phasya

Université de Liège

Le monitoring de la somnolence: une solution pour améliorer la sécurité

Clémentine François, Jérôme Wertz, Jacques G. Verly

Liège, le 23 février 2017

Phasya

- Spin-off of the University of Liège
- Software for monitoring physiological/cognitive states
- Provider of technologies and services
- 8 years of R&D
- Engineers collaborating with experts in human factors, sleep, neurology,…
- High potential company

TiE 50 2015 TOP START-UP

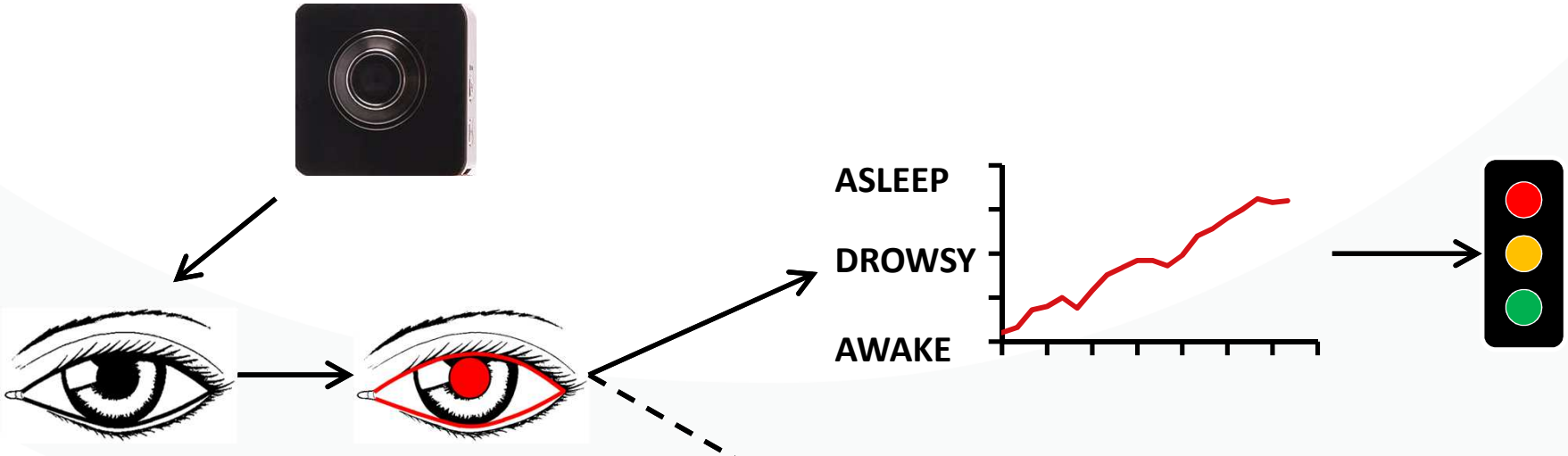
Trends 50 START-UP 2015 AVEC FUNDME - LEANSQUARE - MYMICROINVEST

MIT Technology Review INNOVATORS UNDER 35

Core business

SOFTWARE for

Signal/image processing & monitoring of physiological/cognitive states



MIND WANDERING, CONSCIOUSNESS, STRESS,…

For a variety of applications including SAFETY, medicine, education,…

Drowsiness

6-11% of the population suffers from excessive daytime sleepiness

20% of severe road accidents

Not only transport !

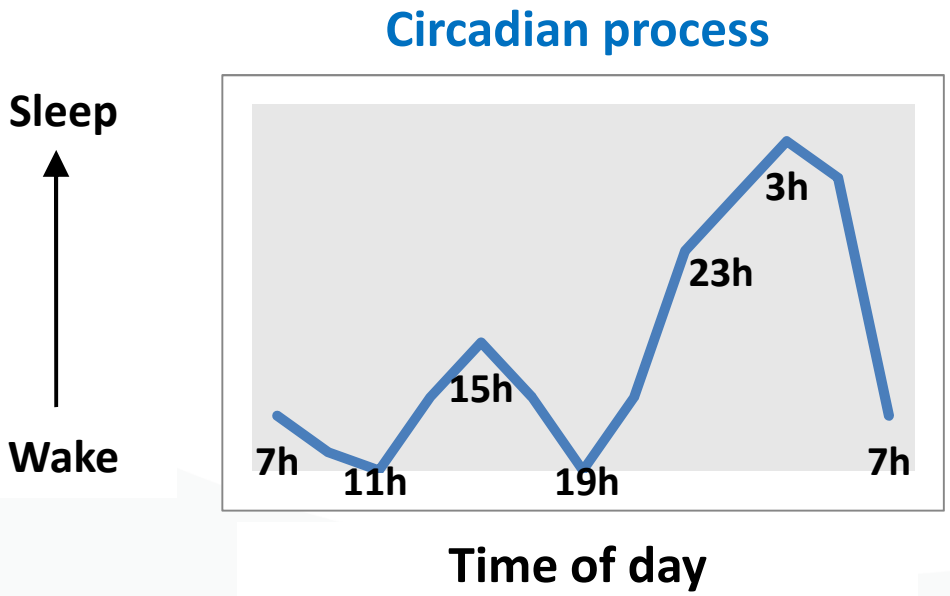
Results of a recent study from IBSR

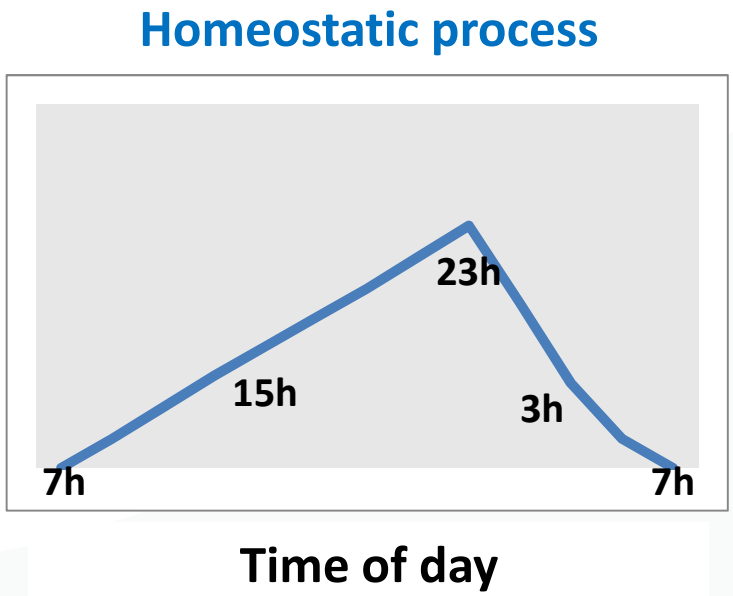
Effects of variables on the prevalence of driver sleepiness:

Frequent driving	**Acute Sleep Shortage**
> 4hours/day: **31%**	4-8 hours: **11%** - 0-4 hours: **25%**
Irregular Sleep Pattern	**Young drivers**
> 2hours: **15%**	18-30y: **11%**
Night driving	**Long-distance**
8%	> 60km: **11%**

- **"At the level of individual trips, on average 4.8% of the Belgian car drivers shows signs of sleepiness"**

Drowsiness





We all go through a phase of drowsiness in the course of the day, e.g. before falling asleep.

