Using the Pepper Robot in Cognitive Stimulation Therapy for People with Mild Cognitive Impairment and Mild Dementia

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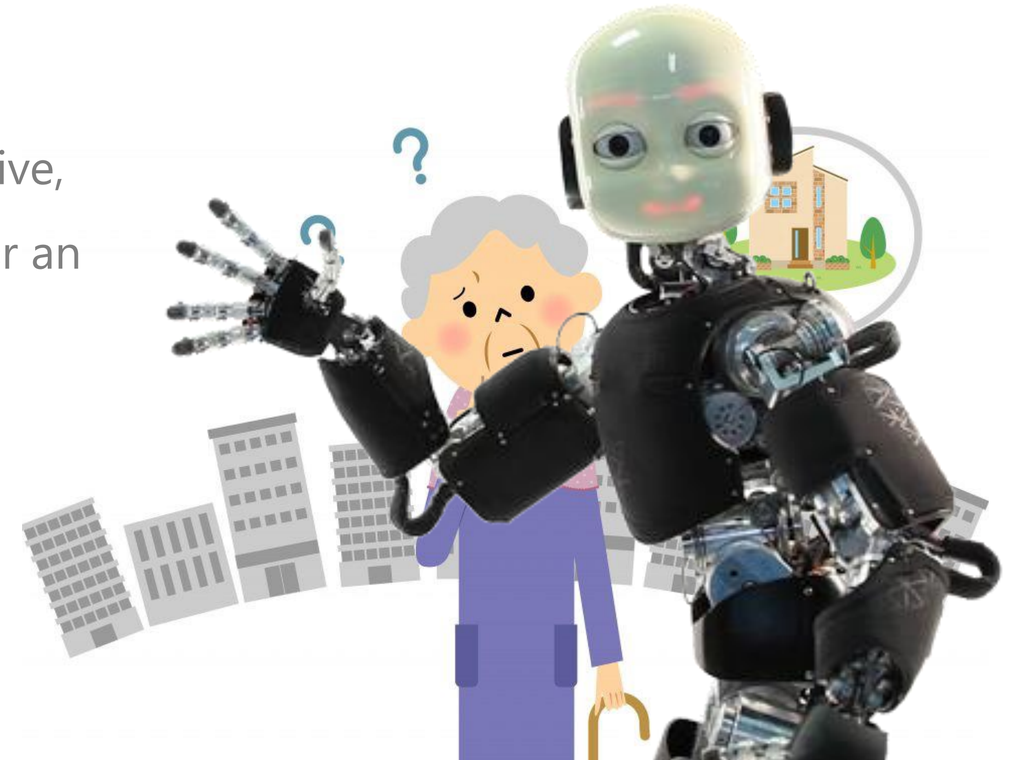
MILD COGNITIVE IMPAIRMENT AND MILD DEMENTIA

Mild Cognitive Impairment and **Mild Dementia** are diseases, common in elderly, characterized by cognitive impairment and poor performance on objective cognitive assessments that represents a decline from the past

Socially Assistive Robotics is a field of robotics that focuses on assisting users through social rather than physical interaction
Socially assistive robots provide the appropriate emotional, cognitive, and social cues to encourage development, learning, or therapy for an individual



“Are Social Robots a suitable technology for cognitive stimulation?”

THE PROPOSED STUDY:

Development of a set of therapeutic interventions performed using the Social Robot Pepper to stimulate patients cognitively and to assess and compare the results of this intervention with the one made by human therapists

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THE EXPERIMENTAL STUDY

Planned: 2 conditions:

a. 4-weeks cognitive stimulation sessions with the Social Robot Pepper

b. 4-weeks cognitive stimulation sessions with a control group with a human therapist considering a weekly meeting of about 35 minutes in both conditions

Due to the **COVID-19 emergency**:

- The experiment with Pepper was interrupted one session earlier
- It was not possible to compare Pepper's sessions with those of the control group

PARTICIPANTS

Before the start of the experiment:

- Mini Mental State Examination (MMSE)
- Participants and their legal representatives signed their **consent** to participate and be videorecorded during the sessions

The sampling was carried out by selecting a group of 8 elderly people, considering patients with Mini Mental State Examination scores that indicate **Mild Cognitive Impairment or Mild Dementia**

