



# SUBJECTBOOK: Web-based Visualization of Multimodal Affective Datasets Residing on the Cloud



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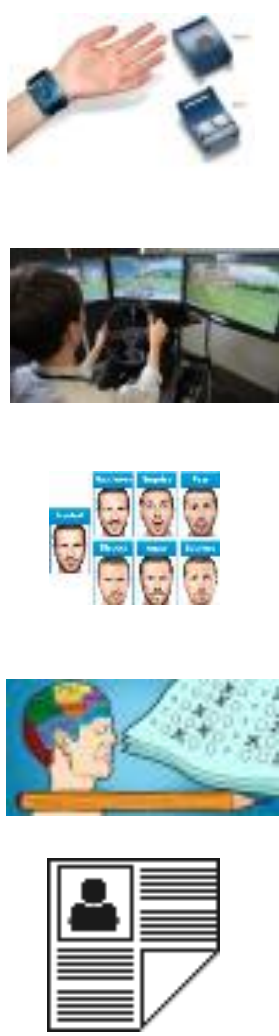
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## Motivation

- ❖ Affective datasets are multimodal
  - ❑ Physiological sensor streams
  - ❑ Performance data
  - ❑ Observational data
  - ❑ Psychometrics
  - ❑ Biographic data



- ❖ Affective studies are often longitudinal
- ❖ Visualization helps to cope with complexity in affective studies

## Introduction

- ❖ **SubjectBook** : Interactive web-based visualization
  - ❑ Brings together different forms of data
  - ❑ Facilitates data sharing
  - ❑ Supports hypothesis-driven research
  - ❑ Three layer abstraction

## Acknowledgements

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## Data Abstraction

### Experimental Specification

- ❖ What are the experimental sessions?
- ❖ What are the stimuli?
- ❖ What are the explanatory variables?
- ❖ What are the response variables?
- ❖ What are the covariates?

Subjects	Experimental sessions	Explanatory and response variables
T001	1 Practice-Drive	T001-004.avi1.avi
T002	2 Normal-Drive	T001-004.avi2.avi
T003	3 Motoric-Drive	T001-004.pp
T004	4 Cognitive-Drive	T001-004.res
T005	5 Normal-Failure-Drive	T001-004.res2
T006	T001.b	T001-004.stm
T007	T001.bar	
T008	T001.tp	