Operational, real-time monitoring of drowsiness

Process behavior

User behavior

User state

Operational, real-time monitoring of drowsiness

Process behavior

User behavior

User state

Behavior approach

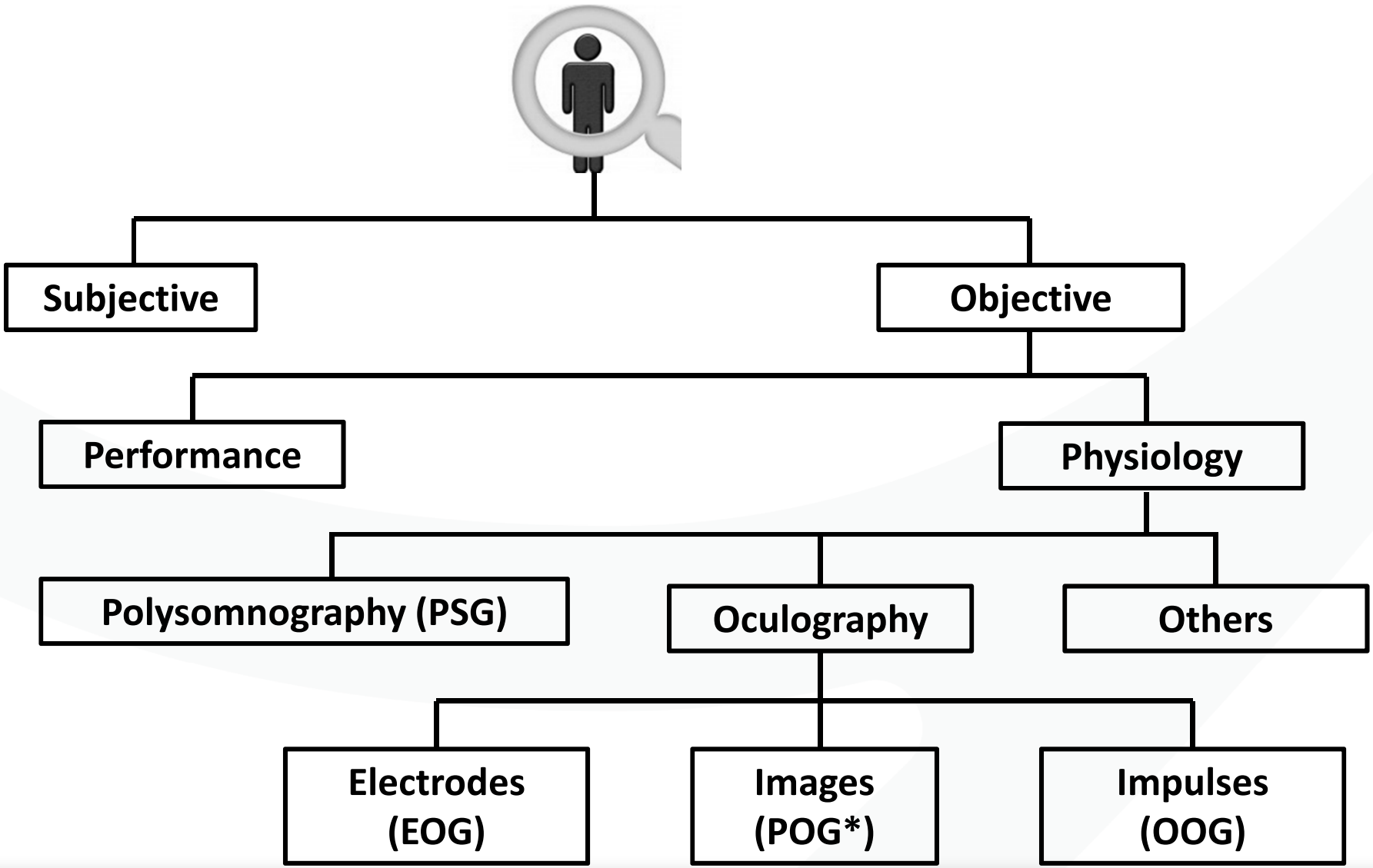
Operational, real-time monitoring of drowsiness

