Report on the outcomes of a Short-Term Scientific Mission

Action Number
CA24123

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Research Title
Bridging Clinical Assessment and XR-AI Analytics for Spatial Neglect: A Conceptual Framework (WG2 & WG4 Synergy)

Visit Schedule
June 22 – 30, 2026

Bridging Clinical Assessment and XR-AI Analytics for Spatial Neglect: A Conceptual Framework

1. Description of the work carried out during the STSM

1.1. Introduction & Overview

The Short-Term Scientific Mission (STSM) took place at the Department of Psychology and MIBTEC facilities of the Università degli Studi di Milano-Bicocca from June 22 to June 30, 2026. The primary objective was to bridge the gap between technical XR-AI engineering and clinical neuropsychology, focusing on spatial neglect (SN) and related cognitive-motor disorders. The planned activities were executed successfully, fostering deep multidisciplinary collaboration.

1.2. Clinical Immersion and Knowledge

In-depth meetings were held with the host, Prof. Daniele L. Romano, and clinical experts including Prof. Roberta Daini, Dr. Giorgia Tosi, and Dr. Silvia Gobbo. A core principle emerged and guided our discussions: if XR doesn't provide what paper-and-pencil tests cannot, it has no meaning, underlining the need for real technological value. *We critically analyzed the traditional 2D paper-and-pencil assessments, noting that their inadequacy lies in the lack of spatial representation, multisensory stimulation, criteria validity and ecological validity, rather than merely being subjective.*

To overcome these limitations, we focused on XR's unique capabilities. We established that XR can continuously test different portions of space, such as peri-personal and extra-personal areas, and capture complex ego-centric and allo-centric neglect features. Furthermore, we discussed innovative XR applications that are impossible with traditional tests, such as assessing auditory neglect, presenting stimuli from behind the patient, and dynamically modulating test difficulty to increase diagnostic sensitivity. This can be achieved through real-time saliency alterations, such as color masking and transparency adjustments via passthrough layers.

1.3. Technical & Infrastructural Alignment

To ensure technical feasibility, dedicated sessions were held with MIBTEC engineers. We reviewed current Unity development pipelines and hardware constraints. This alignment established a common technical language and operational framework between MCBU XRLab and MIBTEC, ensuring that the conceptualized clinical metrics can be robustly translated into functional XR environments.

1.4. Conceptual Framework Design and Synthesis

Through collaborative face-to-face sessions, *we defined the foundational parameters for "common data elements"* that are compatible with machine learning analysis. Specifically, we identified crucial data types for XR assessment, including comprehensive *space logging, eye tracking, kinematic logging, and head tracking.* We also structured the outline for a joint publication presenting this conceptual framework.

1.5. Deviations from the Working Plan

There were no negative deviations from the initial work plan. The mission achieved its primary goals and organically broadened its scope to include future collaborative topics. *As secondary discussions, we briefly explored XR assessment strategies for other neurological conditions* like Alzheimer's disease and Parkinson's disease (e.g., quantitative facial and gait assessments), the Turkish adaptation of "The HEXACO Scales," and the correlations between cybersickness and motion sickness. These topics served as an incubator for broader future European research initiatives without detracting from the main COST Action objectives.

2. Description of the STSM main achievements and planned follow-up activities

2.1. Main Achievements

The STSM successfully achieved its planned goals by establishing a robust conceptual framework that bridges clinical neuropsychological assessment with advanced XR-AI analytics. *A major achievement was the expert consensus that XR applications must provide real technological value; if XR does not offer what paper-and-pencil tests cannot, it has no clinical meaning.* We agreed that traditional tests primarily suffer from a lack of criteria and ecological validity and limited space exploration. Consequently, we defined actionable XR parameters to detect complex deficits, such as auditory neglect, ego-centric and allo-centric neglect features, and impairments across peri-personal and extra-personal spaces. *We also conceptualized how XR can continuously modulate test difficulty and attentional saliency* through real-time color masking and transparency adjustments.

2.2. Contribution to COST

Action Objectives The mission's outcomes directly support the core objectives of the NeuroXRehab COST Action (CA24123), specifically fostering strong synergy between Working Group 2 and Working Group 4:

- WG2 (Assessment of Spatial Neglect): The STSM significantly contributed to the operationalization of assessment methodologies. By utilizing 360-degree XR environments, including the presentation of auditory stimuli and targets from behind the patient, *we laid the groundwork for improving the diagnostic accuracy of specific SN subtypes and overcoming the limitations of traditional tests.*
- WG4 (Data Collection and Sharing Policy): We successfully identified and structured key "common data elements" derived from clinical observations. *Specifically, we determined that comprehensive space logging, eye tracking, kinematic logging, and head tracking are crucial data types for XR assessment.* These elements were conceptualized into machine-learning-compatible formats, directly supporting the Action's goal of creating a standardized data-sharing platform for future multicenter studies.

2.3. Planned Follow-up Activities and Collaborations

To ensure the sustainability of the STSM outcomes, several specific follow-up activities have been agreed upon:

- Prototype Development and Joint Publications: We will initiate a targeted literature review to inform the *development of a preliminary XR prototype designed specifically for the assessment of spatial neglect.* Following the creation of this prototype, *we plan to conduct a preliminary study.* The findings from this initial phase will be disseminated through both peer-reviewed journal papers and conference presentations, contributing directly to the Action's knowledge-sharing objectives.
- Long-Term Multicenter Collaborations: A strong technical and clinical bridge has been established between MCBU XRLab and the MIBTEC facilities. We plan to leverage this partnership for upcoming large-scale European funding opportunities (e.g., Horizon Europe) to conduct extensive multicenter clinical trials.
- Expanded Research Initiatives: While maintaining focus on the COST Action objectives, we also established a foundation for future collaborations on the secondary neurological conditions and psychological scale adaptations identified during the mission.