MODULE 1-P1: SPACE: Spatial Performance Assessment for Cognitive Evaluation.

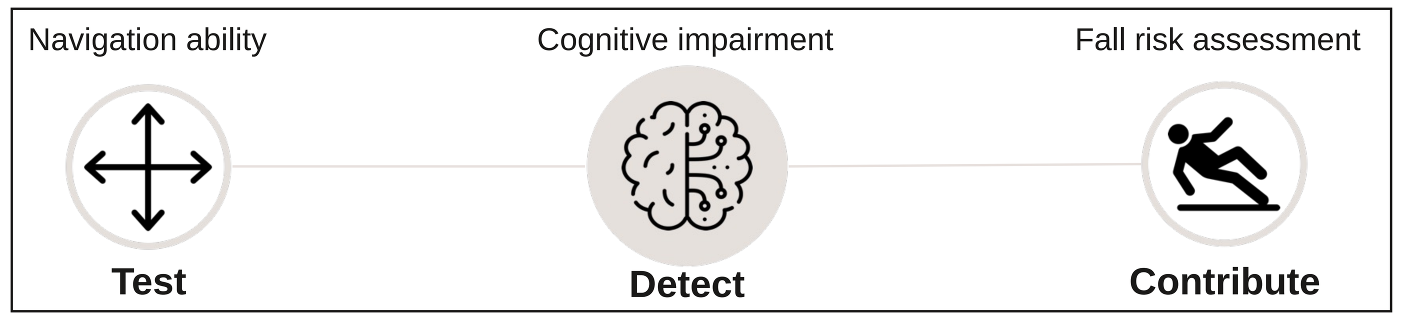
Giorgio Colombo[1], Karolina Minta[1], Jascha Grübel[2], Victor Schinazi[1,3]
[1]Singapore-ETH Centre, Future Health Technologies Programme, CREATE campus, Singapore, [2]ETH Zürich, Zürich, Switzerland, [3]Department of Psychology, Bond University, Gold Coast, Queensland, Australia