Process behavior

User behavior

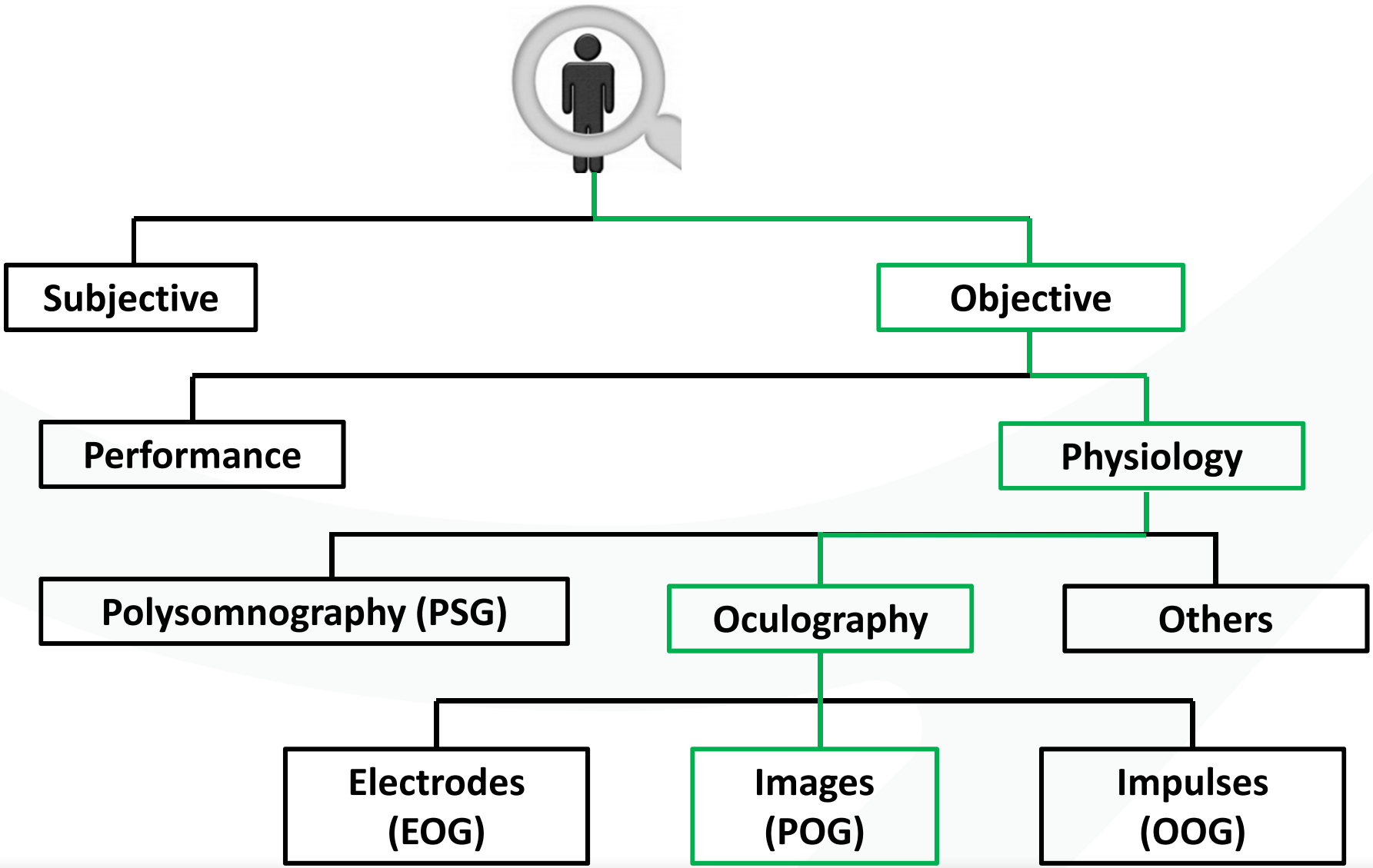
User state

User state approaches



**POG = PhotoOculography*

Our approach



Our approach

A drowsiness monitoring system

- **automatic**
- **real-time**

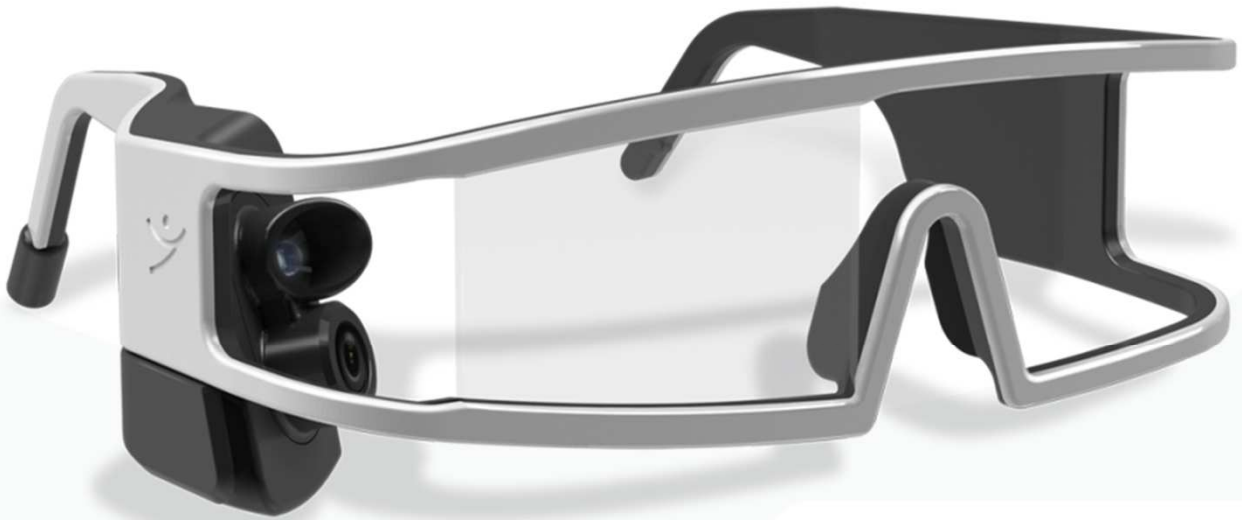
based on

- **<u>physiological state</u> of subject (images of the eye)**

producing

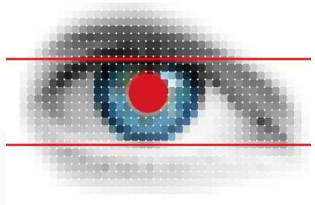
- **a level of drowsiness (<u>task independent</u>)**

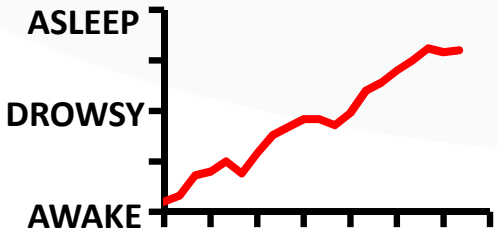
Our head-mounted system



phasya

Our head-mounted drowsiness monitoring system





Acquisition

↓

Eye images

Processing

↓

Ocular parameters

LoD* computation

↓

POG-based LoD

LoD = Level of Drowsiness

1st product – Drowsimeter R100

- Launched in June 2015
- Dedicated to research purposes
- Scientifically validated
- Already sold and used

