# Motor and cognitive dynamic difficulty adjustment for robot-mediated upper limb rehabilitation after stroke

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## Introduction

- Our team developed ROB*i*GAME, a serious game that:
  - ✓ Is implemented on an end-effector type robot for the upper limb
  - ✓ Allows combined motor and cognitive rehabilitation
  - ✓ Adjusts task difficulty to individual degree of impairment
  - ✓ Keeps success rates at 75% to maintain motivation and enhance re-learning

**Is this adaptation mechanism optimal (rapid, dynamic, individualized) ?**

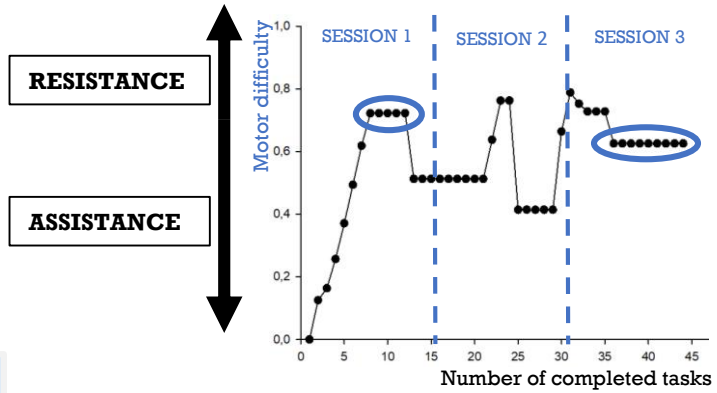
## Methods

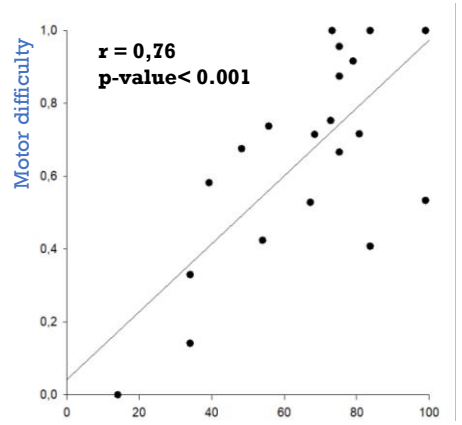
- Uncontrolled open label clinical trial
- 24 adults, subacute/chronic, stroke survivors
- Hemiparesis and/or hemineglect
- REAplan® robotic device
- 5-day protocol: evaluation + 3 x 45-minutes RAT sessions
- Detailed clinical and robotic evaluation

- Task difficulty indicators determine motor difficulty and cognitive difficulty
- Difficulty indicators adapt simultaneously and independently to configure the game
- Game parameters continuously vary according to real-time performance
- Levels of difficulty fluctuate from 0 to 1 and determine both motor (robotic assistance or resistance) and cognitive (attentional load and presence of cues) parameters

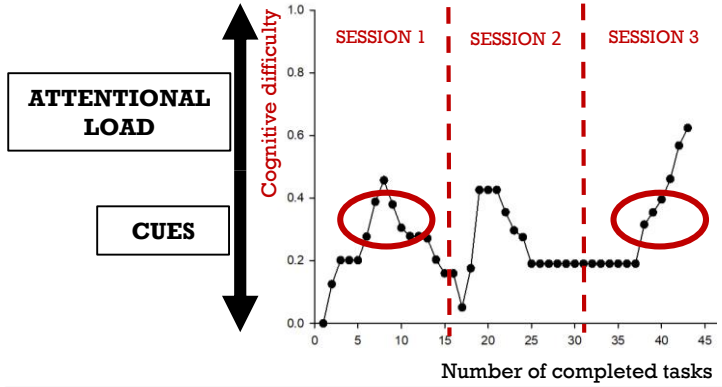
## Results

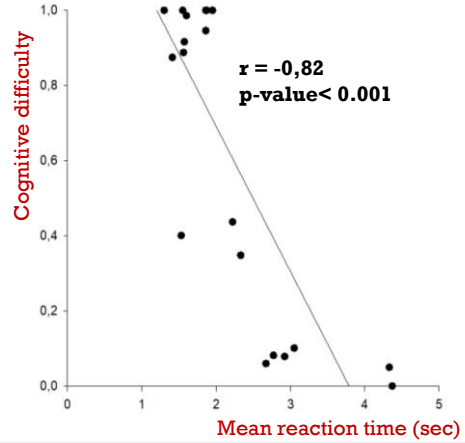
Evolution of motor game difficulty over 3 RAT sessions:




Evolution of cognitive game difficulty over 3 RAT sessions:




## Conclusions

- This study illustrates that ROB*i*GAME's dynamic difficulty adjustment mechanism is rapid, dynamic and individualized for each patient.
- Future work should evaluate effectiveness of this mechanism during upper limb recovery post-stroke.

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