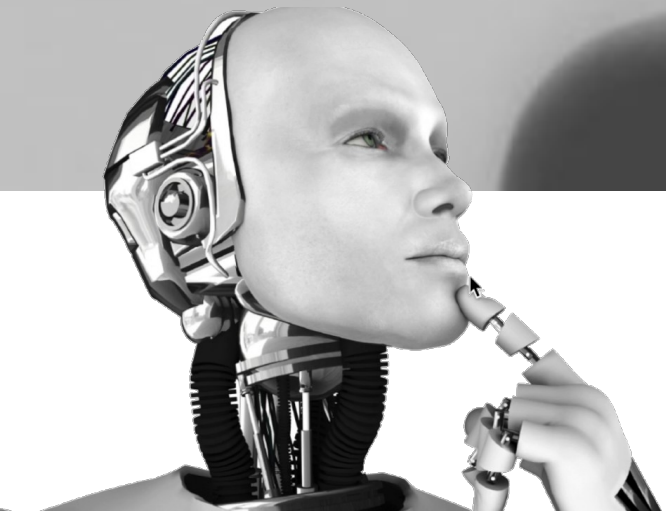


# CyberTherapy: The use of VR and Artificial Intelligence in the Psychological Practice



Giorgio M. Grasso  
Università degli Studi di Messina

# Cyber-Therapy

Cyber therapy can be defined as the use of innovative technologies that help traditional therapy in the clinical field of psychology.

Its effectiveness is mainly due to:

1. its imaginative power, which allows patients to experience real situations
2. the ability to actively perceive one's body within a simulated environment (i.e., virtual reality - based on VR)
3. its connectivity



Virtual Reality allows the subject to feel immersed in a temporally and spatially different place, thanks to the technological setup capable of processing the visual-sound information and returning it to the subject in real time.

# Cyber-Therapy



Social Phobia



Arachnophobia



PTSD

Bringing a person into a stressful virtual situation increases heart rate, increased skin conductance and other body responses such as the real-world situation

CBT



CBT+VR

For these reasons, recent studies show that cyber therapy allows the patient to obtain better results than traditional therapy. It is used to treat anxiety or specific phobias such as fear of public speaking, arachnophobia, and post-traumatic stress disorder.

# Post-Traumatic Stress Disorder

The use of VR technology in the clinical setting is a valid support for memory or imagination helping the user to face the feared situation.



The therapy has been shown to be highly effective in treating PTSD, in which there is constant fear generated by a previous trauma. Here mental images, for example flashbacks, intrusive images, memories, play an important influence in the amplification of emotions.

VRET aims to access memory, thoughts and traumatic behaviors to induce positive responses that allow the user to cope with fear



# Post-Traumatic Stress Disorder



However, this disorder is also present in other situations, such as a ROAD ACCIDENT. For example, in the United States, there are approximately 77 accidents per 100,000,000 miles.

Wald et al. (2004); Beck et al. (2007); Gamito et al. (2008); Kaussen et al. (2020)

# Our preliminary research

Based on previous studies, we propose to build a virtual environment where the exposure to fear related scenario is dynamically calibrated to the level of tolerance of the patient, established from the analysis of his psychophysiological response. This tool can be used by psychologists to create an Avoidance Hierarchy of stressful situations based on the analysis of psychophysiological signals, which can be automatically used to establish the exposure to progressively stressful (i.e., anxiety generator) scenarios, as the level of tolerance to the previous one increases.

