

# Brain Controlled Piano Keyboard for Children with Severe Motor Impairments

Anusha Broekhuysse<sup>1,2</sup>, Jenny Tou<sup>1,3</sup>, Jason Leung<sup>1,3</sup>, Tom Chau<sup>1,3</sup>  
 1 Bloorview Research Institute, Holland Bloorview Kids Rehabilitation Hospital  
 2 Integrated Biomedical Engineering and Health Sciences, McMaster University  
 3 Institute of Biomedical Engineering, University of Toronto

## Background

**Brain Computer Interface (BCI):** Converts brain signals obtained from an electroencephalogram (EEG) into commands that enable users to interact with their environment

**P300 Event Related Potential (ERP):** Brain signal that is generated approximately 300ms after presentation of the target stimulus (flashing image)

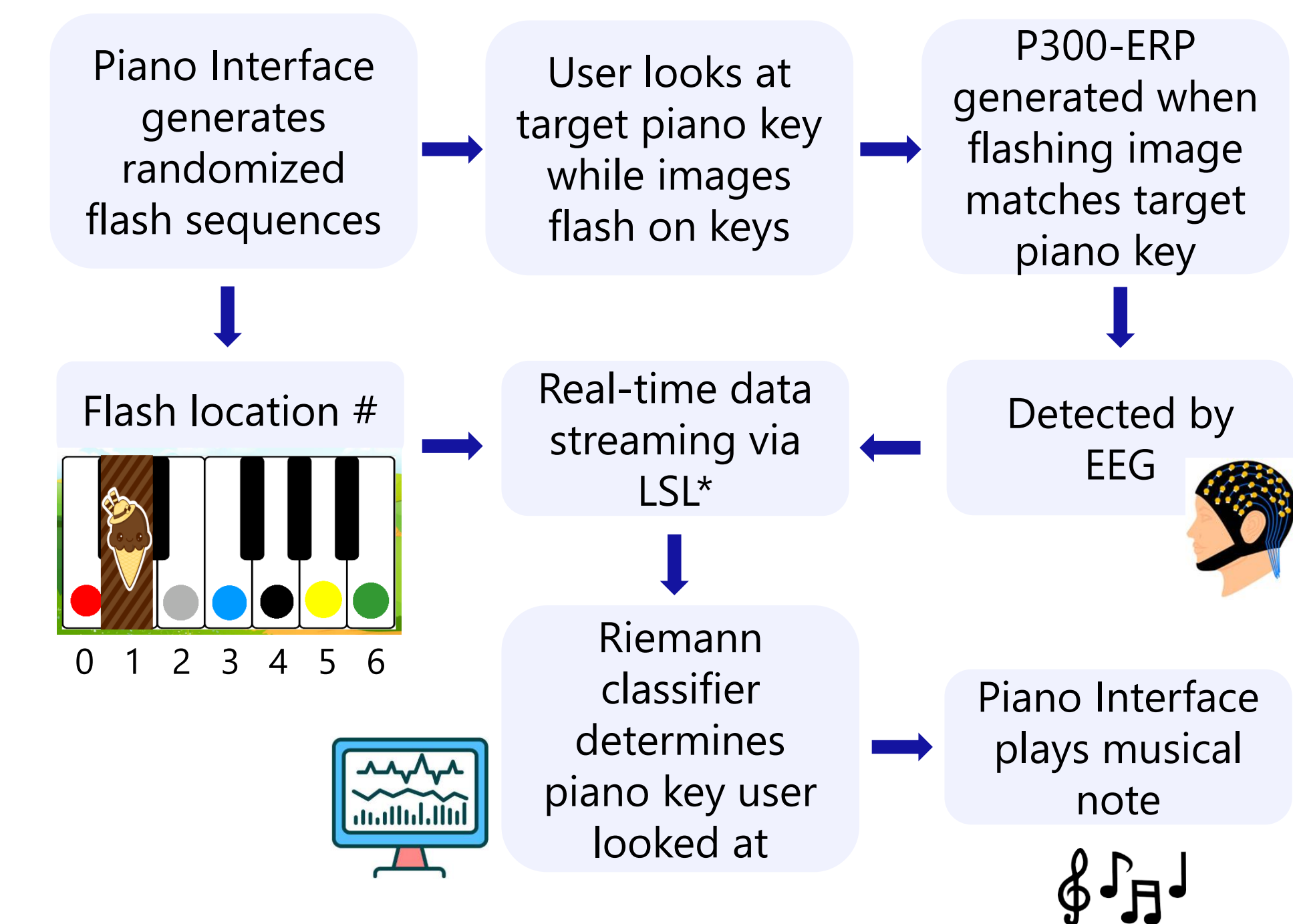
**Opportunities:** Children with severe motor disabilities, due to neurological conditions, cannot play normal musical instruments. However, BCIs & the P300-ERP can enable children to play music without their hands

