Action Observation Therapy: From Unimodal to Multisensory Integration for Enhancing Body Ownership in Pediatric Neurorehabilitation

OUR EXPERIENCE WITH IVS3 IN NEUROMOTOR DISABILITIES IN PEDIATRIC POPULATION

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The "Eugenio Medea" Institute

- Scientific Institute for Research, Hospitalization and Health Care.
- Officially recognized in 1985
- 29 centers In Italy, 2300 Workers, 25’000 patients per year
- Specialized in neurological and neuropsychological diseases of the developmental age, focusing on research, treatment and training
- Research section of Associazione La Nostra Famiglia, a non-profit organization founded in 1946, dedicated to the care and rehabilitation of people with disabilities, special focus on children and young adults
- 4 Research Area :
  - Area 1: Child Neurology rehabilitation
  - Area 2: Psycopathology of neurodevelopmental age
  - Area 3: Genetic, computational and pharmacological aspects of neurorehabilitation
  - Area 4: Innovation technologies in rehabilitation, mental health and human factors

IRCCS EUGENIO MEDEA

LA NOSTRA FAMIGLIA

IRCCS Associazione la Nostra Famiglia

A HI-TECH REHABILITATION LAB
for children and adolescents

ASTROLAB

Our Cohort with IVS3

Acquired Brain Injury: 13 (7 TraumaticBrainInjury, 1 enkephalitis, 1 Neurosurgery due Epilepsy, 1 NeuroOnchology, 3 stroke)

Cerebral Palsy: **5** (Unilateral)

Age: 5 - 23

Distance from Noxa Event (ABI group): From 3 month to 12 years

Very eterogeneous cohort : age, etiology, rehab stage (sub-acute vs chronic), comorbidity

Treatment Characteristics

- **Duration of session**: 15 – 30 minutes accordingly with focus/attention capabilities of the subjects
- **N° of sessions:** 10 – 20 during a 4 weeks programs

CAVEAT:

Most of the subjects were enrolled in a TechChildRehab Research Project (Fit4MedRobotics) and received additional upper limb technology-based treatment during their rehabilitation programs (i.e: 20 rehabilitation treatment with technologies: 10 with IVS3 and 10 with other UL Tech)

Outcome & Patients experience

Patients experience & Feasibility:

- Subjects with involuntary tremors, or involuntary movement report disullusions, and lacking in sense of ownership
- Subjects with high cognitive level understands the function of the device and provide reality check now and then despite having good understanding of tasks (Behavioural components?)
- Subjects with low cognitive level was engaged more in the illusion but have to remain on easy tasks and showed less understanding of some activity
- Subjects prefer more interactive, representative and practical video instead of more abstract and less representative ones
- The majority of subjects prefer doing others,more practical activity, despite the effort to create a more motivated session
- Provide videos of RDA that engaged hand and other parts of body (zip up the sweatshirt, tie shoelaces..)

Outcome:

Most of patients was enrolled in MultiTech UL Rehab with MA2 (Melbourne Assessment 2) and AbilHand Kids as outcome measures.

Pediatrics AOT: Some Considerations

Problems:

- Lack of Engagement
- Lack of sense of ownership (SO)

Causes:

- Motivational issue / no representative-boring activity
- Attention deficit
- Reality check

Interventions:

- Right/Left Discriminations
- Daily uni & bimanual representative activity accordindg with subjects motor possibilities
- Failed Vs Accomplished Task
- Finding the differencies (cognitive demands)
- Multisensory matched stimulation

Achivement:

- Increased Engagment
- Increased SO
- Increased RDA (representative daily activity) understandings and usefulness of more impaired UL

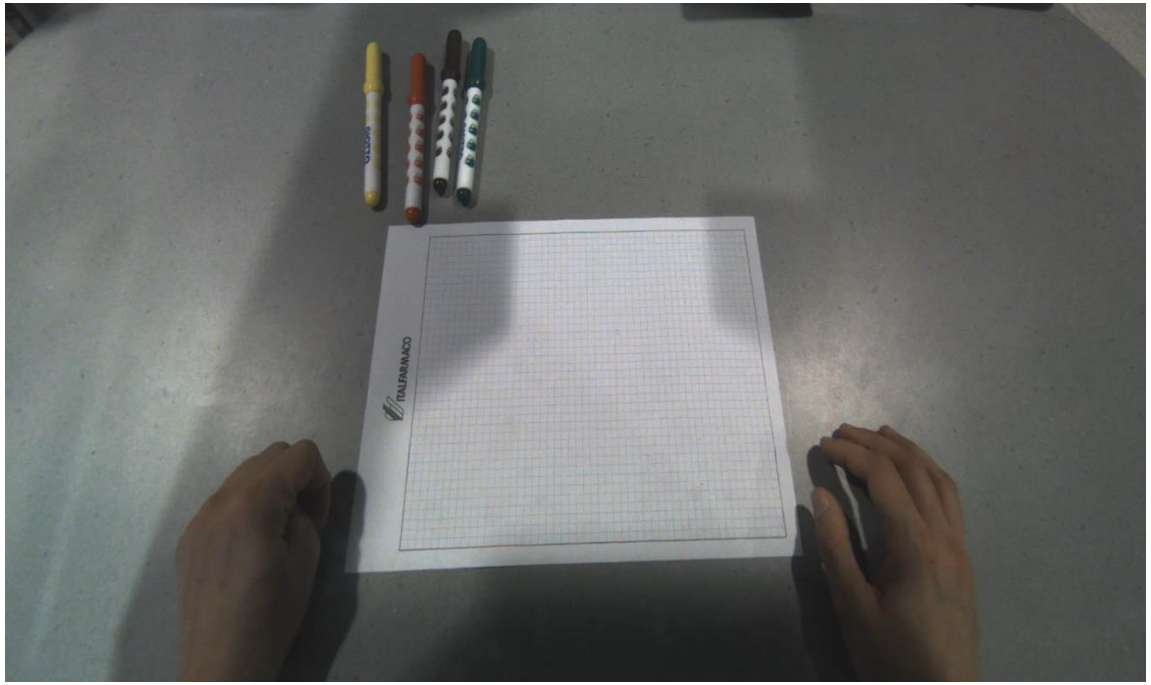
Beyond Vision:
Multisensory Representative AOT

- Daily uni & bimanual representative activity

- Failed Vs Accomplished Task

Beyond Vision:
Multisensory Representative AOT

- Multisensory matched stimulation



- Find the differencies (cognitive demands)

Insight, Issue, and future Ideas/Research

- Sound/acustic record of RDA matched with visual and aptic/proprioceptive stimulation to foster the illusion of body ownership
- Video bank of RDA based on age-specific-needs, specific side impairment (right vs left), level of hand function, difficulty of tasks, bimanual and unimanual activity
- Download and upload videos
- Modify the size of the video-hand to improve motor observation on specific hand

(i.e: improve 10% size of impaired hand and reduce 5%size of less affected hand to highlight the impaired hand behaviour during the observed task)

- Home-deliverable platform (tablet, materials) with videos & audiotracks, for Guided GMI (Graded Motor imagery)

AstroTeam