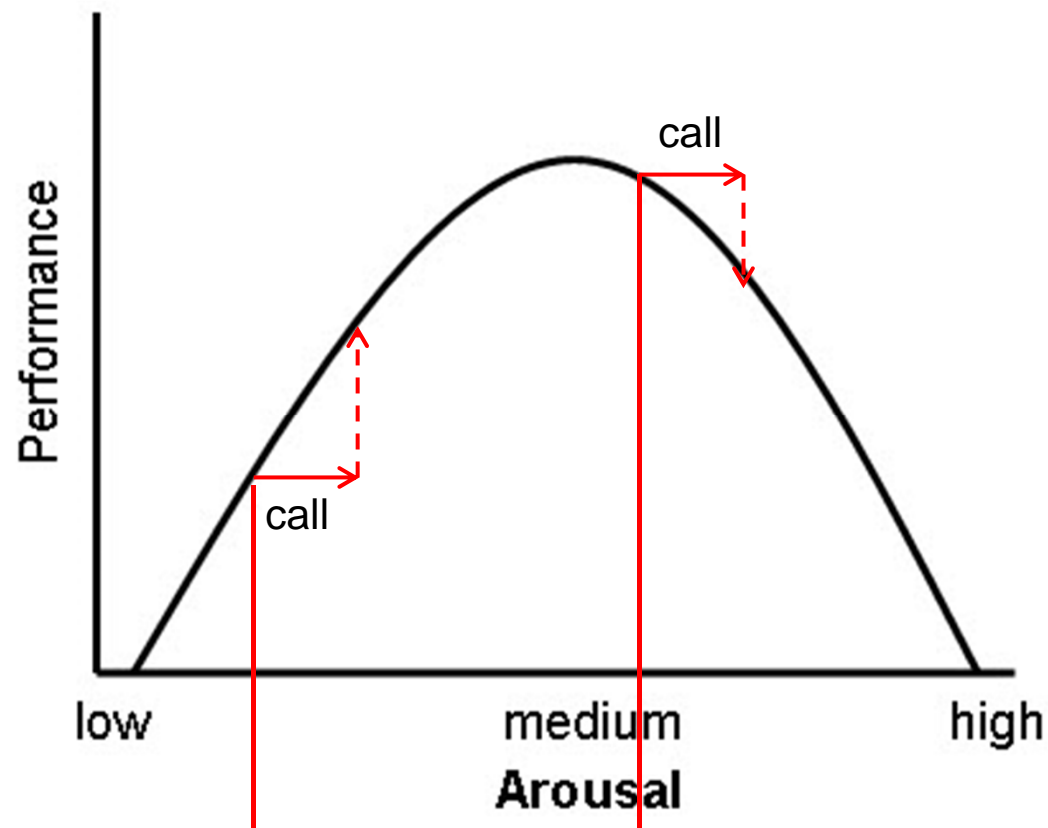
## Telephoning while driving

- Most studies focus on the distractive effect of telephoning: phone calls lead to a higher risk of driving errors (e.g. Alm & Nilsson, 1994; Horrey & Wickens, 2004; McKnight & McKnight, 1993).
- But:
  - Studies assume that conversation adds extra load on the driver in an already demanding driving situation.
  - In situations of underload, telephoning might help to improve drivers' condition



## Theoretical background

Phone calls as distraction vs. as countermeasure



Monotonous driving  
-> fatigue

Normal driving

(Yerkes & Dodson, 1908)



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# Hypothesis

- driving is not always a demanding task
- longer periods of underload lead to a state of reduced vigilance of the driver and then, even to fatigue
- adding some extra load, e.g. through conversation might improve drivers' condition



