

4. Evaluation of the effects of music and artistic interventions on children through interoceptive sensitivity assessment

Progress until FY2024

1. Outline of the project

This project aims to evaluate the effects of music and artistic interventions on children from both physiological and psychological perspectives by assessing interoceptive sensitivity. In the study titled "Enhancement of Interoception and Sensitivity Through Group Music Experiences in School-Aged Children," physiological data and interpersonal network dynamics are collected and analyzed during rhythm-based musical activities involving lower elementary school students. In the studies "Establishment of Parent - Child Relationship Evaluation Indices and Verification of Music Intervention Effects" and "Short-Term Music Interventions and Their Influence on Interoceptive Awareness in Parent-Child Dyads," we investigate how synchronized musical play between infants or young children and their caregivers influences physiological states and the quality of the parent-child relationship.

2. Outcome so far

"Establishment of Parent-Child Relationship Evaluation Indices and Verification of the Effects of Synchronous Music Interventions"

This study examined preschool children and their caregivers to explore how synchrony during rhythm tasks (e.g., tapping) relates to parenting styles and child traits. Phase synchrony and leader-follower patterns were compared with questionnaire results (e.g., TK Parent-Child Relationship Inventory), revealing unique interaction patterns. Hyperscanning MEG also showed distinct frontal alpha-band synchronization, differing from adult pairs. These results suggest music interventions may enhance parent-child relationships and emotional stability.

"Enhancement of Interoception and Sensitivity Through Group Music Experiences in School-Aged Children"

Drum circle-based music activities were held in elementary schools to assess emotional and physiological synchrony using face-to-face detection, heart rate monitoring, and hormone analysis. Caregivers showed increased oxytocin and decreased cortisol. Although children's responses varied, overall group cooperation improved. Continued participation led to greater movement synchrony and broader communication networks.

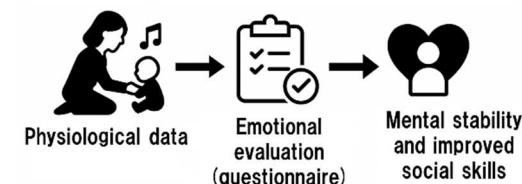
"Short-Term Music Interventions and Their Influence on Interoceptive Awareness in Parent-Child Dyads"

Plan 1: We assembled a corpus of 208 traditional children's songs from around the world and developed an online survey system to assess familiarity and valence/arousal ratings in approximately 300 parent-child pairs. Based on these evaluations, nine songs with BPM 110 were selected for experimental use. Preliminary testing confirmed that the music could be reliably delivered in remote settings. A computational model was also applied to assess acoustic similarity among songs. These efforts established a foundation for large-scale, short-term interventions aimed at examining the relationship between music-induced prediction error and individual physiological traits.

Plan 2: A separate short-term intervention targeted infants up to 12 months old and their parents. Following a one-week in-home music listening protocol, laboratory-based assessments were conducted. Two conditions were compared: (1) music-driven interactive play and (2) background music during separate activities. Results showed increased synchrony in brainwave and heart rate activity when parents and children actively engaged in rhythmic movement together. Notably, specific maternal behaviors were associated with enhanced

inter-brain phase synchrony. Similar trends were observed during rhythm-based movement sessions in nursery schools, where caregivers reported increased positive affects. Observational data suggest that caregivers' attentiveness may promote physiological synchrony and emotional connectedness with their children.

Musical activities for parents and children, multimodal measurements



3. Future plans

By continuously developing a longitudinal database that integrates EEG, heart rate, hormonal data, and body movement network metrics, this research is expected to contribute to the creation of a personalized intervention model that proposes "music prescriptions" optimized for age and individual characteristics. Furthermore, by integrating wearable sensing devices with a cloud-based analytic platform that connects schools, homes, and childcare settings, this work envisions the development of a social system that promotes autonomous regulation of interoceptive awareness through real-time feedback in everyday environments. To prepare for such applications, it remains essential to longitudinally examine the effects of rhythm-based interaction on emotional stability and parent-child relationship enhancement—including in high-risk populations such as those with emotional or neurodevelopmental vulnerabilities—and to accumulate a robust evidence base for implementation in educational and health domains.