
The Bits & Atoms of Play: Critical Engagements with Intercultural Meaning Making

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Abstract

Dream Stones is a set of physical programmable robotic balls that facilitates new intercultural meanings for children. It weaves together the benefits of physical *embodied* play with *tinkering* in material making of technology that connects and transcends. The paper is contextualized in over 40 ideas from children around the world who facilitated our design thinking.

Author Keywords

Diversity; design; intercultural communication; materials; physical computing; future of play.

Introduction

We are living in an increasingly diverse world where migration and globalization are reconstituting national identities, communities and communication [3]. The IDC 2018 committee launched a design and research competition calling for creative technology design concepts that may facilitate an understanding of *diversity*. To achieve this, the organizers invited designers to think about digital technology design through a global engagement with over 40 ideas generated by *child designers* through an initial stage.

Critical Engagements with Children's Ideas

At the onset, we recognized the different ways in which design researchers have engaged with children's ideation, ranging from a literal uptake and mixing of ideas, to a critical approach that seeks to uncover latent concepts



Figure 1a: Exploring the emergent concepts from all of children's ideas.



Figure 1b: Critiquing key ideas that told compelling stories.

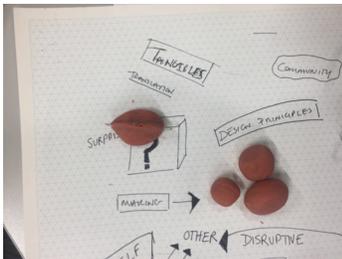


Figure 1c: Tactile materials playing a central role in reaching a design concept.

[1]. Initially aligned with the former view, we individually and then collaboratively interpreted emergent themes from children's ideas (see Fig. 1a). We found that child designers predominantly interpreted diversity from a cultural perspective {e.g. The Friend Fisher, The Culture Box}, although two teams also explored age {Elderly App} and visual impairment {Braille Smartphone} as other forms of diversity. Children's ideas coalesced into *four lenses*. Though the boundaries of these lenses often intersected, drawing them apart helped us to identify the different ways in which the design problem was framed, the role of technology was characterized and its material representation defined.

Technology as a natural mediator: Geographical and language barriers can hinder diversity. Technology can foster diversity by connecting people and translating language differences {e.g. Tech Power}.

Technology as teaching authority: To appreciate diversity, knowledge about other cultures must be acquired. Technology can play an explicit teaching role, or act as an authority in resolving intercultural differences {e.g. F.R.E.D}.

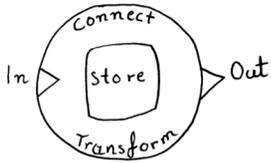
Disruptive experiences: Empathy and perspective taking can facilitate a deeper understanding of difference. Technology can create disruptive empathic experiences by flipping around roles and raising awareness on cultural stereotypes {e.g. The Mirror of Differences}.

Technology as a shared experience: Differences can be mediated through shared experience where embodied communication subverts language. Technology can serve as a shared object through which we express culture and create joint meaning {e.g. 3D Globe Picture Transporter, Friendship superbracelet}.

Our subsequent engagements with children's ideas focused on the fourth perspective, which in our team discussions invited a multilayered account of technology. Whereas initially we embraced the divergence reflected in children's ideas, at this second stage, we chose to focus on a subset of ideas that served as branching points (see Figs. 1b and 1c) for developing a new design concept, *Dream Stones*. *Dream Stones* aims to promote the material and dialogic exchange that is at the core of intercultural communication. Our concept transcends the need for language through embodied, multimodal play. The materiality of our technology invites playful tinkering that fosters socially constructed, intercultural learning.

Dream Stones

Dream Stones is a collection of physical programmable robotic balls (RB) aiming to foster intercultural communication. Intercultural communication involves "dialogical and material exchanges between members of cultural groups" [3]; our technology mediates self-expression, discovery of the other, and joint meaning making through new material engagements. More so, we consider these material engagements to facilitate learning about the self and the other through *tinkering* i.e., the playful experimentations and improvisations around cultural identity [4]. Children can program a RB to express their own narrative but they can also connect their RB with those from other children around the world, in turn mixing tangible bits (robotic balls) and digital atoms (children's story data). Our concept reflects a broader shift away from screen-mediated interactions to tangible ones where technology takes new **material forms**, such as 3D printed images {3D Globe Picture Transporter}, or smart wearables {Loud Communicator}. To connect the design narrative that follows to the "language of technology", in Figs. 2-3, we



In: the input the ball takes

Store: the bits that the ball stores

Transform: how actions and self-expressive energy transform the bits that the ball stores

Connect: how the **Store** and **Out** change when connected to another ball

Out: the outputs of a ball or connected balls

Figure 2: The core elements of physical programmable balls

present a parallel, technical narrative that bridges the experiences we want to provoke with the technical landscape described by inputs, outputs, storage and other programmable elements of physical computing.

