

Leveraging Data-Driven Approach to Empower Assistive Technology

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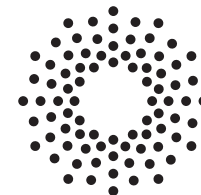
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Sabin Nakarmi received the master's degree in Artificial Intelligence from London Metropolitan University, United Kingdom in 2021. He is currently a KTP Associate working alongside London Metropolitan University and Filisia Interfaces Ltd.

His work focuses on a combination of artificial intelligence, business intelligence, EdTech and Assistive Technology.

Aims and contributions of the paper

Aims:

Explore how a data-driven approach can be leveraged to empower the emerging potential of assistive technology and its impact on EdTech.

Investigates how assistive technology is being used and the limited options for customizations and personalization for individuals with different physical or cognitive conditions

Contribution:

Identification of key metrics to be collected by assistive hardware for progress tracking in users with Special Educational Needs and Disabilities (SEND).

Creation and implementation of an integrated system using COSMO assistive devices and companion app that processes and visualizes data for interpretation by therapists and teachers for progress tracking purposes

COSMO

cosmo
by filisia



COSMO is a Bluetooth-enabled switch also known as Cosmoids developed by Filisa Interfaces Ltd.



It works alongside an iOS application to give access to multiple training and learning activities,



It can also be customized as a Human Interface Device to register a keystroke to control 3rd party devices and apps.

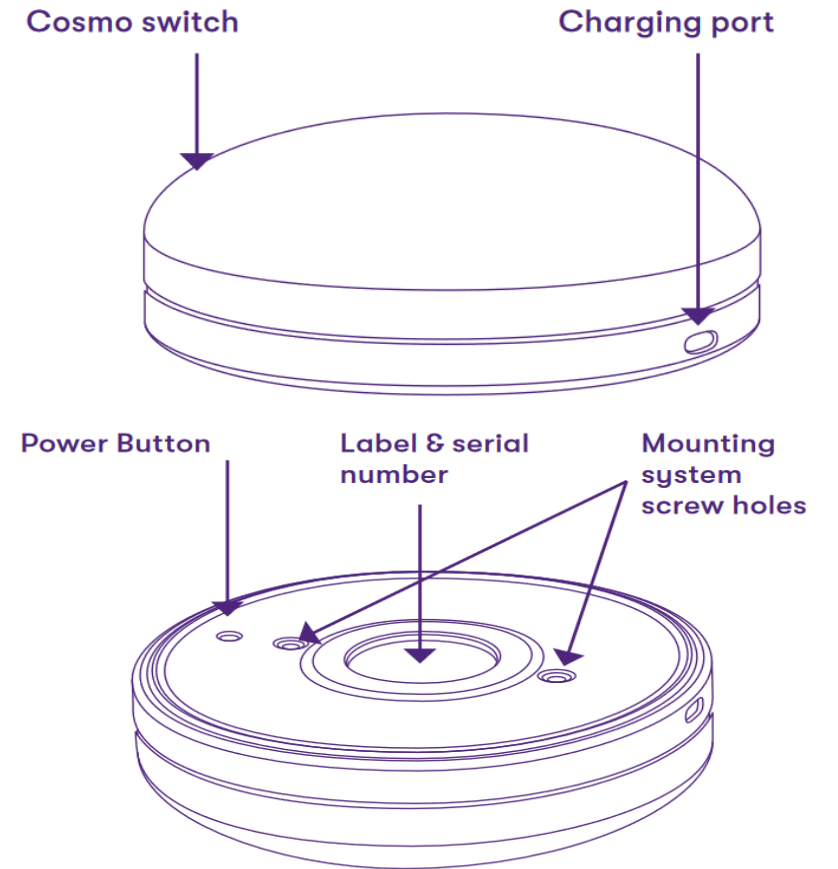


The company works with various Occupational Therapists and schools where these devices are used in therapy and educational settings

COSMO



Cosmo Excel: A pack of six cosmooids as sold by the company



Top and bottom view of the cosmooids

Progress Tracking using COSMO

An activity - **Sequence**, was developed from scratch with the idea that its data insights will be useful for both the company and the user.