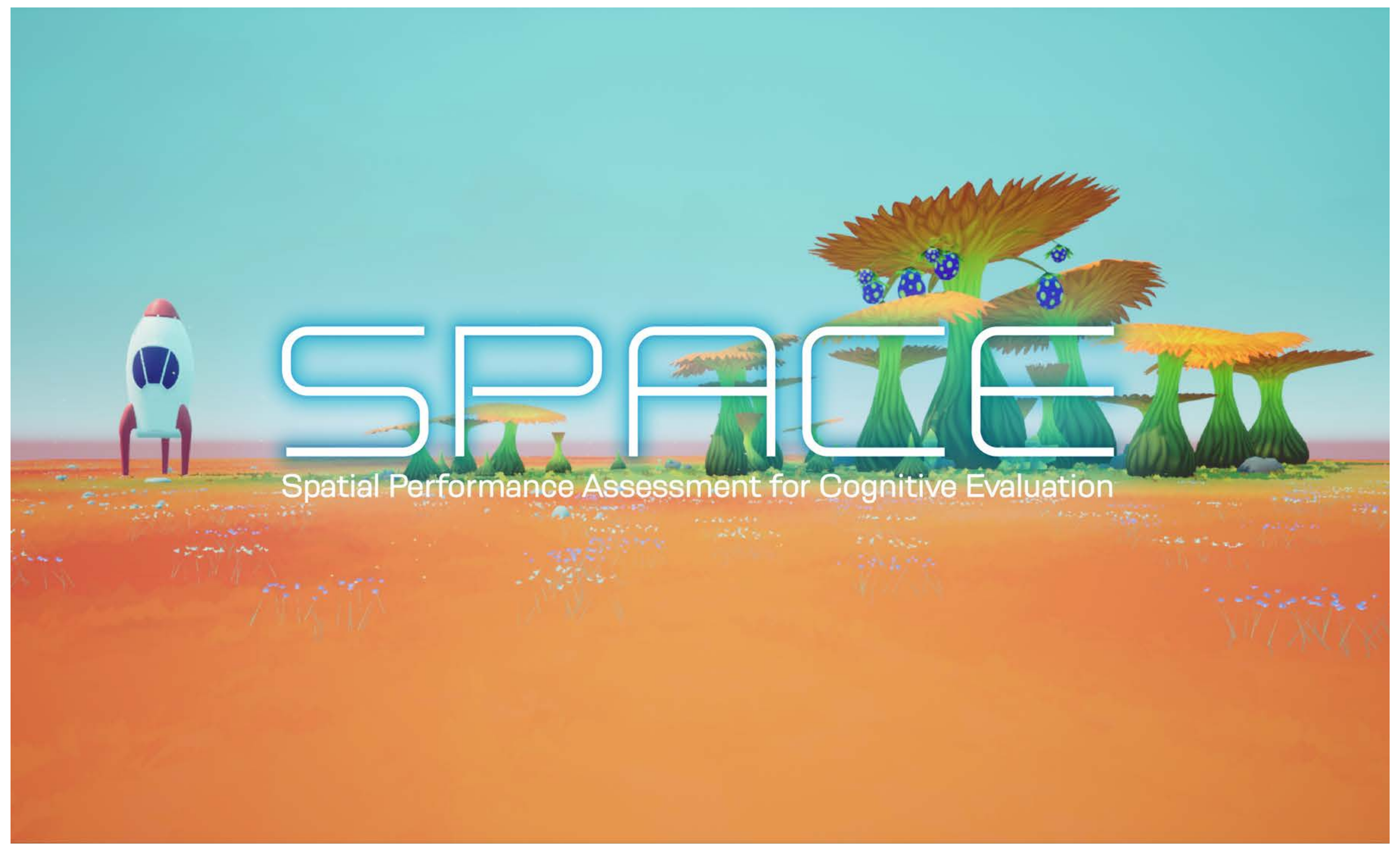
1 Introduction

The diagnosis of cognitive impairment requires very expensive or intrusive methods (e.g., PET and CSF) or lacks the necessary sensitivity (MoCA and MMSE) to identify early signs of cognitive impairment.

Navigation is known to recruit hippocampus and entorhinal cortex and these regions are among the first to be affected during early stages of cognitive impairment.

Deficits in navigation have been found to be promising markers of cognitive impairment. We have developed SPACE to investigate individual differences in navigation and how these may contribute in the detection of cognitive impairment.





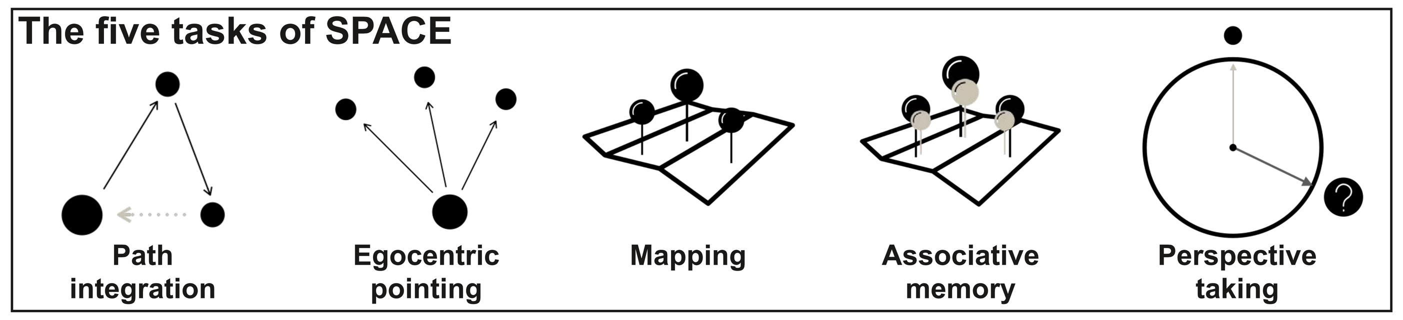


Figure 1: SPACE Splash screen and schematic of the tasks.

2 SPACE: The ecosystem

SPACE includes different configuration panels that allow experimenters to adapt the spatial tasks and set up various experimental designs.