# Our preliminary research

In our experimental setup we use a virtual reality driving simulator (based on the VR headset “Oculus Rift”), equipped with rotation and position sensors and integrated headphones, that provide a 3D audio effect. The driving simulator is composed of a steering wheel with force feedback and pedals (Logitech G27), combined around a real car seat, used to provide a full driving experience during the simulation

# Experimental Gear



We use an hardware setup composed by:

- Logitech steering wheel with force feedback
- Logitech pedals
- Logitech gearshift
- HMD for virtual reality (Oculus Rift)
- Graphics workstation, equipped with NVIDIA Titan X GPU (11GB)
- Real adjustable car seat
- Custom made support platfor

# Experimental Gear

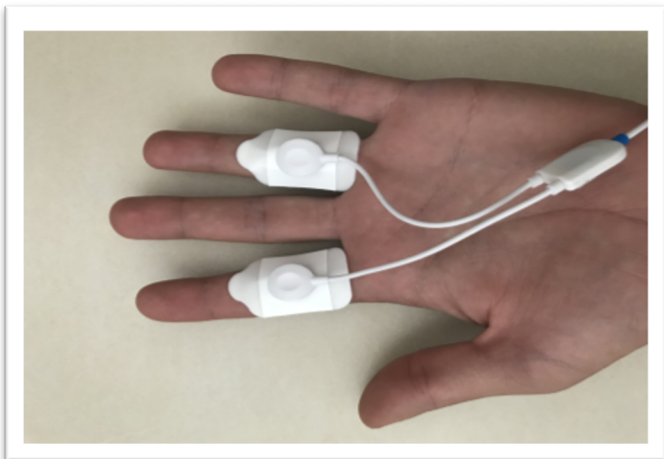


We use the BioSignalsPlux Kit:

- electrocardiogram ECG
- Respiration
- electrodermal activity EDA

Electrocardiogram allows us to measure the electrical activity of the heart using electrodes placed on the skin, which enables the detection of small electrical changes during each cardiac cycle;

Electrodermal activity (EDA) records attentional, affective and motivational processes through bodily responses. In particular, the skin conductance level (SCL) and the Respiration rate are reliable measures of the degree of stress.



