POLYTECHNIC UNIVERSITY OF BARI

DEI - Department of Electrical and Information Engineering

Motor Assessment and Rehabilitation: the role of the Serious Games

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Motor Assessment in neurological patients

Table 3. Overview of clinical scales used to assess motor deficits in neurological patients in this survey

Scale and Reference	No. of centres using scale	No. of centres using scale in 75–100% of patients	Standardisation factor (of 100)
(Modified) Ashworth Scale (8,9)	38	11	33.09
Functional Independence Measure (FIM) (10)	15	12	20.59
Fugl-Meyer (11)	22	4	14.71
Barthel ADL Index (12)	7	5	8.46
Action Research Arm Test (ARAT) (13)	18	0	8.09
Rivermead Motor Assessment (motor) (14)	4	2	5.15
Motor Assessment Scale (MAS) (15)	3	2	3.68
American Spinal Injury Association (ASIA) (16)	2	2	2.94
Motricity Index (17)	2	2	2.94
Stroke Impairment Assessment Set (SIAS) (18, 19)	2	2	2.94
Trunk Control test (20)	2	2	2.94
Medical Research Council Scale (MRC) (21)	2	1	2.57
Canadian Occupational Performance Measure (COPM) (22)	2	1	2.21
Unified Parkinson's Disease Rating Scale (UPDRS) (23)	3	0	2.21
10 m. walking test (24)	2	1	1.47
Assessment of Motor and Process Skills(AMPS) (25)	3	0	1.10
Other tests of impairment/disability, described in literature, each used by one centre only	20	NA	NA
Unidentified tests	5	NA	NA

For each clinical scale that was used in more than one respondent centre: key reference, the number of centres using the scale, the number of centres using the scale routinely and its Standardisation Factor. Total number of scales related to motor deficits, 42.

NA, not applicable.

** van Wijck, F. M., Pandyan, A. D., Johnson, G. R., & Barnes, M. P. (2001).* ***Assessing motor deficits in neurological rehabilitation: patterns of instrument usage****. Neurorehabilitation and neural repair.*

Fugl-Meyer Assessment of Motor Recovery after Stroke

- FUGL-MEYER ASSESSMENT UPPER EXTREMITY (FMA-UE)
- It consider 33 specific tests. Each test can be valuated with three values (0, 1, 2)
- Score (0-66)

https://www.gu.se/digitalAssets/1328/1328946_fma-ue-english.pdf

https://www.youtube.com/watch?v=B70qDfl3LyA

Other Sensorimotor Tests

- Nine Peg Hole test

https://www.youtube.com/watch?v=kkyfI5OvfJo

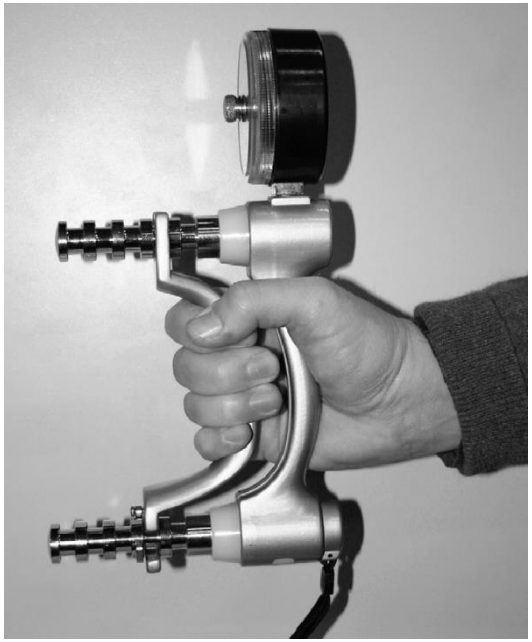
- Box and Block test

https://www.youtube.com/watch?v=jmpNXj5oOo0

Examples of clinical tests for orthopedic assessment

- VAS test
- DASH test
- Constant-Murley Score
- Shoulder Rating Questionnaire (SRQ)
- JAMAR test

https://www.youtube.com/watch?v=11kB2Ar-r88



Some Main Limitations

- Subjective Evaluation (Repeatability)
- Boring Tests
- Discrete Evaluation
- Can we get more information?