## Does talking on the phone improve drivers' state?



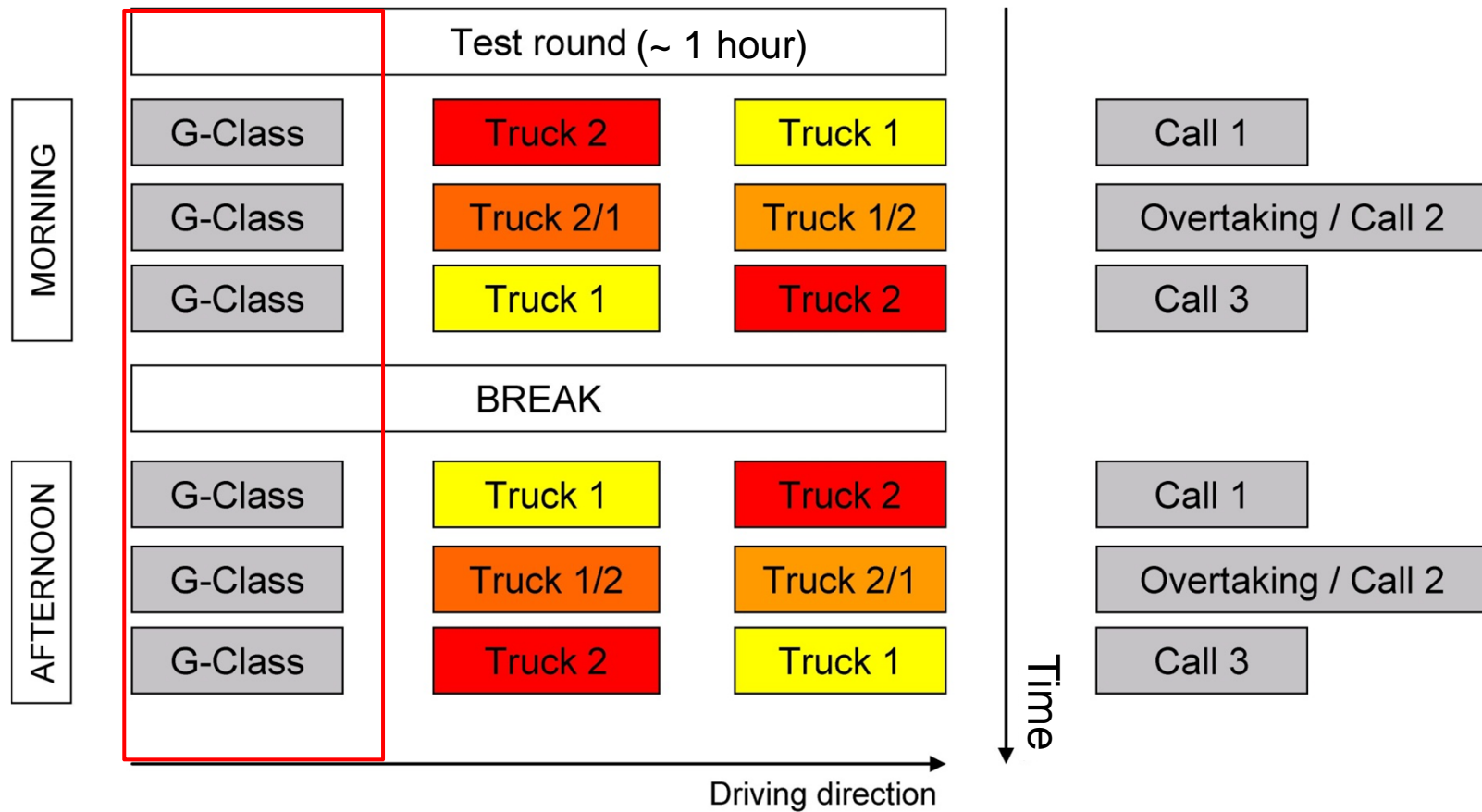
## Selected Track

- former military area in southern Germany
- circular road: 36 km
- no traffic
- curves and moderate upward and downward gradient





# Experimental design





## Phone calls

- phone calls in each block after
  - 60 min.
  - 120 min.
  - 150 min.
- duration: 5 min
- opinion on certain issues was asked; no knowledge
- questions of six categories:
  - history, politics, geography, technology, sports and experiences of the everyday life