# Experimental Gear

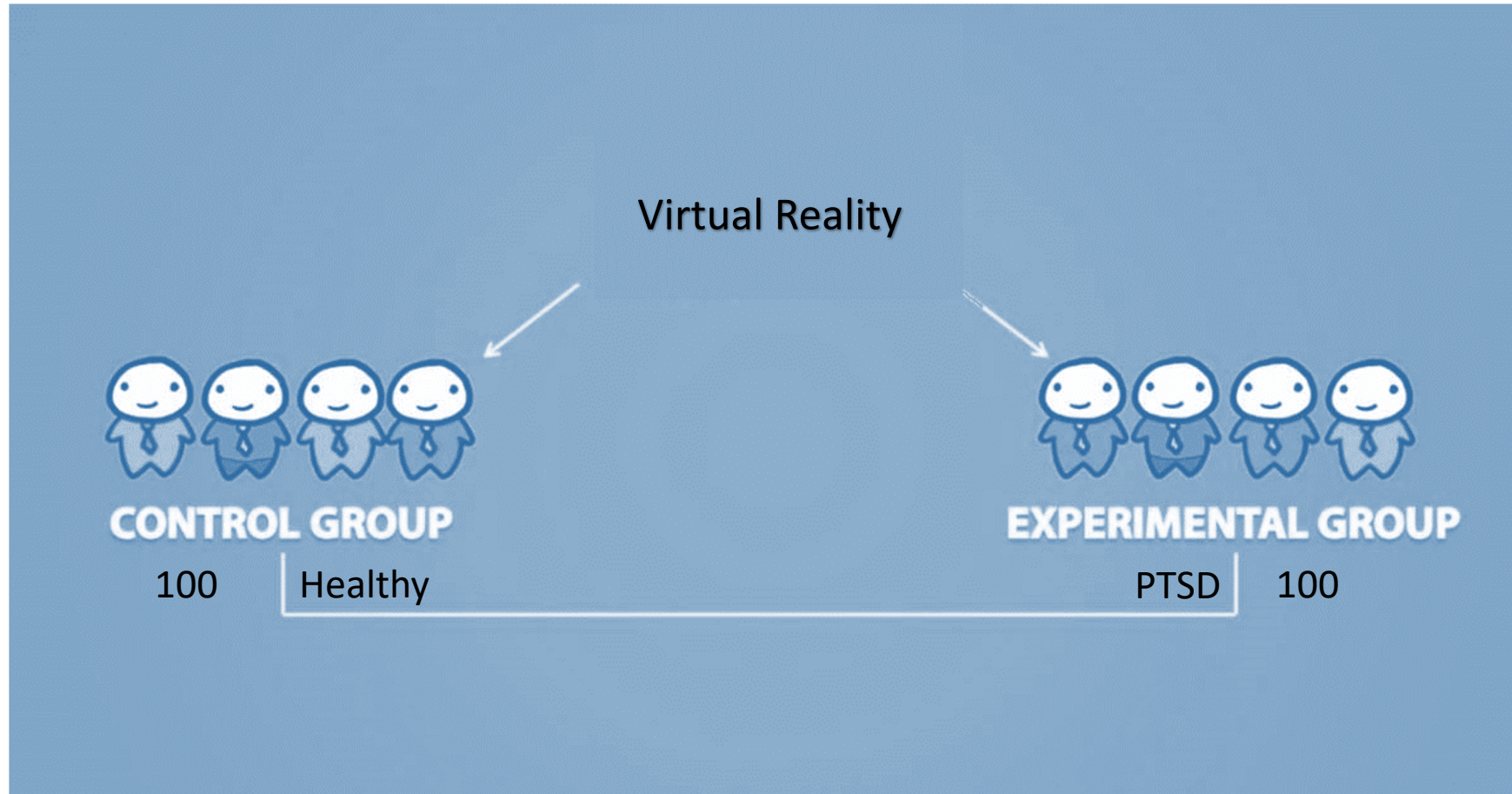


We use the computer graphics software Unity Engine 3d (18.4.22), with Windridge City for AirSim as scenario to build highly immersive and realistic virtual scenarios





# Procedure



Currently, for our prototype, we have outlined 15 scenarios of stressful driving situations, divided into 3 groups.