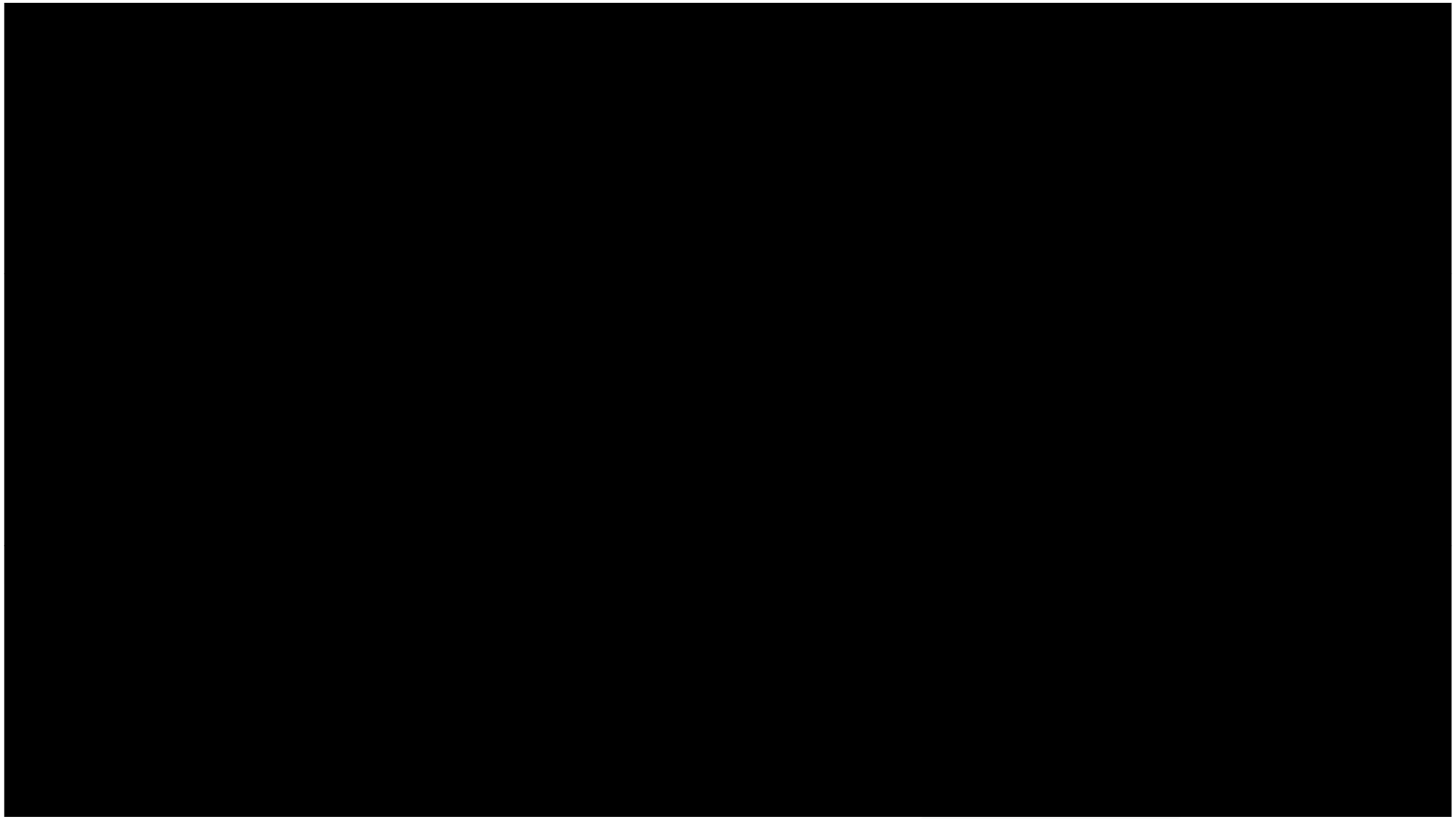
OKAYAMA UNIV.

universiteit hasselt

SNUH SEOUL NATIONAL UNIVERSITY HOSPITAL

idewe Optimising work environments

Drowsimeter R100 – Video (1)



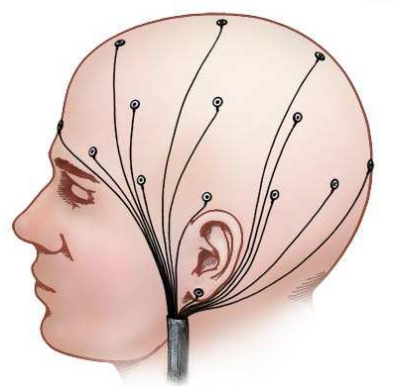
Drowsimeter R100 – Video (2)

Drowsimeter R100 – Validation

Our technology is validated against

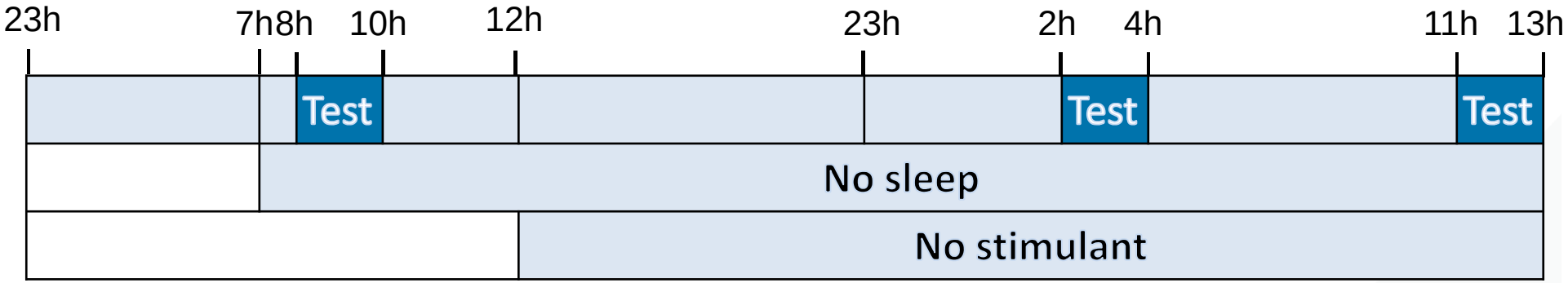
Reaction time

Driving performances



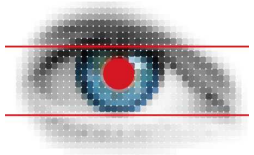
Brain activity

Validation - Data acquisition

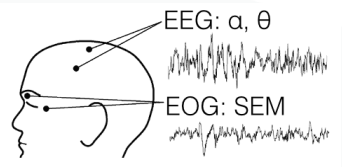


Experiment A	Experiment B
• 27 participants (12 M, 15 F, mean age of 24.3 years, range of 19-32 years)	• 12 participants (6 M, 6 F, mean age of 24 years, range of 21-33 years)
• Test = PVT (duration of 10 minutes)	• Test = Driving in a simulator (duration of around 45 minutes)