## Objective

Develop a motor independent BCI piano keyboard & determine if a robust P300 brain signal is produced & detected while this interface is in use



## Methods



\*LSL: Lab Streaming Layer (software)

# P300 Brain Signals can be used to Control a Brain Computer Interface Piano Keyboard



Scan QR for a Project Demo

## BCI Piano Keyboard Interface

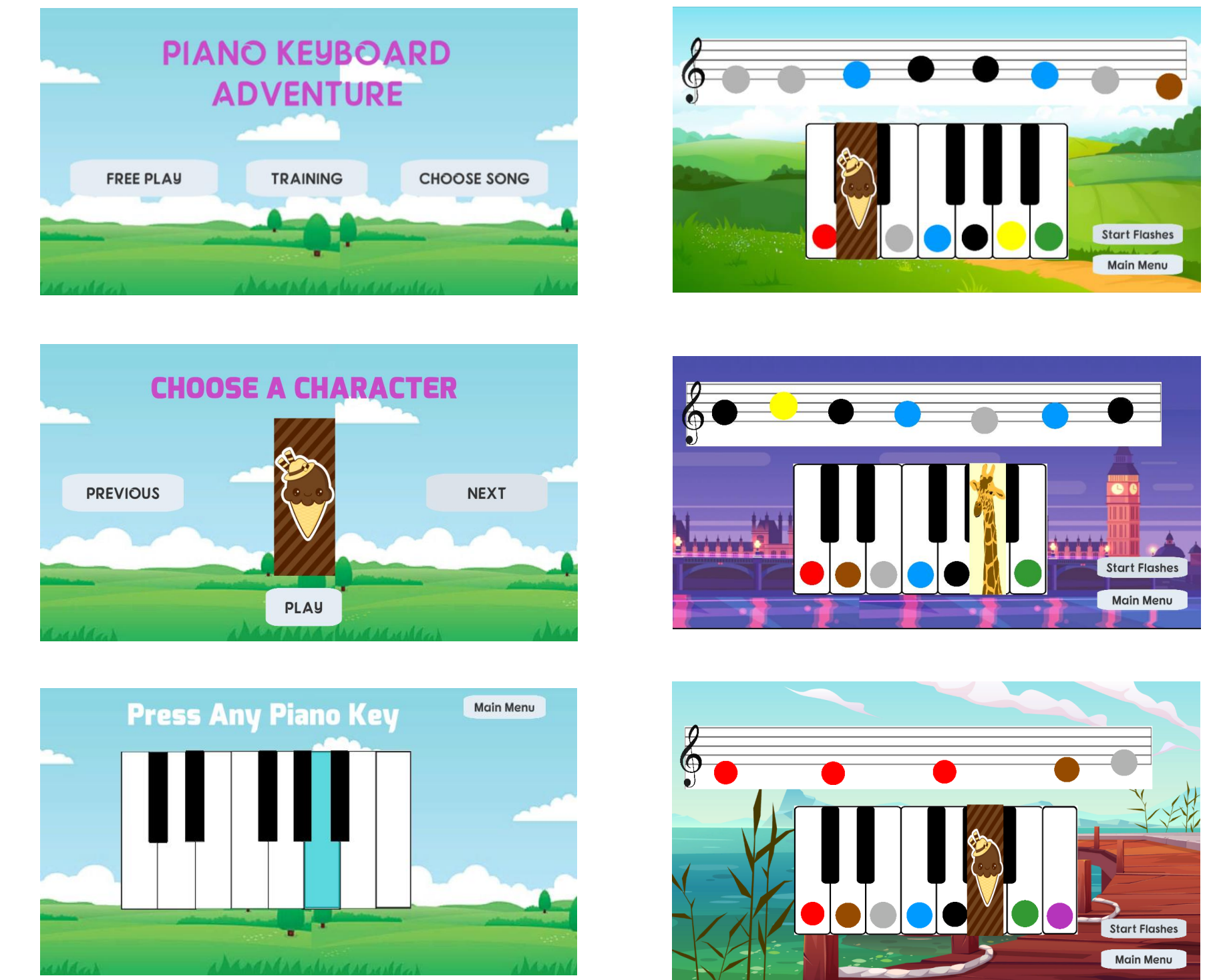
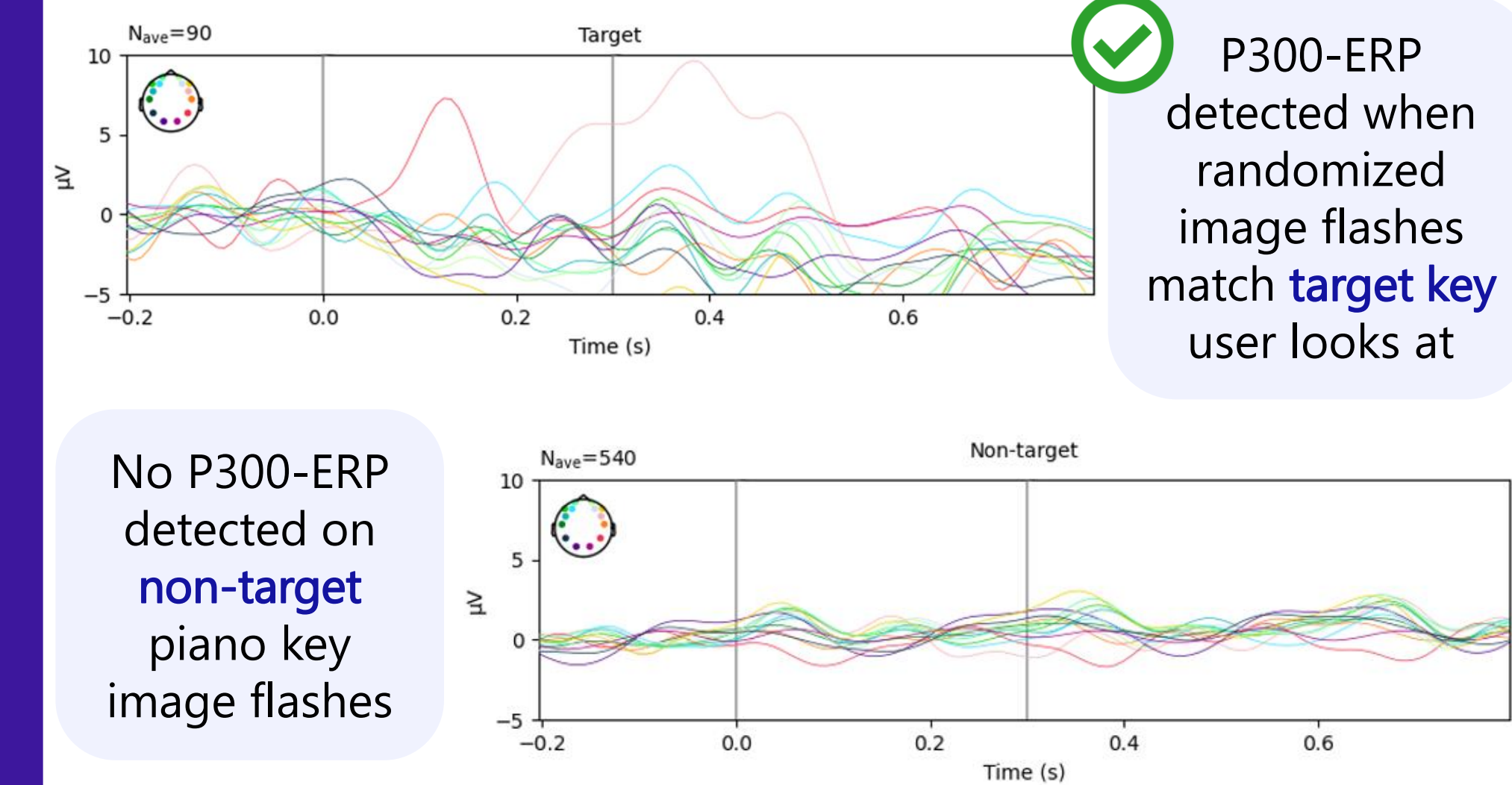


Figure 1: Interface has 3 modes – Free Play Mode, Training Mode and Song Choice Mode ; (Scan QR code for demo)

## Results



No P300-ERP detected on non-target piano key image flashes

## Conclusion & Next Steps

P300 signal detection will enable children to play the piano by simply looking at a piano key on the interface. Interface will be used as a **rehabilitation tool in music therapy sessions** (8 weeks) and structural/functional changes will be **evaluated in the brain** with MRI.



## Relevance

Children with severe motor impairments will:

1. Experience the **joy** of playing music
2. **Exercise** their brains throughout the process of rehabilitation
3. Be **included** in musical activities