# Prototype



**Soft group:** driving in adverse weather and / or heavy traffic conditions.



**Mid-Hard group:** driving while an accident occurs that does not involve the driver.



**Difficult group:** driving into an accident that involves the driver

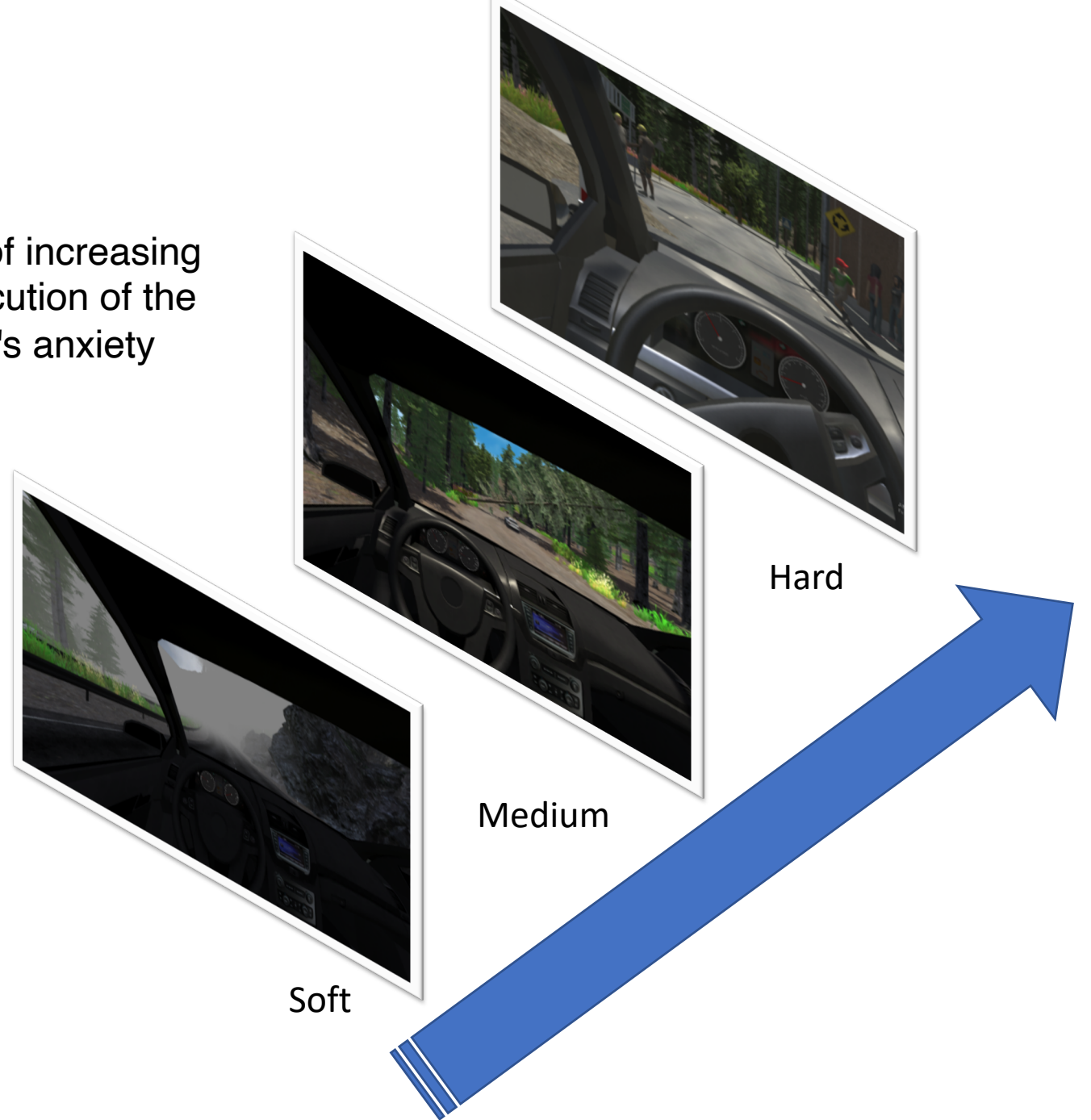