The core concept for this activity came from discussions on how the hardware and data generated from it can be integrated with a therapy sessions.

The results obtained from this activity can be interpreted to aid in the progress tracking of a patient.

The activity was designed with various predefined configurations to minimize the external factors that could skew the measurements of the experiment.

The predefined configurations consider the number of devices, the duration of the session and distance between the devices to ensure the experiments generate consistent data

Progress Tracking using COSMO

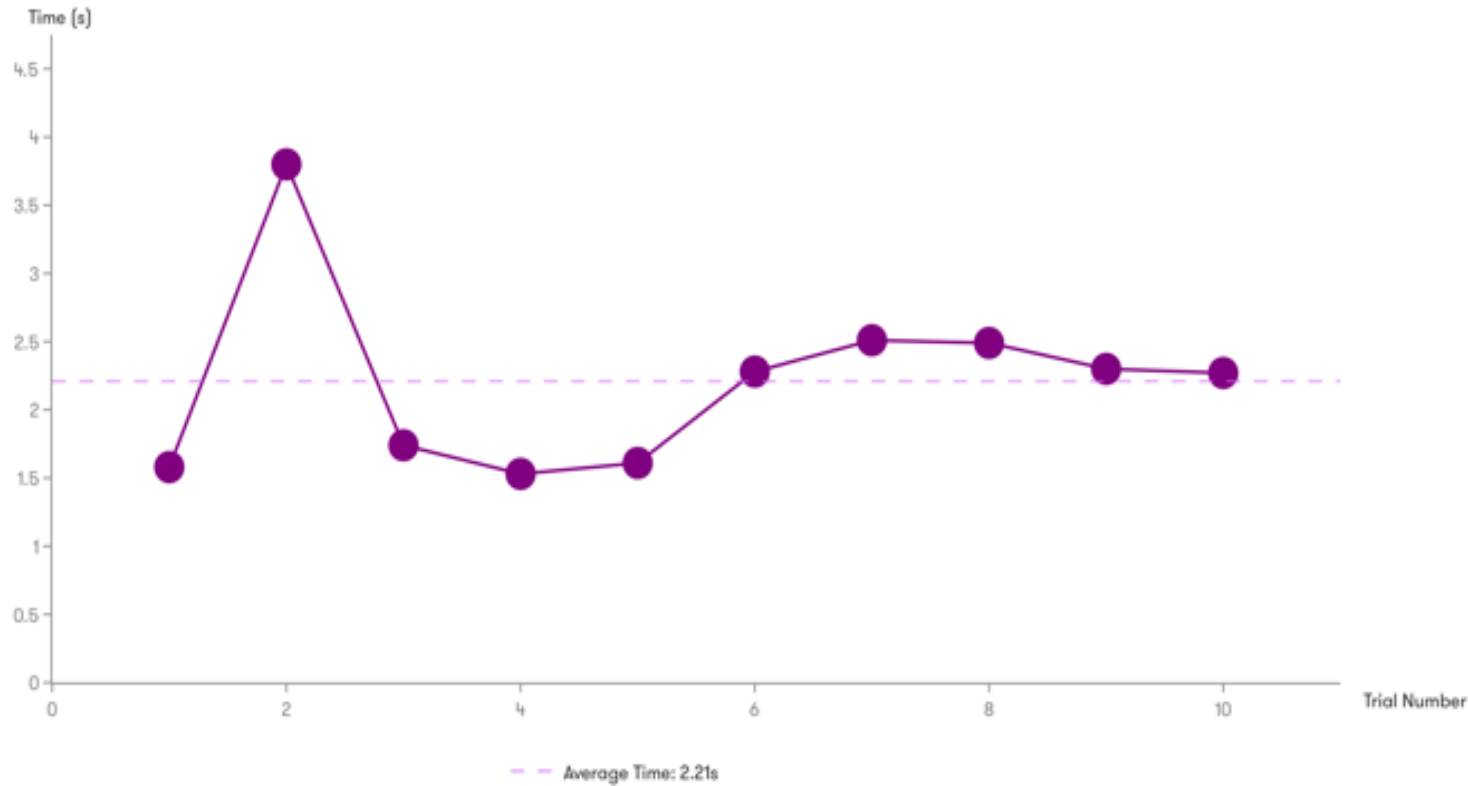
In the experiment the following key metrics are collected so that it may be used in progress tracking:

1. **Number of Trials:** The number of times in an experiment where a sequence of all devices was pressed.
2. **Total Duration:** The time the experiment was conducted.
3. **Response Times:** The time it took to press each cosmoid in each trial. This value is later used to calculate the average response time for each cosmoid.
4. **Force Values:** The force with which each cosmoid was pressed in each trial. This value is later used to calculate the average force value for each cosmoid.

Other metrics are also tracked and collected for processing, but the above-mentioned metrics are key for interpreting progress in a patient.

☑ Trial Time ☑ Time across Sessions ☑ Response time ☑ Force value

Trial time ⓘ



Time Trail: Interpretation of results

The figure shows the time it took for users to complete each individual trial in each session

Here, lower times denote better performance and vice versa.

The variance in times can be an indicative metric of the patient's progress.

This chart is independent of all other sessions (except for the average trial time) meaning that this can be used for immediate feedback of the patients,

Trial Time Time across Sessions Response time Force value

Time across Sessions (i)



Time Across Sessions: Interpretation of results

In this figure, the graph represents the average time for a user to complete a trial over multiple sessions.

This can be an overall indicator of progress since the time taken is plotted against the date the session it was conducted on.

This can be useful in a therapy setting where sessions are conducted weekly provided the same configurations are replicated for each session



Response Time: Interpretation of results

The response time denotes the time taken to press a specific cosmoid after it was lit up

