



# **THE MENTAL SCREENING-360° (MS-360°)**

***A SCREENING TEST FOR AN ECOLOGICAL  
ASSESSMENT OF EVERYDAY COGNITIVE  
FUNCTIONING***

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# A Multicentric Collaboration



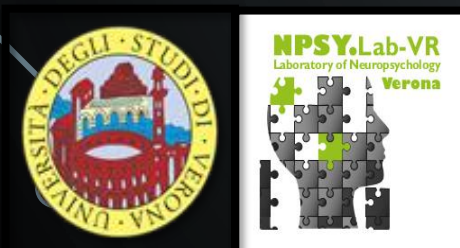
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# Introduction

- **Dissociation** between the performance showed by patients during the neuropsychological evaluation and their everyday cognitive functioning (Mondini et al., 2016, p. 117)



- Difficulties emerged during the psychometric testing / No difficulties in the everyday functioning
- Normal performance showed in the psychometric testing / Difficulties in everyday functioning
- Chaytor and Schmitter-Edgecombe (2003): low to moderate value of neuropsychological tests in predicting everyday cognitive functioning

# Introduction

## Neuropsychological Test Design

- Most test are designed following a ***construct-driven approach***: to measure abstract cognitive constructs (e.g., working memory) without an explicit interest in predicting real-life functional abilities



## Ecological Validity

- This construct refers to the functional and predictive relationship between patients' performance on neuropsychological tests and real-life cognitive functioning (Sbordone, 1996) → better ecological value, better diagnostic/prognostic indexes



## A Possible Solution

- ***Function-led approach***: building neuropsychological models derived from the observation of everyday behaviors, allowing the development of more ecological assessment procedures → can be very resource-intensive

# Introduction

## A Further Step: Virtual Reality (VR)

- Allows to realistically simulate the challenges of everyday life in a **controlled, standardized** and **safe** context (Schultheis et al., 2002; Parsons, 2015)
- **Immersivity and Presence** involve and motivate the patients to perform as naturally as possible



- Better compliance to the evaluation
- Higher Ecological Validity → More meaningful clinical information
  - Better prognostic indexes



# Introduction

## Which Kind of Virtual Environment (VE)?

- **Model-Based VEs:** scenarios implementing 3D computer-generated models which resembles real-life objects
- **360° Spheric VEs:** scenarios implementing spherical photos or videos which are captured from real-life environments



### Model-Based VEs

- + Totally Customizable
- + 6-DOF Interaction
- Specific know-how for the implementation
- Moderate graphic realism



### 360° Spheric VEs

- Not Customizable
- 3-DOF Interaction
- + Easy to implement
- + Photorealistic

# Designing the MS-360°

- 360° Spherical VEs were mainly used for the neuropsychological assessment of executive functioning (Serino et al., 2017; Realdon et al., 2019) and memory (Ventura et al., 2019; Pieri et al., 2021)

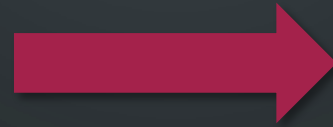


## **Mental Status 360° (MS-360°)**

- A pilot screening tool
  - 14 scenarios
- Tasks resembling everyday activities
- Familiarization Phase → Test Phase
  - Administration: 20 minutes