SubjectBook file structure

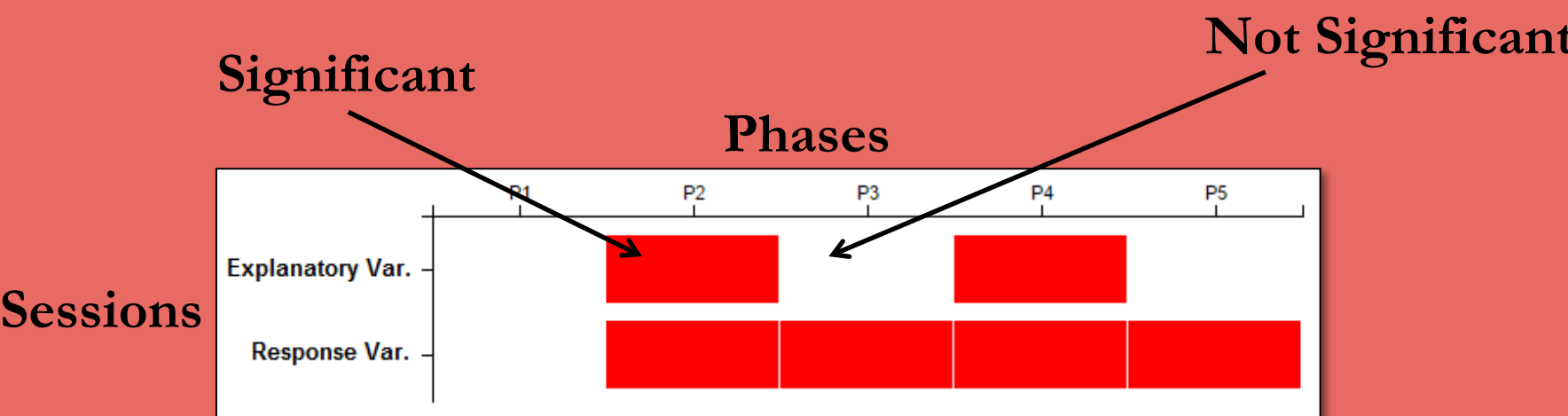
### Data Types

- ❖ Videos (2D over time or space)
  - ❑ Facial video
- ❖ Signals (1D over time or space)
  - ❑ Heart rate
- ❖ Rank
  - ❑ Questionnaire scores
- ❖ Categorical
  - ❑ Gender

Hypothesis Set

### STUDY PORTRAIT

- ✓ Grid visualization of outcomes
- ❖ Rows : Experimental sessions | explanatory & response
- ❖ Columns : Experimental phases in each session
- ❖ Cells : Interventional vs. baseline paired tests (red=\*)



### Case Study

- ❖ Study of driving behaviors under distracting stressors ( $n=59$ )
  - ❑ Baseline Session : Normal driving
  - ❑ Interventional Sessions : Driving under distractions
  - ❑ Key Explanatory Variable : Sympathetic state
  - ❑ Key Response Variable : Steering angular deviation
  - ❑ Supplemental Explanatory Variable : NASA LDX

Study Portrait: Distracted driving study

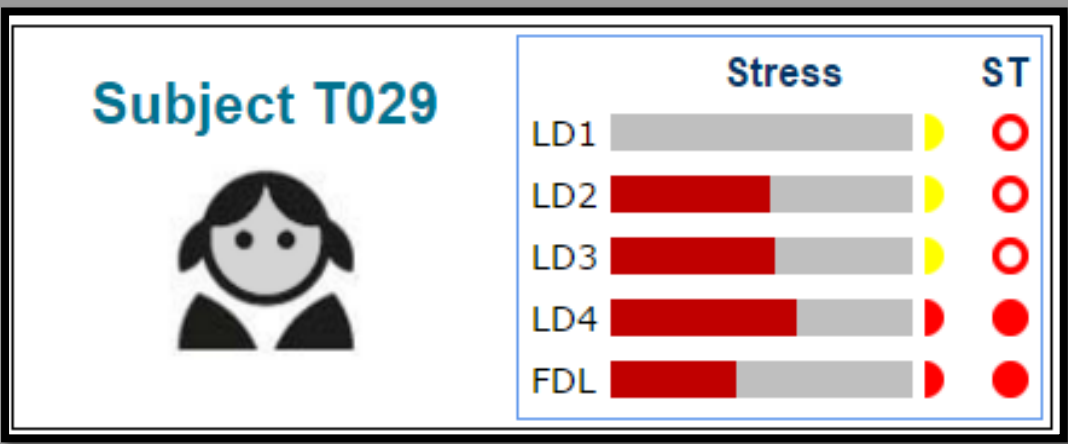


Test Unit Set

### SUBJECT PORTRAIT

- ✓ Summary of subject level phenomena
- ✓ Covariates | Explanatory => Response variables
- ❖ Key Explanatory Variable : Physiological measure of affect
  - ❑ One bar per session
  - ❑ Baseline session : Top grey bar
  - ❑ Interventional sessions : Proportion of red color reflects the percentage of time the subject's arousal stayed above the mean baseline
- ❖ Key Response Variable : Performance measure
  - ❑ One disk per session
  - ❑ Filling levels represent levels of performance
- ❖ Supplemental Explanatory Variable : Subjective measure of affect
  - ❑ One semi-circle per session
  - ❑ Color coded semicircles represent levels of perceived affect