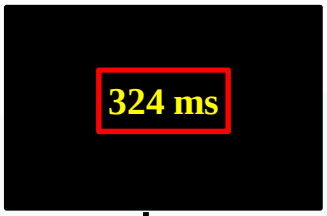
Validation – Data analysis



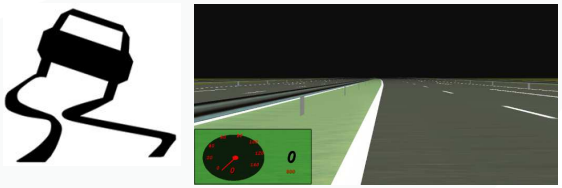
POG-based LoD



PSG-based LoD



Mean reaction time & percentage of lapses

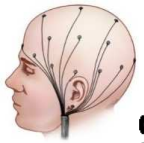


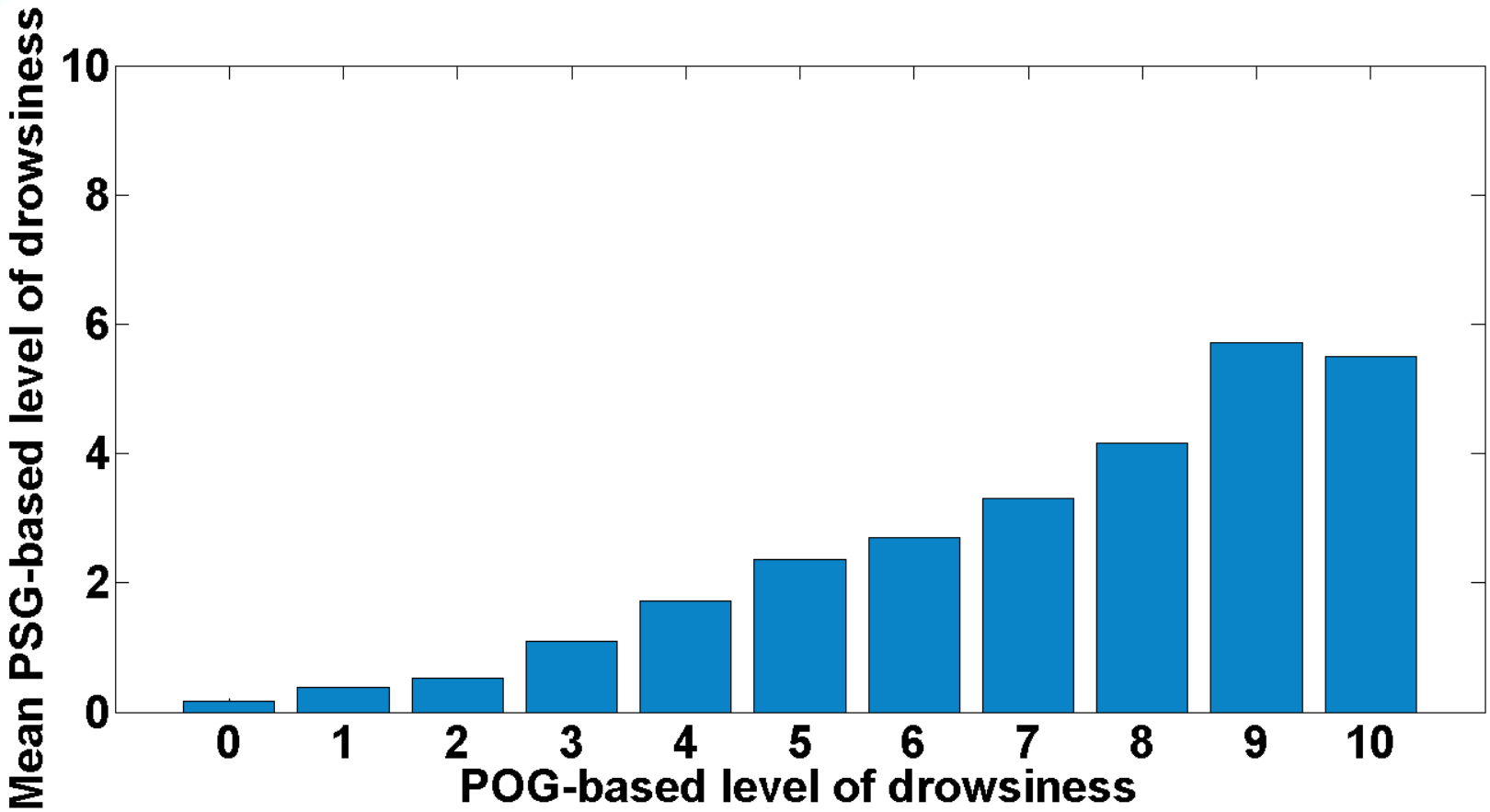
Standard deviation of the lateral position of the vehicle on the road (SDLP)