Serious games

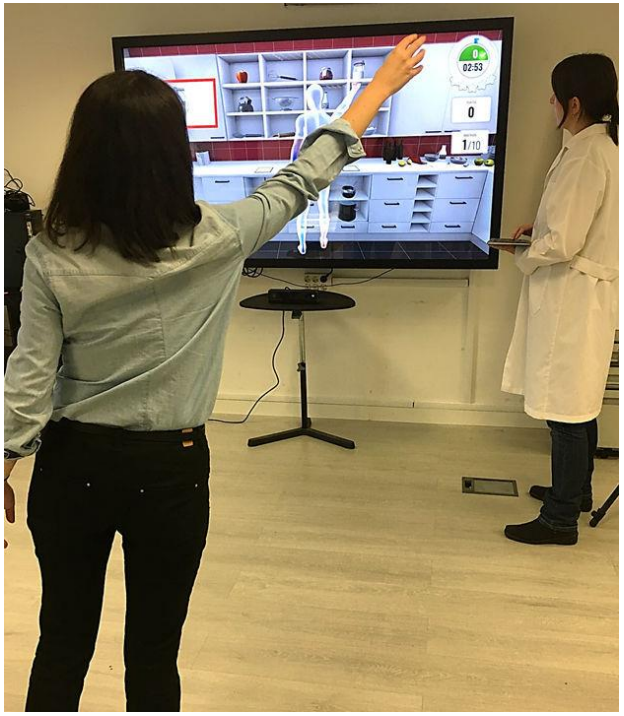
- A **serious game** (or applied game) is a game designed for a *primary purpose other than pure entertainment*.

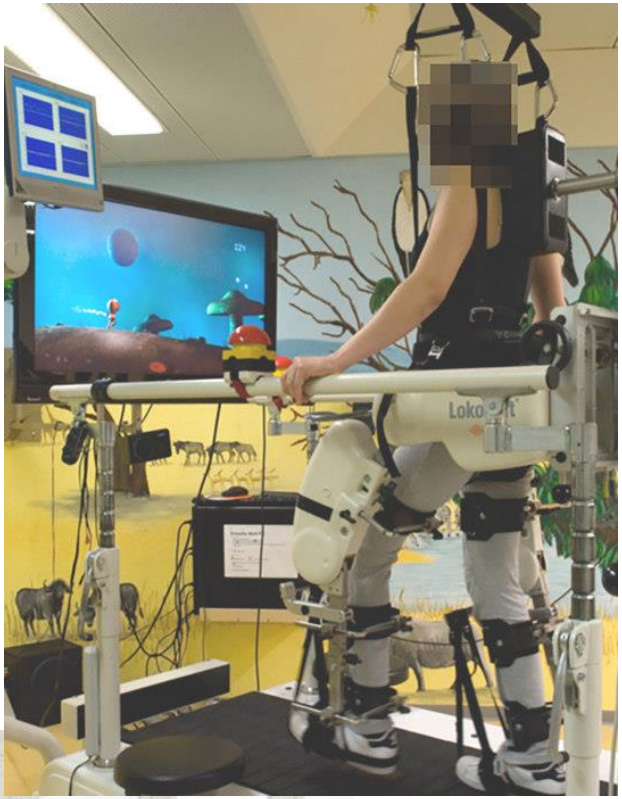
- The "serious" adjective is generally prepended to refer to video games used by industries like defense, education, scientific exploration, *health care*, emergency management, city planning, engineering, and politics.

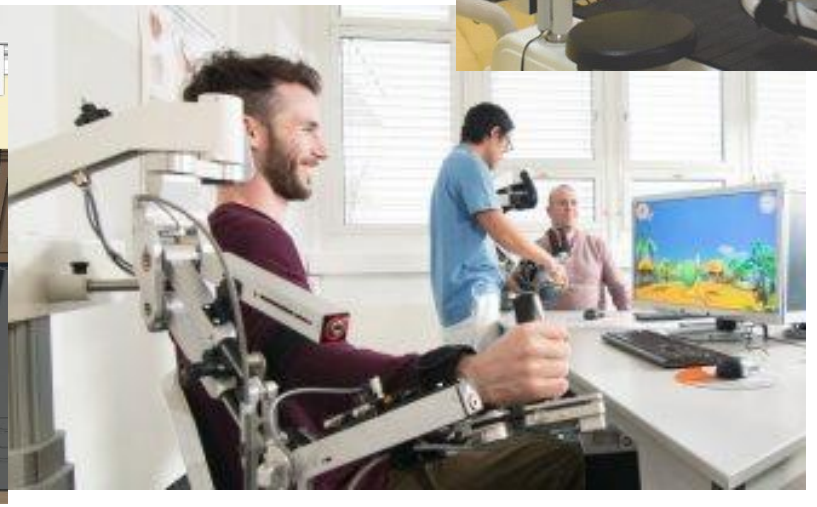
Why Serious games ?

