Angry drivers: A simulator study on investigating on/off- road anger

Jordan Maillant[12], Stéphanie Dabic[1], Christophe Jallais[2]
[1] Valeo Switches & Smart Controls Product Line , Rue Jules VERNE - Vetraz Monthoux
BP 509 - 74106 Annemasse Cedex, FRANCE
[2] Univ Gustave Eiffel, IFSTTAR, Univ Lyon, LESCOT, F-69675 Lyon, France

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Introduction

- **Anger degrades driving performances** such as lane keeping (Jeon et al., 2014).
- **Anger** may stem from the **driving environment** but also from **no driving-related** events linked to **inattention** episodes such as ruminating on past anger-inducing events (Suhr, 2016).
- **Current research** on anger detection **differently induced anger** and highlighted various results with **either** an **increased** (e.g., Wang et al., 2024) **or decreased** (e.g. Lafont et al., 2019) in **sympathetic nervous system activity.**
- **Ruminating on negative thoughts increases** the likelihood of **mind-wandering** episodes and **inattention** (Albert et al., 2022)**,** leading to a **narrowing of visual exploration** while driving (He et al., 2011).

Objectives

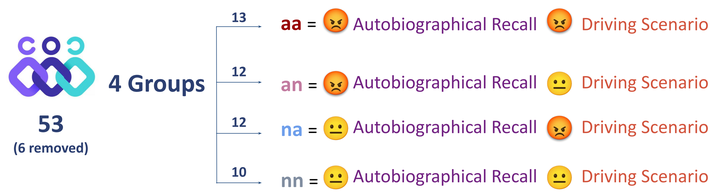
Do visual and **physiological** responses **differ depending of the source** of the anger ?

Less visual exploration ?

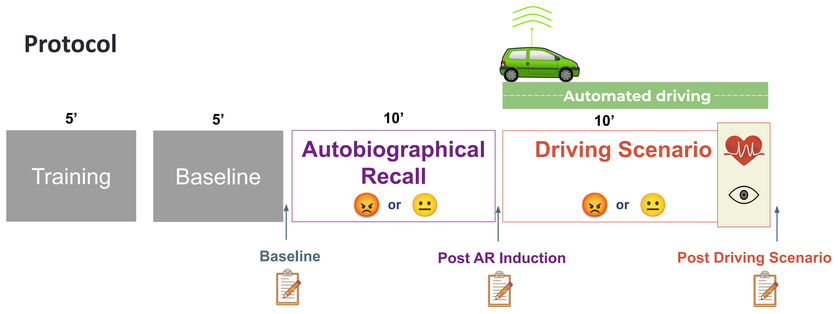
More physiological arousal ?

Methods

Participants



Protocol



- ***Autobiographical Recall induction:*** Writing a personal memory (anger) or daily routine (neutral).
- ***Driving Scenario:*** 4 events were manipulated in automated driving to induce anger/neutral.

Results

No driving-related or/+ Driving-related anger

Anger, Arousal
Valence

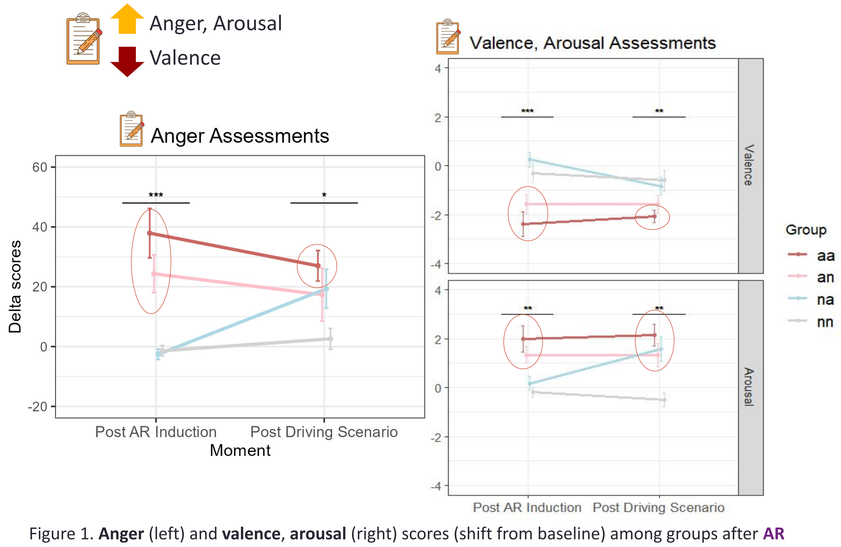


Figure 1. **Anger** (left) and **valence**, **arousal** (right) scores (shift from baseline) among groups after **AR induction** and after the **driving scenario**

No driving-related + Driving-related anger

HRV : SDNN, LF
Fixations number on mirrors

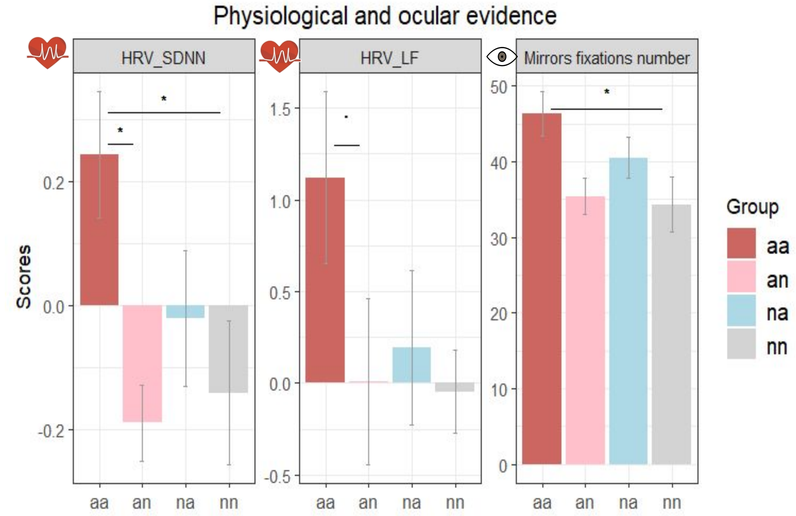


Figure 2. **SDNN, LF and fixation numbers on mirrors** among groups from the last minute of the driving scenario

Conclusions

- **Non driving-related** and **driving-related** techniques **both increased emotional arousal.**
- **The combination of both** showed mainly **physiological and visual differences**.
- Unlike manual driving scenarios, our findings specifically focus on **autonomous driving**, where **trust** plays a crucial role in the interaction between the driver and the system. **The origin and expression of anger may differ significantly**.
- While distinguishing between anger sources may not be essential for detecting a state of anger, it may remain important to consider the sources of anger when designing interventions to help drivers manage their emotions based on the specific cause of the anger.
- As autonomous vehicles become more prevalent, emotional triggers unrelated to driving itself are likely to increase. Anticipating these external sources of anger and incorporating strategies to mitigate their effects will be crucial for future emotional regulation and road safety measures.

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