# Implementing the MS-360°

## MS-360° Implementation:



## MS-360° Administration:



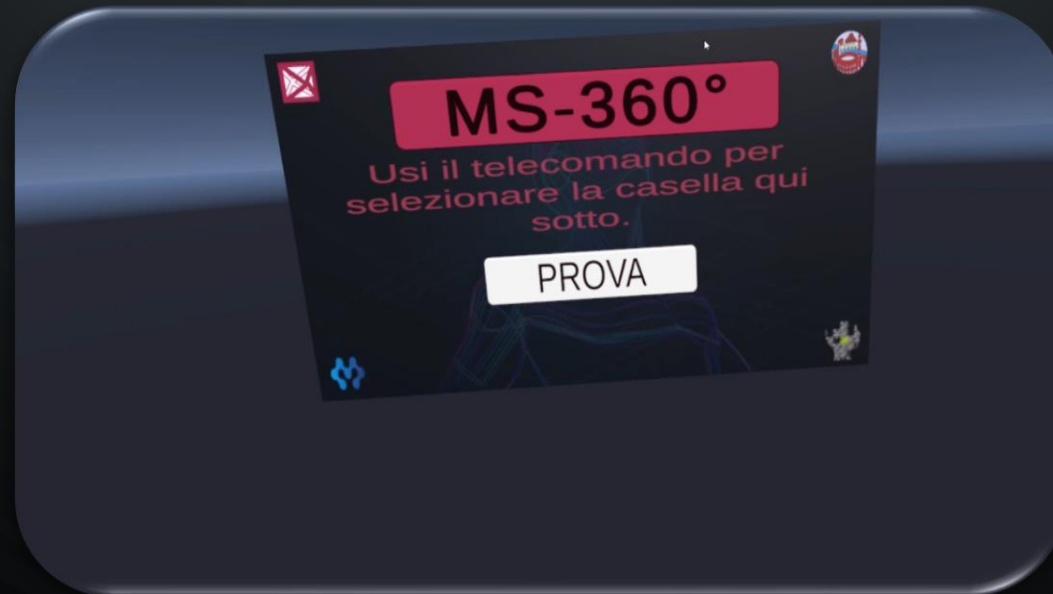


# MS-360°: Familiarization Phase

- Raycaster-based interaction
  - Audio instructions
- Prompt the user to find and select 3 numbers put around them at different heights



- Users can understand how to explore the upcoming environments and how to proceed through the different scenarios





# MS-360°: Tasks

- 1. Visual Exploration:** freely explore the surroundings in a living room and report all the objects which can be seen within a minute
- 2. Target Selection:** find and count a series of 11 yellow cups among distractors (green cups and glass cups)
- 3. Object Naming:** denominate a series of 10 common object put on a table
- 4. Object Recall (Immediate):** pay attention to a tv show where the chef lists 4 ingredients for a recipe and recall them immediately after the presentation
- 5. Story Recall (Immediate):** pay attention to the details of a story reported in a tv news service and recall all the information immediately after the presentation
- 6. Words Reading:** read the names of some objects included in a shopping list
- 7. Verbal Production:** list a series of fruits which can be added to the previous shopping list, within one minute



# MS-360°: Tasks

- 8. Estimations:** answer to 3 questions asking to estimate some quantities concerning the objects of the shopping list
- 9. Action Planning:** list a series of action to perform in order to resolve a simple cleaning problem using the target items included in the shopping list
- 10. Comprehension:** read a title of a newspaper and answer to a simple question about the situation described
- 11. Sustained Attention:** pay attention to a lottery draw shown on the tv to check if the numbers are present in a lottery ticket
- 12. Object Recognition:** examine a set of 10 boxes to check if in each of them there is one or more of the object that were denominated previously
- 13. Object Recall:** recall the ingredients shown previously by the chef in the tv program
- 14. Story Recall:** recall the details about the story previously presented during the tv newscast

# MS-360°: Experimental Procedure

## Between-Group Design

**Experimental Group:** Patients with age >60 , Subjective Cognitive Impairment (SCI)

**Control Group:** Individuals matched for age and education



- MoCA (Montreal Cognitive Assessment, Nasreddine et al., 2005)
- SSQ (Simulator Sickness Questionnaire, Kennedy et al., 1993)
  - SUS (System Usability Scale, Brooke, 1986)

# MS-360°: First Patient

**GENDER:** Male

**AGE:** 61 Years Old

**EDUCATION:** 11 Years

**MoCA Score (Raw):** 25/30 | **Corrected:** 24,98 (Cut-off: 19,26) (Conti et al., 2014)

**Errors:**

- wrong repetition of 1 out of 2 sentences
- remembers only 1 item out of 5 in the delayed recall task

**SSQ (Pre):** no symptoms

**MS-360°**

**Errors:**

- misses 2 out of 11 target items in the target selection task
- misses both the immediate and the delayed recall of 1 out of 4 item

**SSQ (Post):** slight nausea symptoms

**SUS:** 90



# MS-360°: Second Patient

**GENDER:** Male

**AGE:** 76 Years Old

**EDUCATION:** 23 Years

**MoCA Score (Raw):** 23/30 | **Corrected:** 21,59 (Cut-off: 19,26) (Conti et al., 2014)

## **Errors:**

- 2 errors in the clock drawing task
- wrong repetition of 1 out of 2 lists of numbers
- wrong repetition of 2 out of 2 sentences
- misses 3 items out of 5 in the object delayed recall task

**SSQ (Pre):** moderate nausea and slight oculomotor symptoms

## **MS-360°**

### **Errors:**

- misses 1 out of 11 target items in the target selection task
  - misses the delayed recall of 1 out of 4 item
- misses only 1 item out of 10 in the recognition task

**SSQ (Post):** no symptoms

**SUS:** 85

# MS-360°: Results

## Preliminary Results

**User-Experience (UX):** both patients reported to have enjoyed more the VR tasks rather than the standard paper-and-pencil tasks

## Expected Results

- Adequate UX rates, comparable with those resulting from other tools implementing the same technology
- Correlations between our test and the paper-and-pencil screening tests (range between |.5| and |.8|)
- MS-360° will be able to distinguish patients' and control's performances

# THANK YOU FOR YOUR ATTENTION



## Contacts

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