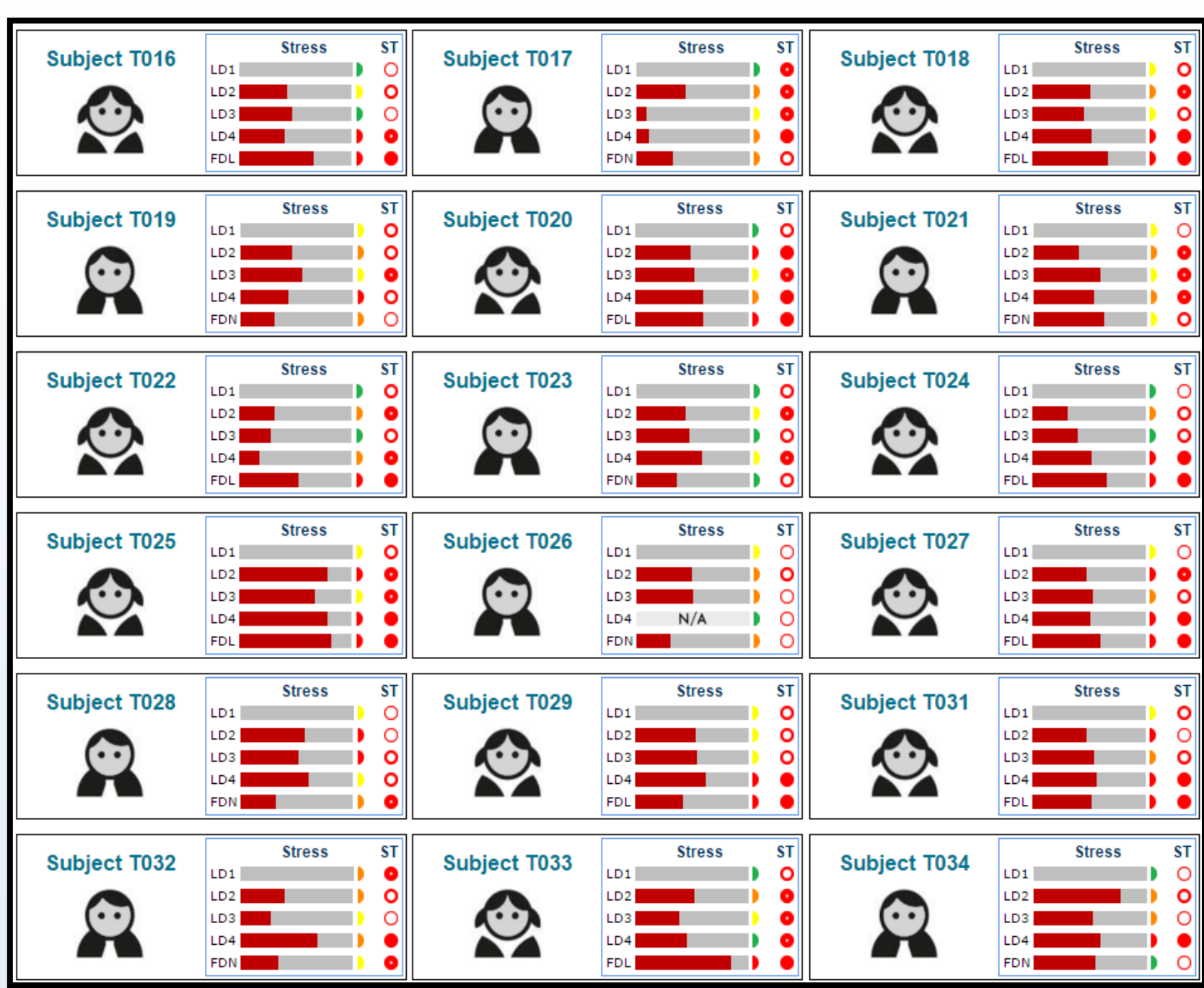
ID metaphor



1<sup>st</sup> Quartile 2<sup>nd</sup> Quartile 3<sup>rd</sup> Quartile 4<sup>th</sup> Quartile