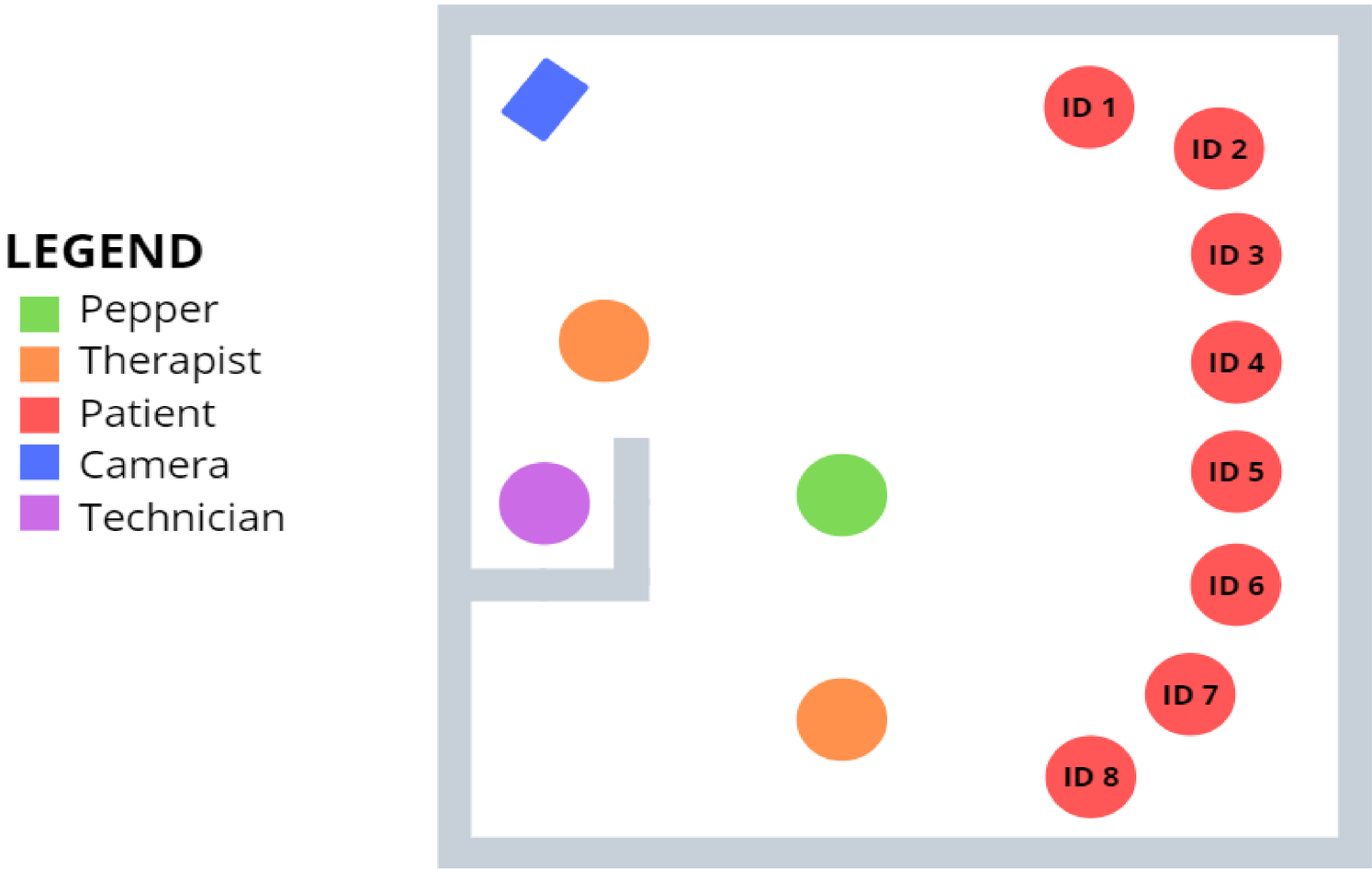
The selected patients were:

- 5 women and 3 men
- most of them acquired only the third-grade diploma
- avg age 79.88 y.o
- deficits in cognitive state, memory of prose, speech

ID	Gender	Age	MMSE
1	F	89	23.4
2	F	77	26.2
3	M	82	24.1
4	M	89	21.1
5	M	82	13.0
6	F	79	13.2
7	F	69	20
8	F	72	17

SETTING THE ENVIRONMENT

We chose to conduct the experiment in the room in which usually patients carried out musical sessions

