PLENARY LECTURE | Reliability of Neuroimaging Technologies in Developmental Research: Current Challenges and Future Directions

ILIAS TATCHIDIS

July 13, 2026
12:00 to 13:00
ICFO Auditorium

Neuroimaging technologies such as EEG, functional near-infrared spectroscopy (fNIRS), and MRI/fMRI have become essential tools for studying brain development in children and adolescents. These methods offer unprecedented opportunities to understand both typical and atypical neurodevelopment. However, developmental changes in brain structure and function, age-specific physiological factors, and methodological challenges can all influence the reliability of the measurements obtained.
Despite the growing use of these technologies, the question of how reliable they are in

pediatric populations has received relatively little attention. In this work, conducted within the Respect4Neurodevelopment UK Network, we examined how reliability is currently evaluated across developmental neuroimaging modalities. We combined the findings from a community survey of neuroimaging researchers and technology developers with a systematic review of the literature.
Our survey revealed broad agreement that reliability is critical for the successful translation of neuroimaging methods into clinical practice and personalized interventions. However, our literature review highlighted a striking gap: among 1,245 screened publications, only 15 studies assessed EEG reliability in developmental populations, 16 examined MRI/fMRI reliability, and just 2 investigated fNIRS reliability.
These findings suggest that reliability assessment has not yet become standard practice in developmental neuroimaging research. Key barriers include the lack of standardized protocols, limited funding and time, and academic incentives that often prioritize novelty over methodological rigor.
To move the field forward, greater emphasis must be placed on reliability testing, standardization, and collaborative community efforts. Improving the reproducibility of neuroimaging measures in younger populations is essential for robust scientific discovery, large-scale cohort studies, clinical applications, and the development of effective interventions. This work provides a roadmap for the methodological, organizational, and institutional changes needed to support the next generation of reliable developmental neurotechnologies.

Neuroimaging technologies such as EEG, functional near-infrared spectroscopy (fNIRS), and MRI/fMRI have become essential tools for studying brain development in children and adolescents. These methods offer unprecedented opportunities to understand both typical and atypical neurodevelopment. However, developmental changes in brain structure and function, age-specific physiological factors, and methodological challenges can all influence the reliability of the measurements obtained.
Despite the growing use of these technologies, the question of how reliable they are in pediatric populations has received relatively little attention. In this work, conducted within the Respect4Neurodevelopment UK Network, we examined how reliability is currently evaluated across developmental neuroimaging modalities. We combined the findings from a community survey of neuroimaging researchers and technology developers with a systematic review of the literature.
Our survey revealed broad agreement that reliability is critical for the successful translation of neuroimaging methods into clinical practice and personalized interventions. However, our literature review highlighted a striking gap: among 1,245 screened publications, only 15 studies assessed EEG reliability in developmental populations, 16 examined MRI/fMRI reliability, and just 2 investigated fNIRS reliability.

These findings suggest that reliability assessment has not yet become standard practice in developmental neuroimaging research. Key barriers include the lack of standardized protocols, limited funding and time, and academic incentives that often prioritize novelty over methodological rigor.

To move the field forward, greater emphasis must be placed on reliability testing, standardization, and collaborative community efforts. Improving the reproducibility of neuroimaging measures in younger populations is essential for robust scientific discovery, large-scale cohort studies, clinical applications, and the development of effective interventions. This work provides a roadmap for the methodological, organizational, and institutional changes needed to support the next generation of reliable developmental neurotechnologies.

* This plenary lecture is part of the Hands on Course on Mindlab 2026 Program

Hosted by: Prof. Dr. Turgut Durduran