## Recorded measures

- elektroencephalography (EEG)
  - Alpha spindle rate:  
Fatigue leads to increase in spindle rate
- eye-closure coils
  - Relative blink duration  
Fatigue leads to increase in blink duration
- electrooculography (EOG)
- electrocardiography (ECG) (covered)

### Participants

- car: 20
- truck: 2x20
- ➔ 18 analyzable data sets (car drivers)

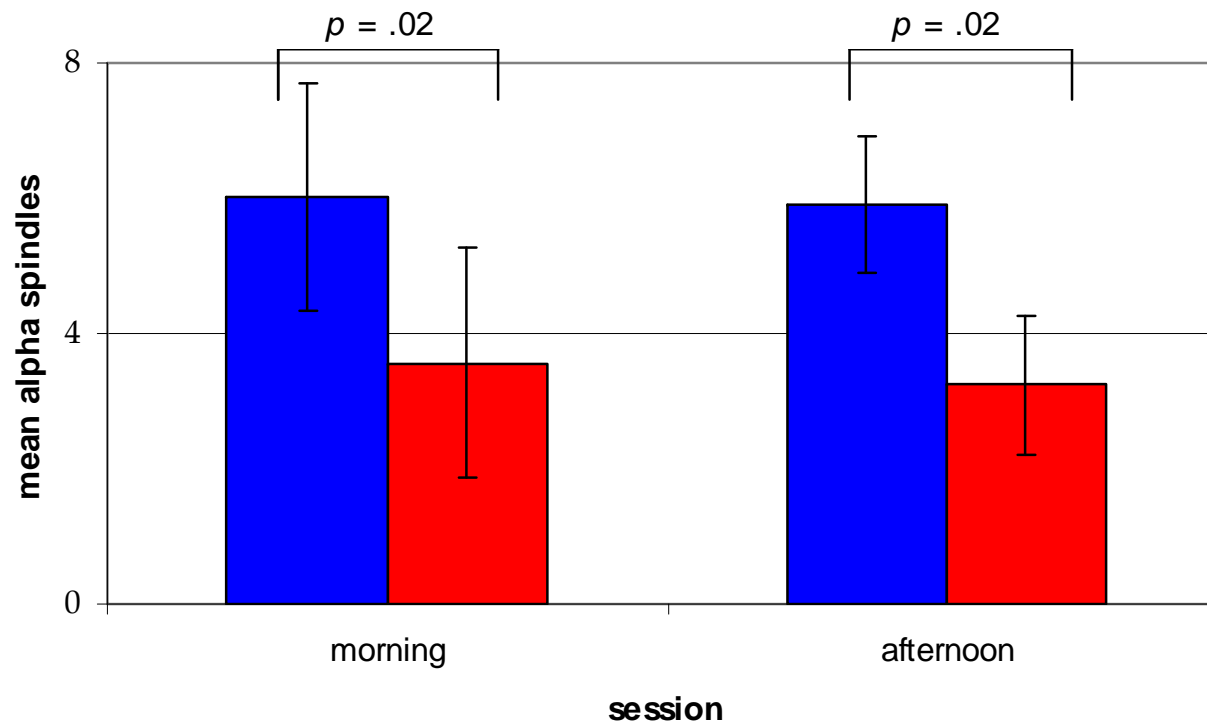






## Results

### Impact of phone call on Alpha spindle rate (EEG)

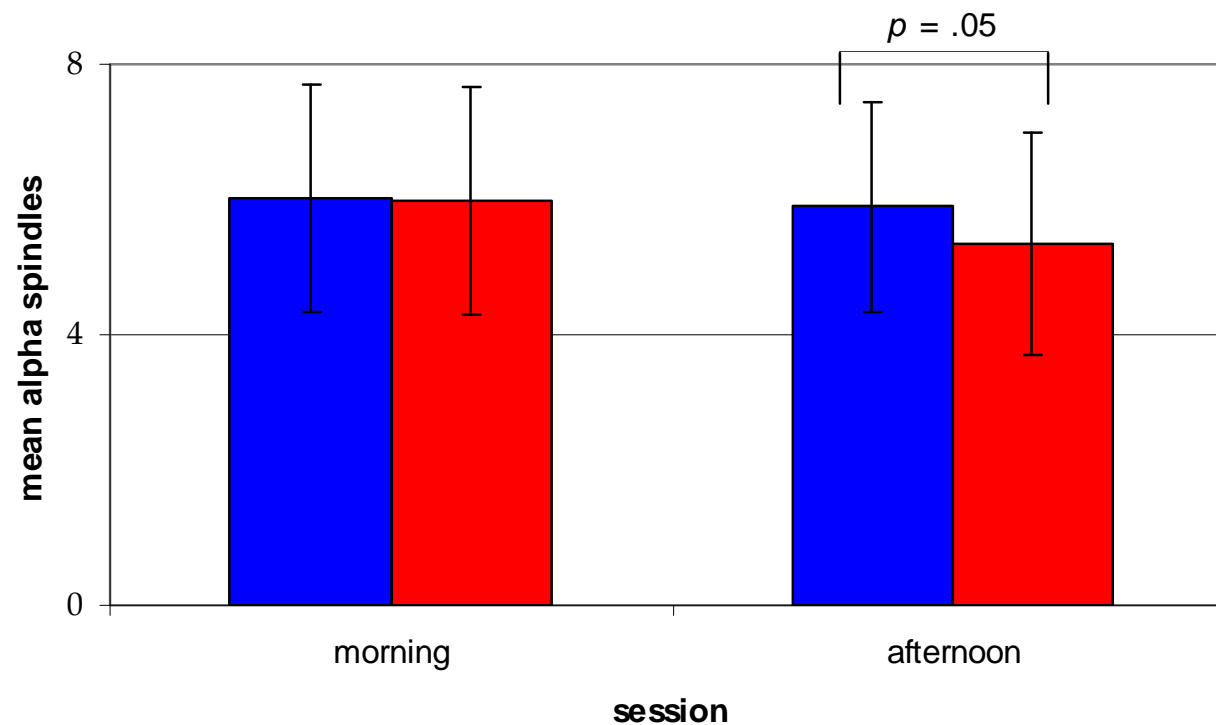


- Factor before vs. during call:  $F(1,16) = 6.90$ ,  $p = .02$
- Factor time of day (morning vs. afternoon):  $F(1,16) = 1.37$ ;  $p = .26$



## Results

Duration of effect : Alpha spindle rate (EEG)