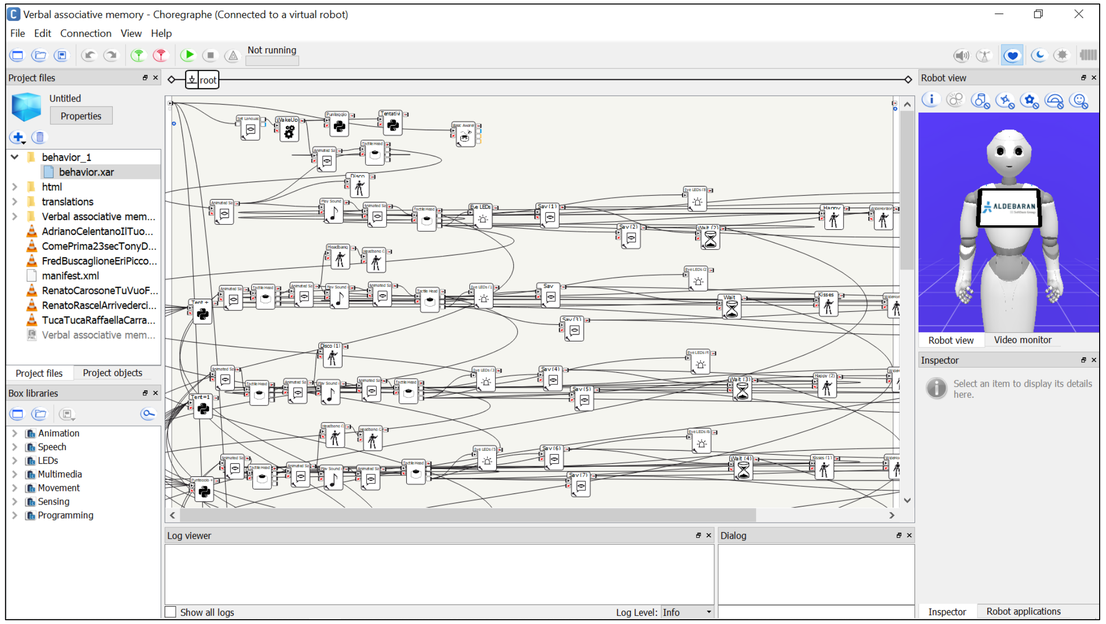


TASKS

The tasks to be performed were taken essentially from the volumes of "**A Gym for the Mind**" and they were developed using **Choregraphe** programming environment for Pepper

The chosen tasks are:

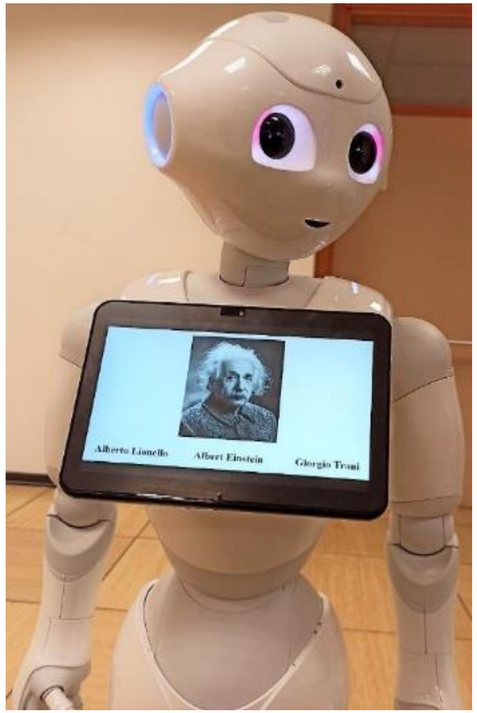
- Motor imitations (opening each session)
- Verbal associative memory (closing each session)
- Word completion (on the first session)
- Memory of prose (on the second and third sessions)
- Visual-verbal associative memory (on the third session)