Low Fair Medium High

Subject Portrait: Distracted driving study

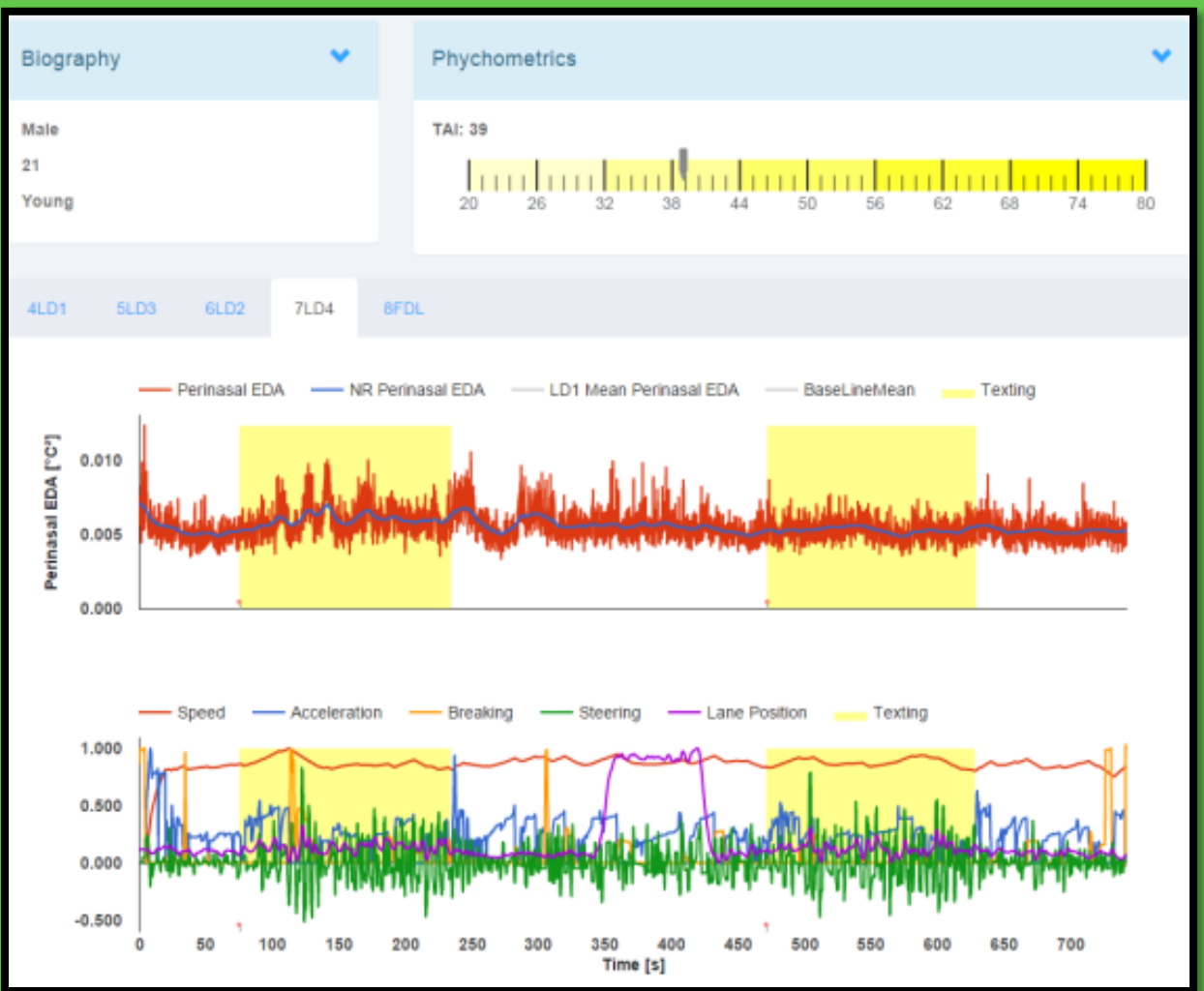


### SESSION PORTRAIT

- ✓ Measurements per session per subject

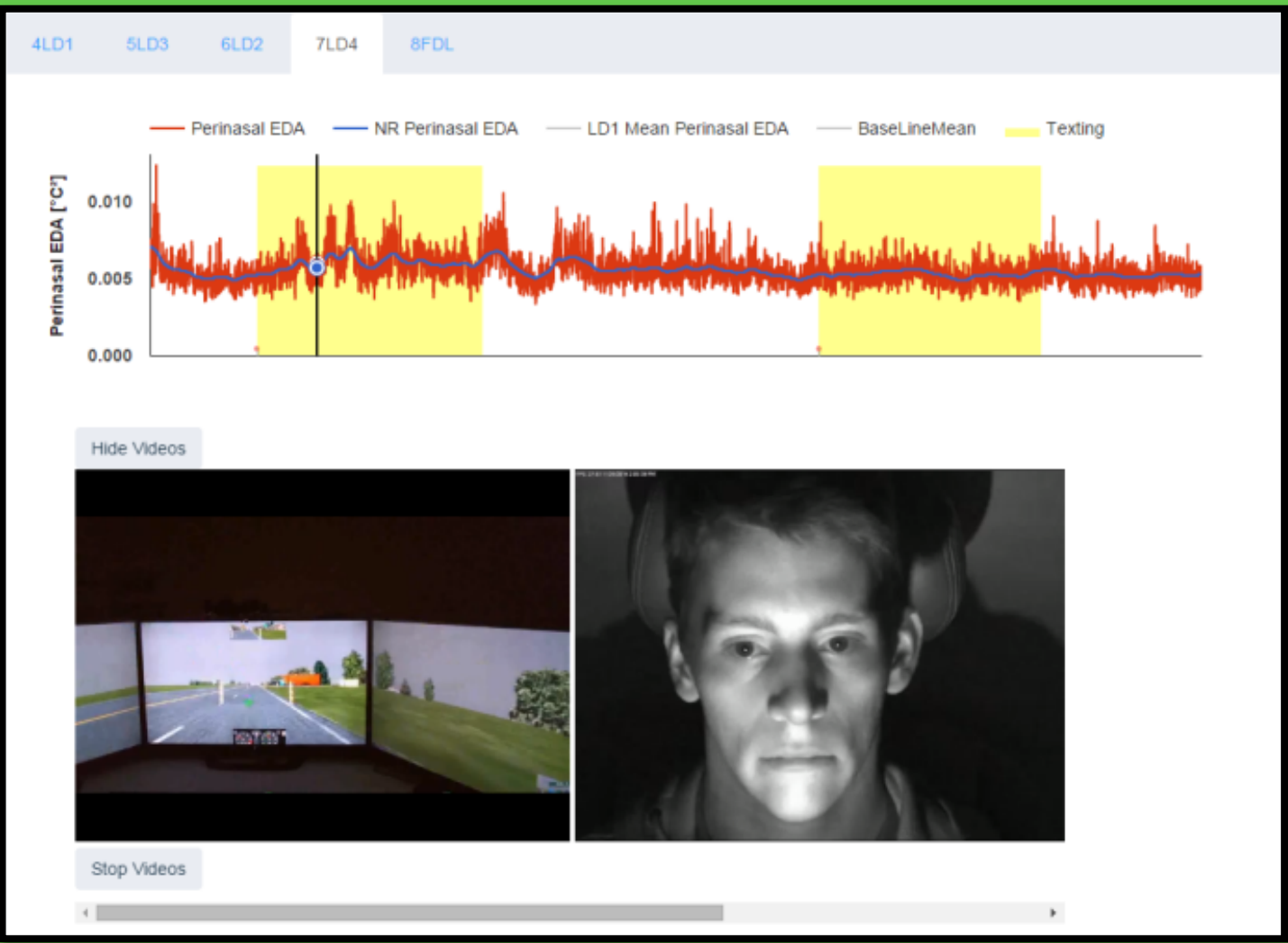
- ❖ Session specific multimodal data under tabs
- ❖ Session independent data above tabs

Tab view



- ❖ Physiological signals synced to observational data
  - ❑ Internal ↔ external states

Synced data streams



Session Portrait: Distracted driving study

Arousal

Steering

