New ICT tools to support well aging

Stefania Pazzi – Operational Director CBIM

IMIT 2014 Genève April 13-15, 2014
INTERNATIONAL MEDICAL INFORMATICS and TELEMEDICINE CONFERENCE

Consorzio di Bioingegneria e Informatica Medica (CBIM)

University of Pavia (founder)

IUSS – Institute for Advanced Study, Pavia

Research and Care Excellence Centers

Policlinico San Matteo Foundation, Pavia (founder)

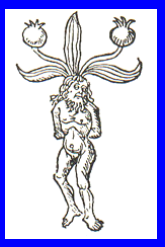
S. Maugeri Occupational Health and Rehabilitation Foundation, Pavia (founder)

C. Mondino National Neurological Institute Foundation, Pavia (founder)

Bambino Gesù Children's Hospital, Roma

Activity Areas

e-Health

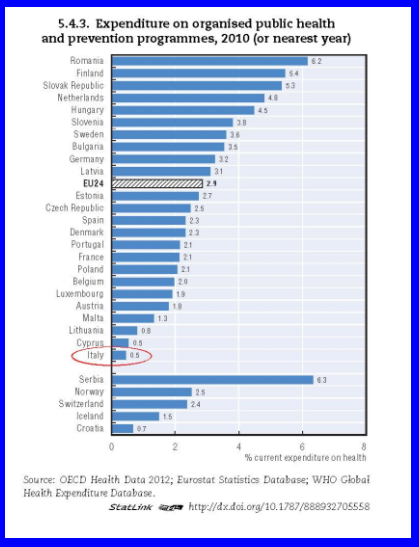


Hospital Information Systems

e-Learning

Benchmarking (e-Procurement)

EXPENDITURE ON PREVENTION



- **Only 3% of the current health expenditure in the EU are invested in prevention and public health programmes**
- **In Italy 0.5%**

OBJECTIVES AND EXPECTED OUTCOMES

"Innovative organisational approaches and technical solutions that screen, identify and target frail older people for evidence based interventions **could achieve a more efficient use of resources, skills and technology**, improve health and quality of life of older people and caregivers, delay disability, **slow the progression of the disease**, avoid unnecessary hospitalisation and institutional care and **increase the sustainability of health and care systems**."

A3: Prevention, early diagnosis of functional and cognitive decline

Smart Aging Serious Games Software Platform for pre-symptomatic and early-symptomatic assessment of cognitive impairments

- **Smart Aging Association**, *Italy*
- **CBIM** Pavia, *Italy*
  - C. Mondino National Neurological Institute Foundation - Pavia, *Italy*
  - University of Pavia- Department of Psychology, *Italy*
  - Universitat Politecnica de Catalunya, *Spain*

May–October 2013: platform assessment

March 2014 – December 2014: large scale test (about 1000 persons aged 50-80 in Calabria Region)

THE SMART AGING SERIOUS GAMES PROJECT GOAL

The project goal is the realisation of a Serious Game platform, able to **replace the «classical» neuropsychological paper&pencil tests**, that results low ecological and very expensive in terms of time and human resources.

Considering the high number of cognitive functions that can be tested through the Serious Game, the Smart aging platform is able to screen the subjects in a similar way to the traditional tests, with a **more friendly approach**, useful to decrease the induced stress.

The environment is **closer to real life**, resulting more interesting and stimulating in the task execution, providing measurements of every day tasks that could be insufficient in the real life.

THE SMART AGING GAME SCENARIO

The 3D environment consists of a **loft** with a **kitchen corner**, a **bedroom corner,** a **living room corner** and apart a **bathroom**

The application is based on a **first-person paradigm** so there is no 3D avatar.

The **virtual position** of the user within the environment is **associated with a camera** and the navigation model allows users to move within the environment at a **constant height over the floor plane** and to rotate the camera (head) within a limited range of angles.

THE SMART AGING SERIOUS GAMES TASKS

The **Smart Aging Games** have been designed in order to evaluate, performing the following **5 tasks**, all the above mentioned cognitive functions.
The evaluation time is of overall **25 minutes** and **no skilled resource** is needed to attend the subject.

Task	Cognitive Functions
TASK 1 - OBJECTS IDENTIFICATION **The subject is asked to identify and locate a list of objects in the kitchen.**	Memory, spatial orientation and attention
TASK 2 – WATER THE FLOWERS WHILE LISTENING TO THE RADIO **The subject is asked to turn on the radio and press the spacebar every time the word "sun" is aired, while watering the flowers on the windowsill in the dining room.**	Executive functions (planning), divided attention.
TASK 3 - MAKE A PHONE CALL TO … **The person is asked to make a phone call to Paolo Rossi using the phone book and the phone placed on the night table next to the bed. Once the number is dialled, the subject is asked to turn the TV on.**	Executive functions, selective attention, short-term and long-term memory.
TASK 4 - OBJECTS RECOGNITION **A 2D screen with 24 images of objects is presented to the subject. The task is to identify and then click on the 12 objects that the subject was asked to identify in TASK 1.**	Memory
TASK 5 - REPEAT THE OBJECTS IDENTIFICATION (TASK 1) **The subject is positioned in front of the kitchen, and he/she is asked to find each of the objects that he looked for in TASK 1.**	Long-term memory, spatial orientation and attention

COGNITIVE TASKS N.1, 4, 5
Objects identification and location

The aim of the task is the identification of 12 objects within the kitchen.