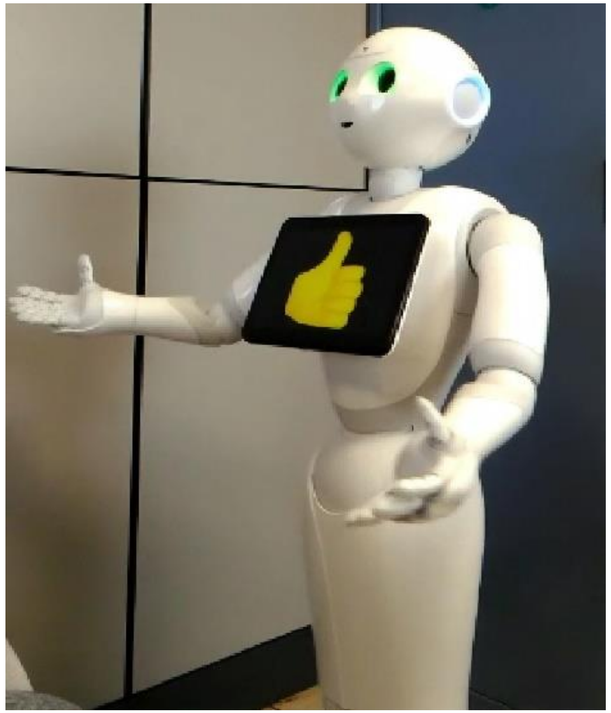


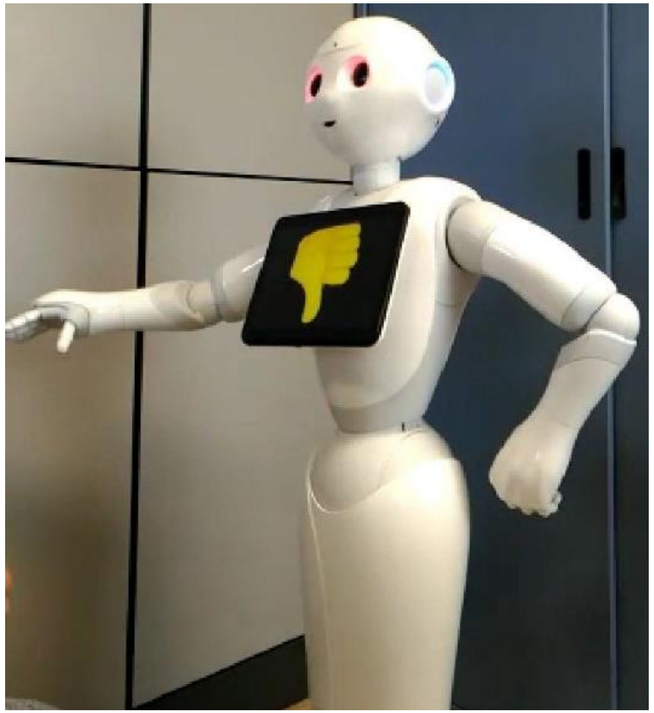
AN EXAMPLE OF MOTOR IMITATIONS TASK

ROBOT SETTINGS

Pepper has been set up to use the **sensors** on the head, the **tablet**, **eyes LEDs** and **body movements**







ANALYSES ON RECORDED VIDEOS

MEASURES:

- Answers given by the patients for each task
- Engagement of each patient's computed as nr. of eye gaze towards Pepper
- Expressed emotions: **happiness, sadness, fear, disgust, anger, surprise, neutral**
- Possible linear correlations among the collected data

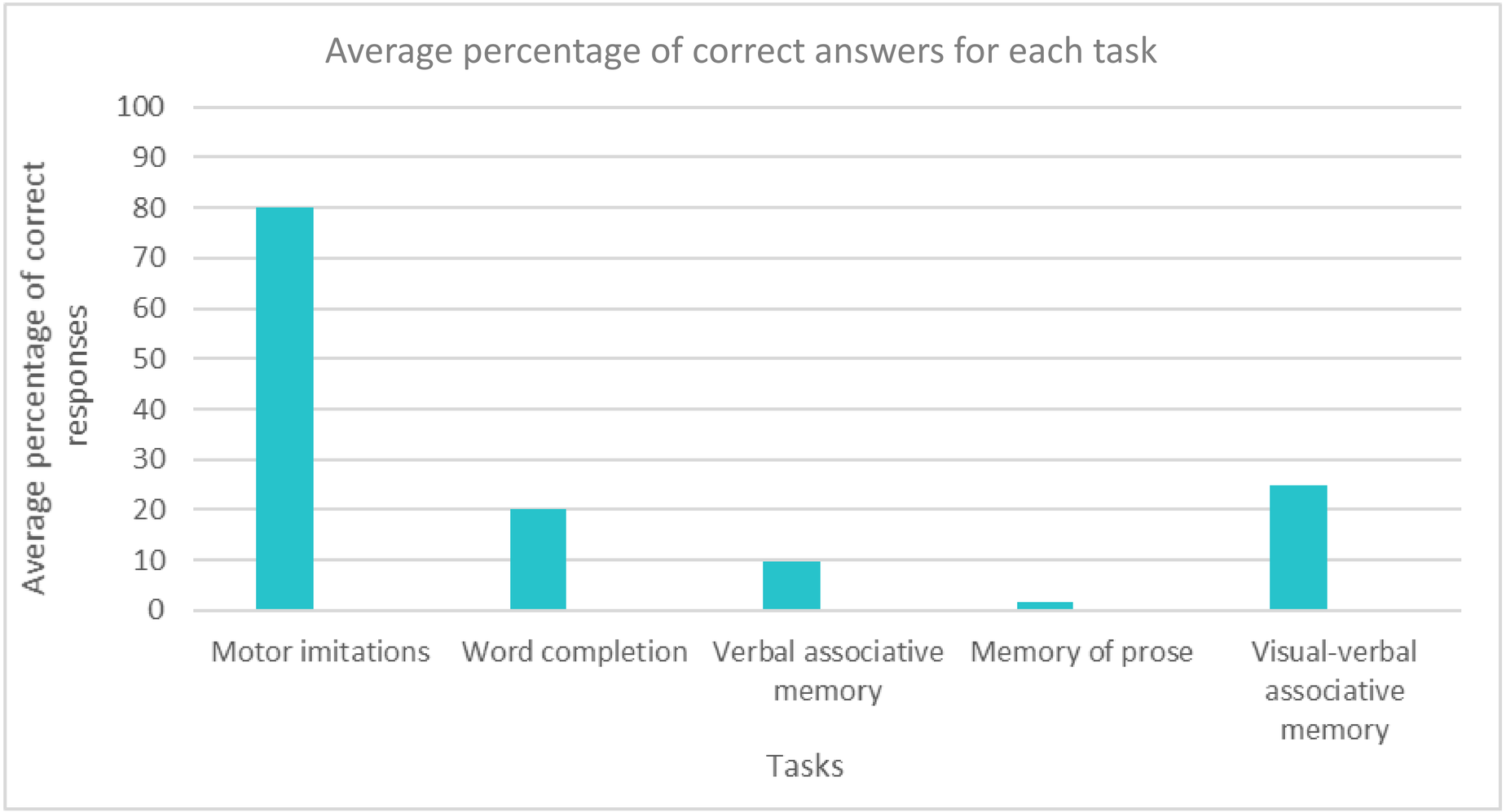
ANNOTATION:

Three observers, trained on the **Facial Action Coding System,** of average age 37.67 annotated the **correct answers, nr. of eye gazes and emotions** experienced by each elderly person

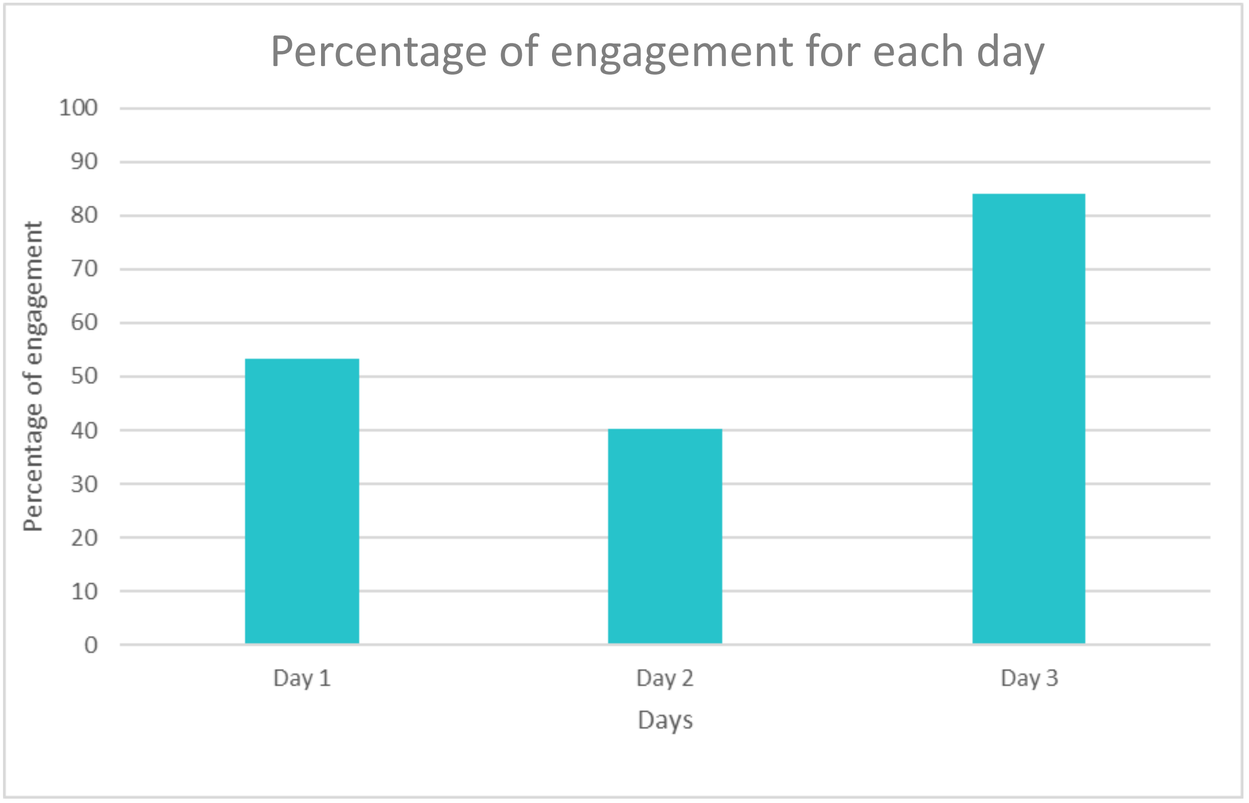
The raters had an almost perfect agreement index (0.83), calculated through the Fleiss' Kappa