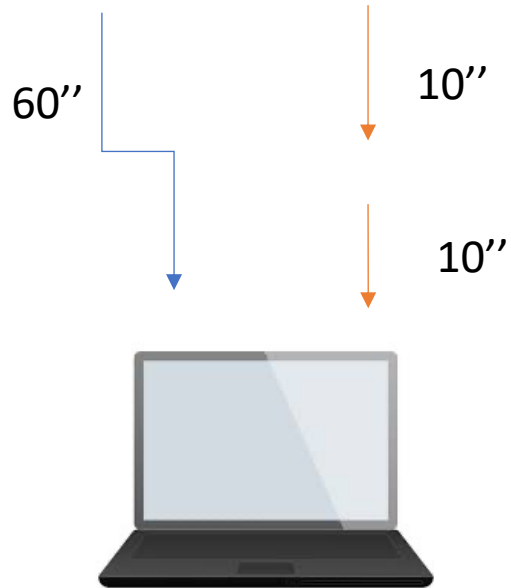
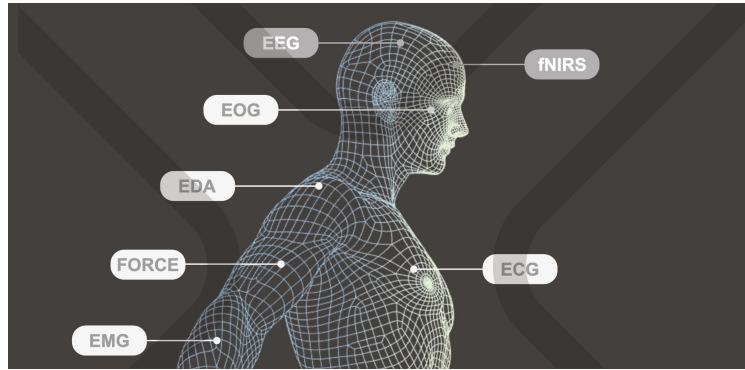


# Procedure

Our scenarios will be combined creating an order of increasing difficulty (easy-medium-hard), but the order of execution of the scenarios can be changed according to the patient's anxiety state.