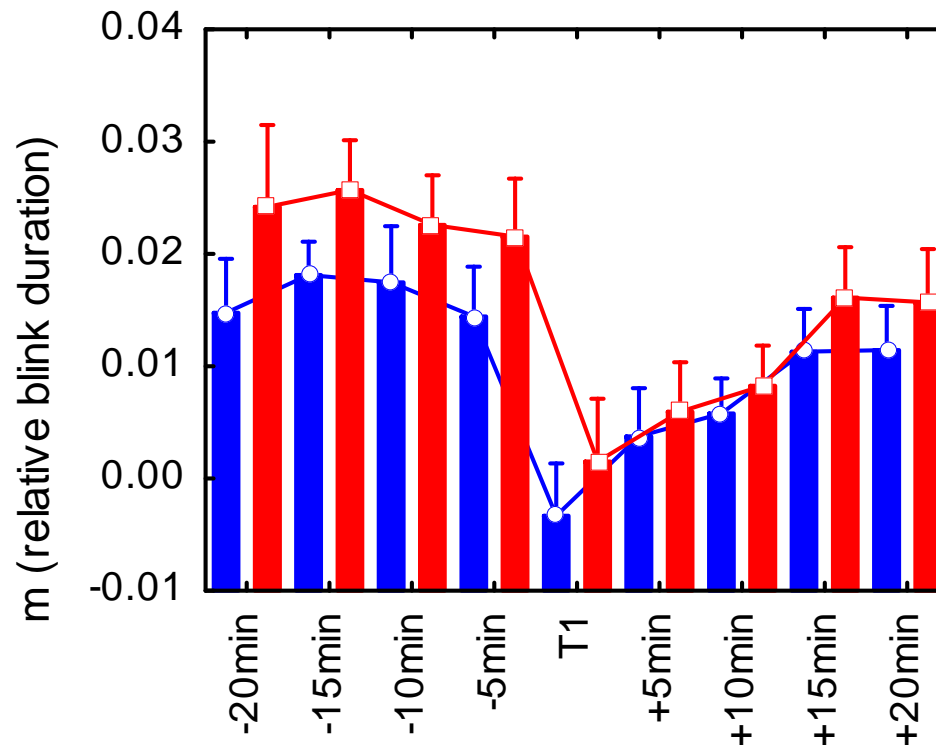


- Factor 20 minutes before (blue) vs. 20 minutes after (red) phone call:  $F(1,16) = p = .05$
- Factor time of day (morning vs. afternoon):  $F(1,16) = 4.20, p = .06$
- Interaction:  $F(1,16) = 4.57, p = 0.05$



## Results

### Blink duration: call 1



➤ decrease due to the first call:  
morning:  $N=14$ ,  $F(8,104)=7.50$ ,  $p < .001$ ;  
afternoon:  $N=11$ ,  $F(8,80)=5.74$ ,  $p < .001$