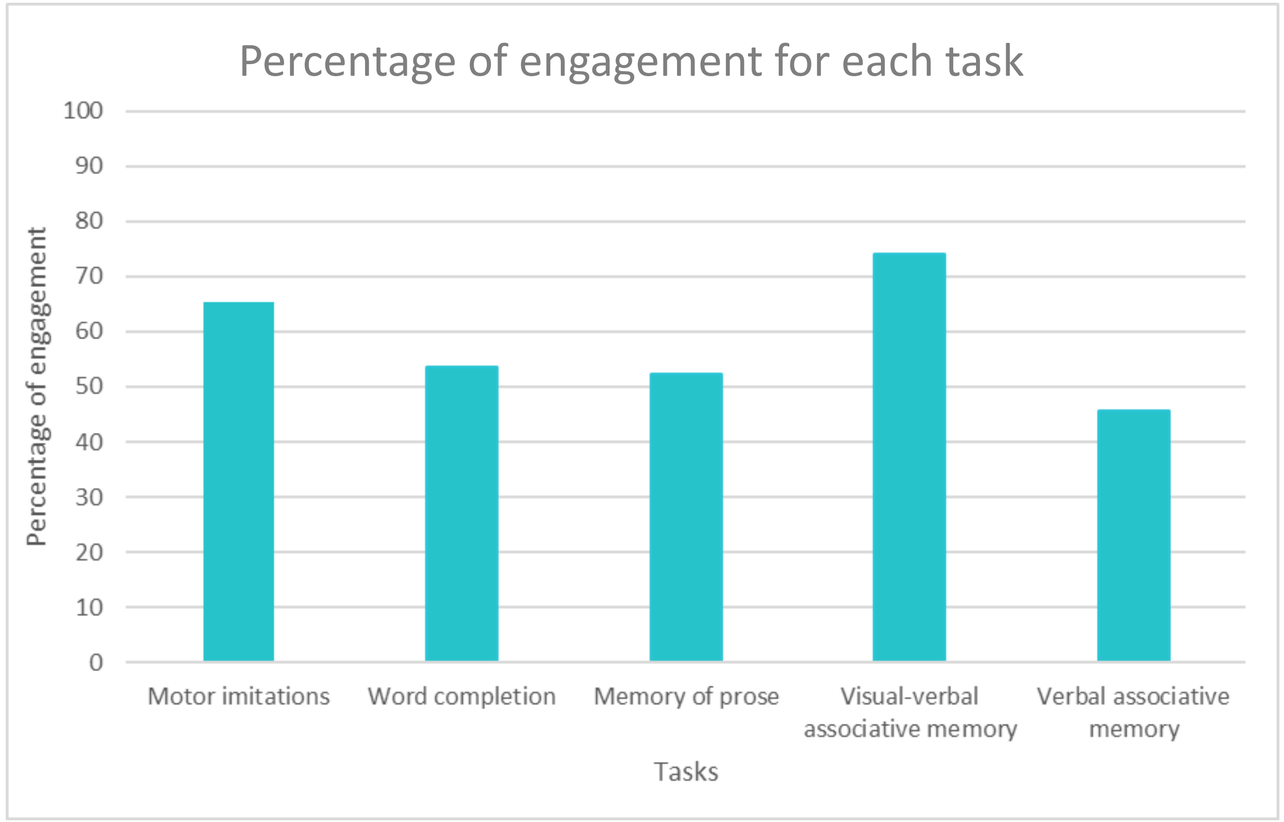
FACE ANALYSIS – an example

ANALYSIS OF CORRECT ANSWERS FOR EACH TASK

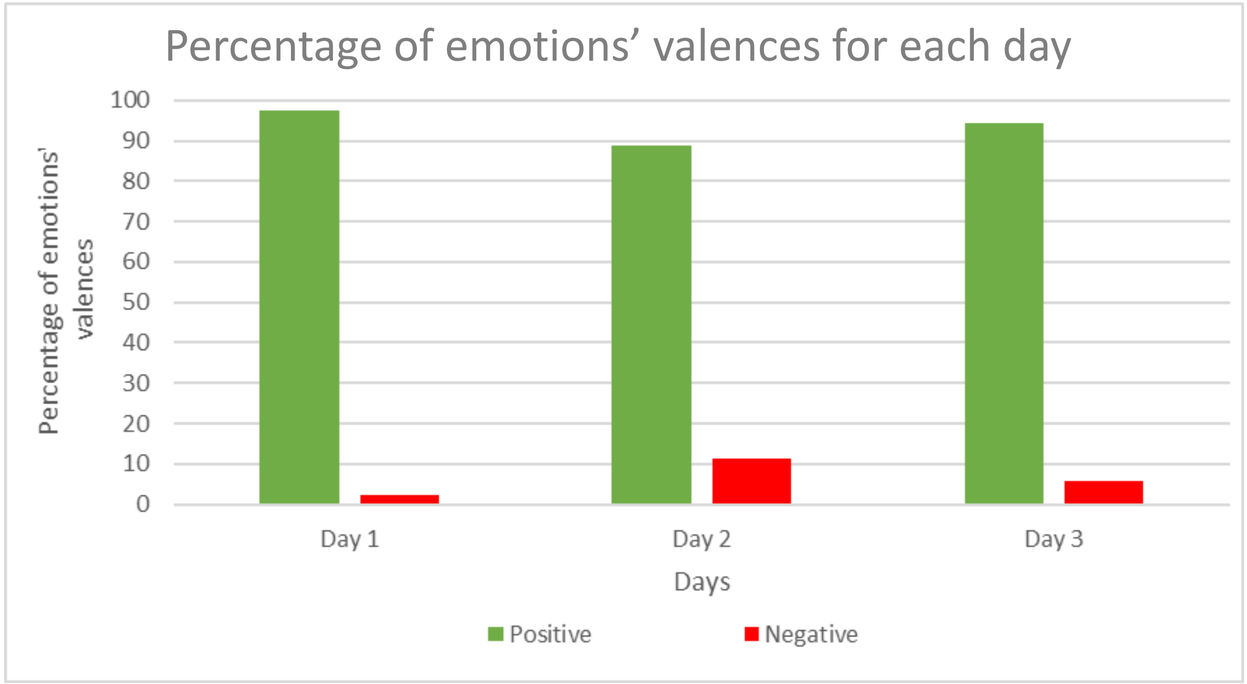


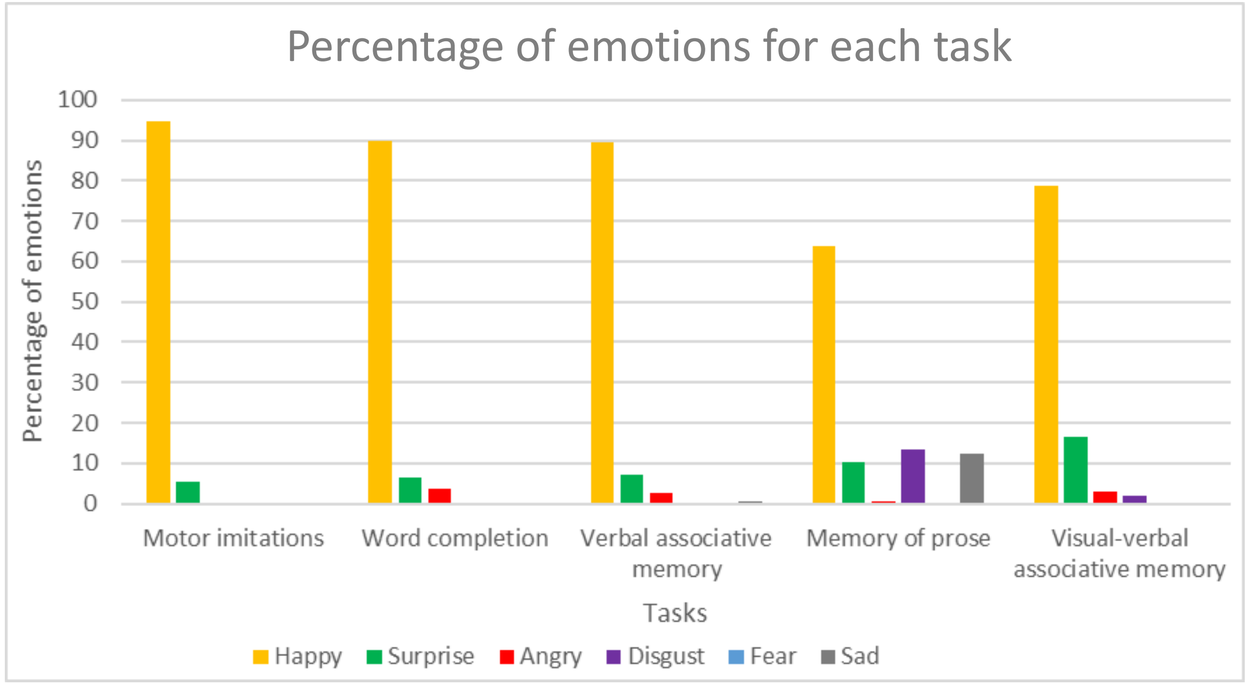
EYE GAZE ANALYSIS





ANALYSIS OF EMOTIONS





CORRELATIONS RESULTS

The Pearson Correlation Coefficient was used to evaluate possible correlations between the results of neuropsychological assessments, emotions and engagement.