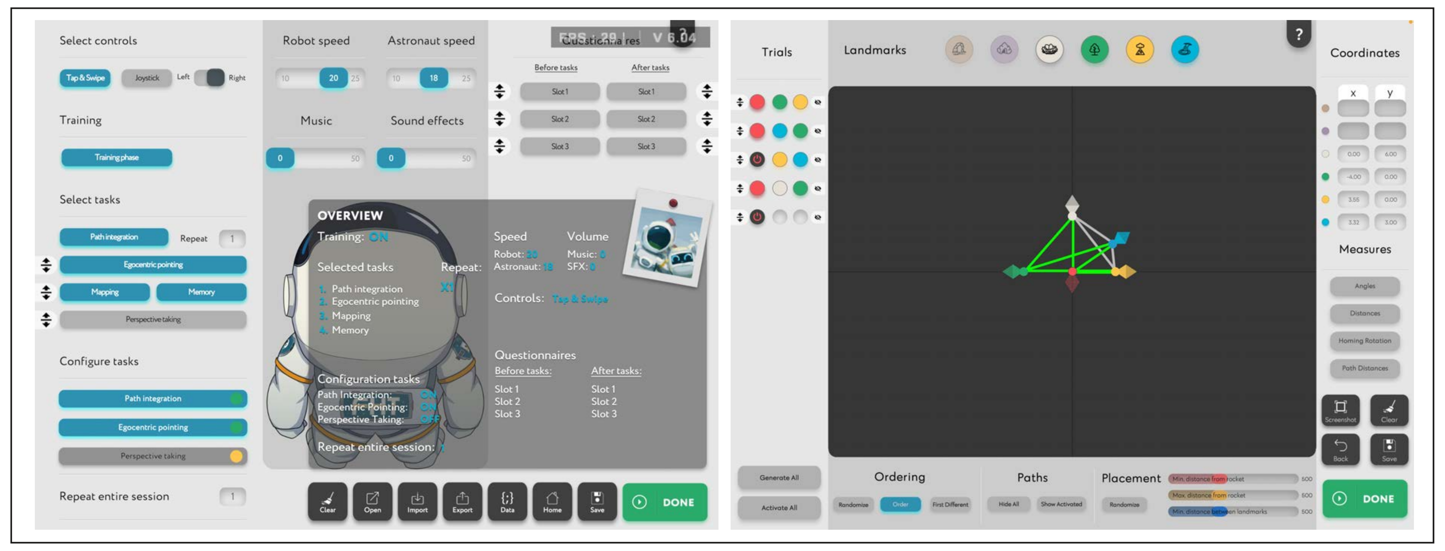


Figure 2: Experimenter menu (left) and path integration configuration panel (right)

3 SPACE: The training

SPACE starts with an extensive four-phases training in which participants familiarise with the game's controls.

During these phases, participants are also tested on basic visuo-spatial abilities (e.g., Object tracking, mental rotation and translation).

The training phases and the following spatial tasks are scaffolded and increase in difficulty to help further differentiate individual differences in navigation.

