# Using Tangibles to Support Young Children's Physical and Cognitive Health

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**Abstract**

This report describes our initial exploration toward designing an interactive toolkit for young children to enhance parent-child interaction and cognitive development. We present our ideas around an interactive playmat, a set of design principles to support interactions of young children and their parents, and the suitable methods for evaluating tangible user interface to assess young children typical development.

**Author Keywords**

Tangible interaction; cognitive health; physical development; toolkit; young children.

**ACM Classification Keywords**

H.5.m [Information Interfaces and Presentation (e.g., HCI)]: Miscellaneous.

## Research Summary

Early child development, including speech and language, motor and cognitive development are important predictors of health, mental wellbeing, school attainment and consequently, the life chances of children as they grow to adulthood [1-5]. Thus, investing in early childhood is a priority to support parents, ensuring their child's healthy development and earlier detection of any atypical development. This research is interested in exploring the design of a tangible toolkit to enhance parent-child interactions and their child's cognitive development. The interactive toolkit and its contents will be designed with parents and young children using an iterative user-centered design cycle.

The HCI community has long been interested in designing interactions to support parents and their children in communication and engagement. A notable example is KidCam, a prototype rich media capture device for generating sentimental keepsakes and monitoring activities, and also enables kids to play and communicate through distance. The user interface of the toolkit is themed as a child friendly monitor, which has the functionality of recording video, audio, and photographs in order to keep a record of a young child's life events [8].

There are also a number of tangible toolkits that support young children in communication and play and to develop motor skills and literacy [6]. Family Story Play is a tangible system that supports parents and grandparents in improving communication over a distance to foster the literacy development of young children. By offering a rich long distance book reading environment, Family Story Play aims to converge entertainment, education, and communication among young children to play, learn, and connect with the people who love them [7].

Pokaboo combines networked physical toys with networked photo sharing or mobile video chat to show how networked toys could assist children to engage in connections through distance physical play. Results demonstrated that the children greatly enjoyed playing together using Pokaboo, finding it a compelling experience [9].

Moreover, Video Play is a tangible book-reading interface consisting of special books with light sensors to read an encoded pattern on the book, and an arduino microcontroller. The book reader device also includes an RFID reader to sense the presence of mask phicons –small animal toys with embedded RFID tags that aimed to create a sense of togetherness between long distance family play and communications [10].

Video Playdate facilitated video-mediated free play between children aged 7 and 8 supporting social play. The study investigated four conditions of Vanilla, Pan-zoom-tilt, Mobile, and Projector rug to understand how different affordances to controlling view may influence free play. Though challenges in managing visibility, attention, and intersubjectivity, the study was largely successful in playing together across videoconferencing [11].

ShareTable System is a system that facilitated interaction opportunities for divorced parents and their children via a videochat and shared tabletop task space for sharing physical objects. The main objective of this study was to support families to communicate through

metaphorical touch and giving a sense of closeness [12]. In addition, Virtual Box is designed to support mediated family intimacy via virtual and physical play using Bluetooth triangulation and proved successful to facilitate expressions of intimacy [13].

This body of previous research demonstrates that there is great interest, and success, in supporting tangibles among parents and children. However, this has mostly focused on children aged 4 to 12 years [14]. There is significant space to extend this work in the HCI and interaction design community. For example, emphasizing a younger target age may be one avenue for productive research and design for tangibles for parent-child interaction.

Additionally, many of the tangibles discussed earlier focus on supporting parent-child interaction over distance. A significant challenge for the community will be the design of tangibles that can support moments of play that are laden with communicate values, such as eye contact, close physical interaction, and shared gaze. My PhD work seeks to explore this space by examining how tangibles can be designed to support close, physical interaction and play between parents and their very young children.

One potential design solution could be the development of an interactive playmat. As many parents play with their young children on a playmat, this provides an interesting tangible space to design to support parent-child interaction. For example, the playmat could be a tangible user interface, and the cards (including animals, numbers, and fruits) will be tokens to placed and detected by the mat for the users interaction. The

playmat will also be safe, soft to play, and easy to interact for the babies.

Additionally, the researcher aims to perform a comparison between the existing evaluation methods and discovering beneficial tangible user interfaces design issues for young children cognitive health. Finally, the results will be used for developing evaluation guidelines. Therefore, the proposed research questions in this research are:

- What are the appropriate design considerations for young children in order to be more effective and less harmful for their cognitive development?

- Which elements could be adapted and incorporated in the proposed interactive toolkit from the perspective of parents and health providers?

- What are the interactions that would be beneficial and acceptable to a community in supporting parent-child interactions and child cognitive health development?

- In what ways could the proposed interactive toolkit support parents? And what are the barriers to delivery of the toolkit?

- What are the suitable methods for evaluating tangible user interface to assess young children cognitive development?

## About Author

Zeinab has the experience of design, and evaluation of tangibles to facilitate split attention in their learning environment for people with Autism Spectrum Disorder (ASD). The main goal was to produce an effective learning environment by identifying the appropriate teaching methods for children with ASD. Currently, Zeinab is undertaking a PhD in Open Lab, Newcastle University, on supporting parent-child interactions by designing an interactive toolkit to enhance the child's physical and cognitive development.

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