- The Assessment/Rehabilitation sessions are less boring
- The Assessment/Rehabilitation exercises are task-oriented
- There is the possibility to extract extra information related to game scores
- The difficulty of the game can be modulated according to the motor capability of the patients (rehabilitation)
- Objective evaluation of the motor capabilities by integrating the serious games with movement tracking systems. (Continuous variables as scores)

Serious games

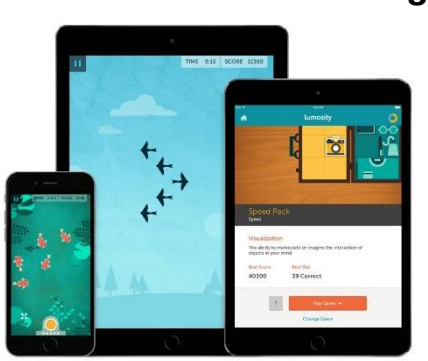


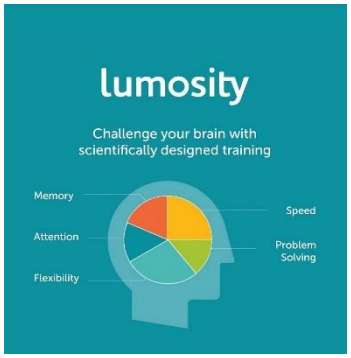




Human-Game Interaction Paradigms

Lumosity: Cognitive assessment and training



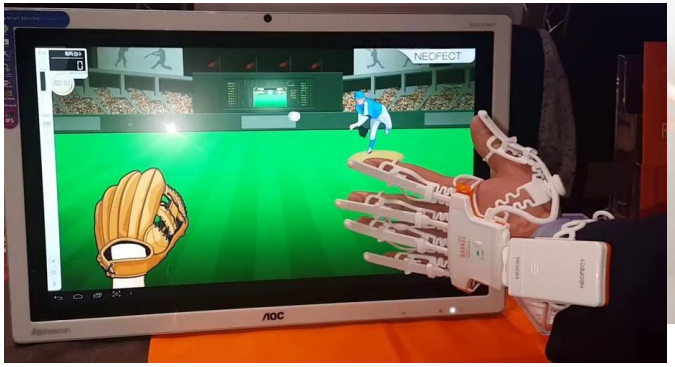


Touch Screen

Leap Motion

Kinect

Video Stream Analysis



Wearable Sensors

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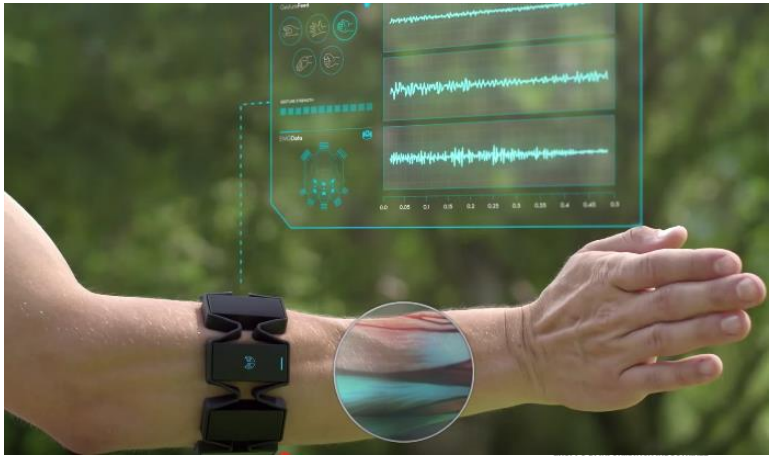
Human-Game Interaction Paradigms