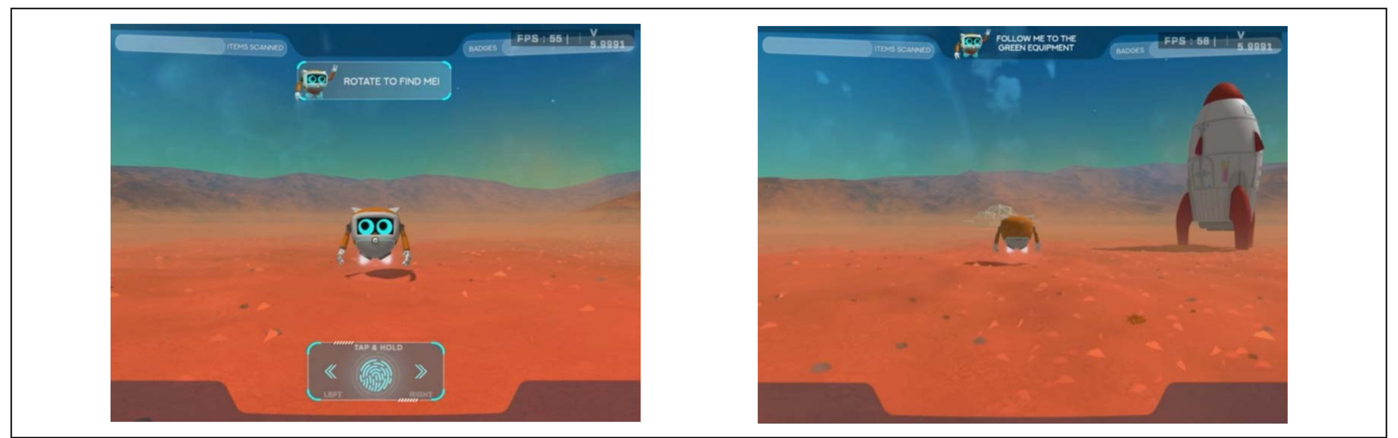


Figure 3: Screenshots from the SPACE training phases.

4 SPACE: The five tasks

After the training phases, participants complete five tasks specifically designed to recruit hippocampus and entorhinal cortex.

Path integration

Participants are asked to follow the robot from the rocket to two distinct landmarks in the environment and return unguided back to the rocket. At each landmark, participants are asked to remember an item scanned by the robot which they will be asked to retrieve for memory in a later task. During path integration, participants are reminded to also remember the actual position of the various landmarks in the environment.

Egocentric pointing

Based on their acquired knowledge of the environment, participants are asked to direct the robot to a subset of landmarks learned during the path integration task.

Mapping

Participants are asked to create a map of the environment that they have learned during the path integration task.

Associative memory

Participants are asked to pair the scanned items with the related landmarks learned during the path integration task.

Perspective taking

Using a map of the environment, participants are asked to imagine standing at a landmark facing another landmark. The task is to indicate the correct bearing towards a third landmark.

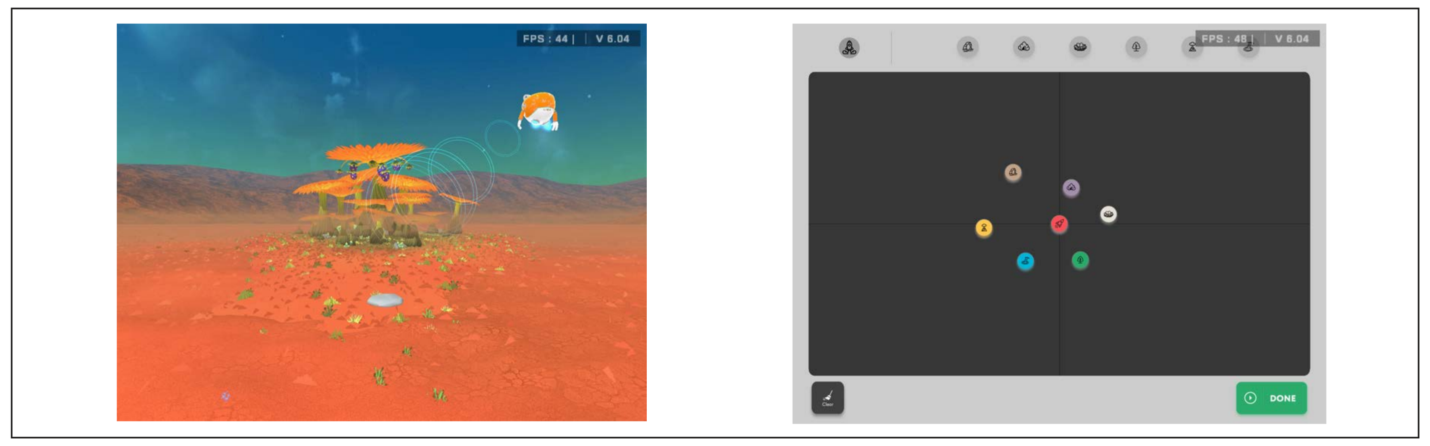


Figure 4: Screenshots from path integration (left) and mapping (right) in SPACE.

(FHT) FUTURE HEALTH TECHNOLOGIES

(SEC) SINGAPORE-ETH CENTRE CREATE ETH zürich

BOND UNIVERSITY FACULTY OF SOCIETY & DESIGN