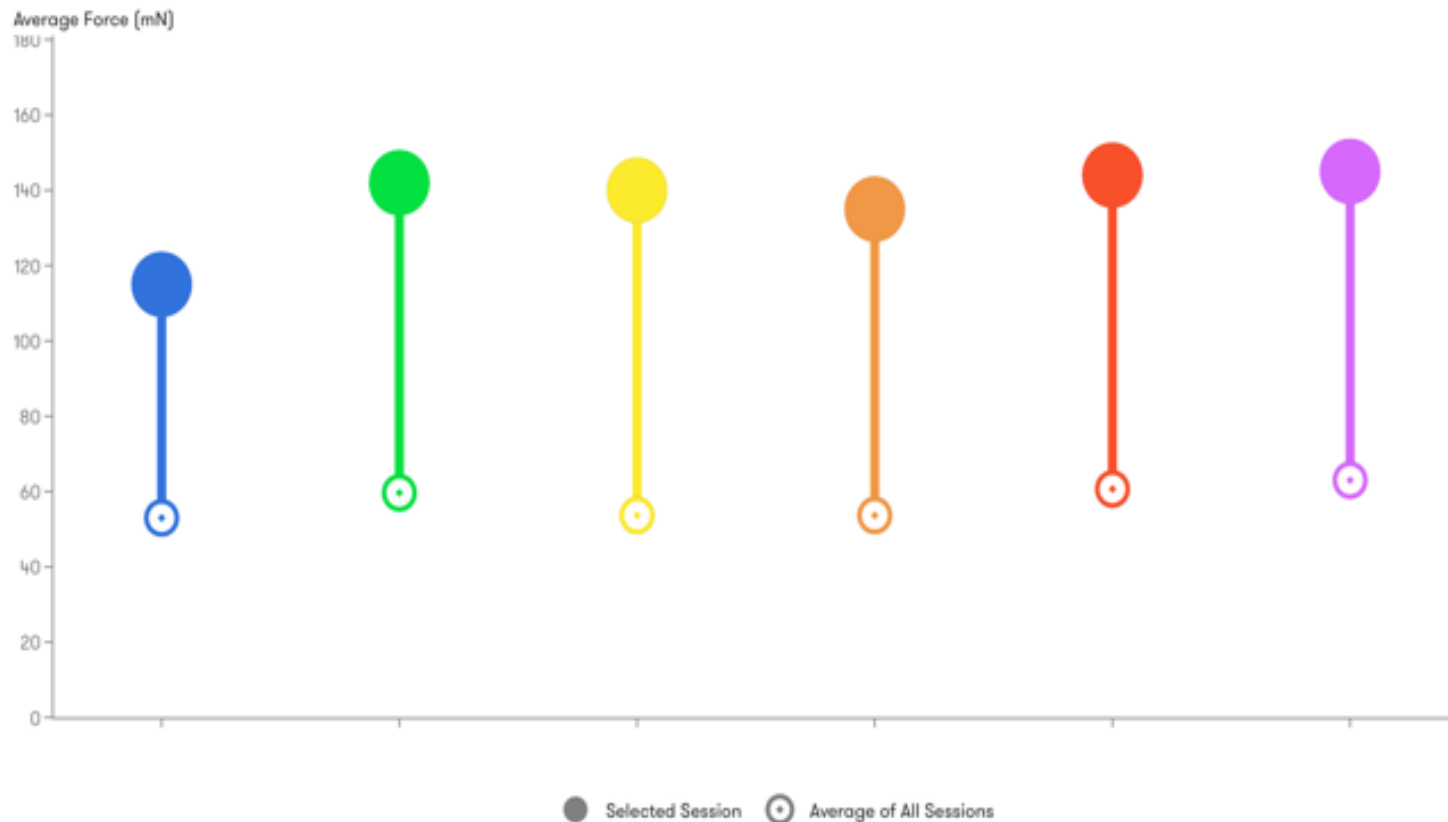
The figure shows two distinct types of plots can be seen paired up by color, a larger dot (Selected session average response) and a smaller dot with just an outline (average of all similar sessions) of the same color are plotted and joined by a line of the same color.

Here, we see a comparison between the average response time of one specific session versus the overall average of similar sessions.

If the average response time of the selected session is lower than the average response time of the overall sessions it can be interpreted as positive progress in that session.

Trial Time Time across Sessions Response time Force value

Avg Force value ⓘ



Force Value: Interpretation of results

The force value denotes the force with which a specific cosmoid is pressed after it was lit up.

Similar to the graph for response time, in this figure we see two distinct types of plots can be seen paired up by color, a larger dot (Selected session average force value) and a smaller circle with an outline and dot in the middle (average of all similar sessions) of the same color.

Here, we see a comparison between the average force value of one specific session versus the overall average of similar sessions.

Positive progress can be interpreted if the value of the larger dot is less than that of the smaller circle.

Conclusion and Future work

Conclusion:

An experiment was conducted alongside Filisia Interfaces Ltd with their assistive technology implemented in an EdTech setting

Data was collected from therapy sessions/ learning environments where the relevant metrics (response time, force value, and trial duration) were built into the activities to facilitate progress tracking for the users

The experiment proved on the viability of the data collected from their device for critical internal decision-making and at the same time provide a means of progress tracking to their users in a therapy/ school environment

Future Work:

This will be used in conjunction with different ML models for adaptive gaming where the data will be processed to predict and adjust the difficulty and/or configurations of a user based on how they are performing.

From a research perspective in SEND, this approach can be utilized to discern if there are any specific markers in the data for certain physical or cognitive conditions that can be recognized and potentially be used for predicting said conditions which is one way to address the gap in terms of research and development.

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