From their Dream Stone set, a child can author one or more RB to express dimensions of their culture. RBs are programmed by attaching to them new sounds or images, constructing new transformations of these inputs, or by configuring RB behaviors such as its ability to vibrate, change color, and shape (e.g. by contracting expanding). By providing new ways for encoding **self-expression** {e.g. World Online Newspaper} through symbolic and multisensory cultural resources [3], Dream Stones transform children's experiences from the outside world facilitating new engagements with identity and culture.

To develop a **relational connection** with other children, Dream Stones enables children from around the world to centrally store the data attached to their RBs in the cloud. Through this mechanism, children can download to their Dream Stone set stories created by others. Initially each RB acts independently, giving a child the opportunity to interact with others' creations and explore different cultural expressions. As new stories are downloaded into one's Dream Stone set emotional attachments may begin to form as the child 'reads' and negotiates the meaning of each RB from their own experiences. Dream Stones is designed to move these initial relational connections into **shared intercultural meanings**. Child designers expressed the role of joint activities as bridging and celebrating difference, for example hobbies {Mondo Chat}, dance {Friendship's super bracelet}, food {The Friendly Cooking Event!} or music {Candy Super-necklace, Create}.

Transcending language, these bridging concepts were characterized by **embodied interactions** and **movement** in the creation of joint meaning.

The diversity of joint activities identified by children highlighted the importance of designing our concept for **appropriation**, i.e. leaving the design space open for engagement with a richer realm of activities and interpretations where learning is not prescribed [2]. Employing an open-ended design, Dream Stones allow children to connect their RB with those of others. Using the RB's sensors (e.g. light, sound, proximity, acceleration, and pressure), children program new relational behaviors between RBs allowing their RBs to 'talk to each other'. Resultant digitally mediated connections will promote new forms of play, discovery, and embodied experiences. Most importantly, by contrasting and blending RB meanings in repeated experimentations, children may reframe the ways in which they relate to others. Two fictional scenarios are presented next to illustrate the possibilities of Dream Stones for appropriated experiences and joint intercultural meanings.

SCENARIO #1 – MUSIC DREAM STONES

Nishiime lives on a Anishinaabe First Nations Reserve in Canada where she learns traditional dance and music from her elders. She records a song snippet into her RB. Mathijs from the Netherlands is a fan of Dutch pop music and likes to experiment with different music forms. In his RB, Mathijs' has recorded an existing pop music piece that he transformed from its original state through repeated experimentations with dance movements. Initially drawn by the tempo of Nishiime's song, he downloads her song into his Dream Stone set and uses 'proximity' to try out new connections such as



Self-expression

Play Dream Stones

In= image, sound
Transform= n/a
Store=image, sound
Out= hologram

Music Dream Stones

In= sound
Store= sound
Transform= move kinesthetic
Out= sound transformed



Interconnectedness

Play Dream Stones

In= pressure
Transform= no change
Store= no change
Connect= no change?
Out= vibration, sound

Music Dream Stones

In = proximity
Store = no change
Transform = twist
Connect = sequence,
foreground-background
Out = sound

Figure 3: Language of play and music Dream Stones

sequencing the sounds or overlaying them, ultimately fostering his understanding of how these different sounds may work in harmony together. Finally, in choosing to sequence the two sounds, in a final touch, Mathijs twists the RB holding Nishiime's sound transforming it and in turn their joint piece.

SCENARIO #2 – PLAY DREAM STONES

At a UK school playground, Leila and her friends' hobby is to collect seed pods from a tree and pretend they are dinosaur eggs. Eggs require care and preservation, and so they store them in a container indoors. Using her RB, Leila narrates her play story and attaches two images of the tree and the eggs collected. In Sweden, Jarmo downloads and explores Leila's story represented as a hologram in his Dream Stone set. Captivated by her story and his own curiosity in dinosaurs, he creates a new RB that shows how you can identify a genuine egg. By signaling that the two RBs share common ground, Jarmo unlocks new actions. He chooses 'pressure' to program his RB so that whenever Leila's one is pressed onto his there is a cracking sound and movement as if the egg is hatching. As Andreas from Greece, Siddhart from India, and Lucie from France join their RBs to those of Jarmo and Leila, new actions are created and thus RB interactions form new, shared meanings.

Conclusion

Building on past research, Dream Stones invites different physical configurations of tangible programmable RBs recognizing that learning is an embodied experience. Identifying tinkering as a mechanism to learning, in Dream Stones, tinkering happens when the child explores new expressions of their own diversity through the available

representations. Tinkering also happens whilst programming different RBs to interact with one another, during which experimenting with different actions can promote an ongoing reframing of the intercultural meanings produced. In situating these ideas outside the STEM context where they are often found we hope to inspire new questions about the role of this technology in children's lives and the future of play. Does our design promote tinkering, what intercultural meanings arise from this process and how do these shape how children understand difference? In seeking to build a global community of children what kind of assemblages do Dream Stones invite between - people, materials, and the digital?

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