Robotic Interfaces

Muscle Activity-based Interfaces



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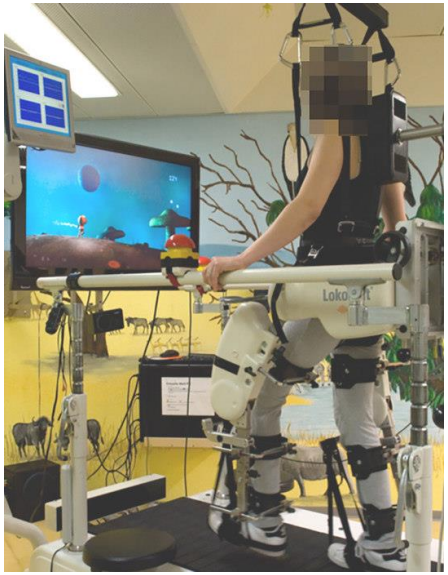
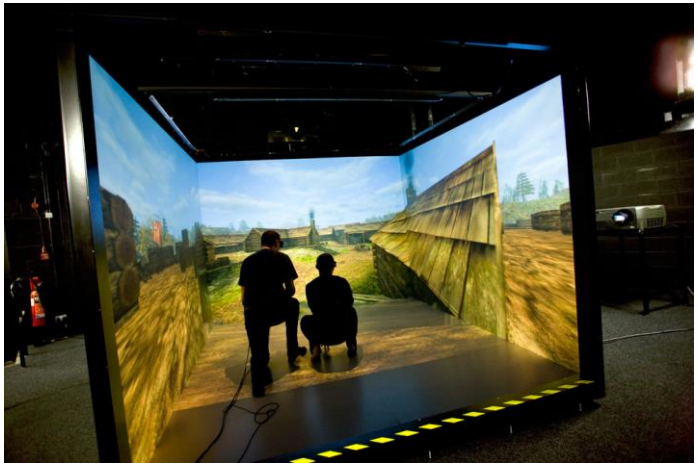
Serious Games visualization

- 2D Visualization

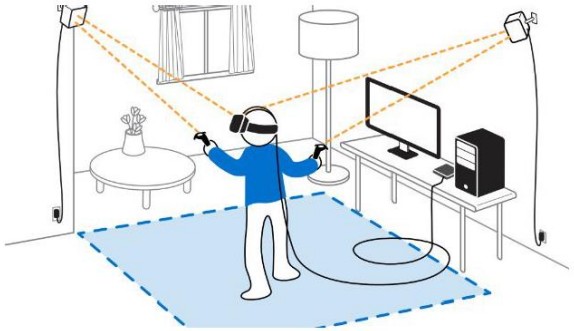


- 3D Visualization



HTC Vive

A



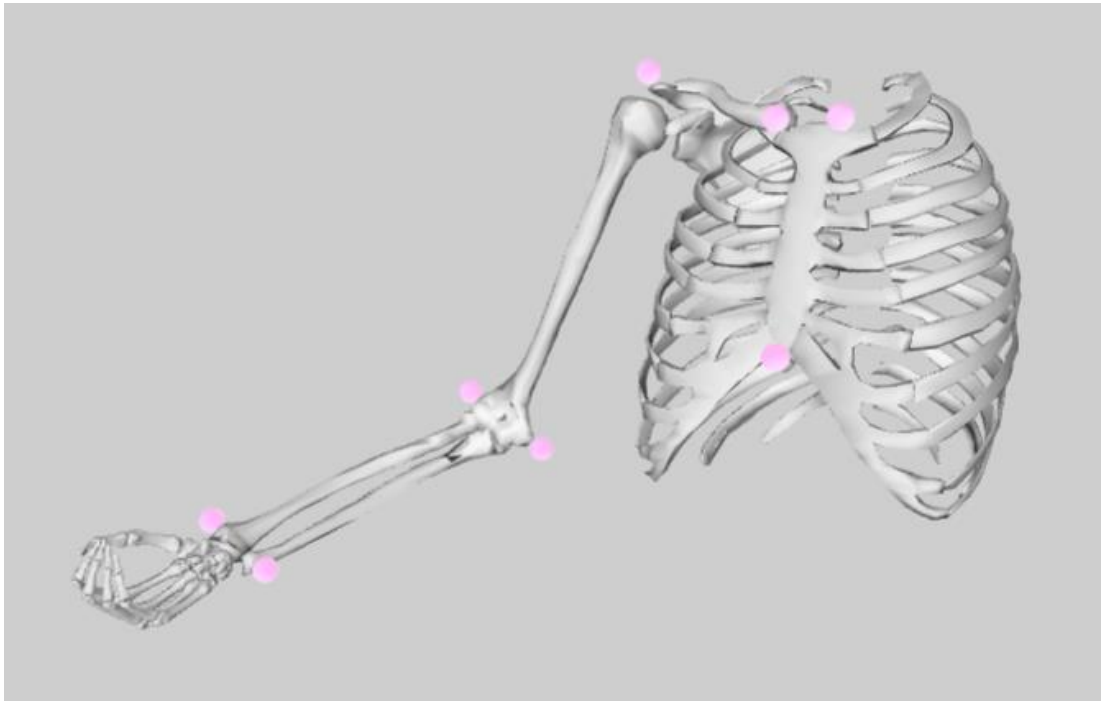
B

C

A) Il sistema HTC Vive. B) Il setup del sistema HTC Vive. C) Il Vive Tracker.

Tracking System based on the HTC Vive

Inverse Kinematics: OpenSim



thank you!

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