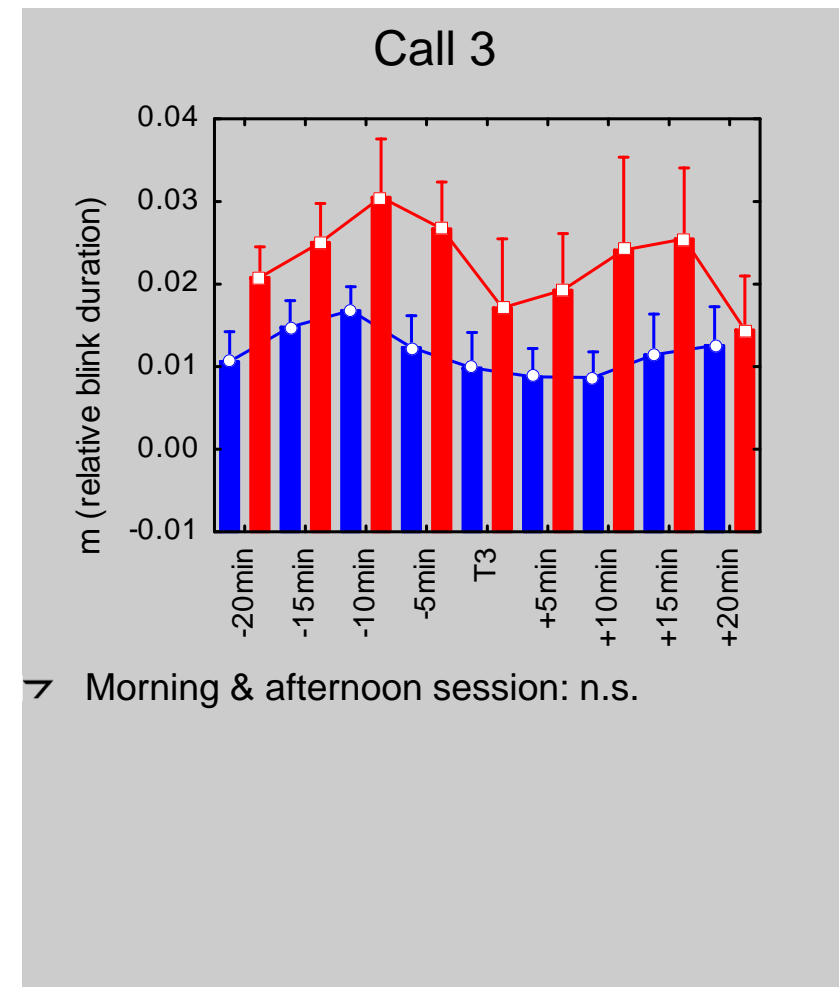
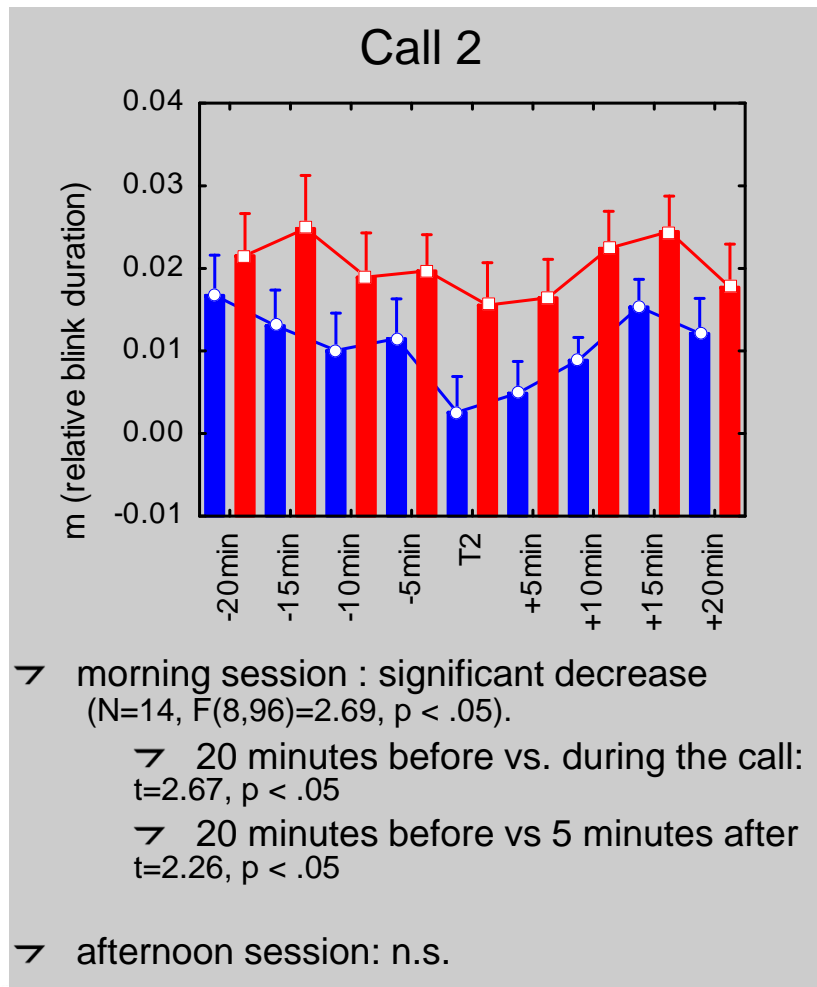
➤ Contrast analysis:

- 20 minutes before vs. phone call  
 $t=4.40$ ,  $p < .001$
- 20 minutes before vs. two 5-minutes-intervals after the phone call  
 $t=2.51$ ,  $p < .05$



## Results

### Blink duration: call 2 & call 3







## Summarized results

- During monotonous driving situations, talking on the phone shows an activating effect for a period of up to 10-20 minutes
- In the morning and afternoon session the first telephone call was most effective
- The effect diminished over time-on-task and lasted for a shorter time
- **The experiment shows that communication can have a positive effect on the state of the driver**
- **Effect of talking on the phone depends on situational circumstances**



**Thank you for your attention!**

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# Motivation

## Accidents caused by micro-sleep