Physiological reference

Performance reference

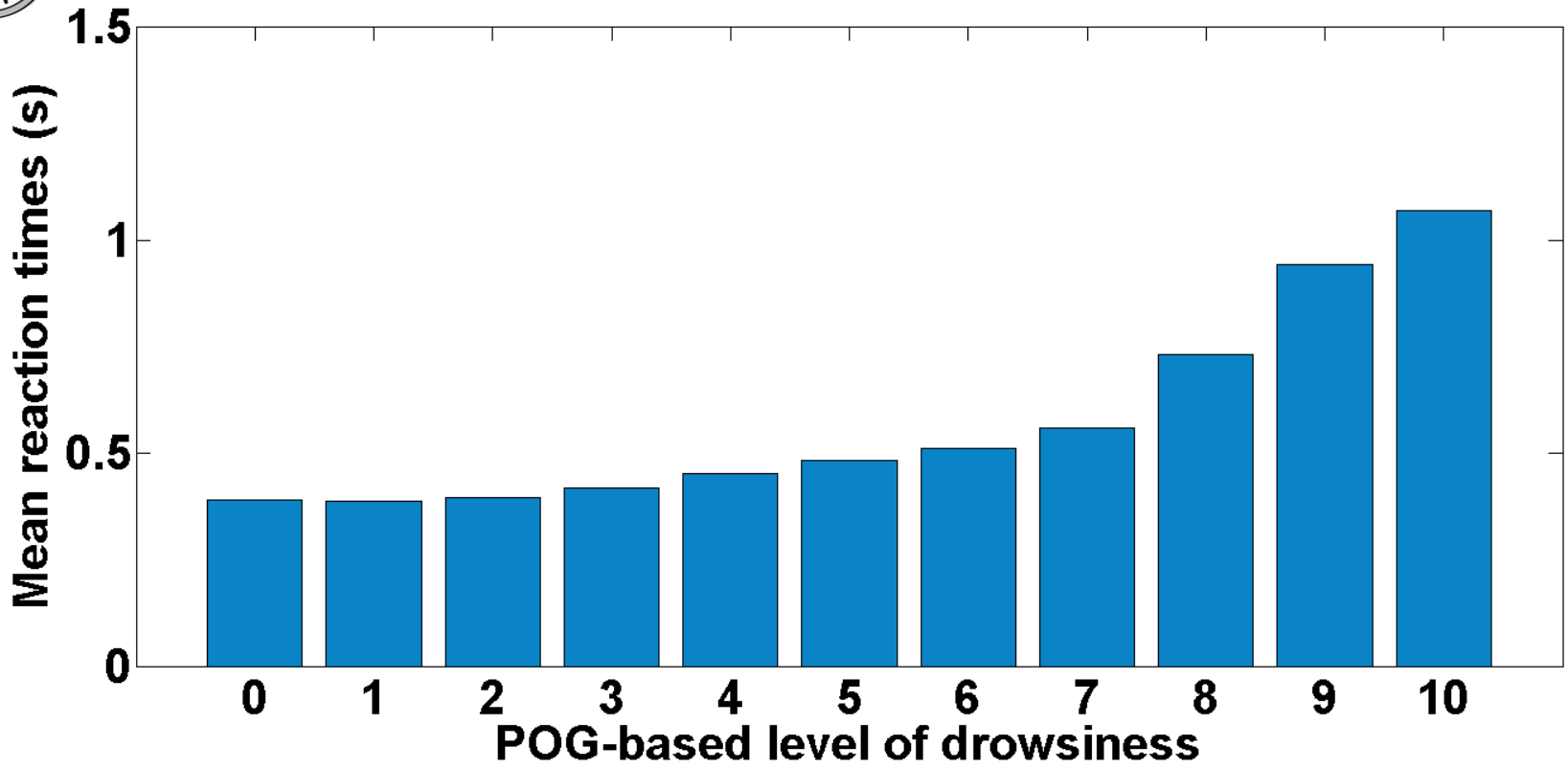
Validation - Results POG vs PSG





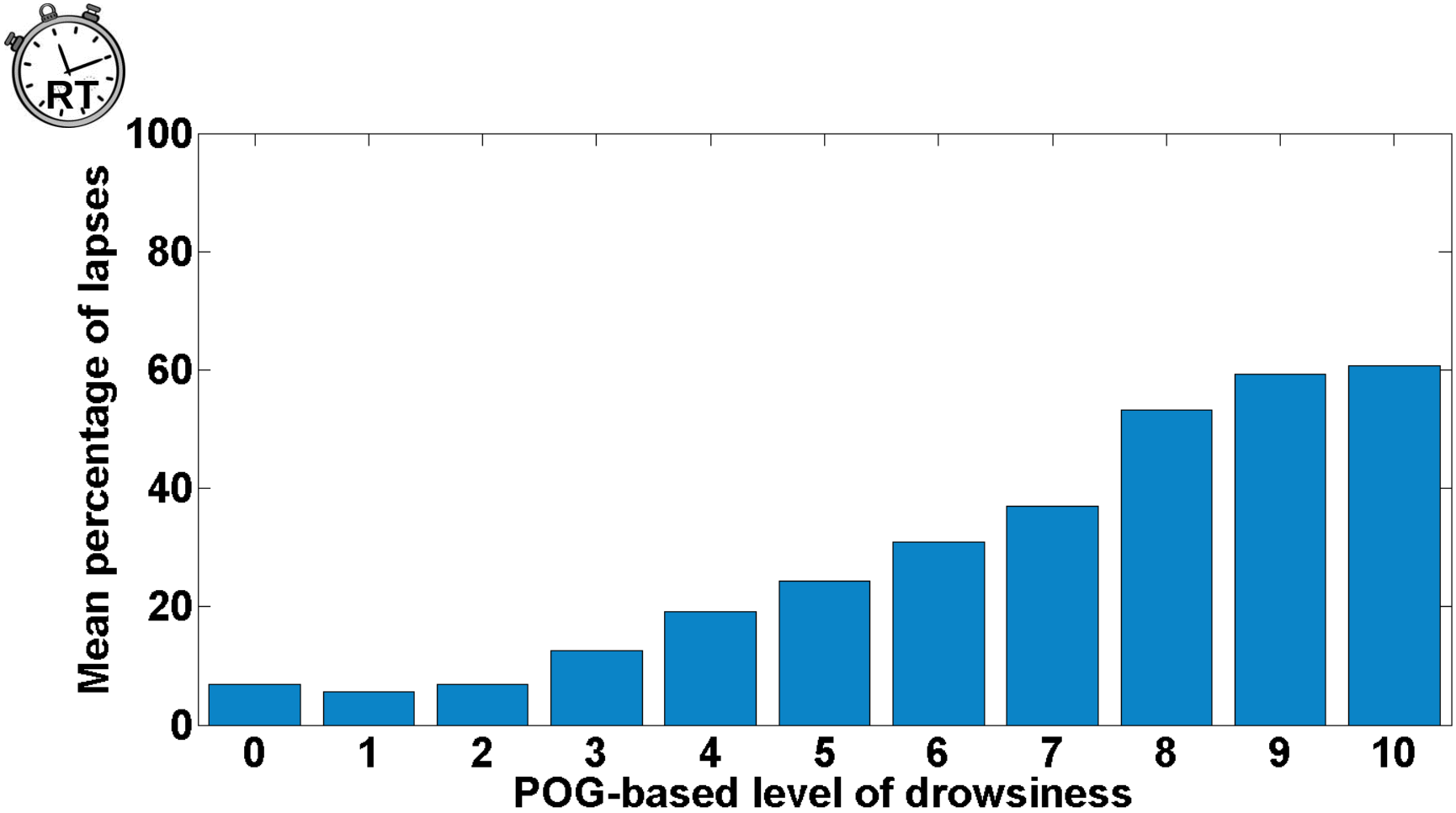
n = 1876 epochs of 1 min (27 subjects)