	NEUTRAL	HAPPY	SURPRISE	ANGRY	DISGUST	FEAR	SAD	EYE GAZE
MMSE	0.70**	-0.80**	0.06	0.09	-0.47*	-0.22	-0.26	0.42**

CONCLUSIONS AND FUTURE WORK

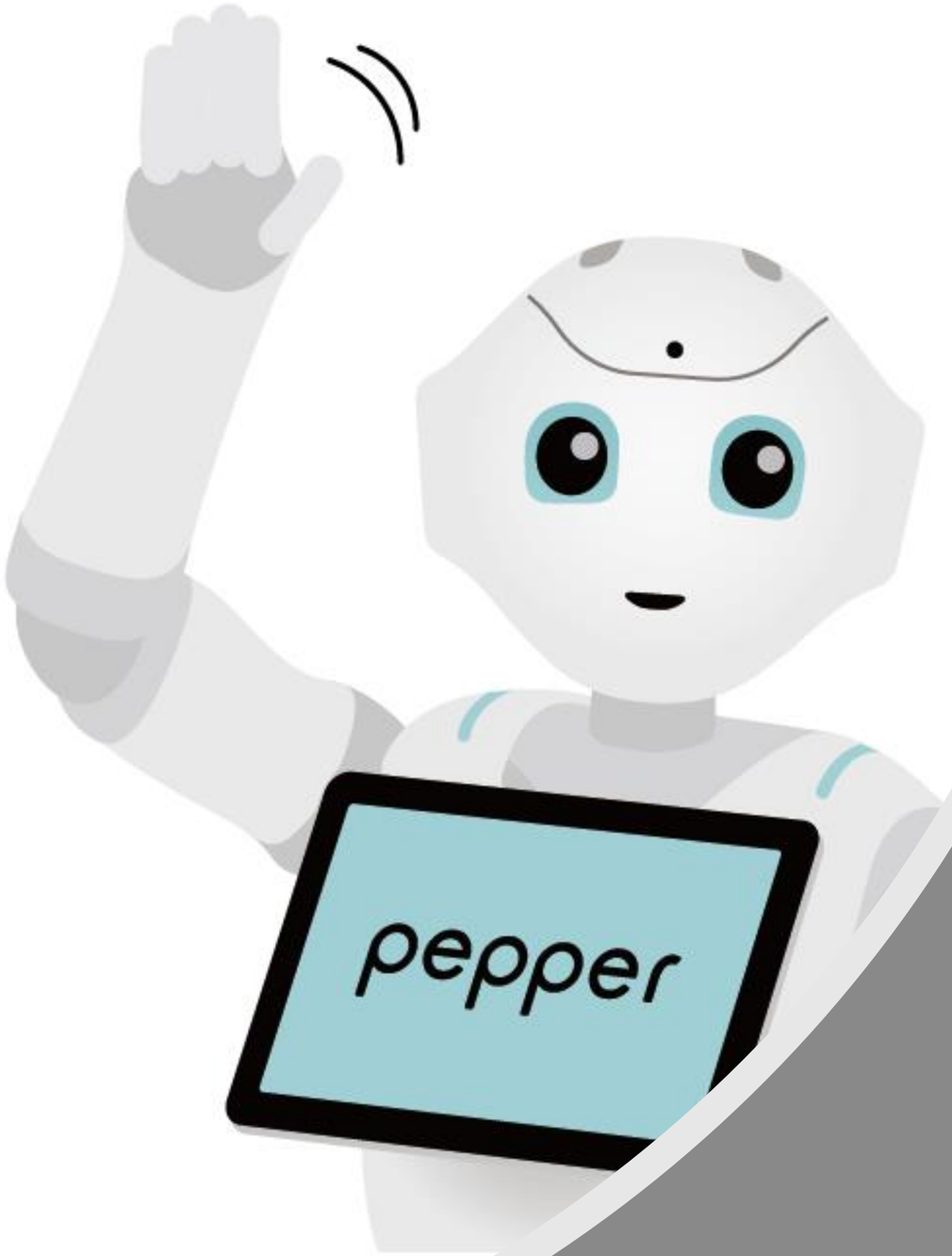
- ✓ Pepper seems to be a suitable technology for cognitive stimulation therapy
- ✓ Seniors with a milder cognitive impairment are more engaged during the experiment but tend to be less happy during the sessions

However, we are aware in our future work we need to:

- Reproduce the same study with a larger number of patients and annotators
- Carry out analyses on the differences in behavior between women and men
- Make the comparison with a control group

Moreover,

- Develop a software for automatic analysis of engagement and emotions from facial expressions specifically trained on elderly faces



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