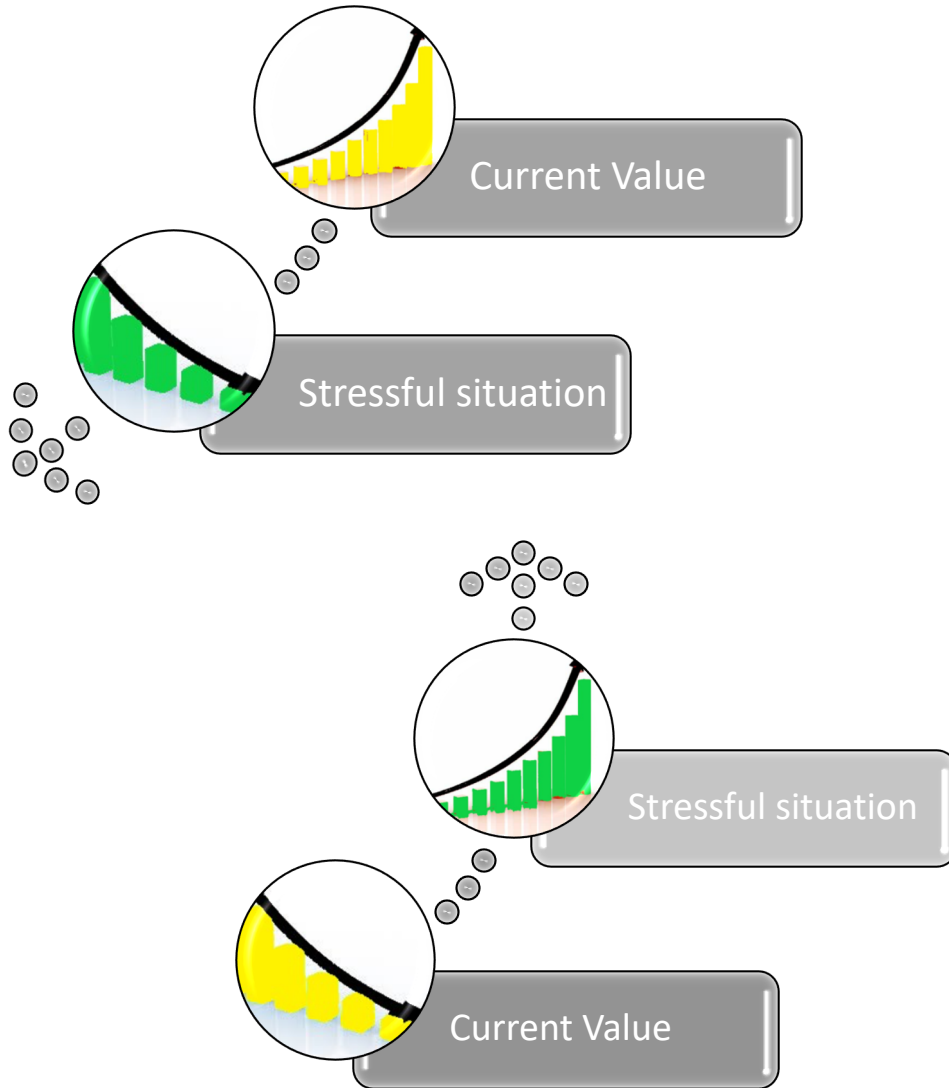


# Implementation



1. Impact of Event Scale IES (0-4)
2. Baseline 60 seconds
3. Patient vital sign 10 seconds

# Implementation

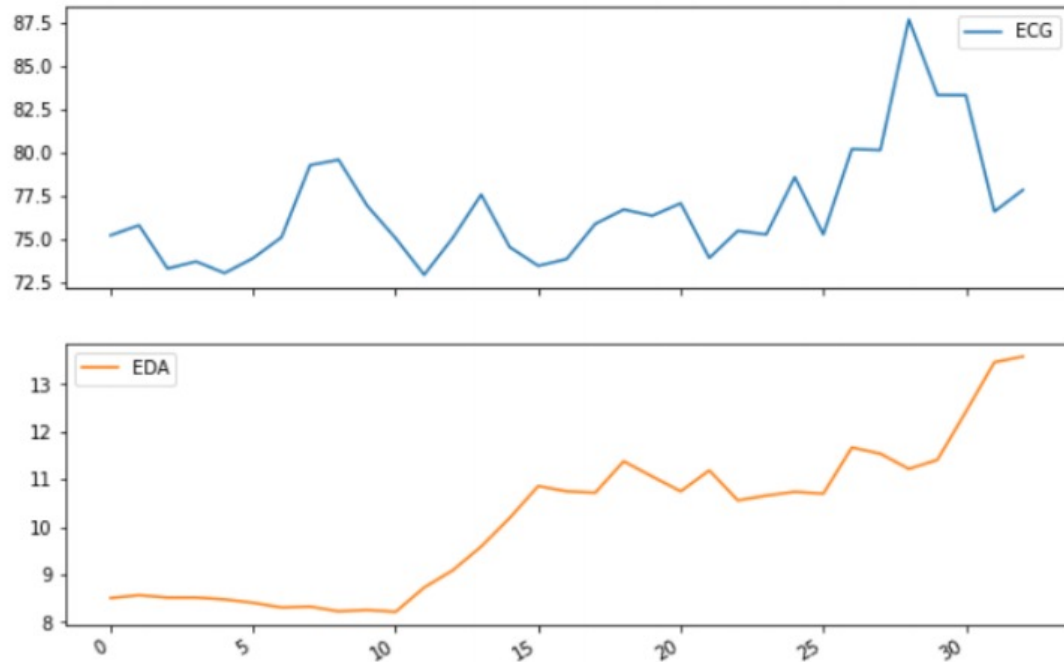


When the difference between the current value and the baseline is greater, the road situation changes to a less extreme situation.

If the user is relaxed, there will not be many differences between the baseline and the current value, so the simulation environment offers phobic stimuli with an increasing level of difficulty.



# Preliminary Results



So far, we have performed tests on only one person from the non-clinical population. The user was subjected to 3 scenarios belonging to 2 different levels:

Easy : driving in adverse weather conditions

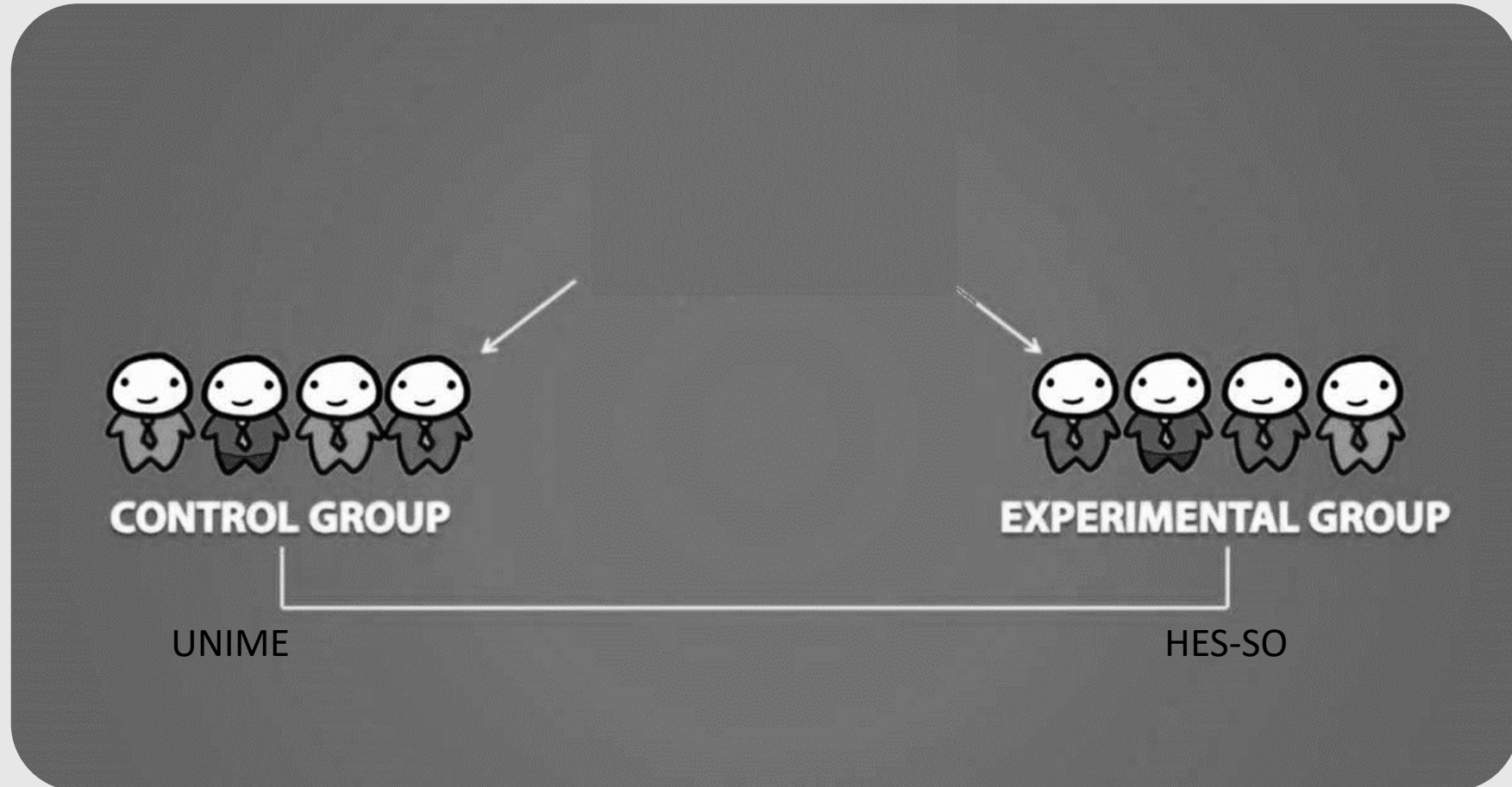
Medium: side impact between two vehicles

Medium: falling of a tree

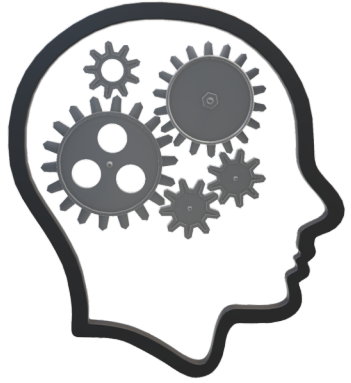
The results showed a slight increase in ECG signals and a noticeable change in SCL as user transition from easy to medium level.

Motion Sickness as important limitation of the study.

# Future Development



# Conclusion



To improve the success of CyberTherapy could be useful both for the user, to face his own fear independently, and for the psychologist, to know in real time the user's degree of fear and to intervene easily. We believe that building a phobic stimulus that changes based on the user's stress can allow the patient to feel safe, within the environment, which is essential for the success of the therapy.



# NISC Lab

Laboratorio di Neuro-Informatica  
e Scienze Cognitive



Università degli Studi  
di Messina