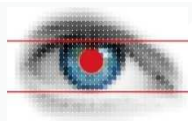
Validation - Results POG vs PVT



n = 17476 stimuli (27 subjects)

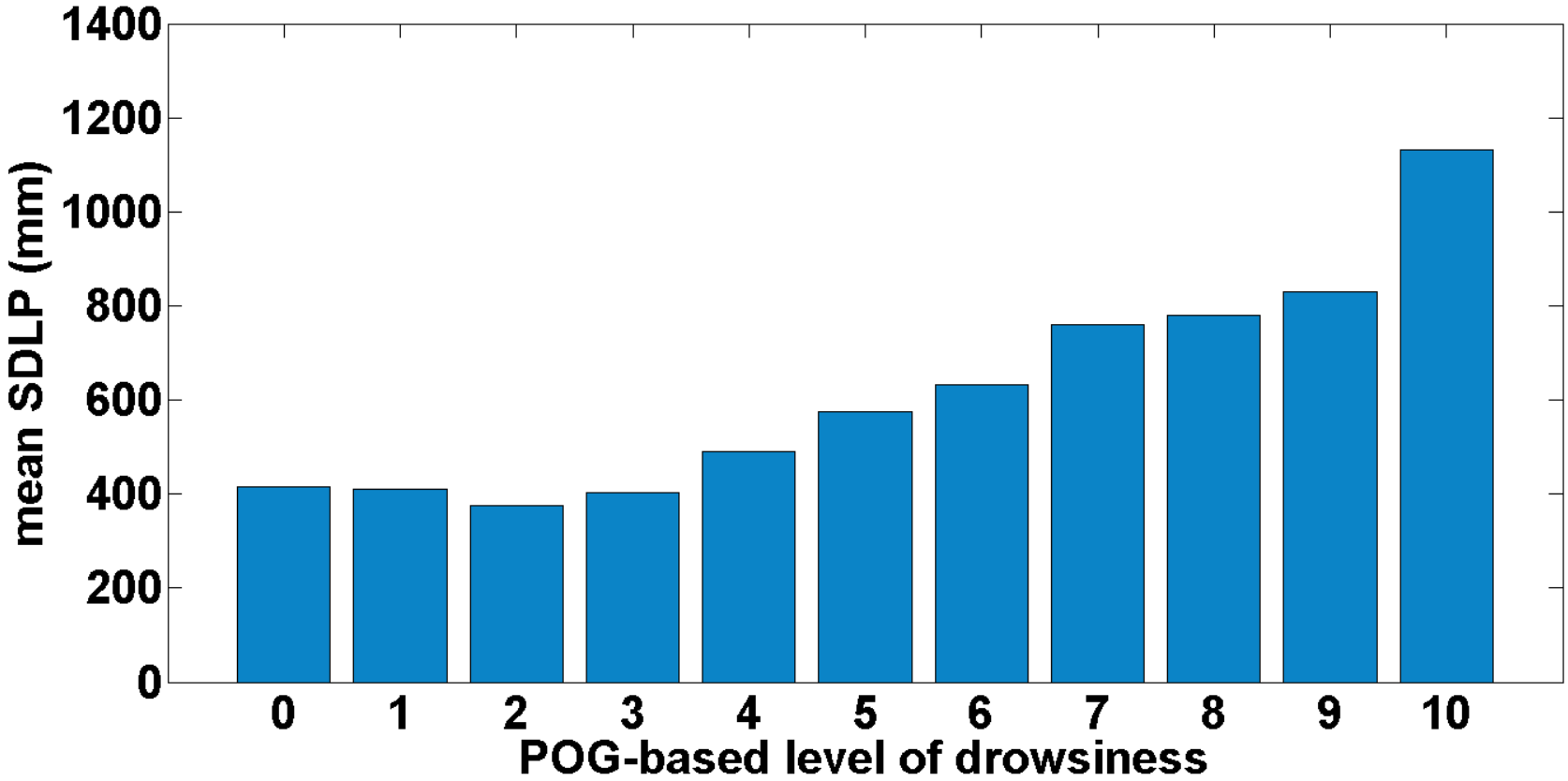
Validation - Results POG vs PVT





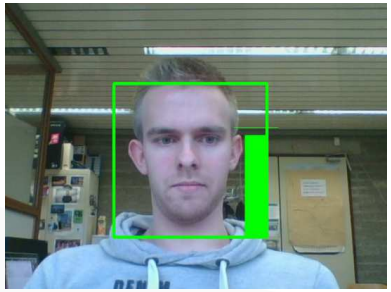
n = 1876 epochs of 1 min (27 subjects)

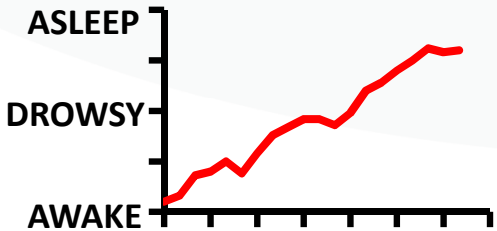
Validation - Results POG vs Driving



n = 3266 epochs of 1 min (12 subjects)