TASK 1

The subject can navigate and memorise the objects: all the cupboards are open and show their content. When they close, in a 2D frame appear 12 objects for the localisation.

TASK 4

A 2D screen with 24 images of objects is presented to the subject. The task is to identify the 12 objects of TASK1.

TASK 5

The subject is required to locate the same 12 objects of TASK1, without any help.

COGNITIVE TASK N. 2

Water the flowers while listening the radio

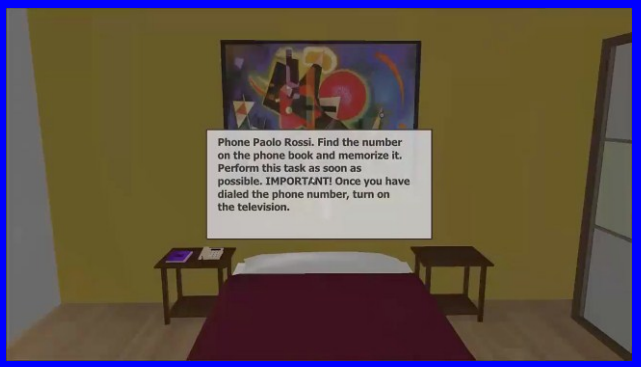
The subject is asked to **turn on the radio and press the spacebar every time the word "sun" is aired, while watering the flowers** on the windowsill in the dining room. The right sequence for flowers watering is:

- *Keep the sprinkler in the sink*
- *Open the faucet*
- *Close the faucet*
- *Take the sprinkler to the windows*
- *Click the flowers*
- *Take back the sprinkler to the sink*

COGNITIVE TASK N.3

Phone Mario Rossi and turn on TV

The subject is asked to **make a phone call to Paolo Rossi** using the phone book and the phone placed on the night table next to the bed, finding the number within 10 names and learning it. **Once dialled** the phone number, the person has to **turn on the television**.



SMART AGING EVALUATION INDEX

An ***Evaluation Index*** is created based on the performance at the task, taking into account the following parameters:

- *number of correct actions*
- *number of errors*
- *omissions*
- *time needed to complete the task*
- *number of clicks*
- *distance travelled with the mouse*

The score of the serious game will be compared with traditional paper&pencil neuropsychological tests in order to validate the Smart Aging platform as a large scale screening tool for pre-symptomatic and early symptomatic assessment of cognitive impairments.

PLATFORM ASSESSMENT

30 people 50-85 years old (average 68):

- *Mini Mental State Examination*
- *Rey Test (15 words)*
- *Raven Progressive Matrices*
- *Verbal fluency Test*
- *Trail Making Test A and B*

For all the people the cognitive score was over 27

USABILITY ASSESSMENT

- *3D environment navigation problems → authomatic navigation and touch screen*
- *Improvment of the objects look*
- *Feedback to the people after the tasks execution*

COGNITIVE ASSESSMENT

- *Better specification of tasks instructions*
- *Personalisation of familiarisation tasks*
- *Tasks time reduction*

PLATFORM VALIDATION

The **Smart Aging** platform large scale evaluation has already started: 1.200 healthy persons aged 50-80 are under evaluation for early detection of mild cognitive impairment (MCI). Subjects with confirmed MCI and/or neurodegenerative dementia represents the secondary target group.

The evaluation activity is involving the following Institutions:

National Neurological Institute Foundation C.Mondino and Don Carlo Gnocchi Foundation
60 neurological patients with MCI
Cognitive and functional assessment using conventional neuropsychological battery. The inclusion criteria are: MMSE > 24 and the memory domain subscale of the Clinical Dementia Rating Scale <0.5.

Calabria Region
1.000 healthy subjects aged between 50 and 80 years
Neuropsychological assessment with traditional tests. The inclusion criterion is: MMSE > 24.

Non-profit associations:
200 healthy subjects aged between 50 and 70 years
Neuropsychological assessment with traditional tests. The inclusion criterion is: MMSE > 24

CONCLUSIONS

The **Smart Aging SG** platform constitutes a **powerful screening tool for the early detection of cognitive impairments on a wide scale**, characterised by:

- *Innovative ICT approach, able to change the organisational way to deliver prevention services*
- *A friendly game, useful to decrease the stress induced by a cognitive screening*
- *Inter-generational cooperation in the game platform utilisation*
- *Innovative follow-up opportunity, also without skilled (psychologists) carers involvement*

Horizon 2020
The EU Framework Programme for Research and Innovation

- ICT CALL: ICT21-2014 Advanced digital gaming /gamification technologies

- Health CALL: PHC20-2014 ICT solutions for indipendent living with cognitive impairment