Moving in Autism

Toward Improved Autistic Wellbeing through Motion Analysis

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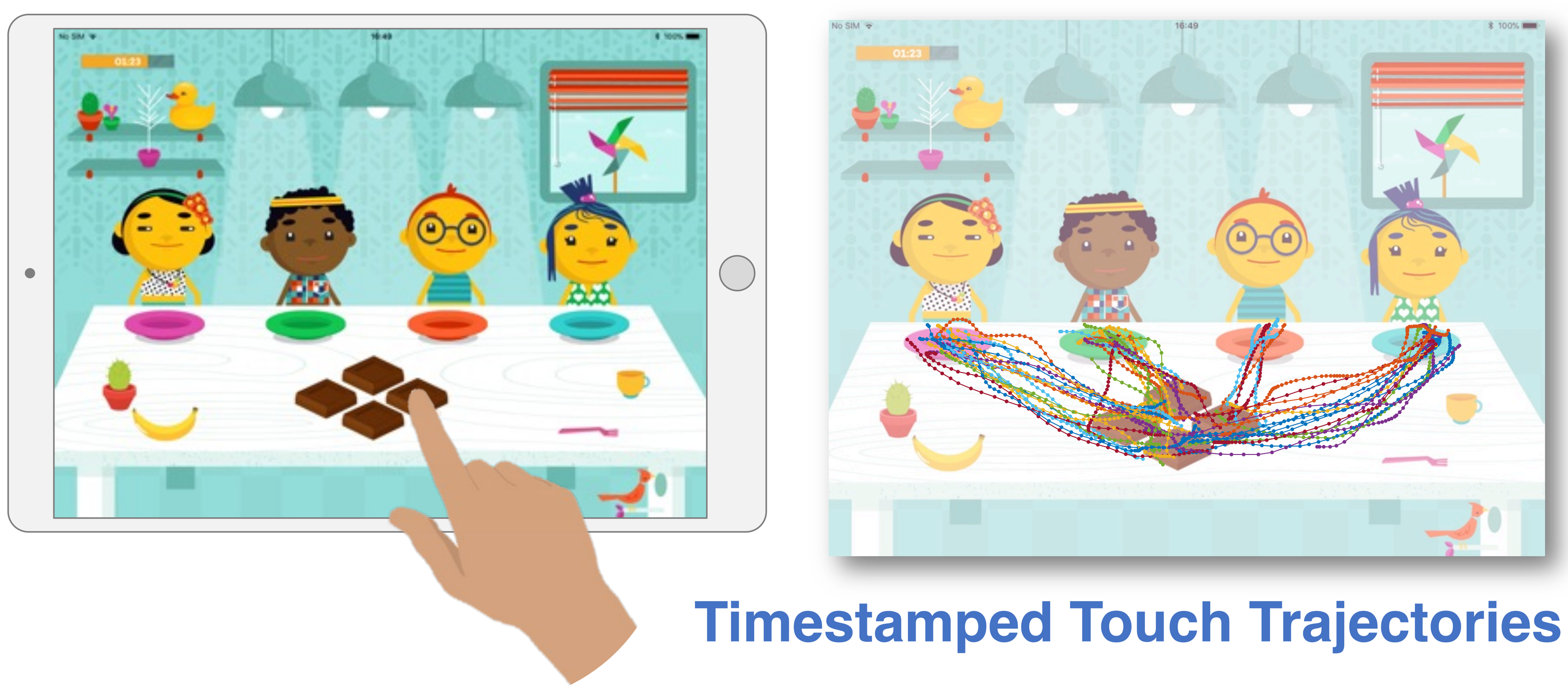
Motor differences are prevalent in autism, affecting 88% of autistic children (Bhat, 2022) and often persisting into adulthood (Cho et al., 2022). These motor challenges have the potential to impact the overall wellbeing of individuals on the autism spectrum.