Our remote system - demonstrator





Acquisition

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Face images

Processing

↓

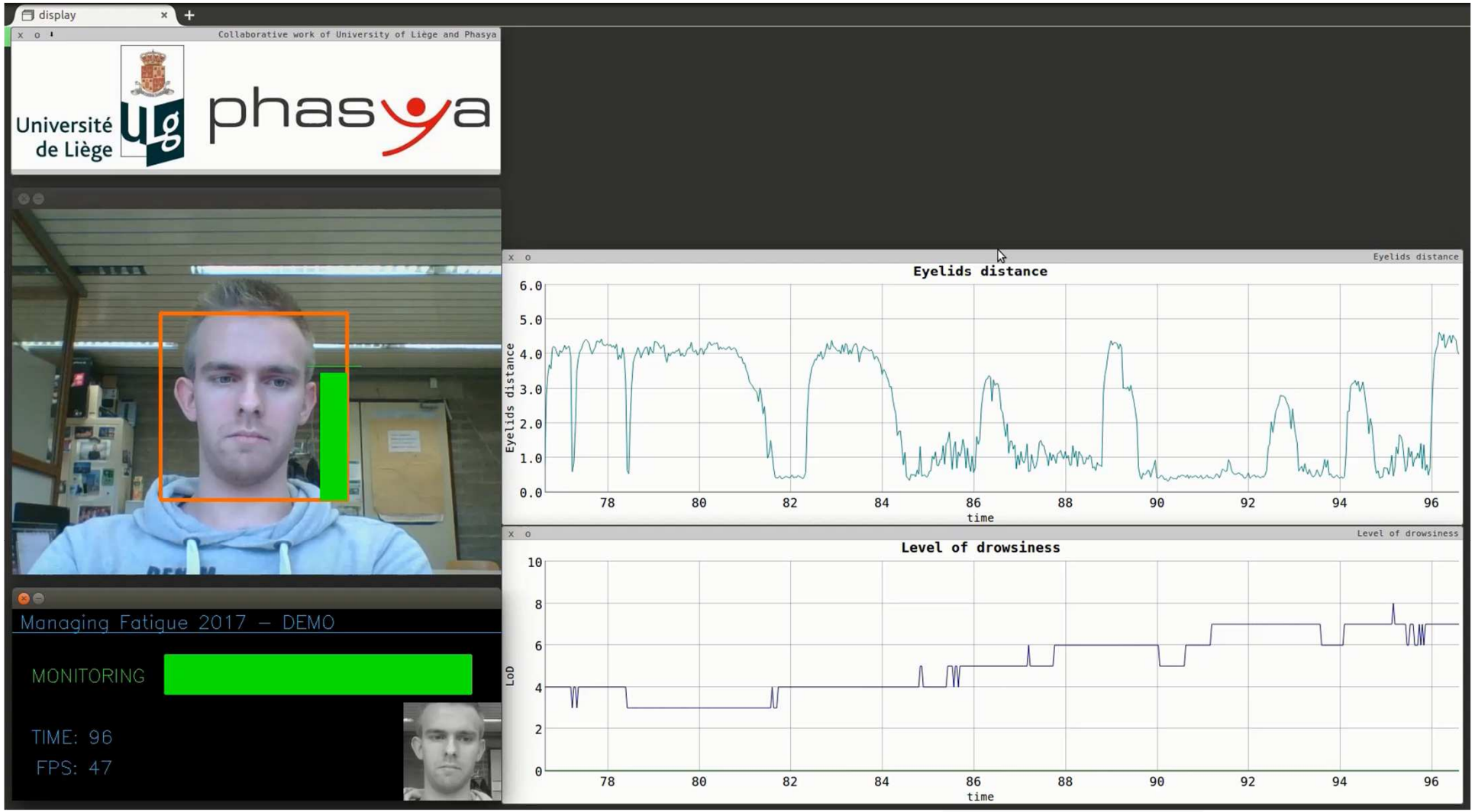
Ocular parameters

LoD computation

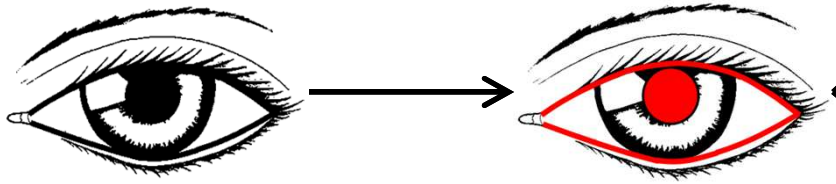
↓

POG-based LoD

Our remote system - Video



On-going R&D projects



MIND WANDERING

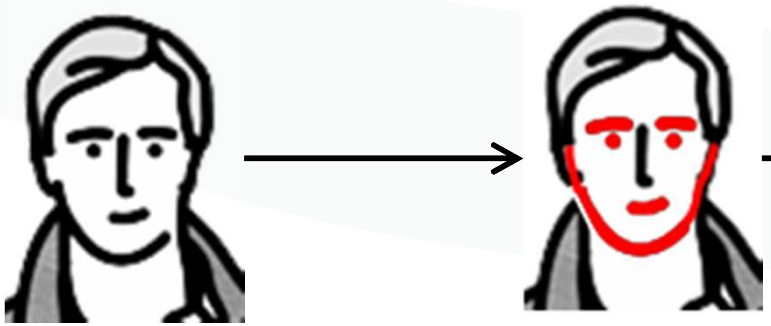
With Univ. Liège – Dpt. of Psychology
A. D'Argembeau (PhD)

CONSCIOUSNESS

With Univ. Liège – Coma Science Group
S. Laureys (MD, Prof.)

DROWSINESS PREDICTION

With Univ. Liège – Dpt. of engineering
J. Verly (Prof.)



DROWSINESS

With Univ. Liège – Dpt. of engineering
J. Verly (Prof.)

Vision

Devices

Physio./Cogn. states

DROWSINESS

STRESS

MIND WANDERING

CONSCIOUSNESS

…

Applications

SAFETY

MEDICAL

EDUCATION

…

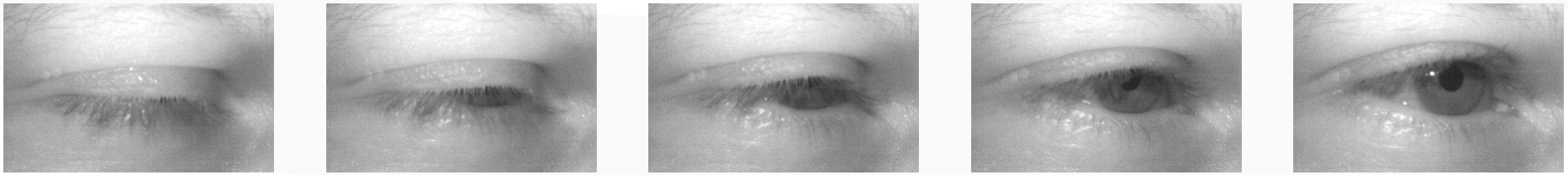
Why Phasya?

- Focus on physiological/cognitive states
- 8 years of experience
- Multidisciplinary approach (not only engineering)
- From idea to product
- Innovative company
- Continuous R&D

MIT Technology Review INNOVATORS UNDER 35

Université de Liège

Thank you !



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