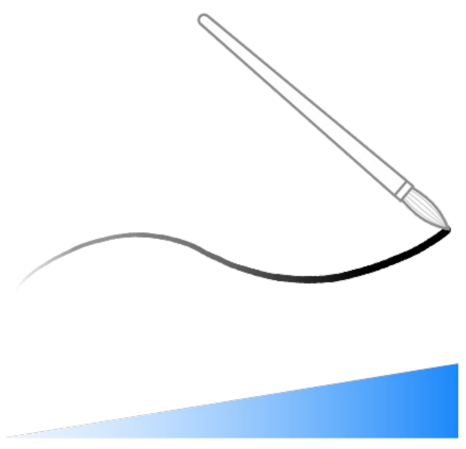
Our research team has utilised smart tablet gameplay to explore motor differences between autistic children and their typically developing peers. Developmental trends in motor control were found to differ in autistic children (Chua et al., 2022), and the movement differences were context-dependent during gameplay (Lu et al., 2022). Additionally, these motor signals can be leveraged to develop machine learning models for early identification of autism, enabling timely intervention (Anzulewicz et al., 2016). Ellipse drawing tasks on a smart tablet have also revealed variations in adherence to the two-thirds power law in both autistic children (Fourie et al., 2022) and adults (Lu et al., 2023). Furthermore, efforts are underway to translate this knowledge into wearable sensor technology, enabling the identification of motor signatures in younger children who may lack the motor control skills required for smart tablet-based activities.

Smart Tablet Motion Capture



Timestamped Touch Trajectories

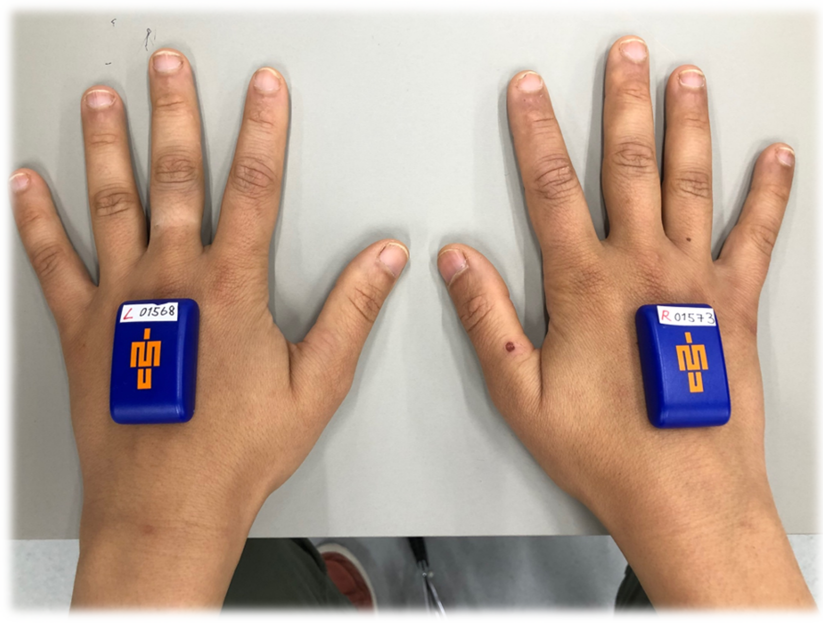
An engaging "Food Sharing" game on smart tablet was implemented to collect movement data from children aged 3-6 years old. Their timestamped touch trajectories were collected during gameplay, enabling subsecond motor control analysis.



Force Quantification

An ellipse drawing activity was designed to examine the covariance between moving speed and moving path curvature. In addition to capturing the movement trajectory on screen, force control information was quantified using a digital stylus.

Wearable Sensor Motion Capture



In a specific motor control paradigm, participants were asked to keep their arms straight for a defined period of time, with the lightweight inertial measurement units (IMUs) attached to the backs of their hands.

These wearable sensors also allow us to study the movement features of younger participants (e.g., 0-3 years old) without the need to follow instructions.

Additionally, the portability of IMUs enables whole-body motion capture in a more natural social context, rather than confining the study to an unfamiliar laboratory environment. As such, we can use these wearable sensors to understand movement interactions between non-speaking or minimally-speaking individuals and their communication partners.

Leveraging smart sensors in tablet or wearable devices provides a means to identify these motor signatures in autistic individuals. This understanding not only raises awareness of the motor differences but also facilitates the development of tailored intervention plans and policy changes aimed at reducing the challenges associated with these motor differences. Ultimately, such initiatives aim to foster a more autism-friendly environment that promotes the wellbeing of individuals on the autism spectrum.

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